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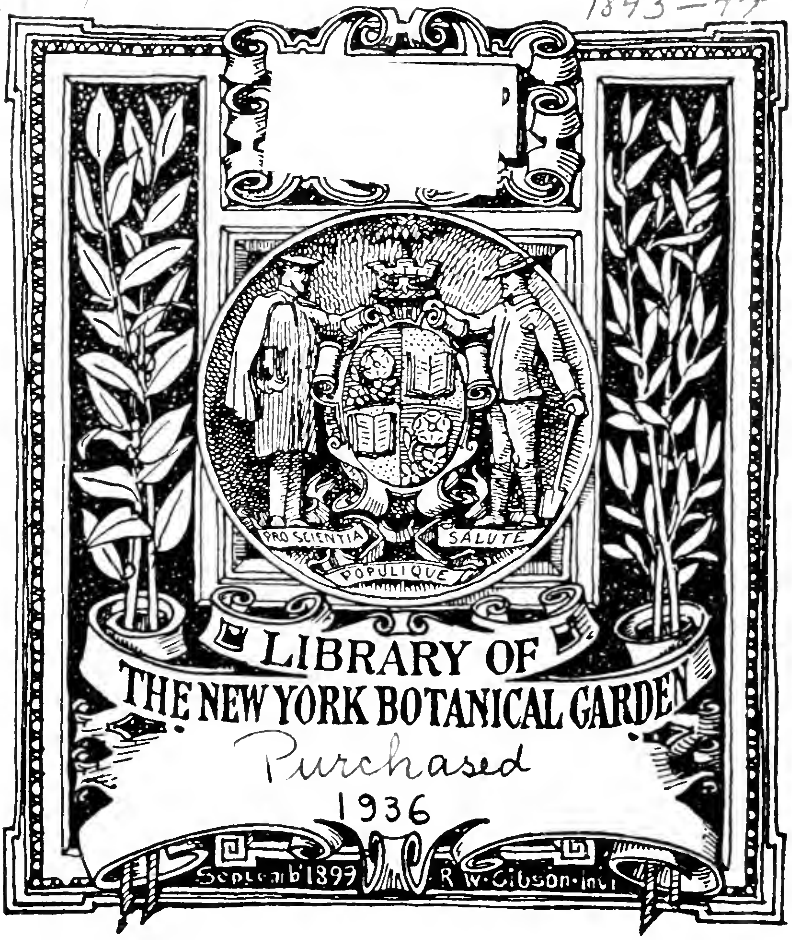

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JOURNAL OF NATURAL HISTORY.

Vol. IV. JANUARY, 1842. No. 1.

Art. I.—DISSECTION OF TWO ADULT DROMEDARIES; A MALE AND A FEMALE. By J. B. S. Jackson, M. D.

The animals which are the subjects of this paper, died in this city within a day or two of each other, having been well, so far as was known, till within a few days before death. They were about six years old, and weighed, by estimate of their keepers, about 850 lbs. each. Most of the organs were carefully examined, but some, though not overlooked, were not particularly noted, and have therefore not been recorded.

The *Hump* on the back of the female consisted principally of dense fat; fifteen inches long, twelve wide, and five and a half thick. Masses of fat, of a very regular and oval form, were found in the soles of the feet, apparently intended to give elasticity to the step.

Tongue of the male, sixteen inches long and two and one half wide at the tip. Anteriorly thin, and covered by a rough cuticle. Thickened portion, posteriorly, seven inches long and two wide; on each side of it a row of five or six glands, from two to seven lines in diameter and remarkably developed.

The *Soft Palate* of the female was seven inches in length. To its under surface was attached that remarkable organ, which has been often described by naturalists, but of which, so far as I am aware, there has been no anatomical descrip-

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tion given, except that of Prof. Savi, of Pisa, (Edinburgh Phil. Journal, Vol. XII.) It consisted of a duplicature of mucous membrane hanging in loose folds, extremely soft and flaccid to the feel, and held together by a very lax cellular tissue; the surface had rather a dark red color. On cutting it through, there was no appearance of a cavity, neither of glands nor muscular fibres. It descended into the cavity of the mouth three and a half inches, and arose by a broad base, of a triangular form, having its apex posteriorly, and measuring two inches transversely in front; it commenced one and a half inches from the anterior extremity of the soft palate and did not reach its posterior or free edge by three and a half inches. Above it, and as if forming a part of the soft palate, is a firm and highly vascular tissue. Anterior to it there is, beneath the mucous membrane, a great number of glands, of a very regular, flattened oval form, of the size of large apple seeds, and situated close together, as they are often found about the lower extremity of the œsophagus of birds. On each side of it, and occupying about the seat of the tonsils in man, are numerous glands of a rounded form and about the size of peas; from the large and open orifices of the ducts of many of these there projected, sometimes one or two and sometimes several light colored fibres, which looked like coarse hairs or bristles, about two or three lines in length, and easily withdrawn, not seeming to be attached within the cavity of the follicles; what these were was by no means apparent. Between this organ and the posterior edge of the soft palate there were no glands to be seen, except a few towards the sides; the upper surface of the palate, however, within the posterior nares was covered with them, though they were not larger than pins' heads.

Prof. Savi, who made his observations upon the large collection of dromedaries near Pisa, remarked, as naturalists generally have, upon the rattling sound which the palatine organ produces in the throat when the animal is excited, especially during the rutting season, and that during the act of copulation it is even protruded externally from the mouth, in the form of a deep red, vascular, membranous bag or bladder, which seems to be inflated. It may be protruded forward by the air forced upon it from behind, or it may perhaps be susceptible of a sort of erection, but it cannot be properly inflated, as it contains no cavity. Prof. S. considers this organ as the uvula, and labors strenuously to maintain the point; but he seems to have been led to this view of the subject from having fallen into the great error of supposing that the uvula is found in all the other mammalia as well as in man. Cuvier (Anat. Comp. III. 283,) and Mr. Lawrence, in a note to his edition of Blumenbach, state that it is found only in man and in the simiæ; there certainly was no appearance of it in the present case, and the peculiar organ in question, as already stated, did not reach within three and a half inches of the posterior edge of the soft palate.

In the male, the palatine organ was rather larger, but otherwise the same as in the female; the arrangement and development of the glands were also the same, with the same appearance as of hairs projecting from the orifices of some of the ducts. As to the size of the palatine organ, Prof. S. makes it about four times as long as it was in the present individuals, though these had died in the month of March, which is just the rutting season, the time when the organ is more frequently protruded, seems to be more excited, and would be at least as much developed as at any other time.

The *Stomach of the Female* consisted of three cavities. The first, or the *paunch*, was of a rounded form, about two or two and a half feet in diameter, and nearly filled with food, which was unchanged and for the most part dryish, though in the depending parts there was a little water. The inner surface was formed by a white, thin, dense, wrinkled cutis, without papillæ, and lined by a delicate cuticle. The muscular coat was strongly developed, the fibres generally extending from the cardiac orifice to the opposite extremity of the organ, so as to force up the contents towards the œsophagus in the process of rumination, the cud being evidently returned into the mouth from this cavity, and not from the second, as in the bullock; there was also a thin layer passing in an opposite direction, besides some irregular fibres which would give a rotatory movement to the contents. The most efficient muscular power, however, was a large, thick band in the posterior parietes; it was eighteen inches in length, arose near the cardiac orifice, around which it communicated with the small band which went to the second cavity, and was at this part six inches broad; at the thickest part, midway, it was an inch and a quarter in width, and at the further extremity it became broader, thinner, and was gradually lost in the parietes.

The cells in the first cavity, which serve the animal as a reservoir for water, were arranged in two rows. The first extended fifteen inches from the orifice of the second cavity, along the posterior parietes, towards the left side. Ten transverse and parallel septa were sent off at a right angle from the strong muscular band, varying in length from five to nine inches, and in depth from three-fourths to more than two inches, but becoming less and less marked towards the left side, where they gradually disappear. These septa are intersected by others which are thinner, for the most part quite regular, and situated about one inch apart, thus forming the cells which, by estimate, would hold generally from one to four ounces; at the left extremity, where these last septa are most deficient, the cells are very large, one of them measuring five and a half by two inches, and being capable of holding not far from three or four gills. The first named transverse septa are from two to four lines thick on their free edge, in which are seen well developed muscular fibres arising directly from the large band in the posterior parietes of the organ, though less strongly marked than they are represented by Sir E. Home (Comp. Anat. pl. 25); his figure, however, was taken from the two-humped camel, and not from the dromedary; the cells, also, are surrounded by a few irregular fibres, which would tend to expel their contents. In order to see the fibres in any part of this cavity, the cutis had to be dissected away.—The second row of cells commenced about opposite the middle of the first row on the right side, and extended thirtyfour inches round towards the front of the organ. There were nine transverse septa, from three to five inches in length, quite regular at the anterior extremity, but much less so posteriorly; the largest were two and a half inches apart. Midway they formed large continuous cells, capable of holding eight ounces or more; anteriorly, they were intersected by other septa, forming very regular cells which would have held from two to four ounces, but posteriorly the cells were very irregular, holding about two ounces.

The second cavity of the stomach, which must serve merely as a receptacle for water, had a crescentic form, the small curvature measuring seven inches, and the large fifteen. It communicated very freely with the first cavity at the distance of four and one half inches from the œsophagus: the opening into the third cavity is smaller, and immediately below this it formed a cul-de-sac which was two inches deep; midway, it measured transversely on the inner surface, nine and a half inches. In the small curvature there was a smooth space, four inches wide at the left extremity, but diminishing to one inch at the right. Along this space there ran a strongly marked muscular band; it arose on the left side of the termination of the œsophagus, measured there one inch wide, but gradually diminished and terminated at the opening of the second cavity into the third. Thus the opening of the third cavity is drawn up towards that of the œsophagus to receive the cud that has been chewed, and which is prevented from falling again into the first cavity by the united action of the large muscular band in the first cavity, and the small one in the second. The cells of this cavity were much more numerous, and very much smaller than those of the first, with which they were almost directly continuous; on an average, they would have held from three to four drams, but the largest, which were situated at the left extremity, were from two to four times as large. There were thirteen transverse septa, counting them on the large curvature, but some of these bifurcated and some united towards their extremities. These were intersected by two others, four or five inches long and one fourth of an inch wide, which arose from the left extremity of the cavity, ran parallel along the large curvature and were gradually lost; they were also intersected by very numerous, short, but not continuous septa which formed the cells. This cavity, like the first, was lined by cutis, without papillæ; cuticle not raised. Muscular coat about two lines thick; fibres mostly longitudinal, though some were transverse; the same structure was also seen about the cells and in the septa.

The third cavity, or true organ of digestion, was for the most part thin and membranous, of an elongated form, but somewhat incurvated, and measured three and a half feet in length. Being cut open, it measured three inches across at the left extremity, fourteen inches at the largest part or about the junction of the first and second thirds, eight inches where it became contracted, or at the distance of six inches from the pylorus, after which it dilated to twelve inches, and then contracted again at the pylorus to four and a half inches. This cavity at the left extremity was of about an uniform size throughout the first five inches, but there was not the slightest appearance of a separate cavity as generally described, and as is strongly represented by Home in the Bactrian camel; otherwise, the form of this third cavity corresponded perfectly with his figure (pl. 24.) He remarks upon the intermediate cavity as so small that it might be overlooked were it not for the distinctness of its orifices; but this last was not found in either of the individuals under description. He remarks, also, upon the absence of septa and of the cuticle which generally characterize the third cavity of ruminants, and which absence, in the present case, seemed to be a strong additional reason for denying the existence of an intermediate cavity. The mucous membrane generally, was smooth, soft, extremely thin, and thrown into loose longitudinal folds, of which there were counted about forty, commencing towards the left extremity, where the dilatation began, and terminating within six inches of the pylorus; in it were some small mucous follicles. Upon the inner surface of that portion of the left extremity which is generally described as an additional cavity were seen the faint remains of cells which passed imperceptibly into the plicæ; Sir E. Home remarks upon "a faint appearance of a honey-combed structure, so slight as to require a close inspection to ascertain it." In the last six inches of the pyloric portion, the structure of the lining membrane was entirely changed. The greater part had the soft villous appearance of a mucous coat, but was much thickened. The remainder, situated in the large curvature and to the extent of about six inches square, was about one line in thickness, and very peculiar in structure, consisting of fine, upright, parallel fibres, easily separated from each other and from the subjacent parts; the surface was smoother than that of the surrounding mucous coat, though thrown into very thick and strongly marked rugæ. Just at the pylorus was the glandular body, as it is described in the camel and bullock by Home; it was about one inch broad and about one half an inch thick, from which place it extended backwards along the small curvature, and was gradually lost in the parietes; it was covered by mucous membrane and consisted of a soft, white tissue, without any glandular appearance. The pylorus was well marked, though not very prominent. The muscular coat of this cavity was quite thick, especially at the rugous part, the fibres being transverse.

The *Stomach of the Male* corresponded mainly with the above description. In the first cavity, the cells on the left side extended fourteen inches; there were ten transverse septa, four and a half to nine inches long, three-fourths of an inch to two inches apart, and intersected, though not regularly, by short septa; three or four of the cells would probably have held eight or ten ounces. The cells on the right side commenced about opposite the middle of the large muscular band and were thirtynine inches in extent; thirteen transverse septa; cells midway about three inches wide and very shallow, but at each extremity much smaller. The muscular band was twentytwo inches long, and midway one half inch thick. Small curvature of the second cavity eight and one half inches, and the large ten and one half; inner surface midway and transversely ten and one half inches; twelve transverse septa, more regular than in the female, the two large ones which intersected them, running about half the length of the cavity; cells would have held from half an ounce to an ounce; small muscular band seventeen inches long, one inch wide, and about two lines thick; muscular coat generally thick, and the fibres transverse, being in the female mostly longitudinal. Third cavity forty inches long. Measured transversely at the left extremity three inches, diminishing afterwards to two and three-fourths, but without any appearance of there being an intermediate cavity; at the largest part it was fourteen inches, at the contracted part nine, at the largest part after it again dilated nineteen, and at the pylorus four inches. There were about forty or fifty longitudinal plicæ; beyond these the lining membrane was about one half a line thick, firm and rough on the surface, and there was seen the peculiar rugous membrane that was described in the female, except that the color here was cineritious. The gland at the pylorus, as it has been called, was two inches long, one inch wide, and half an inch thick.

Small Intestine of the male eightyfive feet long, of the female eighty and a half. Just below the pylorus, and to the extent of about one foot, was a remarkable dilatation, the change from this to the smaller part below being very abrupt; this is well represented in Sir E. Home's figure of the Bactrian camel, (pl. 24;) he describes it, however, as a dilatation between the pylorus and the duodenum, and not as a dilatation of the intestine itself. Being cut open throughout, the male intestine measured at the dilated portion sixteen inches; below this, varying from two and a half to four inches, and at the cœcal valve five and a half inches; mucous membrane quite thin and smooth in the upper third, but became more and more thick and villous towards the cœcum; muscular coat quite thin and the fibres transverse.

Aggregate glands very strongly marked and peculiar in structure. In the upper quarter of the female intestine were six patches, from two to eight lines in diameter, circular, well defined, but not at all raised. In the male, just below the dilatation of the duodenum, were numerous and similar patches, from two to three lines in diameter, and arranged in parallel rows. In all of these the openings of the follicles were large. Within the last fifteen inches of the intestine, in the female, were also six patches, situated in a straight line, and opposite the mesentery, generally from half an inch to one inch in diameter, of a circular form, and well defined; the smallest were two or three lines only, some were oval, and one measured one and a quarter inches by half an inch. These appeared, at first sight, like decided ulcerations, being surrounded for the most part by a sharp and raised edge, which, beginning almost imperceptibly, became gradually wider, until at last it was expanded into a proper membrane, partially overhanging the surface of the patch, but not connected with it except at its circumference. The width of this membrane varied in the different patches, the greatest being six lines; it was soft, smooth, rather thick, apparently organized and continuous with the surrounding mucous membrane. The surface itself of these patches seemed healthy, the follicles of which they were composed being quite distinct, and as much so where they were covered by the membrane as where they were not. In the male, the patches at the lower end of the intestine had a similar appearance, but were less carefully noted. The small patches in the upper part of neither the male nor female intestine showed any trace of the peculiar membrane above described.

Large Intestine sixtytwo and a half feet long in the male, and fifty and a half in the female; length of cœcum in each, twenty inches. Being cut open throughout, the dimensions and general structure in each was about the same. In the male the measurements transversely were as follows: in the cœcum from eight to ten inches; for the first eight feet (from the cœcal valve,) six to nine inches; it then diminished to two or three inches and so continued for the next eighteen or twenty feet, the convolutions at this part being closely connected and embedded in fat; it afterwards increased again to four and a half inches. Mucous membrane at first quite thin and smooth, but thrown into longitudinal folds after the intestine became smaller. Muscular coat thick; fibres mostly transverse, but throughout there were some longitudinal.

Aggregate glands. In the cœcum and ascending colon were numerous patches resembling in structure those found in the small intestine. In the female there were seven about the cœcal valve, from two to five lines in diameter, of a dark grey color, partially covered by the peculiar membrane above described, and having at first sight the appearance of burrowing, cicatrizing ulcers; in the cœcum were four others, about three lines in diameter and resembling the above. In the first part of the colon were numerous patches without the membrane; generally from two to three lines in diameter, but one, which was nearly circular, was over an inch, and another, of an oval form, measured six by eight lines. The patches in the male were much less numerous; in the colon were five, from two to four lines in diameter, having the peculiar membrane, but being much less grey than in the female.

The *Liver* was an irregular, flattened organ, consisting mainly of one large right lobe, from the anterior part of which there extended a long, thin, narrow lobe towards the left side. In the male, the transverse diameter of the two lobes, taken together, was twentysix and a half inches; right lobe twentyone inches antero-posteriorly, and three and one half inches thick; left lobe twelve inches long, from five and one half to nine inches wide, and one inch thick; the female was rather smaller. On the surface were numerous irregular fissures and small imperfect lobes. The organ had a bluish ash-color, was quite dense though flaccid, and seemed made up of large and very distinct granulations. Near the posterior edge of the right lobe in the male were two morbid productions, each about one inch in diameter, of a regular, rounded form, and well defined, the surrounding substance being quite healthy; one was apparently a tuberculous mass, white, opaque, and curdy; the other was an hydatid, consisting of a firm external cyst, within which was a second, quite distinct from the first, very delicate, villous on the inner surface and filled with serum.

Gall-bladder wanting. In the female the length of the duct external to the liver, was three and one half inches. Opening into the intestine eleven inches from the pylorus, without a valve, and very little oblique; being cut open, it measured transversely, to a small extent at this part, eight lines, but just after receiving the pancreatic duct, it was contracted to two. In the male it measured transversely, without being cut open, three lines before and four lines after receiving the pancreatic duct.

The *Pancreas* consisted of small, flattened lobules, of a dull pink color, loosely connected and intermixed with a great abundance of fat. It was twelve inches long in the male, eighteen in the female, and for the most part from three fourths to one and a half inches wide, there being a second lobe arising from near the head of the first. The duct, in the female, measured two lines across in the body of the organ, when cut open, and terminated in the hepatic duct, two inches from the opening of this last into the intestine.

The *Spleen* was a thin, flattened organ, of a crescentic form, the convexity being towards the abdomen; it adhered to a very small extent to the stomach, and extended into the left iliac fossa; color dark red, and texture coarse. In the female it was twentytwo and a half inches long, from four to five inches wide, and three-fourths of an inch thick.

The *Kidneys* were very regular in their form, somewhat rounded, and measured seven inches long, from three and a half to five inches wide, and about three inches thick. Tubular portion single, and terminated in an uniform, concave surface, opposite to the centre of which was the opening of the ureter.

Bladder of the female about the size of a common orange, and empty; mucous membrane somewhat rugous; muscular coat thin.—Urethra three and two-thirds inches in length; transversely, one inch at neck of bladder, one and a half inches midway, and seven lines at opening in vagina. Well marked, dense, longitudinal rugæ on whole length of inner surface, with intermediate, oblique lines, somewhat like the arbor vitæ in the human cervix uteri. Muscular coat became more and more thick towards opening into vagina, where at last it measured from two to three lines.

Penis twenty inches in length, and for the most part about as large as the fore-finger, though near the pubes much larger. Towards the free extremity it gradually diminished in size, tapering almost to a point, and in a very remarkable manner; the last seven lines were bent to a right angle with the body of the organ, and somewhat twisted, having the dense feel of cartilage, and measuring at the very extremity but two lines in diameter. The urethra terminated just at or beneath the angle formed by this last portion, and was still further concealed by a firm, sharp point, two lines in length, which projected forwards from one side of its orifice. The lining membrane of this canal was dense, and about one-half a line thick; some spongy tissue externally about midway; no muscular fibres seen. Corpora cavernosa formed by an abundant, coarse, cellulo-fibrous network, without a septum; the investing fibrous membrane extremely thick and dense, measuring from one to one and a half lines. Besides some smaller muscles, a short, thick pair arose from the pubes to be inserted into the penis near its origin, and a long, slender, and very beautiful pair ran nearly the whole length of the organ, along its under surface, connected with the sphincter ani at one extremity, and lost in the integuments at the other. The prepuce was five inches long, and formed a large, thick mass of flesh, consisting of cellular substance intermixed with some muscular fibres; frænum distinct.

Vasa Deferentia within the pelvis at first tortuous, but for the last four or five inches straight; rather more than one line in diameter at first, the canal being a mere pin hole. Towards their termination the diameter increases to three lines, and being cut open, the cavity measures about three lines transversely; inner surface smooth and polished, showing the openings of numerous minute follicles. Terminated at last in the urethra, on each side of the verumontanum. No note made of the testicles.

Vesiculæ seminales wanting.

Membranous portion of the urethra six and one-fourth inches long; transversely, on the inner surface, one inch at neck of bladder, one and seven-eighths inches at verumontanum and five lines only at the commencement of the penis. Verumontanum two and one-quarter inches from the neck of the bladder and not very prominent; numerous fine, dense rugæ diverged off from it, amongst which were concealed the openings of ducts; there were, also, longitudinal rugæ, more marked and extending off from it along the median line anteriorly and posteriorly. Spongy tissue external to the mucous coat, and about one line thick. Muscular coat very strongly developed, measuring one-half an inch at the thickest part; the fibres were transverse and met upon that surface of the canal which was towards the rectum, in a thick mass of condensed cellular membrane or tendon about three-fourths of an inch wide.

The *Prostate gland* consisted of a single, broad, thick, and very regular lobe, of a somewhat triangular form, the apex being directed towards the urethra, measuring two and three-fourths inches transversely, and two inches in the opposite direction. The texture was close, whitish and homogeneous; filled with an opaque, creamy fluid, the ducts terminating in many openings on each side of the verumontanum. According to Cuvier, (Anat. Comp., 1st ed., Vol. V., pp. 43 and 47,) this gland in the ruminants is always double, and has but a single excretory duct; he also remarks on the large size of the central cavity in the camel.

Cowpers glands, situated just behind the bulbo-cavernosus muscle, were remarkably distinct. They were of a very regular, oval form, one inch long and one-half an inch at the widest part, of a light red color, slightly granular in structure, and directed obliquely forwards towards the median line. The ducts were large, filled with a starchy secretion, and terminated at the bottom of a cul-de-sac, which was five lines in depth and formed by the inner membrane of the urethra. Each of these glands, separately, was surrounded by a strongly developed expulsor muscle, which was from one-fourth to one-third of an inch thick at the free extremity; towards the urethra it became much thinner, and had on its external surface a very thin fascia, giving to the whole, before being cut open, a striking resemblance to the gizzard of a bird; this same structure I have lately met with in a ram from Africa, and it is said to be found in the ruminants generally.

Vagina ten and one-fourth inches in length from the opening of the urethra; transversely, on the inner surface, three and one-fourth inches at the meatus, six and three-fourths inches midway, and five and one-fourth inches at the upper extremity. Lining membrane thick, dense and polished; longitudinal rugæ towards the meatus, but they become very fine and irregular higher up. Muscular coat distinct throughout, though for the most part very thin; fibres longitudinal; more developed towards the outlet, and measured there from two to three lines in thickness.

The *Uterus*, being cut open, measured from its commencement to the bifurcation internally two and one-half inches, and to the same externally five and one-half inches; transversely, on the inner surface, four inches at commencement, and three and one-eighth inches at bifurcation. The left horn, cut open, was five and one-fourth inches long, two and seven-eighths inches transversely near its commencement, but afterwards becomes smaller. Parietes varied from one and one-half to three lines in thickness. Upon the inner surface of the uterus were five or six irregular, transverse folds, which gradually became less marked from below upwards, the last half inch being quite smooth. Inner surface of the left horn somewhat rugous towards the free extremity, but smooth towards the uterus; muscular coat again well marked, but became thinner towards the extremity. Left Fallopian tube six inches long and rather smaller than the human; projected two lines into the cavity of the uterus in the form of a conical papilla; the other extremity extremely tortuous and terminated in an expansion of peritoneum, which almost completely invested the ovary.

The *Left ovary*, one and one-half inches long by one inch wide, was apparently diseased; about two-thirds of it occupied by a cyst filled with a watery mucus, and lined by a proper villous membrane; in the remaining portion was a dark grey cyst.

In each of the *Broad Ligaments* were distinct, but scattered and irregular, transverse muscular fibres.

The *Heart* was about as large as in the horse, and had the same conical form. Auricles of a regular, rounded form, and equal to about two and one-half or three inches square; appendices not strongly marked; muscular substance in the left from two to three lines thick, but in the right it was thinner; fossa ovalis deep. In the female, the left ventricle was nine inches long and the right seven and one-half, measuring on the outside; the left was ten lines thick at the upper extremity, then diminished to eight, increased again to twelve, and at the apex was but two, without the fat, of which there was some at that part; the right was from two to four, averaging about three; inner surface of the left for the most part smooth. Mitral valve divided into two distinct portions, and measured along its adherent edge eight inches; the tricuspid eight and one-third. Pulmonary artery six inches transversely on the inner surface, just above the valves, and one and one-half lines in thickness; ascending aorta four and one-half inches and three lines thick. From the arch of the aorta there arose two vessels, so near to each other as almost to have a common origin; one of these was the left subclavian; the other was the common trunk of the right subclavian and the two carotids. The above measurements were taken from the female; the heart of the male was rather larger.

The *Trachea* of the male had seventyone rings, ranging from five to nine lines in width, and expanded posteriorly, so as to overlap each other; also overlapped so as to form more than a complete circle, except at the lower extremity. Transverse diameter inferiorly one and one-half inch, the antero-posterior being rather less; superiorly the flattening was lateral. On the right side a large bronchus was given off just above the proper bifurcation. Muscular coat very strongly developed, the fibres measuring one and one-fourth inch in length. Towards the upper part of the trachea, on the right side, was a dark red, glandular looking body, of a regular form, three and one-half inches long by two inches wide; probably one lobe of the thyroid gland.

The *Lungs* consisted of a single lobe on each side, without any trace of division, but sending a prolongation upwards from the apex. The left, in the male, measured twentyseven inches along its outer surface; greatest width ten inches, and thickness two and one-fourth inches. Cells and lobules about as large as in man. These organs, in both subjects, contained very numerous diseased masses, from one-half an inch to two inches in diameter, apparently a chronic affection, and consisting of a deposit of very soft lymph with a mixture of pus, the surrounding structure being quite healthy. The bronchial and some of the cervical glands were similarly affected. The inner surface of the trachea, also, was diseased at its upper extremity, and on the anterior face, to the extent of two inches by one and one-half inch, being thickened, rough and opaque, but not properly ulcerated.

Art. II.—DESCRIPTIONS OF THE FISHES OF THE OHIO RIVER AND ITS TRIBUTARIES. By Jared P. Kirkland, M. D.

(Continued from Vol. III., page 482.)

Lepisosteus. Lacep.

L. *oxyurus*. Raf. The Ohio Gar-Fish.

Lepisosteus oxyurus. Raf. Ichthyol. Ohiensis. p. 74.
" " Kirtland. Report on Zoology of Ohio. p. 196.
Lepisosteus Huronensis. Richardson. Fauna Boreali-Amer. p. 237.

Plate I. Fig. 1.

Head more than one-fourth of the total length; *jaws* eleven-seventeenths of the total length of the head; *forehead* flattened between the eyes; base of the head less in circumference than any other section of the body anterior to the dorsal fin; sub-quadrangular; *jaws* narrow, elongated, slightly narrowed towards the tip ; *upper jaw* longer, terminating in an oblong knob. A series of unequal teeth are placed in clusters along the margin of each jaw. *Eyes* behind the angle of the mouth.

Body small, regularly fusiform, transversely flattened anterior to the dorsal fin ; *scales* hard, corneous and arranged in oblique rows.

Dorsal fin situated nearer the base of the tail than the anal fin.

Caudal fin oblong, oblique, upper and lower edge obscurely serrated.

Anal fin larger and longer than the dorsal.

Pectoral fin ovate and short.

Length. The specimen before me is twentytwo inches ; I have seen them five feet in length.

Color. Back and head brown or umber-colored, sides yellow, and belly white.

Habitat. Lake Erie, Ohio river, and many of their tributaries.

D. 7 ; C. 12 ; A. 6 ; P. 10 rays.

Observations. This species is readily distinguished from the *Duck-bill* and *Alligator-Gars*, by the great length of the jaws. It may be seen, apparently sleeping, on the surface, and gently carried round on an eddy for an hour at a time. Before our streams were interrupted by the construction of mill-dams, it was common in most of the permanent rivulets in Ohio, but it is now becoming scarce. As an article of food it is not much esteemed, and is not often eaten.

It is not a little surprising that this species should be introduced by Richardson into his " Fauna Boreali-Americana," as being previously unknown, with the name of " L. *Huronensis*," when it had been so well described by Rafinesque *sixteen years* before. Cuvier was acquainted with Rafinesque's publication, as his occasional references to it prove, and still, when a prepared specimen of this fish was sent to him by Richardson, he called it " *Esox ósseus*, Lin. *Lepisósteus rostràtus*, Nobis." M. Agassiz, however, considering it a distinct species from E. *ósseus*, requested Mr. John E. Gray, the dis-

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tinguished curator of the British Museum, to draw up a minute description for him. Mr. Gray must have been unacquainted with the "Ichthyologia Ohiensis," else he would never have remarked of the species referred to, "It also differs from all the other known species of the genus in being spotted."

L. *ferox*. Raf. The Alligator Gar-fish.

Lepisósteus ferox. Raf. Ichthyol. Ohien. p. 75.
" " Kirtland. Rep. on Zool. of Ohio, p. 196.

Plate I. Fig. 2.

Head one fourth of the total length of the fish, broad and flat on its upper surface ; *skin* rugose ; *jaws* nearly equal, not half the length of the head, short, oval and obtuse, armed with numerous strong and prominent teeth, of various sizes and lengths ; the palatine arch armed in a similar manner. The upper jaw expands into a knob, beneath its extremity. Eye situated behind the angle of the mouth.

Body fusiform, cylindrical, and flattened on the back, covered with large bony scales, which are imbricate, and arranged in oblique series ; each scale is sculptured on the external surface.

Dorsal fin more posterior than the anal, and its tip reaches beyond the commencement of the caudal fin at its inferior edge. The anterior ray serrated before.

Caudal fin oblique, serrated on its superior and inferior edges. Several of the rays in this fin, and in some of the other fins, are compounded at the middle of their lengths.

Anal fin serrated on its anterior edge, and attains with its tip the commencement of the base of the *caudal fin.*

Ventral fin horizontal ; its anterior ray serrated.

Pectoral fin ovate, situated beneath the posterior edge of the operculum.

Color yellowish brown, in the prepared specimens.

Length from four to six feet.

Habitat. Ohio river, very rare.

D. 8 ; C. 11 ; A. 8 or 9 ; V. 6 ; P. 15 rays.

Observations. This fish is an inhabitant of the Mississippi, and occasionally strays up into its tributaries, the Illinois, the Ohio, and perhaps some others. I have never met with a recent specimen, but find the skins of two, prepared in the Western Museum of Cincinnati; one was stuffed, the other dried in an extended form. Mr. Dorfeuille, the former proprietor, informs me that one of them was taken some distance up the river, towards Pittsburg. It is five feet and eight inches in length, and twentyfive inches in circumference, and is so well prepared that, though somewhat decayed, it is believed the drawing taken from it, and accompanying this description, affords a tolerable representation of the recent fish. I am under great obligations to Mr. Bartlett, of the Museum, for permission to use his specimen.

Mr. Silsbee, a member of my medical class, has also presented me with the bony scales of one taken about four years since, by some fishermen, with a seine, at the mouth of Mill Creek, a mile below the city of Cincinnati. It must have been still longer than those in the Museum, judging from the size of the scales.

Both my figure and description disagree in many points with the description of Mr. Rafinesque, but are essentially correct in reference to the specimens from which they were taken. And it should be recollected that he made out his description from a sketch and a jaw in possession of Mr. Clifford.

Rafinesque says, that in the Mississippi it attains to the length of eight to twelve feet, and is a match for an alligator. It is truly a formidable fish,—*the shark* of fresh water. Its bony scales and head must be almost impenetrable, and impervious as the mail of the alligator; and its formidable teeth and bony jaws, as well as its superior agility, must render it a powerful competitor; though I should doubt its ability to destroy a full grown alligator.

The shortness of the jaws and head, the sculptured surface of the scales, and the great size and general contour of the body, will readily distinguish it from the *common* or the *duck-bill* Gar-fish.

L. *platóstomus*. Raf. The Duck-bill Gar-fish.

Lepisósteus platóstomus. Raf. Ichth. Ohien. p. 72.
" " Kirtland. Rep. on Zool. of Ohio. p. 196.

Plate I. Fig. 3.

Head hardly one fourth of the total length of the fish, flattened above the angles of the mouth, broader behind the eyes. *Upper jaw* the longer, equal to the remainder of the head; expanding on the under side of the tip into an elastic knob, and gradually widening from thence to the junction with the skull; its surface rough and deeply furrowed with a curved sulcation extending from behind the nostril to the head, above the eyes, on each side. *Lower jaw* wider at the base than the upper, but narrower at the tip; their margins furnished with numerous sharp and prominent teeth. *Tongue* asperous, bi-lobed at its tip. *Throat* lax and pendulous beneath. *Operculum* and *pre-operculum* bony and compressed. *Nostrils* near the extremity of the upper, and anterior to the tip of the lower jaw.

Body cylindric, flattened above; back somewhat elevated; *scales* corneous, and arranged in oblique series.

Dorsal fin sub-oval, posterior to the anal.

Caudal fin oblong-oval, the base oblique; upper and lower rays serrate.

Anal fin similar to the dorsal, in form and size.

Ventral fin ovate, its rays cartilaginous, anterior to the middle of the body.

Pectoral fin ovate-falcate.

Color. Head and back dusky, and umber; sides yellowish; abdomen white; iris golden yellow. Dorsal, caudal, and anal fins maculate. A series of obscure, circular spots is situated on the medial line behind the anal fin.

Length. The specimen I have before me is twentysix inches; others, it is said, have attained the length of four or five feet.

D. 8; C. 12; A. 9; V. 6; P. 10 rays.

Observations. I have had the good fortune to obtain a solitary specimen in the Cincinnati market, but did not learn where it was taken. Rafinesque speaks of the species being common in the western waters. This might have been true in earlier times, but at this date, it is so rare here that I have found one fisherman only, who professes to know it. The shorter, wider, and flattened jaws, distinguish it from the *Common-Gar*,—and the longer and tapering jaws from the *Alligator-Gar*.

Fig. a. The entire fish.

Fig. b. The upper surface of the head and upper-jaw.

POLYODON. Lacepède.

P. fòlium. Lacep. The Spoon-bill Sturgeon. Paddle-fish.

Polyodon feuille. Lacepède. Griffith's Cuvier, Vol. X. p. 591.
Polyodon fòlium. Wilson. Article "Ichthyology," in Encyclopædia Britannica, seventh edition, p. 230.
" " Rafinesque, Ichthy. Ohien. p. 82.
" " Mitchill and Hildreth. Silliman's Journal, Vol. XII. p. 362, and figure.
Spatulària reticulàta. Shaw. General Zöology, Vol. V. p. 362, et fig.

Pl. II. Fig. 1.

Head regularly conic, extended into a spatulate snout, on a line nearly continuous with the back. *Snout* flat, its edges thin and compressed, its centre furnished with a firm and thick cartilaginous rib, extending the whole length, but gradually diminishing in size from the junction with the head to the tip of the spatula. The surfaces marked with irregular hexagonal reticulations. Two parallel, cartilaginous nerves extend from the base of the skull to the termination of the snout, running through the centre of the upper surface. They appear to be formed by numerous diverging and concentric rays.

The *Head* is somewhat gibbous at its union with the body, from thence it is declivous to the first third of the length of the snout. *Operculum* invested with a fleshy membrane, which extends as far as the abdominal fin. In the dry specimen the operculum is radiate, which is not apparent when recent.

The *Head*, including the operculum and snout, is longer than one half the total length of the fish, and the snout exceeds the united length of the head and operculum. *Nostrils* double, situated immediately above and before the eyes. Spiracles behind and above the eyes, on a line with the nostrils and edge of the snout. *Jaws* expansive, thin, flexible, cartilaginous, acutely margined and minutely denticulate. The lower jaw closes within the upper. The palatine arch, the lingual cartilage, and the inner extremities of the first pair of branchial arches are furnished with numerous small teeth.

Body sub-cylindric, flattened laterally, and tapering from the pectoral fin to the tail. Skin scaleless; smooth in the recent specimen, but asperous when dried. Vent prominent, situated beneath the dorsal fin.

All the fins numerously rayed, and all except the caudal one, trapezoidal, and inserted on fleshy and elevated bases.

Caudal Fin expanded, bi-lobed; the lower lobe shorter, broader, and less oblique than the upper, which is serrated on its superior edge.

Color. The head, back and sides are of a beautiful steel blue, the throat and abdomen white, and the gill-covers maculated by stellate impressions.

Length, from one to five feet.

Habitat. The Ohio river and its tributaries.

Observations. This species is distinguished from the *Platiróstra edéntula*, of Lesson, by possessing numerous teeth, by the snout being on a line with the back, by the greater length of the appendage of the operculum, by the form, size, and direction of the lobes of the caudal fin, and by the smaller size and less oval form of the body.

It is taken in considerable numbers in the Licking river, near Cincinnati, and exposed for sale in the markets. Its flesh, I am informed, is tough and not palatable, though it is occasionally eaten.

During the winter it does not forsake our streams, but secretes itself in the mud and beneath logs in the deepest waters. The peculiarly shaped nose seems designed to enable it to search in the mud for its favorite food; and we often find the end of that appendage coated with tenacious clay, when first taken.

What it subsists on I have never been able to discover from any thing contained in the stomach. In the specimens which I have examined, a quantity of thick, muddy mucus only, was contained in the stomach, except that in two there were a number of *Tænia* or *Tape-worms*. Each of these parasites was about two inches in length when extended, and was made up of numerous joints about a line in length.

Two drawings, with descriptions of this fish, were published in the American Journal of Science, Vol. XII. one by Dr. Hildreth, another by a Mr. Clements. These authors probably overlooked the minute teeth, which, in recent specimens, are thickly invested with a tenacious mucus, but are more evident when the specimens are dessiccated.

Luxilus. Rafinesque.

L. *erythrogáster*. Raf. The Red-belly Shiner.

Lúxilus erythrogáster. Rafinesque. Ichthyologia Ohiensis, p. 47.
" " Kirtland. Report on the Zoology of Ohio. Catalogue, p. 169.

Pl. II. Fig. 2.

Head short, rather obtuse. *Eyes* circular; irides golden yellow; pupils black. *Jaws* equal.

Body full, sub-cylindrical, slightly compressed laterally. *Lateral line* curved downwards along the abdomen, but upwards as it approaches its base.

Caudal fin bi-lobed; dorsal, anterior to the anal fin.

Length, from three to four inches.

Color. Fins a delicate yellow, back dark olive, with an interrupted black stripe through its centre; sides with two black stripes, the upper extending from the caudal fin to the base of the head; the lower from the tail to the operculum, and interruptedly along the base of the head, across the iris, to the tip of the nose. The space between these black stripes, white and silvery; the abdomen white, occasionally tinged with carmine in some specimens, and wholly of a bright carmine in others. The colors of the female are less vivid than those of the male, and the black stripes on the sides are often displaced by a muddy dun color.

C. 20 ; D. 8 ; P. 12 ; V. 8 ; A. 8.

Habitat. All the small brooks and rivulets in the West.

Observations. In my specimens, the anal fins were eight rayed, though Rafinesque describes the species as having only seven rays.

The colors are the most vivid in the Spring of the year, when great numbers may be seen congregating on the shoals and ripples of every spring-run, preparing to deposit their spawn. After that process has been completed, they cease to be gregarious, lose their beautiful colors, and return to the deeper waters.

The thicker and more cylindrical form of the body, the shortness of the head and jaws, and the different arrangement of the colors, as well as its different habits, will readily distinguish it from the *Lúxilus elongàtus.*

A hasty observer might mistake the male and female for distinct species. I have therefore furnished a sketch of both sexes.

Fig. a. male.
Fig. b. female.

Lota. Cuvier.

L. maculòsa. Le Sueur. The Eel-pout.

Lota maculòsa. Cuv. Griffith's Cuv. Vol. X. p. 487.
" " Richardson. Fauna Boreali-Americana. p. 248.
" " Kirtland. Report on the Zoology of Ohio. p. 196.
Gadus maculòsus. Le Sueur. Journ. Acad. Nat. Sci. Vol. I. p. 83.

Pl. III. Fig. 1.

The following description, of Le Sueur, I extract from the first volume of the "Journal of the Academy of Natural Science, of Philadelphia."

" *G. maculòsus.* *Jaws* equal; lower one with a single cirrus; ground color of the *body* reddish, marbled with brown, with roundish white spots scattered throughout; *head* large, long and depressed; *eyes* oblong, in a vertical line with the angle of the mouth; *nostrils* double, anterior are elongated into a small barbel; *pectoral fins* long, subtriangular, placed horizontally; *jugular fins* pointed, falciform, and whitish; *anal fins* shorter than the dorsal, and marked with pale spots; *caudal fin* large and rounded; *body* mucous, covered with small roundish scales, resembling depressed tubercles; *lateral line* in the middle of the body; *teeth* small, sharp, and disposed in twelve or fifteen ranges, resembling those of a wool-card; the *palate* and *throat* are equally furnished with teeth.

Branchiæ 7; P. 18; D. 10—71; Jug. 6; A. 70; C. 44 rays.

The above described species I discovered in Lake Erie, on the 14th of July, 1814. It is an esteemed fish, and is commonly known under the name of the Dog-fish, and Eel-pout. My specimen was two feet four inches in length."

Observations. Le Sueur is incorrect in giving this species the common name of *Dog-fish*—that term is exclusively applied to the *Amia calva.*

The *Eel-pout* is an eatable fish, but is far from being esteemed, its flesh being dry, tough, and not highly flavored. It is taken in considerable numbers about the harbor of Cleaveland, by hooks and seines.

Salmo. Lin.

S. namaycush. Pennant. The Namaycush. The great Trout of the Lakes.

Salmo namaycush.	Pennant. Arctic Zoology, Vol. II. Supplement, p. 139.
" "	Richardson. Fauna Boreali-Americana. p. 179, et fig.
" "	Kirtland. Report on Zoology of Ohio. p. 195.
Salmo amethystus.	Mitchill. Journal Academy of Nat. Science, Vol. I. p. 410.

Pl. III. Fig. 2.

Head obtuse, broad between the eyes, near one-fourth of the total length of the fish. *Maxillaries* equal to one-fourth the length of the head, curved downwards behind their middle, armed with strong teeth through the whole extent of their inferior edges; a second row of teeth on the interior margin of the upper jaw, and a single row on the lower jaw. Anterior teeth inflected. *Eyes* anterior to the angle of the mouth. *Tongue* armed with two rows of strong teeth.

Body sub-cylindric, fusiform, compressed a little on the sides.

Dorsal fin over the middle of the body, and anterior to the ventrals.

Adipose fin small, falciform.

Caudal fin rather broad, bi-lobed, lobes equal.

Anal fin reaches with its tip the base of the caudal.

Ventral fin situate behind the dorsal and attains to the vent.

Pectoral fin falciform, acute, and does not extend as far back as the dorsal.

Color clouded with brown and white; darker on the back, lighter on the sides, and white on the throat and belly. All the fins reticulated with brown.

Length. Thirtyfour and a half inches is the length of a specimen before me.

Habitat. Lake Erie and the Upper Lakes.

B. 13; D. 13; C. 19; A. 12; V. 9; P. 14 rays.

Observations. This fish inhabits the deepest waters of Lake Erie, but does not often approach the shores. One was however taken at the end of the pier by a boy fishing for pike, two years since. It is caught in considerable numbers during the winter, near Buffalo, by letting down lines through holes in the ice. In some of the upper Lakes it is abundant.

Art. III. OBSERVATIONS ON THE GENUS SCALOPS, (SHREW MOLES,) WITH DESCRIPTIONS OF THE SPECIES FOUND IN NORTH AMERICA. By J. Bachman, D. D., Charleston, S. C.

Although this genus has, until very recently, been composed of only a single acknowledged species, (*Scalops Canadensis* of Desm.) its systematic derangement has given great perplexity to naturalists. Linnæus placed it among the

Shrews (*Sorex*), and Pennant among the Moles (*Talpa*). Baron Cuvier finally established for it a new genus (*Scalops*), where it still remains. The specimen, however, which he made the type of the genus, contained but thirty teeth. The upper jaw had but three lateral incisors, or false molars, on each side, leaving considerable intermediate spaces between the incisors and true molars. In this dental arrangement he was followed by Desmerest, Dr. Harlan, Griffith, and nearly all the naturalists of that period. Subsequently, however, Fred. Cuvier gave a correct description of the teeth, which he found amounted to thirtysix. Dr. Harlan, finding a skeleton from the vicinity of Philadelphia, which, in its dental arrangement, corresponded generally with the characters given by Fred. Cuvier, considered it a new species, and described it under the name of *Scalops Pennsylvanica*, (see Fauna Americana, p. 33). Finally, Dr. Richardson described a specimen which was obtained on the Columbia River, which contained fortyfour teeth, very differently arranged. This animal he refers to the S. *Canadensis*, (*aquaticus*, of Linnæus,) supposing that the difference in the dentition, as observed by different authors, was owing to their having examined and described specimens of different ages. (See Fauna Boreali-Americana, p. 82). I will endeavor to explain and correct these contradictory views.

The specimens examined by Baron Cuvier, Desmarest, and Dr. Harlan, were evidently young animals, with their dentition incomplete. One half of the specimens now lying before me, present the same deficiency in the number of teeth—also the edentate spaces between the incisors and grinders, remarked by those authors. Those, on the other hand, that were examined by Frederick Cuvier, Dr. Godman, and the skeleton of Dr. Harlan's *Scalops Pennsylvanica*, were the adults of the same species; and the description of Dr. Richardson's specimen was that of a new species. (See Journal Acad. Nat. Sciences, Vol. VIII. p. 58.) I have been obliged to make a slight alteration in the generic characters to admit the species which have since been discovered.

FAMILY. INSECTIVORA.

Genus Scalops. Cuv. *Shrew-mole.*

Generic Characters. *Teeth*, from thirtysix to fortyfour. *Head* long, terminated in an extended, cartilaginous, flexible, pointed muzzle. Hands and arms broad, and armed with strong nails, fitted to excavate the earth, resembling in their general appearance those of the European mole, (*Talpa*). *Eyes*, and *ears* concealed by the hair, and scarcely perceptible. The hind *feet* are slender. *Toes* five on each foot, furnished with small, hooked nails.

1. Scalops aquaticus. Linn. *Common Shrew-mole.*

Sorex aquáticus; Lin., *System. Nat. 12th edition, corrected*, Vol. I. 74.
Talpa fusca; Pennant, *Brit. Zool. Quadrupeds.* 314.
Scalops Canadensis; Desm., *Mam.* 115.
Scalope de Canada; Cuv., *Regne. Anim.* 134.
Shrew-mole; Godman, *Nat. Hist.* I. 84. pl. 5, f. 3.
Scalops Canadensis; Harlan, *Fauna.* 32, young.
Scalops Pennsylvanica; Harlan, *ibid.* 33, adult.

Dental formula. Incisors $\frac{2}{4}$. False molars $\frac{12}{6}$. True molars $\frac{6}{6}$.=36.

In the adult animal there are twenty teeth in the upper jaw. The incisors are of a moderate size, rounded on their front surface, and flattened posteriorly. Immediately behind the incisors are found two minute teeth on each side, crowded together. These are succeeded by four larger, false molars of a cylindrical shape, and pointed. The fourth is the smallest. The fifth is a little larger, and slightly lobed, and the sixth, which is the largest, is more conspicuously lobed. Then follow three true molars, each furnished with three sharp tubercles.

In the lower jaw, which contains sixteen teeth, the two posterior incisors are very small; these are succeeded on each side by another, much larger, pointed, and extending forwards. The three false molars which succeed these are pointed, and the third and largest slightly lobed. The three true molars are composed of two parallel prisms, terminated, each by three points, and presenting one of their angles on the outer side, and one of their faces on the internal surface; the two first are of the same size; the last somewhat smaller.*

In the young animals, which I conjectured to be under a year old, I have found the two small thread-like teeth that are placed behind the incisors, in the upper jaw, entirely wanting, as also the fourth lateral incisor on each side, leaving vacant spaces between them and presenting the appearance ascribed to them by Cuvier and Desmarest. The latter teeth are first supplied, and finally, as the animal becomes fully matured, the two first also make their appearance, when all the edentate spaces between the molars and grinders are filled up.

The description, not only of the teeth, but of the form and habits of this quadruped, are so correctly given by Godman, in his excellent article on the Shrew-mole, (Vol. I. p. 81,) that in the present state of our knowledge little remains to be added. My descriptions, from specimens now before me, of an animal common in every part of the United States, are only given in this place to enable the student of nature conveniently to compare it with other species which will be noticed in this article.

Form. The common Shrew-mole has a thick, cylindrical body, and the head, at the first sight, seems attached to the shoulders without an intermediate neck. The snout is naked, cartilaginous, and very flexible, extended five lines beyond the incisors. The under surface projects a little beyond the nostrils, which are oblong, and open on the upper surface near each other. The mouth is large, and when open, resembles in miniature, that of the hog. The eyes are a mere speck, concealed by the fur, and, to appearance, covered with an integument. There is no external ear, but a small, circular aperture exists, about three-fourths of an inch behind the eye.

The whole of the fore-arm is concealed by the skin, and its broad palms only are visible. The palms are large and naked, not unlike those of the human hand, bordered with stiff hair. The nails are large, nearly convex above, and

* Godman.

flattened on the inner surface. The hind feet are comparatively small, naked on the under surface, and nearly so above. The nails are slender, and moderately arched. The tail is short, round, nearly naked, sparingly sprinkled with short hairs.

Color. The nails are a horn-color. The snout, in the living animal, is of a light flesh-color; chin, feet, and tail, being the naked portions of the body, are nearly white. The hair, which is about five lines in length, and very soft, smooth and lustrous, is for three-fourths of its length dark plumbeous, tipt on the outer surface with light brown, giving the whole animal, above and beneath, a dark brown appearance, varying under different lights, with black, silvery, and purple reflections.

Dimensions. Measurement of a specimen in the flesh.

Length from snout to root of tail, -	4 inches, 7 lines.
do. of tail, - - - - -	9
Breadth of palm, - - - -	6
Length of do. to end of nail, - - -	9
Heel to extremity of nail, - - -	6

Geographical Distribution. I have received specimens of this animal from nearly all the States of the Union, East of the Mississippi. It abounds in South Carolina and Georgia, and is common in the Middle States. I have obtained it in Mississippi and Florida; it exists also in Canada and the New England States. In restoring to this species the specific name of its first describer, I have adhered to a rule which it is necessary to adopt in order to prevent the repetition of synonyms. The name "*aquaticus*," certainly does not apply to the habits of the animal, but that of *Canadensis*, in reference to its locality, is equally unfortunate, as it is far more common in the Southern States than in Canada. I have attached the name of the original describer of the species, although it has been removed to another genus; believing that the first describer is entitled to this credit, in preference to him who has merely placed it under another genus. Were this rule adhered to, in all cases, some check might be put on the art of system-making, now carried to such an extent, that the student of natural history finds it a grievous evil.

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2. SCALOPS TOWNSENDI. Bach. *Townsend's Shrew-mole.*

Scalops Canadensis; RICHARDSON. *Fauna Boreali-Americana.* p. 9.
Scalops Townsendi; BACH. *Jour. Acad. Nat. Scien.* VIII. p. 58.

CHARACTERS. Townsend's Shrew-mole. Larger than *Scalops aquaticus*, color darker, having a different dental arrangement.

This species, first described by Dr. Richardson, was incorrectly referred to the common Shrew-mole of the United States; but its size and dentition are sufficient evidence of its being a new and distinct species.

A specimen of this quadruped was kindly presented to me by Mr. Nuttall, who requested that, in case it should prove a distinct species, it might be given under the above name. I subsequently received from Mr. Townsend another specimen, a little larger in size, which I presume to be a mere variety, although very singularly marked.

Dental formula. Incisors $\frac{2}{4}$; False mol. $\frac{12}{12}$; True molars $\frac{8}{6}$=44.

Length of the head and body, -	7 inches,	6 lines.
Length of tail, - - - -	1	6
Breadth of palm, - - - -		6

The body of the specimen received from Mr. Nuttall, is thick and cylindrical, shaped like the Shrew-mole of the United States. The whole upper and under surface is of a dark color, in most lights appearing black; the hair, when blown aside, exhibits a greyish black color, from the roots to near the tips. The tail is slightly clothed with short, strong bristles.

The specimen brought by Mr. Townsend, is thicker, and about an inch longer. It has a white stripe, about two lines wide, commencing under the chin and running in a somewhat irregular line, along the under surface of the body to within an inch and a half of the insertion of the tail; there is also a white streak commencing on the forehead and extending along the snout.

The specimen of Mr. Townsend is labelled, "Banks of the Columbia River, May 9th, 1835;" that of Mr. Nuttall was, I believe, obtained in the same locality.

In the upper jaw, the incisors are large, and a third higher than the false molars which immediately follow them. These are succeeded by three small teeth of a nearly conical shape, increasing in length from the first to the third. The fourth false molar on each side is the smallest, the fifth is a little larger in size, and slightly compressed, the sixth still larger, and has a considerable posterior projection. The four posterior grinders, or true molars, are much larger and higher than the anterior ones. The first of these is rather small, and has two lobes with a small internal tubercle; the second and third are the largest, and nearly resembling each other, exhibiting three distinct points, two external and posterior, one anterior, the external ones being the longest; the last grinder is the smallest and of a triangular form.

In the lower jaw are two very small incisors in front. Next to these are two of a considerably larger size, which, although regarded as incisors, are nearly of the same shape and appearance as those which come next to them. The false molars are six on each side, of nearly the same size and inclining forward. The three true molars which succeed, are large, nearly of the same size, and although smaller, correspond with those in the upper jaw.

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3. Scalops Breweri. Bach. *Brewer's Shrew-mole.*

Characters. Brewer's Shrew-mole. Glossy cinereous black above, brownish beneath. Palms narrow. Tail flat, broad and hairy.

Through the attention of my friend Dr. Brewer, an industrious and intelligent naturalist of Boston, I am enabled to present a new and very distinctly marked species, to which I have attached the above name. The specimen was found by Dr. L. M. Yale, at Martha's Vineyard, an Island on the coast of New England.

Dental formula. Incisors $\frac{2}{4}$; false molars $\frac{12}{12}$; true molars $\frac{8}{6}$=44.

The skull of *Sc. Breweri* is narrower and more elongated than that of the *Sc. aquaticus.* The cerebral portion of the skull is less voluminous; the inter-orbital portion is narrower, each of the intermaxillary bones in *Sc. aquaticus,* throws out a process which projects upwards and forms the upper boundary of the nasal cavity, and are very slightly separated by the nasal bones, whilst in *Sc. Breweri,* these processes are shorter, and scarcely project upwards above the plane of the nasal bone. Thus, when we view the snout of the *Sc. aquaticus,* laterally, it is distinctly recurved at the tip; whereas in *Sc. Breweri* the upper surface is almost plane. But the most striking difference between these skulls is exhibited in the dentition, inasmuch as, in our present species, there are altogether 44 teeth, in *Sc. aquaticus* there are but 36. Thus, in the number of teeth *Sc. Breweri* resembles *Sc. Townsendi.*

The body of Brewer's shrew-mole is perhaps a little larger than that of the *Sc. aquaticus.* Its snout is less flattened and narrower; its nostrils, instead of being inserted in a kind of bouton, as in the European Talpa, and the swine, or on the upper surface of the muzzle as in the common shrew-mole, are placed on each side, near the extremities of the nose. This species is pentadactylous, like all the rest of the genus. Claws longer, thinner, and sharper than the common shrew-mole. Palm much narrower. Its most striking peculiarity however, is its tail, which, instead of being round and nearly naked, like that of the *Sc. aquaticus,* is flat and broad, resembling in some respects that of the Beaver, and is very thickly clothed, above and beneath, with long stiff hairs, which extend five lines beyond the vertebræ.

