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BULLETIN

(OF THE) 1651

CALIFORNIA
III

ACADEMY OF SCIENCES, San Fran

1887A

VOLUME II.

(Nos. 5-8.)

1886-1887.



SAN FRANCISCO:
1887.

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BULLETIN.

No. 5.

California Academy of Sciences.

Revision of the Californian Species of **LITHOCHARIS** and Allied Genera.

BY THOS. L. CASEY.

Read Jan. 4th, 1886.

The species assignable to *Lithocharis* and allied genera are extremely abundant in California and are also very numerous individually, so that a review of the forms occurring here, although not so desirable as a general revision of the North American species, is, at the same time, amply sufficient to form a systematic basis upon which to found such an extended work, and probably loses little of what importance it may possess from the omission of species occurring east of the Rocky Mountains, as these are comparatively few in number and not as yet sufficiently collected.

Belonging to the region here considered, there are described below twenty-five species, most of which are rather local in habitat, although a few have an extended range. In regard to their favorite haunts, little is to be said; they frequent the margins of ponds and water-courses, and are found amongst decaying vegetable matter, roots of grasses, etc., in stony localities, although more abundant in the deep ravines so characteristic of the Coast Mountains. I have occasionally found particular spots of very limited extent in

these ravines, where they exist in enormous profusion, not only individually, but in species indiscriminately mingled; such for instance was a small area of precipitous rocks covered with mould, moss and thin grass, in the deep ravine at Gilroy Springs, Santa Clara County, where a small trickling stream from one of the sulphurous soda-springs enters the creek below. Here I obtained hundreds of specimens of seven distinct species; associated with them were an equal multitude of *Steni* represented by several species. This concentration of insect life, which is one of the peculiarities of faunal distribution in the Pacific regions, is to be accounted for in a measure by the nature of the climate, the long hot summers drying and baking the surface of the ground, and driving all species, except the comparatively few especially constituted to withstand such conditions, to the moist and secluded localities above mentioned.

The study and proper classification of these varied forms is a matter of considerable, although by no means of insuperable difficulty, there being one important characteristic, which is of very great aid to the investigator; this is the facility with which they may be resolved into perfectly definite, and so far as the material collected will allow of judgment—abruptly limited generic subdivisions. The principal difficulty, therefore, consists in the proper differentiation of the species composing these groups, and which are often very closely allied; but even here the difficulty is partially superficial, as when these closely allied forms are separated and carefully studied, they are found to possess very little variability, and the individuals of the several species appear to be unusually uniform throughout extended series.

The genera here considered possess certain characters in common, among which may be mentioned the rather slender maxillary palpi with the third joint very moderately swollen and the fourth minute, subulate and oblique, but distinctly visible; the antennæ also are singularly uniform in structure throughout, being slender—or very slightly ro-

bust in *Metaxyodonta*—and scarcely perceptibly incrassate. The fifth abdominal segment is almost invariably equal in length to the third and fourth together. The labrum differs throughout, and is, in conjunction with the relative length of the first joint of the posterior tarsi, made the principal basis of generic subdivision. It is singular, however, and a strong proof of the validity of the genera, that these two fundamental characters are accompanied by other very radical differences in many of the most important parts of the body, as well as in completely radical differences in the nature of the male sexual modifications; these are described in the table of genera given below.

The genera *Stilicus*, *Scopæus*, *Orus*, etc., should precede those here given in a systematic arrangement of the *Pæderi*, and are distinguished from them by their very strongly dilated third maxillary palpal joint.

San Francisco, Jan. 1st, 1886.

NOTE 1.—In estimating the order of the abdominal segments in the following pages, the numbers refer to visible segments only.

NOTE 2.—Separate diagnoses of the various species are not given at present, as this paper is simply intended as the forerunner of a more general one upon our *Pæderini*.

GENERIC DEFINITIONS.

Head slightly narrower than the prothorax, sides parallel; eyes moderate in size; labrum 4-dentate, the teeth being rather prominent, acute and nearly equi-distant. Prothorax quadrate; sides parallel or very slightly narrowed from apex to base. Elytra much longer than the prothorax. First joint of the posterior tarsi as long as the next two together, or nearly so. Male sexual characters very simple; fifth segment not modified, sixth narrow, with a small simple sinuation at the apex..... Genus *Caloderma*.

Pronotum longitudinally rugulose..... Species 1 — 3.

Pronotum finely and generally very densely punctate.... Species 4 — 8.

Head rather large, slightly wider than the prothorax; eyes very small; labrum with a very small deep median emargination, slightly wider than deep, immediately adjoining which there are on each side two approximate and exceedingly minute acute teeth. Prothorax with the sides convergent pos-

teriorly. Elytra equal in length to the pronotum. First joint of the posterior tarsi fully as long as the next two together. Male sexual characters very simple; fifth segment not modified, sixth narrow with a very small triangular emargination at the apex (bilobed)..... Genus **Oligopterus**,
Species 9.

Head large, distinctly longer and slightly wider than the prothorax, sub-triangular, very minutely punctate; eyes extremely small, round, on the sides before the middle; labrum with two short, or long and slender acute teeth, the edge adjoining them exteriorly being minutely and abruptly sinuate, and between them narrowly and rather deeply emarginate. Prothorax quadrate or slightly wider than long; sides moderately convergent posteriorly. Elytra as long as or very slightly longer than the pronotum. First joint of the posterior tarsi much shorter than the next two together. Male sexual characters rather simple; fifth segment very slightly modified, sixth deeply and evenly sinuate.....Genus **Lithocharis**, Group **A**.
Species 10 — 13.

Head variable, as wide as or slightly wider than the prothorax, sides parallel, punctuation variable; eyes moderate in size; labrum with two small acute triangular teeth, the edge adjoining them exteriorly being minutely sinuate, and between them rather deeply emarginate. Prothorax finely and sparsely punctate with a rather broad median impunctate area; sides parallel or very feebly convergent posteriorly. Elytra much longer than the pronotum. First joint of the posterior tarsi generally but slightly longer than the second. Male sexual modification of the fifth segment very complex, the sixth being rather deeply and roundly emarginate.

Genus **Lithocharis**, Group **B**.

Prothorax not longer than wide.

Posterior angles of the head moderately broadly or rather narrowly rounded.

Head finely and densely punctate..... Species 14

Head much more sparsely punctate.

Sides of pronotum distinctly convergent posteriorly..... Species 15

Sides of pronotum parallel or extremely feebly con-

vergent posteriorly..... Species 16 — 19

Posterior angles of the head very broadly rounded..... Species 20

Prothorax distinctly longer than wide..... Species 21 — 23

Head rather small, sub-triangular, very minutely alutaceous; eyes very large, coarsely granulate; labrum rather large, truncate at apex, rounded and narrowly explanate at the sides, broadly and very feebly sinuate in the middle, and having a single short, very small, acute median tooth which is slightly dorsal. Prothorax scarcely as long as wide; sides nearly parallel. Elytra very slightly longer than wide, distinctly longer than the prothorax. First joint of the posterior tarsi, much shorter than the next two together. Male sexual modification of the fifth segment simple, of the sixth complex.

Genus **Metaxyodonta**.

Species 24 — 25

CALODERMA n. gen.

The species of this genus present a singularly homogeneous appearance, they being distinguished by their very narrow elongate form, small heads with parallel sides, quadrate prothorax and long narrow parallel elytra; the abdominal sculpture is also a distinguishing feature, the transverse wavy lines of minute sub-asperate punctures being peculiar to them, although having a tendency to reappear in the genus *Metaxyodonta*.

1—*C. rugosum* n. sp.—Slender, moderately convex; sides parallel; color throughout piceous; pubescence extremely sparse and scarcely noticeable upon the head and prothorax, very fine, extremely dense and sericeous on the elytra and abdomen, pale ochreous in color and very conspicuous; under surface and legs piceous-brown, the latter slightly paler, tarsi pale brown; antennæ fuscous throughout. *Head* short and robust, scarcely longer than wide; sides parallel, very feebly arcuate; base transversely truncate, basal angles distinctly rounded; surface feebly and evenly convex, finely and extremely densely punctate throughout, slightly more sparsely so between the antennæ; punctures round, shallow and sub-annular; eyes at much more than their own length from the basal angles, moderately prominent; antennæ slender, nearly as long as the head and prothorax together, scarcely perceptibly incrassate; basal joint as long as the next two together, second very slightly shorter and more robust than the third, tenth slightly longer than wide; maxillary palpi piceous-black; labrum with four equal acute triangular teeth, sides broadly and roundly lobed. *Prothorax* about as long as and slightly wider than the head; sides parallel and feebly arcuate; base strongly arcuate; apex broadly and much less strongly so; apical angles distinctly rounded, basal very broadly so; apex with a very small feeble sinuation in the middle; disk very slightly longer than wide, transversely, moderately and evenly convex, very minutely, rather strongly and evenly rugulose; rugulæ sinuous and interrupted; having a very narrow and imperfect median line toward base. *Elytra* at base very slightly wider than the pronotum; sides parallel and feebly arcuate posteriorly; together broadly, triangularly and feebly emarginate behind; disk transversely and moderately convex, one-third longer than wide, one-half longer than the prothorax, feebly impressed along the suture, which is margined with a slightly elevated line, extremely minutely, evenly and densely punctate; punctures asperate and more sparse near the apices. *Abdomen* scarcely perceptibly paler toward tip, transversely strigate with fine wavy lines of extremely minute asperities. *Legs* moderate; anterior tarsi feebly dilated, first joint of the posterior as long as the next two together. Length 3.7–4.2 mm.

Described from the male, in which the sixth segment is narrow and evenly sinuate at the tip, the sinus being evenly rounded and about four times as wide as deep. The species is one of the most distinct of this portion of the genus, and is widely extended in distribution throughout the middle coast region; it is distinguishable at once by its very dense sculpture, dark color and very dense pubescence of the posterior portions of the body.

2—*C. continens* n. sp.—Moderately robust, rather depressed; head and abdomen black, the latter paler and brownish-ferruginous at apex; prothorax and elytra dark castaneous-brown, the latter slightly the paler; under surface paler, castaneous; legs brownish-flavate; antennæ rufo-fuscous throughout; maxillary palpi piceous-black; head and pronotum almost glabrous, having a few erect black setæ; elytra and abdomen finely and moderately densely pubescent. *Head* moderate, slightly longer than wide; sides parallel and feebly arcuate; base truncate, basal angles distinctly rounded; eyes small, moderately prominent, in great part visible from above, one and one-half times their own length from the base; occiput moderately convex, front flat anteriorly; punctures fine, round, shallow, sub-annular and extremely dense; antennæ nearly as long as the head and prothorax together, slender, not incrassate; basal joint as long as the next two together, second much shorter and more oval than the third, tenth longer than wide. *Prothorax* large, nearly as long as and very slightly wider than the head; sides just visibly convergent from apex to base and very feebly arcuate; base broadly arcuate, sub-truncate in the middle; apex broadly arcuate, as strongly so as the base, narrowly and very feebly emarginate in the middle; apical angles narrowly but distinctly rounded, basal more broadly so; disk transversely and moderately convex, quadrate, very finely, evenly and strongly rugulose, the very fine median line being entirely obsolete in the apical half. *Elytra* at base just visibly wider than the pronotum; sides parallel, very feebly arcuate posteriorly; together broadly and just visibly incurvate at the apex; disk transversely and feebly convex, very feebly impressed along the suture which is very slightly and narrowly elevated, one-fourth longer than wide, slightly less than one-half longer than the pronotum, very minutely densely and evenly punctate; punctures sub-asperate and slightly sparser near the apices. *Abdomen* transversely strigate with very fine wavy lines of minute closely-placed asperities. *Legs* moderate; anterior tarsi very feebly swollen; first four joints of the posterior decreasing uniformly and very rapidly in length, first slightly shorter than the next two together, fourth very slightly longer than wide; claws very small. Length 3.4 mm.

Contra Costa Co., 2; Napa Co., 1; San Diego, 2.

This species, although closely allied to the preceding, is distinguishable from it by its smaller size, more robust form, larger prothorax, coloration of the body, paler abdominal apex, less conspicuous pubescence and shorter first joint of the posterior tarsi. It is described from the male, the sixth segment being sinuate at apex; the sinus is rather more acutely rounded than in *rugosum*, and is about four times as wide as deep. The structure of the labrum is similar to that of *rugosum*.

3—*C. angulatum* n. sp.—Form slender, moderately convex; color throughout black, legs piceous-black, antennæ and palpi same, tarsi piceo-testaceous; pubescence of the elytra and abdomen moderately dense, very fine, recumbent, fulvous in color, sparser and coarser anteriorly except at the sides of the head behind the eyes. *Head* moderate, slightly longer than wide; sides parallel and feebly arcuate; base truncate, angles distinctly rounded; surface moderately convex, depressed anteriorly, very finely and densely punctate; antennæ very slender, nearly as long as the head and prothorax together; basal joint scarcely as long as the next two combined, second and third equal in length, the former scarcely perceptibly more oval, tenth as wide as long. *Prothorax* quadrate; sides just perceptibly convergent posteriorly and nearly straight; base broadly, rather strongly and nearly evenly arcuate, much more strongly so than the apex, which is broadly and rather feebly arcuate and feebly sinuate in the middle; apical angles slightly obtuse and scarcely perceptibly rounded, basal very broadly rounded; disk scarcely wider than the head, moderately convex, very finely, rather strongly and irregularly rugulose; median line rather obsolete. *Elytra* at base very slightly wider than the head; sides parallel and feebly arcuate; together broadly, triangularly and distinctly emarginate behind; disk transversely and very moderately convex, very feebly impressed along the suture toward base, not impressed toward the apex, scarcely one-third longer than wide, about one-third longer than the prothorax, extremely minutely, densely and evenly punctate; punctures asperate and not sparser near the apex. *Abdomen* having the sixth and the apex of the fifth segments very slightly paler, piceo-testaceous; surface transversely and finely strigate in wavy and very broken rows of minute and closely-placed asperities. *Legs* moderate; first joint of the posterior tarsi slightly shorter than the next two together. Length 3.5 mm.

San Mateo Co., 3 (Mr. Fuchs).

Described from the male; the sixth segment is sinuate at apex, the sinus being very broadly rounded and about six times as wide as deep.

This species may be distinguished by its black color, dark legs and coarse pubescence of the head, but especially by the shape of the prothorax, in which the anterior angles are not distinctly rounded.

4—*C. mobile* n. sp.—Rather slender, black throughout, apices of the elytra just visibly paler, fuscous; legs dark brown, castaneous, tarsi testaceous; antennæ piceous, fuscous toward tip; pubescence of the elytra and abdomen very fine, short and extremely dense, sericeous, fulvous, that of the head and pronotum excessively fine, rather sparse, dark piceo-cinereous and scarcely visible. *Head* moderate; sides parallel and feebly arcuate; base truncate, angles rather broadly rounded; surface moderately convex, rather coarsely and densely punctate, more finely so behind, with a narrow median impunctate line; punctures round, feeble; between the antennæ there are two rather large setigerous punctures; labrum with four small, robust, triangular teeth; antennæ distinctly shorter than the head and prothorax together, very feebly incrassate, rather slender; basal joint as long as the next two together, second scarcely two-thirds as long as the third and equal in length to the fourth, tenth slightly longer than wide. *Prothorax* nearly quadrate; sides parallel and distinctly arcuate; base and apex evenly, rather strongly, and nearly equally arcuate, the latter with a small feeble median sinuation; apical angles rather broadly rounded, basal very broadly so; disk transversely and rather feebly convex, very slightly wider than the head, evenly finely and extremely densely punctate; punctures very feebly impressed, almost contiguous; median line almost obsolete. *Elytra* at base just perceptibly wider than the pronotum; sides very feebly divergent and feebly arcuate; together broadly, evenly and rather strongly sinuate at apex; disk transversely and moderately convex, one-fourth longer than wide, nearly one-half longer than the pronotum, feebly impressed on either side of the slightly elevated suture, rather finely and very densely punctate; punctures slightly asperate and much finer near the apex. *Abdomen* nearly as wide as the elytra; sides of the fifth segment feebly convergent toward tip; surface transversely strigate in close wavy lines of minute asperities; each segment having one or two transverse rows of four to six very small setigerous punctures upon both the dorsal and ventral disks. *Legs* slender; first joint of the posterior tarsi slightly shorter than the next two together, as long as the last two, one-half longer than the second. Length 4.0 mm.

Monterey Co.. 2. ♀

Described from the female in which the sixth segment is very evenly rounded behind. There are many erect bristling setæ on the abdomen toward tip; the transverse series of discal punctures upon the abdomen are characteristic of this

entire genus, but are more conspicuous in those species having very dense sericeous abdominal pubescence. This species is very distinct being distinguished by its size and very dense punctuation, also by the rather more transversely oval pronotum with broadly rounded anterior angles.

5—**C. contractum** n. sp.—Slender, black; elytra slightly paler, piceous, slightly rufous at the apices; legs pale brownish-testaceous, tarsi paler, brownish-flavate; antennæ dark rufo-testaceous throughout; maxillary palpi piceous-brown; entire under surface same; pubescence of the elytra moderately dense, very short and fine, that of the abdomen much longer, coarser and denser, that of the head and pronotum excessively fine, rather sparse and not conspicuous. *Head* moderate; sides extremely feebly convergent posteriorly and very slightly arcuate; base truncate, angles narrowly rounded; surface slightly longer than wide, moderately convex, rather coarsely and somewhat sparsely punctate, with a narrow median impunctate line; two setigerous punctures at the apical margin of the epistoma large and prominent; antennæ slender, nearly as long as the head and prothorax together; basal joint scarcely as long as the next two together, second two-thirds as long as the third and slightly longer than the fourth, tenth about as long as wide, eleventh ovoidal, acuminate, slightly shorter than the preceding two combined. *Prothorax* quadrate, distinctly wider than the head; sides parallel and distinctly arcuate; base rather broadly and strongly arcuate, slightly more strongly so than the apex; apical angles rather narrowly rounded, basal very broadly so; disk transversely and moderately convex; median line obsolete, or very nearly so; very finely, feebly and densely punctate; punctures very feebly impressed and separated by their own widths. *Elytra* at base very slightly wider than the pronotum; sides nearly parallel, feebly arcuate, distinctly more strongly so near the apices; together broadly, angularly and very feebly emarginate at the apex; disk convex and declivous at the sides, depressed in the middle, feebly impressed on either side of the feebly elevated suture, scarcely one-fourth longer than wide, one-third longer than the prothorax, rather coarsely and densely punctate; punctures much finer and more asperate near the apex. *Abdomen* slightly narrower than the elytra; sides parallel; sides of the fifth segment strongly convergent posteriorly; surface rather convex, transversely strigate in very disconnected wavy lines of moderately coarse asperities. *Legs* slender; first joint of the posterior tarsi nearly as long as the next two together. Length 3.2–3.6 mm.

Santa Clara Co., 9; Monterey Co., 4; Humboldt Co., 1.

In the specimen from Humboldt the elytral punctuation is decidedly coarser and denser. The type is a male, the sixth segment being slender and sinuate at apex; the sinus is rather narrowly rounded and about four times as wide as

deep. This species is easily distinguished from *mobile* by its smaller size, sparser pubescence and much sparser punctation.

6—*C. luculentum* n. sp.—Form rather robust, depressed; color black, elytral apices abruptly paler, rufous; apices of the abdominal segments beneath pale; legs pale reddish-ochreous; antennæ uniformly dark rufo-fuscous; palpi piceous; head and pronotum almost glabrous; pubescence of the elytra and abdomen very sparse, fine, dark piceo-fulvous and not at all conspicuous; integuments very highly polished. *Head* short and robust, very slightly wider than long; sides parallel and very feebly arcuate; base truncate, angles narrowly rounded; surface moderately convex, rather coarsely and densely punctate at the sides and base, very sparsely so in the middle where there is a rather wide median impunctate area; interantennal area impunctate, two setigerous punctures widely separated and very feeble; antennæ slender, nearly as long as the head and prothorax together, second joint scarcely two-thirds as long as the third and distinctly shorter than the fourth, tenth as wide as long. *Prothorax* quadrate, very slightly wider than the head; sides very feebly convergent from apex to base; the latter broadly, evenly and rather moderately arcuate; apex with a distinct median sinuation; apical angles somewhat narrowly rounded, basal broadly so; disk moderately convex, very finely, rather deeply, evenly and densely punctate; punctures separated by their own widths. *Elytra* at base very slightly wider than the pronotum; sides just visibly divergent posteriorly and feebly arcuate, distinctly more strongly so behind; together broadly and feebly sinuate at apex; disk one-fourth longer than wide and one-third longer than the pronotum, feebly impressed along the slightly elevated suture except at the apex where the elevation and impressions disappear, rather coarsely, sub-asperately and very densely punctate. *Abdomen* broad, very slightly narrower than the elytra; border narrow; sides parallel and nearly straight; transversely strigate in wavy lines. *Legs* slender; first joint of the posterior tarsi as long as the next two together, second as long as the third and fourth, slightly shorter than the fifth. Length 3.7 mm.

Lake Co., 3. (Mr. Fuchs.)

Described from the male; the sixth segment is sinuate at apex, the sinus being acutely rounded and but slightly more than three times as wide as deep. This species, although somewhat resembling *contractum*, may be at once distinguished by its broader form, much paler elytral apices, highly polished integuments and very sparse pubescence of the elytra and abdomen. The sinus of the sixth segment, although rather acutely rounded as in *contractum*, is relatively distinctly deeper.

7—*C. reductum* n. sp.—Slender, black; elytra piceous, paler and distinctly rufous at the apices; femora rather pale castaneous-brown, tibiae and tarsi paler, brownish-flavate; under surface dark castaneous, tip of the abdomen slightly paler; antennae dark rufo-testaceous; pubescence of the elytra very short, fine and rather sparse, that of the abdomen much longer, coarser and twice as dense; head and pronotum almost glabrous. *Head* robust, scarcely longer than wide; sides parallel and nearly straight; base truncate, angles rather broadly rounded; surface rather finely and sparsely punctate, especially toward the middle, where there is a rather broad impunctate line; antennae distinctly shorter than the head and prothorax together, somewhat robust; basal joint as long as the next two together, second very slightly shorter than the third, joints two and four equal in length, fifth slightly shorter. *Prothorax* quadrate, just visibly wider than the head; sides feebly convergent toward base and very feebly arcuate; base and apex broadly, equally and not strongly arcuate; apical angles rather narrowly rounded, basal very broadly so; disk transversely and rather feebly convex, finely, densely and evenly punctate; punctures rounded, feebly impressed and distant by about their own widths; median line almost entire, very narrow. *Elytra* at base very slightly wider than the pronotum; sides nearly parallel and feebly arcuate, more strongly so behind; together broadly, evenly and very feebly sinuate at apex; disk one-fourth longer than wide and one-third longer than the prothorax, narrowly impressed along the feebly elevated suture, except toward tip, where the impression is obsolete, finely, rather densely and sub-asperately punctate; punctures scarcely perceptibly smaller toward the apex. *Abdomen* distinctly narrower at base than at the fourth segment, slightly narrower than the elytra; sides feebly arcuate; sides of the fifth segment distinctly convergent toward tip; surface transversely and finely strigate in very disconnected wavy lines. *Legs* slender; first joint of the posterior tarsi about as long as the next two together, second as long as the fifth. Length 3.0 mm.

Monterey Co., 5.

This species is distinguished from *contractum* by its smaller size, shorter and broader head, which is also more sparsely punctate, and by the form of the prothorax, in which the sides are feebly but distinctly convergent from apex to base. The type is a male, the sixth segment being rather broad and sinuate at apex; the sinus is broadly rounded and about four times as wide as deep. In *contractum* the sinus is much more acutely rounded, although about equally deep, the sides being more gradually recurved exteriorly.

8—*C. tantillum* n. sp.—Very slender; head black; abdomen piecous-black; pronotum and elytra castaneous, the latter slightly paler at tip; legs rather pale brownish, tarsi paler, brownish-flavate; antennæ uniformly dark rufous-fuscous throughout; pubescence of elytra and abdomen very fine, moderately sparse and not conspicuous. *Head* moderate, slightly longer than wide, sides parallel and almost straight; base truncate, angles narrowly rounded; surface moderately convex, rather coarsely and sparsely punctate, with a rather wide median impunctate area; antennæ slender, short, much shorter than the head and prothorax together; basal joint as long as the next two together, second slightly shorter and more robust than the third, as long as the fourth. Outer joints very slightly wider, tenth as wide as long. *Prothorax* quadrate, scarcely perceptibly wider than the head; sides just visibly convergent from apex to base and nearly straight; base and apex broadly, equally and rather strongly arcuate; apical angles rather broadly rounded, basal very broadly so; disk transversely and moderately convex, very minutely, feebly, evenly and rather sparsely punctate, with a narrow but entire and rather well-marked median impunctate line; punctures very feebly impressed and separated by about three times their own widths; surface feebly alutaceous. *Elytra* at base very slightly wider than the pronotum; sides parallel and very feebly arcuate; together broadly, sub-angularly and moderately sinuate at apex; disk nearly one-third longer than wide, and nearly one-half longer than the pronotum, narrowly impressed along the slightly elevated suture, rather finely, densely and sub-asperately punctate; punctures smaller near the apex. *Abdomen* very slightly narrowed toward base, nearly as wide as the elytra; surface moderately convex, very minutely, sub-asperately, feebly and rather sparsely punctate. *Legs* slender; first joint of the posterior tarsi as long as the next two together, about as long as the fifth; second distinctly shorter than the third and fourth combined. Length 2.8 mm.

Santa Clara, Co., 4.

Described from the male in which the sixth segment is sinuate at tip, the sinus being moderately broadly rounded and between three and four times as wide as deep.

This species is at once distinguishable from all the others above described by the abdominal punctuation which is not arranged in very well-defined wavy lines, by the more sparse and minute pronotal punctuation, and by the rather strong dilatation of the joints of the anterior tarsi in the males. It is also the smallest species of the genus.

OLIGOPTERUS n. gen.

The very small species constituting the sole representative of this genus, is very singular and totally distinct in

appearance from those of the preceding group. The head, instead of being small is rather large and very coarsely punctate, the prothorax being slightly elongate and rather strongly narrowed from apex to base; the elytra are equal in length to the pronotum in the male and slightly shorter in the female, with the sides strongly divergent posteriorly, having the surface depressed and very coarsely punctate.

9—*O. cuneicollis* n. sp.—Rather slender; head and abdomen piceous-black; elytra dark blackish-castaneous; pronotum dark rufo-fuscous; legs brownish-piceous, tibiae slightly paler, tarsi still paler; antennae and under surface anteriorly dark rufo-fuscous, the former much paler toward the base and apex; abdomen black, with the extreme apices of the segments paler; head and pronotum nearly glabrous, elytra and abdomen finely and rather densely pubescent; integuments polished. *Head* very slightly longer than wide; sides parallel and slightly arcuate; base truncate, feebly sinuate in the middle, angles rather broadly rounded; eyes very small, at three times their length from the base; surface rather depressed, coarsely and rather sparsely punctate, with a very narrow median impunctate line; epistoma rather strongly produced, sides convergent to the apex and feebly sinuate; apex truncate; antennal tuberculations small and rather prominent; between them there are two small, oblique, impressed foveae, each having a small setigerous puncture posteriorly; antennae rather short, scarcely as long as the head and prothorax together; basal joint slightly longer than the next two together, second more robust but scarcely shorter than the third. *Prothorax* scarcely narrower than the head; sides distinctly convergent from apex to base and slightly arcuate; base broadly and feebly arcuate; apex with the sides very strongly convergent to the neck, which is one-third as wide as the disk and broadly and feebly emarginate; anterior angles obtuse and rather broadly rounded, basal equally so; disk transversely and rather strongly convex, slightly longer than wide, rather finely and moderately densely punctate, with a narrow, entire, impunctate median line. *Elytra* at base slightly narrower than the pronotum; sides rather strongly divergent posteriorly and feebly arcuate; together broadly and feebly sinuate at the apex; disk depressed, very slightly longer than wide, as long as the pronotum, very coarsely, sub-asperately and rather densely punctate. *Abdomen* at base very slightly narrower than the elytra; sides very feebly divergent posteriorly and distinctly arcuate; surface minutely, feebly, densely, sub-asperately and irregularly punctate. *Legs* very slender; first joint of the posterior tarsi fully as long as the next two together. Length 2.4-2.6 mm.

San Francisco, 5.

The elytra are, except near the apex, narrowly impressed along the slightly elevated suture. The type is a male, the

sexual characters being merely a slight emargination at the apex of the sixth segment, slightly wider than deep and not at all rounded, triangular. This species cannot be confounded with any other here described; it is the smallest of this group of genera which has been thus far discovered.

LITHOCHARIS Lacord.

Group A.

We have here another group, of four species, remarkably distinct from either of the preceding. The size is larger than in any of the other genera, and the large, sub-triangular, very finely and densely punctate heads with their very minute eyes, give them a very peculiar appearance which renders them immediately recognizable. The elytra are short, sometimes equal in length to the prothorax and never very much longer. The sides of the prothorax are usually very distinctly convergent from apex to base, and are sometimes feebly sinuate in the middle.

10—*L. sinuatocollis* n. sp.—Form rather slender; elytra and abdomen dark fuscous, the latter paler at tip; head and pronotum slightly paler, dark rufotestaceous; antennæ dark fuscous, paler at the apex; legs rather pale ferruginous throughout; pubescence rather sparse. *Head* rather large, much longer than wide, broadly sinuate at base, angles rather broadly rounded; sides long, very feebly convergent anteriorly and distinctly arcuate; epistoma very broad, moderately produced, apex truncate; surface broadly and moderately convex, rather finely and densely punctate, very feebly alutaceous; punctures feebly impressed, distant by nearly twice their own widths; median impunctate area rather narrow; eyes very small at nearly four times their own length from the base; antennæ slender, much shorter than the head and prothorax together; basal joint as long as the next two together, second and third sub-equal in length, the former slightly more robust and much more oval, distinctly longer than the fourth, tenth slightly wider than long. *Prothorax* quadrate, very slightly narrower than the head; sides rather strongly convergent posteriorly throughout and feebly sinuate in the middle; base broadly truncate in the middle, arcuate at the sides; apex broadly arcuate, feebly and roundly emarginate in the middle third; anterior angles rather broadly rounded, basal slightly more broadly so; disk moderately convex, finely, rather feebly and sparsely punctate; median line equal throughout the length, moderate in width. *Elytra* at base very slightly narrower than

the pronotum; sides moderately strongly divergent and feebly arcuate toward the apex; together broadly and feebly sinuate behind; disk about as long as wide; as long as the pronotum, depressed, feebly impressed throughout near the suture which is feebly elevated, rather coarsely, moderately densely and sub-rugulose punctate. *Abdomen* at base very nearly as wide as the elytra; sides just visibly divergent posteriorly and straight; surface very minutely, densely, irregularly, feebly and sub-asperately punctate. *Legs* long and slender; tarsi rather short, first joint of the posterior much shorter than the next two together, scarcely as long as the fifth, one-third longer than the second; first four joints uniformly decreasing in length. Length 4.6 mm.

Humboldt Co. (Hoopa Val.), 2 ♀.

The anterior tarsi are feebly dilated toward base. This species may be readily recognized amongst the large species with short elytra, by its much paler color, slightly coarser and sparser cephalic punctuation, and by the distinctly sinuate sides of the prothorax.

11—*L. convergens* n. sp.—Form moderately robust, black throughout; legs dark piceous-brown, tarsi paler, testaceous; antennæ fuscous, paler toward the apex; pubescence very fine, rather long, very sparse anteriorly, more dense on the elytra, still denser and more sericeous on the abdomen. *Head* large, broadly sinuate at base, angles rather broadly rounded; sides long, feebly convergent anteriorly, distinctly and evenly arcuate; eyes very small; epistoma very slightly produced, broad, squarely truncate at apex; surface finely and densely punctate, very feebly alutaceous; punctures rather feebly impressed, distant by scarcely more than their own widths above; median line narrow; antennæ one third longer than the head, rather slender, second joint distinctly shorter than the third, very slightly longer than the fourth, tenth slightly wider than long. *Prothorax* widest at the apex where it is slightly narrower than the head and distinctly wider than long; sides moderately strongly convergent posteriorly, very feebly end evenly arcuate; base broadly and rather feebly arcuate; apex rather more strongly arcuate, broadly sinuate in the middle two-fifths; anterior angles rather broadly rounded, basal very broadly so; disk finely, very feebly and sparsely punctate, with an entire and rather wide median impunctate area, and, especially toward base, a very fine and feebly impressed median stria. *Elytra* at base distinctly narrower than the pronotum; sides rather strongly divergent and nearly straight; together broadly, feebly and sub-angularly sinuate at the apex; disk about as wide as long, slightly longer than the pronotum, depressed, feebly impressed along the slightly elevated suture, except at the apex, moderately coarsely, densely and evenly punctate; punctures feebly sub-rugulose. *Abdomen* at base distinctly narrower than the elytra; sides slightly divergent posteriorly; surface very finely, densely, irregularly and sub-asperately punctate. *Legs* rather short and slen-

der; first four joints of the posterior tarsi decreasing uniformly and rather rapidly in length, fourth longer than wide and one-half as long as the first. Length 4.5 mm.

San Mateo Co., 1 ♀ (Mr. Fuchs).

The anterior tarsi are very distinctly dilated toward base. This species can be at once recognized by its black color, slightly transverse prothorax, and the sides of the latter, which are slightly arcuate and not at all sinuate.

12—*L. lepida* n. sp.—Rather robust, dark piceous throughout, head and pronotum scarcely perceptibly paler; abdomen very slightly paler at the immediate apex; legs pale, ferruginous-yellow; antennæ dark fuscous, pale testaceous at tip, basal joint dark rufous; pubescence rather long and dense on the elytra and abdomen, denser and more sericeous on the latter, elsewhere very sparse; integuments very feebly alutaceous, shining. *Head* large, sub-triangular; base broadly and feebly sinuate, angles rather broadly rounded; sides very feebly convergent anteriorly, long, distinctly arcuate; epistomal apex broad, squarely truncate; antennal tuberculations very small and rather feeble; surface finely, densely and evenly punctate; median line rather narrow; antennæ slender, much shorter than the head and prothorax together, second joint distinctly shorter than the third and slightly longer than the fourth, tenth as long as wide. *Prothorax* as long as wide, distinctly narrower than the head; sides feebly convergent from apex to base, straight in the middle; base broadly truncate in the middle; basal angles broadly rounded, apical very slightly less so; sides thence very strongly convergent and straight to the nuchal emargination, which is more than one-third as wide as the disk and very broadly rounded; disk transversely and very feebly convex above, strongly and rather abruptly so at the sides, finely and feebly punctate, sparsely so near the middle, more coarsely and closely at the sides; median line rather broad, equal throughout; very near the base there is a very feeble median stria. *Elytra* at base just perceptibly narrower than the pronotum; sides feebly divergent posteriorly and nearly straight; together broadly and extremely feebly sinuate behind; disk distinctly longer than wide and slightly longer than the pronotum, rather depressed, narrowly impressed along the slightly elevated suture, rather finely, evenly, densely and sub-rugulose punctate. *Abdomen* at base very slightly narrower than the elytra; sides very feebly divergent posteriorly, nearly straight; surface very minutely and densely, feebly and sub-asperately punctate. *Legs* moderate; first joint of the posterior tarsi one-half longer than the second, slightly longer than the fifth. Length 5.0 mm.

Santa Clara Co., 3.

The description is taken from the male, in which the fifth segment is transversely truncate at apex, the edge being

very broadly and feebly undulated and with a transverse row of stiff recumbent setae slightly within the margin; sixth broadly and deeply sinuate, the sinas being twice as wide as deep and very broadly rounded anteriorly; seventh narrowly divided. The species is easily distinguishable from the preceding two by its much longer elytra in both the male and female.

13—*L. puberula* n. sp.—Moderately slender, piceous-black throughout, abdominal apex not noticeably paler; legs dark reddish-brown; antennae fuscous, apex paler; head and pronotum sparsely, rather coarsely and somewhat distinctly pubescent; pubescence of the elytra and abdomen rather long, coarse and somewhat dense, rather conspicuous, pale fulvous throughout; integuments very feebly alutaceous, shining. *Head* moderate; base broadly and very feebly sinuate, angles rather narrowly rounded; sides parallel and distinctly arcuate, slightly more strongly so behind; epistomal apex moderate in width, broadly and very feebly arcuate; surface very finely, densely and extremely feebly punctate; median line narrow, interrupted at the base and with an elongate very feebly elevated ridge anteriorly; antennae very slightly shorter than the head and prothorax together; slender, second joint two-thirds as long as the third and distinctly longer than the fourth, tenth very slightly wider than long. *Prothorax* quadrate, just visibly narrower than the head; sides feebly convergent posteriorly throughout and very feebly arcuate; base broadly truncate in the middle; apical angles rather broadly rounded, basal very broadly so; disk transversely and rather strongly convex very finely, feebly and sparsely punctate, more densely so at the sides; median line broad and well marked, having a short impressed median stria near the base. *Elytra* at base sub-equal in width to the pronotum; sides rather feebly divergent posteriorly and very feebly arcuate; together broadly and moderately sinuate behind; disk very slightly longer than the pronotum, slightly longer than wide, moderately depressed, narrowly impressed along the slightly elevated suture, moderately coarsely, closely and sub-granulose punctate, the punctures being extremely minute and at the summits of fine elevated granules. *Abdomen* at base nearly as wide as the elytra; sides very feebly divergent posteriorly and nearly straight, very minutely, feebly, irregularly and sub-asperately punctate, the bases of the basal segments being impunctate. *Legs* rather robust; first joint of the posterior tarsi very slightly longer than the second, nearly twice as long as the fourth; anterior tarsi narrowly dilated. Length 4.8 mm.

Lake Co., 1 ♂ (Mr. Fuchs).

Sexual characters nearly as in *lepida*, the sinuation of the sixth segment being very broadly rounded and three times

as wide as deep. This species is distinguished from *sinuacollis* and *convergens* by its longer elytra and shape of the pronotum, from *lepida* by its sexual characters, denser pubescence, color, and especially by its much narrower, more densely punctate, and more parallel head.

Group B.

The species here assigned to this group of the genus are in general quite homogeneous in appearance, the elytra being always much longer than the prothorax, and the pronotum always very sparsely and feebly punctate in the middle, with a broad median impunctate area. They, however, vary in the degree of density of the cephalic punctuation, in the prominence of the basal angles, and slightly in the form of the pronotum, this generally being nearly quadrate with the sides parallel, but sometimes having the sides distinctly convergent from apex to base, and being in some cases slightly wider than long and in others longer than wide, within, however, very narrow limits. The head is usually moderate in size, sub-quadrate, and never very much wider than the prothorax.

14—*L. malaca* n. sp.—Rather robust, depressed; piceous-black, abdomen paler at tip; pronotum slightly paler, dark rufo-fuscous; legs pale yellowish-testaceous throughout; antennæ fuscous, pale testaceous at tip; pubescence sparse anteriorly, rather coarse, dense and conspicuous on the elytra and abdomen; integuments strongly shining, very feebly sub-alutaceous. *Head* rather large, slightly longer than wide; sides moderately long and distinctly arcuate; base broadly truncate, angles rather broadly rounded; eyes moderate, at twice their length from the base; epistoma moderately produced, very broad, sides strongly convergent to the apex, which is squarely truncate; antennal tuberculations very small, rather prominent; surface very even, moderately convex, very finely, evenly and densely punctate, with a narrow, even, impunctate line in the middle; antennæ slightly shorter than the head and prothorax together; basal joint nearly as long as the next three together, second very slightly shorter than the third and longer than the fourth, tenth as long as wide. *Prothorax* very slightly wider than long and just visibly narrower than the head; sides very feebly convergent throughout and very slightly arcuate; base and apex broadly, moderately and almost equally arcuate, the former sub-truncate in the middle; anterior angles

rather broadly rounded, basal slightly more broadly so; apical emargination feeble, one-third as wide as the disk; the latter transversely and very moderately convex, very finely, feebly and sparsely punctate in the middle, more strongly and densely so near the sides, with a wide median impunctate area, having a very small feeble impression near the base. *Elytra* at base distinctly wider than the pronotum; sides parallel and very slightly arcuate; together broadly and rather feebly sinuate behind; disk transversely and moderately convex, narrowly impressed along the distinctly elevated suture, very finely, rather densely and sub-granulose punctate, scarcely one-fourth longer than wide, two-fifths longer than the pronotum. *Abdomen* at base very slightly narrower than the elytra; sides parallel and feebly arcuate: surface very minutely, densely, irregularly and sub-asperately punctate. *Legs* robust; first joint of the posterior tarsi one-third longer than the second. Length 4.3 mm.

Santa Clara Co., 1 ♂.

The fifth ventral segment is broadly emarginate in its middle, three-fourths at apex, the emargination being broadly rounded and six times as wide as deep; in the middle there is a short and very broad porrected process at the bottom of the notch, which is broadly and feebly sinuate at its apex, each side of the emargination having elsewhere a porrected fringe of short, robust, very closely-placed spinules, about eleven in number; sixth segment deeply emarginate at apex, the notch being parabolic in outline and slightly wider than deep, exterior angles slightly rounded; seventh narrowly divided.

This species is distinguished from all the others in this division of the genus by its rather large and very minutely punctate head. The anterior tarsi are rather strongly dilated and clothed beneath with very short, pale, densely-placed papillæ.

15—*L. latiuscula* n. sp.—Rather robust and depressed; head and abdomen piceous-black, the latter very slightly paler at the apex; pronotum dark rufous; elytra much paler, rufous throughout; labrum, palpi and legs colorless, pale reddish-flavate throughout; antennæ fuscous; base dark rufous, apex testaceous; pubescence very sparse anteriorly, long, very fine and rather sparse on the elytra and abdomen; integuments polished, very finely sub-alutaceous. *Head* moderate, slightly wider than long exclusive of the labrum which is large and prominent; teeth very small, acute; base broadly truncate angles rather broadly rounded; sides parallel and nearly straight; surface

rather coarsely, very feebly and rather sparsely punctate; median impunctate area rather broad, sub-fusiform; epistoma moderately produced, broad, feebly and abruptly arcuate in the middle at the apex; antennal tuberculations small and rather conspicuous; antennæ nearly as long as the head and prothorax together; basal joint as long as the next two combined, second more than twice as long as wide, very slightly shorter than the third, distinctly longer than the fourth, tenth as long as wide. *Prothorax* slightly wider than long, very slightly narrower than the head; sides distinctly convergent posteriorly throughout and nearly straight; basal angles very obtuse and very slightly rounded, sides of the base thence strongly convergent and broadly arcuate to the median portion which is almost squarely truncate; apex broadly and very feebly arcuate; nuchal emargination very feeble, nearly one-half as wide as the disk; apical angles rather narrowly rounded; disk rather coarsely, excessively feebly and very sparsely punctate; median impunctate area broad, equal throughout, surface not impressed. *Elytra* at base slightly wider than the pronotum; sides almost parallel and very slightly arcuate; together broadly, sub-angularly and very feebly sinuate behind; disk broadly and feebly convex, narrowly and rather strongly impressed along the slightly elevated suture, scarcely one-fourth longer than wide, one-third longer than the pronotum, rather finely, evenly, strongly, rather densely and sub-asperately punctate. *Abdomen* rather short and broad, slightly narrower than the elytra; sides parallel and slightly arcuate; surface very finely, densely and sub-asperately punctate. *Legs* rather short and robust; anterior tarsi slightly dilated; first joint of the posterior one-half longer than the second, nearly twice as long as the fourth and slightly shorter than the fifth. Length 4.1 mm.

Lake Co., 1 (Mr. Fuchs); Southern Cal., 1 (Mr. G. W. Dunn).

The two specimens, of which the first is the type, are both females, and agree tolerably well together, although the one from the possible neighborhood of Los Angeles, has the head slightly narrower and more strongly arcuate behind with the basal angles more broadly rounded, the prothorax very slightly longer, and the elytra very slightly shorter and more finely punctate. There is a strong probability of its being at least a well-marked variety, although lack of material prevents any judgment as to the amount of specific variation; in other portions of this group, however, where the material is ample, the specific variation is seen to be very slight.

16—*L. sublesta* n. sp.—Very moderately robust; head and abdomen black, the latter scarcely paler at tip; pronotum very dark fuscous; elytra dark yellowish-rufous; labrum and antennæ fuscous, the latter pale testaceous toward tip; palpi slightly paler, brownish; legs pale brownish-flavate throughout; pubescence very sparse anteriorly, moderately dense and fine on the elytra, very dense, fine and sericeous on the abdomen; shining. *Head* moderate, as long as wide; base broadly arcuate, angles broadly rounded; sides parallel and nearly straight; eyes at nearly twice their length from the base, somewhat prominent; epistoma moderately produced, truncate at tip; labrum moderate in size; occiput moderately convex, finely and somewhat densely punctate, more sparsely so in the middle; median impunctate area narrow; antennæ nearly as long as the head and prothorax together, basal joint scarcely as long as the next two combined, second nearly as long as the third, slightly longer than the fourth, tenth as long as wide. *Prothorax* very slightly wider than long, equal in width to the head; sides parallel and feebly arcuate; base broadly, evenly and moderately arcuate throughout; apex very feebly arcuate; nuchal emargination excessively feeble, rather wide; apical angles rather broadly rounded, basal more broadly so; disk transversely, evenly and feebly convex, finely margined along the base, extremely feebly, finely and sparsely punctate above, three times as densely so near the sides; median impunctate area rather broad. *Elytra* at base distinctly wider than the prothorax; sides parallel and feebly arcuate; together broadly and very feebly sinuate behind; disk depressed above, strongly convex at the sides, narrowly and distinctly impressed along the slightly elevated suture, one-fifth longer than wide and nearly one-half longer than the pronotum, very minutely, rather feebly, densely, evenly and sub-asperately punctate. *Abdomen* very slightly narrower than the elytra; sides parallel and very feebly arcuate; surface minutely, exceedingly densely and evenly punctato-asperate. *Legs* rather long and slender; anterior tarsi rather strongly dilated, posterior long and slender, first joint about one-fourth longer than the second, slightly shorter than the fifth and as long as the third and fourth together. Length 4.2 mm.

Napa Co., 1 ♂.

The fifth segment is broadly impressed in the middle throughout its length; the apex is very broadly emarginate, the sides of the notch being rather feebly convergent anteriorly and each having a fringe of about eight robust spinules; in the middle of the emargination there is a very short broad process, broadly arcuate posteriorly; sixth segment parabolically emarginate, notch one-half wider than deep; seventh narrowly divided.

17—*L. consanguinea* n. sp.—Moderately robust and depressed; head, pronotum and abdomen black, the latter very slightly paler at the apex; elytra dark

piceo-castaneous; femora piceo-castaneous, tibiæ and tarsi paler, brownish-rufous; antennæ piceous at base, becoming fuscous in the middle and pale testaceous at tip; palpi fuscous; integuments polished, very feebly sub-alutaceous; pubescence anteriorly very sparse, that of the elytra coarse, not very dense, that of the abdomen more than twice as dense, sericeous, fulvous and conspicuous. *Head* moderate, as long as wide; base broadly and very feebly arcuate, angles rather broadly rounded; sides parallel and extremely feebly arcuate; epistoma rather strongly produced, broad, truncate at tip; antennal tuberculations small, rather prominent; surface rather finely and moderately densely punctate; median line narrow, continuous throughout; antennæ slightly shorter than the head and prothorax together; second joint distinctly shorter than the third, very slightly longer than the fourth. *Prothorax* large, just visibly wider than the head, slightly wider than long; sides parallel, extremely feebly arcuate; base broadly, evenly and rather strongly arcuate; apex broadly and very feebly so; nuchal emargination one-third as wide as the disk, very feeble; apical angles rather narrowly rounded, basal broadly so; disk transversely, nearly evenly and rather feebly convex, finely, very feebly and rather sparsely punctate in the middle, slightly more densely so at the sides; median impunctate area broad, equal, narrowly, very feebly and longitudinally impressed near the base. *Elytra* at base distinctly wider than the pronotum; sides very slightly divergent posteriorly and slightly arcuate, together broadly and rather strongly sinuate behind; disk feebly convex, narrowly impressed along the slightly elevated suture, more strongly so at one-third the length from the apex, finely, deeply, sub-asperately, evenly and rather densely punctate; slightly longer than wide, and less than one-third longer than the pronotum. *Abdomen* rather short and broad, as wide as the elytra; sides parallel and distinctly arcuate; surface minutely very densely and sub-asperately punctate. *Legs* slender; first joint of the posterior tarsi one-third longer than the second, nearly as long as the third and fourth together. Length 4.2 mm.

San Francisco, 1 ♀.

This species may be distinguished from the preceding by its shorter and more coarsely and sparsely punctured elytra, its much longer and more evenly punctate pronotum, and especially by its different coloration.

18—*L. contigua* n. sp.—Form rather slender, rather strongly convex; head, pronotum and abdomen black, the latter very slightly paler at tip; elytra piceous-black, immediate apex slightly paler; femora castaneous, tibiæ and tarsi fuscous; labrum, palpi and antennæ piceous, the latter paler and fuscous toward tip; pubescence of the anterior portions sparse, of the elytra moderately dense, long, rather coarse, of the abdomen dense, somewhat sericeous, fulvous; integuments polished, not at all alutaceous. *Head* rather small, distinctly longer than wide; base truncate, angles rather broadly

rounded; sides parallel, nearly straight; epistoma rather strongly produced, broadly and very feebly arcuate at the apex; antennal tuberculations minute and slightly prominent; labrum rather large teeth minute, very acute; antennæ slightly shorter than the head and prothorax together, second joint two-thirds as long as the third and scarcely longer than the fourth; occiput rather convex, somewhat finely, evenly and sparsely punctate; punctures round and rather deep; median impunctate area rather broad, equal throughout, well-marked. *Prothorax* quadrate, just visibly narrower than the head; sides parallel and nearly straight; base broadly, rather strongly and evenly arcuate; apex broadly and very feebly so; nuchal sinuation very feeble, two-fifths as wide as the disk; apical and basal angles rather broadly and nearly equally rounded; disk transversely, evenly and rather strongly convex, finely margined along the base, very finely, feebly and somewhat sparsely punctate in the middle, twice as densely so at the sides; median impunctate area equal throughout, moderately wide, with a very fine feeble median stria near the base. *Elytra* at base distinctly wider than the prothorax; sides parallel and feebly arcuate; together broadly, sub-angularly and distinctly sinuate behind disk one-fourth longer than wide, nearly one-half longer than the pronotum, feebly impressed along the slightly elevated suture, rather finely, densely, strongly and rugulose-punctate, the punctures being in transverse wavy series near the apex. *Abdomen* slightly narrower than the elytra; sides parallel and nearly straight; surface very minutely, densely and sub-asperately punctate. *Legs* rather long and slender; first joint of the posterior tarsi one-half longer than the second, shorter than the next two together, fully as long as the fifth; anterior tarsi very slightly dilated. Length 4.3 mm.

San Mateo Co., 1 ♂ (Mr. Fuchs).

The fifth segment is very broadly emarginate nearly throughout its width at apex, the sides of the notch being straight, very strongly convergent, and each having a fringe of seven stout, equal and closely-placed spinules; median projected process very short and broad, very strongly sinuate at the apex; sixth segment parabolically emarginate at apex, notch nearly twice as wide as deep; seventh broadly divided, incisure in the form of a very elongate acute triangle.

This species is remarkable for the unusually elongate basal joint of the posterior tarsi, which, however, comes well within the generic definition. It bears a considerable resemblance to *consanguinea*, but differs in the narrower form, and especially in the form of the pronotum, which is as long as wide in the present species and slightly, though

very distinctly, wider than long in the former. It is true that the sexes in these cases are different, but on examining a full series of a closely-allied species—*retrusa*—described below, it is readily seen that the sexual differences in the general form of the body, even of the head, are almost absolutely inappreciable; it is in fact a forcible instance of what Dr. LeConte (Trans. Am. Ent. Soc. VI, p. 213) calls the polarity and, it might be added, concentration of sexual characters. Here we have the sexual modifications at the abdominal vertex extremely well marked, elsewhere, however, if we except a slightly longer second antennal joint in the males, they are not at all apparent.

19—*L. luctuosa* n. sp.—Form slender; head, pronotum and abdomen throughout black; elytra rufo-piceous, not paler at tip; legs dark brownish-flavate; antennæ piceous, pale at the tip; pubescence almost absent anteriorly, moderately sparse and fine on the elytra, somewhat dense on the abdomen; integuments polished. *Head* moderate, distinctly longer than wide; base truncate in the middle, angles rather narrowly rounded, sides parallel and very feebly arcuate; vertex moderately produced, truncate at apex, feebly arcuate in the middle; punctures feeble, small and rather sparse; median line rather broad, equal throughout; antennæ distinctly shorter than the head and prothorax together; basal joint distinctly longer than the next two combined, second slightly shorter than the third, sub-equal to the fourth. *Prothorax* fully as long as wide, equal in width to the head; sides excessively feebly convergent posteriorly throughout and very feebly arcuate; base broadly sub-truncate in the middle; apex broadly, rather feebly and equally strongly arcuate; nuchal sinuation feeble, two-fifths as wide as the disk; anterior angles rather narrowly rounded, basal broadly so; disk transversely, evenly and moderately convex, very feebly, finely and rather sparsely punctate in the middle, more closely so at the sides; median impunctate area moderate in width, even throughout, not impressed. *Elytra* at base slightly wider than the pronotum; sides parallel and feebly arcuate; together broadly, roundly and rather feebly sinuate behind; disk less than one-third longer than the pronotum, one-fourth longer than wide, feebly and narrowly impressed along the slightly elevated suture, finely, feebly, evenly, sub-asperately and rather sparsely punctate. *Abdomen* slender, scarcely narrower than the elytra; sides straight and parallel; surface minutely, very densely, sub-asperately and evenly punctate. *Legs* rather slender; first joint of the posterior tarsi one-third longer than the second, much shorter than the fifth; anterior tarsi slightly dilated. Length 4.2 mm.

San Francisco, 1 ♀.

This species, though closely allied to the preceding, differs from it in such an assemblage of minor characters as to leave very little doubt of its distinctness; among these are its more slender form, still more slender prothorax, and more particularly the elytral punctuation which is decidedly more sparse, feebler and less rugulose; the abdomen also is not pale at tip, and the elytra are paler in color in *luctuosa*.

20—*L. retrusa* n. sp.—Moderately robust; head, pronotum and abdomen throughout black; elytra dark rufo-piceous, scarcely perceptibly and gradually paler toward the apices; legs rather pale brownish; antennæ, labrum and palpi piceous-black, the former slightly paler toward tip; pubescence sparse anteriorly, rather dense and very fine on the elytra, twice as dense, very short and fine on the abdomen, not very conspicuous; integuments polished. *Head* moderate; base broadly and distinctly arcuate, angles very broadly rounded; sides behind the eyes rather short, parallel and nearly straight; surface slightly longer than wide, finely, extremely feebly and rather densely punctate; median line rather broad; epistoma very short, rather narrow, truncate at apex; labrum moderate, teeth small, approximate, rather long and very acute; antennæ nearly as long as the head and prothorax together, second joint distinctly shorter than the third, slightly longer than the fourth. *Prothorax* rather large, quadrate, just visibly wider than the head; sides parallel and nearly straight; base broadly, very evenly and rather strongly arcuate throughout; apex feebly arcuate; nuchal emargination two-fifths as wide as the disk, broadly and distinctly rounded; apical angles rather narrowly rounded, basal scarcely more broadly so, very obtuse; disk very finely margined along the base, broadly, nearly evenly and moderately convex, very minutely, feebly and sparsely punctate in the middle, twice as densely, but still rather sparsely so at the sides; median line rather broad, equal throughout. *Elytra* at base distinctly wider than the pronotum; sides nearly parallel, feebly arcuate posteriorly; together broadly, roundly and distinctly sinuate behind; disk one-fifth longer than wide, one-third longer than the pronotum, rather broadly and strongly impressed along the slightly elevated suture, more distinctly impressed near the scutellum, very finely, rather feebly and very densely punctate; punctures sub-asperate and distinctly finer and denser toward the apex. *Abdomen* very slightly narrower than the elytra; sides parallel and very nearly straight; surface very minutely, evenly, excessively densely feebly and sub-asperately punctate. *Legs* rather slender; first joint of the posterior tarsi one-fourth longer than the second, much shorter than the fifth; anterior tarsi very slightly dilated; posterior tibiae obliquely and feebly excavated exteriorly at the apex, the excavation being smooth and glabrous, and bounded internally by a dense row of closely-placed and very fine erect spinules. Length 4.1-4.3 mm.

Mendocino Co. (Anderson Val.), 5.

This very distinct species may be recognized immediately by its rather narrow head, broadly rounded behind, and having the basal angles almost obsolete. The type is a male; the fifth segment is broadly emarginate almost throughout its width at apex, the sides of the notch being very strongly convergent and distinctly incurvate, each bearing a porrected fringe of nine robust, black, short and rather closely-placed spinules; the porrected process at the bottom of the emargination is very short and rather narrow, scarcely wider than the fimbriate sides; it is broadly and feebly sinuate at apex; sixth segment parabolically emarginate at tip, the notch being slightly wider than deep, exterior angles narrowly rounded; seventh narrowly and acutely incised or divided along its lower surface as in the preceding species.

The structure of the posterior tibiæ is peculiar to the genus as far as I have observed.

21—*L. gregalis* n. sp.—Moderately slender, black, abdomen scarcely paler at tip; elytra slightly piceous; legs dark castaneous, tibiæ toward tip and tarsi paler; antennæ piceous-black at base, fuscous in the middle, testaceous at tip; pubescence sparse anteriorly, rather long, dense and coarse on the elytra, very fine, dense and short on the abdomen, not conspicuous; integuments polished. *Head* rather large, as wide as long; base broadly and feebly arcuate, angles broadly rounded; sides parallel and distinctly arcuate; epistoma broad, moderately produced, truncate; antennal tuberculations small, rather prominent; labrum moderate, teeth slightly deflexed, small, equilatero-triangular, antennæ distinctly shorter than the head and prothorax together, second joint slightly shorter and distinctly more robust than the third, distinctly longer than the fourth; surface rather strongly convex, finely, very feebly and densely punctate; median line rather wide. *Prothorax* moderate, slightly longer than wide, very slightly narrower than the head; sides parallel, nearly straight in the middle; base broadly and feebly arcuate, broadly sub-truncate in the middle; apex strongly and evenly arcuate at the sides; nuchal emargination narrow, not one-third as wide as the disk, rather strongly incurvate; apical angles very broadly rounded, basal slightly more broadly so; disk transversely and moderately convex, very finely margined along the base, rather coarsely, very sparsely and excessively feebly punctate in the middle, much more finely, distinctly and densely so at the sides; median impunctate area rather broad. *Elytra* at base very slightly wider than the pronotum, scarcely wider than the head; sides very slightly divergent posteriorly and very feebly arcuate; together broadly, roundly and very feebly sinuate behind; disk one-fourth longer than wide, one-third

longer than the pronotum, very feebly convex, very broadly and feebly impressed along the very slightly elevated suture, finely, rather strongly and densely, sub-asperately and evenly punctate. *Abdomen* at base nearly as wide as the elytra; sides parallel and very feebly arcuate; surface very finely, sub-asperately and densely punctate. *Legs* slender; anterior tarsi very slightly dilated; first joint of the posterior nearly one-half longer than the second, sub-equal in length to the fifth. Length 3.5 mm.

Santa Clara Co, 11.

The type is a male, the sexual characters being of the same general order as in the preceding group of species, although distinctly modified; the fifth segment is broadly and rather feebly emarginate nearly throughout its width at apex, the sides of the notch being very strongly convergent and feebly incurvate, each having a porrected fringe of about thirteen robust, closely-placed spinules; the median porrected process is very narrow, about one-half as wide as the fimbriate sides, and exceedingly short, with the sides acute and not broadly rounded as in the preceding species; it is broadly, roundly and rather strongly emarginate throughout its width at apex, and has its surface smooth, glabrous and conically impressed; sixth segment broadly and parabolically emarginate at apex, the notch being twice as wide as deep, and having the edge at the bottom narrowly membranous; seventh segment broadly divided.

22—*L. mimula* n. sp.—Form rather slender, intense black throughout except the abdomen at tip which is slightly paler; legs rather dark brownish-flavate; antennæ black at base, becoming dark fuscous toward tip; pubescence very sparse anteriorly, long, coarse and rather sparse on the elytra, very fine and moderately dense on the abdomen; integuments polished. *Head* moderate; base truncate, angles rather narrowly rounded; sides parallel and nearly straight; surface scarcely as wide as long, moderately convex, very finely, moderately feebly and rather densely punctate; median line rather broad; epistoma moderate in width, slightly produced, broadly and feebly arcuate at the apex; antennal tuberculations small, rather prominent; labrum moderate in size, teeth broader than long, scarcely deflexed, distinct; antennæ slightly shorter than the head and prothorax together, basal joint rather robust. *Prothorax* scarcely perceptibly narrower than the head, slightly longer than wide; sides parallel, straight or very feebly sub-sinuate in the middle; base broadly and feebly arcuate, broadly sub-truncate in the middle; apex strongly

arcuate at the sides; nuchal emargination one-third as wide as the disk, strongly and evenly incurvate; anterior angles rather broadly rounded, basal slightly more broadly so; disk very evenly, moderately and transversely convex, punctured as in *gregalis*. *Elytra* at base distinctly wider than the prothorax and slightly wider than the head; sides nearly parallel, feebly arcuate; together broadly, roundly and moderately sinuate behind; disk scarcely perceptibly impressed along the very slightly elevated suture, one-fourth longer than wide, nearly one-half longer than the pronotum, finely, feebly, sub-asperately, evenly and not densely punctate. *Abdomen* rather narrow, at base distinctly narrower than the elytra; sides parallel and feebly arcuate; surface finely, feebly, sub-asperately and densely punctate. *Legs* slender; first joint of the posterior tarsi one-third longer than the second, distinctly shorter than the fifth. Length 3.3 mm.

Santa Cruz Co., 5; Santa Clara Co., 3; San Mateo Co., 3.

Described from the male; the fifth segment is broadly and feebly emarginate at apex, the sides of the emargination being extremely strongly convergent and feebly incurvate, each having a fringe of nine closely-placed spinules; the median process is very short, fully as wide as the fimbriate sides, its lateral extremities being in the form of strong acute porrected teeth, and having the apex broadly roundly and strongly emarginate throughout its width, its surface being scarcely perceptibly impressed; the remaining segments modified nearly as in *gregalis*. The species resembles the preceding to such an extent that great care is requisite in its identification; it is, however, distinguishable by its narrower head with straighter sides and much more narrowly rounded basal angles, by its longer elytra, which are also decidedly more sparsely and feebly punctate, and by its sexual characters. The pronotum and elytra are sometimes paler perhaps from immaturity.

23—*L. languida* n. sp.—Form rather slender, depressed; head black; abdomen piceous, slightly paler at tip; pronotum dark rufo-fuscous; sides and apex of the elytra broadly pale brownish-flavate, central and basal portions shaded darker, castaneous; legs pale flavate throughout; antennæ piceous-black at base, becoming gradually rather pale testaceous toward the apex; pubescence of the elytra and abdomen not very dense, fine and inconspicuous. *Head* nearly as wide as long; base truncate in the middle, angles moderately broadly rounded; sides parallel and nearly straight; surface moderately convex, rather

coarsely, very feebly and somewhat sparsely punctate; median line broad; epistoma moderately produced, broadly and feebly arcuate at apex; antennal tuberculations feeble, not prominent; antennæ nearly as long as the head and prothorax together, second joint slightly shorter than the third and much longer than the fourth, not very robust, third three times as long as wide. *Prothorax* just perceptibly narrower than the head, very slightly longer than wide; sides parallel, nearly straight in the middle; base and apex broadly, nearly evenly and rather strongly arcuate, the latter very slightly the more strongly so; nuchal emargination much more than one-third as wide as the disk, broadly and very feebly incurvate; anterior and posterior angles broadly and nearly equally rounded; disk broadly and rather feebly convex, rather coarsely, sparsely and excessively feebly punctate in the middle, the punctures becoming finer, more distinct and denser toward the sides; median impunctate area rather broad. *Elytra* at base distinctly wider than the prothorax, slightly wider than the head; sides parallel, feebly and nearly evenly arcuate; together broadly, roundly and moderately sinuate behind; disk one-fourth longer than wide and one-third longer than the pronotum, rather coarsely, densely, evenly and sub-asperately punctate. *Abdomen* at base distinctly narrower than the elytra; sides parallel and nearly straight; surface very minutely, feebly, densely and sub-asperately punctate; border rather narrow and deep, slightly paler in color. *Legs* slender; first joint of the posterior tarsi one-half longer than the second, sub-equal in length to the fifth. Length 4.0 mm.

Sonoma Co., 1 ♂.

Resembles the preceding two species in its elongate prothorax, but possessing a still different modification of the male sexual characters. The fifth segment is broadly emarginate nearly throughout its width at apex, the sides of the emargination being feebly convergent and nearly straight, each having a porrected fringe of seven rather widely-spaced spinules; the median process is very short and broad, being twice as wide as either of the fimbriate sides adjoining; it is broadly, feebly and evenly arcuate throughout its width at apex, and without any appearance of lateral teeth; sixth segment strongly and parabolically emarginate at apex, the notch being nearly one-half wider than deep.

METAXYODONTA n. gen.

In this genus, represented by two closely-allied species, the form and general appearance again differ most

decidedly from anything hitherto described; the head is small, triangular, with very large, coarsely granulated eyes, robust antennæ and with an entirely different structure of the labrum. The species are rather robust, and the integuments throughout are strongly alutaceous, this appearance being produced upon some portions of the body by an excessively minute and dense punctuation, and upon others by a correspondingly minute and dense granulation. The head in both of the forms here described is blackish, the remainder of the body, legs, labrum and antennæ being flavate or clouded slightly with brownish: they are very rare although the species may perhaps be relatively more numerous.

24—*M. alutacea* n. sp.—Rather robust; head fusco-castaneous or nearly piceous-black; pronotum and abdomen concolorous, pale castaneous; elytra still paler, brownish-testaceous; legs uniformly flavate; antennæ uniformly pale reddish-flavate throughout; palpi flavate; pubescence fine, moderately dense, coarser and more conspicuous on the elytra; integuments alutaceous. *Head* moderate, as wide as long; sides parallel, short and distinctly arcuate; base truncate, angles broadly rounded; eyes very large, at scarcely their own lengths from the basal angles, not prominent, rather coarsely granulate; epistoma rather strongly produced, sides strongly convergent toward the apex, truncate anteriorly; antennal tuberculations rather strong, small; surface moderately convex, extremely minutely and densely punctate, with a very narrow median impunctate line, having two widely distant, annular, setigerous punctures between the eyes and one behind each antennal tuberculation, also several small ones near and behind the eyes; antennæ rather robust, slightly longer than the head and prothorax together, basal joint about three times as long as wide, second two-thirds as long as the third, nearly as long as the fourth, joints four to ten decreasing in length, the latter scarcely as wide as long, eleventh ovoidal, obtusely acuminate, much shorter than the two preceding together. *Prothorax* very slightly wider than long, sub-equal in width to the head; sides very feebly convergent from apex to base, the latter narrowly truncate in the middle; apex broadly and rather feebly arcuate, narrowly and feebly sinuate in the middle; apical and basal angles equally and very broadly rounded; disk transversely and very feebly convex, extremely minutely and densely punctate; punctures slightly more sparse near the middle, where there is a very narrow and obscure median impunctate line. *Elytra* at base very slightly wider than the pronotum; sides nearly parallel, very slightly arcuate; together broadly and feebly sinuate at apex; outer angles rounded; disk quadrate, one-fourth longer than the pronotum, feebly convex, feebly impressed on the suture toward base, the suture not elevated, very minutely, evenly and densely granulose; the granulations

separated by more than their own widths and setigerous. *Abdomen* rather robust, nearly as wide as the elytra; border moderate; surface very minutely, feebly, densely and sub-asperately punctate, the asperities being arranged in very close, interrupted, transverse wavy lines. *Legs* moderate; anterior tarsi distinctly dilated, fourth joint slightly emarginate, first four joints of the posterior tarsi decreasing uniformly and very gradually in length, the first less than one-half longer than the second and much shorter than the fifth, fourth longer than wide. Length 3.8 mm.

Santa Clara Co., 1 ♂.

The fifth ventral segment is thickened in the middle third at apex, the edge being obliquely beveled and having a dense comb-like row of very minute, parallel, longitudinal black ridges or strigæ; sixth segment broadly and very strongly emarginate at apex, the emargination acutely rounded anteriorly and having at each side, slightly distant from the edge of the notch and at about the middle of its length, a small brush of very long densely-placed hairs; seventh segment very narrowly divided, truncate at tip, large and prominent.

25—*M. quadricollis* n. sp.—Form rather robust; head piceous-black; pronotum and elytra pale rufo-testaceous, the latter slightly the paler; abdomen pale brownish-fuscous; legs, antennæ, labrum and palpi concolorous, very pale flavate; pubescence sparse anteriorly, coarser, much denser and not very conspicuous on the elytra and abdomen, distinctly denser on the latter; integuments alutaceous. *Head* moderate, as wide as long; sides short, parallel; base truncate, angles rather broadly rounded and slightly prominent; surface moderately and evenly convex, extremely minutely and densely punctate, with a very narrow median line which is totally obliterated anteriorly; antennæ rather robust, as long as the head and prothorax together, second joint three-fourths as long as the third. *Prothorax* nearly quadrate; sides parallel and feebly arcuate; base broadly and rather feebly arcuate; apex broadly arcuate, very feebly and roundly emarginate in the middle third, with the edge at each side just without the emargination slightly sinuate; apical angles very narrowly rounded, basal broadly so; disk distinctly longer than the head, exclusive of the labrum, and very slightly wider, broadly and rather feebly convex, excessively minutely and densely punctate; punctures noticeably sparser toward the middle, where there is a very narrow imperfect impunctate line, and, near the base, a short median stria. *Elytra* very slightly wider than the pronotum; sides parallel and slightly arcuate; together broadly and extremely feebly sinuate at apex; disk slightly longer than wide, scarcely one-fourth longer than the pronotum, very mi-

nutely and densely granulate. *Abdomen* slightly narrower than the elytra; sides nearly parallel; surface minutely, densely and sub-asperately punctate, without any arrangement in wavy rows. *Legs* moderate; anterior tarsi moderately dilated; first four joints of the posterior decreasing uniformly and very gradually in length, the first one-half longer than the second and shorter than the fifth. Length 3.8 mm.

Lake Co., 1 ♂ (Mr. Fuchs).

This species is rather closely allied to the preceding, the sexual characters being almost identical, the surface of the fifth segment being slightly more strongly swollen in the middle near the apex and the notch of the sixth being very slightly more broadly rounded in *quadricollis*; in the form and size of the pronotum, relative length of the elytra, and in the punctuation of the abdomen, the two species are, however, so distinct that it can scarcely be possible to confound them.

The eastern *Lithocharis corticina* Grav. is somewhat allied to this genus, but is scarcely congeneric. The labrum in *corticina* is very large, broadly explanate and rounded at the sides; in the middle of its apical margin it has a small abrupt emargination, at the bottom of which there is an obtuse tooth which is the prolongation of a small anterior dorsal carina. In the general form of the head it is strikingly different from the members of *Metaxyodonta*.

L. confluens Say must form the type of a genus quite distinct from any other here described, because of the very different structure of the posterior tarsi which are short and rather robust, and in which the basal joint is slightly shorter than the second and less than one-half as long as the fifth. For this genus I would propose the name *Trachysectus*.

I am indebted to Dr. J. Hamilton of Allegheny and Mr. F. M. Webster of Lafayette, Indiana, for specimens of these species.

APPENDIX.

I.

HESPEROBIUM n. gen. (Pæderini).

It is not without great diffidence that I here propose a new name for the American species which have been hitherto placed in *Cryptobium*; especially is this the case since the South American and Mexican species have been passed over almost in silence regarding their generic distinctness by Dr. Sharp, and the North American forms, first by Dr. LeConte and afterwards, independently, by Dr. Horn. Being moved, however, by the conviction that scientific nomenclature has arrived at such a stage that to longer abstain from recognizing and differentiating distinct generic subdivisions, can only be conducive to a superficial knowledge of nature and be detrimental to a scientific arrangement of the species as a whole, I have concluded to make the division and give the differential descriptions in the form of parallel columns, by which means the chief distinctive features can be more readily compared.

In the following statement the type of *Hesperobium* is the Californian *H. tumidum* Lec., the characters of *Cryptobium* Mann. being taken from the very thorough treatise by Mr. C. Rey upon the Pæderini (Hist. Nat. Col. Fr., 1878).

CRYPTOBIUM.

Labrum short, sinuate and bidentate in the middle of its anterior margin.

HESPEROBIUM.

Labrum very short and broad, feebly and triangularly emarginate throughout its width at apex, not denticulate but having in the middle, at the apex of the triangular notch a small rounded emargination; sides strongly convergent toward the base; apical angles narrowly rounded.

Third joint of the maxillary palpi gradually and rather strongly dilated toward the apex which is truncate; fourth small, slender and subulate.

Labial palpi short with the two basal joints sub-cylindrical, the second a little longer than the first; the third small, slender, acuminate.

Paraglossæ acuminate.

Antennæ having the second and third joints sub-equal.

There are also differences in the structure of the abdomen, and in the relative sizes of the segments.

Except in the characters given above, the two genera are somewhat similar. In applying these to the entire group of North American species, it is easily seen that the antennal structure is not entirely constant, there being a few species in which the second and third joints are nearly equal in length. The components of a very limited group of small species containing *pusillam*, *lepidum*, etc., have the fourth joint of the maxillary palpi small, acicular and not conical, and those should probably be referred to a closely-allied genus or to a sub-genus; all the others have the fourth joint conical and pointed, although varying greatly in thickness at the base², all being, however, variations of one common type, which is the *conical and acutely pointed*. Dr. Sharp

Third joint long and slender, rather feebly dilated, obconical; fourth short, slightly oblique, conical, acutely pointed, nearly as wide at base as the apex of the third and received partly within it.

Labial palpi slender, first joint longer than wide, about one-half as long as the second, which is slender and more or less dilated at the apex; third conical, very slender, acute, much narrower at base than the apex of the second.

Paraglossæ elliptically rounded at tip.

Antennæ with the second joint distinctly shorter than the third.

¹ LeConte—Proc. Amer. Phil. Soc. XVII, 1878, p. 392.

² The two species, *convergens* and *parallellum*, described by me (Cont. II, pp. 129-131), and very erroneously united by Dr. Horn (Ent. Amer. I, p. 109) under the head of an entirely distinct species—*floridanum*—serve as a good illustration of this variability of the fourth joint, this being conical and very narrow, small and almost acicular in *convergens*, and scarcely longer than wide, being strongly conical, flattened and almost as broad at base as the apex of the third in *parallellum*. Having here incidentally made a correction

(Biol. Cent.—Amer., I, Pt 2, p. 506), probably because of this variability, considers the palpal structure as of minor importance when compared with others, and does not even employ it in subdividing the genus, although this has been done with more or less success by Dr. Le Conte (Proc. Am. Phil. Soc. XVII, 1878, p. 390), but without considering the structure of the maxillary palpi, we still have, I think, enough characters remaining to confirm the validity of *Hesperobium*.

Dr. Sharp, in the work above mentioned, divides the Central American species into groups depending upon the presence or absence of a lateral raised line upon the lower part of the flank of each clytron; when the *Pæderini* have been sufficiently studied as a group, it may be found desirable to give this character a generic import, in which case the name *Hesperobium* should be retained for the species having this lateral line, as it is present in the type which is assumed above as representing the genus. It is also present in *californicum*, and in an undescribed species, represented in my cabinet by a unique male, found near San Francisco; it is probably characteristic of the Californian species as a group³.

In describing several species of this genus (Cont. II, pp. 127–133), attention was called to two very large and prominent annular punctures, or more properly areolæ, situated behind the eyes. I think that these punctures are of greater importance from a systematic standpoint than was at first supposed, as they constitute one of the distinguishing features of *Hesperobium* and the American species of *Lathro-*

in synonymy. I take the present opportunity to say in addition, that it is very difficult to reconcile Dr. Horn's assertion regarding the mutual identity of my *H. capito* and *H. pallipes*, Grav., with the statement made by Erichson in the description of the latter, viz: "Thorax latitudine sesqui fere longior." The prothorax in *capito* is "scarcely one-fifth longer than wide." (Cont. II, p. 128.)

³ This line is also well developed in the Californian species which have been referred to *Lathrobium* and which are probably generically distinct.

bium, being absent in the latter genus. In *Hesperobium californicum* they are very large, slightly oval, strongly annular and crater-like, occupying the entire summits of slight elevations, and having their planes not exactly parallel to the general surface but tilted very slightly forward, so that the slope of the elevation is more prominent behind. Between them the surface is narrowly elevated or tumid in a longitudinal direction, and from the middle of each arises a very long erect seta from an annular median tubercle, which corresponds to the cone of the crater. These most singular structures are probably an additional distinctive feature of *Hesperobium*.

The genus *Homæotarsus* founded by Hochuth upon an Armenian species, does not concern us at the present time, as, although the maxillary palpi are apparently of like structure, it is, in almost all other respects, entirely similar to *Cryptobium* (Lac. Gen. Col. II, p. 90).

II.

In the first volume of this Bulletin, page 315, I stated that the mandibles in *Orus* were quadridentate within. This is true only of the right mandible. Since the publication of the paper referred to, I have examined the left mandible and find it tridentate, the three teeth being small, approximate and situated almost exactly in the middle of the inner margin: the two basal ones are erect, slightly longer than wide, acute and equal, the third being longer and more slender, acute and rather strongly inclined toward the apex, the latter being evenly and strongly arcuate, very acute and slender. This combination of four teeth in the right and three in the left mandible is of frequent occurrence in the portion of the *Pæderini* near and related to *Lithocharis*, where the mandibular characters appear to lose the importance which they possess in some other portions of the group. The abnormal arrangement of the teeth in *Orus* therefore, although it cannot of itself be maintained as a generic character, still serves to

show that which may easily be inferred from its general appearance, viz: that it is much more nearly related to Lithocharis and its allies than it is to Scopæus. It should, in fact, in a systematic arrangement of our Pæderini, immediately precede Caloderma which it resembles in its 4-dentate labrum, and from which it is distinguished, as before remarked, by its strongly inflated third maxillary palpal joint, and also by its elongate prothorax and short basal joint of the posterior tarsi.

III.

A considerable number of new genera having been described since the publication of the Classification of the Coleoptera of North America by LeConte and Horn, I would propose the following as a substitute for the one given in that work, page 99, for those Pæderi which have the fourth tarsal joint simple.

It will be noticed that, in the following table, the geniculation of the antennæ is considered of secondary importance when compared with other characters. Although this geniculation varies greatly in amount, I have yet failed to observe a single species of North American Pæderini in which it is not more or less manifest; the character is therefore merely one of degree and is only of importance when present in its extremes. There is, however, a marked difference in the nature of the geniculation. In *Hesperobium*, and probably also *Ababactus*, the deep emargination at the apex of the scape which receives the second joint when flexed, is at the anterior portion of the apex, so that the funicle is bent to the front, while in the second section this emargination is at the back of the apex, so that when flexed the funicle projects posteriorly. It is also to be noted that the geniculation of the antennæ prevailing in the Pæderini is not like that to be seen in some other groups of Coleoptera, where the second joint is placed almost immovably at an angle with the scape, and which could appropriately be termed *rigidly geniculate*. In this group the funicle is

capable of being flexed or straightened at pleasure, and, in contradistinction to the former, such an antenna might be called *flexibly geniculate*.

Basal joint of the antennæ greatly elongated, sub-equal in length to the next three or four together; antennæ strongly and anteriorly geniculate.

Neck broad..... **Hesperobium.**

Neck narrow..... **Ababactus.**

Basal joint of the antennæ not greatly elongated; antennæ posteriorly and more or less strongly geniculate.

First four joints of the posterior tarsi sub-equal, first not longer than the second.

Neck rather broad.

Prothorax sub-quadrate or slightly elongate; labrum bilobed

Lathrobium.

Prothorax narrowed from apex to base; labrum truncate, not denticulate, having along the lower edge of its anterior margin four widely-spaced, very short, broadly rounded callosities, and, in the middle a very small, rounded emargination..... **Trachysectus.**

Neck very slender.

Prothorax gradually narrowed anteriorly; labrum quadridentate.

Scopæus.

Hind tarsi with the first four joints decreasing more or less gradually in length.

Prothorax narrowed in front.

Labrum quadridentate..... **Echiaster.**

Labrum bidentate..... **Stilicis.**

Prothorax sub-quadrate, anterior and posterior angles more or less narrowly rounded.

Labrum having four rather large sub-equal teeth; elytra much longer than the pronotum.

First joint of the posterior tarsi very slightly longer than the second.

Orus.

First joint of the posterior tarsi sub-equal in length to the next two together..... **Caloderma.**

Labrum with two pairs of minute approximate teeth; elytra no longer than the pronotum..... **Oligopterus.**

Labrum bidentate; elytra variable in length..... **Lithocharis.**

Labrum unidentate; elytra longer than the pronotum. **Metaxyodonta.**

Labrum rounded; acutely emarginate at tip; elytra as long as the pronotum..... **Dacnochilus.**

Labrum entire; elytra shorter than the pronotum... **Liparocephalus.**

IV.

THYCE Lec.

The following species was recently announced by me under the generic name *Polyphylla* (Bull. Cal. Acad. Sci., I, p. 285). The genus *Thyce*, although resembling *Polyphylla* very greatly, differs radically in antennal structure, the club being trifoliate and the joints of the funicle of nearly equal length; while in *Polyphylla* the greatly developed third joint is a very prominent distinctive feature, in addition to the more complex club.

In *T. marginata* the anterior tibiæ have two teeth exclusive of the exterior apical spur which is very pronounced; these teeth are very unequal, the one nearer the base being very short and obtuse. The males have a large and rather feeble impression in the middle of the abdomen near the base. I have not seen the female.

T. marginata n. sp.—Form moderately robust; sides distinctly arcuate; prothorax piceous; elytra rufo-fuscous; the former having three posteriorly divergent lines of whitish squamose pubescence, the exterior ones widest and interrupted in the middle, the median very fine and almost obsolete toward base; each elytron having along the exterior edge a very wide line of plumbeo-cinereous and very slender squamose pubescence, not very densely placed, which is recurved at the apex continuing thence along the suture as a narrow, whiter and much better defined line to the base; between these there is another very fine line terminating at one-fifth the length from the apex; pubescence elsewhere fine and very sparse; legs and antennæ fuscous; each ventral segment having an irregular spot of whitish squamiform pubescence at each side next the elytra. *Head* excluding the eyes slightly longer than wide, sub-quadrate; clypeus moderately reflexed, broadly and feebly sinuate anteriorly; angles right and not at all rounded; pubescence long, rather sparse, mixed with squamose hairs near the base and sides; antennæ well developed, funicle two-thirds as long as the club and nearly as long as the head, club viewed upon the broad side slightly wider at apex than at base, three and one-half times as long as wide. *Prothorax* widest at the middle of its median length where it is four-fifths wider than long; sides thence strongly convergent and feebly arcuate to the apical angles, feebly convergent and straight to the basal angles which are obtuse and slightly rounded; base broadly angulate, feebly sinuate toward each basal angle; disk strongly convex, rather finely, moderately densely and irregularly punctate; punctures round, very shallow, variolate. *Elytra* at base slightly wider than the prothorax; sides parallel and feebly arcuate; together slightly less than one-half

longer than wide, two and one-half times as long as the prothorax, very finely, sparsely, feebly and irregularly punctate; punctures asperate. Pygidium wider than long, feebly convex, finely and rather sparsely punctate, moderately sparsely and evenly covered with short slender squamose pubescence. Posterior tarsi short, two-thirds as long as the tibiae; claws moderate, having a small erect acute tooth interiorly near the base. Length 19.0 mm.; width 8.5 mm.

California (San Diego Co.), also probably Lower California.

Five or six specimens were taken by Mr. G. W. Dunn, and I have received the present specimen through the kindness of Mr. W. G. W. Harford.

This species differs from *squamicollis*, Lec. in almost every character given by Dr. LeConte in the original description of the latter (Journ. Phil. Acad. III, Nov. 1856, p. 225). It may, however, perhaps be best to call special attention to the more salient differences. These are the size, *squamicollis* being one-third longer, and the form and vestiture of the head and prothorax, the latter in *marginata*, having no sign of a median channel, with the surface not impressed toward the anterior angles, and having the punctuation extremely sparse near the sides of the pronotal disk. The scutellum in *marginata* has no glabrous line, and the pygidium is rather sparsely squamose. If *squamicollis* possessed three prominent lines of scales upon the pronotum, with the surface elsewhere almost entirely free from them, or if it had three distinct lines of slightly denser pubescence upon each elytron, it is to be presumed that such striking characters would have been mentioned by Dr. LeConte; this purely negative evidence alone, therefore, is almost conclusive proof of the specific distinctness of *marginata* and of its validity.

V.

ERRATA.

Several errors occurring in the paper published by me in the preceding volume of this Bulletin require correction, as follows:

Page 299—3th line from bottom, for "Colodera" read "Calodera."

Page 321—1st line of descr., for "L. longipennis" read "V. longipennis."

Page 327—10th and 15th lines from top, for "Horniarum" read "Hornium."

STUDIES IN THE BOTANY OF CALIFORNIA AND PARTS
ADJACENT.

BY EDWARD LEE GREENE.

IV.

I. *On Some Chicoriaceous Compositæ.*

The type of the genus *Microseris*, Don, is a South American plant, and we have no North American species which agree with it in both habit and pappus. It has ten awn-tipped paleæ; the Californian species which seem truly congeneric with it have five only. These species of the northern hemisphere are about seven or eight in number, and agree in aspect perfectly with their type. They are acaulescent annuals, with rosulate-depressed leaves, slender scapes, which are always decumbent at base, never at all thickened above, supporting heads which are uniformly nodding, both before and after flowering, becoming for the second time erect at the maturity of the fruit.

The name *Calais*, DC. appears to be but in part synonymous with *Microseris*. DeCandolle himself thought it might eventually be shown that he had included under *Calais* the types of two genera; and I am persuaded fully that his § *Calocalais* is a real genus, distinct from *Microseris*. The species are few. Their paleæ are five, but the awn rises from an apical notch. These plants are never really acaulescent. Their leaves are ascending, or erect, on the short or long stems. The peduncles are stout, strictly erect, thicker above, and the heads are firmly erect at all stages of growth. Of this peculiar aspect and character there are about five species, four of which have already their suitable names under *Calais*.

Scorzonella, was thirty years ago reduced by Dr. Gray to *Calais*. Bentham and Hooker, in the *Genera Plantarum*, while reducing the whole of DeCandolle's *Calais* to *Microseris*, in recognition of the priority of the latter name, nevertheless perceived the validity of *Scorzonella* as a genus, and restored it; but in the *Synoptical Flora*, as well as antecedently, in volume nine of the proceedings of the American Academy, it reappears as a mere section of *Microseris*. Having studied these plants diligently on their native soil during some six or seven years, I can but agree with the able and experienced founder of the genus, and with the learned authors of the *Genera Plantarum*, that *Scorzonella* should stand. Here the pappus-bristles are somewhat indefinite in number, and are mostly real bristles with paleaceous-dilated base, rather than awn-tipped paleæ. The plants, while caulescent like *Calais*, have nodding heads like *Microseris*, quite distinctive involucre, fusiform perennial roots, and are æstival in flowering; whereas the two kindred genera of annuals have but a very short and strictly vernal season of flowering and fruiting. April is their month, and it is usually in vain to look for them after the beginning of May.

There are some three species of this particular alliance, upon which the eminent author aforementioned in the *Plantæ Fendlerianæ* established a genus *Ptilophora*, concerning which I judge all to have been well, save that the name was already in use for a genus of sea-weeds. These plants, while wholly in keeping with *Scorzonella*, as regards their general aspect, and perennial root, have a pappus of quite different character. The only distinction which has hitherto been definitely stated is that the numerous bristles are white and soft-plumose. This is doubtless the most obvious, indeed it may be the only difference noticeable at first sight, in the very best of herbarium specimens, unless it be this, that the texture of the pappus is not only soft, but very fragile, which is not true of that of any *Scorzonella*. Now,

the field observer, coming in sight of one of these plants in ripe fruit, perceives that these pappus-plumes are not straight and ascending as in all other genera of this group, but that they are regularly and gracefully recurved. This naturally and perfectly developed fruit, just ready to be set afloat in mid air on the jarring or shaking of the parent receptacle, will never be found in herbarium specimens. The nearly ripe heads which partially unfold their pappus after drying, show every character but this important one. It seems to me never to have been spoken of in relation to the large and somewhat varied genus, *Stephanomeria*, where it is universal, and will serve to distinguish between that and its nearest ally, *Rafinesquia*, in which, if my memory serves faithfully, the pappus is straight. Dr. Kellogg must have observed this neat characteristic of the genus in question, when he collected the common species in 1870; and it may well have been this which led him to refer to the plant, with a doubt, to *Stephanomeria*. The quick eye of our venerable pioneer caught at once the new fact, and he unconsciously recorded it in his misnomer. The last peculiar mark of the genus was detected by myself, lately, upon examining the excellent herbarium specimens with which we are now supplied. There are clear traces of a double pappus. I find on about one half of the akenes a solitary, firm, merely scabrous bristle, exterior to the plumose-awned paleæ, and of less than half their length, a kind of character which comes out strongly in another Chicoriaceous genus of California, namely, *Melacothrix*, between which and *Scorzonella* this very clear one ought to be placed. Dr. Gray, a few years subsequently to his founding of *Ptilophora*, having discovered that name to be a synonym, and also having evidently lost somewhat of his faith in the validity of the genus, reduced it to *Calais*; yet with express misgiving, and not without bespeaking for it another generic name in case it should ultimately demand restoration to that rank. Under that very appropriate name, *Ptilocalais*, I propose its reinstatement.

There is a perennial, acaulescent plant of northern habitat which, although admitted by Dr. Gray into his superlatively amplified *Microseris*, is, in my opinion, to be excluded from *Scorzonella*, to which it is more related than to any other recognized genus. The paleæ of its pappus are soft and slender, ending in a sharp, but hardly awn-like point; its involucre has a peculiarity, and the heads are never nodding. The specific name, *troximoides*, was given on account of the close resemblance which the species bears to *Troximon cuspidatum*. But this last-named plant appears to be entirely out of place in *Troximon*: for its pappus is composed, partly of capillary bristles, and partly of very narrow paleæ. My conclusion is, that these two plants will constitute the most perfectly natural genus in the whole group, and I so place them, adopting the name which Dr. Gray coined for sectional use under his *Microseris*.

The form of the akenes in these genera, whether turbinate or cylindrical with truncate apex, or whether more or less attenuate upwards, would seem to be of specific but not generic importance. The basal callosity, although not very seriously taken under consideration by Dr. Gray, appears to have merited more deliberate attention; for, in *Microseris*, as here defined, it manifests a character which runs through all the species, without reappearing in any of the other genera, except that there is a mere hint of it in *Calais*.

The aestivation of the pappus is of one character in all the genera. Whether the paleæ be five, or twice or thrice or four times that number, one is always wholly exterior, and an opposite one interior, while all the others are regularly convolute. In *Microseris* alone the species fall into two quite natural groups by a difference in the expansion of the individual paleæ.

MICROSERSIS, Don.

Involucre oblong-cylindrical to hemispherical, inner bracts in one or two series, equal, acuminate, thin, with

membranous margins; outer very short, calyculate. Receptacle flat, slightly alveolate. Akenes terete, 8—10-costate, with a broad basal callosity, which is hollowed at the insertion and produced upward into a sharp, denticulate-scabrous, collar-like rim. Paleæ of the pappus 4—10 (usually 5), mostly short, tapering into a long or short scabrous awn, in one species nearly obsolete, the awn thicker but hardly flattened at base. Acaulescent, glabrous annuals, with entire or laciniately lobed on pinnatifid leaves, and nodding heads on slender scapes, which are somewhat decumbent at base and not thickened above. Outer row of akenes commonly silky-villous; the others usually scabrous on the ribs. Paleæ of the pappus often villous exteriorly. Génus of very limited range east and west; not found east of the western base of the Sierra Nevada, but occurring near the coast, from the peninsula of Lower California to Oregon.—*Microseris*, Don. Phil. Mag. xi. 388; Benth. & Hook. ii, 506, magna pro parte: *Microseris* § *Eumicroseris* (excl. *M. Forsteri*) & *Eucalais*, Gray, Proc. Am. Acad. ix. 208; § *Eucalais*, Bot. Cal. i. 425, and § *Calais* (excl. sp.), Syn. Fl. ii. 418. *Calais* § *Eucalais*, DC. Prod. vii. 85; *Calais* §§ *Eucalais* and *Aphanocalais*, Gray, Pac. R. Rep. iv. 112.

**Paleæ 5, boat-shaped i. e., a little incurved and the margins involute.*

M. PLATYCARPHA, Gray.—A span or more in height; head a half inch or less in length; main bracts of involucre about 8, oblong; akenes turbinate, 2 lines long; paleæ ovate, 2 lines long, tapering abruptly into a very short awn. Syn. Fl. ii, 420.

San Diego County, and on the northern part of the peninsula below.

M. DOUGLASHII, Gray, l. c.—A span to two feet high; head about $\frac{3}{4}$ inch long; bracts linear-oblong; akenes oblong-turbinate, contracted under the summit, 3 lines long; paleæ

ovate, 2 lines long, tapering abruptly into an awn of the length of the akene.

Monterey to Humboldt County. Common and extremely variable as to the villosity of the paleæ and outer row of akenes.

M. PARISHII.—Rather smaller and more slender than the last; akenes slender, strictly columnar, 2 lines long or more, dark brown; paleæ lanceolate, 3 lines long, very gradually tapering to an awn of a line or a line and a half.

Near San Luis Rey. April, 1881, S. B. Parish; near Tulare, 1882, Dr. C. C. Parry; also collected by the writer near San Diego, 1885.

A very distinct species, evidently belonging to the southern part of the State.

M. ATTENUATA, Greene.—A few inches to a foot and a half high; involucre $\frac{1}{2}$ — $\frac{3}{4}$ inch long; akenes 4 lines long, attenuate-fusiform, the narrowed upper half vacant; paleæ oblong-lanceolate, a line and a half long, tipped with an awn of twice that length. Bull. Torr. Club, ix, 111; Gray, l. c., 419.

Near Berkeley, and eastward to the valleys of the Sacramento and San Joaquin.

***Paleæ straight and flat, 5, except in the last species.*

M. ACUMINATA, Greene.—Size and aspect of the last, the heads an inch long; akenes slenderly fusiform-turbinate, 3 lines long; paleæ 4—5 lines long, lanceolate, very gradually tapering to an awn of 2—3 lines. Bull. Torr. Club, x, 88; Gray, l. c.

Same range as the last species, and rather more common.

M. BIGELOVII, Gray, l. c.—A foot in height, more or less: head about a half inch; akenes oblong-turbinate, hardly 2 lines long; paleæ oblong- to ovate-lanceolate, much smaller

than in the preceding species, but variable in length: passing into an awn twice or thrice as long.

Common in the middle coast section of the State: the awn very long in proportion to the palea.

M. ELEGANS, Greene.—A span or more high, slender: head less than a half inch: akenes turbinate, little more than a line long: paleæ ovate-deltoid, a half line long, the slender awn about 2 lines.—Gray, l. c.

From the mesas back of San Diego to the plains east of Mt. Diablo. Seldom collected, but perhaps not very rare.

M. APHANTOCARPHA, Gray, l. c.—Twelve to eighteen inches high, and rather stout: leaves laciniate-toothed or nearly entire, seldom deeply pinnatifid: heads a half inch high, many-flowered, and subglobose: akenes oblong-clavate, hardly 2 lines long: paleæ minute and very broad or nearly obsolete, the bristles very slender and fragile, about 3 lines long.

Common in the region of San Francisco Bay, and extremely variable as to the pappus, which consists often of bristles with thickened, rather than paleaceous base. It is possible that we have here two or three species, but more probably they are mere forms, passing imperceptibly into each other. The leaves are less dissected in this than in any of the others.

M. PYGMEÆ, Don.—About a span high: akenes 1—2 lines long, slenderly turbinate: paleæ 10, lanceolate, a line or more long, slightly notched at the apex, and tipped with a somewhat barbellate awn of about 2 lines.—Phil. Mag. xi. 388; Gray, Proc. Am. Acad. ix. 209.

Native of Chili. The North American species which looks most like this type of the genus is *M. Bigelovii*. The principal difference between them is in the number of the paleæ and the slight notch at the apex of those of *M. pygmeæ*, which species in that respect only betrays an affinity with the following genus.

CALAIS, DC. sens. restr.

Involucre conical, scarcely calyculate, bracts imbricate, the outer successively shorter, all thin and scarious-margined. Receptacle flat, centrally more or less alveolate-chaffy. Akenes terete, 8—10 costate, the basal callosity not enlarged. Paleæ of the pappus 5, elongated, flat, bifid at apex and short-awned.—Subaculescent annuals, all West North American, with laciniately-lobed or pinnatifid leaves, and erect heads, on strict, erect peduncles which are fistulous-thickened above. Akenes all alike, glabrous, with scabrous costæ. Paleæ of the pappus glabrous and more or less denticulate. Genus of few species but of wider range than the last, the typical species occurring eastward to the borders of Colorado and Texas, and on the Pacific shores, from British Columbia to the island of Guadalupe. *Calais* § *Calocalais* DC. Prod. vii. 85; Torr. & Gray, Fl. N. Am. ii. 471; Gray, Pac. R. Rep. iv. 112. Species of *Microseris*, Gray, Proc. Am. Acad. ix, Bot. Cal. i. and Syn. Fl. ii.

* *Paleæ bright, white, soft, deciduous from the nearly black akenes.*

C. LINEARIFOLIA, DC., Prod. l. c.—Species of the widest range, and of much variability as regards the height of the stem and the number of flowers in each head. Sometimes nearly acaulescent, and with very large heads; but around San Diego the stem is slender and often more than a foot high, the heads being few-flowered; but the bright pappus, promptly deciduous from the mature, almost rostrate-attenuate, black akenes readily distinguishes the species in all its forms, whether on Guadalupe or in New Mexico, Washington Territory, or California.

** *Paleæ brownish, of firm texture, persistent on the light colored akenes.*

+ *Awn of pappus shorter than the palea.*

C. LINDLEYI, DC.—Glabrous, a foot or two high: akenes 5—6 lines long, slightly attenuate toward the summit; palea

linear-lanceolate, 4 lines long, the awn very little shorter.—Prod. 1. c.; *Microseris*, Gray, l. c.

From San Francisco to San Diego; equally as common as the first species.

C. PARRYI, Gray. Furfuraceous-puberulent, 6—8 inches high: akenes 3 lines long, and not at all attenuate; palea softer than in the last, its awn less than half as long.—Pac. R. Rep. iv. 112; *Microseris*, Gray, l. c.

Common from the plains back of Mt. Diablo to San Diego: easily mistaken for small *C. Lindleyi*, but, on closer inspection, appearing clearly distinct. The fruit is here for the first time described. The species does not appear to have been collected save by Dr. Parry, in a very immature condition, and by the present writer; but it is no rarity in the field.

+ + *Awn of the pappus longer than the palea.*

C. MACROCHÆTA, Gray.—Like *C. Lindleyi* in size and aspect, but akenes shorter and more attenuate at summit: palea short, only a third as long as the awn, and cleft to the middle.—Pl. Fendl, 112; Pac. R. Rep., l. c.

From Oregon to San Diego, but very rarely collected.

C. KELLOGGII.—Also resembling *C. Lindleyi*: akenes 3—4 lines long, attenuate at each end: palea a third the length of the awn, and with a shallow notch.

San Bruno Mountains, near San Francisco, Dr. Kellogg.

SCORZONELLA, Nutt.

Involucre campanulate; bracts herbaceous, imbricated in several series, the inner long-acuminate, the outer successively shorter and acute. Receptacle flat or convex, foveolate or alveolate. Akenes linear, or somewhat turbinate, 8—10-costate or -striate, truncate at summit, the basal callosity acute and not expanded, areola lateral. Pappus of about 10 (in one species 5) ovate or lanceolate paleæ, tipped

with a generally much longer, straight, scabrous or barbelate bristle or awn. (Glabrous perennials with fusiform roots, stems mostly leafy at base with laciniate foliage, and long-peduncled heads which are nodding in the bud. Inhabiting wet grassy grounds, chiefly in the mountain districts from middle California to British Columbia, with one species in the high mountains of Australia and New Zealand. Flowering in summer.—Trans. Am. Phil. Soc. vii. 426; Torr. & Gray Fl. ii. 470; Benth. & Hook. Gen. Pl. ii. 533. *Calais* $\frac{2}{3}$ \S *Scorzonella* & *Anacalais*, Gray, Pac. R. Rep. iv. 113. *Microseris* \S *Scorzonella*, Gray, Proc. Am. Acad. ix. 208 and xx. 300, Bot. Cal. i. 424, and Syn. Fl. ii. 417 (excl. *M. Parryi*).

**Caulescent*.—North American species.

S. MEGACEPHALA.—Glaucous, Robust, 2—3 feet high: leaves oblong, acuminate, entire above the middle, laciniate-toothed toward the clasping base, 6—8 inches long: peduncles stout, a foot long: heads hemispherical more than an inch high, 2 inches broad. 200—225-flowered: bracts of the involucre 40 or more, imbricated in 4—5 series, exterior round-ovate, innermost ovate-lanceolate, all (the outer very abruptly) long-acuminate: akenes 2 lines long, somewhat turbinate: pappus brownish and firm, of 5 ovate-lanceolate paleæ a line long, tapering to an awn of 3—4 lines.

Eel River, Mendocino County, 1866, H. N. Bolander, being a part of his number 4737. A single specimen only, differing from the next species, not in habit or general appearance, but remarkably distinct from it in the characters of the involucre, akene and pappus.

S. PROCERA.—Leaves more laciniate: not acuminate: heads narrower, 100—150-flowered: bracts of involucre 25 or more, in 2—3 series, the exterior ovate, innermost ovate-lanceolate, all acuminate: akenes nearly columnar, 3 lines long: pappus brownish, the paleæ 10 (as in all the following) lanceolate, passing into a thrice longer, barbellate

awn.—*Microseris laciniata* var. *procera*, Gray, Proc. Am. Acad. ix. 209 Bot. Cal. i. 424; *Microseris procera*, Syn. Fl. ii. 417.

From Sonoma county to the borders of Oregon.

S. PRATENSIS.—Leafy at base only, the scapose peduncles 2 feet high: leaves linear, lanceolate, long-cuminate, entire, a foot long: heads an inch high and nearly as broad; bracts 16—20 in 3 series, ovate—to lanceolate—acuminate: akenes 2 lines long; pappus white, 4 lines, the triangular-ovate palea $\frac{1}{2}$ line.

Sunny and rather moist meadow lands at Yreka, in the northern part of the State, collected by the writer June 21, 1876, and distributed by him under number 883 as *Microseris laciniata* var. *procera*. It is readily distinguishable from the preceding and the following by its long, scapose peduncles, and narrow, entire, long, slender-pointed foliage.

S. LACINIATA, Nutt.—Stem less robust and more branching and leafy than in the last: leaves pinnately parted, the segments narrowly linear, an inch or more long: heads a half inch high; bracts 16—20, from round-ovate to lanceolate, all abruptly acuminate: akene 2 lines long: pappus white, about 3 lines, the ovate-lanceolate palea less than a line.—Trans. Am. Phil. Soc. P vii, 426: Torr. & Gray, Fl. ii. 470. *Microseris*, Gray, l. c.

Northern borders of California to the confines of British Columbia.

S. LEPTOSEPALA, Nutt., l. c.—Bracts of involucre in 2 distinct series, the ovate outer ones 5 or 6 only, and hardly more than calyculate to the numerous, lanceolate inner ones, akenes, white pappus, etc., in all their parts more elongated than in the last species; foliage less divided, often merely toothed. Torr. and Gray, l. c.; *Microseris*, Gray, l. c.

Same range as *S. laciniata*, from which it differs very obviously in the character of the involucre.

S. BOLANDERI.—A foot or more high; leaves linear-lanceolate, entire or with a few linear lobes; bracts of involucre regularly imbricated in two or three series, all gradually attenuate from a broad base; pappus brownish, 5 lines long, the ovate palea not more than a half line. *Microseris*, Gray, Syn. Fl. ii. 418.

Mendocino and Humboldt counties, and northward.

S. HOWELLII.—Size of the last; leaves with refracted lobes or teeth; heads narrower, 15–20-flowered; akene 3 lines long; pappus white, a half inch, the palea lanceolate and nearly as long as the awn. *Microseris*, Gray, Proc. Am. Acad., xx, 300; Syn. Fl. Suppl., 454.

Southern Oregon, collected only by Mr. Howell.

S. PALUDOSA.—Stems numerous, slender, 2–3 feet high; leaves a foot long and from subentire to laciniate-parted, the segments long and narrow; head an inch high, 50–75-flowered; bracts 20–25, all tapering from a lanceolate base into a long and slender acumination, the outer successively shorter; akene 2 lines long; pappus brownish, the firm lanceolate palea of a line or more passing gradually into a barbellate awn of 4 or 5 lines. *Microseris sylvatica*, var. *Stillmani*, Gray, Bot. Cal., l. c. and Syn. Fl. l. c.

Marshy grounds in the vicinity of Mt. Tamalpais, and in other localities not far from San Francisco Bay. Here described from excellent specimens obtained by Mrs. Curran at Corde Madera, Marin Co. Most distinct from the following.

S. SYLVATICA, Benth.—A foot or two high, mostly simple and monocephalous: head an inch high, 30–40-flowered: bracts broader than in the preceding and more abruptly acuminate: akene $3\frac{1}{2}$ lines long, columnar, the base a little attenuate: pappus sordid, the lanceolate palea 5 lines, tapering to a subplumose awn of 3 lines or less.—Pl. Hartw. 320. *Calais*, Gray, Pac. R. Rep. iv. 112. *Microseris*, Gray, l. c. excl. var. *Stillmani*.

From Contra Costa to Colusa Counties, on wooded hills. Leaves commonly laciniate-pinnatifid as in most species.

S. MONTANA.—Resembling the preceding, but stouter, the foliage less deeply laciniate: akene linear-columnar, not narrowed below, 5 lines long: pappus light brown: paleæ linear-lanceolate, truncate or slightly notched at the apex, only 3 lines long, its short-plumose awn a little longer.

Mountains of Kern County above Tehachapi Pass, June, 1884, Mrs. Curran.

A coarser plant than *S. sylvatica*, with very different fruit. The awn though really plumose, does not bring this species into troublesome proximity to *Ptilocalais*, for it is short, straight, and of firm texture.

***Acaulescent*.—South Pacific species.

S. SCAPIGERA.—*Scorzonera scapigera*, Forst. Prod. 91; *Scorzonera Laurencii*, Hook. f. Lond. Journ. vi. 124; *Phylloppappus lanceolatus*, Walp. in Linnaea, xiv. 507; *Microseris Fosteri*, Hook. f. Fl. Nov. Zel. i. and Fl. Tasm. i. 226; Benth. Fl. Aust. iii. 676; Gray, Proc. Am. Acad. ix. 209.

High mountains of Australia and New Zealand. Outer bracts of involucre somewhat calyculate, as in our *S. leptosepala*. More strictly scapose than any of our species, and a smaller plant; commonly less than a foot high.

PTILOCALAIS, (Gray, Pac. R. Rep. iv. 113).

Perennial root, foliage, involucre, receptacle, etc., as in *Scorzonella*. Pappus bright white, soft and fragile, double, namely, of a single short, external bristle, and 15—20 short, truncate or emarginate paleæ, terminating in a long, gracefully recurving, soft-plumose capillary bristle or awn.—*Ptilophora*, Gray, Pl. Fendl. 112. *Calais* § *Ptilophora*, Gray, Pac. R. Rep. i. c.; *Microseris* § *Ptilophora*, Gray, Proc. Am. Acad. ix. 208, Bot. Cal. ii. 423, Syn. Fl. ii. 416.—Genus with the habit of *Scorzonella*, but pappus resembling that of *Stephano-*

meria, supplemented by the single exterior bristle of *Mala-cothrix*. Geographical range somewhat limited north and south, but extending from central California to Utah.

P. NUTANS.—*Scorzonella*, Geyer in Hook. Lond. Journ. vi. 523; *Ptilophora*, Gray, Pl. Fendl. 112; *Calais*, Gray, Pac. R. Rep. iv. 112; *Stephanomeria intermedia*, Kellogg, Proc. Cal. Acad. v. 39; *Microseris nutans*, Gray, l. c. excl. var. *major*.

British Columbia and Montana to the high Sierras of northern and middle California.

P. MAJOR.—*Ptilophora*, Gray, Pl. Fendl. l. c.; *Calais*, Gray, Pac. R. Rep. l. c.; *Microseris major*, Gray, l. c. excl. var. *laciniata*. Utah and Idaho.

P. GRACILOBA.—*Calais graciloba*, Kellogg, Proc. Cal. Acad. l. c.; *Microseris major*, var. *laciniata*, Gray, l. c.

Still known only from Mendocino County, California; the specimens too young, yet by their pubescence and other characteristics, clearly enough representing a distinct species.

NOTHOCALAIS.

Involucre oblong-campanulate; bracts in two series, narrowly lanceolate, membranaceous, with thinner, somewhat hyaline margins, nearly equal, none calyculate. Receptacle flat, alveolate. Akenes fusiform, contracted or rostrate-attenuate at summit, 10-striate-ribbed. Pappus very white and soft, of 10--30, scabrous-margined, narrow, unequal paleæ, with or without some capillary bristles.—*Microseris* § *Nothocalais*, Gray, Syn. Fl. ii. 420, with *Troximon cuspidatum*, Pursh, added. Perennials with linear-attenuate, undulate or crisped radical leaves marked by white-tomentulose margins, and monocephalous, scapose peduncles. Habitat from Northern California to British Columbia and eastward to the Great Lakes, on dry, open rocky places.

N. SUKSDORFII.—Akene slender, 5 lines long, rostrate-at-

tenuate, only half occupied by the seed: paleæ 10—12, very narrow and nearly equal, strictly linear-attenuate, a half inch long: involucre villous-tomentose or glabrate: scapose peduncles exceeding the radical leaves.

Western part of Klickitat County, Washington Territory, April and May, 1882, W. N. Suksdorf.

N. TROXIMOIDES.—Akene fusiform, scarcely 4 lines long, merely contracted summit, nearly filled by the seed: paleæ 20—25, lanceolate below, very unequal, a half inch long: involucre and peduncles as in the last.—*Microseris troximoides*, Gray, Proc. Am. Acad. ix. 211; Bot. Cal. l. c.: Syn. Fl. l. c.

Northern California to Oregon and Idaho.

N. CUSPIDATA.—Akene little contracted, 3 lines long, filled by the seed: pappus of 40—50 unequal, very narrow, setose paleæ and scabrous bristles: leaves all radical, longer than the flowering scapes: involucre glabrous.—*Troximon* Pursh, Fl. ii. 742; Torr. & Gray, Fl. ii. 489; Gray, Syn. Fl. ii. 437: *T. marginatum*, Nutt. Gen. ii. 127.

On bleak, stony hills and fertile prairies, from Dakota and Colorado to Wisconsin and Illinois. Scarcely distinguishable from its far Western congeners except by the pappus. The undulate-crisped, white-hairy margins of the grassy leaves of this giving it an aspect so strikingly unlike the general appearance of the other species of his genus *Troximon*, were points not overlooked by that well traveled and most keenly observant botanist, Mr. Nuttall. That he noticed the peculiarity and was impressed by it is evinced by his effort to invest the species with a new specific name, *marginatum*, more appropriate than Pursh's *cuspidatum*, which was given to it in reference to the acuminate rather than cuspidate bracts, and has, therefore, no fitness, but which must needs be retained in deference to its priority. The name *marginatum* would, indeed, be equally and in the same way, applicable to each of the three known species of *Nothocalais*.

2. *Some species of EUPHORBIA* $\frac{2}{3}$ *ANISOPHYLLUM.*

E. PARISHII. — Suffrutescent, prostrate, glabrous and glaucescent: leaves thick, round-ovate, entire, veinless, 1—2 lines long: stipules setaceous, entire or cleft, obscurely barbellate above: glands minute, short-stipitate, cupulate, marginless, dark red: seed linear-oblong, $\frac{2}{3}$ line long, quadrangular, faintly rugose.

Warm Springs on the Mohave Desert, May, 1882, S. B. Parish, No. 1384.

This plant wears the aspect of *E. polycarpa*, but has the peculiar flowers of that very dissimilar species, *E. ocellata*, which is annual, with much larger, veiny leaves, and round-oval seeds.

E. NEO-MEXICANA. —Glabrous, light green or glaucescent; a span high, erect-spreading, the few ascending branches acutely angled: leaves linear-oblong, veinless, with a few serrate teeth toward the truncate or retuse apex, the sides entire and revolute: stipules setaceous, mostly bifid, ascending or erect: glands minute, green, with a narrow, white or greenish appendage: seed light gray, indistinctly rugose, acutely 4-angled, thrice as long as broad, the upper half gradually tapering.—*E. inaequilatera*, Engelm. Mex. Bound. as to the plant of New Mexico. *E. serpyllifolia*, var. *consanguinea*, Boiss. DC. Prodr. xv² 43, with the same limitation.

The above character is drawn from specimens of my own collecting, on the plains of the upper Gila in western New Mexico. The sub-erect habit, somewhat wing-angled stem and few branches, must separate this New Mexican plant from the wholly prostrate, terete-stemmed *E. serpyllifolia*. The specimens from California, which the authors referred to have classed with this, must belong to the following. Nothing like *E. Neo-Mexicana* has appeared from any locality west of the Gila Plains.

E. SANGUINEA, Hochst. & Steud.—Glabrous, deep green,

becoming red with age, not glaucescent: a span to a foot high; erect and simple base of stem an inch or two high, parting abruptly into numerous almost horizontally spread-branches: leaves obovate- to spatulate-oblong, with 3—4 pairs of pinnate veins, the margin serrulate above the middle: stipules setaceous, entire or somewhat lacerate, spreading or deflexed: glands minute, dark red with narrow rose-colored appendages: seed dark gray, faintly rugose-pitted, scarcely twice as long as broad.—Boiss. l. c. 35: *E. serpyllifolia* in part, of Watson, Bot. Cal. ii. 74: *E. inaequilatera*, Engelm. Mex. Bound. l. c. as to the Californian plant, doubtless.

Described here from specimens collected by the writer, in Napa county, Cal., October, 1882. *E. serpyllifolia*, besides being wholly prostrate has veinless leaves, and is very brittle, by the absence of fibrous tissue; but the stem and branches of this plant are almost as tough as those of flax. It has the erect-spreading habit, but not the foliage nor the sharply angular branches of *E. Neo-Mexicana*, which latter is also brittle like *E. serpyllifolia*. Our Californian plant matches well African specimens of *E. sanguinea*.

E. RUSBYI.—Annual, pubescent, a span to a foot high, branches ascending: leaves oval, nearly sessile, very oblique, the major side cordate, serrate, and with a single veinlet supplementary to the mid-vein: stipules parted to the very base into a pair of slender, erect, ciliate setæ: glands small, orbicular, cup-shaped, with a reniform, entire, rose colored appendage: seed quadrangular, rugose-pitted, reddish.

Northern part of Arizona, 1883, Dr. H. H. Rusby.

E. VELUTINA.—Velvety canescent: branches and branchlets numerous, prostrate, forming a close mat: leaves crowded and almost sessile, veinless, the lower orbicular and coarsely toothed, the floral obovate-oblong and mostly en-

ture: stipules short, setaceous, entire, deciduous: glands transversely oblong, dark red-purple, with a deep, flabelliform, crenate, white or pinkish appendage: seed light gray, rather sharply angled and faintly rugose.

Probably Lower California, but the specimen has no ticket.

3. *New Polypetalæ.*

RANUNCULUS BOLANDERI.—Stem stout, erect, $1\frac{1}{2}$ —3 feet high, from a fleshy-fibrous, perennial root: glabrous below, the peduncles and calyx pubescent: leaves lanceolate, the radical on very long petioles, the cauline sheathing, margin obscurely repand-denticulate: petals bright yellow, broadly obovate, thrice the length of the sepals; akenes numerous, in a globose head; beak slender, acute, somewhat incurved.

Long Valley, Mendocino County, May, 1886, H. N. Bolander, No. 4730.

This large and showy species has the general appearance of *R. Lingua* of Northern Europe: but that has its akene tipped by a stout, blunt style. The transversely elongated, inflexed callosities which are distributed along the margin of the leaf, together with the great size of the plant, distinguish this Coast Range species from its allies of the Sierra Nevada. *R. Lemmoni* and *R. alismæfolius*.

RANUNCULUS LUDOVICIANUS.—Pilose-pubescent, a foot or two high: branches ascending or depressed, stout and fistular: leaves ternately parted, the segments broad and with some conspicuously callous-pointed lobes or teeth: calyx reflexed, petals 10—15, a half inch long: akenes in a globose head, cuneate-obovate, a line and a half long, thickened upwards, marginless, tipped with a short, slender, recurved style.

High valleys among the mountains of San Luis Obispo County, California, and eastward to Tehachapi Pass. Collected by Mrs. Curran, in 1884. A large-flowered showy species, covering the ground in many places with its depressed flowering stems and branches.

MECONELLA DENTICULATA.—Three to ten inches high: radical leaves entire, the laminal portion rhombic-ovate, acutish: cauline spatulate to linear, obtuse, sharply denticulate: petals narrowly oblong, 2 lines long: stamens 6—9.

Temecula Cañon, north of San Luis Rey, in San Diego County, Cal., March 27, 1885, by the writer.

The genus *Mecanella*, with its few stamens, filiform filaments, narrow stigmas and slender, spirally-twisted capsules, together with its peculiar habit, seems more unlike *Platystigma* a good deal than that genus is unlike *Platystemon*. Hence the action of Messrs. Bentham and Hooker in reducing it to *Platystigma*, appears to have been rather arbitrary. This new species has the small flowers of the original *M. Orejana*, Nutt., but the leaves of the stem are denticulate.

ARGEMONE CORYMBOSA.—Annual or biennial, a foot or two high, robust, simple below, corymbosely branched above, armed throughout with rigid, straight, spreading spines: leaves rather crowded, 1—3 inches long, oval, entire or with shallow, rounded lobes, closely sessile by a broad, somewhat clasping base: flowers white, small, numerous, in an ample corymbose, terminal cyme: capsule oblong-ovate, acuminate, barely an inch long, spinose, 4-valved.

Mohave Desert, June, 1884, Mrs. Curran.

A peculiar species, very leafy, none of the leaves pinnatifid, the uppermost quite entire. The many, small, corymbose flowers mark it at sight as a very distinct, not to speak of the uniformly quadrivalvular, taper-pointed capsules.

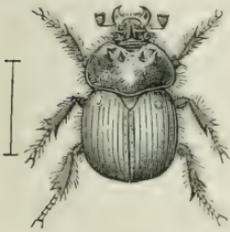
DRABA SONORE.—Annual, leafy at base, sparingly pubescent with branching hairs: flowering branches slender, racemose from the base: leaves spatulate-oblong, or obovate with cuneate base, coarsely few-toothed: pods oblong-lanceolate, 2—3 lines long, on ascending pedicels of about a line: petals white, minute, little exceeding the sepals, rather deeply emarginate.

Northwestern Sonora, March, 1884, collected by Mr. Pringle, and distributed under the name *D. cuneifolia*, var. *brevipes*, Watson; but the minute, emarginate petals, branches racemose throughout their whole length, and pods on not only shorter but ascending or sub-erect pedicels, mark it as distinct from *D. cuneifolia*.

A NEW SPECIES OF CALIFORNIAN COLEOPTERA.

By J. J. RIVERS, University of California.

BRADYCINETUS, Horn.

Bradycinetus Hornii n. sp.

MALE.



HEAD.

Male: Form robust, elliptical. Color ferruginous brown, shining; head, tips of armature, margins of prothorax and a spot near the outer margin of prothorax either dusky or black. Head: Clypeus transverse and feebly angulate at the sides, the front edge rising increasingly backward, until just before reaching the clypeal suture it ends in a well formed tubercle on either side; behind the sutural line on the ver-

tex is a very prominent, stout, conical horn in front of the base of which the surface of the head is slightly concave; three-fourths of the lower portion of the horn and the whole of the frontal area finely rugose. Antennæ: funicle shining, chestnut; club paler, not shining. Thorax: subtriangular, deepest longitudinally through the center; noticeably wider than the elytra at their juncture, and rather wider than their greatest breadth; seen from above the front margin appears truncate in the middle, then trends obliquely forward to the angles which are prominent; sides straight for a short distance, posterior angles strongly rounded; posterior margin much extended in the middle with distinct sinuations toward the angles. The front area deeply concave, surmounted by four well formed tubercles; two occupying the center, bold and projecting over the concavity, two others, one on either side of the central two, situated near the anterior margin of the thorax at its exterior angles. The area around the two anterior tubercles very rugosely punctate; and transversely across the disc are large distinct punctures nowhere extending to the posterior margin. A well defined margin, reflexed at the sides, surrounds the whole. Elytra: very convex, obtusely rounded behind, having fourteen well defined and regularly punctured striæ, the interstices of which are flattened and indistinctly wrinkled. The under side paler than the upper; dense fringes of light chestnut hair line the reflexed portion of the thorax and elytra, while the femora, tibia and tarsal joints, as well as the lower side generally, are well supplied with rather long chestnut hair. Length, .48—.52 inch.



FEMALE.

Female: Form and color as in male. Labrum projecting, rugose, covering the mandibles. Head: clypeal margin raised; a feeble tubercle just in front of the clypeal suture, immediately behind which is a central transverse ridge, undivided, slightly higher in the middle and slightly apiculate at either end. Antennæ less robust than in the male. Thorax: very convex, shining; outline obtusely triangular; anterior margin seen from above, truncate in the centre; angles produced; sides rounded; posterior margin much produced to meet the scutellum, sinuate toward the angles which are rounded; the front discal area characterized by a bi-lobed transverse raised line at either end of which, outward and forward, is a well formed but depressed tubercle; behind which line the disc is dense with coarse corrugated punctures, which become scattered and plain, nowhere reaching the posterior margin, but taking a transverse course, barely reach the side margins, where they become less distinct. Elytra: much the same as in the male, but the interstices of the fourteen punctate striæ a trifle more wrinkled and much more convex. Length, smaller than the male.

Habitat: burrowing in the ground near the city of Sonora, Tuolumne Co., Cal.; found also in Sacramento Co.

The name selected for this species is intended to be a slight tribute of honor to Dr. Geo. H. Horn, the eminent Coleopterist, as a slight return for many favors.

STRIDULATING ORGANS.

Chas. Fuchs, Esq., having obtained living specimens of the above new species of *Bradycinetus* discovered that it possessed the power of stridulating. His researches through coleopterological literature disclose nothing relative to the stridulating faculty in this genus. The latest work on classification, that of Le Conte and Horn, makes no mention of it, and as these able authors always notice such biologic characters when aware of them, it is safe to affirm that the observations of Mr. Fuchs are new, and that to him belongs the credit of the discovery of these particulars.



The anatomical investigation by Mr. Fuchs of this beetle discloses the stridulating apparatus to be well developed, and to consist of three transverse bands situated respectively upon the fourth, fifth and

sixth dorsal segments, that on the fourth segment showing boldest. Each of these bands is seen with a high power to consist of cernuous bristles set in oblique rows, alternating and interlacing with one another; the point of each bristle is bent downward, forming a bow, and the band, as a whole, gains elasticity by the pressure of each bristle thus bowed against the next in the series. The rubbing of these three bands against the edges of the elytra produces the stridulation. The examination of species of the allied genus *Bolbocerus* shows the same stridulating power, but the outline of the bands in each case so differs as to show specific characters.

**CONTRIBUTIONS TO THE LARVAL HISTORY OF PACIFIC COAST
COLEOPTERA.**

By J. J. RIVERS, University of California.

The study of systematic entomology affords the student but a dim idea of what insects are noxious and what are innocuous. The distinctive characters upon which the systematic entomologist builds classification need not be and generally are not the characters of prime importance to the economic entomologist. The names of many of the groups of Coleoptera afford a slight generalized description which is often misleading. In the present state of entomologic science, where systematic is given precedence over biology, it is dangerous to attempt to make a general statement of the habits of a single genus and impossible to generalize the habits of a group or family.

The most valuable contribution to the life history of American insects which is generally accessible is Dr. Packard's "Insects Injurious to Forest and Shade Trees."* In his introduction the author states that this work is purely tentative and designed to elicit the results of the observations of students of economic entomology. It is on that account that I feel at liberty to comment upon or question certain of Dr. Packard's statements.

On page 118, *op. cit.*: *Prionus laticollis*, Drury, is noted as injurious to the poplar. If *Prionus* destroys living trees in other parts of America it has no such destructive habit in California; in fact the charge against borers that they destroy trees is a very old one, but by no means substantiated by my own observations. *P. Californicus* goes through its transformations in the roots of oaks, but these roots were dead in every case observed by me and usually belonged to

*U. S. Entomological Commission, Bulletin 7, Washington, 1881.

stumps whose trunks had been felled years before. Last year I bred several from the decayed part of an old oaken chopping block. In fact Dr. Packard himself throws some doubt upon the destructive habit of *P. laticollis*, for in his note he quotes the report for 1872 of Prof. S. J. Smith, Entomologist to the Connecticut Board of Agriculture, as follows: "I have noticed it in logs of poplar, bass-wood and oak, and in the trunks of old, decaying apple trees."

On page 137 *op. cit.* is the following: "We have found Buprestid and Longicorn borers in a dead sweet gum tree." The caption at the head of the page, "Insects Injurious to the Sweet Gum," seems designed to lead to the inference that these borers killed the tree. But my observation is that the larvæ of insects of the two families noted feed only on dead wood.

Again, on the same page, *Ptilinus basalis* and *Micracis hirtella* are listed as injurious to the California Bay. These species are both found in Berkeley, and I have observed their habits for the last seven years, and as a result of such observation I am in a position to assert that they bore into the twigs of the tree mentioned only when dead, dried and decaying.

On page 71, *op. cit.*, we find a figure of *Oncideres cingulatus* in the act of girdling a hickory twig. In connection with this insect we meet with one of the most interesting and remarkable points in the whole range of insect biology. For, knowing that its larva will have to feed upon dead and sapless wood, this beetle, at the time of depositing its egg in the living and easily penetrated green wood, has instinct or forethought to girdle the twig, and thus assure the future larva the conditions necessary for its metamorphosis.

The question, "Are *Cureulio* larva lignivorous?" has been partially discussed in Bulletin of the Brooklyn Entomological Society, vol. vii, page 150, by Warren Knaus, and in *Entomologica Americana*, vol. i, page 18, by W. H. Harrington. The question was brought up by the finding of

Wollastonia quercicola in cottonwood logs in an advanced stage of decay. The Curculios are a group of insects in systematic value the equivalent to a sub-order, and known as the Rhynchophora (Latreille), which bear certain intimate resemblances to one another in the perfect and final forms, while in their larval stage they may and certainly do differ in many particulars of habit. *W. quercicola* belongs to the Calandridæ, a family abounding in species whose habit in the larval stage is preëminently to feed on dry food. The metamorphoses of the Rhynchophora (Latr.) are not at all well known, but I have bred the following, belonging to this sub-order, and have found them to be lignivorous in the larval stage:

PLATYRHINUS LATIROSTRIS Fabr. — Decaying oak stumps highly charged with mycelia of a fungus.

SCOLYTUS DESTRUCTOR Oliv. — Dead sapwood of elm.

MESITIS TARDII Woll. — Decaying beech.

MONARTHUM HUTTONI Woll. — Various hard woods.

HYLESINUS CRENATUS Fabr. — Dying ash.

ANTHRIBUS ALBINUS Lin. — Old wood.

BRACHYTARSUS SCABROSUS Fabr. — Elm bark.

RYNCOLUS — several species. — Bark of trees.

The foregoing are old world species of Curculios that do not affect a herbaceous diet; and the three following species are of similar habits.

SCOLYTTIDÆ.

MONARTHUM SCUTELLARE Lec. — Bark of dead *Quercus agrifolia*.

MONARTHUM DENTIGERUM Lec. — Bark of dead *Quercus agrifolia*.

MICRACIS HIRTELLA Lec.—Dead branches of California laurel, *Umbellularia Californica*.

The Brenthidæ are well known to have the general habit of perforating trees and of depositing a single egg in each hole thus made, by this means providing that the larva shall have a full supply of the wood upon which it feeds.

The question, then, should not be: are *Curculio* larvæ lignivorous? but rather, how many have that habit? In a great group like this of *Curculios*, comprising many forms varying greatly from one another, one can easily appreciate the fact that we meet with many different tastes and habits. Some are known to feed upon all kinds of grain in store; one finds its food in rice, another in barley, and others in maize. Many species of *Balanus* undergo their changes in nuts, the larva feeding upon the kernels; another group is to be found in *Cynips* galls; and one species, geographically distributed from San Diego to Alaska, is to be found beneath seaweed upon the shores. Enough has been instanced to show clearly that we can draw no inference from the fact that two insects are found in the same natural group, that for that reason their habits are similar; and it is evident that a classification by habits would be of little aid to the systematic entomologist.

CHRYSOMELIDÆ.

DIABROTICA 12-punctata Oliv.—This is a most destructive insect to our peach orchards, and is not as yet sufficiently studied. If it resembles in habit the eastern species of the genus, and feeds in the larva stage upon the roots of cereals, it may be possible to rid ourselves in some degree of this pest by some rotation of crops. In the meanwhile sprays and washes are beyond a doubt not only useless, but in most cases a positive injury. We shall have to study further before speaking positively of the larval history of this insect pest.

The Ptinidæ is a family of limited extent, whose habits seem to be very similar wherever members of it are found. In California I have observed the following:

MELANDRYIDÆ.

DIRCEA RIVERSII Lec.—Larva feeds in decaying trees of Madrona, *Arbutus Menziesii*. In trees in position the insect is found in the primary forks of the roots, and in prostrate logs among the more seasoned fibers of the wood.

PTINIDÆ.

PTINUS INTERRUPTUS Lec.—Black fungus of the laurel, *Umbellularia Californica*.

PTINUS QUADRIMACULATUS Melsh. — Decayed *Ceanothus thyrsiflorus*.

HEDOBIA GRANOSA Lec.—Dead branches of *Umbellularia Californica*.

HADOBREGMUS GIBBICOLLIS Lec.—Decaying wood of *Myrica Californica* and dead willow.

VRILLETTA CONVEXA Lec.—Dead *Quercus agrifolia*.

PTILINUS BASALIS Lec.—Dead twigs of *Umbellularia Californica*.

SINOXYLON DECLIVE Lec.—Any dead tree or unpainted wood, very partial to wine casks and oak barrels. The depredations are done by the beetle while boring for a suitable place to deposit its eggs. Its burrow is straight across the grain of the wood, reaching the interior of the cask, causing waste and deterioration of the contents. Hot solution of alum applied to the outside of the casks will prevent boring.

POLYCAON STOUTHII Lec.—Dead and dried willow.

POLYCAON CONFERTUS Lec.—Found boring into a slab of chestnut oak that had been deposited for years in the museum of the University of California; also bred from the stem of dead apricot trees that had been grafted on a peach root.

There appears strong evidence that these trees were not destroyed by the borer, but through the influence of the "black knot" on the roots, they being diseased with knobs as large as a man's fist on every root; while all the trees killed had the root diseased, only a portion was infested with the larva of this beetle.

Many similar observations made by myself and others go to show that in the larval stage this beetle is xylophagous. On the other hand, there is indisputable proof that this larva infests living trees by entering the twigs at the axils of the leaves.

LYCTUS STRIATUS Melsh.—Devastates furniture made of California laurel, *Umbellularia Californica*. Dr. Packard, *op. cit.* p. 75, quotes Dr. LeConte as saying that it affects the trunks and branches of *Carya tomentosa*. This is not borne out by my observations, as I am well satisfied that the larva lives in dead and dry wood.

SCARABÆIDÆ.

POLYPHYLLA DECEMLINEATUS, Say. Larva that produced this species was found in the earth from one to two feet from the surface, among root fibres of a coarse grass and roots of a Californian Laurel. *Umbellularia Californica*. The earth was sandy loam situated upon the banks of a river, and which is overflowed during the rainy season of the year.

ODONTAEUS OBESUS, Lec. This has a light chestnut larva with tufts of bristles surrounding each spiracle. Mandibular and clypeal portions well developed, redder in color and

thicker in texture than any other part. The legs are prominent. Feed upon rootlets of *Umbellularia Californica*. It is much infested with a small, pale-colored mite which is evidently parasitic on the species.

LUCANIDÆ.

PLATYCERUS OREGONENSIS (Westwood) — Dead trees of *Photinia arbutifolia*, *Umbellularia Californica*, *Quercus agrifolia* and *Eucalyptus*.

PLATYCERUS AGASSII Lec. — Decayed trees of *Arbutus Menziesii*; also in wood too much decayed to be identified.

SINODENDRON RUGOSUM Mann. — Decayed oak, *Quercus agrifolia*.

The 522 North American species of *Cerambycidæ* are all borers; the insect deposits its egg in a hole perforated in the wood, and the larva penetrates further and further according to a rhythmic order peculiar to the species until its metamorphoses are completed. The following is a list of the Californian species whose habits I have observed:

CERAMBYCIDÆ.

ERGATES SPICULATUS Lec. — Rotting coniferous trees. Bred from *Sequoia sempervirens*, *Pinus insignis*, *Abies Douglasii*, etc.

PRIONUS CALIFORNICUS Mots. — Bred from rotten damp roots of *Quercus agrifolia*.

ASEMUM NITIDUM Lec. — Decayed *Pinus insignis*.

HYLOTRUPES LIGNEUS Fab. — Dead trees of *Libocedrus decurrens*.

ELAPHIDION IMBELLE Lec. — Bred from decayed oak near San Diego, Cal., by F. E. Blaisdell.

HOLOPLEURA HELENA Lec.—Dead twigs of *Umbellularia Californica*.

ROSALIA FUNEBRIS Mots. —Decaying *Umbellularia Californica* among the mycelia of some fungus.

XYLOTRICHUS NAUTICUS Mann.—Dead sapwood of the oak, *Quercus agrifolia*.

XYLOTRICHUS PLANIFRONS Lec.—Dead branches of willow.

NECYDALIS LEVICOLLIS Lec.—Decayed oak, *Quercus agrifolia*, and in dead *Eucalyptus globulus*.

LEPTURA LÆTA Lec.—Dead *Quercus agrifolia* and *Quercus* sp.

LEPTURA CRASSIPES Lec.—Decayed wood of *Umbellularia Californica*.

SYNAPHÆTA GUEXI Lec.—Dead limbs of California buckeye, *Æsculus Californica*.

POGONOCHERUS CRINITUS Lec.—Dead branches of *Quercus agrifolia*.

TROGOSITIDÆ.

TROGOSITA VIRESCENS Fab.—Dead *Libocedrus* and several kinds of oak.

CLERIDÆ.

THANASIMUS EXIMIUS Mann.—Dead twigs of *Umbellularia Californica*.

Among many entomological enigmas of long standing is one that is about being solved. From time to time in many parts of the United States, large luminous larvæ of some Coleopteron have been found, and it has been conjectured that these larvæ belong to some of the Elateridæ, the general supposition being that they were larvæ of the genus *Melanaetes*. Every attempt at breeding them resulted in

failure because their natural food was unknown. I have recently found what their food consists of. Before making this discovery I had arrived, from a careful study of the anatomy of the mouth parts of these larvæ, at the conclusion now confirmed that they are carnivorous in habit.

Their food consists of the vegetable feeding Myriapoda, particularly of *Julus* and *Polydesmus* with a preference for *Julus*, because the large area of the rings of this genus affords space for the larva to penetrate the interior of the Myriapod. Its manner of feeding is to seize the hinder part of the *Julus*, and perforate a segment, reaching the soft inner parts, which it devours at leisure, creeping through many segments without disjoining them, and remaining inside these rings for days at a time, till one can see little else but the slowly wriggling form of the dying *Julus*.

I have a full fed larva, which I hope will go through its metamorphosis, and solve the problem. And now its mode of life is made known, other persons who are equally anxious with myself that nature shall yield this long kept secret, can apply themselves with renewed energy to the task of discovering the identity of the perfect insect.

NOTES ON SATURN.

By Prof. GEORGE DAVIDSON, A. M., Ph. D.

After midnight of Friday, the 13th November, 1885, the atmosphere was unusually steady; sky clear; no wind; atmosphere saturated with aqueous vapor; heavy dew falling. The satellites of Saturn were plainly visible with a moderate power to the equatorial of 6.4 inches objective. The planet was examined for nearly two hours with different powers, the best effects being obtained with powers of 300 to 350 diameters; and the summary of the matters of interest is as follows:

The Encke division was traced for 120° about each end of the major axis, leaving only 120° not seen. The division was faint but it was there, a little outside the middle of the ring *A*.

In the ring *B* the inner part presented such an appearance in its delicate shading as would arise from a rapid horizontal rotary motion being given to a disc of irregularly distributed and yielding matter. I could detect no atmospheric unsteadiness that would give rise to this phenomenon.

The dusky ring presented equally distinct ansæ; on former occasions I had been satisfied that they were sometimes of different brightness, and had endeavored to find some law for this variation. The dusky ring was well defined at the ansæ and across the body of the planet, but I was convinced that the limb of the planet was visible through the dusky ring, very nearly, if not quite up to the inner edge of ring *B*.

The shadow of the planet was cast upon the preceding side, and where it reached the outer edge of the ring *B*, it was recurved farther from the planet as if the outer edge of *B* had a round moulding above the general level of the plane.

The markings of the planet were quite distinct. The darker color of the pole was gradually toned down until it met the second moderately faint belt south of the equator. The second belt was quite dark but appeared to have a more marked darkness on the following side of the central line, where it should have been brighter on account of the sunlight. Then came the bright equatorial belt without markings and north of it a narrow dark band about half as broad as the trace of the dusky ring across the planet, with a narrow dark band about half as broad as the trace of the dusky ring across the planet, with a narrow lighter space between it and the edge of the dusky ring.

January 8, 1886. The atmosphere was unsteady, but at quiet moments I saw the Encke division by using a power of 250 diameters. Observations made with the Clark Equatorial of 6.4 inches.

January 25, 1886. The atmosphere was wonderfully steady. I saw the dusky ring of Saturn with powers as low as 150 diameters, and the equatorial beltings were beautifully sharp. The shape of the shadow on the outer part of the *B* ring was apparently not so recurved as heretofore. I saw the limbs of the planet through the dusky ring to the inner edge of ring *B*. I was able to follow the grayish inner edge of the *B* ring across the body of the planet and in contrast with the dusky ring below it. The Encke division at the preceding part of the ellipse was clearly outside the middle of *A*; at the following part it was barely outside the middle of *A*; no difference of breadth of the Cassini division could be distinguished at either extreme.

February 14, 1886. Atmosphere steady. Carried powers to 450 diameters. The Encke division clearly exhibited; on the preceding side it is outside the middle of *A*, on the following side it is barely inside the middle of *A*; I carry it well down to the narrow part of the ellipse. The dusky ring is well seen and it seems that the inner edge extends more than half way from *B* to the planet. The limbs of the

planet are seen through the dusky ring and the inner edge of *B*. I cannot determine any difference of brightness between the preceding and following parts of the dusky ring.

I have watched carefully and repeatedly a minute—excessively minute—and white protuberance on each side of the planet apparently off the broad bright equatorial belt, but really at the points where the faintly dark belt nearest the dusky ring disappears at either limb. This would seem to indicate that this faint dark belt is raised above the general surface of the spheroid.

March 31, 1886. To this date I have not been able, on account of atmospheric conditions, to test the last observations of February 14.

WEATHER TYPES ON THE PACIFIC COAST.

By W. A. GLASSFORD, 2d Lieut. Signal Corps, U. S. A. Assistant.

(With Four Plates.)

A short study of the charted weather reports of the Pacific Coast, reveals certain types lasting for a considerable period which admit of classification. East of the Rocky Mountains, however, no such characteristics are present; the storms or cyclonic areas, as well as the anti-cyclonic or areas of high pressure generally originate in the Gulf of Mexico, the Rocky Mountain slopes, or in British America, and move in succession over a curved path almost invariably to the eastward at a uniform rate, and with uniform characteristics. They disappear as regularly near Nova Scotia. It is very seldom, if ever, that perfect paths of low pressure areas are traced from the Pacific Coast across the mountain plateaus and ranges, although some few cases have been charted on the storm track maps; but even these are not so uniform as in the East, for they frequently tarry for quite a period, clinging to some valley or plateau. On this coast a noticeable feature is the difference in the storm frequency between the northern and southern boundary lines of the United States. Areas of low pressure of any intensity are of infrequent occurrence in southern California, but going north become more frequent as Vancouver Island is approached. From a search of the Weather Reviews for three years, it is found that areas of low pressure entering the Pacific Coast states from the ocean during that period number 90; those north of the 45th parallel are 54; between 45° and 40°, 25; between 40° and 35°, 10; below the 35th parallel, 1. Another peculiarity of the areas of high and low pressure here is their arrangement in recurring and symmetrical types; recurring, because there is a tendency to assume the same barometric condition on successive days; symmet-

rical, because the recurrence as denoted by the barometer takes about the same area, shape and intensity.

Except the November, and the greater storm of January last, and in fact the centers of these were the whole time at sea, there has been no distinct cyclonic area, such as appear in the Eastern States, central over California during the past season. Those who examine the Signal Service synoptic charts with its reports may have observed "High" and "Low" designated, but these are often such only by contrast; the areas where the group of barometric readings, reduced to sea level, are the greatest or the least that appear on the map, being so named.

Another observation may be noted. When severe and stormy weather prevails on this Coast, and especially in California, almost invariably the press dispatches announce from the East the prevalence of cold waves, snow blockades, tornadoes, etc. If complaint be made at any time that the climate of the Pacific Coast is in no way superior to the ordinary Eastern weather, attention may be drawn to the fact that at that time cold waves, snows, etc., prevail over the East; if here the winds are high they are balanced by tornadoes or hurricanes there; if washouts delay travel on this slope, floods in the streams of the great Eastern valleys and seaboard do vastly more damage; if frosts nip the buds in our California citrus belt, in Florida oranges are frozen. Such is the action of storms on this Coast relative to the margin of the great Arctic high pressure ridges which surge down from British Columbia. These coincidences show a common sensitiveness to distant weather conditions. Contrary to the usual rule in the states east of the Rocky Mountains, we have observed here a recurrence and persistence of fine clear weather, or of rainy days for quite a period. The interruptions are slight, of short duration, and the prevalent types are unmistakable. The synoptic charts during these periods show a general resemblance. For instance, during February last scarcely any rain fell.

In April we had almost constant rain from the 1st to the 17th, then followed suddenly clear weather to the month's end and after. The fact that the change from one type to another is so very sudden is what causes the difficulty on this coast in forecasting the weather. These phenomena, as aids to forecasting, I call weather types.

This study is only possible by reference to the reports of the observations taken three times a day simultaneously at 4 A. M., noon and 7 P. M., Pacific time, telegraphed to San Francisco and charted by entry on outline maps. Isobars and isotherms are drawn showing the belts or areas of like pressure and temperature, and symbols are added marking stations where rain has fallen or cloudiness exists. It is seen that map after map, day after day is almost identical. A persistence of some one barometric characteristic covers the same region. Applying the principle of composite photography, taking a transparent outline map of the same scale as the weather map and drawing lines enclosing like areas, and continuing this process on the same transparent map, we have represented a great number of like areas superimposed upon each other.

We thus find the high or low barometer regions to correspond with certain characteristic conditions of cloudiness and rain, which remain stationary and hover over the same locality during the continuance of the high or low. For instance, grouping all the charts that have high pressure over Oregon, and the low over southeastern California, it is noticed that remarkably fine warm weather with northwesterly winds continues for a succession of days, while this condition lasts. When the barometer changes, it does so suddenly, and the weather changes with equal rapidity. The greater the number of these like features of barometer and weather found, the greater, of course, is the frequency of the type. Illustrating in the case of February last, it is found that a persistent high overlay the district embracing Oregon with parts of Nevada and Idaho. Plate II illus-

trates the superimposing of a series of daily charts showing this feature.

Indeed, if only the observations of a single station are studied, taking a specific instance of the recurrence of a persistent weather type, the list of days in which rain of any consequence fell on successive days in San Francisco during the last rainy season, shows six such periods lasting from six to fifteen days each. These periods of the rainy season, and the contrasting conditions of rain absence intervening, are the special object of this inquiry.

I now come to determining and naming these weather types, commencing with the rainy season of 1885-6. On November 1st, the first interruption of the dry season of 1885, disregarding some slight rains occurring prior to this date, began at the time when the high, which had moved inward from the coast with the advance of the season and finally hung stationary over the eastern slope of the Cascade Range, moved further eastward before the low area advancing on the Washington Territory coast from sea. This low area spread south and brought the rainy season for San Francisco and this portion of the State. This type I call the

NORTH PACIFIC CYCLONIC.

It prevailed from November 1st to 10th, and from January 11th to 14th, and is distinguished by a low barometer area of considerable depth over and to the westward of Oregon and Washington Territory, which, striking the mountain range and high pressure to the eastward, cannot break over the barrier, and is held there with fluctuating depth for some time.

The high, which always exists somewhere in the margin of the low, continues central in the district north of Salt Lake. During the prevalence of this type, southerly gales occur from Cape Mendocino to Vancouver Island. Rain prevails and frequently becomes heavy over Oregon, Washington Territory, in California south to San Luis Obispo

and in the San Joaquin Valley. The temperature throughout the coast is about normal. It is only when a subsidiary low is developed in southeastern California, locally called a "Sonora Storm," that rain spreads over the southern part of the State, being generally of short duration. See Plate III as an example of the conditions existing during this type.

INTERIOR ANTI-CYCLONIC.

This second type closely resembles the preceding in that the interior high is well marked, but differs in that the low upon the coast is less in depth. This type prevailed from November 11th to 15th; November 25th to December 6th; December 14th to 26th; January 27th to February 12th. It is characterized by a high barometer (about 30.30 inches) over Utah, Nevada and Southern Idaho. The accompanying low barometer on the northern coast drops down frequently to 29.70, and is central west of Washington Territory. These lows appear to beat against the high, the low area often dropping down for a short time nearly to Cape Mendocino. At other times they push the high southerly over Arizona and pass eastward beyond our boundary. Again when the surge of high pressure is very great over Idaho, a low often pushes upon it from the southwest coast of California, at which time rain may occur in light showers on the southern coast. The rainfall, except as just mentioned, never passes south of San Francisco, and is generally limited to light showers in Oregon and Washington Territory. Gales are very strong from the southeasterly at Cape Mendocino and at the mouth of the Columbia River, north of which they come more from the south. The temperature is usually high, and at times, of steep gradients, from Nevada southward; near Los Angeles, the warm "Santa Anna" winds may occur. Plate III serves to illustrate this type if the pressure over Idaho and Nevada is considered about 30.30, and the low on the North Pacific Coast about 29.80 inches.

NORTH PACIFIC ANTI-CYCLONIC TYPE.

This type is very frequent, but sometimes of short duration. It prevailed from November 10th to 15th; December 7th to 13th; December 31st to January 10th; February 12th to 21st; February 23d to 25th; March 10th to 12th; March 23d to 28th; April 2d to 5th, and April 17th to 29th. While this type is prevalent the high, as is implied by its name, rests over Oregon and Washington Territory, with a permanent low over southern California. It is attended with clear weather, only interrupted by an occasional shower near Vancouver Island. During its prevalence in its perfection and greatest intensity, and while the isobars are perpendicular to the coast line, is the time when the dreaded desiccating "north wind" prevails in the Sacramento and San Joaquin valleys. The temperature is high during the day, especially after several days' continuance of the type, while at night frosts often occur. The winds are usually light and variable on the coast of Washington Territory and Oregon, but on the coast of California high with southerly gales. If in the spring during the prevalence of this type high winds and sandstorms occur in southern California, they are almost sure to be followed by rain. The proverb that a succession of frosts is liable to be followed by rainy weather, obtains warrant from the fact that the breaking up of this type is usually foretold by frosts and most certainly followed by rain. The occurrence of this type on the first ten days of January, 1886, appears to bear a certain relation to the great surges of high pressure from the Arctic regions moving well westward over British Columbia. The isobar of 30.3 to 30.5 inches enclosed the area. The weather on the coast was unusually cool and clear; frosts extended into southern California. During this period remarkably cold weather was prevailing in the Eastern States. These surges of high pressure in their movement covering almost the width of the continent during the first ten days of January, caused the development

of intense cyclonic areas originating in the Gulf of Mexico or Texas and moving northeastward along the Atlantic coast, accompanied by the most severe cold wave of the year east of the Rocky Mountains. Plate II illustrates this type.

THE GENERAL CYCLONIC TYPE.

This type is characterized by the most severe storms that occur on this coast. The rain area overspreads all sections, falling in torrents, and gales of the greatest violence with frequent thunderstorms occur, rivers overflow, and wash-outs impede travel. The barometer drops very low and suffers rapid fluctuations, and remarkable gradients occur between the coast and interior. Simultaneous with this type is a series of exceedingly high pressure waves over the Rocky Mountain plateau and states to the eastward, accompanied by severe storms and intense cold. During the last season there were only two occurrences of this type, viz., from November 15th to 25th, and January 15th to 26th. The general feature is a cyclonic disturbance on the Pacific coast line, which, apparently unable to cross over the Sierra Nevada, seems to spread out over the entire length of our region, until it gradually wastes away or finds escape beyond the limits of our field of observation. The occurrence of this type in January last is especially worthy of careful review. On the 15th another surge of high pressure followed the north Pacific anti-cyclonic of the first ten days of January, extending from British America over the Rocky Mountain region. On this coast was developed a series of storms among the severest in the history of the country. The temperature was very low in Montana, and spread its influence over portions of this coast, causing frost, snow, ice and unusual cold in portions of the Pacific States. Rains were heavy and almost continuous, gales frequent and severe, needing no description to those who were here at the time. The storm, as represented by

the barometer, was a series of most extraordinary fluctuations; the disturbance would suddenly appear at any given station, and after a few hours be scarcely perceptible, only again to appear at this or some other station. A diagram showing these fluctuations is interesting. The center appeared for a time to be over the interior valleys of California, and not great in depth, and it was only upon consulting ship reports that it was found that the eye of the storm was far to the westward. This center appeared first upon the coast about 3 A. M., January 20th, off Point Conception, where the roughest weather was experienced. A few hours later it was reported off the mouth of the Columbia River. From 5 to 8 A. M., about 175 miles southwest of San Francisco, the *Zealandia* was in a southeast and southwest hurricane, with the glass at 29.23. The barometer, about the same time at San Francisco, was 29.31 inches; at 8 A. M., at Cape Mendocino, the barometer fell to 29.15, with the wind a hundred miles per hour from the S.E.; at noon it was 29.06, with the wind from the southeast and blowing with hurricane violence, carrying away the anemometer, after which accurate observations were interrupted for a few hours. At the same time the wind was southwesterly at San Francisco, blowing 42 miles, but at Point Lobos, the south head of Golden Gate, six miles away, it was 96 miles an hour. The cyclone was off the coast of Oregon at 7 A. M., as shown by a pressure of 29.17; but by the following morning, the 21st, at 4 A. M., the pressure had risen, and the cyclone had completely vanished from the charts, and by 12 M. the isobar of 30.20 passed from Washington Territory through Oregon down to the center of California and out near San Luis Obispo. But one other isobar (30.10), drawing isobars for every tenth of an inch, appeared on the chart, and this enclosed northwest Washington Territory. The next morning (22d) the cyclone reappeared at the mouth of the Columbia River, here also carrying away the anemometer. It again subsided, and burst in once more the same day at the

Straits of Juan de Fuca, the glass going down to 29.00. Again almost disappearing, it came in upon the Washington Territory coast the 26th, the barometer falling this time to 29.15. On the 27th it was not to be seen, and if it passed eastward it did so far beyond the northern boundary.

During this time severe washouts occurred in Southern California, and the telegraph lines were everywhere prostrated. I find this type is not a frequent one, and comes only in such intensity as described at long intervals. The great storms of 1875 and 1879 are the only ones that can be ranked with this one. See Plate IV.

The next distinct type is the

SOUTH PACIFIC ANTI-CYCLONIC,

which appears as a moderate high along the southwestern California coast. It is peculiar on account of the rains which accompany it, being one of those types which bring out many inquiries from those having and observing barometers, asking the question, how it is that we have rain with so high a barometer. It creates isobars somewhat perpendicular to the coast, bringing in the rain-bearing southerly winds at San Francisco. It is noteworthy that any type exhibiting isobars perpendicular to the coast line is almost sure to bring rain, while if the isobars are parallel to the coast, fair weather follows. This type was in existence from March 31st to April 2d, and from April 7th to 17th. During its prevalence a faint low may exist in the north Pacific. Rain occurs in the interior California valleys and northward, also in the vicinity of Los Angeles. Should the general pressure fall considerably below the normal, but with the relatively high barometer continuing in the same region, gales with thunder and hail storms are frequent in southern California. The winds are not strong north of San Francisco, except when the barometer becomes very low, and such cases are few. This type disappears by the movement of the high along the coast into Oregon, and

ceases very suddenly. The temperature is unusually low. See Plate V.

SUB-NORMAL TYPE.

This type is marked by a succession of days when the pressure is moderately low, and below the normal over a large area. The isobars are broken up, are wavy or enclose several subsidiary low areas, with an absence of any decided gradients. This type prevailed from February 26th to March 4th, and from April 5th to 7th. Rain at intervals occurs, frequent local storms, and thunder storms are reported. Occasionally a gale, but local in character, does considerable damage. The winds are variable, and the weather cool and cloudy.

It might be well to add that the changes occurring in the cyclonic types follow a general principle that a disturbed equipoise recovers itself in proportion to the intensity and rate which the disturbance has originally developed. The greater the high, the greater the depth of the low which follows, and if the change is sudden, the appearance of the opposite condition is sudden. In meteorology, as in mechanics, these vibrations of the disturbed equipoise are liable to continue for some time in waves of gradually decreasing length before coming to rest; and the observance of this principle enables us to say that a disturbance is not definitely passed although the synoptic charts give but little indication of its recurrence.

The dry season demands only the briefest consideration, having but one general characteristic—high pressure over the sea and low over the land. The type of the dry season has about the sameness of the weather which accompanies it. The high is greatest and most persistent over the ocean and north Pacific coast, and lowest from Arizona to Nevada including eastern California. Almost the only peculiar feature of the type is the occasional low over the central valleys of California.

Rain is almost entirely absent when this type becomes perfectly established, and only occurs in light showers in Oregon and Washington Territory, when the high happens to drop down well on the California coast, creating a condition similar to that of the "South Pacific Anti-Cyclonic Type," already described. Another feature of the dry season is the development of considerable intensity of the high in Oregon, the pressure being at the same time very low in southern California, creating the northerly winds in the Sacramento and San Joaquin valleys.

The boundary between the wet and dry season would, I believe, be as definite as the sun's march north or south if not for these disturbing weather types, which bring into effect conditions overriding the gradual change of temperature. It is well established that the temperature of the Pacific Ocean differs very little anywhere on the coast, and the monthly variation is so slight that it may be disregarded. We can in a general discussion say that the temperature of the ocean washing our shores is about constant. It is wholly different over the land, and the difference increases in proportion to the distance from the sea. In the winter, the prevalent type is such as to drive the ocean winds over a country where the temperature is cooler than themselves, and where the condensing conditions are strong enough to well deplete them of moisture; hence rain results upon the western slopes and little remains for the Rocky Mountain country. During the summer, on the contrary, the winds from the Pacific Ocean passing at once over the drying country, do not precipitate their moisture at all till the Rocky Mountain summits condense them. Thus the rainy season is transferred from this coast to these higher regions. The change of one season to another is best illustrated by projecting the curve of surface temperature of the Pacific Ocean, with the mean daily temperature of a place in proximity to it, for instance, San Francisco. As soon as the air temperature curve permanently crosses the former, the

change of season takes place. A specific case of this principle is discussed and well illustrated in the last Bulletin of this Academy, by Prof. Davidson, in his paper on the air and water temperature at the Golden Gate.

NOTE—The plates show in figures for each station: 1st, temperature; 2d, barometer; 3d, wind velocity and, when reported, the minimum velocity since the last report, in brackets; 4th, the amount of rainfall. The wind direction is shown by an arrow flying with the wind. The state of the weather at the time of the report is shown thus: cloudy or fine day, circles fully or one-half shaded; rain by L. R. or H. R., as it is heavy or light; S. for snow.

TRANSITS OF THE II AND III SATELLITES OF JUPITER.

By GEORGE DAVIDSON, U. S. Coast and Geodetic Survey.

[Davidson Observatory, March 20th, 1886.]

About three o'clock in the morning of Sunday the 21st, I watched the transits of the II and III Satellites of Jupiter and their shadows. The shadow of the II Satellite was on the northern edge of the northern dark belt, but it was intensely black; the image of the satellite was probably a diameter from the shadow but was in the edge of the white part of the planet. This image was more than white; it was a *brilliant white*. The image of the III Satellite was yet three or four diameters outside the planet's limb; a few minutes before its first contact therewith the black image of the shadow of II was not so conspicuous as it had been, for I picked out the bright image of the satellite before seeing the dark shadow. I was using a power of 150 diameters.

About the time of the first contact of III, the sky became slightly hazy and I did not get the time of the contacts of the shadow with the planet's limb. After the shadow of the III Satellite was on the disc of the planet, and just after the first contact of III as a white image, the image of II became too faint to be certain of my seeing it.

The haziness or light fog increased, and the planet was invisible to the naked eye, but occasional thin openings through the mist enabled me to see III and its shadow after both were certainly on the disc of the planet. For seven minutes after, the white image was brighter than the body of the planet; both the shadow and image were transiting the disc where it was moderately clear of dark lines; yet the shadow was traversing the northern edge of a faint one. In fifteen minutes after the second contact, I noted the shadow of III, but could not see the image of the satellite. At twenty-three

minutes after second contact, the shadow was clear and black, but I could make out no image of the satellite.

When the II shadow was half way across the planet, I could not see the image of II at the clearest intervals.

At forty-three minutes after the second contact of III, the shadow looked elongated; a minute later, I saw a small darkish speck where the image of III should be, and the shadow of this speck immediately suggested a balloon and its car. In place of the white image of the satellite, there was a small darkish speck, and as the seeing was difficult, I could not detect any definite form to it. This appearance continued until the satellite was nearly half way across the planet's disc. The planet was getting low down, day had broken, and the haze was increasing, so further observations were discontinued.

Several sketches were made of the planet during the transits.

THE ANNULAR SOLAR ECLIPSE OF MARCH 5, 1886.

By GEORGE DAVIDSON, U. S. Coast and Geodetic Survey.

[Davidson Observatory.]

This eclipse was only partial at San Francisco, where four digits of the sun's diameter were obscured on the south-east border.

At San Francisco the clouds broke away about an hour before the time of first contact, and the atmosphere became moderately steady at that epoch. The sun's disc was marked by three large groups of spots north of the equator, and the details of these spots became very sharply defined. The bright faculæ about the western group were plainly traced, and the rice-grain structure of the whole surface was easily made out.

The observations were made with the full aperture of the Clark Equatorial of 6.4 inches diameter, using a Herschel solar prism, and a power of about 170 diameters.

The first contact took place at 1h. 16m. 58.5s. local sidereal time, and the second contact at 3h. 30m. 21.0s. The second contact is a good observation, because it is easy to watch the narrowing, dark segment of the moon, and also because the observer can almost proportion the rate of the rapid shortening of the two cusps. This observation is within a fraction of a second. The observation of the first contact is always more or less in doubt, because the dark limb of the moon must have made its impression upon the limb of the sun before the eye detects its approach; and this dark segment is relatively long and narrow. When the border of the sun is unsteady from the disturbance in the atmosphere, the difficulty is still further enhanced. Nevertheless, I consider the observation within a second or two.

During the progress of the eclipse the images of the sun

and moon were projected upon a white background, and exhibited as in a camera obscura.

The geographical position of the Davidson Observatory is latitude, $37^{\circ} 47' 24.75''$ north; longitude, $122^{\circ} 25' 40.54''$, or 8h. 09m. 42.70s. west of Greenwich.

The phenomenon was also observed with three-inch and smaller telescopes, by Messrs. Lawson, Morse, Welker and Hill, of the Coast and Geodetic Survey.

BULLETIN.

No. 6.

California Academy of Sciences.

THE WASHOE ROCKS.

BY GEO. F. BECKER.

INTRODUCTORY.

It is well known to all who are interested in lithological geology that Messrs. Hague and Iddings¹ have denied the validity of many of the results which I reached concerning the rocks of the Washoe district.² These geologists frankly confess that they commenced the study of the Washoe rocks with a preconceived theory which they desired to prove, and that they found my collections convenient for this purpose.³ To prove their hypothesis, however, it was essential to ignore or disprove a large part of my conclusions as to the structure of the district; for though my results were not inconsistent with their main thesis, the region could not be

NOTE ¹.—Bull. U. S. Geol. Survey, No. 17.

NOTE ².—Monograph III, U. S. Geol. Survey.

NOTE ³.—They say, page 10: "In studying the collections of lavas from the Pacific Coast volcanoes we were forcibly impressed with the insensible gradations in the micro-structure in the groundmass of rocks of the same mineral composition from a purely glassy form to one wholly crystalline and corresponding exactly in structure to a fine-grained granite-porphry. * * * In seeking a locality in the Great Basin which could afford the necessary conditions for carrying out such an investigation as we desired to make, showing the actual transition from the glassy to the granitic structure, it was readily seen that the Washoe district was the only place offering sufficient material for the work."

said to afford conclusive proof of it unless my conclusions as to structure and succession were first overthrown. This demolition they have somewhat ruthlessly attempted. During the past season I have re-examined the Washoe district with their paper in hand, but without being able to detect any substantial error in my former results. I also gathered many new facts concerning the relations of the rocks and, much as I regret being drawn into a controversy, it seems needful to call attention to these as well as to arguments not presented, or imperfectly presented in my former report. I shall be as brief as possible and deal only with the more essential points, being unwilling to contribute an unnecessary word to controversial literature.

SOME GENERAL PRINCIPLES.

Before proceeding to points which are in dispute, I desire to state certain principles concerning which, so far as I know, Messrs. Hague and Iddings would wholly agree with me. Given the chemical composition of an eruptive magma; the mineralogical results are dependent solely on the physical conditions to which it is subjected. It is not a question therefore, whether if similar magmas are subjected at different times to similar temperatures and pressures similar mineralogical and lithological results will ensue, but whether at different geological eras the physical conditions attending the cooling of eruptive masses have been substantially identical. That this has sometimes been the case will scarcely be denied. The problem with which geologists have to deal, however, is not precisely that just stated, for, since the earlier formations have been deeply eroded while the degradation of comparatively recent rocks is as a rule correspondingly small, upper portions of more recent eruptions have to be compared with lower portions of more ancient eruptions. The lithological problem is thereby greatly complicated.

The main purpose of lithology, to my thinking, is to trace

the physical conditions through which a mass of readily ascertainable chemical composition has passed. Hence, in the present state of ignorance concerning the effects of high temperatures and pressures, the most rational method is to study and record every peculiarity of every occurrence and every perceptible difference between rocks. When at some future time the causes of the observed effects are well known, it will be easy to ignore distinctions which are insignificant. If all traceable distinctions are not now preserved, however, it will then be necessary to trace them out lest significant differences should be neglected. It has never appeared to me, for example, that a distinction between pre-Tertiary and Tertiary eruptions was a natural one, but I regard it as an artificial substitute which it would be unwise to abandon, at least until some available natural principle distinguishing little eroded from deeply eroded rocks is discovered and thoroughly established.

Rocks can, of course, never be classified with the sharpness of minerals. Rocks are essentially mixtures and therefore pass over into one another insensibly. The wonder is, that rocks not only conform in some degree to a system, but that certain lithological types exhibit such an extraordinary persistence, being met with at the most remote quarters in typical development. While the very nature of the case thus excludes a rigid classification of rocks, observation clearly indicates the possibility of reducing them to a natural system.

THE PORPHYRITIC PYROXENE ROCKS.

The Issue.—Those who are familiar with the points at issue between Messrs. Hague and Iddings and myself, will readily see that the main subject of controversy is the pyroxenic rocks.¹ In my memoir on the Comstock, I claimed

NOTE ¹.—Mr. W. Cross' paper on hypersthene andesites was published after my lithological discussions of the Washoe rocks was ready for the press, and too late for a revision. The Washoe pyroxenic rocks contain much hypersthene, although the quantity of augite usually exceeds that of hypersthene.

that there were two separate eruptions of porphyritic, pyroxenic, plagioclase rocks, closely allied, indeed, but presenting peculiarities in structure and occurrence which made it necessary, according to the accepted criteria of the time, to separate them into diabase and andesite.⁵ Messrs. Hague and Iddings consider both of these masses literally or substantially as a single Tertiary eruption.

During the past season I have found additional reasons for maintaining the existence of diabase, and also for dividing the pyroxene andesite into two distinct outflows separated by a long interval of time.

Diabase at Steamboat.—At Steamboat Springs, at the western foot of the Virginia range, and about six miles from Virginia City, occurs an extensive series of sedimentary beds. They are for the most part in a condition of great alteration, much plicated, on the average nearly vertical, the strike following the general direction of the Sierra. Andesites and basalts have broken through them and overlie them. No trace of a fossil could be detected in these rocks. They are certainly pre-Tertiary, however, for the Miocene to the north and the Pliocene to the south (at Carson) are very differently characterized. This series appears to be at least as old as the beds determined as Jura-Trias by the geologists of the 40th parallel. These beds contain pebbles of the exact physical and mineralogical character of the most typical portion of the east wall of the Comstock lode, which I determined as porphyritic diabase.⁶ It is

NOTE ⁵.—In my memoir on the Comstock lode, it is maintained that the rocks of the district, in the order of their succession, are as follows: Granite, metamorphics, granular diorites, porphyritic diorites, quartz-porphyr, porphyritic diabase, later diabase (black dike), earlier hornblende andesite, augite andesite, later hornblende andesite, basalt. It will be shown in this paper that the augite andesite would be more properly entitled pyroxene andesite, and that it is divisible into two eruptions, between which, however, no other lava is known to have been ejected.

NOTE ⁶.—As is almost invariably the case at Virginia, the pyroxenes are represented only by pseudomorphs, but these are unmistakable.

thus absolutely certain that there is somewhere in the neighborhood of Mount Davidson real pre-Tertiary diabase, not distinguishable either by definable characteristics or by those more subtle properties known as habitus from Comstock diabase. The locality in which these pebbles occur now receives the drainage from Mt. Davidson. According to my investigation of the faulting action on the Comstock, this locality formerly received the drainage from the diabase area at Virginia. Be this mentioned, however, only as evidence that the two localities are substantially in the same district. It would be impossible and is unnecessary to show that these pebbles are from the particular mass which forms the east wall of the lode. This occurrence throws the burden of proof on to anyone who chooses to deny the pre-Tertiary age of a rock which, in its characteristic exposures, has a distinctly different character from representative augite andesites.

The lithological distinctions between the porphyritic diabase, and the augite andesite of Washoe are somewhat refined, and in many cases it may be impossible from the mere study of specimens to discriminate them.

This could hardly be otherwise, for it is difficult to conceive that a porphyritic diabase could so differ from a porphyritic pyroxene andesite, that every hand specimen, or every slide could be unhesitatingly referred to its proper category. In their typical developments, however, they are distinguishable without difficulty. It may be that this is only because in the course of geological periods the older rock has been eroded to a depth at which the glassy magma had a better opportunity to crystallize and at which fluid inclusions were more readily formed, while the infiltration of waters for ages has produced, even in the freshest specimens, effects familiar to the observers of the older rocks; or the distinctions between the older and younger rock may be due to some other cause not yet elucidated. However this may be, the east wall of the Comstock, at the higher

levels, and particularly on the 500-foot level, is entirely similar to diabases of well ascertained age, while the augite andesite found over a thousand feet lower is equally typical augite andesite. Of these two types, one answers perfectly to the pebbles in the pre-Tertiary rocks at Steamboat, while the other does not. There are thus good lithological arguments, as such arguments go, for the assertion that the east wall of the Comstock is diabase, though these do not by any means complete the chain of evidence admissible.

Pyroxene Andesite at Steamboat.—There are at Steamboat Springs extensive masses of pyroxene andesite, indistinguishable from a portion of the indubitable Washoe andesites. This rock also cuts ordinary hornblende andesite in dikes at the springs, and furthermore, passes by insensible gradations and in good exposures into an extremely micaceous "trachytic" andesite in all respects similar to the later hornblende andesite of the Comstock region. The hypersthene seems to be gradually suppressed and replaced by mica, the augite at the same time yielding to hornblende. So gradual is the transition, that in some croppings of the intermediate rocks one may search for half an hour before detecting a flake of mica, and from this rock with a vanishing trace of mica to one which looks as if it contained 30 or 40 per cent. of biotite, every degree of admixture can be found. In large adjoining areas on the other hand the pyroxene andesite appears to be entirely free from mica. The exposures are so good and so extensive that there can be no mistake about these facts. At Steamboat Springs then, only six miles from the Comstock and on the same mountain range, there is certainly a pre-Tertiary porphyritic pyroxene rock in pebbles and a very recent porphyritic pyroxene lava in large masses. The latter is certainly more recent than the ordinary dense hornblende andesite.

Micaceous Pyroxene Andesites at Washoe.—Having studied

these relations at the Springs I made an examination at Washoe for purposes of comparison. On Mt. Kate, and the range of hills to the southeast of it, I detected the same transition rocks, in small quantities but distinctly developed. This range is mostly composed of a very coarse pyroxene andesite. Its structural relations had always puzzled me, for while the rock of which it is composed presents, as a whole, apparently insignificant lithological differences from the ordinary pyroxene andesite of the Comstock area, there seemed plain evidence that the main mass had been much eroded, while this range seemed to have suffered but little. It now appears to be the first portion of the series of eruptions of which the later hornblende andesite was the last, and I believe it to have been much later than the main, comparatively level pyroxene andesite area, though no eruptive rock, intermediate in age, has been detected. I may also mention that I have traced the same passage from pyroxenic to micaceous andesite at Mt. Shasta and at Clear Lake.

Messrs. Hague and Iddings recognize that my diabase preceded the older hornblende andesite. They also recognize that the later hornblende andesite was ejected long after the earlier hornblende andesite. The pyroxene andesite of the Mount Kate range, which is connected with the later hornblende andesite by transitions, must, therefore, to accord with their admissions, be younger than the rock which I called diabase. The discovery of these transitions thus leads inevitably to the conclusion that the pyroxenic porphyries of Washoe are not substantially one eruption.

Earlier Hornblende Andesite.—The relative age of the older hornblende andesite of Washoe seems to me very clear. It overlies both the diabase and the diorite in thin sheets, and Messrs. Hague and Iddings admit that it is younger than these rocks. They assert, however, that it is also younger than the mass of rock laid down on my maps as augite andesite. They are consequently compelled to

argue that in the region penetrated by the Forman shaft, a thickness of over 1,300 feet of hornblende andesite has been injected beneath an earlier mass of pyroxene andesite. This I regard as a mechanical impossibility.

Granting, for the sake of argument, the soundness of the theory of laccolitic eruptions, these can occur only where the overlying rock is coherent and tough. If a sheet of wet paper is laid on a slab of glass or marble, it is not difficult to inject beneath it a mass of water, which will simulate a laccolite. But a single pin-prick in the dome allows the water to escape and the paper to flatten. Eruptive rocks after cooling are always cracked, and they are also brittle. Laccolites cannot therefore be formed in eruptive rocks. The only remaining supposition is, that the pyroxene andesite floated upon the hornblende andesite. If solid pyroxene andesite will float upon melted hornblende andesite at all, which seems improbable, the pyroxene andesite would certainly not float high out of the melted mass, but would be almost submerged. The hypothesis of flotation, therefore, implies that the whole region was flooded with hornblende andesite to the level of the top of Mount Kate, a supposition which is entirely at variance with all appearances. I believe also that a careful inspection of the promontory of augite andesite, in which the Forman shaft is situated, on my map, including an examination of the topography, or a very hasty glance at the model prepared from the map, will lead most geologists to regard the supposition that the hornblende andesite has been injected beneath the pyroxene andesite, as highly improbable.

Conclusions as to Pyroxenic Rocks.—I re-assert, therefore, that there was an eruption of porphyritic pyroxene rock (diabase) prior to the hornblende andesite eruption, and that pyroxene andesites also followed the hornblende andesite. These pyroxene andesites appear divisible into two outflows, one of which certainly immediately preceded the later hornblende andesite, while there

seems sufficient evidence that the other eruption of pyroxene andesite was far earlier and comparatively near to the date of the hornblende andesite. It is worth noting that most of the glassy pyroxene andesite, and perhaps all of it, belongs to the eruption immediately preceding the later hornblende andesite.

DIORITE.

Not characteristically pyroxenic. — Messrs. Hague and Iddings maintain that the two walls of the Comstock are the same rock and both originally in the main pyroxenic. That in some cases the granular diorite of my report contains fresh brown hornblende, far exceeding the accompanying augite in quantity, they do not deny, but they assert their belief that in the main mass of the granular rock, containing green fibrous hornblende in irregular patches, this mineral is uraltic. This is a case in which full direct evidence is scarcely available, there being commonly no means of deciding whether the bisilicate in a particular slide is a product of the degeneration of pyroxene or of hornblende. During my last visit I collected a series of specimens with a view to testing this question on the fine exposures of the face of Mount Davidson.

In a great portion of this rock the grains are somewhat indistinct from an admixture of the minerals. In other portions equally granular, the grains are sharp and apparently free of impurities. Specimens of the latter class were selected and slides from them show that they contain unquestionable crystals of hornblende with characteristic outlines.

Porphyritic diorite. — Renewed observations were also made on the porphyritic patches of the mass. On the bare faulted surfaces of the diorite of Mount Davidson, though considerably more than 90 per cent. of the rock is granitoid in structure, there are patches of porphyritic rock surrounded by granular material, and patches of granular matter sur-

rounded by porphyritic rock. Neither one nor the other form inclusions. They resemble the dark spots so constantly found in granite and show in innumerable instances, a transition from one structure to the other. In some cases this transition is rapid though unmistakable, in others it is very gradual, so that it would be impossible to say within some inches where the mass should be called granular, and where porphyritic. In a great proportion of cases, the porphyritic portions contain hornblende recognizable with the naked eye. Under the microscope, hornblende is seen to be abundant, and augite almost entirely wanting. Now, I know of no reason to suppose that the change from a porphyry with a granular ground mass to a thoroughly granular structure is regularly accompanied by a change of the bisilicate from hornblende to augite; indeed, there is ample direct evidence that this is not necessarily the case. The inference then is strong that where these patches occur, and I know of no part of the mountain which is free from them, the mass is essentially and originally hornblendic.

Crystallization of diorite does not vary with depth.—But even if it could be shown that the granular west wall of the Comstock were of the same mineralogical composition as the east wall, as I believe impossible, it would be a necessary inference from the whole nature of the occurrence that the two rocks which I call granular diorite and porphyritic diabase are different eruptions which have cooled under wholly different conditions. The diorite is now exposed on the 3,000 foot level of the Chollar mine. It is at this point absolutely identical in mineralogical and physical character with the rock on the surface. This statement is not founded on general impressions. I gathered every variety of the diorite which was to be found on the 3,000 level, and took the specimens with me to the flume above the croppings. I found no difficulty in matching each of them perfectly as to structure and coarseness. The only trace of difference was in the color, which was of course a bluish

gray in the specimens from the mine and a yellowish tint where the rock was exposed to the air. It is manifest and indisputable that the west wall of the 3,000 foot level cooled under a pressure greater than the rock of the west wall of the croppings, the difference amounting to that of a vertical column of 3,000 feet of west country rock. The specific gravity of this rock is about 2.80. It is consequently certain that a pressure of above 3,600 pounds per square inch, or about 256 kilos per square cm. has produced no perceptible difference in the mineralogical or physical character of the west country rock.

Nor that of diabase.—The diabase of the 3,000-foot level is porphyritic and rather finer grained than it usually is on the Sutro Tunnel or any higher level. An additional pressure, nearly as great as in the case of the diorite, has equally failed to produce a coarser or less porphyritic character in the diabase, or, in short, to induce any approximation between the rocks. These rocks are so distinct at the 3,000-foot level that no common miner fails to see the difference between them, or to recognize the character of each and the distinction between them as the same which prevailed at higher levels. In short, there is at the lode a very sharp break in the general character of the rock.

In the effort not to burden my memoir with wearisome details, I there perhaps insufficiently described the distribution of the granitoid diabases, though I distinctly asserted that the commonest variety of the east country diabase is a fine-grained blackish-green rock. The granitoid variety is, in fact, decidedly rare, though circumstances led me to pay particular attention to its occurrences. The granitoid form is not only most likely to be confounded macroscopically with diorite, but is also least subject to decomposition and best fitted for microscopic study. It forms a very small portion of the mass.

The two rocks cannot be one eruption.—According to my

calculations, the faulting on the Comstock amounts, at this locality, to about two thousand feet vertical dislocation. If this is correct, and if the two walls are portions of the same eruption, the fine-grained diabase of the 3,000-foot level cooled under a pressure of at least one thousand feet *greater* than the coarse granitoid rock which forms the west wall at the croppings. It is also to be observed, that since these rocks are separated only by the width of the fissure, and must have been in contact before the fissure formed, it is impossible to suppose those portions of the rocks which were originally on one level subject to different physical conditions in cooling, if they originally formed parts of one eruption. It is of course open to all to doubt the correctness of my theory of the faulting on the Comstock. If I am wrong, the fault may have been greater, but I think few geologists who have studied the district would be willing to admit a fault of above three thousand feet. If the vertical displacement is supposed three thousand feet, the fine-grained diabase of the 3,000-foot level must have cooled under a pressure not less than that of the granitoid diorite west of the croppings, if the two rocks formed portions of the same eruption. On the other hand, this would involve as a consequence the assumption of an immense erosion since the fault took place, an hypothesis at variance with many observed relations. One of these is on Messrs. Hague and Iddings' hypothesis, the survival of glassy portions of the great eruption of porphyritic pyroxene rock. There being no limit to suppositions, however, any amount of faulting may be supposed. It then appears that if the texture of these rocks is a function of the depths at which they cooled, the coarseness and granulation increasing with the depth, though slowly, the amount of faulting which will account for the character actually observed must exceed six thousand feet by a distance which is indefinite but certainly enormous. This no one will maintain for a moment.

PROGRESSIVE CRYSTALLIZATION.

Observations on the surface.—Messrs. Hague and Iddings, however, claim to observe in my slides a progressive increase in the coarseness of the grain of the rocks from the contact between the later hornblende andesite with the augite andesite to the lode itself. This is a distance of about ten thousand feet. They appear to me to have been misled, and for this opinion there are various grounds. Messrs. Hague and Iddings admit that the later hornblende andesite is much later than the pyroxene andesite. The latter has, consequently, been subject to very considerable erosion. If, therefore, there is a progressive tendency in the physical character of this rock on the Sutro Tunnel level, such a tendency should also be sensible on the present surface of this rock, lying as it must considerably below the original surface. Indeed, as I shall presently show, it should afford a better opportunity for establishing their theory. I have gone over the entire surface area east of the lode, with a view to the examination of this point. I found that while the pyroxene andesite is as a whole pretty uniform, quite as much so as similar rocks usually are, it was possible in any area of a few yards square to find very considerable differences in the grain of the rock. Carrying quantities of chips about with me for comparison, I found it impossible to establish anything like a tendency in the crystallization. I examined with particular care a belt about 7,500 feet long lying directly above the Sutro Tunnel, and could detect no tendency to coarser or more uniform grain at the western edge of the pyroxene andesite area above the tunnel than near Shaft No. II, nor could I detect anything of the kind at any intermediate point.

Secondary Minerals in the Tunnel Rocks.—I have also re-examined the Sutro Tunnel which is no longer a satisfactory field for observation, being now almost everywhere timbered. I have carefully reviewed my own slides from

the adit as well as the new ones prepared for Messrs. Hague and Iddings. In the greater part of these, the groundmass, as well as the porphyritic crystals, are highly modified, and a very large proportion of the grains so carefully measured by Mr. Iddings are neither more nor less than secondary quartz. In my opinion, if his microscopic analysis of the groundmass of these rocks proves anything, it is simply that solfataric action increased in intensity as the distance from the lode decreased, an interesting result but not a new one.

Physical Conditions.—If the diabase and augite andesite formed a single eruption, the original surface may have been level. If so, there could have been no difference in pressure or rate of cooling on any horizontal line. Those who do not accept my theory of faulting on the Comstock will probably regard the east country as a single continuous mass. In that case, it is hard to see how there can have been any notable increase of pressure or retardation of cooling along the Sutro Tunnel. If the truth of my theory of the faulting is granted, the tunnel strikes the east wall of the Comstock at a point which was originally about 1000 feet lower than the eastern edge of the augite andesite. But I have already shown that an increase of depth of 3000 feet makes no perceptible difference in the character of the rock. The influence of a single thousand feet cannot possibly be traceable therefore.

The supposed eruption may also have formed a volcanic cone above the Comstock instead of a level surface. In this case, too, horizontal planes would be level or equipotential surfaces, or planes of equal pressure, and there could be no tendency induced by pressure to more thorough crystallization on horizontal lines, even if it were supposed

NOTE 7.—This can readily be seen by considering extreme cases. Suppose a hollow cone filled with fluid. Then of course horizontal surfaces are surfaces of equal pressure. Suppose a perfectly rigid cone; the same result follows. From these extremes any intermediate case of a viscous cone follows.

that crystallization could progress after the cones were complete though still hot. It is difficult to imagine any influence other than pressure tending to modify the character of the rock in a horizontal direction excepting the rate of cooling, which would depend upon the distance from the nearest surface. The dip of the lode is 45° , an angle greater than that of any volcanic cone,⁸ hence the rock at the lode on the 3000 foot level must have been further from the surface of the supposed cone than that at the croppings, besides being under enormously greater pressure. Since no difference tending to confirm the views of Messrs. Hague and Iddings is perceptible on the dip of the lode, it seems improbable that any could be detected along a horizontal line equally far removed from the surface.

Rate of variation of crystallization.—It is very evident from Messrs. Hague and Iddings' paper, that the rate of increase of crystallization is more rapid near the inner end of the tunnel than near the outer end. The difference in this respect between the ordinary fine-grained diabases and the diorites, supposed by them to be the same rock, is very great; while they do not claim to have found anything like so great a difference between different portions of those tunnel rocks which I regard as pyroxene andesites. Now, one cannot consider the laws of cooling and the curves and functions representing them for a moment without perceiving, that the difference of rate of cooling decreases very rapidly near the surface of a cooling body, and almost disappears at considerable distances from the radiating surface. Hence, it would seem that if the difference in crystallization is dependent on the rate of cooling, and if Messrs. Hague and Iddings have correctly interpreted the structure of the district, the rate of increase in the Sutro Tunnel should have been greatest at the eastern edge of the pyroxene andesite and nearly or quite imperceptible near the lode.⁹

NOTE ⁸.—American Journal of Science, 1885, vol. 30, p. 283.

NOTE ⁹.—It is well known that iron-blast furnace slags, which are glassy if

The present surface of the pyroxene andesite lies some 1,200 or 1,500 feet nearer the original surface than the section of it made by the Sutro Tunnel. If a cone of the rock originally existed here, it follows from the above that the surface should afford a sensibly better opportunity than the Tunnel for tracing the increase of crystallization. It offers the further advantages of more extensive exposures and far greater freedom from decomposition. As already pointed out, however, it yields no argument in favor of the theory propounded by Messrs. Hague and Iddings.

The intensity of solfataric action must approximately follow the logarithmic conduction curve which, as I showed, represents the distribution in the east country of heat emanating from the lode. So far as the observation of Messrs. Hague and Iddings on the ground mass of the rocks refers to secondary products, it thus appears in entire consonance with my investigations.

Progressive crystallization not proved at Washoe.—The case with reference to progressive increase of crystallization then stands as follows: On the line of the Sutro Tunnel the augite andesite at the surface above the tunnel has been examined for over 7,000 feet, and no tendency could be detected to any progressive change in the rock. It is difficult to imagine any conditions under which such progressive tendency (if it ever existed) would not be more marked at the present surface than in the Sutro Tunnel; or in other words, the change between the extreme ends of the line examined on the surface would be expected to correspond to the change on a longer line in the tunnel. Other portions of the augite andesite area were examined with a similar result. There is no sensible difference between the diorite at the crop-

allowed to cool in the air, are "basaltified" or converted into a tough, lithoid mass if they are run into pits and covered with a few feet of non-conducting material. Laboratory experiments, of course, prove much the same thing. In these cases the relation of the change to the distance from the surface is just what would be expected if the granulation is a simple inverse function of the rate of cooling.

pings and that at the 3,000 foot level. The distance between these exposures is about 4,200 feet. Since the pressure must have differed more for these two points than for points equally removed on a horizontal line at the inner end of the tunnel, and since the difference of distance from the original surface of these points on the dip can hardly have been less than that for corresponding points on the tunnel, a much greater difference in degree of crystallization would be expected on the dip of the lode than in an equal distance on the tunnel. Similar remarks apply to the diabase. The variation of the rate of increase of crystallization indicated by Messrs. Hague and Iddings is the reverse of that of the rate of cooling, while theory and experiment seem to indicate that these two quantities should vary in the same sense. The grains which Mr. Iddings measured are largely those of secondary quartz and perhaps other secondary minerals. These secondary crystals appear actually to increase as the lode is approached, as would be expected. The Suro Tunnel and, so far as is known, the Washoe district afford no valid proof of progressive increase of crystallization in holocrystalline rocks.

OTHER DISPUTED POINTS.

Diorites. — Although the main issues have now been treated, it appears unavoidable to make some remarks as to other points upon which Messrs. Hague and Iddings disagree with me. I have already mentioned in this paper the relations between the porphyritic diorites and the granular forms of the same rock which make it impossible to separate them. I also enlarged upon the same relation in my memoir on the Comstock. The area I have laid down as diorite is, I repeat, after re-examination, substantially one rock. If (as my opponents claim) the porphyritic diorite is hornblende andesite, then the whole mass of Mount Davidson is hornblende andesite and neither augite andesite, as they assert, nor diorite as I believe. I am not so rash as to

assert that my lines of demarcation are faultless. I can only say that they were laid down with the most scrupulous care and as the result of arduous labor, and that I know of no errors. If, however, it may hereafter prove that I have erroneously determined some slide, specimen or cropping, here or elsewhere in the district, this will not invalidate the general truth of my conclusions.

The case of the micaceous diorite is precisely analagous to that of the porphyritic hornblende diorite. Mica occurs in patches on the bare rock surfaces of Mount Davidson—here a flake or two, there a group fading out into rock in which there is no mica discoverable. These occurrences are less striking than those of porphyritic diorite in the region immediately above the central group of mines, because the presence of mica at this point is unattended by any physical or structural modification of the granitoid mass. To the north of Spanish Ravine there is an increase in porphyritic forms, both micaceous and hornblendic, but the change is very gradual, and as typical granitoid diorite occurs here as on Mount Davidson. If the micaceous rock is all later hornblende andesite, as Messrs. Hague and Iddings pronounce it, then Mount Davidson is later hornblende andesite.

“*White rock.*”—Messrs. Hague and Iddings assert that some white rocks found in the tunnel are identical with the rock called, in my report, felsitic quartz porphyry. The white rock contains no original quartz, but abundant secondary grains. It is connected macroscopically and microscopically by transition with less altered andesites. This can be shown from some of the slides referred to by Messrs. Hague and Iddings as the white rock, when compared with others which they recognize as andesites. An exactly similar case is exposed on a very large scale by the cuttings made in the hillside to gain space for the Combination Hoisting Works. Here typical hornblende andesite is intersected by a belt of solfataric action: and every imagin-

able intermediate stage, from a mass like hard, white chalk to a fresh andesite, is plainly visible on an unbroken exposure. There are other exposures in abundance on the surface. The analogy between this white rock and the felsitic quartz porphyry depends on a single specimen of the former, which shows a banded structure something like that of rhyolite, a feature which is also of common occurrence in the felsitic rock. Now, I have called attention to this structure of the east country rock in the following terms:¹⁰

“In several of the rocks a stratified or laminated structure is visible; but in the half-dozen such cases known to me, the phenomenon extends for very short distances, often only a few feet, and appears to be the result of some local variation in the composition of the rock; for not only can I perceive no general uniformity in the direction of the layers in these different spots, but I have a single hand specimen which shows two sets of them at an angle of nearly 90° to one another.”

“There are limited occurrences of excessively fine-grained, closely laminated diabase, resembling slate. The diorites and both the andesites show the same phenomenon.”

The specimen of white rock supposed to be so significant came from one of these spots, which occur not only in it but in other rocks as well. The lamination, however, is not characteristic but extremely exceptional in the white rock. The specimen is not representative, but was carefully preserved as an exception, and the peculiarity which it presents has no taxonomic value.

Quartz porphyry.—Messrs. Hague and Iddings employ this as it appears to me, wholly baseless identification, to argue that the white rock containing no quartz excepting as a result of decomposition, is a dike of rhyolite, and proves that my identification of the only quartzose rock in the district as pre-Tertiary quartz porphyry is erroneous, as well as my interpretation of its structural relations. A very large body

NOTE ¹⁰.—Geology of the Comstock Lode, pages 51 and 182.

of quartz-porphry is met with in the mines, and is intersected by the Baltimore, Caledonia and Knickerbocker shafts.¹¹ The bottom of the Forman shaft is also in this rock. The last occurrence is referred to by Messrs. Hague and Iddings as "a small body," though of its size no one can possibly know anything. They explain these occurrences on the same intrusive theory adopted to account for the hornblende andesite in the Forman shaft. The same objections stated above, in regard to the applicability of this theory to the hornblende andesite, apply also to this case, but with still greater force; for it seems certain that andesites could not float in melted quartz porphyry. The quartzose rock, it is true, must be viscous when melted and might therefore carry up small fragments of andesite or even heavier substances, but that it could lift and support a mass of rock specifically heavier than itself and over 2000 feet in thickness I believe quite impossible.

Rock inclusions in quartz porphyry—In the hope of obtaining evidence as to the succession of the quartzose rock and the andesites which should appear to every one unequivocal, an earnest search was made last summer for included fragments, near Basalt Hill. In the augite andesite nothing could be found. This is perhaps not strange since this rock, particularly in this neighborhood, was evidently of very great fluidity. Lighter rocks would have floated upon it and would have been the first portions of the mass to be removed by erosion. Heavier rocks would have sunk to the bottom. In the quartz porphyry, inclusions of metamorphic rocks and of granite (entirely similar to that of the adjoining area, to that of Steamboat Springs and of the Sierra Nevada), were in some localities tolerably abundant. There was nothing like andesite to be found, which seems strange, if the quartz porphyry broke through the andesite carrying with it fragments of the other rocks through which it burst. This evidence, however, is only negative.

NOTE ¹¹.—See Atlas, sheet VI.

The porphyry an orthoclase rock.—Messrs. Hague and Idings assert that there are plagioclastic as well as orthoclastic rocks among the specimens brought in by my party as quartz-porphry. For the purpose of testing the character of the rock, large specimens were gathered at five localities in the district last summer, and separated by the Thoulet method. The localities were chosen at points as far removed from one another as possible, in order that the entire area might be represented as well as practicable by so small a number of specimens.¹² The localities are as follows: Dump of the Forman shaft; quarry near toll-gate on American Flat road; 1,500 feet south of the Amazon mine; 1,200 feet W.S.W. of Excelsior mill; 1,200 feet N.E. of Roux' ranch. These rocks are not well fitted for complete separation by the Thoulet solution, the quartz, orthoclase and groundmass coming down together in an almost continuous stream between specific gravities from 2.63 to 2.58. The material of a specific gravity exceeding 2.64 consists almost exclusively of ferro-magnesian silicates, iron ores and plagioclase. Making allowance for mixtures, it appears from the experiments that the specimens in the order named contain approximately the following percentages of plagioclase: 8, 8, 8, 1.5, 4.5. Although the orthoclase could not be separated, it is evident that the rock contains above 25 per cent. of feldspar,¹³ and that all of these specimens are to be regarded as orthoclase rocks.

That at some point or points in the district some small portion of the rock may contain an excess of plagioclase, in the nature of a local segregation, I cannot deny. The rock

NOTE ¹².—In order that no unconscious bias might affect the selection, I chose these localities on the map without visiting them, and requested my assistant, Mr. Lindgren, to proceed to the points chosen and take the specimens. He collected the freshest rock he could find at each spot, irrespective of the frequency of quartz grains. Mr Lindgren also made the separations.

NOTE ¹³.—On the quantitative composition of quartz porphyry. see Roth Allg. Geol. Vol. 2, p. 108.

as a whole, however, is much the most uniform in the district, and no such local exception to the representative mineral composition can properly affect its classification.

Fluid inclusions in quartz porphyry.—According to Messrs. Hague and Iddings, the microscopic characteristics of most of this rock are exactly the same as those of rhyolites from the Great Basin. They will not, however, deny that they are also exactly similar to those of well known pre-Tertiary rocks. These geologists seem to attach little importance to fluid inclusions,¹⁴ though I should have thought that on their own hypothesis such inclusions would be valuable as an indication of the amount of the erosion. They grant, however, that this rock contains more fluid inclusions than are usual in the later quartzose volcanics of the Great Basin. Every single slide of the quartz porphyry which I have seen contains fluid inclusions. In many cases they are extremely abundant. I have made no extensive special studies of rhyolites, and cannot therefore state how frequent such occurrences are. I note, however, that Professor Zirkel says¹⁵ of a rhyolite from the Washoe Mountains: "A remarkable phenomenon, discovered in this genuine rhyolitic rock, was a quartz which contained the most characteristic fluid inclusions." If one supposes that fluid inclusions in the quartzes of rhyolites as now exposed are so rare as they appear to be only because the deeper portions of the eruptions are not yet laid bare, then the quartzose rock of Washoe, if it is a rhyolite, is a very deeply eroded one. If it is indeed younger than the glassy augite andesites, as Messrs. Hague and Iddings maintain, and as if, as I believe with them, rocks with a glassy groundmass are found only near original surfaces, it is strange that these andesites have not been eroded as well as the rhyolite.

NOTE ¹⁴.—That I regarded the evidence of fluid inclusions as one to be appealed to with caution, may be seen from my memoir, page 50, foot-note.

NOTE ¹⁵.—Exploration of the 40th Parallel, Vol. 6, page 197.

They do not indeed state that fluid inclusions are confined to, or specially characteristic of the lower portions of rhyolite eruptions, but they do make an equivalent statement regarding the andesites, and their description of the passage from a glassy to a highly crystalline mass is couched in such general terms that I cannot doubt their holding similar views with reference to rhyolite. Of course a similar train of reasoning makes it apparently inexplicable that the surface exposures of Mount Davidson should show fluid inclusions, while glassy rocks still remain on the Mount Kate range, if the augite andesite and the diorite form substantially one eruption. There is no reason why the Davidson range should have been deeply eroded while the Kate range escaped degradation. A range may escape erosion while the valley at its base is deeply excavated, but that of two parallel ranges, distant a couple of miles, one should be deeply eroded while the other escapes almost entirely, is conceivable only under most extraordinary meteorological conditions, if at all. There are no such remarkable conditions at Washoe.

Hornblende andesite in the tunnel.—The rock laid down as hornblende andesite on my section of the Sutro Tunnel is comparatively fresh at the eastern edge. The remainder of the occurrence in the tunnel is far too thoroughly decomposed for direct determination either macroscopically or microscopically. Messrs. Hague and Iddings, however, assume that only a narrow dike of this rock is intersected by the adit, and conclude that the earlier hornblende andesite of my report is younger than any of the pyroxenic rocks. My determination of the width of this mass was not founded exclusively upon the exposure in the tunnel. The combination shaft is only 400 feet distant from the tunnel section. The top of this shaft is in the typical hornblende andesite figured in my report on plate V. Some of the stations of the shaft were accessible, and I also had access to a private collection of rocks from the shaft which were

gathered during the sinking of the shaft. By repeated study of these specimens, and by comparisons between them and decomposed portions of the hornblende andesite, near the top of the shaft on the one hand, and with diabases of the Sutro Tunnel level on the other hand, I came to the conclusion that the hornblende andesite of the surface was continuous from the top of the shaft to a point about 250 feet above the tunnel level. At this point there was a change in the character of the rock which corresponded to a similar change in the tunnel about 100 feet further east than the shaft. Through these points I drew the contact after taking all available facts into consideration. My determination of the width of the hornblende andesite in the tunnel was neither a guess nor was it founded on any theory, but was legitimately based upon the best observations which the nature of the case permitted. It is in entire accord with the results of my more recent studies at Steamboat Springs, where as has been pointed out, the earlier hornblende andesite is younger than one portion of the pyroxene rocks and older than another portion.

Dikes.—Messrs. Hague and Iddings claim that there is a dike of later hornblende andesite in the pyroxene andesite of the Sutro Tunnel. That for some distance the rock here carries some mica is unquestionable. When I first detected the presence of this mica, I believed that the later hornblende andesite was the last andesitic eruption, but the evidence on this point gathered up to that time was not so good as I desired. I should consequently have been glad to consider this a dike, and during some sixty visits to the tunnel, I examined this occurrence many times, but without being able to make up my mind that there was sufficient evidence to warrant the assertion of its intrusive character. It is true that I did not regard mica as necessarily an un failing indication of one and only one rock, nor do I now. It may be that this really is a dike. If so, it is a very obscure case. They also maintain that dikes are very numerous

throughout the region. This I deny. It is a region where dikes should be expected, and to this fact I was fully alive. Mr. King, in his hypothetical section of the country, showed several; and Mr. Church asserted that there were at least twenty-five or fifty north and south dikes. Messrs. Stretch, Reade and I were constantly on the lookout for these important aids to geological interpretation and their almost entire absence was repeatedly a matter of surprised comment in my party. Except under unusual conditions, a dike is recognizable with the utmost ease, and very few cases could escape reasonably careful scrutiny. It is, of course, possible to interpret variations in the state of decomposition and similar phenomena as dikes on superficial examination. This has often been done at Washoe, but these cases do not stand the tests of careful study. At Steamboat, among the same rocks, real dikes are not infrequent, and the indications of their character are clear.

Lithological criteria.—I cannot but believe that Messrs. Hague and Iddings, led away by the fascination of their hypothesis, have unconsciously made a somewhat arbitrary use of lithological criteria. Because the pyroxene andesite strongly resembles the porphyritic diabase, they insist the two rocks must be substantially of the same age, notwithstanding the structural evidence to the contrary. Yet they believe that pre-Tertiary eruptions are not, as such, distinguishable from later volcanic rocks. On general principles, therefore, they would be satisfied with a moderate amount of evidence of the diversity in the age of rocks which were lithologically similar. In this particular case, however, such proof would diminish the strength of their argument for a relation between granulation and distance from a fixed point. But lithological dissimilarity does not stand in the way of their identifying rocks; for though only an infinitesimal portion of the highly decomposed andesite of the Suto Tunnel, possesses a banded structure, and though this structure, common to various rocks, is the only point of

similarity which appears to exist between this material and a quartzose felsitic mass distant over two miles, they do not hesitate to identify the two, structural evidence again to the contrary notwithstanding. While a large part of the granular diorite is, beyond question, hornblendic, and a still greater portion is of such a character that it is now impossible to say with certainty whether the green amphibole is original, uralitic, or results from an alteration of brown hornblende, they regard the whole mass as altered pyroxene rock. Yet when any specimen of this rock is found to contain mica, they pronounce it later hornblende andesite, no matter how it may be involved in the mass of their supposed pyroxene andesite. But mica is not a more significant mineral than hornblende or augite, as I feel confident from many observations. It would seem to me as reasonable to call the later hornblende andesite, diabase, because it contains some augite as to call the micaceous spots in the granular mass of Mount Davidson later hornblende andesite because they carry mica. Black dike again they identify with the very dissimilar basalt of the district. The structure and physical character of this rock are exactly similar to the commonest variety of diabase elsewhere. They state, indeed, that they have seen basalts of the same structure, but these are certainly rare, for though I have had occasion to make microscopic examinations of many basalts, I have never seen one which at all resembled black dike. The excellent representation of this rock in my memoir will enable lithologists to judge for themselves on this point. Its bearing on Messrs. Hague and Iddings' theory is manifest, for, if it is a diabase, the surrounding masses must be pre-Tertiary; but if it is basalt, it is in so far possible that the enclosing rocks may be Tertiary or later.

It is surely unnecessary to go into further detail on the subject of the Washoe rocks. I find that several of them at least, extend into the area of the Gold belt of California,

on which work by my parties has already begun, and to which my whole attention will be given for many years to come. It is not unreasonable to expect, that in the extensive area which will there be examined, some 12,000 square miles, the questions raised at Washoe will be presented, in a sufficient variety of forms, to ensure correct solutions.

Conclusions.—While I do not deny that the granular and granitoid rocks are simply those which have cooled at great depths and under great pressure, I can see no evidence at Washoe to prove it. Pressure and depth, not improbably, tend to produce the effects which Messrs. Hague and Iddings ascribe to them, but I am certain that in many cases, minute differences of chemical composition produce effects greater than differences of depth of, say, from one or two thousand feet.¹⁶

The only important changes which I feel called upon to make in the results of my former investigation of the Comstock lode are that hypersthene is present in the pyroxenic rocks, and that the area of these rocks laid down on my

NOTE ¹⁶.—An eruptive magma is probably never fluid enough to become thoroughly homogeneous, and where the products of the chemical reactions are multifarious, it is to be expected *a priori* that minute differences in composition should establish strong tendencies which may manifest themselves either in the mineralogical or the structural results. Observation also shows that cases are very frequent in which adjoining rock masses so related that they cannot have been subjected to different physical conditions, exhibit differences not otherwise to be accounted for. Easy as it is to ascertain the ultimate composition of rocks, every one recognizes that we know too little as yet of the intricacies of mineral chemistry to be able to establish a thorough correlation between the composition and the lithological results. One road to a more satisfactory knowledge of this subject appears to be presented by the principles of thermo-chemistry. I have attempted a slight theoretical advance in this direction in an article which will soon be printed. [American Journal of Science, vol. 31, 1886, p. 120]. Meantime, although it is as yet impossible usefully to employ quantitative determinations so accurate as those which chemists are in the habit of making, it is most desirable that these records should be correctly kept. I pointed out in my memoir on the Comstock that two analyses, originally published in the reports of the Exploration of the 40th Parallel, contained inconsistent data. These analyses are numbered V, and VII, by Messrs. Hague and Iddings (page 33), who

maps as augite andesite is divisible into two separate eruptions of different dates.

I affirm that the structural relations and the succession of rocks as set forth in my memoir, is substantially correct. In particular, the pyroxene andesite, diabase and diorite exposed in the Sutro Tunnel, do not form one continuous or contemporaneous rock mass, as would be necessary if this exposure were to lend any support to the hypothesis of progressive increase of crystallization. On the contrary, these rocks constitute at least three distinct eruptions, separated by long time-intervals.

I consider it possible that the quartz porphyry, although of greater age than the andesites, may have been erupted in early Tertiary times, but this I think unlikely.

Though there may be local segregations of plagioclase in the quartz-porphyry, five new separations by the Thoulet method show that it is substantially an orthoclase rock.

I think it possible, but improbable, that the black dike is basalt. In the present state of science, an absolute decision on this point is impossible.

The remainder of the conclusions stated at the close of Messrs. Hague and Iddings paper, I deny.

I conclude also that valuable as is the study of collections, inferences from them may easily be pushed too far; and that it is impracticable to elucidate the structure of a complex region from collections, however extensive.

OFFICE OF THE U. S. GEOLOGICAL SURVEY, }
 SAN FRANCISCO, December, 1885. }

state that they have revised them by comparison with the original records so far as possible. This was evidently by no means superfluous. They have made four changes in V, which seems a large number of misprints in a single analysis. In VII, they have made only one correction; but the original record of this analysis must be faulty, since the sum of the items, as they give them, still fails to tally with the total. While the effect of minute variations of composition seems beyond question well marked, it is not entirely clear what effects should be expected from high pressures, the consideration of which, at once brings up the perplexing question of the relative dynamical influence of absolute stress and stress-difference.

**PROVISIONAL VALUE OF THE LATITUDE OF THE LICK
OBSERVATORY.**

By Professor GEORGE C COMSTOCK.

Communicated by Captain R. S. FLOYD, President of the Lick Trustees

The following provisional value of the latitude of the Lick Observatory depends upon observations made upon four nights in August, 1886, with the Repsold meridian circle by Professor Geo. C. Comstock, assisted by President E. S. Holden, who kindly read the microscopes. All of the stars observed were selected from the star list of the *Berliner Astronomisches Jahrbuch*, and the latitude depends upon the apparent declinations of the stars as given in that ephemeris. Both the fixed and the movable circle of the instrument were read for each star, and were separately reduced. The discordances found between the results from the two circles are not greater than may fairly be attributed to division errors; the results from the fixed circle are, however, rather more accordant with each other than are those from the movable circle, indicating either inferior graduation or unstable clamping of the latter.

Each observed star furnishes a value of the reading of the circles when the telescope is pointed to the celestial equator (technically called an equator point), and the mean of all the equator points obtained during a night is taken as the equator point for that night. The circle reading corresponding to the nadir was obtained at the beginning and end of each night's observations, and the mean of these nadir points is assumed as the nadir point for the night. The agreement of the individual nadir points is fairly satisfactory, the difference between separate determinations upon the same night in no case amounting to as much as

1". The difference between the mean equator point and the mean nadir point is the supplement of the latitude.

The following table furnishes a brief summary of the results derived from the observations of each night:

Date.	Position of Instrument.	No. of Stars.	Latitude from Fixed Circle.	Latitude from Movable Circle.
1886—August 5.....	Clamp W.	7	37° 20' 24".7	37° 20' 24".5
August 8.	" W.	12	24.2	25.1
August 13.....	" E.	8	25.3	24.8
August 14. ...	" E.	11	25.3	25.4

The mean of the results Clamp W. is 37° 20' 24".6; the mean for Clamp E. is 37° 20' 25".2, showing a slight discordance between the results derived from different positions of the instrument. Such a discordance was *a priori* probable, having been found in the case of other meridian circles.

The most probable value of the latitude that can be derived from these observations, is the mean of the results Clamp W. and Clamp E.:

$$37^{\circ} 20' 24''.9,$$

which may be adopted as a provisional value for the latitude of the center of the mercury basin of the meridian circle. The probable accidental error of this result, estimated from the discordances of the individual results, is not far from $\pm 0''.10$, but the above value of the latitude provisionally assumed, may be affected by systematic errors arising from defective graduation of the circles, flexure, irregular refraction, etc., amounting in the aggregate to a considerably greater quantity.

The north dome of the Lick Observatory is twenty-seven feet north of the meridian circle, whence its latitude results from these determinations, 37° 20' 25".2.

Mr. C. A. Schott, Chief of the Computing Division of the U. S. Coast and Geodetic Survey, has kindly communicated results for the position of this station, which have been

derived from the triangulation measures of Professor Davidson.

These are (for the dome of the 12-inch equatorial):

Latitude = $+ 37^{\circ} 20' 24''.752$.

Longitude = $+ 121^{\circ} 38' 35''.284$ (Greenwich).

Longitude = 8 h. 6m. 34.352 (Greenwich).

Longitude = 2 h. 58 m. 22.26 (Washington).

It will be observed that our determination of the latitude gives a result, $0''.4$ greater than that of the U. S. Coast Survey. This corresponds to about forty feet, six inches. The agreement between the two results is perfectly satisfactory, when we consider the small number of stars observed by us, and also that the position derived by the U. S. Coast and Geodetic Survey is not strictly definitive, as two stations (viz., Macho and Sta. Aña) require to be occupied to complete the primary triangulation in this vicinity.

STUDIES IN THE BOTANY OF CALIFORNIA AND PARTS
ADJACENT.

BY EDWARD LEE GREENE.

V.

(With Plate VI.)

1. *Some Genera which have been Confused under the Name Brodiaea.*

Of the species herein to be discussed, only five or six are presumed to be new. Many of them have long been known, and most of them have been collectively elaborated by at least two eminent botanists within a few years. There has been the widest diversity of opinion among authors regarding the limits of the genera, and the entire group is confessedly a perplexing one. Before so many as twenty species had become known, no less than thirteen genera had been either established for, or more or less replenished with them; but in the most recent pronouncement,¹ the bulk of the species, embracing at least three very good genera, as we understand them, are all disposed under *Brodiaea*. From the earliest days of my residence on this coast, where these plants are indigenous, I have regarded the arrangement placed before students and amateurs in the Botany of California, as most unnatural; and having now given five successive seasons to the study of the commonest species under circumstances peculiarly favorable to the forming of a sound and rational judgment upon them, I am now ready to offer the result of my investigations.

The Liliaceæ as an order are poor subjects for herbarium study. The fabric of their flowers is delicate, being made up of a maximum of water and a minimum of permanent

NOTE ¹.—Botany of California, Vol. ii, by Sereno Watson, pp. 152-157.

tissue, and the characteristics of the filaments and their appendages, matters of acknowledged importance to the systematist, are sure to suffer obscuration, if not entire obliteration, in the process of drying under pressure. Nevertheless, almost all which has been written hitherto upon *Brodiaea* and its allies has been written from the herbarium, and all our authorities upon the group are foreign authorities. No exception is to be made of botanical scholars belonging to the Atlantic side of our own continent: for they are three thousand miles distant from the habitat of these plants, and as regards facilities for acquiring familiar and thorough knowledge of the genera and species, possess little if any advantage over authorities residing at London or St. Petersburg, Paris or Berlin.

In the field there stand forth a few broad hints of generic limitation which must, I think, impress every observer. We have, for example, a group of perhaps a half dozen species whose scapes are tall and weak and either actually twining or else, by a marked tortuosity, expressing a demand for extraneous support. And there is another group, more numerous in species, whose scapes are short and rigidly erect. But the external dissimilarity does not end here. The voluble or tortuous kinds bear compact umbels of small flowers; the stiff-stalked species have loose umbels of large flowers; and, moreover, the two groups, as we for the present call them, have each its own pattern of a perianth; something in the outline of that organ which, though nearly impossible to define in words, is recognized at a glance by the botanist's eye, if he have the fresh flower before him. Now if the individual perianths of the two kinds be carefully examined, other differences easily definable reveal themselves. The weak-stalked, small-flowered assemblage of species have uniformly a thin, somewhat inflated perianth-tube with the body of which the filaments are so perfectly coalescent as to disappear from the wall of the tube altogether. In the stiff-stalked, loose-umbeled group the perianth-tube is of

firm texture and not inflated, and the filaments, stout and angular, are prominent upon the wall of the tube, down to its very base, being attached only by one of the sides or angles. This last named character I discovered in the field, but am able henceforth to trace it even in the dried specimens. In the first named group the volubility of the scapes is the most striking outward mark of a genus; but it is very apt to disappear before the specimens are ready for the herbarium; and the one unlucky species whose stalk does not altogether untwist itself in drying has, by closet botanists, been forced away from its less strongly twining relatives, and must henceforth labor bibliographically under the weight of at least four generic synonyms, of which *Macroscapa* is barbarous; *Rupalleya* and *Dichelostemma* in good form, *Stropholirion* admirably chosen, but all equally uncalled for.

The confusion of the two genera whose respective limits I have thus briefly and informally indicated, was begun by the very first author, Salisbury, to whom any of the species were known; and it was continued by his contemporary Smith. The renowned author of the *Enumeratio Plantarum* was first to recognize in the species of Smith's *Brodicea* two distinct generic types. I was long under the impression that Kunth's name, *Dichelostemma*, would have to be continued for one of these two genera. Of the priority of Salisbury's *Hookera* over *Brodicea* I was not aware until that fact was so clearly brought out, less than a year ago, by Mr. Britten, editor of the *London Journal of Botany*, and this important circumstance being recognized, it does not appear necessary to take up the name *Dichelostemma*; for, the plant which Salisbury brought forward as the type of *Hookera*, namely *H. coronaria*, being of one genus and that which Smith figured as the type of *Brodicea*, that is, *B. congesta*, representing the other, I see no reason why both these generic names ought not to be continued in use.

But, *Brodicea* and *Hookera*, as thus outlined, will include

somewhat less than one half of the species under consideration. The others have in no instance the perianth-pattern of either of those genera; are never, like them, merely triandrous; and their anthers are in no instance adnate. Along with considerable variability in the shape of the perianth, they display always six perfect stamens with versatile anthers. There is, moreover, a striking peculiarity in the way in which the filaments are joined to the tube of the perianth, and that is of the following description: the filament is slender and the upper part free, more or less; the adnate portion inconspicuous down the upper part of the tube, reappearing toward the base in the form of a thin but prominent crest. The species, however closely agreeing in habit and in the points of floral structure thus indicated, are diverse to a troublesome degree in the relative proportions of the tube and limb of the perianth, and more especially in the structure and attachment of the andræcium. The three or four species representing the very extremes of this diversity were, singularly, those which fell first into the hands of botanists, and each of these was very naturally and, under the circumstances, quite logically taken to be the type of a genus; and so there was *Triteleia*, seeming to approach *Brodiaea* by its broadly tubular perianth; *Seubertia*, in which the tube is attenuate below and the internal crests very strongly brought out; *Calliprora*, in which the cristiform reappearing of the filament quite fails, but is compensated for by an alar dilation of the upper free part of that organ; *Hesperoscordum*, in which the whole perianth is open campanulate, and the filaments dilated and monadelphous below. This last has, in my opinion, better claims than any of the others to separate generic rank. A year ago I should probably have insisted on its restoration. But the past season's collecting has yielded us a second species whose filaments are not at all dilated, but simply and singly adnate to the perianth for one half their length. Morphologically there is nothing in these two plants to keep them out of

Allium. The old species was actually referred to that genus by ²two celebrated botanists of Europe, each acting independently of the other. Its showy umbels very closely resemble those of the beautiful *Allium unifolium* of nearly the same habit; but *Hesperoscordum* is wholly wanting in alliaceous properties. With this group, therefore, collectively distinct as it is from both *Hookera* and *Brodiaea*, I see nothing to be done but to join the whole in one under the oldest name, *Triteleia*. Against Mr. Baker's view that they are susceptible of admission to the South American genus *Milla* there appear to me some quite insuperable objections. All the South American species which he has so referred have inarticulate pedicels, different subterranean parts, and some of them at least are strongly alliaceous. We have some North American plants which seem to be exactly intermediate in character between *Brodiaea* and *Milla*, namely, the two species of *Androstophium*, forming a genus whose validity has not, I believe, been called in question. It exhibits the coronated perianth of *Brodiaea*, but has alliaceous qualities. Our California plant, which now goes happily, in my estimation, under Mr. Watson's name, *Mulla*, is also a connecting link between—or rather, an argument for the distinctness of—the North and South American genera. This is excluded from *Allium* only by its wanting the well-known properties of that genus, while, on the other hand, it is inadmissible to *Triteleia* by reason of its jointless pedicels.

Two other of our California genera of this alliance need to be here spoken of: *Bloomeria*, which, although it now rejoices in three well-marked species, is, I apprehend, in danger of falling into *Triteleia* through the *Calliprora* group; and *Brevoortia*, which has an inflated perianth to bring it close to *Brodiaea*, and a development of the filaments at the base of the tube suggestive of *Triteleia*, but which is best

NOTE 2.—*Allium lacteum*, Benth. Pl. Hartw. 339; and *Allium Tilingi*, Regel. All. Monogr. 124.

retained in generic rank, especially since a new plant from Lower California with a somewhat similarly inflated and as brilliantly scarlet colored perianth, must also be accorded a like grade, on account of the very distinctive character of its andrœcium.

BRODIÆA, SMITH *in part.*

Tube of the perianth thin and subtranslucent, campanulate or somewhat urceolate, more or less inflated and angular or saccate: segments about equaling the tube, campanulate or rotate-spreading and often somewhat recurved. Filaments 6, inserted on the throat of the perianth, coalescent with the tube below and disappearing from its surface, developed above the insertion into petaloid appendages, those opposite the outer segments sterile, or with a half-sized anther, the other three always fertile. Anthers basifixed. Ovary sessile, or nearly so. Style stout. Stigma 3-lobed. Leaves 2, deep green, very fleshy. Scape tall, weak and tortuous, or, in several species occasionally twining under the many-flowered, compact umbel.—Smith, Linn. Trans. x. 3. excl. *B. grandiflora*: Baker, Journ. Linn. Soc. xi, 375, in part; S. Watson, Proc. Am. Acad. xiv. 236, and Bot. Calif. ii. 152, in part. *Dichelostemma*, Kunth. Enum. iv. 269; Wood, Proc. Phil. Acad. 1868, 173. *Macrosapa*, Kell., Pacific, 1854. *Stropholirion*, Torrey, Pac. R. Rep. iv. 149. t. 23. *Rupalleja*, Morière, Bull. Linn. Soc. Norm. 1863. *Hookera*, in part, of Salisb. Parad. Lond., and of Britten, Journ. Bot. xxiv. 51.

* *Fertile stamens 3; perianth-tube much constricted under the segments.*

B. VOLUBILIS, Baker, l. c. 377. Scape 4—10 feet high, in smaller plants tortuous only, in larger ones firmly twining towards the summit; perianth rose-purple, 6—8 lines long; tube 3—4 lines in diameter, hardly as long, hexagonal, the angles somewhat saccately enlarged about midway;

segments rotate-spreading, with recurved tips; fertile filaments produced behind the anthers into a pair of ligulate, emarginate appendages nearly equaling the linear-sagittate anthers, and, like the very similar staminodia, ciliolate-scabrous.—*Microscapa*, Kell. l. c.: *Rupalleya*, Morière, l. c.: *Stropholirion Californicum*, Torr. l. c. and Watson, l. c.: *Dichelostemma Californicum*, Wood, l. c.

Of rather extended yet well defined habitat, being found exclusively among the foothills on either side of the Sacramento valley, but not crossing either divide of mountains; thus ranging northward and southward for a hundred miles. The figure in the Pacific Railroad Report is not very accurate, for the angularity of the tube of the perianth is not at all brought out; but this may be owing to the fact of the artists having only dried specimens to work from; and in such this character is not apparent. The scape is also wrongly represented, twining as it were evenly and regularly, like that of a *Convolvulus*, for almost its whole length, a condition not likely to be found in reality. The plant inhabits the outer borders of thickets and also the open grounds adjacent to bushes. The scapes commonly grow erect and independent of foreign support, and remain so until toward the time of flowering; then a short coil of a few very abrupt turns is made just below the umbel around some more or less horizontally projecting branch or twig. This is the condition of tall and luxuriant specimens growing near small trees and shrubs. Those farther off from such extraneous supports twine in like fashion about each other, or if entirely isolated, do not twine at all. All the other species, except *B. congesta*, which has its own peculiar mode of taking hold of bushes, are occasionally twining; this one almost universally so. There is therefore no difference in habit between this and the other species, and Mr. Baker's transference of it to this genus is one of the good points which in his elaborate monograph, he has made with

respect to our Californian species. I may add, that in respect to color, *B. volubilis* is commonly rose or nearly white, but not rarely exhibits the violet shade which predominates in the genus. Its flowering season is from early in May to the middle of June.

B. MULTIFLORA, Benth. Scape 2—4 feet high, scabrous under the umbel, tortuous or occasionally twining as in the last: perianth deep violet-purple, 8—10 lines; tube narrowly constricted above, twice as long as broad, shorter than the spreading segments: staminodia obtuse, entire, little exceeding the oblong, deeply bifid anthers.—Pl. Hartw. 339; Baker, l. c. 154; *B. parviflora*, Torr. & Gray, Pac. R. Rep. ii. 125; Wood, l. c.: *Hookera multiflora*, Britten, l. c.

From central California to Oregon, in the mountains only, at least in California. Mr. Watson's remark in the second volume of the Botany of California, that the present species flowers a month or two earlier than *B. congesta*, evinces entire lack of knowledge on the part of his informants. *B. multiflora* is the latest of all species, being found in good condition of flower as late as July. It is considerably later than *B. congesta*, which is next to it in tardiness.

B. CONGESTA, Smith. Scape 3—5 feet high, flexuous, but apparently never twining: flowers blue-purple, in a dense capitate raceme: perianth as in the last species: staminodia bifid, spreading with the limb of the perianth, and purple, as in no other species. Trans. Linn. Soc. x. 3. t. 1; Baker, l. c.; Watson, l. c.: *Dichelostemma*, Kunth. Enum. iv. 470; Wood, l. c. 173: *Hookera pulchella*, Britten, l. c. in part, not of Salisb.

Central California to the borders of British Columbia, in open or wooded places among the foothills, flowering in May and June. The figure in the Transactions of the Linnean Society was apparently taken from a specimen not well developed, and does not indicate that distinctly racemose character of the inflorescence which Mr. Watson supposes to be

exceptional, but which we see every year hundreds of luxuriant specimens know to be universal. This, like *B. volubilis*, attains its best development when growing in the edges of thickets where its tall scapes obtain their needed support by taking a zigzag course up among the branches of the bushes. It is a peculiar species in this respect, and more peculiar still in the racemose inflorescence.

** *Fertile stamens 6.*

+- *Perianth-tube constricted above.*

B. PULCHELLA. Scape 2—4 feet high: flowers umbellate: perianth as in *B. congesta*: appendages of filaments erect or somewhat convergent over the anthers. *Hookera pulchella*, Salisb. Parad. ii. t. 117; Britten, l. c. excl. syn.: *B. congesta*; *B. capitata* in part of several authors (?).

The plant which I here quite confidently take for the real *Hookera pulchella*, has not been long known to me; but I had named and diagnosed it as a new species before having seen the figure in the Paradisus. It is distinguishable from *B. congesta*, with which it grows, by its umbellate inflorescence and hexandrous flowers, and from *B. capitata* by its differently shaped perianth and æstival flowering season, that species being early vernal. Its existence, as a species, is certified to me, first, by my own field observations and comparisons, made at Berkeley, where it grows and flowers with *B. congesta*, or even a little later than that, and fully six weeks after *B. capitata* has passed out of the field. I have also a single specimen from the Yosemite Valley, obtained late in June, 1886, by Miss Brunton. The hexandrous character of Salisbury's plant has been a stumbling-block in the path of all authors from his own time down to the present; for every one has inferred from the close, indeed quite perfect, similarity of the perianth, that this and Sir J. E. Smith's *B. congesta* were identical; but that is plainly triandrous. Salisbury himself, believing them to be the same, was able to reconcile in his own mind the dis-

crepancy by a supposition that three of the anthers were deciduous. He says he has observed that to be the case. Our field studies reveal no tendency even, to anything of that kind. Kunth, in the *Enumeratio*, supposes the hexandrous representation in the *Paradisus* to be an error of the artist. Perhaps this learned author did not read English, and so, failed to be instructed by Salisbury's verbal testimony to the faithfulness of the figure in this respect. It is a very interesting piece of information, that which Mr. Britten has given us in a foot-note appended to his valuable article that, among the original specimens of *B. congesta* collected by Menzies, he finds one whose difference from all the others had not escaped the keen perception of Robert Brown, who marked it "Distinct and hexandrous." This specimen will most likely prove to be of the present species; for, as I have already said, this grows with *B. congesta* and flowers at the same time. A collector would naturally obtain the two at once, and at a season of the year when the other common and well known hexandrous species would be long out of flower. The plant which Professor Wood saw at Yreka, in the northern part of the State, "Growing with the other [*B. congesta*], readily distinguished at sight," must have been this and not *B. capitata*, which, apart from its far earlier flowering, does not grow so far to the northward, to my knowledge.

÷ ÷ *Perianth-tube funnelform, not at all constricted above.*

B. INSULARIS. Scape 3—5 feet high: leaves often a yard long and an inch broad: bracts elliptic-lanceolate, acuminate, scarious, tinged with purple and marked by dark veins; umbel elongated: perianth light purple, ten lines long; tube about 4 lines; segments ovate-oblong, obtuse, campanulate, not recurved: appendages of filaments erect, not convergent.—*B. capitata*, Greene, Bull. Cal. Acad. i. 227, not of Bentham.

Islands off the Californian coast, from San Miguel to Gua-

dalupe. Closely related to the next but many times larger: best distinguished by the elongated umbel, of which the central pedicels are longest and the outer gradually shorter, giving the cluster the peculiar configuration of the raceme of *B. congesta*: indeed, the pedicels need only to be united, and then we should have a repetition of the inflorescence of that species. The corms are the largest in the genus, often two inches in diameter; and those brought from Guadalupe and grown at Berkeley flower simultaneously with *B. congesta*, many weeks later than the species to which, morphologically, it is nearly related, namely—

B. CAPITATA, Benth. Scape 6—18 inches high; leaves nearly as long, 3—6 lines wide: bracts elliptic-oblong, obtuse or acute, herbaceous and, in California, of a rich dark violet-purple: pedicels unequal but the outer elongated, not the inner, forming a loose, broad umbel: perianth as in the preceding, but smaller: corona connivent over the anthers.—Pl. Hartw. 339; Watson l. c.: *Milla*, Baker, l. c. 381: *Dichelostemma capitatum*, Wood. l. c. in part, doubtless.

Central California to Utah and New Mexico and southward to the northern districts of Mexico, flowering from January to April. In the vicinity of San Francisco, hillsides may be found empurpled with it in early March. It commonly grows in masses, on very open stony ground, the weak scapes often twining about one another for mutual support. In this species alone are the umbels occasionally compound, the elongated outer pedicels becoming true peduncles, each bearing its bracted umbel within the common spathe. The figure in the Botanical Magazine, t. 5912, does not fail to illustrate the dark, almost metallic beauty of the bracts which is a fine peculiarity of this species, at least in California; but the stamens are wrongly represented as exposed by an open corona, whereas in nature the parts of it are sufficiently convergent to hide them.

HOOKERA, SALISBURY *in part.*

Tube of perianth firm and opaque, turbinate or somewhat urceolate, but never at all inflated or saccate: segments equaling the tube, campanulate- or rotate-spreading, the tips often recurved. Filaments 6, stout and 3—4-angular, not coalescent with the perianth-tube, but coherent with it by one side or angle and remaining prominent down to its base, 3 antheriferous and the alternate 3 bearing white, petaloid lamellæ. Anthers basifixed. Pistil as in the preceding genus. Scapes shorter, more rigid, never twining or tortuous. Umbels loose and mostly few-flowered, the pedicels elongated and firm.—Parad. Lond. ii. t. 98; Britten, Journ. Bot. xxiv *in part.* *Brodiaea*, *in part.*, of Smith, Baker, Watson and others.

H. CALIFORNICA. Scape 2 feet high, stout and somewhat scabrous: leaves a foot or two long, a fourth of an inch broad, flattened: pedicels 10—25, 2—3 inches long: perianth $1\frac{1}{2}$ —2 inches, rose-color to deep purple: anthers $\frac{1}{2}$ inch long, slightly shorter than the ligulate, retuse staminodia.—*Brodiaea Californica*, Lindl. Trans. Hort. Soc. iv. 84; *Brodiaea grandiflora*, var. *elatior*, Benth. Pl. Hartw. 339; *B. grandiflora*, var. (?) *major*, Watson, Bot. Cal. ii. 153.

Upper part of the Sacramento Valley.

H. CORONARIA, Salisb. l. c. Scape stout, about a foot high: leaves a line wide, somewhat terete: pedicels 3—10, 1—4 inches long: perianth an inch or more long, purple: anthers 4—5 lines long, exceeding the oblong-lanceolate, mostly acute staminodia.—*Brodiaea grandiflora*, Smith, Trans. Linn. Soc. x. 2; Hook. Bot. Mag. t. 2877; Baker, l. c. *in part.*; Watson, l. c. excl. var.

The commonest species, occurring nearly throughout California, Oregon and Washington Territory.

H. MINOR, Britten, l. c. Scape very slender, 3—6 inches high: pedicels 2—6, 1—3 inches long: perianth an inch or

somewhat less, the limb rotate-spreading: anthers 2 lines long, shorter than the retuse or emarginate staminodia.—*Brodicæ grandiflora*, var. *minor*, Benth. Pl. Hartw. 340; *B. minor*, Watson, l. c.

Common from the Sacramento Valley to the southern extremity of the State. Readily distinguished from the preceding, when seen in the field, by its rotate perianth-segments.

H. TERRESTRIS, Britten, l. c. Scape commonly altogether subterranean, the umbel only above ground: leaves subterete: pedicels 2—10, slender, 3—4 inches long: perianth less than an inch, the limb rotate: anthers $1\frac{1}{2}$ lines long, shorter than the yellowish emarginate staminodia, the margins of which are involute.—*Brodicæ*, Kellogg, Proc. Cal. Acad. ii. 6; Watson, l. c.

From near San Francisco northward to the borders of Oregon, toward the coast. Its yellowish staminodia, with their margins rolled in, resemble true anthers but are wholly sterile.

H. STELLARIS. Scape 2—6 inches high: leaves nearly terete: pedicels 3—6, an inch or more long: perianth 10 lines long, red-purple: fertile filaments wing-appendaged behind the anther, the appendages broadly oblong, half the length of the anther: staminodia longer than the stamens, white, emarginate, their margins slightly involute.—*Brodicæ*, Watson, Proc. Am. Acad. xvii, 381.

Near Ukiah, Mendocino County, discovered in 1881, by Mr. Carl Purdy, and not yet found elsewhere.

H. ROSEA. Scape slender, 3—6 inches high: leaves subterete: pedicels 5—8, an inch long: perianth 10 lines long, rose-red, the segments narrow and apparently campanulate-spreading: free portion of fertile filaments deltoid-dilated; anthers not quite equaling the white, obtuse, slightly involute staminodia: capsule short-stipitate, the cells 5—8 ovuled.

Collected at Hough's Springs, Lake County, May, 1884, by Mrs. M. K. Curran. Distinguished from *H. stellaris* by the narrower segments of the perianth, and by the deltoid filaments and the absence of appendages behind the anthers.

H. FILIFOLIA. Scape slender, 6—12 inches high; leaves linear-filiform; pedicels 3—6, $\frac{1}{2}$ —2 inches long; perianth dark blue, 6—9 lines long; segments rotate, broadly oblong; anthers sessile, 2 lines long, nearly twice the length of the triangular staminodia.—*Brodicea*, Watson, l. c.

Neighborhood of San Bernardino; collected by the Parish Brothers and by G. R. Vasey.

H. ORCUTHII. Scape stout, a foot or more high; leaves linear, flat or conduplicate, not terete; pedicels 5—15, an inch or two long; perianth-segments oblong-lanceolate, twice the length of the short tube; free portion of the filaments about two lines long, the linear anthers nearly as long; staminodia wanting(?).

San Diego county, near the city of that name, and also thirty miles to the northward.—C. R. Orcutt, 1884.

The comparatively short tube of the perianth and the elongation of the filaments are peculiarities of this species quite as remarkable as the absence of staminodia; although I do not speak positively on the last named point. I have seen only dried specimens, and shall not be surprised if an examination of the living flower brings to light some trace, at least, of staminodia.

TRITELEIA, DOUGL. HOOK. LINDL.

Tube of the perianth from narrowly turbinate to open campanulate, not inflated, angular, or saccate, longer or shorter than the segments. Stamens 6, usually in two rows; filaments slender, from almost wholly adnate, to nearly free, the free portion mostly without wing-like appendages, coalescent with the upper part of the perianth-tube, but usually reappearing strongly at base of the same, in the form

of thin but prominent crests. Anthers smaller than in *Hookera* and *versatile*. Ovary on a long slender stipe, or rarely almost sessile. Scapes tall and slender, but firm, not tortuous. Umbels loose, many-flowered.—Lindl. Bot. Reg. t. 1293 and t. 1685; Hook. Fl. Bor. Am. ii. 186, t. 198, B.; Kunth. Enum. iv. 465, as to the N. Am. species only; Wood. Proc. Phil. Acad. 1868, 171. *Hesperoscordum*, Lindl. l. c.; Hook. l. c.; Hook. & Arn. Bot. Beech. 400; Kunth, l. c. 464; Wood, l. c. *Calliprora*, Lindl. Bot. Reg. t. 1590; Hook. & Arn. l. c.; Kunth, l. c. 476; Wood, l. c. 172. *Seubertia*, Kunth, l. c. 475; Wood, l. c. 171. Part of *Milla*, Baker, and of *Brodiea*, Watson.

* *Perianth broadly tubular*.—TRITELEIA proper.

T. GRANDIFLORA, Lindl. l. c. Scape a foot or two high; pedicels numerous, an inch long; perianth light blue, an inch long; anthers oblong, a line long, the lower sessile in the throat opposite the outer segments, the upper on the inner segments on a short, free filament which is winged below.—*Milla*, Baker l. c. 380; *Brodiea*, Torr. Stansb. Rep. 397; *Brodiea Douglasii*, Wats. l. c.

From Oregon and Washington Territory eastward to northern Utah and western Wyoming.

T. HOWELLII. Scape 2 feet high, or more; umbel and perianth as in the first species, filaments of the lower stamens very short and deltoid, those of the upper a line and a half long, and winged broadly, the wing truncate or retuse, or nearly rounded above.—*Brodiea*, Watson, Proc. Am. Acad. xiv. 301.

First collected in Oregon, by Mr. Eddy, 1871; more recent specimens are those from Washington Territory, collected by Mr. Howell; and from these Mr. Watson defined the species.

** *Perianth turbinate, attenuate at base*.—SEUBERTIA.

T. CANDIDA. Scape 2—4 feet high; umbel 6—10-flowered; perianth an inch and a half long, shining white with 6 green

veins on the outside, segments equaling the tube; filaments with a slender free part which is $2\frac{1}{2}$ lines long and coiled almost or quite into a ring; anthers oblong, a line in length, obtuse at each end, fixed exactly in the middle; ovary half exerted from the throat of the perianth, on a slender stipe 8 lines long; style slender, 2 lines long, somewhat incurved; cells of capsule about 6-seeded.

Foot-hills of the Sierra Nevada back of Fresno, June, 1886. Mr. J. R. Scupham. A beautiful species, related to the next, but very distinct, with its snow-white, green-veined perianth and coiled filaments.

T. LAXA, Benth. Scape about two feet high, rigid and stoutish: umbel 10—30-flowered: perianth an inch and a half long, from light to dark violet, cleft to the middle: filaments free for a line's length; anthers ovate-lanceolate with a 2-lobed base, fixed below the middle and borne erect: ovary on a slender stipe a half-inch long.—Hort. Trans. n. s. i. 413, t. 15; Lindl. Bot. Reg. t. 1685; Hook. & Arn. Bot. Beech. 401: *Seubertia*, Kunth. l. c.; Wood, l. c.: *Milla*, Baker, l. c.: *Brodiaea*, Watson, l. c.

Very common in the central parts of California, flowering in May and June, the most showy and beautiful species of the whole alliance.

T. PEDUNCULARIS, Lindl. Scape 1—3 feet high: umbel 15—35-flowered, the pedicels greatly elongated, often 6—10 inches long: perianth pale rose-purple or nearly white, about an inch long, cleft below the middle, the segments wide-spread: stamens and pistil nearly as in the last species, but the anthers nearly linear, with retuse apex.—Bot. Reg. t. 1685; Hook. & Arn. l. c. 401; Kunth. l. c. 469: *Milla*, Baker, l. c.: *Brodiaea*, Watson, l. c.

From Point Tiburon, near San Francisco, northward to Lake and Mendocino Counties, also in the Sacramento Valley, growing in moist springy places, and later in its flowering than the other species.

T. BRIDGESII. Scape rather slender, a foot or more in height: umbel few-flowered: perianth as in *T. laea*, but with a more slender tube, stamens in one row, the free portions of the filaments dilated downwards.—*Brodiaea*, Watson, l. c.

A well-marked species, of somewhat limited range, apparently. We have it only from near Chico (Mrs. Bidwell), and from near the coast in Humboldt County (Mr. C. C. Marshall).

T. LEMMONÆ. Scape a foot high: pedicels an inch long: perianth deep orange, 4—5 lines long, segments twice the length of the tube: filaments stout, terete, nearly equal, inserted at the mouth of the tube; anthers 1—1½ lines long: ovary short-stipitate.—*Brodiaea*, Watson, Proc. Am. Acad. xx. 376.

Mountains of the northern part of Arizona.

T. CROCEA. Scape a foot or more in height: pedicels 6—15, slender, an inch or two long: perianth yellow, 7—9 lines long, cleft below the middle: anthers oblong, less than a line long, obtuse at each end, the lower nearly sessile on the tube, the upper borne on a free filament reaching the middle of the segment: ovary on a slender stipe 2 lines long.—*Subertia*, Wood. l. c. 172: *Milla*, Baker, l. c. 384: *Brodiaea*, Watson, l. c.

Known only from the extreme northern part of California.

T. GRACILIS. Half as large as the last species, the leaf usually solitary, pedicels more numerous: perianth yellow, cleft below the middle: filaments subequal, the free part much elongated, carrying the sagittate acute anthers above midway of the segments: ovary as in the preceding.—*Brodiaea*, Watson, l. c.

Common in pine woods of the Sierra Nevada, from Plumas to Merced Counties. Collected by Mrs. Austin, Mrs. Curran, Dr. Kellogg, Mr. Sonne, and others.

*** *Perianth tube short, the segments rotate-spreading, filaments below coalescent with the short perianth-tube, free and broadly appendaged above it.*—CALLIPRORA.

T. IXIODES. Scape $\frac{1}{2}$ —2 feet high: leaves 1 or 2: filaments of two lengths but all bifurcate at apex, the oblong anther inserted on a central cusp: color light yellow, or the anther only sometimes bluish.—*Ornithogalum*, Ait. f. Hort. Kew ii. 257: *Milla*, Baker, l. c. 383: *Brodiaea*, Watson, l. c.: *Calliprora lutea*, Lindl. Bot. Reg. t. 1590; Hook. Bot. Mag. t. 3588; Kunth, l. c. 476; Hook & Arn. l. c. 400.

Common from the southern portions of the State to Oregon.

T. LUGENS. Like the preceding in size and habit; appendages of the filaments rounded, not bifurcate, at apex: perianth deep saffron color within, exteriorly the entire tube and the broad midvein of the segments brownish black.

Collected only by the writer, on mountain summits back of Vacaville, May 4, 1886.

**** *Perianth open-campulate, cleft below the middle, segments not rotate-spreading.*—HESPEROSCORDUM.

T. HYACINTHINA. Scape a foot or two high: pedicels 5—20. slender: perianth 5—8 lines long, white with green veins, or sometimes tinged with purple: stamens in one row; filaments deltoid-dilated and monadelphous below, attenuate above and tipped with a small ovate-oblong anther: capsule short-stipitate.—*Hesperoscordum hyacinthinum*, Lindl. Bot. Reg. t. 1293; *H. lacteum*, Lindl. l. c. t. 1639; Wood, l. c.; *H. Lewisii*, Hook. Fl. Bor. Am. ii. 185, t. 198; *H. hyacinthinum* and *H. lacteum*, Kunth, l. c. 464: *Milla hyacinthina*, Baker, l. c. 385: *Brodiaea lactea*, Watson, l. c.: *Allium lacteum*, Benth. Pl. Hartw. 339; *A. Tilingi*, Regel. All. Mon. 124.

From middle California to British Columbia; affecting moist grounds, flowering in May and June. The var. *lila-*

cina, Watson, said to inhabit Mendocino and Humboldt counties in this State, is not known to me unless it be the following very distinct species.

T. LILACINA. Scape less than a foot high: pedicels 10—15: perianth a half inch long, lilac-purple: stamens in one row; filaments not deltoid-dilated or in any degree monadelphous, coalescent with the tube: throughout, free above it, and bearing the linear-oblong anthers more than half way up the segments.

Amador County, May 25, 1886, Mrs. M. K. Curran.

BEHRIA Nov. Gen.

Perianth tubular, persistent, abruptly subglobose-inflated and 6-saccate above the attenuate base, thence more gradually contracted into the long, narrow, 6-toothed tube. Stamens 6: filaments filiform, free down to the base of the sac of the perianth, there abruptly dilated and united into a short crown: anthers versatile, exerted from the perianth. Ovary stipitate, 3-celled, many-ovuled: style filiform, long-exserted: stigma small, 3-lobed. Plant with the scarious-bracted umbel and slender, jointed pedicels of *Triteleia*: scape apparently tortuous or twining as in *Brodiaea*: leaves and corm (?) unknown. The genus is dedicated to our excellent friend, H. Herman Behr, M. D., Professor of Botany in the College of Pharmacy of the University of California.

B. TENUIFLORA. Pedicels 8—15, very slender, an inch or two long: perianth 10 lines long, the supra-basal sac 3 lines broad, tubular portion hardly more than a line in diameter, the ovate-oblong teeth about a line long, erect or slightly spreading, brownish, apparently; whole body of the perianth bright scarlet: anthers linear-oblong, a line long, obtuse at each end, fixed by the middle, yellow: capsule ovate, a half inch long.

The umbels are all we possess of this very beautiful and interesting new ally of *Brodiaea*. They are ticketed "San Jose del Cabo," which means that they are from Cape St. Lucas, or thereabouts, but the name of the collector is unknown. The fragments have been lying in the herbarium of the Academy for many years, and I had supposed, before opening a perianth that the plant would be a second species of *Brevoortia*.

2. *Miscellaneous Species, New or Noteworthy*

HELIANTHEMUM OCCIDENTALE. Suffrutescent, a foot or more high, stout and much branched; stellate-hirsute throughout except the corymbose inflorescence, which is more densely hirsute, with simple, glandular-viscid hairs: leaves linear-lanceolate, an inch long, their margin more or less revolute: inner sepals 4 lines long, ovate, acuminate, outer linear one-half as long: petals 5 lines long: stamens about 20: capsule equaling the calyx.

On a dry summit in the central part of the Island of Santa Cruz, growing there along with *H. scoparium*, which is common all over the island.

CEANOTHUS ARBOREUS. A small tree 15—25 feet high, trunk 6—10 inches in diameter, smooth, with a light-gray bark: branches soft-pubescent: leaves ovate, acute, serrate, or often rather crenate, 2—4 inches long, green and puberulent above, whitish and soft-tomentose beneath: flowers pale blue in a compound raceme: fruit not crested.

Island of Santa Cruz; common on northward slopes in the more elevated regions. The largest known species, with more ample foliage than is found in any other; always tree-like in shape, with clean trunk and open but round head, like a well-kept orchard tree; in this particular most unlike any other *Ceanothus*.

LUPINUS CARNOSULUS. Annual, not slender, 1—2 feet high, somewhat succulent, finely pubescent, with appressed

hairs: leaflets oblanceolate, an inch long, obtuse, but with a small, recurved cusp: racemes loose: bracts equalling the calyx, the upper lip of which is deeply cleft: corolla 5 lines long, deep blue throughout, keel naked: pods when young strongly villous-hirsute.

Near the village of Olema, Marin County, April, 1886.

Plant with the habit of large states of *L. nanus*, but very distinct, wanting the variegated or changeable petals and villous-edged keel of that species; the herbage fleshy as in *L. affinis*.

LUPINUS UMBELLATUS. Annual, slender and much branched, a foot or more high, canescent with a soft, villous pubescence: leaflets 7—11, only a half-inch long: peduncles slender: pedicels elongated, bearing the few small flowers in an umbellate cluster: calyx-lips narrow, the upper deeply cleft: corolla 2--3 lines long, light blue: pods 5—7-seeded.

Island of Santa Cruz, 1886.

Near *L. micranthus*, but distinguished therefrom by its dense white pubescence, small, crowded leaflets and almost umbellate inflorescence.

SYRMATIUM, Vogel.

Calyx campanulate-tubular, almost equally 5-toothed or -cleft, persistent. Petals subequal, free from the stamens: claw of the vexillum remote from the others; wings spreading; keel broad above and usually obtuse or retuse. Stamens 10, diadelphous; anthers uniform. Style incurved. Pod linear, compressed, rostrate-attenuate, falcate-incurved, 1—3-seeded, indehiscent, deciduous by an articulation of the pedicel.—Herbs or shrubs with 3—7-foliolate leaves and gland-like stipules. Flowers small, in few-flowered, bracted or naked umbels, yellow changing to red.—Linnaea, x. 591 (1836): *Drepanolobus*, Nutt. MS. cited in Torr. & Gray, Fl. N. Am. i. 324 (1838): part of *Hosackia*, Bentham, Torrey, Gray, and all recent authors.

In restoring this long neglected genus, I am not obliged

to rest it upon those characters alone, sufficient although they would seem to be, which were indicated both by Vogel and by Nuttall a half century ago. The indehiscent pods, promptly deciduous at maturity, are so utterly and widely unlike those of any *Hosackia* that I suppose, the character being here pointed out, there will henceforth remain less excuse than formerly for confounding the genera. It is so manifest a character to any one examining the plants in the field at the maturing of the fruit, that I wonder Nuttall, in his field-researches, did not notice it. The generic name proposed by him is more pleasing than that of Vogel, but it came into publicity after *Syrmatium*. It is therefore now of little importance that the authors of the Flora of North America, in the place referred to, did not make unmodified use of Nuttall's manuscript of *Drepanolobus*, but only employed his names and descriptions, referring the species generically to *Hosackia*. The goodly number which have been newly discovered in later years have all come out under that name, excepting the three herein first described. Full descriptions of all the rest are to be found in either the Botany of California or the Bulletins of the California Academy, that of each under the specific name here adopted.

S. DENDROIDEUM. Shrubby, erect, 4—7 feet high, with roughish brown stem an inch or two in thickness, and many short ascending branches: branchlets angular, their growing parts more or less minutely appressed-silky, the plant otherwise glabrous: leaflets three, narrowly oblong, obtuse: umbels numerous, on short peduncles, not bracted: calyx 3—4 lines long, the triangular-subulate teeth a fourth as long as the nearly cylindrical tube: corolla 4—6 lines long: pod $\frac{3}{4}$ -inch long, slightly curved, 3-seeded: seeds terete and straight.

Hill tops, among other bushes, on the higher parts of Santa Cruz Island. Near *S. glabrum*, but of entirely different habit, with much larger flowers and fruit, on short, rigid, crowded branchlets.

S. PATENS. Shrubby, like the preceding, but the stem low, and branches spreading horizontally; silvery-canescant throughout: leaflets 4—5, obovate-oblong, rather acute: umbels numerous, sessile, bractless: corolla as in the last species; calyx with very short teeth: pod 6—8 lines long, the short 1—2-seeded body nearly equalled by the slender, nearly straight beak.

Island of San Miguel, in the Cañon del Mar, but more abundant on the summit of the islet known as Gull Island, a mile or more off the shore. Of very different aspect as compared with its kindred species of Santa Cruz; and there is a difference of another kind quite as striking as any mentioned in the specific character. The Santa Cruz species was in full fruit at the beginning of July. That of San Miguel was just well in flower two and a half months later: and the two islands are not more than forty miles apart.

S. GLABRUM, Vogel, *Linnaea*, x. 591.—*Hosackia*, Torr. Bot. Wilkes Exp. 274; Watson, Bot. Cal. i. 137: *Drepanolobus scoparius* and *D. crassifolius*, Nutt. in Torr. & Gray, Fl. N. Am. i. 325.

S. CYTISOIDES.—*HOSACKIA*, Benth. Trans. Linn. Soc. xvii. 366; Torr. & Gray, l. c. 324; Watson, l. c. 138: *Drepanolobus*, Nutt, l. c.

S. JUNCEUM.—*Hosackia*, Benth. l. c.; Torr. & Gray, l. c. 325; Watson, l. c.: *Drepanolobus*, Nutt. l. c.

S. PROSTRATUM.—*Drepanolobus*, Nutt. l. c.: *Hosackia decumbens*, var. *glabriuscula*, Hook. & Arn. Bot. Beech. 137; *H. prostrata*, Watson, l. c.

S. MICRANTHUM.—*Drepanolobus*, Nutt. l. c.: *Hosackia*, Watson, l. c.

S. SERICEUM.—*Hosackia*, Benth. l. c.; Torr. & Gray, l. c.; Watson, l. c.

S. ARGOPHYLLUM.—*Hosackia*, Gray, Pl. Thurb. 316; Wat.

son, l. c.; *H. argentea*, Kellogg, Proc. Cal. Acad. iii. 38, fig. 8.

S. PROCUMBENS.—*Hosackia*, Greene, Bull. Cal. Acad. i. 82.

S. VEATCHII.—*Hosackia*, Greene, l. c. 83.

S. ORNITHOPUS.—*Hosackia*, Greene, l. c. 185.

S. DISTICHUM.—*Hosackia*, Greene, l. c. 186.

S. DECUMBENS.—*Hosackia*, Benth, l. c.; Hook. Fl. Bor-Am. i. 34; Torr. & Gray, l. c. 324; Watson, l. c. 138, excl. var. (?) *Nevadensis*: *Drepanolobus*, Nutt. l. c.

S. NEVADENSE. Annual, diffusely procumbent, the slender branches 1—3 feet long: sparingly villous or somewhat tomentose: leaflets 3—5, small, cuneate-obovate: umbel on a short peduncle and with a unifoliolate nearly sessile bract: calyx a line long, the slender teeth a half-line: pod $2\frac{1}{2}$ lines, strongly incurved, yielding a single curved seed.—*Hosackia decumbens*, var. (?) *Nevadensis*, Watson, l. c.

Common from Donner Lake and Yosemite to the eastern borders of Nevada.

S. TOMENTOSUM, Vogel, l. c.—*Hosackia*, Hook. & Arn. l. c. 137; Torr. & Gray, l. c.; Watson, l. c. 139: *Drepanolobus lanatus*, Nutt. l. c.

S. HEERMANNI.—*Hosackia*, Dur. & Hilg. Pac. R. Rep. v. 6. t. 4; Watson, l. c.

S. NIVEUM. Suffrutescent, a foot high, white, with a villous-tomentose pubescence: leaflets 5, obovate or oval, acute: flowers capitate, the head nearly sessile, bractless: corolla 4 lines long, little exceeding the calyx of which the equal, filiform teeth are as long as the turbinate tube: pod 1-seeded, very short, wholly included in the calyx.

Island of Santa Cruz on exposed rocky slopes, but nearly extinct. The few specimens collected do not at all indicate the shrubby character of the species; for they are young seedling plants of perhaps the second year, just beginning

to show their first flowers, and were found in the sandy moist bed of a deep ravine, out of reach of the sheep. The remnants of a few of the parent shrubby plants were afterwards discovered on the rocky summit above.

HEUCHERA MAXIMA. Caulescent, the stout, fleshy decumbent branches 1—2 feet long and nearly an inch thick, leafy throughout: leaves round-cordate, 3—6 inches in diameter, with 5 shallow lobes and large rounded, but abruptly slender-pointed teeth: petioles and leafy peduncles stout, of about equal length, hirsute: thyrsus narrow, 8—12 inches long: calyx white, 3 lines long, acute at base: petals minute, white.

Rocky steeps near the sea, on the northward slope of Santa Cruz Island. An enormous species of *Heuchera*, the stout caudex-like stems more or less reclining, often fully two feet long, and many of them from the same root; simple or with suberect branches, all having numerous axillary, leafy peduncles which are rather short, the thyrsus alone rising higher than the leaves.

LYONOTHAMNUS ASPLENIFOLIUS, Greene, Bull. Cal. Acad. i. 187.

Having been favored with an opportunity of visiting the island where this interesting tree is endemic, I wish to add here a few remarks concerning it. The fruit, which in the latter part of July was found nearly mature, is assuredly that of a Saxifragaceous rather than a Rosaceous plant, consisting as it does of a pair of folicles rather than a two-celled capsule: and so the opinion of Professor Gray as to the ordinal place for the genus is well confirmed. But the flowers are altogether indistinguishable from those of the Rosaceous genera *Vauquelinia* and *Heteromeles*. The tree is no rarity on its native shore. There are a hundred fine groves of it distributed up and down the thirty miles of the island's northward slope, individual specimens often as high as thirty-five and forty feet. The wood, close-grained

and hard, is called "iron wood" by the men on the island. No other small tree of our coast equals this in grace of form and beauty of foliage. The flowers, too, are quite showy in their season, the larger corymbs often measuring a foot in diameter. Plate VI is from a pen-tracing of a branchlet and fruit-cluster made by Dr. Kellogg.

GALIUM BUXIFOLIUM. Shrubby, two feet high, erect and compactly branching: branches sharply quadrangular, the uppermost subdivided into innumerable, short, slender, very leafy branchlets: leaves coriaceous, evergreen, the lowest in fours, those of the branchlets in pairs, all obovate-oblong, acutish, tapering to a short petiole, 4—8 lines long, sparsely scabrous on the margin and along the midvein beneath: flowers unknown: fruit dry, minutely hispid, short-pedicelled, solitary, terminal and axillary.

On rocky shelves in a deep ravine near the sea, Island of Santa Cruz; also a single plant in a similar locality on San Miguel. A beautiful species and a rare one.

MATRICARIA OCCIDENTALIS. Annual, glabrous, scentless, robust, 1½—2½ feet high, corymbose-paniculate above: leaves 2—3-pinnately dissected into linear segments: heads discoid, 6—8 lines high, bracts of the involucre oblong, a line and a half long, scarious-tipped: corolla 4-toothed: akenes sharply angled, and with a broad coroniform margin a little below the summit: receptacle somewhat fusiform.

In grain fields of the lower San Joaquin and Sacramento region, collected by the writer in May, 1886, near Byron and at Elmira and Vacaville. I have seen this plant in earlier years, but was wont to pass it by unexamined, supposing it to be some species introduced from the old world, its restriction to cultivated fields of wheat and barley suggesting the idea. But on inspection I find it a very near relative of our American *M. discoides*, distinguishable from it, indeed, more by its different habit and size, lack of fragrance, and its late flowering than by any striking charac-

ters of flower or fruit. The better known species, common in all parts of the country, and although a low and homely weed, always pleasing with its delightful fragrance, is quite past its season and nearly dead when the larger is beginning to develop its large heads. It is, moreover, a puny dwarf compared with the new plant.

BERIA (*DICHETA*) *BURKEI*. Erect, slender, freely branching, 1—2 feet high, slightly hirsute-pubescent: leaves pinnately parted into long, linear lobes: bracts of the involucre 10—12: rays as many and conspicuous: pappus of 8—10 minute, entire, acute paleæ and a single slender awn which is nearly twice as long as the akene.

Near Ukiah, Mendocino County, common in moist fields, flowering in June. Collected by Mr. J. H. Burke.

Species well marked by its large size, and peculiar pappus, although closely allied to *B. Fremonti* of the valley of the Sacramento.

CNICUS FONTINALIS. Two feet high, robust, with widely spreading branches ending in middle-sized, nodding heads: stem and upper surface of the broad, pinnately-parted leaves glandular-pubescent: bracts of the involucre imbricated in many series, herbaceous, broad, squarrose-spreading or reflexed, abruptly acute, with a short spinose tip and no viscid or glandular spot: flowers dull white: anther-tips triangular, acute.

At Crystal Springs, San Mateo County, growing among the various springs and streamlets at the north side of the reservoir from which San Francisco is supplied with water. A rather surprising spot in which to find, at this late day, so large and conspicuous a plant unknown to botanists. The entire physiognomy of the plant, so to speak, is peculiar; but its low stature and stout branches recall the common *C. quercetorum*, which, by the way, is abundant on grassy, stony knolls just above the springs. The ample recurved bracts are the most singular characteristic of this excellent,

perhaps quite local, new thistle. The root is, as in all our native species, biennial.

STEPHANOMERIA TOMENTOSA. Annual, stout, 3—5 feet high, paniculate above the middle, white-tomentose throughout when young, the inflorescence glabrate: lower leaves spatulate in outline, runcinate-pinnatifid, upper lanceolate, nearly or quite entire: heads 3—4 lines high, closely ranged along the upper half of the virgate branches, 5—8 flowered; ligules pale pink: akenes rugose-tuberculate between the five angles: pappus white, of about twenty distinct, fragile bristles, which are plumose to the base and deciduous.

Central parts of the Island of Santa Cruz, but not common.

MALACOTHRIX INDECORA. Annual, diffuse, forming a mat 2—5 inches deep and twice as broad: leaves very thick and succulent, oblong-lanceolate, pinnately lobed, the lobes obtuse: involucre 3 lines high, inner series of scales linear-lanceolate, herbaceous and green, the outer successively shorter and purple: ligules short, greenish yellow: akenes a half line long, 5-angled and 2—3-striate between the angles: pappus with no exterior bristle, wholly deciduous in a ring, the bristles barbellate above, ciliolate below the middle: receptacle naked.

MALACOTHRIX SQUALIDA. Annual, 8—12 inches high, with stout branches from near the base: leaves not succulent, lanceolate, laciniate-pinnatifid, the segments and their teeth acute: involucre a half inch high, its imbricated scales pale green with dark midveins and tips: akene less than a line long, angled and striate as in the preceding: pappus wholly deciduous in a ring, the bristles retrorsely ciliolate at base, barbellate-scabrous above: receptacle with minute paleæ.

The two plants above described inhabit together two or three execrable islets, nesting places of innumerable cormorants and gulls, close by the northern shore of Santa Cruz Island. Similar as to the technicalities of akene and pappus,

they are very distinct species, and, in appearance, not much like their nearest relatives, *M. foliosa* and *M. insularis* of other islands lying to the southward. They have not comeliness or even cleanliness to recommend them, yet make a valuable accession to an interesting genus; but the following may perhaps be reckoned a still more welcome discovery, or rather, rediscovery.

MALACOTHRIX INCANA, Torr. & Gray, Fl. N. Am. ii. 486; Gray, Bot. Cal. i. 434; Syn. Fl. 423. Scanty specimens were obtained by Nuttall, just fifty years ago, on an "Island in the Bay of San Diego," and no more has been seen or heard of the species until this year. A *Malacothrix* answering perfectly to the description published is abundant on San Miguel, the smallest and remotest of the Santa Barbara group of islands. But I met with it first on the western extremity of Santa Cruz, where it was growing in small quantity, on a shaded sandstone terrace a little above the beach.

CALAIS CLEVELANDI.—*Calais Parryi*, Greene, page 49 of this volume, not of Gray.

Dr. Parry has shown me that my plant described in the last number of the Bulletin cannot be the species so named by Gray. I had entirely overlooked the statement of that author, that, in *C. Parryi*, the awns are twice or thrice longer than the paleæ; and I here dedicate what now appears plainly a new species, to my esteemed friend, Mr. Cleveland of San Diego, who was I think the first collector of it.

DOWNINGIA CONCOLOR. Slender, diffusely branching, 4—6 inches high, minutely puberulent under a lens: tube of the corolla turbinate, nearly as long as the limb, cleft from the base of the upper lip one third of the way down; lobes of the upper lip lanceolate, deflexed and appressed to the sides of the tube: flower blue throughout, the central part of the lower lip dark, surrounded by a narrow border which is paler than the deep sky-blue of all the other parts.

In a wheat field near the village of Suisun, May 2, 1886, growing with the common species, each plant forming a compact, well rounded mass altogether intensely blue with an extraordinary profusion of flowers. The other three species already recognized are almost impossible to distinguish, in herbarium specimens, but this, even when dried, looks very different from those. Its cleft corolla-tube is a new and unwelcome character, too much like *Lobelia*.

ON TETRAODON SETOSUS, A NEW SPECIES ALLIED TO
TETRAODON MELEAGRIS LACEP.

BY ROSA SMITH.

Length 12 inches (14 inches to margin of caudal fin); depth, inflated, 6 inches. Head 4 ($4\frac{2}{3}$); orbit 4 in head. Snout about 3 in head (measuring to front of orbital bone), the upper profile abruptly concave behind lip. Interorbital space moderate, one and a-half times diameter of orbital bone. The eye itself seems to be drawn backward from its proper place in the orbit and has been stretched out of shape in drying. Orbital ridges not greatly elevated, the interorbital region nearly flat.

Body everywhere thickly beset with short, slender, stiff spines, except around mouth, at bases of fins and around vent; these spines or bristles averaging one-eighth of an inch in height, their insertion in the skin not quite so far apart as their height. The spines are nearly uniform everywhere. Some of them show no lateral roots, while many are from two- to five-rooted, giving the skin a stellate appearance. About seventy spines from eye to dorsal fin, but the spines are thickly scattered without being in regular rows. The smooth area about the mouth is two-thirds diameter of orbit. The dorsal and anal peduncles are wholly smooth and the caudal peduncle has spines only at its base, which are recumbent and mostly imbedded in the skin.

Caudal fin subtruncate, one-half longer than caudal peduncle, the base of the fin entering twice in its height. Base of dorsal fin two and a half times in its height; margin unevenly rounded. Base of anal one and three-fourths in height, the fin rounded posteriorly. Pectorals truncate, one-fourth higher than broad.

Color dark brown, everywhere with roundish white spots, most of them one-eighth of an inch in diameter, equal to or exceeding the pupil; these spots coalesce on the ventral surface, forming vermicular markings, which usually are wider than the brown interspaces; the dorsal dots are narrower than the brown ground between. All the fins similarly spotted, though the spots are smaller than on the body. No streaks nor black marks anywhere. Pectoral and dorsal fins with a white edge as wide as the dorsal spots. Anal fin very narrowly margined with white.

This description is made from a dried skin in fine condition which came from Mexico. The specimen is now in the collection of the California Academy of Sciences, and bears the registered number 2,996.

October 30, 1886.

DESCRIPTIVE NOTICES
OF
NORTH AMERICAN COLEOPTERA.

I.

(With Plate VII.)

BY THOS. L. CASEY.

Read Oct. 18th, 1885.

Under the above title it is intended to publish short studies, either of species or small groups of genera, which may from time to time be investigated in a detached and desultory manner. Care will be taken, however, to indicate the relationships wherever possible and whenever these are at all obscure, so that it is hoped no confusion will be introduced into our already overburdened nomenclature. Large and complicated genera, or those^e in which the species are very closely allied and difficult of recognition, will not be touched upon except under very peculiar conditions, as these should form the subject-matter of separate essays.

In this connection it may be stated that it is my intention to include, if possible, within the faunal region considered, the entire North American continent terminating on the south in the isthmus of Panama and including the islands of the West Indian archipelago, as this appears to constitute a more natural region than that which is limited on the south by the Mexican boundary of the United States.

The present paper contains descriptions of new genera and species, mostly from the Pacific Coast, but with a few from

other portions of the continent: they are, in addition, principally members of the clavicorn families Pselaphidæ and Staphylinidæ.

In the latter family there seems to be considerable confusion in regard to the estimation of the number of abdominal segments, and having recently seen some remarks by M. H. Jekel (Col. Jk. Eleuth. Bibl., p. 22-23), which set forth the subject very clearly and fully, I take pleasure in transcribing them as follows:—

“Une autre cause d’embarras très sérieux pour les étudiants est l’instabilité—ou plutôt la non-concordance des auteurs dans l’énumération des segments abdominaux. Erichson avait parfaitement reconnu l’existence des deux pièces du dos situées entre le metanotum et les segments normaux de l’abdomen—visibles et découverts seulement chez un petit nombre de groupes où les élytres n’atteignent pas l’extrémité des épimères metathoraciques— et il avait prévenu ses lecteurs que, pour éviter des erreurs, il ne compterait les segments du dos qu’à partir de—et avec—celui qui se présente comme premier en dessous, et dont la contexture est semblable en dessous comme en dessous aux suivants et fait corps avec eux, et offrant la même consistance. En cela il fut suivi—comme il avait été précédé—par un grand nombre d’auteurs recommandables. Plus tard les uns n’ont voulu compter qu’une seule de ces deux pièces dorsales ‘*interthoracico-abdominales*,’ regardant l’une d’elles comme un faux-segment à cause de son étroitesse et de sa consistance membraneuse; d’autres la comptent aussi, de sorte que nous sommes en présence de trois systèmes, de sorte que le segment anal est pour les uns le 6^e (la plupart des auteurs jusques et y compris Erichson, Fairmaire etc), pour d’autres le 7^e (Kratz, G. Thomson etc), pour d’autres enfin le 8^e (Pandelle etc).

“Tout en constatant l’existence des deux pièces dorsales en question,—dont la consistance est si différente de celle des autres segments, et qui ne se détachent pas du thorax lors de la rupture de l’abdomen—elles ne devraient pas être comptées comme abdominales dans les travaux descriptifs des espèces, d’autant plus que les auteurs qui les comptent n’en parlent jamais dans leurs descriptions—et pour cause—ces minces filets semicoriaces, semimembraneux n’offrant aucune modification de forme ou de sculpture appréciables, lorsque, par exception, ils sont découverts par la brièveté des élytres. Enfin, même dans ce cas, leurs analogues ne se présentent pas en dessous cachés qu’ils sont par les épimères, le metasternum etc. Dans cette illogique situation on se trouve avoir un ou deux segments de plus—selon la fantaisie des auteurs—en dessus qu’en dessous de l’abdomen, 6 ventraux et 7 ou 8 dorsaux *ad libitum*.

“N’eut-il pas été préférable, pour la compréhension de tous, de s’en tenir au sage conseil et à l’exemple d’Erichson, dont la judicieuse logique n’amène aucune perturbation dans les errements antérieurs, basés sur la parité

des segments extérieurement appréciables et conformes en dessus comme en dessous? Que l'on nous prouve, comme question d'anatomie générale et transcendante et technique des Staphylinides, qu'il y a 8 pièces, 10 même (Pand. Ann. Soc. Ent. Fr. 1869, 265) en dessus de l'abdomen, cela est fort bien, mais ceci une fois établi n'énumérons pas dans des descriptions qui doivent être claires et compréhensibles pour tous, et n'assimilons pas aux véritables segments abdominaux ces annexes metathoraciques *qui s'arrêtent au niveau des épimères du metasternum, et qui font corps avec lui*

“Je préviens donc que j'en reviens à l'ancienne méthode, et que, quelque soit l'allongement ou la brièveté de l'élytre, le compte des segments abdominaux se fera dans mes descriptions, à partir du premier ventral et de son correspondant dorsal, ce qui est la logique et la précision, que l'on ait affaire à un Aléocharien ou à un Omalien.”

These remarks fitly convey my own views and are similar, in substance, to what I should have stated as a result of study and observation. In all my future writings the ventral segments will be counted from and including the first as seen from below, which is the real first segment of the abdomen.

For an illustration of this structure the reader is referred to the plate at the end of the present paper, where the basal portion of the abdomen of *Hesperobium* is figured in detail. It is there seen that the first segment has at the base a raised flat margin, rapidly diminishing in length to the median carina, where it almost disappears. It is possibly this raised margin which has been mistaken by several authors for a small basal segment, partially hidden by the posterior margin of the metasternum and the coxæ.

The true significance of the basal elevation is not apparent, unless, perhaps, that it serves to form a closer joint when the abdomen is drawn up, and still allow of a certain amount of flexibility. That it is not the ventral portion of the small membranous or coriaceous posterior segments of the metanotum is abundantly proven by the fact, as shown above by M. Jekel, that these coriaceous parts do not project beyond the metasternum and do not in reality form part of the abdomen; also because the other segments are also provided with an entirely analogous raised basal

margin, and finally very conclusively by the fact that these margins also exist on the dorsal surface of the segments, being practically continuous from the ventral to the dorsal plate. The coriaceous segments merely serve to connect the abdomen proper to the metanotum, and apparently do not even extend through to the under surface of the metasternum, or at least one specimen—from which the drawing is taken—has the first ventral so far exerted from the posterior margin of the metasternum as to leave a very large extent of membrane exposed to view, and no signs whatever of a segmental division are visible.

Another inaccuracy mentioned by M. Jekel, is in regard to the measurement of length in the Staphylinidæ, where the abdomen is often extended. This is not, however, of so great importance, as it is much easier to state, if the specimen be unique, whether or not the abdomen is extended, than to make minute measurements of other portions of the body. If the specimens be numerous, the lengths of extreme examples should be quite sufficient for all practical purposes.

As a source of ambiguity often observable in the writings of coleopterists, may be mentioned the variety of ideas attached to the word *epipleure*, in describing the elytra. Pascoe has alluded to this subject (Ann. Mag. Nat. Hist. Jan. 1869, p. 2), and suggested a definite meaning for the word: the notation here proposed is similar to that of Mr. Pascoe, with a single exception.

The inflexed sides of the elytra—for which I would propose the word *hypomera*—are generally composed of two parts, the first being a more or less elevated lower margin of greater or less width, and the second the remainder of the inflexed side, usually limited above by a more or less distinctly defined edge, generally reflexed. Above this the disk of the elytra is declivous, the declivity merging gradually into the dorsal and central portions of the disk, which are nearly always less convex. When the sloping sides of

the disk are very abrupt and more or less distinctly limited by a line, as in many species of *Læmophlœus*, they are designated as the *pleuræ*, the word *epipleuræ* being applied to the second portion of the inflexed sides above mentioned, and the word *hypopleuræ* to the first, or raised lower margin. This last has been called the *epipleural fold* by Pascoe; but in addition to the undesirability of two words to express our meaning where one can just as well be employed, we must consider the fact, admitted by the distinguished author quoted, that the hypopleuræ are not in reality folds at all. In a few of my previous descriptions I have used the word hypopleuræ to designate the entire inflexed sides or hypomera, but in future the names here given will be adhered to.

While dealing with kindred topics, it seems desirable to indicate the perversity of the brain in interpreting the images formed upon the retina of the eye in delineating and describing form. A good way to illustrate this is to observe the letter S in print, where the two salient curves in the ordinary position of the letter appear to be of nearly equal size; if now the letter be inverted, it will be seen at a glance that the lower portion in its former position is much the larger. In a similar way vertical lines appear relatively longer than transverse lines, and this has led to many errors in describing the shape of the prothorax; when the width and length of the latter are equal, it invariably appears at the first glance to be longer than wide, and is generally so described, thus introducing an element of confusion and doubt for those attempting to identify species from descriptions. This defect can be gradually overcome in various ways, but perhaps best by trying to delineate the form of the insect; for those who have never attempted it, this will generally be found a very difficult feat, and one requiring several attempts before a satisfactory outline can be produced.

The short diagnoses usually given are purposely omitted,

their place being sufficiently supplied by the first few lines of the descriptions, which deal with the general form, color and other similar characters, in conjunction with the general remarks usually appended in large type. In general monographic memoirs they are quite unnecessary, and merely consume space which might better be occupied by descriptive matter, because in such monographs or revisions, the key-tables, which should always be given, amply serve the purpose for which the diagnoses are intended.

It will be observed that the descriptions refer in all cases to the single specimen assumed as the type. The diversity of opinion as to the proper definition of a genus or the structural differences warranting the generic isolation of special groups, holds with almost equal force in regard to the ideas attached to the species which compose them. Forms which some coleopterists would regard as specific, are held by others to be simply racial, and by others again as merely accidental variations not even worthy of a name. This divergence of opinion must necessarily exist until our knowledge becomes more extensive, and until an approximately complete series of specimens of all species can be obtained from every region of the globe. I have preferred, therefore, in the existing state of knowledge, to describe one definite type and give such general remarks as may indicate the variation exhibited by the material at hand; additional series may alter our conception of the species to a considerable degree, but having a single typical description, we possess something tangible upon which to base the subdivisions into races or definite varieties, as may be determined by such representatives. In other words, it would produce more confusion than benefit to attempt to give a general description based upon material which must inevitably be incomplete.

It will also be noticed that the English language is alone employed in descriptions and diagnostic tables. My reasons for this course are, first, because I believe that the

time necessarily employed in learning to write the Latin language with fluency, in such manner as to be entirely certain that our ideas are being properly expressed—and it is useless to attempt it without such knowledge—might be better occupied in a study of the technicalities of the science, especially in view of the fact that there is probably no man of even moderate education possessing a good knowledge of Latin, who cannot at least understand descriptions drawn up in the three languages—French, German or English. Again, supposing a student to be ignorant of the indispensable triad of modern languages, it is easily seen that the amount of information concerning a species which he can obtain from the short three or four lines written in Latin and forming the diagnosis, is simply tantalizing. Either the entire description with all appended remarks should be written in Latin, as in the *Staphylinidæ* of Erichson or the *Tomicini* of Eichhoff, or else the student must perforce have a knowledge of these languages in order to read the description of the species, otherwise the most important part, as far as identification is concerned, or that relating to the details, is entirely lost to him. Without wishing to be considered unduly iconoclastic, it must be candidly confessed that the necessity for the latinization of the few lines usually beginning a description is not readily appreciable.

When used with a moderate amount of care, the French and English languages are very perspicuous and eminently adapted to concise scientific expression. The spirit of these languages demands simplicity and conciseness, and they are, in addition, peculiarly fitted for technical descriptions because of their power of absorbing words derived directly from the Latin and Greek. In regard to ambiguity, there are few who can maintain that they possess this undesirable quality to a greater degree than the Latin, and we may go so far as to say that they are far less ambiguous than a large proportion of the ordinary entomological Latin of the present day. The majority of our working coleopterists are com-

pelled to engage in active pursuits, either professional or commercial, which demand a knowledge of the three languages mentioned, and, if after acquiring them, these can also serve them in the scientific recreations of their leisure moments, thus rendering unnecessary the acquisition of a special language for such purposes, it appears to the writer that we have gained one very important point, since just so much time and labor may be saved for useful scientific work. Physicists, mathematicians, astronomers, and zoölogists in fields other than entomological, have long since abandoned the Latin as a medium of publication. The leading mathematical and astronomical journals employ the modern languages exclusively, and, although they appeal to a much more extensive class of readers than do the entomological journals, it has not been found that anything has been lost by the change, but on the contrary, as they at present reach a larger number of readers, such a course has tended to more widely diffuse scientific knowledge, and to create a more universal desire for its advancement.

This subject is, however, a somewhat delicate one, and merits further consideration and argument.

The binocular microscope, with objectives of from two-thirds to two inches focal length, is inevitably destined to supplant the hand-lens in the future study of entomology, its advantages being perfect steadiness of the object, sufficient magnifying power to bring all the organs prominently into view, and the healthful and unconstrained use of both eyes, giving a stereoscopic effect; at the same time both hands remain free for writing or drawing. To one accustomed to this mode of studying insects under ten mm. in length, an adherence to the usual method of research by means of the hand-lens, where the eye is unnaturally strained, and the images consequently apt to be distorted and to convey a wrong impression, seems entirely unaccountable. A long list of errors in describing sculpture and formation of various parts of the body, owing to insuf-

ficient magnifying power and other unsatisfactory conditions, could easily be given, and in this connection it must be borne in mind that it requires much more amplification and acuteness of sight and perception to discover a character or the structural nature of an object than it does to see the same after it has once been described. I allude to the use of the microscope rather for original research than for cursory observation and comparison, as these objects can be much more conveniently attained with a good hand-lens.

As greater attention is being given to exactness and perspicuity in describing the characteristics of species, a general catalogue of terms to be employed for the almost infinite variety of sculpture, punctuation, lustre, pubescence, form and color, should be compiled, each modification being illustrated by reference to a particular species wherein it is preëminent; the colors should be indicated on a lithographic plate. Such a catalogue as this would conduce greatly to uniformity in description, and therefore to ease of identification of species; it should be undertaken by a special congress of entomologists, or by some one of the large European societies, and would be of great value in systematizing the science.

In conclusion, the author begs the indulgence of coleopterists for errors, past, present and future. Having entered upon the detailed study of our smaller Coleoptera, he finds himself forced to rely in great measure upon the library, which, although undoubtedly a most trustworthy and unbiased guide, is still more or less unsatisfactory because of the insufficient and often erroneous descriptions of our earlier authors. Under such circumstances errors are unavoidable, and he trusts they may be overlooked to some extent, upon the assurance that his utmost endeavors have and will be employed in seeking the truth regardless of all other considerations.

SAN FRANCISCO, October 11, 1886.

The following is a list of the genera and species here described or brought to notice:—

- HYDROPHILIDÆ.
- Limnocharis picea* Horn.
polita.
angustula.
alutacea.
congener.
coniciventris.
- SILPHIDÆ.
- Silpha ænescens.*
- PSELAPHIDÆ.
- Batrissus mendocino.*
zephyrinus.
speculum.
monticola.
occiduus.
- Bryaxis texana.*
infinita.
- Nisa* n. gen.
- Reichenbachia tumorosa.*
tumidicornis
informis.
gracilicornis.
nevadensis.
fundata.
franciscana.
- Nisaxis* n. gen.
- Sonoma* n. gen.
- Oropus striatus* Lec. n. gen.
convexus.
interruptus.
abbreviatus.
- Actium* n. gen.
- STAPHYLINIDÆ.
- Lomechusa montana.*
Tachyusa crebrepunctata.
Autalia elegans.
Eumitocerus tarsalis n. gen.
Heterothops exilis.
- Ababactus pallidiceps.*
Lena testacea n. gen.
Ramona capitulum n. gen.
Leptogenius brevicornis n. gen.
Scopeus rotundiceps.
truncaticeps.
Scopæodera nitida Lec. n. gen.
Leptorus texanus n. gen.
bicolor.
versicolor.
longiceps.
- Orus parallelus.*
Apocellus niger.
Phleopterus filicornis.
Amphichroum flavicorne.
alutaceum.
pilosellum.
veterator.
crassicorne.
- Pelecomalium binotatum* n. gen.
modestum.
- Lathrimæum humerale.*
Orobanus rufipes.
densus.
- TRICHOPTERYGIIDÆ.
- Actidium rotundicolle.*
Ptilium sulcatum.
Smicrus americanus.
- BYRRHIDÆ.
- Ditaphrus scymnoides* n. gen.
- TENEBRIONIDÆ.
- Eleates occidentalis* n. gen.
- CURCULIONIDÆ.
- Barinus squamolineatus* n. gen.
- SCOLYTIDÆ.
- Renocis heterodoxus* n. gen.

LIMNOCHARIS Horn.

The species of this genus are probably numerous in North America, although but two have been described; I now add several other peculiar forms. The genus is apparently valid, since in all the numerous specimens which I have examined, there are clearly eight ventral segments, the eighth being small and more or less retractile, so that, while in the type of *angustula* it is nearly as long as the seventh and very conspicuous, it may sometimes be almost entirely withdrawn; it is never entirely invisible, however. The labrum also differs greatly from that of *Limnebius* as described by Lacordaire, for in *Limnocharis* it is not broadly rounded, but is deeply sinuate in the middle. The antennæ have, as stated of *Limnebius* by Du Val, nine joints, the first two subanchedylosed so as to form a long slender scape.

The mentum instead of being strongly rounded, approaches in *Limnocharis* more nearly the trapezoidal form, and in the very singular *L. coniciventris* described below, it is almost perfectly trapezoidal, being transversely truncate at apex.

The eighth segment of the abdomen does not bear a tuft of hair, but has one or two terminal setæ, perhaps according to the sex.

The species of the genus at present known from the United States are as follows:—

Sides of the elytra distinctly arcuate.

Surface more or less polished.

Prothorax very strongly transverse, at apex nearly twice as wide as long..... **picea.**

Prothorax less strongly transverse, at apex less than one-half wider than long.

Apical angles of elytra narrowly but distinctly rounded..... **polita.**

Apical angles not rounded..... **angustula.**

Entire surface more or less alutaceous.

Elytra at base slightly narrower than the prothorax; surface strongly alutaceous..... **alutacea.**

Elytra at base equal in width to the prothorax; surface feebly alutaceous; scutellum larger..... **congener.**

Sides of elytra strongly convergent, almost perfectly straight.. **coniciventris.**

L. picea Horn.—Trans. Am. Ent. Soc., 1872, p. 144—A specimen before me from Gilroy, Santa Clara Co., appears to satisfy the description given by Dr. Horn for this species; it is, however, rather smaller and the prothorax appears to be slightly less strongly transverse than shown in the figure and described in the text; it is two-thirds wider than long at apex and nearly two and one-half times as wide as long at base.

L. polita n. sp.—Narrowly oval, strongly convex; black; legs and palpi dark piceo-testaceous; upper surface polished, with rather long, recumbent, very fine and sparse pubescence; under surface black, rather densely pubescent. *Head* one-half wider than long, feebly convex, very feebly reticulate, excessively minutely and rather sparsely punctate; epistomal suture transverse, well marked; last joint of maxillary palpi darker in color. *Prothorax* at apex just visibly wider than the head, at apex broadly and very feebly emarginate, two-fifths wider than long; base two and one-third times wider than the median length, transversely truncate, broadly and very feebly sinuate on each side of the scutellum, and very feebly and anteriorly oblique at the sides; sides feebly and evenly arcuate; disk evenly convex, very feebly reticulate, very minutely, sparsely punctate, with a transverse row of dense punctuation at the apex on each side. Scutellum distinctly wider than long, sides feebly arcuate. *Elytra* at base equal in width to the prothorax; sides strongly convergent and rather strongly and evenly arcuate to the apex, which conjointly is not truncate, but rather acutely rounded; each elytron at apex rather acute and very distinctly rounded; disk strongly convex, scarcely two and one-half times as long as the prothorax, finely and very distinctly reticulate, more finely and densely so than the pronotum, not visibly punctate. *Legs* rather slender. Eighth segment with two apical setæ. Length 1.4 mm.

California; (San Francisco). Several specimens.

May be distinguished by its blackness, polished integuments and elytral structure.

L. angustula n. sp.—Narrowly oval, strongly convex, piceous-black; legs and palpi dark piceous-brown; pubescence very fine, not dense; integuments shining. *Head* one-half wider than long, feebly convex, not visibly reticulate, very minutely and sparsely punctate; epistomal suture very feebly arcuate toward the eyes; last joint of maxillary palpi scarcely at all darker in color. *Prothorax* at apex not wider than the head, broadly, very feebly sinuate, two-fifths wider than long; base transversely truncate, almost perfectly straight, two and one-fourth times as wide as the median length; sides feebly and evenly arcuate; disk not visibly reticulate, excessively minutely, sparsely punctate, with a feeble row of larger and denser punctiform subasperate erosions on each side behind the apical margin, and, near the basal margin, two small impressed punctures distant by slightly more than the width of the

scutellum. Scutellum very slightly wider than long. *Elytra* at base as wide as the prothorax; sides strongly convergent to the apex, evenly and rather feebly arcuate; apex feebly subtruncate, together rounded, each angle nearly right and scarcely at all rounded; disk slightly less than one-half longer than wide, two and one-third times as long as the prothorax, strongly convex, finely, feebly reticulate, not visibly punctate. Eighth ventral segment large, having two apical setæ; sixth broadly emarginate. Length 1.3 mm.

Texas; (Austin 1).

This species, as may be inferred from the description, is very closely allied to *polita*, but is well distinguished by the form of the elytral apices; in addition the reticulations of the elytra are finer and stronger in *polita*, and the punctation of the pronotum is less evident in *angustula*. It may be considered unwarrantable to trust to the conformation of the elytral apices for specific characters in the Hydrophilidæ, but in the present instance there is much more probability of both the typical representations being of the same sex, than that they are not, for the eighth segment in each is large and very distinct and is provided in each with two equal apical setæ. *Angustula* is a narrower and slightly more convex species than *polita*, and has the prothorax slightly less strongly transverse.

All the species of the present genus have the two basal punctures and the two apical rows of asperities; the pronotum is, in addition, always very finely margined along the apex and sides, but not along the base, the latter being abruptly convex and narrowly declivous to the plane of the elytra.

L. alutacea n. sp.—Suboblong, moderately robust, not strongly convex, black, piceous by diaphaneity; legs dark piceo-testaceous; palpi and antennæ slightly paler; pubescence extremely fine, recumbent, not dense above; integuments alutaceous, elytra scarcely more strongly so than the pronotum. *Head* scarcely one-half wider than long, feebly convex, finely reticulate, very minutely, sparsely punctate; epistomal suture transverse and very feeble in the middle, oblique and almost completely obliterated at the sides; epistoma with a small discal puncture near each apical angle. *Prothorax* at apex slightly wider than the head, broadly, moderately and trapezoidally emarginate, two-fifths wider than long; at base transversely truncate, broadly and

very feebly sinuate at each side, two and one-third times as wide as long; sides evenly and feebly arcuate; basal angles from above narrowly rounded; disk very broadly convex, finely reticulate and subgranulose; punctures excessively minute, rather sparse and scarcely visible. Scutellum very small, twice as wide as long, parabolically rounded behind throughout. *Elytra* at base slightly, but distinctly narrower than the prothorax; sides not strongly convergent, evenly and moderately arcuate to the apex, which, conjointly is obtusely and evenly rounded, not at all truncate; inner angles narrowly but distinctly rounded; disk two-fifths longer than wide, two and one-half times as long as the pronotum, moderately convex, reticulate and subgranulose like the pronotum, excessively minutely and scarcely visibly punctate. Eighth segment having a long, robust apical style, with one or two short robust spinules on either side. Length 1.6 mm.

California; (Mendocino Co. 1).

Easily distinguished by its wider prothorax and distinctly alutaceous surface sculpture. The maxillary palpi are distinctly more slender than in the following species:

L. congener n. sp.—Narrowly oval, rather convex, black; legs piceous; pubescence fine, sparse; integuments shining, very feebly subalutaceous. *Head* feebly convex, finely, evenly and distinctly punctate; epistomal suture transverse, distinct, slightly arcuate and very fine near the eyes. *Prothorax* at apex just visibly wider than the head; proportions nearly as in *alutacea*; sides evenly and more feebly arcuate; apex more feebly and arcuately emarginate; disk broadly convex, finely, densely reticulate; finely, evenly and distinctly punctate. Scutellum triangular, apex not rounded, three-fourths wider than long. *Elytra* at base fully as wide as the prothorax; sides convergent, evenly and not strongly arcuate to the apex, which, conjointly is obtusely and evenly rounded, not at all truncate; inner angles very narrowly rounded; disk nearly two and one-half times as long as the prothorax, moderately convex, more finely and densely reticulate than the pronotum, not perceptibly punctate. Eighth segment with a long anal style and two short spinules on each side. Length 1.6 mm.

California; (Mendocino and Humboldt Cos.). Several specimens.

This species is closely allied to *alutacea*, but differs in its more evenly oval and narrower form, its relatively narrower prothorax, much more shining surface, stronger and more evident pronotal punctuation, shorter, more robust maxillary palpi, and particularly in the form of the scutellum. The two discal punctures of the epistoma are slightly stronger,

and the transverse epistomal suture is less obsolete than in *alutacea*. The sides of the prothorax are very distinctly less strongly arcuate in *congener*.

L. coniciventris n. sp.—Oval, attenuated behind, piceo-testaceous, paler beneath; legs pale brownish-flavate; pubescence extremely fine and sparse; integuments polished. *Head* not one-half wider than long, feebly convex, scarcely perceptibly reticulate, excessively minutely, feebly and not distinctly punctate; epistomal suture almost completely obsolete. *Prothorax* at apex about equal in width to the head, broadly, feebly, arcuately sinuate, fully one-half wider than long; at base broadly truncate, very feebly sinuate on each side of the scutellum, nearly two and one-half times as wide as long; sides evenly and distinctly arcuate; disk broadly convex, polished, scarcely perceptibly reticulate, excessively minutely, feebly punctate; punctures somewhat irregularly disposed, very sparse. Scutellum very small, more than twice as wide as long, triangular. *Elytra* at base scarcely as wide as the prothorax; sides strongly convergent, nearly straight to the apex, which conjointly is abruptly and transversely truncate, one-half as wide as the elytral base; outer angles rounded, inner very narrowly so; disk rather strongly, conically convex, smooth; coarsely, very finely reticulate, not perceptibly punctate; one-third longer than wide, two and one-half times as long as the prothorax. Seventh segment broad, broadly rounded behind; eighth having two equal apical setæ. Posterior femora very strongly compressed. Length 1.0 mm.

Texas; (Austin 1).

The labrum is more continuous in curvature with the epistoma, and is consequently more prominent from above than in the other species; it appears from above to be transversely subtruncate or very broadly rounded, but when viewed in prolongation of the axis of the insect it is seen to have the lower edge rather abruptly deflexed, and broadly, rather feebly sinuate.

The general outline of this species is very different from that prevailing in the genus, but it appears to possess all the generic characters of *Limnocharis*. It is decidedly the smallest species described.

SILPHA Linn.

S. ænescens n. sp.—Form rather depressed, elongate, oval, black; upper surface with a bright æneous lustre; legs and antennæ black throughout; shining; pubescence in the form of an excessively minute and almost invis-

ible short seta from each puncture. *Head* rather small, constricted behind the eyes; front feebly convex, finely and rather densely punctate, more closely so near the eyes, and much more sparsely and finely so near the apex and on the labrum; the latter very deeply and rather narrowly sinuate at apex; eyes moderate, slightly prominent, much shorter than wide, vertically oval; antennæ slender, as long as the pronotum, first joint as long as the next two together, second much longer than the third, last four joints forming a rather narrow, elongate, perfoliate club, the last three joints of which are rendered opaque by an excessively fine and dense pubescence, eleventh slightly longer than wide, flattened, evenly and broadly rounded at tip. *Prothorax* widest at the base, where it is generally slightly more than one-half wider than long; sides strongly convergent thence to the apex, broadly, evenly and distinctly arcuate; apex broadly and feebly incurvate, one-half as wide as the base; the latter broadly truncate in the middle and thence slightly oblique and very feebly sinuate to the basal angles; the latter slightly obtuse, narrowly rounded; disk broadly and rather feebly convex, more strongly so in the middle anteriorly, narrowly and absolutely impressed along the middle, and more broadly and obliquely near each basal angle; sides narrowly and gradually subexplanate, narrowly margined with an elevated border; surface finely and very densely punctate; punctures round, deep, sometimes with a few smaller ones intermingled. *Scutellum* very densely punctate; pubescence longer and more dense. *Elytra* at base about as wide as the prothorax; sides parallel and nearly straight, rather abruptly and broadly rounded behind, slightly truncate in the males; disk one-third longer than wide, more than twice as long as the prothorax, transversely and moderately convex, narrowly and abruptly reflexed at the sides; each with three longitudinal, feebly-elevated costæ, with numerous intermediate and subtransverse elevations; depressed areas rather coarsely and not very densely punctate, interspaces finely and strongly granulose. *Legs* moderate in length, slender; first joint of the posterior tarsi fully as long as the fifth, and as long as the next three together. Length 11.0-13.0 mm.

California; (San Francisco).

The sexual characters are as follows:—

Male—Last ventral segment transversely truncate at apex, edge almost perfectly straight; anterior tarsi very feebly dilated, middle not at all dilated, very slender.

Female—Last ventral segment narrowly and strongly rounded behind, immediate apex narrowly truncate or subsinuate; tarsi all narrow and slender.

This species resembles *ramosa* Say, but differs in its

æneous lustre, much coarser elytral sculpture, and in the sexual characters; both the anterior and middle tarsi of the male in *ramosa* are strongly dilated. All the many specimens which I have seen are æneous above, and this appears to be a very persistent character. The form is mentioned by Mannerheim (Bull. Mosc. 1843, No. 2, p. 252) as *Silpha cervaria*, Var. b. It is also mentioned by Dr. Horn (Tr. Am. Ent. Soc. VIII, p. 241) as one of the variations of *S. ramosa* Say.

S. cervaria Mann.—This is apparently a valid species, being represented in my cabinet by two specimens of unmistakably more broadly oval outline than *ramosa*; the dorsal surface also exhibits very decided differences in sculpture.

BATRISUS Aubé.

Although this large and important genus is in a state of comparative confusion, it is believed that the description of the following forms is warrantable, since no species have yet been described from California, and the possibility of increasing our synonymy is, therefore, very slight. It is true that *B. albionicus* Aubé has been ascribed to California, but as the locality is not mentioned by Aubé in either of his descriptions, this would appear to be more or less doubtful; at any rate it is easily distinguishable from any of the species here described.

The following species all belong to the group having trisulcate and bituberculate pronotum, although in one or two forms the median channel becomes almost or quite obsolete; they also agree throughout in having a terminal process at the apex of the posterior tibiæ, and in the similarity of the sexual characters. The latter are well marked, and are as follows:—

Male.—Abdomen more or less deeply impressed near the apex; terminal process of posterior tibiæ short and nearly straight; intermediate trochanters

dentate or prominent externally at apex; tenth antennal joint finely tuberculate, eleventh with a short, erect arcuate process at base, both projecting internally.

Female.—Abdomen, trochanters and antennæ normal; terminal process of posterior tibiæ long, slender and contorted. Body smaller, more slender.

The funicle of the antennæ is remarkably constant in structure throughout the series, but the last four joints differ in shape and relative size.

In this group the head is not materially modified in the male, so that it differs greatly from a large and important group of eastern species. From a direct comparison with *B. formicarius* Aubé, the type of *Batrissus*, it is probable that these species should be separated as a subgenus; this has apparently been already done by Reitter under the name *Batrisodes*.

The type of the European *Batrissus* is found, as its name implies, with ants; the Californian species are never found in such localities, but are to be met with only in wet moss or under stones near water-courses; although widely diffused, they are scarcely ever abundant, and are generally extremely rare.

B. mendocino n. sp.—Moderately robust, convex, dark brownish-rufous; legs same; abdomen and antennæ darker, castaneous, the latter pale toward apex; integuments polished; pubescence coarse, rather long, suberect, rather sparse. *Head* moderate, scarcely as wide as long; eyes rather small, very convex, prominent, at more than their own length from the base; sides behind them strongly convergent and arcuate to the neck, which is slightly less than one-half as wide as the width at the eyes, very feebly sinuate; surface impunctate, slightly convex; on a line through the posterior limits of the eyes there are two distinct, deeply impressed foveæ, apparently nude, connected by a deeply impressed, strongly and evenly arcuate channel; antennal tuberculations broad and prominent; antennæ rather slender, distinctly longer than the head and prothorax together, club slender; basal joint rather robust, scarcely longer than wide, apex deeply notched posteriorly for the reception of the second joint when flexed; joints two to five equal, slightly longer than wide, sixth and seventh equal, slightly smaller, longer than wide, eighth as wide as the seventh, rounded, as wide as long, eighth to eleventh gradually wider, ninth and tenth equal in length, the latter much more strongly transverse, eleventh elongate, conoidal, pointed. *Prothorax* widest at two-fifths the length from the apex, where it is as wide as the head, slightly wider than

long; sides strongly rounded, thence convergent and deeply sinuate to the base which is broadly arcuate, nearly three-fourths as wide as the disk and one-third wider than the apex; the latter transversely truncate; basal angles slightly obtuse, not rounded; disk very feebly and sparsely punctate, broadly, strongly convex, having in the middle near the base a very deep, nude fovea, continued anteriorly to within two-fifths the length of the apex by a narrow, not deeply impressed channel; on each side and slightly in advance of the fovea, a rather large, obtusely pointed tubercle; also near each basal angle a large, deep, irregular, nude fovea; continued anteriorly by a very broadly and feebly impressed arcuate channel, and connected with the median fovea by a narrow, extremely feeble, transverse line. *Elytra* at base equal in width to the base of the pronotum, at apex two and one-third times as wide; sides evenly, rather strongly arcuate; together trans-versely truncate behind, nearly as long as wide; disk evenly, moderately convex, very minutely, sparsely, feebly punctate; sutural striæ approximate, distinct; discal very broadly impressed, becoming extinct at one-third the length from the base. *Abdomen* as wide as and slightly longer than the elytra, convex, very minutely, sparsely punctate. *Legs* long, slender; femora rather abruptly swollen before the tip. Length 2.1 mm.

California; (Anderson Val., Mendocino Co. 1.)

The male, has near the apex of the abdomen beneath, a large, very deeply-impressed fovea, wider than long, with the anterior edge broadly and roundly sinuate in the middle. There are two small, deeply-impressed foveæ near the basal margin of the pronotum on each side, the outer being at the basal angles as seen from above.

B. zephyrinus n. sp.—Moderately robust, very convex, rufous; elytra brighter; abdomen slightly darker; legs and antennæ darker, rufous; the latter pale at apex; integuments highly polished; pubescence coarse, sparse. *Head* about as wide as long; eyes rather small, prominent; sides behind them strongly convergent and very feebly arcuate to the neck; the latter broadly sinuate, much less than one-half as wide as the width at the eyes; on a line through the middle of the eyes two small, nude, very deeply, longitudinally impressed foveæ, connected by a strongly arcuate groove, the sides of which are parallel in the basal half of its length; antennal tuberculations prominent, coarsely punctate; antennæ long, slender, much longer than the head and prothorax together; basal joint moderately robust, subcylindrical, longer than wide, eleventh joint robust, conoidal, very obliquely pointed. *Prothorax* widest at two-fifths the length from the apex where it is fully as long as wide, as wide as the head; sides strongly arcuate, thence convergent and distinctly sinuate to the base; the latter broadly arcuate, three-fourths as wide as the disk, one-fourth wider than the apex; the latter transversely truncate; disk strongly convex, finely, sparsely, feebly punctate; near the

base a very deep, rounded, nude median fovea, continued anteriorly by a narrow, feebly impressed groove to within one-third the length of the apex; slightly in advance of the fovea, nearly midway between it and each side, a rather acute tubercle; between the latter and the edge a moderate, irregular, deeply impressed fovea, connected with the median by a feebly impressed, anteriorly arcuate line, and each continued anteriorly by an outwardly arcuate, distinct, impressed channel; also at the base near each basal angle, two small, deeply impressed foveæ. *Elytra* very minutely, sparsely punctate, convex; discal stria in the form of a broad impression, becoming extinct at one-third the length from the base; humeri longitudinally slightly prominent; each elytron with three foveæ at base. Abdomen very finely, sparsely punctate; basal segment with two short, approximate, parallel carinæ at base. *Legs* long, slender. Length 2.2 mm.

Nevada; (Reno, Washoe Co., 1).

This species is closely allied to *mendocino*, and agrees with it in the form of the elytra, abdomen and legs, and nearly so in the antennæ; it, however, differs in the form of the head and prothorax, the lateral channels of the latter being more broadly arcuate in the present species. The basal segment of the abdomen in *mendocino* has two very short rudimentary carinæ not one-half as long as in *zephyrinus*, and the sexual characters differ; in the present species the abdomen has on the under surface, near the apex, a large deeply impressed fovea, as wide as long, which is emarginate anteriorly, the notch being in the form of a very broad cusp.

B. speculum n. sp. — Rather slender, convex, very dark rufo-piceous; legs and antennæ paler, dark rufous, the latter paler at apex; abdomen piceous-black; integuments highly polished; pubescence rather coarse, suberect, sparse. *Head* slightly longer than wide; eyes small; sides strongly convergent, distinctly arcuate to the neck; the latter much less than one-half as wide as the width at the eyes; surface feebly convex, impunctate; antennal tuberculations not punctate; antennæ long, slender, longer than the head and prothorax together; eighth joint slightly longer than wide, ninth and tenth equal in length, rounded, the former nearly as long as wide, the latter very slightly wider than long, eleventh wider than the tenth, no. as long as the three preceding together, conoidal at base, very obliquely pointed. *Prothorax* widest at slightly more than one-third the length from the apex, where it is as wide as the head, very slightly longer than wide; sides feebly sinuate posteriorly to the base, which is three-fourths as wide

as the disk and one-fourth wider than the apex; disk strongly convex, scarcely punctate; basal fovea large, deeply impressed, rounded; median channel very feeble, evanescent near the fovea, extending scarcely beyond the middle of the disk; lateral foveæ moderate in size, not very deeply impressed, extended anteriorly in the usual arcuate groove, and connected with the median by a fine line; immediately behind the middle of the latter, acutely, feebly elevated or subtuberculate; between the median fovea and base a fine elevated carina; on each side, at the base, two small, deeply impressed foveæ. *Elytra* and abdomen nearly as in the preceding species; the former finely and sparsely punctate, the first visible dorsal segment of the latter with two small, short basal carinæ. *Legs* slender. Length 1.9 mm.

California; (Alameda Co. 1).

This species agrees in general structure of the head and prothorax with the preceding species, but may be distinguished from both by its much darker color and structure of the antennal club; from *mendocino* it differs in its much more elongate prothorax and longer basal carinæ of the first abdominal segment; from *zephyrinus* in its shorter basal abdominal carinæ and smaller size, and from both in the much more feeble median channel of the pronotum. The basal carina of the pronotum is common to all these species.

The above description is taken, unfortunately, from the female, but the species is so distinct that there can be very little doubt of its future identification, its small size, slender form, dark color, narrow ninth and tenth antennal joints and especially the very feeble median channel being its distinctive characters.

B. monticola n. sp.—Rather robust, convex, intense black throughout; legs very dark rufo-piceous; antennæ fuscous, very slightly paler, rufous at apex; integuments polished; pubescence coarse, pale, suberect, not very dense. *Head* moderate, scarcely as wide as long; eyes moderate in size, very convex, rather finely granulate, just behind the middle; sides behind them very strongly convergent and feebly arcuate to the neck; surface feebly convex, impunctate; occipital foveæ longitudinally elongate, deeply impressed, on a line through the posterior portion of the eyes, connected by a very strongly arcuate impressed groove; antennal tuberculations large, very coarsely and feebly punctate; antennæ robust, scarcely longer than the head and prothorax together, club rather robust; ninth joint slightly wider than

long, tenth scarcely as long as the ninth, strongly transverse, obliquely truncate throughout its width at apex, eleventh as long as the three preceding together, very slightly wider than the tenth, ovoidal at base, much more convex exteriorly than within, obliquely attenuate and obtusely pointed. *Prothorax* widest at two-fifths its length from the apex, where it is fully as long as wide, as wide as the head; sides very strongly rounded, thence convergent and rather strongly incurvate to the base which is transversely, very feebly arcuate, but slightly more than two-thirds as wide as the disk, one-third wider than the apex; disk strongly convex, very finely, feebly and sparsely punctate; median fovea rather large, rounded, very deep; lateral smaller, continued anteriorly by parallel, arcuate, broadly impressed grooves, connected with the median by anteriorly arcuate and scarcely visible grooves just before the basal tuberculations, which are but slightly elevated, more abrupt anteriorly than posteriorly; lateral basal foveæ rather distant from the basal margin; median carina strong. *Elytra* at base very slightly wider than the base of the pronotum, nearly as long as wide, strongly, evenly convex; very minutely, feebly and sparsely punctate; sutural striæ fine, deeply impressed; discal broadly impressed, short, feeble. Abdomen shorter and very slightly narrower than the elytra, convex, extremely minutely, sparsely punctate; first segment with two short, approximate, parallel carinæ at base. *Legs* long, somewhat robust; posterior tibiæ distinctly bent; tarsi much paler in color. Length 2.2 mm.

California; (El Dorado Co., 1).

The male has at the apex of the venter, a large, very abrupt, deeply impressed fovea, slightly wider than deep, the anterior edge of which is almost entire and transversely truncate.

This species can easily be distinguished from any other here noted by its intense blackness, shorter antennæ, absence of median pronotal groove, and form of the sexual fovea.

The species thus far described have two basal carinæ on the first visible dorsal segment of the abdomen; the following has no basal carinæ, and the elytra are much shorter.

B. occidentus n. sp. — Rather slender, strongly convex; body very uniform in color throughout, dark brownish-rufous; legs slightly paler, rufous; antennæ fuscous, very slightly paler at tip; integuments very highly polished; pubescence coarse, pale, very sparse. *Head* moderate, as wide as long; eyes small, prominent; sides behind them very strongly convergent, strongly arcuate to the neck, which is transversely truncate, two-fifths as wide as the

width at the eyes; surface broadly convex, impunctate; occipital foveæ rather large, very deep, but slightly elongate, joined by the usual strongly arcuate, impressed groove; antennal tuberculations rather prominent, with a few small, widely scattered punctures; antennæ slender, slightly longer than the head and prothorax together, club rather strong, rapidly increasing in width from the ninth joint which is slightly wider than long, tenth strongly transverse, much wider than the ninth, slightly obliquely truncate at the apex, eleventh twice as wide as the ninth, truncate at base, ovoidal, obliquely acuminate, rather acutely pointed, as long as the three preceding together. *Prothorax* nearly as in *monticola*; sides less acutely rounded before the middle, slightly less strongly narrowed toward base; apex slightly broader; basal tubercles more symmetrically pointed and more prominent; median groove narrow, rather deeply impressed, continuing from the basal fovea nearly to the apical margin. *Elytra* at base as wide as the base of the pronotum, at apex more than twice as wide; sides evenly, very strongly arcuate; disk strongly convex, distinctly wider than long, rather coarsely, very sparsely and feebly punctate; sutural striæ deeply impressed, nearly straight; discal very short, very broadly and roundly impressed, gradually evanescent at a little more than one-third the length from the base. *Abdomen* as wide as and much longer than the elytra, convex; first visible segment with three large equidistant, densely-pubescent foveæ along the basal margin; carinæ completely obsolete. *Legs* rather long, very slender; femora rather abruptly, strongly swollen beyond the middle; posterior tibiæ scarcely perceptibly bent. Length 1.9-2.1 mm.

California; (Humboldt Co. 4).

Described from the male, in which the apical fovea is large, slightly wider than long and rather feebly impressed; the anterior edge is truncate and very broadly, feebly sinuate toward the middle. In the female the elytra are slightly shorter.

Easily recognizable by the very long, well marked, median pronotal sulcation, by the short elytra, and absence of basal carinæ.

BRYAXIS.

This genus, in the broad sense indicated by LeConte, (Tr. Am. Ent. Soc. VIII. p. 181), contains a rather heterogeneous assemblage of species, although the various groups are clearly indicated. It will be noticed that there are two classes of foveæ upon which the subdivisions are based—

those of the head and pronotum respectively, the former being made to serve in subdividing the genus *Reichenbachia*. It will be well to consider these sets of foveæ in order.

During a recent collecting tour in Texas, I secured a large series of a uniformly flavo-ferruginous species of *Reichenbachia*, belonging to the group in which the male and female antennæ are different in structure. These specimens were all taken in a very limited area, and are without the least doubt of a single species. The males have the fifth and sixth joints of the antennæ elongate and swollen; upon the occipital portion of the head there are two small, widely distant, spongiöse foveæ, but the apical fovea is completely wanting. The females also have the same joints of the antennæ elongate and slightly dilated; the head has the occipital foveæ exactly similar in size and position to those of the male, and in addition a third apical fovea, similar to the others and equally pronounced. The male above noted was described by Dr. LeConte as *tumida*; whether the female has been described as a trifoveate species is a question requiring further investigation.

It is seen, therefore, that the presence or absence of the apical fovea may sometimes be a sexual character, at least in a certain class of species of which one is *R. tumida*, and it is consequently of very little moment in a generic classification, although the occipital foveæ appear to hold a very different position, and are evidently of more distinct value.

The pronotal foveæ are very important from a generic point of view, since they indicate great and radical differences, which extend throughout the body, and are evinced by peculiar manifestations of sexual identity. For instance, restricting ourselves for the present simply to the American fauna,—those species having three small, equal, punctiform foveæ, are the only ones which are subject to a very decided sexual modification of the antennal club. Those having three large, subequal, spongiöse foveæ are,

amongst those having occipital foveæ, the only ones exhibiting sexual modification of the dorsal surface of the abdomen; while those which have two large spongiose lateral foveæ and a minute nude median puncture are the only ones which possess a sexual modification of the middle joints of the antennæ, although there are many species which have the antennæ similar, as there are several in the preceding section which have the abdomen similar, in the two sexes.

Again, those having three nude pronotal foveæ which are unequal, are distinguished by a complete absence of occipital foveæ, and, considering the sexual modifications apparent in other portions of the group accompanying such decided differences in the foveæ, we might be led to expect a peculiarity here also.

From Galveston, Texas, I have before me two species of this section. One of these is represented by seven males and three females, the other by three males only, the latter having an almost impunctate head and longer elytral striæ; these have the first segment elongate, and the middle portion of the dorsal surface behind its apex exhibits sexual modifications consisting of excavations and minute tuberculations of the greatest complexity. The males of the first species have shorter elytral striæ, a more punctate head, and also exhibit sexual characteristics affecting the dorsal surface of the abdomen, although of an entirely different kind. The first two segments are perfectly normal, the first slightly elongate, but the third is very broadly and feebly impressed, the impression having in the middle a tuft of long erect sparsely-placed setæ. The sexual characters, therefore, affect the same part of the body as in *Bryaxis*, but instead of being limited mainly to the first segment, it is the portion posterior to this which is principally modified. These species are, however, well distinguished from *Bryaxis* by the presence of lateral carinæ on the lower surface of the head.

In at least certain groups of Coleoptera, sexual characters should be considered generic when they are evinced by such radically different modifications, for these imply decided differences in the methods of exercising the functions pertaining to reproduction, the most important act in the lives of these organisms, and are the outward signs of innate differences much greater than those made apparent by mere external form. From a biological standpoint they are the most important characters which can be assumed, and in the present instance have an unquestionable value.

I have, therefore, drawn up the following scheme of genera, the differences being indicated by characters which are non-sexual, and which readily serve for identification irrespective of the more important differences which have been indicated above.

- Head having two occipital foveæ, not carinate laterally beneath.
- Pronotal foveæ joined by an impressed line.....**Rybaxis.**
- Pronotal foveæ three in number, generally not connected.
- Foveæ subequal, large, all spongiose.....**Bryaxis.**
- Foveæ equal, smaller, punctiform.....**Nisa.**
- Foveæ unequal and dissimilar.
- Lateral large, spongiose; median small, nude...**Reichenbachia.**
- Head having no occipital foveæ, finely and strongly carinate beneath laterally.
- Pronotum having small, feebly-impressed, lateral foveæ and a very minute, more abrupt median puncture, all nude.....**Nisaxis.**
- Pronotum devoid of foveæ; elytral striæ obsolete¹..... _____²

RYBAXIS Sauley.—In our fauna this genus contains the three species *sanjuinea* Leach, *conjuncta* Lec. and *Brendelii* Horn.

NISA n. gen.—There being no specimen of this genus before me at the present time, I cannot state positively whether the head is laterally carinate or not, it is, how-

¹ LeConte—Tr. Am. Ent. Soc. VIII, p. 183.

² The characters given for *inornatu* Brend. indicate a very peculiar species which warrants closer study than has yet been given it. As the occipital foveæ are wanting, it may be attached for the present to *Nisaxis*, but it probably possesses differential characters of generic value.

ever, attached to that group to which it is probably most closely allied. *Nisa* includes but two species, *luniger* Lec. and *cavicornis* Brend.

REICHENBACHIA Leach.—By direct comparison with European representatives there is no apparent difference in the American forms.

NISAXIS n. gen.—Here the species are decidedly more minute than in any of the other genera of this group, and are probably more abundant than hitherto supposed. It is very distinct in its cephalic characters, as well as those of the pronotum and sexual modifications. The discal striæ of the elytra are usually shorter than in the other genera, and the basal carinæ of the first dorsal segment short and widely distant. At present it can include only *tomentosa* Aubé.³

BRYAXIS Leach.

The more salient characters separating *Bryaxis* from the other genera here noted, besides the sexual modifications already mentioned, are the comparatively large size, more distinct abdominal border, the pronotal foveæ and the very large eyes situated almost at the extreme base of the head.

B. texana n. sp.—Form rather slender, pale rufo-testaceous throughout; legs concolorous; antennæ and abdomen very slightly darker; integuments polished; pubescence very short, suberect, not dense. *Head* rather small; eyes very large, prominent, situated very close to the basal angles, more convex posteriorly; base broadly truncate; surface feebly convex, impunctate, occipital foveæ situated on a line through the anterior portion of the eyes, moderate, rather deeply impressed, mutually more than three times as distant as either from the eye; apical fovea very slightly smaller, more broadly impressed at the sides; apical angles very slightly rounded; antennæ rather slender, distinctly longer than the head and prothorax together, club rather

³The species described by me (Cont. I, p. 33) as *inopia*, has been considered a synonym of this species in the recently published Check List of North American Coleoptera. As *inopia* has two well-developed occipital foveæ, it cannot be placed in the neighborhood of *tomentosa*. If the compilers of the catalogue are determined to regard it as a synonym, some more appropriate species should be selected with which to combine it; it belongs near *rubicunda*, although somewhat resembling *tomentosa*.

prominent; joints three to eight equal in width, nine to eleven increasing uniformly and rather rapidly in width. *Prothorax* widest in the middle, where it is scarcely wider than the head, distinctly wider than long; sides very narrowly rounded, convergent and more broadly rounded anteriorly, moderately convergent and rather deeply sinuate toward base; the latter broadly, feebly arcuate, five-sixths as wide as the disk, one-half wider than the apex; the latter transversely truncate; disk strongly convex, not perceptibly punctate, broadly impressed before the base toward the sides, transversely subgranulose along the base; lateral foveæ rather large, deeply impressed, at one-third the length from the base; median about equal in size, less deeply impressed. *Elytra* at base distinctly wider than the prothorax, at apex twice as wide as the latter; sides evenly and moderately arcuate; disk distinctly wider than long, broadly and not strongly convex, more abruptly declivous along the sides; humeri rather prominent; surface excessively feebly and obsoletely punctate; sutural striæ fine, deeply impressed, nearly parallel; discal very fine and feeble, slightly arcuate, gradually evanescent at slightly less than one-third the length from the apex. Abdomen polished, impunctate; border strong; carinæ of first segment very short, divergent, distant by fully two-fifths the total width. *Legs* rather long and slender; posterior tibiæ feebly clavate, very slightly bent, very feebly and obsoletely grooved exteriorly at apex. Length 1.3 mm.

Texas; (El Paso 1).

The sole representative is a male, exhibiting the usual very marked abdominal characters. The first segment is very long, four-fifths as long as the elytra, and is almost the only portion of the abdomen seen when viewed vertically; its apex is rather abruptly deflexed, transversely impressed in the middle; the edge with a small, rounded, very distinct, median sinuation; remaining segments almost vertical, very short, almost equal; second broadly and extremely feebly sinuate in the middle; surface anteriorly with a transversely arcuate, impressed channel which is partially hidden under the first segment, and which corresponds in outline with the sinuation of the first; remaining segments not sensibly modified. The apical margins of the first and second segments are abruptly thinner.

This species probably belongs to the *Belfragei* type, but the description of that species will not apply to this.

B. infinita n. sp.—Form slightly robust, dark rufo-castaneous; head blackish; elytra rufous, darker at base and apex; antennæ and legs concolorous,

dark fuscous; integuments polished; pubescence rather coarse, very short and rather dense. *Head* moderate, much wider than long; eyes very large, prominent; base broadly truncate; surface feebly convex, scarcely perceptibly punctate; occipital foveæ rather large, feebly impressed, on a line through the anterior margins of the eyes, mutually two and one-half times as distant as either from the eye; apical equal in size, feebly impressed; surface between the antennæ gradually declivous; antennæ somewhat robust, distinctly longer than the head and prothorax together, club rather prominent; basal joint feebly dilated, slightly longer than wide, second slightly smaller, longer than wide, subcylindrical, third slightly shorter, slightly obconical, distinctly longer than wide, tenth as long as wide, much wider than the ninth, eleventh distinctly wider than the tenth, slightly elongate, obliquely acuminate. *Prothorax* widest at two-fifths the length from the apex, where it is scarcely wider than the head, nearly one-third wider than long; sides rather strongly rounded, rather strongly convergent and feebly sinuate to the base; the latter broadly, feebly arcuate, three-fourths as wide as the disk, one-half wider than the apex; the latter transversely truncate; disk strongly convex, scarcely punctate; lateral and medial foveæ equal, moderate, the former more broadly impressed. *Elytra* at base distinctly wider than the prothorax, at apex slightly less than twice as wide as the latter; sides evenly, not very strongly arcuate; disk slightly wider than long, evenly, rather feebly convex, extremely minutely punctate; sutural striæ very distinct and deeply impressed, rather approximate, nearly parallel; discal deeply impressed and distinct, becoming slightly recurved posteriorly, and terminating abruptly at one-fifth the length from the apex. *Abdomen* fully as wide as the elytra; border wide and prominent; surface scarcely punctate, moderately convex; basal carinæ distant by slightly more than one-third the total width, distinct, less than one-third as long as the segment, almost parallel. *Legs* rather long and slender. Length 1.5 mm.

Texas; (Austin 14).

This species is remarkable amongst the American representatives of the genus, in the complete absence of male sexual modifications of the dorsal segments of the abdomen. The male described above is very slightly more robust than the female, and has the antennæ slightly longer and with a more prominent club, the tenth joint especially being shorter and more transverse in the female. The type specimen has the cedeagus protruded. The lateral members are seen to be two thin, elongate laminae, obliquely acuminate at apex and having at the middle of the external edge a small tuft of dilated membranous hair.

REICHENBACHIA Leach.

The species are numerous, as a rule smaller than in the preceding genus, and especially distinguished by the rather finer abdominal border and the dorsal surface similar in both sexes. The species here described may be assigned as follows:—

Head ♂ and ♀ with three foveæ.

Antennæ dissimilar in the two sexes.

tumorosa, *tumidicornis* and *informis*.

Antennæ similar in the sexes *gracilicornis* and *nevadensis*.

Head ♂ and ♀ bifoveate.

Antennæ dissimilar in the sexes *fundata* and *franciscana*.

The special relationships will be indicated under each description.⁴

R. tumorosa n. sp.—Rather robust; color rather dark rufo-castaneous; antennæ concolorous in the middle, paler at base and toward the apex; elytra and legs paler, much more flavate. the former not darker at apex; pubescence fine, short, not at all dense. *Head* rather small; eyes moderate, prominent, very coarsely granulate, at nearly their own length from the base; front transversely and rather strongly convex, almost completely impunctate, highly polished, having on a line through the middle of the eyes, two small, deeply impressed foveæ, mutually three and one-half times as distant as either from the eye; with a large, deep impression between the antennæ at the bottom of which there is a very minute, spongy-pubescent fovea; apex strongly declivous, angularly and slightly produced in the middle; antennæ rather short, robust, as long as the head and prothorax together; first joint moderate, second smaller, subglobular, third wider, short, strongly transverse, triangular, closely adjacent to the fourth, which is very large, strongly transverse; joints five to eight, transverse, very rapidly and uniformly diminishing in width, sixth shorter than the seventh, eighth normal, eight to eleven evenly, very gradually increasing in width. *Prothorax* moderate in

⁴The long, erect, stout setæ, growing upon the lower surface of the head are sometimes bulbous at the extremity, the enlargement being apparently formed of a viscid substance which may perhaps be a secretion. If, however, this is the case, the setæ are in all probability hollow tubes. It may be this secretive matter which is so pleasing to ants, with which so many species of Pselaphidæ are associated. The same appearance of the setæ has been before referred to in a short paper on our Euplectini (Cont. II, p. 94), although at that time I had not remarked the viscid nature of the material forming the enlargement.

size, widest at two-fifths its length from the apex, where it is slightly wider than the head and distinctly wider than long; sides strongly, evenly rounded, moderately convergent and feebly sinuate toward base; the latter broadly, very feebly arcuate, one-half wider than the apex, which is transversely truncate, and four-fifths as wide as the pronotal disk; basal angles obtuse and very slightly prominent, not at all rounded; disk strongly, evenly convex, polished, almost impunctate, lateral foveæ rather small, not very deeply impressed; median puncture very small; base finely margined, surface immediately before it feebly impressed, the impression obsolete in the middle. *Elytra* at base distinctly wider than the prothorax, at apex fully twice as wide as the latter; sides evenly, rather strongly arcuate; together broadly truncate behind; disk evenly, rather strongly convex, much wider than long, two-thirds longer than the pronotum, finely, very feebly and obsoletely, evenly and rather sparsely punctate; sutural striæ strong; discal strong, feebly arcuate, abruptly terminating at one-fifth the length from the apex. *Abdomen* impunctate, highly polished, rather convex; first segment longer than the next two together, with two fine, very distinct carinæ, which are distant by two-fifths the entire width, nearly one-half as long as the segment, and nearly parallel; at each side, near the border, and partially under the elytra, there is a large spongiöse fovea; between this and the border a fine attenuated carina, two-thirds as long as the segment. *Legs* long and slender. Length 1.4 mm.

California; (Sonoma Co. 4).

The description is taken from the male; the female antennæ are normal, robust and scarcely as long as those of the male. In the latter the terminal segment of the dorsal surface is very broadly emarginate at apex, the emargination being evenly rounded and nearly ten times as wide as deep; the ventral segments are not at all impressed.

This species belongs near *saxæ* Lec., but differs greatly in the structure of the male antennæ as recorded in the original description of that species.

R. tumidicornis n. sp.—Form rather slender, piceous; antennæ slightly paler at apex; elytra bright rufous, base and apex clouded with a darker tint, legs dark rufous; pubescence rather coarse, very short, not dense; integuments polished. *Head* moderate in size; eyes rather small, very convex, coarsely granulated and prominent, at fully their own length from the base; sides behind them feebly convergent, distinctly arcuate; base broadly truncate; angles narrowly rounded, not prominent; surface broadly, feebly convex, excessively minutely, sparsely punctate; on a line through the middle of the eyes there are two large, deeply impressed foveæ, mutually three times as distant as either from the eye; also near the apex a slightly smaller fovea, with the

sides more broadly impressed; apex broadly angulate; antennæ as long as the head and prothorax together; basal joint rather small, longer than wide; second slightly smaller, cylindrical, slightly longer than wide; third small, scarcely as long as wide, obconical; fourth as wide as the second, very strongly transverse; fifth strongly inflated, transversely oval, more than twice as wide as long; sixth slightly more strongly dilated; longer, transversely ovoidal, slightly more acute inwardly; seventh widest, shorter than the preceding, apex truncate, very strongly transverse, more acute inwardly, more than three times as wide as long; eighth slightly longer than the seventh, one-half wider than long, obliquely truncate inwardly; ninth very small, slightly wider than long; tenth slightly wider than long, distinctly wider than the ninth; eleventh rather slender, pointed, as long as the three preceding together, distinctly wider than the tenth. *Prothoracæ* widest very slightly in advance of the middle, where it is slightly wider than long, very slightly wider than the head; sides strongly arcuate, feebly sinuate before the basal angles; disk strongly convex, very minutely punctate; lateral foveæ very large, rather deep; surface near the base slightly impressed and coarsely punctate toward the sides; median puncture elongated longitudinally. *Elytra* at base much wider than the prothorax, at apex more than twice as wide as the latter; sides strongly and evenly arcuate; truncate behind; disk rather strongly and evenly convex, excessively minutely, rather sparsely punctate, one-fourth wider than long, two-thirds longer than the prothorax; sutural striæ strong, nearly straight; discal very fine, rather feeble, terminating at one-fifth the length from the apex. First ventral segment much shorter than the next two together; carinæ very fine, two-fifths as long as the segment, distinctly divergent, distant by one-third the total width; carinæ near the lateral border nearly as long as the entire segment; lateral basal foveæ distinct. *Legs* rather long, very slender; posterior tibiæ very slender, distinctly arcuate and clavate, scarcely at all flattened. Length 1.2 mm.

California; (Santa Cruz and Santa Clara Cos.)

Described from the male in which the terminal dorsal segment is narrowly and very feebly emarginate at apex, the emargination much narrower than in *tumorosa*, evenly rounded, about eight times as wide as deep; ventral segments not impressed. In the female the antennæ are slightly shorter than in the male, normal, club robust.

Very abundant throughout the region indicated. It belongs near *albionica* (Mots.), but differs according to the description given by Dr. LeConte in the structure of the male antennæ, and more especially in that of the posterior tibiæ which are not perceptibly flattened. The antennæ

of *albionica* are described as having the "fifth joint dilated, sixth larger than the following, rounded, 7—9, large, transverse." This description evidently cannot be applied to *tumidicornis*. One of the localities given by the above-mentioned authority is Colorado; this is probably a misprint for California, as there is very little likelihood of *albionica* occurring east of the Sierra Nevada Mts.

In the description of *albionica* given by Mannerheim (Bull. Mosc. 1852, p. 371), the only joints which are described as dilated are the fifth and sixth. In the present species the seventh is distinctly the widest. The posterior tibiæ are not described by Mannerheim as being flattened, but simply dilated, which is more nearly the case in *tumidicornis*. There have probably been several species confounded by the various authors, as these species do not appear to have a very wide distribution, but are more or less local.

Although so abundant about Santa Cruz, I have not yet found this species to the north of San Francisco, although I have collected over very extensive regions, giving special attention to the Staphylinidæ and Pselaphidæ. Its gait is rather more rapid than is usual in this genus.

R. informis n. sp.—Rather slender, dark rufo-castaneous; elytra bright rufous, slightly darker near the apex; antennæ and legs pale rufo-testaceous; integuments polished; pubescence very fine, short and sparse. *Head* moderate; eyes very convex, at scarcely their own length from the base; sides behind them feebly convergent and arcuate; base broadly truncate; angles distinctly rounded; surface feebly, evenly convex, excessively minutely, sparsely punctate; punctures slightly larger and closer toward the sides; having, on a line through the middle of the eyes, two moderate, not very deeply impressed foveæ, mutually three times as distant as either from the eye; near the apex a more broadly impressed fovea, with the pubescent portion equal to that of the occipital foveæ; apex declivous, broadly angulate; antennæ as long as the head and prothorax together, club robust; basal joints moderate, second slightly the smaller; third slender, much longer than wide; fourth small, slightly transverse; fifth slightly dilated, a little longer than wide; sixth as long as wide, as wide as the fifth, obliquely truncate at apex, joints seven to nine, very slightly wider than long, equal in width to the fifth; the eighth slightly smaller; nine to eleven very rapidly increasing in width. *Prothorax* widest very slightly before the middle, where it is very slightly

wider than the head and slightly wider than long; sides rather strongly, evenly rounded, moderately convergent to the base, very feebly sinuate near the basal angles, which are obtuse, not rounded; base broadly, feebly, but distinctly arcuate, one-half wider than the apex; the latter transversely truncate; disk strongly convex, excessively, minutely, sparsely punctate, coarsely so along the basal margin; lateral foveæ rather small, not very deeply impressed, at less than one-third the length from the base; median very small, longitudinally, slightly elongate. *Elytra* at base distinctly wider than the prothorax, at apex more than twice as wide as the latter; sides evenly, not very strongly arcuate; apex truncate, feebly sinuate laterally; disk very slightly wider than long, nearly three-fourths longer than the prothorax, evenly, moderately convex, excessively minutely, obsolete and sparsely punctate; sutural striæ deeply impressed, nearly straight; discal fine, distinct, slightly arcuate, terminating at one-tenth the length from the apex. *Abdomen* rather elongate, convex; first segment not as long as the next two together; basal carinæ distinctly divergent, separated by distinctly less than one-third the total width, one-half as long as the segment. *Legs* rather long and slender; hind tibiæ not strongly clavate. Length 1.4 mm.

California; (Mendocino Co., 2).

Described from the male: the terminal dorsal segment is more than four times as wide as long, very broadly, feebly emarginate at apex.

This species belongs near *propinqua* Lec., but is not very closely related to any other described species.

R. gracilicornis n. sp.—Rather robust, dark rufo-castaneous; elytra dark, obscure rufous; antennæ and legs paler, dark rufo-testaceous; integuments rather dull, head and elytra more polished; pubescence coarse, rather long, moderately dense, suberect, rather conspicuous. *Head* moderate or rather small, much longer than wide; eyes rather large, very convex, at much less than their own length from the base; sides behind them strongly concave to the base which is broadly subsinuate; surface feebly, evenly convex, not perceptibly punctate; having on a line through the middle of the eyes two rather large and feebly impressed foveæ, mutually more than three times as distant as either from the eye; apical fovea slightly smaller but more widely and deeply impressed; antennal emarginations rather approximate, angular; apex slightly produced, narrow, declivous, with the sides nearly straight and feebly divergent anteriorly; antennæ very slender, slightly longer than the head and pronotum together; first and second joints longer than wide, cylindrical, the second slightly smaller, three to six each cylindrical, slender, more than twice as long as wide, sixth slightly smaller, seven and eight scarcely more robust, the former twice as long as wide, the latter quadrate, ninth slightly more robust, a little longer than wide, tenth slightly wider than long, two-thirds wider than the ninth, slightly trapezoidal, elev-

enth one-half wider than the tenth, obliquely ovoidal, pointed. *Prothorax* widest at two-fifths the length from the apex, where it is much wider than the head and one-third wider than long; sides acutely rounded, slightly convergent and feebly arcuate to the base, before which they are nearly straight; base broadly, feebly arcuate, one-half wider than the apex and three-fourths as wide as the disk; apex broadly, very feebly emarginate; disk strongly convex, very minutely punctate; lateral foveæ large, feebly impressed, at two-fifths the length from the base; median small, well before the base. *Elytra* at base just visibly wider than the prothorax, at apex slightly less than twice as wide as the latter, broadly truncate, feebly trisinnate; sides evenly, not strongly arcuate; disk broadly convex, finely, not densely, very feebly punctate; sutural striæ deep, feebly arcuate; discal fine, distinct, not deeply impressed, terminating at one-tenth the length from the apex. Abdomen rather short, moderately convex; first segment distinctly longer than the next two together; carinæ fine, distinct, nearly one-half as long as the segment, feebly divergent, feebly directed outward at apex, distant by less than one-fourth the total width; carinæ adjoining the margin extremely fine, almost obsolete. *Legs* long and slender; posterior tibiæ feebly clavate, slightly bent inward toward the apex, where there is externally a short groove for the reception of the tarsi when reflexed. Length 1.3 mm.