Color. The color, above and beneath, is a glossy cinereous black, like velvet, precisely similar to that of the European mole (*Talpa Europæa*) with which I have compared it. Under the throat there is a slight tinge of brown, the tail is ashy brown above and light beneath. The fur is about one-third longer than that of the common shrew-mole.

Length of the head and body,	5 inches	11 lines.
Tail vertebræ,	1	
Do. including fur,	1	5
Breadth of tail,		4
Do. of palm,		4
Length of do. to end of middle claw,		7

In the Museum of the Zoological Society of London there is a specimen, obtained from the United States, which I think is the same species. It is marked in the printed catalogue, No. 145 "*Sc. Breweri*, Bachman's MSS." It however differs in having the fur more compact and shorter, the color somewhat darker, and in fact almost black. The hairs of the tail, instead of being of a brownish ash color, are black, and the hind feet, instead of being covered above with brownish white hairs, as in my specimens, are brownish black.

Dimensions of the skull of the above three species.

	Length of Skulls.	Width of do.	Length of palate.
S. aquaticus,	1 inch 4 lines	8 lines.	7 lines.
S. Townsendi,	1 " $7\frac{1}{4}$ "	$9\frac{1}{2}$ "	$8\frac{1}{5}$ "
S. Breweri,	1 " 3 "	$7\frac{1}{3}$ "	$6\frac{1}{2}$ "

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4. SCALOPS LATIMANUS. Bach. *Broad palmed Shrew-mole.*

CHARACTERS. Broad palmed Shrew-mole, larger than the common Shrew-mole, intermediate in size between *Sc. Townsendi* and *Sc. Breweri.* Hair longer and thinner than in either of the other species, and slightly curled. Palms larger than in any of the known species; color nearly black.

In the rich and daily increasing collections contained in the Berlin Museum, one of the most valuable in Europe, especially in the Mexican and South American birds and animals, I observed two specimens of an undescribed species of Scalops, obtained from some part of Mexico, which, through the kindness and liberality of Professor Lichtenstein, the director of the Royal Museum, I was permitted to describe. I subsequently received a similar specimen from Texas, near the northern boundary line, and I have no doubt it exists also in Arkansas. I regret that I had no opportunity of examining the skulls and teeth of the specimens in the Berlin Museum, and that, in the specimen from Texas the skull is wanting. The external form, however, is sufficient to establish it as a distinct species.

In shape this species resembles our common Shrew-mole; it is, however, much stouter and larger, appearing nearly double the size. Its color is darker, the hair is longer and coarser, and much less compact, presenting none of the smooth, lustrous appearance of the *Sc. aquaticus*. Its most striking peculiarity, however, and that which entitles it to its specific name, is its very broad palm.

Color. Hairs, from the roots, dark gray, tipt with dark brown, giving it a blackish appearance. Teeth large, nearly double the size of *Sc. aquaticus*. Tail naked, as in the former species.

Length from the point of nose to root of tail,	7 inches	7 lines.
Length of tail, - - -	1 "	7 "
Breadth of palm, - - -		10 "
Tarsus, - - - - -		7 "

Art. IV.—ON THE OCCURRENCE OF THE PHOSPHATE OF URANIUM IN THE TOURMALINE LOCALITY AT CHESTERFIELD. By J. E. Teschemacher.

In breaking up for examination some specimens of the green and red Tourmaline, from the well known Chesterfield locality, for the purpose of finding the Microlite of Professor Shepard, I observed a few minute, yellow crystalline plates of a cubic form; as I found them completely soluble in nitric acid, it was evident they could not be the mineral described by the Professor.

Possessing, myself, but few facilities for chemical analysis, I collected together sufficient to forward to Mr. A. A. Hayes, of Roxbury, requesting a qualitative analysis, with the suggestion that the external characters agreed entirely with those of the Salts of Uranium. This gentleman kindly sent me the following reply:

"The mineral is one of the Uranium family, as you suggested, and appears to contain phosphoric acid and oxide of Uranium, as essential constituents, only. In nitric acid it readily dissolves, without effervescence; the result of the solution treated with ammonia, gives a yellow ammoniacal salt of uranium. When the ammoniacal salt is treated with carbonate of ammonia it dissolves, and in a solution of muriate of ammonia can be precipitated as a white flocculent matter, resembling the phosphate of uranium. The solution in nitric acid gives with Ferrocyanate of Potash the characteristic chesnut-brown precipitate of Uranium Salts."

The quantity found was small; there were however two or three well defined cubic crystals, from two to three lines diameter, and varying in color from straw-yellow to light green. Some crystals exist in the red centre of the Tourmaline, and are exposed on splitting the crystals; others are on the quartz and on the Albite forming the mass.

Many of these Tourmalines are in a state of internal disintegration; the interior is then often found in a fibrous state. In the midst of, and attached to, the fibres, I have found several crystals of this phosphate of uranium, probably existing there originally, and not sharing in the decomposition of the surrounding substances.

I am not aware that this mineral has yet been noticed from this locality, and believe it to be hitherto of very rare occurrence in the United States.

The examination of these Chesterfield Tourmalines is extremely interesting. I have found two other substances accompanying them, of species unknown to me, and differing from any I possess; these shall be examined at my leisure.

The frequent abandonment of the study of Mineralogy for that of the more imposing science of Geology, is much to be regretted; and I believe when the former shall be pursued with the peculiar views of elucidating the processes of the formation and consolidation of rocks of various mineralogical composition, the actions by which crystalline deposits, including those in cavities, are produced, and particularly of investigating the changes, re-combinations and metamorphoses different minerals undergo from the commencement and throughout the progress of internal as well as of external decomposition, that much unexpected light will be thrown on several of the great problems of Geology.

Boston, 6th April, 1841.

Art. V.—DESCRIPTIONS OF TWENTYFOUR SPECIES OF THE SHELLS OF NEW ENGLAND. By J. W. Mighels, M. D., of Portland, Me., and Prof. C. B. Adams, of Middlebury College, Vt. (Read Nov. 17, 1841.)

We regard nineteen of the recent, and the two fossil species as new. The other three species we have discovered, for the first time, on our coast. The two species of *Cingula*, viz. C. *semicostàta* and C. *arenària*, are *probably* identical with Turbo *semicostàtus* and T. *arenàrius*, of Montagu : one species of Margarita, *probably* identical with M. *acuminàta*, Sowerby.

Notwithstanding the extraordinary advance which has been made, within four years, in the Conchology of New England, by the discovery of species hitherto unknown, or not observed within our limits, the rich treasures of Nature's storehouse are not yet entirely exhausted. The stomachs of fishes, to which attention was first directed by our honored associate, Mr. J. P. Couthouy, have been fertile sources of discovery. With the exception of Pleurótoma *violàcea*, all the following recent marine species have been taken from the stomachs of Haddocks, (*Morrhua æglefinus.* Lin.) and Codfishes, (*Morrhua Americana,* Storer.) In addition to these, a rich store of most of the species described by Mr. Couthouy and Dr. A. A. Gould, and until very recently extremely rare, has been obtained from the same sources.

We most cheerfully acknowledge our indebtedness to our esteemed friend, Dr. Gould, for his aid in identifying most of the species, and to several gentlemen who have aided us in our explorations ; among whom we would particularly notice

J. Ray, M. D., formerly of Eastport, now superintendent of the Insane Hospital at Augusta, Me., and Mr. N. T. True, Preceptor of the Academy at Monmouth, Me.

THRACIA TRUNCATA.

Plate IV. Fig. 1.

T. testâ parvâ, solidâ, per-inequilaterali, posticè truncatâ, et striatâ: callo nymphali producto.

Shell small, white, rather solid, abruptly truncate posteriorly, very inequilateral; surface with three regions; the anterior region separated from the posterior by an umbonial angle, which extends from the beak to the lower extremity, marked with numerous minute incremental striæ; posterior region with the incremental striæ distinct and very much crowded; areolar region narrow, with regular striæ of growth; epidermis thin, of a pale straw-color; beaks small, that of the right side moderately excavated for the reception of the left; posterior dorsal margin straight, descending abruptly to an angle with the anterior, which is also straight, making an angle with the inferior, which is moderately curved: anterior margin regularly rounded; anterior dorsal margin slightly curved; ligament rather large and prominent; interior of a clear white; nymphæal callosity not spoon-shaped, produced; pallial impression deeper than wide.

Average length, ,75 inch; height, ,5 inch; width, ,29 inch.

Cabinets of Bost. Soc. Nat. Hist., J. W. Mighels, and C. B. Adams.

Habitat. Casco Bay, Me., obtained in 1840, from stomachs of haddock.

Remark. Although this shell is small, its solidity, quite unusual in the genus, forbids the supposition that it is immature. It is remarkably distinct from other species in the disparity of the anterior and posterior sides, whose length are as eight to three. It must be regarded as exceedingly rare, three or four years exploration having developed only four or five specimens.

CYCLAS MINOR.

Plate IV. Fig. 2.

C. testâ, minimâ, ovatâ, inequilaterali; natibus tumidis, approximatis; marginibus rotundatis; dentibus omnibus fortibus.

Shell very small, ovate, inequilateral, finely striate, shining. horn color, yellowish towards the margin; beaks rather prominent, moderately tumid, not undulate, approximate, situated two-fifths the distance from one extremity to the other; margins rounded, both the cardinal and lateral teeth well developed.

Length, ,18 inch; height, ,15 inch; width, ,11 inch.

Habitat. Found among dead leaves, in a swamp, in Weybridge, Vt., in the spring of 1839. Subsequently it has been found in several other places in the vicinity, and in Portland, Me. It is not confined to the water, but is often found a foot or more from it, burrowing deep in the mud, and under stones. It is in the Cabinets of the Bost. Soc. Nat. Hist., J. W. Mighels, and C. B. Adams.

CYCLAS NITIDA.

Plate IV. Fig. 3.

C. testâ sub-ovatâ, inequilaterali; natibus parvis, haud approximatis; dentibus lateralibus fortibus, cardinalibus obsoletis.

Shell sub-ovate, inequilateral, finely striate, shining, horn color, yellowish towards the margin, often blueish on the umbones; beaks small, rather prominent, not undulate, not approximate, situated about two-fifths of the distance from one extremity to the other; inferior margin well rounded, the other margins moderately rounded; cardinal teeth obsolete, lateral teeth well developed.

Length, ,3 inch; height, ,24 inch; width, ,2 inch.

Habitat. We obtained a few specimens of this species at Norway, Oxford Co., Me., in the summer of 1840. It is very rare. It is in the Cabinets of the Bost. Soc. Nat. Hist., J. W. Mighels, and C. B. Adams.

Remarks. The embryo shell is elliptical, obliquely striate, compressed; is ,06 inch long, ,05 inch high, and ,025 inch wide. It resembles C. *minor*, Nob., but the beaks in these shells are approximate and proportionally larger; this species differs also in having the cardinal teeth obsolete both in the young and mature shell, and it is much larger.

NUCULA DELPHINODONTA.

Plate IV. Fig. 5.

N. testâ parvâ, solidâ, trigonâ, transversè sub-sulcatâ; angulis umbonalibus duobus; natibus prominentibus, sub-terminalibus; dentibus anticis tribus, posticis septem, elevatis, conicis, acutis.

Shell small, solid, very wide, oblique, triangular, transversely ribbed and striate irregularly; anterior margin nearly straight above, curved below, inferior margin well rounded, posterior moderately curved, making a right angle with the anterior; surface divided into three regions by the umbonial angles which diverge from the beaks; these are prominent, nearly terminal, often eroded; epidermis green; seven posterior and three anterior teeth, which are very long, slender and pointed.

Average length, ,13 inch; height, ,11 inch; width, ,09 inch.

Cabinets of Bost. Soc. Nat. Hist., J. W. Mighels, and C. B. Adams.

Habitat. Casco Bay. Several hundred specimens were taken from the stomach of a single haddock, in the spring of 1841. At several times subsequently we have obtained them from the same source, sparingly.

Remarks. This species is allied to N. *proxima*, Say, and N. *tenuis*, Turton, but is distinct from both in the number and arrangement of the teeth; also in respect to form, anterior and posterior umbonial angles, and in its greater width.

NUCULA CASCÖENSIS.

Plate IV. Fig. 6.

N. testâ ovato-lanceolatâ, sub-inequilaterali, compressâ; posticè attenuata; areolâ valdè compressa; natibus parvis; dentibus anticis decem, posticis duodecim, parvis.

Shell ovate-lanceolate, rather thin, finely striate, slightly inequilateral ; anterior half regularly semi-oval ; posterior half tapering nearly to a point, with an areola well defined, sharply compressed, with a slight wave below the areola ; epidermis greenish straw-color ; beaks small, nearly central ; within pearly-white ; teeth small, ten anterior, and ten or twelve posterior, including some very minute ones near the beaks.

Length, ,6 inch ; height, ,35 inch ; width, ,09 inch.

Cabinets of G. B. Sowerby, Esq., J. W. Mighels, and C. B. Adams.

Habitat. Casco Bay. A single specimen was found in the stomach of a haddock in the spring of 1840. Subsequently we have found a single specimen of the above dimensions, and four or five very small ones.

Remarks. This species is allied to N. *limátula*, Say, and N. *myalis*, Couth., but is easily distinguished from both by the number of the teeth, the beaks being nearer the posterior extremity, and being much more compressed than either. It more nearly resembles the latter, but is uniformly lighter colored.

PECTEN TENUICOSTATUS.

Plate IV. Fig. 7.

P. testâ parvâ, tenui, sub-inequivalvi ; valva superiore plerumque rubro-fuscâ, tenuicostatâ, costis majoribus 25 usque ad 30, totidem minoribus ; auribus costulatis ; valvâ inferiore pallidè rubro-fuscâ ; extus et intus lævi.

Shell small, sub-orbicular, higher than long, thin, equilateral, sub-equivalve, upper valve a little more convex ; with twentyfive to thirty slender ribs and smaller ones intermediate ; for the most part reddish-brown ; inferior valve smooth, paler than the upper ; ears slightly unequal, those of the upper valve delicately ribbed, of the other smooth ; color internally the same as externally ; inner surface of the lower valve smooth, that of the upper grooved.

Length, ,5 inch ; height, ,56 inch ; width, ,14 inch.

Cabinets of Mons. Largillier, J. W. Mighels, and C. B. Adams.

Habitat. Casco Bay, taken from stomachs of haddock in the summer of 1840. We have found but four specimens.

REMARKS. This is unquestionably a very rare species. It does not appear to be very nearly allied to any of the other species found on our coast. Further research will be necessary to determine whether or not the specimens already found are mature. Like most of the Pectens, this shell varies very much in coloring.

CHITON MENDICARIUS.

Plate IV. Fig. 8.

C. testâ elongatâ, in medio longitudinaliter ad latus irregulariter granulatâ, cinereâ, nubeculatâ ; areis-parum conspicuis ; margine coriaceo, rubro.

Shell cinereous, with dark clouds, long-oval with obtuse dorsal ridges, surface with elevated dots or granules disposed in longitudinal lines, except towards the margin, where they are irregular and larger ; no visible concentric striæ ; triangular areas very indistinct, outer ones small ; margin coriaceous, red.

Length, 1 inch ; breadth, ,4 inch ; width of margin, ,06 inch.

Habitat. Casco Bay. This very distinct species was taken from the stomach of a haddock in June, 1841. Only a single specimen has been found, which is in the cabinet of J. W. Mighels.

CEMORIA PRINCEPS.

Plate IV. Fig. 9.

C. testâ albâ, procerâ, costulatâ, punctulatâ ; rimâ intus in canalem productâ, fornice obtectus ; fornice lateraliter testæ alis adjuncto ; aperturâ ovatâ, crenulatâ.

Shell clear white, elevated, conical, with twentyfive to thirty slight, obtuse ribs, and intervening small ones, the dividing striæ minutely punctured ; summit decumbent, with a single minute whorl ; apex visible on the right side ; anterior slope rectilinear, posterior slope sub-rectilinear ; from the rima within, a narrow groove with callous sides proceeds anteriorly, covered in part by a flattened arch, which arises from the summit of the rima, and is strengthened above by a plate uniting it with the sides of the shell; aperture ovate, slightly crenate.

Length, ,46 inch; width, ,33 inch; height, ,35 inch.

Cabinets of G. B. Sowerby, J. W. Mighels, and C. B. Adams.

Habitat. This shell was taken from the stomach of a haddock, by Mr. Newbegin, a fisherman, in July, 1840, seventy-five to one hundred miles off the mouth of Kennebec river, on fishing ground called by the fishermen "*Monhegan Falls.*" The water at that place is from forty to seventyfive fathoms in depth.

Remarks. This very singular and truly splendid species resembles C. *Noachina*, Lin., but differs from that shell in the following characters; in C. *Noachina* the ribs are more elevated, the corresponding interior sulci are much more obvious; posterior slope much and regularly curved, shell smaller, proportionately longer, not so high, interior arch without wings. Only four specimens have been found.

BULLA PUNCTO-STRIATA.

Plate IV. Fig. 10.

B. testâ albâ, solidâ, eleganter striatâ; striis crebris, inequidistantibus, punctatis; spirâ occultâ; aperturâ magnâ.

Shell white, rather solid, ovate, with crowded, inequidistant, distinctly punctate striæ; spire concealed; aperture very large, contracted at the upper third by the intrusion of the body whorl; labrum rising above the apex, very sharp and regularly arcuate; labium with a very thin lamina extending to the apex.

Length, ,38 inch; breadth, ,24 inch.

Habitat. Casco Bay; taken from the stomach of a haddock, in the summer of 1841.

Remarks. This remarkable and truly beautiful shell, resembles an enlarged specimen of B. *lineolata*, Couth., to which it is allied; but it is easily distinguished by its larger size, by the elevation of the labrum above the apex, and above all, by the punctate striæ. Only a single specimen has been found. It is in the cabinet of J. W. Mighels.

PHYSA FRAGILIS.

Plate IV. Fig. 12.

P. testâ tenuissimâ, obliquè ovatâ; spirâ brevi; anfractibus quatuor; aperturâ subovata, repandâ; labio tumido, laminâ obtecto.

Shell very thin and fragile, translucent, horn-color, obliquely ovate; whorls four; last whorl campanulate; suture deeply impressed at the enlargement of the last whorl; spire usually less than one, sometimes only one-fourth part of the length of the shell; labrum very thin, advanced; labium tumid with a thin, loosely adherent lamina.

Length, ,55 inch; greatest breadth, ,4 inch; divergence, 90 degrees.

Animal of a very obscure, light green color; whole surface of the body covered with oblong dark spots; foot *shorter* than the shell, lanceolate; tentacles nearly white, rather long, very slender; mouth blood-red. Its motions are exceedingly rapid; very timid, withdrawing itself on the least alarm. It is very tenacious of life, at least it is not easily *starved.* Three specimens are now before us in a tumbler of water, November 10th, where they have remained since the first of July. The water has not been changed more than half a dozen times, yet they are as brisk as when first taken; and, moreover, they have *grown* at least one quarter; exuviæ white, abundant, vermicular.

Cabinets of Bost. Soc. Nat. Hist., Amherst and Middlebury Colleges, Mons. Largillier, S. S. Haldeman, J. W. Mighels, and C. B. Adams.

Habitat. Monmouth, Maine; discovered in a mill-pond after the water was drawn off, by Mr. N. T. True, to whom we are indebted for specimens.

Remarks. This species is distinguished from P. *heteróstropha* by the campanulate aperture, which is constant, shorter spire, tumid labium, and by its remarkable tenuity.

LIMNÆA DECOLLATA.

Plate IV. Fig. 13. 13, a, b, c.

L. testâ ventricosâ; anfractibus duobus vel tribus, ultimo magno; spirâ breviuscula, plerumque decollatâ; suturâ impressa; aperturâ maximâ, sub-campanulatâ; labro porrecto; columellâ validè plicata.

Shell very ventricose, rather thick, sub-ovate, or sub-rotund, in outline an irregular rhomboid; epidermis of an olivaceous green color, rather thin, deciduous; whorls two to three; spire very short, generally decollated; whole surface generally rather rough; striæ of growth coarse and fine alternately; transverse striæ on the body whorl sparse, interrupted, sometimes obsolete; body whorl composes almost the whole shell; aperture very large, sub-campanulate; its length is very little greater than the breadth, and occupies more than two-thirds the length of the shell; labrum rather thin, simple; fold of the columella very prominent.

Length, ,6 inch; breadth, ,5 inch; height, ,4 inch.

Animal dingy mouse-color, with a slight tinge of purple, covered with numerous, microscopic, elongated, white spots, on every visible part of the surface, including the mouth and tentacula; foot of a chocolate-color, rather broad, length rather greater than the aperture; habits sluggish.

Cabinets of Bost. Soc. Nat. Hist., Dr. Gould, S. S. Haldeman, J. G. Anthony, J. W. Mighels, and C. B. Adams.

Habitat. Unity, Me., discovered by Dr. Milliken of that town, to whom we are indebted for specimens.

Remarks. This odd, but interesting shell, is easily recognized by its rhomboidal aspect, wide aperture, decollated spire and rather rough and distorted appearance. It is allied to L. *catascopium*, Say, but is distinct from that shell by having less whorls by two, and a much shorter spire; by being wider, and its divergence greater by more than thirty degrees. By some it has been supposed to be identical with L. *emarginata*, Say. This is impossible. L. *emarginata* is much more cylindrical, the divergence of its spire is scarcely half as great as that of our shell, it is much thinner, and has at least two more volutions. Our shell is also destitute of the "deep emargination" which distinguishes L. *emarginata*.

MARGARITA VARICOSA.

Plate IV. Fig. 14.

M. testâ parvâ, tenui, conicâ; anfractibus quatuor, convexis; longitudinaliter costulatis, transversè striatis; suturâ sub-canaliculatâ; umbilico magno, profundo.

Shell small, thin, low, conical, of a dingy white or drab color; whorls four, convex, covered with numerous longitudinal, oblique ribs, intersected by a great number of transverse, revolving striæ, which are most conspicuous on the lower part and base of the lower whorl. The striæ on the upper part of the whorls can only be seen with a magnifier. Suture distinct, sub-canaliculate; umbilicus rather large and deep, bounded by two rather rugged varices, intersected by the ribs which are continued to the verge of the umbilicus; aperture circular; labrum simple, sharp; within perlaceous.

Height, ,25 inch; diameter of base equal to the height; divergence, 90 degrees.

Habitat. Bay Chaleur; taken from the stomach of a cod-fish, (*Morrhua Americana*, Storer,) in the summer of 1841, by our fisherman, Mr. Foster.

Remarks. Only a single specimen of the above dimensions has been obtained, and one other, much smaller and somewhat worn. It is easily distinguished from all its congeners by the longitudinal, oblique ribs, and the two varices at the base. It is in the cabinet of J. W. Mighels.

MARGARITA ACUMINATA.

Plate IV. Fig. 15.

M. testâ parvâ, orbiculari, tenui, albicante; spirâ acuminatâ; anfractibus quatuor, rotundatis, lævibus; suturâ valdè impressâ; aperturâ orbiculari, intus iridescente; umbilico parvo.

Shell small, orbicular, sub-conical, thin, of a grayish white or russet-color; spire acuminate; whorls four, well rounded, smooth, covered with a thin, semi-transparent epidermis; striæ of growth very fine and compact; suture well impressed; aperture orbicular, considerably oblique, beautifully iridescent within; operculum horny, spiral.

Height, ,25 inch; diameter, ,26 inch; divergence, 80 degrees.

Habitat. Gulf of St. Lawrence; taken from the stomach of a cod-fish, by Mr. Foster, in the summer of 1841. Only a single specimen was found, which is in the cabinet of J. W. Mighels.

REMARKS. Identical with a species described by Mr. Sowerby, Conch. Illustr., fig. 7, under the above name. Although Mr. Sowerby's figure agrees well with our shell, his description does not so in all respects. For instance, "anfractibus quinque." Our shell has but four turns. Again, "Long. 0,55, lat. 0,5 poll." Thus we see that Mr. Sowerby's shell is not only twice as large as our specimen, but *proportionally* higher. The breadth of our shell in its longest basal diameter is greater than the height. But as we have only a single specimen, we prefer to publish it with the assumption that it is identical with M. *acuminata*, rather than produce confusion by hazarding a new name for an old shell.

TROCHUS OCCIDENTALIS.

Pl. IV. Fig. 16.

T. testâ, pallidâ, imperforatâ, anfractibus septem, convexis; carinis pallidè fuscis; infrâ lævi; suturâ impressâ; columellâ callosâ.

Shell rather small, somewhat solid, sub-translucent, pale horn-color, with light brown revolving carinæ, of which there are three on the upper whorls, and four to six on the lower one; whorls seven, convex; suture distinct; spire three-fifths of the length of the shell; apex acute; last whorl with a smooth space between the carinæ and two or three course revolving striæ around the umbilical region; aperture moderately depressed, transversely ovate; labrum crenulated by the carinæ; columella callous; umbilical region indented.

Height ,5 inch; greatest basal diameter ,43 inch; divergence 60 degrees.

Cabinets of Bost. Soc. Nat. Hist., G. B. Sowerby, Mons. Largillier, J. W. Mighels and C. B. Adams.

Habitat. Casco Bay; taken from stomachs of haddock, in the summer of 1840, and subsequently.

Remarks. This is the only species of true *Trochus* that has ever been discovered on this Atlantic coast. It is not nearly allied to any species with which we are acquainted, unless we regard *Turbo (Margarita) cinereus*, Couth. — *Trochus costalis*, Lovèn, as a true Trochus. A careless observer would be likely to confound them; but besides several other essential points of difference, our shell is easily distinguished from all the known species of *Margarita*, by the absence of an umbilicus.

CINGULA LATIOR.

Plate IV. Fig. 22.

C. testâ minimâ, ovato-conicâ, lævi, pallidâ; anfractibus quatuor, convexis; suturâ impressâ; spirâ quàm aperturâ longiore; anfractu postremo magno; apertura sub-ovatâ; operculo corneo.

Shell minute, ovate-conic, smooth, pale horn-color; whorls more than four, convex; suture much impressed; spire three-fifths of the length of the shell; last whorl broad, larger than the rest of the shell; aperture ovate-orbicular, left margin with a lamina; operculum horny.

Length ,08 inch; breadth ,05 inch; divergence 60 degrees.

Habitat. Casco Bay; taken from the stomach of a haddock in the spring of 1841.

It is in the cabinet of J. W. Mighels.

Remarks. This species has a slight resemblance to C. *minuta*, Totten, in the absence of sculpture; but the spire is shorter, more pointed, and its divergence is much greater, giving a very different form to the shell. It is, moreover, a much smaller shell. It appears also to be allied to *Turbo reticulàtus*, Montagu, but is distinct from that species in not having as many turns by one and a half; it differs, also, in not being "*strongly* striate, both longitudinally and transversely," and in not having the "aperture thickened by a rib." It has been found very rarely, usually in company with C. *semicostatus* and C. *arenarius*, Mont.

CINGULA ARENARIA.

Plate IV. Fig. 24.

C. testâ minimâ, sub-cylindraceâ, striatulâ, subplicatâ; spirâ conicâ, elongatâ; anfractibus sex, convexis; suturâ impressâ; aperturâ sub-orbiculari, dimidium spiræ æquante; operculo corneo.

Syn. *Turbo arenarius*, Montagu.

Shell minute, white, sub-cylindrical, sub-plicate longitudinally, and minutely striate transversely; spire elongated, conical; whorls six, convex; suture impressed; aperture sub-orbicular, half the length of the spire; operculum horny.

Length ,10 inch; breadth ,05 inch; divergence 30°.

Habitat. Casco Bay, taken from the stomach of a haddock in the summer of 1841.

But few specimens, have been found, which are in the Cabinet of J. W. Mighels.

CINGULA SEMICOSTATA.

Plate IV. Fig. 23.

C. testâ minimâ, ovatâ; anfractibus quinque, convexis, infrâ carinatis, suprà plicatis; spirâ conicâ; suturâ valdè impressâ; aperturâ suborbiculari; operculo corneo.

Syn. *Turbo semicostatus?* Montagu.

Shell very small, ovate-conical, of a ferruginous red color, very thin; whorls for the most part five, convex; with longitudinal ribs on the upper half, and revolving impressed striæ on the lower half; last whorl carinate; spire conical, obtuse; suture well impressed; aperture nearly orbicular; labrum thin, sharp; labium smooth; operculum horny.

Length ;11 inch; breadth ,7 inch; divergence 45°.

Cabinets of Bost. Soc. Nat. Hist., Dr. Gould, Mons. Largillier, J. G. Anthony, and our own.

Habitat. Casco Bay; taken from stomachs of haddock in the summer of 1841.

Remarks. We offer this with some hesitation, as identical with *T. semi-costatus*, Mont. If it should finally prove to be distinct, we would propose to call it *Cingula carinata.*

TURRITELLA COSTULATA.

Plate IV. Fig. 20.

T. testâ albidâ; transversè subtilissimè striatâ; anfractibus decem; superioribus sub-plicatis; duobus ultimis sub-lævibus, ultimo sub-carinato; aperturâ sub-ovatâ, anterius productâ.

Shell whitish, translucent; whorls nine or ten, nearly flat, or very slightly convex; suture well impressed; last two whorls nearly smooth; the others longitudinally plicate, with microscopic transverse striæ; last whorl sub-carinate; aperture rather less than one-fourth the length of the shell, sub-ovate, produced anteriorly.

Length ,7 inch; breadth ,23 inch; divergence, 22°.

Habitat. Casco Bay; taken from the stomach of a haddock in the summer of 1841.

Remarks. Although only a single specimen has been obtained, its characteristics are so obvious that we have not hesitated to describe it. It has no analogue on our coast, to our knowledge; it, however, resembles a very much enlarged T. *interrupta*, Totten. It is in the cabinet of J. W. Mighels.

TURRITELLA RETICULATA.

Plate IV. Fig. 19.

T. testâ turrito-subulatâ; anfractibus duodecim, convexis, longitudinaliter plicatis, transversim striatis; suturâ valdè impressâ; aperturâ sub-orbiculari.

Shell turreted, very slender, of a dingy white or ash color; whorls eleven to twelve, convex, distinctly, though somewhat irregularly plicate longitudinally, with from three to five delicate, impressed, revolving striæ on the five lower whorls; from and above the fifth whorl the transverse striæ gradually diminish in number, until they wholly disappear on the upper two or three whorls. The whole surface of the shell has a reticulated appearance. Suture well impressed; aperture sub-orbicular; labrum thin; operculum horny.

Length ,7 inch; breadth ,2 inch; divergence 20°.

Cabinets of Bost. Soc. Nat. Hist., Dr. Gould, J. W. Mighels, and C. B. Adams.

Habitat. Bay Chaleur, in the Gulf of St. Lawrence; taken from the stomachs of cod fishes (*Morrhua Americana*, Storer,) by Mr. Foster, fisherman, in the summer of 1841, to whom we are indebted for specimens.

REMARKS. This species is allied to T. *erosa*, Couth., but is easily recognized by the longitudinal ribs, and by its more slender form.

PLEUROTOMA VIOLACEA.

Plate IV. Fig. 21.

P. testâ atro-purpureâ, longitudinaliter sub-plicatâ, transversè striatâ; anfractibus sex, ultimo suprà carinato, plicis in medio evanescentibus, alteris medio carinatis; spirâ acutâ; aperturâ angustatâ; caudâ brevi.

Shell small, of a blackish purple color, ovate, with a pale brown epidermis, irregularly sub-plicate, with numerous faint revolving striæ decussating by the incremental striæ; whorls six; whorls of the spire carinate in the middle; last whorl shouldered by a continuation of the same carina, with the plications terminating on its convexity; spire acute, conic; suture distinct; aperture narrow, rather less than half the length of the shell; labrum simple, sharp, regularly curved, with the sinus at the extremity; canal short, wide.

Length ,3 inch; breadth ,15 inch; divergence 40°.

Cabinets of Bost. Soc. Nat. Hist., G. B. Sowerby, J. W. Mighels, and C. B. Adams.

Habitat. Casco Bay; found without the animal, at low-water mark, in the summer of 1840, and subsequently in the stomachs of *haddock*.

REMARKS. This species is remotely allied to *P. decussata*, Couth.; our shell, however, is always longer, aperture narrower, and the sculpture less regular and distinct; but it is especially characterized by having the spiral carina far below the suture.

FASCIOLARIA LIGATA.

Pl. IV. Fig. 17.

F. testâ elongatâ, fusiformi, crassâ, rubro-fuscâ, transversim costulatâ; anfractibus sex, convexis: spirâ acuminatâ; suturâ valdè impressâ; aperturâ ovato-elongatâ; labro crenato: columellâ plicis duabus.

Shell elongated, fusiform, rather thick, of a reddish-brown color, when fresh, covered with a thin and almost perfectly transparent epidermis; whorls six, well rounded, and covered with six or seven equidistant, revolving, thread-like ribs, with grooves alternating; suture well impressed; spire regularly tapering, pointed; aperture oblong-oval, polished; within of a bright reddish-brown color; canal rather narrow, nearly straight; labrum rather thin, crenulated by the ribs and grooves; columella arcuated above the middle; two distinct, oblique, delicate folds above the commencement of the canal.

Length ,7 inch; breadth ,3 inch; divergence 45°.

Cabinets of Dr. Gould, J. G. Anthony, J. W. Mighels, and C. B. Adams.

Habitat. Mingan, in the Gulf of St. Lawrence; taken from the stomachs of cod-fishes, by Mr. Foster, fisherman, in the summer of 1841.

Remarks. This remarkable and truly beautiful shell is not very nearly allied to any species with which we are acquainted, unless it be to that of *F. fusiformis*, Valenc., from New Holland. That species, however, is much larger than our shell, is much less regularly and strongly ribbed, and has a tooth-like process on the labium, of which our shell is destitute. We suppose this to be the first and only species of the genus that has ever been found on our coast.

FUSUS CANCELLATUS.

Pl. IV. Fig. 18.

F. testâ subulatâ, longitudinaliter plicatâ, transversè striatâ: anfractibus septem, convexis: suturâ valdè impressâ; spirâ acuminatâ; apice acutâ; aperturâ sub-ovatâ; labro crenato.

Shell rather slender, turreted, with about twenty longitudinal ribs, running a little obliquely to the left, crossed by numerous transverse, revolving, raised lines, giving the shell a cancellated appearance; whorls seven, convex; suture well impressed; spire gracefully tapering; apex acute; columella slightly arched at the upper part; aperture rather narrow, sub-ovate; canal short, straight, rather wider at the base; labrum thin, delicately crenated by the transverse striæ.

Length $\frac{13}{20}$ inch ; breadth $\frac{1}{4}$ inch ; divergence 22°.

Cabinets of Dr. Gould, and J. W. Mighels.

Habitat. Casco Bay ; taken from the stomachs of haddock in the summer of 1840. It must be regarded as very rare.

Remarks. This species is very nearly allied to *Murex purpureus*, Mont., (Turton Conch. Dict. 95,) but is distinct in having a less number of volutions by three or four, by the direction of the ribs, which are "obliquely to the right," in *M. purpureus ;* Montagu's shell is also described as "rugged," "very rough," &c., terms which will not apply to our shell ; it is also said to be "purple," which color is regarded by the author as characteristic ; our shell is variously colored, some specimens being tinged with purple, others are white.

The following species of *Fossil Shells* occur at Westbrook, in the vicinity of Portland, in company with *Nucula Portlandica*, Hk., in the post-tertiary formation, described by Prof. Hitchcock in Vol. I. No. 3, of this Journal. Prof. H. found one or two specimens of the *Bulla*. Dr. Wood, of this city, was the first to discover the *Nucula*.

NUCULA ANTIQUA.

Pl. IV. Fig. 4.

N. testâ parvâ, sub-trapeziformi, per-obliquâ, transversè sulcatâ : dentibus posticis sexdecim, anticis sex : margine simplici.

Shell white, small, somewhat trapeziform, very in-equilateral, covered with deep transverse sulci ; epidermis dark brown ; teeth, sixteen posterior and six anterior to the beaks ; beaks low, approximate ; anterior margin abrupt, posterior regularly rounded, basal margin slightly curved, simple.

Length $\frac{7}{10}$ inch ; height $\frac{11}{40}$ inch ; breadth $\frac{1}{5}$ inch.

Cabinets of Boston Soc. Nat. Hist., J. W. Mighels, and C. B. Adams.

Remarks. This species resembles N. *proxima*, Say., and N. *tenuis*, Turton, but differs from both in the number and arrangement of the teeth, in the deep transverse sulci, and in its length compared with its height and width. It is scarce.

BULLA OCCULTA.

Pl. IV. Fig. 11.

B. testâ parvâ, ovato-cylindricâ: spirâ occultâ: labro suprà elevato, medio recto; aperturâ sub-angustâ, infrà latâ, rotundatâ.

Shell small, of a dingy white color, ovate-cylindrical, covered with very minute transverse striæ, and with indistinct longitudinal striæ of growth; spire concealed; labrum extends a little below the spire, nearly *straight* above the *centre*, regularly rounded below and at the base; aperture narrow at the upper part, rather broad at the base.

Length $\frac{1}{5}$ inch; breadth $\frac{3}{20}$ inch.

Cabinets of Bost. Soc. Nat. Hist., Amherst and Middlebury Colleges, J. W. Mighels, and C. B. Adams.

Remarks. If not identical with, this shell is the analogue of, B. *triticea*, Couth. It however differs from that species in being proportionably wider. It is very scarce.

Art. VI.—DESCRIPTIONS AND FIGURES OF THE ARANEIDES OF THE UNITED STATES. By Nicholas Marcellus Hentz. (Communicated July, 1841.)

The Publishing Committee think it proper to inform the readers of this Journal, that the following article is the first of a series on the Araneides of the United States, which has been offered for publication, by the author, to the Boston Society of Natural History. These descriptions and figures will be followed hereafter by others, and the whole will form an illustrated monograph of all the Spiders observed by Professor Hentz in various parts of this country, and will supply a want which has been long felt in this department of our Natural History.

Class. ARACHNIDES.
Order. PULMONARIA.
Family. ARANEIDES.
Section. *Tetrapneumones.*

Genus. MYGALE. Walckenaer.

Characters. *Eyes eight, placed near together, on the anterior edge of the cephalothorax, in two rows, variously curved; fang of the cheliceres articulated downward; palpi inserted on the extremity of the maxillæ; feet* 4. 1. 2. 3. *or* 4. 1. 3. 2.

Observation. The distinction between MYGALE and OLETERA is artificial, as a slight elongation of the maxillæ of Mygale would place the palpi at the side; witness MYGALE ? *unicolor.*

1. MYGALE TRUNCATA.

Description. Piceous; cephalothorax with a curved impression behind the middle, *cheliceres* (mandibulæ) terminated by several points above the fang, hairy; abdomen cylindrical, suddenly truncated at the end, and callous at that place, with concentric grooves and six circular impressions; thighs more or less rufous at base; a white membrane between the joints. Feet 4. 1. 3. 2.

Observations. This spider dwells like other species of this subgenus in cylindrical cavities in the earth. Though many specimens were found, I never saw the lid described by authors as closing the aperture of its dwelling. The very singular formation of its abdomen, which is as hard as leather behind, and which forms a perfect circle, induces me to believe that it closes, with that part, its dwelling, instead of with a lid, when in danger.

Habitat. Alabama.

Fig. 1. Mygale truncata. *a.* Arrangement of the eyes. *b.* Trophi. *c.* Side view of the spider. *d.* Hole in which it resides. *e.* Respective length of the legs.

2. MYGALE SOLSTITIALIS.

Description. Deep black; cephalothorax with two indentations, cheliceres moderately large; abdomen with several impressions above, and four yellow spots underneath; membrane between the joints white; third pair of legs with the third joint short and crooked; feet hairy, 4. 1. 2. 3. A large species.

Observations. One specimen only (a male,) was found in July, wandering on the ground. The character, derived from the third pair of legs, does not seem to be a mere sexual distinction, as MYGALE *Carolinensis*, the next species, has the same peculiarity, and the description was taken from a female.

Habitat. Alabama.

Fig. 2. Mygale solstitialis. *a.* The eyes. *b.* The Trophi. *c.* The abdomen viewed underneath.

3. MYGALE CAROLINENSIS.

Description. Brownish, very glossy; cephalothorax with two slight impressions near the base; abdomen blackish, not glossy; third joint of the third pair of legs very short and crooked; feet 4. 1. 3. 2.

Observations. This species was communicated to the author by the late Mr. Levi Andrews, of Chapel Hill, North Carolina, a promising young naturalist, snatched by consumption from his numerous friends, and to the memory of whom this tribute is due. The character derived from the third pair of legs is not a sexual one, as this was a female, and the description of MYGALE *solstitialis* was taken from a male, which has the same character.

Habitat. North Carolina.

Fig. 3. Mygale Carolinensis. *a.* The Eyes.

4. MYGALE GRACILIS.

Description. Rufous; cephalothorax somewhat six-sided, long and narrow; abdomen plumbeous, two nipples very long; feet long, hairy, penultimate joint of the anterior pair with a notch; feet 4. 1. 2. 3.

Observations. This spider, hitherto always found in mid-winter, under stones or on the ground, is probably not the male of Mygale *Carolinensis;* but the peculiarity of its *first* pair of legs, is, no doubt, a sexual character. The same joint of the feet of the male of my Dysdera *bicolor*, is not only bent, but has powerful prongs and bristles, which nature has given him as a defence, or as the means of grasping the female.

Habitat. Alabama.

Fig. 4. Mygale gracilis. *a.* The eyes. *b.* The right palpus, with the maxilla.

5. MYGALE ? UNICOLOR.

Description. Deep rufous; cephalothorax depressed in the middle, with two impressions, cheliceres very large; abdomen smooth; third pair of legs with short, very thick joints; feet 4. 1. 2. 3.

Observations. This species is very distinct from any other, particularly by the manner in which its palpi are inserted. Were the maxillæ extended a little more at their extremity, this spider should be placed in the sub-genus Oletera, which follows. The specimen, from which this description was taken, (a female,) was turned up by the plough, in a field, in the month of May. The manner in which the spiders belonging to Mygale and Oletera live, hidden under ground, and probably issuing out only at night, prevents our becoming acquainted with their habits. I doubt whether the males ever dwell in tubular habitations. Much remains yet to be done to complete the history of this genus and that of the next.

Habitat. Alabama.

Fig. 5. Mygale ? unicolor. *a.* The eyes. *b.* The trophi.

Art. VII.—DESCRIPTIONS OF TWO NEW SPECIES OF FISHES.

By D. Humphreys Storer, M. D. (Read April 21st, 1841.)

A few weeks since, through the kind attention of Mr. Moses Williams, Jr. of Roxbury, a member of this Society, I received from Lake Winnipissiogee, a beautiful fresh specimen of Lota, a description of which I beg leave to offer.

Lota Brosmiana.

Plate V. Fig. 1.

The specimen, which was a female, was twentyseven inches in length ; the length of the head was five and a half inches. The body is very broad in front of the dorsal fin ; it becomes much compressed on the sides back of the first dorsal, and tapers to the caudal fin. Its general color is yellowish ; the back, between the back of the head and the origin of the dorsal fin, exhibits a reddish tint : the top of the head and the opercula are fuliginous, the latter exhibiting golden reflections in their centre. The body beneath is white. The whole body is perfectly smooth, covered by innumerable cup-shaped depressions, like that of the *Zoarchus anguillaris*, and like that species is lubricated by a viscid secretion.

The depth of the body at the base of the pectorals, is three and a half inches ; its greatest depth is four and a half inches ; its depth at the vent is three and a half inches.

The greatest breadth of the head, across the opercula, is five inches. Its breadth across the eyes, is three and a quarter inches. The snout is blunt. The top of the head is flat. The distance between the eyes, is less than two inches. The eyes are circular, one half inch in diameter ; the nostrils are double—the posterior, half of an inch in front of the eyes ; the anterior, which is tubular, and furnished with a cirrus two lines in length, is less than half of an inch in front of this. The opercula are nearly two inches in length.

The vertical gape of the mouth, is two inches in extent; the jaws are equal; the jaws, palatine bones, and pharynx are armed with numerous fine teeth, placed like those of a card. The tongue is large, smooth and white. Suspended from the chin is a cirrus one and a half inches in length.

The lateral line commences above the operculum, and very gradually curving downwards, does not reach the middle of the body, until beyond the middle of the dorsal fin.

The dorsal, pectoral, anal, and caudal fins are colored, as well as the sides of the fish, with bluish blotches, and are margined with black. The ventral fins are white beneath, and fuliginous above.

The first dorsal fin is situated eleven inches back of the snout; it is two inches long, one inch high, the posterior portion barely higher than the anterior.

The second dorsal fin commences half an inch back of the preceding; it is less than an inch high at its commencement, and is half an inch high at its posterior extremity. This fin is continued nearly to the base of the tail.

The pectoral fins are situated directly behind and beneath the posterior angle of the operculum; they measure three and a half inches across, when extended, and are rounded at their posterior extremity; they are an inch deep at their base.

The ventral fins are situated in front of the pectorals; the rays are fleshy; the first ray is an inch long, the second ray is continued an inch beyond this; the remainder of the rays are shorter than the first ray.

The anal fin commences half an inch back of the vent, and terminates on a line with the second dorsal fin; the rays are of equal height throughout. The vent is large.

The caudal fin is three and a half inches in length; when expanded, it is three and a half inches high, and rounded at its extremity.

The weight of this specimen was five and a half pounds.

B. 7; D. 10—71; P. 16; V. 6; A. 68; C. 34.

In the œsophagus of this fish I found a blade of grass, and the stomach contained numerous bones of a fish, too far digested to be determined; a large quantity of viscid mucus enveloped these bones. In the intestines were several pellets, apparently of soft mud.

I received a specimen of this species a year since, from a pond in Alexandria, N. H. It was not, however, in a proper state for description. There, as well as in Lake Winnipissiogee, it is known by the common name of *Cusk.* As it might readily be mistaken for that fish, by a cursory observer, I have based my specific name upon that genus.

I learn from Mr. Henry Bryant, of this Society, that the inhabitants around Lake Winnipissiogee affirm that this fish was originally taken from the sea and placed in that sheet of water. I should doubt the correctness of these remarks, from the circumstance, that this species having ever been considered a *Cusk*, an inhabitant of the sea, and the sea only, they drew the inference that it must have been transferred; not considering that the Lake had an outlet, and that its waters passed by a river of the same name into the Merrimack, and thence directly to the sea: the dams and various other obstructions which have been thrown across the Merrimack within a few years, would undoubtedly, at the present time, as perfectly check their progress from the sea, as they are known to have impeded the advance of the salmon; but at an earlier period, they did not exist—and for centuries, perhaps, this species may have dwelt in the Lake.

Two species only of Lota, the *Ling* and the *Burbot*, are found among the Fishes of Great Britain, The latter "lives permanently in fresh water, and prefers slow running rivers," but it is found in only a few of the rivers. I know of but two species besides that I have now described, which are found in this country. One of them, the *maculosa*, first observed by Le Sueur, in Lake Erie, is found, according to Richardson, "in every river and lake from Canada to the western extremity of the continent." Another, which he calls *compressa*, Le Sueur received from Northampton, on the Connecticut river. A specimen of this latter species, from the Ashuelot river, a branch of the Connecticut, I presented to the Cabinet of this Society, several years since.

There are many points of resemblance between this fish and the species taken by Le Sueur in 1816, and described by him in the first volume of the "Journal of the Academy of Natural Sciences," under the name of *Gadus maculosus* in 1817, and in the "Mémoires du Museum d'Histoire Naturelle, t. V. p. 159," for 1819, and also there figured, under the name of *Molva maculosa.* It is very evident that that figure was drawn from a preserved specimen, which had lost its original proportions by the process of drying. The difference which exists between the *Lota maculosa* and the species I have now described, may at once be recognised, by examining the plates of each species contained in this number of our Journal. In the first number of the "American Monthly Magazine and Critical Review," for 1818, Dr. Mitchill refers to a species which he calls *Gadus lacustris.* In the course of his remarks, he states that this "appears to him to be the same fish" that "Le Sueur found in Lake Erie, and has figured," &c. He supposes a fish which is found in Sebago Pond, Maine, and called there the *Sea-cusk,* to be the identical species. Never having seen a Lota from the last locality, I am unable to decide what the fish referred to may be. Dr. Mitchill's *Gadus lacustris* is evidently the *Gadus maculosus* of Le Sueur, and he infers, without having ever seen the species, that the Lota from Maine, is the same fish.

Etheóstoma Olmstedi.

Plate V. Fig. 2.

The beautiful little species here described, was found at Hartford, by Charles H. Olmsted, Esq. President of the Hartford Natural History Society. He is a very accurate observer, and is striving to advance the science which has been so long and so inexcusably neglected among us. I take great pleasure in associating his name with this species.

Length of the fish, which is of a cylindrical form, three inches. Color yellowish, marked upon the back and sides with reddish brown blotches, which, when looked upon from either extremity of the fish, resemble interrupted longitudinal bands, through the largest of which passes the lateral line; when the fish is examined from above, these markings present more or less distinct transverse bands upon the back, which are situated at the origin, the middle, and the termination of both the dorsal fins.

Length of the head five lines: flattened back of the eyes. Eyes less than a line in diameter.

Preoperculum golden; the upper part of the operculum is scaly, and it terminates in a sharp spine. A narrow, deep black band runs from the tip of the upper jaw to the anterior inferior angle of the eye, and a second band passes upwards from the lower anterior angle of the preoperculum to the middle of the lower edge of the eye, and thence to the upper edge of the orbit, interrupted by the globe of the eye.

The teeth in the jaws are very minute.

The first dorsal fin commences one line back of the opercular spine; it is almost colorless, half an inch long, three lines high, rounded posteriorly.

The second dorsal fin is seven lines long; three lines high; the extremities of the rays are bifurcated; the rays being crossed by transverse reddish lines, present a very pretty appearance.

The pectoral fin is light colored, and spotted like the dorsals; one line long, and five lines high.

The ventral fins are situated directly below the opercular spine; they are one line long, five lines high, and are variegated like the second dorsal fin.

The anal fin, which is of the color of the abdomen, commences back of the second dorsal; it is three lines long and two lines high.

The caudal fin is in color similar to the second dorsal; it is two lines deep at its base, and is five lines long.

The fins are rayed as follows:

D. 9—13; P. 15; V. 6; A. 11; C. 15.

ART. VIII.—ON A NEW SPECIES OF RAFFLESIA, FROM MANILLA. BY J. E. TESCHEMACHER. (Read 16th June, 1841.)

Plate VI.

Having just received from Manilla, preserved in spirit, several buds of that rare and singular parasite, *Rafflesia*, which, on examination appeared to differ essentially from the species hitherto described from Java and Sumatra, I beg to offer to the Society the following account, with a drawing.

The specimens were gathered in Basei, a district of the province of Leite, on the same spot visited by Mr Cuming, for the purpose of finding this plant, during his late excursion to the Philippine Islands. Not having seen any description of this plant by him, in the Scientific Journals, I am uncertain of the result of his visit; and although I propose the specific name of *Manilana* for this species, I would readily yield it to any other he may wish it to retain.

The only accounts of *Rafflesia* to which I have access are, that of *R. Arnoldi*, from Sumatra, in the 13th volume of the Transactions of the Linnean Society of London, and that given by Sir W. J. Hooker, in the Companion to the Botanical Magazine, of *R. Patma* detected by Dr Blume, in Noussa Kambangan, a small island on the coast of Java, and described and figured by him in the *Flora Javæ*.

The column of one of my specimens was sent by itself from Manilla, and of two others I have dissected buds; the larger by a vertical cut, the section shown in the figure, the second, a smaller specimen, by the removal of the whole of the envelopes, exhibiting the naked column with its processes, edge, anthers, &c. The column from Manilla, being dissected when fresh, was considerably dried when placed in spirits. Its form and several parts are therefore not very distinctly retained, but the number of anthers and several other particulars are clear enough.

The largest bud of those I dissected is two and one-half inches in diameter, and arises from a cup three-fourths of an inch in depth, the outer part of which is formed of the same substance as the external bark of the root on which it is parasitic, and which is evidently of the same structure as that of the root of *Cissus augustifolia* on which the *R. Arnoldi* was found.

It is probable that the smaller size alone would sufficiently distinguish this from the last mentioned species, the buds of which are stated to be one foot in diameter ; because, although the respective age of these buds is not known, yet every part is so perfect in the buds I dissected, even to minute and glandular hairs, that it is not probable they would have been long in this state before opening.

There are apparently in this, five series of bracteæ ; the middle one, at its origin, about three-eighths of an inch in thickness, or three times the thickness of the two outer and the two inner series. These bracteæ are imbricated over, and completely envelop the perianth ; they are marked by prominent veins, precisely as in *R. Arnoldi ;* the tube of the perianth originates on a line with the central row of bracteæ below the two interior rows, and although in the bud at its upper part, it is undivided, yet the lines of its divisions, when expanded, are clearly discernable. The interior of these divisions of the perianth is marked by tubercles of various forms, as in the other species.

The column has a convex disc, surrounded by a raised edge ; on the surface of this column are eleven processes, rather more than one-eighth of an inch in height, differing from each other slightly in size and form, the summits of which are entire and hispid, the hairs much resembling pistillary projections. One of these processes is in the centre, the other ten arranged around it at about an equal distance between it and the raised edge.

The anthers, which are of the same form, with pores and cells like those of the other species described, are ten in number, and are also suspended from the under side of the upper edge of the column, in open cavities formed in the lower part or base of it ; both edges of the open part of these cavities are covered with hairs resembling those on the tips of the processes on the disc, and that part of the tube of the perianth opposite to these openings is studded with thick, capillary hairs, each terminated by what is apparently a glandular knob.

Down the centre of the column are lines, evidently bundles of vascular tissue, which pass through the substance of the cup into the root of the cissus; all the rest of the interior is cellular.

I could not perceive any very distinct appearance, in the bud, of an annular process at the mouth of the tube of the perianth, although it is not improbable, from various marks, that such a ring may be developed when the flower is open.

There is no appearance, in any of these three specimens, of the cavities exhibited in the figure of *R. Patma*, which contain the spores; on this part of the structure of *Rafflesia*, therefore, these specimens from Manilla do not throw any farther light. They are probably male flowers. Of *R. Horsfieldii*, which, when expanded, is only three inches diameter, I have not seen any description.

I close this paper with the following comparisons of the two species described, and of that which I call, at present, *R. Manillana.*

R. Arnoldi. Bud, before expansion, one foot diameter, sessile on root of *Cissus angustifolia*, the under side of its base reticulate; disc of column convex, processes on surface forty to sixty, close together, divided at the summits, which are hispid; anthers forty to sixty, with numerous cells, and furnished with pores at summits; a moniliform cord at base of column; interior of perianth covered with variously formed tubercles.

R. Patma. When expanded, two feet diameter, arising directly from the root of the *Cissus;* disc of column concave, processes on surface of disc *numerous*, of a pyramidal form, the summits of which are entire and hispid; lower part of tube of perianth and column glabrous, interior of perianth covered with variously formed tubercles; anthers with cells and pores; number not mentioned; no moniliform cord at base of column; antheriferous flower containing cavities filled with spores, hence hermaphrodite.

R. Manillana. Bud, before expansion, two and one half inches diameter, arising from a cup three-fourths of an inch high, formed by the thickened bark of the root of the *Cissus;* the bracteæ originating from the inner side of the upper edge of the cup; no appearance of reticulation under the base; disc of column convex, processes on surface eleven, one of which is in the centre, the rest arranged around it, their summits entire and hispid; lower part of tube of perianth studded with thick glandular hairs; anthers ten, with cells and pores, as in the other species; no moniliform cord at base of column; sporiferous cavities not apparent, flowers examined probably male; interior of perianth covered with various formed tubercles.

Art. IX.—REMARKS UPON CORAL FORMATIONS IN THE PACIFIC; WITH SUGGESTIONS AS TO THE CAUSES OF THEIR ABSENCE IN THE SAME PARALLELS OF LATITUDE ON THE COAST OF SOUTH AMERICA. By Joseph P. Couthouy. (Read December 15, 1841.)

Among the various geological phenomena which at once bear record of the past changes in the structure, conditions and climate of our planet, and indicate the alterations at this moment slowly and silently, but effectually going forward; few have given rise to more speculation, than the countless coral isles and reefs, which stud the equatorial seas, especially in the Pacific and Indian Oceans.

It is my intention, in this communication to, throw together a few observations upon this class of rocks, and such correlative topics as may present themselves as I proceed. With regard to the latter, no fixed system or order of introduction will be pursued, but they will be taken up at random, as suggested by the main subject.

The vastness of the region over which these singular formations are scattered; the evidence they afford, by analogy, of the existence, in former epochs, of a more uniformly warm temperature of the earth than has prevailed since its present organization — in the fact that such rocks now form only in the more heated parts of the ocean, while their fossil types and analogues extend even into the arctic regions — the great density of the beds of coral, exhibited in some of the uplifted islands — the light thrown by an examination of them, on the origin of the wide tracts of chalk and limestone found in various parts of the globe — the apparent insignificance and insufficiency of the tiny architects that construct these singular edifices when compared with the stupendous results of their labor — all these are points which have long directed to them the researches of the geologist, and given rise to a variety of theories upon the mode in which such innumerable masses of coral have risen from the bottom of "the vasty deep."

The inaccurate statements of early voyagers, relative to the rapidity with which coral rose to the surface, seemed to be in a measure corroborated by the accounts brought home by almost every vessel trading to these regions, of new reefs springing up as by magic, in the most frequented tracks.

Many were in consequence, induced to regard the coral seas as containing the rudiments of a new continent, which, silently but rapidly, rearing itself above the waste of waters, was destined, at no very remote period, geologically speaking, to equal in magnitude either of those now existing.

Later, and more systematic examination, however, has shown that such an inference was deduced from very erroneous premises. By observations upon the depths of channels in well known harbors, and the level of reefs in their vicinity; by the fact that not the slightest increase of the coral is perceptible on or around anchors and guns cast upon a reef from a stranded vessel, and known to have remained undisturbed for more than half a century — and by similar means of arriving at an approximation to the truth; it is now ascertained that the growth of coral is exceedingly slow.* The lapse of many

* I am inclined to believe that the increment of the branching corals, or at least of certain species, is much more rapid than that of the sessile or encrusting genera; having observed such shells as Pecten, Lima, Plicatula and Pedum, of an inch and a half in length, completely overgrown by the Polyparia, while their colors and internal polish were scarcely impaired. These were not lodged as we frequently see Arcæ and Mytili, in accidental cavities, but for the most part imbedded at the divergence of the branches. There are specimens exemplifying this, now in my possession, and also in the Society's collection, in which the branches are enlarged, and sometimes deflected by their envelopment of these foreign bodies. The rate of increase in such cases, might be approximately ascertained, by experiments upon the time requisite for shells of this kind to attain a size equal to the imbedded specimens, which it is very likely were lodged upon the corals soon after their expulsion from the parent shell.

centuries would be requisite for the construction of a solitary reef, and myriads of ages must pass before the lateral growth of the thousands of scattered islets and shoals could extend itself so widely as to unite them all in one continuous body.

That so many new islands in those seas, were and are still discovered by almost every navigator, need not excite our surprise if we consider their small extent, in general rendering them mere specks in the ocean, which, together with their slight elevation, prevents their being visible more than a few miles under the most favorable circumstances. By day they are often concealed by a veil of mist and cloud, and I have myself passed within three miles of one, whose existence, owing to this cause, would never have been suspected had we not previously been well assured of it. During the night especially, in consequence of their being surrounded by deep, blue water, vessels may, and do, frequently pass within a very small distance of such perilous spots without receiving the slightest warning of such proximity.

On this subject the *facts* stated by intelligent, though unscientific observers, are entitled to our respect and consideration, whatever may be our opinion of the *inferences* they draw from them.

The Rev. John Williams,* late missionary from England to the South Seas, had bestowed much attention upon the subject of coral formations, among which he spent about sixteen years of his valuable life. In his "Narrative of Missionary Enterprise in the South Seas," p. 49, (1st Am. Ed.) he observes, "the rapidity of the coral growth has been egregiously over-rated and over-stated." "You seldom find a piece of branching madrepore, of brain, or of any other coral, however deep in the water, above two or three feet in height."

And again on p. 50, alluding to the formation of new islands, he remarks, "I have traditions of the natives on almost every subject, especially of their former navigators, wherein every island which has subsequently been discovered within

* Mr W. was barbarously murdered in November, 1839, by the cannibals at Errumanga, one of the New Hebrides, while endeavoring to open a communication with them, for the object of introducing some native teachers from Samoa.

a thousand miles, is named; but in no one of them is there any mention of, or reference to, a newly formed island. I am familiar with one tradition in which there is a genealogical account of the reigning family for thirty generations, which is equally silent upon the subject of new formations."

In conversation with Mr W. at Upolu, one of the Samoan or Navigator Group, but a few days prior to his death, he stated that on the reef bordering that island, there were particular clumps of coral, known to the fishermen by names derived from either some particular configuration, or tradition attached to them, and handed down from generation to generation from time immemorial. By careful inquiry among the natives, he had satisfied himself that these had undergone no perceptible alteration since the earliest mention of them. The testimony of the missionaries, and other foreigners, at the Tahitian and Hawaiian Islands, some of whom had resided during nearly forty years within sight of the reefs, confirmed, as far as it went, the remarks of Mr Williams. Did the limits of this communication permit, many other facts might be adduced, corroborative of the evidence given by these persons of the extremely slow increase of the living corals; but the point is perhaps now too generally conceded, to render farther details necessary in an article like the present. In connection with this subject of growth, a few remarks, however, upon some of the theories respecting recent coral formations, which have found supporters among men of science, may not be misplaced.

It was at one time a very generally received opinion, founded chiefly upon the circumstance that a fathomless ocean laved the very margin of the reefs; that the coral animals commenced their labors at an illimitable depth, and, governed by a certain instinct or impulse, toiled upward to the light, giving to their sub-marine structures the peculiar form they exhibit, through the same instinct teaching them that it was the best adapted to afford shelter from the violence of wave and tempest.

Thus, the windward portion of the reef was supposed to be that first elevated, presenting a perpendicular face to the breakers, and shelving away on the opposite side. Protected by this wall, it was thought the polypes next constructed their edifices at some distance to leeward, which at first rose in a series of detached masses arranged in a somewhat circular form. But gradually the intermediate spaces were filled up and a continuous chain was thus formed, enclosing a deep, bowl-shaped lagoon, which, in process of time was also filled up by the stony dwellings of the polypes.

Fragments of coral, heaped up by wind and sea, and cemented together, formed a ridge of two or three feet elevation above the level of the surrounding ocean. Multitudes of marine birds frequenting the rock to deposit their eggs — the exuvia of crabs and shell-fish on which they fed, the sediments left in hollows by the heavy and frequent rains ; gradually prepared a light soil for the reception of the few seeds wafted thither by favoring currents, or brought by stray land birds — these sprang up, and by their subsequent decay added continually to the depth of soil, — a single cocoa-nut perhaps, cast upon the beach, germinated, and arriving at maturity, its seeds in a few years were scattered over the island, which was then fitted for the abode of man.

That this is the manner in which the once sterile and weather-beaten ledge of rocks has been here gradually covered with the most luxuriant vegetation, there can be no question.* Perhaps no more striking proof of it can be adduced,

* An instance of the rapidity with which even the largest plants multiply and spread themselves over the soil in these regions, is afforded in Christmas Island, an extensive lagoon island, situated between about 1° 40′ and 2° 10′ North lat. and 157° 10′ and 157° 50′ West long. By the statement of Capt. Cook, who discovered it in 1777, "on the cocoa-nut trees upon the island, (the number of which did not exceed thirty,) very little fruit was found ; and in general, what was found was either not fully grown, or had the juice salt or brackish ; so that a ship touching there must expect nothing but birds, fish and turtle, and of these an abundant supply may be depended upon."

In 1837, the English whale ship Briton was wrecked on this reef, and her Captain, George Benson, with his crew of twentythree persons, remained upwards of seven months on the island, from which they were finally taken by an American whaler. According to Capt. Benson, there were several large groves of cocoa-nut trees, one of them containing between six and seven hundred, and the whole number exceeded two thousand, bearing excellent fruit, although many trees had been cut down by the whalers occasionally touching than the fact that the small number of species of plants found on these islands previous to the visits of man, are all those whose seeds would bear this mode of transportation, without injury to the germinating principle, and belong to an almost equal number of orders, and sometimes of classes, whose primeval soils were widely remote from each other.

But there is nothing whatever in the appearance of the reefs, confirmatory of the supposition that the windward portion was constructed anteriorly to the opposite one. They have both precisely the same level, present similar inequalities of surface, and an equally perpendicular wall facing the sea. The only material difference is, that the elevated fragmentary beach is in general, as might be expected, first formed and highest on the windward side.

But even this is not invariably the case. At Minerva or Clermont Tonnerre Island, which is situated on the southeastern skirts of the Dangerous Archipelago, in about 18° 26′ South lat. and 136° 30′ West long., and whose greatest extent is from E. S. E. to W. N. W., or nearly in the direction of the S. E. trade wind; the northern shore is the more elevated one. The southern or windward side of the lagoon is here bounded by a low, naked line of reef rock, and several small, detached islets. At Ocean Island, in lat. 28° 22′ North, long. 178° 30′ West, near the limits of the N. E. trade wind in the Pacific, the highest points, and the only ones in fact above water, are a ridge some three miles long and no where above ten feet high, at the S. E. extremity of the reef; and two knolls about a mile and a quarter in circuit, on the South skirt of the lagoon. The reef extends from the S. E. ridge, about eight and a half miles to the N. W. in form of an oval, whose shorter diameter is six miles from N. E. to S. W.

On no part of this extensive reef, is there any thing to show that one portion of it is of higher antiquity than the rest, and it is on all sides washed by an unfathomable ocean. It cannot surprise us that while so little was known of the habits

there for supplies. The turtles, however, appear to have been driven away by the intruders, as he caught but about twenty, of small size, during his long stay; whereas Capt. Cook procured three hundred during his brief visit.

of the saxigenous polypes, reefs of this nature were supposed to be raised by them from a depth like that found outside. But later and more careful investigations of their habits, have undeniably proved the incorrectness of this opinion. By the concurrent testimony of all recent observers, it is now shown, that instead of inhabiting such profound depths, the reef-building polypes require for their development and support, a certain degree of light and heat, not penetrating lower than one hundred and twenty, or at the utmost, one hundred and thirty feet in any part of the ocean. Some indeed have asserted less than half that depth to be the limit of growth, but this can only be true of particular tracts, as I shall have occasion to show in another place.

Another theory, and one obtaining the sanction of some distinguished names among the geologists of Europe, was suggested by the circumstance of nearly all the coral islands having a lagoon of variable depth in their centre. From this peculiarity it was conjectured that the reefs rested upon the summit of extinct sub-marine volcanoes, whose craters were represented by the lagoon.

It cannot be denied that this hypothesis presents many plausible features, but still there are some knotty and stubborn facts for which it fails satisfactorily to account. It is true, that a knowledge of such enormous craters as those on the summit of Mauna Loa in Hawaii, and Haleakala in Maui,* which are estimated at twentyfour and twentyseven miles in circuit, might in a measure quiet the doubts of those to whom the great extent of some of these lagoons, appeared the chief obstacle in the way of assuming their crateric basis. Yet although it may be possible that some of the lagoon islands

* Hawaii and Maui are the two principal islands of the Hawaiian Group. The great crater on Mauna Loa, here spoken of, is on the very summit of the mountain, which is little less than fourteen thousand feet high. It must not be confounded with that of Ka lua Pele, or Kilauea, spoken of by Lord Byron, Ellis, Stewart, and others. This latter is on the S. E. flank of the mountain, about four thousand feet above sea level, and is at present in full activity. No signs of action, other than a faint smoke, have been perceived in the terminal crater for about fifteen years. The great crater of Haleakala, or "The House of the Sun," also a terminal one, at an elevation of nearly eleven thousand feet, has been extinct from a period beyond that reached by the traditious of the islanders.

having a circuit of twenty, forty, or even eighty miles, are thus based; it is rather startling to assert that such a multitude of submarine craters, and of such varied and anomalous configuration, were grouped together in so small a space as the coral archipelago of Polynesia; not to mention the still greater number that, if this theory is correct, must have existed in other parts of the Pacific, and in the Indian Ocean, where similar formations prevail to a great extent. There is, I believe, nothing analogous to this hypothetical huddling together of craters in any of the present volcanic regions of the globe. It is true, that the Galapagos have been estimated to contain from fifteen to eighteen hundred craters, of various magnitude, but nine-tenths perhaps of these, are rather to be regarded as funnels, or chimnies, composed of scoria, or gravel and ashes, which are constantly crumbling in and becoming obliterated merely through the action of the weather; and could not have been formed under water at all. It is indeed very probable that at some remote period of the past, the agency of internal fires may have been much more powerfully manifested than at a later day, and the vents therefore much more numerous then than since the earth received its present form. But admitting that submarine volcanoes once existed in the number and limited space required by this theory; there are still one or two points that would seem to be fatal to it, though they appear to have been overlooked by its advocates.

From the peculiar adaptation of structure in every other class of animated beings to certain habits and conditions, analogy would certainly lead us to the conclusion, that the organization of creatures flourishing so luxuriantly near the surface, could hardly be capable of supporting the great pressure resulting from such a column of water as would rest upon them at profound depths. But besides this objection, there was the improbability that beings so frail could exist equally well, amid temperatures so widely different as those of the surface of the ocean and its bed or any considerable depth. In the parallel of 16° South, where the surface temperature was 82° Fahr., that of six hundred feet below it was shown by a registering thermometer to be but 56°, and at nine hundred feet but 48°. This experiment was made by myself, in the open ocean. At the same depths upon soundings, the difference would, I doubt not, have been still greater, but not having actually ascertained this by experiment, I cannot speak positively on this point.

According to the statements of those zealous naturalists, MM. Quoy and Gaimard, the result of their observations during the first voyage of the Astrolabe, was, that the growth of the more solid corals was limited to a depth of five or six fathoms.* In fixing this limit, however, I think they have not sufficiently taken into consideration the variations of temperature at small depths, produced by accidental causes, and that in the tropics, where the sea is warmed to a considerable depth by the presence of large bodies of land, these corals may flourish considerably lower.

In approaching the island of Tutuila, one of the Samoan group, I remember suddenly coming from deep water upon a shelf, upon which there were but thirteen fathoms. This ledge, distant about two and a half miles from the coast, which was very steep, was profusely covered with coral. The surface temperature was here 81°, and that of the bottom 76°,

* The work of Q. and G. not being accessible here, I trust of necessity to memory, in quoting the depth assigned by them, as the lowest limit for the growth of the coral in any considerable quantity.

It is well perhaps to notice here, that wherever, in this communication, certain depths and temperatures are spoken of, as essential to the growth of the polypes, I refer only to the reef-constructing genera, and more particularly to those whose Polyparia form hemispheral masses, broad, lamellar incrustations, or solid palmate clusters. Some of the arborescent corals have been found in extra-tropical seas, in very low temperatures, and depths far exceeding those here assigned as the limits of the saxigenous polypes. There is now, or should be, in the collection at Washington, a small species of Madrepora, dredged on the coast of Patagonia, from a depth of eighty fathoms; and Dr. Gould has lately received specimens of another from our coast, in the vicinity of Portland, Maine. I have also picked up specimens on the New Jersey shore. But these have all a shrunken, dull, and if I may so call it, starved appearance, and are of insignificant size. Such species may, and I doubt not do, exist at depths of corresponding temperature, in the tropics, but they bear the same affinity to those constituting the coral reefs, that our humble bracken does to the magnificent and stately palm-tree-like Ferns of Polynesia.

Fahr. Throughout the coral archipelago to the eastward of Tahiti, the surface temperature ranges from 78 to 81°. The same may be said of that in the neighborhood of the detached islets, between Tahiti and Samoa to the west. Throughout this region, I observed all kinds of coral flourishing in perfection on the outer plateau of the reefs, at a depth of seven, eight, and in some cases, as that just cited, twelve or thirteen fathoms.

In our own hemisphere, in the vicinity of Eleuthera and Abaco, and also of the Stirrup Keys on the N. E. edge of the great Bahama Bank; I have dredged up considerable masses of Meandrina from a depth of sixteen fathoms, and in sailing over Salt Key Bank, have seen them, on a calm day, in twenty fathoms. This is probably attributable to the increased temperature caused by the proximity of the Gulf Stream which has here a heat of 85° Fahr. The most compact and vigorous growth, may, I think, however, be considered as prevailing, in general, at a depth of from three to eight fathoms.

To assume, therefore, that the lagoon islands are based upon extinct submarine volcanoes, we must also suppose that these all had their summits raised to nearly an uniform level, and that, the one best adapted to the habits and development of the coral animal, an arrangement scarcely within the bounds of probability. It is difficult to believe that some two hundred or more craters, if they ever existed in so narrow a space as that occupied by some groups containing that number of lagoon islands, nowhere presented more than one hundred or one hundred and twenty feet difference of level.

But granting that all these requisites for the establishment of this theory existed; it offers no explanation of the circumstance that some of the reefs have, as ascertained by sounding, a thickness of several hundred feet, and of their fossil representatives in the chalk and marine limestone being found in strata of still greater density. Neither does it in any way account for the existence of extensive shore reefs like those of Samoa, Hawaii and Tahiti; or of encircling reefs with lagoons between them and the shore, as at Vanikoro and several of the New Hebrides and Friendly Islands; or for the immense barrier reefs of New Caledonia and Australia, the latter of which, at a distance of thirty or forty miles from the coast, extends in an unbroken chain nearly one thousand miles from north to south. It affords at best, but a very questionable explanation, of a single variety of structure in these wonderful edifices, than which nothing more forcibly illustrates the immense results that may ensue from the operation of apparently trifling causes, when continued unremittingly throughout a long series of ages.

It is my belief that, to a certain extent, the corals are limited in their range of growth by temperature rather than depth, and that wherever this is not below 76° Fahr. there, *cæteris paribus*, they will be found to flourish as in the Polynesian seas; accordingly we find that their principal formations are placed within the tropics, and though I have no means of ascertaining at this moment the fact, I apprehend that in the Indian Ocean, as in the Pacific, the saxigenous polypes will be found most abundant and at their greatest depths, in a belt comprising about twenty degrees on each side of the equator.

But even allowing that they invariably commenced their structures at the extreme depth of twenty fathoms, it is obvious that no reef would attain a thickness of much more than a hundred feet, before the labors of the polypes must cease and themselves perish, in consequence of their exposure to the sun's rays. The question then naturally arises, how are we to account for the existence of coral banks, so greatly exceeding this thickness as some are known to do; if it is thus disproved that their polypes build at corresponding depths?

Mr. Charles Darwin, who accompanied King and Fitzroy, as Naturalist, in their late survey of the southern extremity of our continent, was led by his examination of a lagoon island, (the only one I believe on which he landed,) and a comparison of the observations of his predecessors on this subject, to frame an hypothesis, which appears to offer us a solution of this problem, at once satisfactory, simple and rational.

According to the statements lately given by Prof. Lyell, in his lectures before the Lowell Institute, Mr. D supposes the great thickness of the reefs, to have been formed by a gradual and long continued subsidence of the original shelf of coral, while the surface was maintained at the same level as at first, by the unceasing additions made by the polypes. Carrying out this principle, he attributes the peculiar conformation of lagoon islands to the operation of similar causes. That is to say, he considers that the site of those islands of such a character, now sprinkled over the whole vast coralliferous belt of ocean, was once occupied by islands of various elevation, surrounded as many of the same class now are, by a fringing or shore reef; that as these have slowly sunk, the reef has gradually receded from the shore, and on their total disappearance left the lagoon only to mark the place of their existence. Thus the coral islands instead of being looked upon as the germs of a new continent, should be contemplated as the wrecks, or rather as beacons, pointing out where lie the wrecks of one, long since

"In the deep bosom of the ocean buried."

Having personally examined a large number of these islands, and also resided eight months among the volcanic class having shore and partially encircling reefs, I may be permitted to state that my own observations have impressed a conviction of the correctness of the theory here advanced by Mr. Darwin. Indeed without being aware at the time that such views were entertained by any one else, but failing to discover in any author a satisfactory elucidation of the apparent anomalies they exhibited, I was led, more than two years ago, by a comparison of the features presented by the reefs of Tahiti with those of the Dangerous Archipelago and Paumotu Group, (of which I had just enjoyed an opportunity of examining a very considerable number,) to similar conclusions as to their origin, with those recently published by that gentleman; though not to entertain his opinions respecting limited and definite areas of subsidence and elevation.

My observations in MS. on this subject are now in the possession of the Navy Department at Washington; but not being permitted to have access to them, I am compelled, in all the statements made in this communication, to rely upon memory alone. I shall in another place, briefly give my reasons for believing that the whole of Polynesia is at present slowly rising, and proceed, here, with a few remarks suggesting themselves at the moment, relative to its former subsidence.

It is not denied that some portions of this region may exhibit certain peculiarities of structure, which, in the present state of our information we may find some difficulty in reconciling with this theory.

But I feel persuaded, that as this is enlarged, as a greater number of facts bearing on the question are brought together, and we are enabled to fix with more certainty than can now be done, the causes of such variations from a general character, these will nearly if not quite all be found consistent with the admission of a principle, which holds out a rational explanation of phenomena, inexplicable upon any previous hypothesis.

The immensity of the tract, throughout which it is assumed this subsidence or submergence of land has prevailed, will appear less astonishing, when we reflect that nearly the whole of that now elevated above the level of the ocean bears upon its surface incontestable evidence of having been slowly uplifted from its depths, and that in some regions, as on the Baltic coast, the process is still going on under our own observation. On the loftiest heights to which man has ascended, as in the lowest vallies, the presence of beds of marine shells and other fossils, attest that there once were the "foundations of the great deep." Even in New Holland, whose animal and vegetable productions differ so singularly from those of all the world beside, as to leave conjecture itself at fault, in attempting to account for the fact; and which a learned German author, once gravely endeavored to show was the nucleus of some comet that had come in collision with our planet—even there, beds of marine limestone, and marine fossils of the same genera, and evidently belonging to the same era as those found in some of the Silurian rocks of Great Britain, have lately been found in large numbers far inland and on the highest mountains. On the lower grounds of the coast, in the vicinity of Newcastle, New South Wales, there are strata of clay from sixty to one hundred feet thick, abounding in marine shells, many of them analogous to, and some of them identical with, species at this moment living in the adjacent seas.

It is not unreasonable to conjecture, that when the existing lands constituted the bed of an ocean, teeming, as evinced by their fossil remains, even in regions now condemned to the regions of perpetual winter, with forms of animal life peculiar to our tropical seas; then the balance of land and water was preserved by the existence of a broad equatorial continent, or it may have been a number of large islands, whose structure was chiefly, if not entirely volcanic. We can then conceive, how by one of those stupendous oscillations, which an examination of its various strata, shows the earth's crust to have experienced at different epochs; as the Alps, the Andes, and the Himalayas uprose from the abyss, and age after age continued to raise their aspiring summits to the skies; the pre-existing lands gradually sank and finally disappeared; even the elder mountain ranges, hiding "their diminished heads" beneath the waters; a few only of the loftiest remaining, like scattered monuments, in those ancient

> "Titan peaks that overtop the waves,
> Beaconing a sunken world." *

* It is a curious coincidence, if nothing more, and even to those who are not in the habit of attaching much importance to the signification of names, may seem worthy of this passing notice, that the appellation of "Paumotu," bestowed by the natives upon the extensive group of lagoon islands to the eastward of Tahiti, is compounded of "*Pau*," lost or passed away, and "*Motu*," an island. They have also an ancient tradition that all this region was once high land; but the gods being angered by the inhabitants, caused the sea to rise up and overflow it, when all perished but one chief and his family, who were saved by escaping to the top of Raiatea, an island a few leagues to the northwest of Tahiti. From these, when the waters partially subsided, the islands were re-peopled. Similar traditions are extant in Samoa and Hawaii. In one of these the story is precisely that of Deucalion and Pyrrha, excepting that the rescued pair raised up a new race by scattering cocoa-nuts instead of stones behind them. I mention this only as one more instance, in addition to those already well known, of the widely spread if not universal belief, in the occurrence of a deluge by which nearly the whole of mankind were once destroyed.

Such we may consider the Tahitian, Samoan and other groups of elevated volcanic islands in Southern Polynesia, interspersed among which are occasionally found lagoon islands also. The rocks of the former class, from New Zealand to Tahiti, (and I might include most of the Hawaiian islands, two thousand four hundred miles farther north,) are so nearly alike in all respects, that on seeing a series of specimens from each group placed together, any mineralogist ignorant of the fact would in all probability decide that the whole were collected within a short distance of each other. Indeed, it was necessary in packing specimens collected by myself of the deeper seated rocks of South New Zealand, Tahiti and Kauai, for me to use great precaution in keeping them separate; as if once mingled it would have been impossible from any difference of character to identify their several localities again.* May we not be justified then, in assuming this common character to be some proof of a common age as well as origin for those islands, and an indication at least, that though now so widely separated, there was a period when they were connected together in a grand whole?

It may perhaps be asked, if this theory of subsidence be well founded; why is it that the original shore reef does not, instead of forming a lagoon, present a flat surface, on the total submergence of the land, extending over the whole area once occupied by this latter? But this could not possibly occur unless the submerged island had been of very small extent, and rose almost perpendicularly from the sea. In all the shore reefs that I have seen, there is a narrow interval of shallow water between them and the shore, which the wash of the beach renders too impure and turbid for the growth of the coral in any quantity. This space would be continually widening during the subsidence, (even were the lateral increase of the coral equal to that upwards, which is doubtful,) by reason of the recession of the mountain side from the reef being greater than its perpendicular descent. Thus if we

* These specimens are now deposited in the new Patent Office at Washington, and, as I learn, are open to public inspection; so that any one may there easily convince himself of the truth of these remarks.

suppose the face of the mountain to have presented an angle with the horizon of say 30°, it is evident that for every foot of subsidence there would have happened three feet of recession from the reef's original limit. By the time it had sunk two thousand feet, allowing as above, the lateral and upward growth of the reef to be equal in rate, and that rate sufficient to maintain it at its primary level, a channel would thus be formed four thousand feet in width, between reef and shore. The steeper the mountain, the narrower would be the lagoon formed by the same amount of subsidence; and the reverse.

Now this difference is precisely that which is really exhibited by the encircling and barrier reefs, according to the nature of their coasts. In the abrupt and lofty volcanic islands of Polynesia, the lagoons seldom exceed three fourths of a mile or a mile in breadth, while on the gently ascending coast of New Holland, the reef is in some places fifty miles from shore.

I shall notice at present but one more feature in these lagoons, which is their small depth, in comparison with what the assumed subsidence would at the first glance lead us to expect. But the wash from the beach, which in every instance under my observation, spite of the protection afforded by an outlying reef, was very considerable; and the detritrus of the reef itself, together with the alluvium deposited by streams, would be sufficient to raise the bed of the lagoon very materially. If in addition to this we suppose, what may well have been the case, that there were intervals of time during which the land was stationary, while these causes continued in full operation, or that any considerable time has elapsed since a cessation of the subsidence, there is no longer any difficulty in accounting for this comparative shallowness of the lagoons.

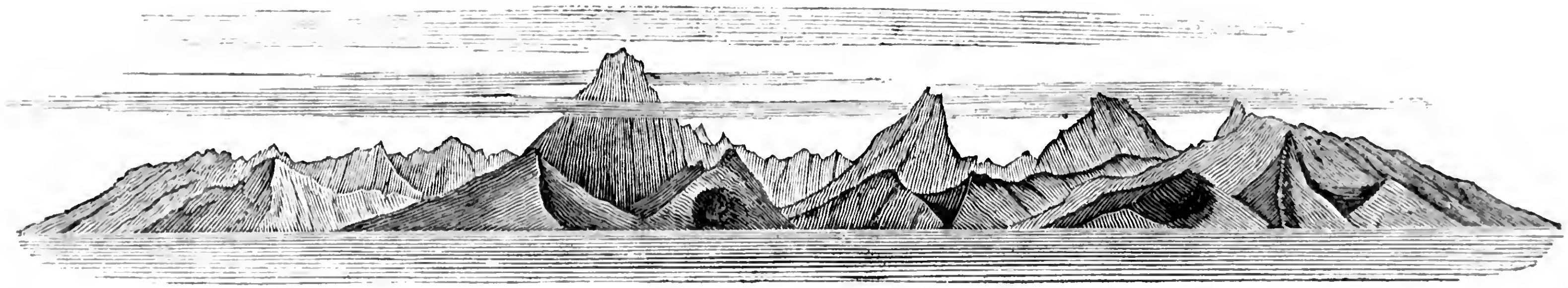
As the general character and aspect of the low coral islands is not very clearly understood by some of our number, I may be pardoned for venturing to occupy a few moments in a hasty sketch of their structure. This seems the more called for, because in the recent course of Lectures delivered for the

Lowell Institute, in this city, by that eminent Geologist, Prof. Charles Lyell, a part of his language, while describing these Paumotus or Attols, was calculated to mislead many of his audience as to their general configuration. He invariably spoke of them as "circular," "annular," or "ring-shaped," and they were so represented in the drawings illustrative of his remarks. Indeed, the question has since been more than once put to me, how was this uniformity of outline to be accounted for, unless the reefs really were based on submarine craters?

But so far from this particular shape being the constant or even most frequent one, it is of comparatively rare occurrence, at least in the Polynesian seas. The most ordinary form is that of a short bow, crescent, or horseshoe; the convex side facing different points of the compass in different islands. In those of the Dangerous Archipelago, a very common figure is a long, narrow, sinuous ellipsis. This, indeed, is the configuration one might expect a group of these Paumotus to assume, following that of the pre-existent ridges whose site they occupy.

Unassisted by plans or sections, it is not easy for the mind to follow out the appearances that would be presented by a mountainous tract surrounded by a shore reef, during its transition to the lagoon formation. Nevertheless some notion of this may be formed, if we imagine to ourselves an island like Tahiti or Eimeo, or some of those in Samoa, consisting of a number of central conical peaks, (some of them crateriferous,) from which diverge in all directions, sharp ridges having upon them, here and there, hills sometimes several hundred feet high — these ridges intersected by profound ravines, whose walls frequently present a precipice of fifteen hundred or two thousand feet elevation—and the ravines sometimes barred by a transverse ridge, perhaps a portion of the mountain, which has fallen down, so as to give the space between the barrier and the head of the chasm the appearance of a long, narrow, and deep pit or trench.

The stupendous ravines which separate the lateral ridges of the central chains, form such a remarkable feature in all the volcanic islands of Polynesia, that they seem to me entitled



Island of Eimeo, as it Appears from the Harbor of Pappeiti, in Tahiti. Principal Peak W. N. W., Dist. 18 Miles.

to something more than a mere passing notice of their existence. They may be divided into three classes. The most common and extensive is that descending from the base of the central ridge, where it is often so narrow that a person may spring across with ease, to the sea shore, where it gradually widens into a plain of a mile or more in breadth, and constitutes the most fertile and valuable portion of the soil. The ravines of this character are in general the bed of streams, fed by mountain torrents and cascades, of which I have counted eleven from one point of view, having a fall of from two hundred to twelve hundred feet, and glittering like so many veins of burnished silver, on the black face of the volcanic rock. They are bounded on each side by steep and frequently inaccessible walls, every crevice and ledge of which is clothed with the most luxuriant vegetation, and are generally terminated at their upper extremity by the central mountain, which rises in a perpendicular barrier of occasionally two thousand feet elevation. The only way in which these central peaks can be reached, is by following up the securiform lateral ridges, and even this method is not always practicable, on account of the steep and lofty cliffs that rise from their summits, and frown a stern denial to all further progress.

It is on the plains at the termination of these ravines, that the villages of the natives are usually situated, and the voyager who has coasted the shores of Tahiti, can never forget the Eden beauty of some of these spots. The groves of orange, whose golden fruitage and snowy blossoms gleam star-like from a mass of dark verdure ; the intermingling of the tall cocoa's graceful, plumelike crest of drooping foliage ; the lofty and wide spreading Vi, (*Spondias dulcis*,) and Barringtonia, (*B. speciosa*,) the rich hues of the bread fruit tree ; the deep shining green of the broad, bannery leaves of the plantain ; the Hibiscus, with its large, gay blossoms of orange and crimson ; the coral tree, (*Erythrina corallodendron*,) one dazzling mass of scarlet flowers ; with a little wilderness of limes, guavas, and other trees peculiar to these climes—the picturesque cabins, peering out here and there from the dense vegetation—the wild and gloomy ravines in the rear, lighted up in spots by sparkling waterfalls; and in the remote background, the fantastic pinnacles of the grandly broken mountains, towering up in clear relief against the soft blue tropical sky—all these combine to form a picture of such transcendant loveliness as can be scarcely equalled in any other part of the world.

The second class of ravines is often not to be distinguished from the first, where it opens on the coast, but at some distance inland it contracts to a very narrow gorge, of varying extent, which again opens suddenly into a sort of circus, occasionally eight or ten miles in compass, but usually from an eighth to three-fourths of a mile in diameter, surrounded, except at the outlet, by a lofty and precipitous escarpment, so as to present exactly the aspect of a crater whose walls have been riven asunder by some violent convulsion. This structure of the ravines is of more common occurrence in the Samoan and Hawaiian Islands, than at Tahiti. They are sometimes dry at bottom, but more frequently form the basins of streams, which, flowing through a tract of table land above, throw themselves over a precipice of from one to five hundred feet in height, and pass out through the narrow gorge to the sea. At Upolu there is a fine instance of this, in the cataract of Vainafa, or "the broken water." The river, about seventy feet wide, and four deep just above the pitch, falls in three sheets about two hundred feet, into an oval basin, about three-fourths of a mile in circuit, from which it escapes between two high cliffs, not above twenty yards asunder.

In the following cut it is attempted by different lines, to exhibit at one view four distinct sections of this class of ravine, to show the character of its terminating circus.

a. Natural section presented at the falls.

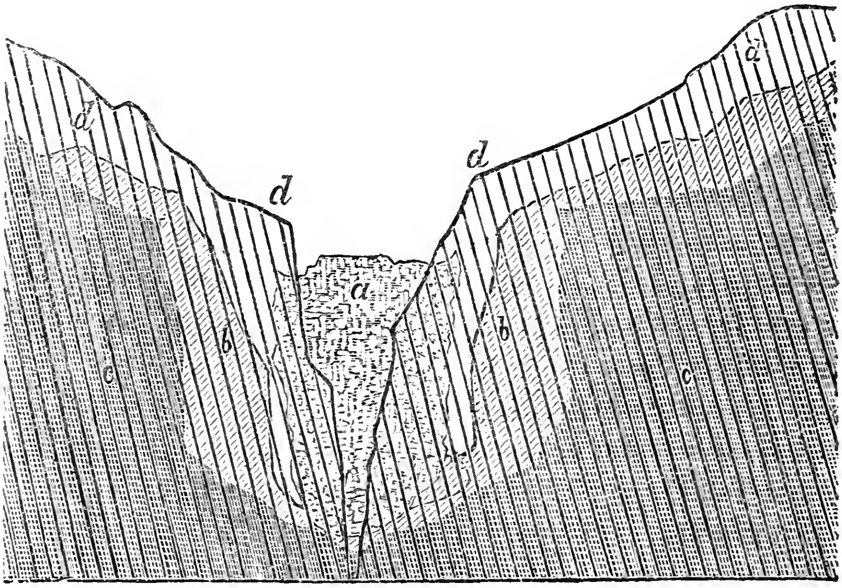
b. b. Imaginary transverse section at forty yards below them. The dotted curve line crossing *b* near the bottom, represents a large excavation, worn by the spray at the foot of the falls.

c. c. Similar section at widest part of circus, about one hundred and fifty yards below the falls.

d. d. d. d. Do. at the gorge where the river enters it from the basin.

The gorge, which in this instance may possibly have been formed by the recession of the falls, extends almost three-fourths of a mile, and then gradually widens into a common valley, terminating seaward in a broad plain.

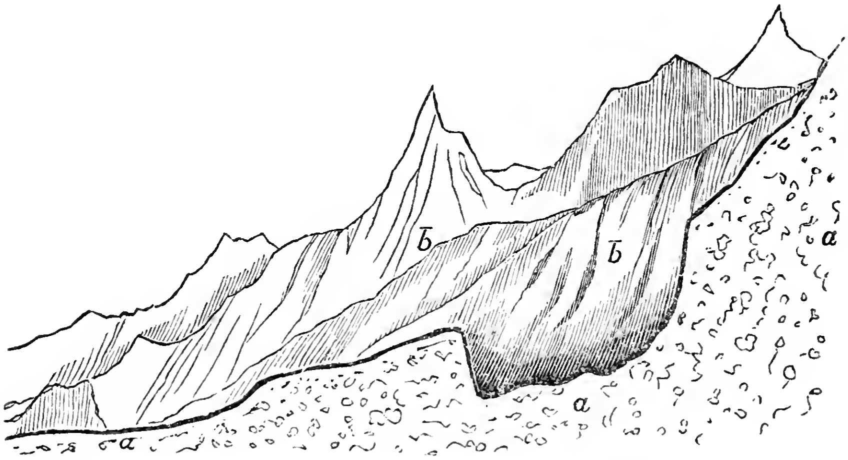
SECTIONS OF THE RAVINE AT THE FALL OF VAINAFA.



At Hilo, on the Island of Hawaii, there is a very beautiful miniature ravine of this class, at the cascade of Waianuenue, ("the water of the rainbow,") and there are grand examples of it in the falls of Wailua and Hanapépé in the island of Kauai, especially in the latter, which pitch down full five hundred feet, into a circular basin about one thousand feet round, hemmed in by walls of alternately columnar and stratified lava, the only break in which is the narrow outlet for the stream. If we imagine the rapids of Lake Erie to be a plain, girt with lofty mountains, with the Niagara flowing through it, and this latter narrowed below the falls to one-fourth its present width, we shall have a very good idea of the ravine under consideration. Of those similar in form, but having no stream of water, there is a fine exemplification in the great amphitheatre at the head of the Nuuanu valley, in Oahu. They are also to be seen in full perfection, on the north side of the ridge of Konahuanui, between the Pali, or precipice of Nuuanu, and Kualoa. There is one near Waiahole, described by the late Meredith Gairdner, M. D. (in a "Sketch of Oahu," published in the Hawaiian Spectator,) as "very remarkable for its great depth and narrowness; resembling exactly the section of an immense chimney, rising from the heart of the mountain; an effect which is heightened by the black color of the rocks."

If we picture in our minds a ravine of this description, having a barrier across the narrow gorge or outlet, we shall then have an accurate conception of the structure of the third class. Although this doubtless exists in the other islands, I only met with it at Tahiti. There is one example of it in the mountain lake of Waihiria, at the head of the Waihara valley, North of Mairapehi. This lake is about fifteen hundred feet above sea level, three-fourths of a mile in circuit, and ninety feet deep, bounded on all sides except the southern by a wall of rock from one thousand to fifteen hundred feet high. To the South it is dammed up by a barrier of inconsiderable height on the lake side, but on the other descending several hundred feet to the valley, and apparently formed by the crumbling down of a large body of rock from the Western ridge. This is the same lake referred to by Beechy, Tyerman and Bennet, and others, and prior to our visit was believed by the natives to be unfathomable. There is a similar pit, except that it has only a small stream at the bottom, discharging itself by some crevice, between two of the lateral ridges of Waritiva. With great difficulty and some risk, I descended perhaps twelve hundred feet into this ravine, near its commencement, thinking to find an easier path to the shore; but after scrambling and wading, for nearly a couple of miles, was to my vexation arrested by a naked wall of lava, several hundred feet high, which nothing but a bird or a lizard could scale. I was thus compelled to retrace my steps, and toil up once more to the crest of the ridge. My guide informed me that in the upper portion of the valley of Atehuru, leading from Matavai to the foot of Orohena, there were several of these barred ravines of less extent.

SECTION OF A RAVINE CLOSED AT BOTH EXTREMITIES, IN ONE OF THE VALLIES RUNNING FROM THE COAST TO THE BASE OF WARITIVA, IN TAHITI.



a. a. a. Longitudinal section of the ravine.

b. b. Steep lateral ridge, rising to a height of two thousand feet.

The mountains in outline, are from five to eight thousand feet high.

It is difficult, satisfactorily, to account for these singular chasms. That at Waihiria may indeed have been produced by a landslip blocking up the valley, but the one last mentioned would rather appear, were it not for the perpendicularity of its terminal walls, to have arisen from a confluence of the two great lava streams forming the lateral ridges, as the rocks are on all sides in a normal position and of uniform structure. Or they may be owing to a sudden sinking in of the crust at the time when the subterranean fires were in activity. Pits, very similar to them, but of less extent, are of quite frequent occurrence on the black ledge of lava surrounding the crater of Kilauea. The second class of ravines may, I think, generally be referred to ancient craters, one side of which has been rent apart by earthquakes. In their situations and outline, in the uniform perpendicularity of their parietes, and the sub-columnar structure of the lava composing them, they correspond exactly to the craters of the table land of Mauna Loa. In fact, not many years ago, during a sharp earthquake, a similar outlet, since filled up near its commencement by subsequent overflowings of the lava, was produced on the S. W. side of the great crater of Kilauea or

Ka lua Pele, and extended if I remember aright, some seven or eight leagues to the coast.

But to return from this long digression, to the subject more immediately under consideration.

It is obvious that as the land sinks, and the water reaches the base of any ridge, barrier, or mount, a shore reef may be formed upon or around it, which, if the subsidence continues, will, from the operation of causes already explained, be gradually converted into an encircling or outlying one. There will naturally be intervening channels, in place of some of the ravines, while on those of a trench-like character and upon the ruins of ancient craters, will form lagoon reefs, and on the whole being overflown, there will thus be formed a group of lagoons varying in size and configuration, according as they rest upon a sunken crater, a ridge, or one of the trench-like ravines, and surrounded by a common reef, which is traversed at intervals, as in its primary state, by passages of various breadth and depth. And such, on a large scale, as I have before observed, is the appearance presented by the Paumotu groups and dangerous archipelagos of Polynesia.

Although the seaward side of the reefs encircling these, has been described as rising in a perpendicular wall, yet it must not be understood, that by this it is meant, that we literally step from an unfathomable ocean, upon the upper surface of a reef. They present a succession of terraces or plateaus, the outer having sometimes twelve or fifteen fathoms; and in one instance, that of Bellinghausen's Island, twentyeight fathoms of water was found upon it. This lowest plateau is of variable breadth, but I think seldom exceeds one hundred and fifty feet; declines somewhat rapidly seaward, and apparently projects beyond the wall like a shelf, as I have known the lead to fall from twelve fathoms on it, to two hundred and no bottom, within a distance of about ten yards.

These terraces become, as they recede from the sea, narrower and shoaler, presenting a like declination with the lowest, and having at their extremity an abrupt descent of several feet. The highest, or last formed, differs in its margin forming a sort of steep talus extending to the next below it; and allowing for inequalities in the growth of the corals, offers a dead level of from twenty to one hundred and fifty yards broad, terminating for the most part at the fragmentary beach, and often having less than a foot of water upon it at low tide, except in the numerous hollows and gullies.

It has been suggested that this succession of terraces was owing to the action of the surf, which breaks heaviest, and of course tears off the largest masses, upon the extreme edge of the plateau; that when this has proceeded so far as to weaken in a measure the force of the rollers, a less powerful surf breaking against the inner wall thus formed, will in time form a second terrace, and then a third, or even a fourth, though this is perhaps rare, before it spreads harmlessly over the broad upper shelf. Yet although the sea acts with great force in abrading the reef, I doubt much whether it can have produced such results as these. It would be more likely to cause a long uniform slope, from the farthest limit of the breakers, to their origin at the margin of the reef.

It is more in accordance with appearances to suppose that such a slope once really existed, and that the reef subsequently sunk so low as to prevent the growth of the coral on this inclined plane beyond a certain line. There may then have ensued an interval during which the reef was stationary, when the polypes would naturally build upwards from the depth suited to their habits, and in time raise it to its former level, thus forming the lowest wall, while the dead reef beyond constituted the lowest terrace. A second inclined plane would be produced by the abrasive action of the surf, and a second or third period of sinking, followed by one of rest and re-elevation, would give the outer portion of the reefs that peculiar conformation which they at present exhibit.

It is upon the lower terraces and margin of the upper one, that the corals are found in their greatest variety, and exhibit the richest hues. Clusters of orange, violet, crimson, green of every shade, purple, blue and yellow, are intermingled in gay confusion, and with a brilliance yet softness of coloration of which pen or pencil can give but a faint idea. When first passing over them, I could compare their appearance to nothing but a pavement thickly strewn with bouquets of beautiful flowers.

At a depth of three or four fathoms, the forms were as manifold as their coloration, some branching like beautiful shrubbery, others spreading out like the most delicate mosses, and others again resembling beds of saffron, or daisies and amaranths, while in and out of, above and between the thickets of these Neptunian gardens, sported thousands of splendidly colored fishes, from not more than an inch to two or three feet in length. A large bright scarlet Diacope (*D. Tiea,* Lesson) a Julis about a foot long, of a rich bluish green, marked with blood red bands crossing the back to the lateral line, and intersected by others extending from the opercles to the tail, (*J. quadricolor*, Less.) Serrani, Scari, Glyphisodons, Chætodons, Balistes and Holocentri, all richly adorned, were some of the most conspicuous in the bright array. The water was so transparent that the smallest object on the bottom could be seen as distinctly as if it were not three feet from the surface; and gazing down upon the beautiful creatures that tenanted these coral groves, like Coleridge's "Ancient Marinere," "I blessed them unawares" — although the next moment I could not avoid wishing to coax them into my net. As a drawback however, upon all this beauty, silently but swiftly, near the surface, glided in shoals, the spectral and malignant, "ravening salt sea shark," reminding one of satan's intrusion of his hateful presence amid the bowers of Paradise. So fierce were these tigers of the deep, that they repeatedly seized hold of the oars as we pulled toward the reef; rendering the attempt to reach by swimming (often the only chance) a coast thus sentinelled, rather a hazardous affair.

The solid, massive and encrusting genera of corals which enter most largely into the composition of the reefs, appear to flourish best in exposed situations and violently agitated waters. On the upper plateau the coral has generally a stunted, dwarfish appearance, and the branching genera predominate over the more showy Astræas. Near its edge, and lining the crevices, certain Goniopores, Porites and Pavonias, spread themselves in thin lamellæ; but these gradually disappear as we recede from the surf, and finally abandon the field almost entirely to the Madrepores. Ill calculated, however, by reason of their fragility, to withstand the force of the breakers that occasionally roll over the whole ledge, even these latter are only found in small detached clusters, principally in the little sandy pools and cavities which are scattered over the surface, their greatest luxuriance being displayed in the clear, tranquil waters of the lagoon, where they form submarine thickets of great beauty, many yards in extent.

The major portion of the plateau is encrusted by Nulliporæ and a laminar deposition of carbonate of lime. In this are imbedded multitudes of Tridacnæ, the edges of whose mantles, as shown by the gaping of the shell, are so gorgeously colored, that a correct representation of them would certainly be thought exaggerated by one who had not seen the originals. The varieties in this respect are very numerous, but the most common are a deep vivid ultramarine blue or green, with dark orange, purple or golden ocellations and wavy lines interspersed. The marginal papillæ are similarly ornamented.

The Tridacnæ appear like the Pholades, Lithodomi, &c., to secrete a peculiar acid, enabling them to perforate calcareous rocks, since, differing altogether in this from the shells imbedded in branching corals, the situation in which they were generally found, was not caused by the growth around them of the polyparia, nor by the deposition of calcareous matter. This was evident at once, from their being in some cases imbedded in small clusters or masses of coral, which were cut through by them in such a manner that the parietes of the cavity exhibited sections of the polyparia, transverse, vertical or oblique, just as the Tridacna chanced to have worn its hole. I have seen the base of large Madrepores, cut in this way, at the origin of the branches, so that the upper portion of a branch was on one side of the shell and the lower on the other. The cavity is usually worn quite smooth, and fits closely to the shell, there being often but just space left at the surface for the valves to open about half an inch. They bury themselves, beaks downward, and the basal margins of the valves parallel with the surface — adhering very strongly by a coarse corneo-fibrous prolongation of muscle. It differs somewhat from the byssus, properly so called, of the Mytilacea, which is produced at pleasure by the animal, may be torn away without injury to it, and terminates in a sort of receptacle at the base of the foot. Here the fibres proceed from a thick, conical, tendinous mass, and though I have reason to believe the animal has the power of detaching itself, yet when it was attempted to pull one away from the rock, in almost every case, the whole muscle was torn from the body, inflicting a fatal wound. I have often pulled them off in this way and left them on the reef, to see if they would re-produce the byssus, but always found them dead the next day. It is a little singular that the Tridacna, when immoveably imbedded, should continue to moor by as strong a cable, as when free upon the surface it is exposed to the rude assaults of the breakers. The manner in which they become thus buried, seemed to require a word of explanation, because this condition has been considered a proof of the rapid increase of the coral, which it was imagined had thus covered the shell subsequent to its attainment of full size, yet during the animal's life.

On all parts of the reef, Crustacea and Echinodermata are met with in astonishing numbers and variety. The Mollusca generally speaking, are less abundant as a whole. The pools and gullies literally seem alive with beautifully painted fishes, a bare enumeration of whose genera would almost fill a page. Among these a large spotted Muræna was conspicuous for its fierceness not less than size. It lurked under stones or in crevices, and when molested, instead of retreating, darted directly at the intruder, and unless promptly avoided, inflicted a most formidable bite. It moved with exceeding rapidity, sometimes scuttling over the coral, sometimes making a succession of horizontal leaps from the water, of a couple of yards' length. I have seen, at the attack of one, a whole boat's crew flying in terror, who would fearlessly chase the numerous sharks infesting the edges of the reefs and lagoons, till up to their breast in the water.

Scattered along the plateau are fragments of greatly varying size, thrown up by the surf, some loose, and affording shelter to a multitude of small fish, crustacea, &c.; others forming tabular masses of such magnitude as to render it almost incredible that any wave could be sufficiently powerful to tear them off and transport them to their present locality. They constitute one of the most remarkable features of the surface reef at several islands. I have seen it for miles lined with these nuclei of future ridges, from a yard square, to thirty or forty fect long by four or five broad, and averaging three and a half in height. Their lower portion is worn by the water so as to cause the smaller blocks to assume a variety of fantastic shapes. By the percolation and infiltration of water charged with carbonate of lime, these masses are in general firmly cemented to the subjacent coral, and converted into a very solid limestone, called by seamen, "reef-rock," in which the original cellular structure is sometimes almost obliterated. This reef-rock appeared to be the basis of the elevated belt between the lagoon and sea, in almost every Paumotu that I examined. I shall refer to these erratic blocks again, under the head of re-elevation.

It sometimes occurs that the plateau or surface reef, instead of extending quite to the beach of coral sand, is separated from it by a strip of smooth coralline limestone, apparently formed by cementation of the finer detritus, dipping from 5° to 7° seaward, and from ten to fifty or sixty yards wide. A peculiar character in these belts, is the fissures, which from one-eighth to three-fourths of an inch wide, run nearly parallel with the beach for one hundred rods together, and sometimes cross them at very large angles with it. There are similar formations along the North coast of Tutuila, one of the Samoan Group, and in its harbor, Pangopango. They also occur, but of coarser texture, on the East coast of Kauai, near Wailua, where they are from eight inches to two feet in thickness, and are frequently quarried for building materials, such as foundations, door-stones, &c.

To this limestone shelf, or the surface reef, as the case may be, succeeds a narrow and rather steep coral sand beach, beyond which rises the fragmentary ridge, composed of large blocks of reef-rock, having their interstices filled with a rubble consisting of small fragments of coral, shells, and Echini, cemented together so firmly as to require a smart hammer-stroke for their separation. It has an elevation of from three to ten feet, and varies in width, even on the same island, from one hundred and twenty feet to one thousand yards. It is highest on its seaward side, where it rises somewhat abruptly, but shelves very gradually towards the low, sandy shores of the lagoon. There is rarely much vegetation till the summit is crossed, but thence inland it frequently flourishes luxuriantly to the very brink of the water. This elevated tract seldom if ever entirely surrounds the lagoon. I do not remember having seen a single Paumotu, which had not, on one side, a considerable space of low, naked reef, or detached masses of rock, over and between which, the sea at high water broke into the lagoon. At Raraka, on the southern side, to the westward of the passage between this and the sea, where the upper plateau is rather narrower than common, the ridge was of a character entirely different from what was observed at any other island, being mostly a heap of loose rubble, eight or ten feet high, and perhaps a hundred yards in breadth at the base, nearly as steep on the inland as on the seaward side, and destitute of any trace of vegetation. Just inside of this ridge, were numerous shallow pools of salt water, ebbing and flowing with the tide, and abounding in Ophiuræ, Cidarites, Fistulariæ and Actiniæ. A large species of Melampus was so plentiful among the fragments at the base of the ridge, that it could be collected by handfuls. Beyond the pools was a plain of coral, which I estimated to be a large mile across to the lagoon, but had no opportunity of ascertaining it by actual measurement. It appeared to have a very slight ascent from the sea, and was tolerably well clothed with trees and shrubs, though the species were few in number. A few cocoa-trees only were seen, and those had, as the inhabitants (about thirty Chain Islanders, engaged in collecting pearl shells,) stated, been introduced recently by themselves.

Crossing the plain, which is overrun with a variety of burrowing Crustacea, terrestrial Paguri, and on some islands a species of Birgus, as often found on trees as among stones; we emerge from a tangled thicket upon the light green waters of the tranquil lagoon. This of course, varies greatly in extent and depth, and not less in the character of its bed. Some have the appearance of being very shallow throughout, the water being, except where darkened by occasional gullies, of an uniform pale, yet brilliant green hue. In others, there are large strips and patches toward the centre, where it is nearly as blue as the surrounding ocean. At Aitoho, one of the Disappointment Islands, the whole central portion of the lagoon is of this latter color, as if it were very deep, although less in circuit than many others. From the beach of some, I have waded out for a couple of hundred yards, with the water deepening almost imperceptibly, over a bottom of fine sand, with only a few scattered bunches of coral; while in others, their bed is very unequal, full of large and deep pits, and traversed by gullies several fathoms deep and from ten to three hundred yards wide, occasioned probably by like irregularities in the submerged land.

At Serle Island, and several other Paumotus, I observed at a couple of miles or so from shore, several small islets and clumps of rock, rising above the surface of the lagoon, nearly as much as its bordering ridge, and apparently encircled by water much deeper than the average.

It would have been exceedingly interesting, and was certainly of importance in arriving at a correct idea of the structure of these islands, to have ascertained the composition of such islets; but the circumstances in which I was placed, entirely dependent on the pleasure of those in whose opinion such objects were of merely secondary consequence, and by whom my every movement was limited and controlled, rendered it impossible for me to make an examination so desirable. Should they hereafter be found to consist of volcanic rock, they would establish beyond all question the theory of subsidence first advanced by Mr. Darwin. Should they, on the contrary, be as I suspect, of coralline formation, this would not by any means, as I conceive, disprove it, but rather afford us the means of determining with some degree of exactitude the amount of re-elevation that has taken place at such islands.

I was informed by Mr. Samuel Wilson, of Tahiti, who had long resided among the Hervey Islands, that at Mangaia, which is an ancient reef elevated nearly three hundred feet, there are in the central hollow formerly the bed of the lagoon, many scattered patches of coral rock, some of them raised to a height of forty feet. At a certain stage of the elevatory process, it is evident that these patches must have presented an appearance very similar to the lagoon islets to which I have referred.

So far from the beach as examined, the bottom in some lagoons I have found to be a clean coral sand, composed of a detritus of coral and shells, but in most instances this was covered to the depth of a foot by an exceedingly fine white sedimentary paste or ooze, which on desiccation had every character of common chalk, except in being much more friable. I think it is principally formed by the decomposition of flexible corallines and alcyonia, and the softer Echinodermata, such as Fistularia and its congeners, all of which abound in the lagoons, rather than from that of corals proper. It may also partly arise from the excretions of certain fishes, which feed occasionally on the tender extremities of Madrepores, as readily as on Crustacea, Echini, &c. I once collected a quantity of these corallines and kept them in a jar of water till the muscular and fibrous portions were entirely decomposed, when an impalpable sediment was deposited, in all particulars answering to that obtained from the lagoons.