Texas; (Austin 1).

Described from the male; the terminal dorsal segment has at the apex a small semicircularly rounded emargination, nearly twice as wide as deep, the angles being acute and slightly produced; last ventral segment very feebly impressed in the middle.

This species belongs to the *rubicunda* type of the genus and should be placed near that species, from which it differs in the smaller and deeper apical emargination of the male.

The external groove at the apex of the posterior tibiæ appears to be a generic character.

R. nevadensis n. sp.—Moderately slender, piceous; elytra rufous, slightly darker at apex; legs dark, brownish-piceous; antennæ slightly paler, rufous; integuments polished; pubescence short, coarse, evenly but not densely placed. *Head* moderate; eyes rather large, prominent, at scarcely more than one-half their own length from the base; sides behind them rather strongly convergent and strongly arcuate to the base, which is very broadly truncate; surface rather strongly convex, not perceptibly punctate behind; having on a line just in advance of the middle of the eyes two large, deeply impressed foveæ, which are mutually two and one-half times as distant as either from the eye; between the antennæ transversely impressed,

impression finely punctate, having at the bottom a smaller circular fovea; antennæ short and robust, not as long as the head and prothorax together, club robust, second joint subcylindrical, longer than wide, slightly narrower than the first, three to eight narrower, subequal in width, third, fifth and sixth slightly longer than wide, fourth and seventh subquadrate, eighth smallest, wider than long, eight to eleven increasing evenly and very rapidly in width, ninth and tenth strongly transverse, eleventh slightly longer than wide, obtusely and obliquely acuminate. *Prothorax* widest at one-third the length from the apex, where it is very slightly wider than the head and one-fifth wider than long; sides rather strongly, narrowly rounded, moderately convergent and nearly straight toward base, just before which they are very feebly sinuate; base three-fourths as wide as the disk, one-third wider than the apex; the latter transversely truncate; disk strongly convex, scarcely perceptibly, sparsely punctate; lateral foveæ moderate, at two-fifths the length from the base; median small, distinct, not at all elongate. *Elytra* at base distinctly wider than the prothorax, at apex distinctly more than twice as wide as the latter; sides evenly, rather strongly arcuate; disk moderately convex, scarcely perceptibly punctate; sutural striæ deeply impressed, nearly parallel; discal rather strongly arcuate and deeply impressed, terminating at one-fifth the length from the apex; together distinctly wider than long, two-thirds longer than the prothorax. *Abdomen* moderately convex; basal segment as long as the next two together; carinæ distant by two-fifths the entire width, very short, distinctly less than one-third as long as the segment, distinctly divergent, nearly straight. *Legs* slender, posterior tibiæ feebly clavate, strongly arcuate. Length 1.3 mm.

Nevada; (Reno, Washoe Co. 3).

The sexual characters appear to be very slight, but there is apparently very little doubt that it belongs in the *rubicunda* group of species. It may be readily distinguished by the transverse impression between the antennæ and the very short basal carinæ of the first dorsal segment; in the type these are scarcely more than one-sixth or one-eighth as long as the segment, but in another specimen which has shorter antennæ, and therefore probably the female, they are more than one-fourth as long as the segment. The posterior tibiæ are unusually strongly arcuate.

R. fundata n. sp.—Moderately robust, piceous-black; elytra rufous, clouded slightly darker at apex and base; antennæ dark brownish-piceous; legs dark brownish-piceous, femora more rufous; integuments polished; pubescence fine, very short, somewhat dense on the abdomen. *Head* moderate, wider than long; eyes moderate, at less than their own length from the base;

sides strongly rounded to the base, which is transversely truncate; surface broadly, feebly convex, scarcely perceptibly, sparsely and very obsoletely punctate; occipital foveæ on a line through the anterior portions of the eyes, moderate in size, not very deeply impressed, mutually three times as distant as either from the eye; apical foveæ entirely wanting; apex abruptly and very strongly declivous, having two small approximate ciliate tubercles; antennæ long and slender, one-half as long as the body, club slender; basal joint large, irregular, second much smaller, slightly more robust than the third, the latter distinctly longer than wide, fourth smaller, subquadrate, fifth to seventh slightly dilated, the sixth slightly the shortest, as wide as long, eighth narrow, joints eight to eleven very gradually, evenly increasing in width, all longer than wide. *Prothorax* widest at two-fifths the length from the apex, where it is as wide as the head, distinctly wider than long; sides evenly, strongly arcuate, moderately convergent and feebly sinuate to the base; the latter broadly, feebly arcuate, four-fifths as wide as the disk, nearly one-half wider than the apex; the latter transversely truncate; disk strongly convex, not visibly punctate except along the base; lateral foveæ rather small, not very deeply impressed, at one-third the length from the base; median rather large, somewhat longitudinally elongated. *Elytra* at base slightly wider than the prothorax, at apex twice as wide as the latter; sides evenly and rather strongly arcuate; disk evenly, rather strongly convex, sparsely and very obsoletely punctate; sutural striæ deep, nearly parallel; discal distinct, arcuate terminating at one-fifth the length from the apex. *Abdomen* moderately convex; first segment scarcely as long as the next two together; basal carinæ fine, slightly divergent, distant by slightly more than one-third the total width, very short, about one-fourth as long as the segment. *Legs* slender; posterior tibiæ very feebly clavate, slightly bent; tarsi rather long. Length 1.2 mm.

California; (Sonoma Co. 3).

Described from the male, the terminal dorsal segment being rather broadly emarginate, the emargination evenly rounded and feeble, about eight or nine times as wide as deep. The female is quite similar to the male, but has the antennæ normal in structure and slightly shorter; the vertex also lacks the two ciliate tubercles, and the median puncture of the pronotum appears to be less elongate.

Belongs near *compar* Lec., but is abundantly distinguished from that species by the structure of the antennæ and the darker colors.

R. franciscana n. sp.—Form rather slender, black; antennæ brownish-piceous; elytra dark rufous; legs dark piceous-brown; under surface black;

integuments polished; pubescence fine, short, subrecumbent, rather dense. *Head* moderate, slightly wider than long; eyes moderate, at less than their own length from the base; sides strongly rounded to the base, which is very broadly truncate or just visibly sinuate; surface feebly convex, finely, evenly and distinctly punctate; occipital foveæ rather small, feebly impressed, on a line through the middle of the eyes, mutually slightly more than twice as distant as either from the eye; apical fovea wanting; vertex broadly, feebly sinuate above, abruptly and very strongly declivous, the face of the declivity bearing a transversely oval sensitive area of very dense, erect, short setæ; antennæ rather short and robust, about as long as the head and prothorax together, club somewhat robust; two basal joints, rather small, the second slightly the smaller, third narrower, slightly longer than wide, perceptibly obconical, fourth very slightly wider, a little transverse, fifth slightly dilated, a little longer than wide, seventh and eighth equal, a little narrower, very slightly narrower than long; joints eight to eleven uniformly, rather rapidly increasing in width, eighth as wide as the seventh, eight to ten wider than long. *Prothorax* widest at two-fifths its length from the apex, where it is scarcely perceptibly wider than the head and distinctly wider than long; sides strongly, evenly rounded, moderately convergent and nearly straight toward base; the latter broadly, feebly arcuate, four-fifths as wide as the disk, one-half wider than the apex; the latter transversely truncate; disk strongly convex, finely, rather densely and evenly punctate, lateral foveæ rather large, moderately impressed, at slightly more than one-third the length from the base; median very small, near the base. *Elytra* at base slightly wider than the prothorax, at apex scarcely twice as wide as the latter; sides evenly and rather strongly arcuate; disk very slightly wider than long, moderately and evenly convex, very minutely, not densely punctate; sutural striæ deep, nearly parallel; discal distinct, arcuate, terminating at slightly less than one-fifth the length from the apex. Abdomen moderately convex; basal segment nearly as long as the next two together; basal carinæ very fine, very distinctly divergent, distant by about one-fourth the total width, slightly less than one-third as long as the segment. *Legs* short and robust; intermediate tibiæ short, robust, not at all clavate, slightly thicker in the middle, having a large, robust terminal spur; posterior tibiæ longer, more slender, slightly clavate. Length 1.3 mm.

California; (San Mateo Co. 1).

The description is taken from the male. The terminal segment is rather broadly and extremely feebly emarginate at apex.

This species belongs near the last, but may easily be distinguished from any hitherto described by its colors, punctuation and male sexual characters. The female probably

has simple antennæ and lacks the sensitive oval patch on the declivity of the vertex.

R. deformata Lec.—Three specimens of this species were taken at Paraiso Springs, Monterey Co. The antenna is figured on the plate; the abnormally large second joint is excavated and coarsely punctured beneath.

SONOMA n. gen. (Euplectini.)

The following genus belongs near *Faronus* and *Sagola*, with apparently much greater resemblance to the latter. The species thus far described belong to the Pacific Coast fauna, and were placed by Dr. LeConte in *Faronus*. The diagnosis may be given as follows, the general characters being those of the Euplectini.

Posterior coxæ contiguous; tarsi with two equal claws. Antennæ rather distant at base, feebly but distinctly clavate; first joint much longer than the second. Head slightly smaller than the prothorax, with three nude foveæ not connected, the two posterior small, the apical large and very deep; genæ not at all prominent, rounded. Prothorax with two small discal foveæ before the middle, a very large, deep, widely dilated basal fovea, and one at each side not connected. Elytra with sutural striæ; discal deep and broad, short, basal. First segment of the abdomen very short, shorter than the second or third, coriaceous above, corneous beneath, without basal carinæ; second segment having an apical transverse line of finely spongiöse sensitive surface which is interrupted in the middle. Tarsi rather short. Eyes well developed. Body very depressed, linear.

The head is not carinate beneath, but has a deep transverse groove just behind the mentum and maxillæ. The elytra are much longer than the prothorax, depressed. The flanks of the elytra are normal. The middle coxæ are sub-contiguous, separated by a very narrow carina.

The genus *Sonoma* is distinguished from *Faronus* by the form of the genæ and the short basal segment of the abdomen; from *Sagola* Sharp it differs in its less approximate and less prominent frontal tuberculations, and especially in the structure of the antennæ, which are in *Sagola* not at all clav-

ate: the three outer joints in Sonoma are distinctly enlarged, forming a loose club.

The transverse areas of sensitive surface near the apex of the second dorsal segment are analogous to similar transversely oval patches previously noticed by me as being very common in the Homalini of the Staphylinidæ, and they probably serve the same purpose in each group. They have been noticed by Dr. Sharp in Sagola. Although both the species of Sonoma before me have these sensitive patches, I am not certain that their presence is constant throughout the genus.

OROPUS n. gen. (Euplectini.)

Tarsi with two unequal claws, posterior coxæ very closely approximate. Maxillary palpi moderate in length, fourth joint rather elongate and spindle-form, widest near the middle, bristling with minute setæ at apex. Head with two small occipital foveæ, which are spongiöse and connected by an arcuate, impressed groove; antennæ similar in the sexes; eyes well developed. Prothorax with two lateral spongiöse foveæ at base, connected by a deeply impressed line, also with an impressed median canaliculation; sides near the base with a small, acute, reflexed tooth. Elytra with acute lateral margin; each having four deep punctures at base, prolonged posteriorly as fine distinct striæ. Abdomen with a short basal segment, hidden by the elytra above, visible beneath, not extending beyond the coxæ; second segment long, more than twice as long as the third. Tarsi three-jointed; basal joint very small, second very long. Abdomen strongly margined above. Body rather robust and convex.

This genus belongs to the *Trichonyx* group of the *Euplectini*, but differs greatly from that genus in the position of the posterior coxæ, which are here very narrowly separated, almost contiguous at base. In *Trichonyx* they are quite distant, more than three times as distant as in the present genus. *Oropus* belongs near *Trogaster* Sharp, and differs from it in the form and position of the pronotal teeth. In addition, the following characters distinctive of *Trogaster* are not found in *Oropus*:—Antennæ dissimilar in the sexes; fourth joint of maxillary palpi rather short, widest near the base; head with two small occipital foveæ, which

are not spongiose, and not connected by the anterior arcuate groove, the latter terminating posteriorly in two very deep foveæ just in advance of the occipital pair. Elytra each with three foveæ at base, the lateral prolonged posteriorly in two divergent striæ.

The structure of the abdomen differs decidedly in the two genera, although *Trogaster* has the short basal segment, the second ventral is but very little longer than the third. In *Trogaster* the first three visible dorsal segments are nearly equal; in *Oropus* these decrease uniformly and rapidly in length. *Amauronyx* agrees well with the present genus in abdominal structure, but has the posterior coxæ separated as in *Trichonyx*, the elytra with but two basal foveæ, and the pronotum without lateral teeth.

I have drawn my comparisons from specimens of *Amauronyx Muerkeli* Aub.; *Trichonyx sulcicollis* Reichb., and *Trogaster aberrans* Sharp, very kindly given me, together with many other Pselaphides and Scydmanides, by Capt. Ch. Kerremans of the Belgian army.

Oropus has thus far occurred only on the Pacific Coast; one species has already been described by Dr. Le Conte under the name of *Trichonyx striatus*; I now add three others from more southern latitudes, of which *convexus* is assumed to be the type of the genus.

In the following descriptions the elytral striæ are designated by the numbers one to four, in order from the suture outward.

The four species may be distinguished as follows:—

Elytral striæ two and three subequal, extending distinctly behind the middle.

Pronotal canaliculation not interrupted before the transverse basal groove.

Canaliculation dilated anteriorly.....**striatus.**

Canaliculation not dilated anteriorly, coarse, dilated in the middle,
convexus.

Canaliculation completely interrupted behind the middle...**interruptus.**

Elytral striæ two and three unequal, shorter.....**abbreviatus.**

These species, with exception of the first, which was described by Dr. Le Conte from Vancouver Island, were all taken in wet moss at the bottom of ravines near the sea-coast, and within a very limited area. I have met with them in no other locality.

O. convexus n. sp.—Form rather robust, convex, dark rufo-castaneous; elytra scarcely perceptibly paler, dark rufous; legs and antennæ slightly paler, rufous; pubescence coarse, rather long, not very dense; integuments polished. *Head* robust, much wider than long; eyes moderate, prominent, at their own length from the base; sides behind them strongly convergent and arcuate to the base, which is about one-half as wide as the width at the eyes; impressed groove strongly arcuate; occiput with a narrow canalicularation in the middle at base; antennæ robust, short, as long as the head and prothorax together; basal joint robust, longer than wide, distinctly narrowed toward base, second slightly narrower, cylindrical, as long as wide, three to eight slightly narrower than the second, gradually slightly shorter, third slightly wider than long, ninth and tenth abruptly much wider, short, transverse, the tenth slightly the larger, eleventh distinctly wider than the tenth, conoidal, acutely pointed, as long as the four preceding joints together. *Prothorax* widest slightly before the middle, where it is scarcely visibly wider than the head and nearly as wide as long; sides here very strongly rounded, thence rather strongly convergent and distinctly sinuate to the base; the latter broadly arcuate, two-thirds as wide as the disk, one-third wider than the apex; the latter feebly arcuate; sides toward the apex slightly sinuate. basal angles prominent, slightly obtuse, not at all rounded; disk broadly convex; canalicularation terminating at one-sixth the length from the apex, slightly dilated in the middle in the form of a small puncture, continued toward base beyond the transverse groove nearly one-half the distance between the latter and the base; transverse groove deeply impressed, very feebly posteriorly arcuate, at one-third the length from the base; lateral foveæ deeply impressed, spongiose; disk between transverse groove and base strongly convex; surface finely, sparsely punctate. *Elytra* at base slightly narrower than the prothorax, at apex one-half wider than the latter; sides rather strongly and nearly evenly arcuate; disk broadly and rather strongly convex, as long as wide; humeri longitudinally prominent but not carinate; sutural striæ very deeply impressed, entire, slightly arcuate, two and three equal, fine, strongly impressed, two-thirds as long as the disk, four short, arcuate, terminating slightly before the middle, fine, strongly impressed; surface rather finely, feebly and sparsely punctate. *Abdomen* slightly shorter and narrower than the elytra; border inclined, strong and conspicuous; surface broadly convex, very minutely, sparsely punctate. *Legs* moderate in length, slender; femora slender, very slightly clavate; posterior tibiæ nearly twice as long as the tarsi, very feebly dilated toward tip. Length 1.9–2.0 mm.

California; (Sonoma Co. 2).

The type is a male; the abdominal sexual characters are not very well marked and consist of a very small transverse impression beneath, near the apex. The under surface of the head is moderately convex, with a fine but distinct median carina; it is coarsely, rather deeply and not densely punctate.

The female which I have associated with this male is very slightly more depressed and very slightly more robust; the antennæ are shorter and more robust; the under surface of the head is more finely and feebly punctate; the median pronotal channel is finer and not so distinctly dilated in the middle; the elytral striæ are more feebly impressed; the pubescence of the body is slightly denser and the color is paler, especially that of the elytra, which is rather bright rufous. If the specimen were not a female I should not hesitate to describe it as distinct, but as the sexual characters in this genus are not known the above differences may be due simply to the usual sexual modification. The material before me is so limited that very little can be learned of specific variability, but in tabulating the species above I have made use only of those characters which are regarded as of great importance in other portions of the *Pselaphidæ*.

O. interruptus n. sp.—Moderately robust, convex, uniformly dark rufous; legs and antennæ very slightly paler; pubescence rather coarse, not long, moderately dense; integuments shining, pronotum slightly duller. *Head* much wider than long; eyes moderate, convex, at their own length from the base; sides behind them strongly convergent and arcuate to the neck, which is deeply impressed, broadly sinuate; occipital foveæ on a line through the anterior limits of the eyes; occiput with a narrow median canalication; antennæ rather robust, as long as the head and prothorax together; basal joint slightly robust, a little longer than wide, second very slightly narrower, cylindrical, scarcely as wide as long, three to eight very slightly narrower, decreasing in length, third distinctly wider than long, nine and ten rather abruptly longer and much wider, transverse, tenth distinctly longer and slightly wider than the ninth, eleventh more robust than the tenth, elongate, conoidal, slightly obliquely pointed, scarcely as long as the four preceding together. *Prothorax* widest at a little more than one-third its

length from the apex, where it is distinctly wider than long, very slightly wider than the head; sides strongly rounded, thence convergent to the basal angles, bisected by the lateral teeth, very feebly sinuate between the teeth and the basal angles; base broadly arcuate, two-thirds as wide as the disk, one-third wider than the apex; disk broadly convex; canaliculation abrupt, rather narrow and deep, beginning slightly behind the apex, abruptly terminating at the middle; transverse groove deeply impressed, broadly, feebly arcuate, at distinctly less than one-third the length from the base, prolonged posteriorly in the middle in a deep broad channel nearly half way to the base. *Elytra* at base nearly equal in width to the pronotum, at apex nearly one-half wider than the latter; sides evenly and strongly arcuate; humeral prominences convex, strong, elongate; disk slightly wider than long, rather strongly convex, broadly impressed along the suture; striae one strongly impressed, fine, two and three approximate, equal, fine, distinct, two-thirds as long as the disk, four five, deeply impressed, one-third as long as the disk; surface rather coarsely, feebly and sparsely punctate. *Abdomen* broadly convex, impunctate; border strong, rather strongly inclined. *Legs* moderate in length. Length 1.9 mm.

California; (Sonoma Co. 1).

The type is a male. The species is easily distinguished from *converus* by the shorter and less robust basal joint of the antennae, more broadly and evenly arcuate impressed frontal groove, short pronotal canaliculation, broader median posterior continuation of the transverse groove, and by the color, which is more uniform and paler rufous.

O. abbreviatus n. sp.—Rather robust, moderately depressed, very dark rufo-testaceous; an ennae and legs concolorous; elytra scarcely perceptibly paler; integuments polished; pubescence coarse, rather long and somewhat dense. *Head* much wider than long, neck one-half as wide as the width at the eyes; surface almost impunctate; frontal impressed channel very strongly arcuate; antennae as long as the head and prothorax together, moderately robust; basal joint robust, longer than wide, second slightly narrower, a little longer than wide, third very slightly wider than long, ninth and tenth abruptly wider, subequal in length, the latter very slightly the wider, eleventh slightly wider than the tenth, oval, symmetrically pointed, scarcely as long as the preceding four together. *Prothorax* widest very slightly before the middle, where it is as wide as long; sides very strongly arcuate, convergent and very feebly arcuate to the apex, sinuate near the latter, less strongly convergent toward the base, strongly sinuate just before the latter; base broadly arcuate, three-fourths as wide as the disk, one-half wider than the apex; disk broadly convex; median canaliculation rather fine but deeply impressed, beginning near the apex, continuous in width and depth across the

transverse groove nearly one-half the distance between the latter and the base; transverse groove deeply impressed, at slightly more than one-fourth the length from the base, feebly, posteriorly arcuate; lateral foveæ rather large, moderately impressed. *Elytra* at base slightly narrower than the pronotum, at apex one-half wider than the latter; sides evenly and rather strongly arcuate; humeral prominence convex, elongate; disk very finely, sparsely punctate, nearly as long as wide, moderately and nearly evenly convex; stria one deeply impressed, entire, two and three very closely approximate, finely impressed, distinct, the former three-sevenths, the latter four-sevenths as long as the elytra, four fine, deeply impressed, more divergent, one-third as long as the disk. *Abdomen* slightly narrower and much shorter than the elytra; border strong. *Legs* slender. Length 1.8 mm.

California; (Sonoma Co. 1).

This species, which is represented by the male, is easily distinguished from the others by the brevity of the second and third elytral striæ. It is further distinguished by the shape of the pronotum and by the form of the frontal impressed groove, which is here very strongly arcuate, more so than in *convexus*.

The antennæ are very similar in structure throughout, but present slight differences mainly affecting the first, ninth, tenth and eleventh joints.

ACTIUM n. gen. (Euplectini.)

The Californian species hitherto placed in *Trimium* in reality form a very distinctly characterized genus. In the following comparative statement, I have had before me a male and female of the European *Trimium brevicorne* Reichb. which was taken by Aubé as the generic type. In *Trimium* as thus represented, the eyes are very unequal in the sexes, in the males being moderate in size, in the females much smaller. The pronotum is crossed by a very fine, feebly impressed, basal groove. The flanks of the elytra are perfectly devoid of humeral foveæ. The first visible dorsal segment is elongate, equal in length to the next two together.

The generic character of *Actium* may therefore be briefly given as follows:—

Maxillary palpi rather small, second joint very strongly clavate, third minute, subglobular, fourth elongate, oval, moderately robust, longer than the remainder taken together. Basal groove of pronotum very strong and deeply impressed. Eyes rather large, convex and prominent in both sexes. Elytra having on the flanks, just behind each humeral prominence, a large spongiose fovea, which is continued to the elytral apex by a broadly and deeply impressed groove, limited inferiorly by a fine acute ridge. First three visible dorsal segments of the abdomen subequal, first slightly the longer.

Actium differs from *Euplectus* in its more abrupt terminal joints of the antennæ, in the presence of spongiose foveæ on the head, in the very much more robust and convex form of body, and in the structure of the abdomen. In *Euplectus*, as represented by *Bonvouloiri* Reit. and *signatus* Reichb. the first three visible dorsal segments are equal, the fourth very much longer; the second and third ventral segments are equal in length. In *Actium* the fourth visible dorsal is but very slightly longer than the third, and the second ventral is distinctly longer than the third. It will be seen therefore that the genus *Actium* properly occupies a position intermediate between *Trimium* and *Euplectus*.

The sexual characters at the apex of the venter are usually quite complex.

It is highly probable that our eastern representatives of *Trimium* will also necessitate the founding of a separate genus, although this cannot be definitely stated at present.

LOMECHUSA Grav.

L. montana n. sp.—Robust, rather depressed; sides parallel; pale rufotestaceous throughout; antennæ and legs concolorous; pubescence very fine, sparse, abdomen polished, almost glabrous; anterior portions finely alutaceous, elytra more shining than the pronotum; under surface polished. *Head* small, much wider than long; eyes rather large and prominent, at nearly their own length from the base; sides behind them nearly parallel; very feebly arcuate; front with a large deep impression; entire surface very minutely granulose and excessively minutely, not densely punctate; antennæ very slender, not incrassate, two-thirds as long as the body; basal joint very large, twice as long as wide, rather abruptly narrowed at the base, not as long as the next three together; second slightly longer than wide, not one-half as wide as the first, scarcely two-thirds as long as the third; joints three to seven

equal, seven to ten very slightly decreasing in length, eleventh long and slender, attenuate; apices of joints three to ten obliquely truncate. *Prothorax* twice as wide as the head; apex throughout the breadth of the latter broadly, roundly emarginate; apical angles thence very broadly rounded, coarctate with the sides which become nearly straight and slightly divergent to within a short distance of the base, where they become abruptly slightly convergent and nearly straight to the basal angles; the latter obtuse and scarcely rounded; base broadly and strongly arcuate in the middle, sinuate laterally; disk twice as wide as long, depressed in the middle, very broadly and strongly reflexed at the sides, extremely feebly reflexed anteriorly, more strongly and broadly so along the arcuate portion of the base, also more strongly impressed at the sides and toward the apical angles, very minutely subgranulose with evenly distributed, not dense, fine, granulose or strongly asperate punctures. *Elytra* as wide as the prothorax; sides nearly parallel, feebly arcuate; apex broadly truncate, feebly sinuate laterally; inner angles distinctly rounded; humeri rather broadly rounded; disk nearly two-thirds wider than long, one-third longer than the pronotum, feebly convex, more strongly so toward the humeri; base feebly declivous, finely, feebly subgranulose, finely, rather sparsely granulosely punctate; punctures more distinct than those of the pronotum; suture margined with a fine, polished but not distinctly elevated line which extends along the scutellum and base. *Abdomen* as wide as the elytra; sides nearly straight and parallel; broadly, obtusely rounded behind; surface strongly impressed in the basal half, broadly, feebly convex behind; lateral tufts of hair bright fulvous; under surface strongly convex, having very sparsely placed, erect setæ. *Legs* long and slender; tarsi cylindrical; first joint of the posterior longer than the next two together, one-third longer than the fifth. Length 4.3 mm.

California; (Truckee, Nevada Co. 1). Elevation 6,000 feet.

A very interesting addition to the fauna of California; the typical representative was found under a stone deeply imbedded in soft soil near the margin of a small stream; no ants of any description could be seen, and in fact myrmecophilous Coleoptera of all kinds appear to be extremely rare on the Pacific Coast.

TACHYUSA Erichs.

T. crebrepunctata n. sp.—Rather slender, moderately convex, black throughout; antennæ and legs same; tarsi and palpi paler, piceo-testaceous; pubescence short, fine, dense and recumbent, coarser, longer and more sparse on the abdomen; integuments shining, finely, deeply, evenly and very densely punctate, head and abdomen slightly more coarsely and sparsely

so. *Head* and labrum together slightly longer than wide; front and occiput strongly convex and declivous at the sides, flat above; eyes large, at scarcely their own length from the base; sides behind them slightly convergent, strongly arcuate; base broad, truncate; antennæ slender, very feebly incrassate, scarcely as long as the head and prothorax together; second joint slender, elongate, much longer than the third; joints three to ten decreasing in length, the former more than twice as long as wide, the latter very slightly wider than long. *Prothorax* slightly wider than long, widest at one-third its length from the apex, where the sides are rather broadly arcuate, thence rather strongly convergent and nearly coarctately rounded to the apex, and slightly less strongly convergent and feebly sinuate to the base; the latter broadly and strongly arcuate throughout, four-fifths as wide as the disk and slightly wider than the apex; the latter broadly and feebly arcuate throughout; basal angles very obtuse and distinctly rounded; disk broadly and rather strongly convex, depressed in the middle toward base, and immediately before the basal margin transversely and feebly impressed. *Elytra* at base one-fourth wider than the pronotum; sides nearly parallel, feebly arcuate near the base, strongly so near the apex; apical angles acute and slightly produced; together subtruncate behind, feebly emarginate at the suture; disk nearly quadrate, two-fifths longer than the pronotum, feebly and nearly evenly convex; suture very finely margined. *Abdomen* distinctly narrower than the elytra; sides parallel and nearly straight; border wide and prominent; surface feebly convex; three basal segments rather deeply impressed at base but not more densely or coarsely punctate, not carinate in the middle. *Legs* moderate in length, very slender; tibiæ densely herissate with coarse, semi-erect setæ; joints of the posterior tarsi decreasing rather rapidly in length, first nearly one-half longer than the second. Length 2.5 mm.

California; (Monterey Co. 1).

This species is rather closely allied to *T. Harfordi*, but differs in its smaller size, shorter, smaller and more transverse prothorax, and denser and stronger punctuation.

The middle coxæ are distinctly although not widely separated; the mesosternal process is rather short, broadly angulate, the apex of the angle being broadly rounded; the connecting surface is deeply impressed

AUTALIA Leach.

A. elegans n. sp.—Rather slender and depressel; head and abdomen toward tip piceous-black, remainder dark piceo-castaneous; antennæ dark fuscous throughout; legs rather pale brownish-flavate; pubescence fine, sparse, long and distinct; integuments polished. *Head* slightly longer than wide; semicircularly rounded behind from eye to eye; surface strongly and evenly

convex, impunctate; antennæ distinctly longer than the head and prothorax together, distinctly incrassate toward the apex; three basal joints elongate, second very slightly shorter than the first or third, four to ten gradually shorter and wider, the former distinctly longer than wide, the latter slightly wider than long. *Prothorax* very slightly longer than wide; sides in the anterior third strongly convergent and nearly straight to the nuchal emargination which is broadly and feebly incurvate and one-third as wide as the disk; in the posterior two-thirds the sides are parallel, broadly and feebly incurvate at the posterior third, at the anterior third strongly rounded; disk transversely and rather strongly convex at the sides, feebly so in the middle, where there is a narrow, rather feeble canaliculation extending from near the apex to slightly behind the middle; also at the base four foveæ, the inner pair continued anteriorly and slightly obliquely nearly to the middle by narrow, deeply impressed canaliculations; the outer pair dilated laterally, and anteriorly, obliquely and briefly prolonged at their inner extremities; surface highly polished, finely and sparsely granulose in the middle toward base; basal margin broadly and feebly arcuate; angles right and very narrowly rounded. *Elytra* at base nearly one-half wider than the pronotum; sides nearly parallel, strongly arcuate toward apex; together subtruncate behind; disk feebly convex, abruptly and strongly so at the sides, impunctate; sutural striæ fine and distinct; each elytron strongly bifoveate at the base. *Abdomen* at base three-fourths as wide as the elytra; sides parallel and feebly arcuate; border narrow, deep and strongly inclined; surface feebly convex; first three segments transversely and very strongly impressed at base; impressed areas coarsely, strongly and densely granulose, traversed longitudinally by five carinæ, remainder of the surface scarcely punctate on the basal segments, finely, separately and very sparsely so on the apical. *Legs* slender; first four joints of the posterior tarsi slightly elongate, nearly equal. Length 2.0 mm.

California; (Lake Co. 1). Mr. Fuchs.

The prosternum is well developed in front of the coxæ, slightly swollen, connected with the supracoxal surface by an even convexity without trace of raised line; between the coxæ it is produced back as an acute angle, strongly carinate in the middle and projecting under the apex of the mesosternum, the posterior edges of the supracoxal surface being narrowly and strongly reflexed; the portion behind the coxæ is membranous.

The mesosternum is ample, broadly arcuate and very narrowly reflexed anteriorly, finely carinate throughout along the middle, the surface on either side of the middle being broadly impressed for the reception of the anterior coxæ in

repose; posteriorly, between the widely separated middle coxæ, it is scarcely at all produced, but is very broadly areolate, reflexed and far above and free from the long truncate metasternal process; the entire mesosternum is coarsely, strongly and densely granulose, forming a striking contrast to the highly polished pro- and metasterna.

The anterior and middle tarsi have each four distinct joints, but the long, very slender fourth joints are provided at base with a very small and ill-defined segment, which renders the accurate determination of the structure a matter of great difficulty⁵.

EUMITOCERUS n. gen. (Tachyporini.)

Head moderately deflexed; eyes adjacent to the prothorax; antennæ long, very slender, capillary, verticillate; two basal joints much more robust, first slightly less than twice as long as the second; labrum very small, much wider than long, arcuate anteriorly, strongly inflexed and hidden under the projecting clypeus; maxillary palpi long, filiform and slender; second joint long and very slender, third obconical, scarcely more than two-thirds as long as the second, fourth slender, finely acuminate, slightly swollen toward base, longer than the third, much more finely and densely pubescent. Pronotal hypomera extremely strongly inflexed, almost parallel with the dorsal surface; wide behind, very narrow anteriorly. Elytra passing a little beyond the metasternum. Anterior coxæ narrow, conical, convex anteriorly; posterior moderately prominent, conical posteriorly, emarginate externally; posterior femora and trochanters attached at the apices, their point of insertion not at all concealed. Ventral segments margined; sixth exposed dorsally. Tarsi five-jointed. Inguements asperate.

It can be readily seen that *Eumitocerus* bears a great resemblance to *Habrocerus*, but differs from that genus in the

⁵.—I cannot but agree with Wollaston in his statement (Cat. Can. Col., p. 535; foot-note), concerning the difficulties of the tarsal system as applied to the Aleocharini. In many of the minute species it is impossible to determine the number of tarsal joints in such manner as to leave no doubt in the mind of the investigator, because of the hairy vestiture and the apparent division of the terminal joint in many cases, which, as I have before remarked, may be indicative of a real division at an early period in the history of the species. The more the subject is investigated, the more apparent is it that the division of the Aleocharini in accordance with the number of tarsal joints, is neither scientific in indicating true affinities, nor practical in its application.

relatively much shorter third joint of the maxillary palpi, and more especially in the structure of the posterior coxæ. In appearance it differs considerably, by reason of its asperate sculpture, in this respect being apparently related to *Tricophya*. In the latter genus the elytra do not extend beyond the metasternum, and the third and fourth joints of the maxillary palpi are subequal in length.

There is at my disposal, unfortunately, but one specimen. I cannot therefore give a representation of the maxilla; the labial palpi appear to be very minute and are not distinctly visible in the type. From the cursory glance which I obtained before the antennæ were broken, I am confident that these are filiform and verticillate throughout.

E. tarsalis n. sp.—Form rather slender, dark castaneous; abdomen black, paler at the apex; legs pale piceo-testaceous; antennæ flavate, basal joints piceo-testaceous; pubescence fine, denser on the elytra, recumbent, brownish, not conspicuous; integuments very feebly alutaceous, shining. Head moderate, slightly wider than long, feebly and evenly convex; eyes small, convex, finely granulate, rather prominent; front feebly, densely and subasperately punctate; palpi testaceous; infraorbital ridge not visible. *Prothorax* widest at two-thirds its length from the apex, where the sides are obtusely subangulate and where it is nearly one-half wider than long; sides thence moderately convergent and feebly arcuate to the apex, slightly less strongly convergent and nearly straight to the base; the latter squarely truncate; basal angles obtuse and very slightly rounded; apex broadly and feebly emarginate, distinctly narrower than the base; disk evenly and moderately convex, obliquely and feebly impressed near each basal angle, very finely, rather densely and evenly punctate; punctures strongly asperate. Scutellum rather large, as wide as long, asperate. *Elytra* at base as wide as the base of the pronotum; sides feebly divergent, nearly straight toward the base, feebly arcuate posteriorly; together as long as wide, broadly sinuate at apex, nearly one-half longer than the pronotum; disk feebly, transversely convex, finely, rather densely and evenly punctato-asperate; punctures slightly coarser than those of the pronotum. *Abdomen* at base very slightly narrower than the elytra; sides rather strongly convergent toward apex and nearly straight; border moderate, feeble on the fifth segment; surface transversely and moderately convex, even, minutely, very feebly and rather densely punctato-asperate at base, the punctures becoming more minute and sparse toward the vertex; under surface more coarsely and strongly punctato-asperate toward the base, sculpture subimbricate. *Legs* moderate, anterior short, rather robust, remainder slender; posterior tarsi long, much shorter than the tibiae,

very slender, first joint longer than the next three together, as long as the last three. Length 1.8 mm.

California; (San Mateo 1). Mr. C. Fuchs.

The type of this interesting species is probably a male. The tarsi are very remarkable; the anterior are irregular, attached obliquely to the tibiæ, and have the basal joint large, broadly dilated and slightly darker in color; the next three joints are very small, emarginate at tip, pale flavo-testaceous in color, and moderately dilated, successively less strongly so; the fifth slender. The intermediate tarsi are irregular and are very distinctly dilated toward base; both the anterior and middle tarsi are densely clothed beneath with very slender papillæ, and are verticillate at the sides; the papillæ beneath are sometimes terminated by very minute enlargements which are apparently composed of a viscid substance, and analogous to the erect setæ observed upon the under surface of the head in the Euplectini of the Pselaphidæ. The claws are very small. There are no sexual characters of importance observable at the abdominal vertex.

HETEROTHOPS Steph.

H. exilis n. sp.—Form very slender, rather convex; pale reddish-testaceous throughout; head slightly darker, more castaneous; antennæ and legs slightly paler, pale flavate; integuments polished; head and pronotum glabrous; elytra and abdomen finely and rather densely pubescent, the elytra the more sparsely so. *Head* rather strongly deflexed, oblong, abruptly and feebly constricted at the neck; sides thence to the eyes feebly convergent, feebly arcuate, twice as long as the eyes which are small, not at all prominent and almost at the apical angles; surface transversely and rather strongly convex, impunctate, finely and excessively feebly strigose; antennæ inserted at a very short distance from the eyes, shorter than the head and prothorax together; feebly incrassate; first joint as long as the next two together, third small, much shorter than the second, slightly longer than wide, tenth distinctly wider than long, eleventh slightly longer than the two preceding together. *Prothorax* scarcely longer, and, at the apex very slightly wider than the head, widest at the base where it is but very slightly wider than long; sides convergent from base to apex, broadly, evenly and distinctly arcuate; apex broadly and very feebly arcuate, three-fourths as wide as the base; the latter evenly and very

distinctly arcuate throughout; angles broadly rounded; disk transversely and rather strongly convex, impunctate, excessively minutely and obsoletely strigose with a few setigerous punctures along the sides and base and four discal punctures, one near each apical angle, and another just before and on either side of the centre of the disk. *Elytra* at base very slightly narrower than the prothorax; sides very feebly divergent, very feebly arcuate; together broadly and distinctly sinuate behind; disk very feebly convex, slightly wider than long, very slightly shorter than the pronotum, evenly, not very coarsely, deeply, moderately densely and asperately punctate; intervals extremely feebly reticulate. Scutellum rather large, triangular, asperate. *Abdomen* long, slender, at base nearly as wide as the elytra; apparently not capable of much contraction; sides gradually convergent and nearly straight to the apex; border rather wide, deep, nearly vertical; surface rather convex, finely and very densely punctate. Legs rather short and slender; first four joints of the posterior tarsi decreasing rapidly in length, first subequal to the fifth. Length 2.4 mm.

California; (Monterey Co. 1).

The single representative is probably a female; the anterior tarsi are slightly dilated; the seventh segment has four long, setigerous, anal styles, but both the dorsal and ventral plates of the sixth segment are broadly and evenly arcuate at apex.

It is related to *pusio* Lec., but differs in the arrangement and number of the occipital punctures; these are one at the middle of the upper margin of the eye and one below the posterior margin of the eye between the latter and the infraocular ridge; at the base on the sides there are a few very minute punctures, and a transverse row of large setigerous punctures immediately before the nuchal constriction extending across the head.

The type specimen was found under pine bark early in February near the town of Monterey.

ABABACTUS Sharp.

A. pallidiceps n. sp.—Slender, rather depressed, piceous; head rufo-testaceous; legs pale flavate; antennæ opaque, pale flavo-testaceous; head sometimes clouded in the middle of the disk; pubescence sparse throughout, fine; integuments polished. *Head* distinctly longer than wide; post-ocular portion slightly less than twice as wide as long, semicircularly rounded be-

hind; eyes large, at twice their length from the base, finely granulate; surface moderately convex, rather sparsely, unevenly and not deeply punctate; punctures varying in size; antennal tuberculations abrupt, small and strong, with the anterior edges acute and prominent; surface between them gradually and anteriorly declivous, transversely truncate at apex; labrum short and broad, acutely incised in the middle, finely, acutely and prominently bidenticulate, edge just without each tooth finely sinuate; fourth joint of the maxillary palpi small, much narrower than the apex of the third, conical, acute; antennæ long and slender, as long as the head and prothorax together, not incrassate; second joint distinctly shorter than the third, all the joints longer than wide. *Prothorax* nearly three-fourths as wide as the head; sides parallel, distinctly and almost evenly arcuate; base and apex almost equal in width, truncate; basal and apical angles equally and rather broadly rounded; disk cylindrically convex, one-half longer than wide, coarsely, feebly and irregularly punctate; punctures sparse near the sides, more dense in an irregular line bordering the median impunctate area, which is very slightly more strongly convex throughout its length. *Elytra* at base one-third wider than the prothorax, slightly wider than the head; sides nearly parallel, extremely feebly arcuate; together broadly and very feebly emarginate behind; humeri very narrowly rounded; disk two-fifths longer than wide, nearly one-third longer than the prothorax, depressed, very feebly impressed toward base along the narrowly elevated suture, rather coarsely, feebly and evenly punctate; punctures impressed, distant by more than their own diameters, not appreciably more feeble toward apex. *Abdomen* slightly narrower than the elytra; sides parallel and straight; surface finely, more deeply, evenly and not densely punctate. Length 4.8-5.2 mm.

California; (Santa Rosa, Sonoma Co. 2; Anderson Val., Mendocino Co. 1)

In the male the second ventral segment has in the centre of its disk a small deep fovea bearing a small brush of erect hairs, the third segment having two similar foveæ, rather approximate, arranged transversely, distinctly before the middle, each bearing one or two erect robust setæ; sixth segment with a very narrow deep incisure, with the sides nearly parallel, very acutely rounded at apex and five times as deep as its mid-width, bordered throughout its length with a narrow, deeply concave gutter which is prolonged anteriorly, continuing thence as a single groove to the base of the segment, becoming gradually attenuated.

The prothorax is very slightly narrowed toward apex, the basal angles thus being more prominent than the apical.

The color may vary somewhat from immaturity, both the head and prothorax being sometimes paler. The single specimen upon which this statement is based differs, however, in its slightly denser elytral punctuation: it is probably a female, the sixth segment being entire, narrowly rounded at apex; the second segment is entire, but the third has the two foveæ as described in the male.

The present species belongs near *A. politus* Sharp, which it resembles greatly in sexual characters; from *nictus* Horn, it differs in color and in its much more elongate prothorax and elytra.

The genus *Ababactus* differs from *Hesperobium* not only in the structure of the labrum,—which allies it more closely with *Cryptobium*,—and tarsi, as remarked by Dr. Sharp, but also in the complete absence of the large basal carina of the first ventral segment, which is such a prominent feature of *Hesperobium*. The two post-ocular annular punctures are well developed in *Ababactus*, and are completely absent in *Cryptobium fracticorne* Payk.

LENA n. gen. (Pæderini.)

Body robust, depressed; head rather large; antennæ short and robust; labrum rather short, broadly rounded, with a simple median sinuation about twice as wide as deep with no trace of denticulation or carina; third joint of labial palpi very minute and slender; third joint of maxillary palpi much longer than the second, slender, fusiform, obtusely pointed at tip; fourth excessively minute, slender, subulate; eyes moderate, coarsely granulate. Prothorax subquadrate, narrowed toward base, shorter than the elytra. Intermediate and posterior tarsi rather slender, cylindrical; first joint of the latter as long as the next two together, distinctly longer than the fifth; fourth short, very slightly dilated, oblique at apex; anterior tarsi robust and spongy-pubescent beneath, very feebly dilated. Integuments rugulose, coarsely punctate, shining. Neck rather slender; gular sutures well separated.

This genus belongs near *Medou*, but is easily distinguished from it by a peculiar and complicated modification of the pronotal hypomera, the surface being deeply grooved opposite the base of the coxæ and the acute dividing line

being bisinuate anteriorly. It does not appear to be very closely allied to any of the Central American genera, and may be easily recognized by its short robust form, rather large truncate head, simple sinuate labrum, slender fusiform third maxillary palpal joint, short antennæ and non-carinate prosternum. I have compared it directly with *Medon brunneus* Erichs.

We have but one species.

L. testacea n. sp.—Robust; sides parallel; pale rufo-testaceous, elytra, legs, palpi and antennæ toward apex slightly paler and more flavate; pubescence of elytra and abdomen fine, rather long, not dense. *Head* about as long as wide; sides parallel, almost straight; base transversely truncate, feebly sinuate in the middle third; angles right, very narrowly rounded; eyes at twice their length from the base, slightly prominent; front finely subgranulose, coarsely, very feebly and not densely punctate, with a rather broad median impunctate line; antennæ equal in length to the head, distinctly incrassate toward tip; basal joint distinctly longer than the next two together, second distinctly longer and more robust than the third, the latter slightly longer than wide, joints four to ten subequal in length, increasing distinctly in width, the former as long as wide, the latter much wider than long. *Prothorax* widest at the anterior angles, slightly shorter and narrower than the head, very slightly wider than long; sides rather feebly convergent from apex to base, very feebly areolate; base broadly subtruncate; angles rather broadly rounded; anterior angles rather more narrowly rounded; sides of apex very strongly convergent to the neck, nearly straight; nuchal truncation rather feebly sinuate, two-fifths as wide as the disk; the latter feebly and evenly convex, finely subgranulose, rather coarsely, evenly and feebly punctate; punctures denser and finer than those of the head, with scarcely a trace of a median impunctate line. *Elytra* at base very slightly wider than the prothorax, as wide as the head; sides very feebly divergent, nearly straight; together broadly and extremely feebly emarginate behind; disk as long as wide, one-third longer than the prothorax, very feebly convex, scarcely impressed along the suture, which is bordered with a thickened but scarcely elevated margin; surface not granulose, polished, rather finely, evenly and not densely punctate, punctures impressed, deeper but not as large as those of the pronotum. *Abdomen* very slightly narrower than the elytra; sides parallel and distinctly arcuate; border rather narrow, deep and strongly inclined; surface broadly convex, very finely and feebly reticulate, polished, excessively minutely and rather sparsely punctate, each puncture being entirely filled by a hair. *Legs* rather short and very slender. Length 2.2 mm.

Texas; (Austin 2).

There is unfortunately no male of this genus yet discovered; the sixth segment of the female is short and broad, very broadly and feebly rounded nearly throughout its width at apex, subtruncate. The species may perhaps prove to be apterous.

RAMONA n. gen. (Pæderini.)

This genus belongs to the Lithocharis and Medon division of the Pæderini, and is allied somewhat to Caloderma and to several genera recently described from Central America. It may be distinguished by the following characters:—

Head smaller than the prothorax; the latter quadrate, shorter than the elytra. Labrum entire, short, broadly rounded throughout, without inequality except some very minute and feeble undulations, three or four in number near the middle, having dorsally a small median carina; neck rather slender, one-third as wide as the prothorax. Anterior tarsi broadly dilated; posterior slender, cylindrical, first four joints decreasing very rapidly in length, first nearly as long as the next two together, fourth cylindrical, very slightly longer than wide. Head and pronotum without trace of median impunctateline, stria or elevation; integuments extremely finely and densely punctate, alutaceous. Eyes moderate in size, coarsely granulated.

The third joint of the maxillary palpi is rather more strongly dilated than is usual in this group, the fourth being normal. The elytra differ from those of many allied genera in having no sign whatever of the usual narrow elevated margin adjoining the suture. The genus is distinguished from Medon and Caloderma by many characters, the most important of which is the strong dilatation of the anterior tarsi.

The sexual modification of the male is very slight, consisting of a simple broad sinuation at the apex of the sixth segment, the fifth being entire.

But one species is known at present.

R. capitulum n. sp.—Rather slender and depressed, black throughout, apical edges of the ventral segments paler; intermediate and posterior legs

piceous, anterior legs and tarsi throughout paler, piceous-brown; palpi piceous; antennæ piceous, paler toward tip; pubescence extremely short, fine and excessively dense on the elytra and abdomen, much less dense anteriorly. *Head* small, as wide as long; sides behind the eyes very slightly divergent posteriorly, feebly arcuate; base truncate; angles not prominent, rather broadly rounded; front evenly and feebly convex, excessively minutely and densely punctate; antennæ rather long, slender, as long as the head and prothorax together, not incrassate; basal joint scarcely as long as the next two together, second three-fourths as long as the third, scarcely as long as, but slightly more robust than the fourth, joints four to six equal, twice as long as wide, six to ten decreasing in length, the latter scarcely as wide as long. *Prothorax* widest in the middle, where it is distinctly wider than the head; sides parallel, feebly arcuate; base and apex broadly arcuate, the latter very feebly so; basal angles broadly rounded; apical more narrowly so; disk as wide as long, feebly and evenly convex, excessively minutely, evenly and densely punctato-granulose. *Elytra* at base just visibly wider than the prothorax; sides nearly parallel, feebly arcuate; together broadly and very feebly emarginate behind; disk slightly longer than wide, nearly one-fourth longer than the prothorax, feebly convex, not appreciably impressed along the suture, excessively densely and very finely granulose, each granule bearing a minute hair. *Abdomen* not narrowed toward base; sides parallel and straight border narrow, erect; surface feebly, cylindrically convex, excessively minutely, feebly and densely punctate; punctures slightly asperate and not arranged in any order. *Legs* rather short and robust; first joint of the posterior tarsi fully as long as the fifth. Length 3.7 mm.

Nevada; (Reno 1).

The unique specimen is a male, the sinuation of the sixth segment being about four times as wide as deep and acutely rounded.

The pronotum has besides the regular system of excessively minute granulate punctures, a widely and irregularly scattered system of larger, though still very small, rounded, shallow punctures, each of which bears a small, erect seta. The elytra are opaque, the head and prothorax somewhat shining.

LEPTOGENIUS n. gen. (Pæderini.)

Body slender, roughly sculptured. Head large, borne on a narrow neck. Prothorax small. Elytra longer and wider than the pronotum. Abdomen as wide as the elytra, gradually decreasing in width toward apex; four basal segments equal in length; fifth nearly one-half longer than the fourth; sixth

very short. Antennæ short; basal joint very robust. Maxillary palpi large; basal joint small, slender, second longer, robust, sublunate, third very large, flattened, subsecuriform, much longer than the first two together, fourth very minute, in the form of a very short robust spine, erect, protruding from the apex of the third. Labial palpi extremely small, slender; third joint apparently long and slender, second scarcely shorter and distinctly more robust, basal joint not visible. Mandibles long and slender. Gular sutures contiguous throughout. Labrum short, very broad, strongly arcuate, with a minute median emargination slightly wider than deep, on each side of which there are two exceedingly minute, approximate and robust teeth, upper surface having a fine median, longitudinal carina. Legs slender; anterior tarsi not at all dilated; first four joints of the posterior decreasing uniformly and rapidly; in length, first slightly longer than the fifth. Prosternum having a fine, strongly elevated, median carina, slightly less elevated at the anterior margin; under surface of the neck carinate.

The exact relationship of this genus is not apparent; it is different in appearance from any of the other Pæderoid genera with which I am familiar, and in fact appears to be a transitional form having uncertain affinities. The labial palpi are very minute and in their position in the two representatives before me are so deeply placed that it is impossible to give their exact structure.

The principal points of departure from the normal Pæderid are in the peculiar short antennæ and spiniform—not sublunate, oblique and retractile—terminal joint of the maxillary palpi, also in the large third and small robust second joint of that organ. The coxæ are normally Pæderoid.

L. brevicornis n. sp.—Slender, pale ochreous-testaceous throughout; elytra slightly darker, castaneous except near the base; pubescence extremely short, sparse, very evenly distributed throughout; integuments thick, opaque, very coarsely scabrous, not at all shining. *Head* slightly longer than wide; sides parallel, nearly straight; base truncate, narrowly and distinctly sinuate in the middle; angles moderately broadly rounded; surface transversely and moderately convex, coarsely and very densely granulose; eyes moderate, slightly convex, on the sides at a little less than twice their length from the base, very coarsely granulate; antennæ a little shorter than the head, distinctly clavate, funicle slender at base, posteriorly and strongly geniculate; basal joint robust, one-half longer than wide, second slightly less robust, subglobular, three to six very small, very slightly wider than long, equal, scarcely more than one-half as wide as the second, seventh slightly wider,

seven to nine increasing rather rapidly in width, ninth and tenth strongly transverse, equal, a little longer than the third, together scarcely as long as the eleventh, which is ovoidal and pointed. *Prothorax* widest at one-third its length from the apex, where it is very slightly narrower than long; sides thence very strongly convergent and broadly sinuate to the apex which is slightly produced, truncate at tip and less than one-third as wide as the disk; sides in the posterior two-thirds rather rapidly convergent to the base and very feebly arcuate; apical angles obtuse, rather narrowly rounded and somewhat prominent; basal rather broadly rounded; disk feebly convex, feebly and broadly ridged along the middle especially in the basal half where it is broadly and feebly bimpressed. *Elytra* at base distinctly wider than the pronotum; sides very feebly divergent, feebly arcuate; together broadly, angularly and feebly emarginate behind; disk quadrate, subdepressed, very slightly longer than the pronotum, coarsely and very closely granulate; on each elytron there is a very feeble impression extending from the scutellum slightly obliquely and near the suture nearly to the apex. Scutellum very indistinct, small, rounded. *Abdomen* at base as wide as the elytra, and, at the apex of the first segment, slightly wider; sides gradually convergent and slightly arcuate to the apex; border strongly inclined and very distinct; surface moderately convex, coarsely and densely ruguloso-granulate. Under surface of the head coarsely and closely punctate; punctures round, variolate and almost in contact; under surface of the abdomen shining, rather finely punctate; punctures asperate and arranged in wavy, interrupted, transverse rows. Length 1.7-2.0 mm.

Texas; (Galveston 2).

The sculpture of the pronotum consists of a very minute reticulation of coarse strongly elevated lines.

The sexual characters are very feeble: the type is a male and has the apex of the sixth segment broadly truncate or excessively feebly sinuate throughout; in the female the sixth segment is longer and extremely feebly angulate throughout its width at apex. The male is much smaller than the female.

The two representatives of this very interesting species were found in detritus and rubbish on the inner side of the sand dunes lining the ocean beach. It is the smallest *Pæderide* described from the United States.

SCOPÆUS.

The genus *Scopæus* of Erichson was distinguished from the other *Pæderoid* genera by a remarkable character relat-

ing to the ligula, which organ is here, in opposition to the general rule, tricuspid at the apex. Many representatives having the tricuspid ligula are found in America, and as they are all small and generally possess some of the characteristics of *Scopæus*, such as the narrow neck, they have been assigned to that genus without due consideration. Upon examination these various forms are found to differ considerably in structure, so much so in fact that the desirability and propriety of generically separating them can no longer be doubted; several of the more markedly distinct groups have already been noticed. Diagnoses of the genera which inhabit the United States, may be stated as follows:—

Posterior angle of prosternum prominent, the lower edge of the intercoxal lamina being reëntrant or inwardly arcuate at and near its vertex and not longitudinally continuous in curvature with the prosternum. Anterior angles of prothorax very broadly rounded or obsolete.

Posterior under side-pieces of pronotum well developed. Surface punctate or alutaceous *Scopæus*.

Posterior under side-pieces rudimentary. Surface polished and nearly impunctate throughout..... *Scopæodera*.

Posterior angle of prosternum not prominent, the lower edge of the intercoxal lamina being outwardly arcuate at and near the angle and longitudinally continuous in curvature with the prosternum. Anterior angles of the prothorax more or less prominent. Posterior under side-pieces of the pronotum rather well developed.

Neck very slender; integuments excessively minutely punctate, alutaceous,..... *Leptorus*.

Neck broader; integuments coarsely punctate, polished..... *Orus*.

The generic characters of *Scopæus* have been taken from a typical representative of *S. levigatus* Gyll., for which I am indebted to M. A. Sallé.

SCOPÆUS Erichs.

Several American species are assignable to this genus, among others *opacus* Lec. The following species of the Pacific Coast may also be placed here at present.

S. rotundiceps n. sp.—Rather slender, black; legs castaneous, paler toward tip; antennæ and palpi rufo-fuscous, the former paler and flavate at the apex; pubescence fine, short, very dense, more sparse on the pronotum, most conspic-

nous on the head; integuments shining. *Head* distinctly longer than wide, semicircularly rounded behind from points slightly behind the eyes; sides parallel and nearly straight; surface rather strongly convex, very minutely and densely punctate; punctures much feebler and sparser along the middle; antennæ slightly shorter than the head and prothorax together; first joint but very slightly longer than the second and third together, the latter subequal in length, the second joint somewhat more robust, joints three to ten decreasing rather rapidly in length, the former distinctly longer than wide, the latter slightly wider than long. *Prothorax* distinctly narrower than the head, two-fifths longer than wide, widest in the middle; sides in the anterior third rather strongly convergent and very feebly sinuate to the nuchal emargination which is narrow and deeply sinuate; sides in the posterior two-thirds rather feebly convergent and broadly arcuate throughout; anterior angles extremely obtuse and broadly rounded, almost obsolete; posterior broadly rounded; base extremely feebly arcuate; disk transversely and moderately convex, very minutely and not very densely punctate; punctures subasperate, evenly distributed; a narrow line along the middle impunctate; at the base there is a very fine median carina. *Elytra* at base nearly one-third wider than the prothorax; sides nearly parallel, feebly arcuate posteriorly; together broadly, angularly and extremely feebly emarginate behind; disk feebly convex, slightly longer than wide, distinctly longer than the pronotum, feebly impressed on the suture toward base, rather coarsely and densely punctate toward the suture and base, excessively minutely and slightly more sparsely so exteriorly and apically; suture finely margined with a narrow elevated border which is depressed and much narrower at the scutellum. *Abdomen* at base slightly narrower than the elytra; sides very feebly divergent and nearly straight to the apex of the fourth segment; fifth as long as the two preceding together; surface broadly and feebly convex, extremely minutely and densely punctate. *Legs* finely punctate, rather stout and robust; first joint of the posterior tarsi one-third longer than the second, slightly shorter than the fifth. Length 3.3 mm.

California; (Mt. Diablo, Contra Costa Co. 2).

The specimens are both females:⁶ the sixth segment is broadly angulate behind, the apex scarcely at all rounded, the sides of the angle being broadly and very feebly arcuate. The species is easily distinguished by its narrow head semicircularly rounded behind.

⁶.—In a male since obtained at Reno, Nevada, the fifth segment is deeply and roundly emarginate at apex, the lateral angles being slightly produced; the surface has a deep oval impression, becoming extinct near the base; the sixth segment is deeply sinuate at apex, the sinus fully twice as wide as deep, with the edges slightly reflexed; the surface impressed.

S. truncaticeps n. sp.—Slender; sides nearly parallel; black, posterior margins of the four basal abdominal segments paler; legs castaneous, paler toward tip; palpi and antennæ reddish-brown throughout; pubescence very fine, short, rather dense, pale fulvous in color, more conspicuous on the pronotum toward the apex; integuments shining. *Head* robust, rather depressed, very slightly longer than wide; sides parallel, feebly arcuate behind the eyes; base truncate and very feebly arcuate; angles rather broadly rounded; surface rather feebly convex, broadly impressed between the antennæ, very finely and densely punctate, the punctures deep and much sparser in the middle anteriorly, slightly sparser posteriorly; antennæ slightly shorter than the head and prothorax together; basal joint distinctly longer than the next two combined, second slightly more robust and a little shorter than the third, the latter much longer than the fourth, joints four to ten decreasing gradually in length, the latter slightly longer than wide. *Prothorax* distinctly narrower than the head, widest slightly in advance of the middle, but slightly more than one-third longer than wide; sides in the anterior third strongly convergent and distinctly sinuate to the nuchal emargination which is broadly and feebly sinuate, in the posterior two-thirds moderately convergent and distinctly areolate to the base which is narrowly truncate in the middle; angles rather broadly rounded; apical angles very obtuse and very broadly rounded; disk very broadly and feebly convex, minutely and not very densely punctate, with a narrow impunctate median line, having also a very short median basal carina extending thence as a very fine, nearly obsolete stria nearly to the middle. *Elytra* at base one-fifth wider than the prothorax; sides nearly parallel and straight; together almost transversely truncate behind; disk rather feebly convex, impressed on the suture toward the scutellum, finely, evenly and not very densely punctate; punctures slightly finer exteriorly and apically; suture finely margined, margin very gradually finer toward base. *Abdomen* at base slightly narrower than the elytra; sides very feebly divergent and nearly straight; surface rather feebly convex, very minutely and densely punctate; basal segments transversely impressed at base, with the impressed areas much more coarsely and densely punctate; fifth segment much shorter than the two preceding together. *Legs* rather short and slender; first joint of the posterior tarsi scarcely one-fourth longer than the second, much shorter than the fifth. Length 4.0 mm.

California; (Anderson Val., Mendocino Co. 1).

Described from the female in which the sixth segment is broadly angulate, with the apex of the angulation scarcely at all rounded; sides forming the angle broadly and feebly incurvate.

This fine species is readily distinguished from the preceding by its form, size and sexual characters.

All the species of this genus which I have examined have the bases of the first three or four dorsal segments of the abdomen transversely impressed and densely and coarsely punctate. In the Orus group the impressions are simply finely reticulated or alutaceous and are entirely devoid of punctures.

S. brunripes Lec.—(Tr. Am. Ent. Soc. VIII, p. 179).—This form is described as having “pale brown legs.” I have thus far seen no such species in California, the legs of all the Californian species here described being very dark.

SCOPÆODERA n. gen.

The species composing this genus have a distinctly Stilioid outline and do not resemble Scopæus in outward form. In addition to the characters given before, we may mention the much longer legs and longer and more slender tarsi. Besides *nitidus* Lec. this genus will perhaps comprise several allied species described from South America by Dr. Sharp, and also those Central American species placed by this author in Scopæus under group 4, together with the Colombian *S. pulchellus* Erichs.

LEPTORUS n. gen.

The species assignable to this genus have a peculiar appearance and differ considerably from Scopæus. They are elongate, very slender, parallel, with oblong prothorax having the anterior angles more or less prominent, and the sides parallel or slightly convergent behind and nearly straight.

The genus is widely extended in its distribution throughout the eastern portion of the United States, extending through Mexico to Central America where it is represented by *fulum*, *concolor*, *Salvini*, *obscurus*, *piceolus*, *brevipennis*, and *umbra*, recently described by Dr. Sharp in the *Biologia Centrali-Americana*. It will also include *exiguus* Er. and

picipes Cas. On the west coast it is replaced by *Orus*, having a much wider neck and a distinctly different system of punctuation; this appears to extend down the western slope of the continent, also to Central America, where it is represented by a species recently described by Dr. Sharp from Guatemala.

Leptorus is probably a large genus, and the several forms, which are often closely allied, should be described with great care and constant attention to details if they are to be even approximately identified by future reviewers.

In addition to the characters pointed out in the preceding table, it should be stated that the eyes are situated just before the middle, on the sides of the head; they are strongly, longitudinally oval, very coarsely granulated, and have on their upper edge in the middle a large, rather shallow, spongiose fovea bearing a single very long seta.

In *Orus* the eyes are larger, less coarsely granulated, more broadly oval, and have near the upper border, and in a transverse line with the posterior margin, a small, deep, setigerous puncture which is entirely nude. The puncture in this case, though very near the eye, is entirely disengaged from it, while in *Leptorus* the fovea, which is of an entirely different structure, intrudes slightly upon the continuity of the edge.

***L. texanus* n. sp.**—Slender; sides parallel; moderately depressed; pale rufo-testaceous, elytra clouded with piceous toward base; abdomen piceous, very slightly paler toward tip; antennæ testaceous throughout; legs palflavate; pubescence excessively fine and short, dense except on the pronotum where it is sparse; integuments alutaceous, except the pronotum which is polished. *Head* slightly longer than wide; sides parallel, very feebly arcuate behind the eyes; base transversely truncate; angles narrowly rounded; surface transversely and rather strongly convex, excessively minutely and densely punctate; punctures impressed, deep, slightly sparser along the middle; eyes rather prominent, at twice their length from the base; antennæ slightly shorter than the head and prothorax together, basal joint slightly longer than the next two combined, second slightly longer and more robust than the third, joints four to ten decreasing distinctly in length, the former

slightly longer than wide, the latter a little wider than long. *Prothorax* very slightly narrower than the head, one-third longer than wide, widest at one-fourth the length from the apex; sides thence extremely feebly convergent and nearly straight to the base, and very rapidly so and very feebly sinuate to the apex which is very narrow; anterior angles obtuse, slightly rounded; posterior rather broadly rounded; base broadly and very feebly arcuate; disk transversely and feebly convex, excessively minutely punctate; punctures about one-half as wide and more than twice as distant as those of the head, slightly more sparse in the middle, where there is a narrow impunctate line, and toward base a very fine, feeble and obsolete median stria. *Elytra* slightly wider than the prothorax; sides nearly parallel, feebly arcuate posteriorly; together broadly, angularly and very feebly emarginate behind; disk one-fourth longer than wide, slightly longer than the pronotum, very feebly impressed on the suture toward the base, extremely finely and rather feebly punctate; punctures evenly distributed, scarcely as sparse as those of the pronotum, distinctly asperate; suture finely margined with an elevated line which is much finer near the scutellum. *Abdomen* at base slightly narrower than the elytra and slightly narrower than at the apex of the fourth segment, rather strongly convex, excessively finely, densely and subasperately punctate; first four segments equal in length, the fifth one-half longer. *Legs* rather short and robust; joints of the posterior tarsi decreasing very gradually and uniformly in length, first slightly longer than the second and shorter than the fifth. Length 2.5 mm.

Texas; (El Paso 2).

The type is a male, the sixth ventral segment being narrowly and deeply emarginate; emargination very small, distinctly deeper than wide, sides nearly parallel and straight, bottom broadly rounded. In the female the sixth segment is broadly and feebly angulate, the apex being broadly rounded.

L. bicolor n. sp.—Slender; sides parallel; moderately convex; pale rufo-testaceous, four basal segments of abdomen piceous-black, last two slightly paler; elytra clouded with piceous at base near the scutellum; antennae throughout and legs pale rufo-testaceous, the latter slightly more flavate; pubescence extremely short and fine, rather dense on the elytra and abdomen. *Head* slightly longer than wide; sides behind the eyes parallel and very feebly arcuate; base truncate; angles narrowly rounded; eyes moderate, slightly prominent, on the sides just before the middle; front transversely and evenly convex, minutely reticulate, extremely minutely and rather densely punctate; punctures more dense toward the eyes, less dense along the middle; antennae one-half longer than the head, second joint slightly longer and more robust than the third, joints two to five longer than wide, six to ten shorter,

equal in length, the latter slightly transverse. *Prothorax* widest at one-fourth its length from the apex, where it is scarcely as wide as the head, one-fourth longer than wide; anterior angles very narrowly rounded, decidedly prominent; sides thence strongly convergent and feebly sinuate to the neck, which is not excessively narrow, and distinctly convergent and very feebly arcuate to the base which is transversely truncate in the middle, two-thirds as wide as the disk; angles somewhat narrowly rounded; disk transversely and feebly convex, very minutely reticulate or subrugulose; excessively, minutely punctate; punctures finer and more sparse than those of the head, with a very narrow indistinct median impunctate line, and, toward base a very feeble median carina which is finely striate along its crest. *Elytra* at base very slightly wider than the pronotum; sides nearly parallel, feebly arcuate; together very feebly and broadly emarginate behind; disk distinctly longer than wide, one-fifth longer than the prothorax; feebly convex, broadly and feebly impressed along the suture, extremely minutely, evenly and rather densely punctate. *Abdomen* very slightly narrower toward base, feebly convex, very minutely and densely punctate. Anterior femora nearly twice as robust as the intermediate, abruptly and deeply sinuate on the inner edge near the apex; tarsi very feebly dilated, finely and densely pubescent beneath. Length 2.3 mm.

Texas; (Austin 5).

The anterior tibiae of the male exhibit very striking characters; they are distinctly dilated and have along the flattened interior face six parallel, oblique rows of short, inclined setae, the rows becoming shorter toward the apex. The four posterior femora are distinctly compressed and arcuately bent. The male has the sixth segment broadly sinuate at apex, the sinus being four or five times as wide as deep and rather narrowly rounded, the sides being very gradually recurved; from beneath the sinuation, and apparently attached to the seventh segment, there protrudes a robust ligala, slightly longer than wide, strongly convex on its lower face, abruptly constricted at base, squarely truncate at apex, with the angles not rounded; the upper face is broadly concave, serving as a rest and guide for the male generative organ; the latter in the present species is very complex, being cylindrical, with two unequal lateral processes, angulate on the right and broadly rounded on the left.

The peculiarity of the anterior tibiæ is apparently generic, or at least affects a large number of species.

L. versicolor n. sp.—Very slender; sides parallel; colors and pubescence as in *bicolor*, except that the abdomen is dark fuscous and slightly paler at apex. *Head* rather large; distinctly longer than wide; sides behind the eyes feebly but distinctly divergent and feebly arcuate to the base which is broadly and distinctly sinuate; angles rather prominent and narrowly rounded; front broadly and feebly convex, not reticulate, shining, very minutely, evenly and rather densely punctate; punctures separated by two or three times their own diameter; antennæ one-half longer than the head, second joint much longer and more robust than the third, fifth very slightly longer than wide, tenth very slightly wider than long. *Prothorax* widest at one-fourth its length from the apex, distinctly narrower than the head; anterior angles narrowly rounded, prominent; sides thence strongly convergent and distinctly sinuate to the neck which is very slender, and distinctly convergent and nearly straight to the base which is transversely truncate and three-fourths as wide as the disk; angles somewhat narrowly rounded; disk one-third longer than wide, feebly convex, very minutely, evenly punctate, scarcely visibly subrugulose; punctures scarcely perceptibly more sparsely distributed than those of the head; median stria toward base nearly obliterated. *Elytra* at base scarcely perceptibly wider than the prothorax; sides distinctly divergent and very feebly arcuate; disk very feebly convex, very feebly impressed along the suture toward base, minutely and feebly subrugulose, finely, evenly, rather densely and subsparsely punctate; slightly longer than wide and just visibly longer than the pronotum. *Abdomen* nearly as in *bicolor*, slightly more sparsely punctate. Length 2.1–2.5 mm.

Texas; (Austin and Waco).

The sixth segment in the male is broadly sinuate at apex, the sinus being slightly less than four times as wide as deep, rather acutely rounded; ligula long and narrow, perfectly flat, gradually wider toward the apex which is broadly and extremely feebly sinuate, angles rounded.

The anterior femora and tibiæ are as in *bicolor*, but the former are not so robust as in that species. The form of the head and the sexual characters will serve to distinguish this species from the preceding, to which it is otherwise closely allied.

L. longiceps n. sp.—Very slender, rather convex; sides parallel; head and elytra pale brownish-testaceous; prothorax paler, more flavate; abdomen dark fuscous, scarcely paler at apex; antennæ and legs throughout pale rufo-

testaceous; pubescence fine and dense throughout, longer on the head, less conspicuous on the pronotum. *Head* much longer than wide; sides parallel and distinctly arcuate; base transversely truncate; angles not prominent though rather narrowly rounded; front transversely, rather strongly convex, extremely minutely, feebly, evenly and not densely punctate; eyes at much more than twice their length from the base; antennæ short, scarcely longer than the head, rather robust, second joint very slightly longer than wide, slightly longer and much more robust than the third, tenth rather strongly transverse. *Prothorax* very slightly narrower than the head, widest at one-third its length from the apex; anterior angles very broadly rounded; sides almost parallel and distinctly arcuate; base transversely truncate, angles rather broadly rounded; disk nearly one-third longer than wide, moderately and evenly, cylindrically convex, very minutely, evenly and rather densely punctate; punctures appreciably closer than those of the head; throughout the basal three-fifths there is a fine, well-marked, median stria. *Elytra* at base distinctly wider than the prothorax and fully as wide as the head; sides parallel and very feebly arcuate; together distinctly longer than wide and just visibly longer than the pronotum; surface rather feebly convex, rather narrowly and feebly impressed along the suture toward base, very minutely, evenly and densely punctate; punctures slightly coarser and just appreciably more dense than those of the pronotum. *Abdomen* very slightly narrowed toward base, excessively minutely, feebly and rather densely punctate. Femora and tibiæ as in *bicolor*. Length 1.9 mm.

Texas; (Austin 1).

This species is aberrant not only in the more broadly rounded apical angles of the prothorax, the elongate head and shorter antennæ, but in the smaller eyes, more compressed and truncate third maxillary palpal joint, and especially in the position of the spongiose setigerous fovea, which is not at the middle of the upper margin of the eye as in the other species, but behind the eye one-half the length of the latter, and in a line with its upper margin. The neck also is relatively much less slender than in the other species. With exception of *Leptogenius brevicornis* it is the smallest Pæderide described from our territories. Unfortunately there is before me but a single representative, a female, so that the sexual characters of the male cannot be given; the form is very distinct, however, and will be easily recognizable.

The Central American species described by Dr. Sharp,

alluded to above, are apparently all distinct from those here brought to notice. *Filum* differs in the coloration of the antennæ and in the sexual characters; *concolor* decidedly in coloration of the entire body; the œdeagus, however, is apparently similar to that of *bicolor*; *Salvini* appears to be closely allied to *versicolor*, but as no ligula is described in alluding to the male sexual characters,⁷ and as the elytra appear from the figure to be longer and broader, and the apical angles of the prothorax much less pronounced, the two species are probably distinct, more especially in consideration of the very different faunal regions involved. *Obscurus* and *piccolus* are very distinct in color; *brevipennis* and *umbra* differ altogether in structure. *Exiguus* Er. differs radically in coloration.

Color appears to be a very constant character, as it is practically the same throughout large series of several species which I have before me.

ORUS Cas.

This genus, and the closely related *Leptorus*, constitute a group differing remarkably from *Scopæus* and *Scopæodera* in the structure of the intercoxal portion of the prosternum. In *Orus* the posterior edge of the prosternum is more swollen than in *Leptorus*, and the median portion is, posteriorly, elevated into a longitudinal ridge which becomes the lower edge of the intercoxal lamina. *O. punctatus* Cas. and the species here described are the only known representatives of this genus in the United States.⁵

⁷.—The ligula is present in all the species of this genus, but, probably only before copulation, is securely held within the long angular cleft of the seventh segment, and is only pushed down and out of the cleft, so as to be plainly visible, after sexual connection has occurred.

⁸.—By a very regrettable error it was stated by me (Bull. Cal. Acad. Sci. I, p. 315) that the ligula in *Orus* is bicuspid. One of the very minute teeth was in all probability hidden under a particle of dust, as the appearance in the specimen examined was undoubtedly that of a bicuspid ligula;

O. parallelus n. sp.—Narrow, rather depressed; sides parallel; piceous-black throughout; legs rufo-piceous; tarsi and antennæ throughout paler, rufo-fuscous; pubescence fine, rather sparse on the pronotum and elytra, denser and more conspicuous on the head and abdomen; integuments polished, head subalutaceous. *Head* very slightly longer than wide; sides distinctly convergent anteriorly from the base, distinctly arcuate behind the eyes; base broadly and extremely feebly arcuate: angles broadly rounded; surface broadly and feebly convex, very feebly impressed in the middle anteriorly, very minutely and densely punctate, also extremely finely and rather feebly subrugulose; punctures not sparser but rather coarser along the middle; antennæ slightly shorter than the head and prothorax together; basal joint slightly longer than the next two together, joints two to four subequal in length, slightly elongate, fifth very slightly shorter, joints five to ten decreasing rapidly in length, the former distinctly longer than wide, the latter very slightly wider than long. *Prothorax* very slightly narrower than the head, oblong; sides extremely feebly convergent from apex to base and nearly straight; anterior angles obtuse and broadly rounded; sides thence very strongly convergent to the nuchal emargination which is two-fifths as wide as the disk and feebly incurvate; basal angles broadly rounded; disk transversely and feebly convex, two-fifths longer than wide, rather finely, feebly and densely punctate; very narrow median area impunctate throughout the length. *Elytra* at base slightly wider than the pronotum; sides very feebly divergent, feebly arcuate toward the apex; together broadly, angularly and very feebly emarginate behind; disk slightly longer than wide and slightly longer than the pronotum, feebly convex, broadly and feebly impressed on the suture, more particularly near the base, finely, rather densely, evenly and subasperately punctate; suture finely margined with an elevated border which becomes rather abruptly less than one-half as wide near the scutellum, where also it is not so strongly elevated. *Abdomen* at base slightly narrower than the elytra; sides very feebly divergent posteriorly; surface broadly convex, extremely minutely and densely

subsequent observation, however, of cleaner and more perfect specimens, reveals the fact that the ligula is tricuspid, hence the statements made upon the apparent relationship of the genus with *Lithocharis* (l. c. II, p. 36), which were based primarily upon the assumption of a bidentate ligula must be considered ill-founded. The wide departure of the genus from *Scopæus* in general form, but particularly in the relatively wide neck and prosternal structure, is very convincing proof that the time has come for a division of the Scopæoid species into distinct generic groups, and also points strongly to the advisability of a division of the Pæderini into two sections depending upon the formation of the ligula.

Although Dr. Sharp has, in the *Biologia Centrali-Americana*, correctly placed the genus near *Scopæus* since the above was originally written, I still deem it proper to publish the rectification in the same work in which the error was committed.

punctate; fifth segment two-thirds longer than the fourth. *Legs* rather short; posterior tarsi short, first and second joints equal in length, slightly longer than wide, much shorter than the fifth; tibiæ obliquely truncate and finely fimbriate at tip. Length 3.3 mm.

California; (Napa and Sonoma Cos. 4).

The specimens are all females, the sixth segment being broadly rounded behind. The present species is remarkable for its long parallel prothorax, which is scarcely at all produced in front of the apical angles. It may be distinguished from *punctatus* by its slightly larger size and much finer and denser pronotal punctuation.

The oblique apical truncation of the hind tibiæ appears to characterize a large number of genera; the truncation is slightly excavated and bordered exteriorly by an erect line of long, slender, closely-placed setæ.

The tabular statement of our Pæderini given in this Bulletin (Vol. II., p. 38), requires modification since the publication of the Central American genera by Dr. Sharp in the *Biologia Centrali-Americana*, and as the assumption upon which the positions of one or two genera are assigned has been found to be erroneous, the following table is offered as a substitute until the entire group can be revised. This scheme would be much more useful if it could have included all the American genera, but as in the present state of literature there would be considerable doubt regarding the position of several, I have thought best to restrict it for the present to the genera occurring north of Mexico.

I—*Ligula not tricuspis*, usually bilobed.

Prosternum membranous under and behind the coxæ.

PÆDERI.

A—Fourth tarsal joint normal, not bilobed.

Antennæ anteriorly geniculate, first joint greatly elongate.

Neck broad; abdomen carinate at base **Hesperobium.**

Neck narrow; abdomen not carinate **Ababactus.**

Antennæ posteriorly geniculate, basal joint moderate in length.

First joint of the posterior tarsi not longer than the second.

The sequence of genera in the above tabular statement is, it must be confessed, unnatural in approximating *Stilicus* and *Pæderus*, these being undoubtedly widely divergent forms. It merely serves to show, however, that it is impossible to present in a linear arrangement, groups composed of elements which are divergent from one or more central types, and which can only be represented graphically by the diagrams adopted in chemical science to exhibit the structure of a compound molecule, the various affinities being shown by connecting lines.

If a linear arrangement be pursued, based upon the modification of any special organ or part of the body, similar breaks must inevitably occur. Assuming, as above, that the structure of the prosternum is of more importance than that of the tarsi, the latter being in turn of greater moment than that of the labrum or mandibles, we should isolate *Pæderus* as a group intermediate between the *Lathrobii* and the *Sunii*, and it would not be consistent to separate them by the the latter group, although it may include forms which in a radial arrangement would be brought very near certain types of the *Lathrobii*. Such for instance are *Stilicus* and *Echiaster*, in distinguishing between which the prosternal character loses some of the importance which it is supposed to possess, unless we regard the similarity of habitus as a mere coincidence. The latter I have assumed in the case of *Stilicus* and *Scopæus*.

NOTES.

AEABACTUS Sharp. — This genus is represented in our fauna by *A. nactus* Horn. and *A. pallidiceps* Cas.

TRACHYSECTUS Cas.—Represented by *T. confluentis* Say.

CALODERMA Cas.—Recent investigation shows this genus to be similar in prosternal structure to *Medon*, from which it is distinguished by several important characters. The labrum is short, small, conical, very feebly explanate near

the sides, triemarginate, the notches being similar in shape, deep, the middle about twice as large as the lateral; laterally the apex is broadly sinuate, thus giving four small, acute, prominent denticles. In *Medon*, as represented by *M. fuscus* Mann., the labrum is much larger, nearly flat, broadly explanate at the sides, not at all sinuate laterally at the apex, so that it is at most bidentate.

In comparing the European *Medon*, as for instance *brunneus* Er., with many of the American genera, there is one feature relating to the metasternum which appears to have been generally overlooked, and which is indicated on the upper surface by the length of the clytra. The metasternum in the European genus is remarkably short, strongly convex, and much shorter than the intermediate coxæ. This appears to be a rather important character in the present comparison, and distinguishes *Caloderma* at once, for in this genus the metasternum is unusually well developed, and is more than one-half longer than the coxæ, which in turn are relatively distinctly smaller than in *Medon*.

The species having a rugulose pronotum are the most highly developed forms of the genus, and should be considered typical, although much less numerous in species than the form with punctate pronotum.

OLIGOPTERUS Cas.—Allied to *Medon* in prosternal and metasternal structure. It differs from *Medon* in the structure of the labrum, which is here distinctly 4-dentate, and from the more typical forms of that genus in the very widely distant gular sutures, rapidly divergent toward base, in this respect being more closely allied to *Pseudomedon* Rey. It differs from *Caloderma* in its very short metasternum.

MEDON Steph.—This genus as represented in our fauna will consist for the present of the two groups of species previously placed by me in *Lithocharis*. There is another group of nondescript species, occurring in the Southern

States, which may also be considered as *Medon* until future investigation can be made with more ample material. These three groups will then probably give rise to four allied genera, or perhaps more properly, subgenera.

LITHOCHARIS Lacord.—Represented in our fauna by *ochracea* Grav., *alutacea* Cas., and *quadricollis* Cas. The last two differ from the first in sexual characters—although they have the characteristic comb-like sculpture at the apex of the fifth segment—and in the smaller, more acute and prominent labral tooth.

METAXYODONTA Cas.=**LITHOCHARIS** Lacord.

LIPAROCEPHALUS Mann.—No description of the anterior tarsi is given, and the position of the genus is assumed.

ADEROCHARIS Sharp.—Represented by *A. corticina* Grav., and possibly also by *tabacina* Cas.

ECHIASTER Er.—No species of this genus has yet occurred within the United States, and it is therefore omitted from the table.

SCIOCHARIS Arrib.—Although Dr. Sharp intimates that this genus may occur within our limits, I have not yet seen it. It may be easily recognized by the very robust first and second joints of the antennæ. The labrum is bidentate and the integuments are generally very finely and densely punctate.

APOCELLUS Erichs.

A. niger n. sp.—Moderately robust, convex; upper surface intense black throughout, except the elytral suture which is dark piceo-testaceous; metasternum, abdomen and head beneath black; prosternum and side-pieces paler, piceo-testaceous; antennæ same toward base, black toward tip; legs pale luteo-testaceous, femora shaded piceous in the outer half; pubescence extremely sparse; integuments highly polished. *Head* distinctly longer than wide; sides behind the eyes distinctly convergent and rather strongly arcuate; base truncate and very feebly incurvate in the middle; angles very broadly rounded, coarctate with the sides; eyes small, in the middle, rather prominent; on a transverse line slightly less than their own length behind them,

there are two small, widely distant, deeply impressed occipital foveæ; antennal tuberculations slightly convergent posteriorly; epistoma distinct, declivous, wider than long, very feebly arcuate at apex; labrum short, broad, rather strongly and evenly emarginate throughout its width; antennæ slightly longer than the head and prothorax together, rather strongly incrassate; second joint much shorter than the third, longer than the fourth, tenth very slightly wider than long. *Prothorax* widest at one-third its length from the apex, where it is slightly wider than long and as wide as the head across the eyes; sides thence very strongly convergent to the apex which is squarely truncate and about one-half as wide as the disk, and rather feebly though distinctly convergent, evenly and distinctly arcuate to the base; the latter broadly and extremely feebly arcuate, two-thirds as wide as the disk; angles very obtuse and rather broadly rounded; sides at the apical third rather broadly rounded; disk strongly convex, with a few very widely scattered setigerous punctures. *Elytra* at base slightly wider than the prothorax; sides rather strongly divergent, distinctly arcuate toward the apices; together transversely truncate behind; disk rather depressed, abruptly strongly declivous at the sides, slightly wider than long, nearly one-fourth longer than the pronotum; suture narrowly and strongly margined with an elevated line; surface having a few very small, widely scattered, setigerous punctures having a tendency to lineal arrangement. *Abdomen* at base very slightly narrower than the elytra; sides parallel and nearly straight; border very thin, erect and deep, nearly equal on the five basal segments; surface very finely and sparsely pubescent and punctate toward the sides, almost impunctate in the middle. *Legs* moderate in length; femora robust; third joint of the posterior tarsi less than twice as long as the first and second together. Length 2.8-3.3 mm.

Texas; (Galveston 5).

The description is taken from the male, the sexual characters of which are of the usual form in this section of the genus; the double, posteriorly excavated emargination of the sixth segment is scarcely more than one-third the width of the segment, and the arched laminae of the seventh nearly meet over the broadly rounded excavation; eighth segment broadly impressed. It is a very distinct species and belongs immediately after *crassicornis* in the list of the genus as published by me (Cont. II, p. 153). The order of the species has been changed in the recently published check-list of Mr. S. Henshaw, so that the least characteristic forms of the genus there head the list, while the species upon which Erichson founded the genus appear last. My only commentary is a passing allusion; I cannot refrain, however, from

expressing the opinion that the reversal was unnecessary, and that the order proposed is far less scientific than that published in the revision above referred to.

Apocellus brevipennis Cas.—Five specimens of this species were recently taken, also at Galveston, Texas: it was originally described from a single specimen from Louisiana.

PHLEOPTERUS Mots.

P. filicornis n. sp.—Rather robust, depressed, black throughout; trochanters slightly paler, dark rufous; legs piceous-black; tibiæ much paler and rufous toward tip; tarsi rufous; palpi fuscous; antennæ black throughout; pubescence rather long, very dense, subrecumbent and conspicuous, fusco-cinereous in color; legs densely pubescent; tibiæ abruptly nearly glabrous in the apical fifth or sixth; tarsi glabrous, joints finely spinulose at the apices; shining. *Head* as long as wide, depressed, transversely and rather strongly impressed between the antennæ, deeply and widely biimpressed between the eyes; surface finely and rather densely punctate; ocelli very minute, round, distant, on a line slightly in advance of the posterior margins of the eyes; the latter very prominent; fourth joint of the maxillary palpi slightly more than twice as long as the third, the latter not three times as long as wide; antennæ very long, slender and filiform, not in the least incrassate, two-thirds as long as the body; second joint much shorter than the third, joints three to ten subequal in length, much elongated, eleventh slightly longer, fusiform. *Prothorax* widest slightly before the middle; sides thence very feebly convergent, feebly and evenly arcuate to the obtuse and rather broadly rounded anterior angles and somewhat strongly convergent, rather strongly and evenly incurvate throughout to the basal angles, which are nearly right and not at all rounded; base broadly and extremely feebly arcuate throughout, three-fourths as wide as the disk and distinctly narrower than the apex; the latter transversely truncate, feebly excurvate toward the apical angles; disk scarcely one-third wider than long, transversely, rather strongly and perfectly evenly convex; having at the middle of each side, a very deep punctiform impression; flanks thence to the basal angles very abruptly and strongly declivous; surface very finely, evenly and densely punctate; punctures perforate. *Elytra* at base slightly wider than the pronotum; sides moderately divergent; humeral and apical angles very broadly rounded; together broadly arcuate behind with the inner angles abruptly and rather strongly rounded; disk nearly one-third longer than wide, slightly more than twice as long as the pronotum, broadly and feebly convex, rather coarsely, very evenly and densely punctate; punctures impressed, slightly more distant than those of the pronotum. *Abdomen* very short behind the elytra, much wider than long, subalutaceous, very minutely, evenly and rather closely punctate. *Legs* rather slender; first joint of the posterior

tarsi slightly longer than the next two together; anterior tarsi distinctly dilated. Under surface of the abdomen minutely, densely and evenly punctate. Length 5.0 mm.

California; (Placer Co. 1). Mr. Fuchs.

The mesosternum is minutely and strongly rugulose and alutaceous toward the middle, finely and imperfectly carinate posteriorly, more strongly so anteriorly, terminating near the anterior margin in a small, abrupt, acute tubercle. The abrupt loss of the dense pubescence at the tips of the tibiae is very remarkable.

This species is rather smaller and much more densely punctate than *longipalpus*, and has a much less transverse prothorax.

AMPHICHROUM Kraatz.

A. flavicorne n. sp.—Moderately robust, depressed; pronotum and elytra glabrous; abdomen very sparsely pubescent laterally; male black, with the lateral edges of the pronotum and elytra testaceous; female having the entire disk of the pronotum rufo-testaceous and the elytra luteous, except the suture, which is piceous; antennae pale flavate throughout; legs piceo-testaceous; integuments polished. *Head* scarcely longer than wide, depressed, densely, rather coarsely and deeply punctate in the middle; having a small, punctiform impression at the base of each antenna; obliquely and very deeply bifoveolate between the eyes; antennae moderate in length, less than one-half as long as the body, rather slender; basal joint three-fourths as long as the next two together, second two-thirds as long as the third and about as long as the tenth, joints three to ten decreasing perceptibly in length and increasing in thickness. *Prothorax* two-thirds wider than long, widest in the middle; sides strongly and nearly evenly rounded, slightly more strongly convergent toward the apex, which is broadly and very feebly emarginate and equal in width to the base and to the head; base truncate; apical and basal angles broadly rounded, the former slightly the more narrowly so; disk moderately and evenly convex, more strongly so at the sides, which are narrowly and abruptly explanate, extremely sparsely, rather finely and very unevenly punctate except along the sides and base, where the punctures are much denser. *Elytra* at base very slightly wider than the prothorax; sides very feebly divergent and nearly straight; together truncate behind; humeral and exterior apical angles broadly rounded; disk as long as wide, slightly less than twice as long as the prothorax, depressed, more convex at the sides, narrowly elevated along the suture except near the base, feebly, rather sparsely and unevenly punctate. *Abdomen* as wide and long as the elytra; sides strongly arcuate; surface shining, extremely finely and feebly punctate,

very minutely, feebly and transversely reticulate. *Legs* moderate in length; anterior tarsi feebly dilated. Length 3.5-4.0 mm.

California; (San Francisco 2; Lake Co. 2.) Mr. Fuchs.

The pronotum has a very small impressed fovea in the middle at the base which is sometimes absent and sometimes replaced by a larger and more irregular impression which, however, is not transverse as in *floribundum*.

This species resembles *floribundum* Lec. in several characters, especially in the punctate head and coloration of the body, but differs remarkably in the antennæ, which are of a pale and pure flavate throughout in the former; the antennæ are piceous in *floribundum* except the three basal joints, which are paler.

In all the species of *Amphichroum* here described, there are visible on the first, or sometimes the second, exposed dorsal segment of the abdomen two small, approximate patches of a more or less transversely oval shape, on which the pubescence is excessively short and dense and usually of a pale cinereous or bright fulvous color: they are also to be seen in a similar position, but oblique in direction, on the abdomen of *Homalium algarum* Cas. These pubescent and very minutely rugulose areas, which are probably sensitive, are not sexual, and appear to characterize a large portion of the Homalini.

A. alutaceum n. sp.—Form rather slender, depressed; head and abdomen black; pronotum, elytra, palpi and antennæ toward tip rather pale castaneous; basal margin and sides of the pronotum very narrowly pale flavate; antennæ same toward base; elytral suture dark rufo-testaceous; legs dark brownish-testaceous; pronotum and elytra rather densely pubescent; head and abdomen very sparsely so; integuments shining. *Head* longer than wide; surface depressed, impunctate, coarsely granulose, shining, broadly and distinctly impressed between the antennæ, obliquely, very finely and feebly bistriate between the eyes; ocelli small, approximate, distinct; antennæ scarcely two-fifths as long as the body, slender, slightly incrassate; basal joint very slightly longer than the second; joints two to ten nearly equal in length, the latter one-half longer than wide, eleventh longer, obliquely pointed at tip, cylindrical at base. *Prothorax* widest in the middle, where it is scarcely one-fourth wider than long; sides nearly parallel, feebly arcuate

throughout; apex very slightly narrower than the base, broadly and evenly sinuate; angles rather narrowly rounded; base very feebly arcuate throughout, angles rather broadly rounded; disk broadly, very evenly and rather feebly convex, very narrowly and abruptly explanate at the sides anteriorly, slightly more broadly and less abruptly so posteriorly, extremely finely, evenly and rather closely punctate; punctures slightly asperate; intervals finely subgranulose, subalutaceous. *Elytra* at base very slightly wider than the pronotum; sides rather distinctly but very feebly divergent, very feebly arcuate; humeral angles narrowly, apical broadly, rounded; together truncate behind; disk depressed, broadly impressed in the middle; as long as wide, slightly less than one-half longer than the pronotum, rather coarsely, very evenly, closely and rather strongly punctate; punctures subasperate; intervals polished. *Abdomen* at base as wide as the elytra, at the apex of the third segment nearly one-fourth wider; sides strongly arcuate; border rather broad, feebly inclined; surface depressed; three visible basal segments transversely impressed at base; segments two to four finely, evenly and rather densely punctate; segments one, five and six impunctate; second visible segment with two small, transverse, approximate, minutely rugulose and apparently pubescent patches. *Legs* moderate in length, slender. Under surface piceous-black, with exception of the pronotal and elytral hypomera, which are flavate. Length 3.5 mm.

California; (Marin Co. 1).

This species resembles *veterator* in the general character of its sculpture and pubescence, but differs greatly in general form, and especially in its much less transverse prothorax with but slightly arcuate sides.

A. pilosellum n. sp.—Males slender; females rather robust, depressed; color rather pale reddish-testaceous, nearly similar in the two sexes; head posteriorly, prothorax anteriorly, and elytra broadly and very indefinitely toward the suture and apices, clouded with a slightly darker castaneous tint; abdomen intense black throughout; antennæ fuscous toward tip, basal joints pale testaceous; legs rufo-piceous; pronotum and elytra finely and sparsely pubescent, integuments shining. *Head* very slightly longer than wide, rather depressed, glabrous, finely reticulate or subalutaceous, impunctate, broadly and rather feebly impressed between the antennæ, feebly, finely and obliquely bistrate between the eyes; antennæ rather short, moderately incrassate, less than one-half as long as the body; basal joint but slightly longer than the third, second nearly as long as the first, as long as the fourth, and slightly longer than the tenth, joints four to eight equal in length, eight to ten decreasing, the latter but slightly longer than wide. *Prothorax* widest in the middle, one-half wider than long; sides strongly rounded in the middle, feebly convergent and nearly straight anteriorly and

posteriorly; basal angles broadly rounded; apical more narrowly so; disk evenly and moderately convex, rather broadly and gradually explanate and feebly reflexed at the sides, and especially near the basal angles, very obsoletely impressed along the middle and in front of the scutellum, finely reticulate or subalutaceous, very finely, feebly and rather sparsely and evenly punctate. *Elytra* at base very slightly narrower than the prothorax; sides very feebly divergent, feebly arcuate; disk depressed, very slightly longer than wide, two-thirds longer than the pronotum, rather strongly, coarsely and sparsely punctate; intervals polished; punctures tending to form coarse, transverse rugulae. *Abdomen* as wide as and distinctly longer than the elytra; sides rather feebly convergent posteriorly, on the first four segments feebly arcuate; border depressed, scarcely at all inclined; surface polished, nearly impunctate in the middle, excessively minutely and feebly punctulate toward the sides. *Legs* slender; anterior tarsi very feebly dilated; first joint of the posterior as long as the next three together. Length 2.5-3.6 mm.

California; (Lake Co. 7). Mr. Fuchs.

Described from the male, which is more slender than the female. The species belongs near *puberulum* Fauv., but differs in its longer elytra and much sparser elytral punctuation.

A. veterator n. sp.—Moderately robust, depressed, dark piceous-brown; antennæ toward base, narrow side and basal margins of the pronotum, and under surface of the head and prothorax, pale testaceous; abdomen black throughout; femora piceo-testaceous; tibiæ and tarsi darker, piceous; antennæ infusate toward tip; palpi fuscous; head and pronotum subalutaceous; pronotum and elytra finely and densely pubescent, the latter shining. *Head* rather small, scarcely as wide as long, transversely and feebly impressed between the antennæ, very finely, feebly and obliquely bistriate between the eyes; surface rather coarsely and strongly reticulate or subgranulate, impunctate; ocelli very small, round and distinct; antennæ about one-half as long as the body, moderately slender, all the joints distinctly elongate, joints four to ten almost equal in length, the latter nearly one-half longer than wide, second distinctly shorter than the third, the latter subequal in length to the first. *Prothorax* anteriorly as wide as the head, widest in the middle; sides very slightly more strongly convergent anteriorly than posteriorly, evenly and rather feebly arcuate throughout; apex distinctly narrower than the base, broadly and feebly sinuate; the latter truncate in the middle, broadly arcuate toward the basal angles which are broadly rounded; apical broadly rounded, slightly less so than the basal; disk nearly one-half wider than long, evenly and very moderately convex, rather abruptly and very narrowly explanate at the sides anteriorly, broadly and very gradually explanate and feebly reflexed toward the basal angles, very obsoletely and vaguely impressed before the scutellum, finely and very feebly subgranulate, very minutely, feebly, subas-

perately, evenly and rather closely punctate. *Elytra* at base scarcely as wide as the pronotum; sides very feebly divergent, very feebly arcuate; outer apical angles rather narrowly rounded; together truncate behind; disk depressed, quadrate, two-thirds longer than the pronotum, rather coarsely, very densely, evenly, strongly and subasperately punctate. *Abdomen* as wide as and slightly longer than the elytra; sides convergent and evenly arcuate to the apex; border rather strong, very slightly inclined; surface polished almost impunctate in the middle, finely rather strongly and densely, subasperately punctate laterally. *Legs* rather slender. Under surface finely, evenly and sparsely pubescent; tibiae finely pubescent, sparsely and minutely spinulose. Length 3.0 mm.

California; (Lake Co. 2). Mr. Fuchs.

This species also belongs near *puberulum*, from which it is easily distinguished by its much longer elytra. It bears a very deceptive resemblance to the following species, so that the identification and separation of the two will require some care.

A. crassicorne n. sp.—Moderately robust, depressed, piceous-black; head dark rufous; basal third of the pronotum and the lateral and anterior margins very narrowly pale testaceous; just behind the elytral humeri there is on each side a small, very indefinite paler spot; under surface of the abdomen and metasternum piceous-black; prosternum, head, legs throughout, palpi and antennae toward base, pale brownish-flavate; antennae toward tip piceous; head and pronotum subalutaceous; elytra polished; head glabrous, remainder finely and moderately densely pubescent. *Head* rather small, finely reticulate and subrugulose, transversely impressed between the antennae, finely, deeply and obliquely bistriate between the eyes; ocelli large, flat, not distinctly limited, round; antennae rather strongly incrassate, scarcely one-half as long as the body; joints four to ten decreasing very slightly in length, the latter slightly longer than wide. *Prothorax* scarcely more than one-third wider than long; anterior angles much more narrowly rounded than the posterior; form and sculpture nearly as in *veterator*; punctures slightly coarser and more distinct. *Elytra* at base fully as wide as the pronotum; outer apical angles rather broadly rounded; together quadrate, two-thirds longer than the pronotum, nearly as in *veterator*, except that the punctures are obliterated along the apex. *Abdomen* in form nearly as in *veterator*, punctate throughout; punctures fine, asperate, evenly and rather closely placed, and more distinct toward the sides. *Legs* slender. Length 3.3 mm.

California; (Siskiyou Co. 1). Mr. Behrens.

The fourth joint of the maxillary palpi is nearly circular in cross-sections and convex throughout, while in all the

other species which I have seen the fourth joint is more or less deeply excavate interiorly, nearly throughout its length and is, in addition, strongly bent in *flavicornæ*.

Although the present species bears a remarkably strong resemblance to *veterator* in its sculpture, it may be distinguished by its sparser pubescence, slightly more elongate prothorax, much deeper interocular striæ, but especially by the form of the ocelli, which in this species are fully twice as wide as in *veterator*, and more indefinite in outline; no dependence is placed on color as this is known to vary greatly; it is, however, strikingly different in the representatives of the two species.

A. floribundum Lec.—One specimen which I have referred to this species was collected by Mr. Fuchs in Lake Co. The antennæ are relatively longer and more filiform than in any here described, and are piceous except the first three joints and the bases of some of the succeeding ones.

The relationship of the species here described with those given by Mr. Fauvel (Not. Ent. vii, p. 72), is best shown by the following table, which is merely a continuation of the one given by that author, with a few slight alterations.

Elytra shining, with more or less distinct punctuation.

Pronotum and elytra glabrous.

Pronotum polished.

Elytra with very sparse, nearly obsolete punctuation..... **sparsum.**

Elytra coarsely and generally distinctly punctate.

Head distinctly and densely punctate; elytra black or maculate with testaceous, with the suture blackish or brownish.

Antennæ piceous, three basal joints paler..... **floribundum.**

Antennæ clear flavate throughout.... **flavicornæ.**

Head impunctate.

Head shining, with two oblique striæ between the eyes. . **scutatum.**

Head dull, granulose, strongly bifoveolate between the eyes.

lævicolle.

Head and pronotum alutaceous, size large..... **testaceum.**

Pronotum and elytra visibly pubescent or pilose.

Size large; pronotum and elytra very strongly and densely punctate, the former distinctly impressed along the middle..... **maculatum.**

Size rather small; pronotum very finely, elytra generally densely and more coarsely punctate; pronotum not distinctly impressed in the middle.

Elytra less than one-half longer than the pronotum.

Sides of the prothorax very strongly arcuate..... **puberulum.**

Sides of the prothorax very feebly arcuate..... **alutaceum.**

Elytra more than one-half longer than the pronotum.

Elytra coarsely and not densely punctate..... **pilosellum.**

Elytra very finely and densely punctate.

Interocular striæ very fine; ocelli minute and distinct.. **veterator.**

Interocular striæ deep; ocelli large, not very well defined.

crassicorne.

Elytra dull, very finely and transversely rugulosæ..... **opaculum.**

The genus is probably a very extensive one in California, which region also appears to be very rich in the entire group Homalini.

PELECOMALIUM n. gen. (Homalini).

Body depressed, winged; elytra longer than the prothorax; antennæ filiform, very feebly incrassate, front not produced. Maxillary palpi with the first joint small; second elongate, slender; third and fourth flattened, the former slightly longer than wide, obconical; fourth about one-half longer than the third, strongly securiform. Labial palpi small; first joint very small; second much wider and longer, slightly longer than wide, sides parallel, tip transversely truncate; third slender, oblique, truncate at tip, sides nearly parallel, much narrower and slightly longer than the second; second and third joints flattened. Posterior tarsi very long and slender, shorter than the tibiæ; first and second joints elongate, the former much the longer; fourth deeply bilobed. Posterior tibiæ slender, terminated by two slender, unequal spurs and several small spines. Tibiæ rather finely and sparsely pubescent, having a very few small lateral spines.

It will be seen from the above diagnosis that this genus bears a great resemblance to *Amphichroum*, and in fact if the palpi were removed, it would be almost impossible to distinguish *P. modestum* from *A. veterator*, so great is the resemblance in every feature of the body, antennæ and legs.

The two species described below may be recognized by the following characters:—

Size large; elytra coarsely and rather sparsely punctate..... **binotatum.**

Size small; elytra finely and very densely punctate..... **modestum.**

P. binotatum n. sp.—Rather robust; body and legs throughout dark rufo-testaceous; head, abdomen, and under surface except the prosternum, black; elytra and hypomera rather paler and more luteous; each elytron having a median apical spot of piceous-black, clearly limited and very distinct; antennæ piceous-black, three basal joints abruptly pale testaceous; palpi and mandibles same; head and prothorax alutaceous, remainder shining; pronotum almost glabrous; elytra and abdomen finely and very sparsely pubescent, the latter toward the sides only. *Head* slightly longer than wide, depressed, nearly flat, transversely and feebly impressed between the antennæ, finely, not deeply and obliquely bistriate between the eyes; surface finely and strongly granulose and subrugulose, impunctate; antennæ scarcely two-fifths as long as the body, very slightly flattened and incrassate toward tip; joints one, and three to seven nearly equal in length and one-half longer than the second; joints seven to ten rather rapidly decreasing in length, the latter one-fourth longer than wide. *Prothorax* anteriorly as wide as the head, widest in the middle, about one-fourth wider than long; sides parallel, evenly and moderately arcuate throughout; apical angles rather narrowly rounded, basal very broadly so; apex and base equal in width, the former broadly and distinctly sinuate throughout, the latter very feebly and broadly sinuate in the middle; disk very broadly and very moderately convex, narrowly and obsoletely impressed along the middle, broadly and very feebly so near the scutellum, narrowly and abruptly explanate anteriorly at the sides, more broadly and gradually so thence to the base, finely and strongly reticulate, excessively minutely, sparsely and feebly punctate except near the sides and especially along the base, where the punctures are closer, larger and deeper. *Elytra* at base as wide as the pronotum; sides feebly though distinctly divergent; apical angles moderately broadly rounded; together transversely truncate behind; disk depressed, about as long as wide, two-thirds longer than the pronotum, finely margined along the suture, rather coarsely, strongly, evenly and rather sparsely punctate. *Abdomen* about as wide as, and slightly shorter than, the elytra; sides convergent and strongly and evenly arcuate to the vertex; border rather narrow and feebly inclined, finely and densely punctate; surface broadly polished and impunctate in the middle. *Legs* slender. Length 4.7 mm.

California; (Marin Co. 1). Mr. Harford.

In the type of this very interesting species the middle tibiae are broadly and strongly emarginate interiorly at one-third the length from the apex, the others being perfectly entire.

P. modestum n. sp.—Moderately slender; head and abdomen black; pronotum, except the lateral limbs, narrowly, and a short basal margin, antennæ toward tip, and elytra, dark blackish-castaneous, the latter having on each side near the humeri a small, very indefinite spot of slightly paler tint; an-

tennæ toward base, palpi, pronotal and elytral hypomera and anterior legs pale testaceous; middle and posterior legs infuscate throughout; remainder of the under surface blackish; head and pronotum very feebly alutaceous, remainder shining; head glabrous, pronotum and elytra finely and densely pubescent. *Head* very slightly longer than wide, broadly and feebly impressed between the antennæ, finely, very feebly and obliquely bistriate between the eyes; surface finely and rather feebly reticulate, impunctate; ocelli small, round, distinct; antennæ long and slender, more than one-half as long as the body; joints one and three subequal in length, distinctly longer than the succeeding ones; joints two and four to seven nearly equal in length, tenth fully one-third longer than wide, cylindro-obconical. *Prothorax* anteriorly slightly narrower than the head, widest near the middle, where the sides are nearly evenly and moderately arcuate, slightly straighter toward the apex and base and very slightly more strongly convergent in the former direction; apex slightly narrower than the base, broadly and very feebly incurvate; the latter broadly and very feebly arcuate; apical and basal angles moderately broadly rounded, the former the more strongly; disk nearly one-half wider than long, moderately and evenly convex, not at all impressed, abruptly and narrowly explanate at the sides anteriorly, more broadly and gradually so toward the basal angles, where it is also slightly reflexed, extremely finely, evenly, feebly, subasperately and rather densely punctate, finely and distinctly reticulate. *Elytra* at base scarcely as wide as the pronotum; sides very feebly divergent and arcuate; apical angles moderately broadly rounded; disk depressed, quadrate, nearly three-fourths longer than the pronotum, very densely, rather finely, deeply and evenly punctate. *Abdomen* produced slightly at the apex, the last segment being rather long and slender; as wide at base as the elytra, polished, feebly and finely punctate near the sides, impunctate in the middle. *Legs* slender. Length 2.7 mm.

California; (Lake Co. 2). Mr. Fuchs.

Readily distinguishable from the preceding by its much smaller size, more transverse prothorax, finer and much denser elytral punctuation and coloration. Its approximation in appearance to *Amphichroum veterator* has been before alluded to, and is most remarkable; it is a smaller and slightly more slender species than the latter, but in pronotal and elytral form and punctuation it is almost precisely similar.

LATHRIMÆUM Erichs.

L. humerale n. sp.—Rather robust, moderately convex; head blackish, epistoma dark rufous; pronotum dark rufous, obscurely piceous in the middle; elytra pale luteous, dark rufous at the apices, immediately before

which there is a large rather indefinite area of dark piceous obliquely limited just behind the middle; on each elytron there is also, just before the middle, a small obscure spot of dark castaneous, not attaining the suture, and parallel to the oblique edge of the posterior spot; abdomen dark rufous; entire under surface and legs bright rufo-testaceous; antennæ piceous, apical joint paler, first three joints very dark rufo-fuscous, nearly glabrous, remainder finely and densely pubescent; integuments nearly glabrous; highly polished. *Head* slightly wider than long, convex along the middle, broadly impressed along the sides, obliquely and very feebly bisulcate between the eyes, finely and not very densely punctate; sides behind the eyes short, rectangular, ocelli rather large, very prominent; eyes moderately prominent; antennæ distinctly shorter than the head and prothorax together, feebly incrassate; third joint slender, distinctly longer than the second or fourth; the latter subequal, distinctly longer than the fifth, which is nearly one-half longer than wide; tenth slightly wider than long. *Prothorax* widest slightly behind the middle, where it is three-fourths wider than long; sides thence rather strongly convergent, strongly and evenly arcuate to the very broadly rounded apical angles, and slightly less strongly convergent and straight to the basal angles, which are obtuse and not rounded; edges finely serrulate; base broadly and very feebly arcuate, four-fifths as wide as the disk and wider than the apex; the latter truncate in the middle between the broadly rounded and slightly advanced lateral apices; disk rather strongly convex in the middle, where there is a rather deep longitudinal sulcation, limited laterally by two narrow well-defined ridges which terminate at one-third the length from the base; on each side, exterior to these, there are two rather strong, irregular elevations, thence to the lateral edges the surface is broadly explanate and feebly reflexed, broadly and very feebly impressed at the middle of each side; surface very coarsely, deeply and irregularly punctate; punctures sparser toward the sides. *Elytra* one-third wider than the pronotum, at base equal to it in width; sides nearly parallel and somewhat strongly arcuate; together broadly subtruncate behind; exterior angles broadly rounded; disk strongly convex, slightly less strongly declivous behind than on the sides, nearly one-third longer than wide, two and one-half times as long as the pronotum, coarsely, deeply punctate; punctures closely placed in rather well-defined striæ; intervals rather feebly convex, the third and seventh more strongly so; the latter near the humeri very strongly so. *Abdomen* very short and narrow behind the elytra, having two almost impunctate segments exposed. *Legs* long and very slender; posterior tarsi short, first two joints slightly elongate, the first slightly the longer; fifth much shorter than the first four together. Length 4.3 mm.

California; (Humboldt Co. 1).

The under surface, except the pronotal hypomera, and including the elytral hypomera, is very coarsely and deeply punctate; the abdomen finely subalutaceous and almost

impunctate. The femora are very sparsely pubescent, the hairs being very short, stout and recumbent; the tibiae finely and densely spinulose. The mesosternum is finely carinate in the middle anteriorly. The maxillary palpi are very slender and filiform, the third joint being twice as long as wide, the fourth being very slender, pointed and more than twice as long as the third.

This species differs from *pictum* Fauv. in elytral structure, that species having all the elytral intervals equally and very feebly convex, and from *subcostatum* Mäkl. in the shape of the prothorax.

OROBANUS Lec.

O. rufipes n. sp.—Rather slender, cuneate; black throughout except the eleventh joint of the antennæ which is testaceous, and the legs which are rufous throughout; integuments shining; pubescence rather long, very fine, dense, recumbent, dark grayish-brown in color. *Head* moderate; eyes at nearly their own length from the base, moderately prominent, rather finely granulate; sides behind them feebly convergent and strongly arcuate, prominent; front feebly convex, very finely and extremely feebly punctate; having on a line slightly in advance of the middle of the eyes two deeply impressed, narrow, oblique and very short canaliculate punctures; ocelli minute, circular; antennæ moderate, slender, filiform, slightly less than one-half as long as the body; joints two to six subequal in length, the former slightly more robust and very slightly shorter; joints six to ten decreasing in length, the former nearly three times as long as wide, the latter distinctly thicker and three-fourths longer than wide, eleventh slender, shorter than the two preceding together, finely acuminate, compressed near the tip. *Prothorax* cordate, widest at one-third its length from the apex, where it is distinctly wider than the head and very slightly wider than long; sides very moderately convergent posteriorly, deeply and evenly incurvate throughout, strongly arcuate anteriorly; basal angles slightly obtuse, very slightly rounded; base broadly, evenly and very feebly arcuate, about three-fourths as wide as the disk and very slightly wider than the apex; the latter broadly, evenly and just visibly emarginate; apical angles almost obsolete; disk strongly and nearly evenly convex, having near the base a transverse row of small feeble erosions, and at each side, just before the middle, a rather strong impression which is continued posteriorly, gradually becoming more feeble and disappearing before reaching the basal angles; very finely, feebly, evenly and somewhat densely punctate. *Elytra* at base slightly wider than the prothorax, widest at the apex where together they are slightly less than twice as wide as the prothorax; sides nearly straight; each elytron broadly rounded behind; hu-

meri broadly rounded; disk depressed, with a feebly impressed line on each parallel and near the suture, minutely, evenly, very feebly and not very densely punctate, slightly more than twice as long as the prothorax, one-third longer than wide. *Abdomen* at base slightly narrower than the elytra; sides convergent to the apex, strongly and evenly arcuate; extremely minutely, densely and asperately punctate. *Legs* slender; first joint of the posterior tarsi distinctly longer than the next two together, much longer than the fifth. Length 3.0-3.7 mm.

California; (Hoopa Val., Humboldt Co. 7).

The type is a male, the sixth segment being broadly and feebly emarginate at tip; in the female the prothorax is much more distinctly wider than long and less strongly cordate; the antennæ are slightly shorter and do not attain the middle of the elytra; in size the female is smaller than the male.

There is scarcely a trace of a median sulcation on the pronotum, the sides of which are more deeply sinuate toward the basal angles than in either *densus* or the Vancouver representative of *simulator*. The species is chiefly remarkable because of its slender form, sparse punctuation and rufous legs. It was found in wet moss in the interior of a flume for conveying spring-water.

O. densus n. sp.—Rather robust, depressed; body entirely black above and beneath, oral organs rufo-testaceous; legs fuscous throughout; antennæ entirely piceous-black; pubescence cinereous, rather short, recumbent, extremely dense; integuments shining. *Head* moderate, slightly longer than wide; sides behind the eyes strongly convergent to the neck and strongly arcuate; eyes rather prominent, large, coarsely granulated, very densely setose; front depressed, feebly biimpressed between the eyes, finely and densely punctate, more sparsely so along the middle; antennæ filiform, fully one-half as long as the body; basal joint subcylindrical, three times as long as wide, second two-thirds as long as the third, the latter slightly shorter than the first, joints three to six equal, slender, six to ten gradually diminishing in length, the latter more than twice as long as wide, eleventh fusiform, slightly oblique at tip, one-half longer than the tenth. *Prothorax* widest at the anterior third, where it is distinctly wider than long and slightly wider than the head; sides strongly arcuate, strongly convergent and distinctly and evenly sinuate toward the base; apex transversely truncate, about equal in width to the base which is broadly, evenly and very feebly arcuate; basal angles slightly obtuse, very narrowly rounded; disk transversely, evenly and moderately convex; impress-

ed in the middle near the lateral edges, the impression becoming extinct toward the basal angles, finely, evenly and very densely punctate. *Elytra* at base two-fifths wider than the prothorax; sides distinctly divergent, nearly straight, slightly obliquely truncate at apex; exterior angles broadly, inner more narrowly, rounded; humeri broadly rounded; disk feebly convex, broadly and feebly impressed on the suture toward base, nearly one-third longer than wide, two and one-half times as long as the prothorax, very finely, evenly and extremely densely punctate. Three segments of abdomen exposed together wider than long, as wide as the base of the elytra; margin distinct, inclined; surface feebly convex, finely, very feebly and very densely punctate. Under surface and legs finely and densely pubescent, less densely so toward the tip of the abdomen. Length 3.4-3.9 mm.

California; (San Diego 3). Mr. W. G. W. Harford.

Distinguishable immediately from the preceding by its more depressed and broader form, more parallel elytra, nearly three times as dense punctuation, darker legs, etc. It differs from *simulator* in its much denser punctuation and more depressed form.

The three species may be distinguished as follows, the characters of *simulator* being taken from a specimen from Vancouver Island, kindly loaned me by the Museum of Comparative Zoölogy at Cambridge:—

Legs dark fuscous.

Surface polished; strongly convex.....*simulator*.

Surface under low power dull; very depressed.....*densus*.

Legs clear rufous; punctuation more sparse; form more slender....*rufipes*.

Since it is now known that there are several distinct species of this genus, the absolute identity of the Vancouver specimens taken by Crotch with *simulator* Lec., which was described from the regions east of the Rocky Mountains, may reasonably be questioned; a careful comparison of the two is therefore very desirable. By careful comparison of the above Vancouver type with the description given by Dr. Le Conte and M. Fauvel, I am inclined to believe that the former is a fourth species, hitherto undescribed. M. Fauvel mentions the prothorax as being longer than wide; if this is actually the case, it is very distinct from any of the

specimens before me, all of which have it distinctly wider than long.

ACTIDIUM Matth.

A. rotundicolle n. sp.—Rather robust, strongly convex, piceous-black; legs and palpi pale flavo-testaceous; antennæ pale testaceous at base, becoming piceous-black at apex; pubescence fine, very short, not at all dense; integuments shining, sublutaceous. *Head* much wider than long, rather convex, very minutely and sparsely punctate; eyes moderate, rather prominent, coarsely granulate; antennæ as long as the head and prothorax together; funicle slender; club robust; joints increasing in length and thickness. *Prothorax* slightly wider than the head, about equal in length, two-thirds wider than long; sides parallel and strongly, evenly arcuate; base broadly arcuate, distinctly sinuate laterally; basal angles obsolete; apex broadly truncate; disk broadly, evenly convex, very minutely reticulate or subgranulose, minutely, evenly and sparsely punctate. Scutellum small, equilatero-triangular, coarsely asperate. *Elytra* at base as wide as the prothorax; sides parallel for two-thirds the length from the base, rather strongly, evenly arcuate, thence feebly convergent, very feebly arcuate to the apex which, conjointly, is rather abruptly truncate; exterior angles broadly rounded, inner angles narrowly rounded; disk widest at nearly two-fifths its length from the base, narrowly one-half longer than wide, one-half longer than the head and pronotum together, strongly cylindrically convex, minutely, densely reticulate or subgranulose, shining, very minutely, evenly, rather sparsely, subasperately punctate; punctures without definite arrangement. *Legs* rather long, somewhat slender; posterior tibiæ very slender toward base; rapidly dilated, widest at the apical third, compressed; tarsi short, very slender. Length 0.4 mm.

Texas; (Galveston 2).

This species differs from those previously described from California in the sculpture which is much more feeble, and in the form of the prothorax. It is as robust as *robustum* and does not appear to possess many characters in common with the three species described by Mr. Matthews.

PTILIUM Erichs.

P. sulcatum n. sp.—Rather slender and convex; sides nearly parallel; color pale brownish-testaceous, antennæ and legs slightly paler, more flavate; integuments coarsely sculptured, shining; pubescence fine, subrecumbent, not very dense. *Head* moderate in size, much wider than long, triangular; surface moderately convex, rather coarsely, irregularly and feebly tubercu-

late; eyes small, at the base, convex, prominent, coarsely granulate; antennæ rather long, distinctly longer than the head and prothorax together; two basal joints robust; funicle very slender; club strong, joints increasing in length and thickness. *Prothorax* widest at two-fifths its length from the apex, where it is distinctly wider than the head, one-half wider than long; sides strongly arcuate anteriorly, strongly convergent and very feebly sinuate toward base; the latter broadly, extremely feebly arcuate throughout, very slightly narrower than the apex, nearly three-fourths as wide as the disk; apex transversely truncate throughout; basal angles obtuse, scarcely perceptibly rounded; disk transversely, moderately convex, densely, feebly, irregularly tuberculate or granulose, the tubercles nearly confluent and differing greatly in size; in the center there is a small, strongly marked canaliculation two-fifths as long as the disk, and, at each basal angle, a small impressed puncture. *Elytra* at base as wide as the prothorax; sides parallel, distinctly and nearly evenly arcuate; together abruptly, very broadly rounded behind; apex broadly truncate; disk widest in the middle, where it is distinctly wider than the prothorax, nearly one-half longer than the head and prothorax together, rather depressed in the middle, rather abruptly, strongly convex at the sides, finely, evenly, not very densely, subasperately punctate; asperities not definitely arranged. Scutellum moderate, asperate, triangular, slightly wider than long. Under surface pale brownish-testaceous, except the abdomen toward base, which is dark, blackish-piceous. *Legs* rather slender, short; tarsi rather short, very slender. Length 0.35 mm.♂

Texas; (Austin 1).

This species can be readily recognized by its very minute size, there being but one smaller species of Coleoptera known; it is also distinguished by the peculiar form and structure of the prothorax. The metasternum appears to extend to the elytra at the sides.

P. Hornianum Matth., which is of about the same size as the present species, differs from it in color, shape and sculpture.

SMICRUS Matth.

S. americanus n. sp.—Rather elongate; sides parallel; body depressed, black; legs and antennæ pale, dusky yellow; pubescence rather long, recumbent, not very dense; integuments shining. *Head* large, triangular, slightly wider than long; eyes large, strongly convex, prominent, coarsely setose; surface feebly convex, smooth, obsoletely and finely reticulate; labrum prominent, acutely rounded; second joint of antennæ distinctly shorter than the first, both rather slender and elongate. *Prothorax* as long as the head, very slightly wider, three-fourths wider than long, widest in the middle; sides

parallel, evenly and very feebly arcuate throughout, not at all constricted at base; apex broadly, very feebly and evenly emarginate throughout its width; angles slightly acute, very narrowly rounded; base transversely truncate and straight throughout its width; angles nearly right, not rounded; disk broadly, feebly convex, more strongly so near the sides, not very densely covered with rather fine, flat, somewhat indefinite tubercles. Scutellum large, triangular, feebly, rather densely asperate. *Elytra* equal in width to the prothorax; sides parallel, nearly straight, abruptly transversely truncate behind; outer angles narrowly rounded; disk scarcely one-fifth longer than wide, very slightly longer than the head and prothorax together, depressed in the middle, rather convex at the sides, finely, feebly, not very densely asperate; asperities not definitely arranged. *Abdomen* with four fully exposed segments, the fifth, the basal, also being almost completely exposed; together as long as wide; outline parabolic; surface rather convex, rather finely, not densely, very feebly asperate or subgranulose, margined laterally with a flat border, becoming attenuated posteriorly; last segment as long as the three preceding together, rounded at apex. *Legs* rather short and robust. Length 0.9 mm.

Texas; (Austin 1).

The entire abdomen, extending under the elytra, is composed of eight segments; the under surface is polished and very feebly transversely asperate along the apex of each segment, and the apical two-thirds of the terminal; the latter at apex has a narrow, porrected, pale membranous border. The antennæ in the type are missing with exception of the two basal joints.

The apex of the abdomen, more especially beneath, and the sides of the elytra toward the base, are slightly pale. The abdominal border beyond the elytra is not appreciably elevated, and its surface is almost continuous in convexity with that of the upper surface; under the elytra and toward the base of the abdomen it becomes thinner, deep and erect.

This species differs greatly from *jilicornis* Fairm. in the structure of the pronotum, which is not at all constricted at base.

DITAPHRUS n. gen. (Byrrhidae.)

Body oval, pubescent. Head deflexed, retractile; eyes large, rather coarsely granulated, nearly hidden in repose, front excavated at the sides near the

eyes for the reception of the antennæ when in repose; epistoma very small, deflexed, divided by a fine distinct, straight suture; labrum small, transverse, vertical, detached from and covered by the epistoma; antennæ inserted under the sides of the front, immediately before the eyes, 11-jointed, base thick, gradually diminishing in thickness to the sixth joint, seven to nine very small, tenth wider, small, transverse, eleventh widest, longer than wide, ovoidal, maxillary palpi small, last joint slightly longer than wide, ovoidal, pointed, slightly compressed. Prosternum well developed, transversely truncate anteriorly, widely separating the anterior coxæ; process transversely truncate at apex, on the same level and in contact with the anterior edge of the mesosternum; the latter extremely short, strongly transverse, very broadly and feebly emarginate anteriorly; metasternum large, long; episternum narrow, elongate, obliquely truncate anteriorly, widest and angulate anteriorly near the apex; metasternum slightly excavated at the side anteriorly for the reception of the tips of the intermediate femora, the excavation extending very deeply and obliquely into the base of the elytral hypomera. Anterior coxæ very small, transverse, attenuate laterally, open behind, widely separated; trochanters large; middle coxæ not at all prominent, transversely oval, very widely separated; trochanters large; posterior coxæ strongly transverse, attaining the metasternal episterna, short, distinctly separated. Ventral segments five; three basal not distinctly connate; first four uniformly and gradually decreasing in length; fifth as long as the two preceding together; first segment deeply and transversely excavated at base for the reception of the posterior femora. Prothorax short, broad; sides with an acute edge; inflexed sides divided from the prosternum by a very distinct suture; prosternum laterally and inflexed sides deeply and transversely excavated for reception of the anterior femora; pronotum excavated laterally at apex for reception of antennal club. Scutellum small, triangular. Elytra convex, covering the entire abdomen; hypomera distinct, extending only for two-fifths the length from the base, devoid of hypopleuræ. Legs short, rather slender; femora not very robust, excavated along the lower edge for reception of the tibiæ; the latter simple, rather slender, not grooved, having a line of short, very fine, densely placed cilia along the outer edge; tarsi free, rather short, five-jointed joints simple; first of the anterior as long as the next two together; two to four very small; fifth as long as the three preceding together; claws divergent, small, simple, slender.

This genus is very remarkable in antennal structure, in its excavated pronotum and many other characters. The single representative almost exactly resembles a minute *Scymnus* in external form.

The median portions of the three sterna form a continuous surface from the head to the posterior coxæ, the meso-

sternum being not at all depressed or impressed, and divided from the metasternum by a very feeble straight suture.

Ditaphrus is related to Bothriophorus Muls., but is very distinct in antennal structure and in the form of the prosternum, this not being broadly emarginate at apex, nor "postérieurement rétréci en point," as in the latter. From Physemus Lec. it is apparently distinguished by its antennal structure.

D. scymnoides n. sp.—Form elliptical, distinctly longer than wide, convex, black; under surface, legs and antennæ fuscous; integuments alutaceous; pubescence fine, pale, short, subrecumbent, rather dense. *Head* rather small, wider than long; surface broadly, evenly convex, finely, deeply and densely punctate; punctures coalescent and scabrous at base; antennæ as long as the width of head; occiput margined laterally along the eyes with a narrow impressed channel for the reception of the antennæ which joins the deep apical excavation of the pronotum. *Prothorax* about three times as wide as long; sides convergent anteriorly, feebly arcuate; base broadly arcuate, abruptly more strongly so in the middle; apex broadly emarginate; surface broadly convex, very minutely, deeply, evenly, not very densely punctate; punctures separated by three or four times their own diameter. Scutellum slightly longer than wide. *Elytra*, viewed vertically, nearly three times as long as the head and prothorax together, widest at one-third the length from the base; sides strongly arcuate, coarctate with those of the pronotum, evenly rounded to the apex which, conjointly, is rather narrowly rounded; surface strongly convex, rather finely, evenly, deeply and moderately densely punctate; punctures decidedly larger than those of the pronotum, distant by two to three times their own diameters. *Legs* short; tarsi slightly reflexed. Under surface alutaceous and minutely punctate; abdomen finely, rather densely pubescent. Length 0.8–1.0 mm.

Texas; (Austin 11; El Paso 1).

Rather abundant amongst decaying vegetable matter on the soft mud left by the receding water of the Colorado River. The antenna is figured on the plate and is seen to be of very singular structure. The club in Physemus, the only genus with which this can be confounded, is described as being three-jointed and almost solid. It is also highly probable that Physemus is distinct from Bothriophorus. These three genera should be separated as a group distinct from Limnichus.

In the Californian species of *Limnichus*, the prosternum is very long, prolonged between the coxæ, the apex of the process being strongly rounded and entering a deep emargination of the mesosternum; along the middle the surface is deeply grooved. The first two ventral segments are subequal in length, the first three connate. The first four joints of the anterior tarsi are short, equal and together but slightly longer than the fifth. The antennæ are eleven-jointed; club loose, three-jointed, joints gradually increasing in thickness; first joint, as in *Ditaphrus*, deeply seated in the lateral excavation of the front.

I have carefully verified this observation regarding the number of antennal joints in three or four species of *Limnichus* and several specimens of *Ditaphrus*, and can state with great certainty that the antennæ are not 10-jointed, as represented (*Class. Col. N. A.*, LeConte and Horn pp. 159, 161). Du Val had already corrected this error in his classic work on the genera of European Coleoptera (*Vol. II*, p. 267 foot-note).

ELEATES n. gen. (Tenebrionidæ).

Body oblong, strongly convex. Epistoma and sides of the front coarctate at apex, very broadly and evenly arcuate; front distinctly dilated before the eyes; the latter small, completely divided by the lateral edges, more than their own length in front of the prothorax; epistoma transverse, enclosed by the front; suture distinct and impressed in the middle. Maxillary palpi scarcely at all dilated; third joint distinctly longer than wide, slightly shorter than the second; fourth twice as long as wide, distinctly longer than the second, subcylindrical, slightly bent and compressed, obliquely truncate at tip. Labial palpi rather small; third joint most robust, longer than the first two together, ovoidal, narrowly and obliquely truncate at tip. Mentum moderate, wider than long, its plane below the general surface of the head; ligula large, strongly and broadly bilobed; lobes almost entirely exposed. Maxilla exposed at the sides. Antennæ gradually and very strongly incrassate, very strongly compressed; second joint globular, one-half as long as the third; the latter longer than the succeeding joints; four to seven, densely spongiose at the exterior apical angles; the remainder more extensively so and at both apical angles; joints more strongly pointed outwardly than on the inside; five to ten transverse, the latter very strongly so; eleventh large, as wide as the tenth, as long as wide, obliquely conoidal; antennal grooves deep near the eyes, obliterated in the middle. Anterior coxæ transversely oval,

strongly convex, slightly separated. Middle coxæ with small trochanters; posterior transverse, separated by a triangular process of the first ventral segment. Tibiæ scarcely dilated; spurs small but distinct, unequal; tarsi moderate, setose beneath, the posterior more densely so at base; last joint slightly longer than the preceding together; first four joints of the anterior and middle very short equal; first of the posterior as long as the next two combined. Elytral hypomera continuous throughout the length, rather narrow, strongly inflexed, nearly equal in width throughout, slightly concave near the base, elsewhere plane. Prothorax transverse; sides of the pronotum very abruptly and narrowly explanate or feebly reflexed; edges neither denticulate nor crenulate. Elytra finely costate; intervals punctate.

The affinities of this genus are very readily seen to be in the direction of *Bolitophagus* and *Eledona*; it agrees with the first in the structure of the front and eyes, but differs in appearance, in this respect agreeing more closely with *Eledona*, from which, in turn, it differs radically in the structure of the eyes. In *Eleates* the epistoma is separated from the labrum by a very short, coriaceous bond, as is usual in this group, but the eyes are well in advance of the prothorax. It differs from both *Bolitophagus* and *Eledona* in the non-denticulate sides of the prothorax, a character considered more or less important by Lacordaire and Du Val, who divide the European genera into groups depending upon the presence or absence of denticulations.

E. occidentalis n. sp.—Rather robust; sides nearly straight and parallel; black throughout; legs, palpi and antennæ dark rufo-fuscous; glabrous; integuments rather finely sculptured. *Head* nearly twice as wide as long; apex very narrowly reflexed throughout; surface near the apex and in front of the eyes slightly tumid; front broadly and feebly convex, extremely densely, rather deeply and coarsely punctate; punctures very much finer and obsolete on the epistoma. *Prothorax* widest near the base, where it is two-thirds wider than the head and twice as wide as long; sides feebly convergent from base to apex, feebly arcuate; base broadly arcuate, more strongly so in the middle; angles slightly obtuse, not rounded; apex slightly narrower than the base, broadly and rather strongly emarginate; angles slightly prominent, anteriorly narrowly rounded; disk broadly, strongly and very evenly convex, rather coarsely, evenly, deeply and excessively densely punctate; punctures polygonal, intervals in the form of very narrow, strongly elevated lines. *Scutellum* broader than long, rounded behind. *Elytra* at base slightly wider than the prothorax; sides nearly parallel and straight to within a very short distance of the apex, where, together, they are abruptly and very broadly rounded;

humeral angles distinctly rounded; sides narrowly reflexed, edges acute; disk broadly and very strongly convex, nearly three times as long as the pronotum; ridges very fine, rather feebly elevated; intervals evenly concave, each with a single series of round, rather deep punctures, distant by slightly more than their own widths; along each side of the immediate crests of the costæ there is a line of very small, round, closely-placed areolæ; remainder of the surface slightly and irregularly roughened or subalutaceous, moderately shining. *Legs* moderate; femora compressed, excavated beneath through two-thirds the length for the reception of the tibæ; tibial spurs situated at the inner apex, arranged parallel to the lower edge of the apex and almost in line with the point of insertion of the tarsi, claws large, simple, divergent. Length 4.5-5.0 mm.

California; (Truckee, Nevada Co. 2). Mr. Harford.

The lateral edges of the prothorax are sometimes extremely feebly and irregularly undulated.

This species, the first of its tribe to be announced from the Pacific slope of the continent, lives in fungus growing upon fallen logs.

BARINUS n. gen. (Curculionidæ.)

Body rather slender and elongate, clothed with large, elongate scales, entirely without hairs. Beak very short, rather stout, much shorter than the prothorax, slightly flattened, rather strongly arcuate; scrobes beginning slightly before the middle, descending obliquely to the eyes; the latter large, vertically oval, not very prominent, finely granulated; interocular surface scarcely wider than the beak, feebly impressed. Antennæ rather slender; first joint of funicle slightly shorter than the scape, rather strongly clavate, very slender toward base, nearly as long as the remainder of the funicle; second to seventh nearly equal, cylindrical, more slender than the apex of the first; club abrupt, very elongate, oval, finely pubescent, slightly longer than the preceding six joints of the funicle combined. Prothorax without postocular lobes. Prosternum rather long in front of the coxæ, rather narrowly and deeply sulcate throughout its length, moderately separating the coxæ. Middle and posterior coxæ widely separated. Metasternum longer than the first ventral segment. First two segments of the abdomen rather long, nearly equal in length; suture almost entirely obliterated in the middle; third and fourth segments short, equal, together scarcely longer than the first; fifth rounded behind, as long as the third and fourth together; posterior sutures strongly sinuate at the sides. Elytra conjointly rounded at tip, concealing the pygidium. Legs moderate in length, rather robust; tibæ not grooved, all mucronate at tip; spur of the anterior and middle pairs vertical, of the posterior oblique and nearer the insertion of the tarsi; all very small and robust; second and third

joints of the tarsi broadly dilated, the latter strongly bilobed; fourth slender; claws very small, narrow, connate throughout their length except at the immediate apex.

It will be noticed that this genus corresponds quite closely with *Zygobaris*, and I have drawn up the description in such form that it can be readily compared with the one given by Dr. LeConte for the latter (*Proc. Am. Phil. Soc.* XV, p. 321). It differs conspicuously in its shorter beak, in antennal structure and in its strongly grooved prosteronum; also in the claws, which are connate nearly through their length.

B. squamolineatus n. sp.—Form very narrowly elliptical, moderately convex, black; legs and antennæ dark fuscous; coxæ black; integuments shining. *Head* rather small, hemispherical, sublutaceous, finely and not very densely punctate, with a few small robust scales along the inner margins of the eyes; beak scarcely twice as long as the head, slightly enlarged and flattened toward tip, finely and rather densely punctate toward the base, much more sparsely so near the apex. *Prothorax* about as long as wide, very feebly constricted near the apex, sides very feebly convergent from base to apex, abruptly and more strongly arcuate behind the constriction, base broadly arcuate, more strongly so in the middle; apex transversely truncate. three-fifths as wide as the base; disk transversely, nearly evenly and strongly convex, coarsely, rather densely and evenly punctate; punctures round, deep, perforate, separated by about their own width, distinctly finer along the apex; surface abruptly and densely squamose at the sides, with a narrow, sparsely squamose line along the middle; elsewhere each puncture bears a very minute, slender scale; scales all arranged transversely. *Elytra* at the humeri slightly wider than the prothorax; sides gradually convergent, broadly and nearly evenly arcuate to the apex, which, conjointly, is rather narrowly rounded; humeri longitudinally and rather strongly swollen; disk transversely and rather strongly convex, fully twice as long as the pronotum, extremely feebly constricted at one-fifth the length from the apex, deeply and narrowly grooved; striae finely, deeply and rather distantly punctate; intervals finely, feebly and more closely punctate, alternating broader and narrower; the narrow intervals having a single, the broad ones two rows, of large elongate scales arranged longitudinally; humeral row broader; the scales along the suture and also those near the the sides very much smaller and narrower. *Scutellum* slightly longer than wide, oval. *Legs* finely and rather sparsely squamose; tarsi densely covered above with fine hair-like scales, densely spongiouse beneath. *Abdomen* densely squamose at the sides, sparsely so in the middle; devoid of scales along the bases of the last three segments. Length 3.8 mm.

Central Illinois 1; Mr. F. M. Webster.

The scales are generally white, but are slightly darker along the flanks of the elytra, where they are very small. The rows of scales upon the elytral intervals are not uniformly single or double, but in many spots become more crowded and irregular.

RENOCIS n. gen. (Hylurgini).

Body subcylindrical. Head prominent, not concealed by the prothorax, inserted in the prothorax nearly to the eyes; slightly deflexed, not at all produced, beak entirely obsolete; eyes rather finely granulated, not at all prominent, on the sides, extending slightly under the head, short, very strongly transverse, with a small feeble sinuation in the anterior margin; antennæ inserted on the sides of the head just before the eyes, short, ten-jointed; basal joint longer than wide, rather robust; second not one-half as long, subglobular; three to six very small; joints seven to ten forming a very abrupt, elongate, oval club, longer than the entire preceding portion, strongly compressed, sparsely pubescent. Mandibles prominent, short and stout, perfectly chisel-shaped apex transversely truncate, straight; inner face at apex obliquely truncate. Mentum short, transverse; maxillæ, ligula and palpi very small, invisible under a mass of coarse hair surrounding the mentum. Labrum wanting. Anterior coxæ prominent, subglobular, contiguous; middle coxæ widely distant, small, not prominent; posterior separated, transverse, attenuated laterally, only attaining the metasternal episternum, which is long, rather wide; sides parallel; epimeron not visible. Anterior coxæ in contact with the head beneath; prosternum entirely obsolete before them; femora rather robust, simple; tibiæ very narrow at base, rapidly dilated and compressed toward apex, margined externally with a row of short, very robust spinules, obliquely truncate at apex; tarsi rather short, slender, not at all dilated but rather compressed, five jointed; third obliquely truncate and slightly produced beneath, not bilobed; fourth very minute; fifth slender, longer than the preceding united. Abdominal segments five in number; first two subequal, each nearly as long as the third and fourth together. Elytra covering the entire abdomen; pygidium invisible; prothorax strongly rounded at the sides, transverse, convex; sides continuous in curvature from the dorsal surface to the anterior coxæ. Integuments covered with a dense scabrous mass of scales; base of elytra elevated and tuberculate. Scutellum not distinctly visible.

In this genus the antennal club is strongly compressed, elongate-oval, obtusely pointed and four-jointed, the joints being connate and separated by straight transverse sutures. Both surfaces are glabrous, except the apices of the joints,

which are fringed with hairs, and the terminal joint which is sparsely pubescent over the entire surface. The scape is rather short and robust, distinctly shorter than the funicle and is not received in transverse grooves in front of the eyes, these being almost completely obsolete. The genus therefore seems to form a group intermediate in many of its characters between the Polygraphi and the Hylurgi, but for the present it should be placed between Chætophlœus and Carphoborus, from the latter of which it differs in the structure of the elytra behind,—these being evenly convex with no spinulose crests,—and in the structure of the antennal club, which is here divided by three sutures, and not by two, as in Carphoborus.

R. heterodoxus n. sp.—Oblong; sides parallel; integuments black, densely clothed with scales mostly dark fuscous in color, but interspersed with whitish ones especially on the flanks and toward the base of the pronotum, replaced on the head by a dense growth of longer, robust, shaggy pubescence. *Head* wider than long; front impressed, coarsely and sparsely punctate, shining; antennæ dark brown. *Prothorax* more than twice as wide as the head; sides in the basal two-thirds parallel and distinctly arcuate, slightly constricted near the apex which is broadly arcuate and slightly sinuate in the middle, more than one-half as wide as the base; the latter transversely truncate; disk transversely, strongly convex, two-thirds wider than long, very coarsely, rather densely punctate; scales generally recumbent toward base, erect toward apex; the latter fringed with a dense row of short, very robust, squamiform hairs. *Elytra* at base as wide as the prothorax; sides parallel and nearly straight for two-thirds the length from the base, then gradually rounded; to the apex, which, conjointly, is almost semicircularly rounded; disk cylindrical, nearly one-half longer than wide, two and one-half times as long as the prothorax, elevated along the basal margin, the summit of the elevation being broken into small crests; surface feebly striate; striæ punctate; intervals flat, coarsely, rather sparsely and unevenly punctate; smaller scales usually recumbent; along the middle of each interval there is a row of longer, erect, fuscous scales. Under surface scabrous, black, coarsely punctate. *Legs* piceous; tarsi paler. Length 1.7 mm.

Nevada; (Washoe Co. 1).

The scales of the pronotum are generally entire, but upon the flanks they become narrow, almost hair-like, and are bifurcate from their base, becoming, anteriorly and near the

coxæ, trifurcate. The sparse vestiture of the entire under surface is of this same nature.

The single representative of this interesting species was beaten from the low trees bordering the Truckee River, in early spring, at Reno, Nevada.

Chatophlœus hystrix Lec., found at San Diego, California, is another singular species and appears to resemble that above described in the structure of the head, but as that species is described as robust and oval, having the surface clothed with erect hair, it is abundantly distinguished from the present which is squamose and nearly cylindrical.

APPENDIX.

NOTES.

I.

The genus *Colusa* is apparently regarded as identical with *Echidnoglossa* Woll. In order to determine if possible the truth in regard to the mutual relationship of these two genera, I have, therefore, made a short comparative study, taking as a basis the careful description of *Echidnoglossa*, given by Wollaston (Cat. Can. Col., p. 530). As this study may be useful in future systematic investigations, it is given below:—

In *Echidnoglossa* the ligula is slender, minutely bifid at apex; the labial palpi are distinctly 3-jointed, the joints subequal in length, the width decreasing. The posterior tarsi have the joints gradually and slightly decreasing in length to the fourth.

In *Colusa* the ligula is elongate, very slender, slightly longer than the terminal joint of the labial palpi and is apparently perfectly simple at apex. The first two joints of the labial palpi are apparently cylindrical, rather short,

equal in diameter and closely connate or anchylosed; in most cases the suture is completely obliterated so that they appear to form but a single joint; the last joint is very long and slender, affixed very obliquely and is generally slightly longer than the first two together. The posterior tarsi are of rather peculiar structure; the first joint is fully as long as, sometimes distinctly longer than the next two together, the latter being equal in length and each distinctly shorter than the fourth; the fifth is generally longer than the first.

If the words "*elytris brevissimis*" are to be accepted in their ordinary meaning, the genus of the Atlantic Islands must be remarkably different in appearance, since the elytra in Colusa are unusually long, wide and well developed. In the description of the single species of *Echidnoglossa*, Wollaston states that it is alutaceous, scarcely punctulate, and sparsely pubescent. In Colusa the integuments are not alutaceous but polished, rather densely pubescent and deeply punctate, the elytra very coarsely and conspicuously so.

The two genera are, nevertheless, allied by a very striking character which I have repeatedly verified in Colusa—the pentamerous tarsi—and Colusa is evidently the American representative of the eastern *Echidnoglossa*. I believe that enough has been said, however, to show that they should not be united without a much more careful comparison than has yet been accorded them.

II.

The species described by me under the names *Ilyobates* (Bull. Cal. Acad. Sci. I, p. 307) belong in reality to *Bolitochara*. By an unfortunate oversight the number of joints in the tarsi was recorded erroneously; both these genera possess the strongly elevated mesosternal carina. I am indebted for this rectification to M. A. Fauvel.

III.

Attention is called to a very singular sexual character in a Californian species of *Leptacinus*, a figure of which is given on the plate. The species may possibly be *brunnescens* Lec. The pronotum of this specimen is not foveate at the sides, but another specimen of apparently the same species has a large deep fovea at about the middle of each side of the pronotum and very near the edge; the latter example has the sixth ventral segment simple and broadly rounded at the apex.

IV.

In the classification of the Coleoptera of North America—p. 97—occurs the sentence: “The second ventral segment is marked with two short ridges.” As there is no such structure in our species of *Stenini*, the insertion of this phrase must be the result of an oversight.

V.

Although the synonymical notices recently published by M. Fauvel through Dr. Horn (Proc. Ent. Sec. A. N. S., Phil., June, 1886, p. xiii) relating to several species of *Stenini* described by me may possibly be correct, there is a much greater probability of error. This probability almost amounts to a certainty in the case of *Hemistenus reconditus*, which is not the same as *tarsalis* Ljungh. In order to substantiate this statement I would refer the reader to the outlines of the tarsal claws of the two species, which I have figured on the plate accompanying the Revision.

As for the other synonyms indicated by M. Fauvel, it can only be said that the descriptions of the species mentioned which are given by Erichson and Rey do not agree very satisfactorily with those which I have drawn up as carefully as possible in the Revision of the North American *Stenini* for the corresponding American forms.

In a group where the species are so excessively numerous and closely allied as in the Stenini, great care should be exercised in making synonymical statements, and, it may be added, there are probably extremely few species common to Europe and North America. It is even possible that our familiar *juno* is not the same species as the European *juno*, for the figure of the male sexual characters of this species given by Rey does not correspond, particularly the modification of the fifth segment, which scarcely agrees at all with the description which I have given for the American species.

VI.

PINOPHILI.—The statement made concerning this group (Class. Col. N. A., p. 99), viz, that the species are found under the bark of trees, is erroneous as far as the genus *Pinophilus* is concerned: the correct derivation of the word is given by Erichson (Gen. Staph., p. 670). Of the four species in my cabinet, the two collected by myself were taken in damp earth, under decomposing vegetable matter, and in a few instances under stones; the other two were attracted at night to the electric lights at El Paso, Texas.

VII.

PLATYSTETHUS SPICULUS Er.—Specimens of this species, which was described by Erichson from Colombia, South America, were recently taken at Galveston and Austin, Texas. These specimens correspond with others communicated by Dr. Dugès, taken at Guanajuato, Mexico, showing that the species is of very wide distribution. The name should be added to our lists.

VIII.

AGLENUS Er.—A colony of about forty specimens of a species which is probably *A. brunneus* Gyll. was recently taken by me in the environs of San Francisco. Full de-

tails concerning the locality and other circumstances have been sent to the Entomological Society of Washington.

IX.

The statement of Dr. Horn (Proc. Ent. Sec. A. N. S. Phil.; June, 1886, p. xiii) concerning the identity of *Platycerus Agassii* Lec. and *californicus* Cas. is erroneous. These two species are mutually more dissimilar in outline, punctuation and general appearance than even *oregonensis* and *depressus*. Before describing *californicus* I had access to a very fine series of ten specimens of *Agassii* in the cabinet of Mr. C. Fuchs, a specialist in this family, who had previously written a synopsis of the American species (Bull. Bk. Ent. Soc. V., p. 57). The specimens of this series agree perfectly with Mr. Fuchs' description of the type of *Agassii*, and also with the description recently given by Mr. F. Blanchard (Tr. Am. Ent. Soc., XII. p. 169).

Such absolute and unqualified assertions as the one referred to on the part of Dr. Horn, unaccompanied by any comparative statements and hastily made without examining the type or even an authentic representative of the species condemned, are entirely uncalled for and generally of very little scientific value.

ADDENDUM.

As the present paper was passing through the press, it was found that the specific name *exilis* had already been employed for a species of *Heterothops*, and I therefore substitute the word *occidentis*.

EXPLANATION OF THE PLATE.

- Fig. 1—*Reichenbachia tumorosa* Cas.—Antenna ♂
 Fig. 1a—*R. tumidicornis* Cas.—Antenna ♂
 Fig. 1b—*R. informis* Cas.—Antenna ♂
 Fig. 2—*R. deformata* Lec.—Antenna ♂
 Fig. 2a—*R. fundata* Cas.—Antenna ♂
 Fig. 2b—*R. franciscana* Cas.—Antenna ♂
 Fig. 2—*Eumitocerus tarsalis* Cas.
 3a—Anterior tibia and tarsus.
 3b—Maxillary palpus.
 3c—Posterior coxa.
- Fig. 4—*Leptacinus* sp. incog.—Abdominal vertex showing long rigid sexual spine.
 4a—Lateral view of same.
- Fig. 5—*Hesperobium* Cas.—Base of abdomen beneath, showing structure.
 NOTE—This figure is referred to in the introductory notes of the present paper, p. 159.
- Fig. 6—*Leptogenius brevicornis* Cas.
 6a—Maxillary palpus.
- Fig. 7—*Scopæus lævigatus* Gyll.—Infralateral view of prothorax showing form of intercoxal lamina.
 7a—Labrum.
- Fig. 8—*Scopæodera nitida* Lec.—Same.
 8a—Labrum.
- Fig. 9—*Leptorus picipes* Cas.—Same.
 9a—Labrum.
- Fig. 10—*Orus punctatus* Cas.—Same.
 10a—Labrum.
- Fig. 11—*Pelecomalium binotatum* Cas.—Labrum.
 11a—Maxillary palpus.
 11b—Posterior tarsus.
 11c—Labial palpus.
- Fig. 12—*Lathrimæum humerale* Cas.
 Fig. 13—*Orobanus rufipes* Cas.
 Fig. 14—*O. densus* Cas.
 Fig. 15—*Actidium rotundicolle* Cas.
 Fig. 16—*Ptilium sulcatum* Cas.
 Fig. 17—*Smicrus americanus* Cas.
 Fig. 18—*Ditaphrus scymnoides* Cas.—Antenna.
 Fig. 19—*Eleates occidentalis* Cas.
 Fig. 20—*Renocis heterodoxus* Cas.
 20a—Slightly oblique side view of head.

**SUBMARINE VALLEYS ON THE PACIFIC COAST OF THE
UNITED STATES.**

BY GEORGE DAVIDSON.

Read at the Meeting of October 4th, 1886.

(This paper was illustrated with diagrams.)

The plateau of the Pacific Ocean reaches a depth of 2,000 to 2,400 fathoms within as little as forty or fifty miles of the Coast to the southward of Cape Mendocino. The descent to these profound depths is not uniform, however, except off the high range of the Santa Lucia. Generally there is a marginal plateau of ten miles out to the hundred fathom curve, and then the descent is sharp to five or six hundred fathoms. Off the level and shallow plateau of the Gulf of the Farallones, the descent is rapid within five miles of the South East Farallones, and reaches 2,000 fathoms in fifty miles. The determination of these great depths we owe to the deep sea soundings of Commodore Belknap, of which a full discussion was presented by me to the Academy in 1873-4.

Into this marginal plateau of one hundred fathoms there have been developed, in the course of the operations of the United States Coast and Geodetic Survey, several remarkable submarine valleys. Notably that in Monterey Bay, heading to the low lands at the great bend of the Salinas River; and that off Point Hueneme at the eastern entrance to the Santa Barbara Channel, also heading into the low coast at the wide opening of the Santa Clara Valley. Then there are one or two near the mouth of the Laguna Mugu, two or three off the southern point of Carmel Bay, while the deepest one enters far into the Bay. These all have remarkable characteristics which I have heretofore brought to the notice of the Academy.

Submarine Valley I. The latest developments of submarine valleys are near the high, bold coast under Cape Mendocino. A submarine ridge runs southward from Point Delgada at Shelter Cove, in latitude $40^{\circ} 01'$, for ten miles or more. But the depth of the marginal plateau at 100 fathoms is about six or seven miles from the shore. Just north of this bank, off Shelter Cove, there has been developed a deep submarine valley where it breaks through the marginal plateau and runs sharply into the immediate coast-line under the culminating point of the crest-line of mountains. The head of this submarine valley is 100 fathoms deep at one and a quarter miles from the shore, and the depth of 25 fathoms almost reaches to the rocks under the cliffs. The mountain peak toward which it points is 4,236 feet above the sea and only two and a half miles inside the shore line. The 100 fathom line lies six miles off Point Delgada, but where the valley breaks through the marginal plateau the depth reaches 400 fathoms. The slopes of the sides of this valley are very steep.

Submarine Valley II. Hence northwestward to Point Gorda the 100 fathom line of soundings continues nearly parallel with the coast line except about midway, where a minor submarine valley 300 to 150 fathoms deep stretches sharply toward the shore, and within two and a half miles thereof. The head lies two and a half miles south by east from Spanish Flat, under the mountains. But immediately north of the point, there is a very deep submarine valley which comes in from the westsouthwest, and heads close under the shore three miles north of Point Gorda, and therefore less than a mile north of the mouth of the Mattole River.

The head of this great submarine valley, at the 30 fathom line, is only one-third of a mile from the shore in latitude $40^{\circ} 18\frac{1}{2}'$. The depth of 100 fathoms in the valley is only one and a half miles from shore, and the sides of the valley

are remarkably steep. The 100 fathom curve of the valley comes close between the general 30 fathom curve on the north and south, where they are one-third of a mile apart.

The opening of this valley through the edge of the 100 fathom plateau is 520 fathoms deep, and is only six miles S. 62° W. from Point Gorda. The barrier of coast line at the head of this valley is over 2,000 feet high.

Submarine Valley III. Between Point Gorda and Cape Mendocino there is a second submarine valley, a little nearer to the cape. It comes in from the westward, but does not indent the 20 fathom line along the shore, but the depth of 100 fathoms in the valley is only one-third of a mile outside the regular 25 fathom coast line, and lies five miles S. by E. from Cape Mendocino light house.

The 450 fathom sounding in the entrance to the valley is only six and a half miles SW. by S. from the cape, and this valley is comparatively wide. Its north side is formed by a 30 fathom submarine plateau extending five miles from the cape. This valley heads under the great mountain mass, rising behind Cape Mendocino and reaching 3,400 feet elevation.

The bottom of the valley is green mud, and yet in two places, at depths of 320 fathoms, broken shells were brought up with gravel. Both slopes of the valley are green mud up to about 30 or 35 fathoms, when the bottom changes to fine gray sand.

Between the two submarine valleys of Point Gorda (II.) and Cape Mendocino (III.), the submarine ridge carries 50 fathoms out for four and a quarter miles from shore; the bottom is green mud outside of 35 to 40 fathoms, with fine gray sand inside.

Northward of the Cape Mendocino submarine valley, the irregular bottom off Cape Mendocino, marked by Blunt's reef, stretches well to the westward of the usual coast

depths, and is thence spread out towards Humboldt Bay as a broad and comparatively shallow plateau.

Two problems are at once suggested by these submarine valleys. One is eminently practical. Steam coasting vessels bound for Humboldt Bay, when they get as far north as Shelter Cove in very thick fogs, haul into the shore to find soundings, and then continue parallel with the shore. One vessel has been lost by failing to find bottom until close upon the rocky coast. This steamer doubtless sounded up the axis of the deep submarine valley off King Peak, and could find no bottom. Had the existence of this valley been known, the vessel would have proceeded in a more guarded manner.

The second bearing which these great submarine valleys have, is upon the deep sea fauna which must be brought close under the shores, the more especially as they bring in the colder waters coming down the coast outside of the influence of the close inshore eddy current to the northward.

ADDITIONS TO THE ORNITHOLOGY OF GUADALUPE ISLAND

BY WALTER E. BRYANT.

The avifauna of Guadalupe Island was entirely unknown to science until 1875, when Dr. Edward Palmer, in the interest of the U. S. National Museum, made a collection of seventy-two specimens embracing eight species of land birds and one water bird found dead on the island.¹ The results of this work were published by Mr. Robert Ridgway.²

In "The Birds of Guadalupe Island," Mr. Ridgway remarks that "the land birds contained in the collection from Guadalupe embrace only eight species, so that the fauna of the island is by no means fully represented; indeed, the collector observed a humming-bird, two kinds of owls, and a hawk, of which no specimens were obtained. This is to be regretted, since most, if not all, of these would doubtless have proved new. It is altogether likely, too, that other species escaped notice, and thus remain to be discovered; a rich field is therefore left to the future explorer."

I have twice visited in pursuit of ornithological studies this remote island, which is extremely difficult of access. In January, 1885, I spent a brief time on Guadalupe, sufficient time, indeed, to but increase my desire for further investi-

NOTE ¹.—The eight species of land birds were determined to be new to science. The water bird was an adult specimen in breeding plumage of the Pacific Loon (*Urinator pacificus*).

NOTE ².—"Ornithology of Guadeloupe Island, based on notes and collections, made by Dr. Edward Palmer." Bulletin, Hayden's Survey, 1876, No. 2, p. 183.

See, also, Bulletin of the Nuttall Ornithological Club, Vol. II, p. 58, July, 1877.

gation. Through the kindness of Mr. Luis Huller I was enabled at the end of the same year to make a second visit, landing on the island on December 16, 1885. My expectation was to stay about six weeks, but as it eventuated, it was one hundred and twelve days before an opportunity presented itself for me to leave the island. During these three months and a half I had ample time to most thoroughly prospect the island and to make a careful study, not only of the birds themselves but of their habits, number and distribution.

Guadalupe being almost unknown and charts quite unattainable, a few words in the way of description may serve to render more lucid the remarks which follow.

Guadalupe Island is situated about two hundred and twenty miles to the southward and westward of San Diego, the northern extremity lying in about $29^{\circ} 10'$ N., $118^{\circ} 18'$ W. Extending about fifteen miles in length, with a maximum width of five miles, it is said to reach at its highest point an altitude of 4,523 feet. It is of volcanic origin, as is evidenced by the loose, burnt rocks, and broken lava which cover the entire island. Rocks varying in size from the smallest pebble to that of a cocoa nut are thickly strewn about on every hand, while in places, huge boulders and ledges crop out. An unbroken ridge rising to its greatest height in the central portion extends the entire length of the island from north to south, forming a "hog's back." On the western side of this range, the land slopes rapidly towards the ocean, ending in many places in high perpendicular cliffs.

Towards the south the land is somewhat lower, sloping more gradually and ending less abruptly. It is noticeable that the southern part of the island, which is the lowest, is very rocky and barren, no trees growing below the central mesa. Whatever vegetation exists there, consists of stunted aifileria and scattered sagebrush. The western side is broken by two great cañons separated by a barren hill of

reddish rock. The northern portion consists of a very sharp ridge nearly or quite perpendicular on the western face, while on the eastern slope it descends rapidly and hides its surface under a covering of sagebrush.

For convenience of reference, I shall mention the wooded tracts under four distinct heads:—

First—At the northern end of the island is a fast decaying forest of pines, extending within narrow limits along the sharp ridge and down the almost perpendicular western face. Among these pines are to be found a few hardy oaks upon whose branches grow huge acorns, said to be the largest in the world. A few isolated pines are found growing along the ridge nearly to its central portion.

Second—Far down on the northwestern slope is a large grove of cabbage palms.

Third—On the highest part of the island, with the exception of a single peak (Mt. Augusta), is situated a large grove of cypress trees covering an area of a mile or more on the western slope; the eastern side of this forest ends abruptly at the edge of the ridge, below which is a comparatively level table land.

Fourth—On this plateau grows a small cypress grove. Here I had my permanent camp, within half a mile of which were several springs and pools of water. With the exception of one spring here and one or two towards the north, all the waters were more or less strongly alkaline. Whenever rain collected in the rocky basin of the small arroyos, this water was used in preference to the alkali water of the springs.

The vegetation in a wet season, as was the winter of 1835-6, consisted chiefly of the common alfileria, while in places, especially about old goat corrals, dense growth of *malva* had sprung up. Throughout the entire length of the island, there grows in places a small white sagebrush with yellow blossoms. This sagebrush, together with the bark of the cypress trees, serves

in dry years as food for the goats, who numbered, I should judge, about two thousand. In the large cypress grove I saw scarcely a tree that did not bear the marks of their teeth.

The climate of Guadalupe was, at that season of the year, quite cool, in fact the nights were so cold that ice occasionally formed, while frost was of common occurrence. Towards spring the weather moderated considerably, and in the summer, I am told, it is very warm. During many days the north-westers blew keenly, rising at times almost to a gale. The fogs were very dense, and, driven by high winds, swept over the island, saturating it like rain. Although the rains were at no time very heavy, the sloping and rocky formation of the land allows most of it to flow off, so that a few hours of rain would send small torrents rushing down the arroyos.

The work of preparing specimens was beset with many difficulties. On some days the large blow-flies that swarmed about camp compelled me to prepare and pack in a green condition the specimens as soon as brought in. But more trouble was caused by the dense fogs that often enveloped the camp and so relaxed skins that were not tightly boxed, as to render it necessary to reset them. The accommodations, moreover, were not the most suitable, nor were the comforts of life in excess of the demand for them. As a result of three and a half months' sojourn on the island, the number of known species has been increased by twenty-seven, making a total of thirty-six known to the island.

Four of the straggling species, viz.:—Mountain Bluebird, Varied Thrush, Townsend's Sparrow and Golden-crowned Sparrow, are recorded for the first time from so southern a latitude as Guadalupe Island, while their presence so far off shore, is of scarcely less interest. It is shown quite conclusively that the four species (certainly three of them) that were noted, but not taken in 1875, are not new to science. The very natural supposition to the contrary held by many, served to attract me to the island.

There yet remain unknown the eggs of *Pipilo consobrinus*, *Thryothorus brevicaudus* and *Polyborus lutosus*, and also the young plumage of *Thryothorus brevicaudus*, *Colaptes rufipileus* and *Regulus obscurus*.

From Dr. Palmer's notes I was led to suppose that the breeding season on Guadalupe differed but slightly, if any, from that about the vicinity of San Francisco Bay. Personal observation, however, reveals the fact that on the island it is several months earlier, nesting beginning with many of the species in the winter, as will be seen by the dates accompanying the notes.

The researches made by Mr. L. Belding on the western coast of Lower California, disclose the fact that, as far south as Cerros Island (about 23 deg. north), the birds do not differ from those found near San Diego.