Not least among the phenomena attracting our attention in these Paumotus, are the channels which in the majority of them afford a passage from the sea into the lagoon. There is usually but one of any consequence at each island, though there are rare instances of the occurrence of three or even four at different points of the reef. They are almost invariably situated in the leeward reef, but there are occasional exceptions and deviations from this general rule, some of which will be specified presently.

These outlets are by some persons supposed to designate fissures in the walls of submerged craters, represented by the lagoons. If we admit, however, that these islands have been formed by the process which it has been attempted to describe in this communication, such an explanation is rather unsatisfactory, since if the coral began to grow in the fissure immediately upon the water covering it, there is no reason why the reef should not reach the surface there, as early as at any other point, and the rent thus be filled up.

In his lectures for the Lowell Institute, Prof. Lyell expressed an opinion, that these channels were formed at a period when the encircling reef was nearly on a level with the surface of the ocean, by the rapid rush of the ebb over the leeward side of the lagoon, whose waters at high tide were raised considerably above sea level by the breakers bursting into it from the windward quarter. The passage, he argued, once thus opened by the water forcing its way out, would ever after be maintained by the same power.

Now this might possibly have occurred, provided the rush of waters had ever been directed for a length of time to one particular point. But if the surface of the reef was in times past, as it now is, nearly of one level throughout, which there seems no reason for doubting, it is evident that the ebb would, at the period alluded to by Prof. Lyell, set equally over the whole leeward portion, till uniformity of level between the lagoon and sea, was restored at low tide. As he had no reference either in his descriptions or diagrams, to the plateau which I have described as extending from the beach to some distance seaward; but rather spoke as though he supposed the whole space between the lagoon and surf to be a fragmentary ridge; I have sometimes thought that when he spoke of the reef, as nearly on a level with the surface of the ocean at the period when the passages were formed, he meant that this ridge was much lower then than at present, yet sufficiently high to oppose a considerable obstacle to the efflux of the surplus waters of the lagoon; or in other words, that the difference of level between the sea and reef, consisted in the latter being a little the higher, instead of as it really is, the lower of the two. If it was in fact his idea, that the lagoon had once been girt by such a wall, the conclusion was not unreasonable that the constant pressure of the water, poured over from the windward side of the reef, would eventually form a breach in the weakest portion of its leeward side. But in truth such a condition of things never existed, there being in most Paumotus to the present day, on one side or other, a considerable portion of the reef where there is no ridge to bar the escape of the water from the lagoon, and yet a passage is found. Nor, as I have said, is this always on the leeward side. At Raraka, which is situated in the full strength of the south-east trades, it is on the southern, or windward side. At Clermont Tonnerre, and Tooa, the westernmost of the Disappointment Islands, the entrance, if any exists, must be to windward, as the coast in that direction is very low and broken, and none was discovered in running down the lee shore. At Waterland Island the opening is in the eastern or weather reef.

Moreover, there are reefs, like that of Ocean Island, as yet wholly submerged, save in two or three small spots, which are intersected by no less than four canals. At this island, there is one entrance on the south-east side, and three about half a mile apart in the south-west portion of the reef. In these last, it is worthy of notice that the depth is eight or ten feet greater than that of the lagoon, and therefore could not have been excavated by the outward rush of its waters, as this at most could have worn a passage in the reef to the level of their bed.

On the other hand, at Aitóho, the eastern Disappointment Island, no passage was met with, in pulling all round the island, although portions of it are so low, that the surf at high water must break heavily into the lagoon.*

At Rose Island, where, judging from the drift line on the beach, there is a rise and fall of about five feet, the entrance is to leeward, and the same at Christmas Island. Through all these channels, the ebb pours out with great velocity,

* This peculiarity, with the apparent great depth of its waters, and its circular outline, render it possible that this lagoon is one of those occupying the site of a submerged crater.

whether they are on the windward or leeward side, the water falling into them from the lagoon and fringing plateau, so as to resemble a mill race.* At Raraka, six stout oarsmen, in a swift whale-boat, were a full quarter of an hour, vainly attempting to enter the lagoon, though the passage was not above seventy or eighty yards in length; and finally succeeded only by taking an eddy pointed out by the natives. The velocity of the current here could not have been less than six or seven miles an hour, and it was not greater at Rose Island, where the entrance is on the opposite side. The lagoon of this latter is however of comparatively small extent.

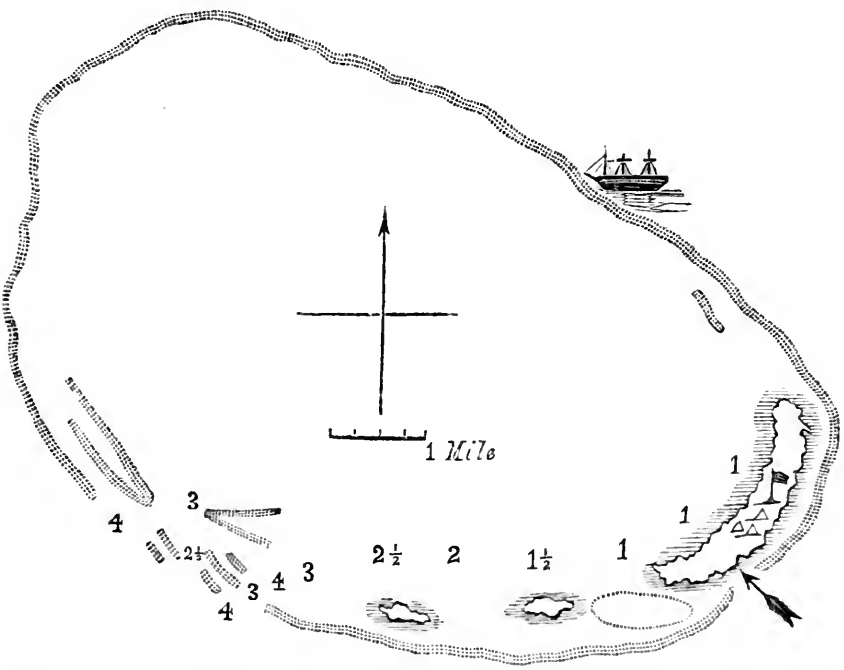
But rapid as it is, this current alone does not account for the existence of such channels. It is difficult to believe that the attrition of the passing water would suffice to prevent their being closed or filled up by the labors of the polypes, when we see these flourishing in the greatest perfection on the margin of the reef, exposed to the unceasing and far more violent action of the surf, which is continually tearing off large masses of rock, and driving them toward the beach. And were we at first sight disposed to consider their formation the result of the powerful tides, a closer examination would convince us of error, by showing that in no portion of the reef is the growth of the encrusting and lamellar corals more profuse than upon the sides (and in some instances the bottom also,) of these very channels. Even the more fragile Madrepores are to be seen there, though less in size and number than inside.

The tides on the weather side of Christmas Island, whirl round it with frightful rapidity, so that it is highly dangerous to venture into them with a boat. The surf also, on this side, runs to an amazing height, especially during the spring tides, rising sometimes, like that of Guam, to the altitude of twenty feet, before it bursts upon the reef. Yet though the extreme edge of the plateau has been greatly shattered by these tremendous rollers, the polypes are no where more industrious or numerous than just inside the breakers.

* Christmas Island is an exception to this rule, the ebb current setting out moderately, owing probably to the shallowness of the lagoon, and unusual width of the passages.

It is another argument against the probability of the reef passages being produced by the tides, that they are generally deepest toward the outer margin of the reef, where the current is weakest, and shoal gradually as we approach the lagoon, near whose entrance it is most rapid. Moreover, no accumulation of water would be likely to force a passage either into or from the lagoon, *through* the reef, against wind and sea, or even aided by them, when it could without difficulty flow *over* it on the leeward side, till the waters of the lagoon were on a level with those of the ocean. Much less should we expect it to scoop out several channels, and that too on both sides of the reef, as we see them in some Paumotus. At Ocean Island, whose lagoon of twentyfour miles in circuit, has no less than four entrances, situated as shown in the accompanying sketch; seven-eighths of the reef are, even at low water, overflowed to the depth of two feet or more.

SKETCH OF OCEAN ISLAND AND REEF.*



The figures represent the depth of water in fathoms. The dotted lines inside of the reef indicate coral patches nearly bare at low tide. The arrow denotes a passage through the reef to the main island. The other figures explain themselves. The centre of the island is in 28° 22′ N. lat., and 178° 30′ W. long.

* The British whale ship Gledstanes, Capt. J. R. Brown, was wrecked on the reef at midnight of July 9th, 1837. The cut here given is reduced from a

The lagoon is everywhere full of sand-banks and patches of coral, having only a few inches of water upon them, and as will be seen by reference to the figures, is not so deep by from ten to eighteen feet as the channels in the reef. Whatever may be thought of the other passages, it is clear that the one leading to the island is not owing to the action of currents, as from its sheltered situation, and the shallowness of the water between the beach and margin of the reef, they are scarcely felt.

I cannot, therefore, in view of these facts, coincide with those who entertain the opinion that the lagoon entrances were primarily hollowed in the reef by the rush of surplus waters from the enclosed basin, and have been kept open ever since by the tides. If we adopt the doctrine of a general subsidence of the land, with its attached shore reef, during which the latter has been maintained at its original level by the polypes; it appears to me that the facts admit of an explanation more probable, though not covering perhaps every difficulty.

I believe that these reef channels, in almost every instance, originated during the primal condition of the islands, in the influence of fresh water streams preventing the growth of the coral where they emptied themselves. Instances of the same thing now happening, are frequent in all the volcanic islands of Polynesia. I observed especially at the Samoan and Hawaiian islands, that there were openings in the shore reefs opposite the mouths of streams, and sometimes very insignificant ones, which I am convinced were caused by the fresh water acting detrimentally upon the polypes. While the island remained above the sea, or rather while the stream continued to flow, the same causes in which it originated would keep the channel open. When the subsidence had reached that point at which these causes ceased to operate,

chart engraved for the third number of the Hawaiian Spectator, by a native scholar of the Mission Seminary at Lahainaluna, Maui, from surveys by Capt. Brown, who remained upwards of five months on the island, with his crew. "The only fresh water is what drains through the sand, after the heavy rains." —[Haw. Spec. July, 1838.]

provided the depth was not too great, the polypes would soon by the diffusion of their gemmules, extend themselves over this portion of the reef, the same as elsewhere. Assuming the depth of the channel at that period to have been from twenty to forty feet, and the upward increase of the coral therein, to have been ever since equally rapid with that on the reef, it is clear that the original difference of level, between this latter and the bed of the channel would remain unchanged to this hour, were there no tide whatever setting in or out. Even supposing that before the action of the fresh water ceased, the subsidence had been so great that this difference of level amounted to between two and three hundred feet, (though it is very doubtful whether such could ever have been the case, since the amount of elevation from the deposition of alluvial matter, would in all probability be sufficient to counterbalance the depression by subsidence,) this would not invalidate the explanation here suggested.

In all the Paumotus that I have seen, these channels are very narrow, often but a few feet, and rarely exceeding forty or fifty yards in width. Even in the semi-encircling reefs of Tahiti, Samoa and Hawaii, they are seldom more than a few rods across. Supposing then the bed of a channel to have been at any period so far below the surface as to preclude the formation of coral upon it ; still, in process of time, the lateral increment would form a bridge across, at the depth best adapted to the requirements of the zoophytes. During the same period its width would be considerably contracted at the surface, and except in large openings, might be wholly closed up. Instances of these bridged channels are numerous throughout the coral islands of Polynesia. It frequently happens that the approaching shelves have not yet come in contact, and a crevice from only a few inches to a yard in breadth, is left. On looking down this, the bottom and sides of the ancient channel, are seen as distinctly through the transparent water, as if within reach of the hand. Such crevices are unusually frequent at Rose Island. An examination of these has led me to conclude that the existing entrances into lagoons, are attributable only to their original magnitude having been such as to prevent their being, as yet, obliterated as others have been, by the extremely slow growth of the coral; and that in the lapse of future ages, they too will disappear, when the lagoons will gradually dry and be partially filled up with detritus from the neighboring beaches. Possibly, the level between the sea and the lagoon of Aitóho, to which I have stated no entrance was seen, may be restored by the water accumulated during floodtide passing out by subterranean canals, such as are described above.

It is not improbable that some channels were produced by other causes than that here mentioned, such as original inequalities in the submerged land, or fissures made in the reef by earthquakes, which we may presume to have been, at a former period, as frequent in this region as they now are in those where volcanic fires are still raging; but I am convinced that instances where a passage has been cut through a reef by the action of tides are of exceeding rarity, if indeed they occur at all. So long as it is the tendency of water to seek an uniform level, I cannot conceive how that accumulated in the lagoon during the flood tide, or from the rolling in of the surf, should in flowing out over a reef covered even at low water to a depth of from one foot to ten fathoms, excavate a narrow canal, occasionally (as at Christmas and Ocean Islands,) deeper than the lagoon itself.

It is my impression that Prof. Lyell described these channels as invariably situated on the leeward reef; yet suggested no cause for their assumed absence on the windward side, except the inference that as the water was forced into the lagoon from that direction, it would naturally seek to escape in an opposite one; and at a late meeting of this Society it was asked why, if his reasoning was not just, such should be the case.

But they are, as I have endeavored to show, confined to no particular portion of the reef, though they certainly do occur most frequently to leeward. Nor will this, upon reflection, appear so singular as it may at first be considered. Admitting that there were originally as many in the weather as in the leeward reef, by far the greater number would long since have been filled up by fragments broken from the outer margin of the plateau and carried landward by the surf, together with the drift and wash from the beach of loose coral sand and shingle. Others we may suppose have been obliterated by the natural increase of the coral, till, from both causes, only one remains here and there. Still there are sufficient to show us that the formation of these channels cannot with propriety be attributed to causes that would operate but in a certain direction, such as we must regard the tide, which can scarcely be supposed to seek an egress against the continual rushing in of a powerful surf.

Much light would no doubt be cast upon this and many other peculiarities in the coral formations we have been considering, by an examination and comparison of the phenomena presented by those of the Antilles, the Caribbean Sea, and along our southern coasts. In fact, I believe that without such comparison, it is impossible for a person to arrive at a full knowledge of the structure of these rocks. Those especially, bordering the South coasts of Cuba and Florida, deserve particular attention, on account of the numerous canals intersecting the extensive reefs, the varied nature of their lagoons, and the opposite character of their neighboring lands, which, broken and mountainous in the one case, are in the other low, sandy, and level. I trust that at some future period it will be in my power to examine these interesting formations, with more time and opportunity for their study at command, than were enjoyed in my brief and restricted visit to those in the great coral region of the Pacific.

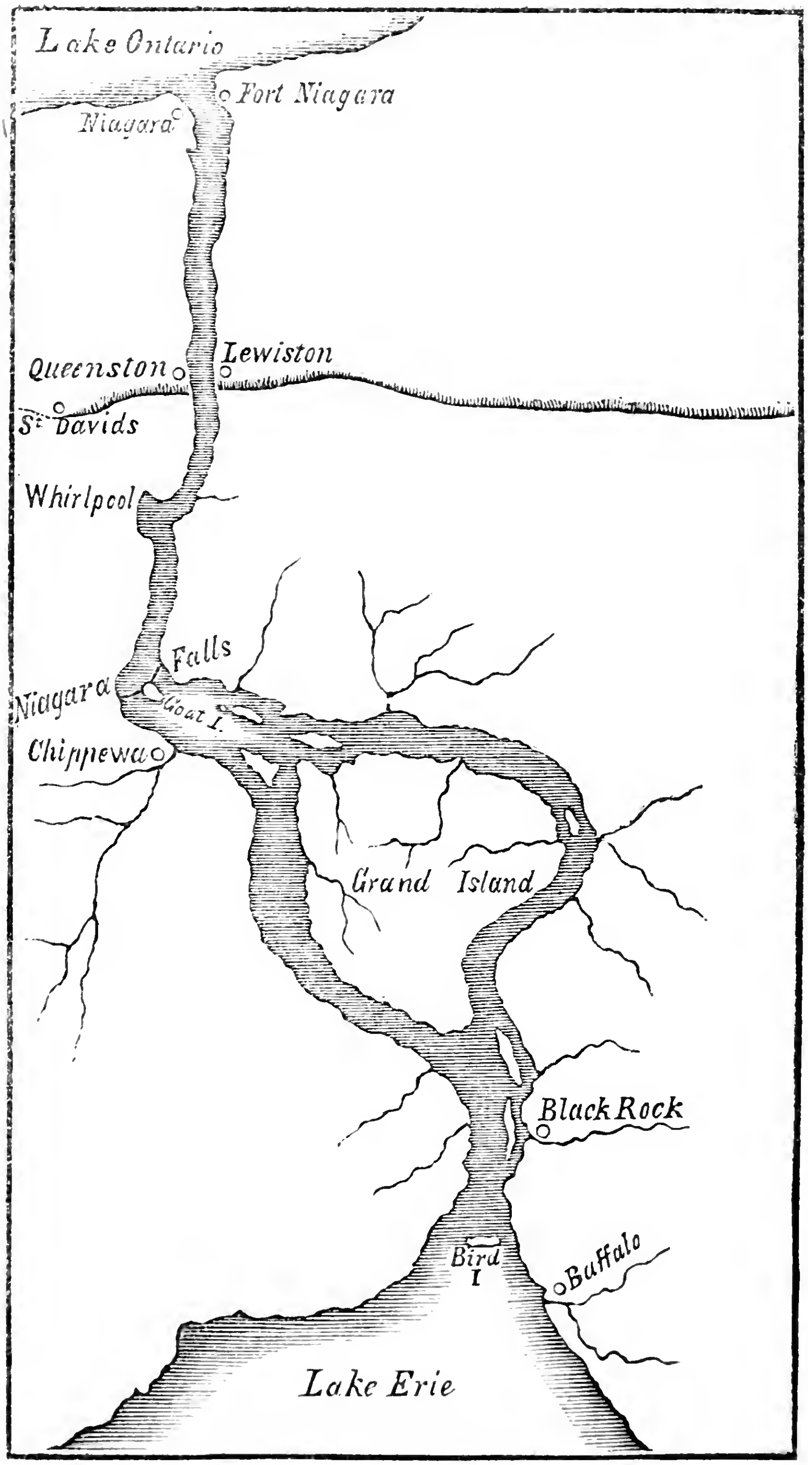
(To be continued.)

Art. X.—NIAGARA FALLS — THEIR PHYSICAL CHANGES, AND THE GEOLOGY AND TOPOGRAPHY OF THE SURROUNDING COUNTRY. By James Hall, State Geologist of New York; Corresponding Member Bost. Soc. Nat. Hist., &c.

The cataract of Niagara and the geology of the surrounding country, have been often described; but believing that there are many facts unnoticed, and others which have not had due weight in these considerations, I shall venture a further attempt at illustrating some important points regarding this great finger post in the path of time. I am far from asserting that the problem regarding the recession or the former condition of this great cascade is settled. So many disturbing causes are constantly presenting themselves, that although the great principles may be deemed established, yet it is impossible to calculate accurately the effect of these minor influences. Every fact recorded of the past, the present, or the future condition of this cataract will aid in the calculation of the final result, which, some thousands of years hence, may be made with tolerable accuracy. In the mean time we must content ourselves with observing these facts and laying down land-marks for the guidance of those who may follow us in the attempt to decide the effect of time upon these ancient rocks.

A striking feature in the Topography of western New York, is the great difference of elevation between the Lakes Erie and Ontario, when taken in connexion with the generally level or but slightly uneven surface of the country, and where there are no disturbances among the strata. The difference of elevation between the other great lakes is comparatively small, although Superior is situated in a disturbed geological region. The elevation of Lake Erie is three hundred and thirtyfour feet above Lake Ontario, and the greater part of the difference is overcome by Niagara river in the space of one mile at the rapids and falls.

The barrier at the outlet of Lake Erie is formed by a terrace of limestone which extends from the Hudson river, west-



Lake Ontario
Fort Niagara
Niagara
Queenston
Lewiston
St Davids
Whirlpool
Falls
Niagara
Goat I.
Chippewa
Grand Island
Black Rock
Bird I
Buffalo
Lake Erie

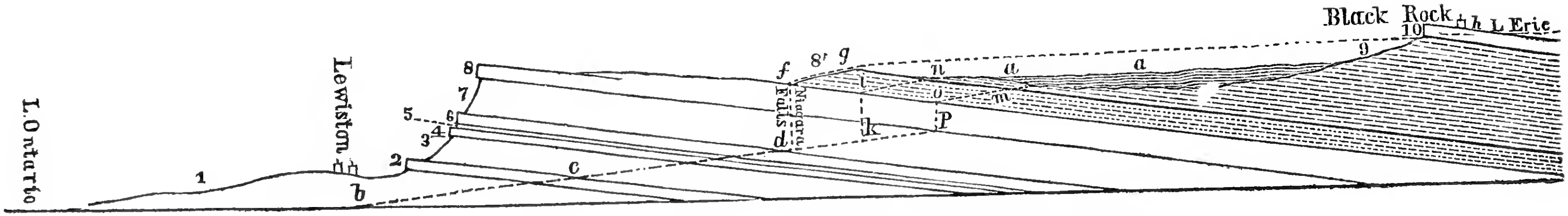
ward far into Canada, forming for many miles the northern boundary of the lake. The southern slope of this terrace or platform of limestone passes off beneath the water, forming the bed of the lake. This terrace terminates abruptly on the north, within a short distance of the lake, and we descend into a low, level country, underlaid by marles and shales of the saliferous formation, which extend for a distance of fifteen or eighteen miles. Beyond this, there is an almost imperceptible ascent for eight miles, when it suddenly plunges down about 250 feet, over the outcropping edges of various strata, which here terminate abruptly, to the low table land, bordering Lake Ontario. From the base of this escarpment, the country slopes almost imperceptibly to the level of the lake, seven miles distant, and one hundred and twenty feet lower. A great portion of the country for twenty miles north of the first terrace, or that bordering Lake Erie, is so level that a rise of the Niagara river for thirty feet, would inundate an extent of thirty miles on both sides. After leaving the level country, the ascent, as before stated, is very gradual to the north ; but when we arrive at the edge of the great terrace of Lewiston and Queenston, the elevation is thirtyeight feet above the level of Lake Erie. The general outline of this part of the country will be seen in the section from Erie to Ontario.

This great terrace or platform is known in New York as the mountain ridge, and in Canada as Queenston heights. It extends to the westward of Niagara river, beyond the head of Lake Ontario, and eastward beyond the Genesee river, where it merges in the general level of the country ; partially from the dip of the rocks in that direction, and partially from the thinning of some of its members. The abrupt termination of the various strata in the face of this cliff, prove conclusively the extent of denuding action upon this portion of the country. The basin of Ontario, on the north of the terrace, has evidently been excavated from the sedimentary strata, the limit of denuding agency and that of the lake basin being the line of this escarpment. The edge of this escarpment is indented by numerous ravines or gorges, extending to a greater or less distance; they usually present a broad opening to the north, and terminate at a point within the first mile, and generally within a shorter distance. The streams now flowing in these ravines, evidently had little or nothing to do with their excavation, as the space is partially filled with drift, a deposit from another source. These indentations are doubtless in part the effects of the great denuding agency which produced the escarpment, by undermining and removing the different materials.

It has been supposed by some, and Dr. Daubeny has adopted the opinion, that the terrace or escarpment at Lewiston was produced by a fault; either an uplifting of all the strata on the south, or a downthrow of those on the north. Not having Prof. Daubeny's paper before me, I cannot state his arguments, but whatever they may be, they are certainly unsupported by facts. The strata are all visible in either direction, and there is no evidence of even the smallest disturbance.

The strata, as they are exposed in the terrace of Lewiston and Queenston, and in the banks of the river on either side, are exhibited in the section on the next page.

There is here not only no evidence of a fault causing the difference in elevation, but direct proof to the contrary; the soft marl and shale, forming the base of the cliff in the river banks, underlies the plateau from this place to Lake Ontario, and is visible, almost continuously, for the whole distance. On the other hand, there are the most unequivocal proofs of denuding action, and that the whole basin of Ontario is due to the excavating power. It will be seen that the character of the strata is such as to offer great facilities for the operation of such an agent, consisting of alternating hard and soft beds. The action of water would undermine the harder, and leave them to fall by their own weight, while the softer materials were removed. The denudation of such extensive districts, could only have taken place while the country was submerged, and during the period of its elevation from beneath the ocean. This principle has been recognized by Mr. Hayes, in his description of the "Geology and Topography of Western



SECTION OF THE STRATA FROM LAKE ONTARIO TO ERIE.

EXPLANATION OF THE SECTION.

1. Red shale or marle in the bank of the river at Lewiston, and extending to Lake Ontario.

2. Grey quartzose sandstone.

3. Grey shale, like No. 1, with their courses of sandstone near the top.

4. Red and mottled sandstone, a part of No. 8—Grey band of Eaton.

5. A thin mass of green shale.

6. Compact grey limestone,—a member of the "Protean Group."

7. Soft shale, slightly calcareous—*Niagara shale—Rochester shale.*

8. Limestone, compact and geodiferous; Magnesian but not siliceous—*Lockport limestone*—Niagara limestone.

8′. The upper thin bedded portions of the Niagara limestone.

9. Onondaga saliferous group, including the water limestone, or beds of passage to the next mass.

10. Helderberg limestone formation—much thinner than farther east.

a. a. Deposit of gravel, &c. south of the rapids. Probably similar to the fluviatile deposit of Goat Island.

b. c. d. f. g. h. The dotted line representing the surface of the water from Lewiston to Lake Erie.

d. f. The perpendicular fall over the Niagara limestone and shale.

f. g. The rapids, fiftytwo feet over the upper thin bedded portions of the Niagara limestone.

c. The whirlpool.

i. k. The position of the falls after a recession of one mile.

i. n. The line of the rapids at that time.

o. p. The position of the falls after a recession of two miles.

o. m. The rapids at the same time.

New York,"* By adopting this mode of explanation, we are enabled to account for the existence of this and similar terraces, along the lines of bearing of our extensive limestone formations, as well as for the deep valleys of ancient origin.

The strata forming the escarpment at Lewiston, as seen in the section, are those through which the chasm of the Niagara is excavated. The whole dip gradually to the south, and all below No. 8, disappear below the level of the river before reaching the falls, as may be seen by the dotted line bed which represents the surface of the river below the falls. The strata above this line are those excavated to form the channel of the river. The limestone forming the summit of the terrace, and at its margin not more than twenty feet thick, gradually increases from the addition of higher layers, till at the falls it has acquired a thickness of one hundred and twenty feet. This limestone, about one mile south of the falls, disappears beneath the surface, and is succeeded by a soft marl of a bluish or greenish grey color, with purple bands. This formation, which is a continuation of the Onondaga saliferous group, occupies all the level country from two miles south of the falls, to Black Rock, a distance of eighteen miles by the course of the river. This is succeeded by the water limestone and Helderberg limestone group. The saliferous formation, occupying this great breadth of country, and forming an important item in any calculation regarding the recession of the falls, has nevertheless always been overlooked by observers, and its existence in that part of the country was never noticed by any one, till the publication of the New York Geological Reports, in 1838. Previously, all the distance between the falls and Lake Erie was considered as underlaid by limestone; and the limestone of Black Rock, or the Helderberg group, was placed immediately above the Niagara limestone, and represented as resting upon it.

The Niagara river, in its escape from Lake Erie, has excavated a passage through the Helderberg limestone, (No. 10,) which forms the upper terrace before noticed, leaving a small

* Am. Journal of Science, Vol. XXXV. No. I.

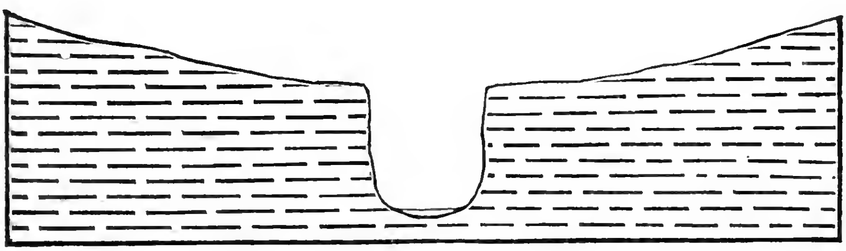
island, known as Bird's Island, in the midst of the stream. From Black Rock to within two miles of the great fall, the channel is excavated in the rocks of the saliferous group, the descent in this distance being only fifteen feet. About one mile south of the fall, the Niagara limestone approaches the surface, and forms the commencement of the rapids. The current, for the first two miles after leaving the lake, is very rapid; after this distance, it flows on more gently, the channel gradually widening as far as Grand Island, where it is nearly two miles wide. It then divides, the greater quantity of water running on the west side of this island. There are several small, low islands in the river, above Grand Island, but this is far larger than all of them. Below this island the river expands to a width of two or three miles, and presents all the appearance of a quiet lake with small, low islands. Approaching the rapids, the river narrows, and the current becomes more rapid, and for about one mile before reaching the grand cascade, rushes on with inconceivable velocity, over a declivity of fifty two feet, to the edge of the precipice, where it is precipitated into a gulf one hundred and sixty feet below.

The chasm through which the Niagara river flows, from this point to its emergence into the low country at Lewiston, is excavated in the rocks represented in the section, Nos. 7 and 8 only being visible at the falls, the others rising successively from beneath the water, owing to the declivity of the bed of the river, and the ascent of the rocks to the northward. The sides of this chasm present almost perpendicular walls, with a talus at the bottom, formed by the falling of some of the higher masses. The outlet of this chasm, where the river emerges into the plain at Lewiston, is scarcely wider than elsewhere along its course. In some places the river flows in a channel of less than two hundred yards across, and again is expanded to twice that width. The breadth of the chasm across the top, is nearly twice that of the channel or stream at the bottom. The declivity of the bed of the river, from the falls to Lewiston, is one hundred and four feet, or nearly fifteen feet to the mile, which gives great velocity to the stream. At one place, however, about a mile below the fall, and where the channel is narrowest, the stream glides along with comparative quiet, while below this, where the channel is broader, it is thrown into great confusion. Again, below the whirlpool the surface of the river is more smooth, and the current more gentle, though the channel is narrower than above. The cause of these appearances, which have seemed inexplicable upon the common theory, and have been used as arguments against the recession of the falls, is to be sought in the geological structure of the place. It will be seen that below the whirlpool there are no hard rocks in the bed of the river, and consequently the channel is deeper than where such rocks exist. At the whirlpool, and above that place, the hard sandstone, No. 2, is at and near the level of the river, and consequently the channel is not worn so deep. Again, after this hard mass has dipped beneath the surface, the channel is excavated in softer rocks ; hence the narrow channel and smooth water a mile below the falls. Near the falls, the higher beds of sandstone and the Protean limestone come to the level of the river, and thus cause a wider, shallow channel, and more tumultuous water. Such, simply, I conceive to be the explanation of the variable width of the chasm, and the greater or less violence of the water.

Upon the west bank of the river, at the whirlpool, there is a depression, and a deflection in the course of the river to the right, as will be seen by referring to the map. Standing upon the east bank of the river, this depression has the appearance of having been worn by the eddying current of the stream ; but on farther investigation it proves to be of different origin. During a recent visit, in company with Mr. Lyell, we examined this place, and found it to be an ancient gorge, filled with drift, except a narrow ravine through which a small stream flows into the river. This stream may be traced in a north-west direction for two miles, where it comes to the level of the surrounding country. In one or two places, near the river, the bed of this stream has laid bare the rocks, which proves that they are not excavated so deeply as the bed of the Niagara. From the termination of this ravine, upon the table land, going in a north-west direction about one mile, we commence descending through another deep gorge, which terminates upon the plateau at the base of the escarpment, at St. Davids. It will be perceived, by referring to the map, that the course of the river before coming to the whirlpool, if continued in the same direction, would lead to St. Davids. From this fact it has been inferred that there is a continuous ancient ravine, filled with drift, from the whirlpool to this place. This most remarkable fact has been cited as a strong objection to the theory of recession by the action of the river upon its own bed. Still, however, I hope to show that its existence is equally an objection to the chasm having been produced by the action of the sea.

If this ravine be continuous from the whirlpool to St. Davids, and existed previous to the excavation of the Niagara channel to Lewiston, it seems natural to suppose that it would have taken that direction. If we suppose that the undermining agency of the ocean, aided by the stream, excavated the Niagara chasm, why would not the same agency have cleared out this ancient ravine? And if it be assumed that the stream had commenced flowing by way of Lewiston, then we require nothing more to account for the commencement of the chasm. The assumption that the sea excavated the present channel of Niagara, does not aid in the difficulty of explaining why the ancient ravine of St. Davids was not cleared out; but on the other hand, the existence of that ravine, filled with drift, is a strong argument that the Niagara did excavate, of itself chiefly, its present channel. For had the sea remained long enough after the filling of this ravine with drift, to excavate that of Niagara, it would have removed a portion at least of it, and have drained the water in that direction. We can scarcely conceive it possible that this ravine could have been filled with drift, by any means, while such a stream as the present Niagara river was flowing through it, and if it has, at any time, been a large water course, there must have been a cessation of the stream during the time of this filling up.

The most rational explanation, and the one most consonant with existing facts, appears to me to be, that the ravine of St. Davids was excavated by the power of the waves, aided probably by a stream, though it may have been a very insignificant one. That this ravine was formed previously to the period of the drift, and that during this time it became filled with the transported materials to such an extent that the stream afterwards was unable to excavate a channel through the mass. Under these circumstances, the water would find an outlet at the lowest point, into the basin of Ontario; whether that point were over a surface of rock or of drift, and after the channel was once commenced, it would go on deepening, unless some violent change should alter the configuration of the surface. Now there is no evidence of such a change in the Niagara district, and it seems more rational to conclude that the stream, which may have formerly found its way through the ravine of St. Davids, after the filling up of that channel, took the course by Lewiston, that being the lowest point at which it could find a passage to the lower country on the north. It may be necessary, perhaps, to suppose a depression in this direction before the water would flow there; and such a depression may have existed from causes in operation previously, or there may have been an indentation in the edge of the terrace at this place, like those farther east, near Lockport. There appears, indeed, strong reason for supposing that there was a depression in the surface at the place where the river now flows, before the deep channel was excavated; there is a general depression on either side, and a transverse section of the river would present the appearance represented in the annexed diagram.



The recent deposit, forming Goat Island, is upon a surface lower than the top of the rapids, indicating removal of the surface rock to some extent, before the period of that formation.

I will now proceed to consider, first the objections to the theory that this ravine was produced by the combined action of the stream and the waves of the sea ; and next the arguments in favor of the hypothesis that the river has excavated its own channel, or by far the greater portion of it.

Examples are not unfrequent where the closing up of an outlet by drift, has caused the excavation of a new channel through solid rock. Perhaps the best illustration of this fact occurs in the passage of the Genesee river from the upper to the lower valley, from Portage to Mount Morris. The river, flowing from the south as far as Portage, is suddenly turned around to the opposite direction, and then again turns to the north, cutting its channel for about two miles through solid rock, in some parts to the depth of three hundred and fifty feet. At the end of this chasm it emerges into a more ancient valley, and at a point which would communicate with the river at Portage, before its deflection, by less than half the distance which it has required in its present course to reach this place. Now had this short space been occupied by a bluff of rock, we should easily have found an explanation of the reasons why the river did not pursue a direct course. But what are the facts? This shorter space, intervening between the two portions of the channel, is occupied by a deep deposit of drift, rising higher than the surface of the rocks where the river has found its channel. In the process of examination and excavation for the Genesee valley canal it has been found that this drift is of great depth, extending even below the level of the present bed of the river. The question presents itself, why did not the stream remove the gravel and sand, and make itself a channel in the shortest direction, instead of going twice as far through rocky strata? Or if we advance the argument that this channel was excavated in part by the aid of the sea, why did not this undermining agency affect this deposit of sand and gravel? The truth is incontrovertible that many streams have excavated their channels to great depths in rocky strata, long after the ocean left the surface.

Passing lower down on the Genesee river, there are other places where the stream has left the old channel, now filled with drift, and formed a new one, through rocky strata; and finally, at Mount Morris, it emerges into another ancient valley from a narrow gorge bounded by mural escarpments. It would be absurd to assert, that broad valleys, with sloping sides, filled, or partially filled with drift, are of the same age, or due to the same agency, as the narrow, deep valleys or chasms with clean, rocky embankments, and containing no other loose materials than those arising from the adjacent rocks.

Similar examples may be found in the outlets of Seneca and Cayuga Lakes, which flow into Lake Ontario. Now the course of these outlets is not in a direct line north to the lake, but from Seneca it turns to the eastward, excavating its course through the limestone and gypsum beds, between that lake and Cayuga. From all examinations I have made, there appears to be an ancient valley, filled with drift, between the northern end of Seneca Lake and Ontario; and yet, notwithstanding this, the stream has excavated harder materials, and taken a much more circuitous route to Lake Ontario. The same explanation may be given of Canandaigua and the outlets of other lakes.

As an analogous case, we may compare the ravine of St. Davids and the whirlpool, with that of Iroudequoit, a few miles east of Rochester. The Genesee river, after leaving the gorge at Mount Morris, flows in the bottom of an ancient valley to within a short distance of Rochester, where it enters a new channel. This channel is narrow, with almost perfect mural banks, and nowhere contains deposits of drift. On the lake shore, about two miles east of the mouth of the Genesee, we find a broad and deep ravine, known as the Iroudequoit bay. This ravine is excavated to an unknown depth below the level of Lake Ontario. The Iroudequoit creek which takes its rise in the southern part of the county, flows through this ravine for a few miles before reaching the lake. This ravine presents a very different appearance from either that of the Genesee below Rochester, or of the Niagara, and no one could suppose that the present stream had ever excavated such a channel. At the lake shore, it has a broad opening with sloping sides, and appears much like a bay worn by the action of the sea, while perhaps a stream was flowing in at the same place. It appears very natural to suppose that this may at one time have been the continuation of the ancient valley of the Genesee, which was commenced south of Dansville, and continued northward as the land was upraised above the sea.

Now had the sea ever washed the base of the cliffs at Lewiston long enough to allow of the excavation of this gorge of the Niagara, we should find some evidence of its sojourn there, in the shape of a beach, or rounded pebbles; but we find nothing of the kind. The continuance of a line of coast of sea or lake may be determined comparatively by the character of the materials along its margin; whether they are completely rounded, or still much angular; or if rounded, whether the forms are very much flattened. But in the case before us we find nothing at a greater elevation than the ridge road, or lake ridge, which, from its nature and contained remains, must have been the boundary of an ancient lake.

Other examples might be cited, but these appear to me sufficient as an explanation of causes why the Niagara did not take its course from the whirlpool through the ravine filled with gravel, rather than excavate a new channel from the rock.

We come now to the consideration of the argument that the chasm of Niagara has been worn by the sea, previous to, or during the elevation of this part of the country above its level. In the absence of direct proof, we must resort to analogy, and relying on this mode, we find that all indentations or ravines, excavated in the face of sea cliffs, have a broad or trumpet-mouthed opening toward the sea, and recede abruptly to a point. They never present a long, narrow ravine, of equal width; and when of a length at all approaching Niagara, they have an opening many times broader than this at Lewiston. I might cite numerous examples of ravines excavated by the sea, aided by a stream coming in at right angles, but none of these are of the character of Niagara. In such cases they are broad enough to allow the stream to flow through the bed, leaving waterworn materials along the sides, monuments of the wearing action of the waves. In the Niagara chasm there are no pebbles, boulders, or gravel; the river occupies nearly the whole width at the bottom, allowing a talus of angular fragments of the rocks fallen from above.

The valley of the Genesee, from Rochester to Dansville, affords a good example of a ravine excavated during the emergence of land from beneath the sea; but this valley is broad, and partially filled with drift, the sides sloping gradually and for the most part covered with deep soil, partially from decomposition and disintegration of the rocks beneath, but principally from transported materials.

The small amount of wearing accomplished by a stream during the period of our observation might incline us to doubt the possibility of any body of water having excavated its channel backwards for a length of seven miles, and to a depth of from three to five hundred feet. But if the period of one life be sufficient to admit of observation proving the *smallest amount of recession*, then it is only requisite that we should carry on the process for an indefinite period, to accomplish the utmost that we require; or, that we extend backward our imagination regarding time, in order to prove what is already accomplished. Now it is attested, within the recorded observations of those residing in the vicinity of Niagara, that the falls have receded within their recollection. If then it is proved that this ravine could not have been excavated by the sea during the emergence of the land, we have only this mode of operation left to account for its formation.

From analogous facts, we learn that it only requires an elevation of the drift, filling up the old channel, to be greater than that of the rocky strata, in order to turn the water in that direction, and cause it to form a new channel. We have only to suppose the ravine, from the whirlpool to St. Davids, filled, as it now is, with drift, to such a height as to prevent the water from flowing in that direction, and the consequence would be, as I said before, that it would seek an outlet at the lowest point along the terrace, which appears to have been in the direction of Lewiston. Here the water commenced the work of excavation, cutting down the higher strata, and rapidly undermining and removing those below. It is only necessary to refer to the accompanying section, in order to discover what materials the river had to work upon at this period.

It is impossible that there could ever have been a perpendicular fall of the whole height of the cliff at Lewiston, for the limestone at the top, being so much thinner than at the present falls, would soon be broken down by the pressure of the immense body of water precipitated over its edge upon the shale below. It may even be doubted whether the shale would be excavated fast enough to form a perpendicular fall, and it is probable that the water would be projected over a declivity of the upper shale (No. 7,) to the limestone below, which together with the higher layers of the sandstone would form the crest of a second fall. From this again the water would be precipitated as far as the sandstone, (No. 2,) where a third fall would be formed. Thus, instead of a single fall of three hundred and fifty feet, we should have the whole height divided into three falls, at some distance from each other. In consequence of the thinness of the upper limestone, that fall would recede faster than either of those below it; and the middle faster than the lower one. Even under these circumstances, the wearing action would go on much faster than at present. Finally, however, the recession would become less and less rapid, from the thickening of the limestone above; and from this cause, the two lower falls having the same resistance to overcome as at first, would gradually approach the upper, till the whole became one.

At the same time there are other circumstances to be taken into consideration, and among the most important of these will be the dip of the strata and the ascent of the bed of the stream; both together tending to bring the strata down to the level of the water as we progress southward. This fact has also an important bearing upon the rate of recession; for while a hard mass remains at a considerable height above water, with a soft one below, the excavation of the softer one and undermining of the upper hard one, tends to the recession much more rapidly than if the whole were of uniform character. Thus it must have been that the fall over the sandstone, (No. 2,) receded much more rapidly while there was a considerable thickness of shale below, than when it approached the level of the water. This would happen after the falls had retreated about three miles, or nearly to the whirlpool. At this point the recession would go on very slowly for a long period, for this hard mass, being at the level of the water, would effectually suspend the undermining process. Even at the present time the mass may be seen stretching into the river from either side beyond the other rocks, and at the point where it crosses, producing a fall of eight or ten feet within a few rods.

After this long and almost stationary period at the whirlpool, the recession would again go on more rapidly; soft materials being presented at the river level to be excavated by the force of the falling water, which would thus undermine the harder mass above.

When the cascade had receded to near its present position, another pause similar to that at the whirlpool would occur, from the approach of the higher layers of sandstone, (No. 4,) and the hard limestone, (No. 6,) to the surface of the water. There are various proofs of this halting, both in the form of the chasm below the present fall, and from the fact that this lower limestone still remains in place; for it is seen that having passed a few feet beneath the water at the cascade, it supports large fragments of the upper limestone fallen from above.

The conclusion then, seems inevitable, that the river has been the great agent in excavating its own channel, from near the escarpment between Lewiston and Queenston, to the present position of the cataract; that the recession has been aided by the character of the rocks, presenting alternate hard and soft strata;—and that the descent was overcome, not by one perpendicular fall, but by several, produced by the successive harder layers. In support of this latter assertion, a single analogous case will furnish stronger evidence than a long argument.

The course of the Oak Orchard creek, in Orleans County, is over the same strata, and furnishes direct confirmation of the succession of falls and rapids, precisely in the manner I have just enumerated. But as this is little known, I will adduce that of the Genesee river, in its descent from Rochester to Lake Ontario.

In consequence of the dip of the strata, or from its absence, the hard, quartzose sandstone (No. 2,) of the Niagara section does not appear in the Genesee river. On entering the river from the lake, we find an open channel for five miles, where the river descends perpendicularly for about one hundred feet from the top of the sandstone, No. 4. The hard limestone layer, or one filling the place of that at Niagara, has retreated a quarter of a mile farther up the river, where it forms a fall of twentyfive feet. This recession of the limestone, beyond the sandstone, is owing to a mass of green shale below it, twentythree feet thick, while at Niagara the same shale is but four feet thick. From this place to the upper fall, about a mile and a half distant, we have a rapid stream. This fall is one hundred and ten feet high, and over precisely the same rocks as the Niagara fall at present, viz. Nos. 7 and 8 of section, the Niagara shale and limestone. The limestone at the top of the fall is much thinner than that at Niagara, in consequence of the less recession into the mass, as well as from being thinner as a whole. We have here a case precisely analogous to Niagara as I have supposed it to have been formerly.

Had there been a quantity of water flowing down the Genesee equal to the Niagara, the upper fall would have been excavated farther backward, and the lower fall, in all probability entirely obliterated, presenting a rapid current from the upper fall to the present site of the Rochester landing. There appears here positive proof that there never has been so large a body of water passing down the Genesee as down the Niagara, and the concurring testimony is to the effect that the wearing action has been far less. The recession of the lower falls at Rochester would add little or nothing to the height of the upper; for the ascent of the river bed, and the dip of the strata, would cause the disappearance of the whole beneath the water, before reaching that point.

In support of the hypothesis that streams do cut back their channels, we may adduce sufficient evidence. An observation of the last four or five years upon the waterfalls of Western New York, has furnished positive evidence of their recession. Among these may be noticed the falls on Jacock's run, near Genesee, and Fall brook, a few miles further south, both of which have evidently receded, from the undermining of the platform over which the water is precipitated. The amount during this time is very small, but sufficient to be appreciated. The lower falls of Portage furnish another example of recession, where large masses have been removed, the channel deepened, and cut backwards many feet in the space of four years.

Lateral streams flowing into ravines or river courses, furnish the most palpable evidence of the excavating power of water. The channel of Wolf creek, which comes into the Genesee through a perpendicular wall of rock, is a good example of this kind, where the evidence is conclusive that the excavating power is alone due to the stream. The junction of a small stream with the Genesee, on the west side, below Rochester, furnishes another example of this power. This stream has cut its channel through soft shale for fifty feet or more, a bed of limestone eighteen feet thick, a bed of shale of equal thickness, and below this another bed of limestone nearly equal to the upper one. Many more examples of a similar kind might be named, on the Seneca and Cayuga lakes, and their valleys continued to the south.

A remarkable fact connected with these lateral water courses is that their dimensions bear some proportion to their present quantity of water. And although the actual quantity flowing in any stream may seem insufficient to excavate its bed, yet I believe, generally, the largest streams will be found in the largest ravines, and the small lateral streams have always a proportionately smaller channel. If in any case we find the stream débouching into the lake, river, or valley, through a chasm with nearly perpendicular sides, and little or no wider than it is farther up the stream, we may infer that the action of the sea has had nothing to do with its excavation.

So far as our present knowledge extends, regarding the mode of excavation by streams, conjointly with the action of the sea upon cliffs, I consider the question regarding Niagara as settled; both by the analogy thus afforded, and by the examples of streams passing over the same succession of rocks; as the Oak Orchard creek and the Genesee river. The narrowness of the chasm from Lewiston to the site of the present cascade, the nearly perpendicular sides, and the absence of drift within its banks, are strong negative facts in support of the proposition. The evidence that the falls are now receding, and the incontestible proof that they have receded considerably since this region has been inhabited, are positive facts in favor of the hypothesis. Within four years, a large triangular mass has disappeared from the top of the American fall, and the outline is becoming more curved. At several successive periods, large masses have fallen from the table rock, on the Canada side, which has considerably changed the outline of the fall.

There is still further evidence that the waters of the Niagara river have once extended much nearer to the brow of the escarpment than they do at present. The nature of this evidence I pointed out in my report on the fourth Geological District of New York, in 1838, pages 271, 272, and 273. At that time, I was not aware that the same phenomena had before been noticed, though I have since learned that the existence of fresh water deposits in Goat Island had been mentioned some years previous. Whether the important inference had been deduced from this fact or not, I do not know.

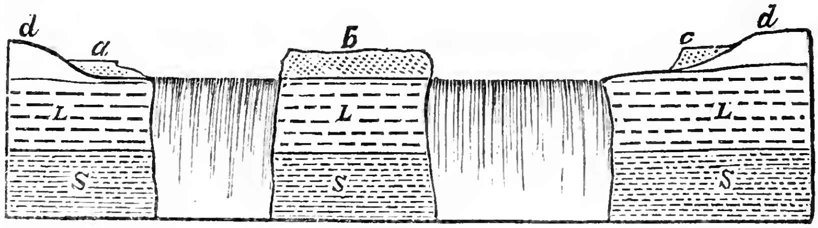
Goat Island stands upon the top of the precipice separating the two falls; it is formed by the accumulation of gravel, sand, and clay, upon the surface of the limestone, and is evidently a portion of a once much more extensive deposit. Upon the southern side of this island, where there is an escarpment, the thickness of the mass is about twentyfive feet. The upper half of the deposit consists of coarse gravel and sand, with abundance of fresh water shells of the genera

Unio, Cyclas, Limnea, Planorbis, Valvata, and Melania; the same both in genera and species as those now inhabiting the river and lakes. The occurrence of these shells, in this situation, about twentyfive feet higher than the top of the fall, proves the existence of a river or lake at an elevation sufficient to allow of such a deposition, for this accumulation of shells and gravel bears all the evidence of a fluviatile deposit.

During the past season, in company with my friend, Mr. Lyell, I re-examined this region, and upon the east side of the river, in a terrace about the same elevation as Goat Island, we discovered the Cyclas, Valvata, &c. which had been thrown from an excavation made several years since. At the same place, a tooth and some bones of the Mastodon were discovered eleven feet beneath the fluviatile deposit. Farther northward, and more than half a mile north of Goat Island, in another excavation, we discovered similar shells. We also noticed the continuation of this terrace, or one about the same elevation, as far north as the whirlpool. We did not search for shells in it at this place; but from its character and position there can be little doubt but it is a continuation of the same deposit, and probably will be found to contain the same shells. Now in order to raise the water of the river to sufficient height to make this deposit, it would require a barrier for the water at some distance north of the whirlpool. On the other side of the river a similar terrace exists, but this I have not particularly examined.* Now these banks or terraces on either side of the river, and that of Goat Island, are clearly not deposits made in this form, but the remains of a once much more extensive one. During the time of its deposition the river occupied this valley, having its barrier far towards Lewiston. In the bed of this expanded river or lake, much as it now is above the rapids, this deposit was made, covering the whole extent; but from the wearing back of the fall it has been carried off, the margin only being left on either side, and a small portion of the central part forming Goat Island. The following diagram will exhibit the posi-

* Mr. Hayes speaks of the terraces on both sides of the river, as containing fresh water deposits. Amer. Journal of Science, Vol. XXXV, No. I.

tion of this fresh water deposit. It is a cross section of the river at the falls.



a. The terrace with shells on the eastern side.
b. Goat Island. *c*. The terrace on the Canada side.
d. The ancient drift. L. Limestone. S. Shale.

From its present position, it seems to have been a continuous deposit, the greater part of which has been removed. The mode of its formation can be well illustrated by referring to Fig. 1, which is intended to represent what is now going on above the rapids, in the broad expansion of the river. *a. a.* represents the fluviatile deposit made by materials brought down by the current, and doubtless mingled with a large accumulation of shells of Unio, Melania, Anculotus, &c. as these shells are abundant above the falls, and large numbers of the shells of Uniones are constantly brought down the rapids during the summer season.

The single terrace containing shells is not the only one, for on the eastern side, at lower elevations, there are in succession two others, which seem to be remains of the deposit in the river bed, as it successively excavated its barrier to the north, and receded towards its present position. For the greater part of the distance from the falls to Black Rock, on the eastern side there is a terrace or bank a few feet higher than the river, which may have originally limited its waters when it stood at the level indicated by the fresh water deposit of Goat Island. Near Black Rock, and bordering the valley of the Tonawanda, there is a terrace some twenty feet higher, which appears to have been the boundary of the river or lake at a still earlier period; but with these we have, at present, nothing to do. The existence of the fluviatile deposit of Goat Island, and at the same level on the eastern side of the river, requires for its elucidation the existence of water standing at a level somewhat higher, in order to allow of the deposit being made in the bed of the stream. To accomplish this, a barrier is required further north than the whirlpool, and about the height of the surface of limestone between this and Lewiston. The occurrence of successive terraces below this one, proves that the drainage to the present point was not effected suddenly.

There is another fact which should be noticed, as proving the existence of a current from south to north, during the deposition of the materials forming Goat Island. The pebbles, at least large numbers of them, are of the limestone of Black Rock, and the harder layers of the saliferous formation, like the rock in place at the upper end of Grand Island. The surface of the rock, on which the deposit forming Goat Island is made, is smoothed and scratched, as are the surrounding surfaces both in the rapids and on either bank of the river. The deposit is of greatest thickness towards the fall, and thins entirely out at its eastern extremity.

There is another indentation on the eastern bank of the Niagara, below the whirlpool. This has been cited as a case where the small stream coming in, is insufficient to account for such an excavation.* It occurs at the junction of Bloody run and the river, and bears the strongest evidence of having been produced by the common agents, frost and water. The wearing action of the stream alone is probably insufficient to produce this short ravine, which extends a few rods back from the margin of the river bank; but when we take into consideration the fact that the water penetrates all the fissures of the rock, and then, during fall and winter, expands by freezing, we shall find means of explaining the mode of operation. At the falls, the recession is by the undermining and breaking down of the upper masses; the action of frost is not to be taken into consideration, as the water never freezes. Now I consider it as an established fact, that small streams, which freeze during winter, will excavate their beds more rapidly

* Am. Journal of Science, Vol. XXXV, No. I.

in proportion, than large bodies of water, which never freeze. It appears to me that the indentation at Bloody run is not greater than might be expected to have taken place while the main channel receded to its present position.

Whatever facts and arguments may be advanced to prove the existence of phenomena indicating the former action of the sea in excavating the Niagara channel, and whatever objections may be advanced for or against other theories, I am fully of opinion that the existence of the falls and the Niagara river, in their present position, is of very recent date, geologically speaking. I cannot resist the belief that at some previous period the waters of the upper lakes were discharged into Ontario at its western extremity, and that subsequently, from causes which at present I have not facts sufficient to explain, the course was changed, and the outlet made through Lake Erie. Previous to this time, there may have been a small stream flowing in the direction of the present Niagara.

We come now to consider the future recession of Niagara falls, and its consequences. This is a subject on which many speculations have been hazarded, but no one appears to have undertaken the calculation with a full knowledge of the geology of the district, or to have taken into account the many disturbing influences. At the present time, the cliff over which the water is precipitated, is nearly equally divided between thick bedded limestone and soft, disintegrating shale. It is by the action of the spray from the falling water upon the shale, undermining and leaving the limestone unsupported, which falls down by its own weight, that the falls recede from their present position. Now if we believe the statements of those who have resided at the falls, the recession has been about fifty yards within the last forty years; but from all the data I have been able to obtain, it appears to be much too great an estimate; indeed, it is extremely questionable if the fall has receded as many feet within that time. The central portion of the Canada fall recedes more rapidly than any other part, for here the greatest force of the river is exerted. We know, likewise, from the testimony of all residents at this place, that the American fall is becoming more curved in its outline, whereas formerly it was nearly in a straight line. The successive descent of large masses of limestone, and the still continued overhanging of the table rock, prove very conclusively the unremitting action of water and air upon the shale below.

In the absence of established landmarks, we are compelled to leave the rate of recession unsettled for the present; and the only mode by which this can be determined accurately is, by a systematic survey and triangulation of the form of the cascade, and the establishment of permanent marks of reference for future observers.

Leaving out of view the time or rate of recession, we have sufficient data to establish with certainty the future changes which will supervene, allowing the recession to go on as it is now doing. The lower half of the rock at the cascade, or about eighty feet, is of soft shale, the limestone above being of equal thickness; higher still is about forty feet of thin, bedded limestone, forming the rapids. These different rocks are represented in the section as 7, 8 and 8′, respectively. Now these beds dip to the south at the rate of about twenty-five feet in the mile, and the declivity of the bed of the river is about fifteen feet in the mile, from the falls to Lewiston. It follows, therefore, that as the falls recede, there will be a less amount of shale above water, owing to the dip, and to this must be added the amount of declivity in the river bed, both together making forty feet. So that when the fall has receded one mile, the surface of the water will stand at *k.*, or a point in the shale half way between the present surface of the water and the bottom of the limestone. Going on at this rate for another mile would take away from the fall forty feet more of the shale, so that the surface of the river would stand at *p.* or the base of the limestone.

The cataract would then have a solid wall of limestone to wear down, the river beneath protecting, in a great measure, the undermining action upon the shale. During this time, and at the end of the first mile, the falls would have arrived at the present site of the commencement of the rapids, and thus about forty feet more of limestone would be added to

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the height; unless from its thin bedded character it continued to recede faster, and thus continue a rapid. In this case, there would be a fall of one hundred and twenty feet at the end of the first mile (*i. k.*); and one of eighty feet (*o. p.*) at the end of the second mile.

At this period, then, we are to contemplate the cataract of Niagara as having receded two miles, the shale having disappeared beneath the river, and the cascade presenting a solid wall of limestone eighty feet high, and a rapid of forty or fifty feet (*o. m.*) beyond. The recession would then go on very gradually, and so soon as masses from this cliff have fallen down to fill up the river bed, as they inevitably will in a great measure, then the base will be protected so effectually that little influence will be exerted by the force of the water. Eventually, however, the cliff will be broken down, and huge fragments piled up below, until the cataract will be nearly lost amid them. This state of things will continue for a long time, the height gradually diminishing, till the river has cut its way back for two miles further, when there will be no thick bedded limestone above water, and the higher beds will form a rapid as before.

This point of meeting, between the surface of the river and the top of the thick bedded limestone, will be about one hundred feet lower than the summit of the present cascade, and as there will be forty feet of rapids in the thin bedded limestone within a short space, as there now is, it follows that there will be added to the descent of the river beyond the rapids, one hundred feet more than at present, as the surface of the limestone has dipped to that amount. The whole fall in the river at that time, from Lake Erie to the point of junction between the limestone and water below the rapids (*h. o.*), will be about one hundred and sixty feet. The distance between this point and Lake Erie is occupied by nearly uniform soft layers, and after a partial wearing down of the limestone forming the rapids, the descent will be equally distributed over the whole extent of sixteen miles, giving a uniform declivity of about ten feet in the mile, or one third less than the present declivity in the bed of the river from the falls to

Lewiston. From the nature of the bed of the river for fifteen miles below Lake Erie, it may be doubted whether this rapid descent along the whole distance would be continued; for the stream, having no heavy blocks of rock to remove, would keep its channel clear with a far less declivity; and should this prove the case here, we might still have a fall of a few feet, at the outlet of Lake Erie, over the limestone succeeding the saliferous group.

Whether such a fall would occur at the outlet of Lake Erie, depends on the solution of the problem regarding the acquired declivity in the bed of the river below Lake Erie. Whichever way it may occur it will make no material difference in the great result, which will be either a continuous rapid stream from Lake Erie to Lewiston, or a rapid stream with a fall at the outlet of Erie. If present causes continue to operate as now, such will be the consummation, the finale, of the grand cataract of Niagara.

It is unnecessary here to follow on this recession gradually from the outlet of Lake Erie to the final drainage of a great portion of its waters. The views which have been entertained of the sudden drainage of this or any of the upper lakes, and a deluging of the country on the north and east, are no longer considered as tenable by any one, and even if Lake Erie could be drained suddenly, it would cause no deluge of any importance. If the whole lake were at once placed upon Lake Ontario, it would only elevate its surface by about one hundred and fifty feet, so that its extent would scarcely exceed the limits of the ancient lake ridge, and the outlet would still be the valley of the St. Lawrence.

In calculating the future recession of Niagara falls, there are many disturbing influences to be considered. At the present time, by means of the Erie and Welland canals, large quantities of water, which formerly flowed over the fall, are returned to Lake Ontario by other than the natural channels. The Illinois canal, at the southern extremity of Lake Michigan, will drain a large amount of water in that direction, which will find its way to the ocean through the Mississippi river and Gulf of Mexico. Extensive improvements have been contemplated at the falls, and the erection of manufactories, by which great quantities of water from above the rapids will be returned to the Niagara channel below the falls. Thus far the country supplying water to the upper lakes has been but little changed by the hand of cultivation, the primeval forests still clothe the surface, and evaporation to a great extent is prevented. This cannot always remain so; the advancing settlements will yet penetrate even the wilderness bordering Lake Superior, and the opening of the surface to the influence of the sun's rays will greatly diminish the supply of water flowing into the tributaries. These causes will sensibly diminish the quantity passing down the natural outlet; and the mighty Niagara, the "*Thunder of Waters*," is destined to be at certain seasons but a diminutive representative of its former grandeur.

NOTE. Since writing the foregoing paper, I have referred to some notes and correspondence with Mr. Roy, Government Engineer at Toronto, U. C. From levels which he has made from Lake Ontario to the Queenston heights, at several places, he says the crest of the terrace constantly declines going westward from the river, while the base continues at the same elevation. This fact is opposed to information I had before received, and to the general belief. If this be substantiated, and I have every reason to believe the statement, it may materially alter the reasoning in regard to the former recession, of the falls, and the manner in which the chasm has been excavated.

From the Niagara river there is a declination of the crest of the terrace eastward, so that at Rochester its summit is about sixtyfive feet below the level of Lake Erie; giving in this direction a descent of about one hundred feet in eighty miles.* I have no data for determining the rate of declination westerly, but whatever it may be, it proves the course of the Niagara to be upon or near the highest part of this terrace. If this inequality of the surface was produced by some force after

* See New York Geological Reports.

the strata became consolidated, there might have been produced a rent in this direction, as in the diagram which represents a transverse section.

This may have been the first cause of directing the water in its present channel, which was afterwards widened by the river. There seems some reason to suppose this may have been the case, from the general direction of the chasm, being at right angles with the strike of the strata. If this be true, however, the fissure must have been extremely narrow, and still have left to the river the work of excavation, though under very different circumstances. The reasoning in regard to the existence of a depression previous to the excavation of a deep channel, will still hold true, as well as that regarding the fresh water deposits, and the terrace extending to the whirlpool. The future recession of the cataract cannot be affected in any manner by this fact, for if such a rent ever existed, it seems not to have extended as far as the present site of the falls, for all the testimony is to the effect that the process of retrogression goes on by the action of the water upon the shale, which undermines the limestone. If there was a fissure in the course of the Niagara, it did not reach so deep as the bed of the river, for it seems quite certain that the thick bed of sandstone (No. 2, of section,) has never been excavated very deeply below the present surface of the river.

If these views regarding the elevation of the terrace are found to hold true, it will aid in establishing the opinion before expressed, that the present channel of Niagara is of recent date. I have long believed that the former outlet of the great Lakes was by the western end of Lake Ontario, though I have not been able to make investigations to the extent desired in order to establish that opinion.

The period when the disturbance of the strata took place, is one of great importance, and may aid in determining the comparative age of the Niagara channel, and the period of the drift. That the former was subsequent, however, does not admit of doubt. I am not aware how far the terrace continues to decline westward from the Niagara river, but it is quite certain that the limestone rises before going as far west as the head of Lake Erie; for we find crossing this lake near its western extremity, an anticlinal axis which extends northward into Canada, and southward entirely across the State of Ohio. Now this may have happened at the same period as the disturbance or uplift, further east, and the production of this western axis may have resulted in turning the course of the outlet, and the formation of the Niagara river; but more facts are required before any speculations can be offered upon this subject.

Art. XI.—NOTE TO THE EDITORS RESPECTING FOSSIL BONES FROM OREGON. By Henry C. Perkins, M. D., of Newburyport.

Gentlemen,—In the last number of the American Journal of Science may be found the description of a fossil *os humeri*, of gigantic dimensions, which, with the knowledge I possessed at the date of that paper, I did not presume to name, although fully persuaded that the animal to which it belonged should be referred to the order Edentata. Having seen, within a few days, in the Proceedings of the American Philosophical Society, the description by Dr. Harlan, of Philadelphia, of a fossil humerus very like to that in my possession, I am induced to offer this note for publication.

The fossil humerus described by Dr. Harlan in the paper above referred to, formed part of a large collection of fossil bones obtained by Mr. A. Koch, in Benton county, Missouri. It was "twenty inches long, and fourteen in diameter; of a massive structure and deeply grooved by the muscular attachments. In place of a foramen, as in the humerus of the Megalonyx, the exterior surface, near the elbow joint has a deep groove for the origin of the flexor muscles. The condyles are of great breadth, as in the Megatherium. The inferior articulating surface consists of two facets, one exterior and convex, the other concavo-convex, admitting a ginglymous and rocking motion." If now we substitute eleven and a quarter in the place of "fourteen," Dr. Harlan has, in the above quotation, with great accuracy, described my fossil, although he has omitted to mention a marked projection upon the outer part of the bone, which is to be found on my specimen, and figured in Prof. Silliman's Journal. It is possible, however, that this process may have been broken off in the fossil he was describing, as they are spoken of by that gentleman as "more or less perfectly preserved."

In the collection of Mr. Koch there "are 2 fossil humeri, 2 tibiæ, 2 portions of the radius, 2 of the clavicle, parts of several ribs, 2 vertebræ, a cubitus, 24 teeth, 8 of them in their sockets, 2 fragments of a lower jaw with 2 and 3 teeth *in situ*, 2 fragments of the upper jaw, 5 ungueal phalanges, a sternum of 4 articulated pieces, and a part of the ileum and sacrum."

From the near approach in the form of these bones to those of the Orycteropus, Dr. Harlan proposes to name his animal the *Orycterotherium Missouriensis*. From the striking resemblance which appears to me to exist between my fossil and the humerus of the Ant-eater, and more especially from the inference I have drawn, that the animal of which it formed a part must have been a *digging animal*, (ορυκτήρ, *a digger*, and θηρίον, *animal*,) I know of no appellation which could have been more appropriate than the one proposed. I regret exceedingly that Dr. Harlan's description was unaccompanied with any drawings, as this would have enabled me to determine positively whether these two animals belonged to the same genus. I strongly suspect, however, for the reason above given, that such was the fact, and with pleasure adopt his generic name. And as his species is designated from the locality, and the locality whence mine was obtained is in another territory, the cast, which will shortly be placed in the Cabinet of your Society, will not, I think, be inappropriately named (for the present at least), if it be labelled, the right humerus of *Orycterotherium Oregonensis*.

Allow me to make one remark in relation to the tooth described and figured in the American Journal. I had supposed, until very recently, that the *Mylodon* of Owen, and the *Megalonyx* of Dr. Harlan were the same. From a comparison of the figure of the tooth of Mylodon, in the Penny Cyclopedia, (and this is the only figure of the tooth I have been able to find,) with that found in the Medical and Physical Researches, this opinion would seem to have been erroneous. Whether the tooth figured by me does or does not belong to Mylodon, it appears to be essentially different, in form and structure, from that of the Megalonyx; and as the teeth found among the fossils described by Dr. Harlan are said "to be very similar to those of the Megalonyx," I am left in doubt whether my tooth and humerus belonged to the same animal, and know of no means of removing this uncertainty, until an opportunity presents of comparing them together, or examining the tooth by the light of Owen's Odontography.

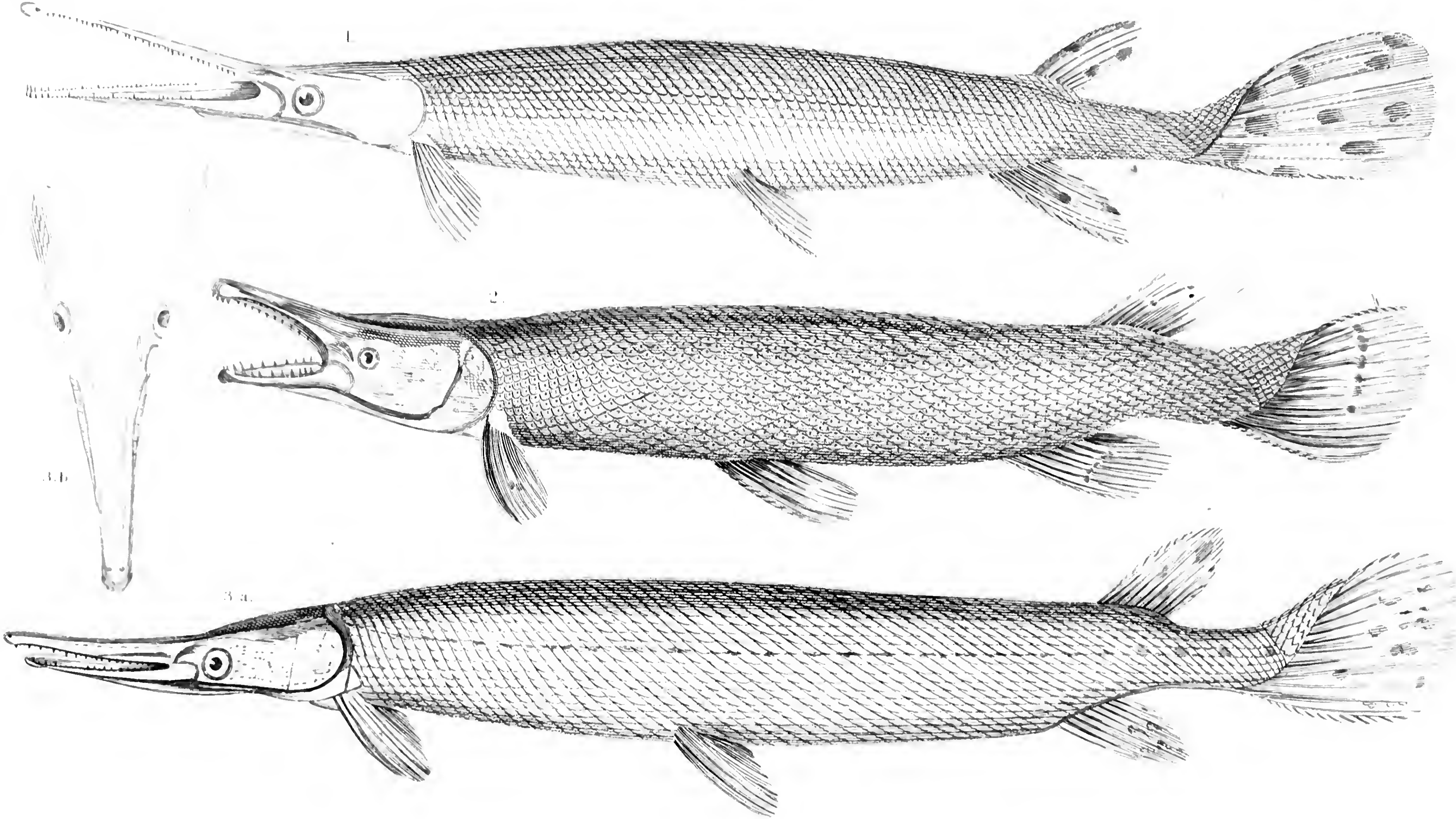
One word in reference to the dentate vertebra spoken of in the American Journal. Although I have only the body of the vertebra, which has left upon it, however, the roots of the transverse processes, I believe the foramen for the passage of the spinal marrow must have been much larger than it appears to have been in the vertebræ of the Orycterotherium; and from its strong resemblance in form and size to that of the Elephant, I would now refer it to the fossil species of this genus.

The fragments of bone belonging to the extremities of some gigantic animal, to which I referred in the Journal, I had hoped, ere this, to have formed some definite opinion upon; this however, for the want of proper facilities, I have been unable to accomplish. It is my intention to exhibit the collection before the Association of American Geologists, at their next meeting, in April, when, without doubt, they will all be assigned to their appropriate places.

Very respectfully yours,

Henry C. Perkins, M. D.

Boston, Jan. 25, 1842.



J. P. Kirtland del

J. Archer Sc.

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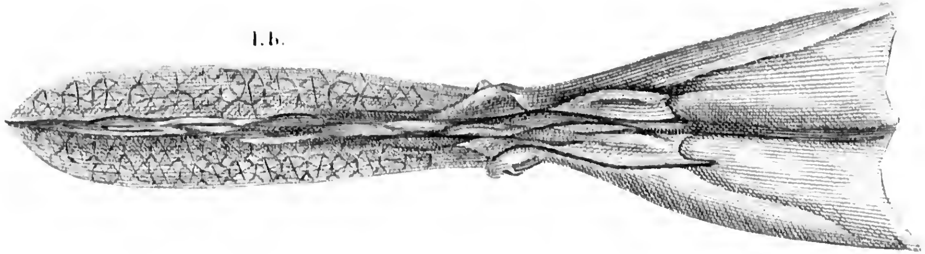

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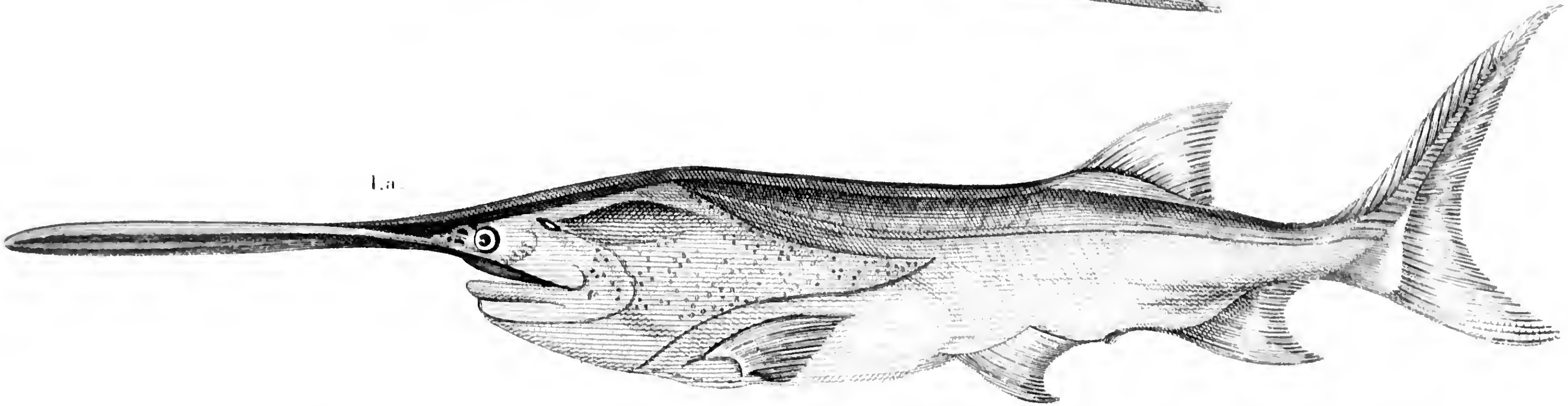

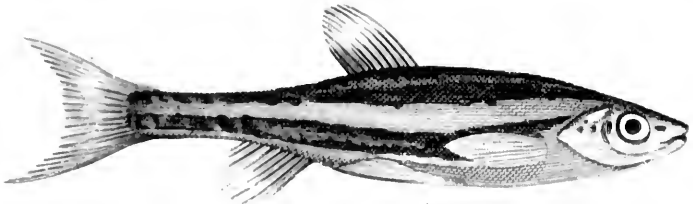

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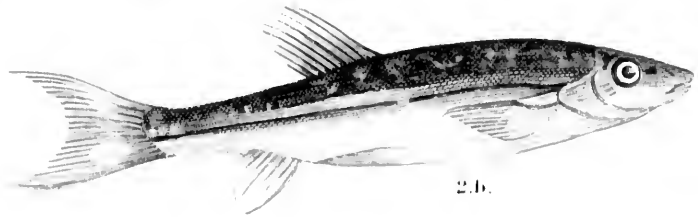

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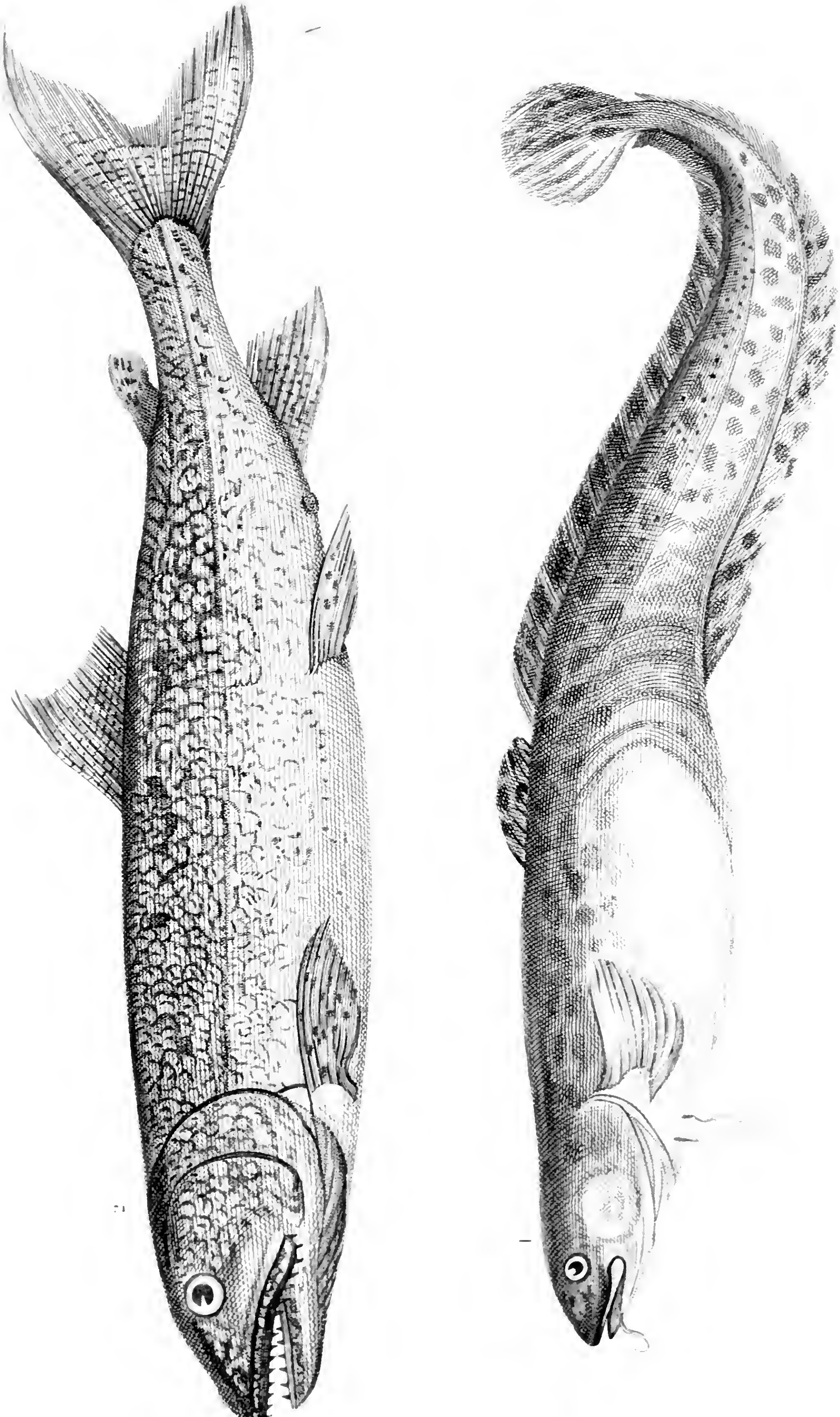
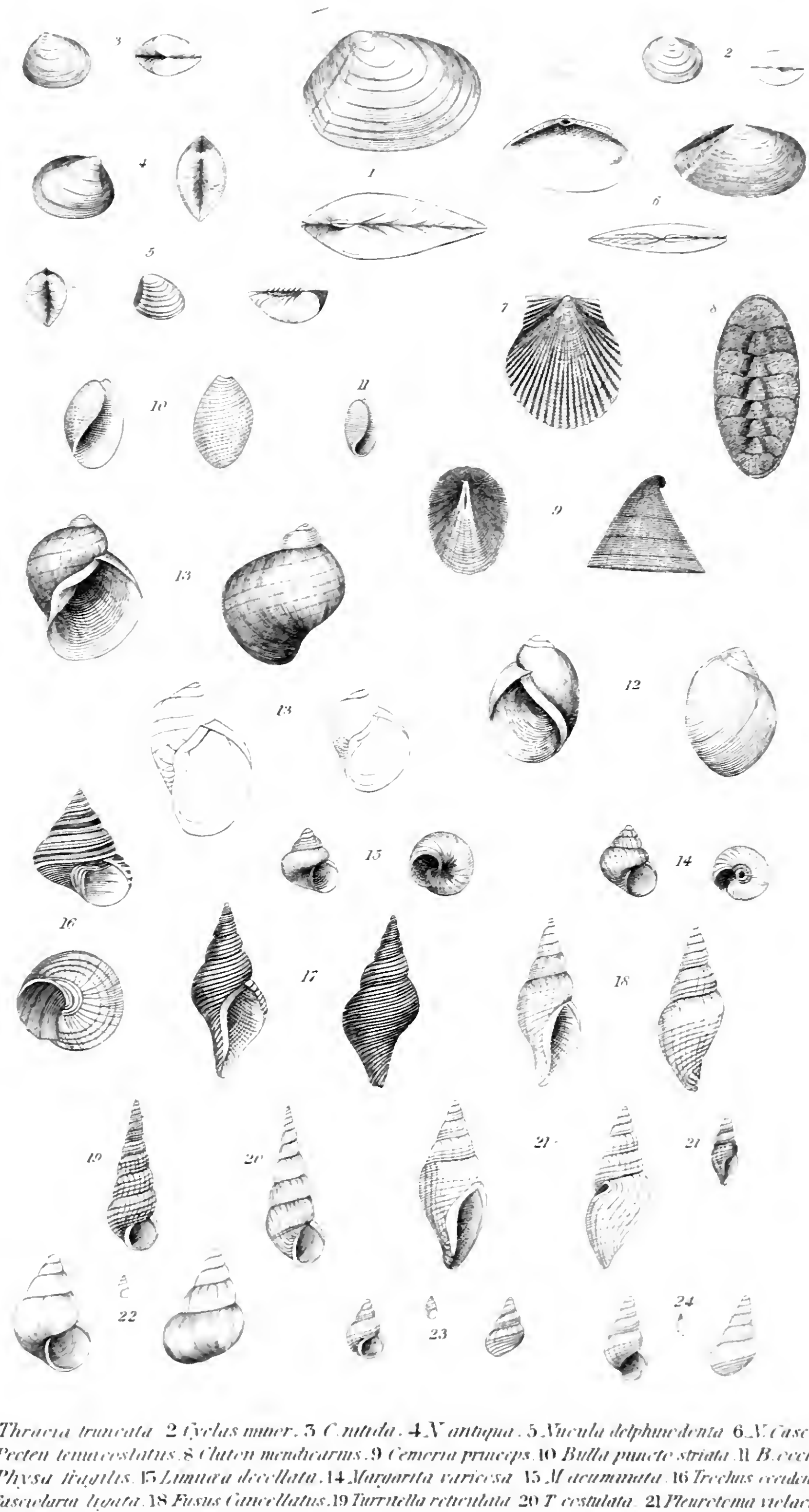
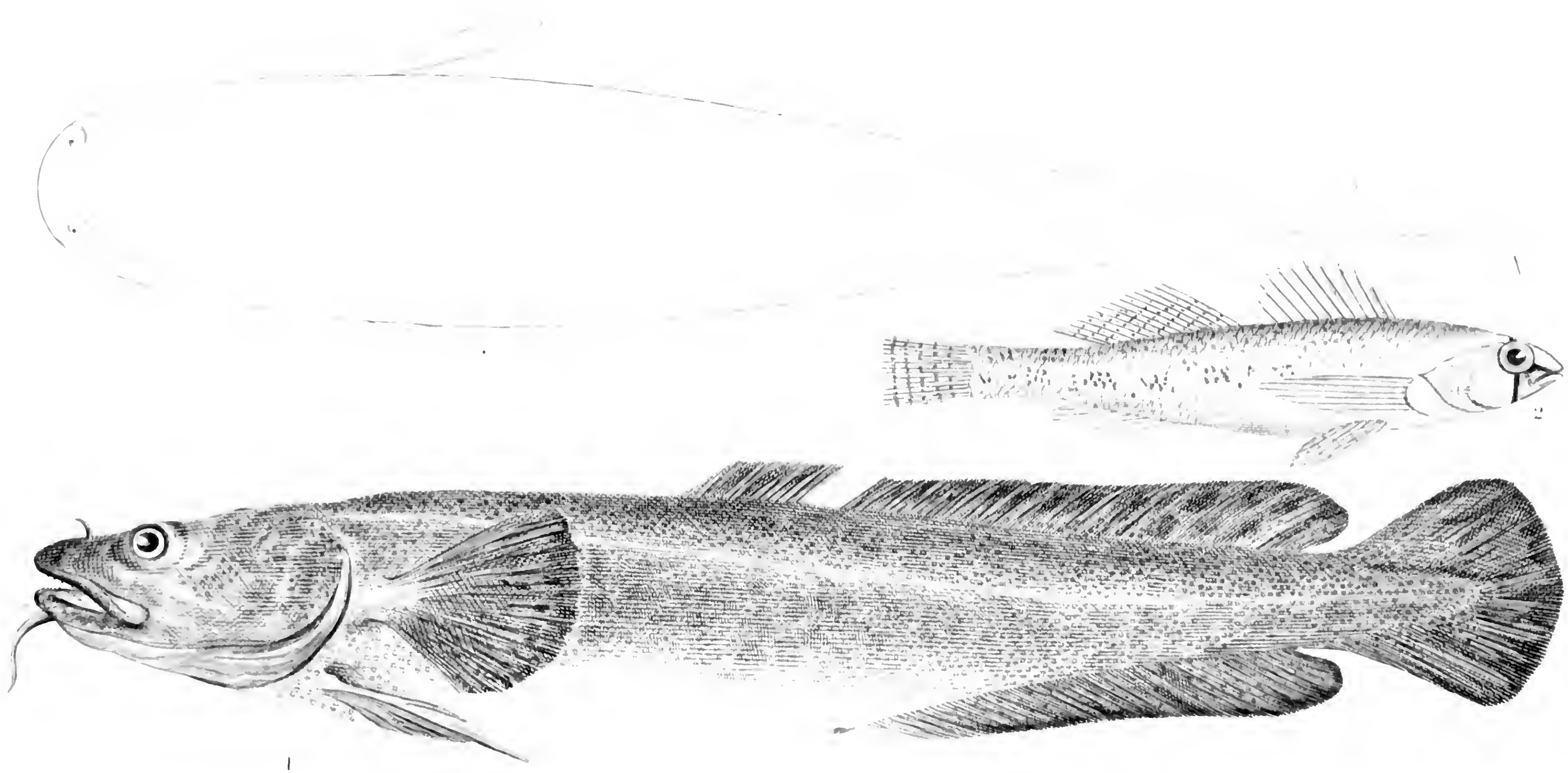




1 *Thracia truncata*. 2 *Cyclas minor*. 3 *C. nitida*. 4 *N. antiqua*. 5 *Nucula delphinodonta*. 6 *N. Cascoensis*.
7 *Pecten tenuicostatus*. 8 *Chiton mendicarius*. 9 *Cemoria princeps*. 10 *Bulla puncto striata*. 11 *B. occulta*.
12 *Physa fragilis*. 13 *Limnaea decollata*. 14 *Margarita varicosa*. 15 *M. acuminata*. 16 *Trochus occidentalis*.
17 *Fasciolaria ligata*. 18 *Fusus Cancellatus*. 19 *Turritella reticulata*. 20 *T. costulata*. 21 *Pleurotoma violacea*.
22 *Cingula latior*. 23 *C. semicostata*. 24 *C. arenaria*.

J. W. Mighels del. *Torbett sc.*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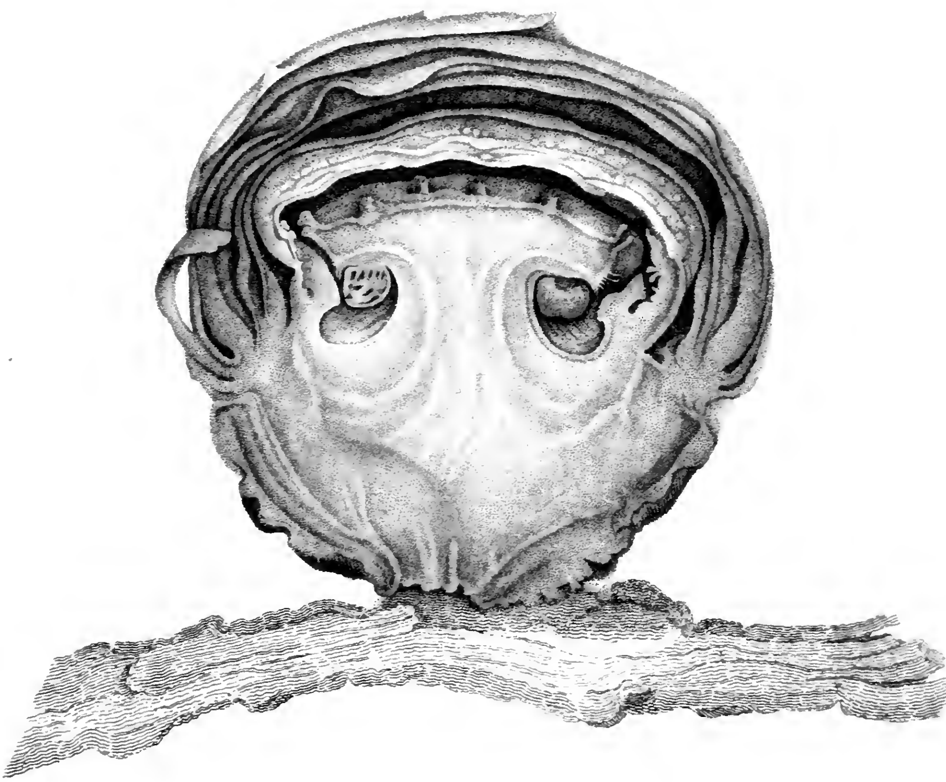
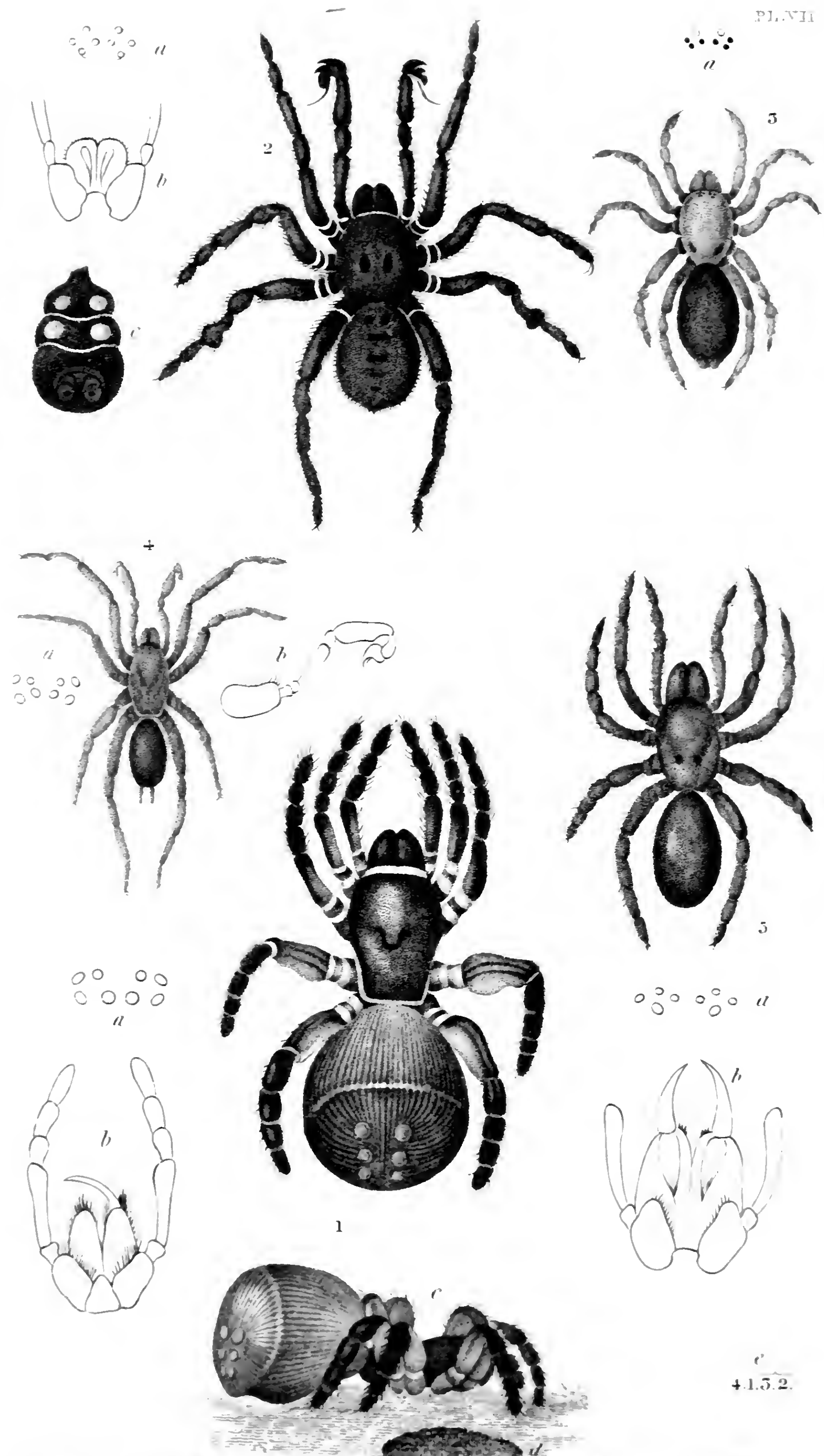


Rafflesia Manillana.



1. MYGALE *truncata*
2 *solstitialis*
3. M *Carolinensis*
4. M *gracilis*
5. *unicolor*

M. M. Hentz del. C. W. Terbett Sc.

CHARACTERS OF SHELLS TO BE FULLY DESCRIBED IN THE NEXT NUMBER OF THE JOURNAL.

Helix sub-plana, Binney. H. testâ subdiscoideâ, fuliginosâ aut corneo-rufescente, nitente; spirâ depressâ; anfractibus quinque vel sex; aperturâ semilunari, transversâ; labro simplici, acuto; basi plano; umbilico parvo.

Lat. ¾ poll. Habitat. Tennessee.

Helix tenui-striatâ, Binney. H. testâ depressâ, carinatâ, umbilicatâ, albido-corneâ; anfractibus septem, obliquè striatis; aperturâ angustâ, depressâ; labro subreflexo; basi convexo.

Lat. ½ poll. Habitat. Tennessee.

Helix penicillata, Gould. H. testâ sub-globosâ, fragili, lucidâ, lævigatâ, infra convexâ; anfractibus quatuor, inornatis vel lineis fuscis longitudinalibus, interruptis diversissimè fasciatâ; labro acuto; columella anticè roseo tinctâ.

Long. .35, lat. .25, poll. Habitat. Ins. Cuba.

Helicina glabra, Gould. H. testâ depresso-globosâ, pallidè corneâ, lævi, lucidâ, subtus convexiusculâ; anfractibus quinque, tenui-striatis; aperturâ ovatâ, labro acuto; columellæ callo latè reflexo, minutè granulato; subtus lineâ volvente dente marginali productâ.

Lat. .3, alt. .2, poll. Habitat. Ins. Cuba.

Pupa carinata, Gould. P. testâ minimâ, ovato-conicâ, luteo-corneâ; anfractibus quinque lævibus, subcarinatis, ultimo acutè carinato; suturâ profundâ; aperturâ amplâ, obliquè semiovali, dentibus quinque instructâ, quorum majori postico, torso et bifurcato, duo ad columellam. uno in faucem, et uno ad labrum positis; peristomate late et inequaliter reflexo; umbilico minimo.

Long. .08, lat. .05 poll. Habitat. Maryland.

Pupa (Siphonostoma) porrecta, Gould. P. testâ gracillimâ, fusiformi, glabrâ, pellucidâ, maculis subquadratis ocscurà tessellata; anfractibus 20 et amplius, ultimo disjuncto et valdè porrecto; aperturâ campanulatâ subquadratâ; peristomate albo, reflexo.

Long. .6 lat. .07 poll. Habitat. Ins. Cuba.

Pupa (Siphonostoma) lituus, Gould. P. testâ lucidâ, cylindraceâ, apice conica, decollatâ; anfractibus circiter quindecim, tenuiter obliquè striatis, ultimo disjuncto et producto; aperturâ albâ, campanulatâ, subquadrata, cervice contractâ; peristomate reflexo.

Long. .7, lat. .15, poll. Habitat. Ins. Cuba.

Cyclostoma bicolor, Gould. C. testâ elongatâ, ovato-cylindraceâ, apice obtusâ; postice stramineâ, anticè purpurascente; anfractibus quinque convexis; aperturâ circulari, fauce rubiginosâ; peristomate crasso, valdè reflexo, postice abscisso; umbilico parvo; operculo corneo.

Long. 1.1, lat. .5 poll. Habitat. Cuba.

Cyclostoma clathratum, Gould. C. testâ conico-cylindriceâ, apice truncatâ, cinereo-viridescens; anfractibus tres ad quatuor, convexis, lineis numerosis incrementi acutis clathratâ; suturâ crenulatâ: aperturâ parvâ, sub-circulari; peristomate incrassato, haud reflexo: umbilico nullo; opercnlo calcareo, lineis incrementi elevatis, acutis.

Long. .35, lat. .2, poll. Habitat. Ins. Cuba.

Cyclostoma mahogani, Gould. C. testâ conico-cylindraceâ, tenui, fulvâ, apice decollatâ; anfractibus 3 ad 4 convexis, striis tenuibus volventibus, lineisque fuscis fulminantibus, in fasciis dispositis; apertura ovatâ; peristomate subreflexo; umbilico parvo; operculo corneo, tenui.

Long. 1, lat. .45, poll. Habitat. Ins. Cuba.

Cyclostomâ catenatum, Gould. C. testâ conico-turritâ, fulvo-viridescens; anfractibus 5 convexis, striis elevatis volventibus, fusco articulatis; aperturâ suborbiculari, anfra tu penultimo disjunctâ: peristomate reflexo, posticè dentato; operculo albo, calcareo.

Long. ½, lat. .4 poll. Habitat. Ins. Cuba.

Conus castrensis, Gould. C. testâ lævi, conicâ, anticè admodum constrictâ; spirâ planulatâ, apice mamillatâ, flammulis radiantibus castaneis notatâ; anfractibus 10, supra concavis; colore albâ, lineis et maculis angulatis castaneis reticulatâ; basi castaneâ.

Long. .3, lat. 1½, poll. Habitat.——

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Art. XI.—REMARKS UPON CORAL FORMATIONS IN THE PACIFIC; WITH SUGGESTIONS AS TO THE CAUSES OF THEIR ABSENCE IN THE SAME PARALLELS OF LATITUDE ON THE COAST OF SOUTH AMERICA. By Joseph P. Couthouy. Read December 15, 1841.

[Continued from page 105.]

The conclusions to which I have been led by all the observations made among the coral islands of Polynesia, may be summed up as follows:—firstly, that the subsidence was not continuous, but interrupted by long periods during which the land, and after its disappearance, the reef, remained stationary, and the successive terraces were formed; secondly, that it continued, at least in certain places, up to a comparatively recent day, and ceased not long after the total submergence of the pre-existing land; thirdly, that there followed an indefinite interval of repose, with the reef at a sufficient depth below the surface of the ocean, to enable the polypes to construct the overhanging shelf whose fragments now strew the upper plateau; fourthly, that to this quiescent state ensued one of re-elevation,* at a period of which, when the shelf was considerably lower than the plateau now is, yet exposed to the full violence of the surf, it was torn off and the fragments carried to their present locality; and lastly, that this re-elevatory process is still going forward, not only in the coral groups, but also in most of the volcanic ones of Polynesia.

After what has been said, it is perhaps unnecessary to remark further upon the first of these conclusions. As regards the second, I will here briefly notice one of the facts on which it rests. At Rose Island, a chain of coral reefs mostly covered only at high tide, and small islets but a few feet

* There is one peculiarity in the sea or barrier reefs of all the volcanic islands, for which, unless it is to be attributed to the recentness of their elevation, I can at present suggest no explanation. I refer to the entire absence upon them, no matter how exposed may be their situation, of any fragmentary ridges, such as are found at every Paumotu, even where the distance from the outer plateau to the lagoon is much less than the breadth of some barrier reefs.

above water, principally loose rubble and sand, the whole about a league in circuit, and situated twentyfive or thirty leagues east of the Samoas—so recent was the formation that besides the main entrance into the lagoon on the leeward side, there were several small channels, others partially bridged over, and some closed only at one extremity. Not a particle of vegetation had yet made its appearance, elsewhere than on the most elevated portion of one sandy knoll, which a solitary shrub (a Pisonia, if I recollect right,) had begun to clothe with verdure. In the shallow lagoon, it would seem as if there had not elapsed since its formation a period sufficient for the coral to have grown in any quantity, as only a few small clusters were seen here and there, the bottom being almost entirely a fine white coral sand, such as is common on the beaches of those islands having shore reefs, and quite destitute of the smooth, calcareous paste, deposited in most lagoons. Scattered over this sand, were a number of boulders of volcanic rock, some of them so heavy that two men could not raise them from the bottom, and precisely similar in appearance and mineral structure to that constituting the mass of the neighboring groups of Samoa and Tahiti. A specimen weighing about twenty pounds was picked up in four feet of water, among small rolled blocks of coral conglomerate. This circumstance appears to afford conclusive evidence that the main rock of the submerged island must be at no great depth below the sandy bottom of the lagoon, since it was evidently not long since acted upon by the surf, the only imaginable power which could have placed these boulders in their present situation. At the same time, that the islets are now slowly emerging, is indicated by the whole surface of the reef, which is so for elevated, that the corals have nearly ceased to flourish, and are for the most part covered with an incrustation of lime, which promises ere long to unite the whole into an uniform consolidated mass.

That there was an interval of quiescence between the last epoch of subsidence and that of re-elevation, is, I think, proved not only by the construction of the marginal projecting shelf, which has evidently once existed on the upper plateau, but by these elevated islands, like Tahiti and others, having both shore and barrier reefs, which are raised to the same level, and where a shore reef does not exist, by the detached masses and clusters of living coral that are found at those islands in only three or four feet of water, and within a few yards of the beach, quite equalling in size any that are found upon the sea reefs, which clusters must both have grown at a considerably greater depth, and required a long time to attain their present magnitude.

In the lectures to which allusion has been made, the island of Tahiti was incorrectly represented in ground plans of it exhibited by Prof. Lyell, and also described by him, as surrounded by a reef enclosing a continuous lagoon of nearly uniform width between it and the shore. Of a fact so important in its geological bearings as the co-existence of a fringing and lagoon-enclosing reef at this island, the distinguished lecturer was, I presume, not aware, inasmuch as it was in no manner alluded to by him. There is scarcely any portion of the reef which I have not visited, and so far from encircling the island, the lagoon only exists at intervals, and in many of these a shore reef runs out so far as to leave but a narrow boat channel between it and the outer one. Sometimes it terminates in a cul de sac; in other places it communicates with the sea by two passages near its extremities, thus isolating a portion of the outer reef, and there are parts of the coast where for miles the two reefs appear to have united, and there is no intervening canal; so that the natives wade from the beach to the breakers. It would be nearer the truth, to state that instead of a continuous lagoon, there is a nearly continuous fringing reef, surrounding the island and varying from a few yards to more than a mile in width, and that the lagoons merely form canals between this and the sea reef. Like the latter, these shore reefs are in general very steep. There is one in Pappeiti, the principal harbor, forming a sort of natural pier, alongside of which a vessel can lie in thirty or forty feet of water, so close that a person may step from her channels, upon the reef, where it is not more than eighteen inches or two feet deep.

The island of Eimeo, lofty and broken like that of Tahiti, from which it is distant between four and five leagues, is almost entirely surrounded by a fringing reef, containing occasional small lagoons inaccessible to any thing but a canoe, and often having no entrance whatever. The same may be said of several other islands in the Tahitian group. For these reefs to have formed upon the shore and extended so far as in some instances to be blended with the outer ones, there must as it seems to me, have been a long period of rest between the cessation of subsidence and the re-elevatory process, which it is my belief has been for some time and is still going forward. For this belief I now proceed to submit some of the reasons.

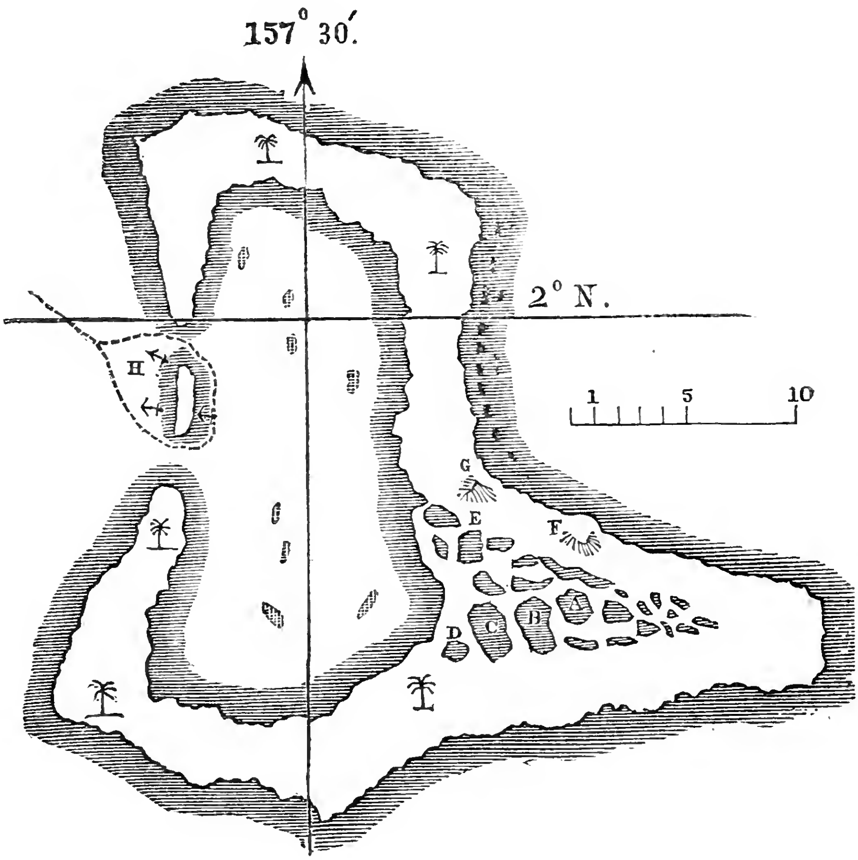
At almost every Paumotu visited, I found the shore of the lagoon raised from eighteen to thirty inches, containing imbedded shells, and corals standing as they grew.

At Clermont Tonnerre Island, on the North shore of the lagoon, there is a reef two feet above sea level, literally paved with the shells of Tridacnæ, imbedded precisely as in the adjacent submerged plateau, and in a state of perfect preservation, even as to color. At Honden Island, some two hundred and twenty miles north-west of this, a similar raised ledge borders the lagoon. At Raraka, three hundred miles further west, on the plain between the windward ridge and lagoon, which had a very slight ascent inland, corals both sessile and arborescent, were met with in a normal position, half a mile from the sea, and at about the same height above it as the shells at Clermont Tonnerre. At King's Island, in crossing from the leeward beach to the lagoon, several large tracts of reef-rock were observed, full of imbedded Tridacnæ, and corals occupying their original locality. Similar appearances were presented by several other islands, to which I cannot refer at present.

The surface reef or upper terrace, every where bears evidence of having been elevated higher than the natural growth of the corals would raise it, in their scanty number and diminished size, and the calcareous incrustations now covering the larger portion of the reef, to the extinction of the polypes. At Waterland Island, the leeward reef is quite bare at low water, and so bold that one may spring upon it from a boat without wetting his feet. So trifling is the depth of water on other reefs, that many arborescent and some even of the sessile corals, have their superior portions so constantly exposed that the polypes are all dead, while below a certain line they still continue to flourish. In the lagoons, also, are frequently seen clusters of Madrepore, whose extremities are from an inch to a foot above water, which like those on the terraces could have been constructed by the polypes, only when continually covered by it.

At Christmas Island, the re-elevation has been so great, that the lagoon, of sixty miles in circuit, is in no part, at half a mile from shore, more than three feet deep, has hardly any where over ten feet of water at high tide and is full of still shallower patches, raised reef-rock, and corals. On the south-east side, numerous lagoons from a quarter of a mile to a couple of leagues in compass, originally no doubt deep hollows in the principal one, have been formed by the elevation of their surrounding bed above water. In some of these, though they have no outlet, the tide continues to rise and fall regularly, the water passing readily through the porous sand, but the evaporation is such as to render them exceedingly salt. In others, the water is entirely dried up, and the bottom covered with a thick saline incrustation. The intervals between these small lagoons and hollows, is sometimes the bare coral rock, but more commonly coral sand and shells, containing an infinite number of Echini, Spatangi, &c. imbedded. Near the centre of the island are plains of perfectly level coral rock, some of them a mile long by half a mile broad, raised eight or ten feet above sea level, and covered with about a foot of black porous earth. The magnitude of these rocks precludes all idea of their having been torn from the reef like the large blocks of similar composition that line the eastern coast. A very remarkable character in the structure of this island is the unusually great width of the two entrances, it being full two miles, as will be seen by the accompanying sketch. The fringing reef runs out about half a cable's length all round the island, except on the south-west side, where the surf rolls in directly upon the beach. There is anchorage for ships in from ten to thirty fathoms water on either side of the low, sandy islet by which the entrances are separated.*

SKETCH OF CHRISTMAS ISLAND.



The letters A. B. C. D. E., and the adjoining dark spots, indicate the position of the smaller lagoons and dry hollows.

F. and G. are two hills of coral sand, about ten feet higher than the rest of the island.

* For the sketch of Christmas Island, and also many of the facts in connexion, I am indebted to the Hawaiian Spectator, for July, 1838. This publication, which was issued quarterly, in a very handsome octavo form, at Honolulu, in Oahu, and conducted with much ability by an association of the foreign residents, was discontinued at the close of the second year, for lack of patronage. This is much to be regretted, as it promised to be the vehicle of much important information, both of a scientific and general character, relative to Polynesia. Its place is in a measure supplied by a weekly paper entitled "The Polynesian," established in June, 1840, and ably edited by our townsman and former associate, J. J. Jarves, Esq., but the size of this renders it less valuable than the Spectator, as a work of reference.

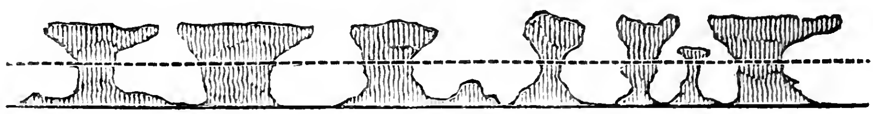
H. the low, sandy island between the entrances, which are marked by the dotted line.

The four trees represent the situation of as many groves of cocoa-nut. The dark dotted patches in the lagoon, which should be much more numerous, are sand banks and coral shallows; and the black spots on the eastern shore, denote large fragments of reef-rock thrown up by the breakers.

At Carlshoff Island, in about 15° 30′ S. lat. and 145° 30′ W. long., near the north-west side of the lagoon, and a short quarter of a mile from the sea beach, is a pool of tolerably fresh water, between fifty and sixty yards round, and five feet deep, which appears to have been formed like the dry hollows at Christmas Island.

But in nothing perhaps throughout the coral seas, are the proofs of re-elevation more conspicuous than in the large tabular masses of reef-rock which have been spoken of as lining the weather shores of many Paumotus. At Serle, Vincennes, (a few miles West of Raraka,) King's, Carlshoff, Honden, Tooa, Aitóho, and Dean's or Prince of Wales' islands, these constitute one of the most prominent features. At the last named, they are strewn along the coast for upwards of thirty miles, and some of the masses, as nearly as I could estimate, were a hundred feet long. It is not improbable that the whole coast here may be a reef raised three or four feet. The enormous size of the rocks in some instances, renders it almost incredible that any surf could have been sufficiently powerful, to tear from the reef and remove them to their present situation.