With the exception of a pair of falcons (*F. mexicanus?*), which were not taken, the subjoined is a complete list of the birds which I found inhabiting Guadalupe Island. Nevertheless, there is a strong probability that others have and will find rest in transit, or permanently, as in the case of the cross-bills and nuthatches. Without going into the details of a strict technical treatise, I will endeavor to give a full account of the habits, distribution and numbers of the birds from my personal observation. The measurements have been carefully taken and compared with specimens and published descriptions, those of the more common species being omitted.

The Mexican names of many birds were not known to the inhabitants, and in some instances it was evident that they either confounded the species or applied to a bird the name of some similar bird with which they were familiar. As they may, however, be of use to others who may visit the island, I append the names as they were given me:

- 1.—*Buteo borealis calurus*.—"Aguilia," which more strictly means an eagle.

- 2.—*Tinnunculus sparverius*.—"Gavalancillo."
- 3.—*Polyborus lutosus*.—"Queleli."
- 4.—*Speotyto cunicularia hypogæa*.—"Lechuza."
- 5.—*Colaptes rufipileus*.—"Carpentero." This name is applied to several of the woodpeckers in California, particularly *Melanerpes formicivorus bairdi*.
- 6.—*Micropus melanoleucus*.—"Golondrina." Also applied to swallows in Lower California.
- 7.—*Trochilus anna*.—"Chuparro." Humming birds generally.
- 8.—*Carpodacus amplus*.—"Gorrion." Pronounced "Burion," as it is spelled in B. B. & R. Hist. N. Am. Birds. In California *C. frontalis rhodocolpus* is also known by this name.
- 9.—*Junco insularis*.—"Gorrion azul."
- 10.—*Oroscoptes montanus*.—"Sinsontle."
- 11.—*Salpinctes guadeloupensis*.—"Saltapared."
- 12.—*Regulus obscurus*.—"Canaria."
- 13.—*Merula migratoria propinqua*.—"Silguero."

To Mr. H. W. Henshaw, Mr. W. O. Emerson and the authorities of the U. S. National Museum, I am much indebted for the use of specimens with which to compare my own. I also wish to express my thanks to Mr. L. Belding for valuable information and suggestion, and to Capt. L. W. Johnston for his many kind offices during the two voyages which I have made with him. To Mr. John Lehr, the island agent, my thanks are due for his valuable aid during my stay.

The nomenclature and order of the A. O. U. checklist has been followed in the preparation of this paper.

1. *Larus occidentalis*.

WESTERN GULL.—A few single birds were seen off shore alighting on rocks which at high tide were entirely covered. I was told that the gulls had formerly bred in considerable numbers at the southern end of the island, where they were

not so frequently molested by the "Quelelis." The latter, said my informant, had often been seen in the act of robbing the gulls of their eggs. The birds can undoubtedly nest at the present time on any other portion of the shore, especially the northern, where they would be comparatively free from this source of danger. Had more time been at disposal, a trip of a few days along shore might have resulted in the discovery of a breeding colony, although the month of April was rather early to look for gull's eggs.

Specimens in both adult and immature plumage in numbers were noticed about the island, but after getting well out to sea on the return voyage, the schooner was accompanied by a few adult birds only. On approaching the Californian coast, these were joined by a number of others, accompanied by a few birds of immature plumage. Apparently the younger birds are not partial to long flights at sea, with the chances of encountering heavy weather, and therefore prefer to follow the coast-line. If such be the case, the immature birds of Guadalupe may have been reared there, and were loath to put to sea in pursuit of vessels.

2. *Puffinus gavia*.

BLACK-VENTED SHEARWATER.—A decayed specimen, found on top of the island in April, has kindly been identified by Dr. Cooper as this species. One stormy night in January, I heard a bird, as he flew past camp, making a peculiar rasping squawk, and although I subsequently heard the same sound on numerous occasions, more particularly when encamped at a lower altitude, I was yet unable to detect the author of it. My Mexican companion said the bird that made the sound was a "Cuapo," common in Mexico; he also drew in explanation the outline of the bill of some rapacious bird; such information is, of course, extremely unreliable.

Since then I have not found any one who knows of a bird by the name "Cuapo." I was inclined to assign the sounds

to sea-birds, which hypothesis was strengthened by my hearing a far greater number of these night-fliers along the beach than on the top of the island, where the dead one was found. In the afternoon on which I left the island, large flocks of Shearwaters were seen a few miles from shore, all of which were on the wing, not much above the waves. Some or all may have been of this species. As the schooner neared Los Coronados Islands (about twenty miles southwest of San Diego), large flocks were seen on the water but rose long before the boat reached them.

3. *Oceanodroma leucorhoa*.

LEACH'S PETREL.—In the latter part of January, I was encamped for a few days upon a narrow shelf of rock below the top of a steep hillside, which formed a quiet lee where some slight protection could be had against the gale. No ornithological work was possible, and nothing could be done for the three days of the storm's continuance but to hug the camp fire. At midnight of the last day, my companion awakened me to announce that some "little owls" were flying about. Every few minutes a bird would pass the small circle of light or hover for an instant in the glow above the fire, while from the enveloping darkness their calls and replies could be clearly heard. There seemed to be four or five close by, but so quick were they in their movements, with flight as erratic as that of a bat, that I found it impossible to shoot them. The next night, I set a steel trap, but the bait, consisting of a Junco, remained untouched. The birds came about my camp only on the darkest nights or, if any were flying during moonlight, they were entirely silent. After the setting of the moon, however, even though as late as four o'clock in the morning, they would make their appearance with their peculiar call. The note I find hard to describe; perhaps I may best characterize it by saying that they seemed to call hurriedly, "here's-a-letter," "here's-a-letter," and then from the dark-

ness came the reply from another that I supposed to be at rest, "*for yóu,*" "*for yóu.*"

Toward the north I often found wings or other fragments of a petrel, and sometimes the entire body with the exception of the head. Of several dozen picked up from the ground but one entire bird was found. Scores of these bodies were found, some of them partially eaten. My Mexican said that this wholesale slaughter was the work of cats, but only one or two of these animals were seen, while decapitated petrels were lying about on all sides.

There were many small holes in the moist hillside opening under boulders and fallen branches. Digging into these holes for a distance of from one to three feet, my search was rewarded by the discovery of petrels and fresh eggs. During the greater part of two days I dug into about eighty burrows, in most of which a single bird was found. In some cases a single egg, never more, laid upon a few pine needles in an enlarged chamber at the extremity of the burrow was disclosed to view on removing the bird. The birds seemed dazed when brought to light, and walked or fluttered helplessly along the ground for a few feet until they sufficiently recovered from their fright to make use of their wings. When tossed into the air they descended lightly and made their way among the tree-trunks and wind-falls, dodging limbs and branches with a quick, bat-like motion. I do not know whether they flew out to sea or found concealment until nightfall, but the latter course seems the more probable.

Seldom did a bird make a sound when seized, but occasionally a cry like that of a bird in distress would escape them. One individual, however, while being unearthed, kept up the peculiar night-call which had so puzzled me about the camp-fire.

Their favorite breeding-ground was on the pine ridge, but nests were found as far south as the small cypress grove. It was very difficult to secure clean specimens since, upon

being caught, they invariably vomited and purged a reddish, thin, oily fluid of an extremely strong odor. The single egg which they lay is held against the abdomen of the sitting bird. It is shaped much like a pigeon's egg, white in color, while one end is wreathed with a fine spattering of minute dots of reddish brown and pale lavender.

The average measurements of fifty eggs taken March 4th and 5th, is 35.7 x 27 mm. The largest eggs measure 37.5 x 27.5; 38 x 27.5; 37 x 28 mm., and the smallest 31.5 x 26; 32.5 x 25.5; ; 33 x 27 mm.

DIMENSIONS OF SPECIMENS.

Collector's No.	Sex and age.	Wing.	Tail feathers	Depth of fork.	Exposed culmen.	Tarsus.	Middle toe and claw.
		mm.	mm.	mm.	mm.	mm.	mm.
2555	♂ ad.	155	85	25	17	25	29
2556	♂ ad.	162	92	28	17	23	29
2558	♂ ad.	158	87	23	16	23	28
2559	♂ ad.	161	90	30	16	25	28
2560	♂ ad.	162	93	25	15.5	25	28
2561	♂ ad.	160	89	32	17	24	28
2563	♂ ad.	166	95	—	17	25	29.5
2564	♂ ad.	168	94	32	17	23	30
2566	♂ ad.	162	92	26	16.5	24	29
2567	♂ ad.	166	97	34	17	24	30
2568	♂ ad.	160	92	—	15.5	22.5	28
2557	♀ ad.	171	99	35	16	24	28
2562	♀ ad.	167	97	30	16	22	29
2565	♀ ad.	159	96	35	17	26	30

No. 11,164 in the collection of the Cal. Academy of Sciences, from Atlantic Ocean, measures—Tail, 94 mm.; depth of fork, 18 mm.; culmen, 16 mm.; tarsus, 22.5 mm.; middle toe and claw, 24.5 mm.

No. 11,165 in the collection of the Cal. Academy of Sciences, from Atlantic Ocean, measures—Tail, 92 mm.; depth of fork, 18 mm.; culmen, 16 mm.; tarsus, 22 mm.; middle toe and claw, 25 mm.

There is indicated in the longer tail, greater depth of fork and longer middle toe which is constant in the Guadalupe example, a Pacific or at least a Guadalupe Island form of *Oceanodroma*, differing mainly in these respects from *O. leucorhoa*. But I have not at present sufficient material from the Atlantic Coast to determine this satisfactorily.

4. *Anser albifrons gambeli*.

AMERICAN WHITE-FRONTED GOOSE.—At my first visit on January 14, 1885, I shot a goose, which I have no doubt was of this species. The bird was a solitary individual, found a few hundred yards from the beach, and when shot fell over a cliff and was lost. Although flying well when flushed, it covered but a short distance before alighting. In the vicinity where it was first seen were many signs indicating that the bird had been there for some time, or that a flock had rested there during a migration. The young grass just appearing above the ground furnished sufficient food.

5. *Buteo borealis calurus*.

WESTERN RED-TAIL.—This is a resident species, and is probably the hawk seen by Dr. Palmer, but of which no specimen was obtained. They were not common, not more than three or four being seen during any single day, and probably the same birds were counted over several times in the course of a week. At the time of my departure I estimated their number as about equalling that of the Caracara eagle. They were oftener seen toward the north where the pines offered a high roosting-place. On pleasant days they extended their hunting excursions toward the south, sometimes remaining for days in the vicinity of the small cypress grove, but on the occasion of foggy or rainy weather they disappeared, seeking shelter among the pines, where, perched on branches close to the leeward side of the trunk, they waited storm-bound till hunger or fair weather called them away. Their extreme wariness and the nature of the country prevented me from securing more than a single specimen. This is an adult male, which was taken on the edge of the small cypress grove January 5.

No nests were seen, but I have no doubt that among the scattered pines these birds hatch and rear their young.

DIMENSIONS OF SPECIMEN COLLECTED.

Collector's No.	Sex and age.	Wing.	Tail-feathers.	Bill from nostril	Tarsus.	Middle toe
2403	♂ <i>ad.</i>	mm. 385	mm. 204	mm. 23	mm. 70	mm. 48

Iris, dark brown. Cere, commissure and toes, chrome yellow. Length, 517 mm. Extent, 1249.5 mm.

6. *Falco sparverius*.

AMERICAN SPARROW-HAWK.—During the two days spent on the island in January, 1885, I saw a single pair of these birds, but only succeeded in securing the female. My sojourn during the winter and spring of the following year showed the birds to be a resident species. It was seldom that one could not approach within gun shot, even in open ground, while the bird was sitting perched upon either a boulder or the dead branch of a cypress. They especially frequented the central and higher portions of the island. By the middle of February male and female were seen in company, one pair remaining near some isolated cypress tree, while another pair had evidently taken up their abode in a rocky cliff, the absence of suitable tree-cavities forcing them to adopt some convenient hole in the rocks for a nesting place.

Their means of subsistence, during the time of my observation, consisted of coleoptera, caterpillars and other insects, upon which food they became quite fat. I did not see them in pursuit of small birds, and believe it is not their custom to molest them, at least while insect food can be obtained.

LIST OF SPECIMENS COLLECTED.

Collector's No.	Sex and age.	Date.	Wing.	Tail feathers.	Bill from nostril.	Tarsus.	Middle toe.
2410	♂	January 21, 1886	mm. 188	mm. 124	mm. 10	mm. 31	mm. 23
2520	♂ <i>ad.</i>	February 15, 1886	188	122	11	34	25
2519	♀ <i>ad.</i>	February 15, 1886	195	122	11.5	35	23
1687	♀ <i>ad.</i>	January 15, 1885	192	125	11.5	36	24

The feet, cere and ophthalmic region, yellow in all four.

No. 2410.—Moulting. Blue of wings almost unspotted. Gizzard contained beetles only.

No. 2520.—Contained insects.

No. 2519.—Very fat. Gizzard contained caterpillars.

7. *Polyborus lutosus*.

GUADALUPE CARACARA.—In January, 1885, during a two days' excursion about the central part of the island, but four "Quelelis" were seen. By 1886 their number had been reduced by more than a score by the island agent, who never missed an opportunity to kill one. Arriving on the island in the summer time, when the birds came to the shallow pools to drink, the agent would lie in wait behind a boulder and pick them off with a rifle. The birds, if missed, heeding not the shot, or, if but slightly wounded, not realizing the danger, remained near, making certain the destruction of all that came to drink at the fatal spring.

During my rambles I frequently came upon the weather-beaten carcasses of "Quelelis" lying where they had fallen. In one place, four were found lying dead together.

In regard to their numbers and destructiveness towards the goats running wild there, the facts noticed by Dr. Palmer in 1875, thoroughly substantiated by information given me by sea-captains and seal-hunters, are not apparent at the present time. Dr. Palmer's assistant, Mr. Harry Stewart of San Diego, writes me that he is unable to say how many were on the island at the time he was there, but that they were in great numbers.

Their range extends over the entire island, from beach to summit. I believe that the killing of several goats each week near the central part of the island, attracted almost the entire number of "Quelelis" to that vicinity,

Being of an unsuspecting character, they will allow a person to walk directly towards them until within shooting distance, merely watching the intruder until the distance becomes less than agreeable. If they happen to be upon the

ground they beat a retreat at an awkward walk or, if necessary, a run, taking wing only as a last resort, and even then flying but a short distance before alighting. Their actions, gait and positions, while on the ground are similar to those of a buzzard. In flight, the light color on the primaries is distinctly shown.

During several consecutive days, a "Queleli" came to my camp, searching for scraps of food. One day I saw him making off, at a walk, from the cook-house, carrying with him a piece of bone from the leg of a goat, and upon which a little raw meat still adhered. With this bone, fully nine inches in length, grasped firmly in his bill, he retired to what he considered a safe distance before commencing his feast.

As far as my observations went, the birds were entirely silent, but the agent informed me that when perchance a rifle ball carried away a wing or a foot, the unfortunate bird would scream long and loudly. If the wounded creature happened to be in company with others of his kind, he would be immediately attacked and killed. One which was badly wounded attempted to escape by running, with the assistance of his wings. Being overtaken and brought to bay, instead of throwing himself on his back in an attitude of defence, or uttering a cry for quarter, he raised his crest and with an air of defiance, calmly awaited death as became the Eagle of Guadalupe. Weakened by the loss of blood which poured from a wound in his throat, he finally fell forward and died—silent and defiant to the last.

If a goat was killed and not immediately taken to camp, the hunter was almost certain to find upon his return that a "Queleli" (rarely more than one) had taken possession of the carcass.

Their food during the season of caterpillars consists almost entirely of these larvæ, with a slight variation afforded by occasional beetles and crickets. Whenever opportunity offers they are ready to gorge themselves upon

the offal of a slain goat, retiring after the banquet to a convenient tree to await the process of digestion. I have never known of their eating the bodies of their own species, but they do not object to making a meal off the flesh of a fat petrel if fortune casts a dead one in their way.

The goats, I believe, are seldom molested in a time of plenty by the few Eagles that remain, although during a scarcity of food, it is not unlikely that they would attack a kid or possibly even a full grown animal. By the latter part of April, the birds had apparently not paired, and I believe the eggs are not laid until the latter part of May or June.

The Mexicans said that a cliff was always chosen for a nesting place, thus making their nests difficult to find and still more difficult of access. This being the case, I fear the eggs will long remain unknown.

LIST OF SPECIMENS.

Collector's No.	Sex and age.	Date.	Wing.	Tail.	Culmen	Tarsus	Middle toe.
			mm.	mm.	from cere.	mm.	mm.
1692	♂ <i>ad.</i>	Jan. 15, 1885	402	260	32	92	51
2387	♂ <i>ad.</i>	Jan. 4, 1886	390	260	33	84	53
2577	♂ <i>ad.</i>	March 16, 1886	399	260	33	88	53
1691	♂ <i>ad.</i>	Jan. 15, 1885	418	276	33	89	53
1699	♂ <i>ad.</i>	Jan. 15, 1885	405	268	33	89	56
2408	♂ <i>ad.</i>	Jan. 8, 1886	412	266	33	90	50
2504	♂ <i>ad.</i>	Feb. 16, 1886	418	285	33	84	54
2581	♂ <i>ad.</i>	March 22, 1886	414	273	33	90	55
2409	♂ <i>im.</i>	Jan. 18, 1886	405	260	32	92	54
2576	♂ <i>im.</i>	March 16, 1886	408	257	32	88	54

Remarks.—The adult birds have light-brown eyes. Bill, pale bluish white. Cere, lores, feet and legs, chrome yellow. The yellow of lores assumes a salmon color soon after death, but this disappears for a short time if a finger is pressed upon the spot, resuming again the salmon color as the skin dries. Immature birds have dark-brown eyes. Bill, light bluish. Lores, not chrome yellow. Feet and legs, nearly "Naples yellow" in color. All of the so-called immature birds which I have seen (five in number) have been in worn or ragged plumage.

No. 1692—Length, 609 mm. One foot missing from below the knee; an old wound.

No. 2387—Length, 603 mm. Extent, 1260.5 mm. Contained feathers and pieces of goat meat.

No. 1691—Length, 631 mm. Extent, 1308 mm.

No. 2581—Fat. Ovaries slightly enlarged. Stomach contained a foot and some feathers of a petrel.

No. 2409—Ovaries very small.

8. *Speotyto cunicularia hypogæa*.

BURROWING OWL.—This species may or may not be one of the two kinds of "*Strigidae*" mentioned in the "Ornithology of Guadeloupe Island," but of which no specimens have ever been taken. It was the only species which I met with, and I have no positive evidence of there being any other owls on the island while I was there, although whenever a favorable night offered itself, I seized the opportunity to watch for nocturnal birds.

The Mexicans said that there was a large Owl ("Tecolote"), which they had occasionally heard hooting at night, but that it was very rare.

From Dr. Palmer's assistant, I learned that one of the owls which was known to be on the island was a Horned Owl (*Bubo*).

A single pair of Ground Owls were the only ones of this species met with. They frequented the open ground on the central part of the island near the alkali pools, appearing only after dusk. The notes made at the time will perhaps give the best idea of the bird's habits as far as these were observed. The third night on which I had watched for them was unusually calm and quite chilly. The lingering twilight rendered objects still visible through the approaching gloom. Nearing a large boulder beside which I purposed to take my stand for that evening, I suddenly started up one of the very birds of which I was in search. Frightened by my approach, she rose a short distance in front of me, and instead of alighting on a rock, as I expected, and thus keeping me within sight, she dropped behind it, dis-

appearing instantly. As I cautiously circled around the spot, I noticed her head peering out from one side of the boulder, and at once fired. After smoothing out her plumage and placing her upon a rock, I stationed myself against the boulder and gun in hand watched for the male whose call I had heard issuing from the darkness. Soon the call was repeated nearer than before, and the form of an owl rose dark above the horizon not twenty feet away. He discovered my presence just as I threw my gun into position, and giving a cry of alarm, swerved off. He was, however, too late and was soon placed upon the rock beside his mate. They were both very fat, one was gorged with caterpillars, the other contained a single small beetle.

LIST OF SPECIMENS COLLECTED.

Collector's number.	Sex and age.	Date.
2453	♂ <i>ad.</i>	Feb. 2, 1886.
2452	♀ <i>ad.</i>	Feb. 2, 1886.

Iris and feet yellow.

9. *Colaptes rufipileus*.

GUADALUPE FLICKER.—Comparatively speaking, this bird was not rare in the restricted area of the large cypress grove, but apart from this locality less than a dozen were seen. Three specimens were taken among some palms within a short distance from the beach on the eastern side of the island. One only was heard among the pines at the northern portion, and in the vicinity of the large palm grove on the northwestern slope they were occasionally seen.

Of all the species of this family I have ever met with, none have been so tame and unsuspecting or less frightened by the report of a gun. In January I witnessed a peculiar habit not before noticed, I believe, in birds of this genus. A pair of Flickers were perched facing each other upon a

gnarled root about three feet from the ground, their heads within a foot of each other. Suddenly the male, who had been sitting motionless before the female, began a somewhat grotesque performance, which consisted in a rapid bobbing of his head. In this he was immediately followed by the female. This spasmodic bobbing and bowing they repeated alternately a few times, when both stopped as suddenly as they had commenced. After an interval of a few seconds the male began again and was joined by the female. The movement resembled more an upward jerk of the head than a bow.

Approaching on my hands and knees to get a closer view, I could hear a low chuckling sound while these strange actions were in progress. What the outcome of this love-making—for such I regarded it—would have been I did not ascertain. The fear of losing the specimens—almost the first I had seen—prompted me to fire. The first shot brought down the female. At the report away flew the male, followed by another male, which, unseen by me, had been quite near, on the ground. They returned while I was still holding the female, and thus gave me an opportunity of securing them both. Their evident lack of timidity permitted me to draw near enough to plainly distinguish the characteristic bright red cheek-patches. In February I saw a repetition of the action above noted, the birds being in a cypress tree above me. They were very tame, especially the female, who came quite near as I lay upon the ground, whistling “*quíit-tu,*” “*quíit-tu,*” and watching her puzzled actions. In a half-dead cypress this pair had partially pecked a cavity for a nest.

In addition to the familiar scythe-whetting notes they have the peculiar “wake-up” call and its rapid prelude of monosyllables. By imitating this call I decoyed a distant female to within short range, the bird coming through the thickest of the cypress grove, stopping at short intervals to call and listen for a reply.

The food of this species during a portion of the year consists largely of smooth-skinned caterpillars, besides numerous beetles and ants; the latter are always obtainable and growing to a large size figure as an important item of their diet. The scarcity of decayed trees with the exception of fallen ones, necessitates either work upon seasoned wood or the resort to dead palm stumps. The nests will therefore be found at heights varying from three to fifteen feet.

By March 16, the birds were invariably found in pairs, and my wish to secure a setting of eggs before departing seemed in a fair way of being fulfilled. Strolling among the cypress on the 27th of March, I found four trees upon which the birds were at work or had been recently, and in such cases the birds themselves were always to be found in the immediate vicinity. Passing a half-dead tree I heard the sounding taps of a woodpecker at work, and as I neared the spot, the slight noise which I made as I carefully picked my way over the rock-strewn ground caused a handsome male bird to suddenly appear at an opening about four feet high. With a foot grasping either side of the entrance he gazed upon the intruder. Having comprehended the situation, he flew to another tree, where he quietly awaited my inspection and departure. The hole was then down about fifteen inches. By April 7, it had reached a depth of about twenty inches and contained six fresh eggs, upon which the female was then sitting. As no description has hitherto appeared of the eggs of this species it may be well to present here the measurements of this set. (No. 803, author's oölogical collection.) They correspond exactly, both in color and general shape, with scores of other eggs of this genus, and offer the following measurements in millimeters: 28x22; 28x22; 28x22.5; 29x22; 29.5x22; 29.5x22.

A comparison of the measurements of the specimens taken on Guadalupe Island with those of the same genus which I have in my possession may be of interest.

Although on the one hand the collection from the island

is probably the largest that has been obtained, yet on the other hand my series of the other form is not as full as could be desired, and furthermore I possess neither specimen nor description of the recently added variety *saturator*. In the late revision of the nomenclature of North American birds, the variety *hybridus* was rejected. It seemed improbable that the wide departures from typical examples of either *auratus* or *cafer* could be attributed to hybridism. This fact impressed itself more and more on my mind by the ever-increasing occurrence of the so-called Hybrid Flicker. Specimens of this genus, however, are found which no stretch of the imagination can reconcile with any existing description of *auratus*, *cafer* or *rufipileus*, and I have no doubt that similar departures may be found in specimens of *chrysoides* and *saturator*.

DIMENSIONS OF ♂ *ad.* C. RUFIPILEUS.

Collector's No.	Date. 1886.	Wing.	Tail.	Tail-feathers	Bill from nostril.
		mm.	mm.	mm.	mm.
2405	Jan. 8.	146	127	110	34
2406	Jan. 8.	149	123	112	32
2460	Feb. 2.	148	120	116	33
2509	Feb. 12.	145	126	116	32
2511	Feb. 12.	147	124	111	34
2514	Feb. 12.	150	122	108	30
2521	Feb. 15.	152	129	109	36.5
2522	Feb. 15.	145	125	108	34
2524	Feb. 19.	147	123	108	35
2525	Feb. 19.	146	128	114	36
Average..	.....	144.5	124.7	111.2	33.5

No. 2406.—Length 312 mm. Extent, 499 mm.

No. 2460.—Stomach gorged with large black ants.

DIMENSION OF ♀ *ad.* *C. RUFIPILEUS.*

Collector's No.	Date. 1886.	Wing.	Tail.	Tail-feathers.	Bill from nostril.
		mm.	mm.	mm.	mm.
2380	Jan. 2.	149	126	111	29
2381	Jan. 4.	146	120	108	32.5
2407	Jan. 8.	143	119	104	33
2526	Jan. 23.	148	123	108	36
2427	Jan. 23.	148	125	110	31
2512	Feb. 12.	154	129	115	34
2513	Feb. 12.	148	124	109	32
2515	Feb. 12.	141	117	104	34
2516	Feb. 12.	146	120	107	33
2527	Feb. 19.	143	125	109	30
Average...	.....	146.6	122.8	108.5	32.4

No. 2380.—Length 328.8 mm. Extent 487 mm. Iris dark reddish-brown.

No. 2381.—Length 312 mm. Extent 476 mm.

No. 2427.—Ovaries small.

COLAPTES CAFER ♀ *ad.*

Collector's No.	Collector's Name.	Locality.	Date.	Bill from nostril.
				mm.
169	W. E. Bryant.	Berkeley, Cal.	Jan. 22, 1881.	31
564	" "	Oakland, Cal.	Feb. 25, 1882.	32
599	" "	Mt. Diablo, Cal.	Apr. 1, 1882.	32.5
772	" "	Oakland, Cal.	Feb. 22, 1883.	30
1065	D. S. Bryant.	Mt. Diablo, Cal.	May 5, 1878.	31
1095	" "	Oakland, Cal.	Mar. 27, 1879.	31
1175	" "	Lafayette, Cal.	Mar. 20, 1883.	30
1742	W. E. Bryant.	Oakland, Cal.	Jan. 25, 1885.	32
1985	" "	" "	Mar. 12, 1885.	31.5
2636	" "	Scott, Cal.	May 28, 1883.	29
Average...	.....	.....	.....	31

No. 564.—Cheek-patches indistinct.

No. 599.—Tail pinkish; crown, light tawny-brown.

No. 1065.—One outer tail-feather yellow.

No. 1095.—Narrow, red nuchal crescent.

No. 1175.—Forehead brown.

No. 1742.—Crown rufous brown.

No. 2636.—Tail red; one outer feather yellow. Anterior portion of crown tawny-brown. Caught on nest containing seven eggs.

COLAPTES CAFER δ *ad.*

Collector's No.	Collector's Name.	Location.	Date.	Bill from nostril.
980	D. S. Bryant.	Oakland, Cal.	Nov. 18, 1877.	33
1006	D. S. Bryant.	Gilroy, Cal.	Dec. 23, 1877.	34

By an inspection of the preceding tables, it will be seen that the long bill is by no means a constant difference. While the length will *average* greater in *rufipileus*, specimens are found with the bill shorter than the average of *cafer*. The two examples of *cafer* given in comparison with *rufipileus* in the "Ornithology of Guadeloupe Island" were from Washington Territory, and under the present arrangement, I presume would be classed as *saturator*, rather than as "true Mexicanus" (*cafer*).

As yet I have seen no description of the male plumage of the Guadeloupe Flicker, but I am informed that one is soon to be published.

Some of the specific characteristics which serve to distinguish this insular species from the continental form, *cafer*, will be briefly noticed.

In the majority of the specimens before me, the characteristic of the more pinkish tinge to the rump and upper tail coverts—especially the latter—seems to hold good. But in some individuals these parts are whiter than will be found in certain specimens of *cafer*. By raising the upper tail coverts and viewing them from the under side, the depth of the coloring may be best determined. This is of a sulphurous tinge in *auratus*.

The bright tawny forehead is usually brighter in the males, and extends farther back on the neck. No specimens of *cafer*, which I have examined, are as richly marked as the most typical examples of *rufipileus*, but individuals of the latter sometimes possess less of the tawny brown than extreme cases among *cafer*.

I have found but two exceptions to the extent of black on the ends of the retrices. One in the case of a female *rufipileus*, in which the black reaches only about 38 mm. from the ends of the feathers, and the other a female *cafer* (formerly *hybridus*) in which the black extends about 57 mm. In typical *rufipileus*, the black covered about 63 mm. of the ends. This I found to be the most constant difference.

The absence in every case of a definite or clearly defined cheek-patch in the females, and also the absence of marginal light spots on the outer web of the exterior retrices in both sexes, will aid in determining this species. These spots, although rarely if ever wanting in typical *cafer* are seldom or never found in *rufipileus*. An apparent exception is found in a male from Guadeloupe Island, which has a slight touch of light on the webs.

10. *Micropus melanoleucus*.

WHITE-THROATED SWIFT.—On January 12, a flock of about fifty swifts passed near camp, moving towards the north-east. They flew in every direction, but kept well together, and gradually ascended to a higher altitude. I could not get near enough to distinguish any characteristic markings. They were again seen during a few hours of sunshine on the 15th, but only at a distance.

A storm of wind, rain and dense fog, which had lasted almost without interruption for twelve days, cleared away January 21, and with the welcome and returning sunshine came the swifts. They were flying lower than usual, and occasionally one would chatter as he swept above the tree-tops. The birds were feeding upon a species of slender black fly, with which the air was swarming, and although dispersed for a time by the report of a gun, they soon returned to their feast. As late as April, they were still on the island, but only a few at a time were seen, the flock having evidently separated, although not apparently paired off. One calm day, about a dozen birds were seen skimming low over the grass in the manner of swallows. As far as my ob-

servations go, this is something unusual for this species, which usually descends towards the earth only in dull rainy weather in pursuit of insects driven lower by the humid atmosphere. If the birds were to remain on the island during the summer, they could find an abundance of suitable nesting places in the cliffs, either on the shore or on the side of the table-land where the small cypress grove stands.

LIST OF SPECIMENS.

Collector's number.	Sex and age.	Date.
2411	♀ <i>ad.</i>	Jan. 21, 1886.
2584	♀ <i>ad.</i>	March 26, 1884.

2584.—Ovaries, small.

11. *Trochilus anna*.

ANNA'S HUMMING-BIRD.—This diminutive straggler is no doubt the species seen by Dr. Palmer eleven years ago, but of which he did not succeed in obtaining a specimen. I had been in hopes of finding in this bird a new species of hummer. When the month of March arrived and I had not even caught a glimpse of the bird, although on one or two occasions I had heard it buzz as it went past, my hopes of securing this unidentified species were almost gone, and I fully resolved to shoot on sight the first I saw. Returning one day to my temporary camp from an excursion through the pine belt, both barrels of my gun loaded with round ball ($1\frac{1}{8}$ oz.), I stopped at the foot of a fallen pine, intent upon watching a small band of goats, when suddenly my Mexican companion seized my arm and whispered: "la chuparrosa, señor." Following with my eyes the direction indicated by his outstretched hand, I saw a female hummer upon a dead twig among the pine branches, pluming herself. The feelings I experienced some years ago in meeting a panther, at dusk, in a wooded cañon when my gun was

loaded for quail, were not dissimilar to those which now came over me as I gazed upon the coveted hummer not fifteen feet away, and realized that my gun contained ball.

As I broke open the breech and dropped the provoking loads, the bird rose and hovering about for a few seconds, during which I reloaded and waited in a fever of suspense, she returned to nearly the same spot, when I fired and killed—only an Anna humming-bird. Later I took another female, and afterwards a male, the two latter being found in the small cypress grove. The dearth of honied flowers must at times force them to subsist almost entirely upon insect food. The Mexicans told me that I would find them in great numbers about the palm trees on the northwestern slope; but an expedition to that region resulted in a total failure as far as the object for which it was undertaken was concerned, although the addition of two more straggling species to those already taken compensated me for the fatigue of the journey.

LIST OF SPECIMENS COLLECTED.

Collector's No.	Sex and age.	Date. 1886.
2588	♂ <i>ad.</i>	March 29.
2531	♀ <i>ad.</i>	March 4.
2582	♀ <i>ad.</i>	March 22.

12. *Sturnella magna neglecta*.

WESTERN MEADOW LARK.—A single specimen was seen in the palm grove on the 22d day of March. Although I approached quite near as he sat, loudly singing from the top branch of a fallen pine, I failed to capture him. That unsuccessful shot, one of the “unaccountables” of a hunter-naturalist’s experiences, seemed at the time to be one of the keenest disappointments of my life.

13. *Carpodacus amplus*.

GUADALUPE HOUSE FINCH.—When I arrived at the island

in January, 1885, a few birds, usually in pairs, were found near the settlement. At the door of one of the huts, hanging in a cage, were several of this species, one of which, an adult male, had assumed the yellow plumage which others of this genus take on when confined.

Soon after settling on the top of the island in December, 1885, the "Gorrions" began to collect about the camp, making the mornings joyous with their song.

By our refraining from discharging fire-arms in the immediate vicinity of the camp, they soon became quite tame, hopping about camp during the day, and roosting at night in the thickest cypress, or, during a storm, under the eaves of the palm-thatched huts. On the 24th of January I counted fourteen within a stone's throw of camp, and attracted by the bread crumbs and other food which I threw out for them, their numbers daily increased until on the 1st of February the census of birds in camp, including both sexes, showed a total of twenty-two. Two weeks later they suddenly departed, and were to be found only in pairs about the cypress groves, save in the center of the pine belt, where the blossoms and seeds of the "chick-weed" sometimes attracted a flock of half a dozen, who busied themselves feasting upon this tender food. Nothing, either in their habits or song, differed from *C. frontalis rhodocolpus*.

They are easily entrapped under a box, and it was in this way that the Mexican women at the settlement succeeded in catching, during my stay, as many as two or three dozen, which they ate.

The dissection of specimens showed the food to consist chiefly of seeds from the cypress tree, mingled with green seeds of "chick-weed." Some of those taken near camp had their crops well filled with bits of tallow picked from the body of a goat which had been dressed and hung under a tree.

Two nests were found in cypress trees nearly completed by February 22. A nest and set of five fresh eggs (No. 792,

author's oölogical collection), which in consequence of a heavy storm had been deserted, was taken on the 1st of March. From this date began the nesting season of this species.

The last nest, taken April 7th, contained five eggs, with small embryos in them. In nearly every instance, the birds selected for a nesting place the upper side of a cypress branch in the angle formed by its intersection with the trunk, thus avoiding the storm-shaken foliage. They seemed to show a preference for the leeward side of a tree, where the nest would be protected from prevailing winds. One prudent couple had built in a clump of mistletoe, at a height of twenty feet.

Several pairs built in the tops of palms. The nests were ordinarily not more than ten or fifteen feet from the ground.

The birds make but slight demonstrations while their nest is being removed, uttering only a few notes of protest, or silently witnessing a wrong hitherto unknown to them.

The material used for the outer structure of the nests consisted of the dark, dead stems of weeds, only the finer ones being selected. One nest found in a pine tree, had the foundation and sides made of pine needles, with the invariable lining of goat's hair, black or white being used indiscriminately. The external diameter of the nest is about 130 mm., with a central cavity of about 65 mm.

The eggs, sometimes four in number, but oftener five during the early part of the season, are colored precisely like the average specimens of *C. frontalis rhodocolpus*, the spots being either sparingly applied or entirely wanting. They also resemble them in general shape, but the size serves to distinguish them. The five eggs of set No. 792, measure respectively 22 x 15; 22 x 15.5; 22.5 x 15.5; 23 x 15.5; 23 x 16.5 mm. The length measurement varies from 19.5-24 mm., and the width 15-16.5 mm. The average of thirty-two specimens is 21.3 x 15.5 mm.

In the table of measurements, I have selected from a good

series, those which exhibit extreme size, more or less, as well as average specimens.

DIMENSIONS OF SPECIMENS COLLECTED.

Collector's No.	Sex and age.	Date.	Wing.	Tail-feathers	Bill from nostril.	Depth of bill.	Breadth of bill.	Tarsus.	Middle toe.
			mm.	mm.	mm.	mm.	mm.	mm.	mm.
1682	♂ ad.	Jan. 15, 1885.	83	65	11	12	9	19	18
1688	♂ ad.	Jan. 15, 1885.	81	63	10.5	12	9	20	16
2376	♂ ad.	Jan. 2, 1886.	82	64	10.5	12	9.5	19.5	16
2377	♂ ad.	Jan. 2, 1886.	80	63	11	12	9	19.5	17
2465	♂ ad.	Feb. 16, 1886.	82	62	10.5	11	9	19	16
2469	♂ ad.	Feb. 16, 1886.	83	65	11	11	8.5	19.5	16
2544	♂ ad.	Mar. 4, 1886.	84	63	10	11.5	9	19	15
2545	♂ im.	Mar. 4, 1886.	80	62	11	11	9	19	17
2549	♂ ad.	Mar. 4, 1886.	79	61	10	10	8	18	16
2550	♂ ad.	Mar. 4, 1886.	81	63	11	12	9	19	16
Average....			81.5	63.1	10.6	11.4	8.9	19.1	16.6

No. 2376.—Testes very small. Length 174 mm. Extent 266 mm.

No. 2377.—Length 171 mm. Extent 263 mm.

Collector's No.	Sex and age.	Date.	Wing.	Tail feathers.	Bill from nostril.	Depth of bill.	Breadth of bill.	Tarsus.	Middle toe.
			mm.	mm.	mm.	mm.	mm.	mm.	mm.
1681	♀ ad.	Jan. 15, 1885	82	62	11	11	9	20	17
1686	♀ ad.	Jan. 15, 1885	80	62	10	11	9	19	17
2689	♀ ad.	Jan. 15, 1885	72	62	10	11	9	19	16
2378	♀ ad.	Jan. 2, 1886	79	60.5	10.5	11	8.5	18.5	17
2660	♀ ad.	Feb. 16, 1886	79	63	10	10	9	18	16
2420	♀ ad.	Jan. 23, 1886	78	57	10	11	9	18	16
2472	♀ ad.	Feb. 16, 1886	79	61	10	11	9	19	17
2551	♀ ad.	March 4, 1886	72	59	10.5	12	8.5	19	17
2552	♀ ad.	March 4, 1886	79	59	11	11	9	19	17
2553	♀ ad.	March 4, 1886	79	60	11	11	9	19	16
Average....			77.9	60.5	10.4	11	8.9	18.8	16.6

No. 2378.—Ovaries very small. Length, 167.5 mm. Extent, 258 mm.

14. *Loxia curvirostra stricklandi*.

MEXICAN CROSSBILL.—This species, found only through the narrow pine belt, I estimated to number about a score. They remained high up in the pines, flying hurriedly among the tree tops, uttering what seemed to me a frightened note. Occasionally a pair, seldom a single bird, would be seen on the top of a fallen tree, but never upon the ground. The only food which dissection proved them to have been feeding upon, was pine seeds. No nests were found, although several were no doubt being built, if not already completed by the middle of February. A comparison of the island cross-bill with typical examples of *minor* and *stricklandi*, shows it to belong to the latter variety, although the upper mandible is nearly or quite one-third thicker than the lower.

If we assign all Eastern birds to *minor* and Western ones to *stricklandi*, an exception must be made of No. 78,186, which in the Smithsonian Institution is labeled *minor*, although it came from Santa Cruz, California.

“The diversity in general size, size and shape of bill, and color which they present is enough to convince any one that these characters are subject to a wide range of variation and are not dependent, except within broad limits, on geographical considerations. * * * * * It seems obvious that the variations just referred to are either purely individual or dependent on age.”³

In the following tabulated measurements, the length of the exposed culmen is given on account of having been oftener measured, although it is more difficult to determine accurately than the distance from nostril, which is also included. The bill is found curving to the right as often as to the left.

NOTE ³—William Brewster in Auk, Vol. VIII, No. 2, p. 261.

LIST OF SPECIMENS COLLECTED.

Collector's No.	Sex and age.	Date, 1886.	Wing.	Tail feathers	Ex-posed culmen.	Bill from nostril.	Depth of bill at base.	Tar-sus.	Mid-dle toe & claw.
2474	♂ ad.	Feb. 16.	mm. 93	mm. 54.5	mm. 16	mm. 14	mm. 10	mm. 16.5	mm. 20
2475	♂ ad.	" "	87	51	15	13	9	14	19
2476	♂ ad.	" "	100	60	18	16	11	17	20
2480	♂ im.	" "	88.5	53	15	14	10	14.5	19.5
2481	♂ ad.	" "	88	52.5	17.5	15	10.5	16	19.5
Average...			91.3	52.2	16.3	14.4	10.1	15.6	19.6
2477	♀ ad.	Feb. 16.	87	52	15	13.5	9	14	19
2478	♀ ad.	" "	84	52	16	14	9	14	18
2479	♀ ad.	" "	90	52	16	14.5	10.5	16	22
2554	♀ ad.	March 4.	90	52	17	15	9.5	17	20
Average...			87.7	52	16	14.2	9.5	15.2	19.7

LOXIA CURVIROSTRA STRICKLANDI.

Collector's No.	Sex and age.	Collector	Locality.	Wing	Tail feathers.	Ex-posed culmen.	Bill from nos-tril.	Depth of bill at base.	Tar-sus.	Mid-dle toe & claw	Date.
705	♂ ad.	C.E. Aiken	White Mts., Ar.	mm. 100	mm. 60	mm. 19	mm. 16.5	mm. 11	mm. 18	mm. 21	Sep. 30, '76
....	♂ im.	L. Locke.	Olema, Cal.	85	51	15	13	8	14.5	21	.....

The first is in collection of H. W. Henshaw, the second in collection of W. O. Emerson.

15. *Zonotrichia coronata*.

GOLDEN-CROWNED SPARROW.—Three birds of this species were found feeding upon "chick-weed" amongst the pines.

LIST OF SPECIMENS COLLECTED.

Collector's Number.	Sex and age.	Date, 1886.	Remarks.
2502	♀ im.	Feb. 16.	
2503	♀ im.	Feb. 16.	
2532	♀ im.	March 4.	Moulting.

16. *Spizella socialis arizonæ*.

WESTERN CHIPPING SPARROW.—Returning to camp one noon, I heard the song-note of this species, and was fortunate enough to secure it. No others were known to be on the island.

In accordance with the division of *S. socialis* into Eastern and Western forms, this single specimen, taken on Guadalupe Island, would have to be assigned to the variety *arizonæ*, but in point of fact it will not answer to the original description (Coue's Key, 1872, p. 143), wherein no measurements are given. A later description, however (B. B. & R. Hist. N. Am. B., 1874, Vol. II, p. 11), may be made applicable to the case of western birds which I have seen from this State by omitting from the original description: "black frontlet lacking, and no definite ashy superciliary line, the sides of the crown merely lighter brown: bill brown, pale below."

Excepting the bill, which is "brown, pale below," in this instance, the measurements fall within the limitations of *arizonæ*.

DIMENSIONS OF SPECIMENS.

Collector's No.	Sex and age	Date.	Wing.	Tail.	Tail feathers.	Bill from nostril.	Tarsus.	Middle toe and claw.	Length.	Extent.
2394.	♂	Jan. 6, 1886.	mm. 72	mm. 64	mm. 60	mm. 6	mm. 18	mm. 15	mm. 147.5	mm. 231.5

17. *Junco hyemalis oregonus*.

OREGON JUNCO.—One bird, which was quite shy, was taken among the pines on a cold, windy day, during which the tops of the trees and part of the timber belt were at times entirely enveloped by fog. When first seen this bird was being viciously attacked by a resident junco (*insularis*).

DIMENSIONS OF SPECIMEN.

Collector's No.	Sex and age.	Date.	Wing.	Tail feathers.	Bill from nostril.	Tarsus.	Middle toe.
2189	(?) ♂ <i>ad.</i>	Feb. 16, 1886	mm. 71	mm. 62	mm. 7.5	mm. 20	mm. 16

Remarks—The wing and tail are both a trifle shorter than specimens from Oakland (3) and Big Trees, Cal., (1), but no more than might be expected in individual variation.

18. *Junco insularis*.

GUADALUPE JUNCO.—In his notes, Dr. Palmer refers to this species as “the most abundant birds of the island.” etc. According to my observation they rank about third in relative abundance, the rock-wrens and linnets taking precedence. No juncos were found at a lower altitude than the palm grove, and the majority were inhabitants of the pines and large cypress grove. A pair which was evidently mated was taken in the small cypress grove on the 15th of January, 1885. The following year not more than two or three were seen in this locality.

I did not find them noticeably tamer than the linnets, nor so confiding as the rock-wrens. Their food was principally of seeds, a partiality being shown for the green seeds of the “wild lettuce.” Their song was twice heard from the top of tall cypress trees. It resembles somewhat the trill of the chipping sparrow. They also had a sharp chipping note when alarmed. They remained mostly either upon the ground or low down in the branches of trees. The limbs of a fallen pine were a favorite resort at all times, and the ground underneath most used as a nesting-place.

The Blue “Gorrions” mated early—soon after the beginning of the year—and were setting by the 26th of January, regardless of the almost continuous fogs and winds. A nest found March 10 contained four young, hatched but a few days before. It was placed in a depression, flush with

the surface of the ground, and so carefully hidden beneath a covering of brush that it was found with difficulty, even though I was guided by hearing the young "peeping" for food. The parent birds, who were close by, seemed but little alarmed, uttering only an occasional chirp while I searched for their treasure. Six days later the nest was vacant, being probably robbed by a stray cat.

Full fledged young were taken March 16; also a nest with three fresh eggs, which had been found nearly completed on the 10th. The position of the nest was curious and unique, and it was only by seeing the birds at work building that I succeeded in discovering it. A pine tree with a cleft six feet from the ground, or rather two trees with a common trunk, grew near to the edge of a precipice, and in this narrow cleft partially filled with pine needles the juncos had built. By standing on a pile of rocks and branches I could see the eggs lying in the nest, about a foot below where the trees joined. A fluff of cotton pushed down on the end of a stick to cover the nest, protected the eggs from bits of bark and chips, while I enlarged the opening to a sufficient size to admit my hand. While the eggs were being carefully placed in a collecting box, the birds, who had remained interested rather than alarmed witnesses to the spoliation, flew to the tree, and, while the male clung to the bark at the entrance, the female hopped down within and began the removal of the débris which had fallen upon the edge of the nest. This was at length cleared away by repeated trips into the hole, each journey bringing to the opening a bit of wood, which was promptly dropped to the ground. The nest is composed of a few pieces of bark-moss, light-colored dry grass blades, and a tail feather of a petrel, all surrounding a quantity of grass blades, lined within with goat hair. It measures externally about 120 mm. in diameter by 80 mm. in height, with a receptacle 60 mm. in diameter and only 28 mm. in depth.

The three eggs which the nest contained (set No. 797,

author's oölogical collection) were probably a second setting, the ragged appearance of the female's plumage indicating previous cares. In color the eggs are a pale greenish white, marked with fine dots of reddish brown clustered around the larger end. They measure 19.5x15; 20x15.5; 20x16 millimeters.

MEASUREMENTS OF SPECIMENS COLLECTED.

Collector's No.	Sex and age.	Date.	Wing.	Tail feathers.	Bill from nostril.	Depth of bill.	Tarsus.	Middle toe.
			mm.	mm.	mm.	mm.	mm.	mm.
1683	♂ ad.	Jan. 15, 1885.	71	61	9.5	7	20	15
2375	♂ ad.	Jan. 2, 1886.	70	62.5	9.5	6	20	15
2385	♂ ad.	Jan. 4, 1886.	70.5	64	9.5	6.5	20	15.5
2418	♂ ad.	Jan. 23, 1886.	65	57	9.5	6.5	19.5	15.5
2431	♂ ad.	Jan. 26, 1886.	70	60	9.	7	19.5	16
2434	♂ ad.	Jan. 26, 1886.	65	59	9.	6.5	20	14
2442	♂ ad.	Jan. 29, 1886.	68	57	9.5	6.5	19.5	15
2458	♂ ad.	Feb. 4, 1886.	69.5	60.5	10.	6.5	20	15
2537	♂ ad.	March 4, 1886.	68	60	8.5	6.5	19	15
2575	♂ ad.	March 16, 1886.	71	62	10.	7	19	15
Average.....			68.8	60.3	9.4	6.6	19.6	15.1
1684	♀ ad.	Jan. 15, 1885.	65	56	9.	7	20	15
2432	♀ ad.	Jan. 26, 1886.	64	55	9.	6	20	14.5
2574	♀ ad.	March 16, 1886.	62	54	8.5	6	19	15
Average.....			63.6	55	8.8	6.3	19.6	14.8

No. 2375.—Testes large; length, 155 mm.; extent, 223 mm.

No. 2385.—Length, 162 mm.; extent, 230 mm.

No. 2431.—Testes very large; mate of No. 2432.

No. 2458.—Testes very large.

No. 2432.—Setting; mate of No. 2431; parents of nest No. 797.

19. *Melospiza lincolni*.

LINCOLN'S SPARROW.—The small cypress grove, on the border of which I had my permanent camp, was my favorite ground for observation and furnished me with many stragglers, among which was a pair of these birds. They were taken on different days from among the brush inclosing

an old goat corral. The slightest noise would drive them into the dense brush, from which they would again appear when all was quiet.

LIST OF SPECIMENS COLLECTED.

Collector's No.	Sex and age.	Date, 1886.	Remarks.
2461	♂ <i>ad.</i>	February 5.	Testes small.
2523	♀ <i>ad.</i>	February 19.	Ovaries small.

20. *Passerella iliaca unalaschensis*.

TOWNSEND'S SPARROW.—One bird was taken among the pines, but so badly cut by the shot that the sex could not be determined. No others were seen.

DATA OF SPECIMEN COLLECTED.

Collector's Number.	Age.	When Collected.
2490	♀ <i>ad.</i>	Feb. 16, 1886.

21. *Pipilo consobrinus*.

GUADALUPE TOWHEE.—The towhees were found only in the large cypress grove. They were easily overlooked unless directly in one's path among the trees. When singing the bird could be readily traced and secured, but in such cases it was always a male. Only two females were seen, and I cannot believe that their number was in any degree equal to that of the males, for otherwise I do not believe it possible that I could have so completely overlooked them, even though they might have been setting. I was about the grove at all hours of the day, camped there, and was astir at break of dawn, even before the male towhee had mounted his throne on the topmost branch of a cypress and had sounded his morning trill. This song closely resembles that of *P. maculatus megalonyx*, but has one important

variation which was almost invariably given, and which I have never heard from *megalonyx*. This consists in a single quick note, somewhat like a bluebird's, given immediately before the trill, as though it was the click or chuck of the machinery that released the sound which followed. At a distance, when the trill could be distinctly heard, the single quick chuck would pass unnoticed. When I first heard this combination it occurred to me that a bluebird was in the same tree or near by, but closer observation proved the Towhee to be the sole author of it.

The only food upon which they fed consisted of insects. A young bird in company with the adult pair was found in a fallen cypress top, but no eggs of this species were taken.

Ch.—Young (first plumage). Above rusty olive brown, darker on sides of head. Feathers of interscapular region black, edged, more broadly on the outer web, with pale brown. Underparts yellowish brown, darkest on throat, grading into white on the abdomen and to light reddish brown on side; the feather streaked with black. Sides of chin, black, leaving a light line of about the same width between. White markings on wings and visible edges of greater wing coverts narrowly edged with rusty brown. Eyes muddy brown.

(No. 2585. Author's collection, Guadalupe Island, March 26, 1886.)

Wing, 80 mm.; Tail feathers, 71 mm.; Bill from nostril, 7.5 mm.; Tarsus, 23 mm.; middle toe, 20 mm.; hind claw, 12 mm.

It much resembles on the back the young plumage of the same age of *P. maculatus oregonus* (No. 983. Author's collection, Wilbur, Or., June 20, 1883), but the latter is darker on sides of neck, and has the feathers of sides and crissum rich reddish-brown.

The underparts correspond closely to the young of *P. maculatus megalonyx* (No. 2298, author's collection, Oakland, Cal., June 3, 1885), which is somewhat younger. I believe

if they were of the same age it would be impossible to separate them.

LIST OF SPECIMENS COLLECTED.

Collector's No.	Sex and age	When collected, 1886	Wing	Tail feathers	Tail	Bill from nostril	Depth of bill	Breadth of bill	Tarsus	Middle toe	Hind claw
2419	♂ ad.	Jan. 23	mm. 80	mm. 86	mm. 97	mm. 9	mm. 9	mm. 7	mm. 26	mm. 18	mm. 13
2459	♂ ad.	Feb. 2	78	81	88	9.5	9	7	26	18	13
2506	♂ ad.	Feb. 12	78	85	93	9	9	7.5	25	19	14
2507	♂ ad.	Feb. 12	80	86	94	9.5	9	7	26	18	12
2508	♂ ad.	Feb. 12	80	88	96	10	9	7	24	19	13
2569	♂ ad.	Mar. 12	79	83	90	9.5	8.5	7	25	19	13
2570	♂ ad.	Mar. 12	79	86	94	9.5	9	7	24	19.5	13
2571	♂ ad.	Mar. 12	80	87	94.5	9.5	9	7	24.5	19.5	13
2580	♂ ad.	Mar. 22	80	87	96	10	9	7	24.5	20	13.5
2587	♂ ad.	Mar. 26	81.5	87	95	10	8.5	6.5	24	19	13
		Av'g...	79.5	85.6	93.7	9.5	8.9	7	24.9	18.9	13
2388	♀ ad.	Jan. 5	74			9.5	9	6.5	24	18	13
2586	♀ ad.	Mar. 26	75.5	81	90	10	9	7	25.5	19	13
		Av'g...	....	.....	.....	.....	.....	.....	.....	.....	.....

No. 2419.—Testes large. Iris orange, tinged with carmine around pupil.

No. 2459.—Iris orange, tinged with carmine.

No. 2507.—Iris carmine.

No. 2569.—Iris carmine.

No. 2388.—Iris orange.

22. *Ampelis cedrorum*.

CEDAR WAXWING.—Christmas morning was the brightest and fairest I enjoyed during more than one hundred days of my sojourn on the island. Taking a stroll through the small cypress grove in search of birds not before met with, I was rewarded by seeing what I supposed to be one of this species, but was unable to capture it. Nothing was seen or heard of it again for more than a month, until one pleasant afternoon, as I was engaged in preparing specimens in the tent, I heard the notes of the Cedar Bird close by, and

going outside, was just in time to get a flying shot at the retreating bird—but missed it. Those who have had a similar experience can imagine my feelings when that bird disappeared. I knew, beyond any reasonable doubt, that it was *A. cedrorum*, yet the lack of any positive evidence of the fact, left me brooding over my disappointment for the next two hours. The unexpected reappearance of the bird, however, quickly dispelled the gloom. This time I took all possible precaution, and succeeded in making this handsome addition to my collection of Guadalupe stragglers.

DATA OF SPECIMEN COLLECTED.

Collector's Number.	Sex and age.	Date.
2437	♂ im.	Jan. 28, 1886.

Remarks—No wax tips.

23. *Lanius ludovicianus excubitorides*.

WHITE-RUMPED SHRIKE.—Two specimens of these butcher-birds were seen on the central part of the island. Both were heard singing in low, liquid tones, quite pleasing to the ear. They were very shy, although to a less degree than birds of the same species which were met with in 1885 on Cerros Island, Lower California.

Considering the abundance of larvæ, coleopterous insects and occasional grasshoppers, one would suppose that the "mênu" of the Shrike left nothing for her to desire, but on dissecting a specimen, I found amongst the caterpillars, which the distended gizzard contained, a tiny golden foot of Guadalupe's sweetest songster, the Dusky Kinglet.

In color this bird is much lighter than the same species from Oakland, Cal., and more closely resembles specimens from Tulare, Cal., and Tucson, A. T.

DATA OF SPECIMEN COLLECTED.

Collector's Number.	Sex and age.	When Collected.
2370	♀ <i>ad.</i>	December 29, 1885

24. *Dendroica auduboni*.

AUDUBON'S WARBLER.—The only ones seen, two in number, were taken on stormy days in the small cypress grove.

LIST OF SPECIMENS COLLECTED.

Collector's Number.	Sex.	Date.
2368	♂	December 28, 1885.
2404	♂	January 12, 1886.

25. *Anthus pensilvanicus*.

AMERICAN PIPIT.—On the evening of February 2, while going to the alkali pools to watch for owls, I heard faintly the note of a Titlark. The evening was very calm, the sun, just set, cast a beautiful afterglow about the sky; there was just light enough remaining to enable me to distinguish the birds working their way among the rocks. That I might make sure of at least a single specimen for identification, I fired at the one nearest me. The flock, about twenty-five in number, at once rose and circled past out of range, and I saw them no more.

DATA OF SPECIMEN COLLECTED.

Collector's No.	Sex.	Date.
2451	♂ (?)	February 2, 1886.

26. *Oroscoptes montanus*.

SAGE THRASHER.—In making my rounds of the small cypress grove on a cold, cloudy and windy morning in Jan-

may, I saw and heard fewer birds than ever before or since. It was seldom that I did not take or note something of interest on these short excursions, and on this day I secured a handsome specimen of the Sage Thrasher, which was found among the leafless branches of a fallen tree. No song nor even a single note was heard from him.

DATA OF SPECIMEN COLLECTED.

Collector's No.	Sex and age.	Date.
2400	♂ <i>ad.</i>	January 7, 1886.

Remarks—Iris yellow. Fat. Contained only caterpillars.

27. *Mimus polyglottos.*

MOCKING BIRD.—Two birds, apparently a mated pair, were seen on a fallen pine at the northern edge of the palm grove. First attracted to the place by the delightful song which floated upon the air, I saw one of the birds in the act of pouncing upon something in the grass, in the manner of a shrike. When alarmed they flew higher and higher among the branches of a tall pine, so that only the female was captured. Having never before seen this bird in a wild state, I regretted the act which, in compliance with strict scientific requirements, deprived that sea bound spot of so much sweet music.

SPECIMEN COLLECTED.

Collector's No.	Sex and age.	Date.
2579	♀ <i>ad.</i>	March 16, 1886.

Remarks—Iris yellow. Ovaries small.

28. *Salpinctes guadeloupensis.*

GUADALUPE ROCK WREN.—This species, undoubtedly the most common of the birds on the island, was distributed

from the beach to the summit, but was found to be most numerous on the upper and central portions. They were by nature tamer than any birds I ever met with. While retreating, if approached, they would in turn draw quite near to a person who remained perfectly quiet. Sitting down one afternoon upon a log, I saw a Rock Wren come hopping closer and closer to where I was resting, until at length he perched upon my shoe. Then seeing a sandy spot just beyond, he availed himself of the opportunity by taking a dust-bath. So close was he to me that I could have reached him with my foot, yet constantly in motion, searching here and there among the rocks for food, he seemed entirely unconscious of my presence. Even when standing they are seldom quiet, a nervous twitch of the tail or toss of the head bearing witness to the incessant activity so characteristic of these little creatures.

Seldom silent, they have, in addition to their ringing call, a considerable variety of song. I became accustomed to the variations of four or five different birds, and noticed that each had a song peculiar to himself but differing from the songs of his fellows. One little wren near camp was in the habit of beginning his song each morning at about half-past six, never varying five minutes from his self-appointed time. They are usually seen on the ground or upon a rock or stump. One remarkably foggy morning, I noticed one sitting on the top of a sage-bush, while on fine days, I have seen them mounted to the height of twenty feet on a dry cypress twig, singing their cheerful song.

Their food consisted mainly of caterpillars and beetles. I watched one pick to pieces and devour successively three small Carabide beetles.

The weather does not seem to be taken into consideration by any of the resident species. The rock-wrens are the first to begin nesting, and endeavor to conduct their domestic affairs through the stormiest times, though not always with success. Many abandoned nests were found,

some with and some without eggs, deserted, probably, on account of long continued wet weather. The location of the nest, however, plays an all-important part in the success or failure of the first builders. A few birds began the construction of their nests in December, and one had her work nearly completed on the 25th of December, 1885. Four fresh eggs were found in it on January 17th. The breeding season, strictly speaking, extends from the middle of January through the month of March.

Nests were found in cavities of immense boulders, under rocks, in fallen and decayed trunks of cypress trees, the latter location being apparently a favorite one. But wherever the nests were located the passages leading to them were, with one or two exceptions, paved with flat pebbles ranging in size from a Lima bean to a half dollar. Fully a quart of these pebbles were removed from the entrance to a nest built in a boulder at a height of four feet, where, at some previous time, other birds had evidently built and accumulated their share of the pavement. As a rule scarcely an ordinary handful of stones are used. The nest is built in close conformity to the size and shape of the cavity which it occupies, being usually circular and varying from a shallow bed of fine dry grasses to a nest of the same material measuring 150 mm. in diameter and 60 mm. high. The egg receptacle is from 55 mm. to 70 mm. in diameter, and not more than 30 mm. in depth. A lining of goat hair when obtainable is invariably used. I followed one bird fully an hundred yards from the spot where she had collected some goat hair before the nest was reached.

The eggs are usually four, though sometimes five in number, and resemble both in color and shape those of the common rock-wren (*S. obsoletus*).

Set No. 781 (author's oölogical collection) measures: 17 x 14; 17 x 14.5; 18 x 14.5; 18.5 x 14.5 mm.

Set No. 782 (author's oölogical collection) offers the fol-

lowing measurements in millimeters: 19 x 14; 19 x 14; 19.5 x 14.5; 19.5 x 14.5; 19.5 x 15.

The average size ascertained from a series of fifty-five eggs, is 19 x 14 mm.

The two largest eggs measured 21 x 15 mm. and 20 x 16 mm. respectively; the two smallest, 17. x 14 mm.

Two different stages of the young plumage were taken, descriptions of which are here given:

Ch.—Young. Above similar to adult but *much* darker, especially the head and neck, which lack the speckled markings. Wings and tail as in adult but darker, the bars across middle tail-feathers dull black. The outer half of the pale cinnamon on end of tail-feather finely mottled with dusky. Under parts pale pinkish cinnamon; the entire throat obscured with a faint dusky suffusion. Crissum darker than abdomen and unmarked.

Wing, 67 mm.; tail feathers, 53 mm.; bill from nostril, 12 mm.; tarsus, 19 mm.; middle toe, 13 mm.

(No. 2530—Immature, author's collection. Guadalupe Island, February 19, 1886.)

First Plumage.—Above lighter than the immature specimen and grayer than the adult plumage. Below, including throat, pale sulphurous white, becoming pinkish on sides, and crissum, which is unmarked.

Wing, 57 mm.; tail feather, 34 mm.; bill from nostril, 8.5 mm.; tarsus, 20.5 mm.; middle toe, 14 mm.

(No. 2425—Nestling, author's collection. Guadalupe Island, January 23, 1886.)

By the table of measurements it will be seen that the bills of specimens (collected eleven years after the species was discovered) average about 15.5 mm.; while those taken in 1875 I find to average fully a millimeter less. A decade hence it will be interesting to know whether this increasing development has still continued.

LIST OF SPECIMENS COLLECTED.

Collector's No.	Sex and age.	Date, 1886.	Wing.	Tail feathers.	Tail.	Bill from nostril.	Tarsus.	Middle toe.
			mm.	mm.	mm.	mm.	mm.	mm.
2395	♂	ad. January 6.	65	48	52	15	21	14
2397	♂	ad. January 6.	66.5	49	54	15.5	21	13
2398	♂	ad. January 6.	67	48.5	56	17	21	14
2422	♂	ad. January 23.	69	52	—	16	20	13
2423	♂	ad. January 23.	68	49	54	16	22.5	14
2443	♂	ad. January 29.	68	51	57	15	22	14
2444	♂	ad. January 29.	68	52	57	16	22	14
2445	♂	ad. January 29.	66	48	54	16	21	14.5
2534	♂	ad. March 4.	71.5	53	58.5	17	22	14.5
2630	♂	ad. January 29.	68	52	57	15	21	15
		Average..	67.7	50.2	55.5	15.8	21.3	14
2396	♀	ad. January 6.	66	50	55	16.5	21	14
2446	♀	ad. January 29.	64	45	50	17	21.5	15
2449	♀	ad. January 29.	63	46	54	15	21	13
2450	♀	ad. January 29.	64	47	53.5	14	20	13
		Average..	64.2	47	53.1	15.6	20.8	13.7

No. 2534.—Ferruginous shade on breast and abdomen.

No. 2396.—Feathers worn off breast from setting. Length, 152 mm.; extent, 217 mm.

No. 2446.—Contained four very large ova.

29. *Thryothorus brevicaudus*.

GUADALUPE WREN. — This rare local species has become much restricted in distribution and perhaps in number since Dr. Palmer obtained the only two known specimens in 1875. I am informed that no collecting was done at that time among the pines on the northern portion of the island, in which place alone was I able to discover any trace of this species; and as no collecting was done by Dr. Palmer among the palms (an unlikely place for the birds to be found), I infer that the two original specimens must have been found toward the central portion of the island.

The birds were timid rather than shy, being alarmed by the crushing of dry branches as I worked my way amid the dense windfalls of pines, where they were found, they

fled into the thickest parts. When all was quiet they would cautiously approach until within a few feet of me, seemingly prompted by curiosity. Fearing the complete extermination of a species so restricted in distribution, I refrained from taking more specimens. All that I secured were taken within an area of sixty by three hundred feet, nor were any seen elsewhere. A frightened female uttered a few "twit" "twits" of alarm, but with this exception they were utterly silent.

A careful and protracted search during the greater part of two days, with the aid of my Mexican companion, failed to discover the whereabouts of a nest, the eggs of which remain unknown.

LIST OF SPECIMENS COLLECTED.

Collector's No.	Sex and age.	Date, 1886.	Wing.	Tail feathers.	Tail.	Exposed culmen.	Bill from nostril.	Tarsus.	Middle toe.
			mm.	mm.	mm.	mm.	mm.	mm.	mm.
2483	♂ ad.	Feb. 16	48	44	48	17.5	12	17	12
2484	(?) ♂ ad.	" "	49	44	50	17	12	18	12
2486	♂ ad.	" "	48	43	47.5	17	12	17	12.5
2487	♂ ad.	" "	48	45	47	17	12	18	12
		Av'g..	48.2	44	48.1	17.1	12	17.5	12.1
2482	♀ ad.	Feb. 16.	47	43	45	16	11	18	11
2485	♀ ad.	" "	47	42	47	16	11	17.5	11.5
2488	♀ ad.	" "	49	43	47	17	11.5	17.5	12
		Av'g..	47.6	42.6	46.3	16.3	11.1	17.6	11.5

No. 2483.—Contained insects and two pine seeds. Length, 134mm. Extent, 165 mm.

No. 2484.—Sex not determined.

No. 2482.—Ovaries large. Eyes, dark brown. Contained insects.

No. 2485.—Ovaries small.

No. 2488.—Ovaries large.

30. *Sitta canadensis*.

RED-BREADED NUTHATCH.—Tolerably common among the

pine timber, and found nowhere else except in the large cypress grove, where two or three were heard.

By the 10th of March several birds had begun their preparations for nesting. Selecting a dead pine stump or branch they worked industriously, striking little resounding taps with their bills. Two unfinished holes were found, one at a height of about forty feet in a slender dead pine, being just commenced, while the other, near the top of a pine stump fifteen feet high, had been cut to a depth of four or five inches, thus rendering necessary the removal of chips. This process was effected by regular stages, the bird bringing a mouthful of debris to the opening, where, entirely visible with the exception of her tail, she clung to the edge of the opening, head downward, until the chips were launched into the air.

Specimens which were taken on January 26 and February 16, do not vary in size from specimens of this species from other localities.

31. *Regulus obscurus*.

DUSKY KINGLET.—Frequenting more numerously the large cypress grove, they are nevertheless found in the smaller grove, and also among the pines. In the former and latter places they are positively known to breed, and there is but little doubt that they also nest in the small grove. They are much tamer than others of this genus found elsewhere, still they do not seek a close acquaintance with a person of hunting proclivities.

In December I found them in full song and as common as in April, although strange as it may seem, it was not until the latter month that any were noticed by Dr. Palmer.

Their song is indescribably sweet and musical, and of wonderful power for so small a bird, commencing with a few low, quick notes, as though the singer were merely trying his voice, then bursting into a full animated warble, it ends in a dissyllabic measure, accented on the first syllable, and usually repeated from three to six times. One remark-

ably fine songster repeated the final dissyllable eight or ten times. Only once did I hear the metallic click, so common with the Oakland birds in winter, but even then it flowed immediately into song.

As early as the middle of February nest-building was in order, the birds selecting the topmost foliage of a cypress, and sometimes the very outer extremity of a horizontal branch.

As the result of many days' diligent search, three nests came under my observation, and these were detected only by watching the birds as they collected building material, or by tracing to its source a peculiar, low song, which the male sometimes sings when close to the nest.

These nests were all found over twenty feet high, and only one could be seen from the ground, and that merely during the intervals when the wind parted the branches. They were placed in the midst of a thick bunch of foliage, and but lightly secured to the twigs. Compact, though not very smooth in structure, they were composed of soft strips of bark intermingled with feathers, bits of moss, fine grass and cocoons. Additional warmth is secured by a quantity either of goat's hair or feathers, and, lastly, a thin lining of goat's hair. Their external measurement is about 70 mm. in height by 90 mm. in diameter, while the internal depth is about 45 mm., and diameter from 35 mm. to 45 mm.. The mouth of the opening is smaller than immediately below.

A nest containing two fresh eggs (set No. 799, author's oölogical collection) was found in the top of a slender cypress twenty-five feet high, March 24. It could not be seen from the ground, but was located by the subdued song of the male bird. As I ascended the tree and approached the nest, the female flew off and joined her mate in a neighboring tree. She made no demonstrations whatever, and was not again seen, while her partner, undisturbed by my intrusion continued to warble his richest song.

In color the eggs are white, with a dense wreath of pale yellowish-brown spots encircling the larger end. In some places, these spots appear to be laid over a pale lavender washing, and in one specimen, these fine, almost indistinct dots extend sparingly over the entire surface. They measure in millimeters 14 x 11 and 15 x 11.

LIST OF SPECIMENS COLLECTED.

Collect- or's No.	Sex and age.	Date, 1886.	Wing	Tail feathers.	Tail.	Bill from nostril.	Tarsus.	Middle toe.	Length.	Extent.
			mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
2371	♂ ad.	Jan. 2	56	44	47	7	19.5	10.5	114	169
2390	♂ ad.	Jan. 6	53	40	—	6.5	18	10	.....	.....
2391	♂ ad.	Jan. 6	53	40	—	6	20	10	111	164
2392	♂ ad.	Jan. 6	55	43	—	6.5	19	10	.....	.....
2399	♂ ad.	Jan. 6	54.5	41.5	—	6	20.5	10	.....	.....
2412	♂ ad.	Jan. 23	54.5	43	—	6	19.5	10.5	.....	.....
2413	♂ ad.	Jan. 23	55	44	—	7	20	10.5	.....	.....
2414	♂ ad.	Jan. 23	56.5	46	49	7.5	19.5	10.5	.....	.....
2441	♂ ad.	Jan. 29	56	44	—	7.5	20	10	.....	.....
2455	♂ ad.	Feb. 2	55	43	—	6.5	19.5	11	.....	.....
		Av'g.	54.8	42.8	—	6.6	19.5	10.3	.....	.....
2373	♀ ad.	Jan. 2	51	38.5	42.5	6	19	10	.....	.....
2439	♀ ad.	Jan. 29	51	40	41	6.5	19	10	.....	.....
2456	♀ ad.	Feb. 2	52	40.5	44.5	6	19.5	10	.....	.....
		Av'g.	51.3	39.6	—	6.1	19.1	10	.....	.....

No. 2371.--Iris dark brown.

No. 2456.--Ovaries small.

The length of bill from nostril of the males taken by Dr. Palmer, all measure 6.3 mm., and the single female has the bill but 5.5 mm., showing a slight increase in length during the past decade. As this measurement can be so accurately taken, I believe the difference is an actual one.

32. *Turdus aonalaschkæ*.

DWARF HERMIT THRUSH.—The strange shyness of the straggling avifauna of Guadalupe Island was well exempli-

fied in the first specimen of this species which I met with. On the 24th of December, I thought I heard the note of a Dwarf Thrush, a sound quite familiar to me during the winter season at Oakland, but could not get a sight at the author of it. The bird was heard for several consecutive mornings in the cypress grove adjoining my camp, but was not seen until the 2d of January. He then succeeded in eluding me and leading me a daily chase until the 7th of January, when he was accommodating enough to call at camp in the evening, announcing his arrival by calling out quickly "chut," "chut." As the sound apparently proceeded from beneath a fallen cypress I worked my way cautiously in that direction, keeping tree trunks between myself and the place. The ground being smoother than where I had previously found him, I was not obliged to look to every footstep, and finally arriving within range, I caught sight of him on the ground. The report of the gun was tremendous in the still evening air, and the result final. I soon had the long-sought prize in hand, beautiful, as freshly killed specimens of *Turdus* always are. Two other specimens were afterwards taken, one in the large palm grove, the other among the cypress. Neither, however, was so difficult to approach as the first.

LIST OF SPECIMENS COLLECTED.

Collector's Number.	Sex and age.	Date, 1886.	Remarks.
2401	♂ <i>ad.</i>	January 7.	Iris dark brown
2436	— <i>ad.</i>	January 23.	
2583	♂ <i>ad.</i>	March 26.	

33. *Merula migratoria propinqua*.

WESTERN ROBIN.—First seen in December. In January three birds were found and taken on the border of the small cypress grove.

LIST OF SPECIMENS.

Collector's Number.	Sex.	Date, 1886.	Remarks.
2382	♀	January 4.	
2386	♀	January 4.	Fat.
.....	--	January 8.	Head only saved.

34. *Hesperocichla nævia*.

VARIED THRUSH.—One bird only was seen on the island among the pine timber.

DATA OF SPECIMEN.

Collector's Number.	Sex and age.	Date.
2533	♀ <i>ad.</i>	March 4, 1886.

Remarks—Gizzard contained larvæ, beetles and one pine seed.

35. *Sialia arctica*.

MOUNTAIN BLUEBIRD.—Three birds of this species were seen on several occasions on the edge of the small cypress grove; a single one being noticed for the last time on the 15th of February.

DATA OF SPECIMEN COLLECTED.

Collector's Number.	Sex and age.	Date.
2369	♂ <i>ad.</i>	December 29, 1885.

Remarks—Iris dark brown. Gizzard contained caterpillars and an elytron of a beetle.

STANDARD GEODETIC DATA.

COMMUNICATED BY AUTHORITY OF THE SUPERINTENDENT OF THE UNITED STATES
COAST AND GEODETIC SURVEY.

BY PROF. GEORGE DAVIDSON.

Read October 18, 1886.

In the development of the main triangulation of the Pacific Coast, it was early discovered that large and irregular deflections of the plumb-line existed at the triangulation stations, whether they were situated on the mountains or in the plains.

When the main triangulation was undertaken it embraced lines of unusual length, and one part of the scheme was the projection of a network across the continent along the 39th parallel.

In order to collect standard geodetic data for the computation of the geographical positions on this coast, Assistant Davidson planned at the outset to have the latitude observed at each triangulation point; and he also observed the azimuth of some one line in the series of directions which were observed from the same station.

This scheme of triangulation commenced from an accurately-measured base-line of nearly eleven miles in length situate in the plains of Yolo county, California. From this line it was carried by quadrilaterals to the Coast Range of mountains, as far west as Mount Tamalpais; and from the line Mount Helena—Mount Diablo it stretched across the great valley of California to the line Mount Lola—Round Top. This scheme of triangulation was named by the Superintendent of the United States Coast and Geodetic Survey the "Davidson Quadrilaterals." The observations at all the stations have been shown to be remarkably satisfactory, and the discussion has been rigorously carried out in

the computing division of the Survey, under the direction of Assistant Schott. From the means already at hand, the following summary of results is made known, wherein it is seen that the accepted standard station for latitude is Mount Helena, and the standard line for azimuth is Mount Helena—Mount Diablo. The tabulation exhibits the observed and computed latitudes and azimuths, the probable error of each determination, and the deflection of the plumb-line from the means.

Including the stations Mount Lola and Round Top, which are the easternmost points of the "Davidson Quadrilaterals," in the Sierra Nevada, we have nine stations, at each of which the latitude and azimuth were determined astronomically; and we shall take the mean results derived from all these observations for the formation of the standard values φ_0 and a_0 .

The direct results of the astronomical observations for latitude require two corrections: one, the reduction to the station point $_$; the other, the correction for curvature of the vertical or reduction to the sea level. The heights required for the latter purpose are given in Appendix No. 10, Coast and Geodetic Survey Report for 1884, (Mount Lola being 2,796.4 metres, or 9,175 feet; and Round Top 3,173.5 metres, or 10,412 feet above the level of the sea.)

For the expression of the curvature between the sea-level and the altitude of the station, we have (see Clarke's

Geodesy, pp. 101-102), $\delta\varphi = -\frac{h}{r \sin 1''} (\frac{3}{2} m - e') \sin 2\varphi$. Putting $\frac{3}{2} m - e' = 0.0052^1$, and $\log. (r \sin 1'') = 1.490$, then for h , the height in metres, and $\delta\varphi$ the correction in seconds of arc we have for the latitude φ

$$\delta\varphi = -0.000167h \sin 2\varphi; \text{ or } [n \ 6.212]h,$$

for the average latitude 39° ; the number within brackets being a logarithm.

¹.—G. Zachariae, in his *Principal Geodetic Points* (German translation by Dr. Lampe, Berlin, 1878), prefers the value 0.00513.

GEODETIC OR STANDARD LATITUDE ζ , OF MOUNT HELENA,
 FOR THE "DAVIDSON QUADRILATERALS."

No.	Astronomical Station.	Year of Obsn.	Observed Astron'mic'l Latitude.	Probable Error.	Red'n to Δ	Red'n to Sea Level.	Resulting seconds of Latitude (A).	Adopted Geodetic Latitude. (G).	A—G
1	S. E. Yolo Base.	1880	38 31 31.52	± 0.06	-0.45	-0.00	31.07	38 31 35.41	-1.34
2	N. W. Yolo Base.	1880	38 40 37.34	0.07	-0.13	-0.01	37.20	38 40 38.03	-0.83
3	Monticello.....	1880	38 39 46.51	0.09	-0.31	-0.15	46 05	38 39 43.85	+2.20
4	Vaca Mt.....	1880	38 22 23.38	0 0	+0 37	-0.12	23.63	38 22 27.02	-3.39
5	Mt. Diablo. . .	1876	37 52 49.59	0.06	0.00	-0.19	49.40	37 52 48.70	+0.70
6	Mt. Tamalpais.	1882	37 55 19.04	0.08	-0.04	-0.13	18 87	37 55 20.69	-1.82
7	Mt. Helena.....	1876	38 40 01.02	0.06	+0.47	-0.22	01.27	38 40 04 26	-2.99
8	Mt. Lola.....	1879	39 25 57.98	0.06	-0 22	-0.46	57.30	39 25 53 34	+3.96
9	Round Top....	1879	38 39 46 89	0.08	+0 01	-0 52	46.38	38 39 43.64	+2.74
								Mean. . .	-0.09

The mean difference, A—G, is small, approximating zero, as it should be. We have, therefore, retained and adopted for the present ζ for Mount Helena 38 40' 04.26'', with a probable uncertainty of $\pm 0.''59$. The average local deflection in the meridian is about 2.''2.

 GEODETIC OR STANDARD AZIMUTH μ OF DIRECTION MT. HELENA
 TO MT. DIABLO, FOR THE "DAVIDSON QUADRILATERALS."

No.	Station Occupied.	To Station Observed.	Observed Astronomical Azimuth.	Probable Error.	Reduction to Sea Level.	Resulting seconds of Azimuth (A)	Adopted Geodetic Azimuth (G')	A—G'
1	S. E. Yolo Base.	N. W. Yolo Base	163 07 13.51	± 0.18	-0.00	13.51	163 07 15.07	-1.56
2	N. W. Yolo Base.	S. E. Yolo Base.	343 05 02.35	0.16	-0.00	02.35	343 05 04.03	-1.68
3	Monticello.....	Mt. Helena.....	91 04 25.16	0.21	-0.00	25.16	91 04 23 79	1.37
4	Vaca Mt.....	S. E. Yolo Base.	235 38 36.44	0.28	0.00	36.44	235 38 33.47	-2.97
5	Mt. Diablo.....	Mt. Helena.....	144 28 16 13	0.15	*	*	144 28 15.06	-1.07
6	Mt. Tamalpais.	Mt. Diablo.....	274 15 15.39	0.14	-0.01	15.38	274 15 15.71	-0.33
7	Mt. Helena.....	Mt. Diablo.....	324 01 24.86	0.19	*	*	324 01 31.04	-6.18
8	Mt. Lola.....	Mt. Helena.....	67 21 62.57	0.17	-0.16	62.41	67 21 59.55	2.86
9	Round Top.....	Mt. Helena.....	90 58 53.67	0.13	-0.16	53.51	90 58 53.01	-0.50
							Mean. . .	-0.11

The mean difference is sufficiently near zero to retain the old value, and we adopt for the present *α*. Mount Helena to Mount Diablo:

$$324^{\circ} 01' 31.''04 \pm 00.''64.$$

This value will slightly change after the Mount Lola and Round Top observations shall have been finally adjusted. The average local difference in azimuth is about 2.''1.

At the stations Mount Diablo and Mount Helena the astronomical azimuths were referred to a mark and not to a triangulation point, and the same is the case at Mount Lola and at Round Top.

The references to the stations marked by an asterisk [*] in the preceding table would therefore be arbitrary since the results must depend on the adjustment of the directions of the figure; but by applying a correction which is the mean of all the corrections to the lines at the stations, the reference of the astronomical meridian to the geometrical figure of the triangulation is effected with respect to all directions; thus for the two stations in question:

At Mount Diablo:—

Observed azimuth of the reference mark (Clayton)=	
9° 42' 25.''92 West of North; hence, astronomical azimuth	
of the mark =	170° 17' 34.''08
Or when reduced to the sea level =	170 17 34. 07
At Mount Diablo the mean correction to the	
six adjusted directions is + 0.''023	
(±0.''11); this added to the observed	
geodetic direction of the azimuth	
(25° 49' 17.''194) gives =	25 49 17. 217
Hence with the corrected direction to Mount	
Helena (see below) =	359 59 59. 273
The angle between the mark and Mount He-	
lena, adjusted =	25 49 17. 94
and the astronomical azimuth referred to	
Mount Helena becomes	144 28 16. 13
as given in the preceding table.	

Similarly at Mount Helena:—

The Observed Azimuth of the reference mark (Woods)=	189 18 14. 36
the same reduced to the sea level	189 18 14. 37
The mean correction to four adjusted directions at the station is —0."032 ($\pm 0."$ 13).	
The angle between the mark and Mount Diablo adjusted=	225 16 49. 51
Whence the Astronomical Azimuth, referred to Mount Diablo=	324 01 24. 86

We have also the following table of adjusted directions at these two stations:—

AT MOUNT DIABLO.				AT MOUNT HELENA.			
Direction to	Result of Station Adjustment	Corr'n. Figure Adjust.	Final Seconds.	Direction to	Result of Station Adjustment	Corr'n. Figure Adjust.	Final Seconds
Mt. Helena.....	359 59 59.918	-.645	59.273	Mt. Diablo.....	359 59 59.927	+1.183	60.110
Monticello.....	20 03 30.611	-.162	30.509	Mt. Tamalpais....	33 43 57.138	+3.303	57.441
Vaca Mt.....	20 19 59.481	-.319	59.800	Azim. Mark (Woods)	225 16 49.650		(49.618)
Azim. Mark (Clayton)	25 49 17.194		(17.217)	Monticello.....	306 46 16.069	+1.008	16.077
North West Base....	38 39 09 129	+.086	09.215	Vaca Mt.....	340 03 44.097	-.621	43.476
South East Base....	43 24 20 921	-.524	21.445		Mean =—	0.032	
Mt. Tamalpais.....	310 12 09.218	-.047	09.171				
	Mean =+	0.023					

Tables of resulting adjusted directions were prepared for all stations, because the respective mean corrections are to be applied to all other directions not yet adjusted before they can be submitted to the process of the next figure adjustment which ordinarily is of a secondary character.

For the standard *Longitude* of the triangulation about the Yolo Base Line, we have to retain at present the telegraphic longitude of San Francisco station at Washington Square, $\lambda = 8h 09m 38.34$ secs, (see Coast and Geodetic Survey Report for 1884, Appendix No. 11, p. 424) and derive from it for

Mount Helena the value $\lambda_0 = 122^\circ 38' 01.'' 41$. [This gives for the present astronomical and telegraphic longitude station, Lafayette Park in San Francisco, the longitude west of Greenwich = $8h\ 09m\ 42.72s$, or $122^\circ 25' 40.'' 75$.]

These standard geodetic data φ_0 , a_0 , λ_0 are subject to changes hereafter; but generally they are best retained and the small corrections are noted, so long as the changes do not exceed the respective probable errors of these quantities.

EARLY SPANISH VOYAGES OF DISCOVERY ON THE COAST OF CALIFORNIA.

PROF. GEORGE DAVIDSON, A. M., PH. D.

Read at the meeting of the Academy, Monday, October 18, 1886.

The following tabulation exhibits in a condensed form the identification of the "landfalls" of Cabrillo and Ferrelo, in their explorations of the coast of California in 1542 and 1543, from Cape San Lucas to latitude 42° 30'.

During my work on the Pacific Coast of the United States since the spring of 1850, I have been deeply interested in the discoveries and explorations of the early Spanish navigators. My special duties have made me peculiarly well acquainted with the coast line, and I have thought it my duty to establish the identity of the landfalls, which I believe I have clearly done. Unfortunately, the great length of the paper in which I have given the details of the narratives of Ulloa, Cabrillo, Ferrelo, Drake and Vizcaïno, and my explanations, together with a chart, precludes its publication by the Academy at this time; and it has been presented, *in extenso*, to the Superintendent of the U. S. Coast and Geodetic Survey for publication.

This tabulation contains the resumé of the identification of the sixty-eight places which Cabrillo and Ferrelo particularly mention. In it are shown, in parallel columns, the names by which Ulloa, Drake and Vizcaïno designated the same localities, together with the modern names. The latitudes of Cabrillo and Ferrelo were given only to a third of a degree, with an occasional qualification of "a little more," or "a little less," while the large and nearly constant errors indicate very defective instruments. The present latitudes are taken from the published charts of the United States Coast and Geodetic Survey.

It should be understood that the whole of the work embraced in the paper and in this condensed statement has occupied much of my unofficial time during the last two years.

THE LANDFALLS OF CABRILLO, (C), AND FERRELO, (F), WITH
AND THE PRESENT

No.	Dates, 1542, 1543.	Name of place by Cabrillo and Ferrelo.	Latitude by Cabrillo and Ferrelo.	Names by Ulloa, Drake or Vizcaino.
1	Jun. 22, 1542 Apr. 14, 1543	El Puerto de Navidad	.....C. F..	El Puerto de la Navidad. V.
2	Jun. 28, 1542	El Cabo de Corrientes	20½°, C..	El Cabo de Corrientes. V.
3	July 2, 1542	La Punta de California	24° "and more," C..	
4	.....	El Puerto del Marques del Valle.....	Do.....	La Bahía de Santa Cruz. U.
	.....	El Puerto de la Cruz..	Do.....	
5	July 6, 1542	El Puerto de San Lucas .....	.....C F..	La Bahía de San Benarbè. V.
6	July 8, 1542	El Puerto de La Trinidad.....	25°, ...F..	La Bahía de San Abad. U.; La Bahía de Santa Marina. V.
7	" " "	La Punta de la Trinidad	25° C. F..	
8	" " "	Una Isla.....	.....F..	
9	" 13, 1542	El Puerto de San Pedro	25½°, F..	El Puerto de la Magdalena. V.
10	.....	La Bahía de San Martin .....	.....F..	La Bahía de Santa Marta. V.
11	" " "	Una Gran Ensenada	26°, F..	
12	July 19, "	El Puerto de la Magda'ena	27° C. F..	
13	" — "	La Punta de Santa Catalina.....	.....
14	" 25 "	El Puerto de Santiago	27½°, F..	La Bahía de las Balenas. V
15	" — "	Habre Ojo.....	27½°, F..	Abreojos, V.'s chart
16	" — "	Punta y Puerto de Santa Ana.....	28°, F..	
17	" — "	Una Isleta obra de una legua de Tierra	28°, F..	La Isla de San Roque. U. V.

THEIR NAMES BY ULLOA, (U), DRAKE, (D), AND VIZCAINO, (V),
NAMES AND LATITUDES.

No.	Present Name of the Place.	Latitude, ° /	Correction to C., F. or D.	Remarks.
1	Port Navidad.....	19 13	.....
2	Cape Corrientes.....	20 25	-05' (a)....	(a) It is more than probable that Cabrillo assumed the latitude as given by previous navigators.
3	Cape Pulmo.....	23 23	-37', "and more" C..	
4	Anchorage under Cape Pulmo.....	23 23	-37', "and more" C..	
5	San Lucas Bay.....	22 52	.....	Cabrillo did not observe the latitude. "They say it is in latitude 23," F.
6	Santa Marina Bay....	24 20	-40' F..	
7	Cape Tosco.....	24 17	-43' C. F..	The S. E. point of Santa Margarita Island.
8	Santa Margarita Island	24 17	.....	The island is 22 miles long.
9	Magdalena Bay.....	24 32	-58' F..	
10	Santa Maria Bay.....	24 44	.....
11	.....	.....	.....	There is no gulf; but the lowland north of Cape Lazaro slightly recedes, and would mislead a navigator in a small vessel in the offing.
12	Pequeña Bay and Point.....	26 14	-46' C. F..	Ferrelo says: "It is 40 leagues from the Bay of San Martin to this coast."
13	San Domingo Point and Anchorage.....	26 19	.....
14	Ballenas Bay.....	26 45	-45' F..	
15	Abreojos Rocks.....	26 46	-44' F..	A dangerous reef of visible and sunken rocks.
16	Asuncion Point and Anchorage	27 07	-53' F..	
17	Island of San Roque..	27 09	--51' F..	Ulloa saw the two islands, Asuncion and San Roque.

THE LANDFALLS OF CABRILLO, (C), AND FERRELO, (F), WITH
AND THE PRESENT NAMES

No.	Dates, 1542, 1543.	Name of place by Cabrillo and Ferrelo	Latitude by Cabrillo and Ferrelo.	Names by Ulloa, Drake or Vizcaino.
18	July 27, 1542	El Puerto Fondo.....	..... F.	
19	July 31, 1542	[Anchorage] .....	..... F..	
20	Aug. 1 " "	El Puerto de San Pedro Vincula	28½° "and more," F..	El Puerto de San Bartolomé. V.
21	" 2 " "	La Isla de San Esteban .....	..... F..	La Isla de Natividad de Nuestra Señora. V.
22	Aug. 2, 1542	Una Ensenada Grande .....	..... F..	
23	" 5 " " Mar. 28, 1543	La Isla de Zedros	29°, F..	La Isla de los Cedros. U; La Isla de Cedros. V.
24	Aug 11, 1542	El Puerto de Santa Clara.....	30° "scant" F..	La Bahía de San Hipolito. V
25	" 14, 1542	La Punta del Mal Abrigo	30½°, F..	
26	" 19 " "	La Isla de San Bernardo	30½°, F..	La Isla de San Geronymo. V.
27	" 20 " "	El Cabo del Engaño... La Punta del Engaño.	31°, C.. 31°, F..	El Cabo del Engaño, 30°, U. Do.
28	" 20 " " Mar. 21, 1543	El Puerto de la Posesión.....	31½°, F..	La Bahía de las Virgines. V.
29	Aug. —, 1542	La Isla de San Augustin.....	..... F..	La Isla de Cenigas. V. La Isla de San Hilario. V.
30	Sept. 4, 1542	[Anchorage, 7 leagues from San Augustin.] .....	..... F..	
31	" 8 " "	El Cabo de San Martin	32½°, F..	
32	" 11 " "	El Cabo de la Cruz.....	33°, C..	
	" 11 " "	El Cabo de Cruz.....	33°, F..	
33	" 11 " "	Una Isla.....	..... F..	
34	" 17 " " Mar. 18, 1543	El Puerto de San Mateo.....	33⅓°, F..	La Ensenada de Todos Santos. V.

THEIR NAMES BY ULLOA, (U), DRAKE, (D), AND VIZCAINO, (V),
AND LATITUDES.—CONTINUED.

No.	Present Name of the Place.	Latitude,		Correction to C., F. or D.	Remarks.
		°	'		
18	Table-Head Cove, or San Pablo Bay	27	11	.....
19	Bay of San Cristoval .....			.....
20	Port San Bartolomè..	27	39	-51' "and more" F	
21	Natividad Island....	27	53	.....	The Afégua, or Bird Island of Father Taraval, 1734.
22	Sebastian Vizcaino Bay	27	45	.....	This is the Gulf of San Xavier, of Father Tara- val. It is 50 by 60 miles in extent.
		28	35	to	
23	Cerros Island.....	28	02	-58' F...	They anchored under the south shore. This is the Amalgua, or Fog island of Father Taraval, 1734.
24	La Playa Maria Bay .	28	55	-65' "scant" F	They anchored here.
25	Point Canoas.....	29	25	-65' F ..	
26	San Gerónimo Island.	29	48	-42' F ..	
27	Point Baja.....	29	56	-64' C ..	
	Point Baja.....	29	56	-64' F ..	
28	Port San Quentín....	30	24	-66' F..	
29	San Martin Island ..	30	29	.....
30	San Ramon Bay	30	49	....
31	Point Santo Tomas, or Cape San Tomas.	31	33	-57' F..	The anchorage under the cape
32	Grajero Point, or Ban- da Point.....	31	45	-75' C..	Distance from Cape San Martin, 4 leagues.
	Do.....	31	45	-75' F.	
33	The Todos Santos Is- lands.....	31	48	.....
34	The Ensenada in To- dos Santos Bay	31	51	-89' F..	Anchorage in the north- east part of Todos Santos Bay.

THE LANDFALLS OF CABRILLO, (C), AND FERRELO, (F), WITH
AND THE PRESENT NAMES

No.	Dates, 1542, 1543.	Name of place by Cabrillo and Ferrelo.	Latitude by Cabrillo and Ferrelo.	Names by Ulloa, Drake or Vizcaino.
35	Sep. 26, 27, 1542.....	Las Islas Desiertas...	34°, F..	Las Islas de los Coronados, V; Las Islas de San Martin, V.'s chart.
36	Sep. 23, 1542 Mar. 11, 1543	El Puerto de San Miguel.....	34 $\frac{1}{3}$ °, F..	El Puerto de San Diego V.; El Puerto Bueno de San Diego, V.'s chart.
37	Oct. 7, 1542	La Isla de San Salvador.....	.....F..	La Isla de Santa Cathalina, V.
38	Oct. 7, 1542	La Isla de la Vittoria.....	.....F..	
39	Oct. 8, 1542	La Bahia de las Fumos.....	35°, F..	
		La Bahia de los Fuegos.....	.....F..	
40	Oct. 9, 1542	[Anchorage].....	.....F..	
41	Oct. 10, 1542	Los Pueblos de las Canoas.....	35 $\frac{1}{3}$ °, C..	
	Mar. 8, 1543	El Pueblo de las Canoas.....	35 $\frac{1}{3}$ °, F..	
42	Oct. 13, 1542	[Anchorage].....	.....F..	
43	Oct. 14, 1542	[Anchorage].....	.....F..	
44	Oct. 15, 1542	[Anchorage].....	.....F..	
45	Oct. 16, 1542	[Anchorage].....	.....F..	
46	Oct. 17, 1542	[Anchorage].....	.....F..	
	Nov. 2-6, "	El Pueblo de las Sardinias.....	.....C..	
	.....	Los Pueblos de las Sardinias.....	.....F..	
47	Feb. 12--14, 1543.....	El Puerto de las Sardinias.....	35 $\frac{2}{3}$ °, F..	
48	Nov. 1, 1542	El Puerto de Todos Santos.....	.....F..	
49	.....	El Pueblo de Xexo..	.....F..	
50	Oct. 18, 1542	El Cabo de la Galera..	36 $\frac{1}{2}$ °, C..	
	" " "	El Cabo de Galera....	36°, "and more." F..	

THEIR NAMES BY ULLOA, (U), DRAKE, (D), AND VIZCAINO, (V),
AND LATITUDES —CONTINUED.

No.	Present Name of the Place.	Latitude, ° /	Correction to C., F. or D.	Remarks.
35	Los Coronados Islands	32 25	—95' F..	
36	San Diego Bay.....	32 40	—100' F..	He has one of the largest errors in the best-known port.
37	Santa Catalina Island.	33 27	.....	At the great depression across the island.
38	San Clemente Island	32 49	.....
39	Santa Monica Bay....	34 00	—60' F..	
	Do			
40	The Anchorage off Laguna Mugu.....	34 05		
41	San Buenaventura....	34 17	—63' C..	
	Do.	34 17	—63' F..	
42	Anchorage off "the Rincon".....	34 22	.....
43	Anchorage off "the Carpinteria".....	34 24	.....	A few miles east of Santa Barbara.
44	Anchorage 4 or 5 miles west of Goleta Point	34 25	.....
45	Anchorage off the Cañada del Refugio....	34 27	.....
46	Anchorage off Gaviota Pass.....	34 27		
	The Indian Villages at Gaviota Pass.....	34 28	.....	Ferrelo says the Indian name was Cicaut.
	Do			
47	Anchorage off Gaviota Pass	34 27	—73' F..	
48	Anchorage off El Coxo	34 28	.....	There are two Coxo's. The Coxo Viejo is one mile east of the usual anchorage El Coxo.
49	Indian Village at El Coxo	34 29	.....
50	Point Concepcion, or Point Conception	34 27	—123' C....	La Punta de la Concepcion of recent Spanish navigators.
		34 27	—93' "and more" F..	

THE LANDFALLS OF CABRILLO, (C), AND FERRELO, (F), WITH
AND THE PRESENT NAMES

No.	Dates, 1542, 1543.	Name of place by Cabrillo and Ferrelo.	Latitude by Cabrillo and Ferrelo.	Names by Ulloa, Drake or Vizcaino.
51	Oct. 14, 1542.	La Isla de San Lucas.	..... F..	
52	" 18 "	Las Islas de San Lucas	..... C. F..	
53	" 25 "	La Isla de la Posesion	... C. F..	La Isla de Baxos. V.
...	Dec., 1542	La Isla de Posesion..	..... F..	
54	Dec., 1542	Una de las Islas de San Lucas ....	..... C..	
55	Jan. 3, 1543	La Isla de Juan Rod- ríguez.....	..... F..	
	Mar. 5, "			
56	Oct. 25, 1542	El Puerto de la Poses- ion.....	..... C. F..	
57	Mar. 5, 1543	[Dangers].....	F.'s consort.	
58	Jan. 29, 1543	La Isla de San Lucas.	..... F.	La Isla de Cleto. V.
59	Mar. 5, 1543	La Isla de San Sebas- tian	F.'s consort	
60	Jan. 19, 1543	La Isla de San Salva- dor.....	..... F..	La Isla de San Am- brosio. V.
	Feb. 14, "			
61	Nov. 11, 1542	El Rio de Nuestra Señora .....	..... C..	
62	Nov. 11, 1542	Las Sierras de San Martin	37½°, C. F..	La Sierra de Santa Lu- cia. V.

THEIR NAMES BY ULLOA, (U), DRAKE, (D), AND VIZCAINO, (V), AND LATITUDES.—CONTINUED.

No.	Present Name of the Place.	Latitude. ° ' "	Correction to C., F. or D.	Remarks.
51	The three Islands, Santa Cruz, Santa Rosa and San Miguel.....	.....	.....	They overlap each other, and were seen as one great island.
52	San Miguel, and then Santa Cruz and Santa Rosa as one.....	.....	.....	One large—Santa Cruz and Santa Rosa overlapping—and one small, which was San Miguel.
53	San Miguel Island ..	34 03	.....	Ferrello says the Indian name was Ciquimuymu.
...	Do.	.....	.....
54	Do.	.....	.....
55	Do.	.....	.....	So named by Ferrello to commemorate Cabrillo's death on the island.
56	Cuylers Harbor.....	34 03	.....	Cabrillo and Ferrello wintered here in 1542-43; it is on the north shore of San Miguel island.
57	Wilson Rock, &c.....	34 06½	.....	The rocks and reefs off the northwest shores of San Miguel island.
58	Santa Rosa Island... ..	33 57	.....	Ferrello says the Indian name was Nicalque.
59	Do.	.....	.....
60	Santa Cruz Island... ..	34 02	.....	Ferrello says the Indian name of the island was Limun.
61	La Purisima, or Santa Ynez River... ..	34 42	.....	Cabrillo and Ferrello did not see it. They learned of its existence north of Pt. Concepcion, from Indian information, when in the Santa Barbara channel.
62	Sierra Santa Lucia....	36 03	-87' C. F.	This mountain range is 50 miles long, and overhangs the coast line. The culminating point is Mt. Santa Lucia, 6,000 feet elevation and 12 miles inside the shore.

THE LANDFALLS OF CABRILLO. (C). AND FERRELO. (F), WITH
AND THE PRESENT NAMES

No.	Dates, 1542, 1543.	Name of place by Cabrillo and Ferrelo.	Latitude by Cabrillo and Ferrelo.	Names by Ulloa, Drake or Vizcaino.
63	Nov. 11, 1542	El Cabo de San Mar- tin.....	38°, ....F..	La Punta de Pinos. V.
64	Nov. 11, 18, 1542.	El Cabo de San Mar- tin	37½°, F..	
65	Nov. 18, 1542	El Cabo de Nieve, ...	28⅔°, C F..	
66	.....	(de las Sierras Nevad- as )	.....
67	Nov. 16, 1542	La Baía de Pinos.....	.....C..	Portus Novæ Albionis 38°.D.
	.....	La Bahía de los Pinos	39° "and more," F..	El Puerto de San Francisco.V.
68	Nov. 14, 1542	El Cabo de Pinos ..	40° "and more," C..	
	Feb. 25, 1543	El Cabo de Pinos....	40°, F..	
	Mar. 3, 1543			
69	Feb. 26, 1543	El Cabo de Fortunas.	41°, C..	

THEIR NAMES BY ULLOA, (U), DRAKE, (D), AND VIZCAINO, (V)
AND LATITUDES.—CONCLUDED.

No.	Present Name of the Place.	Latitude, ° ' "	Correction to C., F. or D.	Remarks.
63	Point Pinos.....	36 32	—88' F.....	
64	The Twin Peaks.....	36 03	—87' F.....	The height is 5,100 feet, and the distance $3\frac{1}{2}$ miles inland.
65	Black Mountain.....	37 09	—91' F.....	The mountain mass 13 miles behind Point Año Nuevo.
66	The Santa Cruz mountains.....	.....	.....	Embracing Black Mountains.
67	Anchorage in Drake's Bay.....	38 00	—00' D... ..	The northern part of the Gulf of the Farallones.
	Drake's Bay, or the Gulf of the Farallones.....	38 00	—60' "and more," F..	"A great gulf," Cabrillo. (Una Ensenada Grande.)
68	The Northwest Cape.	38 31	—89' "and more" C... ..	The mountain mass just east of Fort Ross anchorage, and reaching 2,200 feet elevation.
	Do.	38 31	—89' F.....	
69	King Peak, behind Punta Delgada.....	40 00	—60' C. . .	The mountain mass northward of Shelter Cove, with King Peak, only 10 miles inland and 4,235 feet elevation, as the culminating point.

BULLETIN.

No. 7.

California Academy of Sciences.

OCEAN CURRENTS CONTIGUOUS TO THE COAST OF CALIFORNIA.

BY DR. C. M. RICHTER.

Read February 7, 1887.

The question, not as to the existence, but as to the character of the ocean currents contiguous to the coast of California, is still an open one. Some of the most recently published maps show that a cold current of great width washes our shores, and others again indicate that it is the deflected warm Japanese current which is passing this country in its southward movement. A third opinion gives the surface waters to the Kuro Siwo, and identifies the sub-stream with the Polar current.

The practical seaman is satisfied by the knowledge of the fact, that the direction of the waters along the coast—with the exception of those nearest the coast—is generally southward and northward only during the winter storms. Adjacent to the coast—at a distance of from three to ten miles from it—an eddy current is observed with a northerly direction.

It is obvious that it would be of great value to science to gain positive facts concerning these questions, and especially so in regard to the science of meteorology; for the peculiarity of the climate of California must be de-

pendent to a great extent upon the influences of these ocean currents.

We wish to know the width of the eddy current, the temperature of its water, its origin and extent. We wish to know the width of the gigantic southward movement of waters, its velocity and its temperature; whether there is a distinct cold stream and a distinct warm stream, and their relation to each other, etc., etc.

To decide the direction and velocity of an ocean current, various instruments have been invented, and are still in use, which show as much ingenuity in their construction as they lack in positive demonstration. This disappointment is clearly illustrated by the findings on Maury's charts, and the map affixed to the "Deep-Sea Soundings in the North Pacific Ocean obtained on the U. S. Steamer *Tuscarora*, Commander G. E. Belknap."

We find on Chart I* of this essay, that there is a general southerly direction of the surface currents, even next to the coast north of San Francisco. The under-surface currents show no regularity whatever in their direction, and looking at this chart one is led to believe that the direction of the arrows is given for the purpose of proving the existence of a whirlpool in the ocean near the coast of California. See Chart I.

Undoubtedly many records as to the direction of ocean currents have been made here by vessels, only to explain apparent errors in their nautical observations as to the course of the ship.

The only fact which emanates from these observations is, that a surface current of a southerly direction drives the waters down the coast, and that by strong winds from the south, during the winter storms, its direction may be temporarily reversed.

*Compiled from Maury's and Belknap's charts.

The velocity of this surface current is marked variously as from 0.37 to 1.0 nautical miles per hour.

It is clear that this evidence cannot give satisfaction to science.

But fortunately we have an instrument from which we can obtain the desired information, namely, the thermometer. The sea thermometer is the most sensitive instrument known with which to prove the existence of ocean currents, as well as to determine their extent.

We have historical proof of an ocean current in the landing of Cermeñon, one of the discoverers of California, who was driven to her shore by the great circuit route of the Kuro Siwo. We have many wrecks of Japanese junks along the western coast of North America to bear testimony to its existence. We have also the records given by modern current indicators, which denote a great southerly drift, and still we lack the positive proof whether this current is of Arctic origin, or coming from the shores of Japan, until we have measured the temperature of its waters on the surface and in its depths.

The great Gulf Stream, its origin, its direction, and its extent, has been definitely outlined by measuring the temperature of its waters.

The questions we wish to solve in regard to the California current must necessarily be also answered by the record of its temperature. The material from which to obtain these records is still very meager.

We find it on Belknap's Deep-Sea Soundings, on Maury's charts, and in the records of steamers and sailing vessels. Commander Belknap made a number of trips along the coast of California in 1873, starting from different points, and following each time a line more or less perpendicular to the coast. His real object was to find a practical route for a submarine cable between the United States and Japan. At the same time serial temperatures were obtained of the ocean water in different depths. These

records of temperature are necessarily imperfect, but as they represent mostly the mean temperatures, taken from four to five observations on the surface, and from more than one in great depth, they really are entitled to great consideration, although the apparent smallness of their number may not seem to warrant it.

Furthermore, the temperatures registered on Maury's charts coincide remarkably with Belknap's figures.

We know the law of the evenness of the ocean temperature. In the open sea the temperature of the surface water shows a daily range of hardly more than one degree of Fahrenheit, and nearest the coast sometimes of two or three degrees. The yearly variation will amount only rarely to ten degrees in our latitude. The surface water at the Golden Gate, for instance, shows between the years of 1874 and 1883 a lowest mean temperature of 50°.49 in January, and a highest mean temperature of 59°.68 in September, according to the "Coast Pilot," by Prof. G. Davidson.

In compiling the temperatures derived from the above-named sources, we cannot make therefore a great deviation from truth.

It is proper to mention the fact, that Belknap's temperatures have furnished the foundation for the most recent descriptions of the North Pacific ocean currents. I refer especially to the work on "Oceanography," by F. Attlmayr, published under the auspices of the Secretary of the Austrian Navy in 1883. Yet no attempt has been made to adapt the figures of the *Tuscarora* to the details of the currents along the coast.

Therefore it has been my endeavor to utilize every reliable record of temperature from Belknap's Soundings, as well as from every other trustworthy source, and to determine by them the facts from which I could illustrate the direction and the extent of the ocean currents along the coast of California.

As the figures recorded by Belknap harmonized as afore-

said wonderfully with those of other authors, the task I had undertaken was very gratifying as to the results.

I must add that Belknap's temperatures were taken at the end of October and the beginning of November, between Trinidad Head and San Francisco, and end of December between San Francisco and San Diego. The correction between the two cannot amount to more than one degree of Fahrenheit.

The temperatures on all my charts represent for this reason the winter season, and to give the figures for the summer they must be increased by from five to eight degrees.

The results of my investigation are made clear by Profiles A-F and Charts II and III. They are as follows:

(1.) The greatest difference in the temperature of the surface water, between San Diego and Trinidad Head, is noticeable nearest the shore. The following table will explain it. *See Profiles A-F.*

	Trinidad Head.	San Diego.	Difference.
10 miles off shore.....	48.5°	59.8°	11.3°
50 " " "	50.2	54.4	4.2
100 " " "	54.0	59.9	5.9
220 " " "	54.8	59.6	4.8

(2.) The temperature increases at the line of Trinidad Head gradually from 48.5° 10 miles distant from shore, to 54.8° 220 miles distant from shore, indicating a difference of 6.3° between the two, while off San Diego the temperature remains about the same.

(3.) The ten miles off shore surface temperature of Trinidad Head finds its equivalent ten miles off San Diego at a depth of 100 fathoms. Following the comparison—that of 50 miles off Trinidad Head agrees with the one 200 fathoms deep 50 miles off shore, and 220 miles off shore the Trinidad Head temperature is found 40 fathoms below the surface on the San Diego line.

(4.) Ten miles off shore the ocean has an average depth of only one hundred fathoms, with the exception of three submarine valleys—one between Trinidad Head and Point

Arena, one between Point Carmel and Point Sal, and one stretching from the Santa Barbara channel towards San Diego. The bottom of the one hundred fathom plateau has an average temperature of 45° .

(5.) Fifty miles off shore the average depth of the ocean is 1000 fathoms. At this distance the existence of a submarine mountainous grade, which is highest in latitude of Point Carmel, alters the isothermal lines of the ocean. The same action on the temperature of the water is repeated, though in a less degree, by another submarine grade tending southward towards San Diego.

(6.) The result is, that the isothermal line of 40° , commencing at Trinidad Head at a depth of about 350 fathoms, and which is found to be off San Diego 500 fathoms deep, sinks off San Francisco to 700 fathoms depth, and off Point Sur still deeper. Therefore, off San Francisco and off Point Sur a greater volume of warm water is found in proportion than at any other point on the coast.

(7.) For the same reason the isothermal lines between the two named points are bent upward, indicating thereby that the direction of the current is generally southward, and that the cold waters are crowded back and upwards by the submarine mountain.

(8.) All the isothermal lines, 50 miles off shore, show generally a constant increase of temperature towards San Diego; still the isothermal line of 40° is only 100 fathoms deeper at San Diego than at Trinidad Head.

(9.) One hundred miles off shore the same regularity is observed. On the line of San Francisco, however, the high surface temperature of 58.2 is cooled 18° inside of 300 fathoms depth, and off Point Carmel and Point Sal, a similar proportion is observed; while off San Diego a depth of 600 fathoms is reached before the temperature is lowered to this extent.

(10.) Two hundred and twenty miles distant from shore the evenness of the isothermal lines is remarkable, indica-

ting a slow but constant increase mainly of surface temperature towards San Diego, and in conformity with the general law of temperature of the ocean.

(11.) The isothermal line of 35° is uniformly found at the depth of 1,000 fathoms from 50 to 220 miles off shore.

(12.) The lowest temperature of the water, 32.9° , is found 220 miles off Trinidad Head at a depth of 1,800 fathoms. At the same distance from San Diego a temperature of 33.8° is found 2,260 fathoms deep.

(13.) Off San Diego the temperature of the surface water is highest nearest the shore, while the reverse is true off Trinidad Head.

(14.) The analyzation of all the surface temperatures proves the existence of a cold water current, about 150 miles wide, on the northern boundary line of California, passing southward nearest the coast line, which is reduced in width constantly during its course, until it reaches Point Conception, where it is partly deflected to the southwest and partly buried by warmer surface waters. Its temperature is from 45° to 50° in winter time nearest the coast, before Point Arena is reached, and from 50° to 55° further off the coast and until it is submerged north and northwest of the Santa Barbara channel. *See Chart II.*

(15.) To the west and south of this cold current appears a great body of warmer water, having a temperature of from 55° to 60° in winter time. Its direction seems southerly in the north of California, and is doubtful in the region of Southern California.

(16.) The temperatures of the water 10 fathoms below the surface, generalized on Chart III, demonstrate the accuracy of the foregoing conclusions. For a cold current which comes to an end near the southern part of California must necessarily lose its width by submerging, and we find on Chart III indeed a constant widening of this cold current, and may prove by it again the character of its deflection. *See Chart III.*

Having established the existence of these currents by reference to the temperature of the ocean in its different depths, as found principally by Commander Belknap, the next question arises whether my deductions are in accordance with the balance of observations made by him and other scientists in regard to the temperature of the waters adjoining the California currents.

It is an interesting fact, that midway between Ounimak Pass (Aleutian Group) and Cape Flattery, the temperature at the bottom of the sea, 2,000 fathoms deep, is 2° higher than we noted it for the line of Trinidad Head. In Lat. 54° 21' N., Long. 155° 07' W., it was 34.1° at a depth of 2,850 fathoms, and the same at a depth of 1,500 fathoms.

Then, again, on a line between San Diego and Honolulu, and especially near the latter place, the bottom temperature of the ocean is from 33.2° to 33.5° at a depth of 2,800 fathoms and more; therefore lower than near the Behring Sea. To interpret this fact I quote a notice by Commander Belknap, accompanying his Profile C. "Between Cast A (towards Yokohama) and Cast B (towards Tanaga Island of the Aleutian Group), there appears to exist a stratum of cold water of about 35° at an average depth of 34 fathoms below the surface, and becoming deeper as it proceeds westward."

Belknap's charts show the isothermal line of 40° between Yokohama and Ounimak Pass, to be nowhere below 100 fathoms from the surface, the entire length of the Profile, excepting nearest Japan. This would indicate that the Kuro Siwo drift cannot extend to the latitude which is marked for it on the latest maps, the Austrian Navy map included.

It is apparent from Belknap's observations, that the northern or Arctic currents are powerful enough to alter the direction of the Japanese current materially. They sweep against the warm waters, as the Polar waters meet the Gulf Stream on the north of Scotland. The Arctic waters pre-

dominate on the surface by superior force until the Kuro Siwo gives a stronger wall, which causes the cold current to pass underneath in the direction of the equator.

One or more branches of the Arctic current perhaps pushes eastward towards North America, and we find one such branch marked on the Austrian map as passing down nearest the coast and disappearing at 40° Lat. Our map indicates that this cold current is continued to Point Conception.

The bulk of the Kuro Siwo trends eastward, but perhaps nowhere washes the shores of the United States, being separated from them by the narrow cold stream, and yet being near enough to exercise a powerful influence on her climate. Thereby it is also explained why 200 miles from Honolulu the isothermal line of 40° is at the same depth as we found it off Trinidad Head, and even at a greater depth near San Diego, where the warm waters are no longer affected by a cold current.

Therefore, if we can establish a harmony of our conclusions with the balance of the observations in regard to the northern drifts, we are faced by difficulties in attempting to explain the state of affairs on the line off San Diego. After the cold stream is submerged off Point Conception, we are confronted with a body of warm water which can hardly owe its temperature to the influence of the Kuro Siwo.

How could the cold current be deflected southwestward, if a potent warm stream from the north were pushing against it? How could we account for the great prevalence of seaweeds off the shore of Southern California, if a strong drift were working on these waters?

How could tropical and subtropical fish be found on the adjoining coast, if the Kuro Siwo really had superseded the cold current? Is there not a warm current flowing northward?

To decide this question beyond doubt we need a careful

examination of the ocean temperature off the coast of Lower California, and regret to say that reports are wanting.

We are not less ignorant of the ocean temperature next to the coast of California within the sphere of the so-called eddy current. Of course we have regular observations of the ocean water next to San Francisco, and perhaps to Santa Cruz, Monterey, Santa Monica and San Diego. But they will never determine the width and the character of the eddy current, the existence of which and the northerly direction of which is vouched for by Prof. G. Davidson in his "Coast Pilot" (Manuscript, 4th edition).

Undoubtedly such a current exists, at least to some extent, along our coast, for our coast vessels sailing northward know how to profit by it in keeping close to the shore. We have seen the muddy water of the Sacramento river driven northward as a distinct stream for many miles. We have heard of a part of a wreck, located near the Cliff House, being found not many days after the accident near Eureka, Cal. But still we are doubtful as to its existence, as to its extent, and as to the persistence of its direction.

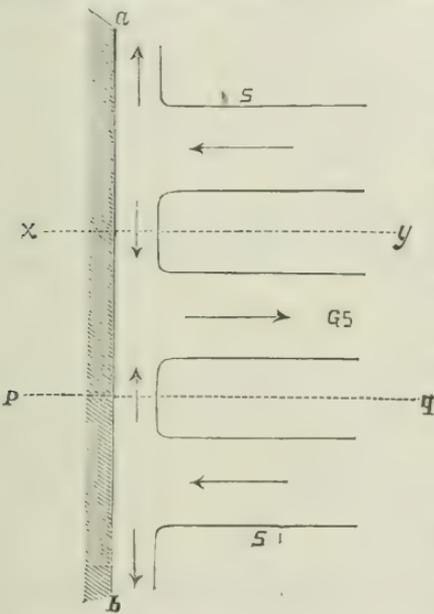
As we are void of scientific proofs to corroborate any assertions in regard to this matter, we have to recur to theory, and fortunately meet with the very plausible one of K. Zoeppritz on ocean currents. He shows by exact physical analysis how superficial impulses will work on liquid masses, and will be extended by the friction of the strata of the liquid against each other downward. He elucidates by his researches that the motion of the principal body of a liquid mass, which is subject to a periodically changing surface power, is determined by the average velocity of the surface, and that the periodical changes penetrate only a thin surface stratum.

Thereby the winds are reinstated as powerful motors of the ocean surface water. They communicate their average direction to the lower masses of the water as well as to the surface water, and Zoeppritz has calculated, for instance,

that a body of water with a depth of 2,000 fathoms, and of infinite extension, would have adopted in 200,000 years the same motion in a horizontal direction as the surface water, provided that a constant motion of the surface water in this direction had been in force.

Before we apply this theory to the currents, which were established by my conclusions, I wish to refer to another essay of Zoeppritz on the configuration of the coast and the formation of the bottom of the ocean as factors, by which the direction of an ocean current is mainly influenced.

I will try to explain his view on this subject by the following diagram taken from his publication :



If a straight coast line ab be touched by two currents s and s' , which have the same velocity and the same width, then those parts of them which are deflected inward, will form a new current G_s between the two former ones, and give it the opposite direction.

It is clear that if a current strikes such a coast line in an oblique direction, as we find it on our coast according to my maps, a deflection of this liquid mass will follow principally in one direction, the one opposite to the original direction of the current.

principally in one direction, the one opposite to the original direction of the current.

If we admit that the general direction of the cold and the warm current along the coast of California is southeasterly, then the force and direction of this large body of water will cause an eddy current running northward.

Taking into consideration the formation of the coast, which, as I mentioned before, forms a plateau stretching out into the ocean to a distance of about ten miles from the coast, and thereby creates a shallow strip of water with a depth of about 100 fathoms, while it then glides rapidly into a depth of nearly 2,000 fathoms, it is apparent that this marginal plateau will be the scene of this eddy current.

It now remains to prove that the average direction of the wind along the coast of California, as well as northwest of our coast, is in harmony with the direction of the currents, as indicated on my charts.

H. Mohn's charts, as well as Attlmayr's, concur with Maury's in giving to the winds which blow over the area of the Kuro Siwo, an average direction corresponding to its course, as we adopted it. They all vary in regard to the direction of the wind next to the western coast of the United States. We have to recur therefore to the observations made at coast stations of the Signal Service, United States Army. Undoubtedly we can judge from these reports with some accuracy the prevailing character of the wind for the 50 or 100 miles of ocean surface adjacent to the stations.

The following table, derived from Appendix 51 of the Annual Report of the Chief Signal Officer for the year 1885, gives the desired information. It is computed from the commencement of observations at each station to and including December, 1884:

STATIONS.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Tatoosh Island, Wash.....	E	E	E	E	SW W	S	SW	SW	E	E	E	E
Canby, Fort Wash.....	E	N	W	W	W	W	W	W	S	S	S	SE
Cape Mendocino, Cal.....	NW	NW	SE	NW	NW	NW	NW	N	N	N	SE	NW
San Francisco, Cal.....	N	W	W	W	W	S	SW	SW	SW	SW	NW	N
Los Angeles, Cal.....	NE	NE	W	W	W	W	W	W	W	W	NE	ENE
San Diego, Cal.....	NE	NW	W	W	W	W	W	W	NW	NW	NW	NE

The western coast of the United States tends northeastward from Cape Mendocino towards Tatoosh Island, and southeastward from Cape Mendocino towards San Diego. Therefore a current with a direction down the coast will depend on easterly winds near Tatoosh Island. These winds will become northwesterly only when it has reached Cape Mendocino, and they will become more and more westerly in the direction of San Diego. This is exactly what the table demonstrates.

We may infer besides, that as the direction of the Kuro Siwo, and the wind above its area, is westerly between Lat. 40° and 50° , its waters will have a general direction towards Cape Mendocino, and that the current which follows the easterly winds off Tatoosh Island cannot be a part of the Japanese, but of an Arctic current. This brings again the currents as represented on my charts in harmony with the observations at the Signal Service stations, and with the theory of Zoeppritz.

It is hardly necessary for me to emphasize the importance which my deductions, if correct, bear upon the climatology of our State.

The mountain barriers of our State which shield us from influences by land, and the evenness of the temperature of the neighboring ocean, guarantee the uniformity of our climate.

A glance at the accompanying charts exhibits the reason why the northern part of California has more fog in summer, and probably more rain in winter; it explains the reason why the temperature of San Francisco cannot sink as low as that of Monterey; it reveals the causes of the subtropical climate of Southern California.

We get from these profiles arguments for a parallelism between the isothermal lines, and perhaps the isobares of California, with the corresponding lines of the neighboring ocean. In short, they teach us graphically the importance

of the ocean currents as factors in determining the climate of our State.

Furthermore, they prove the advisability of our Government, through its branch the Signal Service, continuing this research. The isothermal lines of the ocean for different months at different distances from shore and along the entire west coast of the United States, should be established beyond doubt. They will form the constant factor for the calculations of our meteorologists. They will probably explain the formation of our barometric maxima and minima, and will enable us to make weather predictions with more accuracy than it is possible to do without them.

THE PACIFIC COAST ALDERS.

BY C. C. PARRY.

Read March 7, 1887.

The alders, everywhere easily recognized as a natural group of shrubs or trees, usually bordering water-courses, present certain well-defined botanical characters comprised in the old established genus *Alnus*.

Widely scattered over different portions of the globe, the species, variously estimated at fourteen or fifteen, are not so numerous as to present serious difficulties in systematic arrangement. As one would naturally expect, the species most remote in geographical position present the most marked specific differences, as is manifest in the Asiatic-India group, as compared with those of Europe or North America. At the same time, several of the high northern species have a wide geographical range, in some cases apparently encircling the globe; and one, at least, *Alnus maritima*, Nutt., falls into that singular group connecting the botany of Eastern North America with Japan.

On this coast the Botany of California enumerates four species; one of these, confined to the higher mountain districts, is recognized as a variety of the common Eastern United States species, *Alnus incana*, var. *viridescens*, Watson.

Another well marked species, *A. rubra*, Bong., seems peculiar to the North American Pacific coast, ranging from Alaska to Central California, and apparently confined to the coast districts. Some fine specimens of this latter can be seen along the course of deep ravines in the vicinity of Berkeley.

Of the two other recorded species to be considered, viz: *Alnus rhombifolia*, Nutt., and *A. oblongifolia*, Torr., which,

under favorable conditions of growth, present the largest trees known in this group, frequently attaining a height of eighty feet, with a smooth columnar trunk three feet in diameter at base—observations during the present season have brought to view such peculiar and hitherto unnoticed botanical characters as to justify their presentation before a meeting of the California Academy of Sciences.

It must be premised that Nuttall's original description of *Alnus rhombifolia*, contained in *Am. Sylva.*, Vol. II., p. 49, was taken from a leaf branch without flower or fruit, collected by Nuttall himself in the vicinity of Monterey, probably in April, 1836. Since then the name has been generally, and no doubt properly, applied to the common California alder, of the western and interior districts, extending from Oregon to Southern California. As such, it is included by Watson in *Bot. Cal.* II. p. 80.

Probably about twelve or fifteen years later than Nuttall's description above referred to, Dr. Torrey, in the *Botany of the Mexican Boundary Survey*, p. 204, described *Alnus oblongifolia* from specimens collected by C. Wright in New Mexico, the specific character being mainly based on the foliage; subsequently Mr. Watson identifying Dr. Torrey's species with the Southern California *Alnus*, included *A. oblongifolia*, Torr., in *Bot. Cal.* p. 81. In making a critical comparison of the description of these two species as given therein it is noticeable that the points of difference are very slight, and might easily be comprised within the limits of ordinary variation.

An equal difficulty has been experienced by field observers, and from a somewhat extended observation for several years, I have never yet been able to draw a clear line of distinction between these two species as laid down in botanical works. Accordingly, in order to satisfy myself on this doubtful point, I have undertaken the present season to make a series of observations, including the earliest growth and flowering, some of the results of which thus far reached, may be briefly noted.

First, then, in reference to the species under consideration, the most striking fact is the unusually early period of flowering, equally true of the most southern and northern plants. Thus no sooner do the leaves of the previous season, having fulfilled their office of nourishing the forming buds, begin to fade and loosen their attachment—though often retaining their hold until early winter—than the flowering spikes both staminate and pistillate begin to swell, and by early January the male catkins are fully developed, and the stigmas protuberant. In spite of occasional sharp frosts the process of fertilization proceeds, and by February 1st, at least as far north as the lower Sacramento valley, is mainly completed; the swollen winter streams over which they lean, as well as the adjoining banks, being copiously strewn with the effete male tassels resembling torpid caterpillars.

During all this active vital process, the leaf buds remain dormant, mostly retaining their deciduous scales. Thus, during the month of February, the trees display their smooth naked branches, barely relieved by the matured seed cones of the previous season, which, with the winter rains, relax their scales to discharge their wingless seeds; a remarkable contrast to the more exclusively coast species, *A. rubra* which at the present time, March 1st, is only just loosening its male catkins in connexion with the rapidly swelling leaf buds.

Still farther, a close examination of the male catkins thus early developed, shows a floral character hitherto unnoticed, applying equally to the northern and southern forms, which will require an extension of the generic character of *Alnus* as laid down in systematic botanical works. Thus in the latest authority, Benth. & Hook., Gen. Pl. III, p. 404, the staminate flowers are described as with "four stamens and very short filaments." Now in the species under consideration, while in other respects agreeing closely with the ordinary characters

of the genus, the four somewhat unequal perianth segments enclose quite constantly but a pair of opposite stamens, not infrequently increased to three in the larger perianths, and more rarely reduced to a single one, and instead of very short filaments, they are at maturity exert beyond the perianth.

This character is so obvious on the most casual observation, that the only explanation of its having been heretofore overlooked must be the fact that in the specimens from which the descriptions were drawn, the male flowers were either wanting or not examined.

As the character thus noted serves to give a unique feature to all the various forms of *Alnus* heretofore included under these two described species, and is easily recognized in all the specimens accessible to me, including an undeveloped one in the California Academy herbarium, collected by Prof. Greene in New Mexico, I am led to the conclusion that all these western forms, varying only in unimportant leaf characters, must be reduced to the earliest described species, *Alnus rhombifolia*, Nutt.; *A. oblongifolia*, Torr., representing the most southern and eastern variety.

Another fact in this connection, coming quite accidentally under my observation—more of morphological than systematic botanical interest—is a singular abnormal condition in which some of the lower staminate aments show a transformation at the summit to regular pistillate flowers. While to ordinary view such a transformation of floral organs, involving absolute sterility, and accomplishing no apparent useful purpose in the vegetable economy, may be poetically regarded as a “freak of nature.” It is nevertheless true that by just such abnormal deviations from ordinary processes, nature often gives us the clearest insight into her regular plan of operations, though it may need the genius of a Goethe to interpret their real significance.

The whole subject suggests the value and importance of supplementing or correcting systematic descriptions by careful and intelligent field observations.

WEST COAST PULMONATA; FOSSIL AND LIVING.

BY J. G. COOPER, M. D.

Read March 21, 1887.

A.—EXTINCT SPECIES.

Since the publication of the article in Bulletin No. 4, p. 235, several additional facts have been made known which much increase our knowledge both of fossil and living species.

The most ancient known fossils of non-marine mollusca in North America were those of the carboniferous strata of Nova Scotia, and were of terrestrial forms. Some late discoveries by the U. S. Geol. Survey "from the base of the carboniferous of Nevada," give two fresh-water species, and one of an amphibious or brackish-water type, allied to our *Alexia*. (See "Science," II, p. 806, 1883, and Bulletin U. S. Geol. Survey, No. 18, 1885.) These species show both a wonderful similarity to living species, and an unexpected variety of genera existing in what is so far the oldest land fauna known.

In the last-named Bulletin, Dr. White also figures an extinct *Unio* and an extinct "Helix" (*H. dalli* Stearns, referred doubtfully to *Mesodon*) found in the John Day lacustrine basin of Oregon, together with three other species of land-shells, of which two are inseparable from living species now found only farther west, viz.: *H. fidelis* of Oregon, and *Gonostoma yutesii* of California. The third is doubtfully referred to the eastern species *Patula perspectiva*.

These are the most important evidences yet discovered of the westward migration of the Pacific-slope species, being now found only at 100 miles west and 500 miles south of the locality of the fossils, in regions very different in climate, being far more moist.

The deposit in which they were found is considered miocene from the bones of extinct mammalia found in it, and the land shells help to confirm this.

The extinct *Mesodon* seems to be the ancestor of the species found in the regions north and westward, though not very similar to any of them, while the close resemblance of the other two western forms to living examples is remarkable, for fossils so far anterior in time. The *Patula* is the only one generically allied to the numerous forms of that type now existing in the "Central Province," but unlike them all.

The isolated occurrence at present of the *Gonostoma* about the caves of Calaveras County gives a clue to the explanation of the similar isolation of several other west-slope species, such as *Polygyrella* in Montana, and *Polygyra herfordiana* in Mariposa County, Cal., which may also have ranged widely during the tertiary epochs.

Other geological evidences show that since the miocene epoch the Cascade Range and Sierra Nevada have been elevated much higher than before, together with the "Central Province" east of them, while at the same time vast outflows of lava devastated the latter regions. These shells tend to prove that at the time they lived in Central Oregon, that region had a much moister and milder climate, like that now found west of the Cascades, and at a gradually rising elevation on the west slope of the Sierra Nevada, as we progress southward.

They also make it appear probable that any terrestrial fossils found west of those ranges should be considered as pliocene or later, although we have fresh-water bivalves in the lignitic beds of Mt. Diablo, and it is possible that the forests producing the lignite also contained eocene or older land shells.

B.—GEOGRAPHICAL DISTRIBUTION.

It would be interesting to continue the subject of derivation from fossil species down to the present time, if we had

sufficient data to follow it out, but until more is learned we can only infer part of it from the present distribution and variations of the living species.

In 1869, I published what was then known on the subject, and again, in 1873, gave the special distribution of our banded species and varieties with maps, in the Proc. Cal. Acad., V, 121. Some additional information and corrections have since then been accumulating, especially with regard to the region around San Francisco Bay, which is the only well-explored region of land shells on the west slope, and apparently the richest in variety of species, subspecies etc., of any north of lat. 32° on this side.

1. SIERRA NEVADA.

In addition to what has been stated as to the occurrence of the large Helicoids on the west slope of these mountains only below the elevation of 5,000 feet, probably on account of the absence of lime in a proper amount or condition higher up, it must be noticed that the crystalline limestone is not always sufficient to insure their existence even when climate and moisture are favorable. As will appear later, the lime must be a part of the soil, as the mollusca only obtain it through the vegetation growing in that soil. But above the limits of the large species there is found a group of small, often minute species, rare lower down, which shows that sufficient lime exists in the vegetation above the limestone strata to supply the little they need; and this doubtless comes from the less calcareous rocks, including the volcanic.

These small species include what are conveniently grouped as Vitrinoid and Succinoid species, which are found chiefly from 5,000 to 6,000 feet altitude in the mountains near lat. 39°. Above that height I found no land shells; though the bivalve *Pisidium occidentale* exists in the railroad pass at about 7,000 feet. From there up to 9,000 feet, where patches of snow lie permanently on Mt. Stan-

ford, about lat. $39^{\circ} 25'$, although the summer months are warm and moist, no traces of them were found. As the permanent snow is no doubt proof of a nearly constant night temperature of 32° , and frosts are frequent during summer down to 6,000 feet, we may consider these as the causes of the absence of any mollusca. It is evident that this limit must vary much in different parts of the mountains, as snow does not lie permanently below 10,000 feet on Mt. Shasta, lat. $41^{\circ} 23'$, nor below 11,700 feet on the "High Sierra," lat. $36^{\circ} 30'$ to 38° , according to late explorations of the U. S. Geol. Survey.

The wide gap in the northern Sierra referred to in the last article (Bull. IV, p. 251), in which no land-shells were known to exist for 100 miles north of Yuba river, has been partly bridged over by the discovery of several at Quincy, Plumas County, by Mr. W. J. Raymond. At an altitude of 3,383 feet, or near it, he found (1) a *Mesodon* (*Aplodon*) called by Mr. Binney an aberrant form of *M. armigerus* Ancey, or possibly new (no doubt the one reported as "Columbianus" from Calaveras Big Trees). Also (2) *Patula* (*striatella?*) *crankhitei* Newc., (3) *Pupilla corpulenta* Bld., (4) *Vitriina pfeifferi* Newc., (5) *Succinea oregonensis* Lea. (6) *S. nuttalliana* Lea., (7) *S. stretchiana* Bld. That elevation is therefore about the dividing line between the large and small groups near lat. 40° . It is true that none of the large banded species occurred, as they do up to 5,000 feet toward the south, but No. 1 belongs to a medium-sized group more numerous toward the north, while Nos. 2, 3, 4 and 7 are all of the subalpine group in California, and 5 and 6 rare in the lower Sierras, though common near the coast up to 3,000 feet. Several of them were before known from the same county and southward; in fact all except Nos. 1, 5 and 6.

Respecting "*Microcylis*" *vancouverensis* from the Sierras, mentioned on p. 247, I have seen dead shells apparently of that species from Calaveras County, near Cave City at

nearly 1,600 feet altitude, and others from Fresno County, and near San Diego, both being of the large Oregon form, unlike the small form, so-called, existing in the northern California coast ranges, where it is the size of *M. sportella*. Considering that the banded species of the Sierra extend toward San Diego along the coast, the large form seems to have reached there by the inland route, and not by the coast range of mountains.

It may be remarked that toward the southern end of the Sierras even the Vitrinoid species seem limited to a narrow belt at about 5,500 feet, none being known in the High Sierras above there, nor on the lower slopes; while at Tehachapi Pass none occurred at any elevation below 4,000 feet. Still there seems no reason why they should be absent on the higher slopes up to near the snow line, as they were found in the Rocky Mountains to 9,000 and 11,000 feet by E. Ingersoll.

The large species of the lower elevations also seem to become scarcer on these southern parts of the range, apparently because the lower parts are too dry and the higher too cold for them, but search has not been made carefully enough to prove this. The White River locality is the only one known for 150 miles, though they no doubt occur at intervals nearly all that distance.

While a very interesting group of species was found by Harford and Dunn at the Mariposa Big Tree Grove near 5,500 feet altitude, near lat. 37° 30', none have been reported from Yosemite Valley at 4,000 feet, and few farther south. As the most extensive list of the southern Sierra species yet known, I here publish it for the first time.

A. Vitrinoid species: 1. *Hyalina arborea*; 2. *Conulus fulvus*; 3. *Patula striatella cronkhitei*.

B. Helicoid species: 4. *Helix mormonum* (small); 5. *Helix traski franki* (dwarfed); 6. *Helix tudiculata* (dwarfed); 7. *Triodopsis loricata*; 8. *Polygyra harfordiana*, (9 miles south, in the Fresno grove.)

C. Pupoid species: 9. *Pupilla carpulenta*.

D. Succinoid species: 10. *Succinea stretchiana*.

The other species of the Sierras have been named in several previous articles, being about fifteen besides those here named. (See Binney's 2nd Suppl. to Terr. Mollusks.)

Of this list Nos. 1, 2, 3, are well-known to be widely spread in the Northern States, No. 7 found also in the coast range of California, Nos. 9 and 10 only in the Sierra Nevada, and No. 8 so far only near this locality. No. 4 was traced south only about 50 miles by Voy, No. 6 to about lat. $32^{\circ} 30'$, while No. 5, very small here at its northern limit; becomes "common in the foothills a mile or two north of Posé creek" (Gabb), as the larger variety *carpenteriana*, and continues to Guadalupe Island, Lower California.

Thus it appears that Nos. 4 and 5 overlap in their range for at least 50 miles, and are found together for that distance unconnected by intermediate forms, though both can be connected with *H. fidelis* by links now existing north and west. It seems to me, therefore, that No. 5 must either have reached this N. E. corner of its range from the direction of the fossils of Eastern Oregon, by way of the east side of the Sierra Nevada (the connecting chain being now extinct there) or has come from the south and westward, thus reversing the usual course of migration. For it is well known that the Sierra Nevada are much older than the Coast Mountains, and that the latter are older toward the north than the south, thus compelling a southward migration among all land animals during their gradual extension over the country. However this question may be looked at, No. 5 is unlike any other of the Californian banded Helices in crossing the southern end of the valley between the two ranges of mountains, reappearing on the east slope of the Coast range 58 miles farther south, upon tertiary fossil limestone, at an elevation of about 4,000 feet, where no other species is known to occur, near the summit of the Uvas

Pass, now more like the form first described as *H. traski*.

This form was from Los Angeles, or the mountains near there, about 60 miles farther southeast, but is abundant in many spots along the whole coast slope in that direction, with much variation in size and convexity but uniform in color. Being often found throughout this range in company with No. 6 (but never with connecting forms), as far south as San Diego, it shows that the region has been colonized from the Sierra Nevada with these animals, although the geological structure indicates the period of elevation to have been of very late tertiary or post-pliocene date near the coast. On Santa Rosa Island it seems to have changed to *H. ayersiana*, a rare connecting link having been found near Santa Barbara by Dr. Yates, but on other islands of the group it is represented by the nearer allied *H. rufocincta*, and may perhaps have been the original stock from which the very much dwarfed var. *gabbi* and *H. facta* were derived. On Coronados Island, Lower California, it is however like var. *carpenteri*, and on Guadalupe Island Mr. W. E. Bryant found a form more like that of Lower California peninsula, once confounded with *H. remondi*. Mr. G. W. Dunn informs me that *H. facta* is also found on Guadalupe Island, and the very peculiar Helicoid, *Binneya notabilis*, has been found there by Mr. Bryant, as well as on the peninsula by Mr. Orcutt. The latter also reports *Pupa ovata* from near San Diego, and *P. arizonensis* from under Yucca logs on the east slope of the mountains, which are thus connected with the Arizona fauna, as I stated in the Amer. Jour. Conch. IV, 217, 1869, though there was some doubt then of its occurring in California. No other new facts on distribution toward the southward have come to my notice.

2. THE COAST RANGES SOUTH OF MONTEREY.

It is to be observed that while the Sierra Nevada are to a great extent cut off from the direct force of the sea breeze except near the middle, their higher parts are so much above

the top of the Coast range that they receive more moisture in winter and are no drier in summer, but the foothills below 3,000 feet are both hotter and drier. It thus happens that most of the land shells are to be found from that elevation up to 6,000 feet, and though washed down by the streams, can only exist in the foothills, in places either marshy or springy, or sheltered by rocks, trees and caverns.

But we find two of them, Nos. 5 and 6, of the last list, becoming common down to the sea in the counties south of lat. 35°, the valleys there being open to the sea breeze and less heated or dried up in summer, although the annual rainfall is much less than in the Sierras. They there attain their greatest perfection, and No. 5 becomes much varied, assuming forms on the islands, claimed to be distinct species. Following No. 5 toward the northwest it changes still further, for near Point Conception Dr. Yates obtained a form of large size but with nearly the same dark color as that of *H. dupetithouarsi* combined with the sculpture of *H. traski*. It has, in fact, nearly the same size and form as the figure of the former copied by Binney from Deshayes, but which was described as colored like *H. fidelis*.

Fifty miles farther north Mr. Raymond found a form like No. 5 in color but with the wrinkled epidermis of the Monterey shell, and at San Simeon, 90 miles north, smaller specimens exactly like those from Monterey. So there is here a transition by graded varieties between the two, much as in the links connecting *fidelis* with *infumata* near Humboldt Bay. Still there is a geographical limitation of each leading form, indicating the probability that these links may be hybrids, or not truly species, they being very variable, while the species are quite uniform over wide tracts of country. They are parallel cases to the numerous varieties of *Patula strigosa*, which within a limited range are found in great numbers, so variable in size, form, color, and sculpture, that scarcely two are alike.

These discoveries extend the range of *H. dupetithouarsi*

to 135 miles south of Monterey, where only it was supposed to be found. It is thus limited to the narrow strip of steep, rugged country, forming the west slope of the Santa Lucia Mts., which is a ridge about 20 miles wide close to the sea, and 4,000 to 6,000 feet high, receiving most of the moisture from the sea winds and cutting it off in great degree from the valleys eastward, as well as from the parallel and lower ranges of mountains for about 50 miles eastward, and from much of the highest portion of the Sierras. The only terrestrial Pulmonata known in these arid valleys are Succineas wherever marshes or springs are permanent.

It has been long known that a variety of *H. traski* was found near Paso Robles at the south end of the Santa Lucia range, 25 miles east of San Simeon, and several hundred feet high on the east slope. I included it in the description of *H. diabloensis* in 1872, though somewhat different from the northern type, but since then have considered them all as varieties of *H. traski*. It is evident from the varieties already mentioned, that the distinctions between these and *H. dupetithouarsi* become more decided towards the south, and east, or towards a drier and hotter climate. But the anatomy of the animals is stated by Binney to be so different that unless these connecting links show an intermediate animal there should be no confounding of the two in one species. The animal of var. *diabloensis* is described by Binney as very near that of *traski*. It is however still unsettled whether the internal structure of these animals is less variable than the external. On account of the great aridity of the valleys for 216 miles N.W. of Uvas Pass, which the main routes of travel traverse, no species seem to have been found on the east slopes of the Mt. Hamilton range 50 to 60 miles from the sea. But as No. 5 is found at the pass 45 miles inland, it is possible that the same, or a variety of it, exists above 4,000 feet even in this arid range. Paso Robles is 108 miles distant from Uvas Pass, but nearer the coast and at the head of the

Salinas valley, which no doubt contains them throughout, as Dr. Yates found them living at the river crossing, 90 miles northward, near Monterey Bay. There is a gap of 70 miles from there to Cedar Mountain where the species has not been found, nor indeed any other more than 25 miles east of the coast, but this must be on account of no search having been made thoroughly enough. It seems also quite probable that links between *H. traski* and *H. mormonum* will be found in the Sierra Nevada.

3. THE BAY REGION, LAT. $36^{\circ} 30'$ TO $38^{\circ} 30'$.

I now come to the most productive region in California as to Land Pulmonata, about 45 out of 80 forms known in the State being found in it, having been the most thoroughly searched and naturally having the most suitable conditions for this superiority in numbers. I give a map, copied from the State map of Prof. Whitney's Geological Survey, with the exception that the elevations are indicated by contour lines of 500 feet each, and the heights of the measured peaks given in feet, with some corrections furnished by Prof. Davidson of the Coast Survey. Being triangular in form and approximately 150 by 96 miles in extent, it comprises about 7,200 square miles of land. Of this I have myself traversed carefully more than half on foot or horseback, especially the mountainous parts, when working out the geology of the "Bay Map," which includes four-sevenths of the land here given. The northeast marshy and flat corner of the region, about 870 square miles in extent, is not known to produce any but the amphibious Succineas, except a few washed down by mountain streams, which survive along the borders of the marshes for a short time, and might increase if not trampled on by cattle in the dry season.

This region lies directly west of the most elevated portion of the Sierra Nevada, which also produces the greater part of the Pulmonata characterizing that range, as mentioned previously. The same influences affect both regions

to a great extent; that is, the great gap in the coast ranges made by the outlet of the two chief rivers of California, allows the sea breeze to penetrate freely to the interior, carrying moisture and coolness high up on the Sierra Nevada. There are other "wind-gaps" at Monterey and Bodega Bays, by which the wind passes less freely through the Coast range.

Previous to 1869, when I wrote the article on the distribution of our land shells for the American Journal of Conchology, I had collected along the coast border and in the Santa Cruz Mts. up to about 2,800 feet altitude. As then stated, judging from what was known of their distribution in the Sierra Nevada and Rocky Mts. of Montana, I supposed that the coast range must be well stocked up to the summits with these animals, as lime in fossil beds and plenty of moisture, with no permanent snow, were known to characterize them almost everywhere. But the real distribution has proved so different in the bay region, that I am induced to describe it in detail for each county, taking them up as they are situated—in general—east, south, west and north of San Francisco Bay. The list of species here given is arranged to show this distribution, and to save repetition of names, the species are referred to by numbers. Of this list 15 species are nearly or quite identical with Sierra species, six of them indeed being of that boreal group, in great part circumpolar, which doubtless reached both ranges from the north. The largest is *M. armigerus*, which differs considerably in the Sierras, as far as known, but being quite small, gives little room for specific distinctions, as is also true of the remaining species, which are of the simpler, plainer groups. These identical species are marked *. The most interesting of the species is *H. diabloensis*, as the nearest approach to a proof of the derivation of the Coast Range banded *Helices* from Sierra Nevada species north of lat. 35°. But although it might have been derived from shells washed down the San

Joaquin River from near its head in lat. 37° , that would not have carried it north of San Francisco Bay, and it is known up to lat. 39° on the east slope of the Coast Range, while none like it occur near branches of the Sacramento River eastward. From this I argue that it has either spread from the Coast Range east, or that the forms of each range were derived by changes caused by climate, etc., from the Oregon shells of the same group. More numerous comparisons and dissections of connecting links will be required to decide on the true limits of the species and sub-species.

In the region between Monterey and lat. 35° there are no traces of any forms connecting the only Sierra *Arionta* (*tudiculata*) with those nearest allied to it, which all exist within the limits of the Bay region here given. The same objection applies to the theory of their derivation from shells washed down from the Sierras, as in the previous case, especially as they are known along the coast up to lat. 41° at least. (See article on the law of Variation in the Banded Helices, in Proc. Cal. Acad. VI, 121, 1873.)

The names of localities given on the map are referred to in this article, or in former papers, and to prevent confusion names of towns are omitted, but their locations being marked, they can be easily recognized. The essential outlines are nearly correct, except the position of Mt. St. Helena, the summit of which is nine miles north of the limit of the map, and being in the volcanic region is only given to show the increase of elevation in the country toward the north, as the size of the pages would not admit of including any more of the map in that direction, nor was it needed to illustrate the text. The heights given with exact number of feet are accurate; others, as 300, 2,600, etc., are only approximate.

LAND PULMONATA FOUND AROUND SAN FRANCISCO BAY.

A. LIMACOID.

		N.	E.	W.	S.
* 1.	<i>Limax campestris</i>	*	*	*	*
† 2.	“ <i>agrestis</i>	*	*	*	*
† 3.	“ (<i>Amalia</i>) <i>hewstoni</i>	*	*	*	*
4.	<i>Ariolimax columbianus</i>	*	*	*	*
* 5.	“ <i>californicus</i>	*	*	*	*
6.	“ <i>niger</i>	*	*	*	*
7.	“ (“ ?) <i>hemphilli</i>	*	*	*	*
8.	“ (“ ?) <i>andersoni</i>	*	*	*	*
9.	<i>Prophysion andersoni</i>	*	*	*	*
10.	“ (“) <i>hemphilli</i>	*	*	*	*

B. VITRINO D.

*11.	<i>Mesomphix vancouverensis</i>	*	*	*	*
12.	“ (“ ?) <i>sportella</i>	*	*	*	*
13.	“ (“ ?) <i>simplicilabris</i>	*	*	*	*
14.	“ <i>voyana</i>	*	*	*	*
15.	“ <i>duranti celata</i>	*	*	*	*
†16.	<i>Hyalina cellaria</i>	*	*	*	*
*17.	“ <i>arborea</i> (<i>Breweri</i>)	*	*	*	*
*18.	“ <i>minuscula</i>	*	*	*	*
*19.	“ <i>milium</i>	*	*	*	*
19.α	“ <i>limatula</i> ?	*	*	*	*
*20.	<i>Microphysa pygmæa</i>	*	*	*	*
*21.	“ <i>conspicua</i>	*	*	*	*
22.	<i>Helicodiscus lineatus</i> ?	*	*	*	*
23.	“ ? (<i>undescribed</i>)	*	*	*	*

C. HELICOID.

*24.	<i>Triodopsis loricata</i>	*	*	*	*
*25.	<i>Mesodon</i> (<i>Aplodon</i>) <i>armigerus</i>	*	*	*	*
26.	<i>Arionta arrosa</i>	*	*	*	*
27.	“ “ <i>arborescens</i>	*	*	*	*
28.	“ “ <i>holderiana</i>	*	*	*	*
29.	“ “ <i>stiversiana</i>	*	*	*	*
30.	“ <i>californiensis</i>	*	*	*	*
31.	“ “ <i>nemorivaga</i>	*	*	*	*
32.	“ “ <i>ramentosa</i>	*	*	*	*
33.	“ “ <i>bridgesii</i>	*	*	*	*
34.	“ “ <i>vineta</i>	*	*	*	*
35.	“ “ <i>exarata</i>	?	*	*	*
36.	<i>Campylæa</i> ? (<i>fidelis</i>) <i>infumata</i>	*	*	*	*
37.	“ (<i>traskii</i> ?) <i>diabloensis</i>	*	*	*	*
38.	“ <i>dupetithouarsi</i>	*	*	*	*
39.	“ (“) <i>sequoicola</i>	*	*	*	*

D. PUPOID.

*40.	<i>Pupilla rowelli</i>	*	*	*	*
41.	“ “ <i>californica</i>	*	*	*	*

E. SUCCINOID.

*42.	<i>Succinea oregonensis</i>	*	*	*	*
*43.	“ <i>rusticana</i>	*	*	*	*
*44.	“ <i>sillimani</i>	*	*	*	*
*45.	“ <i>nuttalliana</i>	*	*	*	*

* Sierra Nevada, also. † Introduced.

Contra Costa and Alameda Counties.

These two counties form a quadrangle, including the whole region "East of San Francisco Bay," and are about 40 miles square. About 270 square miles of the eastern portion, rising from the level marshes up to about 200 feet, is very arid in summer, the water-courses nearly all drying up, and no trees growing along their banks for 10 or 15 miles. The river shores south of the westward bend, are, however, lined by large trees and shrubbery, where not too marshy, and would no doubt support many species washed down to them, if the floods, both of summer and winter, did not destroy those that escape tramping cattle.

Only two species have been found living near the marshes, Nos. 25 and 32, besides the four amphibious Succineas, 42, 43, 44 and 45.

At the foothills near Mt. Diablo, water begins to be permanent in pools, and above the porous sandstones is found running in summer down to about 100 feet above tides, wherever the harder metamorphic rocks occur, while trees again become common along the streams, and in cool, springy situations live-oaks, pines and shrubbery cover parts of the hillsides. On the north slopes, and always near fossiliferous rocks between 100 and 1,000 feet elevation, are found small colonies of No. 32. From a similar locality on the east slope, Prof. Brewer brought the type of No. 37. I searched carefully on the south and west slopes, but could find none of any kind in the best localities, nor was Dr. Yates more successful in a careful examination of the ridge 10 or 12 miles S. E. of the peak. None were found above 1,000 feet for 5 miles up the north slope, where little lime and no fossils occur, and though these are found over 2,000 feet on the south side, the greater heat apparently prevents the existence of any except Limacoid species.

But as some of these are found active in wet places through the dry season, and dead shells always show the existence of other kinds when not active, it seems unlikely

that we could miss any where they occurred. Some large permanent springs also produced several fresh-water species in plenty.

The trees on this mountain are usually too scattered to give much shelter, and even where most dense, no pulmonates were found, the rock being metamorphic.

As shown on the map, there are here two spurs of the Mt. Diablo range, separated by Livermore Valley and Walnut Creek, but farther south they join, forming the Mt. Hamilton range, in which the whole country is more elevated, many peaks being higher than Mt. Diablo, and the lofty region near the southern boundary of Alameda County is over 20 miles wide, sloping northwest.

A large extent of this table land is covered with snow for many weeks in winter, and large streams run from it all the year into Livermore Valley. The highest parts are more or less wooded with Cedars (*Libocedrus*), Cypressess (*Cupressus*), Pines and Oaks, sometimes quite densely, but being as far as known metamorphic, no land mollusca have been found high up. The northwest summer winds seem to condense the fogs from the sea upon these high regions, while they cool the air without so much desiccation as on the lower ridges and valleys. But unlike the Sierra Nevada, this range does not seem to produce land pulmonates above 1,000 feet, and as on Mount Diablo they only occur near fossils. Dr. Yates explored much of the region, and not having been there myself, I quote from his letters: "I only found land shells where the miocene or cretaceous fossiliferous sandstones cropped out, between 800 and 1,100 feet elevation, six miles N. W. of the summit of Cedar Mountain. These rocks in the deep ravines along the west side of the ridge near its base, contain many fossils; higher up, it is all metamorphic and no land shells were found." The species he found were 7, 15, 30, 34, 37.

Thus the general fact is confirmed that No. 37 is one of the group living in or near coniferous forests where the soil

is calcareous. It has not been found west of this locality, but reappears southward at Salinas River, and there borders on the range of its nearest allies, Nos. 38 and 39, which, as before stated, may be off-shoots from it in the cool coast ranges. That it does not run into the *Arionta* group westward, is shown by the forms of that sub-genus found with it, being the two most unlike it known to exist.

The most unexpected fact was finding No. 34 exactly like the Monterey variety, which is elsewhere known only near the coast, and rare.

Livermore Valley, which is about 80 square miles in area, is too dry in summer for any species to live, except in very rare spots along the banks of creeks where they may survive under logs, roots or stones, but we found none except on the borders of a marshy lagoon, and the streams entering it from the north or west, near where Alameda Creek cuts through the western spur of the mountains. Those found were Nos. 1, 7, 14, 31, 32, 33, 42, 43, 45 (Nos. 14 and 31 at the base of the hills only). It is probable that the alkalinity of much of the water in summer prevents the existence of both land and fresh-water pulmonates in other parts of the valley.

It is well known that while springs containing little mineral matter except lime, are favorable to them, those having much of other salts are injurious, which explains their absence from many regions where metamorphic or volcanic rocks prevail, as well as from unaltered regions where salts have remained from marine deposits, or percolated through from other rocks.

The northern border of Contra Costa County would appear more favorable to them than we have found it to be, but the summer wind blows through the gap with such force as to desiccate the shores too much for the growth of many trees, and west of the river junction the marshes are too salt to suit them, so that there is very little shelter in the dry season. Those known from there are Nos. 5, 11, 24, 25,

32, 36, 42, 43, four of which were found also on the eastern border.

The western slope of the mountains forming the eastern shore of the bay (called Contra Costa hills), is mostly of metamorphic rocks near its base, but partly covered with pliocene gravels up to 300 feet, while miocene sandstone with many fossils forms the summits and eastern slopes of the spur. The creeks draining it all head within this fossiliferous region, and carry down lime in abundance to the valley soils. There are also calcareous springs depositing tufa along the junction of the pliocene and metamorphic rocks in many places. It receives the full effect of the summer fogs condensing about the summits, as well as more winter rain than eastward, while the sea breezes keep it cool in summer. We therefore find it the most favorable region yet mentioned for land pulmonates, which, however, still seem absent everywhere above 1,000 feet elevation.

The influence of these new conditions is seen here also in the commencement of a new group of botanical species, accompanied to some extent by animals also, of species not known east or southward in the Mt. Diablo range, but characterizing the coast ranges west and north of San Francisco Bay. The most conspicuous example of this is the isolated grove on Redwood Peak; but some of the shrubs and smaller plants have a wider range.

Although Rocky Mound, five miles north, is much higher, its upper parts are entirely metamorphic, and thus unsuited for the redwood. The Peak has its eastern slope and summit composed of sandstone lying upon serpentine, and at the junction numerous springs come out forming creeks running in every direction.

The redwood trees grew in 1850 pretty thickly over a surface about two miles square at the summit, mostly in clumps around the springs, and becoming scarcer down to about 500 feet elevation. Though many hills in the ridge are as high or higher, this was the only one so wooded, being the

only one having the necessary conditions for their growth. The nearest groves of the species are 21 miles N. W. and 23 miles S. W., across the bay, but some buried logs in San Francisco County, about 14 miles distant, show that a few grew there during past centuries. A few grew along San Leandro creek, to a distance of six miles south, and were as large as the others.

Several sawmills were built soon after 1849, and every accessible tree large enough for use was cut down. The roots being almost indestructible, however, have sprouted vigorously, sending up 10 to 20 sprouts about each stump, and these now shade the ground around springs more densely than the large ones, though probably not condensing so much moisture from fogs. They are now a foot thick, fifty feet or more high, and sometimes covered with cones, showing no tendency to die out. The stumps are mostly about 12 feet thick, and the old trees probably averaged 200 feet high. Unfortunately, this magnificent tree grows so much slower than some others that it is not a favorite, and the settlers grub or burn out all those on land suited for cultivation, besides destroying thousands every year for decorative uses.

I have described this grove particularly because its moist, cool locality seems exactly suited for land pulmonates, and yet none are found above 1,000 feet on the peak, and only two species there, Nos. 5 and 11, one a *Limacoid*, the other very thin-shelled, but not found in the drier regions eastward.

The reason indicated by these two species for absence of others seems to be the want of lime, and to confirm this we find at about the lower limit of redwoods on San Leandro Creek, other species of the coast range, Nos. 25, 26 and 31, (26 very small, but typical), appearing where branches from the east bring down lime from the more eastern ridges.

The sandstone of the peak is supposed to be cretaceous, but contains no fossils, while the miocene strata three miles

eastward contain many, but are so much drier that land pulmonates are rare on them, and are the same species found west of Livermore Valley:

There is a dense growth of trees on many of the north and east slopes of these hills, especially where springy, which form shelter for such animals, but only one small grove of pines grows two miles northeast of the peak on a very dry sandstone ridge, and can have no effect on the land shells, being a species of the arid eastern slope of the range. Toward the northwest, however, appears another of the coast range species, No. 36, between 250 and 400 feet elevation, along the belt of calcareous tufa before mentioned, which runs about four miles N. W. through Piedmont Valley, and the same distance S. E.

It is accompanied by the largest number of species found east of the bay. They are Nos. 1, 5, 9, 11, 12, 15, 17, 23, 28, 31, 36, while in scattered localities lower down are found Nos. 6, 24, 25, 42, 43, and near the bay shore Nos. 2 and 3 (introduced), 20 and 21 in gardens, 40, and Nos. 18, 19 and 22 have been reported from the vicinity. Fires, clearing, and cultivation of the land, have no doubt much thinned out most of these, as few of them are found abundantly.

As none exist on the higher and steeper parts of the hills, the settlement of the lower more cultivable parts must tend to cause a still greater scarcity of many of them, especially those limited to this vicinity, Nos. 28 and 33. The tendency of migration is chiefly downward, shells being carried by the winter freshets down the streams, but the more general cultivation of the level lands tends to exterminate them, with some exceptions hereafter noted. There formerly existed large colonies of some species in willow thickets and meadows near the bay, but few are now found in such places. I was told by an old resident that he once found a large colony near Redwood Peak, in a meadow near a mill, and as I have not found any at the sawmills

which were near 1,000 feet elevation, I suppose he meant a flour-mill then standing $5\frac{1}{2}$ miles N. E. of the peak at about 400 feet altitude, near the original locality of No. 33, and where also occur other forms of No. 30. I found a great colony of No. 35 near the head of the bay in 1855, and some were still found there by H. P. Carlton in 1870.

I have heard from gardeners at various places around the bay, of great numbers being washed down in very wet winters, but they often confound the damage done by Lima-coids with that of the less common shelled kinds. The banded Helicoids, Nos. 26 to 35, seem quite able to increase in gardens and meadows, where they run into still more varieties, and have probably supplied the forms figured by authors, which have been hard to identify. From the frequency of the Ariontas in gardens, they are beginning to be known near this bay as "Garden Snails," and foreigners have even attempted to cultivate the larger kinds for food. The shell mounds left by the Indians are also favorite localities on account of the lime; but I have never found any buried in the mounds as proof that the Indians ate them.

The drainage basin next south of Redwood Peak, is on the branches of San Lorenzo Creek, of which the town of Hayward is near the centre, including about 270 square miles, and reaching east 15 miles. It is much drier and warmer, so that most species become more rare, and Nos. 25, 26 and 28 disappear. From ten years residence, however, I have been able to find most of the others found northward, though some are exceedingly rare. No. 2 has not been introduced, nor Nos. 18, 19, 22, found, being rather doubtful as east-side species

On the other hand we find the new forms, Nos. 7, 8 and 13, which may all prove to be varieties of allied species caused by the increased dryness, as they are of doubtful occurrence elsewhere. Much less trees and shrubs grow on the hills, chiefly in cañons and on north slopes, while fossils are limited to the eastern half of the hills. A few species

are found up to 1,000 feet elevation rarely. No. 36 is not found south of Alameda Creek, and No. 32 becomes the prevailing form of 30, as it was in the dry region near Mt. Diablo.

The species of the upper part of Alameda Creek basin having been mentioned, there only remain about 200 square miles of Alameda County around Mission Peak. The only species known from there are Nos. 24 and 32; but close search will probably reveal other smaller species. There is, however, an evidently rapid decrease, caused chiefly by dryness. Dr. Yates thinks that No. 32 goes higher up this peak than elsewhere, fossils being also found nearly to its summit, where a less arid climate must prevail.

From here southeast the Mt. Hamilton range has been mentioned as not known to produce any species on the higher portions. But some of the lower ranges on its west slope are fossiliferous, and may be supposed to have some species, especially Nos. 5, 8, 9, 14, 32, 37, the best suited for dry regions, and in wet places, Nos. 42 to 45. Though part of the same mountain range described last, it belongs to the next county to be mentioned.