Not having landed here, but only seen these ledges through a glass while coasting the island at a mile's distance, I cannot of course speak positively on this question, or as to their exact size; but as regards the latter, any person who has made the experiment, will admit that in viewing objects on a beach in this manner, their magnitude is more apt to be under than over-estimated. In most cases, however, there is no doubt but that these blocks are erratic, and originally constituted the impending shelf of the surface plateau, which from their being torn off now presents at its edge only a steep slope. That this shelf could not have been formed while the plateau was at its present elevation, is apparent not merely from the fact that the surf would prevent its construction, but because as the appearance of the whole reef testifies, it is not covered with a depth of water adapted to the operations of the polypes on such a scale. The fragments must also have been removed to the locality they now occupy, while the reef was at a lower level, since the surf at present scarcely reaches them except during heavy gales. That a considerable re-elevation has taken place since they became fixed where we find them, is evinced by the manner in which their sides and faces have been hollowed out by the action of the waves. Had no change of level occurred, we should naturally expect to see the greatest excavation near their union with the subjacent reef, where they are unceasingly exposed to the flux and reflux of the tide, whereas it is frequently near their upper third, and a portion of it above high water mark, giving to the smaller masses a great variety of configuration, as may be seen in the following sketch of a cluster on the reef at King's island.



The interrupted line in this and the preceding cut indicate the line of high water in ordinary tides.

I incline to a belief that the fissures described as existing in the thin shelves of coralline limestone surrounding some islands, should be included among the evidences of re-elevation. The character of their stratification shows that these were originally deposited on a horizontal plane, and their present dip of 5° or 6° seaward, may have been occasioned by the upward pressure of the submerged summit below the bed of the lagoon, which would also be likely to cause in strata of their extent and tenuity, such rents as I have mentioned. This is certainly the case with similar formations on the eastern coast of Kauai, whose dip is 10° or 12° so that the edges of the laminæ at their landward termination, crop out a foot or more above the beach.

Throughout the volcanic islands of Polynesia the tokens of recent elevation are every where conspicuous in a greater or less degree. At the Society and Samoan groups may be seen above water at low tide, corals *in situ*, whose upper portion and frequently the entire mass is blackened, and their polypes destroyed by exposure.

At the north-west end of Manua, (the easternmost of the Samoas,) fragments of coral, whose quantity and size are such as to render it impossible that they were placed there by other than natural agency, are to be seen at least eighty feet above the sea, on a steep hill-side rising half a mile inland from a low, sandy plain abounding in marine remains. These fragments are imbedded in a mixture of decomposed lava, mould and sand, and some of them are of such magnitude that four stout natives could not turn them over. The immediate coast is rocky and precipitous, the material, a partially decayed lava having a stratified character, but the strata much distorted and dislocated and in many places rent vertically asunder. At this end of the island there is no reef, properly so called, the water shoaling gradually from thirty fathoms at a quarter of a mile distance, till it breaks within a few yards of the beach. There are, however, numerous scattered patches and detached clusters of coral from a depth of ten fathoms to where the sea breaks.

At Tahiti I was informed, that on the sandy isthmus connecting the mountainous peninsulas of Tobreonu and Tiarabu into which that island is divided, eight or ten feet below the surface was a solid bed of coral rock, about the same number of feet above the sea. That this was formerly a reef connecting two islands is the more probable from there being here an interruption of the present shore reef, the deep water continuing quite to the beach.

At the Hawaiian islands, which are still the seat of volcanic action on a magnificent scale, the elevation has been much greater and its proofs more apparent than perhaps in any other region of Polynesia. The islands of Maui, Molokai, Oahu, and Kauai, abound in such evidences, of which I will specify here only a few of the most striking.

At Oahu on the south side, the whole plain on which the town of Honolulu is situated, is an elevated coral reef, extending between three and four miles from east to west, and varying from half a mile to a mile in breadth. The landward side of this reef is highest, being, as well as I can remember, about twenty feet above the sea. In certain parts, like that for instance on which the town is built, the reef is covered to a depth of from two to five feet with ashes and fine scoriaceous sand, which were probably ejected from the now long extinct craters of Puiwa, just behind the town, and Leahi* about four miles east of it on the coast, chiefly, however, from the former, at whose foot the plain terminates, about a mile from the sea. Below this volcanic sand is sometimes found a stratum of slightly cemented coral sand, containing shells and Echinides of species identical with those now living in the vicinity. In other places, as on the plain at the entrance of the Manoa valley, between Honolulu and Waikiki, the reef is entirely bare, with every hollow and gulley as distinctly defined as they are on the present shore reef. A short half mile west of Honolulu and half that distance from the sea, at the mouth of a branch of the Nuuanu valley, a considerable stream flows through a section of this elevated reef some twenty feet deep. A mile and a half farther west there is a similar section at the mouth of the Kalihi valley. These appear to have been anciently passages in the reef, and show that it is composed of the same genera of corals (principally Porites) as constitute the mass of the recent reef. In the district of Ewa, fourteen miles west of Honolulu, on the left bank of Pearl river a few rods from its mouth, there is a bed of oyster shells, twelve feet in thickness and more than a hundred yards in length, whose lowest portion is full five feet above the sea. They are for the most part entire and in a fine state of preservation, the internal polish yet uneffaced and

* Puiwa is the "Punchbowl hill," and Leahi the "Diamond Head," of the foreigners.

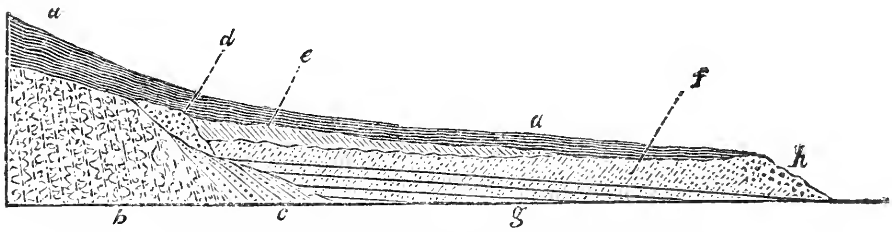
not tacky or "*happante*" to the tongue. They bear a very close resemblance to our *O. borealis*, and it is remarkable that although imbedded with it are found many shells which still inhabit the adjacent coast in great numbers, the Ostrea is apparently an extinct species. It was seen no where else in the Pacific, neither so far as I could ascertain, is it met with either fossil or recent on any other part of this coast.

From Waialua on the north-west side of Oahu I received specimens of a very hard and compact breccia of shells and coral, said to be taken from cliffs of the same material twenty feet high, which the description sent with the specimens left me little doubt, were the remains of an ancient cemented coral beach.

On the coasts of Kauai there are frequent elevated beaches. One of these at Kalihiwai, on the north side of the island, three fourths of a mile inland, is composed of a slightly coherent conglomerate of coral and shells raised about fifteen feet. Aged natives dwelling in the neighborhood, affirmed to me that the sea had retired within their remembrance an eighth of a mile, and that in their youth, old men had told them that they in their boyhood fished in canoes at a spot now full one third of a mile from the sea, which since that period, as they forcibly expressed it, "*ihanauia ka lepo hou*," literally, had brought forth the new earth. Four or five miles west of this, the river Hanalei, flowing through a plain of the same name in the district of Waioli,* displays on its banks rather more than a quarter of a mile from the sea, the section of an ancient beach about five feet higher than the present one, and composed of materials similar to that of Kalihiwai. This line of beach extends from the base elevated table land, forming the eastern boundary of the plain in a westerly direction three miles across, to the foot of the lofty ridges of Mamalahoa and Puünauekia its limits on the opposite side ; following the cur-

* Waioli signifies "the singing" or "the joyful water," and is applied to this region by the Hawaiians, whose names are always not less poetical than descriptive, on account of the numerous glittering cascades that come singing and leaping down from the lofty mountains by which it is girt on all sides but the seaward one.

vature of the hills to the south, and sometimes almost skirting them at from the fourth of a mile to a mile from the shore. The figure below represents a north and south section of the plain, from just back of the ancient beach to the sea, on a scale of 2.5 inches to a mile, and 10 feet to the inch.



a. Surface soil, twelve to fourteen inches deep below the old beach, and eighteen to twentysix inches deep above it.

b. A decomposed lava ten or twelve feet thick, gradually passing into the solid rock.

c. A mixture of decomposed lava, surface mould, and coral and shell detritus.

d. Ancient beach of coral rubble, shells, and volcanic earth and sand.

e. A stratum of like materials with *c.* ten inches thick at its commencement, but gradually attenuating as it approaches the sea till at one-fourth of a mile from it, it is lost.

f. A stratum of fine volcanic sand, chiefly comminuted crystals of olivine, and fine coral detritus and shells.

g. Thin laminæ, the planes of whose stratification are parallel, formed by a concretion of the materials of *f.* and having thin layers of loose sand interposed.

h. Present beach—coral rubble, shells and sand, chiefly coral detritus.

These laminæ were evidently formed by successive horizontal depositions, but have since been tilted up so as to dip about 5° north to the sea. Proceeding inland, after passing the line of old beach, the surface soil is twice the thickness of that on the seaward portion of the plain, and rests on the stratum of decomposed lava. The layer of mixed earth, sand and shells, was no doubt washed from the stratum at the time when the sea was at the old beach. The bed of sand and detritus on which this mixed layer, and after its disappearance, the surface mould rests, is full of slight inequalities, as if rippled up by the wind or sea. Probably the former was the real agent after its elevation. In the opinion of several intelligent residents, this plain has been formed merely by long continued additions to the beach, but there are several facts contradictory of this.

From all the evidence I could collect, either by personal observation or inquiry, it is my belief that the sea instead of augmenting the coast, is yearly encroaching upon it and regaining its previous loss by elevation. The surf which rolls in from the broad open bay of Hanalei, especially during the winter months, with tremendous violence, must operate destructively upon a beach shelving into deep water so abruptly as this.

There is a short beach a mile and a half perhaps from that of Hanalei, between the river Lumahae and the ridge of Puünauekia, which during the winter is sometimes three hundred yards wide, and is every summer narrowed to twenty or twentyfive yards, yet no corresponding increase takes place during the latter season in the main beach. Yet it is evidently the waste of this which contributes to widen the other, it being the only one in the vicinity capable of furnishing the material. If the plain was of gradual formation by successive increment, as a natural consequence the surface soil would be deepest on the inland or older portion, whereas it is of the same thickness one hundred yards from the sea as at the ancient line of coast. Moreover, a transverse section of both the ancient and modern beaches, exhibits a ridge composed of coral in considerable fragments, entire shells, Echinides, &c. mixed with a rather coarse coralline sand, and if the intervening space were merely a succession of similar beaches there is no reason why it should not be similarly constituted. But instead of this it contains only a few scattered corals in small pieces, the shells in it are small and broken up and the sand is very fine, much of it being of volcanic origin; the whole appearing like the finer and heavier particles, now being washed from the beach and carried seaward by the recoil and undertow of the surf. Adding to these facts that of the dip northward, of the lower bed of laminar concretions, I think the plain of Hanalei should be classed among the instances of elevation by subterranean forces. The manner in which the strata of cemented coralline sand are tilted up in the vicinity of Wailua has already been described. At Anahola a few miles north of this, half a mile from the sea is a remarkable beach, more than a mile in length, consisting of a mixture of loose corals, shells and sand, deposited in very regular curved strata. From this and all the other old beaches a sandy plain, with a thin coating of soil extends to the present coast.

That section of the coast at Kauai, designated by the natives as Na Pali, or "the Precipices," which from Hamakoa on the north, to Lapa on the west, extends about twelve miles in an unbroken, inaccessible wall of sub-columnar lava, from eighteen hundred to twentyfive hundred feet high, exhibits continuous traces of exposure to the action of the waves, several feet above the line of cavities now being worn by the surf.

At Molokai, an island a few miles north-west of Maui, Mr. B. Munn, teacher for the Mission, assured me that he had seen masses of coral apparently in their original position, imbedded in calcareous rocks, one hundred and even one hundred and fifty feet above sea level. I suspect, however, that here is some error, either of calculation or observation, having seen nothing on any of the other islands to warrant the belief in such an elevation as this would indicate. Still from the testimony of all the missionaries, there can be no question of the fact that there are really in Molokai raised coral beaches of height at least equal to those of Oahu and Kauai.

By the statements of several persons who have long been residents on Oahu, the elevation there is at present going forward at a very perceptible rate. Henry A. Peirce, Esq., an American merchant who has dwelt at Honolulu for upwards of sixteen years, and whose high intelligence and habits of close observation entitle his opinion on this point to much respect, has informed me that large portions of the reef on both sides of the harbor, which at his first arrival were never uncovered by the sea, have since then risen so much as to be now bare every tide at low water; other parts which were within his knowledge exposed only at that stage, are now naked an hour before it, and the sea has in the same time receded as much as thirty feet from places where canoes were accustomed to land.*

It is to be remembered that throughout this group of islands, earthquakes are of very frequent occurrence, especially at Hawaii, the principal one, and seat of the great volcano of Kilauea, where several occur almost every year. At Hilo, or Byron's Bay, about thirty miles north-east of the crater, during the month of November, 1838, upwards of fifty shocks were experienced within eight days, and not less than twelve more counted in a single night. There is another active volcano in the Vichis, or Fejees, and several more in the islands to the southward and westward of them, nor is it at all improbable that throughout the entire extent of Polynesia, the internal fires are raging below the ocean's bed, and by their upward forces constantly tending to elevate the existing islands.†

* Among the evidences of the slow increase of corals, alluded to on page 67, were included through inadvertence, experiments made at long intervals on the depth of channels and upon well known reefs. These should be set aside, since it is clear that such depth might be increased or diminished by a subsidence or elevation of the reef, and therefore no correct inference as to the growth of the corals composing it can be drawn from such experiments.

† Its bearings on this question, the singularity of the phenomena it records, and the limited circulation of the work in which it appears, will, I trust, be deemed sufficient apologies for introducing here the account of an extraordinary oscillation of the sea, published in the Hawaiian Spectator, for January 1838, by T. C. B. Rooke, F. R. C. S., a resident of Honolulu.

" On the evening and night of the 7th Nov. 1837, a most remarkable commotion of the sea was witnessed at Honolulu, in many respects similar to that witnessed at these islands in May, 1819. One inch and a half of rain had fallen during the previous twentyfour hours; the wind was fresh from the north-east, squally at intervals. The atmosphere was clear and cool,—Therm. 74.5. The Barometer had gradually fallen during the four previous days, but this evening had again risen to 30.06, at 6 o'clock, when the alarm was given that the sea was retiring. The first recession was the greatest,—something more than eight feet; but being unprepared to make observations at the moment, the exact fall was not measured. The reefs surrounding the harbor were left dry, and the fish aground were mostly dead. The sea quickly returned, and in twentyeight minutes reached the height of an ordinary high tide; scarcely remaining stationary, it again receded and fell six feet. This was repeated at intervals of twentyeight minutes. On the third rising it was four inches above ordinary high water mark, and fell again six feet four inches. After the fourth rising, the length of time occupied by the rise and fall varied, and the

Before closing these imperfect reminiscences, a few remarks may be added, respecting Matea, or Aurora Island, a coral reef

rise and fall diminished gradually, but not regularly. At 11, P. M. the Thermometer stood at 74, Barometer 30.04; wind freshening and frequent showers; the ebb now occupied twenty minutes, and the flow ten. At 11.30 it became calm with constant rain. Thermometer 73.5; Barometer 30.03. The ebb and flow still continued, occupying the same space of time, but the rise and fall decreasing. This continued during the forenoon of the 8th. The rapidity with which the water fell, varied in different parts of the harbor. On the east side, the greatest rapidity noticed was six inches in a minute; but on the north, at one time during the third recession it fell twelve inches in thirty seconds. At no time did the water rise higher than a common spring tide; but the fall was about six feet below low water mark. The same occurrence is related to have taken place in 1819, when the tide rose and fell thirteen times in the space of a few hours. On neither occasion was there any perceptible motion or trembling of the earth, or unusual appearance of the atmosphere.

On the leeward side of Maui the same rise and fall took place as at Honolulu, but on the windward part of the island the sea retired about twenty fathoms and quickly returned in one gigantic wave sweeping every thing before it, houses, trees, canoes, and every moveable object exposed to its fury. At a small village, called Kahului, in the district of Wailuku, on the sea retiring, the amazed inhabitants followed it as it receded, eagerly catching the stranded fish, shouting and hallooing with pleasure, when suddenly the sea rose perpendicularly before them like a precipice, and rushing to the beach, buried the assembled multitudes in the flood, and overflowing the shore, swept away every house in the village but one; the canoes and property of the natives were all destroyed. Happily, owing to the amphibious education of the people, but two lives were lost here, but as the same occurrence happened all along the seaside we shall probably hear of more deaths.

At Byron's Bay, on Hawaii, the same phenomenon took place. An unusual number of persons were collected together attending a protracted meeting, consequently every house was crowded. At half-past 6 the sea retired at the rate of four or five knots an hour, reducing the soundings from five to three and a half fathoms at the anchorage, and leaving a great extent of the harbor dry. Hundreds of curious souls rushed down to witness the novelty, when a gigantic wave came roaring to the shore at the rate of six or eight knots an hour, rising twenty feet above high water mark, and fell on the beach with a noise resembling a heavy peal of thunder, burying the people in the flood, destroying houses, canoes, and fish-ponds, washing away the food and clothing of the inhabitants, large quantities of animals, fire wood, and timber collected on the strand for sale. The cries of distress were horrible; those in the water unable to swim among the wreck of houses, and pieces of timber, struggling for their lives, and those on shore wailing for their friends and relatives. The British whale ship Admiral Cockburn was at anchor in the Bay, and to the timely aid and humane exertions of her master, (Lawrence,) and crew, many are indebted for their lives; but for the assistance rendered by their boats many who were stunned and insensible would have been carried out to sea, and perished, as the natives had not a single canoe left that would float. Every thing was destroyed;

which has been elevated about two hundred feet, lying some thirty leagues from Tahiti, in a N. N. E. direction. This island presents a perpendicular wall on all sides but the north-east, where it slopes rather steeply to the water. The greater portion of this wall has no attached reef, and rises abruptly from the ocean, which at one hundred yards distance is perfectly blue; but there are occasionally crescent-shaped tracts of low land between the sea and base of the cliff, which previous to the elevation of the island may have formed small bays, and from these extends a narrow coral plateau. At the inland termination of these plains, is a large talus composed of massy fragments fallen from the cliff, in all probability ruins of the anciently projecting shelf. Their whole surface is worn by the water into deep inequalities, so sharp and rug-

those who escaped with their lives had neither food nor raiment left. In Kanokapa and Kaahelu alone, sixtysix houses were destroyed, and eleven persons lost their lives; four men, two women, and five children; at Waiolama and Hauna, a woman and child were drowned; at Kauwale one woman lost her life. The amount of damage done has not yet been ascertained, nor is it known how many times the sea rose and fell. There was no shock of an earthquake felt at Hilo, or elsewhere, although it is ascertained that the volcano of Kilauea was unusually disturbed the previous evening, the fires were suddenly quenched, and yawning chasms burst open in previously tranquil places, accompanied with violent explosions. Inquiries have been made of masters of vessels who were to the north and to the east of the islands on the 7th, at various distances, but none of them noticed any thing unusual in the sea, or atmosphere. That this apparent submarine volcanic action has taken place at some distance from the islands is proved by the wave striking the different islands simultaneously and apparently in the same direction; but at what distance we have no means at present of determining. Perhaps the internal fires have found a new vent, which may be laying the foundation of a new group of islands in our neighborhood. It is now nineteen and a half years since a similar phenomenon occurred here, but not so violently as the last, nor was it attended with any loss of life."

Cases of the sea during earthquakes retiring for a short time to return with overwhelming force, are but too familiar matter of history. Such are the wave which utterly destroyed old Callao in 1746; that witnessed during the great earthquake of Lisbon, and more recently, in those which have been attended with such fearful consequences along the coast of Chili; but I am not aware that there is on record any parallel to such a series of alternating ebb and flow of the sea, unaccompanied by any perceptible commotion of the earth, as is here described by Dr. Rooke. That it was nevertheless occasioned by the throes of pent up subterranean fires at some remote point, there can I think be little question.

ged as to render walking, or to speak correctly, clambering over them a difficult and fatiguing task. At the foot of the cliff, back of the lowland, are frequent caverns, from whose roofs depend numerous stalactites from the size of a pipe-stem to that of a man's body, the little drops of water at their extremity sparkling like so many diamonds wherever the light from a crevice falls upon them. The floors are also covered with stalagmitic incrustations in every degree of hardness, and assuming a great variety of forms. Those into which I entered, descended for a few feet at an angle of about 30°, like an arched vault, and then expanded into an irregular circular grotto, with a level floor, whose ceiling was from four to fifteen feet in height. Some of these caves are capable of holding at least three hundred persons.

From one of the plains on the north side, where there is a village with some two hundred and fifty inhabitants, a steep ascent leads to the summit, which presents a broad table land, declining a few feet toward the centre, where we may suppose the lagoon to have been situated. Near the eastern extremity, a few yards from the bank, are two knolls gently rising to a height of perhaps forty feet, which I presume to be remains of the ancient fragmentary ridge, formed when this table land was the surface reef, the main portion having been undermined and worn away by the action of the surf on the south-east or windward side during the period of elevation. To this cause, I imagine, is also to be assigned the sloping form of the island in that direction, while the sheltered leeward side has preserved its original sheer descent. The dense growth of forest, and tangled luxuriance of under growth, prevented any minute observation during my hurried visit, but I recollect that the whole surface of the table land, and the ascent of the cliff for eighty or a hundred feet below it, was covered with fragments of coral conglomerate, the species imbedded in which were the same with those found on the reef below. Indeed, the entire mass of the island is a reef-rock in various stages of consolidation, the lower portion approximating to a solid limestone, the cellular coralline structure being in some fragments hardly perceptible, and the imbedded shells frequently losing their texture, becoming blent with the rock, and presenting merely casts.*

The island appears to have been elevated at two successive periods, between which it remained stationary for a considerable time; as rather more than half way up the cliff is a horizontal belt of deep excavations, exactly resembling those now worn at its base by the sea. This belt is not absolutely continuous, being interrupted at intervals by spaces where the action of the water is not discernible. Such, however, should a third elevation occur, would be the condition of the present base of the cliff, at which the line of excavation is apparent only in those portions exposed to the action of the surf. Viewed from a distance, the belt appears distinctly to divide the cliff into two nearly equal portions, and in several places where this latter forms an angle, large perforations are visible, which must have resulted from the wearing away of the rock by the surf.

Thus have I, hastily and at random, as promised in the outset, thrown together some of my reminiscences of these interesting regions. At a future day I may be enabled (abandoning the indefinite specifications whose occurrence I am well aware is too frequent in these remarks, but which under the circumstances are unavoidable,) systematically to arrange my observations, and give the details with the minuteness and precision demanded by the importance of the subject.

Since the remarks upon the influence of tides upon reef channels, in a preceding portion of this communication, have been in press, it has occurred to me that in connection with that topic it will be proper to specify several erroneous assertions relative to the tides generally throughout Polynesia; which derive importance from the name of their authors justly possessing much weight, not less with scientific readers than the public generally.

* Specimens of shells in this state are also found occasionally in the tabular masses of reef-rock, on the shores of some lagoon islands. These fragments, like the rock at Matea, indicate by their structure that the main body of the reefs is not a homogeneous coral rock, but a conglomerate of large pieces of coral and shells, filled in and cemented together by a detritus of similar materials.

Capt. Beechey, in the "Voyage of the Blossom," part I. Chap. IX. Lond. Ed., speaking of tides in the harbors of Tahiti, remarks, "At Toanoa, it is usually low water about six every morning, and high water half an hour after noon," and attributes this peculiarity to the sea breeze by day, forcing the water into the harbor, which is a lagoon between the reef and shore; adding, "as the wind abates, the water subsides, and the nights being generally calm, the water finds its lowest level by morning."

Now the first of these propositions, though strictly true, is only a partial statement, conveying, and (as is evident from the context) designed to convey, the idea that the flood tide lasts only about six hours, while the ebb continues for eighteen, from noon of one day till six the next morning. The second quotation contains a positive mis-statement. In the first place, at Toanoa, as in all the harbors of Tahiti and the other Society Islands, it is full sea regularly twice in twentyfour hours, and always about noon and midnight; and low water about six o'clock, morning and evening. The mornings are calm for perhaps eleven months in the year, the trade wind or sea breeze commonly setting in about eleven o'clock, and prevailing in its greatest strength from noon till four or five P. M. It then dies away, and by eight or nine P. M. there is a dead calm which continues till the next forenoon.

Thus instead of the tide being forced into the harbor by the sea breeze, we find that a great part of the day and all the night flood takes place during a calm, whereas during the afternoon, the water ebbs rapidly against the full power of the breeze. Even if Capt. B. were correct, in regard to the duration of the ebb and flood, his explanation would not reach the case of those harbors on the leeward side of the islands, where the trades are not felt, and yet the tides follow the same course as those on the opposite side.

In Kotzebue's account of his voyage round the world, he also has given currency to very inaccurate statements on this subject. In his remarks on Tahiti, we find the following passage. "Every noon, the whole year round, the moment the sun touches the meridian, the water is highest, and falls with the sinking sun, till midnight."

It would be a difficult matter, to crowd in as few words a greater number of errors than are here contained. They convey a false impression that the tides are governed entirely by the sun; represent them as diurnal instead of semi-diurnal, and name as the hour for the daily recurrence of low water, that when it is actually full sea. Neither is it always high water, as he asserts, "the moment the sun touches the meridian," though this, compared with the rest, is but a trivial misrepresentation.

Capt. Beechy also remarks in the work cited, that "the tides in all harbors formed by coral reefs, are very uncertain, and are almost wholly dependent on the sea breezes." So far however is this from being the case, that throughout the Harvey, Samoan, and Tonga Groups,* for days together at certain seasons, there is no sea breeze whatever; the tides obey the moon with a regularity as undeviating as in any other part of the world, although the majority of the numerous harbors in the two latter are formed by coral reefs. As great regularity prevails also in the recurrence of the abnormal tides of the Society Islands, except when interrupted by occasional heavy gales, and these for the most part blow either across or opposite to the direction of the trade winds.

In a paper professing to be an "Extract from Lieut. Malden's Official Account of the Sandwich Islands," published in the Appendix of Lord Byron's voyage in H. M. Ship Blonde, p. 256, Lond. Ed., 1826, are these remarks in reference to the tides at Hawaii, "The tide was observed to rise about four feet, and to be high water at sunset, and low water at daylight, being influenced by the sea and land breezes. This regularity would probably not take place in the winter months, when they do not prevail."

This is also incorrect in every particular, save the height of the tides. They do not statedly occur at the times here given, neither are they affected to any extent by the prevalence or absence of the breezes, and I am at a loss to imagine upon what grounds Lieut. M. predicated such a statement as

* I include the Tonga or Friendly Islands on the authority of Rev. Mr. Williams, who had spent some time among them.

the above. Had he lacked opportunity during his stay at Honolulu of observing for himself, there were certainly foreign residents enough there, missionaries and others, who could have furnished him with more correct information on this subject, had he sought to obtain it. The truth is, that unless retarded or accelerated by occasional storms, the flood and ebb at these islands, from one year's end to another, summer and winter, in breeze and calm, follow the course of the moon as regularly as do the tides in Boston Harbor. The rise and fall of the tide, varies in different harbors, from four to five and a half feet. Having resided for six months in the Hawaiian Group, traversed the four principal islands in various directions, and beside making careful inquiry of the residents, examined no less than twelve harbors, including nearly all of any consequence, some of them open roadsteads, others formed by small bays, and a large proportion by coral reefs; I can speak with some confidence on this point.

All my visits to islands in coral archipelagos having been very brief, I am unable to state what is the course of the tides among them, but incline to believe that at the detached Paumotus, they obey the usual laws. On landing a second time at Bellinghausen's Island, which is about two hundred and seventy miles west of Tahiti, I found the reef quite bare, at the same hour that it was overflowed on my first visit, some months previous. At the full and change of the moon, the rise at Ocean Island is about twentytwo inches, while at Christmas Island it is five feet, but the tides on both are normal, by the accounts of those who have been wrecked and resided on them for several months.

I hasten to terminate these discursive remarks, (already extended far beyond what was contemplated at the commencement,) by offering a few suggestions relative to a subject which it appears to me has by no means received, hitherto, an attention commensurate with its importance. I allude to the temperature of the ocean, in its influence upon the growth and geographical distribution of corals.

It is a remarkable fact, and one for which I am not aware that any explanation has been offered, that while in the Pacific and Indian Oceans, coral abounds every where between the tropics for a space of about six thousand leagues from east to west, it does not exist on the west coast of South America (at least south of the eighth parallel of latitude,) nor do we meet with any coral islands within the whole space of nearly eight hundred leagues to the westward of it.

Even at the Galapagos, situated directly upon the Equator, there are no traces of a coral reef. This absence of coral formations in portions of the same parallel in which their most profuse display is presented, has by some been referred to one of those inexplicable, apparent caprices of nature, beyond man's ability to fathom, analogous to the well-known fact, that certain classes of plants which flourish luxuriantly in the other hemisphere, will not thrive at all in situations and climates seemingly in every respect adapted to their growth, in our own. It is my impression, that in the Atlantic the same absence of coral characterizes a large portion of the South American coast, and the outlying intertropical islands, such as Trinidad, Martin Vas, and Fernando Noronha; while it abounds in the same parallels north of the line, among the Antilles, and even in the latitude of 32° we find a very considerable group of coral reefs, and islands of coral limestone. At the Cape Verde Islands, and I think the Canaries also, we have again an entire absence of such formations, although the former are 17 degrees nearer the Equator than Bermuda.

On the east coast of South America, this may perhaps be attributed partly to the immense bodies of fresh water poured into the Atlantic from those great streams, which rolling in turbid floods through a course thousands of miles in length, empty themselves at various points from near the Equator to the latitude of 35°. It is well known to what an astonishing distance their waters are carried along the coast, unmingled with those of the ocean, and loaded with a fine, impalpable mud. This must unquestionably be highly deleterious to the coral polypes, if not sufficient to utterly prevent their growth, as they require the purest ocean water for their successful developement.

But I am persuaded, after a careful examination of the facts, that the absence of coral on the other side of the continent, and in the wide space between it and the low islands of Polynesia, is to be attributed to the prevalence of cold currents, which proceeding northward from the Polar regions are perceptible the whole distance from Cape Horn to Callao, and I presume much further to the north, in a temperature of the ocean too low for the existence of the coral animals, and that in a similar low temperature we are to seek for the cause of their absence at the Cape Verde Islands. I have already alluded to the greater heat on the southern part of our coast and the Bahamas, produced by the vicinity of the Gulf Stream.

A like temperature prevails along the southern shore of Cuba, and the islands in its vicinity, and though unable to speak positively, from having no data, as to the Bermudas, I have no doubt from their proximity to the Gulf Stream, that they are washed by an equally warm sea. Now let us glance for a moment at the facts bearing on this question, in regions situated in corresponding parallels of latitude, where no coral formations exist. At Valparaiso, in lat. of 33° south, and thence as far as the 20th parallel, in the month of November, the surface temperature of the ocean near the coast has been found to range from 58° to 60°; at Callao, in the lat. of 12°, from 58° to 62°, and thence in a north-westerly direction to the Galapagos, to increase gradually to 68° and 70°. Among these islands, at the same season, its average was not above 68°, and at some of them it did not exceed 62°. But leaving these islands and proceeding south-west, we find it steadily rising, till on the skirts of the Dangerous Archipelago it is up to 78° and 79°, nearly 20° higher than on the coast in the same parallel. And here we enter upon the coral formations. Among the Paumotus, the field of their most lavish display, the temperature varies from 77° to 83°; at Tahiti from 77° to 80°, and about the same at the large groups to the west of it. At the Hawaiian Islands, lying between 19° and 22° north latitude, it is as high sometimes as 81°.

In our own hemisphere, among the Antilles, Bahamas, and along the southern coast of Florida, I have found the temperature of the water near the shore, at different seasons, from 78° to 82°, and in all these regions coral reefs abound.

At the Cape Verde Islands, and in the neighborhood of Trinidad, Martin Vas, and Fernando Noronha, it falls to 69° and 71° ; and these islands, as was before remarked, are entirely destitute of coral formations. It is not unlikely that there are cold currents from the Antarctic along the East as well as the West coast of South America, which combine with the fresh water of its large rivers in preventing such formations upon a certain portion of it, but this I have at present no means of determining, being without any data as to the temperature north of 35° on that side. It appears to me, that such coincidences as the facts here submitted prove to exist, between certain temperatures of the ocean and the absence or presence of coral reefs, can scarcely be considered by any reflecting mind, as merely casual ; and that there are strong grounds for believing that we have here a clue to the real cause of the singular absence of recent coral formations in certain regions corresponding in every thing save temperature to those where they are most profusely scattered. In order to enable us, however, satisfactorily to determine how far their geographical distribution is affected by such causes, it is essential that we should be furnished with a connected series of observations on the oceanic temperatures at the surface and to certain depths, along both sides of the African continent, the coasts of Australia, and among the coral archipelagos of the Indian seas ; together with that of the seas beyond the limits of such formations, in both hemispheres. Such observations might easily be made on board our national vessels, by direction of the Navy Department, and published in the form of tabular reports at the expiration of their cruise. The Department would, I presume, scarcely refuse to issue the requisite instructions, upon suitable representation. There are also many intelligent commanders in our merchant service, who only require that their attention should be directed to this matter, in order, as I am confident, to ensure their cordial coöperation. By the mass of information which would thus be brought together we might also expect that much light would be thrown on questions relative to oceanic and (as connected with these,) atmospheric phenomena, our knowledge of which is yet in its infancy. Other advantages to the cause of science, which we cannot now anticipate, would doubtless result from such a course, as it frequently occurs that in the collection of facts bearing on a particular subject, something is elicited leading to important conclusions in regard to others having at first sight no connection with it.

While convinced in my own mind of the truth of the suggestions here offered, in regard to the absence of coral formations in certain regions, I feel conscious also that the data upon which they rest, though certainly presenting a strong case as far as they extend, are after all but limited in comparison with those still deficient. I submit them for what they are worth. What this may be, time and more extensive observation must determine. Claiming only to have at least sought a more rational method of accounting for the peculiarities here pointed out, than that of supposing them altogether fortuitous, I shall rejoice if the end show that I have contributed in the slightest degree, or in a single point of view, to the advancement of the great object to which we are all, according to our opportunities, devoted.

In the operations of Nature, or rather of Deity, there is nothing the result of blind chance, and though there may be particular phenomena, which in our present ignorance of the laws controlling them, we are unable to explain; it is not the less certain that these laws really exist, and that patient research will yet be rewarded by their discovery. The day will come, and we may hope is even now dawning upon us, when error and misconception shall vanish before the advance of science, as the morning mist from the strength of the noontide sun; when with the clouds dispersed which yet partially obscure even the brightest intellect, the veil shall be lifted from Nature's most secret mysteries, and those things which we now behold but as "through a glass, darkly," be all revealed in the clear effulgence of immutable Truth.

ERRATA. Page 78, line next to the bottom, for "Silurian," read Cambrian.
Page 79, 10th line from top, for "regions," read rigors.
Page 147, 9th line from bottom, for "base elevated table land," read base of the elevated table land.

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Art. XIII.—DESCRIPTIONS OF SOME OF THE SPECIES OF NAKED, AIR-BREATHING MOLLUSCA, INHABITING THE UNITED STATES. By Amos Binney. (Read Dec. 1841.)

Very little attention has hitherto been given in the United States, to the animals belonging to the family of Limacidæ, or Slugs. The only paper on the subject which I have met with, is one published at Philadelphia by the late M. Rafinesque, in the Annals of Nature for 1820, a periodical work projected by him, but which never extended beyond the specimen number. In this paper M. Rafinesque, with his usual dexterity in proposing new genera and species, gives the characters of two genera and six species, from animals noticed by him in various parts of the country, but not since recognised by other naturalists. One of his genera, however, which, under the name of Philomycus, he intended should embrace those species which are entirely *destitute* of a mantle, and which cannot be included in the genus Limax, as hitherto defined, and may with propriety and convenience be retained, has been adopted by M. Ferussac. It will be necessary, for the same reason, to establish another genus for the reception of those species in which the mantle covers the *whole* superior surface of the body, but which are excluded from all the accepted genera. I propose to designate this genus by the name of Tebennophorus, signifying *wearing a cloak.*

Its characters would be as follows:

Genus Tebennophorus.

Mantle covering the whole superior surface of the body; pulmonary cavity anterior, orifice on the right side towards the head; orifice of the rectum contiguous to, and a little above and in advance of the pulmonary orifice; organs of generation united, orifice behind and below the superior tentacle of the right side: without testaceous rudiment, terminal mucus pore, or locomotive band of the foot.

Dr. Dekay, in his Catalogue of Animals of New York, has indicated *by name*, two new species of Limax, the L. *lineatus* and L. *marmoratus*. As no description or figure of these has yet appeared, it is impossible to determine whether they are identical with any of the species described in this paper, or not.

Genus Limax, Auctorum.

LIMAX FLAVUS.

L. corpore lutescente, maculis albidis insignito; dorso glandulis elevatis angustis instructo; clypeo ovali, lineis concentricis et maculis orbiculatis ornato; tentaculis cæruleis; carina brevi.

SYNONYMES AND REFERENCES.

Limax flavus, LINNÆUS. *Fauna Suecica, 2d edit. No.* 2092.
Systema Naturæ, 12th edit. p. 1081, *No.* 7.
PENNANT. *British Zoology*, IV. 41, *No.* 20.
GRAY. *British Land and F. Water Shells*, 114.
Limax variegatus, DRAPARNAUD. *Hist. des Moll.* 127, *No.* 9.
DE ROISSY. *Buffon de Sonn. Moll.* V. 182.
FERUSSAC. *Hist. des Moll.* 71, *pl.* 5, *f.* 1 *to* 6.
Tab. Syst. 21, *No.* 3.
Supplement, 96, 2, *No.* 3.
LAMARCK. *Anim. sans Vert. 2d edit.* VII. 722.

DESCRIPTION.

Color brownish, yellowish brown, or ashy brown with oblong-oval uncolored spots which have a longitudinal disposition; mantle with rounded spots; head, neck, and superior tentacles blue, semitransparent; lower tentacles white; base of foot sallow white. Body when extended cylindrical, elongated, terminating acutely with a short but prominent keel; upper part covered with long and narrow prominent tubercles. Mantle ample, oval, rounded at both ends, with numerous very fine concentrical striæ. Sides paler, and without spots. Respiratory foramen large, placed near the posterior lateral margin of the mantle and cleft to the edge. Generative orifice indicated by a white spot a little behind the upper tentacle of the right side.

Length, when fully extended, nearly three inches.

Geographical Distribution. Noticed hitherto only in the city of Philadelphia.

Remarks. The contrast of colors, and the elegant arrangement of the spots and lines, render this a beautiful species. The tubercles of the surface are very fine, and so much compressed as to appear in some lights to be carinated. There is often a well defined row of spots down the back. The upper tentacles are long and delicate, the mantle sometimes terminates posteriorly in an obtuse point, and the locomotive band of the foot is narrow and well defined. There is a prominent ridge on the head and neck between the tentacles, and a furrow marks the edges of the foot. It is active in its motions, turns rapidly, and often bends the body so as to form two parallel lines. It does not secrete mucus so freely as *Limax agrestis*. The carina is often yellowish. The testaceous rudiment is oblong-oval, convex above and concave below, thin and membranaceous, with the superior surface smooth, and the lower uneven. No spiral arrangement is visible to the eye, and it appears to be only a thin testaceous plate imbedded in the mantle.

It inhabits cellars and gardens in moist situations in the city of Philadelphia, where it is considered noxious to vegetation. It feeds upon the leaves of plants in kitchen gardens, and upon the remains of the cooked vegetables, and bread, thrown out from houses. It is common, but not so numerous as *Limax agrestis.* I have never seen it suspend itself by a mucous thread.

This species is of foreign origin, but the period of its introduction is not known. It may probably exist in other cities as well as in Philadelphia, or even in the country not far distant from the sea-coast. It was noticed by Mr. Say, more than twenty years since.

LIMAX AGRESTIS.

L. corpore albo, griseo, cinereo, rufescente aut nigrescente, unicolore aut maculato, sub-cylindraceo, glandulis elongatis et sulcis fuscis reticulatis instructo; clypeo anteriore, ovali, gibboso, lineis concentricis striato; carinâ brevi; aperturâ laterali postica.

SYNONYMES AND REFERENCES.

Limax agrestis, LINNÆUS. *Syst. Nat. 12th edit. p.* 1082.
MULLER. *2d part, No.* 204, *p.* 8.
DRAPARNAUD. *Hist. des. Moll. p.* 126, *pl.* 9, *fig.* 9.
FERUSSAC. *Tableau Syst. p.* 21.
Hist. des Moll. p. 73, *pl.* 5, *fig.* 7—10.
Supplement, p. 96.
LAMARCK. *Anim. sans Vert. 2d. edit.* 7. *p.* 717.
Limax tunicata, GOULD. *Invertebrata of Mass. p.* 3.

DESCRIPTION.

Color varying from whitish through every shade of cinereous and gray to black, and through various shades of yellowish, or amber-color, to brownish, and sometimes irregularly spotted with small black points or dots; tentacles darker than the general surface, sometimes black; mantle sometimes mottled with a lighter color; base of foot sallow white; sheath of tentacles indicated by black lines extending backwards from their base under the edge of the mantle. Body when in motion cylindrical, elongated, terminating acutely, the sides towards its posterior extremity compressed upwards, so as to form a short carina or keel; foot very narrow. Mantle oblong-oval, fleshy, convex and prominent, rounded at both extremities, equalling in length one-third of the length of the body, its surface marked by prominent, irregularly waved, concentrical lines and furrows, having their centre or the posterior part, and its edges on the whole circumference unattached. Upper surface of body marked with longitudinal lines, or shallow furrows, darker than the general surface, sometimes black, anastomosing with each other, and forming a sort of net-work; between the reticulated lines are narrow, irregular oblong plates, or smooth, flattened tubercles, giving the surface the appearance of a mosaic work, with lines of dark cement; reticulations less distinct on the sides, and disappearing towards the base; a prominent tubercular ridge extends from between the superior tentacles backward to the mantle, with a furrow on each side. Superior tentacle cylindrical, about one-eighth of the length of the body, with small, black, ocular points on the superior part of the terminal bulb; inferior tentacles immediately under the upper, very short. Respiratory foramen near the posterior lateral edge of the mantle, large, surrounded with a whitish border. Orifice of rectum immediately adjacent, but a little above and anterior to the respiratory foramen. Foot narrow; locomotive band bounded by two distinct longitudinal furrows. Generally about one inch in length, but when fully grown nearly two inches.

Geographical Distribution. Inhabits the neighborhood of Boston, New York, Philadelphia, and other maritime cities. Has not yet penetrated far into the interior of the country.

Remarks. In Dr. Gould's description of *Limax tunicata*, he intimates a suspicion that it may prove identical with *Limax agrestis*, Lin., and further observation has fully confirmed that supposition. It is undoubtedly of European origin, and I have not noticed it at any considerable distance from the sea-coast. It is common in the neighborhood of Boston, under stones at road-sides, and about stables and farm-yards, and in other moist situations, under wet and decaying pieces of wood. It is also found in cellars and gardens, but not in such numbers as to cause much mischief by its depredations. In the city of Philadelphia it is more common, attains a large size, and is more destructive to vegetation. A considerable number of individuals often congregate in the same retreat. Their food appears to be the green leaves of succulent plants, and sometimes ripe fruits; they feed during the night, and are rarely found out of their retreats in the day time. Their growth is rapid, the animal exuded from the egg in the spring, arriving at full maturity and producing eggs before the succeeding winter. They are active in their motions, and soon escape when disturbed. They defend themselves from injurious contact by instantly secreting at the part touched a quantity of milky-white, glutinous mucus, and suspend themselves, head downwards, and lower themselves from plants and fences by forming a mucous thread which they attach to the point from which they hang. They are occasionally seen in this situation in rainy weather. During the process of exuding the mucous thread, the alternate undulating expansions and contractions of the locomotive band of the foot are seen to take place, in the same manner as when they are in motion on a plane surface.

This species varies very much in color, and descriptions by different authors relying principally upon it, differ greatly from each other; but whatever may be the color, the peculiar character of the furrows and tubercles remains constant. In a state of contraction, the back is arched, the head is entirely withdrawn under the mantle, the glands of the skin are very prominent, making the surface appear rough, the carina is more apparent, and the posterior extremity being a little turned to one side, appears to be oblique. It is described by some authors as constantly oblique, but the obliquity disappears when the animal is fully extended. When in motion, the head extends considerably beyond the mantle, and there is an interval between its margin, and the base of the superior tentacle, equal to the length of the tentacles. The mantle adheres to the body by its posterior central portion, and it is in this part of it that is found imbedded the testaceous rudiment, or shell. This is oval, curved above, very thin and delicate, having a transparent epidermis. At its posterior part there is a slight apicial prominence and the appearance of indistinct concentric lines of growth.

In the Philadelphia variety, the tubercles and furrows are less strongly marked than in that found in the neighborhood of Boston.

LIMAX CAMPESTRIS.

L. corpore succineo colore, cylindraceo, glandulis elevatis elongatis sub-rugoso; clypeo sub-antico, ovali-oblongo, lineis et sulcis concentricis striato; caudâ sub-carinata; aperturà laterali posticâ.

SYNONYMES AND REFERENCES.

Limax campestris, NOBIS.

DESCRIPTION.

Colour usually of various shades of amber, without spots or markings, sometimes blackish; head and tentacles smoky. Body cylindrical, elongated, terminating in a very short carina at its posterior extremity. Mantle oval, fleshy, but little prominent, with fine concentrical lines. Back covered with prominent elongated tubercles and furrows. Foot narrow, whitish. Respiratory foramen on the posterior dextral margin of the mantle. Body covered with a thin, watery mucus.

Length, about one inch.

GEOGRAPHICAL DISTRIBUTION. Inhabits all the New England States, New York and Ohio, and was found in Missouri by Prof. Adams.

REMARKS. The resemblances between some of the species of this genus are so great that it is difficult to provide them with distinctive characters, and it is only by close comparison that their differences can be seen. The present species, although considerably smaller, is nearly allied to *Limax agrestis.* Its differential characters are as follows: It is always much smaller, and at all ages possesses a peculiarly gelatinous or semitransparent consistency. The tuberosities of the surface are more prominent in proportion to their size, are not flattened or plate-like, and are not separated by darker colored anastomosing lines, the intervening furrows being of the same color as the general surface. It does not secrete a milky mucus at every part of the surface when touched. Like that species, it is active in its motions, and suspends itself by a mucous thread.

This species appears to be common to all the northern parts of the United States. It is found under decaying wood in the forests and in open pastures, and under stones at road-sides. From its wide distribution, it would seem to be indigenous.

Its testaceous rudiment is minute and delicate in proportion to the small size of the animal.

Genus Arion, Ferussac.

ARION HORTENSIS.

L. corpore albido, aut griseo, glandulis confertis, elongatis striato; clypeo anteriore, ovali, granuloso; cauda obtusa, carina nulla; aperturâ laterali posticâ; margine fasciâ fusca obscurè ornatâ.

SYNONYMES AND REFERENCES.

Arion hortensis, FERUSSAC. *Tab. Syst. p.* 18.
Hist. des Moll. p. 65, *pl.* 2, *f.* 6.
Supplement, p. 96, *a.*
BOUCHARD-CHANTEREAUX. *Catalogue, p.* 24.
Limax hortensis, LAMARCK. *Anim. sans Vert.* VI. *p.* 919.

DESCRIPTION.

Color of upper surface whitish or light ashy, sometimes with a slight tinge of brown; an obscure, ill-defined brownish line extending along the lower margin of the mantle, and of the body on both sides, meeting over the posterior extremity. Body when extended cylindrical, narrow, very much elongated, expanding a little towards its posterior extremity, terminating in a truncated point; the upper surface crowded with fine, oblong tuberosities, its flanks with elongated tuberculated plates, with furrows between. Mantle small, oval, rather narrow, flattened, its anterior margin nearly reaching the head; its surface covered with minute granulations; about one-fourth of the length of the body. Between the superior tentacles a tubercular ridge with furrows on each side. Superior tentacles darker than the general surface; about one-eighth of the length of the body, stout, cylindrical, with black oculiferous points; lower tentacles beneath the upper, very short. Foot whitish, separated from the margin of the body by a furrow, and projecting beyond the body posteriorly, with a flat and rounded termination; locomotive band not distinguished from the foot. At the posterior termination of the body is the triangular sinus, or mucus pore. Respiratory foramen very small, situated near the margin of the mantle, about one-third of its length distant from its anterior extremity. Length rather more than one inch.

GEOGRAPHICAL DISTRIBUTION. Noticed hitherto only in the neighborhood of Boston.

REMARKS. In this species the head alone projects from the mantle, no part of the neck being visible. It is constantly covered with a watery mucus, and suspends itself by a mucous thread, like many other species of this family. I have not noticed any varieties of colors or markings. It occurs only in small numbers, in company with *Limax agrestis*, under stones at road-sides. I give this species with some hesitation, for the foreign descriptions and figures generally do not apply to it, and unless two species are confounded together, the differences of color and markings in the varieties are truly extraordinary. Ferussac's description of the variety, "griseus, unicolor, fasciis nigris," is however so very applicable to ours, and the figure referred to represents it so well, that I cannot doubt that our animal is identical with that variety. From its restricted locality, and small numbers, it is probably an introduced species. It may, however, prove to be a distinct species, and comparison of the foreign and native animals can alone decide its character.

Genus, TEBENNOPHORUS.

TEBENNOPHORUS CAROLINIENSIS.

L. corpore albido, fusco irrorato, fasciis tribus male-circumscriptis longitudinalibus, et punctis nigris sparsis, ornato; clypeo lato et elongato, dorsum integrum vestiente, glandulis undulatis confusis conferto; apertura laterali antica.

SYNONYMES AND REFERENCES.

Limax Caroliniensis, BOSC. *Buffon de Deterville, Coq.* I. *p.* 80, *pl.* 3, *fig.* 1.
FERUSSAC. *Hist. des Moll. p.* 77, *pl.* 6, *f.* 3.
LAMARCK. *Anim. sans Vert. 2d edit.* VI. 719.
Limax Carolinianus, DE ROISSY. *Buffon de Sonnini Moll.*, V. 183.
Philomycus Caroliniensis, FERUSSAC. *Tab. Syst. p.* 15.
Supplement, *p.* 96, *y.*
Limax togata, GOULD. *Invertebrata of Massachusetts*, *p.* 3.

DESCRIPTION.

Color of upper surface whitish, or yellowish white, variegated with clouds and spots of brownish and blackish, so arranged as to form three ill-defined longitudinal bands, one on the centre of the back, and one on each flank, extending from the head to the posterior extremity, anastomosing more or less with each other, and having smaller spots of the same color between them; inferior margin white, or yellowish; foot whitish. Mouth surrounded with a circular row of papillæ. Body elongated, sub-cylindrical, flattened towards its posterior extremity, which is obtuse; superior tentacles one fourth of an inch long, brownish or blackish, stout, terminating in a bulb; ocular points on the superior part of the bulb; inferior tentacles immediately below the upper, white, very short, nearly conical. Mantle fleshy, covering the whole body, its anterior edge tinged with brownish, and falling in a slight curve between the two superior tentacles, reaching on the sides to the superior margin of the foot; posterior extremity rounded; cuticle covered with irregular vermiform glands, anastomosing with each other, and having a general tendency to a longitudinal direction, with shallow furrows between, lubricated with a watery mucus, and susceptible of contractions which produce a slow, undulatory motion, like the flowing of water, over the whole surface. Foot whitish, extending a little beyond the mantle posteriorly, showing a whitish flattened border. Orifice of the organs of generation on the right side at a little distance behind and below the superior tentacle. Respiratory orifice large, on the right side, one fourth of an inch behind the origin of the superior tentacle; anal orifice in close contact, a little above and in front of it; above the respiratory orifice on the back is a deep curved furrow, running upwards and backwards. Locomotive band not distinguished from the lower surface of the foot.

Greatest length, when fully extended, four inches.

Geographical Distribution. Was noticed by the original discoverer in South Carolina; is common in Vermont, the western part of Massachusetts, New York, and Ohio: and was found in Missouri by Professor C. B. Adams, and by Mr. Haldeman in the south-western angle of Virginia.

Remarks. In some individuals the whole upper surface is irregularly clouded with brownish, without any tendency to longitudinal arrangement; in some, fine black spots are numerous; in others, there are rows of large clouded spots; a single one was almost destitute of coloring. The head never projects beyond the mantle. The tentacles are contractile and retractile, as in the other species. When handled it secretes from the skin a thick, milky, adhesive mucus, but I have never seen it suspend itself by a mucous thread. I have noticed its posterior extremity curved upwards when the animal was in motion; at other times flattened and expanded, and again very much corrugated, and apparently truncated; sometimes there *appear* to be one or more mucous glands at this part, and the secretion of mucus from it is more plentiful than from other parts of the body. The mantle is not cleft from the respiratory foramen to the margin, as in some of the species, but is provided with a deep furrow or canal running from the orifice to the edge of the mantle below it.

It is very inactive and sluggish in its motions. It inhabits forests, under the bark, and in the interior of decayed trunks of fallen trees, among which it is particularly partial to the Bass-wood, *Tilia Americana*.

There can be no doubt that this is the animal originally described by Bosc, under the name of *Limax Caroliniensis*, though his description is so imperfect that it can only be recognized by the arrangement of colors which are peculiar to it. His original drawing, engraved in Ferussac's work, is a tolerably accurate representation of one of the varieties. He makes no mention of the mantle, and it does not appear in the figure; hence Ferussac took it for granted that it is destitute of it, and placed the animal in Rafinesque's genus Philomycus, which is chiefly distinguished from Limax by the absence of this organ. Yet with a singular inconsistency, having adopted this genus with all Rafinesque's characters, he arranges it under that division of the family containing the species entirely covered by a mantle. And as the other genera included in the same division, were supposed to possess only *contractile* tentacles, by a convenient method of generalization he inferred that in the present species also the tentacles were destitute of the power of *retraction.* The editors of the new edition of Lamarck have again more recently described it as destitute of a mantle, but in truth it possesses a well characterized mantle, unattached to the body at its anterior part, and around its whole margin, and as before remarked, the tentacles are retractile. M. Ferussac also speculated upon the uses of this peculiar organization, which he supposed might enable the animal to resist the heats of warm climates; it is, however, probably intended for some other purpose, for it is found to inhabit the most northern portions of the United States, where the winters are long and severe, and by its habits it is in a great degree removed from the influence of heat.

It may be noticed that the description of Dr. Gould differs essentially from mine; this arises from his description having been drawn up from specimens preserved in alcohol, which had contracted them and entirely changed their aspect.

Genus Philomycus, Rafinesque.

PHILOMYCUS DORSALIS.

P. corpore cylindraceo, postice attenuato; dorso linea longitudinali nigrescente interrupta et glandulis minutis longulis instructo; clypeo nullo; apertura laterali parvo anticâ.

SYNONYMES AND REFERENCES.

Philomycus dorsalis, NOBIS.

DESCRIPTION.

Color of upper surface ashy, with a shade of blue, an interrupted black line extending down the centre of the back; superior tentacles black, about one eighth of the length of the body; lower tentacles blackish, very short. Body cylindrical and narrow, terminating posteriorly in an acute point; base of foot white, very narrow, its separation from the body not well defined. Upper surface covered with elongated and slightly prominent glandular projections, the furrows between indistinct. Respiratory orifice very minute, situated on the right side about one eighth of an inch behind the insertion of the superior tentacle.

Length three-fourths of an inch.

Geographical Distribution. Noticed hitherto only in Vermont and Massachusetts.

Remarks. This animal is found in woods and forests, in the soil under decaying trunks and logs. It is lubricated by a watery mucus which is not secreted in quantity sufficient to preserve its life when removed from its native haunts and exposed to the air. It is therefore difficult to preserve it long enough for examination, as it becomes dry, diminishes in bulk more than one-half, and dies. I have seen but three specimens. They were very active in their movements, and one of them suspended itself by a mucous thread, in the manner of the Limaces. My specimens were found in Vermont. Dr. Gould has recognized this or a similar species near Boston.

It is quite possible that this is one of the species described by Rafinesque, but from the poverty of his descriptions I am unable to identify it with either of them.

Art. XIV.—ADDITIONAL DESCRIPTIONS OF, AND OBSERVATIONS ON, THE FISHES OF MASSACHUSETTS. By D. Humphreys Storer, M. D. (Read December 15th, 1841.)

Two years since, I presented to the chairman of the Zoological Commissioners of our State, a report upon the Fishes of Massachusetts — the preparation of which, had occupied much of my leisure during the two preceding seasons. When that report was commenced I had devoted but little attention to the subject, and was induced to undertake it because no other member of the Society had made Ichthyology his study. The duty was urged upon, not sought, by me. Could I have selected my department, the chairman of the Commissioners is well aware I should have chosen that branch of science which had been among my earliest studies — which, from the foundation of this Society, I had zealously pursued — and upon which, I had the honor of lecturing to the Society two succeeding seasons — 1831–32. Nobly has another executed that commission; and I would congratulate my friend upon the credit his labors have conferred upon himself, upon our Society and New England. My task was undertaken, and the result has been presented to you. Although my duties as a Zoological Commissioner may have terminated with the publication of my report, as your Ichthyological Curator, I would now present such additional facts respecting our Fishes, as I have since been able to collect, trusting that they may facilitate the researches of the future Ichthyologists of Massachusetts.

When my Report was published, I knew but one species of Perca in our waters, and I felt quite confident that this was the *flavescens*, Mitchill. Several months afterwards, Mr. C. Harding, of this city, attracted by the unusual number of transverse bands upon a specimen taken by him in Concord river, kindly sent it to me for examination. I at once saw that this must be the *flavescens*, as acknowledged by Cuvier, and subsequently described and figured by Richardson, in the "Fauna Boreali Americana." In this specimen, ten bands were perfectly distinct; and the species was readily made out. Soon after, I received several specimens of this species, from Mr. Edward S. Hoar, of Concord, which were also taken in Concord river. The species noticed in my Report, and our most common species, is the *granulata*, Cuv., called at Holmes' Hole, the *Roach.* The coloring of this latter species differs exceedingly in different latitudes. A specimen taken at Fresh Pond, Cambridge, was nearly of a grass-green throughout its entire surface, excepting the fins.

I remarked in my Report, that besides the *Pomotis vulgàris*, I was inclined to believe, from the information I had collected, that another species of Pomotis inhabited our waters. Mr. E. S. Hoar, of Concord, has sent me three specimens of a second species. It may be what Dr. Mitchill called *Labrus appendix*, in his "Supplement to the Fishes of New York," although he makes no mention of the color of the fins, which is a striking peculiarity in our fish. I introduce the following description as of a species new to our Fauna. Should it not prove to be the P. *appendix*, I would propose the name of *rubri-cauda*, from a very characteristic mark it presents, a blood-red colored tail.

POMOTIS RUBRI-CAUDA. The red-tailed Pomotis.

Length of the fish five inches: the length of the head to the outer angle of the operculum one inch and a half; the depth of the body across the base of the pectoral fins two inches. The general color of the fish is a rusty brown, more strongly marked above the middle of the body, which is caused by ferruginous spots being densely distributed along the scales; these spots are more sparse and more distinct below the lateral line; the body, upon the sides, is golden; and beneath, in front of the anal fin, of a blood-red color. The *head*, between and in front of the eyes, is naked. A blueish white undulating line runs from the upper jaw, just beneath the eye, across the operculum and beneath the opercular membrane, to its posterior extremity; a second line of a similar character arises just above this, and, interrupted by the eye, again commences back of it, and passes over the opercular membrane — so that the membranous appendage of the operculum, which is of a deep uniform black color, three lines in length, and one line deep, is included between these lines. Beneath the undulating lines just spoken of, are blueish-white blotches irregularly distributed upon the preoperculum, some of them passing downwards towards its lower edge. The *eyes* are three lines in diameter — the pupils are black, the irides red. The *lateral line* commences just above, and in front of the base of the opercular membrane, and assumes the arch of the body.

The dorsal fin, anteriorly, is of a dark brown color, its posterior portion is red, the spinous portion is not quite as high as the soft rays. The ventral fins are red at their base, and terminate in black extremities. The pectoral fins are of a yellowish brown color. The anal fin is yellowish at its base, and fuliginous at its margin. The caudal fin is of a blood-red color when the fish is alive.

The fin rays are as follows :—D. 11—9 ; P. 11 ; V. 1—5 ; A. 3—9 ; C. 18.

I described the PRIONOTUS CAROLINUS from the only specimen I had then seen, which was sent me by Dr. Yale from Holmes' Hole. In September, 1840, I received a beautiful specimen, twelve inches long, taken in a net at Green Island, by Capt. Nathaniel Blanchard ; and Mr. Henry Sheafe has lately sent the Society two other specimens, captured at Phillip's Point, Lynn.

But three specimens of a species belonging to a genus which I called CRYPTACANTHODES, (and which I am gratified to know has been adopted by Dr. Dekay, in his Report on the Zoology of New York, now in the course of preparation,) had been met with. Since my Report was published, a specimen has been presented me by Mr. Henry Bryant, of this Society, as having been found on the shore at Commercial Point ; and another specimen, which formerly belonged to the New England Museum, is now in the cabinet of the Boston Museum.

During the last summer, Dr. Leach of this city, sent me a fine specimen of the UMBRINA NEBULOSA, fifteen inches in length, which was taken in a net at Lynn. I had previously seen but one specimen, and although my description was drawn up from that specimen, which had been for years preserved in spirits, the colors were so exceedingly well preserved, (as I had an opportunity to decide by comparing the two,) that any further description is unnecessary. The fresh fish when boiled was very palatable.

The specimen of the PELAMYS SARDA, which I described, was received from Holmes' Hole, where, Dr. Yale informed me, it had been not unfrequently met with of late. In June, 1840, I received a specimen from Dr. William Prescott, of Lynn, who wrote me "it was taken, with another specimen, hanging by its teeth to the meshes of a net which had been set for Menhaden. They are considered by our fishermen as *very rare*, but few having been taken or seen by them in our waters." I have heard of a few specimens having been taken in the vicinity of Nahant.

CYBIUM MACULATUM. Cuv. The spotted Mackerel.

Scomber maculatus. Mitchill. Transactions of the Lit. and Philosop. Society of New York, I. 426, et fig.
Cybium maculatum. Cuv. et Valenc. Hist. Nat. des Poissons, t. VIII. 181.

I have the pleasure to present to this Society a specimen of this species, taken on the 24th of July, 1841, in a net at Lynn, together with several specimens of the *Temnodon saltator.* This species is entirely unknown to the numerous fishermen who have examined it; and it is the only specimen I have heard of as being taken in the waters of our State. Dr. Mitchill described and figured it in his "Fishes of New York," under the common name of "Spanish Mackerel," which is the *Scomber colias.* When first taken, it is a very beautiful fish, but the brilliancy of its colors is soon effaced.

The specimen referred to, is twenty one inches in length; its greatest depth, measured from the origin of the first dorsal fin, is about four inches — its greatest thickness is two inches.

The top of the head, and the upper part of the sides of the body, are of a dark leaden color; the sides are lighter; the jaws, opercula, and abdomen are of a beautiful clear white, presenting a satin like appearance — the dorsal ridge, throughout its whole extent, is of a beautiful dark green color; twenty or more bright yellow spots, the largest being three-eighths of an inch in diameter, situated above and beneath the lateral line, ornament its sides — the most anterior of these spots is beneath the pectoral fins — the largest number of the spots is anterior to the dorsal fin.

The length of the head is three and a half inches, terminated anteriorly in a sharp point. The *eyes* are half an inch in diameter: the pupils are black, the irides are golden. The anterior *nostril* is the smaller, and is semicircular: the posterior nostril, which is situated directly in front of the centre of the eye, is a transverse slit. The upper jaw terminates in a point: the prominent tip of the lower jaw projects slightly beyond the upper: both of the jaws are furnished with a single row of prominent, sharp, triangular teeth — those situated towards the angle of the jaws, the largest: the gape of the mouth when expanded, measures from the tip of the jaws two inches.

The *lateral line* which is raised above the general surface of the fish, arises half of an inch above the origin of the pectoral fin, and in the language of Mitchill, " does not travel straight, but crooks and meanders along prettily towards the tail."

The first dorsal fin, which is five inches long, arises less than an inch back of the operculum : its anterior portion is much higher than the posterior : the membrane connecting the first eight rays is black — the remaining portion is white, except at its edge, which is black : the second and third rays, which are the highest, are one and a half inch high : all the rays project above the membrane, and are furnished with delicate filaments.

The second dorsal fin commences three-eighths of an inch back of the first : it is of a lead color, two inches long, one and a half inches high at its highest point : eight finlets about three-eighths of an inch high, of the same color as the fin, are situated between it and the tail.

The pectoral fins which are falciform, arise directly back of the angle of the operculum — they are six lines long and two inches high ; black beneath, above lighter.

The ventral fins are white — two lines long, and seven lines high.

The anal fin arises opposite the middle of the second dorsal fin, and is of the same length as that fin : eight finlets, similar in form to those of the dorsal, are seen beyond the anal fin.

The caudal fin is lunated—four inches high—five inches deep at its extremity, when expanded. At the base of this fin is a lateral prominent carina, upon which the lateral line terminates ; and on each side of this, are two smaller carinæ running the entire length of the fleshy portion of the tail.

The fin rays are as follows :— D. 18—17 ; P. 20 ; V. 4 ; A. 18 ; C. 26.

While preparing my Report, no species gave me more trouble to classify than that, which I there stated, " after considerable hesitation I have concluded to be the ' Trachinotus argenteus. Cuv.' " Dr. Dekay writes me that Mr. Cozzens also considered it a *Trachinotus*, in a paper he read several years since to a Natural History Society, and gave it the specific name of *Cumberlandi.* It appears that Dr. Mitchill published a "Supplement to his Fishes of New York," in "The American Monthly Magazine and Critical Review" for 1818. Of the existence of this paper I never heard, until long after my Report had been published. In that supplement he described this fish, and very well too, under the name of "*Coryphœna perciformis* — Rudder fish, or Perch Coryphene." This species, however, is not a *Coryphœna ;* and Dr. Dekay while he retains the specific name of Dr. Mitchill, has formed a new genus to receive it, which he calls *Palinurus*, from the circumstance of the fish being sometimes called the *Pilot fish.*

In my account of the Peprilus triacanthus, I omitted to mention that it is generally known among our fishermen as the *Sheep's head* — which is the cause of no little confusion, it being confounded with the *Sargus ovis*, so extensively known south of Cape Cod, by the same common name.

Trichiurus lepturus. Lin. Silvery hair-tail.

Trichiurus lepturus.	Lin. Bloch, pt. V. pl. 158.
" "	Strack's plates, pl. XX. fig. 1.
" "	Griffith's Cuv. X. 347.
" "	Cuv. et Valenc. Hist. Nat. des Poiss. VIII. 237.
" "	Yarrell's British Fishes. I. 182 et fig.
Trichiurus argenteus.	Shaw's Gen. Zool. IV. 90 et fig.
" "	Mitchill, Trans. Lit. et Phil. Soc. N. Y. I. 364.

I am indebted to Dr. J. B. Forsyth, of Sandwich, for the only specimen of this species I have known to be taken upon our coast. It was cast upon the beach at Buttermilk Bay, in the north-eastern corner of Buzzard's Bay, during the last summer, and was found while yet in a state of good preservation. A portion of the posterior extremity is now lost, but it still measures two feet and ten inches in length. As its form has lost its proportions in being dried — and its colors are effaced — as its dorsal fin is mutilated, and its tail is broken, while I present you with the specimen itself, I would extract the following description of Mitchill, as being sufficiently clear, and much more accurate than, with such means as I have, I could hope to make it.

"Silvery hair-tail. (Trichiurus argenteus,) with the lower jaw jutting beyond the upper, and a snake-like tail.

Length two feet and four inches; depth at the belly two inches and a half. I measured one August 1, 1814, that was three feet and two inches long, which weighed one pound and a quarter. Figure flat, and thin sideways. Color silvery, with a golden lateral line. This descends from the gill opening, and runs low along the belly. Dorsal fin reaches from the back of the head almost to the tail, which is finless, and ends in an attenuated point. No anal nor ventral fins: but a row of notches or spines along the tail, as far forward as the vent, rendering it somewhat carinated. Gill-openings wide. Eyes yellow, and occupy much space in the flat vertical cheeks. Space between the eyes flattish, giving the head an angular configuration. Nostrils ample, mouth capacious, and jaws armed with teeth. Lower jaw projects, and has two teeth jutting beyond the upper, when the mouth is shut. The upper jaw has, in front, from three to six teeth larger than the rest. All the teeth of the larger order are jagged on the inner or hinder sides, with a single barb towards the points. Throat capacious, and tongue smooth. No scales. Laterally the teeth of the upper jaw project over the sides of the lower. And when the jaws are closed, it is frequently possible to look through the mouth from side to side."

I considered the FISTULARIA which had belonged to the Cabinet of this Society for several years, and which was taken at Holmes' Hole, to be the *serrata*, Bloch — although I had no volume to refer to, which would settle the matter with certainty. Dr. Dekay assures me that I "was right in the species, as he compared the specimen I described, with one he brought from Brazil, some years ago." By an inadvertency, the specimen I described is said in my Report to be *ten inches long*: it should read *twentyseven inches.*

My friend, C. H. Olmsted, Esq. of Hartford, informs me that the LEUCISCUS CORNUTUS, (described by Mitchill in the "American Monthly Magazine," and specimens of which, from New York and Connecticut, we have in our Cabinet,) is common in the small streams of Berkshire County.

Having carefully compared our common SHAD with Yarrell's description of the ALOSA COMMUNIS, the points of resemblance were so numerous that I felt compelled to consider it as identical with the foreign fish. Dr Dekay informs me that it has been somewhere described as a new species, under the name of *sapidissima*.

I have but little doubt that a species of SOLEA, Cuv., is found in our waters, from the description given me, by Mr Newcomb, of Quincy Market, of a fish seen by him during the last season.

But a single specimen of the ACHIRUS MOLLIS had been met with, when I concluded my Report, which was taken at Holmes' Hole. In April, 1840, I received a beautiful specimen, six inches in length, with the transverse bands upon the sides very distinct, which was caught at Nahant.

A second specimen of the ECHENEIS, which I considered the *naucrates* I have seen within a few weeks. It was taken at Hyannis, south side of Barnstable, Cape Cod. Dr Mitchill's "Supplement" has enabled me to identify this fish, as the species described by him under the name of E. *alba-cauda*. His description is rather a general one, but it is sufficient to determine the species.

TETRAODON MATHEMATICUS. Mitchill. Mathematical Tetraodon.

Mathematical Tetrodon. (Tetrodon mathematicus.) Mitchill. Trans. Lit. et Phil. Soc. N. Y. Vol. I. 474 et fig.

A fine specimen of this beautiful species was taken at Nantucket during the last summer, and now belongs to Mr Stackhouse of this city. Its entire length is twentythree inches: its greatest depth is four and a half inches: its greatest width across from the pectoral fin, is four inches. The head and entire back, are of a deep olive-green color; the sides are silvery; the inferior portion of the fish is of a pure white.

The whole surface of the body is perfectly smooth, with the exception of the space beneath, bounded anteriorly by the throat, laterally by the pectoral fins, and posteriorly by the anus, — which is studded with innumerable stellated spines. Length of the head four inches: the distance between the eyes, is nearly three inches. The eyes are oblong, one inch long in their greatest diameter. The nostrils are situated nearly an inch in front of, and rather above, the anterior angle of the eyes. The vertical gape of the mouth is an inch in extent: the lips are fleshy and lax. The jaws are very strong. About half of an inch back of the angle of the jaws, a line commences, which appears like a scratch upon the skin; this passes backward to the posterior extremity of the eye, being less than half of an inch beneath the eye, then ascends obliquely to a point upon the back two inches above the middle of the pectoral fin, then curves downwards to the middle of the side of the fish to a point about an inch back of the dorsal fin, whence it pursues a straight course to the caudal rays. This line from its origin also passes upward and backwards, just exterior to the nostrils, and curving high up over the eyes passes back of them and downward to meet the former line about half of an inch back of the eyes, thus forming a ring around them. Directly above the base of the pectoral fins, a transverse line crosses from the lateral line on one side to that on the other. From this transverse line, an undulating line passes to the ring around the eyes.

The dorsal fin is situated upon the posterior half of the body: its length is equal to one third of its height.

The pectoral fins arise about an inch and a half back of the eyes; they are somewhat quadrangular in their appearance: their length is more than an inch.

The anal fin is opposite to the dorsal; it is of the same form as that fin, and about the same size.

The caudal fin is considerably forked; it is an inch long, and four inches high.

The fin rays are as follows: — D. 13; P. 16; A. 12; C. 11.

My description of the Acipenser oxyrinchus was drawn up from a specimen two feet and three inches in length. During the last season I received another specimen found on the beach at Deer Island, nearly six feet in length.

I remarked in my Report, that Dr. Yale informed me that a species of Zygæna was found at Holmes' Hole.

Within a few weeks, Winslow Lewis, Esq., brought a fish of this genus from Chatham, Cape Cod, at which place it was taken with a second specimen, in a net. It was considered by the fishermen there, as a great curiosity. I have been kindly presented with the specimen, which now lies before you, and would offer the following description.

Zygæna malleus. Valenc. The hammer-headed Shark.

Zygæna malleus. Valenciennes; Memoires du Mus. d'Hist. Nat. t. IV. p. 122. et fig.

The entire length of the specimen is two feet and four inches. All the upper part of the body is of a dark greyish brown color: beneath, it is lighter. The length of the head is three inches, it is rounded anteriorly, very much compressed at its sides, convex at the occiput. The greatest width across the head, is nine inches; the external margins of the sides of the head are rounded, having the eyes situated at their anterior extremity: in front of the eyes, the anterior angle is quite prominent, beneath this angle, in a slight emargination, are situated the nostrils: the posterior portion of the sides of the head, is bordered by a membrane. The *eyes* are prominent and six lines in diameter. The *mouth* is situated beneath, two inches back of the snout, and measures across from the angles, a little more than two inches. The *teeth* are numerous in both jaws, sharp and triangular, having a prolonged base. There are five branchial apertures upon each side — the anterior is the largest.

The first dorsal fin, which is triangular, is situated a little less than three inches back of the head, behind the pectoral fins.

The second dorsal fin is quite small, rounded at its upper posterior extremity, and elongated at its lower posterior extremity into almost a filament: this fin arises about three inches in front of the caudal fin.

The pectoral fins, which are triangular, arise at the base of the fourth branchial orifice.

The ventral fins commence just back of the middle of the body — and are about two inches in length.

The anal fin commences anterior to the second dorsal, and is not continued as far back as the posterior extremity of that fin.

The length of the upper lobe of the caudal fin is equal, as was observed by Valenciennes, to the width of the head. The lower lobe is equal in length to one-third of the upper lobe.

This description is necessarily imperfect, being drawn up from a dead specimen; but as I have never before seen a specimen which had been taken in our waters, I was unwilling to let it pass unnoticed.

The confusion which existed in the genus *Zygæna* — the mistakes which were constantly made by Ichthyologists when speaking of the different species, led Valenciennes to prepare a monograph of the genus, which was published, illustrated with admirable plates, in the ninth volume of the "Memoires du Museum d'Histoire Naturelle."

The plates of Shaw and Strack, and others who copied from them, were calculated to mislead; but the figures of Valenciennes, accompanied with clear descriptions, settle the species with precision.

Dr. Yale informed me that a formidable species of Sting-Ray was found at Holmes' Hole, which he had frequently seen. As I had never had an opportunity of examining this species, I was not ready to consider it the *pastinaca*, the common Sting-Ray, found on the shores of Great Britain, — and made therefore a simple reference only, in my Report, to a species of *Trygon* being found along our coast. In October 1840, Dr. Yale sent me the head and tail of a species "whose whole length" he stated "including the tail, was ten and a half feet: its breadth was four and a half feet at its widest part." The jaws were furnished with numerous rows of rhomboidal teeth. The tail was six feet and three inches long; more than four inches wide at its origin, and tapering to a point at its extremity. A single row of spines was situated at the commencement of the tail — and six or eight inches farther back, upon the sides and beneath, numerous smaller spines were scattered throughout its whole extent: the under edge of the tail was bordered by a fleshy membrane which commenced anterior to two very strong spines situated upon the dorsum of the tail — the anterior one is five inches long, one half inch wide at its base, and pointed at its extremity: the posterior spine is less than half the length of the former: both of the spines armed upon the edges with numerous retroverted teeth.

I have also received from Dr. Yale another tail of a *Trygon* which I suppose to be of this same species. It is forty inches in length, and differs in no important particular from the preceding one, save in the proportions of the serrated spines, which are of equal length — both being four inches long. I suppose these detached portions to belong to that species called *Raia centroura*, Prickly-tailed Sting-Ray, by Mitchill in his "History of the Fishes of New York."

To Dr. Yale I am also indebted for the tail, and portions of the jaw, of a species of the genus Myliobatis, Dumeril. In this genus, "the jaws are furnished with broad, flat teeth, placed like flags in a pavement, and differing in size according to the species: the tail is extremely long and slender, terminating in a point, and is crowned, like that of a Trygon, with a strong spine notched on both sides, supporting near its base, and before the spine, a small dorsal."

I know of but one American species having been described — *Raia quadriloba*, Lesueur. That was taken at Egg Harbor, New Jersey, and was evidently not the species we are now considering. The jaws of our species, are furnished with rows of smooth, flat, elongated plates, with rhomboidal plates exterior to these. The tail, which is thirty inches long from the anus, is of a dirty brown color, and perfectly smooth: in its present dried state, it is an inch and a half wide at its origin, and tapers to a point. Two inches back of the anus is situated the dorsal fin, which is subtriangular, and a little more than an inch long. At the posterior extremity of the dorsal fin is a strong naked spine, three inches in length, closely serrated upon its sides, from its base nearly to its point: and beneath this, is a second similar spine, four inches long. In Lesueur's species, the lateral plates in the jaws, being of a similar form with the central ones, appear in his figure, as mere prolongations of these plates. And the tail in that species was armed with a single spine.

With the fragment of a jaw and the tail merely, it is difficult to characterize a species, the other organs of which, may present striking peculiarities. Unless, however, future research should show the species to which these belong, to possess some remarkably distinct character, I would propose the specific name of *bispinosus*.

In January, 1840, Dr. Prescott, of Lynn, sent me a portion of a Shark's jaw, taken from a species captured near that place in that month. The fish was supposed to weigh about 1000 pounds: the jaws are of equal length, and the gape of the mouth was wide. The fragment of the lower jaw, to which the hook was attached, was the only portion removed by the fishermen. The teeth of this species have no points of resemblance with those of the *Carcharias obscurus*, nor *Lamna punctata*—the edges of the former are serrated throughout—and the latter are very small and triangular. With the minute conical teeth of the *Squalus elephas* no one could confound them; and their difference from those of the *Carcharias vulpes* is at once recognized by the ichthyologist. The portion of the jaw before me is six inches in length, and two inches wide at its tip. From the tip of the jaw, to the posterior angle on each side, are situated seven teeth: the two on each side of the chin are longer, narrower, and straiter than those exterior to them. Dr. Prescott observed in his letter to me, that when taken, "it exhibited three, and in some places four rows of long narrow teeth." Now that the soft parts are removed, the two teeth next the chin, are seen continued back into the mouth seven rows deep: in the first row, the two exterior teeth are shorter than the third within them; this third tooth, with the two still within it, are about the same size: the outer tooth of the second row, is of the same height as the third of the first row, and in this row they pass backwards, decreasing as in the first row. The teeth of the other five rows differ very much from those spoken of, in their form—they are shorter, wider and less stout—curving towards the angle of the jaw; those of the sixth and seventh rows being shorter than those of the previous three rows. Mitchill in his "Fishes of New York," refers to a shark which he calls *Squalus Americanus*, Shaw. Subsequently to this, he considered it an undescribed species in his "Supplement," and from the great size of its teeth, proposed for it the name of *Squalus macrodon*, or long-toothed shark. Our fish is probably identical with that species; should it prove not to be the same, upon the examination of a perfect specimen, it must constitute a new species.

The members of the Society will remember that in a "Supplement" to my Report, I added descriptions of the Lophius piscatorius and Squalus elephas, made from recent specimens: and that while the reprint of my Report was passing through the press, I was enabled to add a description of the Squalus obscurus, also prepared from a recent specimen, in the second volume of our Journal.

In my account of the Orthagoriscus mola, when speaking of the great elasticity of its flesh, I observed, "its flesh is sometimes used for balls." As this expression may appear rather indefinite, I would remark that Dr. Yale, when writing respecting this species, says "what is most peculiar in this fish is, an entire cartilaginous case, of an inch and a half to two inches thick, covering the whole body—perfectly white and milky in appearance, and very elastic. A small ball of it, cut out and thrown, with moderate force, upon the ground, will rebound from fifteen to twenty feet." And, in a newspaper published in this city, several years since, in which reference was made to a specimen of this species having been taken at one of the wharves, I found the following observation. "Several of the fish of this species have been caught at Halifax, N. S. where the boys make balls of the flesh, it being remarkably elastic."

By the assistance of my friends, I have been enabled to offer the foregoing observations. I shall continue, as opportunities may occur, to present you with additional information respecting our Ichthyology.

Art. XV.—AN INQUIRY INTO THE DISTINCTIVE CHARACTERISTICS OF THE ABORIGINAL RACE OF AMERICA. By Samuel George Morton, M. D. (Read at the Annual Meeting, April 27, 1842.)

To the Members of the Boston Society of Natural History.

Gentlemen—On receiving the highly flattering invitation to deliver your Annual Address, it occurred to me that nothing would be so appropriate as a review of the present state of Natural Science in this country: but having almost simultaneously received the Address of Mr. Teschemacher for the past year, I found it so full and satisfactory on this question as to leave little or nothing for further discussion. I have therefore been induced to seek another field of inquiry, and in so doing, have very naturally turned to a subject which has long occupied my leisure hours, and which, though frequently examined, may yet, I trust, be recurred to with pleasure and instruction. I propose to take a rapid glance at what I conceive to be the peculiar traits of the Aboriginal race of America, as embraced in five principal considerations, viz: — their organic, moral and intellectual characters, their mode of interment and their maritime enterprise; and from these I shall venture to draw a few definite conclusions. I am aware that it may appear presumptuous to attempt so wide a range within the brief limits of the present occasion, especially as some points can be touched only in the most general manner; but my object has been to dwell rather upon some of these which have hitherto received less attention than they obviously deserve, and which are intimately involved in the present inquiry. With this explanation I submit to your indulgent consideration the contents of the following memoir.

S. G. MORTON.

Anthropology, the Natural History of Man, is essentially a modern Science. At a time when the study of Nature in her other departments, had been prosecuted with equal zeal and success, this alone, the most important of them all, remained comparatively neglected and unknown; and of the various authors who have attempted its exposition during the past and present centuries, too many have been content with closet theories, in which facts are perverted to sustain some baseless conjecture. Hence it has been aptly remarked that Asia is the country of fables, Africa of monsters, and America of systems, to those who prefer hypothesis to truth.

The intellectual genius of antiquity justly excites our admiration and homage; but in vain we search its records for the physical traits of some of the most celebrated nations of past time. It is even yet gravely disputed whether the ancient Egyptians belonged to the Caucasian race or to the Negro; and was it not for the light which now dawns upon us from their monuments and their tombs, this question might remain forever undecided. The present age, however, is marked by a noble zeal for these inquiries, which are daily making man more conversant with the organic structure, the mental character and the national affinities of the various and widely scattered tribes of the human family.

Among these the aboriginal inhabitants of America claim our especial attention. This vast theatre has been thronged, from immemorial time, by numberless tribes which lived only to destroy and be in turn destroyed, without leaving a trace of their sojourn on the face of the earth. Contrasted with these were a few civilized communities, whose monuments awaken our surprise without unfolding their history; and he who would unravel their mysteries may be compared, in the language of the poets, to a man standing by the stream of time, and striving to rescue from its waters the wrecked and shattered fragments which float onward to oblivion.

It is not my present intention even to enumerate the many theories which have been advanced in reference to the origin of the American nations; although I may, in the sequel, inquire whether their genealogy can be traced to the Polynesians or Mongolians, Hindoos, Jews or Egyptians. Nor shall I attempt to analyse the views of certain philosophers who imagine that they have found not only a variety of races, but several *species* of men among the aborigines of this continent. It is chiefly my intention to produce a few of the more strikingly characteristic traits of these people to sustain the position that all the American nations, excepting the Eskimaux, are of one race, and that this race is peculiar, and distinct from all others.

1. *Physical Characteristics.* It is an adage among travellers that he who has seen one tribe of Indians, has seen all, so much do the individuals of this race resemble each other, notwithstanding their immense geographical distribution, and those differences of climate which embrace the extremes of heat and cold. The half-clad Fuegian, shrinking from his dreary winter, has the same characteristic lineaments, though in an exaggerated degree, as the Indians of the tropical plains; and these again resemble the tribes which inhabit the region west of the Rocky Mountains, those of the great valley of the Mississippi, and those again which skirt the Eskimaux on the North. All possess alike the long, lank, black hair, the brown or cinnamon colored skin, the heavy brow, the dull and sleepy eye, the full and compressed lips, and the salient but dilated nose. These traits, moreover, are equally common to the savage and civilized nations; whether they inhabit the margins of rivers and feed on fish, or rove the forest and subsist on the spoils of the chase.

It cannot be questioned that physical diversities do occur, equally singular and inexplicable, as seen in different shades of color, varying from a fair tint to a complexion almost black; and this too under circumstances in which climate can have little or no influence. So also in reference to stature, the differences are remarkable in entire tribes which, moreover, are geographically proximate to each other. These facts, however, are mere exceptions to a general rule, and do not alter the peculiar physiognomy of the Indian, which is as undeviatingly characteristic as that of the Negro; for whether we see him in the athletic Charib or the stunted Chayma, in the dark Californian or the fair Borroa, he is an Indian still, and cannot be mistaken for a being of any other race.

The same conformity of organization is not less obvious in the osteological structure of these people, as seen in the squared or rounded head, the flattened or vertical occiput, the high cheek bones, the ponderous maxillæ, the large quadrangular orbits, and the low, receding forehead. I have had opportunity to compare nearly four hundred crania, derived from tribes inhabiting almost every region of both Americas, and have been astonished to find how the preceding characters, in greater or less degree, pervade them all.

This remark is equally applicable to the ancient and modern nations of our continent; for the oldest skulls from the Peruvian cemeteries, the tombs of Mexico and the mounds of our own country, are of the same type as the heads of the most savage existing tribes. Their physical organization proves the origin of one to have been equally the origin of all. The various civilized nations are to this day represented by their lineal descendants who inhabit their ancestral seats, and differ in no exterior respect from the wild and uncultivated Indians; at the same time, in evidence of their lineage, Clavigero and other historians inform us, that the Mexicans and Peruvians yet possess a latent mental superiority which has not been subdued by three centuries of despotism. And again, with respect to the royal personages and other privileged classes, there is indubitable evidence that they were of the same native stock, and presented no distinctive attributes excepting those of a social or political character.

The observations of Molina and Humboldt are sometimes quoted in disproof of this pervading uniformity of physical characters. Molina says that the difference between an inhabitant of Chili and a Peruvian is not less than between an Italian and a German; to which Humboldt adds, that the American race contains nations whose features differ as essentially from one another as those of the Circassians, Moors and Persians. But all these people are of one and the same *race*, and readily recognized as such, notwithstanding their differences of feature and complexion; and the American nations present a precisely parallel case.

I was at one time inclined to the opinion that the ancient Peruvians, who inhabited the islands and confines of the Lake Titicaca, presented a congenital form of the head entirely different from that which characterizes the great American race; nor could I at first bring myself to believe that their wonderfully narrow and elongated crania, resulted solely from artificial compression applied to the rounded head of the Indian. That such, however, is the fact has been indisputably proved by the recent investigations of M. D'Orbigny. This distinguished naturalist passed many months on the table-land of the Andes which embraces the region of these extraordinary people, and examined the desiccated remains of hundreds of individuals in the tombs where they have lain for centuries. M. D'Orbigny remarked that while many of the heads were deformed in the manner to which we have adverted, others differed in nothing from the usual conformation. It was also observed that the flattened skulls were uniformly those of men, while those of the women remained unaltered; and again, that the most elongated heads were preserved in the largest and finest tombs, shewing that this cranial deformity was a mark of distinction. But to do away with any remaining doubt on this subject, M. D'Orbigny ascertained that the descendants of these ancient Peruvians yet inhabit the land of their ancestors, and bear the name of AYMARAS, which may have been their primitive designation; and lastly, the modern Aymaras resemble the common Quichua or Peruvian Indians in every thing that relates to physical conformation, not even excepting the head, which, however they have ceased to mould artificially.

Submitted to the same anatomical test, the reputed giant and dwarf races of America prove to be the mere inventions of ignorance or imposition. A careful inspection of the remains of both, has fully satisfied me that the asserted gigantic form of some nations has been a hasty inference on the part of unpractised observers: while the so-called pygmies of the valley of the Mississippi were mere children, who, for reasons not wholly understood, were buried apart from the adult people of their tribe.

Thus it is that the American Indian, from the southern extremity of the continent to the northern limit of his range, is the same exterior man. With somewhat variable stature and complexion, his distinctive features, though variously modified, are never effaced; and he stands isolated from the rest of mankind, identified at a glance in every locality, and under every variety of circumstance; and even his desiccated remains which have withstood the destroying hand of time, preserve the primeval type of his race, excepting only when art has interposed to pervert it.

2. *Moral Traits.* These are perhaps, as strongly marked as the physical characteristics of which we have just spoken; but they have been so often the subject of analysis as to claim only a passing notice on the present occasion. Among the most prominent of this series of mental operations is a sleepless caution, an untiring vigilance which presides over every action and masks every motive. The Indian says nothing and does nothing without its influence: it enables him to deceive others without being himself suspected; it causes that proverbial taciturnity among strangers which changes to garrulity among the people of his own tribe; and it is the basis of that invincible firmness which teaches him to contend unrepiningly with every adverse circumstance, and even with death in its most hideous forms.

The love of war is so general, so characteristic, that it scarcely calls for a comment or an illustration. One nation is in almost perpetual hostility with another, tribe against tribe, man against man; and with this ruling passion are linked a merciless revenge and an unsparing destructiveness. The Chickasaws have been known to make a stealthy march of six hundred miles from their own hunting grounds, for the sole purpose of destroying an encampment of their enemies. The small island of Nantucket, which contains but a few square miles of barren sand, was inhabited at the advent of the European colonies by two Indian tribes, who sometimes engaged in hot and deadly feud with each other. But what is yet more remarkable, the miserable natives of Terra del Fuego, whose common privations have linked them for a time in peace and fellowship, become suddenly excited by the same inherent ferocity and exert their puny efforts for mutual destruction. Of the destructive propensity of the Indian, which has long become a proverb, it is almost unnecessary to speak; but we may advert to a forcible example from the narrative of a traveller who accompanied a trading party of northern Indians on a long journey; during which he declares that they killed every living creature that came within their reach; nor could they even pass a bird's nest without slaying the young or destroying the eggs.

That philosophic traveller, Dr. Von Martius, gives a graphic view of the present states of natural and civil rights among the American aborigines. Their sub-division, he remarks, into an almost countless multitude of greater and smaller groups, and their entire exclusion and excommunication with regard to each other, strike the eye of the observer like the fragments of a vast ruin, to which the history of the other nations of the earth furnishes no analogy. "This disruption of all the bands by which society was anciently held together, accompanied by a Babylonish confusion of tongues, the rude right of force, the never ending tacit warfare of all against all, springing from that very disrupture, — appear to me the most essential, and, as far as history is concerned, the most significant points in the civil condition of the aboriginal population of America."

It may be said that these features of the Indian character are common to all mankind in the savage state: this is generally true; but in the American race they exist in a degree which will fairly challenge a comparison with similar traits in any existing people; and if we consider also their habitual indolence and improvidence, their indifference to private property, and the vague simplicity of their religious observances, — which, for the most part, are devoid of the specious aid of idolatry, — we must admit them to possess a peculiar and eccentric moral constitution.

If we turn now to the demi-civilized nations, we find the dawn of refinement coupled with those barbarous usages which characterize the Indian in his savage state. We see the Mexicans, like the later Romans, encouraging the most bloody and cruel rites, and these too in the name of religion, in order to inculcate hatred of their enemies, familiarity with danger and contempt of death; and the moral effect of this system is manifest in their valorous though unsuccessful resistance to their Spanish conquerors.

Among the Peruvians, however, the case was different. The inhabitants had been subjugated to the Incas by a combined moral and physical influence. The Inca family were looked upon as beings of divine origin. They assumed to be the messengers of heaven, bearing rewards for the good, and punishment for the disobedient, conjoined with the arts of peace and various social institutions. History bears ample testimony that these specious pretences were employed first to captivate the fancy and then to enslave the man. The familiar adage that "knowledge is power," was as well understood by them as by us; learning was artfully restricted to a privileged class; and the genius of the few soon controled the energies of the many. Thus the policy of the Incas inculcated in their subjects an abject obedience which knew no limit. They endeavored to eradicate the feeling of individuality; or in other words to unite the minds of the plebeian multitude in a common will which was that of their master. Thus when Pizarro made his first attack on the defenceless Peruvians in the presence of their Inca, the latter was borne in a throne on the shoulders of four men; and we are told by Herrera that while the Spaniards spared the Sovereign, they aimed their deadly blows at his bearers: these, however, never shrunk from their sacred trust; but when one of their number fell, another immediately took his place; and the historian declares that if the whole day had been spent in killing them, others would still have came forward to the passive support of their master. In fact what has been called the paternal government of the Incas was strictly such; for their subjects were children, who neither thought nor acted except at the dictation of another. Thus it was that a people whose moral impulses are known to have differed in little or nothing from those of the barbarous tribes, were reduced, partly by persuasion, partly by force, to a state of effeminate vassalage not unlike that of the modern Hindoos. Like the latter, too, they made good soldiers in their native wars, not from any principle of valour, but from the sentiment of passive obedience to their superiors; and hence when they saw their monarch bound and imprisoned by the Spaniards, their conventional courage at once forsook them; and we behold the singular spectacle of an entire nation prostrated at a blow, like a strong man whose energies yield to a seemingly trivial but rankling wound.

After the Inca power was destroyed, however, the dormant spirit of the people was again aroused in all the moral vehemence of their race, and the gentle and unoffending Peruvian was transformed into the wily aud merciless savage. Every one is familiar with the sequel. Resistance was too late to be availing, and the fetters to which they had confidingly submitted were soon riveted forever.

As we have already observed, the Incas depressed the moral energies of their subjects in order to secure their own power. This they effected by inculcating the arts of peace, prohibiting human sacrifices, and in a great measure avoiding capital punishments; and blood was seldom spilt excepting on the subjugation of warlike and refractory tribes. In these instances, however, the native ferocity of their race broke forth even in the bosom of the Incas; for we are told by Garcilaso, the descendant and apologist of the Peruvian kings, that some of their wars were absolutely exterminating; and among other examples he mentions that of the Inca Yupanqui against the province of Collao, in which whole districts were so completely depopulated that they had subsequently to be colonized from other parts of the empire: and in another instance the same unsparing despot destroyed twenty thousand Caranques, whose bodies he ordered to be thrown into an adjacent lake, which yet bears the name of the Sea of Blood. In like manner when Atahualpa contested the dominion with

Guascar, he caused the latter, together with thirty of his brothers, to be put to death in cold blood, that nothing might impede his progress to the throne.

We have thus endeavored to shew that the same moral traits characterize all the aboriginal nations of this continent, from the humanized Peruvian to the rudest savage of the Brazilian forest.

3. *Intellectual Faculties.* It has often been remarked that the intellectual faculties are distributed with surprising equality among individuals of the same race who have been similarly educated, and subjected to the same moral and other influences: yet even among these, as in the physical man, we see the strong and the weak, with numberless intermediate gradations. This equality is infinitely more obvious in savage than in civilized communities, simply because in the former the condition of life is more equal; whence it happens that in contrast to a single master mind, the plebeian multitude are content to live and die in their primitive ignorance.

This truth is obvious at every step of the present investigation; for of the numberless hordes which have inhabited the American continent, a fractional portion only has left any trace of refinement. I venture here to repeat my matured conviction that as a race they are decidedly inferior to the Mongolian stock. They are not only averse to the restraints of education, but seem for the most part incapable of a continued process of reasoning on abstract subjects. Their minds seize with avidity on simple truths, while they reject whatever requires investigation or analysis. Their proximity for more than two centuries to European communities, has scarcely effected an appreciable change in their manner of life; and as to their social condition, they are probably in most respects the same as at the primitive epoch of their existence. They have made no improvement in the construction of their dwellings, except when directed by Europeans who have become domiciliated among them; for the Indian cabin or the Indian tent, from Terra del Fuego to the river

St. Lawrence, is perhaps the humblest contrivance ever devised by man to screen himself from the elements. Nor is their mechanical ingenuity more conspicuous in the construction of their boats; for these, as we shall endeavor to show in the sequel, have rarely been improved beyond the first rude conception. Their imitative faculty is of a very humble grade, nor have they any predilection for the arts or sciences. The long annals of missionary labor and private benefaction, present few exceptions to this cheerless picture, which is sustained by the testimony of nearly all practical observers. Even in those instances in which the Indians have received the benefits of education, and remained for years in civilized society, they lose little or none of the innate love of their national usages, which they almost invariably resume when left to choose for themselves.

Such is the intellectual poverty of the barbarous tribes; but contrasted with these, like an oasis in the desert, are the demi-civilized nations of the new world; a people whose attainments in the arts and sciences are a riddle in the history of the human mind. The Peruvians in the south, the Mexicans in the north, and the Muyscas of Bogota between the two, formed these contemporary centres of civilization, each independent of the other, and each equally skirted by wild and savage hordes. The mind dwells with surprise and admiration on their cyclopean structures, which often rival those of Egypt in magnitude; — on their temples, which embrace almost every principle in architecture except the arch alone; — and on their statues and bas-reliefs which, notwithstanding some conventional imperfections, are far above the rudimentary state of the arts.*

* I cannot omit the present occasion to express my admiration of the recent discoveries of Mr. Stephens among the ruined cities of Central America. The spirit, ability and success which characterize these investigations are an honor to that gentleman and to his country; and they will probably tend more than the labors of any other person to unravel the mysteries of American Archæology. Similar in design to these are the researches of my distinguished friend the Chevalier Freidrichthal, the results of whose labors, though not yet given to the world, are replete with facts of the utmost importance to the present inquiry.

I have elsewhere ventured to designate these demi-civilized nations by the collective name of the TOLTECAN FAMILY; for although the Mexican annals date their civilization from a period long antecedent to the appearance of the Toltecas, yet the latter seem to have cultivated the arts and sciences to a degree unknown to their predecessors. Besides, the various nations which at different times invaded and possessed themselves of Mexico, were characterized by the same fundamental language and the same physical traits, together with a strong analogy in their social institutions: and as the appearance of the Incas in Peru was nearly simultaneous with the dispersion of the Toltecas, in the year 1050 of our era, there is reasonable ground for the conjecture that the Mexicans and Peruvians were branches of the genuine Toltecan stock. We have alluded to a civilization antecedent to the appearance of the Incas, and which had already passed away when they assumed the government of the country. There are traditional and monumental evidences of this fact which can leave no doubt on the mind, although of its date we can form no just conception. It may have even preceded the Christian era, nor do we know of any positive reasons to the contrary. Chronology may be called the crutch of history; but with all its imperfections it would be invaluable here, where no clue remains to unravel those mysterious records which excite our research but constantly elude our scrutiny. We may be permitted, however, to repeat what is all-important to the present inquiry, that these Ancient Peruvians were the progenitors of the existing Aymara tribes of Peru, while these last are identified in every particular with the people of the great Inca race. All the monuments which these various nations have left behind them, over a space of three thousand miles, go also to prove a common origin, because, notwithstanding some minor differences, certain leading features pervade and characterize them all.

Whether the hive of the civilized nations was, as some suppose, in the fabled region of Aztlan in the north, or whether, as the learned Cabrera has endeavored to shew, their native seats were in Chiapas and Guatimala, we may not stop to inquire; but to them, and to them alone, we trace the monolithic gateways of Peru, the sculptures of Bogota, the ruined temples and pyramids of Mexico and the mounds and fortifications of the valley of the Mississippi.

Such was the Toltecan Family; and it will now be inquired how it happens that so great a disparity should have existed in the intellectual character of the American nations, if they are all derived from a common stock, or in other words belong to the same race? How are we to reconcile the civilization of the one with the barbarism of the other? It is this question which has so much puzzled the philosophers of the past three centuries, and led them, in the face of facts, to insist on a plurality of races. We grant the seeming anomaly; but however much it is opposed to general rule, it is not without ample analogies among the people of the old world. No stronger example need be adduced than that which presents itself in the great Arabian family; for the Saracens who established their kingdom in Spain, whose history is replete with romance and refinement, whose colleges were the centres of genius and learning for several centuries, and whose arts and sciences have been blended with those of every subsequent age; — these very Saracens belong not only to the same race but to the same family with the Bedouins of the desert; those intractable barbarians who scorn all restraints which are not imposed by their own chief, and whose immemorial laws forbid them to sow corn, to plant fruit trees or to build houses, in order that nothing may conflict with those roving and predatory habits which have continued unaltered through a period of three thousand years.

Other examples perhaps not less forcible, might be adduced in the families of the Mongolian race; but without extending the comparison, or attempting to investigate this singular intellectual disparity, we shall, for the present, at least, content ourselves with the facts as we find them. It is important, however, to remark, that these civilized states do not stand isolated from their barbarous neighbors; on the contrary they merge gradually into each other, so that some nations are with difficulty classed with either division, and rather form an intermediate link between the two. Such are the Araucanians, whose language and customs, and even whose arts, prove their direct affiliation with the Peruvians, although they far surpass the latter in sagacity and courage, at the same time that their social institutions present many features of intractable barbarism. So also the Aztec rulers of Mexico at the period of the Spanish invasion, exhibit, with their bloody sacrifices and multiform idolatry, a strong contrast to the gentler spirit of the Toltecas who preceded them, and whose arts and ingenuity they had usurped. Still later in this intermediate series were the Natchez tribes of the Mississippi, who retained some traces of the refinement of their Mexican progenitors, mingled with many of the rudest traits of savage life. It is thus that we can yet trace all the gradations, link by link, which connect these extremes together, showing that although the civilization of these nations is fast becoming obsolete, although their arts and sciences have passed away with a former generation, still the people remain in all other respects unchanged, although a variety of causes has long been urging them onward to deep degradation and rapid extinction. Strange as these intellectual revolutions may seem, we venture to assert that, all circumstances being considered, they are not greater than those which have taken place between the ancient and modern Greeks. If we had not incontestable evidence to prove the fact, who would believe that the ancestors of the Greeks of the present day were the very people who gave glory to the Age of Pericles!

It may still be insisted that the religion and the arts of the American nations point to Asia and Egypt; but it is obvious, as Humboldt and others have remarked, that these resemblances may have arisen from similar wants and impulses, acting on nations in many respects similarly circumstanced. "It would indeed be not only singular but wonderful and unaccountable," observes Dr. Caldwell, "if tribes and nations of men, possessed of similar attributes of mind and body, residing in similar climates and situations, influenced by similar states of society, and obliged to support themselves by similar means, in similar pursuits, — it would form a problem altogether inexplicable if nations thus situated did not contract habits and usages, and, instinctively modes of life and action, possessing towards each other many striking resemblances." Here also we may draw an illustration from the old world; for, notwithstanding the comparative proximity of the Hindoos and Egyptians, and the evident analogies in their architecture, mythology and social institutions, there is now little reason to believe them cognate nations; and the resemblances to which we have adverted have probably arisen from mutual intercourse, independent of lineal affiliation. And so with the nations of America. The casual appearance of shipwrecked strangers would satisfactorily explain any sameness in the arts and usages of the one and the other, as well as those words which are often quoted in evidence of a common origin of language, but which are so few in number as to be readily accounted for on the foregoing principle.

The entire number of common words is said to be one hundred and four between the American languages and those of Asia and Australia; fortythree with those of Europe; and forty with those of Africa, making a total of one hundred and eightyseven words. But taking into account the mere coincidence by which some of these analogies may be reasonably explained, I would inquire, in the language of an ingenious author, whether these facts are sufficient to prove a connexion between four hundred dialects of America and the various languages of the old world?

Even so late as the year 1833, a Japanese junk was wrecked on the northwest coast of America, and several of the crew escaped unhurt to the shore; and I have myself seen some porcelain vessels which were saved on that occasion. Such casualties may have occurred in the early periods of American history; and it requires no effort of the imagination to conceive the influence these persons might have exerted, in various respects, had they been introduced to the ancient courts of Peru and Mexico. They might have contributed something to extend or at least to modify the arts and sciences of the people among whom they were thrown, and have added a few words to the national language.

I am informed by my friend Mr. Townsend, who passed several months among the tribes of the Columbia river, that the Indians there have already adopted from the Canadian traders several French words, which they use with as much freedom as if they belonged to their own vocabulary.

It follows of course from the preceding remarks that we consider the American race to present the two extremes of intellectual character; the one capable of a certain degree of civilization and refinement, independent of extraneous aids; the other exhibiting an abasement which puts all mental culture at defiance. The one composed, as it were, of a handful of people whose superiority and consequent acquisitions have made them the prey of covetous destroyers; the other a vast multitude of savage tribes whose very barbarism is working their destruction from within and without. The links that connect them partake of the fate of the extremes themselves; and extinction appears to be the unhappy, but fast approaching doom of them all.

4. *Maritime Enterprise.*—One of the most characteristic traits of all civilized and many barbarous communities, is the progress of maritime adventure. The Caucasian nations of every age present a striking illustration of this fact: their sails are spread on every ocean, and the fabled voyage of the Argonauts is but a type of their achievements from remote antiquity to the present time. Hence their undisputed dominion of the sea, and their successful colonization of every quarter of the globe. The Mongolians and Malays, though active and predatory, and proverbially aquatic in their habits, are deficient in that mechanical invention which depends on a knowledge of mathematical principles; while they seem also incapable of those mental combinations which are requisite to a perfect acquaintance with naval tactics. The Negro, whose observant and imitative powers enable him to acquire with ease the details of seamanship, readily becomes a mariner, but rarely a commander; and history is silent on the nautical prowess of his race. Far behind all these is the man of America. Savage or civilized, the sea for him has

had few charms, and his navigation has been almost exclusively restricted to lakes and rivers. A canoe excavated from a single log, was the principal vessel in use in the new world at the period of its discovery. Even the predatory Charibs, who were originally derived from the forests of Guayana, possessed no other boat than this simple contrivance, in which they seldom ventured out of sight of land; and never excepting in the tranquil periods of the tropical seas, when they sailed from shore to shore, the terror of the feebler natives of the surrounding islands. The canoes of the Arouacs of Cuba were not more ingeniously contrived than those of the ruder Charibs; which is the more surprising since their island was the centre of a great archipelago, and their local position, therefore, in all respects calculated to develope any latent nautical propensities. When Cortez approached in his ships the Mexican harbor of Tobasco, he was astonished to find even there, the sea-port, as it were, of a mighty empire, the same primitive model in the many vessels that skimmed the sea before him. Let us follow this conqueror to the imperial city itself, surrounded by lakes, and possessed of warlike defences superior to those of any other American people. The Spanish commander, foreseeing that to possess the lake would be to hold the keys of the city, had fifteen brigantines built at Tlascala; and these being subsequently taken to pieces, were borne on men's shoulders to the lake of Mexico, and there re-constructed and launched. The war thus commenced as a naval contest; and the Spanish historians, while they eulogize the valour of the Mexicans, are constrained to admit the utter futility of their aquatic defences: for although the subjects of Montezuma, knowing and anticipating the nature of the attack, came forth from the city in several thousand boats, these were so feebly constructed, and managed with so little dexterity, that in a few hours they were all destroyed, dispersed or taken by the enemy.

Turning from the Mexicans, we naturally look to the Peruvians for some further advances in nautical skill; but although their country was comparatively a narrow strip of land with an extended frontier on the ocean, we find even here the same primitive vessels and the same timid navigators. It is indeed questionable whether they ever designedly lost sight of land, nor does it appear that they made the sea subservient to their conquests. These were uniformly prosecuted by land, excepting perhaps those of the Incas, in their efforts to subdue the fierce islanders of Titicaca; but even the partial pen of Garcilaso limits all these inventions to log canoes and rafts of reeds; nor does it appear that the ingenuity of these people, so abundantly displayed on many other occasions, had ever added an improvement to the primeval germ of navigation.

Nor are those tribes which depend almost wholly on fish for their daily subsistence, much better provided than the others. The Chenouks and other nations on the western coast of America, have boats hewn with comparative ingenuity from a single plank, and compared to a butcher's tray; but in these frail vessels they keep cautiously within sight of land, and never venture on the water unless the weather is favourable to their enterprise. It is to be observed, however, that when the Indians are compelled to carry their boats across portages from river to river, they construct them of birch bark, and with a degree of ingenuity and adaptation much above their usual resources. Thus boats that would carry nine men do not weigh over sixty pounds, and are therefore conveyed with ease to considerable distances. This is almost the only deviation from the log canoe, and is equally characteristic; for it is common among the interior Indians of both North and South America, and was noticed by De Solis in the Mexican provinces.

Inferior in these respects to the other tribes are the Fuegians; a people whom perpetual exposure and privation, and the influence of an inhospitable climate have reduced to a feeble intelligence, — the moral childhood of their race. Not even the stimulus of necessity has been able to excite that ingenuity which would so amply provide for all their wants; and they starve amid the abundant stores of the ocean because they possess no adequate means for obtaining them. The Falkland and Malouine islands, in but fifty degrees of South latitude, South Georgia, New South Shetland, and some smaller islands in nearly the same parallel, were at their discovery, entirely uninhabited; nor is there any evidence of their ever having been visited by any American tribe. Yet they possess seals and other marine animals in vast numbers, and in these and all other respects appear to be not less productive than the region inhabited by the Eskimaux.

It is generally supposed that nautical enterprise results from the necessity of the case, in nations proximate to, or surrounded by the sea. We have seen, however, that the natives of the islands of the Gulf of Mexico were exceptions to the rule; and we find another not less remarkable in the archipelago of Chiloe, on the coast of Chili. These islands are seen from the shore, and have a large Indian population which depends for subsistence on fish taken from the surrounding ocean; yet even so late as the close of the past century, after more than two hundred years of communication with the Spaniards, their boats appear not to have been the least improved from their original model. The padre Gonzalez de Agueros, who resided many years among these islanders, describes their canoes as composed of five or six boards narrowed at the ends and lashed together with cords, the seams being filled with moss. They have sails, but neither keel nor deck; and in these frail and primitive vessels the inhabitants commit themselves to a tempestuous sea in search of their daily food. The same miserable vessels are found in exclusive use in the yet more southern archipelago of Guaitecas, in which a sparse population is distributed over eight hundred islands, and depends solely on the sea for subsistence. The mechanical ingenuity of these people, therefore, is not greater than that of the other Indians; but from constant practice with their wretched boats, they have acquired a dexterity in the use of them unknown to any other tribe, and in some instances, under the direction of the Spaniards, have become comparatively good sailors.

De Azara mentions a curious fact in illustration of the present inquiry. He declares that when his countrymen discovered the Rio de la Plata, they found its shores inhabited by two distinct Indian nations, the Charruas on the north, and the Patagonians on the south; yet strange to say, these restless people had never communicated with each other for war or for peace, for good or for evil, because they had neither boats or canoes in which to cross the river.

The Indian is not defective in courage even on the water; but he lacks invention to construct better vessels, and tact to manage them. When he has been compelled to defend himself in his frail canoe, he has done so with the indomitable spirit of his race; yet with all their love of war and stratagem, I cannot find any account of a naval combat in which Europeans have borne no part.

The Payaguas Indians at one period took revenge on the Spaniards by infesting the rivers of Paraguay, in canoes which they managed with much adroitness; and darting from their lurking places, they intercepted the trading vessels going to and from Buenos Ayres, robbing them of their goods, and destroying their crews without mercy. Such was their success in these river piracies that it required years of war and stratagem on the part of the Spaniards to subdue them.

The only example of a naval contest that I have met with, is described by Dobrizhoffer, to have taken place between the so-called Mamalukes of St. Paulo, in Brazil, and their enemies the Guaranies. The former were a banditti derived from the intermarriage of the dregs of Europeans of all nations with the surrounding Indians; and assisted by two thousand of their native allies, they came forth to battle in three hundred boats. The Guaranies, on the other hand, had five ships armed with cannon. But it is obvious from this statement, that European vessels and European tactics gave the battle all its importance. It took place on the river Mborore, in Paraguay; but after all, both parties finding themselves out of their element on the water, at length abandoned their vessels by mutual agreement, and fought to desperation on shore.