On the map the number 686 is the height in feet of Livermore Pass (a little west of the figures), 485 is the elevation of the town of Livermore, 264 of Suñol, at the head of Alameda cañon, the lagoon referred to being a few feet higher and some five miles northward. The lettering often obscures the lines of elevation, so that they cannot always be counted for heights.

The next article will describe the distribution in the remaining counties, and give the geological deductions derived therefrom, showing why it differs so much from that of the Sierra Nevada.

Corrections of Article "On Fossil and Sub-Fossil Land Shells in the United States," in Bull. 4.

Page 236—From the full list of Bland's works, published lately by Mr. A. F. Gray, C. E. (Salem, Mass., 1884), it appears that most of his papers on West Indian shells, and those quoted in Binney's Bibliography, are dated before 1858, but those on North American species, between 1858 and 1883.

Page 246—Later information from Mr. Thomson, and also from Mr. Moores (p. 248), will be given hereafter under the head of introduced species.

Page 247—"Macrocyclus." The type of this genus being now known to belong to a different family, I have in the table, page 367 of this article, substituted *Mesomphix*, of Rafinesque, of which the type was "*M. planorboides*," so admitted by Ferussac and Pfeiffer in many publications. The fact that the species was previously named *concava* by Say does not invalidate the generic name, nor does its use as a sub-genus of *Zonites* by W. G. Binney, affect its previously established position. Mr. Ancey has made for the same genus the name *Selenites*, a word already used in mineralogy, and not at all needed here. The genus as named by Rafinesque is as well established as his *Mesodon*, now generally adopted on quite as slender foundations.

Page 252—The lowest paragraph was accidentally misplaced, as it should have preceded *Limax*, etc. Very full information on species near lat. 49, mostly furnished by Rev. G. W. Taylor, will appear later.

Page 255—Mr. Binney's exact words are, "It has simple genitalia without the accessory organs usually found in *Arionta*." He has, however, since described the plainer Eastern forms from Montana, etc., as "*Mesodon ptychophora*," with varieties *major* and *minor*.

STUDIES IN THE BOTANY OF CALIFORNIA AND PARTS
ADJACENT.

BY EDWARD LEE GREENE.

VI.

I. Notes on the Botany of Santa Cruz Island.

Santa Cruz is one of the principal units in a succession of eight islands which lie along the Coast of California south of Point Conception. All but two or three of the smaller members of the group are near enough to the mainland to be plainly visible on a clear day; and the arrival at any one of them, except the two or three most remote, is only a matter of an afternoon's sail from one or another of the mainland seaport towns of that part of the State. To people who know something of the special interest which attaches to insular natural history in general, it may seem strange that, while the mainland botany of California has been, during the last thirty years, assiduously cultivated by many collectors, amateurs and professional botanists, these large islands, so near at hand, have been left until recently quite unexplored. Removed as they are to hardly more than a song bird's flight from the California Coast Range of mountains, it may have been inferred that their vegetation would be altogether that of the mainland; and that the scientific exploration of no one of them would be likely to repay the possible discomforts of a day's sail across the channel and a week's encampment on ground so rugged, and withal so barren looking as all these island steeps appear when viewed from a distance of twenty or thirty miles.

But the few fragments of positive botanical information which did, years ago, come in from one and another of the group, were sufficient to indicate the probability of many interesting peculiarities in their flora. Some forty-four years ago Mr. William Gambel of Philadelphia, an ornithol-

ogist, visited Santa Catalina, the nearest and most readily accessible of these islands. This gentleman, although not a botanist, had the botanical good sense to prepare and take away a few plant specimens; and his small collection was found to contain not only species not known on the mainland, but also some new generic types. One of these, *Crossosoma*, is so peculiar as almost to represent a distinct natural order, and is more related to the *Dilleniaceæ* of Asia and Australia than to any plants of the American continent, except its single congener, more recently discovered, which inhabits the desert region of southeastern California.

Mr. Gambel's trip to Santa Catalina appears to have been the first, and for thirty years and more it remained the only visit which had been made to any of these islands, by any naturalist who had an eye to botany. But in the month of September, 1884, Mr. William S. Lyon of Los Angeles spent three days botanizing on this island, and in June and July of the year following continued his valuable researches during three weeks. Moreover, in April, 1885, he spent four days on San Clemente, in company with another botanist, Rev. J. C. Nevin. The highly interesting results of these several expeditions were published in the *Botanical Gazette* for 1886. Mr. Lyon's lists number, for Santa Catalina, one hundred and fifty-one species; for San Clemente, eighty-one. Out of these about fifteen were new to science, and at least ten others were unknown except from other islands, including the distant and isolated Guadalupe, making, out of a total of two hundred and thirty-two species, at least twenty-five which are not found on the mainland. One of Mr. Lyon's novelties, appropriately named *Lyonothamnus*, was of a new generic type; so that the islands of this group could now boast of at least two peculiar genera of flowering plants.

The fruits of these explorations of Santa Catalina and San Clemente were thus of a nature to intensify our desire of becoming acquainted with the vegetation of Santa Cruz, and

other large islands which lie to the northward and also somewhat to the seaward of those above named. But in the meantime we had not remained in quite total ignorance of the botany of Santa Cruz; for in the year 1874 the late Dr. Albert Kellogg and Mr. W. G. W. Harford were there for some days, in connection with the United States Geodetic Survey of the islands; but it was too late in the season for much botanizing. They were also on the large adjacent island of Santa Rosa at about the same time. I could never find that they brought specimens of more than six species of plants from the two islands; but all were new. Three of them, namely, *Leptosyne gigantea*, from Santa Cruz, and *Dendromecon Harfordii*, and *Grindelia latifolia*, from Santa Rosa, were published by the late Dr. Kellogg shortly afterwards in the Proceedings of the California Academy. The other three, *Saxifraga malvifolia*, *Eriogonum arborescens* and *Hazardia detonsa*, all from Santa Cruz, were published more recently by myself. In 1885 the beautiful new tree, *Lyonothamnus asplenifolius*, a second and very striking species of Mr. Lyon's new genus of Santa Catalina, having been brought to our knowledge by Mr. Hazard of Santa Barbara, as one of the peculiar products of Santa Cruz, determined the present writer to pass, if possible, a part of his next vacation on that particular island. The list of species known as certainly belonging to it numbered now, indeed, only four¹, and all four were apparently endemic; at least not one of them was known to occur on the mainland, or even upon other islands of the group. My opportunity for carrying into effect the purpose I had formed came in July of 1886; and by the kindness of Mr. Justinian Caire of San Francisco, who is the owner of the island, my inspiring task was begun under very favorable auspices, except that I was quite too late in the field for the best botanizing, it being near the middle of the dry season of the year, when

¹The habitat of *Corethrogyne* (now *Hazardia*), *detonsa*, which really made the fifth, was not yet known.

but an imperfect knowledge could be gained of that abundant annual vernaly maturing vegetation which, in all parts of California lying near the level of the sea, is the glory of the floral year.

Before passing to remark upon the flora more particularly, it will not be amiss to speak briefly of the physical aspects of the island in general.

As seen from the city of Santa Barbara, at a distance of about twenty-five miles, the island of Santa Cruz appears to rise, like a blue precipitous mountain range, from the bosom of the sea. It is about twenty-three miles long, and, in different places, from three to seven miles broad, the highest peaks rising to an altitude of somewhat less than three thousand feet. The near approach reveals a succession of more or less sharply outlined hills rising one behind another. This lengthwise range of mountains, which forms all that is seen of the island as it is approached from the northern or Santa Barbara side, is intersected at short intervals by deep and narrow gorges which run down to the sea. In most of these running water of good quality is to be found at almost any time in the year, so that the northern slope may be said to be well watered; and the common trees of the nearest mainland mountain districts, such as the large-leaved maple (*Acer macrophyllum*), live oak (*Quercus agrifolia*), poplar (*Populus trichocarpa*), willow (*Salix laevigata*), and many more are found thriving in all these cañons; and yet the tree which is commonest of all in similar situations on the mainland, the sycamore (*Platanus racemosa*), is entirely absent from Santa Cruz. The mouths of the cañons afford the only landing places along all the coast line. The gravelly beds of the streamlets which run down them, are the only parts of the island's surface which descend at all gradually to the ocean's edge. At these points, and not elsewhere, will the boatman or sailor find a narrow strip of beach, and that barely com-

mensurate with the breadth of the gorge itself. With the exception of these, the whole coast of the island rises almost or quite perpendicularly from the water, the first terrace of comparatively horizontal ground setting in at the height of from twenty-five to five hundred feet above the tide. This lowest succession of slopes forms a considerable part of the best grazing land of Santa Cruz. It is an open, rolling district, extending back for a half mile or more, everywhere intersected by the narrow cañons mentioned, covered with fine grass, dotted with clumps of scrub oak (*Quercus dumosa*), and some patches of manzanita (*Arctostaphylos*), with here and there a grove of the beautiful fern-leaved *Lyonothamnus*. Back of this terrace the land rises more abruptly, breaking into rocky shelves and deep gorges, and the vegetation becomes more arboreal. Here are dense forests of a small pine, identical with that which is found on Cedros and Guadalupe, and which is not heretofore reported from other islands of the Santa Barbara group; clumps of a large-fruited evergreen cherry-tree allied to, but distinct from *Prunus ilicifolia* of the continental Coast Range; impenetrable thickets of manzanita, with here and there a group of oaks, *Q. agrifolia* and *Q. chrysolepis*.

From the summit of this northern acclivity one looks down, not, as one might expect, to the southern shore of the island, but into a deep and fertile valley of considerable extent. Up and down this stretch of valley are fields and vineyards, and, in the midst of all, an assemblage of cottages and barns, the principal one of the four or five ranches which have been established by the owner of the island, and are occupied by superintendents and laborers. This valley, forming, as it does, a great depression in the middle of the island, will, if the island be of volcanic origin, pass for the extinct crater which it looks as if it might be. Down the western half of the depression courses a stream which is flowing, at intervals, at least, during even the dry season of the year, and which finds its outlet into Prisoners' Harbor

by a broad and beautiful cañon between two and three miles long. The valley enjoys immunity from the fogs which for a considerable part of the year shroud the seaward slopes, and has, along with its peculiar climate, a quite characteristic vegetation, as will be indicated in the catalogue of species which is to follow.

To the number of four species which were previously known to inhabit Santa Cruz, my pleasant but laborious weeks of sojourning there have added upwards of three hundred. The list here given numbers, indeed, three hundred and twenty-one. About twenty-five of these are plants indigenous to the Old World, but naturalized in California. Deducting these five and twenty plants of alien derivation, there remains a list of two hundred and ninety-six indigenous species. Out of this number the very surprisingly large proportion of forty-eight are unknown, except from this or other islands off this coast, and as many as twenty-eight of the forty-eight are, in so far as our present knowledge of the other islands goes, peculiar to Santa Cruz itself. Excluding, then, the four endemic species which had been discovered before my advent to the island, there stand forth, as the result of my own researches, twenty-four entirely new to science. A considerable proportion of these novelties have been described already in some earlier pages of the present volume of *Bulletins*. Some others were printed in *Pittonia*, and descriptions of the rest are to be sought in the catalogue which supplements this paper. It must not be presumed that this list is anything like a complete one. My explorations were limited to the western half of the island, and my time was quite too short for a thorough study of even that part of the whole ground before me. The eastern half remains untouched. What was done was done, as I have indicated, at quite too late a season of the year. Several of the new annuals I could not have characterized, as I found them dead and bereft of everything save their

capsules, and I have diagnosed them from plants raised from seed which I brought home. Perhaps the list does not enumerate more than two-thirds of the actual species which exist on Santa Cruz. But it numbers more than twice as many plants as have been reported from any other one member of the group. Peculiar circumstances of the distribution of the species, together with the astonishing number of such as are endemic, will make the list appear more like that of some remote and strictly oceanic island than of one lying close beside a great continent. I do not think that continental islands in other parts of the world offer any parallel to what Santa Cruz exhibits in this respect. That a small ridge of mountain rising out of the sea at only twenty-five miles' distance from a mainland shore should present forty-eight species of phanerogamic plants not to be found on the continent itself is, to my understanding of the case, a fact entirely unique in the annals of phytogeography, and I cannot but wonder if competent geological authority will not, after careful investigation, assure us that this group of islands has a very peculiar geological origin and history. There seem to be indications that, as a group, they have contributed to the flora of the continent as freely as they have received contributions from it. I know not how else to interpret the fact that while those types which are peculiarly and distinctively Californian are strongly predominant on the islands, those which, being found in California, are also common to all North America are but very feebly represented. *Delphinium* and *Ranunculus*, *Ribes*, *Rubus* and *Lonicera*, for example, abound on the Pacific Coast of the continent, but are equally prevalent all the way across it; and the representatives of those genera, and others in the same category, are among the very rarest plants of Santa Cruz, seeming as if their arrival there had been a late one—too late for them to have secured an ascendancy. On the other hand, the distinctively Californian genera, like *Dendromecon* and *Eschscholtzia*, *Thysanocar-*

pus and *Zauschneria*, abound in such numbers, both of species and individuals, as to force on us the strange question of whether it was not from these, as from seed-beds, that our mainland plants of the same genera were derived. There is one species of *Dendromecon* dispersed widely up and down the Californian mountain districts, and this, until lately, was supposed to be a monotypical Pacific North American genus. The hills of Santa Cruz are embellished everywhere with a second strongly marked species much larger than the mainland one; while Santa Rosa, closely adjacent, furnishes the third. It is also to be noted that Mr. Lyon reports the original species as occurring on Santa Catalina, the island nearest the continent; so that the archipelago has all three species of this genus, the mainland one only. In *Eschscholtzia* closely allied to *Dendromecon*, we find two species, and these exclusively insular, on Santa Cruz. In the order of *Cruciferae* the most characteristically Californian genus is *Thysanocarpus*, and its nearest relative is the Asian *Tauscheria*. Santa Cruz has two *Thysanocarpi*, both most distinct from all species hitherto known, having their own well marked habit, but, in fruit character, betraying the closest affinity for their Old World ally.

The *Cistaceae* are prevailingly an Old World order of plants. There is but one representative of it on the western coast of the North American continent. On Santa Cruz this species abounds as nowhere else, and is there associated with a second and new member of the same genus, *Helianthemum*.

In the vast order of the *Leguminosae*, as in *Ranunculaceae*, there is exhibited a dearth both of species and individuals of those genera which belong to the whole of North America, and a superabundance of them in such as are distinctively Californian. One rarely meets with a *Lathyrus*, a *Vicia* or an *Astragalus*, and the few and scattered individuals in such genera occur only by the shores and in places

where we know their seeds could have been driven across the channel during a winter's storm. The clovers also are few, and there is but one peculiar species. But the whole island is abundantly stocked with species of *Hosackia* and *Syrmatium*, which genera are exclusively West American, and about half the species are peculiarly insular. Passing to the *Rosaceae*, we find the island totally destitute of such cosmopolitan genera as *Spiraea*, *Fragaria*, *Potentilla* and *Geum*, of which there is no great dearth on the other side of the channel; but the Californian genus *Heteromeles* is about twenty fold more abundant on this island than on any equal extent of mainland territory; and *Adenostoma* and *Cercocarpus*, also Pacific American exclusively, are very plentiful. Mr. Lyon in his very valuable paper,¹ has spoken particularly of the fine wild cherry (*Prunus occidentalis*) of Santa Catalina, which he fancies may be peculiar to that island. It prevails quite as universally and is equally luxuriant on Santa Cruz. If there exists between this and its depauperate congener of the Californian Coast Range, the relation of parent and offspring, it must be that the insular is the parent species. One of the principal morphological differences between the two is this: the leaves of *P. occidentalis* are ample and nearly or quite entire; those of *P. ilicifolia* are, as the name implies, coarsely spinose-toothed, and they are smaller. But the peculiar foliage of the reduced mainland species is precisely that of all young seedlings of the insular, showing the case of the former to be one of arrested development. The smaller size and the less palatable and smaller fruit of *P. ilicifolia*, are facts which combine well with its habit of retaining the foliage of the insular seedling, to argue that the tree in migrating to our side of the channel found in our mountains a soil and climate less adapted to its full development. In confirmation of this

¹ Botanical Gazette, xi. 197.

view I should say, that in the *Cerastes* section of *Ceanothus* where the prevailing species have entire leaves, and those less common have them spinose-toothed, young seedlings of the entire-leaved kinds always exhibit the spiny-toothed foliage which, as it would seem, has become permanent in the less common and more depauperate kinds.

Before passing from the subject of the concentration of Californian types on Santa Cruz, I will mention one or two further instances of it: that of *Zauschneria*, the original species of which is found here and there along the northward slope only, while the valleys and cañons of the interior and at the south side are, in many places, a very garden in the abundance of two large new ones; and lastly, *Bloomeria*, which, although frequent along our southward mainland districts, is far from ever growing in showy masses. It is common on all parts of Santa Cruz; but on grassy knolls in the middle of the island it thrives in such abundance that the umbels touch each other over almost acres together.

Turning now to a different phase of the subject, it is very evident that a goodly number of less common or even rare plants of our southern counties have, within a comparatively recent period, been given to us from Santa Cruz itself. *Comarostaphylis diversifolia*, a rare shrub of the San Diego region, is now found to be one of the common small trees of our island. This is its native land, and the scattered and ill-grown individuals of the coast below indicate that out of the island's abundance some of the light woody nutlets drifted thither and germinated. In the spring of 1885, I found a small and slender but well grown *Beria*, which was new to me, common along the shores of San Diego Bay, not described in any of our books, and which I had intended to publish sooner or later. It is now found to be precisely the peculiar *Beria* which abounds on Santa Cruz, and which Mr. Lyon has also brought from San Clemente. Still more remarkable is the case of *Malacothrix incana*, discovered at San Diego by Nuttall, more than fifty

years ago, never since seen or heard of until the past season, when I found it plentiful on the remote islet of San Miguel, and also at the western extremity of Santa Cruz. It is more than possible that Nuttall's scant specimens from San Diego were made from a single plant, and that perhaps the only one which ever became exiled there. It would naturally be in this great family of the *Compositae* whose seeds are made to travel with the winds, that we should expect to find plants of insular origin most frequently establishing themselves upon the continental shores, and in the interior beyond the coasts; and more especially, since the dry season, during which the seeds of these plants are matured and given to the air, is the time when the trade winds prevail from the islands toward the continent.

The only thistle on Santa Cruz was evidently a new species. Nothing like it was known to me; but not long after my return, Mr. Parish of San Bernardino, whose district is exactly to the leeward of this island, sent me this same thistle for a new species of his own vicinity. Still another somewhat rare *Composita* of the San Bernardino region, *Stephanomeria cichoriacea*, a species very remarkably differentiated from its numerous congeners, is superlatively plentiful on our island, and that not on the northern slope nearest the mainland, but in the interior and on the southern or seaward slope. With its white-woolly herbage, and tall stems growing in prodigious clumps in every rocky place or hanging from the niches of the highest and most inaccessible precipices, it is one of the striking figures in the Santa Cruz landscape, and doubtless the island is the birthplace of this species.

Thus far our insular botany has yielded two generic types which have no continental species. One of these is *Lyonothamnus*. This is represented by one species peculiar to Santa Catalina, and by a second which in so far as we know is endemic on Santa Cruz, where it is the most beautiful, as it is one of the most abundant arboreal products. The

other genus is *Hazardia*—shrubs of the order of Compositæ in some respects intermediate between the Australian shrubby asters and the Californian genus *Corethrogyne*. Two of the species of *Hazardia* belong to Santa Cruz exclusively, and the third is of that remote and isolated island not belonging to this group, Guadalupe.

The most interesting of all our insular plants to me are the *Lavateras*, of which I could, however, find no trace on Santa Cruz. But they ought to be named in this connection, furnishing as they surely do, one of the most suggesting hints that our little archipelago may actually have been connected with some other continent than ours. Of *Lavatera* there are some eighteen or twenty species in various parts of the Old World, and there is one in Australia. On our American continent we have not one; but the little islands which lie off our southern coasts have already yielded four indigenous and quite peculiar species of this genus. One of these four inhabits Guadalupe: the second, San Benito, a cluster of rocky islets not far off the Lower California peninsula, and nearly east of Guadalupe: the third is peculiar to the Coronados Islands, which lie in sight of San Diego: the fourth has been found on two or three members of the Santa Barbara archipelago. This is, I repeat, the most marvelous fact which I am acquainted with in connection with Pacific North American botany; and it is one which strongly pleads for further exploration and study of these inviting insular fields.

2. *A Catalogue of the Flowering Plants and Ferns of the Island of Santa Cruz.*

1. CLEMATIS LIGUSTICIFOLIA, Nutt.; Torr. & Gray, Fl. i. 9. Growing luxuriantly in cañons on the south side.

2. RANUNCULUS DEPPEI, Nutt.; Torr. & Gray, Fl. i. 21: R.

californicus, Benth.¹ Pl. Hartw. 295; Brewer & Watson, Bot. Cal. i. 1; Gray, Proc. Am. Acad. xxi. 374, excl. var. *latilobus*. North side, near the sea; apparently scarce.

3. DELPHINIUM ———? A single plant, in fruit only, high up in a cañon of the north side.

4. PLATYSTEMON CALIFORNICUS. Benth. Trans. Hort. Soc. 2. i. 405.

5. PLATYSTIGMA DENTICULATUM, Greene, Bull. Torr. Club. ii. 218.

6. MECONOPSIS HETEROPHYLLA, Benth. l. c.

7. DENDROMECON FLEXILE, Greene, l. c. 216.—On bushy hillsides everywhere: quite plentiful on the northward slope no great distance from the shore.

8. ESCHSCHOLTZIA GLAUCA, Greene, Pittonia, i. 45.—Con-
 ed to the interior of the island, and the southward slope.

9. ESCHSCHOLTZIA RAMOSA, Greene, Bull. Torr. Club. xiii.
 7.—On a small rocky islet near the northern shore; a
 ictly maritime plant, growing only within reach of the
 spray; also found on the sea shore on Guadalupe.

10. CARDAMINE INTEGRIFOLIA. = *Dentaria integrifolia*, Nutt.;
 Torr. & Gray, l. c. 88 (1838); *Cardamine paucisecta*, Benth.
 Hartw. (1857).—Northward slope; not common.

This very common field buttercup of California was named by Nuttall, in
 honor of Ferdinand Deppe, a German botanist who had been his predecessor
 in field work on this Coast. The name, *R. Deppei*, was printed, along with
 the essential character of the species, not much less than twenty years be-
 fore the appearance of Bentham's *R. Californicus*.

Mr. Nuttall was entirely correct in placing this plant under *Dentaria*,
 if the genus be kept up it must remain there. But, as Bentham and
 Hooker have said, *Dentaria* does not differ from *Cardamine*, either in habit
 or character.

There is another Californian species which has, until now, remained nomi-
 nally under the former genus, and may be called CARDAMINE NUTTALLII =
Dentaria tenella, Pursh, Fl. ii. 439; Torr. & Gray, Fl. i. 87; Brew. & Wats.
 Cal. i. 30. The adjective specific name *tenella* has already been used in
Cardamine.

11. ARABIS FILIFOLIA=*Cardamine filifolia*, Greene, Pittonia, i. 30.—Notwithstanding its close resemblance, in some respects, to our common *Cardamine oligosperma*, this new insular plant must needs be an *Arabis*, for its siliques are not only not elastically dehiscent; they are very tardily dehiscent, and so, when ripe, plainly those of the genus to which the species is now referred.

12. THELYPODIUM LASIOPHYLLUM, Greene, Bull. Torr. Club. xiii. 142.

13. SISYMBRIUM PINNATUM=*Erysimum pinnatum*, Walter Fl. Carol. 174 (1788): *Sisymbrium canescens*, Nutt. Gen. ii. 68 (1818).

14. SISYMBRIUM OFFICINALE, Scop. Carn. ed. 2, n. 824.—In cultivated lands only.

15. NASTURTIUM AQUATICUM, Tragus, Hist. 82 (1552) Dodonæus, Pempt. 581 (1583): Bauhin, Pinax. 104 (1623) *N. officinale*, R. Br. Hort, Kew. ed. 2, iv. 110 (1812).—Mouth of streamlet at Prisoner's Harbor.

16. BRASSICA NIGRA, Boiss.—Not widely prevalent.

17. CAPSELLA DIVARICATA, Walp. Rep. i. 175.—On a low promontory, near the seashore, on the north side of the island; probably a adventive, for only one plant was seen.

18. CAPSELLA BURSA-PASTORIS, Mœnch, Meth. 271.

19. LEPIDIUM NITIDUM, Nutt.; Torr. & Gray. Fl. i. 116.

20. LEPIDIUM MENZIESII, DC. Syst. ii. 539.

21. ATHYSANUS PUSILLUS, Greene, Bull. Cal. Acad. i. 72.—Common on the northward slope.

22. THYSANOCARPUS CONCHULIFERUS, Greene, Bull. Torr. Club, xiii. 218; Pittonia, i. 31.

23. THYSANOCARPUS RAMOSUS. Wholly glabrous and slightly glaucous, a foot high, the stem parted near the

base into many erect, leafy and at length racemose branches; leaves 2—4 inches long, linear, those of the branches entire, or with a few scattered small but salient teeth, and an auriculate-clasping base, the lower and radical with 2—3 pairs of linear divaricate lobes: raceme naked, the pedicels slender and recurved: sepals minute, cymbiform, erect-spreading in flower, white, with a broad green mid-vein: petals twice the length of the sepals, spatulate-oblong, retuse: stamens 6, all of the same length, three on each side of the broad flat pistil: samara regularly and rather strongly concavo-convex, the crenate margin with or without some oblong perforations: style short, persistent. Species just intermediate between its very singular island congener and the mainland *T. crenatus*; having the foliage and branching habit of the former, nearly.

24. *OLIGOMERIS SUBULATA*, Boiss. fide Brew. & Wats. Bot. Cal. i. 53.—Common along the sea shore.

25. *HELIXANTHEMUM SCOPARIUM*, Nutt., Torr. & Gray, Fl. i. 152.—Common in the interior: suffrutescent, and strongly so when mature; nevertheless flowering freely the first year from the seed, thus often appearing as if annual.

26. *HELIXANTHEMUM OCCIDENTALE*, Greene (see page 144).

27. *FRANKENIA GRANDIFOLIA*, Cham. & Schlecht. Linnaea, i. 35.—Back of the beach, at the west end, abundant.

28. *SILENE ANTIRRHINA*, Linn. sp. i. 419.

29. *SILENE GALLICA*, Linn. l. c. 417.—Quite as common as on the mainland.

30. *SILENE QUINQUEVULNERA*, Linn. l. c. 416?—Smaller than the preceding, with a larger capsule and calyx more stiffly hirsute, growing with it on hillsides everywhere in the interior of the island. The plant was long past flowering, and may possibly be *S. nocturna*: but whichever species, it is otherwise unknown in this part of the world, and must

have arrived there with seed of grain or other cultivated plants, from southern Europe.

31. *SILENE LACINIATA*, Cav. Ic. vi. 44?—Plant glabrous, the leaves all very narrow: stems numerous, slender, decumbent, from a thick, perpendicular fusiform root. Frequent on northward slopes.

32. *STELLARIA MEDIA*, Smith, Eng. Bot. t. 537.

33. *STELLARIA NITENS*, Nutt.; Torr. & Gray, Fl. i. 185.

34. *SAGINA OCCIDENTALIS*, Watson, Proc. Am. Acad. x. 345.

35. *LEPIGONUM MACROTHECUM*, Fisch. & Mey. Kindb. Monog. Lep. 16.—A very robust and viscid perennial, with large fleshy roots: not rare, on the north side, near the sea, among rocks.

36. *PENTACENA RAMOSISSIMA*, Hook. Bot. Misc. iii. 338.—Low bluffs near the sea, toward the west end.

37. *CALANDRINIA MENZIESII*, Hook. Fl. Bor. Am. i. 223.

38. *CLAYTONIA PERFOLIATA*, Donn, Bot. Mag. t. 1336.

39. *MALVA PARVIFLORA*, Linn. Amoen. iii, 416.—Less common than on the mainland, where it is called *M. borealis*; but it is a most distinct species.

40. *MALVASTRUM THURBERI*, Gray. var. *LAXIFLORUM*, Gray. Proc. Am. Acad. xxii. 291.—Rare; only two bushes seen, and these under the protection of large opuntias; perhaps thus kept from the sheep.

41. *ERODIUM CICUTARUM*, l'Her.; Ait. Hort. Kew. Ed. 1, ii. 414.

42. *ERODIUM MOSCHATUM*, Willd. Sp. Pl. iii. 631.

43. *RHAMNUS INSULARIS*, Kellogg., Proc. Cal. Acad. ii. 37?—Tree often 20 feet high, the naked trunks 4—5 inches

in diameter, clothed with a smooth light gray bark: branches few and open: leaves oblong-oval, commonly 3 inches long, including the half-inch petiole, and $1\frac{3}{4}$ inches broad, obtuse at both ends, mucronate at apex, the margin slightly but very regularly glandular-crenulate: color and texture of leaf as in *R. crocea*; fruit also the same except as to size, being much larger.

The tree here spoken of, although receiving its best development on Santa Cruz, is well known in western California from Lake county southward along the Mt. Diablo range, and in herbarium specimens may, with some excuse be referred, as it long has been, to Nuttall's *R. crocea*; but no one in the field can confound the two. I saw the same on Cedros Island two years ago. Yet there is a little doubt about its being the plant described by the late Dr. Kellogg. But in view of their probable identity I dare not propose a new name for what, if it be the same, has already two by the same author, the other one being *R. ilicifolia*.

44. *CEANOTHUS CRASSIFOLIUS*, Torr. Pac. R. Rep. iv. 75; Bot. Mex. Bound. 46. t. 11.—Not rare, yet nowhere forming thickets.

45. *CEANOTHUS ARBOREUS*, Greene (see page 144).

46. *ACER MACROPHYLLUM*, Pursh, Fl. i. 267.—Common in deep cañons of the north side, and very luxuriant.

47. *RHUS DIVERSILOBA*, Torr. & Gray, Fl. i. 218.—North side, rare.

48. *RHUS INTEGRIFOLIA*, Benth. & Hook. Gen. Pl. i. 419. Common on the northward slope, and of shapely tree-like proportions, much larger than ever seen on the mainland.

49. *RHUS OVATA*, Watson, Proc. Am. Acad. xx. 358.—Interior of the island, where it is common.

50. *LUPINUS CHAMISSONIS*, Esch. Mem. Acad. Petrop. x. 288.—Interior; also on islets near the shore; shrub of good size.

51. LUPINUS AFFINIS, Agh. Syn. Lup. 20.
52. LUPINUS NANUS, Dougl. Benth. Hort. Trans., new ser. i. 409. t. 14.
53. LUPINUS TRUNCATUS, Nutt.; Hook. & Arn. Bot. Beech. 336.
54. LUPINUS HIRSUTISSIMUS, Benth. Hort. Trans. l. c.
55. LUPINUS UMBELLATUS, Greene (see page 145).
56. LUPINUS MICROCARPUS, Sims. Bot. Mag. t. 2413.—All the above annual species appear in the interior only. Some of them may easily have been introduced from the mainland with seed of grain.
57. TRIFOLIUM CILIATUM, Nutt. Pl. Gamb. 152.
58. TRIFOLIUM EXILE, Greene, Pittonia. i. 6.
59. TRIFOLIUM TRIDENTATUM, Lindl. Bot. Reg. t. 1070.
60. TRIFOLIUM MICRODON, Hook. & Arn. Bot. Beech. 330 t. 79.
61. TRIFOLIUM MICROCEPHALUM, Pursh, Fl. ii. 478.
62. TRIFOLIUM FUCATUM, Lindl. Bot. Reg. t. 1883.
63. TRIFOLIUM AMPECTENS, Torr. & Gray, l. c. 319.
64. MELILOTUS PARVIFLORA, Desf. Fl. Atl. ii. 192.
65. MEDICAGO DENTICULATA, Willd ; DC. Prod. ii. 176.
66. SYRMATIUM DENDROIDEUM, Greene (see page 146).
67. SYRMATIUM PATENS, Greene (see page 147).
68. SYRMATIUM NIVEUM, Greene (see page 148).
69. HOSACKIA ? OCCULTA. Growing parts of the plant vil-
lous-canescant, the older glabrate and green: leaflets 6, one

of the lateral wanting, membranaceous, cuneate-oblong, an inch long, the apex acute: flower and fruit unknown.

Here and there a seedling of this obscure but unquestionably new species was found in gravelly dry beds of streams in several parts of the island. I judge the perfect plant to be a perennial or a shrub of the mountain sides or summits, but I could never find it. An annual would have been in fruit at the late summer time; but these gave no sign of flower, even. The habit is rather that of *Syrmatium*, but the leaves are too ample for that genus. I have named and thus defined what I have of this variety, both hoping that future search may be rewarded with perfect specimens, yet fearing lest it be one of the insular species now on the verge of extinction, like *Syrmatium niveum*.

70. *HOSACKIA PARVIFLORA*, Benth. Bot. Reg. t. 1257.

71. *HOSACKIA STRIGOSA*, Nutt.; Torr. & Gray. Fl. i. 226.

72. *HOSACKIA MARITIMA*, Nutt. l. c.

73. *HOSACKIA SUBPINNATA*, Torr. & Gray. l. c.

74. *HOSACKIA PURSHIANA*, Benth. l. c.—Only two or three plants seen, and these near a Chinese fishing camp, at the south side; so, no doubt of recent introduction.

75. *ASTRAGALUS DIDYMOCARPUS*, Hook. & Arn. Bot. Beech. 334. t. 81.

76. *ASTRAGALUS LEUCOPSIS*, Torr. & Gray, Bot. Mex. Bound. 56. t. 16.—Southeastern shore; plentiful there, but not elsewhere seen.

77. *VICIA AMERICANA*, Muhl.; Willd. Sp. iii. 1096.

78. *VICIA EXIGUA*, Nutt.; Torr. & Gray, i. 272.

79. *LATHYRUS VESTITUS*, Nutt. l. c. 276.—Only one plant seen, and that in a cañon of the north side.

80. *PRUNUS OCCIDENTALIS*, Lyon, Bot. Gaz. xi. 202 &

333. Tree 15—25 feet high, with compact and well rounded head, the trunk with rough dark bark: evergreen; leaves usually ovate-acuminate, 3—4 inches long, 2—2½ inches broad, entire or remotely denticulate, rarely lanceolate-acuminate, 3 inches long, and ¾ inch broad, sometimes broadly ovate and abruptly acute, the margin spinose-serrate: inflorescence racemose: drupe orbicular, slightly compressed laterally, ¾ inch in length and breadth, with a very conspicuous suture on one side, dark red-purple, the thin pulp sweet, with also a bitter-almond flavor, but no acidity or astringency: putamen thin, rather firm-cartilaginous than ligneous.

Very common on all parts of the island; only occasionally exhibiting the very narrow leaves which I have described: the spinose-serrate foliage mostly appertaining to young trees.

Mr. Lyon cites no place where Nuttall published such a name as *Prunus occidentalis*, and I can find none. Moreover, Nuttall in common with very many able botanists, held that cherries and plums are of distinct genera, and this, if he named it even in manuscript, he must have called *Cerasus occidentalis*, rather than *Prunus*.

81. RUBUS URSINUS, Cham. and Schlect. Linnæa. ii. 11.—Rare near the shore on the north side: apparently not yet of fruiting age.

82. CERCOCARPUS BETULEFOLIUS, Nutt.: Hook. Ic. t. 323. Trees often 18—25 feet high, with clean trunk and smooth light gray bark, the branches somewhat drooping, the whole habit very unlike that of *C. parvifolius*: leaves not rarely 2½ inches long and 1½ inches broad: young twigs with the odor and flavor of the black birch, and it was doubtless in reference to this quality as much as to the morphology of the foliage that Nuttall, who knew all about the tree, named it (ungrammatically) *C. betuloides*.

83. *ADENOSTOMA FASCICULATUM*, Hook. & Arn. Bot. Beech. 139. t. 30.—Common on hills everywhere, and much more luxuriant and tall than on the mainland.

84. *ROSA CALIFORNICA*, Cham. & Schlect. Linnæa. ii. 35. Common along streams.

85. *HETEROMELES ARBUTIFOLIA*, Røemer, Syn. Monogr. iii. 105.—The most common tree on all hillsides sloping northward. It is never found in such abundance on the mainland.

86. *LYONOTHAMNUS ASPLENIFOLIUS*, Greene, Bull. Cal. Acad. i. 187 & ii. 149. t. 6.

87. *SAXIFRAGA MALVÆFOLIA*, Greene, Bull. Torr. Club. ix. 121.—Still known only in the specimens of Kellogg & Harford.

88. *HEUCHERA MAXIMA*, Greene. (See page 149.)

89. *RIBES SUBVESTITUM*, Hook. & Arn.?—A single bush, not fruiting and seemingly young, was found in a deep cañon on the north side.

90. *TILLÆA MINIMA*, Miers. Chil. ii. 530.

91. *COTYLEDON LANCEOLATA*, Watson, Bot. Cal. i. 211.—Abundant on cliffs near the sea.

92. *COTYLEDON LAXA*, Watson, l. c, 212?—In cañons back from the sea; plants too large, and too little glaucous to be well referable to this species.

93. *LYTHRUM CALIFORNICUM*, Torr. & Gray, Fl. i. 482.—Rare; found only in a springy place near the summit of the island.

94. *ZAUSCHNERIA CALIFORNICA*, Presl. Rel. Hænk. ii. 28, t. 52.—Low hills of the northward slope; frequent.

95. *ZAUSCHNERIA VILLOSA*, Greene, Pittonia, i. 27.—Abundant along stream banks in the interior.

96. *ZAUSCHNERIA CANA*, Greene, l. c. 28.—With the last and equally plentiful.

97. *EPILOBIUM COLORATUM*, Muhl.; Willd. Enum. i. 411. Only one or two plants seen.

98. *EULOBUS CALIFORNICUS*, Nutt.; Torr. & Gray, Fl. i. 515.—In a dry sunny cañon opening to the south, or the north side; an enormous growth of the species, several plants more than six feet high.

99. *ÆNOTHERA HOOKERI*, Torr. & Gray, l. c. 493.—Along streamlets in the higher parts of the island: same as the mainland plant commonly called a variety of *Æ. biennis*, which it can hardly be.

100. *ÆNOTHERA BISTORTA*, Nutt.; Torr. & Gray, l. c. i. 508.

101. *ÆNOTHERA CHEIRANTHIFOLIA*, Hornem. Bot. Reg. t. 1040.

102. *GODETIA PURPUREA*, Watson, Bot. Cal. i. 229.—Frequent in the interior valley on grassy slopes.

103. *GODETIA EPILOBIODES*, Watson, l. c. 231.—North side, in shady places; plentiful.

104. *CLARKIA ELEGANS*, Dougl.; Bot. Reg. t. 1575.—Apparently scarce.

105. *MENTZELIA MICRANTHA*, Torr. & Gray, Fl. i. 535.—Frequent in sunny places in cañons opening into Prisoner's Harbor.

106. *ECHINOCYSTIS MACROCARPA*, Greene, Bull. Cal. Acad. i. 188.—Common.

107. *ECHINOCYSTIS GUADALUPENSIS*, Cogniaux in DC. Mon. Phan. iii. 819.—Abundant on the north side.

108. *OPUNTIA ENGELMANNI*, Salm. var. (?) *LITTORALIS*, En-

gelm. Bot. Cal. i, 248.—Abundant on open hills of the lower parts of the island.

109. *MESEMBRIANTHEMUM EQUILATERALE*, Haw. Misc. Nat. 77.—In masses on high rocks overhanging the sea, on the north side, common.

110. *MESEMBRIANTHEMUM CRYSTALLINUM*, Linn. Sp. Pl. 480.—Common at the west end, but not seen elsewhere.

111.—*SANICULA LACINIATA*, Hook & Arn. Bot. Beech. 347. A single specimen a little back from the shore, on the north side.

112. *CONIUM MACULATUM*, Linn. Sp. Pl. 243.—Bank of stream near cultivated ground, seeming well established.

113. *FENICULUM OFFICINALE*, All. Fl. Pedem. ii. 25.—Thoroughly established on hillsides near the landing of Prisoner's Harbor.

114. *APIASTRUM ANGUSTIFOLIUM*, Nutt.; Torr. & Gray, Fl. i. 644.

115. *BERULA ANGUSTIFOLIA*, Koch. Deutschl. Fl. ii. 433. Springy places near the sea, in Laguna Cañon on the south side.

116. *PEUCEDANUM* ——— ? On hillsides in the interior; stem and leaves dead, the species consequently undeterminable.

117. *DAUCUS PUSILLUS*, Michx. Fl. i. 164.—Very abundant and rank; often two feet high.

118. *SAMBUCUS GLAUCA*, Nutt.; Torr. & Gray, Fl. ii. 13. Not common.

119. *SYMPHORICARPUS MOLLIS*, Nutt. l. c. 4.—Like the last occurring only here and there in open cañons toward the sea, on the north side.

120. *LONICERA HISPIDULA*, Dougl.; Torr. & Gray, l. c. 5. Only one plant seen, and that with the two preceding species.

121. *LONICERA SUBSPICATA*, Hook. & Arn. Bot. Beech. 349.—South side near the sea; frequent.

122. *GALIUM APARINE*, Linn. Sp. Pl. 157.

123. *GALIUM ANGUSTIFOLIUM*, Nutt.; Torr. & Gray, l. c. 22.—Rocky places low down on the north side; not frequent.

124. *GALIUM FLACCIDUM*, Greene, Pittonia, i. 34.

125. *GALIUM BUXIFOLIUM*, Greene (see page 150).—Near *G. Catalinense*, Gray, but foliage of different texture and form, and the nodes of the stem lacking the "tumid ring" of that species.

126. *BRICKELLIA CALIFORNICA*, Gray, Pl. Fendl. 64.—In sunny open places among the cañons of the north side; quite as shrubby as the New Mexican plant called *B. Wrightii*, which is doubtless the same thing, specifically at least.

127. *GRINDELIA ROBUSTA*, Nutt. Trans. Am. Phil. Soc. vii. 314.—Interior; not common.

128. *APLOPAPPUS SQUARROSUS*, Hook & Arn. Bot. Beech. 146.—Frequent southward in the interior.

129. *BIGELOVIA VENETA*, Gray, Syn. Fl. i. 2, 142.—With the last and as frequent, but neither of them in any abundance as on the mainland.

130. *BIGELOVIA VENETA*, var. *SEDOIDES*.—Stems woody at base but wholly prostrate and less than a foot long; leaves obovate, coarsely serrate, thick and succulent; heads rather large, crowded in a terminal corymb.

On the edges of low cliffs overhanging the sea, on the north side of the island: at a short distance would be mis-

taken for a sedum; when fresh seeming like a very distinct species of its genus: but the dried specimens go readily for a form of *B. veneta*.

131. *SOLIDAGO CALIFORNICA*, Nutt. Trans. Am. Phil. Soc. vii. 327.—Rare; found in only two or three localities, on the north side; specimens of prodigious size, some being more than five feet high.

132. *CORETHROGYNE FILAGINIFOLIA*, Nutt. l. c. 290.—Rather scarce; seen only in the interior.

133. *HAZARDIA DETONSA*, Greene, Pittonia, i. 29.

134. *HAZARDIA SERRATA*, Greene, l. c. 30.

135. *ASTER RADULINUS*, Gray, Proc. Am. Acad. viii. 388. Rather common in open places of the wooded northward side.

136. *ERIGERON CANADENSIS*, Linn. Sp. Pl. 863.—Only one plant seen, and that not yet in flower.

137. *ERIGERON GLAUCUS*, Ker. Bot. Reg. t. 10.—Abundant on cliffs all along the northern shore.

138. *ERIGERON STENOPHYLLUS*, Nutt. Pl. Gamb. 176; Greene, Bull. Cal. Acad. i. 88, not of Gray.—Frequent on the northern slope.

139. *CONYZA COULTERI*, Gray, Proc. Am. Acad. vii. 355. A fair growth of this plant, not yet in flower, was found in a field of alfalfa, but fell by the sickle shortly after the time of my observing it. It may thus have failed to become established.

140. *BACCHARIS CONSANGUINEA*, DC. Prod. v. 408.—Not at all common.

141. *BACCHARIS PLUMMERÆ*, Gray. Am. Acad. xv. 48.—Growing luxuriantly in the cañon back of Prisoner's Harbor landing.

142. *BACCHARIS DOUGLASHII*, DC. l. c. 400.—Not common.
143. *BACCHARIS VIMINEA*, DC. l. c.—Dry beds of streams on the south side only, near the sea.
144. *MICROPUS CALIFORNICUS*, Fisch. & May. Ind. Sem. Petrop. 1835, 42.
145. *FILAGO CALIFORNICA*, Nutt. Trans. Am. Phil. Soc. vii. 405.
146. *GNAPHALIUM SPRENGELII*. Hook & Arn. Bot. Beech. 150.
147. *GNAPHALIUM RAMOSISSIMUM*, Nutt. Pl. Gamb. 172.
148. *GNAPHALIUM DECURRENS*, var. *CALIFORNICUM*, Gray, Bot. Cal. i. 141.
149. *GNAPHALIUM PURPUREUM*, Linn. Sp. Pl. 854.
150. *AMBROSIA PSILOSTACHYA*, DC. l. c. 526.
151. *FRANSERIA BIPINNATIFIDA*, Nutt. Trans. Am. Phil. Soc. vii. 507.
152. *XANTHIUM CANADENSE*, Mill. Dict. ed. 8.—One plant, fruiting at a Chinese fishing camp near the southern shore; at present therefore merely adventive.
153. *HELIANTHUS ANNUUS*, Linn. Sp. Pl. 904.—In a grain field; the native state of the plant.
154. *ENCELIA CALIFORNICA*, Nutt. l. c. 357.—Common near the sea, on the south side.
155. *LEPTOSYNE GIGANTEA*, Kellogg, Proc. Cal. Acad. iv. 198.—Frequent on cliffs toward the sea on the north side, but preferring islet rocks where sea fowls nest, in which places it grows in greatest abundance. The plant is described by sailors and fishermen as making a fine show during its flowering season, which is said to be February and March.

156. *MADIA FILIPES*, Gray, Proc. Am. Acad. ix. 189.—Abundant on the north side everywhere.

157. *HEMIZONIA FASCICULATA*, Torr. & Gray, Fl. ii. 397.—A low, somewhat congested form, on open grassy lands toward the sea, on the north side; abundant in its several localities.

158. *ACHYRACHENA MOLLIS*, Schauer.; DC. l. c. 292.—In the interior only.

159. *LAYIA PLATYGLOSSA*, Gray, Pl. Fendl. 103?—Not the variety *brevisetata* of the nearest mainland, but the pappus of full length, and the awns manifestly flattened and broadest above the base; very likely a distinct species, but the specimens too old.

160. *VENEGASIA CARPESIOIDES*, DC. l. c. v. 43.—Deep cañons on the north; frequent.

161. *PERITYLE FITCHII*, Torr. Pac. R. Rep. iv. 100.—Clayey banks near the sea, on the south side: herbage resinous-viscid and strongly aromatic, thus most readily distinguished from *P. Californica*, which is scentless and nearly or quite glabrous.

162. *BÆRIA PALMERI*, var. *CLEMENTINA*, Gray, Syn. Fl. Suppl. 452.—Common on the north side, and variable in size: pappus alike in ray and disk, the paleæ invariably four only, in both the plant of Santa Cruz and that of San Clemente, although this fact does not appear to have been observed by the author. The same plant is common near the shores of San Diego Bay, where I collected it in 1885; also from the Coronados Islands I brought specimens of what would appear to be the same, except that in these there is no pappus at all.

163. *ERIOPHYLLUM CONFERTIFLORUM*, Gray, Proc. Am. Acad. xix. 25.—Frequent on the north side.

164. *ERTOPHYLLUM STECHADIFOLIUM*, Lag. var. *DEPRESSUM*, Stems stout, a foot long or less, depressed, forming a low hemispherical tuft: leaves broad and with about two pairs of divaricate linear-oblong lobes. A plant in aspect extremely unlike the continental type of the species; but the flowers and fruit present no characters. Frequent on cliffs near the sea, on the north side only.

165. *AMBLYOPAPPUS PUSILLUS*, Hook. & Arn. Journ. Bot. iii. 321.—Near the shores only.

166. *ACHILLEA MILLEFOLIUM*, Linn. Sp. Pl. 899.—Only on the north side, and rather scarce.

167. *ARTEMISIA CALIFORNICA*, Less. Linnæa. vi. 523.—Frequent, but nowhere plentiful.

168. *ARTEMISIA LUDOVICIANA*, Nutt.; Torr. & Gray, Fl. ii. 420.—The common Californian form: but only one tuft of it seen on the island; that on the north side.

169. *LEPIDOSPARTUM SQUAMATUM*, Gray, Proc. Am. Acad. xix. 50.—On a sandy tract in the interior.

170. *SENECIO DOUGLASII*, DC. Prod. vi. 429.—Interior; only two shrubs of it seen, but these large and beautiful.

171. *CNICUS LILACINUS*.¹ Near *C. occidentalis*, but more slender, much less tomentose, the leaves glabrate above: heads smaller, the long herbaceous-acerose tips of the bracts strongly incurved: corollas lilac-purple, short.—Interior of the island; infrequent.

172. *SILYBUM MARIANUM*, Gærtn. Fruct. et Sem. Pl. ii. 378.—Abundant in the sandy beds of the broader cañons, both north and south, forming thickets impenetrable at the growing season of the year.

¹ Mr. Parish has sent me from San Bernardino what must be the same named by him as new, "*C. neglectus*;" but that name holds for an Old World species.

173. *CENTAUREA MELITENSIS*, Linn. Sp. Pl. 917.—Not at all prevalent as in the continental fields and waste places.

174. *PEREZIA MICROCEPHALA*, Gray, Pl. Wright. i. 127.—Quite common at the north.

175. *STEPHANOMERIA ELATA*, Nutt. Pl. Gamb. 173 ?.²—Very common on the north side; often six feet high.

176. *STEPHANOMERIA VIRGATA*, Benth. Bot. Sulph. 32 ?. As frequent on the south side of the island as the last is at the north. Of different habit from the mainland plant bearing this name; but akenes and pappus the same.

177. *STEPHANOMERIA TOMENTOSA*, Greene (see page 152).

178. *STEPHANOMERIA CICHORIACEA*, Gray, Proc. Am. Acad. v. 552.—Very common, in the crevices of high precipitous ledges, chiefly in the interior.

179. *RAFINESQUIA CALIFORNICA*, Nutt. Trans. Am. Phil. Soc. vii. 429.—Very common at the north.

180. *HYPOCHÆRIS GLABRA*, Linn. Mant. 2. 460.

181. *CALAIS LINEARIFOLIA*, DC. Prod. vii. 85.—Frequent, as on the mainland, and in the same tall state (often more than two feet high), which occurs about San Diego.

182. *CALAIS PLURISETA*, Greene, Pittonia. i. 34.—Plants now growing from seed exhibit leaves laciniate-pinnatifid.

183. *MALACOTHRIX TENUIFOLIA*, Torr. & Gray, Fl. ii. 487. Precipitous places near the sea, at the north; common.

184. *MALACOTHRIX INCANA*, Torr. & Gray, l. c. 486 (see page 153).

185. *MALACOTHRIX INDECORA*, Greene (see page 152).

²Precisely the same plant, whatever it be, was seen by me, on my way home from the islands growing abundantly, on hillsides, at Port Harford, in San Luis Obispo county.

186. *MALACOTHRIX SQUALIDA*, Greene (see page 152).
187. *HIERACIUM ARGUTUM*, Nutt. Trans. Am. Phil. Soc. vii. 447.—Common in bushy places at the north.
188. *TROXIMON HETEROPHYLLUM*, Greene, Bull. Torr. Club. x. 88.—The typical form.
189. *SONCHUS OLERACEUS*, Linn. Sp. Pl. 794.
190. *SONCHUS ASPER*, Fuchs. Hist. 674 (A. D. 1542).
191. *SPECULARIA PERFOLIATA*, A. DC. Torr. Fl. N. Y. i. 428, t. 65.
192. *VACCINIUM OVATUM*, Pursh. Fl. i. 290.—Pine woods at the summit of the island, toward the west end.
193. *ARCTOSTAPHYLOS TOMENTOSA*, Dougl. Bot. Reg. t. 1791.—Forming low thickets near the summit, westward.
194. *ARCTOSTAPHYLOS PUNGENS*, HBK. Nov. Gen. & Spec. iii. 278.—Abundant, but at lower altitudes than the preceding.
195. *COMAROSTAPHYLIS DIVERSIFOLIA* = *Arctostaphylos diversifolia*, Parry; Gray, Syn. Fl. Suppl. 397.—A handsome small tree, 12—20 feet high, flowering in July, having the external appearance, as well as the characteristic inflorescence of our northwestern arbutus, with no likeness at all to the manzanitas; and, if fruit characters are of the value attributed to them in these Ericaceæ generally, *Comarostaphylis* is a very good genus; otherwise this tree will be an *Arbutus*, not an *Arctostaphylos*.
196. *DODECATHEON JEFFREYI*, Moore, Fl. des Serres. xvi. 99, t. 1662.—Hillsides of the interior; common.
197. *SAMOLUS VALERANDI*, var. *AMERICANUS*, Gray, Man. ed. 2. 274.—Wet places, in deep gorges, under dripping precipices, near the northern shores.

198. *ERYTHRÆA DOUGLASII*, Gray, Bot. Cal. i. 480.
199. *GILIA ATRACTYLOIDES*, Steud. Nom. i. 683.
200. *GILIA FILIFOLIA*, Nutt. Pl. Gamb. 156.
201. *GILIA MULTICAULIS*, Benth.
202. *NEMOPHILA RACEMOSA*, Nutt.; Gray, Proc. Am. Acad. x. 315.
203. *EUCRYPTA CHRYSANTHEMIFOLIA*, Greene, Bull. Cal. Acad. i. 200.
204. *PHACELIA HISPIDA*, Gray, 2. i. 161.
205. *PHACELIA SUFFRUTESCENS*, Parry, Proc. Davenp. Acad. iv. 38.
206. *PHACELIA PARRYI*, Torr. Bot. Mex. Bound. 144.
207. *EMMENANTHE PENDULIFLORA*, Benth. Trans. Linn. Soc. xvii. 281.
208. *PECTOCARYA PENICILLATA*, A. DC. Prod. x. 120.
209. *KRYNITZKIA LEIOCARPA*, Fisch. & Mey. Sem. Petrop. 1835, 36.
210. *KRYNITZKIA MICROMERES*, Gray, Proc. Am. Acad. xx. 274.
211. *KRYNITZKIA JONESII*, Gray, l. c.
212. *PLAGIOBOTHRYIS CALIFORNICUS* = *Echidiocarya Californica*, Gray, Proc. Am. Acad. xii. 164 (1877); *Plagiobothryis Cooperi*, Gray, l. c. xx. 285 (1884).
213. *HELIOTROPIMUM CURASSAVICUM*, Linn. Sp. Pl. 130.
214. *AMSINCKIA LYCOPSOIDES*, Lehm. Sem. Hamb. 1831, 7.
215. *AMSINCKIA INTERMEDIA*, Fisch. & Mey. Sem. Petrop. 1835, 26.

216. *CONVOLVULUS MACROSTEGIUS*. Greene, Bull. Cal. Acad. i. 208.—Abundant on the north side, suffrutescent, the stems scarcely twining, but trailing several yards over rocks and bushes. The peculiar inflorescence of this species attains a very remarkable development on this island. The flowers are arranged in a forked cyme, commonly five and seven, sometimes eleven in each cyme, every flower being separately large-foliaceous-bracted, a pair of somewhat larger bracts subtending the whole cyme. The corollas are developed, of course at the rate of one a day only, on each fork of the cyme. They are little larger than those of *C. occidentalis*, which is just as common at Santa Barbara on the opposite side of the channel, but of which no trace is found on the island.

217. *CONVOLVULUS ARVENSIS*, Linn. l. c. 153.—In a field near the principal settlement. Only a few plants, hence no doubt of recent introduction.

218. *CUSCUTA SUBINCLUSA*, Durand & Hilgard, Journ. Acad. Philad. ser. 2. iii. 42.—Not at all frequent, and rather depauperate.

219. *SOLANUM DOUGLASSII*, Dunal. DC. Prod. xiii. 48.—Quite rare.

220. *SOLANUM XANTI*, var. *WALLACEI*, Gray, Proc. Am. Acad. xi. 90.—Frequent, but far less common than on Guadalupe.

221. *DATURA METELOIDES*, DC. Prod. xiii. 544.—In cañons of the northern and western parts of the island.

222. *NICOTIANA CLEVELANDI*, Gray, Syn. Fl. 242.—Like the typical mainland form, and not approaching *N. petuniiflora* of Guadalupe.

223. *LINARIA CANADENSIS*, Dum. Chav. Mon. 149.—

224. *ANTIRRHINUM NUTTALLIANUM*, Benth. DC. Prod. x. 592.—Rocky steeps, near the sea: common and very robust.

225. *ANTIRRHINUM STRICTUM*, Gray, Proc. Am. Acad. vii. 375.

226. *PENTSTEMON CORDIFOLIUS*, Benth. DC. Prod. x. 329.—With woody stems an inch thick, often climbing twenty feet among the branches of trees.

227. *DIPLACUS ARACHNOIDEUS*, Greene, Bull. Cal. Acad. i. 210.—Common in the higher parts of the island.

228. *DIPLACUS PARVIFLORUS*, Greene, Pittonia, i. 36.

229. *MIMULUS CARDINALIS*, Dougl. Lindl. Hort. Trans. ii. 70. t. 3.—Common and extremely luxuriant under dripping precipices and in deep cañons of the north side.

230. *MIMULUS FLORIBUNDUS*, Dougl. Lindl. Bot. Reg. t. 1125.—But one plant seen; in a streamlet well toward the summit.

231. *MIMULUS NASUTUS*, Greene, Bull. Cal. Acad. i. 112. Very abundant on the north side, in shady ravines.

232. *CASTILLEIA AFFINIS*, Hook & Arn. Bot. Beech. 154. Rare; near the summit.

233. *CASTILLEIA HOLOLEUCA*, Greene, W. Am. Sc. iii. 3: Pittonia. i. 38.—Common on hills of the interior; forming no small part of the brushwood in some places.

234. *ORTHOCARPUS DENSIFLORUS*, Benth. DC. l. c. 536.—Grassy slopes in open ground, on the north side.

235. *APHYLLON TUBEROSUM*, Gray, Bot. Cal. i. 585.—A single specimen at the west end.

236. *VERBENA PROSTRATA*, R. Br. Hort. Kew. iv. 41.—Only one small specimen, near the sea shore, on the north side.

237. *SPHACELE FRAGRANS*, Greene, Pittonia. i. 38.

238. *SALVIA COLUMBARIE*, Benth. Lab. 302.

239. *AUDIBERTIA PALMERI*, Gray, Bot. Cal. i. 601.—Widely dispersed, the bushes large and well formed, but seldom met with, never growing in masses.

240. *STACHYS ACUMINATA*.—Stems 2—3 feet high, from rootstocks, retrorsely scabrous or hispid on the very acute angles: leaves ovate-acuminate, or triangular-lanceolate, mostly cordate, coarsely crenate. 2—3 inches long, on petioles of an inch or more, deep green and glabrate above, velvety-canescens beneath: spike naked, a foot or two long in age, the 4—6 flowered verticils an inch apart: calyx-teeth triangular, spine-tipped, less than half as long as the campanulate tube: corolla light purple, more than a half inch long, tube well exerted; lower lip about 4 lines long. Among loose rocks of the northward slope: flowering in July.

241. *PLANTAGO MAJOR*, Camerarius, Epit. 261 (A. D. 1586); Linn. Sp. Pl. 112 (A. D. 1753).—Near Prisoner's Harbor Landing.

242. *PLANTAGO PATAGONICA*, Jacq. Ic. Rar. t. 306.

243. *ERIOGONUM GRANDE*, Greene, Pittonia. i. 38.—All parts of the island.

244. *ERIOGONUM RUBESCENS*, Greene, l. c. 39.—Sandstone cliffs, at the western end.

245. *ERIOGONUM ARBORESCENS*, Greene, Bull. Cal. Acad. i. 11.—Common on hillsides of the northward slope, and in precipitous rocky places of all the cañons; about six feet high when well grown, shrubby and evergreen, forming a rounded and compact bush.

246. *RUMEX SALICIFOLIUS*, Weinm. DC. Prod. xiv. 47.

247. *RUMEX CRISPUS*, Linn. Sp. Pl. 335.

248. *RUMEX MARITIMUS*, Linn. l. c.

249. *RUMEX CONGLOMERATUS*, Murr. Prod. Fl. Gœtt. 52.

250. *POLYGONUM AVICULARE*, Linn. l. c. 362.
251. *CHORIZANTHE STATICOIDES*, Benth. Linn. Trans. xvii. 418.
252. *PTEROSTEGIA DRYMARIOIDES*, Fisch. & Mey. Sem. Petrop. ii. 23.
253. *MIRABILIS CALIFORNICA*, Gray, Bot. Mex. Bound. 173.
254. *ABRONIA MARITIMA*, Nutt.; Bot. Cal. ii. 4.—Abundant on all strips of beach occurring along the southern shore.
255. *ABRONIA UMBELLATA*, Lam. Ill. i. 469. t. 105.
256. *AMARANTUS ALBUS*, Linn. Sp. Pl. ed. 2. 1404.
257. *CHENOPODIUM MURALE*, Linn. Sp. Pl. 219.
258. *CHENOPODIUM ALBUM*, Linn. l. c.
259. *CHENOPODIUM AMBROSIOIDES*, Linn. l. c.—This and the three preceding weeds were seen in only a few specimens of each; none of them being thoroughly established.
260. *CHENOPODIUM CALIFORNICUM*, Watson. Bot. Cal. ii. 48.
261. *ATRIPLEX MICROCARPA*, Dietr. Syn. v. 536.—Frequent on the south side near the sea.
262. *ATRIPLEX LEUCOPHYLLA*, Dietr. l. c.—At the west end only.
263. *ATRIPLEX CALIFORNICA*, Moq. DC. Prod. xiii². 98. Rocky islets off the northern shore; also, in a remarkably robust fleshy form, at the west end.
264. *ATRIPLEX BREWERI*, Watson, Proc. Am. Acad. ix. 119.—Southern shore.
- 265.—*SUEDA TORREYANA*, Watson, l. c. 88.—At the west end, abundant.

266. *URTICA HOLOSERICA*, Nutt. Pl. Gamb. 183.—Seen in but two or three localities, not far from the shore, on the north side.

267. *URTICA URENS*, Linn. Sp. Pl. 984.

268. *PARIETARIA DEBILIS*, Forst. Prod. Fl. Austral. 73.

269. *EREMOCARPUS SETIGERUS*, Benth. Bot. Sulph. 53. t. 26.—Abundant in fields; perhaps brought in with seed of grain.

270. *RICINUS COMMUNIS*, Linn. Sp. Pl. 1007.—Growing spontaneously along the hills back from the landing, forming small trees. It is also thoroughly naturalized on stream banks in the vicinity of Santa Barbara on the mainland.

271. *SALIX LEVIGATA*, Bebb. Bot. Cal. ii. 83.—Fine trees in many of the cañons at the north.

272. *SALIX LONGIFOLIA*, Muhl. DC. Prod. xvi². 214.—One bush, in flower, at the south side near the shore.

273. *SALIX LASIOLEPIS*, Benth. Pl. Hartw. 335.—With the last; a very pubescent form.

274. *POPULUS TRICHOCARPA*, Torr. Hook. Ic. t. 878.—Frequent in deep cañons at the north side: also more rarely at the south.

275. *QUERCUS DUMOSA*, Nutt. Sylv. i. 7.—Very common at the north: the smaller specimens of the open hill country frequently with spikes erect, and many of the flowers perfect, yielding a spike of a dozen acorns.

276. *QUERCUS CHRYSOLEPIS*, Liebm. Dansk. Vidensk. Forbandl. 1854. 173.—At the north, near the summit: not common.

277. *QUERCUS TOMENTELLA*, Engelm. Trans. St. Louis, Acad. iii. 393 —Frequent; the trees smaller than on Guadalupe.

278. *QUERCUS AGRIFOLIA*, Liebm. l. c.—A beautiful growth of this tree in every valley and broad cañon: also on the higher northern slope, on open hill tops, a more reduced and compacted form with all, or nearly all, the flowers perfect, and acorns consequently spicate.

279. *QUERCUS PARVULA*, Greene, Pittonia. i. 40.

280. *PINUS INSIGNIS*, Dougl. var. *BINATA*, Engelm. Bot. Cal. ii. 128.—Small trees, growing in a scattered way along the northward slope, but forming dense forests toward the summit and at the western end of the island.

281. *HABENARIA ELEGANS*, Bolander, Cat. Pl. San Francisco, 29.—Frequent on wooded hills at the north.

282. *SISYRINCHIUM BELLUM*, Watson, Proc. Am. Acad. xii. 277.—Interior only.

283. *BLOOMERIA AUREA*, Kellogg, Proc. Cal. Acad. ii. 11. Common on the north side, but extremely abundant in the interior; see page 386.

284. *BRODLEA INSULARIS*, Greene (see page 134).

285. *LILIUM HUMBOLDTII*, Rœzl & Leicht.; Duchartre, Obs. 105.—Very common in woods everywhere.

286. *CALOCHORTUS* ———. A species of the *Cyclobothra* section; common in woods of the north side; long past flowering, and not to be identified specifically.

287. *CALOCHORTUS* ———. A species of the true *Calochortus* (perhaps, indeed, several species); abundant on grassy slopes of the interior.

288. *ZYGADENUS FREMONTI*, Torr. Pac. R. Rep. vii. 20.

289. *TYPHA BRACTEATA*. Rather slender, 15—18 feet high, the staminate and pistillate spike each 12—16 inches long, separated by an interval of an inch or more, aggregate length of spike in the largest specimens fully 3 feet,

the staminate at flowering time subtended and partly embraced by a linear deciduous bract of its own length, and bearing 3—7 smaller somewhat scarious caducous ones above midway or near the apex: pollen simple.

In a marshy place near the sea on the south side, above the mouth of Laguna Cañon. A gigantic species, and one which will doubtless be found on the mainland southward, whenever our collectors shall cease to pass this genus by as one not meriting their care or notice. These insular plants were not out of flower at the late date of my finding them, namely, the 13th of August: but there was evidence that the mature spike would be an inch at least in thickness.

290. *ZOSTERA MARINA*, Linn. Sp. Pl. 968.—Found on the beach at the landing.

291. *PHYLLOSPADIX TORREYI*, Watson, Proc. Am. Acad. xiv. 303.—Abundant on rocks below tide mark along the northern shores.

292. *JUNCUS BALTICUS*, Dethard, Reichenb. Ic. Fl. Ger. ix. t. 411.—Interior; frequent.

293. *JUNCUS EFFUSUS*, Linn. Sp. Pl. 326.—On the south side; rare.

294. *JUNCUS BUFONIUS*, Linn. l. c. 328.

295. *CAREX* ———. Dry hills among bushes, long past fruiting.

296. *CAREX ANGUSTATA*, Boot. Hook. Fl. ii. 218.—Along streams in the northern cañons.

297. *PHALARIS CANARIENSIS*, Linn. l. c. 54.

298. *POLYPOGON MONSPELIENSIS*, Desf. Reichenb. l. c. i. 15. t. 91.

299. *MUHLENBERGIA DEBILIS*, Trin. Agrost. ii. 49.

300. *STIPA* ———. Apparently an undescribed species, but specimens too old.

301. AVENA FATUA, Linn. l. c. 80.
302. MELICA IMPERFECTA, Trin. Icon. Gram. t. 355.
303. DISTICHLIS SPICATA=*Uniola spicata*, Linn: *D. maritima*, Raf. Journ. Phys. lxxxix. 104.
304. BROMUS ———.
305. ELYMUS CONDENSATUS, Presl. Rel. Hænk. i. 265.
306. AGROPYRUM REPENS, Beauv. Reichenb. Ic. t. 120.
307. HORDEUM MURINUM, Linn. l. c. 85.
308. FESTUCA MYURUS, Linn. l. c. 74.
309. EQUISETUM ———. The specimens do not match any of our mainland forms, and possibly two species are represented.
310. POLYPODIUM CALIFORNICUM, Kaulf. Enum. 102.
311. PELLEA ORNITHOPUS, Hook. Sp. Fil. ii. 143. t. 116.
312. PELLEA ANDROMEDÆFOLIA, Fée. Gen. Fil. 129.
313. CHEILANTHES CALIFORNICA, Metten. Cheil. 44.
314. NOTHOLÆNA CANDIDA, Hook. l. c. 116.
315. PTERIS AQUILINA, Linn. l. c. 1075.
316. ADIANTUM PEDATUM, Linn. l. c. 1095.—A fine growth of this most beautiful fern (rare in California), in one of the principal cañons of the north side.
317. ADIANTUM CAPILLUS-VENERIS, Linn. l. c. 1096.
318. WOODWARDIA RADICANS, Smith. Mem. Acad. Turin. v. 412.
319. ASPIDIUM MUNITUM, Kaulf. Enum. 326.
320. ASPIDIUM RIGIDUM, Swartz, Syn. Fil. 53.

321. ASPIDIUM ———. A fern of more delicate texture than the preceding number, not well in fruit.

3. *Three New Species.*

HORKELIA KELLOGGII. Stems stout, ascending or nearly prostrate, a foot long or more, from a thick ligneous, very branching caudex: leaves of 5—7 pairs of obovate, coarsely and rather deeply toothed leaflets: calyx-tube cupuliform, a line deep and $2\frac{1}{2}$ lines broad; segments lanceolate, about 3 lines long, fully equalled by the oblong bracteoles: petals 3 lines long, spatulate-oblong, clear white: the subulate filaments also white, the 5 opposite the petals perceptibly shorter than the other 5.—*H. Californica*, var. *sericea*, Gray, Proc. Am. Acad. vi. 529; Bot. Cal. i. 181.

Most distinct from *H. Californica* in habit as well as in the color of the flowers and the very dissimilar proportions of tube and limb of the calyx. In that species the tube is not barely campanulate (much farther from cupuliform), it is even somewhat urceolate, and nearly equal to the limb itself in length. The peculiar pubescence of the present plant is a good character, and the only one heretofore mentioned by authors. The species is apparently very local, being now confined, in so far as I can discover, to two or three town lots, which still remain unoccupied, in the western part of Alameda, hence it is destined to an early extinction, unless some new locality can be discovered for it. The lots in which it is now growing are of a sandy soil and form part of a bluff little elevated above the beach. *H. Californica* is a common plant of the wooded hills on both sides of the Bay of San Francisco. The plant was originally discovered by the late Dr. Albert Kellogg, and may appropriately be dedicated to him who has so lately passed from among us.

HORKELIA PARRYI. Cæspitose, the slender stems 6—10 inches high: herbage green, and with a sparse soft pubescence and some glands about the inflorescence: leaflets

cuneate-obovate, toothed or cleft chiefly at the apex: cymes very loose: calyx altogether rotate, with no tube; bracteoles narrow and only half as long as the broadly-lanceolate segments: petals obovate-oblong, not unguiculate, but narrower at base, 3 lines long, far surpassing the calyx, clear white: filaments all subulate, those opposite the petals only $\frac{2}{3}$ the length of the other 5.

Ione, Amador county: collected long ago by Mr. Harry Edwards, and more recently by Mrs. Curran, and by Dr. Parry. A very pretty species, with showy flowers, which are altogether those of an ordinary *Potentilla*, save that the filaments are very strongly dilated; and the genus, as most authorities now think, is rather artificial, and should perhaps be suppressed, following Bentham and Hooker.

CONVOLVULUS BINGHAMÆ. Perennial from creeping rootstocks, the stems 3—6 feet long, twining or trailing: leaves glabrous, oval or oblong, rather abruptly acute, the base with a pair of obtuse parallel or very little divergent hastate lobes: peduncles 1-flowered: bracts oval to narrowly oblong, 4 lines long, flat and closely subtending and appressed to the calyx, which they are too small to half conceal: calyx 6—8 lines long: corolla pure white: stamens rather short, the tips of the anthers attaining to the base only of the linear stigmas.

In marshy places about Burton's Mound, in the city of Santa Barbara; collected in 1886, by Mrs. R. F. Bingham, and the writer. Its rhizomatous subterranean parts place it in close affinity with *C. sepium*, from which its peculiar bracts well distinguish it, and remove it far enough from the two suffrutescent species which are most common in the western parts of California, namely, *C. occidentalis* and *C. luteolus*. These two most distinct species have been very unfortunately run into one by their author, in the Synoptical Flora Supplement. Perhaps some imperfect specimens of the plant here defined as new may have led to this confusion; for the author speaks of some in which the bracts

are "oblong and barely equalling" the calyx. They are often narrowly oblong, but they are always shorter than the calyx and never broad enough to come near covering it.

This plant being removed, I may speak positively to the effect that there are no transitions between *C. occidentalis* and *C. luteolus*. In the former the broad, carinate-conduplicate leafy bracts are inserted close under the calyx, which they wholly conceal. In the latter the bracts are merely subulate small affairs, always situated at the good distance of a half inch or more below the calyx, their tips not reaching its base. The flowers of the former are one third larger, and their anthers equal or surpass the stigmas, while in *C. luteolus* the tips of the anthers come up only to the base of the stigma. The latter is a poor twiner, preferring to spread about over the ground or low bushes; although in age, like a grape vine, it will spread over the head of a small oak and hide it with its profusion of leaves and flowers. *C. occidentalis*, although it becomes shrubby or woody, is from first to last a close twiner, never trailing about, but its stems and branches always spirally twisted around their support: and finally, the two have each its own geographical limits. *C. occidentalis* is wrongly credited to the San Francisco region. I do not know of its occurrence north of Monterey, nor of the existence of *C. luteolus* south of that point. The corollas of both have an uncommon durability among those of their kindred. Those of *C. luteolus* I have long observed to gather up their folds loosely at nightfall of their first day, and unfold them again in the morning for the whole of the second day; and they commonly acquire a deep shade of purple for this second day of their existence. And now that I have the two species growing side by side at Berkeley, I find that the southern species, *C. occidentalis*, does the same, except that the corollas do not very perceptibly change their hue for the second day. I should perhaps say here that the corollas of the new *C. Binghamii*, like those of their ally, *C. sepium*, last for one day only.

ORNITHOLOGICAL OBSERVATIONS IN SAN DIEGO COUNTY.

BY W. OTTO EMERSON.

The months of January, February and March, 1884, found me storm-bound on the Volcano Mountains, about seventy-five miles northeast of San Diego. The intervals between January 15-20 and between April 6-28 were spent in Poway Valley, twenty-two miles north of San Diego.

The Volcano Mountains seem to be a spur from the main range, rising about 5,000 feet above sea level. Eastward as far as the eye can see lies the so-called desert. Westward among the valleys and tablelands (*mesas*) the country is sparsely settled. The western side of the range is well timbered with several species of oaks, while towards the north, dark, heavy belts of timber are seen.

Poway Valley is surrounded by high rolling hills; these in many places are bare and rocky; again, covered with patches of cacti. Black and white sage is the principal vegetation covering the sides of the many ravines. Very few trees of any kind are seen; these comprise oaks, elders, occasional sycamores and clumps of willows. The elders grow very large, the berries furnishing food for Robins, Mockingbirds, Bluebirds, House Finches, and others. The sycamores are the habitation of several species of rapacious birds. Numerous kinds of cacti are found, the one known as *cholla* being used by many birds to build their nests in.

In the present paper it is intended to show the relative abundance of the various species found on the Volcano Mountains in winter; also those of Poway Valley in winter, and of the latter place after the spring migrants had begun to arrive. The lists are somewhat incomplete, owing to my ill health preventing observations during the severest weather. The winter was an unusually severe one on the

mountains, snow often covering the ground to the depth of two feet. Nine inches fell during one night.

I am under obligations to Dr. J. G. Cooper and Mr. Robert Ridgway for identifying several of the species included in these lists. Specimens were taken of all excepting Golden Eagle, Turkey Buzzard, Crow, and Sandhill Crane.

Arriving on the mountains in January, bird life was met with in profusion, scattered among the trees and bushes, no storms having yet occurred to drive them down to the valleys or confine them to sheltered flats along the creeks. After the first hard rain storm they commenced moving lower down, and the first fall of snow, towards the latter part of January, sent them hurrying to the warmer valleys.

The species taken or seen on the mountains were as follows:

1. *Grus mexicana*.

SANDHILL CRANE.—A large flock was seen flying northward March 16th, and another on March 20th.

2. *Oreortyx pictus plumiferus*.

PLUMED PARTRIDGE.—A bevy of forty or more was seen in January. They were not as common as the Valley Partridge.

3. *Callipepla californica vallicola*.

VALLEY PARTRIDGE.—Abundant. This species withstands the cold and snow far better than its larger relative. The Plumed Partridge became scarce after the first heavy fall of snow, having gone to a lower altitude to winter.

4. *Cathartes aura*.

TURKEY VULTURE.—Only noticed on one occasion, when eight or nine were seen circling above the main ridge (February 22d).

5. *Accipiter velox*.

SHARP-SHINNED HAWK.—One seen February 22d.

6. *Accipiter cooperi*.

COOPER'S HAWK.—Tolerably common.

7. *Buteo borealis calurus*.

WESTERN RED-TAIL.—Common. Eggs were brought to me as early as February 20th.

8. *Archibuteo ferrugineus*.

FERRUGINEUS ROUGH-LEG.—A male was shot February 25th, at the foot of the mountains, by my friend Mr. Fred. Paine.

9. *Aquila chrysaetos*.

GOLDEN EAGLE.—Seen flying on several occasions. No doubt breeds in this vicinity.

10. *Falco sparverius*.

AMERICAN SPARROW HAWK.—One bird was seen March 1st.

11. *Bubo virginianus subarcticus*.

WESTERN HORNED OWL.—Sometimes heard calling at dusk from some oaks near the house.

12. *Dryobates villosus harrisii*.

HARRIS'S WOODPECKER.—One male taken.

13. *Melanerpes formicivorus bairdi*.

CALIFORNIAN WOODPECKER.—Common. In stormy weather remaining concealed in the oaks, but on sunny days coming about, with their glad *ēkup, ēkup, ēkup*.

14. *Colaptes cafer*.

RED-SHAFTED FLICKER.—Rare on the mountains.

15. *Trochilus anna*.

ANNA'S HUMMINGBIRD.—A male flew past the house the morning of March 11th, hurrying to leave a place where the snow lay over everything.

16. *Otocoris alpestris rubea*.

RUDDY HORNED LARK.—Common on open flats.

17. *Cyanocitta stelleri frontalis*.

BLUE-FRONTED JAY.—Common at all times.

18. *Aphelocoma californica*.

CALIFORNIA JAY.—Common. More social than the Blue-fronted Jay, coming about the corrals and sheds for scattered corn, and often going to the feed boxes to help themselves. Specimens which were taken differ considerably from the same species found at Haywards, Cal., being smaller and somewhat different in color.

19. *Corvus americanus*.

AMERICAN CROW.—Two or three pairs were seen about the ranch during the winter. A large colony had nesting sites in some willows at the foot of the mountain in the spring.

20. *Sturnella magna neglecta*.

WESTERN MEADOWLARK.—Rarely seen on the mountains.

21. *Scolecophagus cyanocephalus*.

BREWER'S BLACKBIRD.—Three males came around the house during a snow storm on February 11th; a female was seen on March 20th.

22. *Carpodacus frontalis rhodocolpus*.

CRIMSON HOUSE FINCH.—Not common. Heard one singing on February 22d.

23. *Spinus lawrencei*.

LAWRENCE'S GOLDFINCH.—A small flock was seen twice in January.

24. *Ammodramus sandwichensis alaudinus*.

WESTERN SAVANNA SPARROW.—A single specimen was taken March 9th.

25. *Chondestes grammacus strigatus*.

WESTERN LARK SPARROW.—Common in flocks about open ground.

26. *Zonotrichia gambeli*.

GAMBEL'S SPARROW.—Common.

27. *Zonotrichia coronata*.

GOLDEN CROWNED SPARROW.—Tolerably common. Associated with Gambel's Sparrow.

28. *Junco hyemalis oregonus*.

OREGON JUNCO.—Common.

29. *Melospiza fasciata heermanni*.

HEERMANN'S SONG SPARROW.—Rare.

30. *Melospiza lincolni*.

LINCOLN'S SPARROW.—The only individual seen was taken January 25th.

31. *Passerella iliaca unalaschcensis*.

TOWNSEND'S SPARROW.—Common. A specimen which Mr. Ridgway has identified approaches closely to the variety *megarhyncha* in size of bill and coloration.

32. *Pipilo maculatus megalonyx*.

SPURRED TOWHEE.—Common. Could be heard singing on any clear morning from the top of low bushes.

33. *Pipilo fuscus crissalis*.

CALIFORNIAN TOWHEE.—Common.

34. *Tachycineta thalassina*.

VIOLET-GREEN SWALLOW.—First seen March 17th, early in the morning, but finding five inches of snow on the ground they circled about for three hours and then disappeared, returning April 1st, when I noticed them resting on bare oak twigs.

35. *Dendroica auduboni*.

AUDUBON'S WARBLER.—Was seen February 22d, towards the foot of the mountains.

36. *Harporhynchus redivivus*.

CALIFORNIAN THRASHER.—Heard singing on March 9th.

37. *Troglodytes ædon parkmanii*.

PARKMAN'S WREN.—One specimen was taken January 24th, and another seen on the 28th.

38. *Sitta carolinensis aculeata*.

SLENDER-BILLED NUTHATCH.—Seen and heard singing every day. Appeared to be looking for nesting sites March 1st.

39. *Parus inornatus*.

PLAIN TITMOUSE.—Common. The males were singing the latter part of March.

40. *Parus gambeli*.

MOUNTAIN CHICKADEE.—Common. Noticed them singing March 1st.

41. *Psaltriparus minimus californicus*.

CALIFORNIAN BUSH-TIT.—Seen February 24th, during a heavy snow storm, with a flock of the Mountain Chickadee.

42. *Regulus calendula*.

RUBY-CROWNED KINGLET.—Two birds were seen the last of March.

43. *Myadestes townsendii*.

TOWNSEND'S SOLITAIRE.—Only two or three were seen.

44. *Turdus aonalaschkæ*.

DWARF HERMIT THRUSH.—Rare. None were seen after February 22d.

45. *Merula migratoria propinqua*.

WESTERN ROBIN.—Common wherever the ground was bare and soft.

46. *Sialia mexicana*.

WESTERN BLUEBIRD.—Common. Mated by March 1st.

I left the Volcano Mountains on April 2d, and went into camp the same day at the foot of the mountains, on my return to Poway Valley. About dusk two Russet-backed

Thrushes were seen. On entering the Santa Isabel Valley next day, the Arkansas Kingbird was found in pairs perched upon dry weed-stalks. Crimson House Finch, Western Lark Sparrow, Western Meadowlark and Brewer's Blackbird, were common through the green fields, while the air above was merry with the twitter of many Cliff Swallows. Lower in the valley the following were seen: American Sparrow Hawk, Western Red-Tail, Bullock's Oriole, Purple Martin, Audubon's and Pileolated Warblers. On the plains I noticed Western Savanna Sparrow, Western Lark Sparrow, Crimson House Finch, Yellow-headed and Bicolored Blackbirds, flocks of Mountain Plover and Ruddy Horned Lark. A few pairs of Ash-throated Flycatchers, a species which arrives late, showed that the spring migration to San Diego county was far advanced. Cliff Swallows had commenced building under the eaves of an adobe house, and about a moist spot of ground several Killdeers were feeding. The lonesome notes of the Poor-will could be heard almost continually throughout the night.

In the following list of the birds of Poway Valley, seen or taken by me in April, I have included in their order those noticed in January. Such winter birds are indicated by *.

1. *Ægialitis vocifera*.

KILLDEER.—Tolerably common. Breeds.

*2. *Callipepla californica*.

CALIFORNIA PARTRIDGE.—Very plentiful among the cacti.

*3. *Zenaidura macroura*.

MOURNING DOVE.—Tolerably common.

4. *Pseudogryphus californianus*.

CALIFORNIA VULTURE.—I hardly expected to have the good fortune to see this rare bird, but one day I heard a sound, as of wind coming through the oaks, and saw a large shadow passing over the ground. Soon this bird of immense wings

went sailing by towards the mountains. I had time to note the bare, bright colored head, outstretched from the body, and then he was gone. This rare species is now confined to the mountains back from the coast. I have been told by Mr. Henry Chapman (now deceased) that they were once common in San Joaquin and Sacramento Valleys.

5. *Accipiter velox*.

SHARP-SHINNED HAWK.—One specimen was taken in January. Not afterwards seen.

*6. *Buteo borealis calurus*.

WESTERN RED-TAIL.—Common in the vicinity of trees.

7. *Falco sparverius*.

AMERICAN SPARROW HAWK.—Common.

8. *Strix pratineola*.

AMERICAN BARN OWL.—A few seen at dusk among oaks.

9. *Bubo virginianus subarcticus*.

WESTERN HORNED OWL.—Common.

*10. *Speotyto cunicularia hypogæa*.

BURROWING OWL.—Common. Fresh eggs were taken April 23d.

11. *Dryobates pubescens gairdnerii*.

GAIRDNER'S WOODPECKER.—Common among oak trees.

*12. *Colaptes cafer*.

RED-SHAFTED FLICKER.—Common.

13. *Phalænoptilus nuttalli*.

POOR-WILL.—Tolerably common.

14. *Chordeiles virginianus henryi*.

WESTERN NIGHTHAWK.—Common.

15. *Trochilus alexandri*.

BLACK-CHINNED HUMMINGBIRD.—Common. More so than any other of this genus. Fresh eggs were taken, and half-fledged young found April 23d.

16. *Trochilus anna*.

ANNA'S HUMMINGBIRD.—Rare. One male seen.

17. *Trochilus rufus*.

RUFIOUS HUMMINGBIRD.—Rare.

18. *Tyrannus verticalis*.

ARKANSAS KINGBIRD.—Common. Nests were ready to receive eggs by the last of April.

***19. *Tyrannus vociferans*.**

CASSINS KINGBIRD.—Common. Nests about the same time as the Arkansas Kingbird, but the eggs are not distinguishable from those of that species.

20. *Myiarchus cinerascens*.

ASH-THROATED FLYCATCHER.—One pair seen.

***21. *Sayornis nigricans*.**

BLACK PHEBE.—Common. Eggs taken April 27th.

22. *Empidonax difficilis*.

BAIRD'S FLYCATCHER.—Was noticed only once, on April 8th.

***23. *Otocoris alpestris rubea*.**

RUDDY HORNED LARK.—Tolerably common. Incubated eggs were found April 20th.

24. *Aphelocoma californica*.

CALIFORNIA JAY.—Common.

25. *Xanthocephalus xanthocephalus*.

YELLOW-HEADED BLACKBIRD.—Seen in small flocks. The male has an odd way of throwing his head to one side when singing.

26. *Agelaius gubernator*.

BICOLORED BLACKBIRD.—Common.

27. *Agelaius tricolor*.

TRICOLORED BLACKBIRD.—Tolerably common.

*28. *Sturnella magna neglecta*.

WESTERN MEADOWLARK.—Tolerably common.

29. *Icterus cucullatus nelsoni*.

ARIZONA HOODED ORIOLE.—Common. Nests in gum trees were completed by the last of April. From the appearance of specimens taken I should judge that it required from two to three years for the males to attain full plumage.

30. *Icterus bullocki*.

BULLOCK'S ORIOLE.—Common. Not found near the vicinity of the nesting places of the Hooded Oriole.

31. *Scolecophagus cyanocephalus*.

BREWER'S BLACKBIRD.—Very common. Nests in pepper trees. One nest taken April 17th contained seven eggs.

*32. *Carpodacus frontalis rhodocolpus*.

CRIMSON HOUSE FINCH.—Nest and fresh eggs taken April 18th.

*33. *Spinus psaltria*.

ARKANSAS GOLDFINCH.—Tolerably common. Fed on young oak buds.

34. *Spinus lawrencei*.

LAWRENCE'S GOLDFINCH.—Common. Found large young and fresh eggs April 23d.

***35. *Pooecætes gramineus confinis*.**

WESTERN VESPER SPARROW.—Tolerably common.

***36. *Ammodramus sandwichensis alaudinus*.**

WESTERN SAVANNA SPARROW.—Tolerably common.

***37. *Chondestes grammacus strigatus*.**

WESTERN LARK SPARROW.—Common among clumps of cactus. Fresh eggs taken April 20th.

***38. *Zonotrichia gambeli*.**

GAMBEL'S SPARROW.—Common.

39. *Spizella socialis arizonæ*.

WESTERN CHIPPING SPARROW.—Heard singing.

40. *Amphispiza belli*.

BELL'S SPARROW.—Tolerably common. Keeps among thick brush.

***41. *Pipilo fuscus crissalis*.**

CALIFORNIAN TOWHEE.—Tolerably common. Was building by the middle of April.

42. *Habia melanocephala*.

BLACK-HEADED GROSBK.—A single male was seen.

43. *Passerina amœna*.

LAZULI BUNTING.—Rare.

44. *Petrochelidon lunifrons*.

CLIFF SWALLOW.—Common.

45. *Tachycineta thalassina*.

VIOLET-GREEN SWALLOW.—About ten birds were seen flying in a northerly direction April 10th.

*46. *Lanius ludovicianus excubitorides*.

WHITE-RUMPED SHRIKE.—Common.

47. *Vireo gilvus*.

WARBLING VIREO.—Was seen singing in the oaks.

48. *Dendroica æstiva*.

YELLOW WARBLER.—Rare. One male seen.

*49. *Dendroica auduboni*.

AUDUBON'S WARBLER.—A few seen in April.

50. *Geothlypis trichas occidentalis*.

WESTERN YELLOW THROAT.—Rare.

*51. *Mimus polyglottus*.

MOCKINGBIRD.—Could be heard singing morning and evening, and often on moonlight nights.

52. *Harporhynchus redivivus*.

CALIFORNIAN THRASHER.—Quite common throughout the low hills.

53. *Campylorhynchus brunneicapillus*.

CACTUS WREN.—Common. A nest and fresh eggs taken April 18th.

54. *Salpinctes obsoletus*.

ROCK WREN.—Tolerably common in suitable localities.

55. *Troglodytes aedon parkmanii*.

PARKMAN'S WREN.—Common.

*56. *Chamæa fasciata*.

WREN-TIT.—Tolerably common.

57. *Psaltriparus minimus californicus*.

CALIFORNIAN BUSH-TIT.—Found a nest with young, April 23d.

58. *Regulus calendula*.

RUBY-CROWNED KINGLET.—A male was seen April 27th.

59. *Polioptila cærulea*.

BLUE-GRAY GNATCATCHER.—Rare. Two males were taken in January.

60. *Turdus aonalaschkæ*.

DWARF HERMIT THRUSH.—Tolerably common in January. Fed upon the berries of the pepper tree.

*61. *Merula migratoria propinqua*.

WESTERN ROBIN.—Was seen in the valley April 28th.

62. *Sialia mexicana*.

WESTERN BLUEBIRD.—Very common among the pepper trees during my visit in January.

63. *Sialia arctica*.

MOUNTAIN BLUEBIRD.—A few seen about a plowed field in January. I was told that it was the first time that they had been seen in the valley.

DESMIDS OF THE PACIFIC COAST.

IDENTIFIED BY REV. FRANCIS WOLLE.

List of Desmids, etc., collected by Mrs. Hansen and Miss Haggin near Lake Tahoe, Aug., 1886:

1. *HYALOTHECA MUCOSA* (Mert.), Ralfs.
2. *BAMBUSINA BREBISSEONII*, Kg.
3. *DESMIDIUM BAILEYI*, Ralfs.
4. *SPHEROZOSMA EXCAVATUM*, Ralfs.
5. *SPHEROZOSMA SERRATUM*, Bailey.
6. *PENIUM DIGITUS* (Ehrb.), Breb.
7. *PENIUM MINUTUM*, Cleve.
8. *PENIUM CURTUS*, Kirch.
9. *CLOSTERIUM ACEROSUM* (Schrank.), Ehrb.
10. *CLOSTERIUM DIANÆ*, Ehrb.
11. *CLOSTERIUM PARVULUM*, Naeg.
12. *CLOSTERIUM PRONUM*, Delp.
13. *CLOSTERIUM ROSTRATUM*, Ehrb.
14. *CLOSTERIUM SETACEUM*, Ehrb.
15. *DOCIDIUM BACULUM*, D. By.
16. *DOCIDIUM MINUTUM*, Ralfs.
17. *COSMARIUM ACULEATUM*, Wolle.
18. *COSMARIUM AMÆNUM*, Breb.
19. *COSMARIUM BIOCULATUM*, Breb.

20. *COSMARIUM BREBISSONII*, Menegh.
21. *COSMARIUM CONTRACTUM*, Kirch.
22. *COSMARIUM CRENATUM*, Ralfs.
23. *COSMARIUM CUCUMIS*, Corda.
24. *COSMARIUM EXIGUUM*, Arch.
25. *COSMARIUM MARGARITIFERUM*, Menegh.
26. *COSMARIUM MENEGHINII*, Breb.
27. *COSMARIUM MONILIFORME*, Ralfs.
28. *COSMARIUM NITIDULUM*, DeNot.
29. *COSMARIUM ORNATUM*, Ralfs.
30. *COSMARIUM ORTHOSTICUM*, Lund.
31. *COSMARIUM PACHYDERMUM*, Lund.
32. *COSMARIUM PSEUDOTAXICHONDRUM*, Nord.—a form.
33. *COSMARIUM PYRAMIDATUM*, Breb.
34. *COSMARIUM QUADRATUM*, Ralfs.
35. *COSMARIUM RALFSII*, Breb.
36. *COSMARIUM RHOMBUSOIDES*, Wolle, n. sp.
37. *COSMARIUM SUBLOBATUM*, Arch.
38. *COSMARIUM TETRAOPHTHALMUM* (Kg.), Breb.
39. *COSMARIUM TRIPLICATUM*, Wolle—a form.
40. *COSMARIUM TUMIDUM*, Lund.
41. *XANTHIDIUM ANTILOPÆUM* (Breb.), Kg.

42. XANTHIDIUM CRISTATUM (Breb.), Ralfs.
43. XANTHIDIUM FASCICULATUM (Ehrb.), Ralfs.
44. ARTHRODESMUS CONVERGENS (Ehrb.), Ralfs.
45. ARTHRODESMUS OVALIS, Wolle.
46. ARTHRODESMUS SUBULATUS, Kg.
47. EUASTRUM BINALE (Turpin), Ralfs.
48. EUASTRUM ELEGANS, Kg.
49. EUASTRUM INERME, Lund.
50. EUASTRUM SIMPLEX, Wolle.
51. EUASTRUM SPINOSUM, Ralfs.
52. MICRASTERIAS FURCATA (Kg.), Ralfs.
53. MICRASTERIAS PINNATIFIDA (Kg.), Ralfs.
54. MICRASTERIAS RADIOSA (Ag.), Ralfs.
55. STAURASTRUM ALTERNANS, Breb.
56. STAURASTRUM ARCTISCON, Ehrb.
57. STAURASTRUM ARISTIFERUM, Ralfs.
58. STAURASTRUM AVICULA, Breb.
59. STAURASTRUM BRASILIENSE, Nord. Var. TRIQUETRUM.
Wolle, n. var.
60. STAURASTRUM BREVISPIÑA, Breb.
61. STAURASTRUM CREMATUM, Bailey.
62. STAURASTRUM CUSPIDATUM, Breb.

63. STAURASTRUM CYRTOCERUM, Breb.
64. STAURASTRUM DEJECTUM, Breb.
65. STAURASTRUM DICKIEI, Ralfs.
66. STAURASTRUM ECHINATUM, Breb.
67. STAURASTRUM EUSTEPHANUM, Ralfs.
68. STAURASTRUM FURCIGERUM, Breb.
69. STUARASTRUM FUSIFORME, Wolle.
70. STAURASTRUM GRACILE, Ralfs.
71. STAURASTRUM HIRSUTUM (Ehrb.), Breb.
72. STAURASTRUM INCONSPICUUM, Nord.
73. STAURASTRUM LEPTOCLADUM, Nord.
74. STAURASTRUM MARGARITACEUM, Ehrb.
75. STAURASTRUM MUTICUM, Breb.
76. STAURASTRUM PARADOXUM, Meyen.
77. STAURASTRUM SCABRUM, Breb.
78. STAURASTRUM SEBALDI, Reinsch.
79. STAURASTRUM SUBTELIFERUM.
80. STAURASTRUM TRICORNE, Breb.
81. STAURASTRUM TRIFIDUM, Nord.
82. STAURASTRUM XIPHIDIOPHORUM, Wolle.

Most of these are more or less familiar forms, but *Cos-*

marium rhombusoides I consider a new species. The semi-cells are in the form of a rhombus—four-sided—unlike sex-angularare, which has six sides, as its name implies. It is besides a larger plant than the latter.

I was glad to see *Staurastrum xiphidiophorum*, described by me in Bull. Torr. Club, occurring frequently in the vial. It has been hitherto found only in Minnesota, and differs somewhat from the type in not having quite so many spines (daggers).

Staurastrum Brasiliense, Nord. var. *triquetrum*.—This (the typical plant) was originally found in Brazil, and was described as usually four-sided, sometimes five-sided. Your form, although only three-sided, is so like it that I propose to call it var. *triquetrum*.

The ladies to whom we are indebted for these specimens are to be heartily congratulated upon the success of their researches. Never did I see a richer collection of Desmids, and it afforded me much gratification. I have been trying the past ten years to get fresh-water algæ from your State, but always failing, I began to think that California had none, however rich the marine forms might be.

I might have supposed that the forms of Desmids, etc., found on your coast would differ from ours much more than they do, but I was surprised a few days since to observe by a list published in England how like our own those of Japan are.

The following fresh-water algæ, not belonging to the *Desmidiaceæ*, were also found in the vial:

PEDIASTRUM BORYANUM, Turp.

PEDIASTRUM FORCIPATUM, A. Br.

PEDIASTRUM EHRENBERGII, A. Br.

RHAPHIDIUM POLYMORPHUM, Rabh.

MERISMOPEDIA GLAUCA, Nag.

OPHIOCYTIUM CUSPIDATUM, Bailey.

OPHIOCYTIUM COCHLEARE, A. Br.

OPHIOCYTIUM MAJUS, Nag.

ÆDOGONIUM UNDULATUM, A. Br.

ÆDOGONIUM CRYPTOPORUM, Wittr.

NOSTOC—a small form.

CONFERVA. ?

DIATOMS—several species.

LYNGBYA. ?

FUNGI OF THE PACIFIC COAST.

V.

BY H. W. HARKNESS.

- RAMULARIA EYONYMI, E. & K.—On living leaves of *Eynonymus occidentalis*, Santa Cruz, July, 1884. 3721
- RAMULARIA HERACLEI (Oud.), Sacc.—On living leaves of *Heracleum lanatum*, Oakland, September, 1887. 2802
- RAMULARIA MENTHICOLA, Sacc.—On living leaves of *Mentha Canadensis*, Folsom, May, 1882. 3210
- RAMULARIA MIMULI, E. & K.—On living leaves of *Mimulus luteus*, Folsom, May, 1882. 3215
- PHYLLOSTICTA ANGELICE, Sacc.—On living leaves of *Angelica Breweri*, Donner, September, 1884. 3394
- PHYLLOSTICTA CRUENTA, Fr.—On living leaves of *Smilacina amplexicaulis*, Tamalpais, April, 1882. 3178
- SEPTORIA EPILOBII, West.—On living leaves of *Epilobium coloratum*, Folsom, May, 1882. 3218
- SEPTORIA DESTRUENS, Desm.—On living leaves of *Sidalcea malvaeflora*, Tamalpais, April, 1882. 3176
- SEPTORIA (ENOTHERE, B. & C.—On living leaves of *Oenothera ovata*, Piedmont, March, 1882. 3077
- SEPTORIA PENTSTEMONIS, E. & E.—On living leaves of *Pentstemon centranthifolius* and *P. corymbosus*, Central California, May—August. 3112, 4151
- SEPTORIA RUBI, West.—On living leaves of *Rubus Nutkanus*, Piedmont, June, 1882. 3261

SEPTORIA SCUTELLARIE, Thüm.—On living leaves of *Scutellaria tuberosa*, Antioch, April, 1882. 3109

SEPTORIA STACHYDIS, Rob. & Desm.—On living leaves of *Stachys bullata*, San Francisco, February, 1882. 3020

SEPTORIA SYMPHORICARPI, E. & E.—On living leaves of *Symphoricarpus racemosus*, Niles, May, 1882 3248

KELLERMANNIA YUCEGENA, E. & E. Jour. Myc. i. 154.—On dead leaves of *Yucca brevifolia*, Mohave Desert, March, 1878. 698

KELLERMANNIA POLYGONI, E. & K., Jour. Myc., ii. 111.—On dead stems of *Polygonum polymorphum*, Blue Cañon, April, 1882. 3277

KELLERMANNIA SISYRINCHII, E. & E., Jour. Myc. ii. 111.—On dead stems of *Sisyrinchium bellum*, Berkeley, February, 1882. 3017

ASCOCHYTA FREMONTIÆ.—Hypophyllous, scattered, minute: spores pale-brown, nearly cylindrical, slightly attenuated at the ends, flexuous, 1-septate, but often appearing 3-septate by division of the endochrome, very unequal in size. μ 6—12 \times 30—40.

Covering the lower surface of living leaves of *Fremontia Californica*, Tehachapi, June, 1884. 3719

DIPLODIA FRANGULE, Fekl.—On stems of *Rhamnus Californica*. San Francisco, June, 1881. 2618

DIPLODIA PROFUSA.—On twigs of *Robinia pseudacacia*, Oakland, December, 1882, 2990

DIPLODIA NERII, Spæg.—On dead stems of *Nerium Oleander*, Oakland, February, 1884. 3634

PESTALOZZIA GIBBOSA. — Epiphyllous; acervuli black, erumpent: basidia linear, hyaline, shorter than the spore:

spores elliptic, curved, 4-septate; two lower cells pale brown, the two above them so black that the septum can be seen with difficulty; the apical cell hyaline and crowned by three setæ, with capitate extremities.

Spore μ 8×24 ; setæ, 40.

On partly dead leaves of *Gaultheria Shallon*, frequently covering nearly the entire leaf, which is blackened by the spores. Point Reyes, June, 1886. 4130

SYNCHITRIUM MYOSOTIDIS, Kühn. — On *Eritrichium*, San Diego, May, 1884. 3598

ÆCIDIUM ABUNDANS, Pk.—On living leaves of *Symphoricarpus racemosus*, and succeeded by *Puccinia Symphoricarpi*, Hk. May, 1884. 3174

ÆCIDIUM PHACELLÆ, Pk.—On living leaves of *Placelia circinata*, Yo Semite, June, 1883. 3530

ÆCIDIUM RÆSTELIOIDES, E. & E.—On living leaves and stems of *Sidalcea malvaeflora*, Olema, June, 1886. 4123

RÆSTELIA LACERATA, Fr.—On fruit of *Amelanchier alnifolia*, Sierra Nevada, May, 1886. 2723

UREDO IRIDIS, Schw.—On living leaves of *Iris longipetala* and *I. Douglasii*, San Francisco and Sausalito, June, 1886. 4061, 4095

UREDO ———?—On living leaves of *Acena pinnatifida*.

This, which is the Uredo form of some *Phragmidium*, is very abundant throughout the summer, but although frequently sought for, teleutospores have not yet been seen.

2648, 2523

TRICHOBASIS HELIANTHELLÆ, Pk.—On living leaves of *Helianthella Californica*, Donner, September, 1882. 3405

UROMYCES EUPHORBIÆ, C. & P., with ÆCIDIUM EUPHORBIÆ; Gmel.—On living leaves of *Euphorbia serpyllifolia*, Central California. 3208, 3491, 4126

UROMYCES PSORALEÆ, Pk.—On living leaves of *Psoralea physodes*, Mt. St. Helena, May, 1884. 3482, 3687

UROMYCES ZYGADENI, Pk.—On *Zygadenus Fremonti*, Tamalpais, July, 1886. 4139

PUCCINIA PIMPINELLÆ, Strauss, with ÆCIDIUM.—On living leaves of *Osmorrhiza nuda*, Sausalito, August, 1881. 2750

PUCCINIA ARTEMISIARUM, Duby.—On *Artemisia Californica* and *A. pycnocephala*, San Francisco, June, 1884. 3463, 2812

PUCCINIA BALSAMORRHIZÆ, Pk.—On living leaves of *Balsamorhiza deltoidea*, Verdi, August, 1884. 3745

PUCCINIA CLARKIÆ, Pk.—On living leaves of *Clarkia rhomboidea*, Yo Semite, July, 1883. 3592

PUCCINIA PLUMBARIA, Pk., with ÆCIDIUM.—On leaves of *Gilia linearis*, Reno, Nevada, May, 1884. 3348, 3506

PUCCINIA CONVULVULI, Cast., with ÆCIDIUM CALYSTEGIÆ, Desm.—On living leaves of *Convolvulus luteolus* and *C. villosus*, San Luis Obispo, July, 1885. 4003, 4028

PUCCINIA GRINDELLEÆ, Pk., with ÆCIDIUM.—On living leaves of *Grindelia squarrosa*, Williams, Colusa County, May, 1884. 3513

PUCCINIA NIGRESCENS, Pk., with ÆCIDIUM.—On living leaves of *Audibertia incana* and *A. stachyoides*. Reno, Nevada, August, 1882. and Tres Pinos, California, July, 1885. 3365, 4022

PUCCINIA TROXIMONTIS, Pk.—On living leaves of *Troximon heterophyllum*, San Francisco, May, 1883. 3136

PUCCINIA SUBCIRCINATA, E. & E., with ÆCIDIUM.—On living leaves of *Senecio triangularis*, Donner, August, 1883.

3572

PUCCINIA VIOLE, DC., with ÆCIDIUM.—On living leaves of *Viola canina*, Cisco, July—August, 1883.

3486, 3544

PUCCINIA WYETHIÆ, Pk.—On living leaves of *Wyethia mollis*, Donner, Sierra Nevada, September, 1882.

3406

PERONOSPORA VITICOLA, B. & C.—On living leaves of *Vitis Californica*, near Bartlett Springs, Lake County, June, 1884, and Russian River, June, 1886.

3706, 4128

This fungus, forming large white patches, is confined to the lower surface of the leaf, where only the stomata from which it emerges is found. The corresponding part of the upper surface is much paler than the healthy portion of the leaf, on which account it is noticeable to a considerable distance. In both the cases noted above it was very abundant, and is a menace to our vineyards not to be lightly regarded.

It was first observed in 1872, in a vineyard near Sacramento, which has since, the vines having been uprooted, been devoted to other uses. The vineyard was near the levee and in close proximity to wild grape vines, from which the fungus was undoubtedly derived.

Dr. Farlow, in Bull. Bussey Inst. i. 422, March, 1876, speaking of this disease of the vine, says:

“One would naturally suppose that a fungus so common as *Peronospora viticola*, which often is found on every leaf of a vine, would have an injurious effect upon the grape crop. Such, however, is not the case. The fungus does not attack the grapes themselves; nor does it, at least in New England, appear until about the first of August; and its withering effect upon the leaves is not very evident before September. As far as out-of-door grape culture in the Northern States is concerned, we are inclined to believe,

that, practically no harm is done by *Peronospora viticola*, but that, on the contrary, the fungus is really beneficial. Our native vines have a luxuriant growth of leaves; and the danger is that, in our short summers, the grapes will not be sufficiently exposed to the sun to ripen. But the *Peronospora* arrives, with us, at a period when the vine has attained its growth for the season; the important point being then to ripen up the grapes which are concealed by the foliage. By shrivelling up the leaves, the *Peronospora* enables the sun to reach the grapes without loss to the vines, as is shown by the fact that the vines continue to live on, year after year, without apparent injury. Should the fungus be introduced into Central Europe, the case might be different. The foliage of *Vitis vinifera* is by no means as luxuriant as that of our own vines; the winters are warmer, the springs earlier, and the summers much moister than here; and it is quite possible that the advent of the *Peronospora*, by reason of the greater warmth and moisture, would be some weeks earlier than here, before the vine had attained its growth, and at a time when the leaves are needed for the work of absorption and assimilation. It might be that the introduction of *Peronospora viticola* into Europe would prove a repetition, on a small scale, of what has, unfortunately, already happened in the case of *Phylloxera*."

It will be seen that Dr. Farlow thinks that *Peronospora viticola* is not likely to prove injurious in the Northern States, but in California the climate and conditions are similar to those of France and Italy, where he justly feared its introduction. It appears with us on the wild vine at the time of flowering and robs it of the leaves necessary to shield the growing grapes from the scorching rays of the sun.

Sulphuring, washes, and all such remedies, used with more or less success in various fungoid diseases of the vine, are necessarily useless in this; for the resting spore, by

which it propagates in the succeeding year, is formed deep in the substance of the leaf, and only becomes free by its decay.

Vineyards in the vicinity of infested wild vines will sooner or later acquire it from them; and the experience of the coffee plantations of Ceylon will be repeated. These became infected by a fungus, probably infrequent on the original host, which propagated itself to such an extent on the more fertile one as almost to ruin the planters.

The only effectual remedy which can be suggested is to destroy by fire the infected vines—taking especial care that no leaves escape; and where a vineyard is to be planted in the vicinity of wild vines, it would be well to destroy the latter as a measure of precaution.

PERONOSPORA OXYBAPHI, E. & K.—On living leaves of *Abronia Cruc-Malte*, Reno, Nevada, August, and *A. umbellata*, San Francisco, November, 1882. 3368, 3436

VALSA IMPULSA, C. & P.—On *Pyrus sambucifolia*, Donner, August, 1883. 3551

VALSA FEMORALIS, Pk.—On dead twigs of *Alnus rubra*, Sunol, December, 1881. 2961

VALSA EXIGUA, Nits.—On dead twigs of *Acer macrophyllum*, Sunol, September, 1882. 3385

DIATRYPELLA FROSTII, (Pk.)—On dead branches of *Acer macrophyllum*, Tamalpais, February, 1885. 3907

DIATRYPELLA PROMINENS, Howe.—On dead branches of *Platanus racemosa*, Sunol, January, 1885. 4007

DIATRYPE RHOIS (Schw.)—On dead branches of *Rhus diversiloba*, San Francisco, September, 1885. 4074

- DIAPORTHE (TETRASTAGA) ROSTELLATA, (Fr.)—On dead stems of *Rubus Nutkanus*, Cisco, August, 1884. 3782
- DIAPORTHE (CHOROSTATE) TESSERA, (Fr.)—On dead twigs of *Corylus rostrata*, San Rafael, March, 1882. 3066
- STIGMATEA GERANII, Fr.—On living leaves of *Geranium Carolinianum*, Alameda, April, 1882. 3196
- GNOMONIA SETACEA, (Pers.)—On dead leaves of *Corylus rostrata*, Sausalito, January, 1883. 3477
- SPHERELELLA MOLLERIANA, Thüm.—On living leaves of *Eucalyptus globulus*, San Francisco, December, 1881. 2880
- SPHERELELLA GAULTHERIE, C. & P.—On living leaves of *Gaultheria Shallon*, Lagunitas, November, 1882. 3431
- ANTHOSTOMELLA PERFIDIOSA (De Not.)—On dead stems of *Symphoricarpus racemosus*, Sausalito, August, 1881. 2745
- SORDARIA LANUGINOSA, Sacc.—On dead branches of *Lupinus arboreus*, San Francisco, June, 1886. 4137
- LEPTOSPHERIA ARVENSIS, Sp.—On *Equisetum arvense*, Lake Tahoe, September, 1884. 3766
- LOPHIOSTOMA ACERVATUM, Karst.—On dead twigs of *Prunus demissa*, August, 1883. 3555
- PLEOSPORA SALSOLÆ, Fekl.—On dead stems of *Salicornia herbacea*, Tamalpais, February, 1885. 3913
- PLEOSPORA LEGUMINUM, (Wallr.)—On dead stems of *Hosackia Purshiana*, Mt. Diablo, August, 1884. 3798
- PLEOSPORA FRANGULÆ, Fekl.—On twigs of *Rhamnus Californica*, Blue Cañon, June, 1882. 3301

PLEOSPORA OLIGOMERA, Sacc. & Speg.—On dead stems of *Silene Gallica*, San Francisco, 1885. 4089

PLEOSPORA TYPHE, Pas.—On dead leaves of *Typha latifolia*, San Francisco, June, 1882. 2986

CUCURBITARIA RIBIS, Niessl.—On dead leaves of *Ribes sanguineum*, Blue Cañon, June, 1882. 3297

THYRIDIDIUM CINGULATUM, (Mont.)—On dead branches of *Symphoricarpus racemosus*, Alta, August, 1884. 3827

MAZZANTIA GALII, (Fr.)—On *Galium aparine*, Sausalito, August, 1881. 2772

PHYLLACHORA EFFUSA, Schw.—On *Helianthus gracilentus*, San Vicente, July, 1885. 4065

PHYLLACHORA PTERIDIS, (Reb.)—On living leaves of *Pteris aquilina*, Blue Cañon, Sierra Nevada, September, 1882. 3398

PHYLLACHORA? POLEMONII.—Amphigenous; spots black, roundish, 1-3 lines broad, papillate and shining.

Growing on both surfaces of living leaves of *Polemonium humile*, Donner. Sierra Nevada, September, 1882. 3397

This fungus, which is very abundant and showy, has not yet been found mature. A section shows the densely aggregated perithecia involved in the stroma, but no trace of asci.

The high altitude at which it grows (over 7,000 feet) accounts for this fact, as it is covered by the heavy snows of winter before the formation of asci, and the texture of the leaves on which it is found is so thin and fragile that no trace of them can be found the succeeding year.

MONTAGNELLA TUMEFACIENS, Ell. & Hk. Jour. Myc. ii. 41.
Forming gouty swellings which bear considerable resemblance to the "Black Knot," *Dothidea morbosa*, on twigs of *Artemisia Californica*, Mt. Diablo, April, 1882. 3101

TYMPANIS FRANGULÆ, Fr.—On dead stems of *Rhamnus Californica*, Sausalito, February, 1881. 2534

OCCULTATIONS OF STARS BY THE DARK LIMB OF THE MOON

At the Davidson Observatory, San Francisco, Cal.

COMMUNICATED TO THE CALIFORNIA ACADEMY OF SCIENCES, MARCH 1st, 1887,

BY PROF. GEORGE DAVIDSON, A. M., D. Ph.

CLARK EQUATORIAL, 6.4 INCHES.

Date. 1887,	Observer.	Power.	Star.	Magn.	Local Sidereal Times.	Remarks.
Jan. 28.	G. F. D.	90	(? Stone 139).	7	H. M. S. 5 46 41.6	Obsn. good (a)
Feb. 2.	G. D...	90	70 Tauri.....	6	5 49 21.5	“ but * ft. ob- jective partly covered.
“ 2.	G. D...	90	Arg. 15: 630..	8.7	7 50 23.5	Disapp'nce sharp and sudden
“ 2.	G. D...	90	θ Tauri.....	4	7 50 45.5	“ “ “
“ 2.	G. D...	90	75 Tauri.....	6	7 51 23.4	“ “ “
“ 2.	G. D...	90	Arg. 15: 633..	6.5	7 54 30.2	“ “ “
“ 2.	G. D...	90	Arg. 15: 635..	8.5	8 31 21.7	“ “ “
“ 2.	G. D...	90	B. A. C. 1391.	5	8 46 09.6	“ “ “
“ 2.	G. D...	90	B. A. C. 1394.	7	8 53 38.3	“ “ “

(a) The identity of this star somewhat doubtful. Transit Observations for time for this, and the observations of February 2d, by G. D.

Observers:—G. F. D.=G. Fauntleroy Davidson.

G. D.=George Davidson.

Geographical Position of Observatory:

Latitude=37° 47' 24."75 N.

Longitude=122° 25' 40."54 W.

ERRATA.

ADDITIONS TO THE ORNITHOLOGY OF GUADALUPE ISLAND.

- Page 280, in table. For "385 mm." read "384 mm."
- " 283, " " 1691 ♂ read 1691 ♀.
- " " " " 1699 ♂ " 1699 ♀.
- " " " " 2408 ♂ " 2408 ♀.
- " " " " 2504 ♂ " 2504 ♀.
- " " " " 2581 ♂ " 2581 ♀.
- " " " " 2409 ♂ " 2409 ♀.
- " 288, second line. For "form" read "forms."
- " 289, second table. For "Scott" read "Scott Mt."
- " " " " " "Mar. 20, 1883," read "Mar. 20, 1880."
- " 290, eleventh line. For "Guadeloupe" read "Guadalupe."
- " 291, fourteenth line. For "Guadaloupe" read "Guadalupe."
- " 299, thirteenth line. For "by omitting," substitute "it having omitted."
- " 299, eighth line. For "Coue's" read "Coues'."
- " 303, second table. For "♀ ad." read "ad."

BULLETIN.

No. 8.

California Academy of Sciences.

**DISCOVERY OF THE
NEST AND EGGS OF THE EVENING GROSBEAK**
(*Coccothraustes vespertina.*)

BY WALTER E. BRYANT.

Read June 20, 1887.

Although this species was first described in 1825, I believe that no description of its nest and eggs has previously appeared. Accordingly I take pleasure in announcing the discovery of the first nest and eggs, by Mr. E. H. Fiske, in Yolo County, California. Regarding this interesting finding, Mr. Fiske has written me the following particulars from his field notes.

The nest, containing four eggs, was taken May 10th, 1886, but incubation was so far advanced that he was unable to preserve them. In general shape, color and marking, they were similar to eggs of the Black-headed Grosbeak, but in size he thinks they were somewhat larger.

The nest was built in a small live oak, at a height of ten feet, and was a more pretentious structure than is usually built by the Black-headed Grosbeak, being composed of small twigs supporting a thin layer of fibrous bark, and a lining of horse hair.

It is to be hoped that Mr. Fiske will be successful in finding additional specimens from which measurements may be determined.

DESCRIPTION OF A NEW SUBSPECIES OF PETREL FROM
GUADALUPE ISLAND.

BY WALTER E. BRYANT.

Read July 18, 1887.

A series of fourteen specimens of *Oceanodroma*, collected by myself on Guadalupe Island off Lower California in March, 1886, were assigned to the species *leucorhoa* (Leach's Petrel), in my paper on the ornithology of that island.¹

In a foot note, reference was made to the considerable excess in size of the Guadalupe Island specimens over Leach's Petrel of the Atlantic Coast, but from lack of sufficient material for comparison I was unable to satisfactorily determine their differences, although strongly inclined to consider it a distinct race. My supposition has since been confirmed by several prominent ornithologists, and by comparison with typical specimens of Leach's Petrel from Alaska and coast of Massachusetts, which were kindly loaned from the Smithsonian Institution.

The Alaskan birds seem to be the same size as those from the Atlantic Coast, and of about the same color. A single female from Alaska (No. 102,281 Smithsonian Coll.), is nearly as dark as the Guadalupe birds, but the upper tail coverts are much whiter and the measurements less.

For this well marked local variety, I propose the name

Oceanodroma leucorhoa macrodactyla, subsp. nov.

GUADALUPE PETREL.

Subsp. Char.—Similar to *O. leucorhoa*, but larger and darker.

¹ Additions to the Ornithology of Guadalupe Island. Bulletin California Academy of Sciences, No. 6, pp. 269—318.

White of upper tail coverts more restricted, and the ends of coverts broadly tipped with black. Pileum darker than back, lighter anteriorly. Bill broader and deeper at base than that of *leucorhoa*.

Wing, 155—171 mm.; tail feathers, 85—99 mm.; depth of fork, 23—35 mm.; exposed culmen, 15.5—17 mm.; tarsus, 22—26 mm.; middle toe and claw, 28—30 mm.

Habitat.—Guadalupe Island, Lower California.

Types.—Nos. 2567, ♂ ad.; 2565, ♀ ad. Both in collection of Walter E. Bryant.

UNUSUAL NESTING SITES. I.

BY WALTER E. BRYANT.

Read August 1. 1887.

One of the interesting features of the study of oölogy is the selection of strange nesting sites made by many birds when the circumstances of their environment compel a departure from their customary habits. This is especially noticeable in certain tree-building species, which avail themselves of low bushes and sometimes even the ground in the absence of trees.

During a recent trip to Carson, Nev., and vicinity, I was particularly impressed by the unusual and novel situation which had been chosen by birds whose nesting habits were well known. These had adapted themselves to various situations, the mention of which, together with instances noted from other localities where choice rather than circumstances seemingly prompted the departures, may be interesting.

Callipepla californica.

CALIFORNIA PARTRIDGE.—Essentially a ground building species, but several cases have come to my notice of its nesting in trees upon the upright end of a broken or decayed limb or at the intersection of two large branches. A few years ago a brood was hatched and safely conducted away from a vine-covered trellis at the front door of a popular seminary. How the parent birds managed to get the tender young down to the ground is not known.

Colaptes cafer.

RED-SHAFTED FLICKER.—Three instances are recalled when this species nested in unusual places. One of these was in a bridge bulkhead a few feet above the Carson River. The interior of the structure was filled with gravel and large stones, amongst which the eggs were deposited. Another pair used a target butt at a much frequented range as a substitute for a stump. A third nest was in a sand-bank three feet from the top and ten from the creek. This hole was apparently specially prepared, and not one made by a ground squirrel, such holes being sometimes used by these birds.

Trochilus calliope.

CALLIOPE HUMMINGBIRD.—A nest was found built upon a projecting splinter of a wood pile at a height of five feet. Another was secured to a rope within an outbuilding.

Tyrannus verticalis.

ARKANSAS KINGBIRD.—An old and much flattened nest of Bullock's Oriole was found relined and containing four Kingbird's eggs. One of the most remarkable instances of persistency in nest building was met with in the case of a pair of Kingbirds which had attempted to construct a nest upon the outer end of a windmill fan. A horizontal blade had probably been first selected, but an occasional breath of air had slightly turned the mill, bringing into place an-

other and another, upon each of which had been deposited the first material for a nest until several nests were in different stages of construction, varying with the time that the windmill had remained quiet, while upon the roof below was strewn a quantity of debris that had fallen as the wheel revolved. Of course nothing but failure could be expected from their repeated attempts.

Sayornis saya.

SAY'S PHOEBE.—A nest which could be conveniently reached by a person on horseback was found by Mr. Walter Bliss at Carson, placed within and close to the entrance of a deserted Bank Swallow's burrow.

Scolecophagus cyanocephalus.

BREWER'S BLACKBIRD.—All the nests found at Carson were upon the ground, usually on the edge of a bank formed by an irrigating ditch, with the exception of one which was built two feet from the ground upon dry tule and well hidden by the growing stems.

Carpodacus frontalis rhodocolpus.

CRIMSON HOUSE FINCH.—Besides the odd situations which they select about houses, they avail themselves of the last year's nests of Bullock's Oriole.

Troglodytes aedon parkmanii.

PARKMAN'S WREN.—The species has been known to build in the skull of a horse, which had been placed in a fruit tree; in the nests of Cliff Swallows, and within an old shoe lodged in a tree.

Merula migratoria propinqua.

WESTERN ROBIN.—A pair of Robins built and reared a brood in a hanging basket suspended from the edge of the veranda at the residence of Mr. H. G. Parker at Carson, Nev.

Sialia mexicana.

WESTERN BLUEBIRD.—Dr. Cooper informs me that he has known a Bluebird to build in a Cliff Swallow's nest.

Sialia arctica.

MOUNTAIN BLUEBIRD.—Three incubated eggs of this species were taken from the nest of a Barn Swallow at Lake Tahoe, Cal., by Mr. Walter Bliss.

Passer domesticus.

EUROPEAN SPARROW.—Since the introduction of this pest into our cities, many birds, hitherto common, have left for the suburbs, notably the Cliff Swallows, whose nests were appropriated by the Sparrows. In these cases the limited space compelled the latter to dispense with the usual amount of rubbish, and carry in only a lining of feathers.

ON SOME NEW NORTH AMERICAN PSELAPHIDÆ.

(With Plate XVI.)

BY THOS. L. CASEY.

Read July 18th, 1887.

The Pselaphide fauna of the Pacific coast is by no means so insignificant as it has hitherto been considered, and as the search for these singular and fascinating forms becomes more specialized, and their habits and localities better known, new species are discovered in abundance.

For those who would prosecute a more extended collection of these insects, it may be stated that the Californian Pselaphidæ are very seldom found with ants, although a few myrmecophilous species are known, but generally in fungous earth, about the roots of trees, under bark, or in the long wet moss covering the rocks in the secluded ravines of mountainous regions. The genus *Oropus*, and several species of *Reichenbachia* and *Batrisus* are peculiar to the last-named localities, while *Euplectus* and *Pytna* are always found under bark. *Sonoma* and *Actium* are sometimes found under bark, but often also in fungous earth. *Batrisus zephyrinus*, on the other hand, I found in abundance at Lake Tahoe, living in the most indiscriminate localities—under bark, under chips buried in grassy turf, and in fungous earth.

The following forms, most of which were collected by myself, and which have been accumulating in my cabinet during the past two years, are here described as new, although it is possible that *Actium californicum* Lec., may be redescribed under that genus. This can only be the case, however, under the supposition that the description given by LeConte for that species is erroneous in regard to the

length of the elytral striæ, and as the species of this genus are numerous and rather local, the probabilities are decidedly against the formation of a synonym.

<i>Biotus formicarius</i> n. gen.	<i>Tychus bipuncticeps</i> .
<i>Pytna corticina</i> n. gen.	<i>Actium pallidum</i> .
<i>Batrisus cephalotes</i> .	<i>politum</i> .
<i>luculentus</i> .	<i>robustulum</i> .
<i>foveicornis</i> .	<i>testaceum</i> .
<i>punctifrons</i> .	<i>Euplectus californicus</i> .
<i>Decarthron Brendeli</i> .	<i>Rhexidius granulosus</i> n. gen.
<i>Bryaxis arizonæ</i> .	<i>Oropus montanus</i> .
<i>Nisaxis cincinnata</i> .	<i>Sonoma corticina</i> .
<i>maritima</i> .	<i>cavifrons</i>
<i>Tychus sonomæ</i>	

BIOTUS n. gen. (Ctenistides.)

Clypeus simple. Body covered densely with very minute, recumbent setæ. Antennæ elongate, cylindrical, outer joints not enlarged, second joint smallest. Head with two spongiose foveæ; frontal tubercle divided, the canaliculation extending slightly along the front. Prothorax transverse, with longer, more erect and denser pubescence, trifoveate at base, the foveæ large, spongiose, not connected. Elytra with deeply impressed sutural and one long discal stria. Abdomen without ridges; second visible dorsal longer than the first. Posterior coxæ separated. Trochanters normal.

The maxillary palpi are very short, robust and compact; the second joint is somewhat slender, but short; the last two are transverse, anchylosed, forming a circular club which is affixed obliquely to the second joint. No basal joint is visible, and the palpi may possibly be three-jointed. The genus should be placed near *Ceophyllus* Lec. from which it differs in the remarkably minute and singular palpi. It may be easily identified by its non-clavate antennæ with the second joint small.

1. *B. formicarius* n. sp.—Rather robust, pale testaceo-ferruginous throughout; integuments shining; pubescence dense, rather long and erect on the head and prothorax, very short and recumbent on the elytra and abdomen; not perceptibly punctate. *Head* not much depressed, slightly longer than wide; clypeus rounded, conical; labrum very short, strongly transverse;

eyes large, coarsely granulate, convex, prominent, at less than their own length from the base; the latter broadly arcuate; occiput having, on a line through the middle of the eyes, two large, feebly impressed, spongiöse fovee, mutually scarcely more distant than either from the eye; antennæ nearly one-half as long as the body, joints two to ten transverse, cylindrical, first joint flattened, about as long as wide, second small, eleventh slightly longer than the two preceding together. *Prothorax* distinctly wider than the head, widest in the middle; sides rather broadly rounded, almost straight near the apex and base; the latter transverse, abruptly arcuate in the middle third, one-third wider than the apex and but slightly narrower than the disk; apex broadly, very feebly emarginate; posterior angles slightly rounded; disk one-half wider than long, moderately convex, feebly tuberculate in the middle anteriorly; median fovea feebly impressed, elongate, elliptical, beginning at the middle and continuing nearly to the basal margin; lateral foveæ smaller, circular, deeply impressed, at one-third the length from the base. *Elytra* at base as wide as the base of the prothorax, at apex three-fourths wider; humeri but slightly prominent; sides evenly arcuate; together very slightly wider than long, each with two large basal foveæ; sutural stria coarse, deep, nearly straight, approaching the suture toward apex; discal coarse, deep, slightly arcuate, continuing for about three-fourths the length. *Abdomen* slightly narrower than the elytra, about equal in length to the latter; sides nearly parallel, feebly arcuate; border strong, diminishing in width; surface broadly convex. *Legs* rather long and slender, alutaceous, very densely clothed with minute recumbent setæ; middle trochanters very slender; tarsi rather short; claws small, equal. *Metasternum* impressed in the middle, more strongly so posteriorly. Length 2.8 mm.

California (Los Angeles 2.)

The four outer joints of the antennæ are more finely and densely pubescent and slightly paler in color, the eighth joint two-thirds wider than long, much shorter than the ninth or tenth, the latter nearly equal.

This interesting species lives in the nests of a small pale brown ant.

PYTNA n. gen. (Tyrides.)

The present genus has the pubescence fine and subrecumbent and not short, robust and recumbent as in the *Ctenistides*; following the classification suggested by Reiter, it should therefore be placed in the group indicated.

Antennæ approximate; club gradual, three-jointed. Maxillary palpi four-jointed; basal joint minute; second long, clavate, bent; third shorter, ob-

conoidal, as robust as the second; third one-half longer than the second, fusiform, equal in thickness to the second, acuminate at apex, having a slender terminal process. Head with three small spongiose foveæ at the apices of an equilateral triangle; eyes large, convex, rather coarsely granulate; clypeus angulate at the sides. Pronotum with three small basal foveæ connected by a fine impressed line. Elytra each with one sutural and one discal stria. Abdominal border wide, nearly flat; first visible segment with a median basal carina; first two segments equal in length. Prosternum excavated in front of the coxæ; legs rather long; femora slightly robust, the anterior with a short longitudinal carina beneath and near the base; middle tibiæ strongly arcuate; tarsi long and slender, three-jointed; basal joint very small; second and third elongate, the latter the longer; claws simple, moderate in length, equal, slender; anterior trochanters with a small posterior tuberculate tooth; intermediate with a long corneous process, projecting posteriorly from the apex obliquely outward; middle coxæ narrowly, posterior rather widely separated.

The modifications of the trochanters and the inferior carina of the anterior femora are not sexual characters, but are nearly as well developed in the female as in the male. *Pytna* appears to belong in the neighborhood of *Tyrus*, but differs in the structure of the palpi.

P. corticina, n. sp.—Bright rufous, abdomen piceous; integuments polished; pubescence fine, rather short, moderately dense. *Head* very slightly longer than wide, nearly flat above; eyes large, at more than their own length from the base; genæ convergent, feebly arcuate to the neck, clothed with longer, more conspicuous pubescence; foveæ small, the two posterior slightly behind the middle; antennal tubercle slightly transverse, feebly canaliculate in the middle; antennæ long and slender, distinctly more than one-half as long as the body, basal joint subcylindrical, much longer than wide, second slightly narrower, as long as wide, very feebly obconical, three to six subequal, very slightly shorter and narrower than the second, nearly as long as wide, seventh and eighth very slightly smaller, equal, ninth as long as the two preceding together, feebly obconical, one-half longer than wide, tenth as long as the ninth, slightly thicker, feebly obconical, eleventh ovoidal, acuminate, one-half wider than and nearly twice as long as the tenth. *Prothorax* widest at one-third the length from the apex; sides distinctly convergent and nearly straight to the apex; very feebly convergent and just visibly sinuate to the base; the latter broadly and rather strongly arcuate, scarcely perceptibly narrower than the disk, one-half wider than the apex; the latter transversely truncate; surface convex, impunctate, except near the base; transverse line fine, parallel to the basal margin and distant from it by one-fifth the length; foveæ very small; disk slightly longer than wide, very

slightly wider than the head. *Elytra* one-third longer than the prothorax, at apex more than twice as wide as the latter; sides strongly divergent, strongly arcuate; humeri rounded, slightly tumid; disk much wider than long, feebly convex, coarsely but not very densely punctate, truncate behind, the edge densely fimbriate; sutural striae deep, straight, beginning distinctly before the basal margin; discal arcuate, fine, terminating at nearly one-third the length from the apex, broadly dilated and deeply impressed toward base. *Abdomen* fully as wide but scarcely as long as the elytra; sides parallel, strongly arcuate; border wide; surface impunctate, strongly convex; basal carina strong. Length 2.0-2.2 mm.

California (Lake Tahoe 11).

The description is drawn from the male, the sexual modification consisting of a very feeble impression in the middle of the abdomen near the base, and a small deep emargination at the apex of the terminal segment. The female differs but slightly, the terminal segment of the abdomen being broadly angulate at apex.

This species was taken rather abundantly under the bark of various fallen conifers.

BATRISUS Aubé.

B. cephalotes n. sp.—Somewhat robust, very convex, piceous; legs and antennæ pale rufo-ferruginous throughout; pubescence long, coarse, erect, sparse, much denser on the head behind and beneath the eyes, short on the vertex; integuments polished.

Male—*Head* very large, distinctly wider than long and wider than the prothorax; surface feebly convex; apex very broadly and evenly arcuate throughout the width between the very widely distant antennæ; sides parallel; eyes very small, on the sides just behind the middle, convex, prominent; foveæ round, moderate in size, spongiose, at one-third the length from the base, mutually twice as distant as either from the eye; connecting channel feebly impressed, becoming obsolete anteriorly near the edge of the frontal declivity; vertex abruptly declivous between the antennæ, having in the middle of the lower edge two very approximate teeth, each of which has a deep setigerous puncture on the upper surface near the outer edge; laterally the lower edge is setigerous; vertex beneath the dentiferous edge very deeply excavated throughout the width between the bases of the antennæ; clypeus angulate at the sides, with the edges reflexed, more strongly so at apex which is transversely sinuate; portion before the reflexed apex in the form of a large setigerous tubercle which is further advanced than the two teeth of the upper surface; labrum broadly sinuate, anterior angles promi-

ment; antennæ robust, as long as the head and prothorax together, club very large, basal joint large, one-half longer than wide, as long as the next two together, lower surface simple but more strongly convex than the upper, second slightly longer and more robust than the third, joints three to eight equal in width, ninth wider, transverse, tenth much wider than the ninth, very slightly wider than long, subglobular, eleventh wider than the tenth, conoidal, apices of joints six to nine slightly oblique; upper surface very coarsely, feebly and sparsely punctate at the sides near the antennæ, elsewhere impunctate, not carinate. *Prothorax* as long as wide, widest just before the middle, where the sides are strongly rounded and rather prominent, being abruptly and strongly sinuate and rather strongly convergent to the base, broadly rounded to the apex; base scarcely one-fifth wider than the apex, three-fourths as wide as the disk; the latter trisulcate; middle sulcus narrow, deep, obsolete at one-fifth the length from the apex; having near the base a very deep, round, nude median fovea, and two large, spongiose, lateral foveæ, between them bispinose with a longitudinal ridge proceeding anteriorly from each spine, also tuberculate on each lateral edge near the base; surface near the basal margin bifoveate laterally, obsoletely and very finely carinate in the middle. *Elytra* very sparsely, rather coarsely and feebly punctate, each trifoveate at base; discal striæ short, broadly, feebly impressed; humeri minutely and distinctly spinose. *Abdomen* with two short cusps at base. *Legs* rather long; femora robust; posterior tibiæ with terminal process. Length 2.0 mm.

New York 1 (Mr. Henry Ulke.)

Belongs near *denticollis*, from which it is easily distinguished by the form of the bidentate vertex, this being declivous, with the teeth upon the lower edge in the present species, and broadly emarginate, with the teeth projected and but very little below the level of the front in *denticollis*.*

B. luculentus n. sp.—Rather slender, polished, piceous; elytra slightly paler and more rufous; legs pale; antennæ dark rufous, club paler; pubescence rather sparse.

Male—*Head* rather large, wider than long, wider than the prothorax, very feebly convex, coarsely, sparsely and feebly punctate anteriorly, impunctate posteriorly; eyes moderate, convex, prominent, near the base; foveæ deep, round, nude, at two-fifths the length from the base, mutually distinctly more than twice as distant as either from the eye; areolate groove fine, deeply

* NOTE—From material recently sent me for identification by Dr. Emil Brendel, I find that this species is widely diffused through the North Atlantic districts, there being specimens in the series indicated from New York and Illinois.

impressed near the foveæ, becoming completely obsolete anteriorly; vertex gradually declivous between the antennæ the declivity broadly biimpressed, the impressions setigerous; lower edge bidentate in the middle, the teeth slightly reflexed and with many erect setæ on the lower surface, deeply excavated beneath between the antennæ; clypeus broadly arcuate anteriorly, sides feebly divergent posteriorly and nearly straight, angles slightly rounded, not prominent, surface conical, edge not at all reflexed, having in the middle an abrupt, small, strongly elevated tubercle at a considerable distance from the anterior margin and rising just before the two superior teeth, exceedingly minutely and sparsely setose; labrum broadly emarginate, angles prominent; antennæ slightly longer than the head and prothorax together, moderately robust, very strongly clavate, basal joint more convex beneath, not otherwise modified, as long as the next two together, second longer and more robust than the third, eighth shortest, strongly transverse, ninth slightly longer and nearly one-half wider than the eighth, transverse, tenth large, nearly twice as wide as the ninth and very nearly as long as wide, sides parallel, arcuate; eleventh distinctly narrower than the tenth, acuminate. *Prothorax* slightly longer than wide; dorsal ridges and median sulcus almost completely obsolete; median basal puncture small, round, nude, impressed; lateral slightly larger, spongiose; lateral sulcations broadly impressed, feeble; lateral basal tubercles minute; surface near the basal margin bifoveate at the sides, not at all carinate in the middle; disk convex, widest before the middle; sides rather broadly rounded, feebly sinuate toward base and apex; base slightly more than three-fourths as wide as the disk, one-fourth wider than the apex. *Elytra* fully as long as wide, convex; humeri slightly prominent but not at all spinose. *Abdomen* with two long, parallel, prominent cusps at base, distant by one-fifth the abdominal width. *Legs* rather long; femora moderately robust; middle tibiæ with an internal apical spur; posterior feebly arcuate, with a terminal process. Length 1.7 mm.

District of Columbia 2 (Mr. Henry Ulke).

The female has the vertex strongly declivous, and thence less strongly and continuously so over the surface of the clypeus, which is finely, strongly and densely granulose; the vertex is not excavated between the bases of the antennæ, each of which is inserted in a large lateral excavation. The antennæ are more slender, with the outer joints gradually wider, the tenth transverse and but slightly larger than the ninth.

This species should also be placed near *denticollis*; these three species belong to the *nigricans* group; the latter is, however, distinguished by the unusual structure of the

antennæ, the third joint of which is, according to the description of Dr. Le Conte, presumably more robust than the second.

B. foveicornis n. sp.—Rather slender, convex, rufous throughout; integuments polished, impunctate; pubescence rather long, coarse and sparse.

Male—*Head* moderate, slightly longer than wide, very slightly wider than the prothorax; vertex between the antennæ coarsely, feebly and not densely punctate, punctures asperate, elsewhere impunctate; eyes small, very convex, prominent, rather finely granulate; base behind them broadly arcuate; surface very feebly convex, very feebly and finely carinate in the middle near the base, finely and distinctly carinate at each side above the eyes; arcuate groove broadly impressed, extending from the base at the sides to the vertex, where it becomes very feeble; foveæ small, nude, very deep, perforate, situated at less than one-third the length of the superior portions from the base, and on the inner margin of the arcuate impression; vertex declivous and slightly produced in the middle, being separated from the clypeus by a narrow, feebly impressed transverse groove; clypeus large, prominent, conical, strongly rounded anteriorly, very obtusely angulated at the sides, edges not at all reflexed; antennæ rather slender, as long as the head and prothorax together, basal joint subcylindrical, not modified, nearly as long as the next two together, two to seven subequal, distinctly longer than wide, the second slightly more robust and the sixth a very little shorter, eighth equal in width, distinctly wider than long, ninth equal in length to the eighth, one-third wider, inner side much more strongly convergent toward apex, tenth abruptly very large, nearly twice as wide as the ninth, fully as long as wide, flattened, sides parallel, almost straight, eleventh as wide as the tenth, as long as the three preceding together, obliquely acuminate, very slightly flattened on the lower side. *Prothorax* widest slightly before the middle; sides strongly rounded, convergent and feebly sinuate toward base and apex; median and lateral foveæ almost equal, deep, at nearly equal distances from the base, the median nude; median groove short, feebly impressed, lateral more distinct; basal spines small; ridges distinct, becoming obsolete before the middle, separated behind from the spines by transversely arcuate impressions; base bifoveate at each side; disk strongly convex, very slightly longer than wide, base much wider than the apex. *Elytra* fully as long as wide, nearly twice as wide as the prothorax, very convex; humeri prominent, not spinose. *Abdomen* nearly as wide and as long as the elytra; basal cusps rather long, strong, separated by scarcely one-sixth the abdominal width. *Legs* long, slender; anterior trochanters minutely toothed posteriorly; posterior tibiæ with an apical process; tarsi very long and slender, the posterior one-half as long as the tibiæ. Length 1.9 mm.

Tennessee 2 (Mr. Henry Ulke).

The large flattened tenth antennal joint has, on the lower surface and near the base, a very large deep circular perforate fovea. Of the species in which the tenth antennal joint is enlarged in the males, there are some—for example *cephalotes*—in which this joint, although unusually large and prominent, is almost completely unmodified upon the lower surface, others — *virginia*, *denticollis*, etc. — which have the lower surface slightly flattened and with a small, deep fovea near the base; but in no case which has come under my observation is this fovea one-half so large, or the joint itself so strongly flattened as in the present species.

The two specimens indicated are males. The species probably belongs near *spretus* Lec., which is described as black.

B. punctifrons n. sp.—Moderately robust, convex, piceous-black; elytra very slightly paler, rufo-piceous; legs and antennæ pale rufo-ferruginous, the latter slightly darker toward base; integuments polished, impunctate; pubescence rather long, sparse, flavate.

Male—*Head* moderate, slightly longer than wide, just visibly wider than the prothorax; eyes moderate, convex, at their own length from the base; genæ strongly convergent, feebly arcuate; base broadly sinuate; surface feebly convex, very finely, feebly, arcuately carinate above the eyes; impressed groove continuous from the base at the sides to the vertex, at which point it is but slightly more feeble; foveæ deep, nude, in the middle of the groove; vertex coarsely, sparsely and feebly punctate on the antennal tuberculations, which are large and flat, declivous anteriorly, the declivity moderate, beginning along a straight line between the antennæ; apex strongly rounded; declivous surface very strongly, finely and densely punctate, each puncture bearing a very minute, coarse, flavate seta; apex divided from the clypeus by a fine, transverse, strongly arcuate, deeply impressed groove; clypeus short, broadly subangulate, obtusely angulate at the sides; surface finely scabrous, conical; edges not at all reflexed; having in the middle a small, feeble tubercle which bears a tuft of rather long, erect, flavate setæ; antennæ rather long, slender, one-fourth longer than the head and prothorax together, club strong, basal joint not modified, cylindrical, shorter than the next two together, second much longer and distinctly more robust than the third, joints two to seven longer than wide, eighth equal in width, nearly as long as wide, ninth wider and longer, tenth similar to the ninth, distinctly wider and longer, slightly wider than long, inner side much shorter than the outer, eleventh large, twice as wide as the tenth, ovoidal, acuminate, nearly as long as the four preceding together. *Prothorax* slightly longer

than wide, widest slightly before the middle; base two-thirds as wide as the disk, one-fourth wider than the apex; median sulcation feebly impressed, becoming obsolete at one-third the length from the apex; spines moderate; ridges almost obsolete; lateral grooves broadly, feebly impressed; foveæ large and deep. *Elytra* fully as long as wide; humeri prominent, not spinose. *Abdomen* nearly as wide as, but much shorter than the elytra; basal cusps fine, strong, rather long, parallel, separated by one-fifth the abdominal width. *Legs* long, slender; posterior tibiæ with apical process. Length 1.8 mm.

Pennsylvania 1 (Mr. Henry Ulke.)

This species is very distinct in the characters of the vertex and antennæ; the eleventh joint is here more than usually developed, while the tenth is but slightly larger than the ninth and of nearly the same form.

DECARTHON Brend.

D. Brendeli n. sp. — Form somewhat robust, convex, piceo-castaneous throughout; legs and antennæ paler, rufous; pubescence rather long and sparse, more dense on the abdomen and at the sides of the prothorax and head; integuments polished. *Head* moderate, as wide as long, very feebly convex, almost impunctate; eyes large, coarsely granulated, convex and prominent; genæ extremely short behind them; base wide, transversely truncate; on a line through the anterior portions of the eyes there are two widely distant nude foveæ; antennal tuberculations large, distinctly elevated; antennæ as long as the head and prothorax together, rather slender, club rather large, basal joint cylindrical, slightly longer than wide, second slightly shorter and narrower, third feebly obconical, as long as and much narrower than the second, four to six subequal, very slightly longer than wide, and just visibly wider than the third, seven larger, scarcely as long as wide, eight very short, transverse, narrower than the seventh, ninth much wider than the seventh, very feebly trapezoidal, nearly twice as wide as long, tenth very slightly wider than the ninth, ovoidal, pointed, nearly as long as the three preceding together. *Prothorax* scarcely as wide as the head, very slightly wider than long; sides broadly rounded, convergent and feebly sinuate toward base; the latter broadly arcuate, four-fifths as wide as the disk, one-half wider than the apex; disk strongly, evenly convex, not impressed at the sides, having a deep nude fovea in the middle near the base. *Elytra* near the apex fully twice as wide as the prothorax; sides strongly divergent, arcuate; disk wider than long, two-thirds longer than the prothorax, convex, coarsely and extremely feebly punctate; sutural striæ deep, feebly arcuate; discal deeply impressed, feebly arcuate, parallel to the suture, terminating at nearly two-fifths the length from the apex. *Abdomen*

two-thirds as long as the elytra, nearly as wide as the latter; first segment, when viewed vertically, occupying three-fourths of the entire length, feebly convex; border narrow, flat; basal carinæ strong, very feebly divergent, slightly more than one-half as long as the segment, separated by one-half the entire width. *Legs* rather long and slender. Length 1.3-1.5 mm.

Texas (Galveston 8).

The above described type is a male. In this sex the middle femora are very singularly modified, being very strongly swollen, abruptly constricted near the apex, impressed anteriorly, with an anterior tooth near the apex and just before the deep apical constriction. In the female the femora are all simple and rather slender, and the seventh antennal joint is smaller than the eighth. The female is, in addition, smaller than the male, and has the dorsal carinæ of the abdomen distinctly shorter.

I have dedicated this very distinct species to a friend, the author of the genus, and one to whom our systematic knowledge of the American representatives of the family is greatly indebted.

BRYAXIS Leach.

B. arizonæ n. sp.—Form rather slender, pale testaceous throughout; shining, not distinctly punctate; pubescence very fine, short and rather sparse. *Head* moderate, triangular; eyes large, prominent; occipital foveæ on a line just before the middle of the eyes, mutually more than twice as distant as either from the eye; apical fovea equal to the occipital, slightly less distant from either of the others than the mutual distance of the latter; connecting channel almost obsolete; antennæ slender, slightly longer than the head and prothorax together, joints three and five each nearly twice as long as wide, distinctly longer than the fourth and equal in length to the second, the latter more robust, seventh distinctly shorter than the sixth, slightly longer than wide, eighth, ninth and tenth distinctly wider than long, increasing uniformly and very rapidly in size, eleventh wider than the tenth, much longer than wide, obliquely acuminate. *Prothorax* widest at the middle; sides rounded anteriorly, rather deeply sinuate posteriorly; base broadly, very feebly arcuate, five-sixths as wide as the disk, nearly one-half wider than the apex; the latter very feebly arcuate; disk distinctly wider than long, equal in width to the head, convex; middle fovea slightly smaller than the lateral, the former at one-fifth, the latter at nearly one-third the length from the base. *Elytra* at the humeri very slightly wider than the prothorax, at

the apex slightly less than twice as wide as the latter; disk distinctly wider than long, moderately convex; sutural striæ strong, nearly straight, convergent and arcuate near the apex; discal fine, feebly impressed feebly sigmoid, becoming obsolete at one-fifth the length from the apex. *Abdomen* slightly shorter and very little narrower than the elytra; sides nearly straight and parallel; border moderate in width; surface broadly and feebly convex; first segment, the only one seen when viewed vertically, nearly five-sixths as long as the elytra. *Legs* slender. Length 1.2 mm.

Arizona (Tuçson 1).

Described from the male, the sexual characters being similar in form to those of *texana*, but having the median tubercle of the second segment smaller, less transverse and much more prominent.

This species belongs to the *texana* group of the genus, which is distinguished by the great development of the first ventral segment in the male, this being the only part of the abdomen seen when viewed vertically. It differs from *texana* in its smaller size, slightly more robust form, much shorter elytra, narrower abdominal border, in the size and position of the pronotal foveæ, and in its shorter antennæ with less prominent club; the eighth, ninth and tenth joints in *texana* are much less transverse. In *texana* the median fovea of the pronotum is larger, and at about one-fourth the length from the base, the three foveæ being more nearly on a transverse line than in *arizonæ*.

NISAXIS Casey.

N. cincinnata n. sp.—Slightly robust, clear testaceous throughout; legs and antennæ slightly paler; pubescence moderately dense, rather long. *Head* very slightly narrower than the prothorax, as long as wide; eyes rather large, prominent, at two-thirds their own length from the base; genæ very feebly convergent toward base, feebly arcuate, not at all prominent; base transversely truncate; front large, quadrate, feebly convex, coarsely, deeply, not densely punctate, impunctate in the middle, feebly biimpressed near the vertex; antennæ about as long as the head and prothorax together. first two joints nearly equal, slightly more robust, one-half longer than wide, nearly cylindrical, third obconical, longer than wide, much shorter than the second, as long as the fifth, longer than the fourth, sixth and seventh slightly shorter, very little longer than wide, eighth very slightly wider, a little wider than

long, shorter than the seventh, ninth two-thirds wider than the eighth, obtapezoidal, outer side more oblique, tenth one-half longer and wider than the ninth, one-half wider than long, eleventh distinctly wider than the tenth, as long as the three preceding together, longer than wide, obliquely acuminate. *Prothorax* widest at two-fifths the length from the apex; sides strongly rounded, feebly incurvate toward base; the latter broadly, evenly arcuate, three-fourths as wide as the disk, nearly two-thirds wider than the apex; disk one-third wider than long, evenly convex, rather coarsely, extremely feebly and not densely punctate; having in the middle, at one-fifth the length from the base, a small nude punctiform fovea, and, at each side, a larger feebly impressed nude fovea at one-third the length from the base. *Elytra* at the humeri distinctly wider than the prothorax, together distinctly wider than long, one-half longer than the pronotum, and, at apex four-fifths wider than the latter; disk moderately convex, sutural stria deeply impressed, evenly, feebly arcuate; discal fine, distinct, extending very slightly beyond the middle; sutural foveæ very small and at the extreme basal margin; lateral larger and further from the base; base otherwise devoid of foveæ; surface very minutely, feebly and sparsely punctate. *Abdomen* two-thirds as long as the elytra, nearly equal in width, occupied for six-sevenths the entire length when viewed vertically by the basal segment; border rather narrow, flat; surface moderately convex, finely, feebly and sparsely punctate; basal carinæ divergent, straight, strong, nearly one-half as long as the segment, separated by one-half the abdominal width. *Legs* rather long and slender; posterior tibiæ abruptly bent near the apex, middle coxæ large, globose, not prominent, distinctly but narrowly separated by the sternal processes which are truncate and not carinate; posterior small, widely separated. Length 1.1 mm.

Texas (Galveston 10).

Described from the male in which the first two dorsals are simple, the third transversely and feebly impressed, the impression large and anteriorly lunate, the inclosed apical elevation being feebly convex and bearing a loose tuft of long erect setæ; fourth and fifth normal, broadly arcuate at apex, the latter short and with the posterior margin very feebly produced in the middle. Viewed from beneath the abdomen consists of three visible segments, although there is probably a fourth which is completely hidden under the third; the basal segment is very long, and, in the middle, occupies the entire extent, except a very small apical portion where the two short posterior segments become very short, the third being at this point deflexed and channeled

externally. Besides the tuft of long setæ from the median elevation of the third segment, there are many long conspicuous setæ on the second, and at the sides and base of the third.

N. maritima n. sp.—Form somewhat slender, dark rufous throughout; elytral apices slightly darker; legs and antennæ very slightly paler; pubescence long, rather coarse, not dense. *Head* slightly narrower than the prothorax, nearly as wide as long; eyes moderate, at nearly their own length from the base; genæ feebly arcuate, not at all prominent, as long as the eye; front feebly convex, feebly, finely and sparsely punctate toward the eyes, impunctate in the middle; antennæ slender, about as long as the head and prothorax together, nearly as in *cincinnata*, ninth joint symmetrical, but slightly wider than long, tenth strongly transverse, truncate at base and apex, nearly cylindrical, eleventh elongate, but slightly wider than the tenth. *Prothorax* one-fourth wider than long, widest before the middle; sides strongly rounded, strongly sinuate near the basal angles; base broadly arcuate, nearly four-fifths as wide as the disk, one-half wider than the apex; surface very minutely, feebly and sparsely punctate; basal fovea very small, at one-fifth the length from the base; lateral moderately deep, larger, at one-fourth the length from the base. *Elytra* slightly wider than long, at apex four-fifths wider than the prothorax; sides feebly divergent; disk rather strongly convex; sutural striæ strong, feebly arcuate; discal fine, distinct, extending from near the base for two-thirds the length. *Abdomen* but slightly more than one-half as long as the elytra; border rather narrow; basal carinæ short, one-fifth as long as the basal segment, divergent, feeble, separated by slightly more than one-half the abdominal width. *Legs* long and slender; posterior tibiæ bent near the apex. Length 1.0 mm.

Texas (Galveston 3.)

The description is taken from the male, the sexual characters being very remarkable. The first dorsal segment occupies nearly the entire extent of the abdomen when viewed vertically, and has the apex abruptly deflexed in the middle, the deflexed portion being transversely impressed or excavated; its lower margin is reflexed and broken into two lateral crests and a small median and strongly elevated tubercle; the edge of the segment immediately above the deflexed excavated portion is more densely setose and bears two feeble tubercles. The second segment is short, transversely and very deeply excavated in the middle third, the

excavation being anteriorly arcuate and extending under the apical process of the first; at the apex there is in the middle a strongly elevated carinate tubercle which is slightly transverse, with the apex directed anteriorly for a slight distance over the excavation, and bearing two fine setiform appendages; its posterior surface is feebly and minutely tuberculate; the surface of the segment has, at each side of the central excavation, a transverse arcuate canaliculation which is disconnected. The third segment has, just before the middle, two small tubercles distant by nearly one-half the width, the remainder of the surface being unmodified. Fourth segment unmodified. Fifth shorter, feebly produced in the middle.

The under surface, as in *cincinnata*, consists of but three visible segments, the first being very long, the third abruptly and narrowly deflexed in the middle, the deflexed portion being channeled externally. There is, however, a fourth segment to be seen by looking longitudinally under the third, by which it is entirely covered. The surface of this fourth segment is abruptly arched at each side between the middle and the lateral edges, the arching being visible as a semicircular emargination of the edge when viewed longitudinally, and there is on the edge in the middle a strong vertical spine which appears to fit into the channel in the deflexed apex of the third segment.

These species belong near *tomentosa* Aubé, but appear to be smaller and more sparsely pubescent. The genus is almost exclusively confined to the sea-beaches of the Atlantic coast.

TYCHUS Leach.

T. sonomæ n. sp.—Slender, convex, piceous; elytra, legs and antennæ testaceous; pubescence fine, moderate in length, sparse; integuments polished, impunctate. *Head* much narrower than the prothorax, distinctly longer than wide, broadly rounded behind the eyes; the latter rather large, prominent, coarsely granulate, at nearly their own length from the base; surface transversely convex, transversely impressed behind the frontal

tubercle, which is transverse, convex and impressed along the middle; on a transverse line passing through the anterior portion of the eyes there are two minute, widely distant, punctiform foveæ; antennæ slightly longer than the head and prothorax together, robust, strongly clavate, basal joint much longer than wide, arcuate, second slightly narrower, quadrate, third narrower, obconical, longer than wide, joints three to seven subequal, eighth very slightly wider than long, ninth abruptly much wider, tenth still wider, equal in length, ninth and tenth distinctly wider than long, eleventh wider than the tenth, as long as the three preceding together, acuminate. *Prothorax* widest slightly before the middle, as wide as long, strongly convex; sides rather strongly rounded, feebly sinuate near the apex, more strongly so near the base; the latter broadly arcuate, four-fifths as wide as the disk, one-third wider than the apex; basal fovea minute, very near the margin; lateral impressions feeble; along the basal margin between the median fovea and the basal angles there are, on each side, two small punctiform foveæ, nearly as large as the median. *Elytra* at the humeri scarcely perceptibly wider than the prothorax, at the apex nearly twice as wide as the latter; sides evenly arcuate, together transversely truncate behind, convex, as long as wide, two-thirds longer than the prothorax; each bifoveate at base; sutural stria deeply impressed; discal distinct, broadly impressed, terminating slightly before the middle. *Abdomen* two-thirds as long as the elytra, much narrower than the latter, parabolic in form; basal segment much longer than the second; lateral border narrow, flat, rapidly attenuate from base to apex. *Legs* rather long and slender; posterior tibiæ arcuate toward apex. Length 1.25 mm.

California (Mendocino Co., 1.)

The specimen described is probably a male; the sexual characters are very feeble, the fifth segment being longer, feebly flattened, and broadly bilobed at apex. The species is much smaller than either of the two previously described from these regions, and the fourth joint of the maxillary palpi has a long and distinct terminal process. The third joint of that organ is elongate and clavate, the fourth more strongly arcuate within, subsecuriform, elongate and strongly compressed.

T. bipuncticeps n. sp.—Rather slender, convex, polished, impunctate, piceous; elytra, legs and antennæ pale rufous. *Head* moderate, slightly longer than wide, convex; eyes large, convex, prominent, just behind the middle; genæ convergent, feebly arcuate, clothed with longer, dense pubescence; base broadly arcuate; antennal tubercle much wider than long, large, divided by a feeble canaliculation; antennæ as long as the head and

prothorax together, rather slender, basal joint as long as the next two together, subcylindrical, second narrower, second and third slightly longer than wide, the latter slightly shorter and narrower, four to eight equal in width, slightly shorter but scarcely narrower than the third, ninth wider, nearly as long as wide, tenth wider than the ninth, wider than long, eleventh distinctly wider than the tenth, ovoidal, acuminate, as long as the three preceding together; on a line through the anterior portions of the eyes there are two small, very widely distant nude punctures; fourth joint of maxillary palpi dilated internally, truncate at apex, having a slender terminal process. *Prothorax* distinctly wider than the head, one-fifth wider than long; sides strongly rounded just before the middle, convergent and very feebly sinuate toward base; the latter evenly, feebly arcuate, four-fifths as wide as the disk, one-third wider than the apex; the latter truncate; disk strongly convex, with a row of small punctures along the basal margin, very feebly impressed at each side near the base, with a small, deeply impressed, nude fovea in the middle and very near the basal margin. *Elytra* near the apex nearly twice as wide as the prothorax; sides moderately divergent from base to apex, arcuate; disk fully as long as wide, convex; sutural striae distinct, strongly arcuate; discal fine, distinct, terminating at the middle; humeri rather strongly tumid. *Abdomen* much shorter than the elytra, parabolically rounded throughout; border narrow, rapidly becoming extinct; surface convex and declivous posteriorly from the apex of the first visible segment; the latter as long as the next two together, transversely very feebly convex. *Legs* long, slender, simple; tarsi slender. *Metasternum* broadly and strongly impressed along the middle; posterior coxæ rather widely separated. Length 1.4 mm.

California (Lake Tahoe 2).

The type specimen is a male, the under surface of the abdomen near the apex being broadly and feebly impressed. With this specimen I have associated a female, which differs considerably in the much shorter elytra, with more strongly divergent sides; but the material is insufficient to permit definite conclusions regarding its identity.

The individual facets or granules upon the surface of the compound eyes are circular and very widely separated.

This species is very nearly related to *sonomæ*, but differs in its slightly more robust form and slightly more transverse prothorax, with more angulate sides. It occurs under chips and bark slightly buried in grassy turf.

ACTIUM Casey.

Through the kindness of Herr Reitter, of Müdling, Austria, who has sent me several representatives of *Trimiopsis*, I am enabled to give the following statement, showing the relationship of the latter with *Actium*, *Trimiopsis* being represented by *T. Ejgersi*.

The maxillary palpi of *Trimiopsis* are long, the fourth joint being more strongly dilated internally near the base, and therefore distinctly securiform; while in *Actium*, as represented by *pallidum*, the palpi are shorter, more robust, and with the outer joint ovoidal and acuminate. In *T. specularis*, however, the palpi are more robust and do not differ so greatly from the form existing in *Actium*.

One of the most conclusive differences, however, is the presence of a distinct discal stria, extending for one-half to two-thirds the elytral length in *Actium*, and the complete absence of this stria in *Trimiopsis*.

In *Trimiopsis* the isolated fovea at the base of each elytra, between the discal and sutural striæ, which is a constant character of *Actium*, is completely wanting.

Several species of *Trimiopsis* have two basal abdominal carinæ, these being very widely distant in *T. specularis*; others, however,—eg. *Ejgersi*—are entirely devoid of the basal carinæ. In *Actium* the basal carinæ are distinct and rather approximate.

The species of *Trimiopsis* are much smaller than those of *Actium*, and have the head relatively much larger.

Actium also appears to resemble, to some extent, the much more minute African species, recently described under the name *Periplectus* by Raffray,

It is probable that the species described from the eastern parts of the United States under the name *Trimium* might more appropriately be referred to *Trimiopsis*, as the European genus *Trimium* has not yet been discovered within our territories.

A. pallidum n. sp.—Form rather slender, convex; pale flavo-testaceous throughout, antennæ and legs slightly paler and less rufous; integuments polished, impunctate; pubescence fine, short, subrecumbent, rather sparse. *Head* small, very much narrower than the prothorax; as long as wide; eyes rather large and prominent, somewhat finely granulated, at the middle of the sides; genæ distinctly shorter than the eyes, evenly rounded to the neck, not at all prominent; base very feebly sinuate; occiput longitudinally impressed in the middle; front having two round, impressed, spongiose foveæ on a line through the middle of the eyes, mutually twice as distant as either from the eye, connected by a subangulate channel which is rather strongly impressed and much wider than long; antennæ short, one-half longer than the head, club very robust, two basal joints subequal, slightly longer than wide, more robust than the funicle, joints three to seven moniliform, subequal, the former slightly longer than wide, the latter slightly transverse, joints eight to ten very short and strongly transverse, equal in length, acutely rounded at the sides, the former twice, the latter more than three times as wide as long, eleventh much wider, ovoidal, gradually acuminate, as long as the five preceding together. *Prothorax* widest at one-third the length from the apex, where it is scarcely as wide as long; sides rather broadly rounded, feebly convergent and nearly straight toward base; the latter evenly and rather strongly arcuate throughout, fully four-fifths as wide as the disk, one-half wider than the apex; disk convex, having at one-fourth the length from the base a transverse, narrow, deeply impressed, posteriorly arcuate channel, connecting the rather large, deeply impressed, spongiose lateral foveæ and continued posteriorly more than one-half the distance to the basal margin by a canaliculate impression; along the basal margin, very near the edge, there is a narrow deeply-impressed line. *Elytra* at the humeri much wider than the prothorax; sides feebly divergent, arcuate; humeri rather prominent; together fully as long as wide; disk feebly convex, each trifoveate at base; sutural stria fine, deep, nearly straight; discal proceeding from the third fovea, fine, nearly straight, parallel to the sutural, slightly double at base, vanishing at a slight distance before the middle; second fovea without trace of stria. *Abdomen* distinctly shorter, but very slightly narrower than the elytra, rapidly declivous behind, parabolically rounded through its apical half when viewed vertically; border narrow, slightly inclined; first segment slightly longer than the second, having at base two fine, slightly divergent carinæ which are very short and distant by less than one-fifth the abdominal width. *Legs* slender. Length 1.2 mm.

California (Monterey Co.)

This species is abundant under decomposing vegetation, near the margins of small streams.

A. politum n. sp.—Form slender, convex; bright testaceous, legs and antennæ slightly paler, more flavate, abdomen darker, castaneous; integu-

ments polished, impunctate; pubescence fine, short, sparse. *Head* small, as long as wide, distinctly narrower than the prothorax; eyes rather small, at the middle of the sides, convex; genæ distinctly longer than the eyes, arcuate, not prominent; occiput feebly impressed in the middle; front having two large spongiose foveæ on a line through the posterior portions of the eyes and mutually twice as distant as either from the eye, connected by a subangulate impressed groove; antennæ short, slender, scarcely one-half longer than the head, club large, elongate, two basal joints more robust, subequal, slightly longer than wide, joints three to seven moniliform, the latter globular, eighth very slightly wider, a little wider than long, eight to ten very gradually wider and more transverse, equal in length, the latter oval and scarcely twice as wide as long, eleventh nearly twice as wide as the tenth, cylindro-conoidal, acuminate, truncate at base, elongate, nearly as long as the five preceding together. *Prothorax* widest at two-fifths the length from the apex; sides rather strongly rounded, distinctly convergent and feebly sinuate to the basal angles; base feebly arcuate, scarcely more than two-thirds as wide as the disk, one-third wider than the apex; disk convex, about as wide as long, crossed at one-third the length from the base by a narrow impressed groove which is nearly straight; lateral foveæ large, spongiose, deeply impressed; median posterior prolongation rather broadly impressed; basal margin feebly impressed. *Elytral* width at the humeri, which are distinctly prominent, much greater than that of the prothorax; sides very feebly divergent, evenly and strongly arcuate; together as long as wide, transversely truncate at apex; disk feebly convex, each trifoveate at base; sutural striæ deep, feebly and evenly arcuate, rather distant from the suture; discal feebly arcuate, parallel, vanishing very slightly behind the middle, distinctly double at base. *Abdomen* distinctly shorter and narrower than the elytra; sides parallel and straight at base, rounded behind; border rather narrow; first visible dorsal with two fine subparallel basal carinæ which are nearly one-third as long as the segment and separated by nearly one-fourth the abdominal width. *Legs* slender. Length 1.3 mm.

California (Mendocino Co. 1).

Easily known by its dark abdomen, slender antennæ and smaller eyes.

A. robustulum n. sp.—Rather robust, convex, pale testaceous throughout; integuments polished, impunctate; pubescence fine, short, subrecumbent, not dense. *Head* very small, nearly as wide as long, much narrower than the prothorax; eyes moderate, convex, prominent; genæ distinctly longer than the eye, not prominent, rounded; occipital foveæ large, on a line through the posterior portions of the eyes, mutually twice as distant as either from the eye, connected by an impressed angulate groove; antennæ short and slender, scarcely one-half longer than the head, club gradual, elongate, two basal joints subequal, slightly more robust, longer than wide,

three to seven nearly equal in width, the former much longer than wide, the latter distinctly wider than long, ninth to eleventh uniformly and rather rapidly increasing in width, the ninth one-half wider than long, slightly shorter than the tenth, the latter fully twice as wide as long, eleventh elongate, acuminate, as long as the four preceding together. *Prothorax* widest before the middle; sides rounded, convergent and feebly sinuate toward base; the latter evenly and distinctly arcuate, four-fifths as wide as the disk and one-half wider than the apex; disk convex, very slightly wider than long; basal groove at nearly one-third the length from the margin, feebly, posteriorly arcuate, very deeply impressed; lateral foveæ large, deeply impressed, median posterior cusp-shaped prolongation large and long; surface broadly and very feebly impressed anteriorly from the lateral foveæ, and with traces of a narrow median canaliculation near the center of the disk. *Elytra* at the somewhat prominent humeri distinctly wider than the prothorax; sides very feebly divergent, strongly and evenly arcuate; disk about as long as wide, convex; sutural striæ deep, arcuate; discal fine, distinct, nearly parallel, extending to or very slightly beyond the middle; intermediate basal fovea simple. *Abdomen* viewed vertically short and broad, three-fourths as long as the elytra, distinctly narrower; sides straight, parallel, broadly rounded behind; border rather narrow, inclined; first visible segment very slightly longer than the second; basal carinæ rather robust and flat, very feebly divergent, less than one-third as long as the segment, distant by one-fourth the abdominal width. *Legs* moderate in length; femora robust, much more arcuate externally and toward apex, posterior more slender. Length 1.4 mm.

California (Anderson Val., Mendocino Co. 1).

The type is apparently a male, the penultimate segment being transversely and narrowly impressed; the terminal segment is flat, in appearance like a horizontal pygidium; it is slightly longer than wide, oval, slightly more attenuate behind, and entirely surrounded by the other segments. The species is much more robust than the others here described.

A. testaceum n. sp.—Form slender, convex; pale testaceous throughout; integuments polished, almost impunctate; pubescence very fine, short, sparse. *Head* moderate, distinctly narrower than the prothorax; eyes small, convex, prominent; genæ not at all prominent, much longer than the eye, rounded; occiput narrowly and deeply impressed in the middle; foveæ on a line through the posterior portions of the eyes, round, spongiöse, scarcely twice as distant as either from the eye, connected by an impressed channel, which is more broadly arcuate than usual; antennæ scarcely one-half longer than the head, slender, nearly as in *robustum*. *Prothorax*

very slightly wider than long, almost exactly similar to that of *robustum*, except that the transverse basal groove is at scarcely more than one-fourth the length from the base. *Elytra* at the prominent humeri distinctly wider than the prothorax; sides feebly divergent, strongly arcuate; disk convex, about as long as wide; sutural striæ strong, arcuate; discal fine, distinct, terminating at the middle of the disk. *Abdomen* very slightly shorter and much narrower than the elytra, longer than wide; sides nearly parallel, straight, except in the apical fourth, which is parabolically rounded; basal carinæ less than one-third as long as the segment, fine, exactly parallel and straight, separated by slightly less than one-third the abdominal width. *Legs* rather short and slender. Length 1.2 mm.

California (Anderson Val., Mendocino Co. 1).

This species is very closely allied to the preceding, the type specimen, which is apparently a female, is smaller, much narrower, with a narrower, much more elongate abdomen and larger head. The form and position of the basal carinæ differ in the two species, being distinctly stronger and divergent in *robustum*, and finer and perfectly parallel in *testaceum*. Were it not for this character and the probability—because of the sexual characters—of the masculinity of the small-headed type of *robustum*, I should be persuaded to unite the two as very extreme specimens of a single species, but at present this does not appear to be admissible. Although both are from the same region, the localities in which they were taken were widely different.

The four species thus far described differ from *californicum*, as described by LeConte, in the extent of the discal striæ, these being two-thirds as long as the elytra in the latter. The number of species is probably considerable, as scarcely any organized attempt has been made to collect them.

EUPLECTUS Leach.

E. californicus n. sp.—Form slender, parallel, depressed; dark testaceous throughout, polished; pubescence fine, rather short, somewhat dense. *Head* rather large, slightly wider than long; eyes small, convex, rather prominent, at more than their own length from the base; genæ rounded, convergent, not prominent; base broadly sinuate; surface depressed, coarsely, deeply and rather densely punctate; having on a line through the

middle of the eyes, two small nude foveæ, mutually scarcely as distant as either from the eye, connected by a feebly impressed anterior groove; antennal tuberculations small, rather prominent; antennæ three-fourths as long as the head and prothorax together, moderately robust, club moderate, the joints nine to eleven gradually and uniformly wider, the latter oval, as long as the three preceding together; under surface deeply and densely punctate, with an impressed fovea in the middle at the base, without long erect setæ. *Prothorax* slightly shorter and narrower than the head, widest at one-third the length from the apex, very slightly wider than long; sides strongly rounded anteriorly, rather strongly convergent and nearly straight to the base; the latter broadly arcuate, two-thirds as wide as the disk, very slightly wider than the apex; the latter transversely truncate; disk feebly convex, with a slightly elongate foveæ near the center, a broad impression at one-fourth the length from the base, and, on each side, a large rounded deeply-impressed foveæ, at two-fifths the length from the base, not connected with the median impression; surface very feebly and not densely punctate. *Elytra* at the humeri slightly wider than the prothorax; sides nearly parallel, distinctly arcuate; together very feebly sinuate at apex; disk depressed, as long as wide, nearly one-half longer than the prothorax; sutural stria deep, very feebly arcuate; discal fine, distinct, slightly arcuate, vanishing slightly before the middle; each elytron with an isolated basal fovea near the sutural; surface very feebly, sparsely punctate. *Abdomen* as long as the elytra and distinctly narrower; sides straight and parallel; border narrow; surface feebly convex, finely, feebly and not densely punctate; first three visible dorsals equal in length; first two each impressed in the middle of the base; carinae very short and nearly obsolete. *Legs* short; femora not robust; tarsi short and robust. *Metasternum* long, impressed along the middle. Length 1.3 mm.

California (Lake Tahoe 3).

The tarsal claw has a very minute hair-like appendage internally near the base, giving the appearance of a rudimentary second claw, but as all the characters are precisely similar to the European genus *Euplectus*, as seen in *sanguineus*, *signatus*, *Bonvouloiri*, etc., much more similar, in fact, than most of our Eastern *Euplecti*, it is impossible to believe that it belongs to a different group. I would prefer rather to consider this a tendency to revert to the normal condition of Coleoptera, and to hold that similar appearances may occasionally be exhibited in the European genus.

The type is a male, the sixth segment being deeply im-

pressed in the middle. The female does not differ appreciably in form.

The occurrence of a genuine *Euplectus* near the Pacific coast is a very interesting fact, as heretofore the genus has not been discovered west of the Rocky Mountains. The three specimens indicated were found under the bark of fallen trees, and the species appears to be very rare. It should be placed after *confluens* in our lists.

RHEXIDIUS n. gen. (*Euplectini*)

Tarsi with two unequal claws; antennæ straight, basal joint not conspicuously elongate, widely separated at base. Posterior coxæ contiguous. Prothorax without lateral teeth, having a median canaliculation, and two large lateral foveæ near the base connected by a fine transverse line. Antennæ eleven-jointed, short; club long and slender, three-jointed. Maxillary palpi small, slender; third joint oval, slightly longer than wide; fourth much longer than the three basal combined, slender, fusiform. First visible dorsal segment slightly longer than the second; second ventral in the middle as long as the next three together; posterior margins of the posterior segments strongly emarginate. Elytra with lateral subhumeral fovea and fine carina.

This genus is founded upon a small Californian species, bearing a great resemblance in many of its characters to *Oropus*, but differing in the structure of the antennæ and in the complete absence of lateral prothoracic teeth. It belongs in some of its characters near the African genus *Rafraxia*, Reitter, but differs greatly in the pronotal sculpture and elytral structure.

R. granulosus n. sp.—Rather slender and depressed, pale ochreous-testaceous throughout, slightly shining; pubescence rather coarse, moderate in length, not very dense. Head much wider than long; eyes far down on the sides, rather small, feebly convex, at about their own length from the base, coarsely granulated; base broadly sinuate; occiput feebly impressed in the middle at base, having dorsally on a line through the middle of the eyes two small, very widely distant, nude foveæ, also near the apex a transversely and feebly arcuate groove, terminating in minute foveæ which are connected with the occipital foveæ by a finer groove; surface impunctate, rather densely covered with small, round, strongly elevated tubercles; antennæ distinctly shorter than the head and prothorax together, basal joint but very

slightly longer than wide, cylindrical, second shorter, slightly narrower, nearly globular, three to eight narrower, transverse, the latter twice as wide as long, ninth and tenth slightly more than twice as long, much longer than the eighth, nearly rectangular, the tenth very slightly the wider and longer, eleventh scarcely visibly wider than the tenth, very elongate and slender, gradually acuminate and as long as the five preceding joints combined. *Prothorax* but very slightly wider than the head, widest in the middle; sides near the basal angles just visibly sinuate, in the middle strongly rounded, near the apex very feebly sinuate; base broadly arcuate, two-thirds as wide as the disk, one-half wider than the apex; disk as wide as long, moderately convex, covered not very densely with small tubercles; median canaliculation rather fine, equal, terminating near the base and apex; lateral foveæ small, deeply impressed, spongiose, at a little more than one-fourth the length from the base, connecting groove transverse, straight, very fine. *Elytra* slightly longer than the prothorax, at apex one-half wider than the latter, distinctly wider than long; humeri not at all prominent; together transversely truncate behind; disk feebly convex, rather sparsely and more coarsely tuberculate, each with three basal foveæ and four striæ, one evenly and feebly arcuate, two and three feeble, nearly equal, one-half as long as the elytra, four stronger, one-third as long as the elytra. *Abdomen* very slightly wider and longer than the elytra; sides arcuate; border rather strong, inclined; surface rather strongly convex, scarcely visibly tuberculate, *Legs* rather slender. Length 1.0 mm.

California (Alameda 4).

The sexual differences are apparently very feeble, the terminal segment in the male being feebly impressed. The mesosternum is bicarinate.

OÏROPUS Casey.

O. montanus n. sp. — Form slender, rather depressed, uniform dark rufo-testaceous throughout; integuments polished, not perceptibly punctate; pubescence fine, rather long, not dense. *Head* triangular, shorter and narrower than the prothorax; eyes rather small, not very prominent, at slightly more than their own length from the base; genæ strongly convergent, feebly arcuate; base broadly sinuate; base of occiput longitudinally impressed in the middle; occipital foveæ deep, distant, on a line through the posterior limits of the eyes, connected by a narrow, deeply impressed, arcuate groove, much shorter than wide; antennæ short, robust, distinctly shorter than the head and prothorax together, club elongate, rather feeble, joints three to eight transverse, the former slightly wider than long, the latter more than twice as wide as long, ninth and tenth joints twice as wide as long, nearly rectangular, tenth just visibly wider and longer than the ninth, eleventh

distinctly wider than the tenth, nearly three-fourths longer than wide, conoidal, acuminate. *Prothorax* widest in the middle, where the sides are strongly rounded, thence strongly convergent toward base and apex, very feebly sinuate near each limit; base broadly arcuate, scarcely two-thirds as wide as the disk, one-half wider than the apex; the latter feebly arcuate and less than one-half as wide as the disk; lateral teeth minute, in a transverse line with the lateral foveæ; the latter deep, at slightly less than one-third the length from the base, connected by a fine, posteriorly arcuate groove; median canaliculation fine, crossing the transverse groove; obsolete near the base and apex, not at all dilated except near its basal limit; disk about as long as wide. *Elytra* scarcely one-fifth longer than the prothorax, at apex nearly one-half wider than the latter; disk distinctly wider than long, feebly convex; stria one nearly straight, two slightly arcuate, united with one at one-third the length from the apex, three two-thirds and four one-half as long as the elytra respectively, all deeply impressed. *Abdomen* nearly as wide as and distinctly longer than the elytra. *Legs* rather short and robust. Length 1.8 mm.

California (Placer Co. 1).

Described from the female. It can very readily be distinguished from all the species previously known by its slender form, short elytra and peculiar disposition of the elytral striæ.

SONOMA Casey.

S. corticina n. sp. — Linear, depressed, pale testaceous throughout; pubescence fine, rather short, not dense. *Head* slightly wider than long, a little shorter and narrower than the prothorax; eyes small, at the middle of the sides; genæ long, rounded, longer than the eyes and nearly as prominent; front feebly convex, impunctate, having, at nearly one-third the length from the base, two small nude punctiform foveæ, mutually slightly less distant than either from the eye, and, at the vertex, behind the line of the antennæ, a large, deep circular fovea which is completely nude; antennæ one-third longer than the head and prothorax together, slender, feebly clubbed, first joint much longer and slightly more robust than the second, the latter nearly one-half longer than wide, oval, joints three to eight moniliform, gradually shorter, the latter slightly wider than long, joints eight to ten similar in form, gradually slightly larger, eleventh slightly wider than the tenth, a little longer than wide, obtusely acuminate, not as long as the two preceding together; under surface transversely and feebly impressed just behind the mentum, and more deeply so along the basal margin; fourth joint of the maxillary palpi longer than wide, compressed, oval, having a distinct terminal process. *Prothorax* widest in the middle; sides broadly rounded to the neck, convergent and distinctly sinuate near the base; disk

slightly wider than long, feebly convex, having a transverse anteriorly arcuate impression near the base which terminates laterally in two small punctiform foveæ and which is more deeply impressed in the middle, also just before the middle two minute punctiform foveæ, separated by one-fifth the entire width, and at each edge at one-fourth the length from the base, a large disconnected deeply impressed fovea, the impression being continued more feebly to the basal angles. *Elytra* depressed, at the humeri slightly wider than the pronotum; sides nearly parallel, more strongly arcuate behind; together truncate at apex, nearly as long as the head and prothorax together; sutural striæ deeply impressed, beginning at a slight distance from the base; discal broadly impressed, vanishing near the middle, coarsely foveo-punctate; between this and the sutural a few foveate punctures near the base arranged longitudinally. *Abdomen* slightly longer and wider than the elytra; border wide, slightly inclined; first visible dorsal much shorter than the second, having near the apex a transverse interrupted spongiose line. *Legs* rather short and robust. Length 1.4-1.6 mm.

California (Mendocino Co. 8).

This species was found rather abundantly under the bark of fallen trees in the Anderson Valley; it differs from *parviceps* in its larger head, and from *isabellæ* in color and in its less robust form.

S. cavifrons n. sp.—Slender, depressed, pale testaceous throughout; pubescence fine, short, suberect, not dense; integuments polished. *Head* small, much smaller and narrower than the prothorax, as long as wide, eyes moderate in size, prominent, finely granulate; genæ convergent, rounded, not at all prominent, as long as the eyes; base feebly sinuate; surface impunctate, having posteriorly two small round feebly impressed foveæ, mutually slightly less distant than either from the eye, and, just behind the strongly elevated transverse frontal ridge, a longitudinally elongated, very deeply excavated fovea which is slightly spongiose and more attenuated posteriorly; antennæ slender, slightly longer than the head and prothorax together; first joint longer than wide, robust, oval, second shorter, less robust, oval, one-half longer than wide, third small, narrowest, four to seven subequal, much larger than the third, joints three to seven slightly longer than wide, eight as wide as long, nine and ten slightly larger, very little wider than long, eleventh slightly wider than the tenth, longer than wide, acuminate, shorter than the two preceding together. *Prothorax* widest at one-third the length from the apex, where it is distinctly wider than long; sides strongly rounded, convergent and sinuate toward base; the latter broadly arcuate, three-fourths as wide as the disk more than one-third wider than the apex. *Elytra* at the humeri distinctly wider than the prothorax; sides feebly divergent, more strongly arcuate behind; together slightly longer than wide, as long as the

head and prothorax together, depressed; sutural series of four impressed foveæ at the base; the sutural stria deeply impressed and continuous only from the fourth foveæ; discal impression coarsely foveate, terminating before the middle; between them a basal series of two or three foveæ. *Abdomen* as wide as and slightly longer than the elytra; border wide. *Legs* short and rather slender. Length 1.9 mm.

California (Mendocino Co. 1).

The pronotal foveæ and spongiose band of the abdomen are nearly as in *corticina*. This species is abundantly distinguished from the preceding and from *isabella*, Lec. by its smaller head and pale color respectively, and from *parviceps* Mäkl, which it must more nearly resemble, in its smaller size. The present species was found with the preceding under bark, and, as the Alaskan form inhabits grassy places, the two are probably distinct.

S. isabella Lec.—Two specimens of this species, collected by Mr. C. Fuchs, at Alameda, differ greatly from those here described in the shorter, more robust antennæ, with more transverse joints, in the intense black color with testaceous elytra, and in the complete absence of the two discal punctures of the pronotum. They were found in decomposing vegetable mould.

EXPLANATION OF THE PLATE.

The accompanying plate is somewhat experimental, the figures being reproductions by means of photography and gelatine printing, of shaded lead-pencil drawings. Should this attempt be deemed successful, the process must assuredly become popular among entomologists, as it is far easier and less trying to the eyesight to make satisfactory drawings in soft pencil than in ink stipple.

Fig. 1—*Nisaxis cincinnata* Cas.

Fig. 2—*Biolus formicarius* Cas.

Fig. 3—*Eutrichites (Zimmermanni?)* Lec.

Fig. 4—*Oropus interruptus* Cas.

Fig. 5—*Bryaxis texana* Cas.

Fig. 6—*Tychus sonomæ* Cas.

Fig. 7—*Actium pallidum* Cas.

Fig. 8—*Rhexidius granulatus* Cas.

Fig. 9—*Thesium laticolle* Cas.

Fig. 10—*Sonoma corticina* Cas.

NOTE.—The drawings are taken from typical representatives in all cases except *Eutrichites* Lec. and *Thesium laticolle* Cas., which I have identified from the original descriptions. With reference to the former, it may be stated that the specimen figured agrees very well generically, but not so well specifically, with the description of Le Conte. For example, the apical fovea of the front is stated to be smaller than the occipital in *Zimmermanni*, whereas in the representative figured it is in the form of a broad, indefinite impression without trace of fovea. The specimens here figured were found at Austin, Texas.

CALIFORNIAN MANZANITAS.

A Partial Revision of the *Uva-ursi* Section of the genus *Arctostaphylos*,
Adans., as Represented on the North American Pacific Coast.

BY C. C. PARRY.

Read June 20th, 1887.

California is the native home of the "*Manzanitas*," confining the application of this well known common name to the *Uva-ursi* Section of the botanical genus ARCTOSTAPHYLOS, Adans.

Though the typical species on which the genus was founded (*A. Uva-ursi*), is barely found within its northern limits, the more conspicuous forms, including not less than twelve species, constitute a marked feature of Californian scenery, and are everywhere recognized as among its most attractive floral displays.

Having several years ago undertaken a partial revision of the genus *Arctostaphylos* in Proceed. Dav. Acad. Science, Vol. IV, 31-37, the writer was naturally interested in continuing those observations, and being materially aided by free access to the valuable collections and library of the California Academy of Science, it seems eminently proper to present the results to the scientific public through the medium of the California Academy Bulletin.

At the time of the publication above referred to, I very naturally inferred that the commonly received species, as described in current systematic botanical works, were clearly defined, and referred to properly authenticated names. It was therefore a matter of no little surprise to find as the result of careful field observations, that though as growing plants distinct species could be readily recognized, the published descriptions, on account of imperfect material,

or in some instances erroneous mixing of specimens in different stages of growth, could not be made to agree with actual living species. In endeavoring to rectify these unavoidable errors, no doubt largely due to a too exclusive reliance on dried specimens for systematic definition, I was obliged in the first instance to take into consideration that widely applied name of *Arctostaphylos pungens*, HBK, which has heretofore absorbed most of the poorly defined forms brought back in collections, not alone from its original location on the table-lands of tropical Mexico, but extending northward along the Sierra-Madre, and appearing again in unusual rich development on the North Pacific coast, and the Californian Sierra Nevada. Aside from the extreme improbability that a shrub of such peculiar character, not easily adapting itself to changed conditions, either in nature or cultivation, should exhibit such a wide geographical distribution—neither the published figures of the true Mexican plant, nor the original description could, except by a forced construction, apply to our well known Californian *Manzanita*, as seen in the lower foot-hills or the high Sierras. I have therefore undertaken to give a complete and detailed description of this species, combining the common with the botanical name, viz.:

Arctostaphylos Manzanita.

Another species, presenting very constant and distinct characters, such as no one in the field would fail to recognize, in its dense gregarious habit and singular glaucous foliage, has been strangely confounded with the widely distinct *A. glauca*, Lindl., with which it agrees only in leaf characters. As this common foot-hill *Manzanita*, ranging from Southern Oregon to Central California, and possibly beyond, has never yet been clearly defined, I have herewith named, from a very marked character of the inflorescence, *Arctostaphylos viscida*.

Besides the above, my attention has also been called to another undescribed species of remarkable delicacy and

beauty, first collected in fruiting specimens by Mrs. M. K. Curran in Lake County, in 1886, and during the present season abundantly gathered in all stages of growth by the writer, in the vicinity of Calistoga. Desirous of recognizing in some suitable way the facilities for botanical exploration extended to myself and others in California by Hon. Leland Stanford, I have, with his permission, dedicated this interesting species, which I hope to be able to introduce into cultivation, viz.: *Arctostaphylos Stanfordiana*, to the memory of his son, Leland Stanford, Jr., whose name is to be associated with a richly endowed institution for the advancement of human knowledge.

While postponing for the present the consideration and possible settlement of the vexed question of determining just how far the aggregation of constant characters as the result of enlarged exploration, may justify the raising of sub-genera or sections to full generic rank—which is especially urgent in view of the polymorphous character which is now assumed by the genus *Arctostaphylos* in more recent botanical works—I must content myself with a synoptical arrangement of all the known species, heretofore included in Section *Uva-ursi*, giving detailed descriptions of such only as are new, or corrected notes of such as are imperfectly known or wrongly defined.

Preliminary to this, some general observations on the ordinary botanical features, that may aid in discriminating species as observed in the field, is herewith submitted.

GENERAL OBSERVATIONS.

Notwithstanding considerable diversity in habit and growth, varying from low procumbent to almost arborescent forms, this *Uva-ursi* group presents certain uniform features, probably justifying its retention as a distinct genus, under the earliest applied name, *Arctostaphylos*, Adans., separated generically from the other allied groups

with which it has been combined in later systematic works. Thus viewed in all forms, they are densely branched, shrubby plants, with smooth reddish bark, renewed annually by an exfoliation of that of the previous season, which, by the swelling of the branches at the time of growth in May or June, detaches the old in loose flakes, showing beneath, the light greenish new bark becoming tawny-red on exposure, to go through the same process of decortication the next season. In the sub-arborescent forms the branches thickly set on the base of the irregular trunk, project their rigid and crooked limbs in every direction, forming dense, almost impenetrable thickets.

The evergreen foliage, varying in tint from bright vivid to dull green, or glaucous, is smooth, or roughly pubescent, rarely tomentose, and usually entire, the different species generally presenting well marked specific distinctions in shape and texture. Of these, *A. Andersoni*, Gray, is exceptional in its frequent sharply serrate leaves, though in all seedling plants observed, the earliest growth succeeding the cotyledons is invariably serrate, in this respect corresponding to the interesting observations of Prof. Greene in regard to the early growth of *Prunus occidentalis* on Sta. Cruz Island. The usual vertical twist to the petioles, giving the leaves a perpendicular direction, is one of the features common to many shrubs in arid districts, with the obvious result of checking evaporation by less direct exposure to the vivid rays of the summer sun.

The inflorescence always terminal on the growing shoots, is provided for by fully formed buds of the previous season protected by their characteristic bracts, thus prepared to develop their delicate urceolate corollas as early as the season of growth will allow, in favorable seasons attaining a full development by January or February.

The usual form of inflorescence is a panicle, with more or less extended or divaricate lateral and terminal racemes. The subtending bracts are usually quite characteristic in the

different species, usually somewhat rigid and persistent, more rarely thin hyaline and deciduous, the pair of bracteoles at the base of each pedicel, inconspicuous and evanescent. The pedicels, usually exceeding the bracts, are slender or thickened upwards, smooth or pubescent, in some instances viscid-glandular. The corollas are very uniform in character and offer scarcely any features of specific value, being urceolate in shape, white or delicately rose-tinted, deciduous and enclosing a whorl of ten stamens, with appendaged anthers, and filaments dilated and hairy at base. The single style with its short lobed stigmas, exceeds the ovary, and is more or less persistent on the forming fruit. The fruit, technically termed a *nuculanium*, varies in size from one-fourth to one-half inch in diameter, is usually orbicular in shape, occasionally flattened horizontally, and deeply umbilicate, more rarely oblong and acuminate; it is composed of a thin outer pericarp, smooth or pubescent, occasionally glandular-viscid, the color at maturity is a dull white, sometimes with a reddish tint, which soon changes to a dull brownish yellow, and later to a deep mahogany; this encloses within a more or less copious granular sub-acid pulp, a radiating series of osseous nutlets (*Pyrene*), varying from five (the normal number) to seven or eight; these are either loosely united at the ventral edge and easily separable into one-celled divisions, or the separate cells are irregularly coalescent presenting an unevenly lobed nutlet, or more rarely consolidated into a regular solid stone; when separable, each developed nutlet contains a single pendulous seed, composed of a slender erect radicle, and small cotyledons, enclosed in fleshy albumen. When the nutlets are irregularly coalescent the larger divisions include several distinct and fertile cells, and in case of the complete consolidation, the cross-section shows the open cells with inclosed embryo imbedded in the dense woody tissue, only the larger cells being fertile. That this variable character is not as at one time supposed of generic value, is evident in the fact that a

continuous series can be traced from the distinctly separated nutlets through the partially to the completely consolidated drupe. It has seemed important to dwell on these details of botanical characters, as it is only by a combined view of all, that species as they exist in nature, can be properly distinguished.

GEOGRAPHICAL DISTRIBUTION.

Not until such time as the species are correctly determined, can any satisfactory views be taken of geographical distribution. Judging, however, from such as are well known, the range of species is quite strictly limited by the peculiarities of soil, climate, and exposure, to which they are adapted. This is no less true of the world-wide species *A. Uva-ursi*, which in encircling the globe does not extend beyond that degree of north latitude, or elevated exposure, which is suited to its boreal habit, than of the analogous *A. pumila*, Nutt., confined as far as is known to the sandy wastes of Monterey, or the vicinity of San Francisco. Equally may it be inferred that the peculiar Californian species will not be found outside of the peculiar climatic conditions to which they are adapted, the more so as their structure and limited reproductive characters are not adapted to cosmopolitan habits. It is therefore reasonable to conclude that several of the more southern forms, heretofore referred to known species, will on careful examination be found distinct, and thus justify the opening paragraph, that California is, *par excellence*, the home of the *Manzanitas*. Hoping at some future time to verify or disprove these suggestions, I will now simply indicate such species as may at present be accepted, in a preliminary synoptical arrangement, viz.:

ARCTOSTAPHYLOS, Adans.

‡ *UVA URSI*. Gray. Synop. Fl. II, Part I, 27; Parry Proc. Dav. Acad. Science, Vol. IV, 31-37.

1. *Fruit with Pyrenæ distinct, or more or less coalescent.***Low prostrate shrubs.*1. **A. Uva-ursi** Spreng.

The typical species on which Adanson established the genus as distinct from *Arbutus*. This author did not however include the species afterwards united as *A. alpina*, Spreng., which, on account of its very distinct characters, is better referred back to an older genus MAIRANIA, Neck. viz.: *M. alpina* Desv.

2. **A. pumila** Nutt ; Gray, l. c.

This species, first collected by Nuttall in 1836, and described only from leaf specimens, has been long regarded as a doubtful species, and is still imperfectly known. During the present season (1887) the original locality was visited by the writer, on sandy wastes bordering the eastern shore of Monterey Bay. It here forms densely spreading mats, several yards in extent, with assurgent branches, thickly covered with small ovate or spatulate leaves, of a dull green color, lighter beneath, pubescent when young, entire, and short-petiolate; these conceal from view the small clusters of fruit mature in July. The inflorescence is a contracted raceme, with rather conspicuous veiny bracts, shorter than the smooth pedicels, flowers small pinkish-white; the fruit is orbicular, yellowish-brown at maturity, the separable nutlets closely adjoining, broadly carinate, and smooth on the external face, occasionally partly coalescing into irregular, two-celled stones. In the above characters it is clearly marked as a distinct species, of very limited range, and has been known for several years, from an isolated locality at Lone Mountain Cemetery, San Francisco, where it was first detected by the late Dr. Kellogg, and by him properly referred to the Nuttallian species.

3. **A. Nevadensis** Gray l. c.

Confined to the alpine districts of the Sierra Nevada, and clearly distinguished in its peculiar habit, from the mountain form of *A. Munzanita*, with which it is occasionally associated.

* * *Erect shrubs, approaching arborescent.*

A. Hookeri Don, Gard. Dict. III, 836. Gray l. c.

Arbutus? pungens Hook. & Arn. Bot. Beech. 144.

Xerobotrys, venulosa Nutt. Benth. Pl. Hartw. 321.

Short depressed stems, with erect branches, forming loose clumps 1—3 feet in height; young branches and petioles closely pubescent; leaves smooth, bright green on both sides, distinctly veined, ovate, and gradually tapering at base to a slender twisted petiole, cartilaginous-mucronate, and on vigorous shoots occasionally irregularly mucronate-serrate; inflorescence short-racemose, bracts membranous, attenuate, longer than the smooth pedicels, deciduous in fruit, calyx with thin ciliate margins, corolla small, narrowly urceolate; fruit smooth, yellowish-brown at maturity (July), orbicular, flattened horizontally, deeply umbilicate at base, 3 lines broad, 2 lines high, granular pulp rather copious, nutlets separable, rough carinate on the back, and acute at the ventral edge at the base, when less than five, one or more coalescing to form a 2—3 celled stone.

Long known from all the early collectors in the vicinity of Monterey, but poorly defined from imperfect fragmentary material. A recent opportunity for field examination affords the means for completing the description.

5. **A. Andersoni** Gray l. c.

Apparently limited in range to the Santa Cruz Mountains.

6. **A. tomentosa** Dougl. Gray l. c. excl. Southern and Mexican forms.

This is one of the oldest and best known species, having been fairly well figured, and occasionally seen in cultiva-

tion. Notwithstanding variation in habit, and degree of pubescence, shape of leaves, etc., it is readily distinguished in the field, forming usually a low spreading bush, with dull green foliage, hispidly ciliate young branches, and very conspicuous floral bracts, occasionally becoming foliaceous, and generally exceeding the hairy pubescent pedicels, both the ovary and forming fruit are more or less hairy pubescent, but not glandular. It is usually later in flower than other species with which it is frequently associated, thus obviating a confusion that is likely to arise from hybridization. The fruit maturing in August shows the usual character of nutlets, more or less separable or coalescent. Specimens from Southern California and Arizona, extending into Mexico (one of which is characterized below as *A. Pringlei*), heretofore referred to this species, are clearly distinct.

7. **A. Manzanita.** *A. pungens* of various authors, not HBK.

Shrubby to sub-arborescent, 5—25 feet in height, bark smooth, dark reddish brown, renewed annually, younger branches more or less closely pubescent; leaves petiolate, about one-third the length of the blade; smooth, dull green on both sides, entire, varying in shape from narrowly to broadly ovate, usually obtuse at the apex, and abruptly short mucronate, rounded or tapering at the base; inflorescence paniculate, the divisions more or less prolonged, rachis hoary-pubescent, and thickening upwards, bracts broad, acuminate, rigid and persistent, externally pubescent; pedicels smooth, exceeding the bracts, calyx with broad orbicular segments, corolla broadly urceolate, stamens with slightly bearded filaments, style included; fruit smooth, irregularly orbicular, 4—6 lines broad, 3 lines high, dull white at early maturity, becoming reddish-brown with age, nutlets irregularly coalescent, usually one or more broader, with 3 fertile cells, with intermediate 1-celled nutlets, more sharply carinate, the whole including 5—7 fertile cells.

Varying greatly in size from a low bush in the higher mountain districts, to a small tree, with low branching trunk, often over a foot in diameter. It differs from the Mexican *A. pungens*, HBK. to which it has been usually referred, in its more robust habit, its broadly obtuse foliage, its prolonged inflorescence, size of fruit, period of flowering, etc.

It is one of the earliest flowering species, often in full bloom for Christmas decorations; in the higher mountains the flowering period is delayed till May; fruit matures in July and August. As a cultivated shrub it is rather shy, but succeeds tolerably well in natural parks, where it is least disturbed by the processes of cultivation. The leaves of young seedlings are always sharply serrate.

The geographical range of this species, as above defined, cannot at present be satisfactorily determined, though its fullest development is in the lower foot-hills of the coast range north of San Francisco, and on each side of the Sacramento Valley, thence extending in reduced forms to the high Sierras north and south, probably crossing the range into Nevada.

8. *A. viscida*. *A. glauca* in part, of various authors, not Lindl.

Branching from the base 5—15 feet high; branches smooth, reddish, leaves smooth glaucous, finely net-veined, petiolate, varying from broad ovate to sub-cordate or deltoid, entire, abruptly short-mucronate; inflorescence prolonged in a slender spreading panicle, rachis slender, smooth, bracts small, oval, acuminate, pedicels densely glandular-viscid, four to five times exceeding the inconspicuous bracts, which become coated with the copious adhesive viscosity; flowers light pink, calyx with thin margins. corolla short-urceolate, style slender, ovary smooth; fruit orbicular, horizontally flattened, and umbilicate at the base and summit, 3 lines broad, 2 lines high, light yellow to dull brown at maturity; pericarp smooth, copious white granular

pulp enclosing 4—5 rhomboidal nutlets, roughly carinate on the back, one or more broader containing 2—3 fertile cells.

Forming dense thickets on the middle foot-hills of the Sierra Nevada, from the Oregon line to Central California; flowering in March, fruit in July, clearly distinguished by the above characters from *A. glauca*, Lindl., with which it has been confounded. The remarkable viscosity of the pedicels, which draws out into long threads on handling, also serves as a trap to insects, perhaps thereby serving some use in the vegetable economy. At the time of flowering it is one of the prettiest species, in the neat contrast of flower and foliage, being also attractive to swarms of buzzing insects attracted by the copious stores of honey. Though possibly shy of cultivation, its gregarious habit suggests adaptation to park ornamentation, if grown in clumps, as in its natural location.

9. *A. Stanfordiana*.

Low branching, 3—5 feet high, with slender dark-reddish stems smooth throughout; leaves bright green on both sides, narrowly ovate to oblanceolate, tapering below to a short narrowly-winged petiole, entire and mostly mucronate; inflorescence paniculate, prolonged and recurved; rachis smooth, dark red, bracts small, rigid, acuminate; flowers with deep red calyx and thin membranous corolla, light pink and broadly urceolate: style slender, becoming exert, ovary smooth; fruit in pendent racemes, reddish yellow at maturity, uneven orbicular, flattened and umbilicate at base, nutlets broader than deep, lightly connected, carinate, usually two or more coalescent, more rarely all united into an irregular stone.

Covering extensive mountain slopes in the vicinity of Calistoga; flowering in March, fruit in July. Dedicated to the memory of Leland Stanford, Jr.

10. *A. insularis*, Greene in herb. *A. pungens*, Greene, Bull. Cal. Acad., Vol. II, 406.

Smooth throughout; branches light-brown, young shoots rusty green; leaves short, petiolate, ovate, narrowed at base, obtuse, mucous, conspicuously net-veined beneath; inflorescence paniculate, branching, racemes slender, prolonged, bracts short, deltoid, pedicels glandular, hairy (flower not seen); fruit smooth, yellowish-brown, orbicular, 3—4 lines wide, 2 lines high, nutlets irregularly coalescent, the ventral edge acute at base.

Island of Santa Cruz; E. L. Greene, July, 1886.

A symmetrically branched shrub 4—7 feet high, with bright green foliage, and, judging from the fully formed buds (in July), flowering early in the winter. It can hardly be regarded as an insular variety of *A. nutanensis*, the characters above specified seeming constant, and when observed in full flower, it will no doubt exhibit other well marked specific distinctions.

11. *A. Pringlei*.

Young branches, including the petioles and margins of the leaves, copiously ciliate-pubescent, with mixed glandular hairs, leaves short, petiolate, glaucous, minutely net-veined, with conspicuous mid-nerves, ovate to broadly subcordate, abruptly short mucronate; inflorescence closely paniculate from a thickened base, intermixed with bud-scales, indicating a late flowering period, racemose branches slender, thickly covered, as well as the bracts, pedicels and calyx, with ciliate and glandular hairs, bracts lanceolate membranous, petaloid, deciduous, bracteoles linear nearly one-half as long, pedicels slender, divaricate, 4—5 times as long as the bracts, calyx ciliate-glandular, corolla smooth, broadly urceolate; ovary and fruit glandular, hispid, nutlets irregularly coalescent, 5—7-celled.

Mountains of Lower California; C. R. Orcutt, July, 1884;

C. G. Pringle, Arizona, 1885. Distributed as *A. tomentosa*, Dougl., but clearly distinct.

Variety? *drupacea*. Differing from the above only in the completely consolidated stone, deeply sculptured, and usually with a conspicuous one-sided furrow.

Mountains east of San Diego; C. R. Orcutt. No. 543; September, 1886. Distributed as *A. glauca*, Lindl. More material desired for satisfactory determination.

Extra-limital (Mexican).

12. **A. pungens** HBK. excl. synonyms.

2. *Pyrence united into a solid putamen.*

13. **A. glauca** Lindl.

Ten to twenty-five feet in height, branching from the base, with a trunk often more than one foot in diameter, branches and young shoots smooth throughout; leaves glaucous green finely net-veined, short petiolate, with a conspicuous mid nerve, ovate to broadly sub-cordate at base, either acute and sharply mucronate or obtuse with an abrupt mucro, young vigorous shoots frequently irregularly serrate resembling those of young seedlings; inflorescence paniculate prolonged with divaricate and pendent branches, bracts rigid spreading more or less, net-veined the lower foliaceous, pedicels 3 or 4 times exceeding the bracts, glandular-viscid (much less so than in *A. viscida*); flowers rather large, otherwise similar to allied species; fruit ovate, 9 lines long, 6 lines broad, resinous viscid, pericarp thin without granular pulp, stone smooth, usually sharply apiculate with regular perpendicular lines, with intervening netted veins, indicating the separate cells (5—8) more or less abortive.

From Mt. Diablo extending along the Coast range to San Fernando and foot-hills of San Bernardino. Readily recognized from all other species by its light green glaucous foliage, its rigidly persistent bracts, and especially by its

large solid stone. That it should be still properly included in the *Uva-ursi* group is apparent from the fact that it has all the general characters of growth and foliage belonging to that section, and that the solid stone is made up of coherent cells is shown by occasional lines of division, a sharp blow on the outside frequently breaking it along regular lines of separation. On the other hand the species heretofore associated with *A. glauca*, viz. : *A. bicolor*, Gray, exhibits such widely diverse characters of stem, foliage and general habit, as well as a perfectly solid stone, showing no indications of coherent cells, as to justify its re-establishment under the original name *Xylococcus bicolor*, Nutt.

WEST COAST PULMONATA; FOSSIL AND LIVING.

BY J. G. COOPER, M.D.

(Continued from page 376.*)

Santa Clara County.

The eastern half of this county, forming part of the Mount Hamilton range, has been sufficiently alluded to, and the mountainous corner of it in the map is only about half of that part of the range included in the county, while the same unproductive and lofty region extends nearly 200 miles toward the southeast.

The westerly side of the county is shown to be formed by the eastern slope of the Santa Cruz Mountains from near the head of San Francisco Bay and Black Mountain southeast to Pajaro River, thus enclosing Santa Clara Valley, a triangular space of about 200 square miles, little above the sea level. This valley, like the eastern shore of the bay, is supplied with species washed down by the mountain streams, but as far as known only by those from the west. In certain moist shady spots near the streams draining it, several species could formerly be found quite plentifully, but as these willow groves, etc., have been mostly cleared for gardens, few remain. I have thus found in the valley Nos. 1, 5, 11, 26, 30, 31, 32, 33, 35, 40, 42, 43, some of them hidden under logs, brush, etc., in the partial shade of the oaks, which formerly covered about half the drier parts of the valley. These are part of what I give in the table on page 367, as found south of the bay, and the rest naturally follow here.

* Errata, p. 374, line 14 from bottom, for 270 read 210.

The reader will observe that throughout I have used "Helix" in a general way for "Helicoid species," especially Nos. 26 to 39, in table on p. 367.

San Benito County.

Of this county only about 65 square miles are shown, in the triangle northeast of Monterey County and south of Pajaro River. Only one addition to the list is known from there, No. 45, found at "Soap Lake," a marshy expansion of Pajaro River, named from the great alkalinity of the water. This mineralization of the streams, together with the increased dryness of the county, cut off from much of the sea breeze by the high Gavilan range of mountains separating it from Monterey County, shows why the only Helicoid species known from it is No. 32, though a few others may exist, as well as some of the smaller forms, *Limacoids*, etc.

Monterey County.

This extends from Pajaro River south for over 60 miles, and the little known of the species found south of the part on the map has been already given. The influence of the moisture from the ocean on this part is shown by the abundance of several species, between Monterey and Carmel Bays, even on the apparently unsuitable granitic soil, which is however partly covered with tertiary calcareous sandstone, wooded with pine, cypress and oak. There and elsewhere near by, are found Nos. 1, 5, 6, 11, 19, 21, 24, 25, 31, 34, 38, 41, and 42, all within 10 miles of the sea shore, and none are known from higher or more inland localities except No. 37, as stated on page 363. By comparing this with previous lists it appears that while about the same number of species occur as in Santa Clara County, about half of them are distinct, but mostly representative forms, and added together they make only 29 found south of San Francisco Bay, while there were 36 east of there (one of each list doubtful). Increased heat and dryness are the chief causes of this decrease in species.

Santa Cruz and San Mateo Counties.

Returning now north of Pajaro River we find the Santa Cruz range of mountains becoming the most prominent feature of these two counties, which have very little level land throughout. They rise nearly as high as those east of the bay, thus intercepting a greater portion of the moisture from the ocean than any counties yet mentioned. Most of the species of the east slope are the same as are found in Santa Clara Valley, but some are only found on the mountains, and though partly south of San Francisco Bay are included with those "west of the bay," because the same influence controls their distribution. This is, the moister and cooler climate on the west slope, and higher parts of the range, which extends to the eastern slope north of Black Mt., where the peninsula also becomes cooler from the water on both sides.

Santa Cruz County especially, is more densely wooded than any yet named, the redwood and fir, with some pine, having once covered nearly all the west slope, with oaks and other trees, chiefly evergreens, on the remaining surface, except portions covered by the dense shrubbery growing on steep slopes. This abundant shelter, with almost constant moisture from springs, streams, and fogs, in the dry season, and the additional element of abundant lime both in fossils and solid strata, in some parts up to 2811 feet, make it the most suitable region imaginable for land pulmonata. We accordingly found that some species were very abundant in local colonies where all these advantages were combined, and but for the desolating effects of the terrible fires that annually destroy parts of the forests, may suppose that they would be far more abundant and generally diffused.

The same concentration of species and of colonies at low elevations continues as was before mentioned, both decreasing in abundance with elevation, which fact may be partly explained by the greater evaporation and stronger winds

making fires more destructive, and by fewer moist sheltered retreats existing there.

Near the town of Santa Cruz have been found Nos. 1, 3, 5, 6, 9, 11, 12, 13, 19, 25, 26, 30, 31, 35, 39, 42, and most of them below 200 feet only. On the slope of the mountains northward where the pass marked 2216 crosses the summit, the exposure to the sun seems too great for many to live except in the deep cañons, but on the northerly descent Nos. 1, 5, 9, 11, 25, 26, 30, 33, 39, are found near the reservoir, about 1400 ft. alt., and down to the base of the range, where a form occurs between 30 and 32 in character. No. 42 lives about some little marshy lakes at summit of the pass, where others would doubtless exist if they ever got there. Those of Santa Clara Valley occur sparsely, from the foot of the pass northward, to Black Mt., where the fossils are found up to about 2300 ft. west of the peak, but at that elevation I found only No. 17 with 42, along a permanent little springbrook, none of the large species having got so high up. Nos. 4 and 19a have been reported so far only from the northern part of San Mateo County, near the Fig. 1840 on the map, and No. 41 on rotten wood near Fig. 1315 close to the sea shore and northward.

On the west slope, north of Santa Cruz, No. 31 reaches Pescadero Creek and No. 35 to Purissima Creek, where I found very large ones near its source at an elevation of about 1000 ft. approaching in characters No. 26, while the rest of the Santa Cruz species continue into San Francisco County.

Thus we find in these two counties only 20 species and varieties, although the conditions seem so much more favorable than east of the bay, but may safely add to them Nos. 32, 40, 43, found in Santa Clara County, and doubtless entering the mountains of one or both of these.

The height 1840 ft. on the map refers to Mt. Montora, marked by a small circle west of the figure, (two summits there *not intended for towns*). The fig. 1315 is San Bruno Mountain, near the San Francisco boundary.

The addition of Santa Clara Valley, makes a region more similar in form and extent to that described east of the bay, but there are 11 forms found there not known westward, while only 3 occur westward, not found east. Probable reasons for this will be given later, after adding species found in the next county.

It must be remarked that the ledges of limestone are not so productive of land shells as the fossiliferous rocks, the former being so silicified as to be usually little soluble. One runs from Pt. Pedro southeast across the range at Black Mt. to the east base of Mt. Bache; another forms a wide belt around the south end of the spur west of San Lorenzo River.

San Francisco County.

Although only about six miles square and so long occupied by a dense population, this county shows natural advantages for the land pulmonates, superior to any around San Francisco Bay. These consist in its sub-insular position causing a very uniform cool climate, moisture from sea-fogs, and sufficient lime, supplied in part by the remains of marine animals in lately raised beaches, in part from the calcareous veins in the older sandstone. Even the drifting sands that formed arid hills over nearly half its western surface contain numerous fragments of sea shells and microscopic polyzoa, so that where vegetation could grow on them, land shells of all kinds flourished, aided by the dense summer fogs. Yet the higher hills, chiefly metamorphic, although having many rocks and trees to shelter them, show the same absence of these animals as elsewhere, No. 30 and varieties ascending only to about 400 ft. and No. 20 to about 900. I regret that I did not more carefully note the altitudes to which Limacoids ascend in any of the counties, but this could only be thoroughly done in winter, when the higher regions are not easily explored.

Although they were decimated by the domestic animals

of settlers for over twenty years, it was possible up to 1872 to find many species during a few hours' search in the moister and least cultivated spots west of the city, sometimes in quite large colonies, and yet hundreds of collectors were constantly picking them up. It is indeed astonishing that any species survived so long the numerous exterminating influences around them; but the fact shows what persistency they possess wherever the slight moisture from summer fogs assists in retaining their vitality, and above all has probably for ages prevented those desolating fires that killed everything where more luxuriant vegetation covers the soil, and hot dry summers cause fires to rage. For it is not only human destructiveness, or hunters' fires that do the damage, as friction of two dry branches by a gentle breeze, and even the sun's heat, magnified by passing through natural lenses of resinous gums, are believed to be among the causes of fires, even where lightning is scarce, and inflammable vapors may not be ignited by the sun.

That the great number found was not merely due to the many collectors at work, is shown by the scarcity of all the species in any similar extent of land in the neighboring counties; for while all those of the counties southward have been reported to be found except ten, we find added Nos. 15, 16, 18, 20, 24, which, with 1, 3, 5, 11, 12, 17, 19, 20, 21, 25, 26, 30, 31, 41, 42, 43, make twenty-one forms known in the county, to twenty-three in the three large counties next southward, and for the whole region west of San Francisco Bay a total of twenty-nine; while Nos. 14, 34, 37, 38, 39, 44, 45, are found only farther south, and Nos. 2, 7, 8, 14, 22?, 23, 28, 36, 37, 44, 45, occur on the east but not the west side of the bay. Of these, Nos. 7, 8, 14?, 28, 37, 44, 45, may be considered regional variations, due to climatic influences of analogous forms found on the west side, or, more strictly stated, the west side forms have varied from previously existing eastern forms.

There is a possibility that cultivation and preservation of

large tracts in parks, etc., well watered, and protected from other animals, may favor the increase of some or all of the species in this and other counties. I have known of Nos. 1, 3, 5, 16, 17, 21, 26, 30 and its varieties to be found in gardens, while 3 and 16 are imported species, always increasing with cultivation. East of the bay, Nos. 2, 20 and 21 have also been found in gardens.

Marin County.

This county, though lying partly west of the waters connected with San Francisco Bay, and only separated from the last by a narrow channel, differs so much that it is better grouped with those northward. Before visiting that region, I supposed that the mountains so prominent in that direction must be far better suited to produce land-pulmonates than the low sandy peninsula, or the drier and less wooded hills southward.

But while exploring Marin County very carefully, I found none at all on the east slope except near the base of Mount Tamalpais, on Angel Island, where a few only exist, and close to the marshy shores of San Pablo Bay, about Indian mounds or in thickets. Those known there, all quite scarce, are Nos. 1, 4 or 5, 6, 9 or 10, 11 or 12, 23, 30, 31, 42, 43. Connected with this scarcity, we find a new influence beginning to appear, in the occurrence along the northeast slope of the county, of volcanic rocks, as will be later mentioned more fully.

Most of this eastern slope consists of metamorphic rocks, thinly covered, and with little lime, while trees and shrubbery are found only in cañons or on rocky ridges. A few redwoods grow at the east base of Mount Tamalpais, while other coniferous trees occur about the summit, and more abundantly toward the north and west, where they give dense, damp shelter in some localities. Between Mount Tamalpais and Bolinas Bay the tertiary fossiliferous strata cover the west slope, and there are found Nos. 11, 25, 26, 36, be-

sides those last given. Of these I found only No. 11 up to 1200 feet elevation. The triangular peninsula, 1436 feet high, west of Tomales Bay, is chiefly of tertiary strata, but in parts granitic, with much sandy and marshy land about Drake's Bay, quite a dense coniferous forest covering much of its surface. Being also exposed to the sea breeze and fogs, it would seem better adapted for the pulmonates than San Francisco County, which has a similar extent, but so far few species have been brought from there. Along the easterly slope of the ridge a ledge of limestone is exposed, but I could not find any species near it, nor on the higher parts of the peninsula. From the west slope I have received varieties of No. 30, chiefly that often called "*Nickliniana*," which differs from No. 33 in a thicker shell, with a coarsely wrinkled surface, often blotched with whitish patches. This variation is caused by the influence of the spray from the ocean sprinkling the growing shells among the shrubbery just within the sand hills of the beach, where they are sometimes quite numerous, and the same effect is produced on several other species growing in similar situations all along the coast. From this, I infer, arose the reference of "*A. Nickliniana*" to San Diego, where a similar variety of *A. Kelletii* is found.

Marin County thus has only fifteen forms. This great diminution in number of species where conditions seem favorable for more, will be better understood after describing those of the remaining counties.

The figures along the sea coast give the heights of almost perpendicular rocky bluffs, which like the steep Farallone Islands, are chiefly of granite or hard metamorphic rock. Angel Island and all the others near the entrance of the bay, are also chiefly of this nature, and have furnished very few Pulmonata, but Mare Island is tertiary, and supplied more.

Sonoma County.

Little more than half of this is shown on the map, but

enough for present purposes. Near the boundary of Marin County some of the hills are only about three hundred feet in height, allowing the sea breeze to pass inland with almost as much force as at San Francisco Bay, and their desiccating effect in summer is shown by the absence of trees over most of the west slope as far north as the low depression extends. But a little north of Bodega Bay the tertiary sandstones begin to extend over the metamorphic rocks farther inland, rise higher, and accompanied by a dense forest of redwood, etc., soon covering almost the whole surface of the country near Russian River. The fossils are numerous in this sandstone in many places, being as late as the pliocene epoch along Mark West Creek, twenty-five miles inland. The pulmonates of Marin County here become more numerous, extending north throughout the whole width of Sonoma County (excepting limited portions of metamorphic rocks), with increase of numbers, size and perfection. Nos. 10, 27, 29, are apparently varieties produced by improved conditions, especially increase of moisture, lime, shelter, and vegetation suited to their natures. There is no doubt that close search would reveal many others of the bay list there, if not new forms, the smaller kinds being slowly discovered. Among them, No. 23 is likely to be found living.

Fort Ross, in the northwest corner of the map, is the locality where Nuttall obtained some of the types, wrongly credited to San Diego.

Napa County.

The first appearance of volcanic rocks in any great amount has been mentioned as occurring on the northeast slope of Marin County, and they reappear in abundance on Sonoma Mountain, marked 2292 feet high on the map, thence continuing to form most of the mountain ridge which divides that county from Napa, and covering most of Napa County, extend northwest along the boundary between Lake and Mendocino Counties. Though not active in recent times,

there are many old craters on this ridge, the first one met with being Mount St. Helena, of which the summit is nine miles north of the map, on the north boundary of Napa County. There are, however, numerous sulphur and hot springs, which show that the volcanic forces have not yet died out, and the region covered more or less by volcanic materials extends entirely across the ridge west of Napa Creek, and over most of that east of it, as far at least as the heads of streams running into the Sacramento basin. We thus have a region about twenty-five miles wide of volcanic materials, alternating with tertiary deposits containing fossil wood, lignite and other terrestrial products, but no fossil shells yet known. Lime is therefore scarce, and the still heated mineral waters show that during the deposition of these strata animal or vegetable life must have been interrupted as far as the volcanic influence extended, either by flows of lava, hot water or ashes, until the quaternary epoch.

I explored Sonoma Mountain, the head of Napa Valley, and the whole shore of Clear Lake, finding very few land pulmonates, though six aquatic forms inhabit the lake, as well as six non-pulmonate mollusca, while some are also found in several of the creeks of the region, but much fewer than we might expect. This may be considered further proof that these streams have been not long ago heated or mineralized enough to destroy mollusca. Of land species, I can only mention Nos. 1, 4 (or 5), 9 (or 10), 43, 45, as certainly found in the volcanic region, most of which require scarcely any lime, and the two last are almost aquatic.

East of this region we find the foothills forming the east slope of the Coast range, about the headwaters of Putah Creek, composed of cretaceous and tertiary rocks containing fossils, and here are again found, forty-five miles inland, some of the land shells of the west slope, which, with the extensive and luxuriant forest covering much of the country, indicates that the climate is much less arid than along the

tertiary east slope south of the great rivers. I did not reach that region on the geological survey, but Dr. Yates found there Nos. 11, 25, 36, 37 in considerable numbers, and No. 37 also along the outlet of Clear Lake near lat. 39°, where it cuts through the same fossiliferous strata, although not existing around the lake itself. Here we have almost certain proof that No. 37 is not a variety of 36, both living together unchanged. Fig. 2224 is the highest point on the southeast boundary, at the angle west of the figures.

Solano County.

A volcanic ridge runs north, from west of Suisun Creek into Napa County, but the rest of Solano is of cretaceous and tertiary strata containing fossils, excepting the plain sloping eastward from about two hundred feet elevation to the marshes, where only Limacoid and Succinoid species are known to exist.

Mare Island, of pliocene formation, containing bones of land quadrupeds, is the most northern and western known locality of No. 32. No. 25 occurs near there, and Nos. 44 and 45 are to be looked for as in Contra Costa near the marshes, from Suisun Creek eastward. No. 14, first found in Trinity County, must be expected there, also some of the northern forms that occur westward. Small varieties of Nos. 26 and 30 have been found near the borders of Napa County, as in Contra Costa County, but not along any streams of the Sacramento basin.

GEOLOGICAL AND BIOLOGICAL DEDUCTIONS.

I. The marine pliocene fossils found along Mark West Creek, Sonoma County, in San Mateo County, Pajaro Valley, and northeast of Mount Diablo, now elevated at all these points about 300 feet above the sea, show that Marin County, San Francisco County, and the Santa Cruz Mountains, once formed islands 300 feet or more lower in the

ocean than now, and the Mount Diablo range, if not an archipelago, was nearly surrounded by water. In this, great beds of pliocene gravels, containing remains of land animals, were deposited by the streams running from the Mount Hamilton range, while Livermore Valley probably contained a large lake, discharging through Walnut Creek, before the present Alameda Creek cut through the western hills. Fossil fresh water shells found along branches of Walnut Creek both east and west, near Mission Peak, etc., show that lakes or marshes were extensive in pliocene and quaternary times.

II. No extinct land-pulmonata have been found with these fresh water forms (of which several are extinct), but in later beds on Walnut Creek, containing living fresh water forms, are two living land species, Nos. 32 and 33, showing that they were the first of the group to appear in the center of the range they now inhabit east of the Bay. These fossils are plainly quaternary, and the living shells of these two forms become more or less graded into 30, 31, 35, etc., toward the west and south, indicating probably that they may have been the original stock from which the latter were derived. From Marin County a specimen of No. 35 (?) has been brought in a fossil state, unlike those now living southward, being the only evidence known of any fossil forms north of the bay.

III. These few evidences show that the forms of the most characteristic group occurring in the bay region, the *Ariontae*, are either indigenous, or derived from the coast range northward, and have colonized the region during the quaternary epoch, no preceding extinct forms having been discovered there, and no evidence of a transition direct from the Sierra Nevada.

IV. The species given in the table as found also in the Sierras are, 1st, Limacoid, and therefore easily carried by floods without injury; 2d, Vitrinoid, mostly very small, and

supposed to have their eggs transported by adhesion to the feet of birds, although No. 11 may, as before remarked, have spread independently along the two ranges from the north; 3d, Nos. 24 and 25 (?), which may have been spread like the Vitrinoid species; 4th, No. 40, probably in the same way; 5th, Nos. 42 to 45, which may be spread by birds, or, being semi-aquatic, by aid of floods.

V. Considering that none of the Helicoid species are found above 1000 feet east of, and 1400 feet west of the bay, and that they could spread only by crawling (except when shells or eggs were washed *downward* for short distances without injury), we must conclude that they reached the shores of the region by floods chiefly from the north, and landed at heights between the present sea-level and the elevations just given. As they can ascend with more difficulty than Limacoids, they go less high up, and five hundred feet ascent is a liberal allowance for them to have climbed in any numbers. Subtracting this from their highest known ranges, we may assume that they reached the east side of the bay when the land was five hundred feet lower than now, the sea-shore being about two hundred and fifty feet above the fossil bed of Walnut Creek, and as the land rose, gradually spread downward into the valleys, and upward on the hills. Those of the Santa Cruz range would then have colonized that side when it was nine hundred feet lower than now, which may have been about the same period, as the more western range has probably risen more in the same length of time than the eastern, and the whole elevation has been during quaternary times.

VI. The much less abundance and limited diffusion of the species known from the counties north of the bay, within the limits of the map, in spite of the moister and cooler climate, can only be explained by the influence of volcanic forces there, and scarcity of lime along the central ridge of the coast mountains. The twenty-one

forms known there, favored by climate, have extended themselves farther eastward than south of the "Golden Gate," and several large kinds are found east of the volcanic belt, that probably reached there before the last period of volcanic activity buried the "fossil forest," and much life with it. The occurrence of a few species throughout the volcanic region, and of several others at points near its borders, shows that Limacoids spread most rapidly over it, and those with thin shells next, while the large Helicoids were last to obtain a foothold on it.

VII. While it might be supposed that Nos. 30 to 35 could have more easily reached the Bay region from the southward, on account of the courses of most of the present streams, there is no fossil evidence that they ever existed in that direction south of Monterey Bay; while Nos. 26 to 30, and 36, still have their living allies toward the north. That they spread southward at different periods seems also proved by the various distances they have reached, and by the few fossils known.

VIII. Thus we do not find that No. 36 was ever able to cross the salt waters of the Golden Gate to San Francisco County, but can easily believe that it could have been washed down Suisun Creek and across the strait during the winter floods, landing nearly opposite Mare Island, and thence spreading along the moist western slope of the hills to its present terminus, thirty-six miles southward. That it is a very late colcnist there, is also proved by its not having been carried across Santa Clara Valley to the Santa Cruz Mountains, which are better suited for it, while most of the forms of 26 and 30 seem to have drifted over there, and flourished more generally than on the east side. The five or six Helicoid forms out of the twenty-one found in San Francisco County probably reached there in that way, the others coming in the general modes before mentioned. Had they been carried there by floods from the large rivers

they would probably have landed as often on the north shore of the Golden Gate, and become as plenty in the cool damp localities on the west side of Marin County, and more common on the islands of the Bay.

IX. The migration of No. 36 being thus explained, and the general course of distribution of other Helicoids indicated, we can now see how No. 37 may be derived from *C. traskii* by a migration from the Sierra Nevada, but in an opposite direction. The sketch of the distribution of *C. traskii* given on pps. 361 to 364 shows that it intergrades with No. 38 on the coast southward, which may sufficiently account for the origin and range northward of 38 and 39, as they cannot be traced to any form now living within 500 miles north of No. 39. By a quicker route *C. traskii* might have easily been washed down the San Joaquin Valley to the east slope of the coast mountains almost anywhere, but did not find a suitable region for increase until reaching the gap of the Bay region. Any of them landing on the north shores of the strait would ascend along the banks of streams and thus spread to their present northern limit about 50 miles north of the Bay, but have not crossed the volcanic belt to the west side of the Coast range. South of the straits we also find that they have not gone west of the figure 485 in Alameda County, though an allied form reaches Salinas River from the southward. This seems a more natural mode of distribution for this form than that before suggested. Here again the present location of its nearest allies points to its origin, while on the other hand that of the *Ariante* is as plainly traceable to the northern coast ranges instead of the Sierra Nevada. The species found there could apparently be as easily washed down, but seems not to have become colonized.

X. Although there is such a general resemblance in form between Nos. 32 and 37 that Mr. Binney has considered them closely related and mixed them in his figures, I con-

sider this as merely analogical, caused by the general law before stated, that the varieties of each group are more depressed and umbilicate the farther from the coast. Thus we find No. 32 passing into higher forms of 30 to the west, and one variety between 30 and 31 is imperforate though depressed. In the same way *C. traskii* and 37 pass into 38 and 39 near Monterey bay.

A similar effect of climate is observed in the passage of No. 28 toward 26, 27, and 29, in the cooler moister regions west and north, and perhaps into 35 southward. The varieties 30 to 34 seem to have diverged from 33 (or 32) east of the bay, though 30 and 34 are now more abundant on the west side. No. 41 seems also the coast form of No. 40. On the other hand No. 6 may have varied into 7 and 8, which are not known westward. No. 11 seems to have changed into 13 and 14 toward the dry east and south slopes, while 36 has before been traced by intergrades to *C. jidelis*, the northern form as old as miocene times.

XI. The greater extent of both salt and fresh waters through the Bay region, in early quaternary times, no doubt caused a more moist and uniform climate to prevail throughout the Bay region, and was more favorable to the growth and diffusion of Pulmonata than the present epoch. Then the conditions were similar around Livermore Valley to those of Monterey now, and to this I attribute the existence there of No. 34, a few of which still survive toward Cedar Mountain.

XII. In the article on the "Influence of Climate and Topography on our Trees." (Proc. Cal. Acad. V. 285, 1874), relating to the same region included in the map now given, I showed that very few species occurred in San Francisco County, while they increase in numbers of both species and individuals up to 60 miles in nearly all directions. This was attributed to the violence of the summer winds near the

bay, causing too rapid desiccation of the surface to allow of the growth of seedlings, and favoring destructive fires.

It now seems that the effects of the winds in the lower parts of the Bay region, except so far as they spread fires in the forests, are an advantage to pulmonates, which have always been most numerous nearest to the entrance of the bay. This does not, however, prove that they are independent of forests, for these furnish them with shelter and food more abundantly than where no trees exist, so that the finest specimens are found in the forests, though perhaps less frequent, or harder to find. There is also a connection between certain forms and certain groups of trees, as I stated in the synopsis, (*Proc. Cal. Acad.*, III., 260 and 336-7, 1866).

XIII. That the Bay region is, from physical configuration, the best suited for commerce, and a large population, of any on the coast, is a coincidence that may be favorable to the increase of land pulmonates. We find already that three species have become naturalized (though not desirable additions) and the protection from fires, irrigation in summer, cultivation of trees, and destruction of many native enemies, such as carnivorous quadrupeds and some birds, may balance the injuries from cultivation. Some kinds are indeed so numerous already as to be troublesome, especially the Limacoids, in gardens near wet grounds.

XIV. The great difference in distribution of species near the bays from that in the Sierra Nevada may now be explained.

1st. The Sierra having been elevated probably before the tertiary epoch (though no terrestrial fossils yet prove it), was a high range before the miocene land shells of Oregon existed, and they extended over it at an elevation between 1000 and 5000 feet of its present height.

2d. It has continued to rise during the tertiary epoch and since, so that we find the large Helicoids dwarfed at

5000 to 5500 feet elevation, though the degree of cold there has not destroyed them.

3d. The great differences of climate in different zones of the Sierra, cause more distinct limitation of species by different elevations than in the coast range near the sea shore, but as shown by the distribution of *C. traskii* and varieties, it is less apparent at a distance from the Bay region, both northward and southward, where the two ranges of mountains are crowded together. Toward the coast, every group becomes more varied into sub-species, and larger colonies of most of them are found.

4th. The more equable and moister climate near the coast evidently makes it possible for many forms to live together that are more or less limited on the Sierra Nevada to special zones, and this is most apparent nearest to the seashore.

There is an approach in the Santa Cruz range to a higher zone of Vitrinoids and probably of Limacoids. The latter are found, like the Succineas, in the Sierra, both at their base, in damp grounds, and at nearly 6000 feet altitude, though rare between.

XV. To give a practical point to this long article, it may be remarked, that, although the ancient practice of feeding human pulmonates on Helicoid pulmonates as a cure for lung diseases has been justly abandoned (marine mollusca being far preferable), yet they are still much sought for by European epicures, as great delicacies, and may be worth cultivation for this purpose.

It may be added that the search for them in the groves around the bays has been found by the writer one of the most beneficial modes of exercise in his own experience, when threatened with pulmonary consumption. Thus they may benefit health without internal use, and make outdoor exercise more interesting to those who need it, than if taken without any other purpose than to gain strength.

THE FLORA OF THE COAST ISLANDS OF CALIFORNIA IN RELATION TO RECENT CHANGES OF PHYSICAL GEOGRAPHY.

BY JOSEPH LE CONTE.

Read September 5, 1887.

Some of the results reached by Mr. E. L. Greene in his studies of the flora of the islands off the coast of Southern California* have deeply interested me, because I believe their explanation may be found in geologically recent changes in the physical geography of California.

These remarkable islands, 8 or 10 in number, are strung along the coast from Point Concepcion southward, and separated from the mainland by a sound 20—30 miles wide. They are of considerable size (the largest being about 200 square miles in extent), and vary in height from 1,000 to 3,000 feet. They have all the characteristics of continental islands, and are undoubtedly outliers of the mainland, at one time connected with it, but now separated by subsidence of the continental margin. They may be regarded as the highest points of the old coast range outside of the present coast range, the broad valley between the two being now covered with water. Moreover, the date of the separation may be determined with certainty. That they were connected with the mainland during the later Pliocene and early Quaternary is proved by the fact that remains of the mammoth have been found on Santa Rosa, the largest and one of the farthest off of them.† *They were, therefore, undoubtedly separated during the Quaternary Period.*

The main points in Mr. Greene's paper with which we are here concerned are the following:

*Studies in the Botany of California and Parts Adjacent, VI. E. L. Greene. 1—Notes on the Botany of Santa Cruz Island. Bull. 7 Cal. Acad. Sci.

†Proc. Cal. Acad. of Sci. vol. V., 152.

1. Out of 296 species of plants collected by him on the island of Santa Cruz, no less than 48 are entirely peculiar to these islands, and 28 peculiar to Santa Cruz itself.

2. Of the remaining 248 species nearly all are *distinctively Californian*--that is, species peculiar to California are very abundant, while common American species, *i. e.*, those common to California and other parts of North America, are very few and rare. The flora as a whole, therefore, may be regarded as *distinctively Californian*, with the addition of a large number of species wholly peculiar to the islands.

3. A number of rare species found in isolated patches, and, as it were, struggling for existence, in the southern counties--San Diego and San Bernardino--are found in *great abundance and very thriving condition on the islands*.

4. *Locutera*, a remarkable malvaceous genus of which 18 species are known in the Mediterranean region, and one from Australia, but *not a single species on the American Continent, is represented on these islands by four species*. This is certainly a most remarkable and significant fact.

Such are the facts. I account for them as follows:

California, especially the region west of the Sierra Nevada, is geologically very recent. The Sierra region was reclaimed from the sea at the beginning of the Cretaceous, and the coast region as late as the beginning of the Pliocene. When first emerged the coast region was of course colonized from adjacent parts. This colonization was probably mainly from Mexico, either directly or through the Sierra region; for the *distinctively Californian plants, though peculiar, are more like those of Mexico than any other*. Whencesoever it may have been colonized, however, the environment was sufficiently peculiar, the isolation sufficiently complete, and the time has been sufficiently long to make a very distinct flora.

According to Wallace, it is one of the primary divisions of the Nearctic Region.

During the late Pliocene and early Quaternary, as already seen, the islands were still a part of the mainland, and the whole was occupied by the same flora, viz: the distinctively Californian (with some differences doubtless), now found in both, together with the peculiar island-species.

During the oscillations of the Quaternary the then westernmost coast range was separated by subsidence, and has remained ever since as islands. Simultaneously with, or after, this separation, came the invasion of northern species, driven southward by glacial cold. Then followed the mingling of invaders with the natives, the struggle for mastery, the extermination of many (viz: the peculiar island species), and perhaps the slight modification of all, and the final result is the California flora of to-day. But the island flora was saved from this invasion by isolation, and therefore far less changed than the flora of the mainland, *i. e.*, the invading species are mostly wanting, and many species survived there which were destroyed, or else modified into other species, on the mainland, and the remainder probably less modified than on the mainland. The flora of these islands, therefore, represents somewhat nearly the character of the flora of the whole country during the Pliocene times. Some modification they have doubtless suffered, but the time has been too short for any great change in the absence of severe competition.

The question naturally arises, "How is it that with a separation of only 20—30 miles the two floras—insular and mainland—have not become entirely similar by mutual colonization?" The prevailing winds being landward would, I suppose, largely prevent the colonization of common American forms on the islands, although some such colonization has in fact taken place. But with the prevailing winds in this direction, why have not all the peculiar island species been long ago colonized on the mainland? Accord-

ing to the view above presented the answer is evident. These peculiar species did once inhabit the mainland and have been either destroyed or transformed in the struggle with invaders. They are therefore *weaker* species. The same unfitness which made them succumb then, still forbids their successful colonization. This brings me to the next point.

There are quite a number of rare and peculiar forms found struggling for existence in the southern counties which are found very abundant on the islands. This certainly looks like the beginnings of colonization. This is indeed Mr. Greene's view, and is rendered all the more probable by the fact that the ocean currents probably drift in that direction. But there is at least another explanation suggested by the view above presented. These may be, and probably are, *remnants* of Pliocene indigenes still undestroyed, but ready to perish. From this point of view their place far south is just what we might expect, for the main invasion was from the north.

But there is still a last point to be explained. *Lavateras* are unknown in the New World, except on these islands, where there are four species. But they are found in the Old World, in the Mediterranean region and in Australia. Mr. Greene suggests, as a possible explanation, *a former connection of these islands with some other continent*. I think not. The substantial permanence of continental land masses and oceanic basins, with only marginal changes, at least during later geological times—taken together with the comparative recency of the flora of California—renders this explanation extremely improbable. The above presented view suggests another and far more probable explanation.

The existence of *Lavateras* in such widely separated localities as Australia, the Mediterranean region and the coast islands of California, shows unmistakably that existing species are but remnants of an old, once very abundant and widely spread genus, with numerous species. They are now

dying out. They have been mostly destroyed and replaced by newer and stronger forms. I conclude, therefore, that in Pliocene times several species of *Luvatera* existed all over the coast region of California, but probably mostly in the then coast range, viz: the islands; for they love the sea coast. They have all been destroyed by change of environment, physical and organic, except those isolated on the islands and thus saved from the effects of invasion.

Readers of Mr. Wallace's "Island Life" will at once see the analogy between this explanation of the flora of our coast islands and Mr. Wallace's explanation of the mammalian fauna of Madagascar. The mammalian fauna of Africa, south of Sahara, consists of two very distinct groups—the one *indigenous* or descendents of Tertiary indigenes, and *remotely* resembling that of Madagascar, the other evidently *foreign* and resembling that of *Eurasia in Miocene and Pliocene times*. During Tertiary times Africa was isolated from Eurasia, but united with Madagascar, and the whole inhabited by a peculiar fauna, characterized by lemurs, insectivores, etc., which we have called indigenes. About middle Tertiary times, Madagascar was separated, and immediately divergence between the two faunas commenced. In later Tertiary and early Quaternary, the barrier which separated Africa from Eurasia was removed, and the great Eurasian animals invaded Africa, and immediately became the dominant type. In the struggle which ensued, many species, especially of the weaker indigenes, were destroyed, and all on both sides modified. The result is the African fauna of to-day. Madagascar was saved from this invasion by isolation. The fauna there consists of the greatly modified descendants of the African Tertiary indigenes, but far less modified than their congeners in Africa. In the fauna of Madagascar, therefore, we have the nearest approach to the Tertiary indigenes of both.

The difference between the two cases is this: In the case of Madagascar the separation has been very long. The

extreme peculiarity of its fauna is the result partly of progressive *divergence* and partly of *many forms saved by isolation*. In the case of the coast islands of California, the separation is comparatively recent—there has not been time enough for very great divergence by modification. The peculiarity of its flora is due almost wholly to species saved by isolation.

In conclusion I would say, that this short paper is intended merely as an incentive to future investigation and pointing in the direction which it ought to take. Before the views above presented can be definitely established, there must be further investigations, first, on the relation of the island flora to that of the mainland; second, on the relation of the flora of California to that of adjacent points from which it may have been originally colonized; third, and especially, must we have fuller knowledge of the indigenous flora of California in Pliocene times.

PRIORITY OF DR. KELLOGG'S GENUS MARAH OVER
MEGARRHIZA Torr.

BY MARY K. CURRAN.

A recent paper* by Mr. Watson, in which he reaffirms the genus *Megarrhiza* Torr., renders necessary the following statement of the date and circumstances of publication of the first volume of the Proceedings of this Society, more especially as silence on our part would do injury to our venerable pioneer botanist recently dead.

That the eminent author of the above paper has been misled by the ambiguous language of some of our publications is quite possible; his own is however equally so, for as will be noticed, although seeming to deny the priority of *Marah*, he does not specifically do so, and fails to give reasons for his preference of *Megarrhiza*.

Mr. Watson says :

“In the years 1854 and 1855 the same plant and similar Californian species were collected by the botanists of the Pacific Railroad surveys, and specimens were submitted to Dr. Torrey for determination. Some of these species were also known to Dr. Kellogg, of San Francisco, and in March, 1855, he described one of them under the name *Marah muricatus*, noting at the same time its near relationship to *Echinocystis lobata*. In June, however, of the same year, he appears to have silently discarded or to have forgotten his new genus, for he then describes another species of the

*The Genera *Echinocystis*, *Megarrhiza* and *Echinopepon*: Sereno Watson. Bull. Torr. Club. XIV. 155. August, 1887.

'giant root' as *Echinocystis muricatus*. These publications were made in the columns of a daily newspaper. Dr. Torrey, in ignorance of this and as a result of his study of the Government collections made under Lieutenants Whipple, Parke and Williamson, referred the plants to a new genus which he called *Megarrhiza*, publishing a species (*M. Californica*) in Parke's report in 1856 and authorizing the enumeration of that species and of *M. Oregana* in Newberry's report upon Williamson's plants. The descriptions of the genus and species he delayed, intending to give them in full in connection with his report upon the collections made by Lieut. Whipple. The publication of this report, however, was not made until 1857, and in the meantime he learned through Dr. Andrews of Kellogg's genus *Marah*. Consequently, and more especially on account of the difficulty of determining, from the scarcity of the materials, whether there was really more than one species, he omitted from the report all reference to the matter, and nothing more was published by him on the subject. Nevertheless, the genus *Megarrhiza* was recognized by Dr. Gray in 1859, in his list of Xantus' Lower California plants, and in 1860, in the Botany of Ives' Report."

In the above account it will be observed that the author ignores the publication of *Marah* in Proc. Cal. Acad., I, 38, which was not later than April, 1855. An error of this kind can only be explained by supposing that Mr. Watson had never seen the first edition, of which only 250 copies were issued, nor read the preface to the reprint.

The publication of the Proceedings of the California Academy of Sciences was begun in September, 1854. Vol. I was reprinted in 1876, and in the preface the editor, Prof. R. E. C. Stearns, now of the Smithsonian Institution, says:

"The Proceedings of the California Academy of Natural Sciences for the period included in this volume, were originally printed in a newspaper called *The Pacific*, published

in San Francisco; the columns were afterward re-arranged, with but little regard for uniformity and size into double-column pages approximating to octavo, and printed four pages to a signature."

The exact date of issue of these folio sheets cannot now be determined, but it was certainly in each case less than a month after the meeting reported. The limited font of a weekly paper of that time would not admit of the withdrawal of much type locked up in galleys. Most of the early folios bear the signature date, which is at any rate approximately correct.

Scattered through the minutes of this Society in 1854-1855 are brief notes recording the issue of these signatures, and on February 5, 1885, a letter was received from the Imperial Academy of Sciences at Berlin acknowledging the receipt of the first, so that it is probable that the large societies of Europe are better informed concerning this question of priority than our friends at home.

A full list of the plants described by Dr. Kellogg with their dates and media of publication is to be found in Bull. Cal. Acad., Vol. I, 128. In that paper it was taken for granted that the date of publication of the volumes of our Proceedings was sufficiently well known. This would seem from Mr. Watson's paper to have been, at least in his case, a mistake.

As to the statement that Dr. Kellogg gave up his genus *Marah* when he published *Echinocystis muricatus*, the fact of his using the same specific name for the second plant is conclusive evidence that he considered them generically distinct, and if further proof were needed it is furnished by his publication of *Marah minima* four years later. This is, however, a matter of small consequence, as the prevailing opinion of biologists seems to be that over a name once published the author has no more rights than any other person.

Into the question of sufficiency of a weekly, not "daily," newspaper as a medium of publication, or the validity of *Marah* as a genus distinct from *Echinocystis*, it is not now necessary to enter; they have been already treated by pens far abler than mine.

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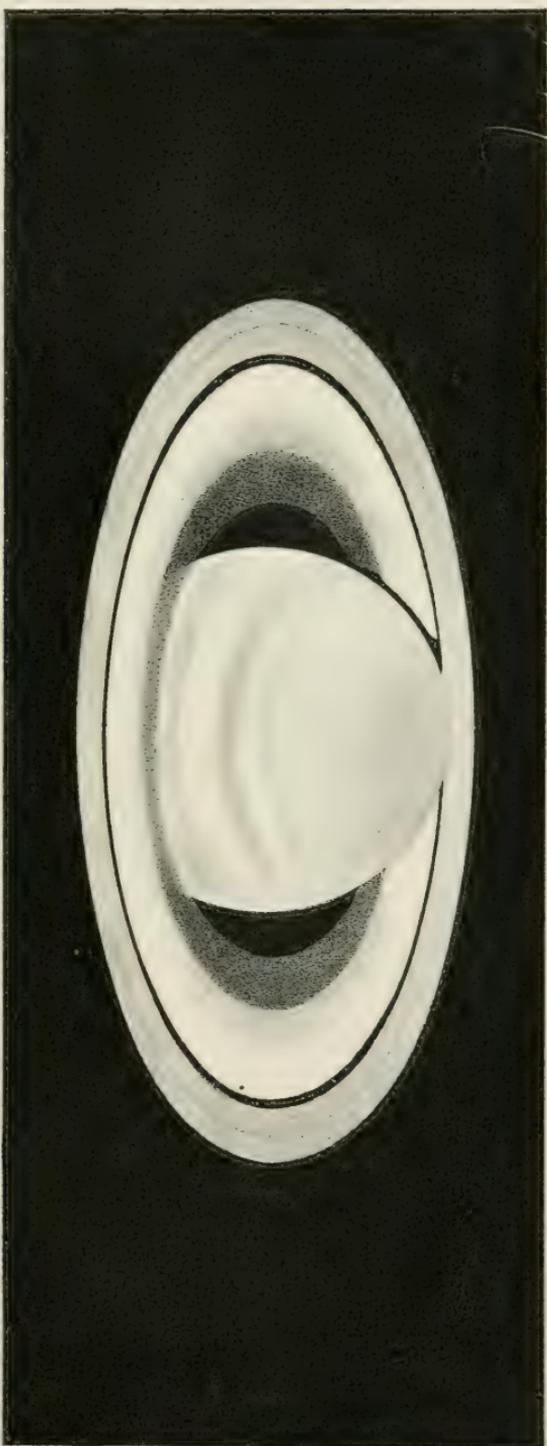
ERRATA.

- Page 41, fourth line from top, for "Chicoriaceous" read "Cichoriaceous."
" 44, third and sixth line from bottom, for "Microseris" read "Microseris."
" 53, eighteenth line from top, for "Fosteri" read "Forsteri."
" tenth 57, " " " " "inæquilatera" read "inæquilatera."
" 125, 127, for "Bro licea" read "Brodiaea."
" 141, twelfth line from bottom, for "Subertia" read "Seubertia."
" 280, in table. For "385 mm." read "384 mm."
" 283, " " " 1691 ♂ read 1691 ♀.
" " " " " 1699 ♂ " 1699 ♀.
" " " " " 2408 ♂ " 2408 ♀.
" " " " " 2504 ♂ " 2504 ♀.
" " " " " 2581 ♂ " 2581 ♀.
" " " " " 2409 ♂ " 2409 ♀.
" 283, second line, for "form" read "forms."
" 289, second table, for "Scott" read "Scott Mt."
" " " " " "Mar. 20, 1883," read "Mar. 20, 1880."
" 290, eleventh line, for "Guadeloupe" read "Guadalupe."
" 291, fourteenth line, for "Guadaloupe" read "Guadalupe."
" 299, thirteenth line, for "by omitting" substitute "it having omitted."
" " eighth line, for "Coue's" read "Coues'."
" 303, second table, for "♀ ad." read "ad."
" 308, eleventh line from top, for "polyglottos" read "polyglottus"
" " third " " " " bottom, for "guadeloupensis" read "guadalu-
pensis."

" 374, fourteenth line from bottom, for 270 read 210.

The reader will observe that throughout "Helix" is used in a general way for "Helicoid species," especially Nos. 26 to 39, in table on p. 367.

LITH. BRITTON & GER



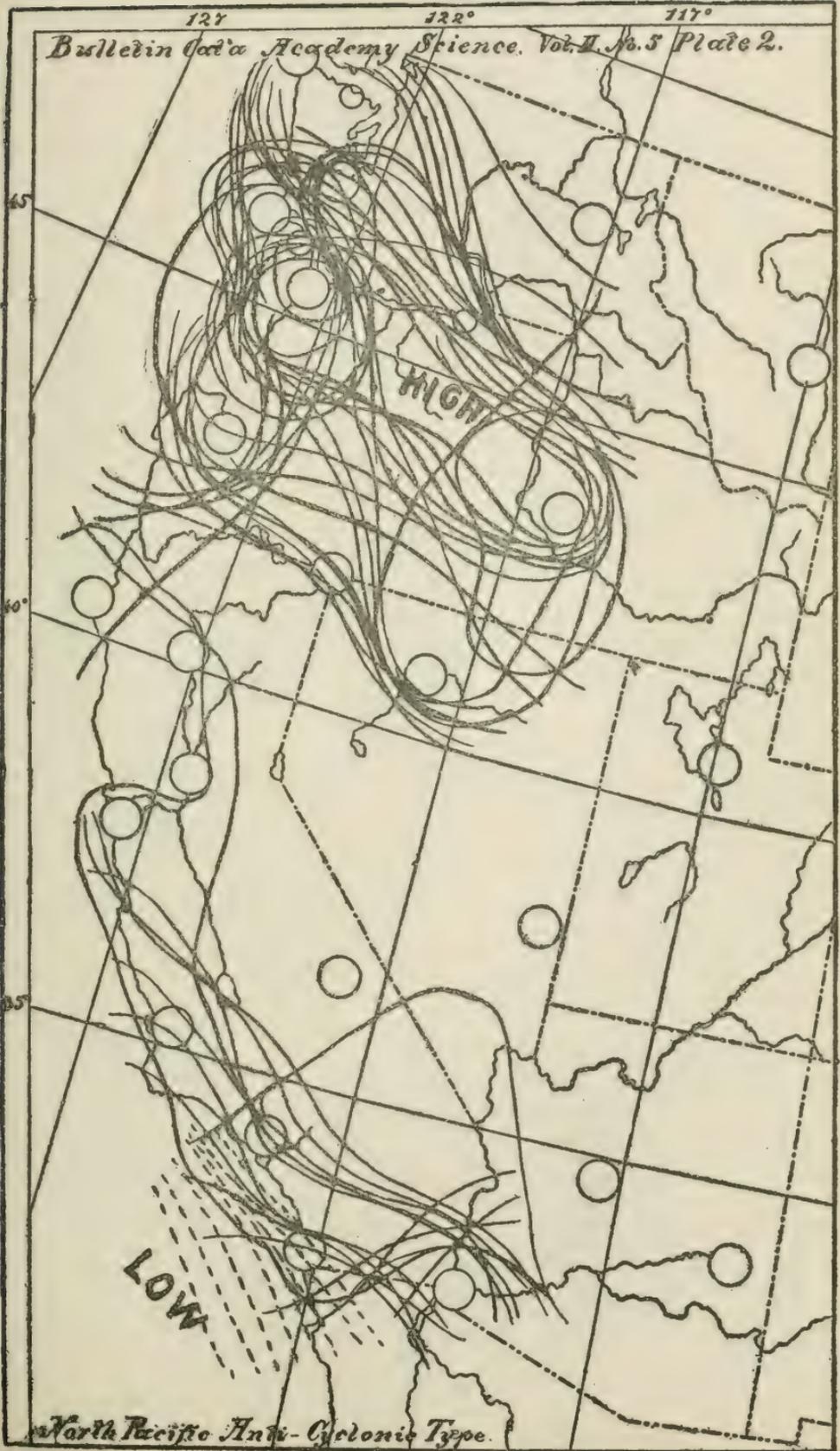
Davidson del.

Davidson Observatory.

SATURN

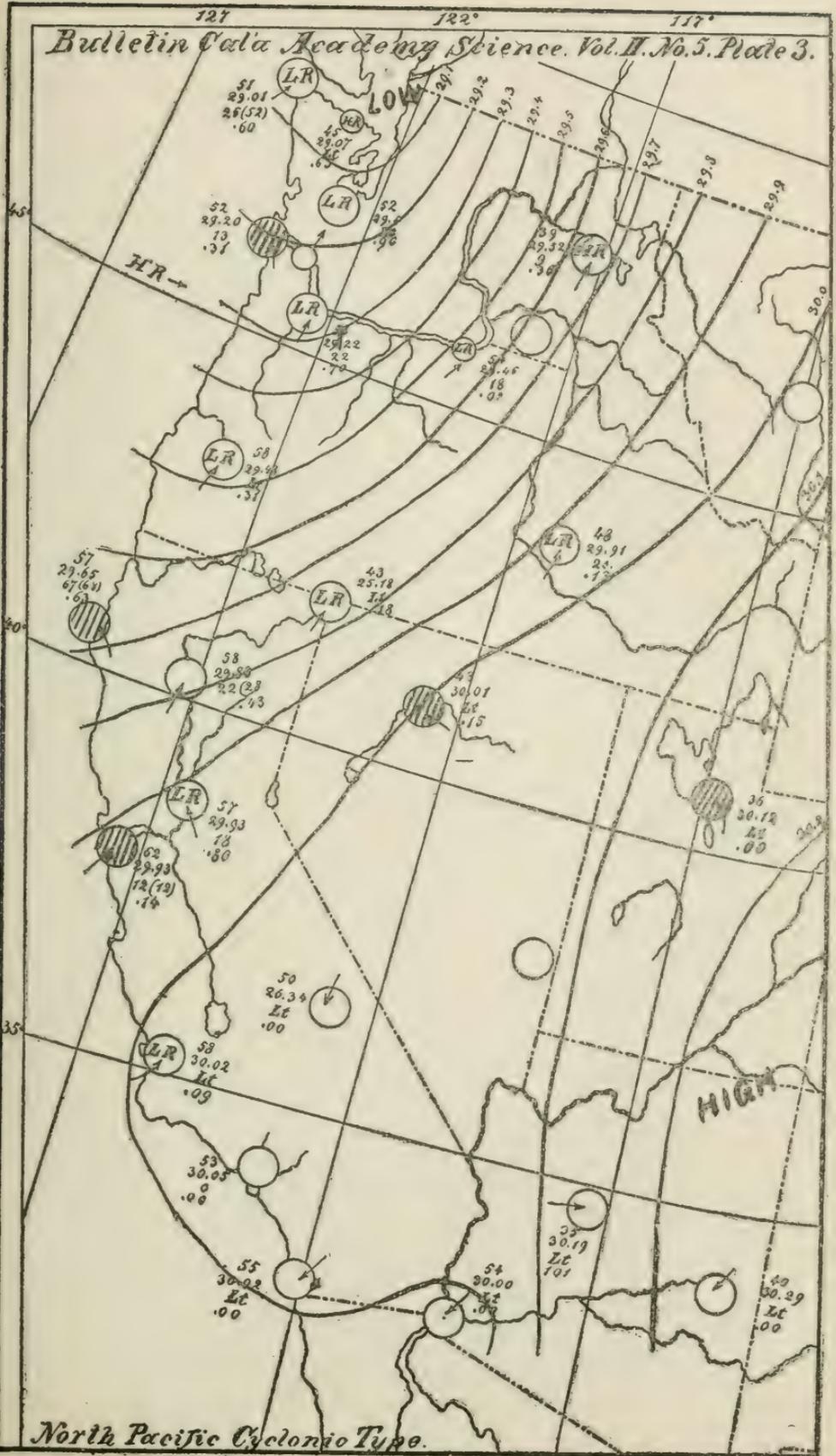
As seen in an Inverting Telescope

November 13th 13^{hr} 21^m



North Pacific Anti-Cyclonic Type.

Bulletin Cala Academy Science. Vol. II. No. 5. Plate 3.



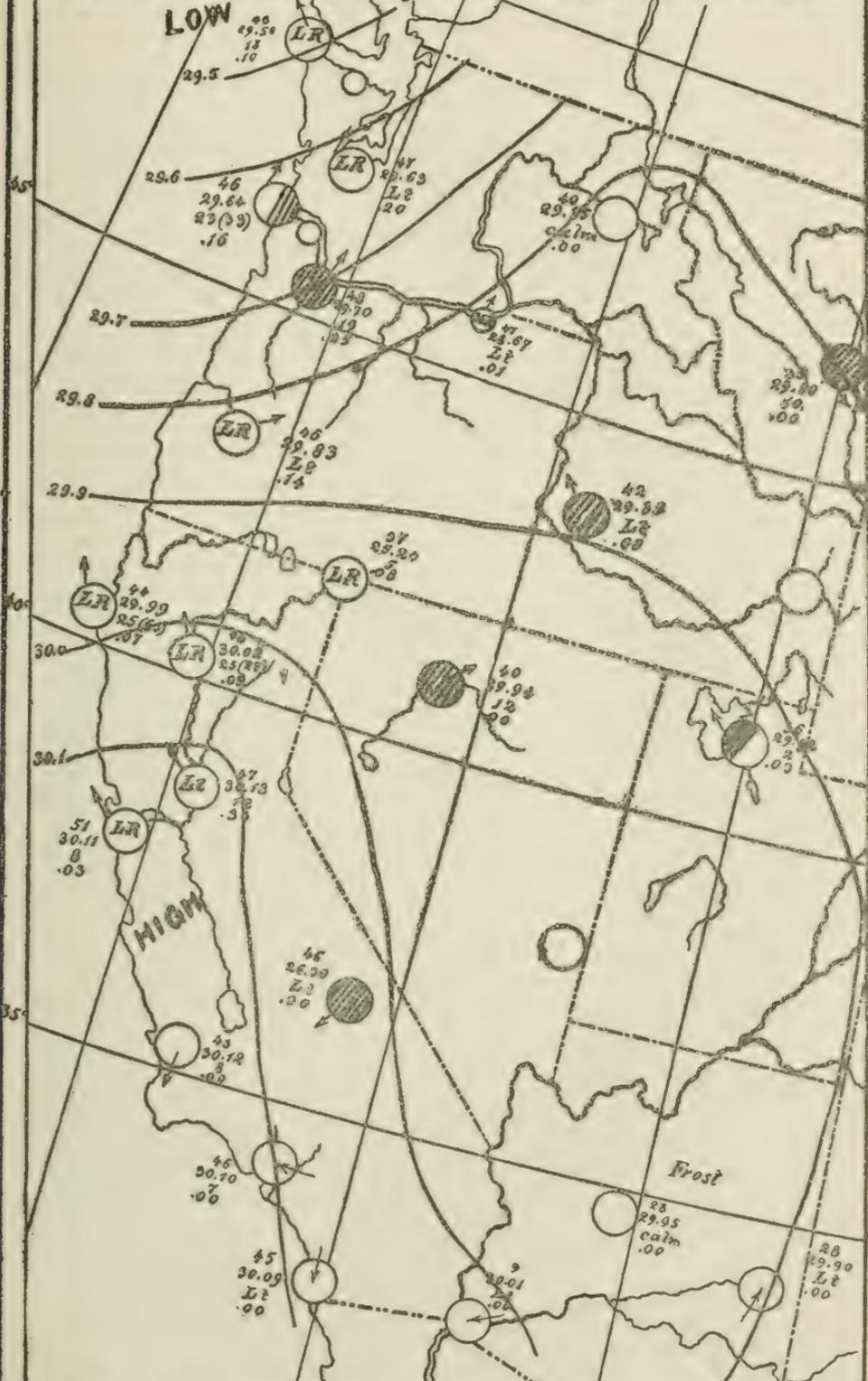
North Pacific Cyclonic Type.

127°

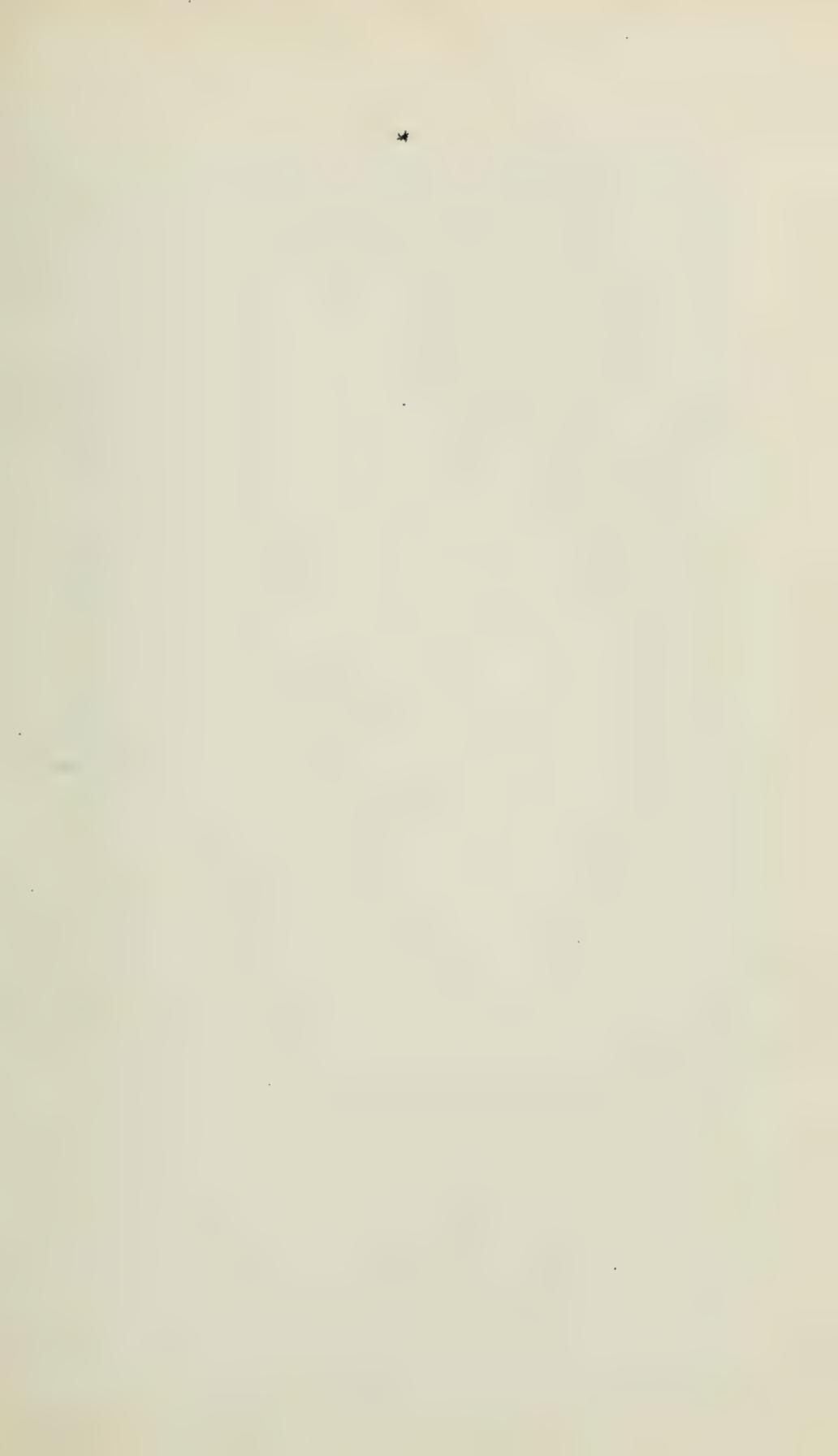
122°

117°

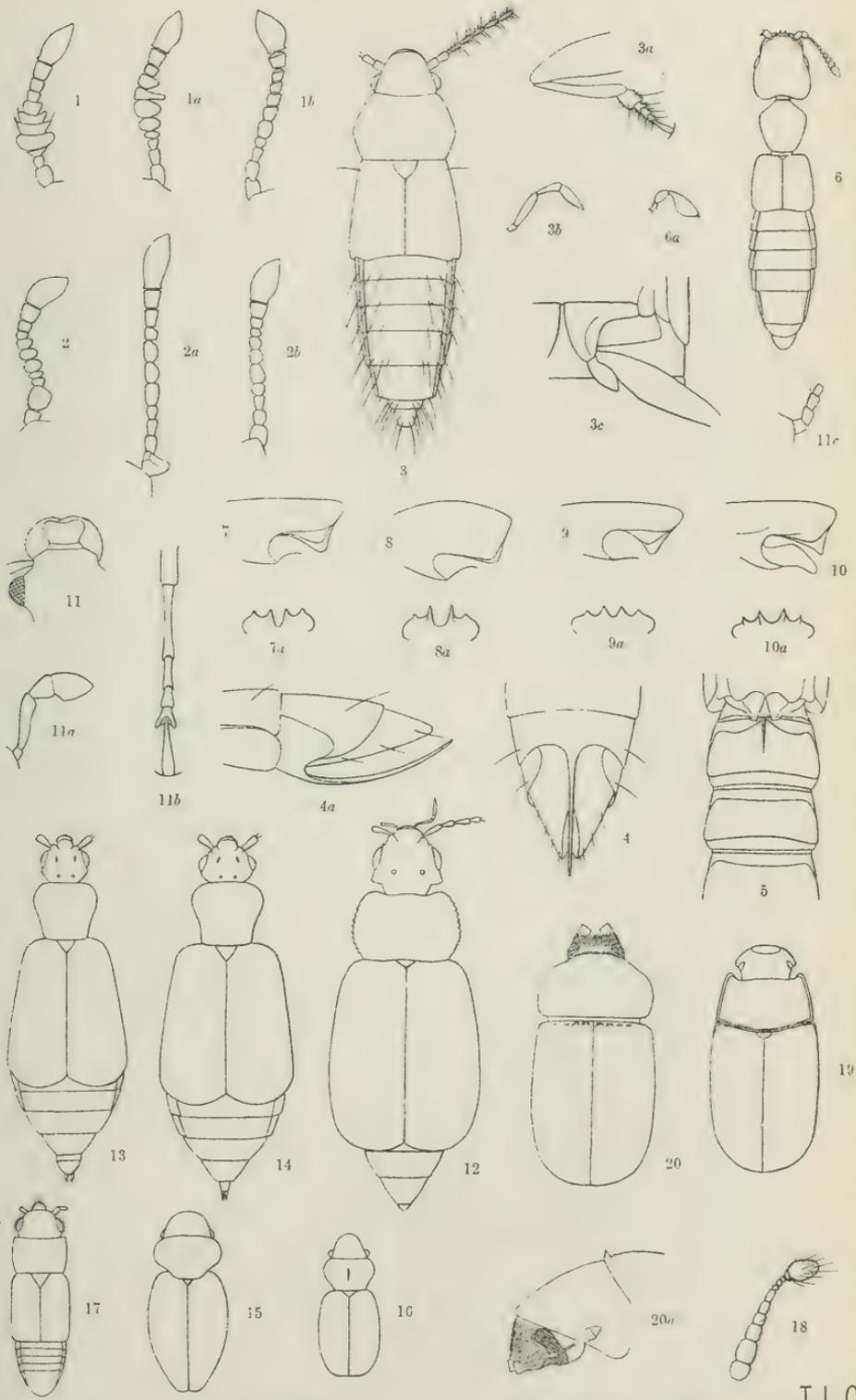
Bulletin Cal. Academy Science Vol. II No. 5. Plate 5.



South Pacific Anti-Cyclonic Type.



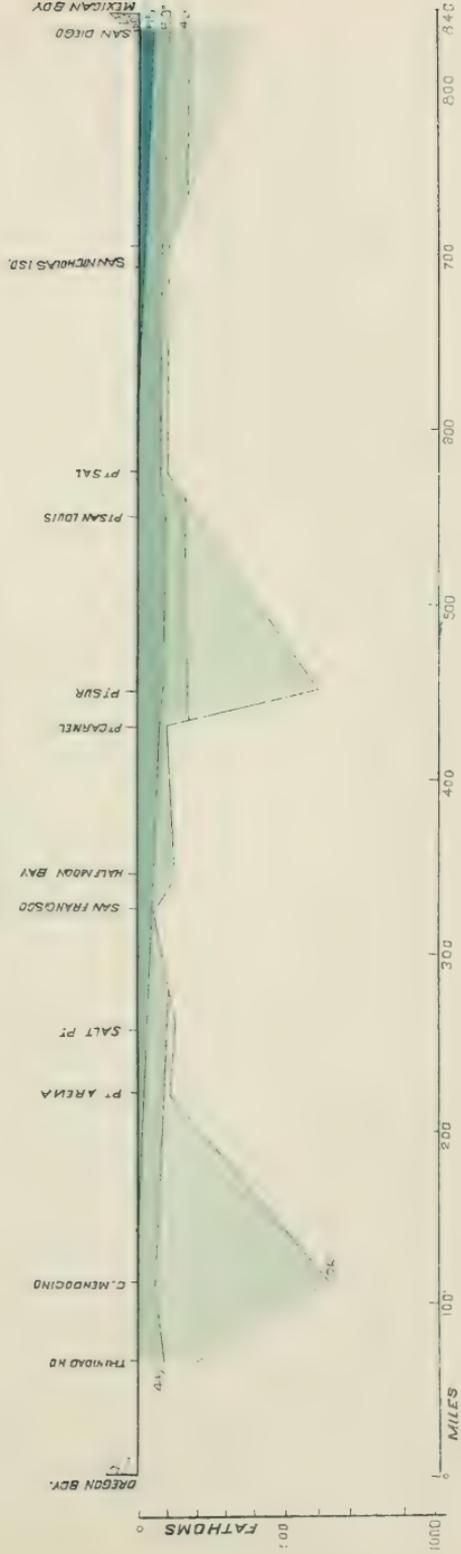




T.L.C.

Profile A.

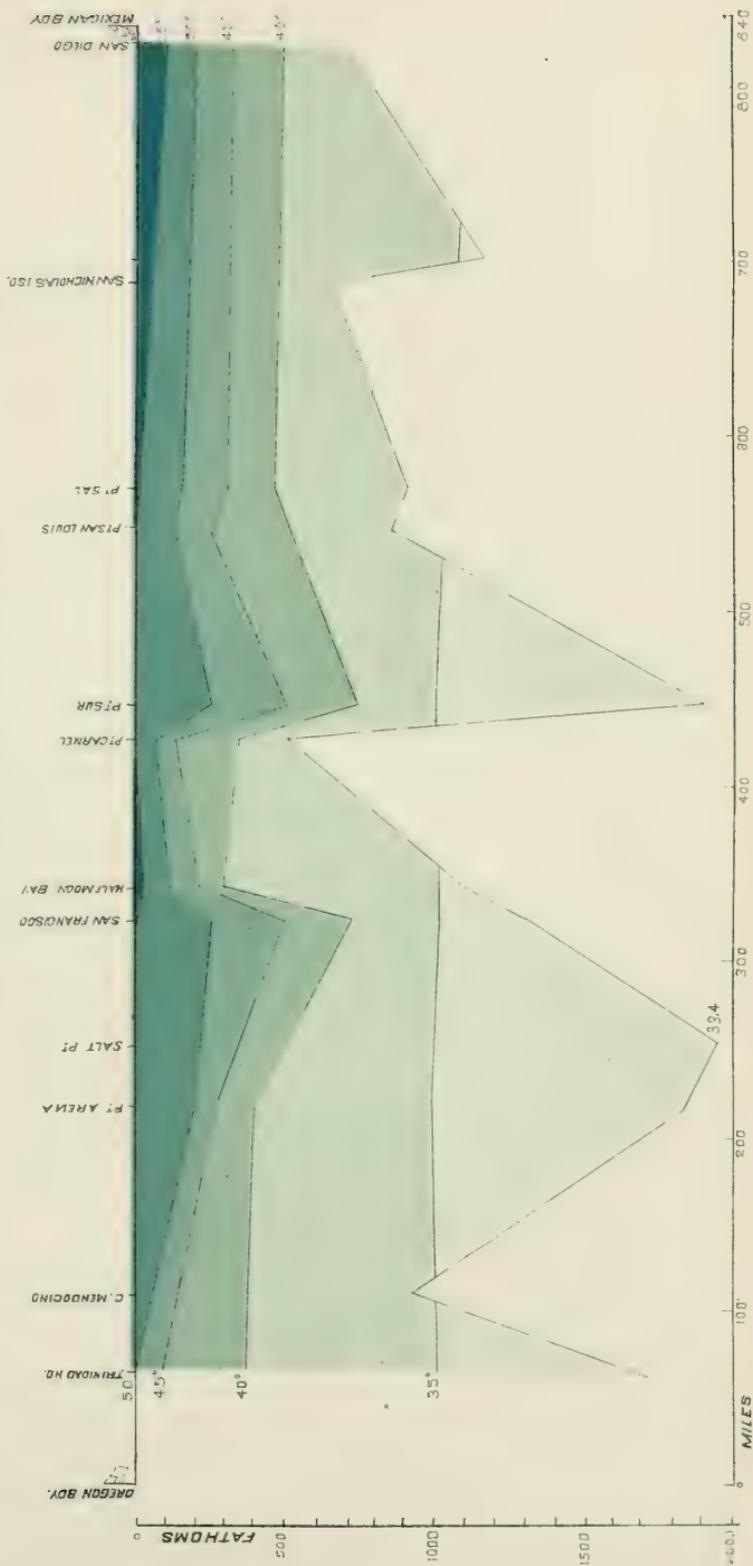
Section of the North Pacific Ocean, between Trinidad Head and San Diego, Cal.
10 miles off shore,
showing Isothermal Lines.



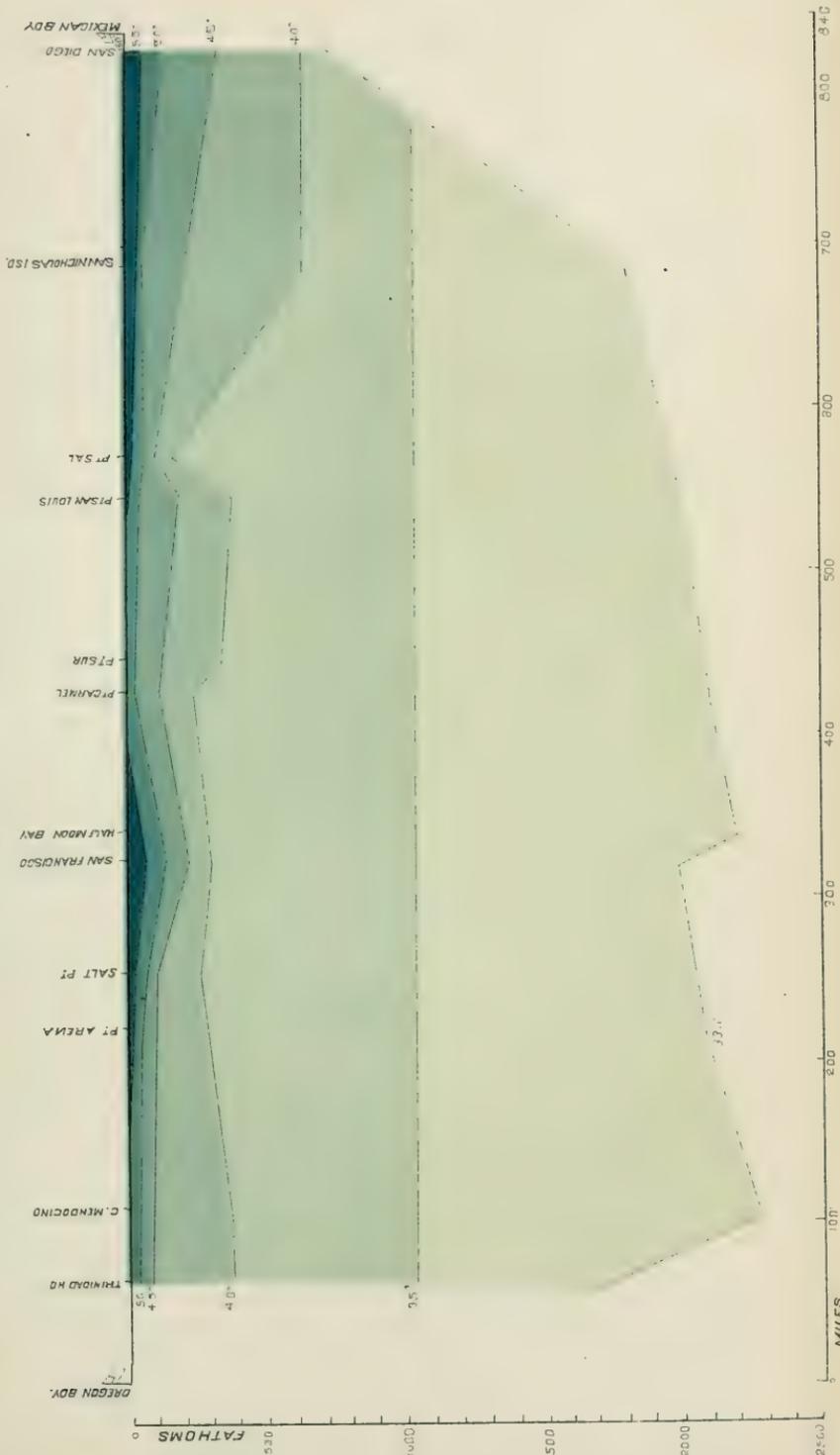
Lith. Bishop & Key, S.F.

Profile B,

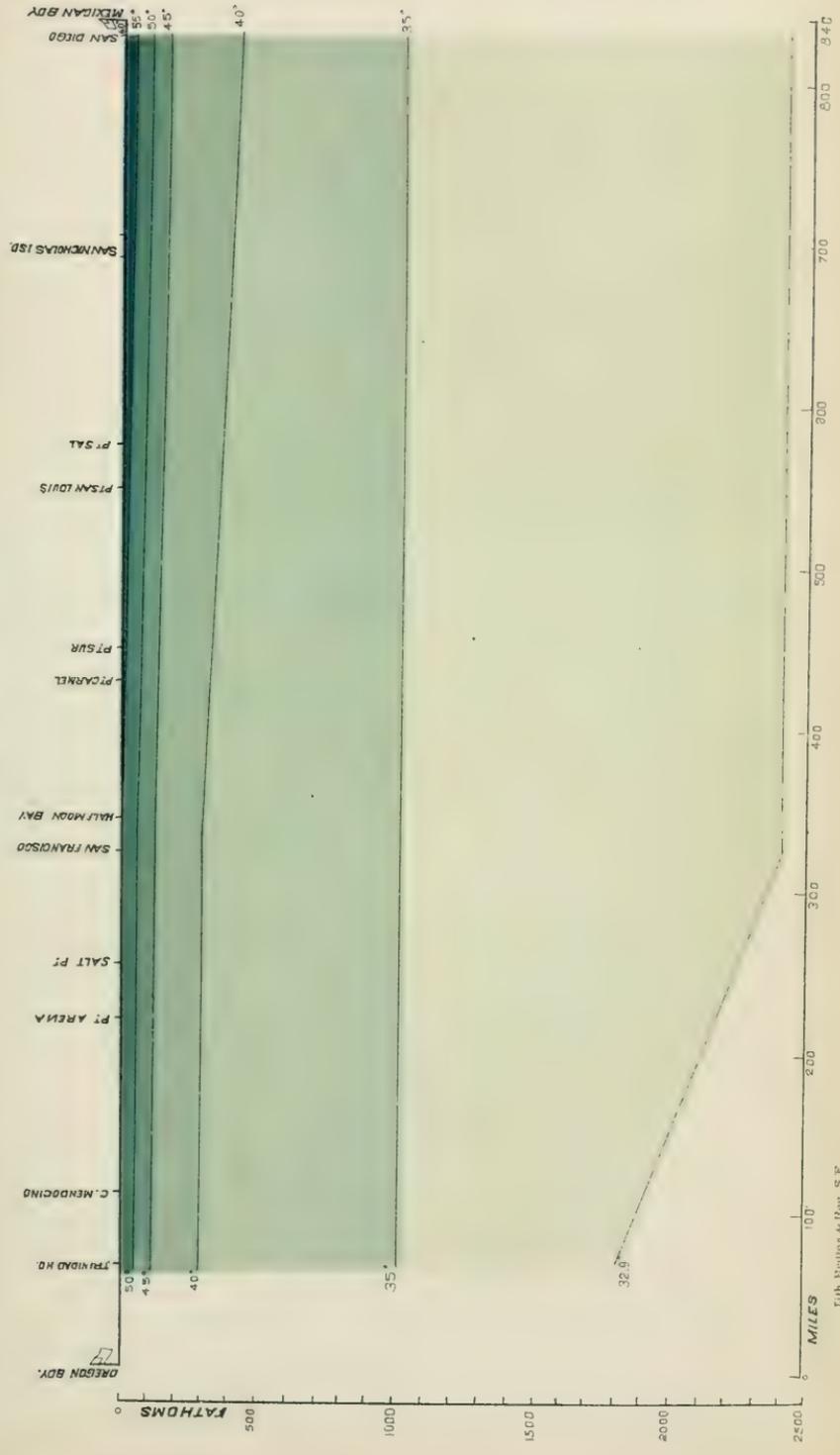
Section of the North Pacific Ocean, between Trinidad Head and San Diego, Cal.
 50 miles off shore,
 showing Isothermal Lines.



Section of the North Pacific Ocean, between Trinidad Head and San Diego, Cal.
100 miles off shore,
showing Isothermal Lines.



Section of the North Pacific Ocean, between Trinidad Head and San Diego, Cal.
 220 miles off shore,
 showing Isothermal Lines.

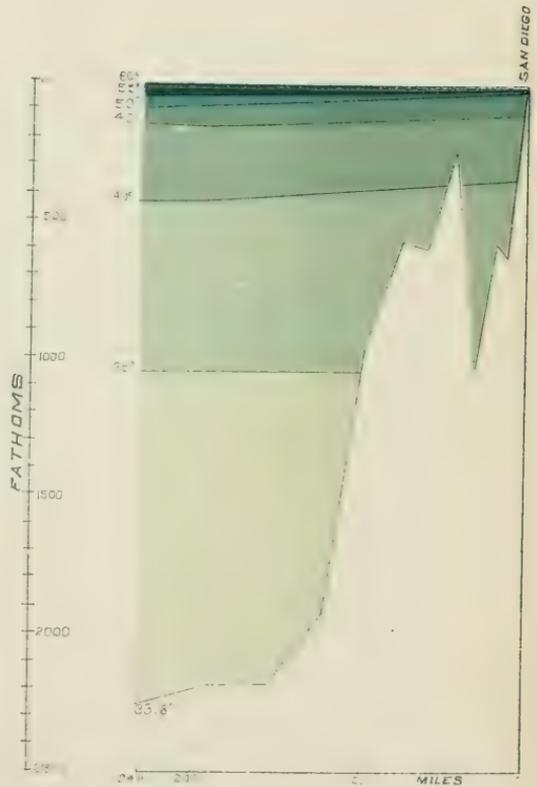
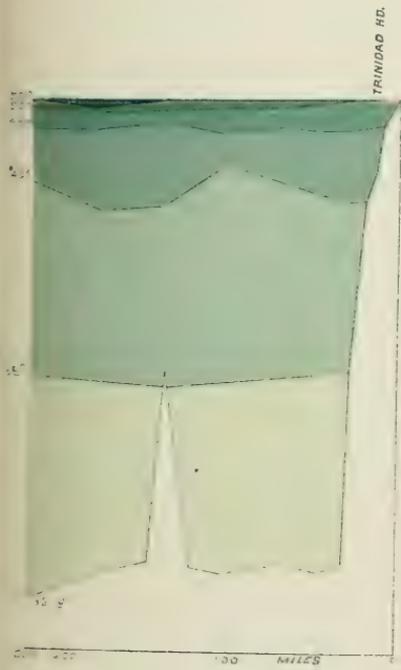


Profile E.

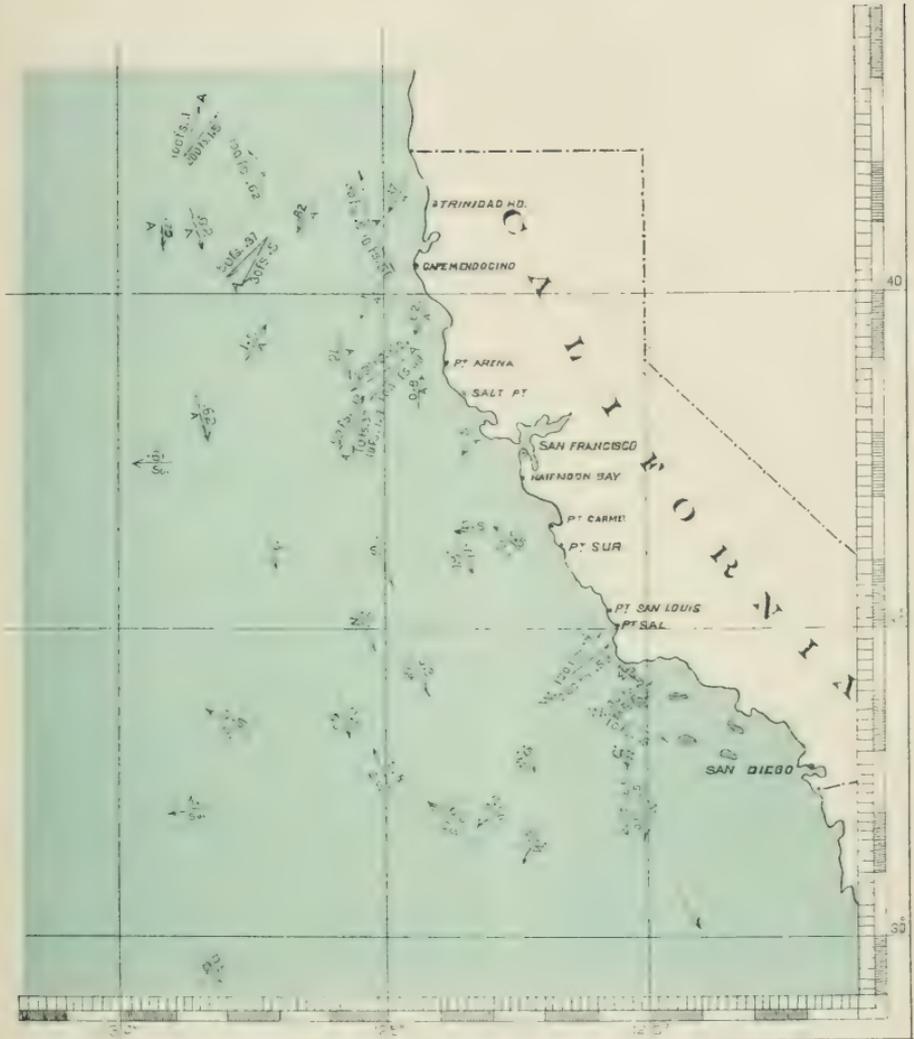
Profile F.

Section of the North Pacific Ocean, between Trinidad Head, Cal., and a position 220 miles West from it, showing Isothermal Lines.

Section of the North Pacific Ocean, between San Diego, Cal., and a position 240 miles West from it, showing Isothermal Lines.



*Current Chart
of the North Pacific Ocean, off
the Coast of California.*



Lith. Dutton & Rev. S F

NOTE.

The straight arrows, barbed on one side, represent the Under Surface Currents, and point in the direction toward which they set. The figures represent the different depths in fathoms at which the currents were observed, and their rates per hour in nautical miles or fractions thereof.

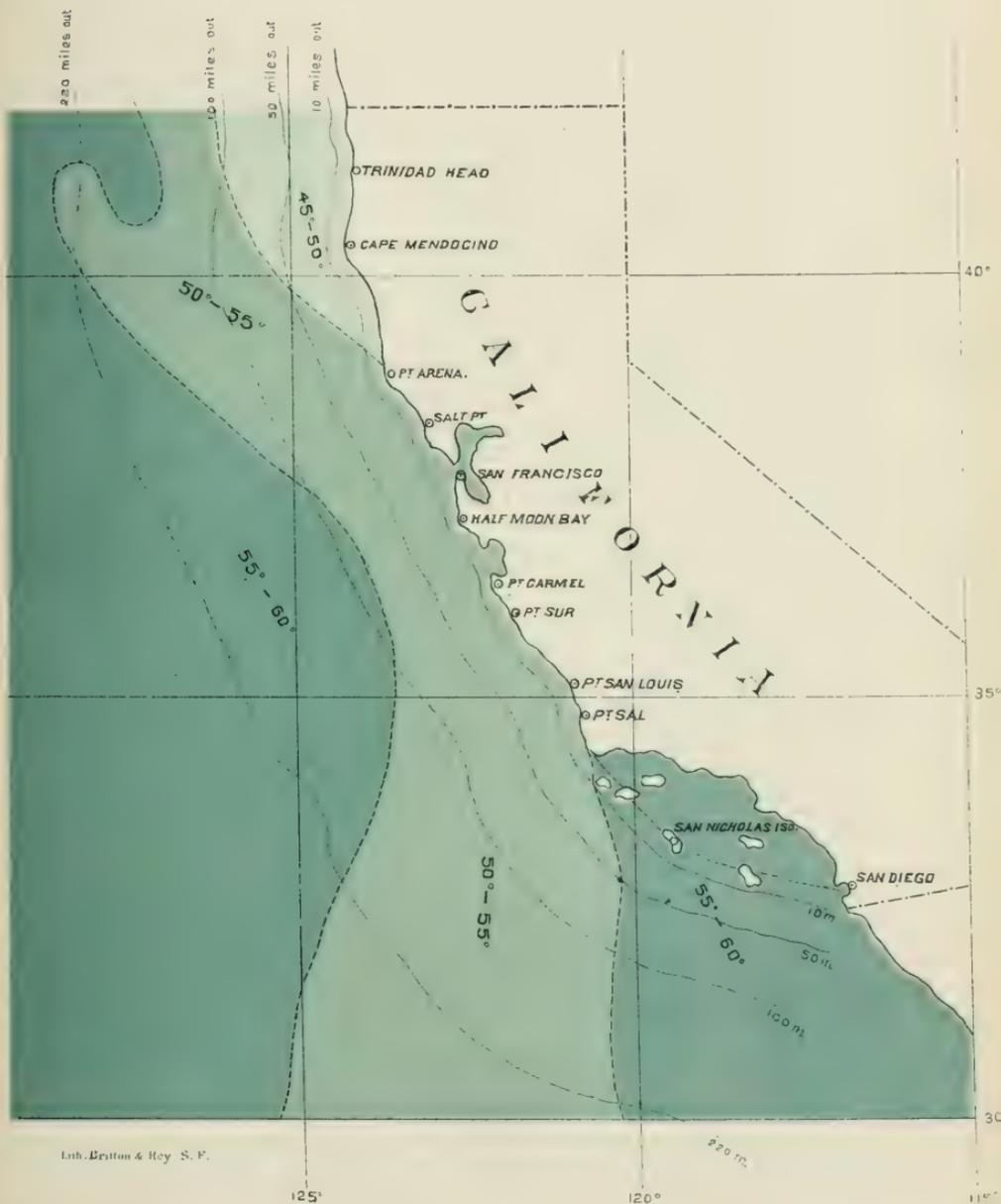
The crooked arrows represent the Surface Currents, and point in the direction toward which they set. The figures represent their rates per hour in nautical miles or fractions thereof.

The letters refer to the season of the year in which the observation was made. S.—Spring. Su.—Summer. A.—Autumn. W.—Winter.

*Section
of the North Pacific Ocean,
showing Surface Temperature
off the Coast of California.*



*Section
of the North Pacific Ocean,
showing temperature 10 fathoms below surface,
off the Coast of California.*



Lth. Eaton & Rey S. F.



1



2



3



4



5



6



7



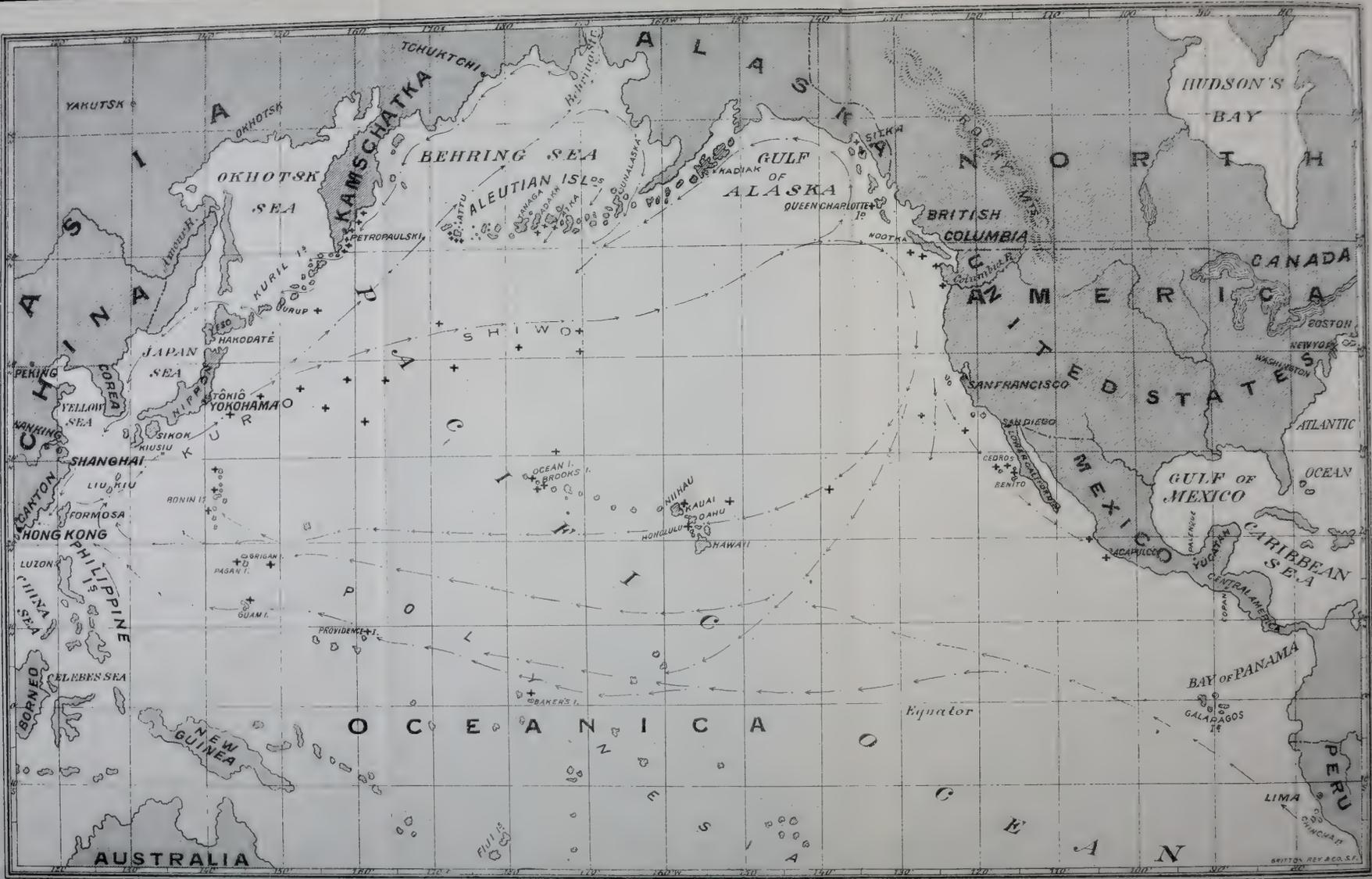
8



9



10



+ JAPANESE WRECKS.

DRAWN BY CHARLES WOLCOTT BROOKS.

OUTLINE MAP OF THE NORTH PACIFIC OCEAN,

Showing the Distribution of Disabled Japanese Junks by Winds and Currents; also Direction of the Kuro Shiuo, or Japanese Warm Stream, as corrected by the Observations and Investigations of Professor George Davidson, U. S. C. S.

CALIFORNIA ACADEMY OF SCIENCES.

JAPANESE WRECKS,

STRANDED AND PICKED UP ADRIFT

IN THE

NORTH PACIFIC OCEAN,

ETHNOLOGICALLY CONSIDERED,

AS

Furnishing Evidence of a constant infusion of Japanese
Blood among the Coast Tribes of Northwestern
Indians.

BY

CHARLES WOLCOTT BROOKS,

Member of the California Academy of Sciences; Ex-Consul of Japan for California;
and Attaché of the Japanese Embassy to fifteen Treaty Powers, 1871-72-73.

Read before the California Academy of Sciences, at their Meeting,
March 1st, 1873.

SAN FRANCISCO, CALIFORNIA:

Printed by the Academy.

1876.

INTRODUCTION.

As nature is a mechanism whose parts are intimately associated, so all work has its co-laborers. I am indebted to many kind friends for their co-operation and assistance in verifying the particulars of individual cases. The collection, as a whole, is entirely my own, and has been progressing since March, 1853, when at sea off the coast of Japan I first fell in with the water-logged wreck of a junk.

In issuing this reprint of a paper published in the Proceedings of the California Academy of Sciences, no one can be more aware than myself, of how much is left undone; but I must in frankness say, that thus far the collection of exact particulars has involved a voluminous correspondence, and been industriously prosecuted, in spite of great difficulties, (often of distance); and had I awaited to obtain perfect completeness, this publication would have been indefinitely postponed.

By calling attention to material already in hand, I hope other cases may be brought to light, and thus a chain of evidence become established, which shall point to hidden laws, underlying the ethnological as well as physical conditions here presented.

With each step in the progress of these investigations, I have been deeply impressed how largely this list is capable of being increased, by studious and systematic search through all the ancient literature, relating to countries whose shores are washed by the North Pacific Ocean.

In the aim to exercise especial care, where partial discrepancies were found to exist, the version which, after diligent examination, appears to me most reliable, has been adopted. Reports of Japanese wrecks not here enumerated, or any well authenticated corrections to this list, will, if addressed to CHARLES WOLCOTT BROOKS, care of Japanese Consulate, San Francisco, California, be thankfully received, and posted in the official record book, accessible to all for future reference.

Among those whose kind co-operation I take pleasure in acknowledging, are: Their Excellencies the Ministers of Foreign Affairs of Japan; His Excellency Kats Ava, H. I. J. M. Minister of Marine; His Excellency Hirobumi Itô, H. I. J. M. Minister of Public Works; Nakahama Manjiro; Fukuzawa Ukitchy, now one of the most advanced literary men of Japan; Yoshinari Hatakéyama, A. M., one of their ripest scholars, and head of the Imperial College at Tokio; and especially to my former colleague and present successor, Samro Takaki, to whom I am largely indebted for many valuable translations and researches into official records; to Professor George Davidson, United States Coast Survey, for reliable information regarding the physical features of the Kuro Shiwo; and to members of the Academy for their kind appreciation of the importance of the work undertaken.

C. W. B.

SAN FRANCISCO, OCT. 1, 1876.

REPORT
OF
JAPANESE VESSELS
WRECKED IN THE NORTH PACIFIC OCEAN
FROM THE
EARLIEST RECORDS TO THE PRESENT TIME.

Every junk found adrift or stranded on the coast of North America, or on the Hawaiian or adjacent islands, has on examination proved to be Japanese, and no single instance of any Chinese vessel has ever been reported, nor is any believed to have existed.

This may be explained by the existence of the Kuro Shiwo, literally "black stream," a gulf stream of warm water, which sweeps northeasterly past Japan toward the Kurile and Aleutian Islands, thence curving around and passing south along the coast of Alaska, Oregon and California. This stream, it is found, has swept these junks toward America at an average rate of fully ten miles a day.

There also exists an ocean stream of cold water, emerging from the Arctic Ocean, which sets south close in along the eastern coast of Asia. This fully accounts for the absence of Chinese junks on the Pacific, as vessels disabled off their coast would naturally drift southward.

A noticeable feature is the large number of disasters on the coast of Japan in the month of January, during which season the strong northeast monsoons blow the wrecks directly off shore into the Kuro Shiwo.

The climate of Japan is temperate, with the exception of the extreme northern provinces, where intense cold prevails and where snow is abundant; and the extreme southern provinces, whose climate is very warm.

About the year 1639 the Japanese Government ordered all junks to be built with open stems, and large square rudders, unfit for ocean navigation, hoping

thereby to keep their people isolated within their own islands. Once forced from the coast by stress of weather, these rudders are soon washed away, when the vessels naturally fall off into the trough of the sea, and roll their masts out. The number, of which no record exists, which have thus suffered during the past nineteen centuries must be very large, probably many thousand vessels.

Among Japanese mariners, the fear of being thus blown off their coast, has been an ever-threatening danger; and the memory of such time-honored accidents, is a common feature in the traditions of every seaport settlement along the eastern coast of Japan.

By the Government Census, taken in 1874, the total population of Japan was 33,300,675 souls, and there were 22,670 registered sailing vessels of Japanese style, (junks) of from 8 to 383 tons, engaged in the coasting trade. The crews of ordinary trading junks average from eight to twelve men each.

In the sixteenth year of the reign of the Emperor Suizin, B. C. 81, merchant ships and ships of war are first spoken of as built in Japan.

Under the Shogoon Iyémitsu, about 1639, edicts commanded the destruction of all boats built upon any foreign model, and forbade the building of vessels of any size or shape superior to that of the present junk.

By the imperial decree of 1637, Japanese who had left their country and been abroad, were not allowed to return, death being the penalty for traveling abroad, studying foreign languages, introducing foreign customs, or believing in Christianity.

The Empire of Japan is situated in the northwestern part of the Pacific Ocean, and is composed of four large islands and of a great number of smaller ones. It faces to the northwest the Kingdom of Corea, and is separated from it by the Japan sea. To the northeast the archipelago of Chijima (Kurile Islands) extends towards Kamtschatka. At the southwest the Liu Kiu Islands are situated opposite the Island of Formosa.

Its whole length, extending from one end to the other of the empire, measures more than 500 Ris (about 1225 English miles), and its breadth varies from 20 to 60 Ris (about $73\frac{1}{2}$ to 146 English miles.) Its total area is 23,740 Square Ris.

The sources of information at command have been exceptionally good. During seventeen years, in which I represented the Government of Japan at this port, it has been my pleasure to devote much critical attention to the subject of Japanese wrecks, picked up adrift in the North Pacific Ocean and stranded upon the northwest coast of America and its various outlying islands, and those of the chain extending from Hawaii towards Nippon. Besides keeping a detailed record of all wrecks reported during this period, I have also collected and verified many cases of earlier reports, which although still extant, were likely to be overlooked.

In at least 37 of the cases quoted, I have either seen the saved, or received a personal account from those who were themselves witnesses. Hawaiian and Japanese traditions I have myself gathered in those countries.

In March, 1860, I took an Indian boy on board the Japanese steam corvette *Kanrin-maru*, where a comparison of Coast-Indian and pure Japanese words was made at my request, by Fukuzawa Ukitchy, then Admiral's Secretary;

the result of which I prepared for the press, and it was at that time published in the *Evening Bulletin*, suggesting further linguistic investigation.

The following examples submitted for consideration to the Academy, fairly illustrate the subject in its various phases:—

1. In Mr. Hubert H. Bancroft's unparalleled collection of ancient books and valuable manuscripts relating to the early history of the native races of the Pacific States, mention is made of several Japanese vessels reported in some of the Spanish-American ports on the Pacific. In 1617 a Japanese junk belonging to Magomé, was at Acapulco.

In 1613, June 10th, the British ship *Clove*, Capt. John Saris, arrived at Nagasaki, having on board one Japanese, picked up from the island of Bantam.

2. "In 1685," we read, "the Portuguese tried for the last time to re-establish their trade by sending back a number of shipwrecked Japanese, picked up adrift, to their own country. The Japanese did not molest them, but strictly prohibited their re-appearance on the Coast of Japan."

3. In 1694, a Japanese junk from Osaka was driven by adverse winds and weather and stranded on the coast of Kamschatka, at the mouth of the river Opala, on the south of Bolschaia Reka. The only survivor was afterwards taken to Moscow.

Muller, in his "Voyages from Asia to America," published in 1761, remarks that when in 1696 the Russians reported the above, they said: "we have learned of several other instances of Japanese wrecks previously stranded on the coast of Kamschatka."

4. In 1710, a Japanese junk was stranded on the coast of Kamschatka, in Kaligirian bay, north of Awatscha. Ten persons landed safely, of which four were killed and six taken captive in an encounter with Kamschadels. Subsequently four of the captives fell into Russian hands, and one named Sanima, was sent in 1714 to St. Petersburg.

5. On the 8th of July, 1729, a Japanese junk called the *Waka-shima* of Satsuma, in distress, after having been driven about at sea for six months, was finally stranded on the coast of Kamschatka, south of Awatscha bay, and 17 of her crew were saved. She was loaded with cotton and silk stuffs, rice and paper; the two latter articles shipped by *Matsudaira Osumi-no-kami*, (Prince of Satsuma) were government property.

A petty Russian officer named Schtinnikow, desiring to plunder the cargo, had fifteen of the survivors shot; for which crime he was subsequently condemned and hung. The two remaining, an old merchant named Sosa and a young pilot Gonsa, were sent to Irkutsk in 1721, and thence via Tobolsk, they reached St. Petersburg in 1732, where one died in 1736, the other in 1739.

6. In 1782 a Japanese junk was wrecked upon the Aleutian Islands, from which the survivors were taken in one of the Russian-American Company's vessels to the town of Ochotsk, and thence to the inland city of Irkutsk. In 1792, the Governor-General of Siberia ordered the transport *Catherine*, then at Ochotsk, to return these men to their native country. The Russian vessel, after wintering in a harbor at the north end of Yeso, proceeded to the port of Hakodaté, where the Japanese officials politely but

firmly refused to allow their countrymen to land. They were subsequently returned to Siberia.

7. Among items of history mentioned in Japanese records, I find that in October, 1804, a Russian frigate commanded by Capt. Krusenstern, conveying Count Resanoff, as Ambassador of the Czar, brought back to Nagasaki five Japanese seamen, being part of a crew of fifteen rescued from a stranded junk; the other ten preferred to remain in Siberia.

8. In 1805, a Japanese junk was wrecked on the coast of Alaska, near Sitka; the seamen were quartered on Japonski Island, whence they were taken by the Russians, and finally landed on the Coast of Yeso in 1806.

9. In 1812, Capt. Ricord, commanding the Russian sloop-of-war *Diana*, took seven Japanese, six of whom were seamen recently shipwrecked in a junk on the coast of Kamschatka, in the hope of exchanging them for seven captive Russians, confined in Japan. Being unable to land, they were returned to Kamschatka, reaching there October 12th. The *Diana* made a second attempt, and finally succeeded August 16th, 1813, in landing these Japanese at Kunashie Bay, the 20th Kurile, and effected the liberty of the Russian Capt. Golownin and his associates.

10. In 1813, the Brig *Forrester*, Captain John Jennings, when in latitude 49° N., longitude 128° W., rescued the captain and two seaman from a dismasted junk, timber laden, when 18 months from Yeso, bound to Nippon. Thirty-five men were on board, of whom thirty-two died of hunger. They were delivered to the Russians, who undertook to return them to Japan.

11. Captain Alexander Adams, formerly pilot at Honolulu, relates that March 24, 1815, in latitude $32^{\circ} 45'$ N., longitude $126^{\circ} 57'$ W., when sailing master of brig *Forrester*, Captain Piggott, and cruising off Santa Barbara, California, he sighted at sunrise a Japanese junk drifting at the mercy of the winds and waves. Her rudder and masts were gone. Although blowing a gale, he boarded the junk, and found fourteen dead bodies in the hold, the captain, carpenter, and one seaman alone surviving; took them on board, where by careful nursing they were well in a few days. They were on a voyage from Osaka to Yedo, and were 17 months out, having been dismasted in consequence of losing their rudder.

12. In 1820, a junk was cast upon Point Adams, the southern shore of the mouth of Columbia river. The vessel, which was laden with wax, went to pieces, and the crew, many in number, landed safely.

13. A junk was wrecked on Queen Charlotte's Island, in 1831.

14. December 23, 1832, at mid-day, a junk in distress cast anchor near the harbor of Waialua, on the shores of Oahu. She was from a southern port of Japan, bound to Yedo with a cargo of fish; lost her rudder and was dismasted in a gale, since which she had drifted for eleven months. Five out of her crew of nine had died. December 30th, she started for Honolulu, but was stranded on a reef off Barber's Point on the evening of January 1, 1833.

The four survivors were taken to Honolulu, where, after remaining eighteen months, they were forwarded to Kamschatka, whence they hoped to work their way south through the northern islands of the group into their own country. This junk was about 80 tons burden. According to the tra-

ditions of the islands, several such junks had been wrecked upon Hawaii, before the islands were discovered by Captain Cook.

15, 16. In 1833, a Japanese junk was wrecked on the coast of Washington Territory, in the immediate vicinity of Cape Flattery. Many of her crew had perished, and several dead bodies were found headed up in firkins, in customary Japanese style, ready for burial. Out of 17 persons, the only survivors, two men and a boy, were rescued from the Indians, by the Hudson Bay Company's vessel *Lama*, Captain McNeal, who took them to England, touching at Honolulu on their way. Thence they proceeded to Canton, where they arrived in 1836, and stopped with Karl Gutzlaff, who learned their language, and intended accompanying them to Japan. In 1837, they left Macao in the American brig *Morrison*, dispatched by Clarence A. King for Yedo bay, to bear them home. Being fired upon, July 27, and prevented from landing, she sailed for Kagosima, where, being equally unsuccessful, she finally returned with the men to Macao. The *Morrison*, on whom Samuel W. Williams and Dr. Peter Parker were passengers, also had on board four other Japanese seamen, rescued from a disabled Japanese junk, which had drifted a long time at sea, until finally stranded on the eastern shore of the Philippine Islands, whence the survivors were forwarded to Macao, to be returned to Japan.

17. In 1839, a wrecked junk was boarded by Captain Cathcart of the American whale ship *James Loper*, drifting in latitude 30° N., longitude 174° W., or about half way between Japan and the Hawaiian Islands.

18. In the *Polynesian*, October 17, 1840, published at Honolulu, I find: "The Japanese who took passage in the *Harlequin* remained at Kamschatka under the protection of the Governor awaiting an opportunity of returning to their native country."

NOTE.—In 1834, the brig *Harlequin* conveyed to Petropaulski from Honolulu 18 Japanese taken from wrecks, who had remained 18 months at Honolulu. They were finally returned to Japan by Russian officials.

In 1840, Mr. Nathaniel Savory, a native of Massachusetts, residing at Port Lloyd, Bonin Islands, reports a Japanese junk of about 40 tons, laden with dried fish, entered that harbor in distress, having been driven from her course along the coast of Japan through stress of weather, with her provisions exhausted. They repaired the damage to the junk during that winter, and she sailed in the spring for Japan. Had these islands been uninhabited, this case would have added another to the list of wrecks.

19. In 1841, a fishing junk from the southeast part of Nippon was wrecked on an uninhabited island, where the three survivors remained six months, until taken off by Captain Whitfield, master of the American whale ship *John Howland*, and brought to Honolulu, where Denzo and Goémon remained, while Nakahama Manjiro went to the United States, and was educated by Captain Whitfield. After being there several years he returned to Honolulu where he found his former companions, and embarked January, 1851, on the *Sarah Boyd*, Captain Whitmore, bound for Shanghai, taking with them a whale-boat called the *Adventure*, with a full rig and outfit. When off the Grand Liu-Kiu, the three Japanese effected a landing and the ship proceeded without stopping. Hence they finally reached Kiushiu and Nagasaki, in the

junk which bears the annual tribute money from Liu-Kiu to Japan. Manjiro afterwards translated Bowditch's Navigator into Japanese, and visited San Francisco as sailing-master of the Japanese steam corvette *Kauri-maru*, which arrived there March 17th, 1860.

20. In 1845, the United States Frigate *St. Louis* took from Mexico to Ningpo, in China, three shipwreck Japanese, being survivors of the crew of a junk which had drifted from the coast of Japan, entirely across the Pacific Ocean, and finally stranded on the coast of Mexico, where they remained two years. The Chinese authorities were willing to receive these men and return them to their native country by their annual junk, which sails from Cheefoo to Nagasaki; but the Japanese objected to their landing, owing to the law of 1637.

In 1845, the Japanese authorities informed Sir Edward Belcher, commanding H.B.S. *Samarang*, that they would not receive returned Japanese from abroad, but "had sent a junk-full back to the Emperor of China," to whose country they had gone to obtain return passages by the annual junk permitted from Cheefoo to Nagasaki. The above leads to the inference that the *Samarang* may have had shipwrecked Japanese seamen on board.

21. In 1845, April 1st, Captain Mercator Cooper, of Sag Harbor, when in the American whale ship *Manhattan*, rescued eleven shipwrecked Japanese mariners from St. Peters, a small island lying a few degrees southeast of Nippon, and took them to Yedo Bay, where they were received under exception. Captain Cooper is also reported to have fallen in with a sinking junk, from which he rescued as many more Japanese seamen. [See Dr. C. E. Winslow's account in *Friend* of February 2d, 1845.]

22. In 1847, a French whaleship while cruising off Stapleton Island, sighted a fire-signal on the shore, and sent a boat to the relief of five Japanese sailors, who were in a helpless plight; the only survivors of a crew, whose disabled junk lay stranded on the beach of a small bay. Later, about 1853, a party of officers from the U. S. steam frigate *Susquehanna* landed and surveyed this wreck, which they then described as "still partly kept together by large nails of copper, and portions of sheets of metal. Her planks, fastened together at the edge, were but little rubbed or decayed."

23. In 1847, April 21st, the Bremen ship *Otaheite*, Captain Weitung, when in lat. 35° N., long. 156° E., fell in with a Japanese junk in distress, which had lost her rudder and had been driven off the coast of Japan in a gale November, 1846, and had drifted five months. Took off the crew, consisting of nine men, also six tons of wax. She was about 80 tons burden and chiefly laden with paper belonging to Osaka, and bound north. Captain Weitung kept them on board four weeks, and May 19th, 1847, put them on board a junk in the Straits of Matsmai. [See *Polynesian*, October 17, 1847, and *Friend*, December 2, 1847.]

24. In 1848, Captain Cox of New London, Conn., picked up fifteen of twenty Japanese seamen from a disabled junk in lat. 40° N., long. 170° W., and kept them on board six months during a cruise in the Ochotsk sea, and finally landed them at Lahaina, where they remained six or eight months.

25. In 1850, during the autumn, S. Sentharo, Toro and J. Heco—the latter then aged 13 years—left Osaka in a junk for Yedo. After discharging and reloading they started to return via Woragawa. After leaving the latter

place their rudder was disabled and they lost their mast and drifted out to sea. Fifty days later the wreck was fallen in with by the American bark *Auckland*, Captain Jennings, who took off and brought the crew of 17 persons to San Francisco, in February, 1851. They were quartered on board the U. S. revenue cutter, and cared for by order of the Collector of the Port. Our citizens generally took much interest in them. The Japanese were subsequently embarked on the U. S. sloop *St. Mary's* and conveyed to Hongkong, where 15 were transferred to the U. S. steamer *Susquehanna* to await the arrival of Commodore Perry and his expedition. Heco and the second mate, Toro, returned to San Francisco on the bark *Sarah Hooper*, reaching there in the autumn of 1852. Sentharo returned with Rev. Mr. Goble, from San Francisco to Japan, and also Toro returned in the American bark *Melita* to Hakodaté from San Francisco, via Honolulu, April 19, 1859.

Toro was for a while clerk with Wells, Fargo & Co., and Joseph Heco, clerk with Macondray & Co. Heco was subsequently appointed for duty on the United States Surveying Schooner *Fennimore Cooper*, about 1858-59, and left her at Honolulu, on account of sickness, but finally returned to Yedo, on the United States steamer *Mississippi*. [See *Evening Bulletin*, June, 1862.]

26. In 1850, April 22d, in lat. 45° N. long. 155° E., the American whale ship *Henry Kneeland*, Clark, master, fell in with a Japanese junk having 13 persons on board. The vessel left Yedo for Kuno, but lost her rudder and was dismasted; then drifted to sea, and had been at the mercy of the winds and currents for sixty-six days, during forty of which they had subsisted on fish and snow water. The Captain and two seamen came to Honolulu on the *H. K.*; two of the crew were transferred to the *Marengo*; six were taken to Petropaulski and taken charge of by the Russian authorities, and two came to Honolulu by the *Nimrod*. [See *Friend*, October 15, 1850; also *Friend*, November 1, 1850.]

NOTE.—In 1851, by Japanese records I find that five Japanese seamen from Honolulu via China arrived at Nagasaki—probably the above.

27. In 1851, a Japanese junk was cast away upon Atka Island, and only three of the crew survived.

28. In 1852, April 15th, in lat. 31° N., long. 150° E., about 300 miles N. N. E. of Guam, Captain West, in the American whaleship *Isaac Howland*, fell in with a small Japanese junk in ballast. The four men on board had but a little oil to sustain life, and were much emaciated. Their tiller was lashed, and the vessel having been forty-nine days out of their reckoning, the crew had given themselves up to die. Two of these men Captain West took to the Atlantic States, and two were transferred to an American whaler about to cruise in the vicinity of the Japanese Islands.

29. In March, 1853, the American ship *John Gilpin*, Captain Doane, passed a water-logged wreck of a junk, her deck awash with the water, in lat. 18° —' N., long. 145° —' E., just beyond Pagan and Grigan Islands. Large numbers of fish were around the wreck. There were no survivors on board. She had every appearance of having been a very long time in the water.

30. In 1853, Captain C. M. Scammon discovered the wreck of a Japanese junk, on the southwest or largest of the San Bonito group of Islands, off

Lower California, in lat. 28° N., long. 116° W., and near Cedros Island. [See *Alta*, April 22, 1860.]

Her planks were fastened together on the edges with spikes or bolts of a flat shape, with all of the head on one side. The seams were not quite straight, although the workmanship otherwise was good. That portion of the wreck in sight, was principally the bottom of the vessel, and gave evidence of having been a long time on shore. [Extract from Captain Scammon's log.]

31. In 1854, August 14th, just after Commodore Perry's departure, the American ship *Lady Pierce*, Captain Burrows, arrived at Simoda from San Francisco via Honolulu June 2, 1854. She returned Dyonoské to Japan, who was the sole survivor of a crew of fifteen men, and was picked off from a drifting junk near the Hawaiian Islands, after being seven months helpless at sea. He had resided some time in San Francisco.

32. In 1855, Captain Brooks, in American brig *Leverett*, which arrived her from Ayan, Siberia, November 29th, picked up an abandoned junk in lat. 42° N., long. 170° W., about 900 miles from the American Coast.

33. In 1856, the American bark *Messenger Bird*, Captain Homer, reported a disabled junk at Guam, Ladrone Islands.

34. In 1856, Captain Jno. C. Lawton, in the brig *Prince de Joinville*, while getting guano at Cedros and adjacent islands, reported a Japanese wreck, seen near Magdalena Bay.

35. In 1858, the U.S. surveying schooner *Fennimore Cooper*, Lieut. John M. Brooke, U.S.N. commanding, sailed from Honolulu for a cruise along the chain of islands extending thence towards Japan. He had on board a Japanese seaman named Marsa-Kitchi, whom he landed at Kanagawa. The junk from which this man was taken, was disabled at sea while engaged in the coasting trade, and her crew were forced to put her before the wind, heading to the eastward, a direction in which they were forced against their will. To prevent drifting too rapidly, they lowered their anchor in the open sea to act as a drag, paying out their full length of cable, and thus allowed it to remain until it finally parted.

36. In 1858, May 19th, the British ship *Caribbean*, when in lat. $43^{\circ} 40'$ N., long. 171° E., about 1,600 miles from the coast of Japan, fell in with a dismasted junk, which had carried away her rudder, and had been about five months floating helplessly at sea. The captain, mate and ten seamen were rescued and brought to San Francisco, where they arrived June 7, 1858. They were cared for by Captain Winchester, who took them in the *Caribbean* to Vancouver Island, whence he was bound for China, but having met a British war vessel off Japan, the rescued men were transferred to her, and thus landed at a Japanese port.

The junk was loaded with barley and rice, and barnacles two feet long were reported found upon the wreck.

The British Government presented £400 to Captain Winchester as a reward and in reimbursement of his necessary outlays.

37. In 1859, the bark *Gambia*, Captain Brooks, found the remains of a Japanese junk on Ocean Island, lat. $28^{\circ} 24'$ N., long. $178^{\circ} 21'$ W.

38, 39. In 1859, July 4th, the remains of two stranded junks, with lower

masts high on the beach, were found on the east or lagoon side of Brooks Island, lat. $28^{\circ} 11'$ N. long. $177^{\circ} 18'$ to $25'$ W.

40. May 11th, 1862, the bark *Yankee*, Captain Claxton, passed in lat. $25^{\circ} 39'$ N., long. $138^{\circ} 24'$ W., a wreck with the stump of one mast only standing, of which the wood was quite black with age. The junk was water-logged, and the sea washing entirely over her. Being satisfied there was no life upon her, and a heavy sea running, did not board; passed her three-quarters of a mile to windward, and the *Yankee* kept on her course.

41. In 1862, a Japanese junk was stranded in September near Attu. They had drifted in distress for 90 days, and out of a crew of twelve only three survived. These were taken in 1863 to Nicolaefsky, Amoor river, and then returned to Hakodaté by a Russian war vessel.

42. In 1862, May 4th, the ship *Victor*, Captain Crowell, arrived at San Francisco, with the captain, officers and crew, eleven in number, of the Japanese junk *Io-maru*, from Kanagawa, December 21, 1861, for Owari and Hiogo. On January 5, 1862, was disabled and drifted from land. Was about three months at the mercy of winds and currents, until picked up April 13th, 1862, in lat. 33° N., long. $161^{\circ} 26'$ E., by the *Victor*. They were cared for by Mr. Brooks, Japanese Consul, and by him returned to Japan, in the American schooner *Caroline E. Foote*, for Hakodaté.

43. A Japanese junk drifted past Baker's Island, lat. $0^{\circ} 13'$ N., long. $176^{\circ} 22'$ W., some time in 1863. Boats were sent out and towed it on to the beach. There were four Japanese bodies on board; all were dead.

44. In 1864, February 4th, on Providence Island, lat. $9^{\circ} 52'$ N., long. $160^{\circ} 65'$ E., on the Lagoon shore of the island was seen the portions of a vessel which had been many years a wreck. Scattered along the outer shore were many redwood logs, some of them of great size.

45. In April, 1869, an abandoned junk was stranded on Adakh, one of the Aleutian Isles.

46. In 1870, in October, the San Salvador ship *Louisa Canovera*, Captain Demoro, when in lat. $37^{\circ} 46'$ N., and long. $158^{\circ} 10'$ E., fell in with a dismasted junk, laden with rice, having four dead bodies on board, and no living persons. The papers and effects were taken and delivered to the Japanese Consul at San Francisco, and by him returned to Japan, November, 1870.

47, 48, 49. In July, 1871, the old chief at Attu Island, aged 70 years, reported that three Japanese junks had been lost upon the surrounding islets, during his recollection, besides one stranded not far from the harbor of that island in 1862.

50. In 1871, February 2d, in lat. $33^{\circ} 45'$ N., long. $141^{\circ} 31'$ E., about 150 miles from the coast of Japan, the American ship *Annie M. Small*, Captain Packer, fell in with the Japanese junk *Sumi-yoshi-maru*, of Kiushiu, and rescued the Captain and three surviving seamen, and landed them at San Francisco, February 24, 1871. They sailed from Shiroko, province of Ise, January 17, 1871, for Dai Osaki, with a cargo of wood. Two days later they were disabled, and drifted to sea, and were picked up seventeen days later.

51. In 1871, May 23d, in lat. $34^{\circ} 54'$ N., long. $143^{\circ} 32'$ E., Pacific Mail steamship *Chima*, Captain Cobb, rescued five Japanese seamen from the disabled junk *Sumi-ayee-maru*, of Kobe. Eleven out of sixteen originally on

board died upon the wreck, and the captain of the junk died on the steamer after being rescued. They were cared for by Mr. Brooks, who returned them to Yokohama, July 1, 1871, and the government presented suitable rewards.

52. In 1871, the Japanese junk *Jinko-maru*, of Matsaka, of 180 kokus measurement, encountered a severe gale January 18, 1871, while going from Isé to Kumano, during which she lost her rudder, and while in danger of foundering cut away her masts. The junk drifted from the coast of Japan in the Kuro Shiwo for 2,500 miles in a helpless condition, her crew keeping a fire and living on rice, and fish they speared, until they drifted on the rocks at Atka, July 10th, 1871, where, by means of ropes, the three men on board landed safely. There they remained until September 19th, 1871, when they took passage by schooner *H. M. Hutchinson* for Ounalaska and San Francisco, whence they were returned to Japan by the Consul.

53. In 1873, Captain W. B. Cobb, in steamer *China*, rescued the crew from a wrecked junk in lat. $0^{\circ} - ' N.$, long. $0^{\circ} - ' E.$, and landed them at Yokohama, in acknowledgment for which the usual present was made him by the Japanese government.

54. A junk has been reported as stranded on the coast of Alaska.

55. A junk was cast upon the windward side of Kauaii, one of the Hawaiian Islands, and the survivors landed at Hanalei harbor.

56. An old resident of Petropaulski informed me there was a Japanese junk stranded below that harbor, previous to 1812, where many years since the wreck still remained. Six of the crew survived.

57. A Japanese wreck was sighted adrift below San Diego. Reported in the *Alta*.

58. A junk was wrecked at Nootka Sound.

59. In 1875, April 6th, in lat. $38^{\circ} 02' N.$, long $164^{\circ} 38' E.$, American ship *Game Cock*, Capt. T. C. Stoddard, fell in with the Japanese junk *Woonohi-maru*, of about 80 tons, dismantled, with her stern stove and rudder gone, and generally in a helpless condition, and rescued therefrom twelve Japanese seamen. The junk was bound from Hakodaté to Tokio, with a cargo of salt fish and sea-weed, when on December 3d they were blown off shore in a severe gale. December 10th they again made the land, when another heavy gale commenced and blew the junk off again. December 19th was forced to cut away the mast to save the hull. December 22d raised a jury mast and got under way, sailing towards Japan whenever the wind permitted: at other times took in sail and drifted. By their reckoning, they estimate having thus sailed 1500 miles west, principally with northeast winds, when, April 5th, in a bad sea, they carried away rudder, and soon after stove stern. At 8 A.M. the following day, they abandoned the wreck, from which they were rescued by the *Game Cock*, and landed at San Francisco April 28th, and were returned to Japan by Mr. Takaki May 1st, per *Great Republic*. For the rescue and kind treatment of these men, the Japanese Government presented Capt. Stoddard with a gold chronometer watch through His Excellency Yoshida Kiyonari, their Minister at Washington.

60. In 1876, July 3d, in lat. $37^{\circ} 10' N.$, long. $167^{\circ} 35' E.$, British barque *Abby Cowper*, Capt. Nelson, fell in with the Japanese junk *Koki-maru*, of Otaru, island of Yeso, of 477 kokus government measurement, equivalent to

about 120 tons. The junk was dismasted and floating in a helpless condition. Sakaki-bara Katsubé, mate, and Tomokitchi, sailor, the only survivors of 12 men, were rescued from the wreck, and made the following statement, which is very interesting as an illustration of many doubtless similar struggles. In October, 1875, the junk loaded at Shari and Abashiri, on the northern coast of the island of Yeso, with salted salmon and preserved roe of salmon. Left latter place November 5th, and touched at Hakodaté, whence they sailed December 6th for Tokio, Nippon. On the 9th, when on the east coast of Japan between lat. 39° and 40° N., and about long. 142° E., a severe westerly gale was encountered. December 12th carried away mainmast. Afterwards got it in and fished it with a piece of the main yard. On the 18th carried that mast away, and the yard was washed overboard. A sea soon after disabled the rudder, which was unshipped and taken in, the vessel in the meantime making water freely. To lighten her, 300 kokus of cargo (nearly two-thirds), was thrown overboard. From this time the vessel floated helplessly.

Early in January, 1876, fresh water gave out, and all the rainwater possible was saved and used. Then three seamen were taken down with the scurvy, which soon appeared among the balance. Towards the close of January, fire-wood gave out, but a small nucleus of fire was preserved in a stove. As a last resort, the junk's boat was broken up for firewood. All hands subsisting on a little rice cooked in rain water, and principally on salt fish, with a very small allowance of water. February 5th Chojero died—the first death. March 9th, Capt. Sato Sangoro died; then followed Kitsaburo, April 16th; Bunkichi, 21st; Kizo, 24th; Renkitchi, May 2d; Skedjero, 2d; Taské, 2d; Heihichi, 14th, and finally, Matsutaro, June 10th. The two survivors, anticipating a similar death, lingered until the forenoon of July 3d, when they sighted a vessel, had strength enough to raise a signal, and were rescued. They caught rain May 24th, after nearly all had died, which largely assisted in preserving the survivors. They also caught fifteen large fresh fish called *bonita*. Before the captain died, he wrote and handed to the mate letters to his family and owners, describing all details. The two survivors, expecting death themselves, boxed these up, with the ship's papers, and fastened them in a conspicuous place, whence they were taken and preserved. After the death of each person, the survivors enclosed their bodies in a Japanese coffin suitably inscribed, and stowed them in the hold of the junk, hoping they might reach some land and receive burial. The survivors reached San Francisco August 15th, 1876, and after recuperating, were returned to Japan by Mr. Takaki.*

Many more might easily be added, but these suffice to establish many facts valuable to science.

The annual rainfall of Japan averages 70.33 inches, occurring on 197.7 days, two-thirds of which falls between April and October; at Tokio the thermometer varies from a monthly maximum of 91° Faht. in August, to a minimum of 20° in January, averaging $58^{\circ} 22$ for the year, and averages $48^{\circ} 33$ at Hakodaté, where the average number of hard gales per annum is 16.79. [See Kaitakushi Reports and Tables, Tokio, 1875.]

*—NOTE.—These last two cases have been submitted by Mr. Brooks as additions to the 1st for publication since the reading of this paper.

The presence of wrecks so far south near the equator, indicates that they had been swept northward from Japan by the Kuro Shiwo, and thence southward along the northwest coast of America until they fell into the equatorial westerly current, where, in company with redwood logs, and drift-wood from Oregon, they must have reached these islands in the equatorial belt.

In illustration of this equatorial current, we have the report of residents of Christmas Island, which speaks of a westerly current setting past that island at the rate of one and a-half to two miles an hour. August 23d, 1861, there was picked up on the shore of the island of Niihau, in latitude 21° 50' N., longitude 160° 15' W., a bottle containing a paper, thrown from the American ship *White Swallow*, thrown overboard July 21st, 1861, in latitude 21° 30' N., longitude 151° 55' W. It had made a nearly due west drift of 460 miles in about thirty-three days. This shows the existence of a very powerful westerly current around the Hawaiian Islands of about 14 miles per diem.

In 1862, September 10th, an enormous Oregon tree about 150 feet in length and fully six feet in diameter above the butt, drifted past the island of Maui, Hawaiian Islands. The roots, which rose ten feet out of water, would span about 25 feet. Two branches rose perpendicularly 20 to 25 feet. Several tons of clayish earth were embedded among its roots. Many saw-logs and pieces of drift-wood came ashore in this vicinity about this time. These were evidently portions of the immense body of ship-timber launched upon the Pacific during the great flood of the previous winter along the American coast. Their almost simultaneous arrival at Maui in September, seems to indicate quite accurately the force and direction of the currents in this ocean. Supposing them to have come from the Columbia River, leaving say February 18th, 1862, and to have drifted 2,800 miles, they must have drifted at an average rate of 14 miles per day to have reached Maui September 10th.

We may argue from the above that there were other ways of explaining the similarity of flora upon many islands of the Pacific and the high terraces of our Sierra Nevada mountains, beside the hypothesis of an intervening continent where the broad Pacific now rests.

There is a strong presumption that the present bed of the Pacific Ocean may once have been an extended valley, submerged by some abrupt and spasmodic catastrophe, at a period when the fiery interior of the earth was in a state of inconceivable agitation, and its equilibrium temporarily disturbed. Abundant ruptures of the entire combined strata of its crust along our mountain ranges, bear indisputable evidence, in prominences tilted up and raised to immense heights: conditions which must have necessitated corresponding depressions, and consequently established new beds for water, forming new islands, re-dividing and re-shaping continents. The existing shore lines of enormous empty basins, the pebble and cobble stones rounded by erosion, at present in the centre of this continent west of the Rocky Mountains, all contribute testimony of some great change.

The spores or seeds of plants may, however, have been more recently transferred by clinging to the earth around the roots of such mammoth trees as floated from the high latitudes of the northwest coast of America. Once cast upon any island and rooted, they would soon replant and extend themselves. Driftwood from Columbia River and Puget Sound distributed itself

throughout the North Pacific, and the windward shores of the Hawaiian Islands are literally lined with it, as well as with redwood logs of formidable size.

Small parties of male Japanese have repeatedly reached the American continent by sea, cast upon its shores after floating helplessly for months. Until recently, the survivors must have remained permanently near where they landed, and naturally uniting with women of the native races, have left descendants more or less impressed with their physical peculiarities. Such a slow, limited, but constant infusion of Japanese blood, almost entirely from male seamen, was undoubtedly sufficient to modify the original stock of all coast tribes along our north-western shore. No marks exist of any immigration *en masse*, neither is there any present record of any Japanese woman saved from such a wreck, although cases may formerly have occurred, but must have been very rare. These unfortunate seamen, often illiterate, and separated from their sources of learning, necessarily lost their own language; but in doing so, doubtless contributed many isolated words to the Indian dialects of this coast. Many shipwrecked Japanese have informed me that they were enabled to communicate with and understand the natives of Atka and Adakh Islands. Quite an infusion of Japanese words is found among some of the coast tribes of Oregon and California, either pure, as *tsche-tsche*, milk, or clipped, as *hiaku*, speed, found reduced to *hyack*, meaning fast, in Indian; or *yaku*, evil genius in Japanese, similarly reduced to *yak*, devil, by the Indians. In almost all words showing such similarity, the Indian word is always an abbreviated word, or shorter word than the Japanese, from which it may be argued that the latter was the original and the former derived. The construction of the two languages is, however, different. There are, however, a large number of pure Japanese words and some very peculiar Japanese "idioms, constructions, honorific, separative, and agglutinative particles" found nearly identical in the American-Indian dialect. Shipwrecked Japanese are invariably enabled to communicate understandingly with the coast Indians, although speaking quite a different language. The great mass of the Japanese people stoutly disclaim any common descent with the Chinese, and firmly believe they have a wholly different origin. Any common ancestor must certainly have been in very remote ages.

Professor George Davidson, in charge of the United States Coast Survey on the Pacific, our highest authority upon questions connected with the great ocean currents of this ocean, has bestowed much critical study upon the physical conditions connected with the Kuro Shiwo. In 1851, when stationed at the mouth of the Columbia river, he began the interesting investigations necessary to demonstrate its complete outline.

In 1868, he communicated to the National Academy of Science his deductions establishing the existence of the return current northwestward, westward and southwestward along the shores of the Gulf of Alaska, and the southern coast of the Aleutian Islands, whilst the great body of the current is deflected down the northward coast until it is drawn into the Great Equatorial Current which moves westward until it strikes the Asiatic barrier, and thence starts on its course, about the island of Formosa, as the great warm stream of Japan. He first showed the striking analogy between this stream and that of the

North Atlantic, especially in their origin at latitude 23° , their being nearly 180 degrees of longitude apart, their general course, etc., etc.

There is a branch of the Kuro Shiwo, which shoots off northward near Kamschatka, and is felt 50 or 100 miles off this promontory; whilst close in shore, a cold current flows southward from the Arctic through the western part of Behring's Straits. On Kamschatka, the Kurile and Aleutian Islands, and on Alaska, great number of disabled Japanese junks must have been stranded in past centuries.

Professor Davidson, who has had occasion to examine the Spanish, English, Russian and American records of discoveries in this ocean, assures me that he has found mention of at least a dozen or more junks, wrecked on the coasts of Kamschatka, within a comparatively recent period; and in the earlier descriptions of the Kurile Islands, and of the Kamschatka Peninsula, he says frequent mention is made of the wrecks of Japanese junks upon these coasts.

Both winds and currents of the North Pacific assist in driving disabled Japanese junks around the great circle of the Kuro Shiwo. A junk disabled in the latitude of Tokio would be swept by alternate southwest and northwest winds, and the existing northeasterly current, towards the northwest coast of America. The distance from Cape King to San Francisco is about 4,500 nautical miles. We have here abundant proof of the track taken by these disabled vessels, by a study of their positions when found drifting at sea in the Pacific, at the mercy of winds and waves.

For many, many centuries the coasting trade of Japan has employed a large fleet of junks in exchanging rice from their southern, for salt fish from their northern ports. Although it may be presumed that the large number of their vessels thus disabled and rendered unmanageable, undoubtedly founder in the heavy gales they experience; yet comparatively large numbers having cargoes suitable for food, and crossing a region subject to much rain, which is easily caught, are enabled to sustain life until either picked up, or stranded somewhere on the American coast, or some island in their course.

In the above sixty cases enumerated, there were, from 1613 to 1694, four cases; from 1710 to 1782, three cases; 1804 to 1820, six cases; 1831 to 1848, eleven cases; and since the rapid settlement of this coast in 1850 to 1876, only 28 years, we have a list of 36 wrecks reported. This apparent increase is not owing to their increased number, but solely to the fact, that increase of commerce on the Pacific has distributed there a large fleet, whose presence has materially increased the chances of rescue to disabled vessels, and the likelihood of receiving reports from stranded wrecks.

In addition to the list we have enumerated, are the Hawaiian traditions that *several* such junks were wrecked on Hawaii before the year 1778; to which add the wrecks from which the 18 Japanese were returned from Honolulu in 1834, also those from which came the junk full of shipwreck Japanese, who attempted to, and failed in returning, by Cheefoo to Nagasaki; also the dozen additional ones, alluded to by Professor Davidson, as stranded on the peninsula of Kamschatka, within a comparatively recent period; and the frequent mention of similar wrecks on the Kurile Islands. These all taken together, with yet others not fully verified, could scarcely have been less than forty

more, rendering it reasonable to suppose that fully one hundred wrecked Japanese junks, have been heard from, in one way or another, adrift upon the North Pacific, or stranded on the northwest coast of America or some outlying islands.

In answer to the question of whether any of these waifs have ever found their way back to Japan from the American coast, in early times, I can say, that from historical data still extant, and from the personal relations of descendants of some of such returned voyagers, I have learned that in rare cases, occurring from 400 to 260 years ago, crews actually reached Japan with tidings of the American coast; and Professor Davidson informs me, that when recently in Japan observing the Transit of Venus, a very intelligent Japanese scholar, well known to me personally, related to him a well authenticated case within this century. Formerly such accounts were not allowed general publicity, because stoutly discountenanced by an ecclesiastical government, to whom such discoveries were quite as repugnant as were Galileo's to the mediæval government of Rome. To the peaceful masses, the confines of their archipelago, were but recently the horizon of the world.

The famous voyage of the Buddhist priest from China, at the beginning of the seventh century, to a country called by him Fusang, (meaning, translated "to aid or cultivating mulberries,") was at the exact period when Japanese historians record their first official intercourse with China; and was probably reached by a coasting voyage along the western coast of Corea, thence along the northern coast of Nippon, around Yeso, and southerly, to the southeastern shore of Nippon, where mulberry trees were then cultivated abundantly, and which was undoubtedly the land he called Fusang. A careful study of the native records seems to indicate that his much mooted Chinese voyage could not possibly have extended to the American coast.

Of the sixty cases here reported, 27 wrecks were encountered at sea, and the balance stranded, as follows: On the Aleutian Islands, 8; Coast of Kam-schatka, 6; Alaska, Oregon, Hawaiian and Brooks Islands, two each; Off San Diego, Acapulco, Nootka Sound, San Bonito, Queen Charlotte, Cedros, Providence, Baker's, Stapleton, Ocean and Ladron Islands, one each.

In 23 cases where the actual number on board was named, they aggregated 293 persons; an average of $12\frac{3}{4}$ persons to a junk; ranging from 3 to 35 in individual cases.

Where definite statistics of the saved are given, we find 222 persons saved in 33 cases; an average of $6\frac{3}{4}$ persons in each disaster. On eight occasions, three persons each were rescued; in four cases, one person; and on four other cases, four persons; three times, eleven were saved; and twice each, 5, 12, 15, 17; and once each 2, 6, 7, 9, 10, 13, were saved.

By an examination of the above figures, we may estimate the probable extent of Japanese blood infused into the Indian tribes around the shores of the North Pacific.

Fifteen vessels mention having drifted helplessly at sea an aggregate of $106\frac{1}{2}$ months, averaging a little over seven months each.

Eleven cases report 122 deaths; averaging a little over eleven deaths to each wreck.

It is sincerely hoped that the publication of this record,* which has so interesting an ethnological import, may result in awakening Japan to the adoption of immediate steps in the great interest of a common humanity; for by improving the models of her vessels, and adopting those with sea-going qualities, this long record of disasters may speedily be abridged, if not wholly terminated.

About a year since it became my duty to forward to Japan, half a dozen wooden models, full drawings and specifications of small vessels, varying from 40 to 200 tons, ordered by the Japanese government for the use of ship-builders, which the now enlightened government has recommended them to adopt, instead of their present form of junks. Thus the edict of 1639 has passed away forever, and young Japan is rising to take her equal place among the advancing nations of the world.

Few are better aware than the scientist, of the manifold and inevitable dangers which attend all radical changes, when suddenly made; for success is a problem seldom solved without repeated trials and inevitable failures. But to-day, Japan is earnestly seeking to establish her national perpetuity, by fostering a discriminating intelligence among her people, and by encouraging general and liberal education among the masses. Thus she reverses in the most practical manner, the other edict alluded to as promulgated in 1637. Her centuries of quiet seclusion are now embalmed with the history of the past, and she seeks true greatness, in an enlightened administration of her national affairs, and bids fair henceforth to reciprocate a generous friendship towards all members of the great brotherhood of nations, from whom she may now claim equal sympathy and neighborly protection.

The great changes in Japan can not be better illustrated than in the fact, that it is now customary for the government of Japan, in common with all other nations, to present through their Foreign office, some suitable reward in acknowledgement of kind service, to the captains of vessels who rescue their shipwrecked seamen.

The Japanese Government have now in their navy ten war ships, five dispatch vessels, and five training ships, all steamers; and in their mercantile marine, one hundred and two steamers of various tonnage, aggregating 30,718 tons; also 32 modern sailing vessels built in foreign style of 7,346 total tonnage.

The great Pacific Ocean and its adjoining waters, under the impulse of this age of steam, is becoming the highway of an enterprising commerce, and steadily unfolds an attractive field of research to ethnological and linguistic archaeologists.

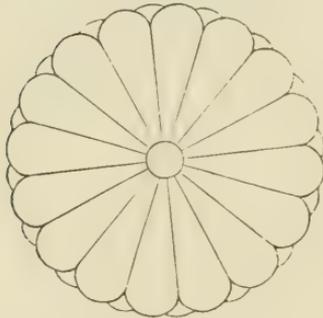
Many young Japanese are already attracted to scientific pursuits, and their valuable technical as well as general results, are beginning to claim the attention of naturalists.

Much valuable scientific work has been done by Japanese scholars since their early lessons received from Professor Wm. P. Blake and Professor Raphael Pumpelly; two eminent American scientists, whom I had the honor of selecting and engaging in the summer of 1861, on behalf of the government of Japan, to act as government Mineralogists and Mining Engineers.

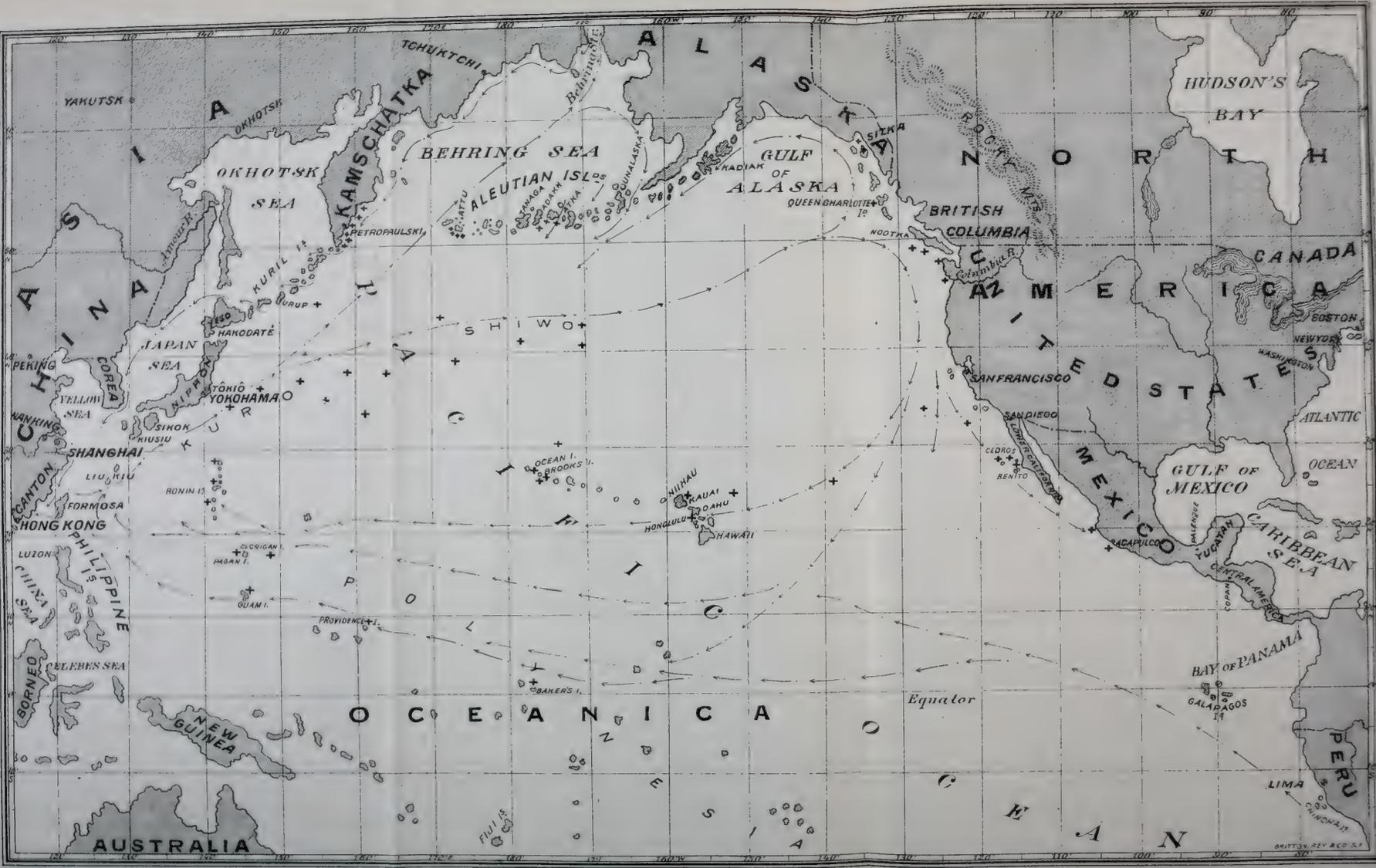
A glorious opening now presents itself for some reliable and competent scholar, with pecuniary means at command, to collect a library of books relating to the Asiatic shores of the North Pacific ocean, as perfect in its way as is that of our great historian, Hubert H. Bancroft, relating to the native races of the American coast; and when as systematically classified, and as thoroughly studied, give to the world full and correct historical details and analytical classifications of all native races on the borders of Asia; many of whose records and traditions must necessarily fade with radical changes in civilization, and soon pass beyond human reach.

The splendid sunrise, now dawning in the Orient, offers golden opportunities, which should be promptly improved while available. Old ways are giving place to new, and invaluable treasures of antiquity, may be lost forever, or cast aside to linger for a generation or two, in the memories of the aged, before their shadowy forms become enshrouded in the misty veil of a forgotten past.

The National Arms of Japan.



(Chrysanthemum.)



+ JAPANESE WRECKS.

DRAWN BY CHARLES WOLCOTT BROOKS.

OUTLINE MAP OF THE NORTH PACIFIC OCEAN,

Showing the Distribution of Disabled Japanese Junks by Winds and Currents; also Direction of the Kuro Shiwo, or Japanese Warm Stream, as corrected by the Observations and Investigations of Professor George Davidson, U. S. C. S.

EARLY MIGRATIONS.

ORIGIN

OF THE

CHINESE RACE,

PHILOSOPHY OF THEIR EARLY DEVELOPMENT, WITH AN INQUIRY INTO

THE EVIDENCES OF

THEIR AMERICAN ORIGIN;

Suggesting the Great Antiquity of Races on the
American Continent.

BY

CHARLES WOLCOTT BROOKS,

Member of the California Academy of Sciences.

Read before the California Academy of Sciences, May 3d, 1876.

SAN FRANCISCO, CALIFORNIA:

Re-printed from the Proceedings of the Academy,

1876.

Entered according to Act of Congress, in the year 1876, by
CHARLES WOLCOTT BROOKS,
In the Office of the Librarian of Congress, at Washington.

ORIGIN OF THE CHINESE RACE,

PHILOSOPHY OF THEIR EXCLUSIVE DEVELOPMENT:—

Inquiry into the Evidence of their American Origin, suggesting a great Antiquity of the Human Races on the American Continent.

BY CHARLES WOLCOTT BROOKS.

In searching for the origin of any race, the careful student is led to the barrier of pre-historic ages, where, amid the scanty remnants of remote antiquity, he seeks the missing links of a chain whose farther end has passed from the vision of general observers.

All ethnologists must recognize the importance of reviewing the early stages of religious belief current among any people, and laws governing its development, in any systematic study of their earliest origin.

Every act of man and every change in nature is self-recording, and although it may require the wisdom of a God to read the record, it yet exists, capable of being deciphered, and contributing to history.

With the advance of scientific knowledge, the human line of division between so-called historic and pre-historic ages is gradually receding. Science and historical criticism are opening many fields long hid in myth and conjecture. Much now classed as ancient mythology is but the lingering remnants of very ancient history, preserved and distorted by tradition. Most ancient nations in their written histories, have aimed as far as possible to ignore all antecedent civilizations, claiming for their own deified ancestry the origin of all men. Barbaric conquerors, filled with the spirit of battle, were early deified as gods, their descendants accepted as demi-gods were founders of reigning dynasties, and naturally sought protection by surrounding their origin with the supernatural. Transformations are frequent in the mythology of all nations, for religion, in whatever stage of its development, ever remains a grand, progressive, moral science. Many ancient forms of pagan worship glided silently into even Christian rites, when martyrs canonized as saints, noiselessly replaced the divinities of former systems.

As most early gods were ancient heroes deified, their worship was a nat-

ural manifestation of a low order of patriotism, which selfishly detested all nations but one chosen people. Each nation seems to have created its own god in the image of its highest ideal. Early ideas of God have been successively adjusted to the intellectual capacity of each progressive age, whose highest ideal has ever been the natural limit to its powers of mental or spiritual conception, possible under existing conditions of development.

Modern science and its civilizing arts have refined our personal conceptions and raised our ideal, by extending our limits of comprehension. Our own conceptions of the Great Architect, the Intelligent Mind of the Universe, as they exist to-day, are as much nobler than those of the ancients, as the magnificent enginery of this nineteenth century excels the rude implements of early ages.

Notwithstanding this tendency to ignore antecedent civilizations, the most ancient peoples of antiquity, at the period of their very earliest records, show plainly that civilized life existed before their time.

In speaking of civilization at early periods, it is evident we cannot mean that of the printing press, telegraph and steam, as known in the nineteenth century, for no record of any such exists, but reference is made to a high state of early culture among cities of solid structure, with foreign commerce and mechanic arts, in contradistinction to barbaric, nomadic, or pastoral conditions.

Great maritime empires existed in very remote periods; and both Atlantic and Pacific Oceans were crossed, and races and civilization widely extended in ages still called pre-historic. Whether we study the historical records of Arabian, Phœnician, Chaldean, Assyrian, Egyptian, Persian, Central Asian, Malay, Chinese, Japanese, Central American or Peruvian nations, we are amazed at the antiquity to which they lead us. Many oriental records now in process of translation, throw much light on the early movements of races. Asia in the far East was long considered the land of enchantment—a name given by superstition to early science. Astronomy was cultivated in Persia B. C. 3209; in India, B. C. 3101; in China, B. C. 2952; and in Egypt, B. C. 2800. Truly, wise men came from far east of Greece and Rome.

In Egypt, India, China, America and South Pacific Islands, evidences of a primitive civilization are found, which, in some instances, must have run its course long anterior to the age of Homer. Unmistakable traces of a primeval and ante-historic culture of the human race in America exist to mark the lapse of many ages of civilized existence. A knowledge of the western shores of the American continent has long existence in both China and Japan. That a restricted communication has existed by sea across the Pacific does not admit of question. When treating of the origin of the Japanese races several historical instances of their early trans-Pacific voyages will be described and discussed.

In comparatively modern times, enthusiastic specialists, versed in Hebrew traditions, have sought to locate the primeval source of all knowledge and culture upon the high table lands of Asia, where they pictured the radiant morning of civilization as immediately succeeding the completion of a cre-

ated world, perfected in all its parts, including man, the most complex being and climax of creation.

In a search after the origin of any race, we are first led to define a belief in the origin of man. I accept the hypothesis of universal evolution by a slow process of cosmic development, from matter which includes within itself the elements of all atmospheric, mineral, vegetable and animal existence, but latent until its energies are quickened by that progressive life-principle which ceaselessly radiates from the Great Intelligent Mind of the Universe, and is everywhere essential to awaken development.

This hypothesis, clearly within the scope of human thought, is able to stand the test of human reason, and now seems tangibly demonstrated, especially in the connected chain of fossils recently discovered and arranged by Professor Marsh, which visibly illustrate, by an incontrovertible record of natural history, the evolution of the *equus* or horse family, anchitherium, hipparion, etc.

All material things appear connected together by gradational forms, from the superior mental culture of man, the highest animal, to the protozoan or lowest speck of gelatinous matter in which life manifests itself to human perception, onward through untold ages of mineral existence and cosmic conditions, ever in exact keeping with its pace of progress. All things that develop have life. Earth has labored to fit itself for the abode of man, and its labors are progressing successfully. Man came by regular stages of gradation from the monad, and his mental development keeps pace with and is restrained by physical surroundings. Immutable natural laws, universally and eternally in force, do not admit of any sudden, special creation of man, nor do they indicate that all forms of animal life could have been created at the same time. What has once occurred will, under similar conditions, occur elsewhere.

Man is the result of all inferior types, whose capabilities are within himself, making him a compendium of all created things. Fossil remains, found in different formations, are plainly revealing the stages of progressive transformation, each successive one having all the attributes of its predecessor, with more added. Crustaceous animals are succeeded by fishes, running into the saurian, thence into birds, next marsupials, followed by the mammalian, up to man. Animal development has unfolded, and is continually improving as the physical conditions of the globe are improved and refined, and higher conditions rendered possible.

Mind is an attribute of matter, each being instrumental and necessary to develop the other. Goethe says: "Mind cannot exist without matter, nor active matter without mind."

The man of cultivated mind has reached more than a mere physical being, having developed within himself a portion of that superior intelligence, the germ of which he inherits from the Mind of the Universe. The human mind is unmistakably progressive, and progression is an eternal principle. Hence, mind, the highest refinement of matter in man, is eternal. Our greatest revelation from the Infinite is in His works, where nature matures a supply for every want she creates. The power to conceive of immortality

therefore implies ability to attain it. This glorious truth is instinctively felt and recognized by every branch of the human race.

The origin of man has been gradually, yet hastily, traced as the result of a constantly progressive life-principle, awakening development in matter, successively evolving from cosmic conditions, minerals, plants, and all the lower forms of animal life, up to its climax, intelligent humanity. In man is to be found the highest physical ultimate of matter, endowed with that further refinement, a moral and progressive spirit, capable of ultimately unfolding his full physical and mental capacities. In human evolution, we can but outline the origin of existing physical forms, which periodically change with constantly modifying conditions. The immortal quickening principle which we inherit, can only be traced to the Infinite.

The animating principle of all existences, appears like a purer and more highly refined essence or form of electric force; equally manifest in mental and physical development, and exactly adjusted in all its different degrees to successive stages of progressive refinement. Natural law is universal. In the material process of electrotyping, man follows Nature's own method of building up metallic forms. The progressive life-principle of the human mind, in common with endless varieties of electric phenomena, manifests universal consistency in the positive and negative phases of a subtle activity. Some correlation with a Central Intelligence seems reasonably indicated, whence these mutually radiate as developing powers; alike in kind, varying only in degree, of force, purity and refinement.

It appears probable that the ancestors of the earlier types of mankind, were evolved, by gradual development, near the oldest parts of continents, along their central summits, upon such portions as first acquired a soil after emerging from a hot primeval sea. Primitive man, at first a speechless animal, may have appeared as a distinct variety of the animal kingdom, in the case of a single pair, from which all human races have multiplied, and differentiated according to the surrounding conditions of their local abode. If so, the physical conditions of certain localities have been far more favorable to the advancement of certain races than others, and early human history must be by *race* and not by *nations*, as communities of individuals come but with the first steps to culture.

Within the limits of races best known, languages and families of languages are found, which preclude any common linguistic origin. It therefore follows, that if man constitutes but a single family in the order of Primates, represented by a single *genus*, the formation of language must have commenced after the still speechless primordial man had diverged into races, and differentiation had set in. With the development of ideas in the mind, however rude at first, and organs capable of articulation in the body, language was a consequent result, under the operation of universal law. The Great Intelligent Principle of the Universe pervades the entire world, as our mind fills our whole physical frame. The manifestation of this principle we call Life, which all things possess in greater or less degree.

Development is ever progressive, although mutability appears to mark every advance, yet no breach of continuity has occurred. Every order has proceeded by natural process from another antecedent. The superimposed

strata which constitute the crust of the earth, form a gauge of relative time, for which human chronology scarcely affords a unit of measure. It is perfectly certain that during the cretaceous epoch, a comparatively recent period in the world's history, none of the physical features existed, which mark the present surface of the globe. Continents have undergone movements of elevation and depression, their shore lines sunk under the ocean, and sea-beaches have been transferred far into the interior of pre-existing continents. All dry land has been submerged, excepting recent volcanic products and metamorphosed rocks. These introductory facts are necessary to ethnological research.

A cooling sphere, having acquired a solid crust around a nucleus of fiery liquid, in parting with its heat by radiation into space, must contract, distorting its outward surface by pressure, raising mountain ridges, and depressing corresponding valleys, where the first seas became located. Sun and moon, obedient to the law that bodies move to each other in proportion to their masses, and inversely as the squares of their distances, attracted tidal movements in molten fluids under the crust, in hot salt seas, and the thick unrefined atmosphere above. Fluids as well as other matter were more gross during their primitive states. Rupture and re-formation succeeded one another, until the primitive igneous period of angular azoic granite, became sufficiently hardened to withstand the ordinary pressure of inward forces, gradually preparing to furnish physical conditions, suitable to begin the evolution of animal life in its most elementary forms, corresponding with the imperfect condition of existing elements.

During the mighty struggles of the unrefined elements, internal convulsions sent the hot salt sea surging over a large portion of the surface, and sedimentary deposits formed new stratifications. Substances impregnating the waters united in forming crystals. The waters, having raged from point to point, were obliged to seek an equilibrium, and retired to the valleys, forming various oceans, seas, lakes, and rivers.

In the early carboniferous period which succeeded, the extra nitrogen and carbon were rapidly absorbed from the air, and the density of all exterior elements greatly reduced. A period was thus established, where, under favorable auspices, and in limited localities, the very imperfect initiatorial orders of vegetable and animal life appeared. An infinity of embryo existences are contained within the crust of the earth, awaiting the slow process of development. Life generated at the initial period was of the very lowest order, unable to support or reproduce itself to any considerable extent. From this threshold of progression, conditions became sufficiently advanced to admit of the systematic reproduction of species; the age of spontaneous generation having performed its limited duty in the general ripening of the globe, may have ceased and passed away with conditions which sustained it, and matter, within itself, matured the power to reproduce its kind, endowed with a progressive principle, destined eventually to evolve its ultimates. This hypothesis explains why spontaneous generation may have had its day and subsequently ceased.

Crinoides, conchiferæ, crustacea, polypi, and polyparia successively appear as elements are advanced to the necessary conditions to sustain such forms of

life. The systematic development of *flora* and *fauna*, in successive ages, extends in an orderly chain from their dim and distant beginning, to our own time, through universal changes of atmosphere, climate, and oscillations of temperature. A continual unbroken chain of organisms has extended from paleozoic formations to those of our day, governed by law that knows no change. Each species has gradually evolved from its predecessor in an antecedent age, by a gradual modification of its parts, culminating in the age it characterizes, and fades away in succeeding ones.

Change is everywhere the soul of nature. The race which first acquired the human form, and became properly entitled to be called Man, probably ascended from one original type, which has since diversified, and may in this age be divided into five distinct *varieties* (not types), generally classified as Caucasians—*white*, Mongolians—*yellow*, Malaysians—*brown*, Americans—*red*, and Negroes—*black*.

As white and black are apparent opposites, and science shows the white race to be superiorly developed, it is fair to presume that primitive man was black; subsequent nations, brown; their branches, red; from these sprang the yellow, and thence the white. Under local changes of atmospherical and physical conditions, of climate, food, etc., the original black became modified to a permanent brown. In like manner one shade and color after another became permanently established. As with complexion, so also with stature, symmetry, and strength. Proper use develops, while disuse brings decay.

Some anatomists have claimed that color may be produced by the arrest of utero-gestation, or is governed by its relative duration in races, thus "causing the ultimate portions of the blood to become so assimilated with the cellular and serous tissues of the fœtus as to render the body variously colored—black, brown, red, or copper color." *Lusus nature* have illustrated this fact.

The present of any race depends largely upon the physical conditions of the soil they inhabit. When these remain unaltered, the race cannot advance, unless it can develop, by brain power, sufficient ingenuity to overcome the drawbacks to advancement; such as draining marshes, heating dwellings, importing ice, etc., thus growing, in spite of natural restraint, faster than the slow process of natural evolutionary changes would permit.

Modifications in different types of vegetable or animal life neither progress equally nor evenly. There is no intrinsic necessity that they should undergo modifications at all, unless conditions change, or in the case of man, who invents ways of surmounting natural conditions. To him the extreme North becomes habitable by the use of warm clothing, artificial heat and light during long winter nights. By a restless spirit pressing him forward and a judicious control of elements, he is enabled to obtain artificial conditions far in advance of the physical condition of his habitation, and thus pre-naturally exalt and develop himself and his race. With the loss of these conditions the highly developed man would perish or relapse into a comparatively barbaric state, to where his development would exactly agree with his actual physical surroundings.

Darwin unmistakably illustrates the tendency of all forms to variations, which when once produced, join in equal battle to survive and supplant their

progenitors and all others. The fittest will maintain itself and the others perish, the parent and derived forms being equally dependent upon their individual adaptability to surrounding conditions. Thus, certain localities still exist in the condition of ages long past, where inferior races yet flourish and find themselves better off, more competent to deal with difficulties in their way, than any variation derived from their type. While conditions continue unchanged they remain un-supplanted by other forms, and their type becomes very pronounced. Exact reproductions are rare. Amid infinite similitude there is infinite diversity; and imperfection is a vast fact, which must always be taken into account in all hypotheses. "Animal beauty arises from the perfect balance of physical parts and the rhythm and perfection of their action." It is probable that no perceptible change has taken place in the Chinese race for many years, because in that time the incomplete changes of physical condition in their country have not admitted of it. Wheat found in tombs with Egyptian mummies, when brought from darkness into sunlight and planted in congenial soil, grew and produced wonderfully, but could never have developed without a change of conditions. Change is imperative to progress.

A complete knowledge of embryology furnishes an unerring record of the origin and development of any form of animal life; for the embryo of higher types, while in process of maturing, pass successively through a recapitulation of all forms by which their species ascended by evolution to their present condition. Since conception, each human being has passed rapidly through modifications, the counterpart of the graduated forms through which his race has been slowly built up, and his present condition reached. Thus, we have a history of human evolution republished in every case of reproduction.

Man, as traced by his embryotic development, commenced, when in darkness, the cohesion of two or more gelatinous molecules, impelled by a constantly-progressive life-principle, united to form a microscopic zoöspERM, capable of preserving its new condition in a thick and heated liquid. The proportionate duration of early life in warm water is revealed by the first nine months of his existence, during which many successive but correlated forms are assumed. Dr. Cohnstein, of Berlin, (quoted in the *Lancet*, May, 1875,) "has determined by means of the thermometer that the temperature proper to the *fœtus in utero* is higher than that of the mother." The hot salt sea in which early life developed, is here typified. The period of atmospheric air having arrived at birth, emerging into light, his aquatic life ends, and becomes terrestrial and aerial. New elements of food are supplied, and the mode of nutrition changed. For awhile his food continues liquid, and he sees, hears, and notices but little. By degrees he arrives at a consciousness of the solid world, first rolling, then creeping, seal-like on four limbs, then sits upon his haunches, and finally walks erect, at first tremblingly, then playfully, but firmly, at last. This reveals how nature required successive physical conditions, to acquire progressive results. Each being owes his present bodily form, to ascent through a parentage, each change of which has passed away, after accomplishing its intended purpose, a culmination reached by degrees, through countless generations of improvement.

In due time, children acquire teeth, and another change of food ensues,

and hair usually darkens. A second set of incisor and carnivorous teeth soon mark another stage of progress, and youth succeeds childhood, bringing an expanded development of bodily form, passions, and intellectual power. No individual can reproduce until he reaches the full maturity of the type to which he at present belongs, which prevents the race from receding, by reproducing a lower type. Leaves grow out or drop off, but never grow back. Nature never retrogrades; advance or perish is law to the individual.

Man can imitate any animal of his species, but no animal can follow man beyond its developed powers. Many traits, exemplified in lower animals, are successively developed in children, and overcome by proper control; such as gluttony, cunning, and deceit—the latter a lingering trait of weakness, general with inferior races. They repeat the antics of a very active and mischievous race; their first attempts at drawing, resemble the rude figures made by our primeval ancestry and present wild tribes; furthermore, like “children of the forest,” our younger children have not reached the age of self-cleanliness.

The impulsive ferocity of youth, and cooler maturity of age, are but characteristic types of human transformation in the evolutionary procession. Our lives acquire a double significance, when we find we are building an inheritance for every one of our descendants, while our race continues.

In our growth, we *re-evolve*, concisely, the story of our race's lineage, as in “*the house that Jack built*,” each succeeding verse comprehends all its predecessors. Our present bodies now barely float; for, as man acquired his upright stature, his frame must have increased in weight and hardened into greater rigidity; while the pelvis, to sustain additional weight thus put upon it, enlarged, thickened and increased his gravity.

The head of the human species seems originally to have been large in proportion to the body, exhibiting a promising germ thus early advanced, a fact to which the race may owe its present superiority; and, possibly, this early development of the organ capable of acquiring knowledge, may account for peculiar sufferings, visited upon woman, more particularly among the most intellectually developed.

The highest type of man has been artificially advanced beyond the condition of some portions of the physical world. Miasmatic swamps are yet insufficiently reclaimed by time, to permit a white man's existence where they continue. Their present condition would involve his speedy illness and dissolution. Lower organizations, congenial to and in harmony with such conditions of physical development, may exist and flourish there: but more refined types of humanity, require the most perfected physical conditions, for their perfect enjoyment and highest attainments.

Centripetal law has consolidated the Chinese into a positive and exclusive people, who delight in ignoring the centrifugal or complimentary force, which induces dispersions. They have long clung to unique customs and dress, resisting change or improvement. In their stereotyped form of frozen civilization, differentiation has been arrested, and a peculiar type intensified. Unalterable fixedness in forms of belief, and habits concentered by centuries, furnishes convincing evidence of great antiquity. The black races are ethnologically far less developed, and having no fixed belief to displace, are more readily converted to any religious sect.

We cannot avoid admitting that the Chinese are one of the oldest families of the ancient world; yet they are by no means the oldest. Until the seventh century before the Christian era, they were perfect strangers to every form of idolatry. Pure Chinese appear like a race absolutely distinct from nations by whom they are surrounded, differing in physical characteristics of form, color, and expression; in language, in their written characters, their literature, and religious observances. Unchanged by foreign conquests, by extensive intermixture with any foreign race, they have developed within themselves, preserving and perhaps intensifying their type; governed and civilized by the principles contained in their own classic literature, and in their pure and excellent book, the Chou-king, compiled fully 3,000 years ago, from their more ancient literature, much as many suppose Moses to have compiled the Pentateuch, or as Heroditus compiled early Grecian history.

China has her ancient picture writings, but no ancient idols. She has her literature older than the Sanscrit races. When the great pyramid of Menes was built, in the fourth dynasty of Egypt, B. C. 3893, we find one vast and expanded system of idolatry throughout Asia, and the countries bordering on the Mediterranean, all worshiping emblems, more or less types of the sun or solar principle, China standing alone—far back in the twilight of history—is a solitary exception on the continent of Asia.

Language is a test of social contact, not of race. Undoubtedly the first expression of human thoughts were by configurations of countenance, such as smiles and scowls, indicating pleasure, dread, or anger. With the invention of complicated forms in language, capable of complete expression without emotion, came deceit, frequently followed by loss of harmonious social relations, and developing combativeness. No primitive history, at present known, conveys any reliable account of an aboriginal language much anterior to that of China; although that of the ancient people of Yucatan and adjoining American nations, as shown by picture-writings on their monuments, appears to have been more ancient.

Both peoples, in common with the Egyptians, expressed thoughts by picture-writing and in hieroglyphics. While other surviving nations improved upon this original style, by developing the phonetic; inhabitants of China alone, became exclusively confirmed in their monosyllabic language, and their manner of vocal communication, is still very peculiar and spasmodic in sound and utterance. Their hieroglyphics, which, in early ages, expressed a single substantial thought, were subsequently assumed as syllabic representations, and became synthetic or compound forms of expression. Thus, to-day, 216 Chinese radicals are made use of, in over 50,000 ideographic combinations.

To investigate this subject, requires extensive research in a multitude of directions—physiological, linguistic, religious, traditional geographical, and migratorial—for it is often by their mutual comparison only, that satisfactory results are reached. The wider view we can compass, the clearer our understanding of general laws. There is in force a law of decreasing vitality, as well as of evolution, both alike depending upon the refinement of surrounding conditions. Great disturbances have affected the earth's surface and all living things, since the tertiary period, when our present zoölogy fairly started

into being. To all these considerations, must be added the ancient migrations which the different families of mankind have passed through, under the changing conditions imposed upon them by geographical and climatic necessities, and thus a systematic arrangement of facts is finally indicated. Physical geography teaches us that of the two great elements, water and land, the latter, which is matter in a more advanced form, is far superior in the animal and vegetable life to which it gives origin; likewise, that low and swampy land is fatal to health and the highest development of man. Geology and Palæontology show this to have been equally true of the *flora* and *fauna*, in ancient days.

Neither tropical Africa nor Asia are adapted to the Anglo-Saxon constitution; every white colony there has been wasted by sickness and death; yet this is the native and natural climate of the dark races, who are there as much at home as is the polar bear on the shores of Greenland. When at Saigon, on the Meikong river, I was told by an officer of the French colony, that 24 per cent. of French troops stationed there died annually. The British occupation of low lands in the southern portion of India, is scarcely more than a military possession, so far as Europeans are concerned, who cannot long live there, but would soon become extinct but for the constant influx of fresh immigration. There, a European struggles for existence, a prey to fever and dysentery, and is unequal to severe labor. White women, as a rule, are especial sufferers, rallying but poorly from any illness. White men must yield the tropics to the dark races. The reverse is also true; negroes are not comfortable in the frigid zone. The American residents of New England States, as at present constituted, have a continual fight with existing conditions of climate, and their survivors and descendants, now in process of acclimatization as a race, are assuming a somewhat typical form.

Whenever we examine nature, we find a perfect adaptation of animals to the circumstances under which they live. The constitutional temperaments of the different races seem to vary. The dark races are less developed than the white; they have a less nervous sensibility, for their physical organization is less delicate. Van Amridge says: "The dark races expire less carbonic acid from their lungs than the white, but transpire the fetid matter chiefly by the skin." According to Dr. Knox, the nerves of their limbs are one-third less than the Saxon of equal height. Great differences of shape in the pelvis of different races, have been classified by Doctors Vrolik and Weber, who thus report the four principal races: "The European is oval; the American, round; the Mongolian, square; and African, oblong."

The characteristics most relied on for the discrimination of races, are the color of the skin, structure of the hair, and conformation of the skull and skeleton. Transitions from one to the other are so gradual, that it seems almost impossible to draw any exact and arbitrary line of inter-demarkation. We now see the various branches of mankind confined to distinct localities, mainly bounded by isothermal lines, with distinction of form and color, with different social relations, religions, governments, habits, and intellectual powers. Wherever men have migrated, they appear to have found and displaced an aboriginal nation, and no record is believed to exist of any people ever migrating to a land which they found entirely destitute of inhabitants,

in some of the various stages of human development. Adelung reckons the total population of the earth as 1,288 millions, professing 1,100 forms of religion, among which there exists 3,664 known languages or dialects, viz.: 937 Asiatic, 587 European, 276 African, 1,624 American. These are significant facts.

Sir Charles Lyell is inclined to admit that an imperfect form of man was living when the tertiary strata was deposited. Agassiz, who pronounced America the oldest continent extant, measured the coral growth during a given number of years along the southern half of Florida, which, he asserts, has been formed by accretion during the geological period known as recent, and must have required not less than 135,000 years to form. We may arrange epochs in their order of sequence, but not of date, for in contemplating the vastness of such a past, the mind becomes lost in amazement at the vista opened into antiquity. The histories of China contain records of the past, which modern chronologies have insufficient room to measure. The limits of history are steadily receding, and Greece and Rome are taking their proper positions in a comparatively modern era. Science is developing unanswerable proofs of the greater antiquity of the human race, than current ecclesiastical histories have been supposed to allow. Greater freedom in chronology is absolutely necessary. No sound religious principles have ought to fear from true interpreters of antiquity. Truth, in all its natural simplicity, is susceptible of proof, and reason is its steadfast supporter. Nature's own religion is grander than any human conception. In the dark ages, mysteries, miracles, and absolute imposture stood in the way of absolute truth. Evolution gives to the Infinite higher attributes, and more nearly connects him with all created things. The God of the true scientist is grander and more comprehensible to mankind. It takes us half our lives to unlearn and eradicate errors honestly taught us in youth, with perfect good faith and intention, which persistently cling to us until displaced by the sound reasoning powers of maturer years. Each conscience is but the result of its own moral education. It is composed of ideas it has fed on. Many imbibe, hereditarily, the opinions of their forefathers, and venerate them because they were first upon their mind, which circumstance alone produces to them an unsophisticated conviction of their truthfulness. None are free but those whom Truth makes free:

"Most men by education are misled,
They so believe because they so are bred;
The priest continues what the nurse began,
And so the child imposes on the man."

America was undoubtedly peopled many ages before Julius Cæsar landed in barbaric Britain, and many of the colossal structures, whose ruins still excite the wonder of the wandering Indians of Central America and Peru, doubtless passed from use long before the Tartar conquerors in Central Asia drove their hordes eastward, or Attila and his Huns swept his legions westward, from the great wall of China and the steppes of Ancient Tartary.

Chinese historians assert that in the fifth year of the reign of Yao, B. C. 2,353, strangers from the south, of the family of Youë-Tchang, brought, as a

present from a maritime kingdom in southern seas, a great turtle, three feet long by three feet wide, and very old, on whose back was written a history of the world, from its commencement to that time, which Yao ordered transcribed and preserved. Turtles have long had a peculiar religious significance in Japan, and also among American aborigines at Copan, where a splendid stone altar of great antiquity, in the image of a similar tortoise, yet remains.

Chinese culture, dwelling apart in the south-eastern extremity of Asia, has developed and retained distinctive national types, coldly conservative, while nations less peculiar, and perhaps more adventurous, rose, scattered, and passed away almost by scores. The isolation of their peculiar civilization must have resulted from the physical conformation of the spot they occupied, encircled by protecting ranges of mountains, and forbidding natural barriers.

Eminent Chinese historians, after describing the fabulous and mythical ages, which are imperfect and idealized recollections of events, peoples, eras, and civilizations; and renowned individuals whose exact history had become confused, extinct or legendary, when their first authentic records of ancient history were penned; come to the reign of men. Greek history appears limited when looking beyond into Oriental records, and proves but a scanty stream leading to a broad ocean beyond.

The deified rulers are naturally the most ancient, and are succeeded by demi-god descendents, in a sort of middle age. The advent of conquering heroes from a foreign soil, by introducing a new element into history, may have changed the national era. A careful study of the various ancient histories of the world has led me to infer, that, generally, rulers who are said to have descended from the gods, were merely successful invaders of the country where they died, and were there canonized or deified. Being born in a foreign land, no local record existed of their parentage, and it was easy to ascribe their origin to supernatural causes, while their death being among the people whose traditions have come down to us, was witnessed and recorded.

All scholars experience difficulty in tracing up and locating ancient places, as most of them were given new and foreign names, by conquerors and explorers. Since the days of Tyre and Sidon, and the ancient and long continued sway of the South Arabians declined, and gave way to the rise of great monarchies in Western Asia and India, places have received new rulers and taken new names. This is true throughout history, of all countries, and is more recently illustrated to us, in the saintly names given by Spanish and Portuguese explorers: or head-lands and islands re-named for British seamen and their patrons. A less troublesome impediment to accurate identification, is found in translated names.

The progress of science, and linguistic and historic researches, continually supplements our knowledge of the mighty past, whose history must now be worked back by degrees, and every fact capable of yielding testimony, preserved and utilized. Chinese records, extending to B. C. 3,588, may yet render valuable aid in perpetuating much that was destroyed in the lost libraries of Phœnicia, Chaldea, and Egypt. The first era of Chinese history is without dates, capable of being accurately fixed by any measure known to us

at the present time. So of Methuselah's age. We cannot believe that the duration of human life changed suddenly from hundreds of years to three score years and ten. The change, if at all, was in the human measure. During our present century, the average longevity of Great Britain has increased nearly ten years. The true "*elixir of life*" is a scientific knowledge of the limits of our being, and wisdom to use our powers so as to obtain their utmost capabilities. Wisdom is the best use of knowledge.

This early Chinese era consisted of three dynasties, who, successively with their descendents, ruled the kingdom of China, whose dominion had not then spread into an empire, and the aggregate terms of their reigns must have extended over a long period of time. This period may represent the rule of early Asiatic aborigines, developed upon the soil of China.

Chinese historians commence their second and more authentic era with the reign of a sovereign named Tai Ko Fokee, or Great King Stranger. He commenced his reign B. C. 3,588, and from this founder of their line of monarchs, they have preserved a national history and true chronological succession of their rulers. His name seems to imply that he was a foreign conqueror, who occupied the country, and doubtless, at the time of his conquest, took no pains to preserve the records of superseded dynasties, which come to us only in the form of tradition.

The pictorial representations of King Fokee which have come down to us, represent him with two small horns, similar to those associated with the representations of Moses, the Hebrew law-giver. He and his successor are said to have introduced into China the hieroglyphic characters for picture writing, somewhat similar to those found in Central America, and from whence the ideograms now in use are conceded to have been derived. He taught his people the motion of heavenly bodies, the twelve celestial signs, and divided their time into years and months, besides bringing them a knowledge of many other useful arts and sciences. The sudden advent of so much new knowledge, brought by one man, indicates that he came from far away—from a country with which no previous communication had existed. As he introduced a new measure of time, we can but estimate the duration of eleven reigns which preceded him.

Probably the solar day was the earliest measure of time; then, the lunar month; and lastly, the solar year. The various words used in all languages, and interpreted to us years, meant, simply, the *periods of time* which at the moment constituted its measure. Thus, if Methuselah lived 969 periods of time when the lunar month was the accepted measure, he died at $74\frac{1}{2}$ years of age, which is not improbable.

The great Chinese history of Tse-ma Chi-ang, written B. C. 122, and purporting to be an accurate transcript of all earlier existing histories, which it was desirable to consolidate and preserve; narrates events, chronologically, from the reign of Hoang-Ti, which commenced B. C. 2,697, when he was eleven years old; during his minority the kingdom was governed by wise and prudent counselors, who, it says, took great care of the young monarch, and educated him in all the useful arts and sciences then known. It is recorded that during his reign physicians first learned to feel the pulse; the magnetic needle was first used, pointing to the south; and civilization greatly

advanced. He lived a useful life, was greatly respected, and died at a ripe old age. During a portion of his reign, a powerful revolt was successfully put down, indicating a mixed race, with the antagonisms of conflicting opinions. Five of his descendents succeeded, in turn, to his throne. Then came *Tai Yao*, followed by *Yuli Tsi Yune*, B. C. 2,294, during whose reign a great deluge occurred in Asia, which flooded fifteen provinces of China and drowned great numbers of inhabitants. Some portions of the country remained under water for several years thereafter.

This rupture of a natural barrier, which held in check some extensive inland basin of water, existing at a higher level, occurred just fifty-four years after Archbishop Usher fixes the arch-catastrophe of Hebrew tradition, and was doubtless like the Noachian flood, a crisis in the physical history of the region where it occurred. It is highly probable that the great interior alkaline deserts of North America, where the successive water lines around the surfaces of every elevation of its various levels, clearly indicate the former presence of vast inland basins of water; have at some remote period been, in like manner, drawn off and precipitated upon lower levels of this continent, in their journey towards the common level of the ocean. This is also shown by the presence of ancient river beds across the present summits of the Sierra Nevada Mountains. Nothing seems to impede the execution of unerring physical laws, and in the consideration of general history, natural science shows no relation between such physical calamities and personal guilt.

B. C. 2,233, the next Emperor, *Tu Yu*, caused canals to be cut, to convey to the sea the immense bodies of water which, during the reign of his predecessor, had been precipitated upon and overflowed so large a part of China. By this means many deep river beds were finally cut, and continued to be worn away by the receding waters, until the whole country was freed from inundation.

His eleventh descendent and successor was a tyrant, and was banished in the fifty-second year of his age, and king *Ching Tang* came to the throne, B. C. 1,766, and died 1,753 B. C. During his reign a great famine existed in China, which the records say lasted seven years. Joseph's famine in Egypt occurred B. C. 1,707, or forty-six years after this date. These coincidences are merely cited as suggestive to historical students.

It is desirable that the historical records of all ancient nations should be sought out and compared; and to our linguistic and archæological students on the Pacific, the early histories of China and Japan should be made the subject of careful study. Much mental and social cultivation existed in Asia when Europe was yet in her dark and undeveloped ages. China and Japan, as well as all the nations of Asia, yet contain many ancient records, that may well repay careful study, revealing traces of a civilization whose history is incredibly remote. Ere the ancient respect for sacred records has become impaired, and they are cast aside or destroyed in the ecstasy of a new-found religion, or the mechanical wonders of a scientific civilization, earnest and reliable students may acquire much important testimony among the archives of India, China and Japan. Few ancient races have preserved a literature of equal value with the Chinese. The great past of prehistoric humanity bears traces of activity and commercial intercourse throughout Asia.

About five thousand years before the Christian era, the Sanskrit branch of the Aryan race invaded and occupied Northern India, while the Arabian Cushites, dwelling in Arabia, held control of Southern Arabia. These South Arabians held innumerable colonies, and were unrivaled in power and commercial dominion. They early established great influence as a maritime people along the coast of South-western Asia, colonizing much of the Asiatic seaboard in the deepest antiquity,—not, however, including the present Chinese territory, but exercised a widespread influence from the extremes of India, even to Norway, acting an important part as pioneers in spreading and developing early civilization. The nomadic tribes of Asia have been classed as of Semetic origin.

China, although well known, and mentioned in the ancient Sanskrit writings, under the name of *Yama*, was never included in statements of the migrations of races and peoples throughout Western Asia, Hindostan, and the islands of the Indian Sea. In remote antiquity, the Chinese nation appears to have lived within itself, cut off from active communication with any neighboring people.

According to Arabian traditions, *Ad* was the primeval father of the pure Arabians, and built a city in Arabia which became great and powerful. The Adites are referred to in the earliest dawn of Arabian history, as enterprising, rich and powerful, having great cities of wonderful magnificence. They were skillful builders, rich in gold, silver, and precious stones, showing them acquainted with metals. Numerous appliances of our civilization had their origin far back in the obscurity of ages now pre-historic, and Adam may be but the Hebrew tradition of the ancient Adites of Arabia, who must themselves have had a long line of ancestry, to have developed and acquired such civilization. Adam was, perhaps, simply the ideal embodiment of a *beginning of humanity*, typified to the Hebrews by an Adite patriarch, beyond the experience of their own history, into which he was adopted by Moses, as the ancestor of their race. It was an effort to extend their national lineage far back to an original First Cause. The distinctive Hebrew race descended from Abraham, that magnificent sheik, the mighty Mesopotamian prince; Israel's ancestral hero and first distinctive Hebrew personality; great grand-sire of the princely Joseph, Lord Chancellor of Egypt, Prime Minister of the first Sesostris, and monotheistic chief of an illustrious line. Thus he stands, in bold relief, on the canvas of tradition, as a great leader of human kind in the period comprised in the first essays of Hebrew literature.

Our opinion of the general inaccessibility of China from other parts of the continent of Asia, in early times, is confirmed by a passage in the history of Besorus, relating the conquests of the Arabian sovereign, *Schamar Iarasch*, *Abou Karib*, who reigned over Chaldea, and 245 years before the rise of the Assyrian empire carried his arms, B. C. 1,518, into Central Asia, occupied Sarmacand, and for a long time attempted, without success, the invasion of China. Humboldt describes an Himyatic inscription existing at Sarmacand in the 14th century, in characters expressing, "*In the name of God, Schamar Iarasch has erected this edifice to the sun, his Lord.*" All facts go to show that migrations over Central Asia, from Arabia across the continent, must have passed north of China, (which country seems to have maintained

her individuality nearly intact), and reached the shores of the Pacific near the peninsula of Corea, which is still inhabited by a populous nation, quite unlike the Chinese race. Many aborigines of Central Asia were doubtless driven toward the coast by these Arabian conquerors. These South Arabians were a people older than the Aryans. The great ages of Cushite civilization, to which we are told they succeeded, closed at a period which was very ancient when the book of Job, the oldest book of the Hebrew scriptures, was penned as a Persian poem.

Testimony is universal that the oldest nations succeeded older pre-existing peoples, and generally received their highest ideas from abroad, showing a descent of ideas as well as of blood. A constant admixture of races, peoples and nations has been successively going on for ages. It is only in some secluded spot that we may, at this late day, discover traces of anything approaching to an early type, with slight recent admixture. Such specimens, if they exist at all, cannot but be extremely rare, and, like the Miauts of China and some remnants in the Tyrolese Alps, inhabit regions virtually inaccessible.

The huge stone structures, cities and temples being unearthed in Yucatan, argue an enormous early population. The ruins of Copan, and disintegrating pyramids of Palenque, are convincing proof of a great pre-historic race in Central America, at an immensely early period; which must have occupied the same relative positions toward North and South America that Asia Minor did, in remote ages, to Central Asia and Africa. The peculiar construction of all the arches found among the buried cities of Yucatan may lead to the discovery of races cognate to its early inhabitants. The same principle of arch was used in very early times by Egyptians, Greeks, and Etrurians.

Notwithstanding the frequent disastrous fires, and destruction of records by conquerors and founders of dynasties, who have annihilated much valuable material, China, Japan, and the interior of India have many copies and manuscript translations of very ancient works and histories, long retained among their sacred treasuries, rich archaeological prizes for modern explorers to unearth, equal in interest to the lost history of Iran, mentioned in the Dabistan and other Asiatic writings.

By an extended research into ancient histories, many plausible reasons are found, which argue the possibility, and almost probability, that some early aborigines of the pure Chinese race may have crossed by sea from the coast of Peru to China in an early or remote age of the world. Recent travelers in Peru inform us, that its aboriginal races have, like our North American Indians, become nearly extinct; and the only remaining traces are found among the China-chola, a mixed result from Spanish and Portuguese ancestors. Last year my attention was called to an article in a South American paper, describing the remnant of a race of aboriginal Mongolians or Chinese, found among the high table lands upon the western slope of the Andes.

Phœnicians and Egyptians, who each received hieroglyphical characters from a common source, originating in an older people, ascribe them to Taut. The Chinese ascribe them to Tai Ko Fokee, their Great Stranger King, who reigned B. C. 3588. Many curious coincidences point to the supposition that

he may have brought them from Peru or Central America, where, among ruins still existing, there has been discovered much early picture-writing, closely corresponding to early Chinese characters, comprising the 216 radical ideographs now used. Thus, heaven is expressed by three horizontal lines, slightly curved; and earth by a cross within a circle. In discoveries at Copan is a figure strikingly resembling the Chinese symbol of Fo-kee, both nations representing him like Moses, as a lawgiver, with two small horns. Many figures on Peruvian water-vessels, of great antiquity, are identical with those found in Egyptian temples; birds' heads, for example, attached to figures resembling a comma, but intended to represent tongues; and other remarkable coincidences. Either one people learned from the other, or both acquired these forms from a common source. Many physico-geographical facts favor the hypothesis, that it is more rational to conclude that Egypt received them from America, through China—possibly through Fo-kee, or some predecessor in very remote ages. Recent scientific explorations are reported to have exhumed Chinese sacred mottoes, carved on tombs in Egypt—counterparts of phrases in use to-day—revealing the existence of an intercourse when China was ruled by kings anterior to Moses.

The present written language of China is undoubtedly an imported method, advanced from such picture-writings as those of the ancient Peruvians, or primitive hieroglyphical signs of ancient Egypt. Among some nations, mental progress evolved a simple alphabet, while others remained content with the increasing complications of ideographic signs, for syllables and objects. Egypt, like China, was tenacious of her individual peculiarities, and long retained her hieroglyphic type. She finally abandoned it, while China clung to but improved it.

The South Arabians and their descendants, the Phœnicians, having an extended commerce established throughout the Indian Ocean, with every known shore, undoubtedly passed more readily into a simple phonetic alphabet, better adapted to the practical wants of a commercial people. Tablets have been discovered among their ancient ruins, by which the various changes are readily traced.

Chinese characters, so long surrounded by the ultra conservatism of an impenetrable isolation, have undoubtedly developed from these common forms of natural objects, and subsequently been adapted to easy and rapid writing, with a peculiar style of brush, and their manner of holding it.

The consideration of whether the Chinese people originally developed in Asia or abroad, bears an important relation to the origin of the Japanese race, the subject we are ultimately investigating and shall consider in our next paper. In seeking the initial points whence migrations have diverged, we naturally gather all possibilities, whence we select probabilities, in the hope of finally eliciting absolute truth. We shall be compelled to limit this already lengthy paper to setting forth certain fundamental principles useful in research; and to a collection of evidence, the full discussion of which will necessarily remain for a future occasion.

Without, in any manner, endorsing the following hypothesis, we shall simply aim to shadow forth a few *possibilities*, which the consideration of many curious facts have suggested during the laborious details of an elaborate search.

How came the Chinese—a people so ancient, so reserved, and so wholly unlike their surrounding neighbors, or indeed any other race upon the continent of Asia—to be thus alone in this corner of a continent, walled in apart from all neighboring races? We may reasonably doubt the assumption of any spontaneous growth in the country they now inhabit. Conjectured migrations among still speechless societies, at an epoch anterior to the formation of nations, are beyond our present ability to trace. We can only surmise whether each continent evolved a type of manhood separately, or whether all higher races have resulted from the various differentiations and dispersions from a single locality, of a common ancestor already developed up to the lowest types of a speechless animal, tending to manhood.

Our best researches indicate an enormous antiquity for man on the American continent, and an advance in general form and brain capacity, with, doubtless, a modification of color, since a very early period. In very remote times, there appears to have existed at least two very distinct populations, differing, in fact, more widely than any existing aborigines of the continent. Portions of North America had been occupied by races far more advanced than its occupants when recently discovered by Europeans. Originating, perhaps, at a very early period in the elevated centres of the American continent, wave after wave of races may have rolled eastward and westward, or northward and southward, to a certain extent, only identified in America to-day by slight signs that mark the nearly extinct descendants of the people with which they amalgamated.

Dogmatic theology retreats before scientific truth. No one will, at this day, pronounce the self-registering records of nature grave heresies. They are vastly more enduring, authentic and reliable testimony than the precarious text of human narrators. It seems a crime against true religion to hang the integrity of its moral principles upon the validity of statistics in any book which merely illustrates, by historical parables, the early development of its traditional ideas. The innate virtue of its pure principles is unharmed by legendary or dogmatic absurdities.

The Chinese have an immense antiquity. They are a peculiar people, very marked in their features, and have multiplied so that at present their population and area of production are so balanced that any marked increase would precipitate a famine, and thus equalize conditions. They not only practice economy, but enjoy it, having learned in centuries to live upon the minimum and enjoy the maximum of life.

All other civilizations and emigrations throughout Asia appear to have moved from Asia Minor, and the high central portions of the North and West. The Chinese appear as an isolated people, and have long preserved the peculiar type of a race wholly unlike any other on the continent of Asia. Their country is situated upon the south-eastern extremity of the continent, and hemmed in on the west and north by a chain of mountains practically impassable, and now made more so by the great wall, 1,250 miles in length, with which, B. C. 220, they sought to complete their isolation.

If this people did not develop from the soil they now occupy, we must search for the most probable mode of access by which their earliest ancestry reached their present home. In this stage of the world, all nations are more or less composite.

The southern and south-eastern portions of China border upon the ocean, and if the earliest Chinese came from an opposite direction they must have reached their country by water. If so, it may account for their skilled boatmen, who have lived upon the water from time immemorial, and for the enormous fleets of junks, generally of large dimensions, which they possess. A taste early cultivated may have come down through many centuries.

If we first seek for testimony from Chinese records, we find they ascribe their own origin to the southern portion of China. In order to ascertain how they could have reached there by sea, and the direction whence they probably came, we must study natural causes, and seek among winds and currents for the first natural distributing agents, whose influence on navigation has been but recently overcome by clipper ships and steamers of modern construction.

The Pacific is a wide ocean to cross, and fair winds must have been relied upon, for muscles could never have paddled a direct course for such a distance. Where, therefore, is the country, from which they could follow a fair, fixed wind in a straight course, and be brought to land upon the southern coast of China, where they claim to have originated?

We find in the South Pacific, between the southern tropics and the equator, a perpetual trade wind blowing from the south-east. Towards the tropics, it blows more nearly from the south, hauling gradually into the eastward as it approaches the equator. This constant breeze would drive a vessel kept before the wind, from a point anywhere on the coast of Peru, about in the neighborhood of the Chincha Islands, by a slightly curved but almost direct line as far as the equator in the direct course for the coast of China.

In the North Pacific Ocean, between the tropics and equator, the north-east trade wind exists, as the almost complementary counterpart of winds in the southern hemisphere, likewise blowing more northerly near its northern limit, and uniting in an almost due easterly wind near the equator. Thus the south-east and north-east trade winds meet, and frequently blow into each other along a parallel line, making a continuous fair wind, uniting them at the equator, and consequently forming an uninterrupted motive power, to their western limit.

Now, if a large junk were started from the coast of Peru, near Central America, and kept off before these fair winds, there is a strong probability that in sixty days she would strike the southern coast of China, about where early Chinese traditions place the origin of their race. This evidence, of natural causes, apparently points to Peru as the possible home of the Chinese ancestral race. What has Peru to offer in support of such an hypothesis?

In Heavside's "American Antiquities," published in 1868, we find that "some of the western tribes of Brazil are so like the Chinese in feature as to be almost identical." There is thus a *possibility* shown, that the ancestry of China may have embarked in large vessels as emigrants, perhaps from the vicinity of the Chincha Islands; or proceeded with a large fleet, like the early Chinese expedition against Japan, or that of Julius Cesar against Britain, or the Welsh Prince Madog and his party—who sailed from Ireland, and landed in America A. D. 1170, and, in like manner, in the dateless antecedure of history, crossed from the neighborhood of Peru to the country now known

to us as China. The very name, *Chincha*, has a Chinese sound, and reads China, with two letters dropped.

For upwards of twenty centuries, Chinese junks are known to have been large, fast, and strong; their people skillful mariners, excellent carpenters, and marine architects. They early possessed the mechanical skill to build junks of comparatively great tonnage, capable of conveying large amounts of cargo and great numbers of passengers. If the measurements of Noah's ark are correctly interpreted, she was larger than any ship of our day. Ship-building, as we have shown in a previous paper, is a very ancient art, known long before the days of Tarshish. We have no history of its absolute inception. Monuments on land endure to perpetuate the memory of a race, but ships are of their nature perishable. A race that could build the magnificent temples and pyramids of Palenque and Copan, in Yucatan, could certainly have their fleets upon the Pacific Ocean, in ages long before any existing record. The construction of a Peruvian or Central American fleet of large vessels, in early ages, capable of transferring to China, if not 100,000 people, certainly quite sufficient to establish a colony, would require far less skill or enterprise, than that which raised the pyramids of either Central America or Egypt.

China had bronzes in perfection during her very earliest ages, and may have introduced them into Western Europe and Asia. Among the most ancient relics found in Peru, are bronze and iron implements. Many Peruvian and Central American antiquities resemble, not modern Chinese, but their most ancient writings and figures. It is not impossible that Cadmus' alphabet, as well as the hieroglyphics of Egypt, may have been suggested and developed from the ancient American hieroglyphics now coming to light, showing such similarity and apparent connection, and which many scholars already consider as the early models, not the results, of Egyptian figures and Chinese ideographic characters.

The Toltec race in America had a god with one arm—so had the Egyptians. The deified Fo—whom they represent with two small horns, similar to those associated with figures of Moses, the Hebrew lawgiver—instructed Chib-ca Indians in Bogota to paint the cross and trigrams used on their inscriptions; and in China, the Chinese historians ascribe to Fohi many new things, among others, how to paint identical figures of trigrams, like those found among the ruins of Central America. With time and perseverance, it may yet be discovered that a knowledge of hieroglyphics came from Peru or Central America to China—a people whose growing commercial intercourse may have spread their knowledge to the ancient monarchies of Egypt.

The recital of facts may be greatly extended, showing a wonderful chain of evidence, which it is hard to conceive can be entirely accidental and coincidental, unless we take the extremely broad and apparently untenable ground, boldly asserting that primitive humanity, through the action of common laws and natural forces, wherever placed, evolves like forms, customs and necessary results, irrespective of variable conditions and individual fancy or free will. Chinese ideas concerning the Tchin, or original eight persons of a supernatural nature who escaped from the sea, point to an origin from beyond seas, or to an early piscatorial age. B. C. 3,588, Tai-ko-Fokee, a king of China from abroad, was deified. China has her ancient pictorial writings.

Fernando Montesino, a Spanish historian, who visited Peru and published his work from 1508 to 1547, says Peru was thickly populated, and had a catalogue of 101 monarchs, with notes of the memorable events of their reign, extending to B. C. 2,655.

Hawks, in his Peruvian antiquities, says that before the Spanish conquest, in the most eminent period of the dynasty of the Incas, the vast empire of Peru contained eleven million inhabitants, which rapidly diminished, until the census of 1580 shows but 8,280,000, and now the valleys of the Peruvian coast contain barely a fifth of what they contained under the Incas. The total present population by census of 1875 amounts to only 2,720,735 souls. A light native is still called a *China-Chola*.

The feast of souls practiced in Central America appears to have been derived from the same source as that of the ancient Egyptians. The Jesuits of the Propaganda report these ceremonies as anciently in practice in China. The ruins of ancient temples found in Central America resemble in form, space, and massive walls, *without roof*, the most ancient temples of Egypt, and many of the carvings are singularly alike.

Traditionary histories among the different groups of the Polynesian Islands indicate that the Hawaiian race came there from the south. The Hawaiian Islands are nearly in the direct line from Peru to China.

While the majority of Hawaiians are probably descended from Malays, their early traditions tell us of the landing of men belonging to a race whiter than their own, upon the southern island of Hawaii, many centuries ago, whom they were at first inclined to consider as gods, but who finally settled among them, and from their wisdom were elevated to high positions. These men undoubtedly came from Central America or Peru, and may have been from the ancient Peruvian empire, or the later kingdom of the Incas, or from that early civilization whose traces yet remain in Yucatan.

It has been sufficiently demonstrated that even frail canoes and boats, either by accident or design, have performed voyages across wide oceans. In 1819, Kotzebue found at Radaek group four natives of the Caroline Islands, who had been driven eastward in a canoe 1,500 miles. In 1849 men came from Honolulu to San Francisco, 2,300 miles, in whale boats. And more recently the boisterous Atlantic ocean has been crossed from New York to Liverpool by a solitary man in a dory.

A dozen of the crew of the clipper ship "*Golden Light*," burned in the South Pacific about 1865, just west of Cape Horn, reached Hawaii in eighty-one days, in a whale boat under sail, and would have run upon the reef at Laopahoihoi, but for natives who swam off to rescue these exhausted people, all of whom survived.

While we have cited facts showing it reasonable to suppose that early Peruvians or Central Americans may have come to China, by the aid of continuous fair winds, it is no less necessary to show the almost insurmountable difficulties which exist during a greater part of the year to impede their return by sea. To beat back against strong trade-winds and the long regular seas of the Pacific, would be a task in which they would surpass our best modern clippers, which now can only make the voyage by running far north and crossing from Japan to the coast of California, upon the arc of a great circle,

and sailing thence southerly, close hauled on the wind, to the neighborhood of Tahiti in the South Pacific, which must then be crossed in an easterly direction, south of the trade winds, which in turn enable them to make northing and reach the coast of Peru. Such a return voyage would require the most skillful knowledge of winds, coasts, and scientific navigation, such as we have only possessed in comparatively recent times, and would also require exceedingly strong and weatherly vessels. There seems, therefore, less likelihood that any Chinese ever reached Peru in pre-historic times by such a route.

Intercourse appears to have existed more recently, but how far it was reciprocal remains to be seen. If it was commercial it was more likely to have been, as reciprocity is the foundation of trade.

In our search for objections to the theory we are exploring we however, find other possible channels of return communication. During the southwest monsoon a fleet of junks might possibly have left China and followed the Kuro-Shiwo, or warm stream that flows along the coast of Japan, with summer winds across to the northwestern coast of America, near our own harbor, and thence gradually have worked its way southward to Central America, keeping along in sight of the coast until it reached the calm belt around Panama. The Abbé Brasseur de Bourbourg makes this statement: "There was a constant tradition among the people who dwelt on the Pacific ocean, that people from distant nations beyond the Pacific formerly came to trade at the ports of *Coutulco* and *Pechoupi*, which belonged to the kingdom of Tehuantepec, in Central America. Baldwin tells us, in his "Pre-historic Times," that "the traditions of Peru told of a people who came to that country by sea, and landed on the Pacific Coast. These may have been from the great maritime empire of the Malays, whose dialects have permeated almost every island in the Pacific oceans. Lang says: "South Sea Islanders exhibit indubitable evidences of an Asiatic origin."

The continent of Asia affords more facilities for reaching Polynesia than America, although stragglers from the latter have doubtless added to its island races, and thus created a mixture of customs which, to some extent, may indicate a partial derivation from both. Probabilities favor Asia, both from certain affinities of tongue, striking resemblance in manners, idols, and physical formation.

Commercial intercourse, although not direct, existed and was maintained between China and Egypt, B. C. 2000. Chinese traditions claim for their people the first use in Asia, of ships and the earliest knowledge of navigation and astronomy. Their people first acquired the mariner's compass and believed the sacred magnetic influence proceeded from Heaven, which they located in the South, and from which they claimed to have come. To this day the heads of Chinese compasses point south.

In Peru, the oldest civilization was the most advanced, and had the highest style of art and mechanical skill. "Her people had an accurate measure of the solar year; a knowledge of the art of writing; and made paper of hemp or banana leaves B. C. 1800." The aboriginal Peruvians have had their dark, as well as bright, ages in history. They may have retrograded while their possible offshoot, the Chinese, progressed. Young colonies often grow and prosper, while their progenitors reach a climax and die out. Dis-

solution is the countercharge, which every material aggregate evolved, sooner or later undergoes. Evolution and dissolution bring to us ever changing, but eternally advancing forms, in their cycles of transformation.

The establishment of a race may be possible from a single pair, of strongly marked distinctive characteristics, whose descendants have continually intermarried. Hebrew patriarchs founded nations, and nations thus springing from a single man of pronounced character, whose descendants remained united and isolated, have often developed strong and peculiar personal characteristics, which have pervaded and stamped themselves upon the race thus descended. Mixed or cosmopolitan races, never possess uniform characteristics as clearly defined.

It seems more reasonable to infer, that a fleet from the neighborhood of Peru may have reached China with the first emigration, perhaps bearing a hero-sovereign and an invading army, which, once landed, found China agreeable, and, being unable to return against those perpetual winds which brought them so swiftly, were compelled to establish themselves in new territory.

Writers on Central America have expressed a decided opinion, that the peculiar character of its ancient civilization, manners, customs, and general structure of the ancient language, point very strongly to a common origin between the Indo-Chinese nations of Eastern Asia and the ancient civilization of America, which appears, in some remarkable particulars, to have been of an Egyptian cast. The Coptic or ancient Egyptian language, however, seems to have been monosyllabic. Hieroglyphic writing is of three kinds: figurative, symbolical and phonetic. Hubert H. Bancroft, in his *Native Races of the Pacific States*, Vol. V, f. 39, says: "Analogies have been or thought to exist between the languages of several of the American tribes and that of the Chinese. But it is to Mexico, Central America, and, as we shall hereafter see, to Peru, that we must look for these linguistic affinities, and not to the northwestern coasts [of America], where we should naturally expect to find them most evident." Count Stolberg, quoted by Humboldt, is of the opinion that the Peruvian cult is that of Vishnu—one of the Brahmin trinity—when he appears in the form of Krishna, or the Sun.

Mexican kings, who reigned previous to the Spanish conquest, all added TZIN to their names as a reverential affix. It resembles in sound a dynasty of China—the Tsin dynasty—which reigned from B. C. 249 to B. C. 205. Tai Ko Foki, the Great Stranger King of China B. C. 3588, or later Hoang Tai, may have landed from such a fleet, and been called by conquest, or through the reverence of superior knowledge, to reign over them. The descendants of these early settlers may have remained clannish, keeping apart, as an entirely distinctive race, from the Miauts or original aborigines, naturally following the customs of their forefathers, and thus have increased and grown into a mighty nation, unlike all people around them.

During many centuries of growth, China, like Japan and Corea, became a sealed empire, when no possible admixture of foreign blood could occur. It seems to have become an established habit with these nations to periodically close their ports to foreign intercourse. Some similarities of race exist between some types of the Coreans and Japanese, while the Chinese are

quite singular and unlike. Their oriental peculiarities, which strike the casual observer, are their dress, shaved heads and queues, habits, odor, and guttural language. Chinese are the only nation on the continent of Asia that use chairs and tables. Isolated nations, like hermits, cannot escape being distinguished by eccentric habits. Now, if the high civilization of Peru, which was in full tide B. C. 1800, and probably many centuries before, crossed to China in very early days, bringing its accurate measure of the solar year, and the arts of making paper and writing, all the necessary material was furnished China for the production of correct and reliable historic records. In reviewing Chinese early history, we have found that, B. C., Tai Ko Foki, their Great Stranger King, introduced a knowledge of these things, with hieroglyphic characters, and first divided time for them into lunar months and solar years. And we have shown that the authentic comprehensible history of China begins with his reign.

Now we inquire, did Foki, with all this valuable knowledge, come from Peru B. C. 3588, and settle among a pre-existing people, perhaps similar to, if not the aboriginal Miautz, long since driven from the plains of China into the almost inaccessible fastnesses of its mountain barriers?

A knowledge of days already existed among the sun-worshippers of Asia, who doubtless kept their records in days; but the introduction of a scale measuring by months and years placed their history on a footing we can comprehend; and the introduction of the art of writing enabled them to perpetuate it by enduring records. When we discover the measures of time, used to gauge ancient histories before these improvements were introduced, we shall doubtless find their records reasonably authentic. We have as little understood their stupendous figures as strangers conceive the value of a Brazilian rea, some 1000 of which, make a sum equal to the United States dollar; and accounts involving such currency bear the formidable aspect of immense sums, to the uninformed. With advancing centuries, the measure of time doubtless lengthens.

After the children of Israel left Egypt, where the solar year was known, records of extreme longevity disappear, and ordinary terms of life are adhered to. We should judge cautiously, and refrain from any interpretation at variance with human reason and common sense. The lunar changes, without doubt, were employed in the measurement of time in all warm climates before the introduction of the solar year. The colder the winter, the more marked the year became as a measure of time. Day and night would naturally suggest themselves as the first measure. Peruvians, Chinese, Egyptians, Hebrews, Japanese, Polynesians, and others, all attribute great longevity to their earliest ancestry, until the introduction of higher mathematics and the solar year.

The oldest histories preserved to us become what in our day we call authentic, when their nations acquired the art of writing, and divided time in a regular and uniform manner, by the solar year.

The first and fabulous epochs of most histories begin with dynasties of deified warriors. The tendency to deification exists among all early nations, and we need not go out of our own history to prove it. Edmond the Confessor, the Archbishop of Canterbury, who died as late as 1242, was canonized as a

saint, only a differentiated form of the same tendency. The gods of antiquity were partly impersonifications of natural forces, and partly deified men. They often bear the same relation to facts that shadows do to forms, being at worst but simple distortions of the truth. Few nations can examine impartially the substratum of their ancestral religious creeds. How often do we find in dogmatic theology the imprint of early paganism? The Hawaiian nation is supposed to have a considerable antiquity. From time immemorial there have been persons appointed by the government to preserve, unimpaired, the genealogy of their kings, which in 1863 embraced the names of more than seventy. Allow an average reign of twenty-five years, this would throw their history back 1,750 years, to A. D. 117 or earlier, say to about the Christian era.

It was a custom throughout the islands of the Pacific to exterminate their enemies, either by killing or setting them adrift in canoes. The latter practice not only led to the peopling of the various Polynesian islands, but was also a cause which led to cannibalism, for want compelled the exiles to subsist on each other, and a taste once indulged in, was continued by survivors who succeeded in reaching some island, and thus cannibalism became established. North American Indians have never been cannibals.

When Spaniards first visited America, the western equatorial regions of the continent were the seats of extensive, flourishing and powerful empires, whose inhabitants were well acquainted with the science of government, and had evinced considerable progress in art. Roads fifteen hundred miles long, remain in Peru, relics of the past, as ancient as the Appian way. In very remote times social etiquette was observed and universally respected. The early Peruvians constructed suspension bridges across frightful ravines, and moved blocks of stone as huge as the Sphinxes and Memnons of Egypt. They built aqueducts of baked clay and constructed dykes and causeways, and preserved a memory of past events by picture writing. They had a language of ceremony or deference, with reverential nouns and verbs, with which inferiors addressed superiors, a feature of resemblance to the Chinese in Eastern Asia.

Ruins of extensive cities and fortifications are now found in Yucatan and regions of Central America; the elevated plains of Bogota and *Cundinamarca*; the open valleys of Peru; and the lofty, secluded and highly fertile tracts of Chili. These colossal remains of ancient primitive civilizations are passing from the memory of a degenerate offspring, who now behold with indolent amazement these interesting relics of their illustrious predecessors. The origin, history and fate of these powerful nations of America, who have left behind them such colossal memorials of an ancient civilization, is a study of profound interest. Stones, thirty by eighteen by six feet, are squared and hewn and reared with utmost exactness. Their style of arch is peculiar. Temples, pyramids, tumuli, and fortifications, with remains of buildings of singularly massive architecture, often exquisitely carved, betokens a civilized antiquity.

It seems impossible that these people should have passed from the continent of Asia by Behring's Straits, for no traces of any such people remain anywhere along that route.

Pyramids of remote antiquity are found in India, China and Tahiti, as well as in Egypt and South America. Those of Egypt are in the best state of preservation and perhaps therefore the most recent.

The learned Bavarian, Dr. Von Martius, regards the evidence incontrovertible "of the existence of the *aborigines of America* long anterior to the period assigned in Hebrew chronology for the creation of the world;" a race whose utter dissolution manifests that it either bore within itself the germ of extinction or attempted an existence under most fatally unfavorable conditions.

Dr. Clarke says: "No race of human kind has yet obtained a permanent foothold upon the American continent. The Asiatics trace back their life in Asia so far, that the distance between to-day and their recorded starting-point seems like a geologic epoch. The descendants of the Ptolemies still cultivate the banks of the Nile. The race that peopled Northern Europe when Greece and Rome were young, not only retains its ancient place and power, but makes itself felt and heard throughout the world. On the American continent, races have been born, developed, and disappeared. The causes of their disappearance are undiscovered. We only know that they are gone." It remains to be seen if the Anglo-Saxon race, which has ventured upon a continent which has proved the tomb of antecedent races, can produce a physique capable of meeting successfully, and advancing under, the demands that our climate and type of civilization make upon it. This is an interesting query.

If we have been utterly confounded in contemplating the stupendous monuments of Egyptian magnificence, which continue to defy the ravages of time, what shall be said of remains of more ancient pyramids and colossal figures in America, of a style and character analogous to those of ancient Egypt, whose very stones are crumbling to decay, and on whose flinty sides verdure has crept over the dust of ages, until ancient and gigantic forests have acquired root-hold, and grown over their very summits? Many an Alexander and Napoleon of pre-historic times has gone to his rest, and left no record, capable of enduring to the age we live in, to mark the glory of his empire. Many mummies are found in Peru, enveloped in bandages of fine cloth, while the bodies of kings are admirably preserved by means of a secret known only to the royal family.

In the far distance of remote antiquity, successive peoples have risen to importance and passed away, long ages before the birth of those from whom the faintest ray of civilization has remained to cast even a feeble reflection of its pale light upon the fading pages of our most ancient historic records.

A period has undoubtedly existed, in the primitive history of our earth, when the necessary equilibrium between its external and internal forces has been lost. When the external pressure on the crust became diminished by the sublimation and recombination of external elements, which, when refined and advanced, were unequal in density to the expansive force of igneous materials confined in the interior mass. The solid enveloping crust of our sphere is the medium constantly acted upon, by these contending forces, in seeking a state of equilibrium. Geologists direct us to many prominences in which the upheaved strata, on one side, is abruptly broken, and on the other, gently inclined. Such ruptures could not have been gradual, for in places the whole combined strata is fractured, depressing portions, and rais-

ing others to immense heights. Earth's surface, to-day, bears unmistakable evidence, to every thoughtful student, that eruptive catastrophes have materially changed its geological features—especially the levels. Many areas, formerly submerged, are now dry, and known as alluvial formations. Seas have changed position, and rivers acquired new courses. New land has been formed, and mountain ranges reared by upheaval. Recent deep-sea soundings of the U. S. steamer *Tuscarora*—commander, Belknap—clearly illustrate how largely the bed of the Pacific Ocean—once but an extended valley, running, perhaps, from the Arctic to the Caribbean Sea—may have augmented its area by a comparatively moderate depression. During the glacial period, immense icebergs were produced at the poles, and as they increased in bulk, during a succession of cold winters, they accumulated an enormous volume of water—human life is considered to have been extant at this period—and when a succession of warm summers, produced by the perpendicularity of the earth's axis to the plane of the ecliptic, succeeded in reducing these huge accumulations of polar ice, its volume retired, covering many valleys not previously submerged. This could have given rise to the legend of a Flood, which may have occurred, but could not have been universal, for a sufficient amount of water does not exist to cover the highest mountains, and submerge the entire earth.

A sudden and eruptive convulsion of earth's crust during the tertiary, near the close of the cretaceous period, whether separate or conjointly with a flood, must necessarily have destroyed a large majority of partially developed men, struggling to evolve the higher human types. Portions of Asia, Africa, and Australia are supposed to have been elevated; while Europe, the extreme northern portions of America, the Caribbean Sea, and the beds of certain oceans were depressed. The effects must have been most forcible around the poles and south of the equator. Dead river beds which cross the highest mountain ranges of the Pacific Coast, and yield so largely of gold to hydraulic washing, clearly confirm radical changes in the physical conditions and levels of this coast.

The surviving remnants of these catastrophes, in Asia, Africa, Yucatan, and a few scattering tribes of North America, thenceforth appear as the progenitors of all living nations. It is only from this period that we can hope to trace the early history of humanity. Previous beings, if in harmony with physical conditions, must have been generally in the incipient stages of human evolution. In Central America alone, we find ruins, whose hoary antiquity seem to claim for its inhabitants the earliest civilization of which any traces remain. It is fair to infer that the pyramids of Yucatan were antediluvian and escaped inundation, as did the cities of Palenque and Copan. These elaborately constructed cities of Central America exhibit conceptions of beauty which, as early specimens of a gradually unfolding art, appear to antedate all similar structures extant.

Plausible grounds of inference exist, that the earliest manifestations of culture known to us, was among the primitive settlers of Central America, who, having acquired mechanical invention, art, and the rudiments of science.

built dwellings and temples, which yet endure as testimony of their progress. Although their minds were doubtless uncultivated in those higher branches of knowledge and refinement which ensures perpetuity to national life, they seem to have led the world in the early use of language, and the adoption of picture-writing to record and communicate ideas.

The sun, which was long the national emblem of Central American nations, is the absolute basis of mythology. It seems probable that Yucatan once extended over the present bed of the Gulf of Mexico, including the West Indian Islands. The Caribs may be a degenerate remnant of some aboriginal race. The ancestors of our North American Indians were very uncultivated in their physical, mental and social condition.

Long before Egypt, the progenitor of Greece and Europe, was settled, the inhabitants of Yucatan appear by their monuments to have been well advanced in general intellectual attainments, and to have led all known nations in art and science. Why may not a branch of this people have emigrated to China and Egypt, and there have become a large and advanced nation?

Many things unite to prove that China, at the opening of her treaty ports to European trade, was unmistakably retrograding in the physical as well as social organization of her people. Her highest prosperity is thought to have been reached about the reign of Genghis khan.

Agassiz tells us that, geologically considered, America is the oldest continent. If so, why should we not look to it, as the spot where the human race first gained ascendancy, and acquired its primeval home? If its primitive races have died out, and stone pyramids crumbled beneath the dust, is it not a strong argument in favor of her antiquity? In Asia, traces yet remain of original races, whose earlier civilization in America, under different physical conditions, *has had time* to culminate, dissolve, and *fade from sight*. When, in the early development of America, progress was sufficient to facilitate emigration, why may she not have furnished population to Asia? In submitting this question, with evidence calculated to warrant further study, and outlining various channels for investigation, we aim to attract for it that scientific attention which, as an ethnological problem, it fairly deserves, hoping some satisfactory answer may be attempted, before facilities for interrogation yet available among American aborigines, shall have passed away forever.

This imperfect collection of facts is laid before the Academy in its present condition, not in any way to ask for present endorsement, but to awaken new sources of inquiry among thoughtful ethnologists, which may ultimately lead to a discovery of the truth. A large mass of additional facts bearing upon this subject require more labor than I have yet found time to bestow, and would also unreasonably swell this already lengthy paper, which is offered as a simple inquiry, suggested to careful and technical scientists, who, by comparing physical, embryological, and linguistic characteristics, pertinent histories, and traditions, may in future establish or disprove the possibilities here shadowed forth.

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Catalogue of the Pacific Coast Fungi.

INTRODUCTION.

Previous to the year 1876 nothing had been accomplished in the study of the fungi of this Coast, with the exception of a few species collected by the Wilkes expedition, which were at that time referred to Professor Torrey for identification. But four or five of these were determined and of these but one or two can now be traced. Since that period, although the flowering plants have been most thoroughly studied, the fungi of this Coast have been entirely neglected.

Fully realizing the importance of the undertaking, not only for its scientific value, but also from an economic stand-point, we, four years since, determined to devote our leisure to making a collection of the Pacific Coast Fungi. To those who have given their time to scientific pursuits we need not say that this has been a work of ever-increasing interest. While we have not been able to visit every portion of our Coast, it will be observed that our explorations have extended over quite a wide range of territory—from Mt. Shasta on the north to Fort Yuma on the south—from the seashore to the eastern limits of the Sierras.

In reference to the geographical distribution of the fungi, it will be seen that most of our species found upon the low lands are common to both Europe and America, whilst of those growing along the Sierras, many are the same as the Alpine species of Europe; others are peculiar to our own Coast. Again, it will be seen, that the hot and arid desert at the south yields species common to Africa. The distribution we have aimed to make clear by giving in every instance the locality where found. We have, in the case of the Hymenomyces and other edible fungi, indicated the fact by appending an *E.* We have also added the habitat of our *parasitic fungi*, to aid the student, and have, as will be observed, indicated the *new species*.

We do not claim for this catalogue that it contains anything like a full list of the fungi of this Coast, or even of our own collection. It is merely a catalogue of such as we know to be found here, and such as we have fully determined. A large mass of material still remains in our hands for study and determination, as our leisure may allow. We give this list, the first of the kind ever published on this Coast, in the hope that it may be of service to others and incite them to a study of this most interesting department of botanical research. In the cave fungi, or fungi of our mines, comparatively little has been done. Want of a literature on this subject has been a great hindrance to us in this work. The single cave fungus placed in the addenda is so striking that we have deemed it worthy of an insertion. There are others which we are at work upon, and in due time hope to report.

We have followed in the first part of this catalogue the arrangement of the genera as given by Fries in his *Hymenomyces Europæi*. For the rest, we have adopted the order, as far as practicable, as given in Cooke's

Hand-book. Special mention should be made here of the valuable assistance rendered us in the determination of species, by Messrs. Cooke, Plowright, Phillips and Vize of England. To these gentlemen our hearty thanks are tendered. To the San Francisco Microscopical Society, for the use of its valuable library and plates, we owe much.

H. W. HARKNESS, M. D.
JUSTIN P. MOORE, A. M.

Family I. HYMENOMYCETES.

Order I. AGARACINI.

I. AGARICUS.

Series I. LEUCOSPORI.

I. AMANITA.

I. (AMANITA.)

- adnatus. Smith. San Raf.
- excelsus. Fr. San Raf.
- nitidus. Fr. San Raf.
- pantherinus. D. C. San Fran.
- phalloides. Fr. San Raf.
- strangulatus. Fr. San Raf.
- strobiliformis. Fr. rare. San Raf.
- vagitanus. Bull. San Raf.
- vernus. Bull. San Raf.
- virosus. Fr. San Raf.

II. LEPIOTA.

A. (LEPIOTA.)

- cristatus. Fr. San Raf.
- excoriatus. Schaeff. *E.* San Raf.
- illinatus. Fr. *E.* San Raf.
- procerus. Scop. *E.* San Fran.
- rachodes. Vtt. *E.* San Raf.

III. ARMILLARIA.

A. (ARMILLARIA.)

- constrictus. Fr. San Raf.
- melleus. Vahl. *E.* San Raf.

IV. TRICHOLOMA.

A. (TRICHOLOMA.)

- albus. Schaeff. San Raf.
- carneus. Bull. San Raf.

colossus. Fr. Nevada.
 columbeta. Fr. San Raf.
 compactus. Fr. San Raf.
 equestris. Linn. San Raf.
 gambosus. Fr. San Raf.
 imbricatus. Fr. San Raf.
 leucocephalus. Kromb. San Raf.
 panæolus. Fr. San Raf.
 personatus. Fr. San Raf.
 pessundatus. Fr. San Raf.
 portentosus. Fr. San Raf.
 resplendens. Fr. San Raf.
 sejunctus. Sowerb. Howards.
 sudus. Fr. San Raf.
 sulfureus. Bull. San Raf.
 terreus. Schaeff. San Raf.
 tigrinus. Fr. San Raf.

V. CLITOCYBE.

A. (CLITOCYBE.)

cyathiformis. Fr. Howards.
 dealbatus. Sowerb. *E.* San Raf.
 fragrans. Sowerb. common. San Raf.
 fumosus. Pers. San Raf.
 geotropus. Bull. *E.* San Raf.
 infundibuliformis. Schaeff. San Raf.
 laccatus. Scop. San Fran.
 maximus. Fr. San Raf.
 nebularis. Batsch. *E.* San Fran.
 odorus. Bull. *E.* San Raf.
 phyllophilus. Fr. San Raf.
 trulloformis. Fr. San Raf.
 tumulosus. Kalchbr. San Raf.

VI. COLLYBIA.

A. (COLLYBIA.)

butryaceus. Bull. San Raf.
 cirrhatus. Fr. San Raf.
 esculentus. Wulf. *E.* San Raf.
 exculptus. Fr. San Raf.
 fusipes. Bull. *E.* San Raf.
 longipes. Bull. *E.* San Raf.
 muscigenus. Schum. San Raf.
 ocellatus. Fr. San Raf.
 racemosus. Pers. San Raf.
 radicans. Rabh. *E.* San Raf.
 tuberosus. Bull. San Raf.
 velutipes. Curt. San Raf.

VII. MYCENA

A. (MYCENA.)

- acicula*. Schaeff. San Raf.
amicus. Fr. San Raf.
capillaris. Schum. San Fran.
citrinellus. Pers. San Raf.
corticola. Fr. San Raf.
debilis. Fr. San Raf.
dilatatus. Fr. San Raf.
echinipes. Lasch. Blue Cañon.
flopes. Bull. San Raf.
hiemalis. Fr. San Raf.
Iris. Berk. Sausalito.
juncicola. Fr. San Raf.
lacteus. Fr. San Raf.
purus. Pers. Howards.
pterigenus. Fr. San Raf.
rugosus. Fr. San Raf.
sanguineolentus. A. & S. San Fran.
stipularis. Fr. San Fran.
strobilinus. Fr. Howard.

VIII. OMPHALIA.

A. (OMPHALIA.)

- fibula*. Bull. San Raf.
gracillimus. Weinm. Howards.
integrellus. Pers. San Raf.
oniscus. Fr. E. San Raf.
pyxidatus. Bull. San Raf.
scyphoides. Fr. San Raf.

IX. PLEUROTUS

A. (PLEUROTUS.)

- applicatus*. Batsch. Sausalito.
circinatus. Fr. San Raf.
hypnophilus. Berk. San Raf.
limpidus. Fr. San Raf.
mutilus. Fr. San Raf.
ostreatus. Jacq. E. San Raf.
pometi. Fr. E. San Raf.
salignus. Abbild. San Raf.
serotinus. Schrad. Sausalito.
sestonoides. Cke. Blue Cañon.
striatulus. Sausalito.
ulmarius. Bull. E. San Raf.

Series II. HIPORRHODII.

X. VOLVARIA.

A. (VOLVARIA.)

- bombycinus. Schaeff. *E* San Raf.
 gloiocephalus. D. C. San Raf.
 speciosus. Fr. San Raf.

XI. ANNULARIA.

XII. PLUTEUS.

A. (PLUTEUS.)

- cervinus. Schaeff. San Raf.

XIII. ENTOLOMA.

A. (ENTOLOMA.)

- clypeatus. Huds. San Raf.
 madidus. Fr. San Raf.
 repandus. Bull. San Raf.
 sericellus. Fr. San Raf.

XIV. CLITOPILUS.

A. (CLITOPILUS.)

- orcella. Bull. *E*. San Raf.
 prunulus. Scop. *E*. San Raf.

XV. LEPTONIA.

A. (LEPTONIA.)

- chalybæus. Pers. San Raf.
 serrulatus. Pers. San Raf.

XVI. NOLANEA.

XVII. ECCILIA.

XVIII. CLAUDOPUS.

A. (CLAUDOPUS.)

- depluens. Batsch. San Fran.
 variabilis. Pers. San Raf.

Series III. DERMINI.

XIX. PHOLIOTA.

A. (PHOLIOTA.)

- marginatus. Batsch. Sausalito.
 mutabilis. Schaeff. *E*. rare. San Raf.
 radicosus. Bull. San Raf.
 squarrosus. Müll. *E*. San Fran.

XX. INOCYBE.**A. (INOCYBE.)**

- cæsariatus. Fr. San Raf.
 fastigiatus. Schæff. San Fran.
 rimosus. Bull. Sausalito.
 sambucinus. Fr. San Raf.

XXI. HEBELOMA.**A. (HEBELOMA.)**

- crustuliniformis. Bull. San Raf.
 glutinosus. Lindgr. San Raf.
 mesophæus. Fr. San Raf.
 sinapizans. Fr. San Raf.
 versipelles. Fr. San Raf.

XXII. FLAMMULA.**A. (FLAMMULA.)**

- lupinus. Fr. San Fran.
 sapinus. Fr. San Raf.

XXIII. NAUCORIA.**A. (NAUCORIA.)**

- erinaceus. Fr. San Raf.
 semiorbicularis. Bull. San Raf.
 triscopus. Fr. San Raf.

XXIV. PLUTEOLUS.**XXV. GALERA.****A. (GALERA.)**

- confertus. Bolt. San Raf.
 hypnorum. Batsch. San Raf.
 lateritius. Fr. San Raf.

XXVI. TUBARIA.**A. (TUBARIA.)**

- muscorum. Hoff. San Raf.

XXVII. CREPIDOTUS.**A. (CREPIDOTUS.)**

- mollis. Schæff. San Raf.
 rubi. Berk. San Raf.

Series IV. PRATELLI.

XXVIII. CHITONIA.

XXIX. PSALLIOTA.

A. (PSALLIOTA.)

- arvensis. Schæff. *E.* common. San Raf.
 campestris. Lin. *E.* San Raf.
 cretaceus. Fr. *E.* San Raf.
 elvensis. Berk. San Raf.
 pratensis. Schæff. *E.* common. San Raf.
 silvaticus. Schæff. *E.* San Raf.

XXX. STROPHARIA.

A. (STROPHARIA.)

- ærginosus. Curt. San Raf.
 caput medusæ. Fr. rare. San Raf.

XXXI. HYPHOLOMA.

A. (HYPHOLOMA.)

- appendiculatus. Bull. San Raf.
 capnoides. Fr. San Raf.
 coronatus. Fr. San Raf.
 dispersus. Fr. San Raf.
 epixanthus. Fr. San Raf.
 fascicularis. Fr. common. San Raf.
 lacrymabundus. Bull. San Raf.
 subaltheritius. Schæff. San Raf.
 velutinus. Pers. San Raf.

XXXII. PSILOCYBE.

A. (PSILOCYBE.)

- corneipes. Fr. rare. San Raf.
 ericæus. Pers. rare. San Raf.
 foeniseeii. Pers. rare. San Raf.
 spadiceus. Fr. San Raf.
 squalens. Fr. San Raf.

XXXIII. PSATHYRA.

A. (PSATHYRA.)

- corrugis. P. San Raf.
 noli-tangere. Fr. San Raf.

Series V. COPRINARIÆ.

XXXIV. PANÆOLUS.

A. (PANÆOLUS.)

- campanulatus. Linn. San Raf.
 fimiputris. Bull. San Raf.
 fimicola. Fr. San Raf.

XXXV. PSATHYRELLA.

A. (PSATHYRELLA.)

- subatratus. F. San Raf.

II. MONTAGNITES.

III. COPRINUS.

C.

- atramentarius. Fr. *E.* common. San Fran.
 comatus. Fr. *E.* common. San Fran.
 deliquescens. Fr. San Raf.
 fimitarius. Fr. San Fran.
 micaceus. Fr. San Fran.
 ovatus. Fr. San Raf.

IV. BOLBITUS.

B.

- conocephalus. Fr. San Raf.
 fragilis. Fr. San Raf.
 tener. Berk. San Raf.

V. CORTINARIUS.

Tribe I. PHLEGMACIUM.

C. (PHLEGMACIUM.)

- callochrous. Fr. San Raf.
 purpurascens. Fr. San Raf.
 seaurus. Fr. San Raf.

Tribe II. MYXACIUM.

C. (MYXACIUM.)

- collinatus. Fr. San Raf.

Tribe III. INOLOMA.

C. (INOLOMA.)

- violaceus. Fr. San Raf.

Tribe IV. DERMOCYBE.**C. (DERMOCYBE.)**

cinnamomeus. Fr. *E.* San Raf.

Tribe V. TELAMONIA.**Tribe VI. HYDROCYBE.****C. (HYDROCYBE.)**

sp. (?)

VI. GOMPHIDIUS.**G.**

gracilis. Berk. San Raf.

viscidus. Fr. San Raf.

VII. PAXILLUS.**P.**

giganteus. Fr. *E.* rare. San Raf.

involutus. Fr. San Raf.

nuda. Bull. San Raf.

VIII. HYGROPHORUS.**H.**

calyptræformis. B. & Br. rare. San Raf.

distans. Berk. rare. San Raf.

eburneus. Fr. *E.* San Raf.

pratensis. Fr. San Raf.

puniceus. Fr. common. San Raf.

IX. LACTARIUS.**L.**

chrysoorrhæus. Fr. San Raf.

controversus. Pers. San Raf.

deliciosus. Linn. *E.* common. San Raf.

insulus. Fr. *E.* San Raf.

mitissimus. Fr. San Raf.

piperatus. Fr. *E.* San Raf.

volemus. Fr. *E.* San Raf.

zonarius. Fr. San Raf.

X. RUSSULA.**R.**

adusta. Fr. *E.* San Raf.

alutacea. Fr. *E.* San Raf.

decolorans. Fr. San Raf.

delica. Fr. San Raf.

emetica. Fr. San Raf.

heterophylla. Fr. *E.* San Raf.
 lactea. Fr. San Raf.
 lepida. Fr. *E.* San Raf.
 lutea. Fr. San Raf.
 ochracea. Fr. San Raf.
 rubra. Fr. San Raf.
 sanguinea. Fr. San Raf.
 vesca. Fr. San Raf.

XI. CANTHARELLUS.

C.

aurantiacus. Fr. San Raf.
 cibarius. Fr. *E.* San Raf.
 crispus. Fr. San Raf.

XII. ARRHENIA.

XIII. NYCTALIS.

XIV. MARASMIUS.

M.

epiphyllus. Fr. San Raf.
 oreades. Fr. *E.* San Raf.

XV. LENTINUS.

XVI. PANUS.

P.

stipticus. Fr. San Raf.

XVII. XEROTUS

XVIII. TROGIA.

T.

crispa. Fr. San Raf

XIX. SCHIZOPHYLLUM.

S.

commune. Fr. San Raf.

XX. LENZITES.

L.

abietina. Fr. Howards.
 confragosa. Fr. Howards.
 flaccida. Fr. Howards.
 sepiaria. Fr. Howards.

XXIII. POLYPORUS.

P.

- abietinus. Fr.
 On cedar. Big Trees.
 adustus. Fr. San Raf.
 annosus. Fr.
 On logs. Big Trees.
 argillaceus. n. sp. Cke.
 On rotting oak. Colfax.
 brumalis. Fr. San Raf.
 carneus. Nees.
 On fir trees. Streetens.
 cervinus. Pers. San Raf.
 cinnabarinus. Fr. San Raf.
 confluens. Fr. San Raf.
 ferruginosus. Fr.
 On charred redwood. Streetens.
 fomentarius. Fr.
 On laurel. San Raf.
 hirsutus. Fr.
 On laurel. San Raf.
 hispidus. Fr. San Raf.
 hybridus. B. & Br. San Raf.
 igniarius. Fr.
 On laurel. San Raf.
 Kalakaua. n. sp. Moore.
 On a boat, sea side Sandwich Islands.
 labyrinthicus. Schw.
 On pinus contorta. Summit.
 obvolutus. n. sp. Cke.
 On fir logs. Blue Cañon.
 perennis. Fr.
 On oak. San Raf.
 quercinus. Fr.
 On oak. San Raf.
 sulphureus. Fr. E.
 On redwood. San Raf.
 varius. Fr.
 On oak. San Raf.
 velutinus. Fr.
 Oak branches. San Raf.
 versicolor. Fr.
 On oak. Colfax.
 violaceus. Fr.
 On oak. San Raf.
 vulgaris. Fr.
 On oak. San Raf.

XXIV. TRAMETIS.**T.**

cinabarinum.

On oak. San Raf.

Bulliardi. Fr. San Raf.

serpens. Fr. San Raf.

XXV. DAEDALEA.**D.**

quercina. Pers.

On oak. San Raf.

unicolor. Fr.

On wood. common. San Raf.

vorax. Harkness.

On libocedrus. Blue Cañon.

XXVI. HEXAGONA.**XXVII. FAVOLUS.****XXVIII. MERULIUS.****M.**

confluens. Schw.

On decaying spruce. Summit.

corium. Fr.

On oak bark. San Raf.

lacrymans. Fr.

Common. San Raf.

molluscus. Fr.

On redwood. San Raf.

rufus. Pers.

tremellosus. Schw.

On logs. Summit.

XXIX. POROTHELIUM.**XXX. SOLENIA.****S.**

candida. Pers.

On liber of fir. Streetens.

fasciculata. Pers.

On redwood. San Raf.

ochracea. Hoff.

On oak bark. San Fran.

Order III. HYDNEI.

XXXI. HYDNUM.

H.

- alutaceum. Fr. San Raf.
 caput ursi. Fr. San Raf.
 chlorinum. n. sp. Cke.
 On maple. Colfax.
 coralloides. Scop.
 E. common. San Raf.
 cyathiforme. Schaeff. San Raf.
 niveum. P.
 On deadwood. Big Trees.
 ochraceum. P. San Raf.
 ramaria. Fr.
 On oak. San Raf.
 repandum. L. *E.* San Raf.

XXXII. HERICIUM.

XXXIII. TREMELLODON.

T.

- gelatinosum. Pers.
 On redwood logs. San Raf.

XXXIV. SISTOTREMA.

XXXV. IRPEX.

I.

- Johnstonii. Berk.
 On various woods. San Raf.
 paradoxus.
 On alder. San Raf.

XXXVI. RADULUM.

R.

- molare. Fr.
 On dead laurel. San Raf.
 quercinum. Fr.
 On oak. San Raf.

XXXVII. PHLEBIA.

XXXVIII. GRANDINIA.

G.

- ocellata. Fr.
 On madroño. Streetens.
 " n. s. (?)
 On redwood. Streetens.

XXXIX. ODONTIA.**'XL. KNEIFFIA.****XLI. MUCRONELLA.**

Order IV. THELEPHOREI.

XLII. CRATERELLUS.**C.**

- cornucopioides. Pers.
On wood. Berkeley.

XLIII. THELEPHORA.**T.**

- arida. Fr.
On pine wood. common. Blue Cañon.
Harknessii. n. sp. Ph.
On ground among redwood. San Raf.
pallida. Pers.
On ground. Sierras.
Sowerbii. Berk.
On ground. Sierras.
terrestris. Ehrh.
On ground. Sierras.

XLIV. STEREUM.**S.**

- evolvens. Fr.
On prunus demissa. Blue Cañon.
hirsutum. Fr.
On dead logs. San Raf.
purpurellum. Fr.
On willow bark. Sac.
purpureum. Fr.
On elder. Streetens.
tabacinum. Mont.
On Baccharis. San Raf.

XLV. HYMENOCHÆTE.

- rubiginosa. Lev.
On stumps. Streetens.
tabacina. Lev.
On redwood. Streetens.
sp. (?)
On charred redwood. San Raf.

XLVI. CORTICIUM.**C.**

- caeruleum. Fr.
On redwood. San Raf.
- calceum. Fr.
On madroño. San Raf.
- carneum. n. sp. B. & Cke.
On pinus contorta. Summit.
- comedens. Fr.
On laurel. Blue Cañon.
- evolvens. Fr.
On cherry. Sac.
- incarnatum. Fr.
On cornus. Blue Cañon.
- laeve. Pers.
On laurel. San Raf.
- lactescens. B.
On willow. Sac.
- lacteum. Fr.
On redwood. Streetens.
- quercinum. P.
On oak. San Raf.
- salicinum. Fr.
On willow. Summit.
- sambuci. Fr.
On elder. Streetens.
- sanguineum. Fr.
On redwood. San Raf.
- scutellare. B. & C.
On adenostoma. Colfax.
- sulfureum. Fr.
Var. ochroideum. on elder. Sac.
- umbrinum. A. & S.
On charred redwood. Howards.

XLVII. CYPHELLA.**C.**

- capula. Fr.
On dead weeds. Berkeley.
- galatea. Fr.
On mosses. Fr.
- ochroleuca. B. & Br.
On bramble twigs. San Raf.
- villosa. Pers.
On dead weeds. Berkeley.

Order V. CLAVARIEI.

XLVIII. SPARASSIS.

XLIX. CLAVARIA.

C.

- abietina. Schum.
 On fir. San Raf.
 coralloides. Linn. San Raf.
 cristata. P.
E. on foliage Big Trees. Big Trees.
 fastigiata. Linn.
E. On ground. San Raf.
 flava. Schaeff.
E. on ground under oak. San Raf.
 inquanda. P. (?) San Raf.
 pistillaris. L.
 On ground. San Raf.
 ——— n. sp. (?)

L. CALOCERA.

LI. PTERULA.

LII. TYPHULA.

T.

- filiformis. Fr.
 On leaves. San Raf.

LIII. PISTILLARIA.

Order VI. TREMELLINI.

LIV. TREMELLA.

T.

- albida. Hud.
 On dead bark. Blue Cañon.
 lutescens. Fr. common. San Raf.
 mesenterica. Retz.
E. on redwood. San Raf.

LV. EXIDIA.

E.

- auricula Judæa. Fr.
 On wood. Sierras.
 glandulosa. Fr.
 On cherry. Sac.
 recisa. Fr.
 On pine twigs. Blue Cañon.
 saccharina. Fr. Summit.

Order X. MYXOMYCETES.

LYCOGALA.

- epidendrum. Fr.
On decaying wood. Sierras.

RETICULARIA.

- maxima. Fr.
On pine stumps. Sierras.
umbrina. Fr.
On oak stumps. Stockton.

ÆTHALIUM.

- septicum. Fr.
On boards of tan vats. San Fran.

DIDERMA.

- albescens. n. sp. Ph.
On pine and oak bark. Blue Cañon.
branneola. n. sp. Ph.
On oak bark. San Fran.
geasteroides. n. sp. Ph.
On dead bark. Colfax.
granulatum. Fr.
On decaying leaves. Sausalito.
lacineatum. n. sp. Ph.
On decaying wood. Cushings.
testaceum. Schw.
On decaying wood. Cushings.
vernicosum. P.
On decaying twigs. San Fran.

CHONDRIODERMA.

- geasteroides. Ph.
On rotten wood. Colfax.

DIDYMIUM.

- cinerium. Fr.
On dead ferns. San Fran.
clavus. A. & S.
On decaying bark. San Raf.
glaucum. n. sp. Ph.
On decaying wood. San Fran.
granuliferum. n. sp. Ph.
On decaying wood. Blue Cañon.
squamulosum. A & S.
On decaying foliage of redwoods. San Raf.

PHYSARUM.

- nutaus.* P.
On decaying wood. Cushings.

BADHAMIA.

- inaurata.* Curr.
On dead pine bark. Blue Cañon.

DIACHÆA.

- elegans.* Fr.
On living strawberry leaves. Sac.

COMATRICHA.

- Friesiana.* DeBary.
On rotten wood. Big Trees.
typhina. Roth.
On dead oak. Colfax.

STEMONITIS.

- arcyriodes.* Som.
On oak bark. Blue Cañon.
ferruginea. Ehr.
On dead laurel. San Raf.
fusca. Roth.
On cedar bark. Yosemite.
globosa. Schum.
On dead oak. Blue Cañon.
nigra. Fl. Dan.
On spruce chips. Blue Cañon.
obtusata. Fr.
On *pinus contorta.* Summit.
typhoides. D. C.
On decaying wood. Blue Cañon.

DICTYDIUM.

- cernuum.* Pers.
On dead pine. Yosemite.

ARCYRIA.

- nutaus.* Fr.
On dead oak. Sac.
punicea. Pers.
On dead laurel. Angel Is.
On pine. Yosemite.
umbrina. Schum.
On dead twigs. San Fran.
versicolor, n. s. p. Ph.
On bark *sequoia gigantea.* Big Trees.
vitellina, n. s. p. Ph.
On *pinus contorta.* Summit.

LVI. HIRNEOLA.**H.**

- auricula Judæa, Berk. Blue Cañon.
polytricha. Mont. Sandwich Is.

LVII. FEMSJONIA.**LVIII. NAEMATELIA.****N.**

- encephala. Fr.
On redwoods. Streetens.

LIX. GUEPINIA.**G.**

- helvelloides. Fr.
On ground. common. San Raf.
(?) cyphella. Fr.
On ground. rare. San Raf.
spathularia. Fr.
On ground. Sac.

LX. DACRYMYCES.**D.**

- chrysocomus. Tul.
On dead spruce. Blue Cañon.
deliquescens. Fr.
On pinus contorta. Summit.
stillatus. Nees.
On dead sequoia gigantea. Yosemite.
sp. (?)
On redwood. Streetens.

LXI. DITIOLA.**D.**

- radicata.
On dead pine branches. Blue Cañon.

Family II. GASTEROMYCETES.**Order VII. HYPOGÆI.****MELANOGASTER.**

- variegatus. Ful. E.
On or under the ground under oaks. San Raf.

Order VIII. PHALLOIDEI.**PHALLUS.**

- impudicus. Fr.
On ground. Oakland.

Order IX. TRICHOCASTRES.

BATARREA.

phalloides. P.

On sand hills south of San Fran. and at Phoenix, Arizona.

PODAXON.

carcinomale. Fr. Colorado desert.

loandensis. W. & C. Colorado desert.

GEASTER.

fimbriatus. Fr.

On ground. San Raf.

hygrometricus. P.

On ground. San Raf.

mammosus. Chw.

On ground. San Raf.

striatus. D. C.

On ground. San Raf.

BOVISTA.

ammophila. Lev.

On ground. San Raf.

nigrescens. P.

On ground. San Raf.

plumbea. P.

On ground. San Raf.

LYCOPERDON.

asperrimum. W. & C.

On ground. San Raf.

bicolor. W. & C.

On ground. San Raf.

cæspitosum. W. & C.

On ground. San Raf.

giganteum. Balsch.

E. on ground. San Raf.

gemmatum. Fr.

On ground. San Raf.

pyriforme. Schw.

On ground. San Raf.

radicata. W. & C.

On ground. San Raf.

SCLERODERMA.

verrucosum. Pers.

vulgare. Fr.

DINEMASPORIUM.

- graminum. Lev.
On wild outs. Berkeley.

ASTEROMA.

- Rosæ. D. C.
On living rose leaves. San Fran.

CYTISPORA.

- sp. (?)
On buckeye husks. San Raf.
fugax. Bull.
On willow bark. Santa Cruz.
leucosperma. Fr.
On twigs wild cherry. Streetens.
populina. Pers.
On poplar bark. San Raf.
salicis. Rabh.
On willow. Summit.
sp. (?)
On liber redwood. Streetens.

Order XIII. MELANCONEI.

PESTALOZZIA.

- planimi. n. s. p. Vize.
On leaves of Euonymus. San Raf.

NEMASPORA.

- crocea. Fr.
On dead oak bark. Streetens.

GLÆSPORIUM.

- carpigenum.
On buckeye. San Raf.

Order XIV. TORULACEI.

SPORIDESMIUM.

- induratum. n. s. p. Cke.
On dead manzanita leaves. Yosemite.
On dead roots sequoia. Big Trees.
lepraria. B. & Br.
On dead oak bark. San Fran.
velutinum. Cke.
On dead twigs. San Fran.

Order XV. PUCINIÆI.

PHRAGMIDIUM.

- bulbosum. Sch.
 On bramble leaves. San Raf.
 gracile. Grev.
 On Rubus Nutkanus. San. Raf.
 mucronatum. Link.
 On rose leaves. San Fran.

PUCINIA.

- amorphæ. B. & Curt.
 On amorpha Cala. Common. San Raf.
 anemones. Schw.
 On anemone. San Raf.
 angustata. Peck.
 On juncus. Sac.
 artemisiæ. Fekl.
 On artemisia. Sac.
 asparagi. D. C.
 On asparagus stems. Sac.
 Berberidis. Mont.
 On Berberis aquifolium. Fresno River.
 coronata. Cord.
 On oats. San Fran.
 gayophiti. *n. s. p.* Vize.
 On gayophitum. Blue Cañon.
 graminis. Pers.
 On wheat and sugarcane. San Fran. and S. Is.
 Harknessii. *n. s. p.* Vize.
 On zigodesmus spinosa. Mt. Rosa, Nev., 7,000 ft.
 helianthii. Schu.
 On helianthus. Sac.
 hieracii. Mart.
 On crepis glaucus. Alta.
 malvacearum. Mont.
 On malva. San Fran.
 menthæ. Pers.
 On menthæ. Sac.
 obtusa. Sch.
 On white sage. Tehachepi.
 oenothera. *n. s. p.* Vize.
 On oenothera densiflora. Colfax.
 polygonorum. Link.
 On polygonaceæ. Sac.
 prunorum. Link.
 On plum leaves. Sac.

TRICHIA.

- chrysoesperma. D. C.
 On balm of gilead, Sac.
 fallax. Pers.
 On decaying wood. Cushings.
 nigripes. Pers.
 On decaying wood. Cushings.
 turbinata. With.
 On decaying wood. Cushings.
 varia. P.
 On Pinus Lambertiana. Colfax.

Order XI. NIDULARIACEI.

CYATHUS.

- striatus. Wild.
 On ground. Sac.

CRUCIBULUM.

- vulgare. Tul.
 On dead pine. Yosemite.

NIDULARIA.

- campanula. With.
 On wood. Sierras.

SPHÆROBOLUS.

- stellatus. Tode.
 On decaying oak. Sauc.

Family III. CONIOMYCETES.

Order XII. SPHERONMEI.

LEPTOSTROMA.

- filicinum. Fr.
 On pteris aquilina. San Raf.

MACROPLODIA.

- arctostaphyli. n. sp. Vize.
 On manzanita.
 sambucina. n. sp. Cke.
 On sambucus niger. Sac.

PHOMA.

- sp. (?)
 On bramble stems. Sac.
 concentricum. Desm.
 On yucca. Sac.

- sequoia. n. sp. Pl.
On dead wood. Big Trees.
verbascola. Schw.
On dead mullein stalks. Sac.

ACTINOTHYRIUM.

- graminis. Kze.
On clover leaves. Sausalito.

CRYPTOSPORIUM.

- lupini. Cke.
On lupins. San Fran.

SHHÆROPSIS.

- mutica. B. & Br.
On elder. Sac.

DIPLODIA.

- aceris. Fekl.
On sycamore twigs. Sac.
salicis. Mst.
On willows. Sac.

HENDERSONIA.

- sp. (?)
On salicornia herbacea. common. San Raf.

VERMICULARIA.

- dematium. Fr.
polygوني. Schw.
On polygonum and pie plant. Sac.

MELASMA.

- arbuticola. n. sp. Vize.
On leaves of madroño. San Raf.

SEPTORIA.

- xanthii. Des.
On xanthium strumarium. Sac.
sp. (?)
On leaves Darlingtonia Californica. Sac.

EXCIPULA.

- hispidula. Sch.
On dead grass. Sac.
strigosa. Fr.
On dead elder branches. Streetens.

Order XVII. *ÆCIDIACEI*.**LYCETHEA.**

- populina. Lev.
On populus moniloides. Sac.

RÆSTELIA.

- cancellata. Ret.
On pear leaves. San Raf.

PERIDERMIMUM

- Harknessi. n. sp. Moore.
On pinus ponderosa. Colfax.
pini. Fr.
On pinus insignis. San Fran.

ÆCIDIUM.

- Berberidis. Pers.
On grass. Sac.
gayophyti. n. sp. Vize.
On gayophitum ramosissimum. Blue Cañon.

Family IV. *HYPHOMYCETES*.Order XVIII. *ISARIACEI*.**CERATIUM.**

- hidneoides. A. & S.
On rotten oak. Streetens.

Order XIX. *STILBACEI*.**OZONIUM.**

- aureconium. Lk.
On rotten pine. Colfax.
On dead fir branches. Blue Cañon.

STILBUM.

- fimetarium. B. & Br.
On ground. Sac.
pellucidum. Schr.
On decaying polyporus. Sac.

VOLUTELLA.

- setosa. B.
On twigs. San Fran.

TUBERCULARIA.

- nigricans. Lk.
On dead fir bark. Big Trees.
- vulgaris. Tode.
On locust. Sac.

FUSARIUM.

- personatum. n. sp. Cke.
On dead laurel leaves. San Raf.

Order XX. DEMATIEI.

HELMINTHOSPORIUM.

- delicatulum. B. & Br.
On umbelliferae. Sac.
- macrocarpum. Grev.
On dead twigs. Sac.
- nanum. Nees.
On dead herbs. Sac.
- rhabdiferum. B. & Br.
On ripe peaches. Sac.
- turbinatum. B. & Br.
On dead wood. Blue Cañon.
- velutinum. Lk.
On dead twigs. San Raf.

CERCOSPORA.

- inquinans. n. sp. Cke.
On gymnocarpus. San Raf.

RAMULARIA.

- obovata. Fekl.
On leaves rumex. Sac.

MACROSPORIUM.

- brassicæ. B.
On decaying cabbage leaves. Sac.

POLYTHRINCIUM.

- trifolii. Kze.
On dead clover leaves. Sac.

CLADOSPORIUM.

- delicatulum. Cke.
On dead leaves. San Fran.
- dendriticum. Wall.
On pear leaves. Sac.

- saniculæ. Grev.
 On *sanicula Menziesii*. San Raf.
 splendens. *n. s. p.* Vize.
 On *tessaria*. Colorado Desert.
 striata. *n. s. p.* Cke.
 vaginalium. Lk.
 On *polygonum*.
 Xanthii. Schw.
 On *Xanthium strumarium*. Sac.

GYMNOSPORANGIUM.

- biseptatum. Ellis.
 On living branches of *zibrocetrus*. Yosemite.

Order XVI. CÆOMACEI.

SYNCHITRIUM.

- fulgens. Schoeter.
 On *cœnothera biennis*. San Raf.
 papillatus. Far.
 On *alfilaria*. San Raf.

USTILAGO.

- carbo. Tul.
 On *oats*. San Fran.
 bromivora. F. de W.
 On *grass*. St. Helena.
 Maydis. Tul.
 On *corn*. Los Angeles.
 utriculosa. Ful.
 On *polygonum aviculare*. Sac.

UROCYSTIS.

- occulta. Preuss.
 On *grass*. Sac.

UROMYCES.

- apiculatus. Lev.
 On *clover*. San Raf.
 appendiculata. Lev.
 On *vicia*. Lake Co.
 Betæ. Kuhn.
 On *beet leaves*. San Fran.
 Ficariæ. Lev.
 On *ranunculus Cal.* San Raf.
 Howei. Pk.
 On *asclepias*. Lake Co.
 intricata. *n. sp.* Cke.
 On *gayophytum*. Blue Cañon.

- junci. Tul.
 On juncus. Sac.
 " var. Scirpi.
 On scirpus. San Raf.
 limonii. Lev.
 On statice limonium. San Raf.
 lupini. Sac.
 On lupins. San Fran.
 oblonga. n. sp. Vize.
 On burr clover. Sac.
 prunorum. Lk.
 On peach leaves. Sac.
 " var. Amygdali.
 On peach leaves. Sac.

COLEOSPORIUM.

- Madiae. n. sp. Ck.
 On madia. San Raf.
 miniatum. Lev.
 On wild rose. Yosemite.

MELAMPSORA.

- populini. Lev.
 On poplar leaves. San Raf.
 salicina. Lev.
 On willow leaves. Sac.

CYSTOPUS.

- candidus. Lev.
 On cabbage leaves. Sac.

UREDO.

- convolvuli. Str.
 On convolvulus. Sac.
 lupini. B. & C.
 On lupins. Sac.
 quercus. Brond.
 On oak leaves. Sierras.
 scirpina. West.
 On scirpus. Sac,

TRICHOBASIS.

- epilobii. D. C.
 On epilobium. San Fran.
 helianthi. Schw.
 On helianthus. Sac.
 polygonorum. Lev.
 On polygonum. Sac.
 rubigo vera. Lev.
 On wheat. San Fran.

- fœni. B. & Br.
On decaying grass. Sac.
roseolum. Stph.
On rotting potatoes. Sac.

Division II. SPORIDIFERA.

Family V. PHYSOMYCETES.

Order XXIII. ANTENNARIEI.

ANTENNARIA.

- Guavæ. n. sp. Cke.
On leaves of guava. Sandwich Islands.

Order XXIV. MUCORINI.

MUCOR.

- amethysteus. Bon.
On rotting pears. Sac.
caninus. Pers.
On dog's dung. Sac.
clavatus. Lk.
On fruit. Sac.
fusiger. Lk.
On decaying fungi. Sac.
mucedo. Linn.
On preserves. Sac.
phycomyces. B.
On oil, etc. Sac.
ramosus. Bull.
On fungi. Sac.
stolonifer. Ehrb.
On melons. Sac.
subtillissimus. B.
On onions. Sac.
tenerrimus. B.
On twigs. Sac.

TRICHODERMA.

- viride. Pers.
On dead bark. Sansalito.

PILOBOLUS.

- crystallinus. Tode.
On cow dung. Sac.
roridus. Schum. On cow dung. Sac.

RHYPARORIBUS.

dubius. Boud.

Cookei.

On dog's dung.

Woolhopenses. Renny.

On bird's dung. San Raf.

ACROSTALAGMUS.

cinnabarinus. Cord.

On dead weeds. Sausalito.

ENDOGENE.

pisiformis. Lk.

On oak bark. San Fran.

Order XXV. SAPROLEGNIEI.

SAPROLEGNIA.

ferax. Gr.

On living salmon and dead flies. common.

Family VI. ASCOMYCETES.

Order XXVI. ONYGENEI.

ONYGENA.

equina. Pers.

On dead horse's hoof. Sac.

Order XXVII. PERISPORIACEI.

SPHAEROTHECA.

castagnei. Lev.

On hop leaves. Sac.

pannosa. Lev.

On rose leaves. Sac.

PHYLLACTINIA.

guttata. Lev.

On oak leaves. Alta.

UNCINULA.

adunca. Lev.

On willow. Sac.

bicornis. Lev.

On maple leaves. San Raf.

PODOSPHERIA.

Kunzei. Lev.

On plum leaves. Sac.

- epiphyllum. Cord.
 On poplar leaves. San Raf.
 fumago. Lk.
 On laurel leaves. San Raf,
 herbarum. Lk.
 On typha latifolia. Sac.

Order XXI. MUCEDINES.

ASPERGILLUS.

- candidus. Lk.
 On decaying substances. Common.
 dubius. Cord.
 On rabbit dung. Sac.
 glaucus. Lk.
 On decaying leaves pinus contorta. Summit.
 mollis. B.
 On dead leaves. Blue Cañon.
 virens. Lk.
 On decaying agarics. San Raf.

PERONOSPORA.

- effusa. Grev.
 On spinach. San Fran.
 ficariæ. Tul.
 On ranunculus repens. San Raf.
 gangliformis. B.
 On lettuce leaves. Sac.
 grisea. Ung.
 On veronica. San Raf.
 infestans. Mont.
 On potato leaves. Coast.
 nivea. Ung.
 On umbelliferae. San Raf.
 obliqua. Ck.
 On dock leaves. Sac.
 parasitica. Pers.
 On cruciferae. Sac.
 potentillæ. Sch.
 On potentilla. Sac.
 pygmæ. Ung.
 On anemone leaves. San Raf.
 sordidæ. B.
 On scrophularia Californica. San Raf.
 sparsa. B.
 On rosa Californica. San Raf.
 trifoliorum. De B.
 On clover. San Fran.

- urticæ. Casp.
 On nettle. San Raf.
 vicæ. B.
 On pear leaves. San Raf.

PENICILLIUM.

- bicolor. Fr.
 On decaying substances. Sac.
 chartarum. Cke.
 On damp wall paper. Sac.
 crustaceum. Fr.
 On decaying substances. Sac.

OIDIUM.

- aureum. Lk.
 On rotten wood. Sierras.
 fasciculatum. Berk.
 On decaying oranges. Sac.
 favorum. B. & Br.
 On honeycomb. Sac.
 fructigenum. Schrad.
 On apples and pears. San Fran.
 Tuckeri. Berk.
 On wild and cultivated grape leaves. Common.

REISSIA.

- semiophora. Fresen.
 On pine. Yosemite.

MYXOTRICHUM.

- ochraceum. B. & Br.
 On liber of redwood. Streetens.

BOTRYOSPORIUM.

- diffusum. Cord.
 On dead twigs. San Raf.

Order XXII. SEPEDONIEI.

SEPEDONIUM.

- chrysopermium. Lk.
 On decaying fungi. San Raf.
 roseum. Fr.
 On decaying fungi. San Raf.

FUSISPORIUM.

- atrovirens. B.
 On onions. Sac.

MICROSPHÆRIA.

- comata. Lev.
 On euonymus. San Raf.
 fulvo-fulera. n. sp. Cke.
 On spiræa dumosa. San Raf.
 Grossulariæ. Lev.
 On wild gooseberry. Sierras.
 pencillata. Lev.
 On alder leaves. San Raf.

ERYSIPHE.

- communis. Schl.
 On leguminosæ. Sac.
 graminis. D. C.
 On grass. Sac.
 lamprocarpa. Lev.
 On plantain. Sac.
 Martii. Lke.
 On peas, beans, etc. common.
 montagnei. Lev.
 On sesbania. Fort Yuma

CHÆTOMIUM.

- elatum. Kze.
 On dead ash wood. Sac.
 glabrum. B.
 On damp straw. Sac.

EUROTIUM.

- herbarorium. Lke.
 On dead bark. San Fran

CAPNODIUM.

- citri. B. & Desm.
 On orange leaves. Los Angeles.
 elongatum. B. & Desm.
 On pear twigs. Sac.
 salicini. H.
 On willow leaves. Sac.

Order XXVIII. ELVELLACEI.

MORCHELLA.

- esculenta. Pers.
 E. under oaks. Streetens.
 conica.
 E. On charred redwood. Streetens.

GYROMITRA.

- esculenta. Fr.
E. under oaks. San Raf.

HELVELLA.

- Californica. n. sp. Ph.
E. on ground. Blue Cañon.
 crispa. Fr.
E. under oaks. San Raf.
 lacunosa. Afz.
 On hillsides.

VERPA.

- digitaliformis. Pers.
 Among redwood leaves. rare. Streetens.

SPATHULARIA.

- flavida. Var. Californica. n. var. Moore.
 On redwood. San Raf.

VIBRISSEA.

- truncorum. Fr.
 On sticks in water. Sierras.

PEZIZA.

- acutipila. Kast.
 On Rubus Nutkanus. San Raf.
 acnum. Fr.
 On fir leaves. Streetens.
 Agassizii. var. rufipes. n. var. Ph.
 On pinus contorta. Blue Cañon.
 alutipes. n. sp. Ph.
 On dead cedar leaves. Blue Cañon.
 arida. n. sp. Ph.
 On pine bark. Blue Cañon.
 aurantia. Fr.
 On ground. Sausalito.
 badia. P.
 On spruce boards. Truckee.
 bicolor. Bull.
 On Rubus Nutkanus. Blue Cañon.
 bufonia. Pers.
 On cow dung in dense woods. Streetens.
 bulgarioides. Rab.
 On dead cones sequoia. Big Trees.
 carbonaria. A. & S.
 On dead leaves sequoia. Big trees.
 caucens. Reben.
 On decaying cedar leaves. Alta.
 " var. fusco-purpurea. n. var. Ph.

- cinerea.* Batsch.
 On decaying twigs. Colfax and Streetens.
- citrina.* Hedw.
 On rotten wood. Streetens.
- clandestina.* Bull.
 On oak. Summit.
- coprinaria.* Cke.
 On cow dung. Truckee.
- corticalis.* P.
 On twigs. San Fran.
- crenulata.* B. & Br.
 On ground. Streetens.
- cupressina.* Batsch.
 On dead leaves redwood. Streetens.
- cyathoidea.* Bull.
 On *aralia racemosa*. Blue Cañon.
- elaphines.* B. & Br.
 On decaying wood. Angel Island.
- epixantha.* n. sp. Cke.
 On oak. Summit.
- escharoides.* B. & Br.
 On sticks. Blue Cañon.
- fulgens.* P.
 On ground. Yosemite.
- fusca.* P.
 On dead redwood. San Raf.
- gemmea.* n. sp. Ph.
 On dead redwood leaves. Streetens.
- granulata.* Bull.
 On rotting straw. Streetens.
- hinnulea.* B. & Br.
 On decaying wood. Colfax.
- hyalina.* P.
 On boards. Sac.
- leiocarpa.* Curr.
 On charred wood and earth. Streetens.
- leporina.* Batsch.
 On ground. Sausalito.
- leucostigma.* Fr.
 On oak. Colfax.
- macrocystis.* Cke.
 On charred wood. Streetens.
- maculosa.* n. sp. Ph.
 On cow dung. Colfax.
- molesta.* n. sp. Ph.
 On redwood chips. Streetens.
- nigrescens.* Ck.
 On willow bark. Summit.

- nivea. Fr.
On oak chips. Blue Cañon.
- obscura. n. sp. Ck.
On oak. Summit.
- omphalodes. Bull.
On ground. Oakland.
- phymatodes. n. sp. Ph.
On dead weeds. Blue Cañon.
- pithya. P.
On redwood bark. Streetens.
- relicina. Fr.
On aralia stems. Colfax.
- rosæ. P.
On dead twigs. San Fran.
- rutilans. Fr.
On damp wall. San Fran.
- sanguinea. P.
On dead oak. Yosemite.
- scabro-villosa. n. sp. Ph.
On Rubus Nutkanus. Blue Cañon.
- scubalonta. Oke.
On cow dung. San Raf.
- scutellata. L.
On damp ground. Streetens.
- secretæ. n. sp. Ph.
On ground—wood^s. Blue Cañon.
- sequoia. n. sp. Ph.
(Hymenosecyphæ.)
On dead leaves sequoia. Big Trees.
- sequoia. n. sp. Ph.
(Sarco-scyphæ.)
On dead leaves sequoia. Big Trees.
- setigera. n. sp. Ph.
On dead stem Saxifraga peltata. Blue Cañon.
- stercorea. P.
On cow dung. Colfax.
- strobiliina. Fr.
On pine cones. Blue Cañon.
- subhirsuta. Schw.
On cinder heaps. San Fran.
- subtillissima. C.
On decaying spruce. Summit.
- sub-urceolata. n. sp. Ph.
On ground under sequoia. Big Trees.
- succina. n. sp. Ph.
On dead oak. Blue Cañon.
- sulphurea. P.
On dead weeds. Berkeley.

- thelebeloides*. A. & S.
 On cow dung. Sac.[?]
uncinata. n. sp. Ph.
 On oak twigs. Blue Cañon.
ustorum.
 On redwood. Streetens.
venosa. Pers.
 On ground. Blue Cañon.
vesiculosa. Bull.
 On dunghill. San Fran.
villosa. Pers.
 On dead weeds. Berkeley.
vinosa. A. & S.
 On ground. Sierras.
virginea. Batsch.
 On dead leaves. San Fran.

HELOTIUM.

- ærginosum*. Fr.
 On dead birch. Sierras.
agaricinum. Berk.
 On decaying wood. Yosemite.
aureum. Pers.
 On dead laurel. Colfax.
citrinum. Fr.
 On dead oak. Yosemite.
claro-flavum. B.
 On oak bark. San Fran.
epiphyllum. Fr.
 On dead leaves. Yosemite.
fagineum. Fr.
 On decaying twigs. Blue Cañon.
fibuliforme. Fr.
 On elm branches. Sac.
herbarum. Fr.
 On dead stems. Blue Cañon.
lutescens. Fr.
 On dead twigs. Blue Cañon.
pallescens. Fr.
 On a dead laurel. San Raf.
salicellum. Fr.
 On willow. Summit.
serotinum. Fr.
 On sticks. Sunimit.
subtile. Fr.
 On fir foliage, dead. Summit.
virgultorum. Fr.
 On dead wood. San Fran.

PATELLARIA.

- abietina. n. sp. Cke.
On fir. San Raf.
olivacea. Batsch.
On rotten willow. Summit.
rhabarbarina. B.
On dead bramble. Blue Canon.

TYMPANIS.

- alnea. P.
On alder twigs. Summit.
conspersa. Fr.
On raspberry twigs. Sac.

DERMATEA.

- flavo-cinerea. n. sp. Ph.
On Cornus. Blue Cañon.

CENANGIUM.

- leptospermum. B. & C.
On fir. San Raf.
prunastri. Fr.
On wild cherry. Yosemite.
Ribis. Fr.
On currant twigs. Sac.
Rubi. Fr.
On raspberry twigs. Alta.
sequoia. n. sp. Pl.
On bark sequoia. Big Trees.

ASCOBOLUS.

- aerugineus. Fr.
On horse dung. Sac.
atro-fuscus. n. sp. Ph. & Pl.
On dung. Sac.
carneus. Pers.
On decaying pine wood. Colfax.
ciliatus. Boud.
On horse dung. Yosemite.
furfuraceus. Pers.
On cow dung. Warm Springs.
Kerverni. Crouan.
On cow dung. Sac.
immersus. Pers.
On cow dung. Sac.
incanus. n. sp. Ph.
On cow dung. Colfax.

- papillatus*. Boud.
On cow dung. Colfax.
patellatus. Wall.
On cow dung. Sac.
pilosus. Boud.
On dog dung. Sac.
rari-pilus. n. sp. Ph.
On cow dung. San Raf.

BULGARIA.

- inquinans*. Fr.
On oak. San Raf.
sarcoides. Fr.
On bark. Sauc.

STICTUS.

- Berkleyana*. De B. & Lev.
On rotten wood. Cushings.
calcera. n. sp. Ph.
On dead willow. Tehachepi.
radiata. Fr.
On oak twigs. Streetens.
versicolor. Ph.
On liber redwood. San Raf.

ASCOMYCES.

- deformans*. Berk.
On peach leaves. Sac.

Order XXIX. PHACIDIACEI.

PHACIDIUM.

- internum*. n. sp. Ph.
On libocedrus. Yosemite.
pini. Schm.
On pine bark. Blue Cañon.
ranunculi. Desm.
On ranunculus. San Raf.
Rubi. Fr.
On *Rubus Nutkanus*. San Raf.
trifolii. Boud.
Clover leaves. Sac.

RHYTISMA.

- acerinum*. Fr.
On maple leaves. San Raf.
arbuti. n. sp. Ph.
On madroño. San Raf.

- punctatum*. Fr.
On sycamore. Sac.
- salicinum*. Fr.
On willow leaves. Sac.
On balm of gilead. Yosemite.

HYSTERIUM.

- acerinum*. Frost.
On maple. San Raf.
- angustatum*. A. & S.
On redwood. Streetens.
- arundinaceum*. Schrad.
On grass. Blue Cañon.
- commune*. Fr.
On dead stems. Summit.
- foliicolum*. Fr.
On oak leaves. Summit.
- formosum*. n. sp. Ck.
On juniper bark. Summit.
- pinastri*. Schrad.
On pine leaves. Summit.
- virgultorum*. D. C.
On bramble stems. San Raf.

LABRELLA.

- pomi*. M.
On apples in damp grass. Sac.

Order XXX. SPHÆRIACEI.

TORRUBIA.

- militaris*. Fr.
On pupa of caterpillar. Sausalito.

CLAVICIPS.

- purpurea*. Tul.
On grass seeds. Sac.

HYPOCREA.

- lenta*. Fr.
On fir boards. Sac.
- rufa*. Fr.
On redwoods. San Raf.

HYPOMYCES.

- aurantius*. Tul.
On dead fungi. Sausalito.
- luteo-virens*. Fr.
On dead fungi. Sausalito.

- rosellus. Tul.
On dead fungi. San Raf.
ochraceus. Tul.
On dead fungi. San Raf.

NECTRIA.

- coccinea. Fr.
On bark lupins. San Fran.
cinnabarina. Fr.
On bark. San Fran.
cucurbitula. Fr.
On bark. Cushings.
episphæria. Fr.
On bark. San Fran.
ochraceo-pallida. R. & Br.
On elder twigs. Streetens.
peziza. Fr.
On lupins. San Fran.
umbrina. Fr.
On decaying bean stalks. Sac.

XYLARIA.

- hypoxyton. Grev.
On roots. Sausalito.

USTULINA.

- vulgaris. Tul.
On dead trees. Sausalito.

HYPOXYLON.

- coccineum. Bull.
On bark. San Fran.
cohærens. Fr.
On twigs. Sausalito.
concentricum. Grev.
On dead ash. Clear Lake.
fuscum. Fr.
On oak. San Raf.
malleolus. B. & Rav.
On oak. Sausalito.
rubiginosum. Fr.
On laurel logs. San Raf.
rufa. Fr.
On wild cherry. Yosemite.
stigmatum. n. sp. Cke.
On dead bark. Tehachapi.
serpens. Fr.
On dead laurel. San Raf.

NUMMULARIA.

- Bulliardi. Tul.
On live oak. Yosemite.

DIATRYPELLA.

- tocciana. De Not.
On bark dead alder. Streetens.

DOTHIDEA.

- graminis. Fr.
On grass. Sac.
junci. Fr.
On juncus. Sac.
potentillæ. Fr.
On potentilla glandulosa. San Raf.
ribesia. Pers.
On currant twigs. Sac.
Rosæ. Fr.
On rose. Sac.

DIATRYPE.

- aspera. Fr.
On oak. Streetens.
bullata. Fr.
On willow. Streetens.
disciformis. Fr.
On buckeye. San Raf.
hystrix. Fr.
On sycamore. Sac.
incarcerata. B. & Br.
On rose. Sac.
strumella. Fr.
On currant. Sac.

MELANCONIS.

- longipes. Tul.
On oak branches. San Fran.

VALSA.

- coronata. Fr.
On oak. Sausalito.
salicina. Fr.
On willow. Santa Cruz.
sordida. Fr.
On poplar bark. Sac.
vitis. Schw.
On grape cuttings. San Raf.

DIAPORTHE.

- arctii. Nke.
On heracleum. Streetens.

CUCURBITARIA.

- confluens. n. sp. Plow.
On oak bark. Colfax.
macilenta. Cke.
On cedar. Blue Cañon.

SORDARIA.

- bombardiodes. Awd.
On colt's dung. Mt. Shasta.
Californica. n. sp. Plow.
On cow dung. San Raf.
coprophila. De Not.
On cow dung. Sac.
fimicola. Rab.
On horse dung. Sac.

BYSSOPHÆRIA.

- aquila. Fr.
On rotten wood. San Francisco.

PSILOSPHÆRIA.

- moriformis. Tode.
On hazel. Howards.
myriocarpa. F.
On elder. Tehachapi.
pulveracea. Ehr.
On oak. Yosemite.

LASIOSPHÆRIA.

- canescens. Pers.
On redwood. Streetens.

SPHÆRIA.

- Arctostaphylos, n. s. Pl.
On dead manzanita. Yosemite.
bombardioides. Awd.
On cow dung. Colfax.
commanipula. B. & Br.
On Aralia Cala. Colfax.
confertissima. n. sp. Plow.
On redwood cones. Streetens.
conflicta. n. sp. Cke.
On oak leaves. Streetens.
Herbarum. Pers.
On soap plant. St. Helena.

- megalocarpa*. n. sp. Plow.
 On maple. Colfax.
morbosa. Schw.
 On living wild cherry. Yosemite.
palmacea. n. sp. Cke.
 On palms. Los Angeles.
permunda. n. sp. Cke.
 On Soap plant. Blue Cañon.
picea. Pers.
 On *Chenopodium alba*. Sacramento.
pulvis-pyrinus. pers.
 On *pinus contorta*. Blue Cañon.
rostellata. Fr.
 On *Ribes ursinus*.
rubella. Pers.
 On *heracleum*. San Fran.
salicella. Fr.
 On willows. Summit.
sambuci. n. sp. Pl.
 On elder. Streetens.
sequoiæ. n. sp. Pl.
 On sequoia. Big Trees.
spiculosa. Pers.
 On ash bark. Streetens.
sub-moriformis. n. sp. Pl.
 On bark. San Raf.
sustenta. n. sp. Pl.
 On manzanita. Blue Cañon.
tumnlata. n. sp. Cke.
 On *pinus contorta*. Summit.
Vizeana. Cke.
 On *lathyrus venosa*. Sac.
Yucca. Sch.
 On *yucca communis*. Sac.
Yuccaegena. n. sp. Cke.
 On *yucca angustifolia*. Mohave.

GNOMONIA.

- alni*. n. sp.
 On alder. San Raf.

SPHÆRELLA.

- brassicola*. De Not.
 On cabbage leaves. Sac.
conglomerata. Wall.
 On alder leaves. Howards.

- erysipheua. B.
 On hop leaves. Sac.
 latebrosa. Cke.
 On fallen sycamore leaves. Sac.
 salicicola. W.
 On willow leaves. Summit.
 simulans. Cke.
 On oak leaves. San Raf.
 sparsa. Awd.
 On chestnut leaves. Sac.

VENTURIA.

- sequoiæ. n. sp. Pl.
 On decaying leaves, sequoia. Big Trees.

STIGMATEA.

- chætonium. Fr.
 On raspberry leaves.
 Geranii. Fr.
 On leaves of geranium.
 polygonorum. Fr.
 On living leaves of Polygonum. San Raf.
 potentillæ. Fr.
 On living leaves of Potentilla. Sac.
 ranunculi. Fr.
 On Rannuculus Cala. San Raf.

OZHOMA. (Sp?)

- On pine wood. Blue Cañon.

ADDENDA.

STEPTOTHRIX.

atra. B. & C.

On grape cuttings. San Raf.

AGARICUS. (Sub. Gen?)

tridens. n. sp. Moore.

CAVE FUNGUS.

Pileus fleshy, conchiform; skin very thick, coriaceous; color light buff. Edge entire, involute. The stem is *three feet and four inches long*, and is attached to the timber on which it grows, and from which it hangs suspended by a disk several inches in diameter. This disk is clothed with a thick, soft brown felt, which extends down and covers the stem for several inches.

At nine inches from the point of attachment the stem divides into three branches, which again unite, singularly enough, at just nine inches from the point of division, and immediately send off two lateral branches.

The main stem continues downward, enlarging to the diameter of nearly three inches. It is no longer covered with the felty mass, but is smooth and hard to the point at which the shell-shaped pileus is thrown off. Here a most singular growth has taken place. From all sides short branches, resembling the young antlers of a stag, are pushed out. Two of these becoming more vigorous than the rest have extended downward, the larger of the two dividing into three branches, thus *terminating the whole in a perfect trident*.

The gills, which are distinct, notched, sinuate, and of a pale straw color, run for some distance up the stem. The spores are ovate, exceedingly minute and borne on true basidia.

The plant was found attached to a timber in one of the abandoned drifts of the Yellow Jacket Mine, Virginia City, Nevada, at the depth of 400 feet below the surface. J. P. M.

XXI. BOLETUS.

B.

luteus. Lin. *E.* rare. San Raf.

flavidus. Bull. San Raf.

piperatus. Bull. San Raf.

variegatus. Swartz. Howards.

subtomentosus. Linn. *E.* San Raf.

edulis. Bull. *E.* San Raf.

impolitus. Fr. San Raf.

aestivalis. Fr. San Raf.

Satanas. Lenz. San Raf.

luridus. Schæff. San Raf.

erythropus. Pers. San Raf.

versipelles. Fr. *E.* San Raf.

scaber Fr. *E.* San Raf.

granulatus. L. *E.* San Raf.

bovinus. L. *E.* San Raf.

castaneus. Bull. San Raf.

XXII. FISTULINA.

PROCEEDINGS

OF THE

CALIFORNIA ACADEMY OF SCIENCES

AT A

Reception Given to the Captain and Officers

OF THE

*U. S. Steamer Thorsen and Captains of the Pacific
Whaling Fleet on their return from the Arctic.*

THEIR VIEWS, AND UNANIMOUS EXPRESSION OF BELIEF IN THE JEANNETTE'S SAFETY.
SPECULATIONS CONCERNING THE WHEREABOUTS OF THE MISSING WHALERS
VIGILANT AND MOUNT WOLLASTON.

INCLUDING

A PAPER READ BEFORE THE ACADEMY DECEMBER 6, 1880,

BY

CHARLES WOLCOTT BROOKS,

Member of the California Academy of Sciences.

SAN FRANCISCO, CALIFORNIA, U. S. A.
Re-printed from the report in DAILY ALTA CALIFORNIA,
1880.

MAP OF BERING STRAIT ENTRANCE TO THE ARCTIC OCEAN

[Showing exploring ground of the Jeannette Expedition.]

This cut is from the San Francisco *Bulletin* of December 8th 1880.



EXPLANATORY NOTES.

- Arrows indicate course of known currents.
- Horizontal shaded lines show condition of the ice in the summer of 1879.
- C—Narrow passage east of Herald Island, most northerly point reached by Revenue Cutter Thomas Corwin.
- J—Cape Serdze, point where Lieutenant De Long left the letter received via Russian Government.
- Jl—Near Herald Island, points where the Jeannette was last seen.
- W—Point where whaling barks Mount Wollaston and Vigilant were last seen.

PROCEEDINGS

OF THE

CALIFORNIA ACADEMY OF SCIENCES

Scientific Inferences, from a Certain State of Facts, as to the Probable Movements and Present Position of the American Arctic Exploring Yacht "Jeannette"—She Must Have Penetrated So Far North as to Have Been Beyond Communication from the South During the Present Year—Probability that Her Crew Are Now Carrying On Sledge Work and Explorations—The Second Year Always Best for Such Work—Possibility that the Missing Whalers Have Communicated with the "Jeannette."

At the regular semi-monthly meeting of the California Academy of Sciences, held on Monday evening, December 6th, 1883, a scientific welcome was extended to Captain C. L. Hooper and officers of the U. S. steamer *Corwin*, and to the Captains of the American whaling fleet, recently arrived at this port from the Arctic Ocean. These gentlemen occupied positions on the stage beside the Vice-President, Justin P. Moore, who occupied the Chair in the absence of Professor Geo. Davidson. Some very valuable specimens were presented to the Museum by Capt. Hooper, including a large fossil tusk of a hairy mammoth, and also one of that animal's enormous teeth taken from Elephant Point, Kotzebue Sound. Also, a large block of excellent coal from the coal seams, from four to twenty feet wide, found in the Arctic at Cape Lisbourne. These seams occur more or less frequently, extending over a distance of twenty miles or so along the Arctic shore of Alaska. He also presented a fossiliferous rock from Cape Thompson, Arctic Ocean. A fine collection of Indian dresses were presented by Ivan Petroff, and also a large collection of stone mortars, etc., from other localities, were presented by B. B. Redding.

The proceedings of the Academy were more than usually interesting, the subject under discussion being the probable position of the exploring expedition under Lieut. De Long, U. S. N., in the steam yacht *Jeannette*, and the fate of the missing whalers *Mount Wollaston* and *Vigilant*, which were unable to get out of the Arctic Ocean in the Fall of 1879, and which have not since been heard from.

Mr. C. W. Brooks then read a full and carefully-prepared paper on the conditions surrounding the *Jeannette* and the missing whalers *Vigilant* and

Mount Wollaston, which was listened to by a crowded house with marked interest, and frequently applauded most heartily.

PAPER BY CHARLES WOLCOTT BROOKS.

Mr. Brooks' paper was entitled "The American Arctic Exploring Expedition; an Enquiry and Review of the probable situation of the *Jeannette* and missing whalers, *Vigilant* and *Mount Wollaston*;" and was finely illustrated by a colored map, drawn on a very large scale, and proved very useful in treating this subject. He began with

The Enquiry.

Before the sailing of the *Jeannette* Arctic Exploring Expedition, this Academy held a special meeting to receive and do honor to Captain De Long and his able staff of officers, and to offer them, in behalf of all men of science, their warm and hearty sympathies, with words of cheering hope and friendly encouragement. *Seventeen months* have now passed since that brave band were escorted outside our Golden Gate by a fleet of enthusiastic well-wishers, and bidden God speed upon their adventurous voyage, with earnest prayers for their success and safe return. Since then the Arctic fleet of American whalers on the Pacific have twice returned to this port, bringing to us much miscellaneous information of a general character calculated, when properly sifted and systematically arranged, to throw some circumstantial light upon the conditions encountered by the *Jeannette*, and the occasion seems an appropriate one, for this Academy, which, by location, is the nearest scientific body to this especial field of Arctic research and by greater proximity enjoys means of verification, to institute a

careful inquiry regarding winds, currents, weather, ice, and by a critical examination of log books, authenticate and establish a careful digest of such physical conditions and scattered reports pertaining to the two past seasons in the Arctic Ocean, as shall assist a just and scientific estimate, when reviewed, of the probable movements and present position of not only the *Jeannette*, but her unwilling companions in the Arctic—the missing whalers *Vigilant* and *Mount Wollaston*. With this object in view, regarding it as the especial duty of this Academy, the following inquiry has been prosecuted with care and industry, and all reasonable effort made to make it both thorough and reliable. After coating at St. Michael's, the *Jeannette* passed through Bering Straits, steering in the direction of St. Lawrence Bay, thence around East Cape, to Cape Serdze, and left a letter on the northern coast of Siberia, in the Arctic Ocean, from which point—after landing a letter dated August 27th, 1879, which was about twelve months in reaching New York—Captain De Long had intended to approach the southern end of Wrangel Land, in latitude $70^{\circ} 45'$ north, and near the prime meridian of 180° , touching, if practicable, at Kolintchin Bay, to inquire regarding Nordenskjöld; but the latter's safe arrival doubtless influenced him to renounce any unnecessary delays and press onward at once. On the 2d of September, 1879, when about fifty miles or so south of Herald Island, Captain Barnes, of the American whale bark *Sea Breeze* saw the *Jeannette* and attempted to communicate with her, but both vessels were at the time in heavy ice and a dense fog was setting in which prevailed up to the following day. Owing to these circumstances, these vessels, which had approached to within less than four miles of each other, resumed their courses without communication. On the following day, September 3d, 1879, Captain Kelley, of the whale bark *Dawn*; Captain Bauldry, of the *Helen Mar*, and several others of the fleet, who were then somewhat to the northward of the *Sea Breeze*, saw smoke issuing from a steamer's smoke-stack, in range of Herald Island, they being then in latitude $70^{\circ} 51'$ N., longitude $174^{\circ} 30'$ W., in a narrow space of open water, and within 25 miles of Herald Island. At that time the *Jeannette* was so far north of these whalers as to be hull-down, hence they did not see the actual vessel, but only her black smoke, although the weather was quite clear at the time. She was standing northward, and was herself a little east of due south from Herald Island. These are the last tidings of the *Jeannette* received at this port by any one, up to date. We now proceed to present such information as we have gathered from the Captains, officers and log-books of whalers, bearing upon the subject of winds, weather, ice-floes, and all physical conditions likely to influence the expedition. Captain Barnes, of the *Sea Breeze*, thinks the ice was unusually heavy, early in the season of 1879, before the *Jeannette* appeared among them, and up to that time the outlook was not promising. Had she arrived in the Arctic any earlier in the season, she could not have

PENETRATED NORTH,

And would have consumed her provisions needlessly while awaiting the opening of channels of clear water, which began to appear almost simultaneously with her arrival there. Captain Kelley

informs us that several days before September 11th, 1879, the ice began to close together, and the whaling fleet consequently ran south for awhile, but on that day he took his first whale of the season, in latitude $69^{\circ} 30'$, longitude $173^{\circ} 30'$. About September 25th the ice began to open up rapidly toward the north, when the fleet again proceeded north, and fished in sight of Herald Island, and the ice was opening up so rapidly to the northward as the season advanced, that in October they could sail all around this island. On the 7th of October the fleet saw Wrangel Land, distant less than 25 miles, the coast line showing very little snow, although the mountain chain in the interior, some of whose peaks are about 2500 feet high, were white with snow. At that date they could not only sail around Herald Island, but saw plainly that there was no ice in sight between them and the east coast of Wrangel Land, which greatly surprised him, as the fact was unusual, and the outlook had been especially discouraging previous to the first week of September. Captain Kelley says he could easily have reached the east coast of Wrangel Land with his vessel at this time, and followed it up if necessary, but having no occasion to, he did not deem it prudent to venture too near a rugged and unsurveyed coast without special object. The second week of October came and was followed by heavy gales; and as he saw indications of a heavy body of ice across the Arctic basin, to the southward of his then position, and the season for bad weather was approaching, he considered all who intended to return, and were bound out past Bering Straits that season, were sufficiently warned to get out of the Arctic as soon as possible. This he accordingly did, passing south through the Straits October 18th, 1879 just eight days after Captain Bauldry, in the *Helen Mar*, that remained later, part of company, farther north, with the missing whalers, *Vigilant* and *Mount Wollaston*. When Captain Kelley came out of the Arctic, in company with the *Sea Breeze*, he passed to the eastward of a large body of heavy ice, then making out from the eastern coast of Asia, and extending northward of the Straits. With the usual northerly winds, he feared this large mass of field-ice would become broken up and detached, and, thus forced southward in mass, it would be likely to close the open straits and block up all open space relied on for egress from the Arctic into the North Pacific Ocean. Several days later he found his anticipations had not been immediately realized, for he mentions in his memorandum, "Fortunately we had a strong gale from the south, which lasted several days and kept Bering Straits open." Captain Oogah, in the whale bark *Rainbow*, says that the early part of the season of 1879 was the iciest one he ever encountered in the Arctic.

THE LATTER PART OF THE SEASON

Was especially an open one, more particularly at the northward. He took nine whales at the edge of the ice, and out in the last one October 2d, when 15 miles south of Herald Island. He saw whales there, plenty, up to October 12th, when he bore off for Bering Straits, the weather having grown too rugged to lower boats. He found the Straits well filled with ice, but October 16th the wind hauled into the southeast, with snow and sleet, but the next day he got out of the ice, passing St. Lawrence

Island October 19th, in company with the bark *Dawn*. This day, October 19th, 1879, the schooner *Newton Booth* Captain Caughell, went ashore on the sand beach at Emma Harbor, situated within a sand spit, at the head of Plover Bay, on the southeast coast of Siberia, and there became a total loss, although her cargo and the entire crew were saved. Captain McKenna, of the schooner *Alaska*, was just south of Herald Island on October 13th, 1879, when he left, and reached Plover Bay, outside or south of Behring Straits, October 22d, having worked his way between large fields of drift ice. There he remained until November 1st, and thence passed through the 72° passage November 9th, when a heavy westerly gale prevailed, which was succeeded by southerly winds, which continued during the rest of his passage to San Francisco. On October 10th, 1879, Captain Bauldry, in the bark *Helen Mar*, was in company with the whale ships *Vigilant* and *Mount Wollaston*, in latitude 71° 50' N., longitude 173° 45' W., in a sluice-way or channel of open water, from 70 to 80 miles southeast of Herald Island. There was then a solid body of heavy ice to the east of them, but no ice to their immediate north or westward. The wind was somewhat northerly, and these two now missing whalers, both steered northwesterly toward the clear water. This was the last time they were seen by any of the whaling fleet; for the *Helen Mar*, finding that a cold north wind was freshening and rapidly forming new ice, spread all possible sail to this strong wind favorable for getting out of the Arctic and plunging her way forcibly through new ice constantly forming around the vessel, she thus ploughed her way as far as Point Hope, on the Alaska side of the Straits, through ice which became six inches thick before reaching the open water—passage then reduced in the Straits to an average width not exceeding ten miles. Five hours later, the wind changed and blew from the south, so had not the *Helen Mar* forced her way through the new ice just as she did that vessel also would have been corralled, and compelled to winter within the ice barrier, which thus early in the season closes up Bering Straits, and prevents all egress or ingress to the Arctic from the North Pacific Ocean. As the changes of wind just referred to extended to Plover Bay on the Asiatic side, Point Hope on the American side, and to St. Lawrence Island (situated south of the mid-channel), as shown by the logs of vessels quoted, they were general, not merely local winds, and doubtless reached northward and affected the course of the *Vigilant* and *Mount Wollaston*, now

ICE-LOCKED WITHIN THE ARCTIC.

With a considerable and indefinite body of clear water extending northward and westward from them while toward the south, impenetrable ice had hopelessly cut them off from all retreat. The life history of Captain Ebenezer F. Nye, of the latter vessel, is a startling romance of hairbreadth escapes from many shipwrecks and positions of great danger, and he has been heard to say that he should not fear to winter in the Arctic with his vessel, were he so circumstanced. Now, what is more natural, than when finding themselves thus cut off and closed in completely by ice in the Straits south of them, and knowing for a certainty that they would be obliged to winter in the Arctic, than a desire to catch another whale or two, and stow away the blubber

untried, to supply the crews with food necessary to withstand an Arctic winter? From the moment their escape was considered hopeless, their tactics wholly changed, and were promptly directed to secure the best possible protection to life, under the changed circumstances. The question with them was not, What will we do? but What can we do? To satisfy their most pressing demand for winter food in so frigid an atmosphere, by capturing and storing up fresh blubber, they would be obliged to keep in channels of open water, however far north such might extend at this late season of the year. As the open area available to them trended northwesterly, continuing probably while ten days of southerly winds prevailed, according to records in the log-books of other vessels south of the Straits, their progress northward would be more easily effected. Some Captains think open water may extend 200 miles further north after passing the ice barrier extending 10 miles above Herald Island. Their next consideration would be to select, as far as in their power to do, the safest place to winter, placing their vessels near some protecting shore, say Wrangel Land, where they would at least be protected on one side from the pressure of large bodies of moving ice. Having seen the *Jeannette*, whom they knew intended wintering far north, and observed her passing up that same northerly channel but five weeks before, it is quite natural that they should seek to reach a point, with a fair wind to favor them, at which they could most nearly hope to communicate with her, either directly or by building a fire, whose rising smoke would attract her attention, knowing that a vessel so well fitted was the nearest and only assistance they could hope for in case of pressing necessity. We hazard no idle opinion, whatever the fate of these now missing whalers may eventually prove to be, when we presume that they made every effort to communicate with the *Jeannette* and to winter their vessel as near to her as the clear water to their northward could possibly enable them to approach her winter quarters. Capt. Bauldry says, that October 24th, 1879, when favored by a northerly wind, he carried all sail he could crowd on the *Helen Mar*, to escape from the Arctic.—She was the last vessel to come out that season. The cold north wind then formed the new ice so solid, and so rapidly, that in twenty-four hours the new ice to the southward where he was, bore a sled loaded with one ton of blubber, having also 15 men alongside of it at the time.

WHEN THE WIND CHANGED

To the south this new ice became more or less broken, but massed up solid excepting a gut or channel running from Point Hope to past the Diomedes Islands, which remained open. While he describes how the ice closed in around Point Hope, preventing all egress, he feels quite confident that for some time the water continued open far north of the spot where he parted company with the *Vigilant* and *Mount Wollaston*, especially along the gut, sluice or channel-way, where the current sets along the east coast of Wrangel Land and past Herald Island. Whatever new ice was formed above, he thinks was continually being broken up and repacked by overriding layer after layer, and first packing solid into hammock ice along the southern borders of the open water in the Arctic. Being once fairly blocked in the Straits, it thus builds

northward, encroaching from the south, until the last remaining open water is closed up solid and disappears for the year. He says the series of gales from the northwest, which prevail in the Arctic late in the season, drift all loose ice southward from the vicinity of Herald Island and channels around Wrangel Land, and while packing this ice into impenetrable masses at the southern portion of the Arctic, he believes they must open a clear channel which would enable Capt. De Long, with the *Jeannette* already in position and capable of steaming against a head wind, to penetrate to higher northern latitudes, if so inclined, and attain a parallel quite inaccessible to any vessel which might enter the Arctic a year later, in 1880. A repetition of the same class of weather and winds this year may again enable him to do in the season, even after the Straits are closed, to follow along northward along the eastern shore of Wrangel Land and attain a still higher degree of latitude, through open areas of water, on the borders of which wild geese, ducks and other sea-fowl go annually north to rear their young. The unseasonable weather of the past two years has been exceptional ('79 and '80.) Ice has made in the Arctic, along the northern coast of Siberia, and accumulated and remained there in heavy masses, as no whaler has ever before observed. Owing to the position of the ice-pack there during these years an unusual current has been observed setting southerly along the east side of Wrangel Land; thence turning westerly again, it curves to the eastward and flows along the northern edge of the ice-pack, extending north of Siberia, toward Point Hope, where this eddy rejoins the Kuro Shiro setting northeasterly past Point Barrow, thence continues south of Prince Patrick's Island, around Point Beechy, through Melville Sound, to Esplanade Bay, and so on into the Atlantic. This Kuro Shiro throws off a branch north-west of Cape Lisburne, in the Arctic, in the neighborhood of latitude $69^{\circ} 30'$ north, longitude 168° west, at the usual apex of the southern point of the ice-barrier extending down from the north early in the season. This branch becomes a strong current setting northwesterly up and along the opening channel, usually passing over Herald Shoal and keeping to the eastward of Herald Island in its progress northward. It is not unlikely that in

THE UNEXPLORED NORTH

It somewhere takes a turn, and flows southerly along the east coast of Wrangel Land, thus supplying that unusual current observed by some of the whalers during the two past seasons. A more careful study of this current may offer some clue to the probable form and extent of the northern part of Wrangel Land, although all currents once within the Arctic basin are liable to change with the wind and position of ice-barriers, except the Kuro Shiro. No piece of any vessel lost in the Arctic was ever found south of the place of her loss. Captain Bauldry says, that if frozen in the Arctic, he should consider the safest winter quarters to be on the southwest side of Wrangel Land, a point unobserved by any vessel this year. Captain E. E. Smith, who acted as ice-pilot of the *Corwin*, informs me that he has made thirteen voyages to the Arctic Ocean from the Pacific side, and has passed one winter among the native Inuits. He says, most

emphatically, that no such thing as an iceberg exists or ever forms in the Arctic Ocean on the Pacific side. There is only what is termed hammock ice which, when crowded together, may occasionally so pile its overlying stratas as to become 100 feet thick. He has seen such ground in ten or twelve fathoms of water. When fairly afloat, seven-eighths of their mass is submerged below the surface. Other captains claim to have seen exceptional ice, grounded or anchored in 19 and 22 fathoms of water, respectively; although they admitted these were the extreme cases within their knowledge. Ice in the Arctic on the Pacific side floats from two to ten feet, averaging more nearly, less than six feet out of water; this would give it a depth of 42 feet under water. Ice often grounds in 7 to 8 fathoms, and when forced by the pack into $2\frac{1}{2}$ fathoms, the friction between blocks, during the compression, emits collision strains of continuous sound. Several captains estimate the average general thickness of the surface ice in this Arctic basin, where it freezes without displacement by pressure, to be about $3\frac{1}{2}$ fathoms, or 21 feet under water. In 1875, he anchored within one mile of Herald Island, the east end of which is situated in latitude $71^{\circ} 23' N.$; longitude $175^{\circ} 40' W.$, but observed no good landing place. He described it as an almost barren rock with rugged sides. It is shaped somewhat like the profile of a human foot, less than five miles long by a mile and a half wide at its broadest part, being probably 800 to 900 feet high at the heel or eastern end. Captain Thomas Long informed me that when in the bark *Nile*, he remained three days within fifteen miles of Wrangel Land on the 14th, 15th and 16th of August, 1867—when he made a drawing of the profile of the Coast from Cape Thomas to Cape Hawaii. Several high peaks were seen, one of which was taken to be a volcano. Although frequently seen, it is generally admitted that no person has yet succeeded in landing upon this generally unapproachable *terra incognita*. This closes the record of reports received concerning the year 1879 in the Arctic. We shall now consider reports received this year, to assist us in forming a just estimate of the prevailing weather and general characteristics of the season, as well as to carefully weigh the value of unfortunate rumors, which have been thoughtlessly, surely not maliciously, circulated in the English papers published in Japan, and extensively copied by the press all over the world, regarding the fate of our brave countrymen. On the 24th of September, 1880, the whaling bark *Legal Tender*, Captain Fisher, was the first vessel to reach our port from the Arctic, and reported nothing has been seen or heard from the *Jeannette* or the missing whalers. She reported passing East Cape, September 1st, and saw a heavy body of solid ice extending from there to within four miles of the Diomedes and from thence to St. Lawrence Bay. Brig *Hidalgo*, Capt. Williams, made a similar report. Dr. W. H. Dall, acting as Assistant in charge of the U. S. Coast and Geodetic Survey in Alaska, has just returned from a cruise in the *Yukon*, with which he made a thorough reconnaissance of the western and northern coast line of the Territory of Alaska as far as Icy Cape, and in his intercourse with the natives he heard of neither the *Jeannette* nor either missing whaler, nor any reports whatever of any wrecks the past year.

BARK "SEA BREEZE,"

Capt. Barnes, came out of the Arctic, passing Icy Cape September 6th, and left Plover Bay September 11th, 1880, where the steam-whaler *Mary and Helen*, Capt. Owen, was boiling out, having taken 27 whales. All vessels reported unanimously no tidings of any of the absent vessels. Schooner *Alaska*, Capt. McKenna, entered the Arctic this year June 24th, and found the weather unusually mild. One whaling Captain told me that the weather north had been so mild this year that he had really suffered more from cold in San Francisco the past week than during the whole of last Summer in the Arctic. Bark *Dawn*, Capt. Hickmott, took her first bowhead whale near Plover Bay, April 30th. Saw but little ice at any time, and that very light, and none loose from the pack. Afterward made fast to the solid ice for ten days, as we would alongside of a wharf. July 18th took a bowhead in sight of Herald Island. Cruised around in the neighborhood of Herald Island until August 10th, then went to the east shore and found whales plenty off Icy Cape. Left Plover Bay to return September 28th. Bark *Norman*, Captain Heenan took her first whale in the Arctic June 3d, and last one September 23d. Came out through Bering Straits and Fox Islands October 15th. Bark *Helen Mar*, Captain Bauldry, was again this year the last vessel to leave the Arctic, from which she passed out October 4th. She had entered the Arctic May 9th, and made strict inquiries from the native Innuits along the coast for news of any kind from the missing whalers and the *Jeannette*, but got no tidings whatever of either. August 21st she sighted Wrangel Land, distant 49 miles, but was unable to approach nearer at that time, on account of heavy ice. Captain McKenna says: "The Captains of the whaling fleet are unanimous in their expressions of approval of the able manner in which Captain O L Hooper and his officers, of the United States revenue steam-outer *Thomas Corwin*, have conducted the search for the *Jeannette* and missing whalers. They are deserving of great credit throughout the voyage for the energy and thoroughness with which they have prosecuted the labor." The *Corwin* made five trips across the Arctic Basin, in a northwesterly course, besides visiting every available point along the coasts of Alaska and Siberia, forming the southern shores of the Arctic Basin. On her first trip she made the ice whed nearly 350 miles south of Herald Island, and returned, July 26th she got within 60 miles of the Island; August 31 within three miles, and again almost as near August 20th. She ran up a lane of open water as far as latitude 71° 37' north longitude, 174° 30' west, and was, August 15th, 1880, 30 miles northeast of Herald Island. On September 11th she ran within 25 miles due east of Cape Hawaii, on the extreme southeastern end of Wrangel Land. Capt. Hooper kindly exhibited to me his chart and track in the late voyage of the *Corwin*. From Bering Straits, where the stream varies from one to three knots, its temperature is 40° to 42° Fahrenheit, and in its course past Point Barrow, it never extends over 40 miles north of the American shore. He visited Point Barrow and found four miles of clear water along the Alaska shore, outside of which the ice was heavily packed. Hammocky ice is not at all impassable for sled parties. The surface is interspersed with hammocks, or little mounds of ice, the

greater part of which rise from ten to fifteen feet above the surface, and occasionally, but rarely, one is seen forty feet high. It is easy to run around them without ever attempting to go over them. He says the main body of the northern ice pack situated near the centre of the Arctic, goes north when it breaks up, while loose ice which may be south of Herald Island, sets south. He thinks that the ice seldom ever melts on the shallow spots between Wrangle Land and Siberia. A deep-water current sets northward in a channel east of Herald Island, indicating an open outlet farther north, sufficient in volume to keep this deep channel open. Captain Hooper's observations found Point Hope was laid down on the charts seven miles too far to the westward. When at Cape Lisbourne she mined and took on board 25 tons of excellent coal, from the surface outcroppings of several fine veins. It burned well, making steam readily, and gave off but little more smoke than anthracite, and no undesirable surplussage of gaseous fumes. It is solid, compact, bright-looking, and breaks in cubical forms. Capt. E. E. Smith tells me that he informed Capt. De Long of this abundant supply of good coal in the Arctic, before the *Jeannette* sailed from San Francisco, in order that he might coal there, should occasion require. By the foregoing carefully-collected data, we establish the fact that the *Jeannette* was last seen September 31, 1879, and the missing whalers,

THE "VIGILANT" AND "MOUNT WOLLASTON" WERE
LAST SEEN

October 10th, 1879, within about eighty miles of the same spot, since which dates nothing whatever has been heard from either of them. All reports claiming to give news of these vessels are thus proved to be wholly without foundation. With the facts so far as known thus fairly before us, we may reasonably argue that, had any abandonment of the *Jeannette* taken place, with her seventy-six trained dogs, her seven dog-sleds, and two experienced Inuit hunters, all admirably trained and equipped for ice-travel, and a liberal supply of pemmican, her sled parties would have made for the southern edge of the ice-pack near Herald Island as the most natural of all spots frequented by American whalers every season, and to them alone could they confidently look for aid and relief. Having abundant proof that no such parties appeared, we may feel assured that the *Jeannette* is safe and sound, and her Polar voyage of scientific exploration is proceeding favorably according to the plan of its enterprising and generous patron, and it is fair to presume that she passed northward along the unknown coast of Wrangel Land beyond immediate communication, just as all on board fully hoped and intended. The icy barrier north of Bering Straits is maintained from 6½ to 8 degrees of latitude further south than on the Greenland side. Its lowest point is usually at the apex which marks the division of the current, and called by whalers "Post Office Point." Just east of this, there generally makes northward a high of open water, in which, Capt. Williams informs me, that he once reached about latitude 78° 33' N., which is about the same latitude reached by the U. S. ship *Vincennes*, in 1855. Observations taken within the Arctic circle, require to be verified with great care, owing to excessive radiation of the atmosphere and the great variation and extreme sensitiveness of the compass. The difference of isothermal lines between

corresponding latitudes in the Atlantic and Pacific sides of the Arctic may be owing to the extreme shallowness of the Arctic basin, just north of Bering Straits, or to the presence of the true magnetic north-pole at a point in latitude $70^{\circ} 08' N.$, longitude $96^{\circ} 45' W.$ where the needle points vertically. Nordenskjöld reports the east coasts of all Arctic lands as heavily iced, when their west coasts are often comparatively free. This is explained by the constant rotation of the earth, making the shores, the weather barriers, or resisting and advancing side, while all western shores are relatively lee shores. His recent tidal observations just south of Wrangel Land, show an average rise and fall of only eight inches. This seems to indicate that the marine basin north of Bering Straits is of limited extent, and either land-locked or composed of an archipelago of numerous islands connected by sands, with little surrounding water. Judging by the comparative size of Greenland any Arctic continent that may exist, if shaped in general proportion, would likely be about four and a half degrees in depth from the physical north pole of the earth. All shores within the Arctic circle appear to be skirted with islands. Captain Keenan, when "boiling out" in the bark *James Allen*, about 100 miles north of Point Barrow, saw with perfect distinctness a range of high land, visible a long way north of the vessel's position. This is annually confirmed by the flight of large numbers of aquatic birds, which pass northward from Point Barrow in the Spring, and return in August or early in September with their young, which are always reared upon land. When we consider that the ice barrier in this part of the Arctic successfully resists the insidious approach of

THE WARM KURO SHIWO,

Coming from the tropics, and a branch of which flows past Japan and through Bering Straits, just north of which it is forced to fork and throw off a branch, it argues a solid backing to sustain it immovably so far south, such as ice frozen solid to the bottom, and thus anchored in shoal water, a compact archipelago, or continental coast line farther north, would present. Our last inquiry is regarding the strength of the *Jeanette* and her powers of resistance. Before leaving San Francisco she was most critically examined at Mare Island Navy Yard, and extraordinary precautions were taken to strengthen and fit her for the severe trials she is likely to encounter in the ice. Ten feet of solid timber were heavily bolted in her bow, and she was plated outside with straps of bar iron and heavy oak sheathing. Extra iron beams were introduced on each side of her boilers, to add resistance to her sides when under pressure. She was fastened throughout, though and through with wooden hooks, far more in number than I ever before saw in a single vessel. Her bilge was strengthened with long layers of six-inch timber, and her deck-frame thoroughly examined and strengthened and renewed wherever in the least required. The extreme sharpness of her model on the bottom is calculated to assist in throwing her hull out of water above the ice-fields when submitted to a side pressure, thus relieving her from the full force of crushing situations. Her copper propeller—to replace which she carries three additional gun-metal ones—holts cut and takes inboard. In addition to being well built and specially adapted

for Polar explorations, these improvements give her a capacity of resistance that few vessels have possessed. Mountains of heavy ice, such as no human agency can contend against, are all she seems unprepared to meet and combat successfully. To the few who question

THE VALUE OF ARCTIC VOYAGES,

A brief outline of their utility may be needed. Dr. Benjamin Franklin, one of the wisest men born on this continent, was in 1753 one of their earliest advocates. Abroad we have seen British, Germans, Austrians, Swedes, Norwegians and Dutchmen taking part in Polar explorations. Their results are very varied. Their constant observations aim at the discovery and seek needed information to aid the correct demonstration of great physical laws, necessary to advance almost every department of science, astronomy, navigation, hydrography, meteorology, including electricity and magnetism. Specimens collected for students of natural history furnish new data for drawing correct geological analogies and ascertaining the geographical distribution of species. The observed variations in the movement of pendulums within the Arctic Circle, gauge the extent that earth is flattened at the poles. Great laws are world-wide, and a knowledge of the whole earth is essential to their perfect understanding. Such knowledge increases the effective power of man by augmenting his knowledge, and thus accelerates scientific discoveries, useful in arts, agriculture, commerce and manufactures. In the climate and winds of Polar regions, the world has obtained a partial clue of fundamental laws regulating the motor agencies of atmospheric currents, and the equalizing influence of warm, gulf and icy streams, that traverse oceans as arterial rivers. How general will be the benefits bestowed, when our National Weather Bureau, assisted by such knowledge, is able to apply wider rules of judgment, and more surely predict the probabilities of approaching storms and seasons one week in advance more certainly than it now ventures to forecast a single day. In Boothia, the two Rosses found the magnetic pole, whose mysterious influence the mariner's compass obeys. The mass of observations collected on all sides of this magnetic pole have assisted science to perfect our knowledge of the laws of magnetic declination and dip. Providence has peopled these high latitudes with human beings, who Winter and Summer there, as do all animals upon which they subsist. Each successive voyage has swept away some old error and brought to light new phenomena, tending to advance human knowledge. The problem of a Northwest passage around North America is not one of any direct utility, although the gain to commerce through such scientific explorations has doubtless been very great, yet difficult for the masses to always discern. Their authentic surveys are valuable to our whaling interests, annually representing many millions. The Northeast passage around Asia, accomplished by Nordenskjöld in 1878-79, promises large rewards to both science and commerce.

The Review of the Situation,

After doubling East Cape in her passage through Bering Straits, the *Jeanette* held a nearly due north course, continuing past that little granite islet called Herald Island, and was reported to us as last seen by an American whaler early one clear Autumnal afternoon in September, 1879. She was steaming north-

ward, also carrying all sail, along the eastern shore of Wrangel Land, about twenty miles from the coast line with a bright prospect before her and a Polar sea stretching its open channel northward as far as the eye could reach. She was making the utmost of her opportunities through this most fortunate opening, then quite clear of old ice. That night was a cold one, but after this the wind blew from the south and the weather continued favorable for several days. Captain Williams says the past two years appear to have been specially made for the success of the *Jeannette*. He cannot imagine any conditions better for her. One whaling Captain said the weather and chance seemed made expressly for her safety.

WHAT MORE ENCOURAGING PROSPECT

Could an enterprising explorer, such as the brave De Long, desire? His previous Arctic record on the Atlantic side, in the little *Juniata*, marked by intrepid grit and perseverance, is well known among careful students of Polar explorations. This year the ice-barrier remained solid during the early part of the season, in a curved and pointed but unbroken line, from abreast the southern limit of Herald Island to Point Barrow, on the American Coast. What it may have done after the last whaler left the Arctic, we can only conjecture. Native Inuits within the Arctic Circle, say their bad, thick and snowy weather is all at Spring and Autumn seasons. The northern and eastern coasts of Asia, as well as the western and northern coasts of North America, are closely skirted with groups of islands, forming an extensive archipelago, some of which are large, especially within the Arctic Ocean. This prevailing similarity of formation leads to a strong inference that Wrangel Land may be but an island fringing the continent. If it accords in general symmetry with other Arctic islands, we may judge that its northern boundary would naturally be situated near latitude 78°, or thereabouts. As no one has yet reported to the world how far this land extends, it is to be expected, and now exceedingly probable, that an avowed explorer like De Long, whose special duty was to explore and report the boundaries of all land encountered within the Arctic circle, should, while running north along a shore of undetermined limits, with open water, whose channels were comparatively free from obstructing ice, stretching out to invite him onward most naturally aim to improve to the utmost such an excellent opportunity to penetrate its unknown mysteries, and definitely fix its boundaries. So we may safely presume with little doubt, that he then and there settled the extent of Wrangel Land, provided it proves to be an island. Nothing is more probable than that the *Jeannette*, fully equipped as she was for steaming through moderately thick layers of freshly-formed ice, perhaps congealed only at night, and, if so somewhat "mushey," should, after she was last reported seen, have continued her course due north, steering toward the Pole along the eastern shore of Wrangel Land under its protecting influence, perhaps aided by a current, whence, from our information, she was likely to find an open sea after passing the shoals, and reaching ten miles or so north of Herald Island, until she passed its northern limit, say 78° or so, when, if finding it to be an island, she met the drift ice setting eastward along its northern

shore through some form of a rift, sound or open sea, where she may have met the barrier of perpetual ice, and become frozen in for the Winter well north of that island. From frequent conversations with Capt. De Long, and Capt. Dunbar, his ice-pilot, before their departure, and the last and most reliable reports of his position, and the conditions surrounding the location of his vessel. It is quite logical to infer that the *Jeannette* passed a cold but quiet Winter, frozen in the ice, north of Wrangel Land, in about latitude 78°, fully three hundred miles or more beyond any communication inaugurated this year and there hibernated, with plenty on board to supply all their necessities, and with all hands well, for sickness is scarcely probable among such a healthy set of men, especially while in the pure, cold air of the Polar regions, which are absolutely free from every kind of tropical miasmatic exhalations. Although they Wintered so far north, it by no means follows as

A NECESSARY CONSEQUENCE

That their long and severe Winter has been passed in absolute solitude. Two adventurous American whale-ships, the *Vigilant* and *Mount Wollaston*, we have shown, were last heard from in the very same neighborhood as where the *Jeannette* was last seen, and they, certainly, when once closed in, had motives likely to influence them also to increase their northing. Because these vessels have not since been heard from by us, we have no absolute right to jump at the hasty conclusion that they must necessarily have been crushed in the ice, or that their crews have perished. Think well of those having friends on board before you hastily reach any such conclusion. It is far from impossible that these two vessels, which we know ventured too far north late in the season, in search for whales, may be simply detained by the ice, and comfortably frozen in, within possible Winter communication of the *Jeannette*, which we also know was well filled with all necessary material for sledge excursions over the ice. When these whalers were last seen by Captain Bauldry, in the *Helen Mar*, they were northward of his vessel, in the direction of Wrangel Land. They remained, while the *Helen Mar* improved a strong north wind, of five hours duration, to leave the Arctic. After this, the wind blew continuously from the south for several days, during which time neither of these whalers could have made any progress southward sufficient to escape. Clear water being north of them, they doubtless worked northward as described, until the usual pack ice formed, growing by accretion from the solid south, until they may have been enclosed within 60 miles or so of the *Jeannette*. The whale ships being in company, and thus separated from the outside world, would surely aim to keep together, and hence, when frozen in for the season, must have been near to each other. The lack of a proper fitting to encounter the rigors of an Arctic Winter, would most likely lead to the temporary, if not the permanent, abandonment of one of the whalers, and the most expedient concentration of their crews on which ever vessel proved most staunch and favorably situated, or most easily heated, which is a consideration of prime importance. In such case, the abandoned vessel could furnish all needed fire-wood for the other, and some might be also availed of by the *Jeannette*, in order to economize her other fuel, should she also prove to be near them. We can

thus readily see how the whalers may have provided themselves with fuel, a most essential item in the desolate regions of the far north; also, how like the native Innuits, they could, while living in that cold climate, eat blubber, or drink whale oil from their cargoes with the keen relish of an Arctic appetite. If either of these vessels were frozen in the ice within, say sixty miles, of the *Jeannette*, it is highly probable that intercourse took place when one party enjoyed such excellent facilities for travel over the icy wastes, provided the surface was at all smooth. The ample supplies of dogs and sledge apparatus carried by the *Jeannette*, doubtless enabled her parties to make sorties last Winter, and thus penetrate, at least, a degree or more northward over the frozen surface beyond the *Jeannette's* Winter quarters. When we hear from one vessel, we may hear from all. During 36 years of active Polar explorations by ship, boat, and sledge, England has spent £932,000, and only fairly lost one expedition and 123 souls, out of 42 successive expeditions; and has never lost a sledge party, out of about 100 that have toiled within the Arctic Circle. The past Winter, having been an unusually severe one, and especially cold,

THE NATURAL ICE BARRIER

Encountered by whale-ships in the southern part of the Arctic, extended lower down than usual, especially early in the season, and it is probable that the open passages in the main body of ice far north in the unexplored regions of the Arctic were late in breaking up, and that the *Jeannette* was unable to move clear of the ice bodies affixed to the shore where she wintered, so as to drift or sail and make any material headway this Summer before the annual retreat of the whaling fleet from the southern shores of the Arctic became necessary to enable them to get out past Bering Straits before their annual blockade, which is often comparatively early. The *Jeannette* would then be far beyond any possible communication inaugurated this year, and most likely made but little change in her position until comparatively late in the season. If the whalers are frozen in near her, the same result applies equally to them and the safety of one at least of them, depends upon their powers of endurance. Not being as heavy built, braced, fitted and protected as the *Jeannette*, their chances of successful resistance are correspondingly less. All the while this mass of ice, and with it, the vessels it may enclose, appears, when not affixed to some island or terra firma, to be steadily setting eastward by an onward progress, moving as regularly as the movement of all glacial floes on mountain sides and valleys; in this case impelled by the action of the Karo Shiwo, or Japanese warm steam, which enters the Arctic Ocean through Bering Straits and flows eastwardly along the northern shore of the Continent of North America, and thence sets down the west coast of Greenland, taking up in its passage a fleet of icebergs incident to the Arctic waters on the Atlantic side, which it bears and discharges into the Florida Gulf stream at a point northeasterly, or abreast of New Foundland, whose renowned fisheries are among the rocky banks largely formed of Arctic boulders, floated there when frozen within icebergs, and precipitated along their course, as dissolving thaws release and drop them. The British discovery ship *Resolute*, one of Sir Edward Belcher's expedition, was abandoned

May 15th, 1854, when frozen in, not far from Beechy Island, and was picked up and brought into New London harbor, in Connecticut, by Captain Biddington, of the American whale-ship *George Henry*, on the 15th of September, 1855, in latitude 67° off the west coast of Baffin's Bay. During this time of her abandonment she had drifted eastward in the ice-floe, over 1200 miles, or about an average of two miles and a half each day. Although the intense cold of the past Winter, whose isothermal records reveal remarkable extremes of temperature, may have so frozen the ice, as to cause a late breaking up this year, and the *Jeannette* consequently has been unable to actually sail in open water but comparatively little distance this Summer, or more properly Autumn; she is now undoubtedly placed, with a crew trained to their business, in the best possible position for her future work; and the second Winter of an Arctic cruise is that to which all experienced Polar voyagers look, for the accomplishment of their most effective sledge-work and important explorations. It is highly improbable that the *Jeannette* could have been at any time during this year sufficiently far south to render communication with her possible, by any vessel which had not, like herself, wintered far north.

IN THE MAIN BODY OF HEAVY ICE,

At any rate, if she was properly engaged, in accordance with the designs of her intended voyage, and laid out before her departure, she should have been, and doubtless was, far beyond any present reach, and few experienced students of Arctic discoveries and previous expeditions will believe that she could possibly have been reached in one single season by any vessel despatched to accomplish in one short Summer a distance which the *Jeannette*, with a much superior outfit, required over a year, including two Summers and Autumn seasons, to traverse. The faithful search of Captain C. L. Hooper and his efficient staff of officers, the honored guests of the Academy this evening, during the recent cruise of the United States Revenue cutter *Thomas Corwin*, in the open sea of the Arctic Ocean south of the ice barrier, and in open channels, 30 miles northeast of Herald Island, August 15th, in latitude 71° 37' N., longitude 174° 30' W., was a noble effort, well-conducted, under an able and sagacious commander, despatched in response to a generous public sentiment, by a considerate Government. Although it reached no higher latitude, it accomplished all that was possible under existing circumstances. But the enthusiastic and plucky De Long had pushed the *Jeannette* far north, within an encircling barrier of heavy ice, through which no vessel could penetrate, except by degrees, and surely not in one solitary season, like the short-lived Arctic Summer. The faithful search made by the Academy's guests this evening was all that could be, but the *Jeannette's* present position must have been so far north that it was simply impossible to reach her. Their search and the constant inquiry of whalers among the Innuits proved the entire falsity of all idle stories, founded on rumors of her loss. This Academy extends a warm and hearty welcome to Captains and officers of our Pacific Arctic whaling fleet, present with us this evening, who have so generously assisted with their counsel our investigation of this subject. Their presence in the Arctic

brought us the last news of the *Jeannette* and missing whalers. Their daring and adventurous spirit leads them annually to explore the intricate and constantly changing ice-barriers and open channels of the Arctic basin north of us. How can we better express our high appreciation of their valuable services and interesting reports, than by adding our endorsement to the well chosen words of the illustrious explorer Nordenskjöld, when he pays this fitting tribute to their intelligence and enterprise, in his despatch dated Stockholm, October 27th, 1880. He says: "The only persons who have an extensive knowledge founded on real experience of the ice in the sea north of Bering Straits are the American whalers. Should it become necessary to send assistance to Captain DeLong, these practical Arctic navigators should be first consulted," and he gracefully adds Admiral Rodgers, Professor Dall, Captain Hooper, and others not to be forgotten. It is quite possible that the coal-seams at Cape Lisburne may have their counterpart on the shores or in the mountain ranges of Wrangel Land, and any coal mine within the Arctic circle could furnish the necessary gas material for inflating a captive balloon capable of rising to an observing height of 2000 feet, from which, with favorable atmospheric conditions, the earth's unknown surface toward the Pole could be discerned with a bird's-eye view, and the position of absent or missing vessels determined, if within the range of vision. Should it ever become necessary to send out any relief expedition to the Polar Basin we desire to call attention to the value of the coal mines at Cape Lisburne, in latitude 69° north, as of inestimable value for balloon purposes—a means which should certainly be availed of. Should flying-machines become practicable, the dangers of polar ice may be avoided. The schooner *Newton Booth*, lost October 19th, 1879, or the schooner *Lotita*, lost on Saint Lawrence Island, September 4th, 1880, might furnish drift-wood from a wreck which always floats northward, and thus account for such stories, had any such wreckage ever been really seen in the Arctic the past year. The closest inquiry fails to show that any has been actually seen. The unpleasant reports received via Hakodate and Tokio are, therefore, wholly without foundation. To those scientists who have the objects of her perilous voyage most at heart, and have made her course a matter of close scientific scrutiny—and they are scattered through every civilized country of the world—the important fact that nothing has been heard from her is the strongest possible testimony that she is just where she was designed to go, and that her brave and accomplished Captain and officers and gallant crew, are indeed earning a worthy record for the *Jeannette*, her owner, their country, and themselves, which shall place their names high upon the roll of honor, in the lists of distinguished Arctic navigators and patrons. Having early acquired a thoroughly practical knowledge of all the important details of seamanship and of ship-building, I can personally vouch, from

A CLOSE INSPECTION

Of every part of the *Jeannette* before she sailed from San Francisco, that she was an able, staunch, and thoroughly-fitted vessel, well calculated for the proposed expedition, and most ably manned and officered, all on board being intelligent and picked men, physically strong in muscle, and in the full

enjoyment of perfect health. None others were accepted for the cruise. In view of these well-established facts, it is to be regretted that so many have lent themselves too readily to the circulation of baseless rumors regarding the safety of the *Jeannette*, when no possible cause for alarm exists, and, on the contrary, we have every cause for earnest congratulation that her special mission is being faithfully executed, and that it will prove of great practical benefit to the advancement of many important branches of science, and thus inure to the benefit of the whole human race. Let us, to-night, as a body of intelligent and scientific men, place upon record before the world our abiding faith in the abundant success and safe return of the *Jeannette*, of the American Arctic Exploring Expedition, which seventeen months ago sailed northward from our port. And as members of this Academy, now assembled in its temple of science, whose walls were first dedicated to the worship of God, may each inquiring soul prove a living shrine, dedicated to the great Giver of all science can investigate, before whom true science and true religion shall be wedded with indissoluble bonds to labor jointly for the elevation of the human race. Who, then, would not rejoice to believe that the kind care of a Divine Providence, whose universal influence is gentle as all-powerful, to direct all things by laws of highest wisdom for the greatest ultimate good, and without whose knowledge not even a sparrow falls to the ground; will most mercifully watch over every movement of the absent ones, and thus finally influence their return to us in safety and in joy, however far they may penetrate into the Arctic domain, beyond any communication which temporary barriers may suspend.

CHARLES WOLCOTT BROOKS.

REMARKS BY CAPTAIN HOOPER.

At the conclusion of Mr. Brooks' paper, Captain Hooper, of the *Thomas Corwin*, was invited to give his views on the subject. Captain Hooper said that the subject had been so ably handled that there was nothing left to say. He complimented Mr. Brooks upon the thoroughness of his paper, with the tone of which he fully agreed. He thanked the Academy for the kind words of approval expressed by their presiding officer and members this evening, of the manner in which he had conducted the attempt made by the United States steamer *Thomas Corwin*, this year, to communicate with the *Jeannette*, and search for traces of the missing whalers. It had afforded him great cause for thankfulness that he had been selected to go on such an errand of mercy, and he deeply felt that all Americans, and we as scientists, should ever be especially mindful of the fact that Captain De Long and his brave comrades, at the sacrifice of comfort and risk of their lives, have penetrated the Arctic regions in the interest of science, and are liable to be in need of assistance, which our country should be prepared to furnish. That in the event of their vessel ever becoming so hopelessly embayed in fixed ice as to compel her abandonment, they would surely endeavor to reach the southern edge of the ice-barrier, or the main coast line of Alaska or Siberia, which they would doubtless be able to do. The ice in that region is treacherous, and a vessel which becomes embayed is for the time being

as helpless as though she were on dry land. To humanely provide help in case of any such contingency, all will see the wisdom of dispatching some vessel next year to communicate with the natives on each side of Bering Straits and continue as far north as the land may prove accessible; to make suitable enquiries in regard to the *Jeannette* and for the crew of the missing whalers; and in case of failure to gain any tidings of them in that way, to continue northward and attempt to communicate with them in the vicinity of Wrangel Land.

Such a vessel should be properly strengthened to withstand the ice, and furnished with food and clothing for at least eighteen months, to guard against any emergency. It would be well for such a vessel to carry at least five good dog teams of ten dogs each, for land or ice travel, and two light but strong boats fitted for transportation over the ice. Nations universally acknowledge their duty to rescue seamen in distress; and sixty or more American whalers are known to have been ice bound in the Arctic. The time will then have come to provide suitable assistance, to be near and *in waiting*, to reach and communicate with the *Vigilant*, *Mount Wollaston* and *Jeannette*, and receive the crews of any who may then unfortunately have been forced to abandon their vessel.

The subject is worthy of consideration, and should not be allowed to drop. With regard to the *Jeannette*, Captain Hooper could offer nothing further than what had been already said by Mr. Brooks. But one thing must always be borne in mind, and that is, that she and her brave crew and the missing whalers, our countrymen, are amid the ice of the Arctic, and may at any time become in need of assistance.

CAPT. WILLIAMS, OF THE WHALING FLEET,

Being called upon to respond on behalf of the Captains of the Arctic fleet, spoke most pleasantly and in clear and straightforward style. He began by saying he could cut in a whale with greater comfort to himself than he could make a speech, but the Academy soon came to the conclusion that he could do both in excellent style. He was one who saw the *Jeannette's* smoke, and says he is sure it was coal smoke from her chimney, and not frost smoke, as had been suggested by some parties.

Captain Williams said that he had seen the smoke of the *Jeannette*, and that it bore almost due south from Herald Island. He remained in the same place for two days after he saw the smoke, and as the hull of the *Jeannette* did not rise above the horizon, he felt sure that she was going north. Captain Nye, of the since missing *Mount Wollaston*, who came on board Captain Williams' vessel, said that he also had seen the smoke to the north. It is likely that, after Captain Williams left him, Captain Nye went to the north of Herald Island. He had been up in the Arctic many years, and sometimes he almost begins to think that the oftener he goes the less he know about it. The Arctic ice is very changeable.

CAPTAIN E. E. SMITH'S VIEWS.

Captain Smith, the ice-pilot of the *Corwin*, who for many years has commanded whalships, said that there was no reason why those on the *Jeannette* should not come out of the Arctic safely, even if the vessel should happen to be lost. He had wintered in the Arctic, and had been out when the mercury was 64 degrees below zero. But he had experienced no inconvenience except as to the parts that might be exposed, as the nose, which sometimes became frost-bitten. Should it become necessary for the officers and crew to abandon the *Jeannette*, if they will travel as their Indian guides will direct, they will be saved. Captain De Long doubtless had no idea of coming out of the Arctic this year, having determined to push north for the time for which he was fitted out. He did not think he would have come out this year if he could have done so. Captain Smith gave an interesting account of wintering south of Bering Straits. His remarks were delivered with earnestness, and received, as were Captain Williams' and others, with frequent applause.

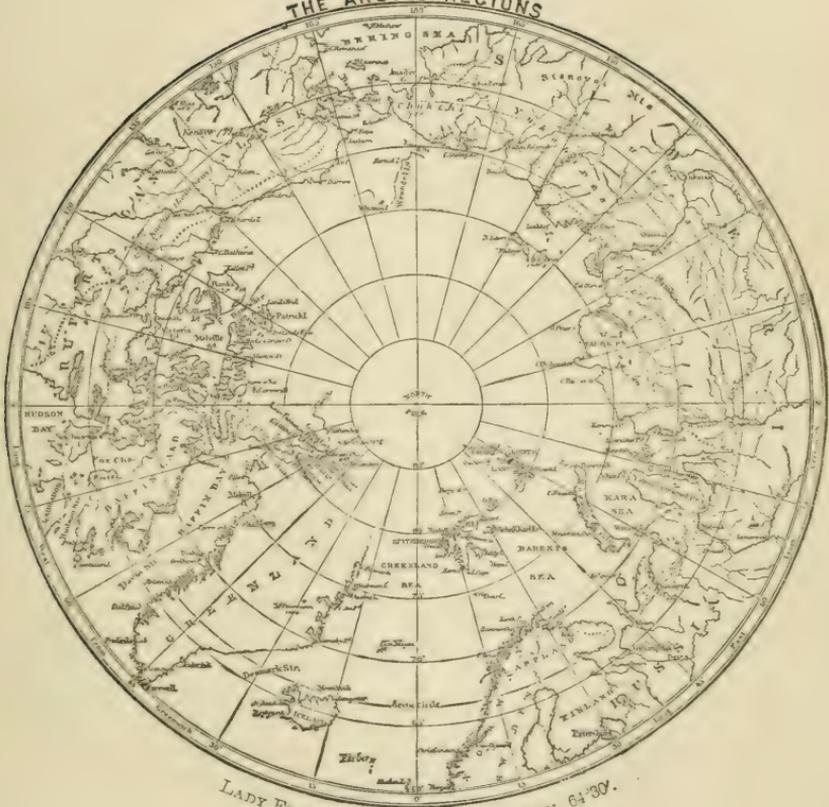
DR. W. H. DALL,

Assistant in charge of the United States Coast and Geodetic Survey of Alaska, being called on, made some happy allusions, and closed by stating that he could only say "ditto" to the remarks of Mr. Brooks.

AN AERONAUT OFFERS HIS SERVICES.

Just before the meeting adjourned Mr. Wells, a veteran aeronaut, made some inquiries of Captain Williams as to the currents of air in the Arctic. He stated that he had always desired to make an ascent in the North, and then offered his services to any expedition that should be sent out next year. He was certain of being able to take such advantage of currents of air that he would be waited without difficulty to the Pole. Or, if he was required to make an ascension in a captive balloon, he offered to ascend to an observing distance of one mile, if desired. He had made over 500 ascents in Europe and elsewhere, and made a balloon 75 feet in length, and heated by an engine of three-horse power, during the Franco-Prussian war. Mr. Wells thought it was more feasible to reach the North Pole by sailing over the ice in a balloon, than by a vessel, and cutting through the mass of ice. He had come to California for the express purpose. Captain Williams told him in Winter he could pretty generally rely upon a northerly surface wind near the earth, to bring him back, and an upper current in the opposite direction, to take him north. Mr. Wells said that if the balloon was sufficiently provisioned to sail to the North Pole, if such was possible, by seeking the currents, he would be willing to risk his life in accomplishing the object, after obtaining all possible information regarding the course of the usual upper and lower currents of air centering around the Pole, such as ordinary caution would dictate. After the unanimous passage of resolutions, tendering to Mr. Brooks the thanks of the Academy for the very able and interesting paper read, the Academy adjourned.

THE ARCTIC REGIONS



LADY FRANKLIN BAY, LAT 61° 40' Lon 64° 30'.

PROCEEDINGS
OF THE
CALIFORNIA ACADEMY OF SCIENCES
AT A
RECEPTION GIVEN TO THE CAPTAIN AND OFFICERS
OF THE
JEANNETTE SEARCH EXPEDITION

When about to sail from this Port in the

UNITED STATES EXPLORING AND RELIEF STEAMER

RODGERS

LIEUTENANT ROBERT M. BERRY, U. S. NAVY, COMMANDING

INCLUDING

PAPERS READ, WITH THE DISCUSSION THEREON, BEFORE THE ACADEMY
AT ITS REGULAR MEETING HELD JUNE 6TH, 1881.

PROCEEDINGS

OF THE

CALIFORNIA ACADEMY OF SCIENCES.

Intentions of the Expedition—Instructions from the Secretary of the Navy—Proposed Exploration of Wrangel Land by sledge parties—Cairns to be sought for—Papers read—Telegraphy in Arctic Regions by James Gamble—Early Discoveries of Wrangel Land, by Charles Wolcott Brooks—Inquiry into conflicting claims to discovery—Evidence presented—Remarks by Lieut. R. M. Berry, U. S. N.—Capt. H. W. Howgate—and President George Davidson, Ph. D., of the U. S. Coast and Geodetic Survey.

[From the Daily *Alta California* published June 7th, 1881.]

The meeting of the California Academy of Sciences last evening was literally packed to overflowing by our leading scientists and citizens, who met to receive the brave officers composing the *Jeannette* search expedition, and to give them words of hearty welcome and cheer in the good work they have undertaken. The President of the Academy, Professor George Davidson, occupied the Chair, and the following guests of the evening were seated around him on the platform: Lieutenant Robert M. Berry, U. S. N., commanding U. S. steamer *Rodgers*; Ensign Henry J. Hunt, U. S. N.; Assistant Surgeon Joaquin D. Castillo, U. S. N.; Col. W. H. Gilder, Pay Clerk, and correspondent New York *Herald*; Assistant Engineer Abraham V. Zine, U. S. N.; Past Assistant Surgeon Meredith D. Jones, U. S. N.; all officers detailed to sail in the *Rodgers*; also, Capt. Henry W. Howgate, of the Howgate Arctic Exploring Expedition, and Mr. James Gamble, General Superintendent Western Union Telegraph Company. The regular order of business was dispensed with, excepting elections of new members, when Hon. Geo. O. Perkins, Governor of California, and Hon. James G. Fair, U. S. Senator from Nevada, were unanimously elected life members of the Academy. President Davidson introduced the guests to the Academy in a few well-selected remarks, saying: The California Academy of Sciences feels a deep interest in the relief voyage of the *Rodgers*, and desires to manifest its good will and readiness to assist in every way possible the gallant officers in their brave undertaking, and avails of this opportu-

nity to wish them a hearty God-speed in all their humane and adventurous efforts. After which

CHARLES WOLCOTT BROOKS

Read a paper on "The *Jeannette* Relief Expedition and Evidences Regarding Discoveries of Wrangel Land, and in the Arctic Ocean," in which he presented the official instructions given to this expedition by the Naval Board, of which Admiral John Rogers was Chairman, and of the Honorable Secretary of the Navy. He gave an abstract of all letters received from Lieutenant De Long, written from on board the *Jeannette*, since her departure from this port. He alluded to the currents in the Arctic, as testified to by whaling captains, spoke of observation balloons and signal bombs, and described Wrangel's first visit to Siberia, when, in 1820-24, at Cape Jakan, he heard from Indians that high land existed far north, but never saw it. He next gave abstracts of Captain Thomas Long's first actual discovery of the southern shore of Wrangel Land, when in the American bark *Nile*, August 14th, 15th, and 16th, 1867; also alluding to Captain Kellet's discovery of Herald and Plover Islands. He then gave a translation of a paper read by Captain E. Dallmann before the German Geographical Society at Bremen, wherein he claims to have

LANDED ON WRANGEL LAND

August 14th, 1866, when in command of the trading schooner *W. C. Talbot* of Honolulu, and there obtained musk-ox horns, finding green grass and a luxuriant arctic vegetation, with extensive fields of flowers. Mr. Brooks then produced a mass of highly interest-

ing evidence received from Honolulu, going to show from the reports of Hawaiian newspapers, whaling captains, the *Talbot's* trading journals, invoices, etc., also from the testimony of Captain Dallmann's mate in the *Talbot*, that he did not land at Wrangel Land, as alleged. If he did, it is strange he should have kept the fact concealed from the public for fifteen years. He was at Honolulu, where, in 1867, the subsequent year, the credit of discovery was publicly awarded to Captain Thomas Long, and to this claim he then made no objection; hence his claim appears but poorly supported. Mr. Brooks' paper was frequently applauded, and the opinion of members seemed to be, that it is now Captain Dallmann's turn to rise and explain, why he got musk-ox horns without entering them on his trading-book, and failed to account for them to the owners at Honolulu, on his arrival there; also, how he found musk-oxen on a place so far from Greenland and Arctic America, the only place they are known to inhabit none being found in Siberia.

[Mr. Brooks' paper will be found published in full beginning at page 6.]

MR. JAMES GAMBLE

Then presented to the Academy a valuable paper on "Arctic facilities for running telegraph wires over frozen surfaces," thus retaining constant communication with parties when detached from the vessel, exploring northward by dog-teams. He recommended the use of No. 20 gauge steel wire, weighing about 20 pounds to the mile, to be coiled on reels and carried on sledges, paying out as the party advances. The ice furnishes perfect insulation, and telephones or telegraphic instruments could easily be attached and used, enabling the parties out to report constantly, or to call at any time for aid. With this connection, rendering intelligent relief more certain, parties could venture much farther away from their base of supplies.

He admitted Mr. George Kennan's experience in Arctic regions, when on the Collins Russian Overland Telegraph expedition, many years ago, but claimed later knowledge, and urged Lieutenant Berry to take a small quantity of wire and some instruments and telephones, and to make the trial, for at least a short distance. He did not believe steel wire was too brittle, but if it proved to be, copper wire could be used. The paper was full of interesting suggestions, and gave much valuable telegraphic experience, while constructing the overland telegraph lines across our continent, especially the Sierra Nevada Mountains, where such cold weather and heavy snow are met with every winter. He said that obstacles should prove stepping-stones to progress, and urged that some practical test should be made as early as practicable, that every possible facility might be afforded to our brave Arctic explorers in the future. These sentiments were freely applauded.

[Mr. Gamble's paper will be found published in full beginning at page 17.]

REMARKS BY LIEUT. BERRY.

Professor Davidson then called on Lieut. Berry to express his views regarding the landing of Capt. Dallmann on Wrangel Land, which the latter says he effected in 1866. To which he answered that at present he was of the opinion that Capt. Dallmann did not land there as is claimed; for he could scarcely imagine how any one could thus withhold so valuable a geographical fact from

public announcement for fifteen years. It was clearly his duty, as a navigator, to publish such information to the world at once, giving it to the nearest hydrographic bureau. While he thought it impossible that Dallmann could have landed there as alleged, yet he would not judge him too hastily, as he should be heard from again, and given opportunities for explanation, as he may possibly be able to bring forward other circumstances which tend to confirm his very late report. All whalers testify that ice usually extends off a great distance from the coast of Wrangel Land, and only one year in ten at least, is it possible to approach at all near to it. He traded there several years, and now claims his discovery the year before the remarkably open season, in which Captain Long made his observations and discoveries. He should most certainly have notified the public at once, and no right thinking man could possibly have kept quiet in regard to it fifteen years. One can scarcely say which is most culpable, his sin of omission, or of commission if his present report is erroneous.

Professor Davidson then made some interesting remarks on Captains Williams, Thomas and Long's reports of Herald and Plover Islands, showing how Dallmann's other statements of his vessel's course did not agree with facts which they had communicated to this Academy. Lieut. Berry offered some further remarks in answer to Mr. Gamble, agreeing to make trial of a limited amount of telegraphic wire and telephones, and began by saying: "I wish to take this occasion to thank this Academy for the information by which the Naval Relief Board and I have profited materially in making up the route by which we are to go out. It will be followed as strictly as practicable. In regard to the experiments with wire, I shall be very happy, indeed, to make those, testing them in every way. I think, however, that it will be very difficult on extended sledge journeys, for the reason that we have an immense weight to draw. When you speak of additional dogs to haul the wire, you must take into account that they will require additional food and additional material on board ship. We find that all Arctic ships, when starting from port, are overloaded with material. The *Jeannette* went out of here loaded to the water-line. I am fortunate in having a larger ship, but she is now crowded, and will be overcrowded when we get the other stores. It will be very difficult to take much wire. When you take that you must give up coal and other things which are very material. I also would be very happy to make those experiments with the signals that were referred to. I don't think it will be necessary to refer to my journey, as we have had it explained as far as I can explain it myself now, because after reaching Wrangel Land I shall have to be guided by circumstances. There I shall find a new country that has not been explored, and after reaching there I shall have to form new plans."

PROFESSOR DAVIDSON,

Of the United States Coast and Geodetic Survey, and President of the Academy, then said that Mr. Gamble's suggestions in regard to the use of telegraph wires over ice or snow, accorded fully with his own experience in field-work on the coast of New Foundland, where they suffered from imperfect insulation of their wires, the weather being wet and stormy. They, however, waited until December, when a cold snap covered everything

with ice, and telegraphic clock signals thenceforth passed with perfect satisfaction to all. He said Mr. Gamble could easily cite the experience of the Western Union Telegraph Company, who experienced no trouble on the Sierra Nevada, high up upon the range, even when the lines became imbedded under the snow, and that they found by practice that dry ice afforded perfect insulation; but it was only imperfect when the snow began to melt, and became slushy.

Professor Davidson then recalled in part what he had said in regard to Mr. Dall's alleged discovery that the Kuro Shiwo, or Japanese warm stream, did not pass into the Arctic through Bering Strait. [See Bulkeley's letter p. 16.] He said he had conversed with Captains Thomas and Williams. The latter's views, founded on his personal experience, had been recorded in the Academy's proceedings for 1867.

Plover Island has been cut out of the U. S. Navy Charts by the Hydrographic Bureau. Admiral John Rodgers, when in the *Vincennes*, on the United States Exploring Expedition of 1855, landed upon Herald Island and from its top saw no signs of Plover Island, but Professor Davidson ascribed this to a false horizon.

SUCH PHENOMENA

He had himself observed in Santa Barbara Channel, off the coast of California, where he had seen islands lifted above the horizon, that belonged 1000 feet below it. He had also seen the reverse, when a rock in Santa Barbara channel disappeared to his view, owing to the aerial phenomena of a false horizon, which again appeared later in the day, when this false horizon broke away.

When Captain Killebrow, on the John Rodgers' United States Exploring Expedition of 1855, failed to see Plover Island, the weather was good, and he was of the impression that the Island did not exist. Captain Kellett, in 1849, in the British ship *Herald*, says he made out Plover Island in dirty weather, and also discovered Herald Island and shoal, and saw the tops of high mountains on what has since been made out to be Wrangel Land. Captains Thomas and Williams say Plover Island is a low pyramidal hillock, from which the low coast trends N. N. W. and W. S. W., stretching as an extended plain of very low land far toward the Kellett Mountains. In 1867 Alaska had an unusual rainfall of 23 inches in July, which weather melted large bodies of ice, and an equal rainfall here would furnish all needed nourishment to vegetation. They did not attempt to land, for the entire coast or beach line was bordered with pack ice. The situation of this land

VARIES FROM CAPTAIN DALLMANN'S MAP,

Furnished the Bremen Geographical Society. If his course is correctly laid down, he appears to have run his vessel between Plover Island and the Kellett Mountains, across where Captains Williams and Thomas report this low land. It appears that Dallmann's claim is incorrect, and conflicts with the testimony of Captains Williams and Thomas, whom we know are careful and truthful and experienced navigators. They reported to us that they saw connecting land with Plover Island, and that it was low, swampy land, with grass.

Captain Henry W. Howgate, of the Howgate Arctic Expedition, said he had been the means of sending North two Arctic expeditions, and a third one is now fitting out in charge of Lieutenant Greeley, U. S. A., to go by Smith's Sound to Lady Franklin Bay, despatched by the War Department. This will carry telegraph wire, flag signals, candle bombs and other apparatus used in the U. S. Signal Service, taking all of these that will prove useful and can be easily transported. Lieutenant Greeley's instructions are to search for and assist, if necessary, Lieut. DeLong and party in the *Jeannette*, should they make their appearance in any of the sounds on the eastern shores of America.

He argued that Capt. Dallmann's statement made at this late day appears to him very doubtful, and hoped that Lieut. Berry and his party would bring us back some reliable information regarding Wrangel Land.

He then offered some interesting remarks on Arctic voyages, and the plan of exploration he referred to was once attempted on the Atlantic side, but failed through an accident to the exploring steamer; it is to establish colonies at short distances in the Arctic, and thus work up to the pole. One colony is to be established as far north as vessels can go, say at Lady Franklin Bay, lat. 81°40' N., long. 64°30' W., and from there a continuous chain of land stations, at short, but regular intervals, will be established, to form bases of communication and supplies, as the advancing party moves northward to approach the pole.

Col. W. H. Gilder, who goes with Lieutenant Berry as Pay Clerk, and who was a member of the Schwatka expedition last year, was then called upon and presented the Academy with a piece of bamboo, evidently part of a fishing pole, one of the relics of the Franklin expedition, of whose wrecked ship and records Lieutenant Schwatka went in search.

The Academy then adjourned, after a highly-instructive and most agreeable meeting.

EARLY DISCOVERIES
— OF —
WRANGEL LAND.

SOME EVIDENCE REGARDING CONFLICTING CLAIMS;
PLANS OF THE RODGERS' EXPEDITION.

A PAPER READ BEFORE THE ACADEMY JUNE 6TH, 1881.

BY

CHARLES WOLCOTT BROOKS,

Member of the California Academy of Sciences.

[From the Daily *Alta California* published June 5th, 1881.]

Two years ago, lacking ten days, this Academy met to receive Lieut. George W. De Long, with his staff of able officers, appointed to sail in the steamer *Jeannette* on an American Arctic Expedition, about to proceed from our port to approach the North Pole as nearly as possible by way of Bering Strait, and thence along the eastern coast of Wrangel Land. The following members of the Expedition were then our guests: Lieut. G. W. De Long, U. S. N., Commander; Lieut. C. W. Chipp, U. S. N., Executive Officer; Lieut. J. W. Dannheimer, U. S. N., Navigator; G. W. Melville, U. S. N., Chief Engineer; J. W. Ambler, Passed Assistant Surgeon; Jerome J. Collins, meteorologist and special correspondent of the New York *Herald*, and R. L. Newcomb, naturalist.

The sailing of the *Jeannette*, and subsequent cruise of the United States revenue steamer *Corwin*, Captain O. L. Hooper, in search for both the *Jeannette* and missing whalers *Vigilant*, Captain Smithers, and *Mount Wollaston*, Captain Nye, gave great interest to all information relating to Wrangel Land and those portions of the Arctic regions where these vessels were last reported to us as seen.

THE "JEANNETTE" SAILED FROM OUR PORT,

Escorted to sea by several steamers and our entire yacht fleet, July 8th, 1879, and steamed hence directly for St. Michael's, in Alaska. There she coaled and took on board 76 trained dogs, 7 dog sleds, fur clothing, and two experienced Inuit

hunters. The expedition thus admirably equipped for ice travel, with a liberal supply of pemmican taken from here, passed through Bering Strait, steering in the direction of St. Lawrence Bay, thence around East Cape to Cape Serdze, on the northeast coast of Siberia, in the Arctic Ocean, from which point—after landing a letter dated August 27th, 1879, which was about twelve months in reaching New York—Captain De Long intended to approach the southern end of Wrangel Land, in latitude 70° 45' north, and near the prime meridian of 180°, touching, if practicable, at Kollutchin Bay. On the 2d of September, 1879, when about 50 miles or so south of Herald Island, Captain Barnes, of the American whale bark *Sea Breeze* saw the *Jeannette* under full sail and steam, and attempted to communicate with her, but both vessels were in heavy ice and a dense fog was setting in, which prevailed up to the following day. These vessels having approached to within less than four miles of each other, held their courses without communication. On the following day, September 3d, 1879, Captain Kelley, of the bark *Dawn*; Captain Bauldry, of the *Helén Mar*, and several others of the whaling fleet, then somewhat northward of the *Sea Breeze*, saw smoke issuing from a steamer's smoke-stack, in range of Herald Island, they being in latitude 70° 51' N., longitude 174° 30' W, in a narrow space of open water, and within 25 miles of Herald Island. The *Jeannette* having pressed forward was hull-down north of these whalers, hence they only saw her black smoke. The weather was quite clear

at this time. She was standing northward, and was herself a little east of due south from Herald Island. These are the last tidings of the *Jeannette* received at this port by any one, up to date. After doubling East Cape, she held a nearly due north course toward Herald Island, and was last seen steaming and carrying all sail abreast of

THE EASTERN SHORE OF WRANGEL LAND,

Some twenty miles or so, from its coast line, with a favorable prospect before her, and an open channel in the ice barrier, stretching northward as far as the eye could reach. She was making the utmost of her opportunities through this fortunate opening, then quite clear of old ice. That night was a cold one, but after this the wind blew from the south, and the weather continued favorable for several days. Captain Williams says the past two years appear to have been specially made for the success of the *Jeannette*. He cannot imagine any conditions better for her. One whaling Captain said the weather and chance seemed made expressly for her safety.

What more encouraging prospect could a brave explorer, such as De Long, desire? His intention, when he sailed, was to remain away three years, for which time his vessel was fitted. Thus, the *Jeannette* was last seen September 3d, 1879, and the missing whalers *Vigilant* and *Mount Wollaston* were last seen October 10th, 1879, within about eighty miles of the same spot. Since then, nothing has been heard from either, reports claiming to give later news have been proven to be wholly without foundation.

The crews of these whalers numbered about 30 persons each. Reports indicate that the past Winter of 1880-81 was unusually severe in portions of Northern Siberia. The United States Revenue steamer *Corwin*, Captain Hooper, sailed hence May 4th, 1881, for a second cruise in the Arctic Ocean, around the southern portions of the Polar basin, and around the entire northern coast of Alaska. We trust she will run lines of soundings across this shallow sea, to increase our knowledge of its bed. The United States relief and exploring steamer *Rodgers*, 420 tons register, now in our harbor ready for sea, commanded by Lieutenant Robert M. Berry, United States Navy, is about to proceed with able officers to the coast of Wrangel Land upon the worthy errand, rendered doubly noble and approved by all, because undertaken in the great cause of human sympathy. The Honorable Secretary of the Navy, in his letter of instructions, dated Washington, May 20th, 1881, addressed to Lieutenant Berry, Commander of

THE "JEANNETTE" SEARCH EXPEDITION,

Writes as follows:

"You will pursue as nearly as practicable the course recommended by the Board of which Rear Admiral John Rodgers was President, for the search you are about to undertake. You will report to the Department your progress, and the condition of your vessel and command, by every available channel of communication during your voyage, making your reports as full and detailed as practicable. In the pursuit of your adventurous and arduous voyage, you carry with you the sympathy and entire confidence of the Department. Nothing that can be done to contribute to your well-being and success shall be omitted. As soon as you

are ready you will sail. The eyes of your fellow-countrymen, and of the scientific men of all the world, and especially of those interested in Arctic explorations, will follow you anxiously in your way through the unknown seas to which you go. May Heaven guard and bless you, and your officers and men, and crown your heroism with success and glory. Very respectfully,

"W. H. HUNT,
"Secretary of the Navy."

The members of this Academy heartily concur in every expression contained in our Country's instructions to our brave guest. [Great applause.] The "Jeannette" Relief Board, composed of naval officers, was organized, with Rear-Admiral John Rodgers as President, and Lieut. Robert M. Berry, our honored guest, acted as Recorder. Its report, filed March 26th, 1881, says:

"Captain De Long wrote to his wife at sea, under date of August 17th, 1879, that he proposed to proceed north by the way of the East Coast of Wrangel Land, touching at Herald Island, where he should build a cairn and leave records, thence landing on Wrangel Land, he should leave records on its eastern coast under cairns at about twenty-five miles apart."

This information of De Long's purpose to land on Wrangel Land and build cairns frequently, as the *Jeannette* moved northward along the eastern coast, is clear and very definite.

After leaving San Francisco, De Long wrote under date of July 17th, 1879, "In the event of disaster, we shall retreat upon the Siberian settlements or endeavor to reach natives around East Cape, and wait for a chance to get back to our depot at Saint Michael's. If a relief ship comes up to merely obtain tidings of us, let her look farther on the east side of Wrangel Land, and on Herald Island. If I find we are being carried eastward, against our efforts to get north, I shall try to push through into the Atlantic by way of the east coast of Greenland, if we are far enough north; but if we are far south, then by way of Lancaster Sound and Melville Bay." This is about all the

POSITIVE INFORMATION OF DE LONG'S INTENTIONS

Now known. Captain Cogan, commanding an American whaleship, who has been many voyages in the Arctic, says: "There appears to be a strait between Wrangel Land and some land to the northeast, which forms a kind of sluice-way, through which the current sets northwesterly, about twenty miles a day. In whaling, we have to run south every day to hold our position, but farther to the eastward of Herald Island we get out of this current. The Naval Board recommend that the *Rodgers* leave San Francisco about June 1st, and, as preliminary work, should visit Petropaulovsk for Arctic clothing, dogs, sledges, and dried salmon for dog food. Thence to Saint Michael's to coal, where the United States Signal Service have a meteorologist stationed, and the Alaska Fur Company have a trading post, onward to St. Lawrence Bay, to East Cape, to Cape Serdze-Kamen, to Kamotschin Bay, for tidings of the *Jeannette*; thence to Herald Island, arriving there about the middle of August, for it does not appear that any earlier arrival will be useful, as generally it is only late in the season that the ice leaves Wrangel Land. After endeavoring to examine Herald Island, the *Rodgers* should proceed thence to

the northeast coast of Wrangel Land for cairns, or other notices, and to examine harbors for winter quarters on the south or southwest of Wrangel Land, or in Siberia, near some Tchuktchi village. She should not be caught in the ice, away from a harbor, except from accident beyond control. If she winters on the southeast coast of Wrangel Land, or along its southern shore she may easily return home next year, after having spent her time available for the purpose, in examining the coast, or exploring the interior by means of sledge journeys. The *Rodgers* was especially built for Arctic navigation, has a speed of about eight knots under steam, and has been so thoroughly strengthened and fitted as to be admirably adapted to the service intended. This we are positively assured by Naval-Constructor Fletcher, now at Mare Island Navy Yard Lieut. Berry, besides his experience on the *Tigress* in search of the missing members of the *Polaris* crew, has been a careful student of Arctic explorations and is passionately fond of the perilous duties assigned him. He was one of the five volunteer officers whose rank entitled them to command this expedition, and his selection meets with the warmest approval among older officers of the Navy, acquainted with his career. The *Rodgers* intends passing the winter of 1881-82 at some harbor on the south or southeast end of Wrangel Land, as such a position will offer greater advantages than any other for examining the locality where people from the *Jeannette*, or missing whalers, are to be sought, if their vessels have been abandoned. Failing this, she will winter at some secure place north of the coast of Russian Siberia, as near Wrangel Land as is possible, for purposes of making sledge journeys on its east coast, if the strait can be crossed by parties on ice. From the general character of ice usually fringing Wrangel Land,

SLEDGE JOURNEYS

Seem the most ready means for carrying out the purpose of this expedition, without inordinate risk of losing the relief vessel. The *Rodgers* is not to winter in the Arctic, except to promote the search for which she is sent out, nor is she to remain more than one winter away from home. Her mission will be finished when she has examined the points indicated, and the proposed sledge journeys have been made or attempted, and all possible information gained of the whereabouts of the *Jeannette*, and of the missing whalers *Vigilant* and *Mount Wollaston*.

We regret that an observation balloon has not been included among her outfit, for since the discovery of coal mines around the shores of the Arctic basin, necessary gas could readily be produced. The marvellous bombs of the signal corps will be sent up as signals in the still northern air, to attract notice at long distances, as paste-board bombs do in pyrotechnic displays. These answer well for rallying signals in case of need. A light telegraphic wire, as proposed by Mr. Gamble, would be another useful adjunct and is a scientific experiment well worth a practical test. In a former paper we have enumerated some advantages derived from Arctic voyages. [See page 13.]

In addition to the relief which this expedition is planned to afford, it seems destined to give us a much better knowledge of Wrangel Land, and may go far toward settling the vexed problem of whether

at the North Pole is to be found an open polar sea, an extensive archipelago, or an Arctic continent. Hitherto there has been no exact information concerning Wrangel Land, save that brought by American whalers, whose observations were generally at a distance of 15 to 20 miles from the shore. The drawing of Cape Hawaii and the profile of the southern coast of this land made by Capt. Thomas Long in 1867, when in the whaling bark *Nile*, indicates a formation of outlying islands, forming fiords inshore of them. Capt. Osgan reported quite a harbor on the southeast end, but whether formed by an island or a deep bay, he was not sure. Baron, afterward Admiral Wrangel, the famous Russian explorer, when Lieutenant Ferdinand Wrangel communicated the first knowledge of the existence of this land to the civilized world, after his expedition of 1820-24 when he simply heard of it, as "extensive high land," from the Siberian Indians. One of the Tchuktchi chiefs said snow-covered, mountainous land could be seen at a great distance north from Cape Jakan, in clear summer days, but in winter it was impossible to see so far. His father told him a Tchuktchi elder once went there with a few followers in skin boats, but he was never told of their return. Still he maintained that this distant land was inhabited, and adduced in proof that some years before a dead whale found at Arantan Island was pierced by spears pointed with slate. As the Tchuktchis have no slate weapons they supposed the whale must have been wounded by inhabitants of the northern land. This chief said, formerly herds of reindeer came across the sea on ice, probably from thence, but they were frightened back by hunters and wolves. He himself had seen a herd returning to the North in this way, in April, and he followed them for a whole day in a sledge drawn by two reindeers, until the rugged surface of the ice forced him to desist.

CAPTAIN THOMAS LONG,

Of the American whale bark *Nile*, personally well known to me, as well as to our President and to many members of this Academy, as a highly-educated shipmaster, having been trained as a United States Naval cadet, examined and sketched the entire southern coast of Wrangel Land on the 14th, 15th, and 16th days of August, 1867. The land is quite elevated, and near the centre has an extinct crater-cone. He named it Wrangel Land. The west point he named Cape Thomas, after the seaman on his ship who discovered it, and the southeast point he called Cape Hawaii. Geographers have since named the crater Mount Long, and the mountain range, of which Kellett saw only the detached peaks, have been named Kellett Mountains.

Captain Long, in his printed report, which he sent me, published in the *Commercial Advertiser*, at Honolulu, November 9th, 1867, says: "During my cruise in the Arctic Ocean this season, I observed land not laid down on any chart I have seen. It was first made out by a seaman named Thomas, from the American whaling bark *Nile*, under my command, on the evening of August 14th, and next day at half-past 9 o'clock A. M., the ship was eighteen miles distant from the west point of the land. I had good observations this day, and made this west point to be in latitude 70° 46' north, and longitude 178° 30' east. The lower parts of the land were entirely free from snow, and had a green appearance, as if

covered with vegetation. There was broken ice between the ship and land, but as there were no indications of whales, I did not feel justified in endeavoring to work through it and reach the shore, which I think could have been done without much danger.

"We sailed to the eastward along the land during the 15th and part of the 16th, and in some places approached it as near as 15 miles. On the 16th the weather was very clear and pleasant, and we had a good view of the middle and eastern portion of the land. Near the centre, or in about the longitude of 180° , there is a mountain which has the appearance of an extinct volcano. By approximate instrumental measurements I found it to be 2480 feet high. By excellent observations I made Cape Hawaii to be in latitude $70^{\circ} 41'$ north, and longitude $178^{\circ} 51'$ west. It is impossible to tell how far this land extends northward, but as far as the eye could reach we saw ranges of mountains until they were lost in the distance; and I learn from Captain Bliven, of the American whale ship *Nautilus*, that he saw land northward of Herald Island, continuing as far north as latitude 72° .

From the appearance of this land as we saw it, I feel convinced it is inhabited, as there were large numbers of walrus in the vicinity, and the land appeared more green than the main coast of Asia, and quite as capable of supporting human beings as the coast from Point Barrow to Mackenzie River, or the northern parts of Greenland, which are in a much higher latitude.

We examined with a telescope a large black place on the slope of one of the hills, which had a very

DISTINCT APPEARANCE OF COAL.

It glistened in the sun and appeared like a large surface which had been used as a deposit for heaps of coal. It was about one and a half miles in length and half a mile in breadth. The country surrounding it was covered with vegetation. Upon reaching Honolulu his chronometer was found to have an error of only one mile and a half." Captain Long further says: "I have named this northern land Wrangel Land, as an appropriate tribute to the memory of a man who spent three consecutive years north of latitude 69° , and demonstrated the problem of this open Polar sea (our present whaling ground) over forty-five years ago, although others of much later date have selfishly endeavored to claim the merit of this discovery."

Wrangel Land is distant about seventy miles from the coast of Russian Siberia. The strait between the two shores is usually blocked with ice, but it was quite clear in 1867. Captain Long thinks the land extends at least several hundred miles northward, and also that a propeller might readily have steamed far north, either on the east or west side of this land, at that time, and could easily have made full discoveries regarding its extent and character. Driftwood was seen floating in the water. In the channel north of Herald Island, the sea was clear of ice as far north as the eye could reach, from the whaleship that penetrated farthest into it. Last year the *Corwin* coaled twice from a coal mine within the Arctic Circle, near Cape Lisbourne, Alaska. Specimens of this excellent coal are in the Academy's Museum. To Captain Thomas Long has always been accorded the discovery of the southern coast of Wrangel Land,

and credited with the first reports of an authentic nature. In the years 1848-9, Captain Kellett, of the British ship *Herald*, discovered Herald Island, which, with Plover Island, he supposed to be a part of the land described to Wrangel by the Tchuktchi Chief.

In the *Pacific Commercial Advertiser*, published at Honolulu, Hawaiian Island, November 9th 1867, Captain George W. Raynor, master of the American ship *Reindeer*, writes under date of November 1st, 1867, giving over his signature an account of what he calls a large tract of land, lying in the midst of the Arctic Ocean, hitherto more surmised than known. He says, until the present time, this land has been considered to be simply two small islands, one of which is marked on the English charts as Plover Island, and laid down W.S.W., of Herald Island. The other is marked extensive land with high peaks, reported by us ives to Admiral Wrangel. On my last cruise I sailed along the south and east side of this land for a considerable distance, three different times, and once cruised along the entire shore. From reliable observations, I placed the extreme S.W. Cape in latitude $70^{\circ} 50' N$, longitude $178^{\circ} 15' E$, and the S. E. Cape in latitude $71^{\circ} 10'$ longitude $176^{\circ} 40' W$. *The South Coast appears to be nearly straight, with high rugged cliffs and entirely barren. Captain Bliven, and others of the whaling fleet, have this year traced this coast to latitude 72° , and believe it extends much farther north.

From formations of the ice, and ocean currents, we feel confident

THERE MUST BE ANOTHER LARGE ISLAND

Lying east of it, in about longitude 170° west, and northwest of Point Barrow, with a passage between it and the land just described. He then gives reasons for this opinion, saying: "We always find ice southward of known land, extending farther south of it, comparatively, than we do eastward from it. There the current runs to the northwest from one to three knots an hour. In the longitude of 170° west we always find the ice barrier from fifty to eighty miles farther south than we do between that and Herald Island, and there is always a strong current, setting to the northwest, between these localities, unless prevented by heavy northerly gales, (for in such shoal water as the Arctic Basin, currents are easily changed by prevailing winds) which indicate there must be a passage in that direction, where waters pass between two bodies of land that cramp them, the one Wrangel Land, now discovered by Captain Long, and the other still unknown."

CAPT. DALLMANN'S CLAIMS.

Early in April of this year, 1881, members of this Academy were surprised at a statement made in a letter addressed to C. W. Brooks by Dr. M. Lindeman, one of the Council of the German Geographical Society at Bremen, wherein, under date of March 10th, 1881, he writes: "I send you our society's journal, just published, which contains the chief facts brought out by your inquiry regarding the *Jeannette* and missing whalers, read before your Academy in your paper of December 6th, 1880. On the sketch map you will find two points on Wrangel Land, where it has been visited by Captain E. Dallmann, on the 17th and 18th of August, 1846, with the Hawaiian schooner *Tulbot*. He is a member of our Society, and has just contributed to our proceedings a paper on the subject of the discovery

of Wrangel Land. We feel sure Americans will not suffer this Summer to pass without sending a ship into that vicinity, with an order to land at Wrangel Land. I do not fear that the brave De Long and his companions are lost, although the ship may have been beset with ice and crushed in the pack. In the short report of Captain Dallmann you will find that on the coast of Wrangel Land there are plenty of traces of game, so that they probably obtained fresh meat enough. We do not know how far the coast stretches northward—Captain Hooper seems to believe not very far; but there may be other islands to which the *Jeanette* resorted, steaming up along the open water, which follows the east coast of the Arctic lands, close to the shore. We shall be very thankful to have forwarded as quickly as possible all important Arctic news."

While this letter shows the deep interest in Arctic explorations taken throughout Europe, it also reveals the fact that, after about 15 years of silence concerning a most important discovery, Captain Dallmann comes forward with his claim to have been the first individual of any civilized nation to land upon the shores of Wrangel Island. If this is indeed true, as he claims, he cannot be accused of any undue haste in the dissemination of knowledge regarding so important an exploration. He seems to have allowed his discovery and adventure to have remained unpublished, as a sealed secret in his bosom, unknown to his employers, the owners of the vessel, and to his most intimate friends. He has been very tardy in claiming the discoverer's medal of the Geographical Society.

We are not in a position to pass judgment upon Capt. Dallmann's claims, but he must readily admit that the peculiar circumstances surrounding his communication to a far distant society, first presented at this late date, warrant a close examination of his statements, which, if true, cannot be better established than by careful inquiry; and if otherwise, it is surely our duty to collect all possible evidence to establish the actual facts. What is here presented this evening is offered kindly for his explanation. All over the United States grave doubts exist, and objections are heard on every side; and the Academy being situated as the nearest scientific body to the scene of these explorations, and consequently best situated to collect evidence immediately available, would be derelict in its duty did it not make these enquiries; and we earnestly solicit any person having further light upon this mooted point, to lose no time in communicating it to some scientific society.

Eastern papers criticise Capt. Dallmann very severely for his long silence. Dr. Lindeman attributes it to the fact that he thought nothing of it, until Wrangel Land became prominent in connection with the *Jeanette* Arctic Expedition. Why he has never before publicly claimed credit does not appear. The following translation claims to have been an extract from Capt. Dallmann's journal of his voyage, as Master of the Hawaiian schooner *William C. Talbot*, in which he purports to have visited Wrangel Land in 1868:

"After I had cruised during the last half of the month of May, June, and the beginning of the month of July, 1868, along the eastern coast of Asia and the northwestern coast of America from Petropavlovski and Norton Sound to Bering Straits, visiting and trading with the native settlements

along those coasts, I passed Cape Prince of Wales and steered northeast to Port Hope, with the intention of trading with the natives in Kotzebue Sound. Early in August, I came out of Kotzebue Sound and again sailed to East Cape, on the southern and eastern sides of which I had visited settlements as early as July. I went there again in order to visit the large settlements on the northern and western side. After finishing my business there, I steered in a northwesterly direction along the North Siberian coast. I found that entire region free from ice and very open as far up as Cape Jakan, in latitude $69^{\circ} 42'$ north, longitude about 177° east. On the way I found several more settlements, where I bought walrus tusks, musk ox horns, and a number of glutton skins.

BEYOND HUMAN HABITATION.

"During the last fifty miles of this journey I found no more settlements, and therefore gave up the idea of proceeding any further to the north-westward, although there was still no ice to be seen. I desired then to try to get eastward to Point Barrow, which is the most northerly point of America. On the 16th of August I left the coast with a moderate southeast-by-east breeze, the weather being generally good, but with frequent fog showers. On the 17th, in the forenoon, the weather began to clear up and I got sight of Wrangel Land, extending from northwest to east-northeast. Our midway latitude was $70^{\circ} 23'$ north, and the supposed longitude about 180° . The wind was southerly and light and changeable. The land to the north was distant about 10 nautical miles. In the afternoon I steered east along the coast at a distance of about 5 nautical miles from the land, with a fresh breeze from the southwest. In the evening the wind died away to a faint air, and at 8 o'clock it was calm. We anchored near the land in six fathoms of water, lowered the boat and landed in latitude about 70 deg. 40 min. north and longitude 178 deg. 30 min. west. The land formed here on the southern side a rather deep, wide, open bay, lying west of a ridge about 500 feet high. To the eastward of this ridge the land stretched more to the northeast. The land, as far as I could see, had a narrow and level beach, like the southeastern coast of Siberia behind which it rose to heights of from five hundred to one thousand feet, the last-named elevation, however, occurring rarely. I saw no signs of human habitations, but found a great many tracks of animals, apparently those of polar bears, foxes and musk oxen.

A SECOND LANDING.

"On the 18th, at five o'clock in the morning, we got a north-northwest breeze, weighed anchor and sailed to the northeastward along the coast. During the day we saw several polar bears on the land. In the afternoon at five o'clock we saw Plover Island (on the east side of Wrangel Land—so called by Kellett in 1849). We were about ten nautical miles from the coast, and the island bore east-northeast. At ten o'clock at night we anchored in ten fathoms of water, and landed again in about latitude $71^{\circ} 5'$ north, longitude $177^{\circ} 45'$ west, where the land extended more to the north and northwest. At the latter place the land was not so high as at the place where I had landed on the day before, or as the land along which I had coasted. I had also found at the first landing place more moss, grass and field flowers, and the low land was entirely free from

snow, while at the second landing place there was a great deal of snow. On the 19th of August, at noon, a fresh north-northwest wind sprang up and we weighed anchor. We passed Plover Island in the afternoon and Herald Island at eight o'clock in the evening. On the morning of the 20th of August I saw the northern ice boundary, and, steering along the ice, I reached Port Franklin (Sea Horse Islands) on the evening of August 24th.

"E DALLMANN."

By this it appears that a year before Captain Long, in the bark *Nile*, sailed along the south coast of Wrangel Land, Captain Dallmann, then trading in a schooner out of Honolulu, claims to have seen and visited it. He now reports, at this late day, the most important fact, if true, that he

SAW TRACKS OF MUSK-OXEN

At the points where he claims to have landed on Wrangel Land, August 17th, 1866, and says, also, that he bought horns of musk-oxen from the inhabitants of the North Siberian coast. We invite especial attention to this claim, not only as it would go far toward showing a terra-firma connection, possibly, an Arctic Continent, connecting Wrangel Land with Greenland, but for other reasons, which require explanation. The musk-ox is a native of Arctic America, on the Greenland side, and is entirely unknown in Siberia, where he reports them so plenty. If the natives of the North Siberian coasts were in possession of the horns of musk-oxen, says George Kennan, a gentleman who assisted in building the Collin's Siberian telegraph line in 1866-67, it shows that those natives must have crossed Long's Strait, and hunted the animals where Captain Dallmann now reports he saw their tracks on Wrangel Land.

Musk-oxen, deer, and marmots, were killed for food in large numbers by the intrepid Arctic Explorer, Charles F. Hall, in his residence among the Eskimos this same year around Repulse Bay, on the coast, opposite Greenland. Careful inquiry of persons who have lived many years in Siberia, fails to learn of any musk-oxen on the Asiatic coast.

Desiring to establish or explain these very remarkable claims of Captain Dallmann, we wrote to Rev. Samuel C. Damon, Pastor of the Seamen's Bethel at Honolulu, and also editor of *The Friend* for the past 39 years. This paper is considered very accurate, and publishes the arrivals of all vessels, especially whaleships, and gives interesting memoranda of their voyages, which it takes extraordinary pains to solicit and collect. Father Damon, who is authority on all matters connected with the Arctic whaling fleet, writes under date of Honolulu, April 19th, 1881:

"I remember Capt. Dallmann; in 1866 he was in command of the *W. C. Talbot*, owned by H. Hackfeld & Co. The vessel returned from the Arctic, and arrived at Honolulu October 19th, 1866, but the Captain's report makes no mention of landing on Wrangel Land, or of any discovery or visit to land not laid down in the charts. I have carefully examined the full files of all newspapers published here, viz: the *Hawaiian Gazette*, *Commercial Advertiser* and *The Friend*, covering the arrival of the Arctic fleet that year, and find no mention or allusion to such an occurrence as he now claims.

"I have this day called upon Mr. J. C. Pflüger, managing partner of the house of H. Hackfeld & Co., and we have together looked over the records, trad-

ing-journals, invoices, etc., of that voyage of the *W. C. Talbot*, but do not find anything to confirm the account, as published by Capt. Dallmann in the proceedings of the Bremen Geographical Society. Mr. Pflüger and myself think Capt. Dallmann was a man to note down in his log-book everything relating to his voyage. Mr. Pflüger exhibited a journal of Capt. D's for the year 1865, thinking he may have made a mistake in the year, for it is hard to think he would have allowed the statement to go forth to the world unless it was based on truth. But although kept apparently with great accuracy, we found no mention of the information you desire. After Capt. D. left the *W. C. Talbot*, he took command of the *Bismarck*, owned by the same firm. He is now sailing out of Bremen to the coast of Russia. I hope soon to meet a mate of Capt. Dallmann's; when I find him, will write you again."

The years 1865-66 and 67 appear to have been remarkably open seasons in these cold latitudes.

In the published report of Capt. G. H. Soule, master of whale ship *St. George*, which arrived at Honolulu on November 6th, 1867, he says: "This season is the most remarkable one known by whalers, for the scarcity of ice and good weather prevailing during the first and middle part of the season. Otoken, a very intelligent native of Indian Point, told me they had

TWO ENTIRE MOONS OF SOUTH WIND

Last Winter, which I think accounts for the openness of the season. The *Ontario* cut-in a whale in December, off the Diomedes, last year.

Capt. J. B. Winslow, master of bark *Tamerlane*, reports mostly fine weather in the Arctic during August and September, 1867. Near St. Paul's Island he took a whale that yielded when tried out, by actual measure, 310 barrels 19 gallons of oil. This is one of the largest ever taken.

Under date of Honolulu, May 4th, 1881, Father Damon again writes: "Since receipt of your letter of April 8th I have been looking up the subject with Mr. Pflüger, who also has received letters of inquiry from Washington, but we cannot learn of anything very satisfactory to confirm Captain Dallmann's assertion. There is an old whaler here who was mate with Captain Dallmann on the next voyage after he claims the discovery. When asked, 'Did you ever hear Captain Dallmann speak of landing on Wrangel Land?' his answer was *he did not*."

Father Damon writes: "Does Captain Dallmann make the assertion on the authority of his log? If he does, my impression must be, that probably he may have done so, even if he has not so recorded in the vessel's log, for I cannot think he was a man to make erroneous statements, although I must say, that musk-ox story rather staggers me, and I shall take great pleasure in looking carefully into the subject still farther. As soon as the whaling fleet are due back from the Arctic, I shall publish your letter of enquiry for the purpose of glean information from old whaler. I was in Bremen less than a year ago, and regret I did not know this then, for I would have hunted up Captain Dallmann."

"No mention is made in the books and invoices of the *W. C. Talbot*, of the musk-ox horns, etc., which Captain Dallmann's narrative says he purchased from the natives. No such trading is recorded, neither had she any musk-ox horns in her cargo when she returned and entered at the Honolulu Custom House. During

three years of subsequent voyages with this old whaleman, who acted as his mate, and while cruising around the same ocean, where everything would tend to remind him of his extraordinary discovery, which then had already been publicly accredited to Captain Long at the port from whence his vessel sailed at a time one year later, this mate states that he made no allusion to his ever having landed on Wrangel Land. This nearly

FIFTEEN YEARS OF SILENCE

is most remarkable, especially when observed in a bright, ambitious, and aspiring member of so well-known, active and enterprising a scientific body as the Bremen Geographical Society, who is industriously searching about to obtain records and to publish just such facts as Captain Dallmann claims to have had to offer. Fifteen years of silence were allowed to pass before this nautical Rip Van Winkle broke his long silence at a city on the opposite side of the earth, from where his adventure is alleged to have occurred. So long, and many will say apparently improbable, a concealment, must naturally cast suspicion on any such statements. In the *Commercial Advertiser* of November 9th, 1867 and in all other Hawaiian newspapers, appears long laudatory articles, minutely describing the discoveries of Captain Thomas Long, giving him full credit as the first actual observer of the southern coast of Wrangel Land, on the 14th, 15th and 16th of August, 1867, just a year after Dallmann now

claims to have landed there. When we consider this fact and also that the entire Arctic whaling and trading fleet arrive at Honolulu about the same time to rest, principally about November 1st to 15th, and that all whalers are thus brought into close contact and usually communicate to each other all they have learned, and that in 1867 all gave unanimous credit to Captain Long as the discoverer, it is a little peculiar, at least, that Captain Dallmann, who at this late day aspires to the honor, fifteen years later, did not then speak out and mention his claim to some one, or in some way record or communicate it, or dispute the claim of priority universally accorded to Capt. Thomas Long. If true, why did not his officers or crew mention the fact to some one? It seems almost like folly to suppose that in so small a place as Honolulu, where nautical news is a current topic of conversation, that he could have avoided being aware of the honor, which all American whalers yet accord to Long as the discoverer. Without desiring to offer any argument, one way or the other, we simply report the result of these investigations, leaving to our respected President to sum up the evidence thus far obtained, and to members of this Academy to draw such conclusions as they may deem alike just to Capt. Dallmann and to Capt. Thomas Long.

CHARLES WOLCOTT BROOKS.

ADDENDA

BY

PROFESSOR GEORGE DAVIDSON

President of the California Academy of Sciences.

*NOTE.—[See page 9.]

SAN FRANCISCO, Cal., June 10, 1881.

Since the meeting of the Academy, I have examined more carefully the statement of Captain George W. B. Bynor, master of the American whaler-ship *Heindeer*, dated Honolulu, November 1st, 1867, and published in the *Commercial Advertiser* of November 9th, 1867, and in *The Friend*, December 2d,

1867; and it would seem that the geographical position which he gives for the South East Cape of Wrangle Land, [Lat. 71° 10' N., Long. 176° 40' W.,] may be no other than Killet's Plover Island; thus confirming the statement which Captains Williams and Thomas communicated verbally to me in 1867.

GEORGE DAVIDSON.

THE OBJECT OF ARCTIC EXPLORATIONS

EXTRACT FROM A PAPER READ BEFORE THE ACADEMY
AT A PREVIOUS MEETING

BY

CHARLES WOLCOTT BROOKS,

[Referred to on Page 8 of this Bulletin.]

To the few who question

THE VALUE OF ARCTIC VOYAGES

A brief outline of their utility may be needed. Dr. Benjamin Franklin, one of the wisest men born on this continent, was in 1753 one of their earliest advocates. Abroad we have seen British, Germans, Austrians, Swedes, Norwegians and Dutchmen taking part in Polar Explorations. Their results are very varied. Their constant observations aim at the discovery and seek needed information to aid the correct demonstration of great physical laws, necessary to advance almost every department of science, astronomy, navigation, hydrography, meteorology, including electricity and magnetism. Specimens collected for students of natural history furnish new data for drawing correct geological analogies and ascertaining the geographical distribution of species. The observed variations in the movement of pendulums within the Arctic Circle, gauge the extent that earth is flattened at the poles. Great laws are world wide, and a knowledge of the whole earth is essential to their perfect understanding. Such knowledge increases the effective power of man by augmenting his knowledge, and thus accelerates scientific discoveries, useful in arts, agriculture, commerce and manufactures. In the climate and winds of Polar regions, the world has obtained a partial clue of fundamental laws regulating the motor agencies of atmospheric currents, and the equalizing

influence of warm, gulf and icy streams, that traverse oceans as arterial rivers. How general will be the benefits bestowed, when our National Weather Bureau, assisted by such knowledge, is able to apply wider rules of judgement, and more surely predict the probabilities of approaching storms and seasons, one week in advance, more certainly than it now ventures to forecast a single day. In Boothia, the two Rosses found the magnetic pole, whose mysterious influence the mariner's compass obeys. The mass of observations collected on all sides of this magnetic pole have assisted science to perfect our knowledge of the laws of magnetic declination and dip. Providence has peopled these high latitudes with human beings, who Winter and Summer there, as do all animals upon which they subsist. Each successive voyage has swept away some old error and brought to light new phenomena, tending to advance human knowledge. The problem of a northwest passage around North America, is not one of any direct utility, although the gain to commerce through such scientific explorations has doubtless been very great, yet difficult for the masses to always discern. Their authentic surveys are valuable to our whaling interests, annually representing many millions. The Northeast passage around Asia, accomplished by Nordenskjöld in 1878-79, promises large rewards to both science and commerce.

DESCRIPTION OF THE RODGERS.

Construction of the Vessel—Her Machinery—Armament and General Outfit—Preparations for Scientific Work—Complete List of Officers, and number of her crew—Outline of her intended Cruise, and probable period of absence—Unanimous approval of the Vessel and endorsement of the expedition by Scientific Societies, and the Public generally—Her Commander's previous Arctic record—Arctic experience among the crew
Mention of Polar Currents and Herald Island—Sailing of the Rodgers.

[From the Daily *Alta California* published June 10, 1881.]

The U. S. Arctic relief steamer *Rodgers*, now lying in this port, will probably sail for the north next Tuesday morning. The following important and interesting particulars of the construction, outfit and contemplated movements of the vessel, together with an accurate list of the officers and crew, will prove of great general interest at this time:

The *Rodgers*, 420 tons register, was built at Bath, Maine, and her machinery was constructed in New York City. She has a full poop, extending nearly 'midships, with a short half-deck, forming aft a lazarette, into which is let an encased wheel-house, thoroughly enclosed. She has built lower masts, coaged and dowelled, and is a full-rigged bark with two royals and double topsail yards. Her rigging is hemp and she carries five whale-boats and an ice dingy, also used as Captain's gig. She has a house on deck forward, in which is situated the Apothecary's dispensary, bath-room, and room with bunks for the native Innuitt guides and interpreters. She is

HEAVILY SHEATHED

With three-inch oak plank. Her frame has been properly strengthened by the addition of bilge streaks, and a very large number of extra hooks and knees, and her bow is made solid with a heavy timber backing, for a considerable distance from the stem. Her kitchen is on deck just forward of the cabin, and on the starboard side in front of the poop opening on deck, is the mess-room of the petty officers. Her fore-castle for seamen is below in the fore peak. She has a steam windlass to get her anchor, and new patent capstans. Her fore and main hatches will remain closed in rugged weather, and all provisions, etc. can be reached through the booby hatch aft. Her propeller is two bladed, and she carries a spare one on deck. A ten-pound boat howitzer mounted on a patent gun carriage stands forward, while aft are racks of boarding pikes, and in the cabin over-

head are breach-loading rifles, pistols and outlasses. When she sails, there will be thirty-five souls on board, all told, consisting of nine officers, one carpenter, three machinists, three firemen, two cooks, one steward, one store-keeper, and fifteen able-bodied seamen. The only live stock on board in the shape of provision, are two pigs. She will have a number of dog-teams on board after leaving Petropaulovsky. Among her stores which are laid in to last four years, and may be eked out to last five years if necessary, are large supplies of lime-juice pemmican for men, and another quality of coarser pemmican for dog food, on

LONG SLEDGE JOURNEYS.

It is made of beef and fat pressed together, in about the ratio of two pounds of fat to one of beef, for dogs, and the reverse proportion for men. She carries several cases of stoves, in addition to those in place. She carries a French cook, and her negro steward is also a good cook. They expect to shoot a plenty of reindeer meat, also ducks and geese in their season, as they carry a large supply of ammunition. She has an upright engine, 22 inch cylinder, and 22-inch stroke, a single low pressure engine, connecting directly with the shaft, which is 6½ inches in diameter. Her single horizontal tabular boiler is jacketed, and has two furnaces with grates now fitted for anthracite coal. She has a jet condenser, and Kingston valves for taking water, and in addition to her regular stationary ship's pumps she carries two auxiliary steam pumps, one a Cameron pump, ready to connect in any way with anything at a moment's notice, and a Davidson pump for

DISTILLING FRESH WATER,

And for fire purposes. All pumps are rigged with iron hand brakes to work them by hand when there is no steam up. She carries a small donkey engine and independent boiler forward, and a pair of hoisting engines for getting the anchor, handling stores, taking in coal, wharving ship, etc., also four bilge pumps and one steam syphon bilge pump. Her

engines and boilers, although small, are now in first-class order. At low pressure she carries forty pounds of steam, but takes with her an extra exhaust pipe so that she can be run at high pressure, with from sixty to seventy pounds of steam if necessary. She has coils of steam heating pipes with radiators in the saloon, cabins, dining and mess rooms and fore-castle, and it is intended to keep a slow fire and steam for this purpose all the time during the long Arctic Winter. Her exhaust pipes are copper, and she carries a spare rudder, with duplicates of important parts of her machinery, to replace others in case of breakage. She carries a liberal supply of spare spars on deck, and lumber for roofing over her deck in winter, which will also be felled, and with snow packed over that, will form a good

WARM COVERING AND CLOSE PROTECTION

Against the cutting cold without. Her main saloon is finished in chestnut-oak and her after cabin laurel and bird's-eye maple. She carries a large outfit of ship's lanterns of various colors, barometers, spare compasses and instruments. In the commander's room is a safe, and a fine library of well-selected standard works on Arctic matters and scientific and useful mechanical text-books covering a great variety of branches, and apparently a full set of the proceedings of the American Geographical Society of New York. She is provided with a dip-circle, theodolite and fine collection of instruments for general scientific work, including an alcohol tank for preserving rare fishes and other Arctic varieties of animals and smaller animals. Observations of magnetic currents and earth magnetism will be taken and all meteorological phenomena will be carefully noted. They will survey all coasts and headlands and make especial geodetic triangulations with observations of currents and soundings, and the altitudes of mountains and headlands. Fossils will be collected for the Smithsonian Institute and everything relating to paleontology as well as the Arctic Flora and Fauna.

They will make careful collections of the Arctic flora for our botanists to classify, and will gather all possible scientific information that will not interfere with the main object of the expedition, which is to

SEARCH FOR THE "JEANNETTE."

And to rescue, if possible, the crews of the missing whalers, *Vigilant* and *Mount Wollaston*. Many of the crew have had considerable Arctic experience. Joseph Hodgson, the Paymaster's yeoman, was on board the whaleship *Acors Barnes*, Captain Hickmott, one of the fleet which got caught in the ice-pack about 1872, beyond Point Barrow, when so many whalers abandoned an entire fleet and escaped in their boats, which they dragged over the many low sand bars just beyond Point Barrow, between that place and the mouth of Mackenzie River. He returned to San Francisco in the bark *Florence*, which brought to our city over six hundred shipwrecked whalers. Mr. Hodgson has lived ashore

AMONG THE INDIANS AT PLOVER BAY,

And made six voyages all told into the Arctic. He also landed on Herald Island, which he describes as a barren rock, around which whales are usually plenty in October and November. The Innuits have told him that they have seen natives land on Herald Islands from canoes, to fish and also to

capture whales. He has seen Wrangel Land from a distance of thirty or forty miles, when ice intervened, and he describes the land as presenting the appearance of very high mountains, abreast of Herald Island, around which the water is shallow, but on the off shore side it soon grows deeper, and a little to the eastward there is a deep water channel through which a two or three knot current sets northerly. During the latter part of the season, the weather becomes overcast, just before the clear, cold Winter weather sets in. The *Rodgers* is provided with a full complement of sheep-skin clothing, and fur clothing will be procured, with dog teams, at Petropaulovsky. A car load of stores, delayed by the floods and washouts in the Platte Valley, and by the strike of railway hands in Chicago, will arrive on Sunday, and the expedition will sail at 10 A. M. on Tuesday next. Cases containing their entire outfit of rubber clothing were shipped long since by railroad from Washington, but as these have not arrived, and nothing is yet heard from them, the expedition will be obliged to sail without waiting longer for them. At Plover Bay, not far from where the schooner *Newton Booth* was wrecked, just behind the spit, opposite shoal water, there are still large quantities of telegraph poles and several thousand tons of coal, thought to have been landed there by the Collins overland telegraph expedition, and subsequently abandoned to the Russians.

THE CONTEMPLATED CRUISE

From San Francisco Lieutenant Berry will proceed with the *Rodgers* to Petropaulovsky, under sail, which, with a favorable chance, will require 25 to 30 days; thence he will cross to Saint Michaels, in Alaska, to coal; then to Saint Lawrence Bay and along the coast of Northern Siberia, communicating with the natives in the hope of gaining some possible intelligence of the *Jeannette*; thence from Cape Serge-Kamen, where letters will be left with some native Innuit or Tschukchi, northward to Herald Island, to land and hunt it well over for cairns. From here it is now the intention, if nothing definite is found to warrant a different course, to proceed toward the southern coast of Wrangel Land, along the shore discovered by Capt. Thomas Long in 1867, and by approaching as near as the ice will allow, to seek for a suitable harbor to winter the vessel. When the sea is frozen over and the ice hard and solid for the season, sledge parties will be sent out over the sea, along the shore line, following northward the East Coast of Wrangel Land, and should it prove practicable, the West Coast may also be thus examined. Unless Lieutenant Berry succeeds in obtaining information calculated to justify his remaining longer, it is his present intention to return here if possible by the second year, and the *Rodgers* may be due back any time after November or December, 1882, depending, however, on so many circumstances, that she is liable to be gone much longer. Probably the last letters she will attempt to send back to us, will be by either some whaling vessel, or by leaving them at Cape Serge, to be forwarded by native messengers to the nearest Russian outpost. The following is a list of the

OFFICERS AND CREW OF THE RODGERS:

Lieutenant Robert M. Berry, U. S. N., commanding United States steamer *Rodgers*, of the *Jeannette*

Search Expedition; Howard Scott Waring, Master, U. S. N., Executive Officer and Navigator; Dr. Meredith Dabney Jones, U. S. N., Passed Assistant Surgeon; William Frederick Halsey, Master, U. S. N.; Abraham V. Zane, U. S. N., Passed Assistant Engineer; Henry Jackson Hunt, U. S. N., Ensign; George Middleton Stoney, U. S. N., Ensign; Dr. Joaquin Demetrios Castillo, U. S. N., Assistant Surgeon; Colonel William H. Gilder, Pay Clerk, and New York *Herald* correspondent, [was with Lieut. Schwartzka's expedition to King William's Land.] Joseph Hodgson, Paymaster's yeoman and store-keeper; Scoby Willard Morrison, George Gardner, Jr., Patrick Cahill, machinists; Herbert P. de Tracy, acting carpenter. Also, 1 steward, 2 cooks, 3 firemen and 15 able-bodied seamen.

Lieut. Berry, the able Commander of the *Rodgers*, is a strong muscular, heavy but symmetrically built man, over six feet in height, of agreeable disposition, firm purpose, quick and thorough in the despatch of business, and very careful of details. As an accomplished officer of the United States

Navy, he is fitted by education, as well as by his character, pleasing manner, and deep interest in Arctic explorations and discoveries, to command such an expedition. It is rarely that a finer set of officers and men—all especially selected for this duty—are found aboard of any vessel, and they unanimously express themselves more than pleased with the *Rodgers* and her present outfit, as she swings at her anchor in our harbor anxious to be off on her errand of mercy and of hope.

Lieut. Berry's well-known experience in the *Tigress* while searching for the *Polaris* gave him an ardent desire to undertake the present voyage, in which he seems to take the deepest interest, in common with all on board. One officer said yesterday: "You could not hire me to remain behind."

From personal observation we are well satisfied that a prettier modelled and better fitted vessel never sailed on an Arctic exploring expedition. May every success attend her, and her brave officers and gallant crew.

EXTRACT FROM A LETTER

ADDRESSED TO THE

CALIFORNIA ACADEMY OF SCIENCES

BY

COL. CHARLES S. BULKLEY

Late Engineer in Chief of the Collins Overland Telegraph.

Having noticed the statement that, in the opinion of Dr. William H. Dall, no part of the Kuro Shiu or Japanese warm stream passes northward through Bering Strait into the Arctic Ocean, and claiming that the U. S. Coast Survey schooner *Yukon*, while in his charge, during the Summer of 1880, when anchored near the Diomedes Islands, in the narrows of Bering Strait, swung with the tide, permit me to say in regard to tidal currents in Bering Strait, that it appears to me that he must have anchored his vessel in some eddy caused by the obstruction which the Diomedes present to the almost constant northerly flow of water which I observed setting into the Arctic Ocean in the Summer and early Autumn of 1865, when I thoroughly sounded and examined most carefully the bottom, and especially noted the currents of this Strait, for information necessary in selecting a telegraphic cable bed for this crossing.

Again, in the Summer of 1866, the investigation was renewed, and numerous crossings were carefully examined at different times, and the same nearly constant current moving northward was ascertained and measured. This seemed an increasing flow of warmer currents only, and checked in its surface by strong North winds. Through Senevaine Strait, which is part of Bering Strait, separated from the main body of waters by Kayne Island, the same northward current pursues its steady way. Dr. Dall may easily, have been led astray, for swinging at anchor in the whirling waters, under the lee of great rocks, like the Diomedes, might readily mislead the most wary.

Very Respectfully,
CHARLES S. BULKLEY.

SAN FRANCISCO, Cal., June 6th, 1881.

THE TELEGRAPH IN ARCTIC REGIONS

BY

JAMES GAMBLE

General Superintendent of the Western Union Telegraph Company.

A PAPER READ BEFORE THE CALIFORNIA ACADEMY OF SCIENCES,
ON MONDAY EVENING, JUNE 6TH, 1881.

[From the *San Francisco Mining and Scientific Press* of Saturday, June 11th, 1881.]

A few weeks ago I made a suggestion that the telegraph be used in Arctic explorations. The views I expressed in relation to the matter were published in the *Evening Bulletin* of this city. They have elicited considerable attention and a good deal of comment, particularly in the East. The plan I proposed was in substance as follows:

To use light steel wire, say number 20 gauge, weighing about 20 lbs. to the mile. The wire, coiled on reels, could be hauled on sledges, either by men or dogs, over the snow or ice, paying it out as the advance exploring party went along. By this means the party would keep in constant communication with their base of supplies. They would have no cause for uneasiness about getting lost or beyond means of rescue, as they would be able at any moment to call for aid. With this feeling of the certainty of relief in case of accident, they would not hesitate to push their explorations to a distance far beyond what would be considered safe in the absence of means of telegraphic communication with the main body. And should any accident happen to the advance party of explorers, or should they require a further quantity of supplies, the line of wire would serve to guide those going to the rescue straight to the spot where the explorers were camped. It would also serve as a guide for their return, materially lessening the chances of danger to life and loss of the party. Having established a base of supplies at some central point there would be nothing to prevent

several exploring parties being sent out at the same time in different directions, they reporting each night to the central station the progress and observations made during the day. Directed in this way, the practicability of one route over another could, from the telegraphic reports sent in, be determined upon and much time that would otherwise be wasted in vain endeavors to make way over barriers of ice be saved.

As hard frozen ground, dry snow or ice, is a perfect insulator, no poles to string the wire would be required. It could be paid out on the snow or ice by the party as they went along. The generally accepted theory of those familiar with the Arctic regions, is that the ice is seldom more than six or seven ft. in thickness—Captain Hooper, in his report, corroborates this—so that by boring through it with a common drill, or through frozen ground, there would be no difficulty in obtaining a good ground connection to complete the electric current. It would not be necessary to carry any battery material. One main battery at the central station would be all that is required. For a distance of 100 to 150 miles telephones could be used, dispensing with practical telegraph operators. Still, it might be advisable to have some of the party possessed of a practical knowledge of telegraphy.

At 20 lbs. to the mile, 100 miles of wire would only weigh 2,000 lbs. It could be wound on reels in size easy to handle. The cost of steel wire of that gauge is about 20 cents a pound, so that the total expense, including cost of reels, winding, etc., would not exceed \$1,000. Among those who have been good enough to notice my suggestion and mani-

fest an interest in it, is Mr. George Kennan, of Washington, a gentleman familiar both with the telegraph and the Arctic regions, having been connected with the Collins Overland Telegraph Co. He assisted in the building of that line during the period of construction and afterwards made a journey through Siberia. In a long letter to the New York *Herald* of May 26th he enumerates a series of difficulties that stand in the way of any profitable results being derived from the use of a telegraph wire in the polar regions. His objections to the practicability of the scheme are founded as he himself states "on the inadequacy of existing transportation facilities."

It possibly may not have occurred to Mr. Kennan that an inventor, to realize his idea, does not content himself with such means or facilities as may exist, but will provide himself with those necessary to its realization if such are to be had. He says, "I understand that Lieut. Berry does not expect to take more than 25 dogs from Petropaulovski on the *Rodgers*." If I had used only 25 men in the construction of the overland telegraph line, the probabilities are that the overland line would not be finished yet. The poles at one end would have had time to rot away before the poles at the other end could have been set. If only a sufficient number of sledges and dogs are used to carry the necessary provisions for the party, then, clearly, there will not be room for anything else. But if more dogs and sledges are used—even Mr. Kenau admits this—there would be room to carry something else besides food for the party.

And in connection with this point, he overlooks the fact that, as the exploring party advances, the load of wire is every moment becoming lighter. It is lightening up at the rate of 20 lbs. to the mile, and if the party make two miles an hour, they are unloading 40 lbs. an hour. Within a week, 100 miles of wire would be paid out. If they started out with 200 miles the different sledges could unload in part alternately so that after having accomplished 100 miles, each sledge would only be carrying a half load. When again, some had entirely unloaded they could return to the base of supplies, the wire being their guide back.

"But," Mr. Kennan says in another place, "100 miles of wire, even if it could be carried without sacrificing every thing else, would be of very little use." That, in one sense, is a mere assumption, in another, it is incorrect. One hundred miles of telegraph would have been the means of saving many a life sacrificed to Arctic explorations. Ten miles is a very long distance in the Arctic regions, more than sufficient to prevent a famishing explorer returning to his party. To show the uselessness for exploring pur-

poses of 100 miles of wire or more, Mr. Kennan cites Lieut. McClintock's journey in 1853, of 1,200 miles, made on sledges with a party from the *Resolute*. Had Lieut. McClintock pursued this journey in anything like a straight line, he would have gone over the North Pole and down the other side. But as he did not do this, it is proper to suppose what in fact is a reality, that the 1,200 miles represent his wanderings forward and backward, hither and thither, on the ice between his leaving and return. The instance therefore cited by Mr. Kennan of 1,200 miles having been traveled and so little accomplished, so far as reaching a higher latitude is concerned, is a strong argument in favor of a telegraph wire. With it Lieut. McClintock and others who have succeeded him, would not have wasted so much time nor incurred so many risks to themselves and parties.

In point of fact, several hundred miles of wire could be taken as easily as 100 miles, the requisite number of sledges and dogs being provided—and without any difficulty whatever. Mr. Kennan says again: "It is very doubtful whether a steel wire of number 20 gauge could be unreeled from a sledge in a temperature 50° below zero without snapping at every turn of the reel." The doubt here expressed seems at first sight a reasonable one. I have, however, supplemented my own opinion on this point with that of one of the best authorities here on the effect of cold on metallic substances, and especially the effect of a very low temperature on iron, steel and other wires. Under intense cold hardened steel is undoubtedly rendered extremely brittle and will readily break when subjected to a blow. But steel wire can be annealed to a degree making it as soft as iron wire, and as easy to handle from a reel in northern latitudes as in warmer ones.

It should also be remembered that the uncoiling is not a snappy or jerky movement. It is not uncoiled any faster than the progress made by the party, and which is about two miles an hour. Moving forward steadily and not faster than two miles an hour, annealed wire could be uncoiled without any trouble or danger of snapping off.

Even in the event of a prejudice existing against steel wire, copper wire could be used. In suggesting steel, I did so simply because of its greater strength and cheapness. But did such a danger exist, as supposed by Mr. Kennan, of the snapping off of the wire at the turn of the reel under a low temperature, how was it then that the wire for those portions of the telegraph line built across Northern Siberia towards Bering strait, to connect there by means of a cable with the Collins overland line on this side was uncoiled? Several portions of that Siberian line were built and the

wire strung during the winter, with the thermometer ranging down to 50° below zero, Fahr. The line running along the head waters of the Anadyr river and along the Okhotsk sea was also built, the wire uncoiled and strung during the winter months. It was the only time of the year, in fact, it could most successfully be done, it being difficult to haul the loads of wire over that part of the country, owing to the wet and swampiness of the land during the other periods of the year. Col. Bulkeley, Chief of the Collins overland telegraph expedition is my authority for this statement. That part of the line from Plover bay to Bering strait was also built during the winter. These are facts that Mr. Kennan ought to be familiar with and which, had he recollected, would have prevented him advancing such objections as he has.

Mr. Kennan is a most intelligent gentleman, but I cannot help thinking that his observations on this subject are mainly the result of his imagination, and not of practical experience in regard to the utility or inutility of a telegraph line in Arctic explorations. You will recollect that when an overland telegraph line was first proposed in Congress it was considered impracticable. Among the earliest suggestions made was one by the Hon. Stephen A. Douglas, and notwithstanding that his plan was clearly elucidated, it was still considered an impossible scheme. The objections raised against the possibility of the construction were: Difficulty of transportation, scarcity of timber along the route, difficulty of protecting the line from Indians, and many others equally plausible and apparently well-grounded by those who made them. But in the face of all these objections and difficulties there were some who were willing to try and willing to risk their money in the construction of such a line. I need not ask you if they succeeded. You, who read in your newspapers, morning and evening, the dispatches from all parts of the world, know that they did. But it should be remembered

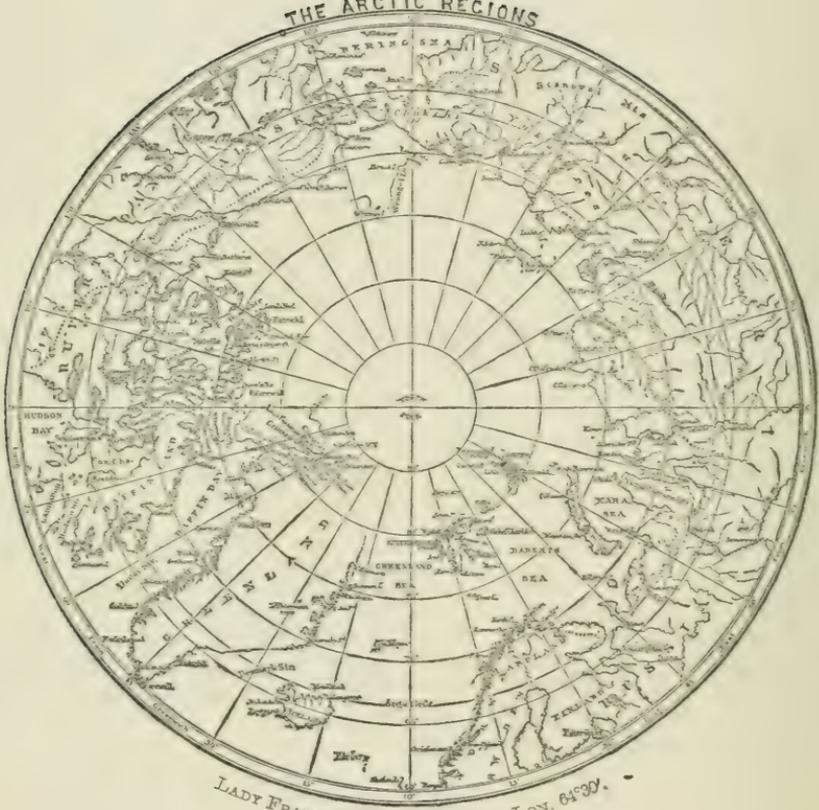
that they not only did succeed in constructing an overland telegraph line, but that through it they also succeeded in establishing the weakness and worthlessness of all the different arguments and objections raised against it when the idea was first suggested. But neither one nor the other would ever have been established had not a trial been made, and that is precisely what should now be done in respect to a telegraph wire in the Arctic regions.

The idea I have suggested is, I think, sufficiently important to merit a practical experiment being made. This can be done by Lieut. Berry, commander of the *Rodgers*, who honors us with his presence here to-night, and who is about to risk his own life and the lives of others in search of those who left on the *Jeannette*. If steel wire is rendered too brittle by the extreme cold, then try copper. There will not be any strain on either as strung out on the ice and there will be plenty of slack to allow for contraction. I can well understand that the greatest difficulty will be the transportation, but is it not worth while to make an effort to overcome this in order to better ensure the safety of the lives of the brave men who undertake the perilous task of exploring that unknown region? It will be impossible, from want of time, for Lieutenant Berry to have prepared a proper outfit for several hundred miles of wire. I would therefore respectfully suggest that he take with him a few miles of three different kinds, say 5 or 10 miles of steel annealed, iron, and copper wires, so as to try, during next winter, the effect of the cold on each. Telephones should also be provided, so that a practical experiment could be made of securing the necessary ground connections, etc.

Theory is not always correct; practical experiments furnish the most satisfactory proof of what can be accomplished, and the opportunity is now afforded to determine whether the telegraph can be utilized to aid in exploring the Arctic regions.

JAMES GAMBLE.

THE ARCTIC REGIONS



LADY FRANKLIN BAY, LAT. 81°40'. LONG. 64°30'.

EARLY MIGRATIONS.

ARCTIC DRIFT

AND

OCEAN CURRENTS

ILLUSTRATED BY THE DISCOVERY ON AN ICE-FLOE OFF THE

COAST OF GREENLAND

Of Relics from the American Arctic Steamer
"Jeannette."

BY

CHARLES WOLCOTT BROOKS

Member of the Academy.

Read before the California Academy of Sciences September 1st, 1884.

SAN FRANCISCO, CALIFORNIA:

Geo. Spaulding & Co., Printers.

1884.

ARCTIC DRIFT AND OCEAN CURRENTS.

ILLUSTRATED BY THE DISCOVERY ON AN ICE-FLOE OFF THE

COAST OF GREENLAND

Of Relics from the American Arctic Steamer
"Jeannette."

SCIENTIFIC IMPORTANCE OF THE SUBJECT.

It is a new and important fact, worthy of careful record by physicists of all nations, that ice-floes from north of Herald Island, opposite Bering Strait, dividing Asia from America, are drifted to the south-western point of Greenland in the Atlantic. The deep and constant interest manifested by this Academy in the American Arctic explorations of the *Jeannette*, which sailed from our port on July 8th, 1879, under command of Lieut. George W. De Long, U. S. N., and in the fate of her gallant crew, is well known to all scientific bodies throughout the world.

Humboldt, the father of modern science, that great and good man, when off the coast of Peru, first discovered the stream that bears his name. Both Humboldt and Sir John Herschel pronounced ocean circulation the greatest problem of terrestrial physics. Ocean currents, with inland water courses, have largely aided and often directed early migrations. Isothermal lines are not strictly coincident with parallels of latitude. Along the Atlantic seaboard of North America, a warm stream flows four miles an hour, which Dr. Croll tells us, conveys as much heat to northern Europe, as the entire Arctic regions obtain from the sun. Dr. Wm. B. Carpenter recently informed the British Association that oceanic currents flow northward into the Arctic, because cold water there sinks, and constantly stimulates the water from warmer regions to advance and fill its place.

Dr. Wm. H. Dall, U. S. C. S., attributes their presence to the inflow of warm fresh water, discharged by the large number of rivers flowing northward, and emptying in the vicinity of the polar basin. Atmospheric pressure, revealed by recent barometric tests, affords data for another plausible theory.

Dr. A. Geike has brought out discoveries in geology which merit consideration in the study of this subject. Earth is an oblate spheroid flattened $26 \frac{9.53}{1000}$ miles at the poles; but recent geodetic measurements show it to be an unsymmetrical form, whose equatorial circumference is an ellipse instead of a circle. Its greatest equatorial diameter at sea-level, where the vertices touch the surface in longitude $14^{\circ} 22'$ E. and $165^{\circ} 37'$ W., is nearly two miles longer than at right angles to it. How far inequalities of earth's form may disturb the equilibrium of its surface waters, and attract them by force of gravitation or some other power yet undemonstrated, is an inquiry pertinent to this subject.

Arcs of meridians have been measured, to determine with great accuracy the actual length of each separate degree of latitude from the Equator to the North Pole. These measurements show that the measured length of a degree increases with the latitude, and that a degree at the pole, where earth's surface is flattened one 300th part of its diameter, is now 3,662 feet, (0.694 of a mile) longer than at the increasing curvature of the protuberant Equator. Earth's form being now unsymmetrical, tends to keep its surface waters in a state of unrest. Many forces are continually laboring by different methods, to attain for these, a state nearer to equilibrium, thereby giving impulse to oceanic currents.

Mathew F. Maury, by an original system of classification, adopted in the U. S. wind and current charts, did much to attract a critical exploration of maritime currents. There may be a partial truth in all the many theories advanced. The voyages of the British ships *Lightning*, *Porcupine* and *Challenger*, United States' ships *Dolphin*, *Tuscarora*, *Fish Hawk*, and Swedish steamer *Vega*, have given us reliable data for scientific study; but a carefully preserved record of

the drift of waifs borne direct on ice-floes and along ocean currents, largely supplements our field of knowledge. The British discovery ship *Resolute*, one of Sir Edward Belcher's expedition, was abandoned Aug. 26, 1854, when frozen in, not far from Beechy Island, in lat. $74^{\circ} 40'$ N., lon. $90^{\circ} 45'$ W., and was picked up without a person on board by Captain Buddington, of the American whale-ship *George Henry*, Sept. 11th, 1855, in lat. $64^{\circ} 40'$ N., lon. $61^{\circ} 30'$ W., off Cumberland Sound, on the west coast of Baffin's Bay, just south of Davis Strait. She was brought to the United States, and by Congress presented to England. In 381 days she drifted eastward in the ice-floe fully 1,100 miles, averaging about three miles each day.

Another remarkable experience of Arctic drift was that of a party of 19 persons, including men, women and children, landed on an ice-floe of five miles in circumference, with boats, stores and provisions from the U. S. S. *Polaris*, Charles F. Hall, Commander, on October 15th, 1872, in lat. $77^{\circ} 35'$ N., not far from Littleton Island, when it was thought that vessel was about to sink. Upon this drifting floe they built snow huts in which they lived and kept their records and provisions. They were rescued by the barkentine *Tigress*, Capt. Bartlett, April 30th, 1873, in lat. $53^{\circ} 30'$ N., which vessel was engaged in sealing.

In the light of information now received, it appears quite certain that had the *Jeannette* proved strong enough to hold together, she would have sailed safely into New York early in the Spring of 1884, if not before. In proof of this opinion, the following facts are now reported as causing great surprise and much attentive study among scientific men in the United States.

HOW THE NEWS WAS RECEIVED.

On Friday, August 15th, 1884, the American bark *Fluorine*, Capt. Alexander Wilson, arrived at Philadelphia, —days from Ovigut, the port of shipment for the cryolite mines, situated a few miles north of Julians-haab, the principal place and seat of the local government of an extensive

district on the southern extremity of Greenland. It is a maritime station situated 110 miles N. W. of Cape Farewell, the extreme southern point of Greenland.

Just before sailing from Ivigtut, in July, 1884, an official dispatch, addressed to the Danish Consulate in New York, was handed him by the Danish Colonial Governor of Juliens-haab, who went at once to Ivigtut and gave the news to Capt. Wilson. Upon the arrival of the *Fluorine* at Philadelphia, Capt. Wilson promptly forwarded the dispatch to the Danish Consul, who kindly furnishes the following official translation, dated

[OFFICIAL COMMUNICATION OF THE DANISH GOVERNMENT.]

“THE COLONY JULIENSHAAB, IN SOUTH GREENLAND, }
 “June 23d, 1884. }

“*To the Danish Consulate in New York:*

“I hereby take the liberty to request the consulate to inform the editors of *The New York Herald* that on the 18th inst., three Greenlanders picked up on an ice-floe some effects, and some partly torn papers belonging to the American Arctic Jeannette expedition, among which are the following:

“1. Two end-pieces of a wooden box, on which are written with lead pencil, on one piece:

GENERAL ORDERS.	SHIP'S PAPERS.
TELEGRAMS.	VARIOUS AGREEMENTS.
SAILING ORDERS.	CHARTER PARTY.
DISCIPLINE.	

“The last words not very plain. On the other piece was:

BEFORE SAILING.

“3. A torn check book. On the back of one of the checks is printed, ‘For deposit with the bank of California.’

“4. A pair of oilskin trousers, marked: LOUIS NOROS.

“These effects, numbering twenty-one pieces (besides the papers), are in my possession. I am going home to remain during the winter. Should anybody want further information, the same can be obtain by addressing

“ KOLONIBESTYRER C. LYTZEN,

“ Kongl. Gronl, Handels-Kontor,

“ Kjobmhavn, K.,

“ Denmark.

“ Respectfully,

CARL LYTZEN.

When Capt. Wilson's report of the barque *Fluorine* was briefly telegraphed over the country, a few were at first inclined to doubt the truth of the report, but when fuller particulars were received, with the unqualified official endorsement of the Governor of Julians-haab to the Danish Consul at New York, and it was learned that the articles recovered would soon follow, the information thus became authoritatively vouched for, and is now attracting that deep interest it so thoroughly merits.

STATEMENT OF CAPTAIN WILSON.

Capt. Alexander Wilson, who now resides at his home, No. 2034 South Fifth street, Philadelphia, kindly furnishes us the following statement. He says: The superintendent of the Kryolite mines at Ivigtut first informed him of this highly important discovery. A party of Esquimaux were out among the floe ice, catching seal. Late in the afternoon of Wednesday, June 18th, 1884, they approached a piece which had attracted their attention, floating in latitude $60^{\circ} 36'$ north, longitude $46^{\circ} 7'$ west, where they found on a large piece of drift ice, the lower part of a tent, the upper part of which had been blown away by the storms of three Arctic winters; also the ends of a provision cask, and some stores marked “*Jeanette*”—a charter party “between S. B. Peterson, managing owner of the American schooner *Funny A. Hyde*, Capt. J. W. Jespersen, of San Francisco, California, and George W. DeLong, from Mare Island Navy Yard, to the port of St. Michaels in Norton Sound, Territory of Alaska, U. S. A., there for delivery to the Arctic steamer

Jeannette'—also a partially used check book on the Bank of California, with a package of cancelled checks, signed by Captain DeLong—a pair of oilskin trousers marked "Louis Noros," and a bear skin, covering something of the size and shape of a human corpse, which the Greenlanders did not remove to ascertain what was under it, owing to a native superstition rendering those temporarily unclean who handle the dead bodies of human beings.

On another piece of floe near by, quite a quantity of sailor's clothing was found. These relics the Esquimaux took to the Governor of Julians-haab, who immediately started, taking one of their number as a guide, to find the ice-floe and the supposed body; but after long search he was compelled to return without success, it having floated off.

We ought to know all about these relics in a short time. There are four American vessels at the little village of Ivigtut at present, loading with cryolite from the mines near that place, and some of them will follow the *Fluorine* very soon.

Capt. Wilson says he believes that Governor Lytzen will send all the things found on the floe to Ivigtut, in order to get them to this country as soon as possible. He wrote to the superintendent of the cryolite mines to send them to the United States on the first vessel which leaves.

"JEANNETTE" RELICS ACTUALLY LEFT ON THE ICE.

On Friday, September 5th, 1879, the *Jeannette* entered the ice pack, and became fixed in the floe, drifting northwardly past Herald Island, until she reached about latitude $73^{\circ} 50'$ north, longitude 180° . Then the drift turned into a more northwesterly course, and kept on in that direction until at 4 A. M., Monday, June 13th, 1881, the vessel sunk in 38 fathoms of water in longitude $154^{\circ} 58' 45''$ E., latitude $77^{\circ} 14' 57''$ N.

The *Jeannette* drifted steadily westward up to the time she sank, and the ice-floe on which these relics were found may have been one of those upon which her party took refuge just before she sunk. It is but natural to suppose that the floe kept on drifting westward, just as the *Jeannette* had been

doing. Her course, while wedged in the ice, is a true proof of a westerly current along this unexplored and shallow portion of the Arctic Ocean north of Siberia.

In Mrs. Emma DeLong's admirable publication of her brave husband's ship and ice journal (see Vol. II, page 578) a list of 170 pieces of clothing is given in detail, consisting of over-shirts, drawers, coats, trousers, fur and woolen blankets, skin-parkies, etc., which remained on hand after the party, then on an ice cake, were clothed, and their knapsacks packed with the regulation outfit for their journey southward. These, he says, "were divided among all hands as required, much of it being in excess."

Besides landing their boats, sledges, equipment of rifles and plenty of ammunition, *six* tents, provisions, including 3,500 pounds pemmican in 45-pound tin canisters, 1,500 pounds hard bread, canned meats, Liebig's extract, alcohol, tea, sugar, and all available equipments necessary for a retreat were securely placed on an ice-floe, distant 400 feet from where the *Jeannette* went down.

The floe bearing the *Jeannette* relics was found off Julian-shaab, the first Danish settlement on the coast, just below Ivigtut, on Wednesday, June 18th, 1884, just *three* years, or 1,076 days after Capt. DeLong and his gallant band broke camp on an ice-floe in Lat. $77^{\circ} 18' N.$, Long. $153^{\circ} 25' E.$ and started southward on Saturday, June 18th, 1881, hoping, as DeLong then wrote in his journal—"with God's blessing to reach the New Siberian Islands, and from there, make our way by boats to the coast of Siberia."

EXPLANATION BY ONE OF THE "JEANNETTE'S" CREW.

Under date of Newburyport, August 20th, 1884, Louis Philippe Noros, one of the survivors who reached Siberia with De Long's party in the first cutter, writes:—

"Before we left the *Jeannette* we carried on to the ice a lot of bear skins, which we spread out to form a floor, and in addition carried clothing, food, rifles, tobacco, etc. After the *Jeannette* was crushed we had to leave the bear skins, a lot of canned goods, cans, rifles, and 200 or 300 pounds of

tobacco behind, as we could not carry them all over the ice. We also left all the clothing except what we had on, and a suit of under-clothing, which we packed and carried in a knapsack. We carried *five* tents with us, De Long's party having two, Melville's two, and Chipp's one. I may possibly have left my sealskin pantaloons on the ice where the *Jeannette* went down, but my impression is that they were left with other clothing, ship's implements, utensils, papers, etc., in the cache left by De Long on the Siberian coast. We had four tin boxes, in which De Long kept the ship's log and valuable papers, two of which were left in the cache and two carried away by De Long when Quartermaster Nindermann and I started south for help. We also left in the cache a small bear skin, the only bear skin in the possession of the party after leaving the *Jeannette*. The account says that a *cask* of miscellaneous ship provisions was found marked *Jeannette*. Now the fact is, we did take some bread *barrels* out, but after putting the bread in bags and loading it on our sleds we left the empty barrels behind on the ice."

A native Greenlander's language may be deficient in words capable of such nice distinctions as the exact difference between our English use of the words *cask* and *barrel*. A large barrel may frequently, for purposes of general description, be called a *cask*. Noros further says:—

"What puzzles me most is how these articles now reported found could have remained on the ice so long. My experience taught me that all small articles placed on the ice in the arctic regions always attracted the sun and gradually melted down through the ice until lost to sight. Why, in a very short time a chip would be buried its own thickness under the ice by this peculiar process, and if the things found really belonged to the *Jeannette* something strangely wonderful seems to have providentially kept them so long a time on the surface of the ice."

WHAT DE LONG'S DIARY EXPLAINS.

Some explanation of the above may possibly be found in Capt. De Long's carefully written and minutely accurate

diary (Vol. II, pages 588 *et. seq.*) where is inserted the copy of a digested synopsis of the cruise of the *Jeannette*, up to her foundering, dated on the ice-floe, Friday, June 17th, 1881, and signed by him officially. This, it is recorded, he prepared and sewed with great care in a piece of black rubber, rendering it as impervious to moisture as possible, and caused the whole to be headed up, inside of an empty water-breaker, or small cask used for carrying water in boats. When thus securely packed, he left it with the debris of their first camp on the ice-floe to which they escaped when their vessel sunk. Capt. De Long must have observed the tendency of small articles to work their way into the ice, and it seems more than likely, that in accordance with the especial care otherwise manifest in regard to this precious record, that he had it covered over before his departure. with some of the clothing, bear skins and other material, which Noros states was left behind on the ice-floé. If covering a large surface of ice with a thick covering would protect it, what course seems more natural for a careful and scientific commander to pursue. This may account for its preservation for so long a period, in good condition.

The men first camped in *six* tents, on the ice-floe, which De Long describes (Vol. II, page 582) as follows: Tent "A., Headquarters; B., De Long; C., Chipp; D., Melville; E., Danenhower; F., Ambler;" in front of which were placed three boats and four sledges. Accepting the statement now made by Noros, "that the party carried south *five* tents, De Long's party having two, Melville's two, and Chipp's one," it is apparent that, as De Long records, *six* as landed on the ice-floe, *one* must have been left there when the retreat began.

This accounts for the partly destroyed tent which Captain Wilson says was found on the floe. He reported that the natives saw a bearskin covering something resembling in size and shape a human corpse. This probably covered some provisions which could not be carried and were abandoned on the ice, and he fully "believes that what was covered up under the bear skin, was only apparently in the

shape of a human body." May it not have been a long water-breaker? Chief Engineer Montgomery Fletcher, U. S. N., informs us that many of such a form were included in the outfit of the *Jeannette* when she left the U. S. Navy Yard at Mare Island, Cal.

FORCE AND DIRECTION OF CURRENTS.

Captain Wilson states that he "thoroughly believes that the articles on the piece of ice found off the coast of Greenland really floated there—borne by the identical cake of field ice upon which the *Jeannette* party encamped after the sinking of their vessel, and upon which they apportioned their outfit, and abandoned all that was unnecessary to sustain life," taking what they could, and leaving the remainder, before starting southward upon their retreat. Capt. Wilson has been on whaling ships cruising in Arctic seas for more than thirteen years. He says there is nothing improbable in this, as he knows from frequent experience that "there is a polar current found as high as eighty degrees North, which runs in a southwest direction closely along the coast of Greenland, then turns at Cape Farewell and flows thence northeasterly along the western coast of Greenland up Baffin's Bay."

Capt. Charles B. Dix, one of the owners of the *Fluorine* fully agrees with Capt. Wilson that these relics could not possibly have drifted eastward, down through the intricate series of channels leading into Baffin's Bay, and thence across Davis Straits, to the point near the coast of South Greenland where they were found. Such a circuitous route, through McClure's Strait, south of Parry Islands, and thence eastward through Lancaster or Jones' Sound into Baffin's Bay, involves a complicated drift of over five thousand miles, over 17 degrees of latitude and 149 degrees of longitude.

Capt. Wilson further says: "The ice would thus be taken between Nova Zembla and Franz Josef Land, where a strong westerly current sets against Spitzbergen, and thence southerly around Spitzbergen, where an indraught of the Gulf Stream gives a northern direction to the current. This northern course continues to nearly latitude 80°, longi-

tude 10° east, where it meets the southward current pouring from the Polar Ocean and is carried down the east coast of Greenland. Of the portion of the journey which the ice-floe probably took I can speak from my own knowledge, as I have sailed along there myself, and the ice is carried southward on the current parallel with the Greenland coast at the rate of about twenty-five miles a day. When the ice got to Cape Farewell it was, very likely, carried around that corner of Greenland by Gulf Stream influence, and floated to the very spot where it was found. In performing this journey the relics of the *Jeannette* went over forty-five hundred miles in one thousand and ninety-six days; allowing for all the twists and eccentricities which the currents may be subject to. This would give the floes an average traveling time of about four nautical miles a day, which is just what took place.

OPINIONS EXPRESSED BY DISTINGUISHED MEN.

Dr. Emil Bessels, the Arctic explorer and well known geologist of the Smithsonian Institution, at Washington, was at first in doubt in regard to the brief telegraphic report, but upon receipt of fuller details he gave as his opinion that to reach that point, the floe on which they were found must have drifted along the northerly part of the known coast of Greenland, and have been carried by the East Greenland ice stream, which doubles Cape Farewell, around that cape into the vicinity of Julianshaab. The currents in Baffin's Bay and Davis Straits are such that the cold current which doubles Cape Farewell runs to the northward on the inside of a branch of the Gulf Stream drift, which probably does not extend further north than Disco. He says most emphatically that "the floe *could not have come down Baffin's Bay* to where it was found, as the currents issuing from Smith Sound, Jones Sound and Lancaster Sound, closely follow the eastern shores of the North American Archipelago, bending—as all southward currents do—to the westward. Whatever channels the ice floe had come through it would necessarily have followed the course of currents along its route."

Chief-Engineer Melville, one of the survivors of the *Jeanette* expedition, after analyzing all data obtainable from the U. S. Hydrographic Office Reports, with a careful scrutiny and comparison of arrows, indicating the currents observed by various navigators and distinguished geographers, and being personally familiar with the Arctic literature in general, and the drift of the *Jeannette* up to her loss, has expressed his carefully determined belief that the drift from where they left the vessel would eventually have taken her safely out had she remained staunch and intact, proceeding south-easterly past the southern end of Franz Josef Land, thence moving at a very rapid rate when the pack impinged upon that group of land, and continuing on in the current, passing south of Spitzbergen, around Bear Island into Atlantic waters.

He says before the *Jeannette* sunk, they all felt sure their vessel would continue to drift northwest during the coming year, they having then got out of that region of Arctic doldrums, as far as drift is concerned, which whirls ice around in circles, in a locality just north of Wrangel island. The Arctic seems to be a very shallow ocean, largely studded with an island archipelago, and on the Pacific side many indications point to the possible existence of a small Arctic continent surrounding the physical pole. The greatest depth encountered by the *Jeannette* during her first year's drift was not over sixty, and the least seventeen fathoms. The bottom from which was taken many meteoric specimens, was generally uniform, averaging about thirty fathoms only. The *Jeannette* had already drifted more than half way to the longitude of the river Yenisei, a point on the northern coast of Asia visited by steamers from Hammerfest in Norway, belonging to Alexander Siberiakoff, an enterprising Russian merchant, who trades there for wheat and other local products.

Professor George Davidson, President of this Academy, who, as Assistant in charge of the Bureau of the U. S. Coast and Geodetic Survey in this city, and author of the Alaska Coast Pilot published by the U. S. Government, has devo-

ted years of patient toil to the consideration of Arctic and kindred currents of the North Pacific and Atlantic Oceans, is as well qualified to express an opinion on such matters as any one on our Coast. He says: It would seem highly probable that the preservation of these De Long relics may have been effected in this wise. After the party left the floe in boats, all relics that remained may have been covered with a blanket of snow, and thus preserved from immediate shifting or loss. This, with subsequent snows and rains, would form a *névé* or snowy body of ice, overlying them, which may have thus remained, not only all the next summer, but have been added to the following winter, more especially if the floe followed a track in the general direction of the pole, keeping thereby in a region of intense cold. This method of preservation, must have been repeated, until the floe passed into currents bearing it southward; where, encountering a warmer temperature, the protective covering of ice or *névé* would melt away three years' deposits, and just at such an opportune period, the party of Greenlanders appeared to witness these relics, and rescue all but the water-breaker, or other stores under the bear-skin and partially destroyed tent.

Nordenskiöld, the first circumnavigator of the continents of Europe and Asia, by this northwestern passage along the Arctic circle, has given us large additions to our knowledge of Arctic phenomena. He says, "In geology a knowledge of Arctic lands is an indispensable condition in determining the former history of our globe." So in physical science, a thorough knowledge of Arctic currents is needed as a key to unlock many an important question, now clouded with uncertainty.

Alfred Russel Wallace, in his work, *ISLAND LIFE*, says it is highly desirable to estimate the amount of heat stored up in currents of warm water, which proceed from the tropics to north polar basins by many large streams and rivers; and by a continual process of gradual equalization, under a dry non-conductor of ice, these operate to a certain extent in ameliorating the rigors of an Arctic winter.

Mr. Clement R. Markham, the distinguished Secretary of the British Royal Geographical Society, after commenting on the unfortunate misadventure and valuable results of the Greely expedition, expresses his firm belief that "Polar research will now continue more vigorously and wisely until this much needed scientific work has been completed."

POLAR EXPEDITIONS CONTEMPLATED AND UNDER WAY.

The Danish government expedition under Liënt. Jensen, of the Royal Navy, left in May to explore the west coast of Greenland, and is expected to return to Copenhagen in October. A similar expedition under Lieut. Holm, is about proceeding northward along the east coast of Greenland, and a third botanical and zoölogical expedition, under Prof. Warming, has left Denmark for West Greenland.

Through these channels we may receive additional information from the De Long records, left afloat in the direct water-breaker.

Another Danish Polar Expedition will start from Copenhagen for the frozen Northwest next summer, proceeding by the way of Franz Josef Land. It will be under the leadership of Lieut. Andreas Hovgaard, R. N. of *Vega* Expedition conjointly with Gamel.

Russia is also organizing a Polar Expedition. From St. Petersburg, under date of August 27th, 1884, we hear that the ministry of marine has issued to several learned societies a plan for a Russian Polar Expedition. The idea is to have several large parties start from Jeannette Island and proceed entirely on foot across the ice, leaving large depots of provisions in their rear. It is thought there are many islands north of Jeannette Island that could be utilized.

Lignite, suitable for fuel, is there found cropping out at the surface in large quantities, also offering facilities for manufacturing gas necessary for use in captive balloons. This is much needed for observations to determine what route to take, and for a general topographical reconnoissance.

Nordenskiöld is contemplating an expedition to explore the Antarctic continent.

The object of the Greeley expedition was to establish one of the thirteen Polar stations, suggested by Lieutenant Weyprecht, of Austria, who discovered Franz Josef Land. Simultaneous observations of all physical phenomena were taken. The complete programme was arranged by an international Polar congress, in which representatives of thirteen nations took part. Observation in which the greatest possible accuracy was to be had were those of declination and deviation of the magnetic needle, height of barometer, temperature of the air and sea, mean and maximum rise and fall of tides, the drift of ice-floes and the direction of currents. All geographical and other explorations were incidental to the main objects of the expedition.

SOME RESULTS AND SUGGESTIONS.

Arctic research, which has advanced about three hundred miles northward since Baffin immortalized himself in the year 1616, will now be more carefully and skilfully undertaken, by the practical application of wisdom gained through experience.

From a scientific standpoint the American Expedition at Lady Franklin Bay in lat. $81^{\circ} 40'$ North, has accomplished noteworthy results. One of its geographical successes "is the attainment of a higher latitude than that reached by Capt. Markham in the British expedition of 1875-6. This feat was achieved by Lieut. Lockwood and Sergeant Brainard on May 13th, 1882, who reached an island off the coast of Greenland in lat. $83^{\circ} 25'$ N., long. $44^{\circ} 05'$ West, from the summit of which, when 2,000 feet high, they saw no land to the northward, but at the northeast a cape, which they named Robert Lincoln, in lat. $83^{\circ} 35'$ N., long. $38^{\circ} 32'$ W. It will be remembered that Captain Markham's farthest was $83^{\circ} 20' 26''$ North, and about 20 degrees of longitude west of Lieut. Lockwood's farthest point.

Greeley makes the suggestive announcement, that at Lady Franklin Bay Lat. $81^{\circ} 40'$ N., Long. $64^{\circ} 30'$ W., the tides rise and fall 8 feet, and come from the north. They average 29° above zero Faht., which is two degrees warmer than

those at Melville Bay and Cape Sabine, where the tides come from the south.

Lockwood found at $83^{\circ} 25' N.$, about the same vegetation as at Lady Franklin Bay, and is confident that with a sufficient supply of provisions they could have reached Lat. 85° North.

All the official records of the Greely Arctic expedition, including the sledge party under Lieut. Lockwood, as well as the private journals of the entire party, are now in the hands of Lieut. P. H. Ray, lately in charge of the U. S. Meteorological Signal Station, Point Barrow, Alaska. He will compile a detailed history of the expedition, which, it is expected, may be ready for publication soon after adjournment of the next Congress.

In conclusion allow me to suggest a new and automatic method of ascertaining the drift of Arctic currents, without any undue exposure of human life. Could not an hundred or more properly constructed casks, capable of withstanding any probable ice pressure, be branded with the date and position in which they may be set adrift, coupled with a request to have all particulars of their discovery sent immediately to Washington?

CHARLES WOLCOTT BROOKS.

THE ARCTIC REGIONS



LADY FRANKLIN BAY, LAT. $81^{\circ}40'$. LON. $64^{\circ}30'$.

EARLY MIGRATIONS.

EARLY DISCOVERIES

OF THE

HAWAIIAN ISLANDS

IN THE NORTH PACIFIC OCEAN:

EVIDENCES OF

Visits by Spanish Navigators during the XVI. Century

BY

HENRY A. PEIRCE

Ex-Minister Resident of the United States of America, at Honolulu, Hawaiian Islands.

ETHNOLOGICALLY CONSIDERED

With introductory remarks, when read before the California Academy of Sciences, June 7th, 1880.

BY

CHARLES WOLCOTT BROOKS.

SAN FRANCISCO, CALIFORNIA:

Re-Printed from the September Number of The "Californian" Monthly Magazine.

1880.

EARLY DISCOVERIES OF THE HAWAIIAN ISLANDS.

At the regular semi-monthly meeting of the California Academy of Sciences, held on Monday evening, June 7th, 1880, the President of the Academy, Professor George Davidson, occupied the chair.

In regular order, after the dispatch of current business, the following remarks were made by Charles Wolcott Brooks, a member of the Sections of Ethnology and Oriental Literature, introductory to the reading of a paper on the "Early Discoveries of the Hawaiian Islands," prepared for the Academy at his request, by Honorable Henry A. Peirce, Minister Resident of the United States of America, at Honolulu, Hawaiian Islands, from 1870 to 1878:

INTRODUCTORY REMARKS.

The many interesting problems of ethnology, which arise while tracing the early migrations of races, have led us to consider the scattered fragments of an ancient people, whose descendants may now be traced over large groups of islands in the Pacific Ocean.

A careful study of co-related evidence, leads us to a firm belief that the present bed of the Pacific Ocean was once an area of earth's surface above the level of the sea, and became submerged by some of the many spasmodic catastrophes, when the resistance of the outer crust was overcome, and the equilibrium of earth's forces temporarily disturbed; involving conditions which depressed new beds for water, and while establishing new water-lines as the boundaries of continents, necessarily formed islands of peaks and mountain summits, lofty enough to remain unsubmerged.

Such a Polynesian Continent, was undoubtedly inhabited by early ancestors of the North American Indian, the Japanese, the Hawaiian, and the broader classification we term the Malay race. All races at the present day, are to a certain extent, composite or mixed races; but a majority of the present Hawaiian blood is probably descended from the ancient Malay race, which formerly inhabited a vast continent, which many thousands of years ago, was broken up and depressed, amid one of those mighty physical convulsions, which have at long but systematic periods of interval, changed the form of continents, by upheavals and depressions of large but local areas of the earth's outer crust. Such violent changes of elevation in the surface of the earth, closing periods of extraordinary electric or attractive tension, and taking place under the general exercise of natural laws of contraction, when the necessary equilibrium between the external and internal forces, acting on the outer crust of our planet had been lost; could not have raised up high table lands and lofty mountain ranges, without simultaneously submerging large continental areas, whose mountain summits remain to us as oceanic islands.

The coincidence of astronomical epochs of extraordinary planetary attraction, with wide and extended cataclysms, involving changes in the outer surface elevation of our planet, is a subject of the deepest moment, and well worthy the most intelligent study of practical scientists.

Mr. Peirce has a thorough knowledge of the Hawaiian language, having learned it fifty-five years ago, when he first landed upon those islands, in 1825, since which time he has resided there nearly a quarter of a century. He conversed freely with many intelligent natives, who were present and witnessed the landing of Captain Cook. His sources of exact information, are therefore not only exceptionally good, but are also most trustworthy and reliable. He has called to my attention, many Hawaiian customs, which are of Spanish origin. Taro plants are cultivated in terraced plots of ground as in Japan. In former times, professional tradi-

tionists existed at the Hawaiian Islands, who were chosen, or held appointment by birth; and their trained memories were exercised to repeat in exact and undeviating words, the ancient history of the nation, and in like manner, hand it down to others similarly trained. Hawaiian natives formerly had a cut stone image, of a man resembling a European, and wearing a cue. This, Mr. Peirce informs me, was either broken up, or thrown into a pond or the sea, when missionaries had all their idols destroyed.

Later intermixtures of races, may be traced by a careful study of traditional histories, among the different groups of the Polynesian Islands; which should be carefully collected and preserved, before the impending changes of civilization, now moving westward, and permeating the whole area of the Pacific, allows them to fade from memory, or pass beyond the recovery of scientific research.

To perpetuate such testimony of certain historical facts relating to the Hawaiian group of islands, Mr. Brooks then read the following detailed account, prepared by Mr. Peirce, of various voyages known to him, where the early navigators of modern, or commonly called Western Nations, reached the Hawaiian Islands.

MR. PEIRCE'S PAPER.

To the people of California the Hawaiian Islands have an especial interest, and the future relations of this charming group are likely to prove of great national import to residents of this entire continent. In geographical location they occupy a direct navigable line between the Pacific States of the American Union and the British colonies of Australia and New Zealand, as well as the rich and populous countries of Asia. Their natural position is a strong strategic point, highly important to the United States of America in the event of foreign war.

To the Christian philanthropist they have presented an interesting field during the labors of earnest American missionaries, sent out in 1819 by the American Board of Commissioners for Foreign Missions, and since maintained for over sixty years by expenditures exceeding one million of dollars, cheerfully contributed in the cause of human advancement. The success which has resulted from this national expression of Christian enterprise is known to all the world. The Hawaiian people are indebted to the American missionaries and American residents at their islands for their present advanced condition in general civilization, christian knowledge, constitutional government, wise and just laws, and even for the preservation of their national independence when formerly assailed by both France and England.

To the scientist they present many highly instructive natural records in the evolutionary history of the earth we inhabit, and their race and language offers an interesting ethnological problem. Many ancient records and prehistoric traditions, unless now carefully noted with a view of perpetuating testimony, will soon pass beyond the reach of future historians.

The beautiful and fertile group of tropical islands composing the Hawaiian Kingdom is situated in the North Pacific Ocean, between 19° to 22° north latitude, and 156° to 159° longitude west from Greenwich, averaging about two thousand miles south-westerly from the coast of California. When the principal islands are officially referred to, by the Hawaiian Government they are written: Hawaii, Maui, Oahu, Kauai, Molokai, Lanai, Niihau, and Kahoolawe. Besides these may be found a number of smaller and comparatively unimportant islets, such as Kaula, Molokini, etc., the least of which are mere rocky or coral reefs, but slightly elevated above the ocean level. When speaking the above names, each vowel is pronounced as one syllable, and the broad accent of European continental languages is given. British geographers formerly spelled these names phonetically, employing vowels as pronounced in English, which accounts for an apparent confusion when written by them—Owhyhee, Mowee, Woahoo, Atooi, etc.

By whom were these islands first discovered? The celebrated English navigator, Captain James Cook, visited them in 1778, and by him they were given the foreign name of Sandwich Islands, in honor of his patron, the Earl of Sandwich, at that time First Lord of the British Admiralty.

The honor and credit of having been the first European to discover this group of islands has hitherto been popularly accorded to Captain Cook. But it is now well known that the fact of their existence was ascertained by Spanish navigators more than two centuries before Cook saw them, and that knowledge was carefully concealed from all other people by the Spanish Government, whose jealous national policy was to selfishly prevent Spanish explorations and discoveries in the Pacific Ocean from becoming generally known. In the history of Captain Cook's third and last voyage it is related that the ships of his expedition, on leaving Christmas Island, steered to the north and westward, and on the 18th of January, 1778, at day-break, they first sighted one island, and, soon after, another. The first land-fall subsequently proved to be the island of Oahu, and the second, Kauai, both portions of the Hawaiian group.

Captain Cook anchored his ships in the Bay of Waimea, on the south side of the island of Kauai, and at that place his free and amicable communication with the natives first commenced. Some pieces of iron were then observed among the islanders, and great avidity was shown by them to procure more of this metal from Cook's officers. He thereupon erroneously concluded that the natives had never seen Europeans before, as they seemed to him unacquainted with any foreign article except iron, which metal, he argued, they might have obtained from Spanish vessels wrecked on the coast of New Spain or Mexico during the past two hundred years, fragments of which may have drifted to Hawaii. Helmets, resembling in form those of ancient Romans, and feather cloaks, similar in shape to those worn in Europe in the seventeenth century, were also seen among the natives. Both articles, as it is now believed, were rude copies of some similar ones originally introduced among the islanders by shipwrecked Spaniards. No iron of any kind exists in the soil or rocks of these islands, and such pieces of iron, with a knowledge of their use, could only have come from some kind of foreign intercourse with a nation of civilized artisans.

From Kauai and Niihau, Captain Cook sailed for the north-west coast of America; and on his return from thence, in November, 1778, he discovered the islands of Maui, Hawaii, and other islands of the group. Captain Cook was killed by the natives on Sunday, February 14, 1779, at Kealakeakua Bay, on the island of Hawaii. He remarks in his journal as follows:

"Had the Sandwich Islands been discovered at an early period by the Spaniards, there is little doubt they would have made use of them as a refreshing place for the ships that sail annually from Acapulco to Manila, and also by the English buccaneers, who used sometimes to pass from America to the Ladrone Islands."

Now, it is singular, and almost incredible, that Captain Cook should have had no knowledge of the existence of the Hawaiian group anterior to actually seeing them himself.

For twenty-eight years before Cook sailed from England on his last voyage of discovery, there had existed a work entitled "The History of Lord Anson's Voyage around the World, during the years 1741 to 1744." Edited by Richard Walter, Chaplain of H. M. Ship *Centurion*. Published in London. 1748." A copy of the first edition of the book is now to be seen in the Mercantile Library of San Francisco, California.

The *Centurion*, under Anson, sailed northerly along the west coasts of South America and Mexico, and on the way up captured several Spanish towns and merchant vessels; but being unsuccessful in meeting off Acapulco the Spanish galleon periodically sailing for Manila, the *Centurion* thence crossed the Pacific Ocean to Macao, in China; and from Macao she sailed to cruise off Cape Espiritu Sancto, Philippine Islands, where, in June, 1743, she fell in with the Spanish galleon, then *en route* from Acapulco to Manila; and, after a bloody engagement, Anson succeeded in capturing her, with the usual treasure and goods on board, to the value of over two millions of dollars. Several drafts and journals were also taken with the galleon, and thus came into possession of the British government as early as 1744. With them was a manuscript chart, drawn for the use of the Spanish General and Pilot-Major of the vessel. This chart contained all the discoveries which had, at any time, been made in the navigation between the Philippine Islands and New Spain, or Mexico; an engraved copy of which is given in the account of Lord Anson's voyage, inserted between pages 94 and 95, Book I., published in London thirty years before Cook's visit. The situations in the eastern part of the chart are, however, laid down ten degrees of longitude too far east, while the

western part of the same is correct in its longitudes. To account for this singular error, it is conjectured that the galleon's chart above referred to, was in two or more separate parts, as was generally the case with early Spanish charts of the wide Pacific Ocean; and that the English editor, or engraver, in joining them, mistook the divisions, by including a margin of ten degrees at the point of contact in mid-ocean.

In the galleon-Anson chart, we find delineated the following islands, with their Spanish names, previously given them by Spanish discoverers, laid down absolutely correct in latitude, and also in longitude if the ten-degree error above alluded to is allowed. These islands comprise a part of the Hawaiian group, and are truly described. No other land exists for ten, or even for fifty, degrees due east of them; neither is there any land to the west, in the same latitude, for a still greater distance. The islands are there named:

La Mesa, or the Table. The name is accurately descriptive of the island of Hawaii, with its high table land.

Los Desgraciado, or the Unfortunate. Probably so named by Spaniards, who may have visited the island and had some fatal encounter with its inhabitants. This island, called Mowee by Cook, is spelled Maui by the natives.

Los Monges, or the Monks. Three islands, lying near each other. Their native names are Molokai, Lanai, and Kekahelaua.

The islands of Woahoo and Atooi of Cook do not appear on this galleon's chart, but in some old Spanish charts they are laid down approximately correct. A table of situations, printed in Manila in 1734, by Cabrera Bueno, Admiral and Pilot-Major in the navigation between the Philippine Islands and Mexico, and published forty-three years before Cook's first visit and discovery, gives the positions of the Hawaiian Islands very nearly correct.

Spanish navigators in the Pacific were accustomed to reckon their longitude from the meridian of the Emboc of San Bernardino, one of the Philippine Islands; thence counting and running eastward to the coast of Mexico, called by them New Spain.

It has been asserted by the Spanish authorities of Manila, that in the archives of the government at Madrid are to be found original charts of Spanish discoveries in the Pacific Ocean, made during the sixteenth and seventeenth centuries. And they show that "Gaetano," a Spaniard, discovered several of the Hawaiian group of islands, as early as the year 1542; and that "Mendana," another of Spain's navigators, discovered Kauai, the most western island of the same group, in 1567, or 235 and 210 years respectively before Cook's first visit.

In three maps, accompanying the geographical work of Charles T. Middleton, published in London in 1777, the year following that in which Captain Cook sailed on his last voyage, and during which he first saw the Hawaiian Islands, their Spanish names are given, and the group is laid down approximately correct in situation. This proves conclusively that the knowledge of them existed in England before any news of their discovery was received from Captain Cook's exploring expedition.

"Honest Bernal Diaz," in his "True History of the Conquest of Mexico," written in 1568, says:

"While Marcos de Aguilar had the government of New Spain, the Marquis de Valle (Cortez) fitted out four ships at Zacatula. The squadron was commanded by Alvarado de Saavedra, who, with two hundred and fifty soldiers, took his course for the Moluccas, Spice Islands, and China. He set sail in December, 1527 or 1528, and sustained many losses, misfortunes, and hardships on the way to the Moluccas Islands. I do not know the definite particulars; but three years afterward I met with a sailor who had been on board of this fleet, and who had told me of many strange and surprising things of the citizens and nations he had visited during his voyage."

From other sources we learn that but one of the four ships of the squadron above referred to reached her destination. The other three were lost on the way. Bernal Diaz further relates that

—"in the month of May, 1532, Cortez sent two ships from the port of Acapulco to make discoveries in the South Seas. They were commanded by Captain Diego Hurtado de Mendoza, who had the misfortune of a mutiny among the troops. In consequence thereof, one ship, of which the mutineers took possession, returned to New Spain, to the great disappointment of Cortez. As for Hurtado, neither he nor his vessel was ever heard of again."

To throw some light upon the probable fate of the missing ships referred to by Bernal Diaz, some traditions of the people of the Hawaiian Islands are herewith presented. Of these, the writer acquired reliable knowledge during his twenty-two years residence at these islands, which first began in 1825. They relate that, in ancient times, two foreign vessels were wrecked on the island of Hawaii (Owhyhee of Captain Cook), one on the south-west side, at Keei, near the Bay of Kealakeakua, not far from the place where Captain Cook was long afterward killed; and the other, on the east side at Kau, district of Puna. These events occurred during the reign of Kealiokaloa, King of Hawaii. He was the thirteenth sovereign, anterior to the reign of Kamehameha I., who came upon the throne in 1792. If twenty years is reckoned as the average duration of life for each of these thirteen kings, we have an aggregate of two hundred and sixty years, which, deducted from 1792, gives the year 1532 as the approximate time of King Kealiokaloa's reign, and also about fixes the date of the wreck of the two ships.

Therefore, it is highly probable that those vessels were some of the missing ones of the respective expeditions fitted out by Cortez in 1527 and 1532, for European vessels on the Pacific Ocean were comparatively few in those days.

Upon the island of Hawaii there is to be found at the present time a mixed race of people, whose ancient family traditions point with pride to some foreign origin. They are said to be the descendents of shipwrecked Spaniards, and the careful scrutiny of expert scientists tends to confirm this native tradition. They have sandy colored hair, and are of lighter complexion than the native Hawaiian race, who call them "ehus"—possibly a corruption of the Spanish word *hijos*. The Hawaiian language contains several words of unmistakable Spanish derivation. Other traces are perceptible in some of their customs and inherited ideas.

Another tradition is, that during the same king's reign (Kealiokaloa) a boat came to Hawaii from *abroad*—that is, "from Tahiti or foreign parts," as expressed by the natives—in which was a foreigner of rank and importance. He remained there many years, and acquired great influence over the Hawaiians, by whom he was much beloved and regarded as a very high chief. He took for wife a native princess, and by her had posterity. After the lapse of several years he built a boat, and then embarked in her with all his family, and sailed for a foreign country, previously, however, giving a promise to return to Hawaii at some future time. It is conjectured that this important person may have been Captain Diego Hurtado de Mendoza, commander of the expedition fitted out by Cortez in 1532, and which Bernal Diaz, the historian, says was never again heard of after the mutiny on board of his ship, and the return of his other vessel to New Spain. This interesting foreigner, be he whom he may, was called by the natives *Olono*; and in process of time divine honors were accorded to his memory. When Captain Cook visited the island of Hawaii in 1778, he was believed to be the *Olono* of Hawaiian tradition, their ancient god, who had returned; and to Cook, it is well known, the natives paid divine honors—for receiving which that navigator has been highly censured by the Christian world. The discovery that he was really a mortal, when the natives witnessed his suffering by reason of a wound, was the immediate cause of their putting him to death.

Hawaiian traditions further testify to the fact, that during very remote times many boats or vessels, with white men in them, have, at long intervals, visited these islands. The crew of one such, it is said, remained permanently, and intermarried with native Hawaiians. In 1740 the King of Oahu, while in a canoe going thence to the island of Maui, saw a foreign ship at sea.

Many years elapsed after Cook's visit before Europeans again visited these islands. The celebrated French navigator, La Perouse, touched at them in 1786, as also did Portlock and Dixon, in the same year, with the British ships *King George* and *Queen Charlotte*. Captain Mears followed them in the ship *Nootka* in 1788. The ship *Eleanor*, of Boston, in 1790, was the first American vessel that visited the Hawaiian Islands; followed, subsequently, by several other vessels of that nationality, all of which were engaged in the lucrative fur trade of the north-west coast of America. In 1794, the American schooners *Jackall* and *Fair American* discovered, and were the first to anchor, in the harbor of Honolulu. Both vessels were captured by the natives, who massacred the principal part of their crews.

The American brig *Lady Washington*, Captain Kendrick, and the British ship *Butterworth*, of London, were at anchor in Honolulu harbor, July 4, 1794. During salutes being given by both vessels, in commemoration of American Independence, Captain Kendrick was struck by a hard wad fired from a gun of the *Butterworth*, and instantly killed.

In 1792, the islands were visited by Captain George Vancouver, commanding the British surveying vessels *Discovery* and *Chatham*. They introduced cattle and sheep, brought for the purpose from Monterey, California. Horses were first landed at the Hawaiian Islands by Captain Cleveland, in 1810, while in command of a Boston ship.

La Perouse, in the journal of his voyage, volume i., page 344, remarks, in regard to these islands:

" Their knowledge of iron, which they did not acquire from the English, is new proof of the communications which these islands formerly had with the Spaniards. It appears certain that these islands were discovered for the first time by Gaetan in 1542. This navigator sailed from Port Nativity, west coast of Mexico, latitude twenty degrees north. He stood to the westward, and having run nine hundred leagues in that direction, he fell in with a group of islands, inhabited by savages almost naked. The islands were surrounded by coral reefs. They afforded cocoanuts and other fruits, but neither gold nor silver. He named them King's Islands; and another island which he discovered, twenty leagues farther westward (probably the island now known as Kauai) he called Garden Island. It would have been impossible for geographers to have avoided placing the discoveries of Gaetan precisely where Cook has since found the (so-called) Sandwich Islands, if the Spanish editor had not said that those islands were situated between 9° and 11° of north latitude, instead of 19° and 21° , as every navigator would have concluded from the course of Gaetan. The omission of ten degrees may be a mistake in figures, or a political stroke of the Spaniards, who had a great interest a century ago to conceal all the islands of this ocean."

As a result of this carefully considered inquiry, directed to determine what European first discovered and landed upon the Hawaiian Islands, within the limited period accessible to existing traditional or historic testimony, it now appears that a British man-of-war, came, by capture, into possession of Spanish charts of the North Pacific Ocean, whereon their location was correctly laid down, at a time full thirty years before Cook's first visit, which may reasonably give rise to at least a possible inference that, before Captain Cook's departure from England, in 1777, some vague intimation of their probable existence and approximate situation may have directed his search to that particular spot.

The most interesting fact disclosed, however, is that they were sighted by Spanish navigators during the sixteenth and seventeenth centuries, probably as early as 1542; and to them is due the circumstance of their first discovery by any European nation.

HENRY A. PEIRCE.

At the end of the paper, the subject of the uniformity of the Polynesian type of race, was discussed by Mr. B. B. Redding, Dr. Hermann Behr, and Mr. Brooks, and the general similarity of language reviewed.

The Academy then adjourned.

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