It is said of the inhabitants of New Holland, that their only substitute for a boat is a short and solid log, on which they place themselves astride, and thus venture upon the water. Even this, the humblest of all human contrivances, was in use among the Indians of the Bay of Honduras, who had learned to balance themselves so dexterously standing upon a log, as to be able in this position to pursue their customary occupation of fishing in the adjacent sea.

In fine, his long contact with European arts, has furnished the Indian with no additional means of contending with the watery element; and his log canoe and boat of birch bark, are precisely the same as at the landing of Columbus.

5. *Manner of Interment.* Veneration for the dead is a sentiment natural to man, whether civilized or savage: but the manner of expressing it, and of performing the rites of sepulture, differ widely in different nations. No offence excites greater exasperation in the breast of the Indian than the violation of the graves of his people; and he has even been known to disinter the bones of his ancestors, and bear them with him to a great distance, when circumstances have compelled him to make a permanent change of residence.

But the *manner* of inhumation is so different from that practised by the rest of mankind, and at the same time so prevalent among the American natives, as to constitute another means of identifying them as parts of a single and peculiar race. This practice consists in burying the dead in the *sitting posture;* the legs being flexed against the abdomen, the arms also bent, and the chin supported on the palms of the hands. The natives of Patagonia, Brazil and Guayana; the insular and other Charibs, the Florida tribes, the great chain of Lenape nations, the inhabitants of both sides of the Rocky mountains, and those also of Canada and the vast Northwestern region, all conform, with occasional exceptions, to this conventional rite. So also with the demi-civilized communities from the most distant epochs; for the ancient Peruvians, to whom we have already so frequently referred, possessed this singular usage, as is verified by their numberless remains in the sepulchres of Titicaca. They did not, however, bury their dead, but placed them on the floors of their tombs, seated, and sowed up in sacks. The later Peruvians of the Inca race followed the same custom, sometimes inhuming the body, at others placing it in a tower above ground. Garcilaso de la Vega informs us, that in the year 1560 he saw five embalmed bodies of the royal family, all of whom were seated in the Indian manner, with their hands crossed upon the breast, and their heads bent forward. So also the Mexicans from the most ancient time had adopted the same usage, which was equally the privilege of the king and his people. The most remarkable exception to the practice in question, is that in which the body is dissected before interment, the bones alone being deposited in the earth. This extraordinary rite has prevailed among various tribes from the southern to the northern extremity of their range, in Patagonia, Brazil, Florida and Missouri, and indeed in many intervening localities; but even in these instances the bones are often retained in their relative position by preserving the ligaments, and then interred in the attitude of a person seated. An example among very many others is recorded by the Baron Humboldt, in his visit to a cavern-cemetery of the Atures Indians, at the sources of the Orinoco; wherein he found hundreds of skeletons preserved each in a separate basket, the bones being held together by their natural connections, and the whole disposed in the conventional posture of which we are speaking.

I am well aware that this practice has been noticed by some navigators among the Polynesian islands; the instances, however, appear so few as rather to form exceptions to the rule, like those of the Nassamones of northern Africa: but I have sought for it in vain among the continental Asiatics, who, if they ever possessed it, would have yet preserved it among some at least of their numberless tribes.

After this rapid view of the principal leading characteristics of the American race, let us now briefly inquire whether they denote an exotic origin; or whether there is not internal evidence that this race is as strictly aboriginal to America as the Mongolian is to Asia, or the Negro to Africa.

And first, we turn to the Mongolian race, which, by a somewhat general consent is admitted to include the Polar nations, and among them the Eskimaux of our continent. It is a very prevalent opinion that the latter people, who obviously belong to the Polar family of Asia, pass insensibly into the American race, and thus form the connecting link between the two. But without repeating what has already been said in reference to the Indian, we may briefly advert, for the purpose of comparison, to the widely different characteristics of the Eskimaux. These people are remarkable for a large and rather elongated head, which is low in front and projecting behind; the great width and flatness of the face is noted by all travellers: their eyes are small and black, the mouth small and round, and the nose is so diminutive and depressed, that on looking at a skull in profile the nasal bones are hardly seen. Their complexion, moreover, is comparatively fair, and there is a tendency throughout life to fulness and obesity. The traveller Hearne, while in company with a tribe of northern Indians, mentions a circumstance which is at least curious, because it shows the light in which the Eskimaux are regarded by their proximate neighbors on the south. He was the unwilling witness of a premeditated and unprovoked massacre of an entire encampment of Eskimaux, men, women, and children; and it is curious to remark that the aggressors apologised for their cruelty not only on the plea of ancient feud, but by asserting that their unoffending victims were a people of different nature and origin from themselves, even in respect to sexual conformation.

The moral character of the Eskimaux differs from that of the Indian chiefly in the absence of the courage, cunning, cruelty and improvidence so habitual in the red man, who, in turn, is inferior in mechanical ingenuity, and above all in aquatic exercises. The Eskimau, notwithstanding the intense cold of his climate, has been called an amphibious animal, so readily and equally does he adapt himself to the land or water. His boat is an evidence of mechanical skill, and the adroit manner in which he manages it is a proverb among mariners. The women are not less expert and enterprising than the men: each possesses a boat of peculiar and distinctive construction; and Crantz informs us that children of the tender age of seven or eight years commence the unassisted management of their little vessels.

How strongly do these and other traits which might be enumerated, contrast with those of the Indian, and enforce an ethnographic dissimilarity which is confirmed at every step of the investigation!

Some writers, however, think they detect in the Fuegian a being whose similar physical condition has produced in him all the characteristics of the Eskimau; but we confidently assert that the latter is vastly superior both in his exterior organization and mental aptitude. In truth the two may be readily contrasted but not easily compared. The Fuegian bears a coarse but striking resemblance to the race to which he belongs, and every feature of his character assists in fixing his identity. The extremes of cold, with their many attending privations, by brutifying the features and distorting the expression of the face, reduce man to a mere caricature, a repulsive perversion of his original type. Compare the Mongols of Central Asia and China, with the Polar nations of Siberia. Compare also the Hottentot with the contiguous black tribes on the north; the Tasmanian negro with the proper New Hollanders; and lastly, the wretched Fuegian with the Indian beyond the Magellanic strait; and we find in every instance how much more the man of a cold and inhospitable clime is degraded, physically and intellectually, than his more fortunate but affiliated neighbor. The operation of these perverting causes through successive ages of time, has obscured but not obliterated those lineaments which, however modified, point to an aboriginal stock.

Without attempting to enter the fathomless depths of philology, I am bound to advert to the opinion of Mr. Gallatin, that all the nations from Cape Horn to the Arctic Ocean, have languages which possess "a distinct character common to all, and apparently differing from those of the other continent with which we are acquainted;" an analogy, moreover, which is not of an indefinite kind, but consists for the most part in peculiar conjugational modes of modifying the verbs, by the insertion of syllables. It has been insisted by some writers that this analogy proves the cognate relation of the Eskimaux and Indians. This, however, is a mere postulate; for from the evidence already adduced in respect to the ethnographic difference between these people, we have a right to infer that the resemblance in their respective languages has not been derived by the greater from the lesser source,—not by the Americans from the Eskimaux, but the reverse: for the Asiatics having arrived at various and distant periods, and in small parties, would naturally, if not unavoidably, adopt more or less of the language of the people among whom they settled, until their own dialects finally merged in those of the Chepewyan and other Indians who bound them on the south.

The Eskimaux, it may be remarked, at the present time extend much further south, and are much more numerous on the western than on the eastern coast of America, being found as low down as Mount St. Elias; south of which, contrary to what is observed on the opposite side of the continent, they become more or less blended with the Indian tribes, and have imparted to the latter some portion of their mechanical ingenuity. This difference in the extent and influence of the western and eastern Eskimaux, is explained by the proximity of the former to Asia; and a redundant population has even forced some of them back to the parent hive, whither they have carried a dialect derived from the cognate tribes of America. Such are the Tsutchchi, who thus form a link between the Polar nations of the two continents.

It is a common opinion, also, that America has been peopled by the proper Mongols of central and eastern Asia; and volumes have been written on supposed affinities, physical, moral and intellectual, to sustain this hypothesis. We have already glanced at the Mongolian features, as seen, though rudely and extravagantly developed, in the Polar nations; but there are some characters so prevalent as to pervade all the ramifications of the great Mongolian stock, from the repulsive Calmuck to the polished and more delicately featured Chinese. These are the small, depressed, and seemingly broken nose; the oblique position of the eye, which is drawn up at the external angle; the great width between the cheek bones, which are not only high but expanded laterally; the arched and linear eyebrow; and lastly, the complexion, which is invariably some shade of yellow or olive, and almost equally distant from the fair tint of the European and the red hue of the Indian. Without attempting a detailed comparison, we may briefly observe that the Mongolian, in his various localities, is distinguished for his imitative powers and mechanical ingenuity, and above all for his nautical skill, in which, as we have suggested, he holds a place next to the nations of the Caucasian race. In fine, we are constrained to believe that there is no more resemblance between the Indian and the Mongol in respect to arts, architecture, mental features and social usages, than exists between any other two distinct races of mankind. Mr. Ranking has written an elaborate treatise to prove that the Mongols, led by a descendant of Genghis Khan, conquered Peru and Mexico in the thirteenth century; but in the whole range of English literature there cannot be found a work more replete with distorted facts and illogical reasoning. The author begins by the singular assertion that "when Cuzco was founded by Manco Capac, none of the civilization introduced by the Peruvians and Mexicans was in existence;" thus overlooking the cultivated tribes who preceded the Inca family, and disregarding also the various demi-civilized nations which successively followed each other in Mexico, before that country fell under the rule of the Aztecs. Mr. Ranking introduces the Mongols in large ships, with all the appliances of war, not even excepting elephants; and in order that the Tartar general may correspond to Manco Capac, he is made to enter Peru by the Lake Titicaca, upwards of an hundred miles from the sea. Such statements may seem too absurd for sober discussion; but they are not more so than various other subterfuges which have been resorted to in explanation of the precise manner in which the new world has been peopled from the old.

But there is not a shadow of evidence that the Mongols ever reached America in ships excepting by mere accident; and therefore their number must have always been too small, and too badly provided, to have dreamt of conquest in a country which has had a population of millions from immemorial time.

There is a third view of this question which remains to be noticed; for, allowing that the Eskimaux and the cognate Polar nations are not the progenitors of the American race; and admitting also that the Mongols of central Asia could never have arrived in any requisite number by a direct voyage from one continent to the other, yet it is supposed by many learned men that these Mongols could have reached America by slow journeys from their own distant country; and that their hieroglyphic charts delineate many of the incidents of their journey: but there is no positive evidence in regard to direction and localities, although these, by a very general consent, are placed in the north and northwest. Cabrera, on the contrary, after the most patient research, aided by unusual facilities for investigation, traces the primal seat of the civilized nations of America to southern Mexico, where the ruined cities of Copan, Uxmal and Palenque, point to an epoch seemingly much more remote than any antiquities contained in the present metropolis of that country.

If we conventionally adopt the more prevalent opinion, and trace the Aztecs back to California or the strait, we have after all but a vague tradition of a handful of persons, who, for all we know to the contrary, may have been as indigenous to America as any people in it. The aborigines of this continent have always been of nomadic and migratory habits; a fact which is amply illustrated in the traditional history of Mexico itself. So also with the barbarous tribes; for the Lenape, the Florida Indians, the Iroquois, the insular Charibs and many others, were intruding nations, who, driven by want, or impelled by an innate and restless activity, had deserted their own possessions to seize upon others which did not belong to them. These nations, like their more polished neighbors, were in the constant practice of recording the events of their battles and hunting excursions by hieroglyphic symbols, made, according to circumstances, on trees, skins or rocks; and this rude but expressive language of signs, has been justly regarded as the origin of the picture-writing of the Mexicans. "The difference between them," observes Dr. Coates, "does not appear greater than must necessarily exist between ignorant warriors and hunters in a simple form of society, and those of the members of a complicated state, possessed of property, and even, as described by Clavigero, of a species of science and literature."

This gradation of the ruder into the more perfect art of hieroglyphic writing, not only affords an additional argument for the unity of origin of the American nations, but also constitutes another proof of the distinctness of their race; for this picture-writing, even in its most elaborate forms, bears no other than the most general resemblance to any exotic hieroglyphics, nor indeed has a real equivalent been detected between them. We may therefore be permitted to repeat our conviction that the annals of the Mexicans bear no indisputable evidence of immigration from Asia; but, on the other hand, that they are susceptible of as many different interpretations as there are theories to be supported.

It is remarked by Dr. Coates, that the Mongolian theory, which we are now considering, is objectionable on account of its vastness. "To derive the population of the whole of the American continent from the northwestern angle, requirés the supposition of a continued chain of colonies during a long succession of ages, acquiring and using an immense diversity of languages, and pursuing each other along the huge ridge of the great American Andes, from Prince William's Sound in the far north, to the extremity of Terra del Fuego, a distance of one hundred and fifteen degrees of latitude, or of eight thousand miles. This long succession of occurrences is absolutely necessary to the theory; which is thus liable to the difficulty of requiring two extensive hypotheses at once. Several hundred colonies must be imagined to have issued from the same point, all completely isolated, as their languages abundantly show, unconnected by peaceful intercourse, but urging each other by war and the destruction of the game, throughout a third part of the circumference of the globe.

"The traces of such a series of human waves would be naturally looked for in a tendency to advance population in the north, from which they emanated, and where the pressure must have been greatest and the colonization of longest duration. Nothing like this is observed; the population of South America, and of Darien, Guatimala and Mexico, being much greater in proportion than that of any country farther north. The marks of early civilization, too, one of the most important proofs of long residence in a fixed spot, are all, as in the older world, in favor of the tropical climates."*

We may further inquire, how it happens that during the lapse of more than three hundred years since the discovery of America, there has not been an authenticated immigration from Asia? The long and desolating wars which have driven whole nations from the central to the northern parts of that continent, have not supplied a single colony to the New World. Nay, if such colonization had occurred within a thousand or two thousand years, would we not now possess more indubitable evidences of it in language, customs and the arts?

We propose in the next place, to make a very few observations in reference to the idea that America has been peopled by the MALAY race, which, in the ordinary classification, includes the Malays proper of the Indian Archipelago, and the Polynesians in all their numberless localities. These people, however, have so much of the Mongolian character, that nearly the same objections arise to both. The head of the Malay proper, is more like that of the Indian, because it not unfrequently presents something of the vertical form of the occiput; and the transverse diameter, as measured between the parietal bones, is also remarkably large. But excepting in these respects, the osteological developement coincides with that of the Mongolian; while the whole category of objections which we have just urged against the latter people, is equally valid in respect to the whole Malay race. For independently of differences of organization, how great is the disparity in their arts and social institutions! So great, indeed, that to account for it, Dr. Lang, one of the most ingenious supporters of the theory, insists on an intellectual degeneracy, consequent to change of climate and circumstances. "It is an easy and natural process," says he, "for man

*On the Origin of the Indian Population of America. By B H. COATES, M. D. 1834.

to degenerate in the scale of civilization, as the Asiatics have evidently done in travelling to the northward and eastward. He has only to move forward a few hundred miles into the wilderness, and settle himself at a distance from all civilized men, and the process will advance with almost incredible celerity. For, whether he comes in contact with savages or not, in the dark recesses of the forest, his offspring will speedily arrive at a state of complete barbarism."

We confess our difficulty in imagining how the Polynesians, themselves a barbarous people, though possessing some of the attributes of civilized life, should become savages in the tropical regions of America, wherein the climate must be as congenial to their constitutions as their own, and the various other external circumstances are calculated to foster rather than to depress the energies of a naturally active and intelligent people. But the general prevalence of easterly winds is adverse to the colonization of America from the islands of the Pacific; for the nearest of these islands is one thousand eight hundred miles from the American coast; and when we reflect on the many difficulties which the mere distance opposes to navigation in small vessels, and the absolute necessity for food and water for a long period of time, we feel compelled to believe that America has received very feeble if any accessions to its population from the Polynesian islands. Such voyages, if admitted, could only have been accidental; for it is not to be supposed that these islanders would have attempted remote discoveries on the vast Pacific ocean in the very face of the trade winds; and a successful issue is among the least probable of human events.

Even admitting that the Polynesians have accomplished all that the theory requires, how does it happen that on reaching the continent of America, they should all at once have relinquished their intuitive fondness for the water, forgotten the construction of their boats, and become the most timid and helpless navigators in the world?

A comparison of languages, moreover, gives no support to the Polynesian hypothesis; for all the zeal and ingenuity which have been devoted to this inquiry, have tended only to disclose a complete philological disparity.

The theories to which we have thus briefly adverted, would each derive the whole American population from a single source; but various others have been hazarded of a much more complex nature, by which the Indian nations are referred to a plurality of races, not even excepting the Caucasian. For example, the Peruvians, Muyscas and Mexicans, are by some advocates of this system, supposed to be Malays or Polynesians, and all the savage tribes Mongolians; whence the civilization of the one and the barbarism of the other. But we insist that the origin of these two great divisions must have been the same, because all their ethnographic characters, not excepting the construction of their numberless languages, go to enforce an identity of race.

Another doctrine which has had many disciples, (among whom was the late Lord Kingsborough, author of *Mexican Antiquities*) teaches that the whole American population is descended from the Jews, through the ten lost tribes which were carried away by Salmanazer, King of Assyria. Here again the differences of physical organization should set this question at rest forever; but independently of these, can we suppose that people so tenacious as the Jews, of their literature, language, and religion, should not have preserved a solitary unequivocal memorial of either among the multitudinous tribes of this continent, if any direct affiliation had ever existed between them? In short, we coincide in opinion with a facetious author who sums up all the evidence of the case with the conclusion, that "the Jewish theory cannot be true for the simple reason that it is impossible."

We feel assured that the same objection bears not less strongly on every other hypothesis which deduces any portion of the American nations from a Caucasian source. In order to solve the problem of the origin of the monuments of America, independently of any agency of the aboriginal race, an opinion has been advanced that they are the work of a branch of the great Cyclopean family of the old world, known by the various designations of the Shepherd Kings of Egypt, the Anakim of Syria, the Oscans of Etruria and the Pelasgians of Greece. These *wandering masons*, as they are also called, are supposed to have passed from Asia into America at a very early epoch of history, and to have built those more ancient monuments which are attributed to the Toltecan nation. This view, supported as it is by some striking resemblances, and especially in architectural decoration, leaves various important difficulties entirely unexplained: it necessarily presupposes a great influx of foreigners to account for such numerous and gigantic remains of human ingenuity and effort, at the same time that no trace of this exotic family can be detected in the existing Indian population. They and their arts are equally eradicated; and we can only conceive of the presence of these migratory strangers in small and isolated groups, which might have modified the arts of an antecedent civilization, while they themselves were too few in number to transmit their lineaments to any aboriginal community.

Closely allied to this theory, is that of our ingenious countryman, Mr. Delafield, who derives the demi-civilized nations of America from "the Cuthites who built the monuments of Egypt and Indostan." He supposes them to have traversed all Asia to reach Behring's strait, and thus to have entered America at its northwest angle, whence they made their way by slow journeys to the central regions of the continent. Our objections to this theory will be found in what has been already stated; and we may merely add, that the *route* by which the author conducts his pilgrim adventurers, appears to constitute the least plausible portion of his theory. Mr. Delafield supposes the barbarous tribes to be of a different stock, and refers them to the Mongolians of Asia; thus adopting the idea of a plurality of races.

We shall lastly notice an imaginative classification which separates the aborigines of America into four *species* of men, exclusive of the Eskimaux. This curious but unphilosophical hypothesis has been advanced by Bory de St. Vincent, a French naturalist of distinction, who considers the civilized nations to be cognate with the Malays, and designates them by the collective name of the *Neptunian species;* while to his three remaining species, — the Columbian, the American and the Patagonian, he assigns certain vague geographical limits, without establishing any distinctive characteristics of the people themselves. The system is so devoid of foundation in nature, so fanciful in all its details, as hardly to merit a serious analysis; and we have introduced it on the present occasion to illustrate the extravagance and the poverty of some of the hypotheses which have been resorted to in explanation of the problem before us.

Once for all I repeat my conviction, that the study of physical conformation alone, excludes every branch of the Caucasian race from any obvious participation in the peopling of this continent. If the Egyptians,* Hindoos, Phenicians or Gauls have ever, by accident or design, planted colonies in America, these must have been, sooner or later, dispersed and lost in the waves of a vast indigenous population. Such we know to have been the fact with the Northmen, whose repeated, though very partial settlements in the present New England States, from the tenth to the thirteenth centuries, are now matter of history; yet, in the country itself, they have not left a single indisputable trace of their sojourn.

In fine, our own conclusion, long ago deduced from a patient examination of the facts thus briefly and inadequately stated, is, that the American race is essentially separate and peculiar, whether we regard it in its physical, its moral, or its intellectual relations. To us there are no direct or obvious links between the people of the old world and the new; for

* With respect to the Egyptians and Hindoos as involved in this question, I can speak without reservation. Through the kindness of an accomplished gentleman and scholar, George R. Gliddon, Esq., late United States Consul at Cairo, I have received ninety heads of Egyptian mummies from the tombs of Abydus, Thebes and Memphis; and I unhesitatingly declare, that, with a very few exceptions, which have a mixed character, and resemble the Coptic form, the conformation throughout is that of the Caucasian race. In every instance in which the hair has been preserved, it is long, soft and curling, and indeed as silky as that of the most polished Europeans of the present time. I am now preparing, with the title of *Crania Ægyptiaca*, a brief exposition of the facts connected with these interesting relics of antiquity.

I possess also about thirty crania of the Hindoos, among which there is not one that could be mistaken for an Indian skull. In fact there is an obvious contrast between them in all respects excepting the internal capacity, which is nearly the same in the Hindoo and Peruvian.

even admitting the seeming analogies to which we have alluded, these are so few in number and evidently so casual as not to invalidate the main position: and even should it be hereafter shown, that the arts, sciences and religion of America, can be traced to an exotic source, I maintain that the organic characters of the people themselves, through all their endless ramifications of tribes and nations, prove them to belong to one and the same race, and that this race is distinct from all others.

This idea may at first view seem incompatible with the history of man, as recorded in the Sacred Writings. Such, however, is not the fact. Where others can see nothing but chance, we can perceive a wise and obvious design, displayed in the original adaptation of the several races of men to those varied circumstances of climate and locality, which, while congenial to the one, are destructive to the other. The evidences of history and the Egyptian monuments go to prove that these races were as distinctly stamped three thousand five hundred years ago as they are now; and, in fact, that they are coeval with the primitive dispersion of our species.

Art. XVI.—DESCRIPTIONS AND FIGURES OF THE ARANEIDES OF THE UNITED STATES. By Nicholas Marcellus Hentz, Florence, Ala.

[Continued from page 57.]

Genus. Atypus, Latr. Oletera, Walck.

Characters. *Cheliceres large with a fang nearly equal to their length, articulated downward; maxillæ tapering upward, insertion of the palpi lateral; lip concealed; eyes eight, subequal, collected in front of the cephalothorax, two in the centre, and, on each side of these, there is a cluster; feet,* 4. 1. 2. 3.

Habits. Araneides sedentary, dwelling in silk tubes placed in the ground.

Observations. The habits of the animals of this subgenus are but little known, owing to the obscure locations which they select. They are probably nocturnal.

ATYPUS NIGER.

Description. Deep black; cephalothorax flattened, horny, with three depressions; a white membrane at the base of the cheliceres. A small species.

Observations. A solitary individual (a male) was found in June, on newly turned soil, at Northampton, Mass., by the son of the late Prof. W. D. Peck. I am not acquainted with *A. rufipes* found by Mr. Milbert, near Philadelphia.

Habitat. Massachusetts.

Pl. VIII. Fig. 1. Atypus niger. *a.* Its trophi. *b.* Its eyes.

Genus. Dysdera. Latr. Walck.

Characters. *Cheliceres large, fangs articulated inward; maxillæ straight, wide at base, narrowed above the insertion of the palpi, inner edge cut obliquely towards the point; lip half as long as the maxillæ, emarginate at tip; eyes six, subequal, four in a line curved towards the base, and one each side nearer the anterior edge, but leaving an open space between them; feet, first pair longest, the second and fourth nearly equal, the third shortest.*

Habits. Araneides sedentary, dwelling in silken tubes, under stones or in crevices.

Observations. The large size of the cheliceres, and other minor characters, show some affinity to Mygale. The only species here described being made known to me by Dr. T. W. Harris, I am not acquainted with many facts necessary to give a good history of this subgenus.

DYSDERA INTERRITA.

Description. Ferruginous; cephalothorax and trophi piceous.

Observations. This species was communicated to me by my excellent friend Dr. T. W. Harris, of Massachusetts, who sent me the male and the female, also, with a correct sketch of both sexes. It inhabits that State and was found in cavities under ground, under rotten wood, &c., in the month of May.

Pl. VIII. Fig. 2. Dysdera interrita. *a.* Its trophi. *b.* Its eyes.

Genus. Pylarus. Mihi.

Characters. *Cheliceres small, fang very short, maxillæ slightly inclined over the lip, long and slightly rounded at tip; lip tapering, half as long as the maxillæ; eyes six, equal, in three pairs, two in the middle, and two each side, placed diagonally on a common elevation, nearer the anterior edge; feet, first, second and fourth pairs subequal, third shortest, penultimate joint of the first pair armed with hooks in the male.*

Habits. Araneides sedentary, forming a silken tube in crevices of walls, with a few threads spreading from the orifice unto the edge of the crevice, the spider watching near the entrance with its three anterior legs extended out.

Observations. This subgenus which was first confounded by me with Dysdera, differs from it by the small size of its cheliceres, and the position of its eyes. By the habits of the spiders which compose it, it bears close affinity to Segestria, but the position of its eyes is reversed. It is obvious that as this is not Segestria, and cannot be referred to Dysdera, it must constitute a new subgenus.

1. PYLARUS BICOLOR.

Description. Cephalothorax piceous; abdomen bluish-black; first and second pairs of legs blackish, hairy, third and fourth piceous. Male piceous; abdomen with the base and sides paler; feet with few hairs, penult joint of the first pair crooked and with two strong spines, the antepenult with about four strong bristles on each side.

Observations. This spider, which is very common in Alabama, makes its tubular habitation in the crevices of walls, commonly waiting near the orifice with its three first pairs of legs directed forwards. Its silken tube spreads out on the outside, and, whenever an insect touches one of the threads, the spider issues out with the rapidity of a hawk and seizes its victim, which it carries immediately within. In damp, rainy nights, the males and females are often found wandering from their homes. The male, which is provided with very unusual means of defence on its first pair of legs, is nevertheless excessively cautious in his approach to the residence of the female. He advances with the utmost caution, remaining motionless near the entrance for hours. This takes place in October. I once observed a male in that situation, and wishing to secure him, suddenly transfixed his cephalothorax with a pin, when the female furiously rushed out and boldly grasped him, struggling to carry him off; and she nearly succeeded in robbing me of my prey, which she seemed to consider her own. I have found this species hibernating in silken tubes, along with various species of Attus, in December and January. This proves that Dysdera *pumila* is not a variety of it.

Habitat. North Alabama.

Pl. VIII. Fig. 3. Pylarus bicolor. ♀. *a.* Its trophi. *b.* Its eyes. Fig. 4. The ♂ of Pylarus bicolor. *a.* Its right palpus.

2. PYLARUS PUMILUS.

Description. Livid yellow; abdomen dusky on the disk and towards the apex; first and second pairs of legs with the two last joints dusky; hairy.

Observations. This species is usually found under the bark of trees, enclosed in silk tubes.

Habitat. North Carolina, North Alabama.

Pl. VIII. Fig. 5. Pylarus pumilus.

Genus. Filistata. Latr.

Characters. *Cheliceres small, incapable of reciprocal motion, fang very small; maxillæ bent and surrounding the lip, terminating in a point; lip more than half the length of the maxillæ, widest in the middle, ending in a point; eyes eight, subequal, placed closely together on a common elevation,* *two in the centre, usually black, three on each side, leaving a space above and below opened towards the middle ones; feet,* 1. 4. 2. 3.

Habits. Araneides sedentary, forming a tube of silk in the crevices of old walls, with loose threads spread out round the orifice, the spider usually watching at the entrance.

Observations. The characters derived from the cheliceres, which are articulated together so as to allow of little or no reciprocal motion, is peculiar to this subgenus. On the whole, it seems to have a greater affinity to CLOTHO than to any of the TETRAPNEUMONES of Latreille; and, by its habits, it is closely related to my PYLARUS and to SEGESTRIA. Independent of the difficulty of ascertaining the pulmonary orifices, these points of affinity between DIPNEUMONES and TETRAPNEUMONES show that the distinction may prove an artificial one.

1. FILISTATA HIBERNALIS.

Description. Deep mouse-colored, covered with fine short hair; cephalothorax darker; cheliceres small. Male pale grey or livid; palpi excessively long, two middle eyes black, the others shining white.

Observations. It makes a tubular habitation of silk in crevices on old walls or rocks, throwing an irregular web which is spread on the wall or stone around the aperture. It comes out occasionally during the winter, but cold is apt to render it torpid, and it then remains several days in the same situation, moving slightly in the middle of the day. In walking, it uses its palpi like feet, and these organs are very long, particularly in the male. I saw one of this species change its skin in confinement. It had previously lost a leg by some accident, but after moulting, it had a new one which had all its joints, only a little shorter than the natural size; its cocoon is spherical.

Habitat. South Carolina on the sea-coast, North Alabama on the banks of the Tennessee.

Pl. VIII. Fig. 9. Filistata hibernalis. ♀. *a.* Its trophi, with the palpi of the ♂. *b.* Its eyes.

2. FILISTATA CAPITATA.

Description. Dusky brown; eyes much elevated, cephalothorax with a deep longitudinal impression, beginning above the eyes and not reaching the base; cheliceres not closely articulated together; abdomen and feet with short hairs.

Observations. This species, communicated to me by Mr. Thomas R. Dutton, was brought by him from Georgia, where it inhabits crevices like FILISTATA *hibernalis.* No females were brought. It is strange that its cheliceres are not joined together as in that species. The trophi in other respects correspond entirely with it.

Habitat. Georgia.

Pl. VIII. Fig. 7. Filistata capitata, ♂.

Genus. LYCOSA. Latr.

Characters. *Cheliceres large, fangs moderate; maxillæ short, parallel, cut obliquely at the tip; lip short, slightly emarginate at the upper edge, which is slightly narrower than the base; eyes eight, unequal, four small placed anteriorly in a straight or slightly curved line, two large placed above the two external ones of the first line, two of middle size placed further out towards the base and nearly forming a square with the intermediate ones; feet,* 4. 1. 2. 3.

Habits. Araneides making no web, wandering for prey, hiding under stones and frequently making holes in the ground in which they dwell, making at the orifice a ring of silk, forming a consolidated entrance; cocoon usually orbicular, often carried about by the mother, the young borne on the back of her abdomen.

Observations. The subgenus LYCOSA is not variable in its characters like DOLOMEDES. The lower row of eyes is straight in some species and more or less curved in others, but I could not avail myself of this to make any satisfactory subdivision. The upper mammulæ, it is true, are longer in LYCOSA *lenta,* but I found them to vary in length in others so imperceptibly that I could not adopt any of the three families of Walckenaer, which appear to me quite artificial. These spiders are the eagles and lions of the family. They are found swarming on the ground, running with great agility, a property belonging to those spiders in which the fourth pair of legs is longest. Most are usually found wandering for prey, except when engaged in maternal duties; others dwell in holes several inches deep, well rounded and supplied with a ring of silk and little straws, consolidated so as to prevent the crumbling of the earth. I have found one of these, in the winter, which was supplied with a lid, and probably they all close the orifice for hibernation. The mother carries its cocoon attached to the posterior part of the abdomen. Small species ramble about with these; but the larger ones watch them in their habitation or under stones. The moment the young ones are hatched, they climb on the abdomen of the mother, and remain there for a considerable time. They give a monstrous and horrible appearance to the mother, which seems hairy and twice as large as usual. If the parent be touched or forcibly arrested, the young Spiders instantly disperse and disappear. The mother when deprived of its cocoon seems to loose all her ferocity and activity, but if it be placed near her, the moment she perceives it, these powers return, and she rushes to the cocoon, which she grasps with renewed vigor. She defends her progeny to the last, and her feet can be torn from her one by one, before she can be compelled to abandon her treasure. Thus can maternal tenderness be exhibited in beings which are relentless to their own species and even to the sex which gives life to its progeny. It is extremely difficult to distinguish the different species of Lycosa, owing to the infinite varieties in colors, marking and size. Future writers will probably clear the confusion which I boast not of having removed during twenty years of studious attention to this subgenus.

1. LYCOSA FATIFERA.

Description. Bluish black; cephalothorax deeper in color at the sides; cheliceres covered with rufous hairs and with a red elevation on their external side near their base; one of the largest species.

Observations. This formidable species dwells in holes, ten or twelve inches in depth, in light soil, which it digs itself; for the cavity is always proportionate to the size of the spider. The orifice of the hole has a ring, made chiefly of silk, which prevents the soil from falling in when it rains. This LYCOSA, probably as large as the *Tarantula* of the South of Europe, is common in Massachusetts; but we have not heard of serious accidents produced by its bite. Its poison, however, must be of the same nature and as virulent. The reason perhaps why nothing is said of its venom, is, that so very few instances can have occurred of its biting any body. All persons shun spiders, and these shun mankind still more. Moreover their cheliceres cannot open at an angle which can enable them to grasp a large object. Without denying its power to poison, which it certainly has, it is well to expose popular errors, such as that of the Romans in regard to the bite of the shrew which it is now proved cannot open its mouth wide enough to bite at all. This spider, when captured, shows some combativeness, and has uncommon tenacity of life. It is a laborious task to dig down its deep hole with the care necessary not to injure it. I have at times introduced a long slender straw downward, till I could feel a resistance, and also the struggle of the tenant; and I could perceive that it bit the straw. In one or two instances, by lifting the straw gradually, I brought up the enraged spider still biting the inert instrument of its wrath. It probably lives many years. A piceous variety is found in Alabama, with the two first joints of the legs, pectus and abdomen yellowish underneath, or lighter in color.

Habitat. Massachusetts, North Alabama.

Pl. VIII Fig. 8. Lycosa fatifera. *a.* Its trophi. *b.* Its eyes.

2. LYCOSA (TARANTULA) CAROLINENSIS? Bosc. M. S.

Description. Mouse-colored; cephalothorax with an indented blackish mark at base; cheliceres covered with rufous hairs in front, and with a red elevation; abdomen with several whitish dots and angular transverse lines on the disk, sides nearly white; beneath, usually quite black, except the legs, which are whitish, the joints tipped with black. Male with nearly the same marks, very black beneath. Attains a very large size.

Observations. This spider has the same habits as L. *fatifera*, making deep excavations in the ground. It is frequently found under stones, and possibly it is in such places, nearer the surface, that the eggs are hatched. The female carries her young on her back, presenting a hideous aspect, being then apparently covered with animated warts. The little monsters have the instinct, if the mother is much disturbed, to escape and scatter in all directions. The male, not unfrequently of an enormous size, is often found wandering in October and November, in Alabama, and sometimes enters houses.

Habitat. North Carolina, Georgia, North Alabama.

Pl. VIII. Fig. 9. L. (Tarantula) Carolinensis? *a.* One leg, seen underneath.

Art. XVII.—DESCRIPTIONS OF THE FISHES OF LAKE ERIE, THE OHIO RIVER AND THEIR TRIBUTARIES. By Jared P. Kirtland, M. D.

[Continued from page 26.]

Coregonus. Cuv.

C. *Artedi.* Le Sueur. The Herring-Salmon.

Coregonus artedi. Le Sueur. Jour. Acad. Nat. Sciences, p. 231.
" " Richardson. Fauna Boreali-Amer., p. 203.
" " Kirtland. Report on the Zoology of Ohio, p. 193.

Plate IX. Fig. 1.

Le Sueur's description of this species, contained in the first volume of the " Journal of the Academy of Natural Sciences, of Philadelphia," I copy entire.

" C. Artedi. *Body* sub-fusiform, a little elevated at the back ; *head* small, having an osseous radiated plate, which is covered by the skin ; *snout* pointed.

In form this species approaches the Scombers; a section of it is oval. *Head* small and narrow; *snout* short, terminated by small intermaxillaries; *maxillaries* wide, sharp-edged as in the herring, edges entire; *mandibles* carinate, producing inversely a triangular pedunculate expansion, very small conical teeth inserted in the skin of the lips, at the extremity of the jaws: these teeth were sufficiently manifest in a small individual, but not visible in a larger one, a female, which came under my observation. Rays in the osseous plate of the head tubular, and open at the exterior, some tending backwards, and others towards the end of the snout. A faint carinated line divides the top of the head in the dried specimens. *Lateral line* straight and near the middle; *nostrils* double, close to the end of the snout, and articulation of the maxillaries; scales round, approximated, easily falling off; the base of the tail is covered with them.

Color. Ash blue at the back, paler and silvery on the rest of the body, with yellow tints on the tail, head and dorsal; *iris* whitish, pupil black.

B. 9; P. 16; D. 12; V. 12; A. 13; C. $\frac{6}{6}$ rays.

Length ten to twelve inches. Very delicate food. Taken in Lake Erie, and at Lewiston, Upper Canada. Called Herring-Salmon."

Observations. The specimens I have seen of this species, were more highly colored than those described by Le Sueur. The upper surface of the head is tinged with green; the back is of a bluish ash-color and olive, fading on the sides to sky-blue; the sides and abdomen of a brilliant silver lustre. The side of the head anterior to the eye is delicately diaphanous, and the gill-covers are slightly touched in different parts with a metallic lustre.

The rays of the caudal fin are so much blended, that they cannot be accurately counted.

It is taken in the month of September at Cleveland, in considerable numbers, and is decidedly the best fish for eating obtained in that vicinity.

Esox. Lin.

E. *reticulatus.* Le Sueur. The Pickerel. Pike.

Esox reticulatus. Le Sueur, Jour. Acad. Nat. Sciences, Vol. I. p. 414.
" " Kirtland. Report on the Zoology of Ohio, p. 194.
" " Storer. Report on the Ichthyol. of Mass., p. 97.

Plate X. Fig. 2.

Head elongate, sloping from the base of the skull to the tip of the nose, longitudinally sulcate between the eyes.

Lower jaw longer, the front teeth short, the lateral elevated and larger; a series of large glandular orifices evident on the edge of the lower jaw and preoperculum.

Body sub-cylindric, compressed laterally; back rounded, slightly depressed longitudinally before the dorsal fin; scales emarginate, small.

Dorsal and *anal fins* rounded, the former larger, the latter slightly posterior, both placed on fleshy bases.

Caudal fin bi-lobed, lobes obtuse, rounded.

Ventral and pectoral fins small, short and falcate.

Color. *Head* and *back* deep olive and green, *sides* yellowish, marked with oblique and longitudinal bars of green, which give them a reticulated appearance; *throat* and *belly* white. *Dorsal, caudal* and *anal fins* yellowish and reddish, reticulated in a similar manner with bands and spots of deep olive or green.

Length. The specimen before me is 21 inches. Some are taken that are 4 feet in length.

Habitat. Lake Erie, the Ohio river and most of their tributaries.

D. 18; C. 20; A. 15; V. 11; P. 16 rays.

Observations. The drawing was made from a specimen taken at Cleveland. The colors were darker and more brilliant than in any that I have seen. The number of rays in the caudal and anal fins does not agree with Le Sueur's description.

It is probably specifically identical with the fish known in ponds and rivers of the Atlantic States under the same name, but from locality, assumes some variety of form and colors, and also attains a greater size in the large Western Lakes, than in any other part of the country. Those taken in the Ohio are generally of a smaller size.

ANGUILLA. Cuv.

A. *lutea*. Raf. The Yellow Eel.

Anguilla lutea. Raf. Ichthy. Ohien. p. 78.
" *laticauda*. Raf. Ichthy. Ohien. p. 77.

Plate XI. Fig. 2.

Head flattened, abruptly elevated behind the eyes, ventricose beneath the throat: *jaws* short, furnished with numerous minute teeth, clustered and extending upon the anterior part of the vomer: *lower jaw* projecting: *eyes* small, situated above the angles of the mouth.

Body cylindric, elongate and fusiform, covered with minute oval-oblong scales, evident to the naked eye only when the skin is dessicated. *Vent* anterior to the middle of the body: *lateral* line commences before the pectoral fins and is flexuous above that fin.

Pectoral fin small, obovate-falcate; with about 15 rays.

Dorsal, caudal and *anal fins* continuous and uninterrupted, wider above and near the tip of the body, acuminate at the extremity. The dorsal commences anterior to the anal, and immediately behind the vent; numerously rayed.

Length from 2 to 3 feet. The specimen from which the drawing was made was 2 feet 9 inches long; 5 inches in circumference at the commencement of the dorsal fin and 4 $\frac{5}{8}$ inches behind the base of the pectorals. From the tip of the lower jaw to the base of the pectoral fin, 4 inches; and from the last point to the vent, 11 inches.

Color. Yellowish-brown on its sides and back, and whitish on the belly; the two colors meeting abruptly on the sides of the abdomen.

Habitat. Ohio and its larger tributaries.

Observations. This species was occasionally seen in the markets of Cincinnati three years since, and being informed that it could be obtained at any time, I took no pains to secure a specimen. Since that time, I have never met with it, and am therefore compelled to make a sketch from a well prepared specimen in the Western Museum in this city, and which Mr. Bartlett has had the politeness to place in my hands for the purpose.

This specimen is labelled "Murena, or Anguilla laticaudata" of Raf. It differs from the description of that species in having the dorsal fin commence so far behind the pectoral fins, and the tail acuminate at its extremity. Further observation may decide that Mr. Rafinesque has made two species out of mere varieties.

None of the species of this genus originally inhabited Lake Erie or its tributaries; but since direct communication has been opened between them and the waters of the Ohio and Mississippi rivers and some of the Atlantic streams, by the construction of several canals, it is said that eels are beginning to appear in the Lake and some of the Lake streams.

I have not at present the means of deciding whether some of our species may not be similar to those of the Atlantic tributaries.

Chatoessus. Cuv.

C. *ellipticus.* Kirtland. The Hickory or Gizzard-Shad.

Chatöessus ellipticus. Kirtland. Report on the Zoology of Ohio, p 195.
Dorosoma notata. (The young.) Rafinesque. Ichthy. Ohien., p. 40.

Plate X. Fig. 1.

Head small, sub-oval, compressed on its sides, $\frac{1}{5}$ the total length; *nose* globose, obtuse; *mouth* small; *upper lip* emarginate, thus increasing the opening of the mouth; *lower jaw* closes into the emargination. *Eyes* large, circular and silvery. *Body* oval, elliptical; *sides* flattened, *back* rounded, *abdomen* compressed, carinate and serrate: *lateral line* not apparent.

Dorsal fin triangular; the posterior ray greatly elongated, recurved.

Caudal fin deeply bilobed, lobes equal, with scales extending upon the base of the rays.

Anal fin narrow, slightly falciform.

Ventral fin narrow, short, and does not extend as far back as the base of the dorsal.

Pectoral fin does not reach to the commencement of the ventral fin.

Length from 12 to 18 inches.

Habitat. Ohio river and its tributaries.

Color. *Back* and *head* olive and bluish, iridescent; *sides* silvery; *abdomen* white, fins, dusky brown.

D. 13; C. 22; A. 32; V. —; P. 15 rays.

Observations. The description of the *Dorosoma notata* by Mr. Rafinesque, would not lead us to suspect that he had this fish in view, yet I believe such was the case. He has applied to the *Dorosoma* the same popular name that this is known by in our markets. The characters he has mentioned of, "a large brown and round spot above the base of the lateral line and two oblong spots of an emerald color above the head" are equally evident in the young of our species but disappear in older specimens.

He however omits to notice an important generic character, the elongated posterior ray of the dorsal fin which is so peculiar and prominent that it could hardly escape observation.

He is also incorrect in saying that "it is a small species, seldom reaching over 9 or 10 inches." I have often met with it measuring 18 inches in length.

He is still further incorrect in his statement that "it comes in the Spring and disappears in the Fall." It is common in the market of Cincinnati during the whole of winter.

There is no necessity for his genus *Dorosoma,* as it was instituted exclusively to embrace this one species, and that species adapts itself so well to the genus *Chatöessus.*

We should, however, have retained the specific name "*notatus*," had not the preference belonged to Le Sueur's *Megalops notatus*, which Cuvier says is a *Chatöessus.* Le Sueur published his description in 1818, and Rafinesque his in 1819 and '20.

It receives the name of the *Gizzard-Shad* from the circumstance that it possesses a muscular stomach, which is large, and resembles the gizzard of a gallinaceous fowl.

The older fishermen inform me, that its appearance in this part of the Ohio, is comparatively rare; it was unknown here until the last twenty years. I believe it never bites at a hook.

A singular mortality seems to have befallen this species during the last few days. From the 1st to the 8th of January, of the present season, 1840, the weather was uniformly cold. It then became warm and pleasant, when great numbers of this species were observed to be dead in the Miami Canal. Others were still living, but in a dying condition. The greater part were found with their heads crowded into some hole in the muddy bank, or some recess under stones. They might also have been seen under similar circumstances along the shores of Mill-creek, near this city. As the mortality was confined exclusively to this species, while others, inhabiting the same localities, were in no wise affected, it is evident that it was the effect of some cause acting peculiarly on these fish.

They probably came up the Mississippi, from some warm climate, and could not resist the late severe cold.

Their object in running their heads into the holes and recesses about the bottom of the Canal, was no doubt to obtain warmth from the earth, beneath, which was of a higher temperature than the water, abounding with numerous floats of ice.

Lucio-perca. Cuv.

L. *Americana.* Cuv. The American Sandre.

Le Sandre d'Amerique. (*Lucio-perca Americana.*) Cuv. et Val. t. 11. p. 122. pl. xvi.
Lucio-perca Americana. Richardson. Fauna Boreali-Americana, p. 10.
" " Kirtland. Report on Zoology of Ohio, p. 19.
Perca fluviatilis, var? Richardson. Franklin's Journal, p. 725. 1823.
" *salmonea.* Raf. Ichthy. Ohien. p. 21.
P. nigro-punctata. Raf. " " p. 23. (The male.)
Salmon of the Ohio river: Pike, of Lake Erie: Pickerel, settlers on Lake Huron: Sandre of the French Canadians: Horn-fish of the Fur traders.

Plate IX. Fig. 2.

Head elongate-cylindric, slightly flattened above the eyes and beneath the throat; not $\frac{1}{4}$ the total length of the fish. *Eyes* oblong-oval, situated above the angles of the mouth. *Iris* yellow. *Pupil* semi-transparent, brownish. *Jaws* equal, armed with sharp, strong, and slightly incurved teeth, those of the vomer, finer. *Tongue* smooth. *Operculum*, margined behind with a membrane and furnished with a spine that is not terminal. *Preoperculum* delicately serrated.

Body cylindric and fusiform. *Vent* behind the middle.

Lateral line straight. *Scales* small and irregular.

Dorsal fins two; the anterior spinous; the posterior soft and elevated before. *Caudal fin* lunate. *Anal fin* not equal to the soft-dorsal; remote from the caudal. *Ventral fin* falcate, horizontal, situated beneath the pectoral. *Pectoral fin* extends as far back as one third of the spinous-dorsal, but not as far as the tip of the ventral.

Color. Head and back blackish, sides dusky and edged below the middle with golden or coppery yellow; the back and sides banded or blotched irregularly with black; abdomen white. The fins diaphanous and banded with interrupted series of blackish dots.

Habitat. Lake Erie, the Ohio river and their tributaries.

D. 13—20; C. 16; A. 1—12; V. 6; P. 14 rays.

Observations. The males are smaller than the females; more slender, and more dusky colored. The former do not often exceed 12 or 18 inches in length, while the latter are met with measuring more than two feet in length.

In the water of the Lake they readily bite at a baited hook, but are much more coy in the Ohio and its tributaries. They are highly esteemed in the markets of Cincinnati and command an exorbitant price.

At certain seasons of the year, they are taken in great quantities in some parts of Lake Erie and especially in the Maumee River, where they are salted down in barrels, for supplying the interior of the State. When thus salted, they become at best, a tough, tasteless and insipid article of food, and the day is probably not distant, when they will be displaced in that market, by other species of a superior quality, from the Atlantic sea board.

A profitable and mutually advantageous barter might be carried on, between the fisherman of our Eastern States and the farmers of the West, in exchanging the fish of the one section, for the pork, flour and butter of the other.

The demand for salted fish at the West is unlimited. Shad, Cod and Mackerel are now carried there in considerable quantities, and it is believed that other species, but little esteemed at the East, yet very abundant, would, if suitably cured, meet with a ready sale at the West. The Alewife, Herring and even the despised Menhaden, would pay for all the expense of catching, packing, salting and transportation, and find a quick market at the West.

Centrarchus. Cuv.

C. *æneus.* Cuv. et Val. The Rock-bass: Goggle-eyed bass. Black Sunfish.

Centrarchus æneus. Cuv. et Valenc. t. III. p. 84.
" " Richardson. Fauna Boreali-Americana, p. 18 et fig.
Cychla ænea. Le Sueur. J. A. N. Sciences, Vol. II. p. 214.
" " Kirtland. Report on Zoology of Ohio, pp. 168, 191.

Plate XI. Fig. 1.

Head obtuse; *jaws* somewhat rounded, furnished with numerous small teeth; *lower jaw* the longer. Tongue and palate also furnished with teeth; *mouth* large, extending as far back as the middle of the eye; *eyes* large, convex and prominent; the *pupil* black, tinged with bluish and is semi-pellucid; the *iris* black, with a red border surrounding the pupil; the eye-lids ferruginous or yellowish, often margined with blue.

Body oblong, horizontal under the dorsal fin, rounded under the throat and abdomen; prominent at the base of the soft-dorsal and soft-anal fins.

Dorsal fin long; spinous part half the height of the soft parts, slightly recurved; each spinous ray strong, and acute.

The soft rays diaphanous, connected by a dusky, opaque interstitial membrane, and extending to the base of the caudal fin.

Caudal fin short, abrupt, slightly lunate.

Anal fin, not as long as the dorsal, the four first spinous rays gradually increasing in length, the fifth and sixth equal to the fourth, and two thirds the length of the longest of the soft rays, which equal those of the dorsal.

Ventral fin triangular, but in the specimen before me, does not attain to the anal, in accordance with the description of Le Sueur.

Pectoral fin ovate rounded, pellucid, and does not reach as far back as the point of the ventral.

Length 7 to 10 inches.

Color is generally coppery, occasionally tinged with green; *head* and *back* dusky-olive, blotched irregularly with dark spots: the jaws, lips and throat dusky; thorax bluish or steel-grey. The black spots on the bases of the scales give a banded appearance to the sides and back. The bright colors so vivid during life, fade away at the approach of death.

D. 11—11; C. 17 $\frac{2}{2}$; A. 6—10; V. 5; P. 16.

Observations. The preoperculum is minutely but distinctly denticulated on its inferior edge and posterior angle, and the operculum terminates behind the eye in two obtuse spines connected by an intervening membrane.

It abounds in almost every permanent stream in our State, and usually harbors beneath logs, rocks and stumps, where it is easily taken by a baited hook. During winter it does not migrate.

The specimen before me, was obtained in the Cincinnati market, and is of the same size as the plate. It has one less spinous ray than Le Sueur's figure in the 2d vol. of the Jour. Acad. of Nat. Sciences, Philadelphia.

Art. XVIII.—DESCRIPTION OF A SPECIES OF HELIX, NEWLY OBSERVED IN THE UNITED STATES. By Amos Binney. (Read December 1, 1841.)

HELIX SUB-PLANA.

H. testâ discoideâ, fuliginosâ, aut corneo-rufescente, nitente; spira depressâ; anfractibus quinque vel sex; aperturâ semilunari, transversâ; labro simplici, acuto; basi plano; umbilico parvo.

Description.

Animal. Not hitherto noticed.

Shell. Flattened, planulate above and beneath; epidermis brownish or smoky horn-color, shining; whorls five and a half, those nearest the apex striated transversely with very minute and delicate wrinkles; suture distinct, not much impressed; aperture transverse, not expanded, the plane of the aperture making nearly a right angle with the plane of the base of the shell; lip simple, thin, acute; base flattened, umbilical region a little impressed; umbilicus very small, round and deep, not exhibiting the volutions. Greatest transverse diameter less than three-fourths of an inch.

Geographical Distribution. Found hitherto only in the mountainous region of eastern Tennessee.

Remarks. The only American species which this shell can be said to resemble, is *Helix inornata,* which in size and color is quite like it, and at first sight may be taken for it. It differs from it in the following particulars. The upper and lower surface are both more flattened, and the outline is a more perfect circle. The number of whorls in specimens of the same size is greater by nearly one volution. The surface of the whorls is less rounded; the last whorl expands but very little towards the aperture; the base is broader, less indented, and very flat; the umbilicus is rounder, and better defined; and the aperture is not thickened within by a white testaceous deposit.

I have seen but two specimens, which were brought from Tennessee by Mr. S. S. Haldeman.

Art. XIX. — OBSERVATIONS ON THE HABITS OF THE PYTHON NATALENSIS. By Thomas S. Savage, M. D., of Cape Palmas, Western Africa. (Communicated April 8th, 1842.)

In the ninth number of the "Illustrations of South Africa," Dr. Andrew Smith has minutely described and beautifully figured the *Python Natalensis.* During the present season Dr. Savage has kindly sent our Society a specimen of this species, in fine preservation, accompanied with a valuable communication respecting its habits, from which the Publishing Committee present the following extracts. Other papers respecting the habits of the Chimpansè and many of the curious and interesting animals of that country, now so imperfectly known, have been received, and will be published as our limits may admit. — *Pub. Com.*

This serpent, when spoken of by travellers and residents, has been erroneously called Boa, and thus confounded with the South American genus. There is a striking similarity, however, between the two, both in structure and habits, so that were it not for the arrangement of the sub-caudal scales, one would be identified with the other.

During my residence here, which has been five years, I have seen a number of individuals of this serpent, but one, however, alive, which is the specimen I now send.

The first of which I had any authentic account was one that appeared on the Mission premises of the A. B. C. F. Missions. The facts in the case have been kindly furnished by my friend, the Rev. J. L. Wilson. He informed me that it was attracted into the yard by a dog. He says, in answer to my inquiries, "He was fourteen feet long, and held the dog not more than two minutes before the natives came to his relief. I suppose that the snake had stretched himself across the path, and seized the dog in the act of jumping over him. I was too much frightened to observe what was the shape of the body while he held the dog in his folds. I am inclined to think that he had nothing to fasten his tail to, while he held the dog. None of the bones of the dog were broken, and I am inclined to think that he received no injury whatever. The snake did not let go his hold until he had received a fatal blow from a bill-hook. The dog then leaped up suddenly, several times, as if he were not sure of having been extricated, ran around and entered the back yard, but, for some time appeared afraid of every thing and every body. His back only was *slimed*, and this could not be washed off, but gradually wore away in the course of a week or ten days."

The next individual of which I have heard, was attracted into the house of a colonist, an old woman, by a hen and her chickens. An unusual noise was heard under the bed, in the night, which awakened the woman. By a light she discovered the serpent in the act of seizing its prey ; affrighted, she fled to the house of a neighbor, who came and captured him with his gun.

The third individual appeared upon my own premises early in 1837. An antelope was discovered by some workmen a short distance from my house. Upon the first sight the natives, as usual, raised a cry, when he suddenly disappeared among the bushes. They started in pursuit. But a few moments elapsed before they heard a cry from the antelope, which directed them to the spot, where they beheld the animal struggling in the folds of a large Python. They all fired simultaneously, and shot at the same instant both the serpent and his victim. The former I measured, and found it over fourteen feet. The antelope was a large one, and it was difficult to believe that it could have been received through the throat of the serpent comparatively so small. The head had been cut off, and the body greatly mutilated before I saw it, but taking a section of the skin where the abdomen begins to expand, above the vent, and not including the greatest volume, I stretched it moderately. It was very easily distended ; and I soon satisfied myself that without going beyond the natural power of expansion, it would have taken in the body of the antelope.

It was skinned by the natives, and the flesh, when denuded, was of the most delicate white. It was divided among them, and not a particle, whether of skin or any other was lost. All was carried home, cooked, and eaten. From the skin was made a soup. I was extremely disgusted at the sight of a man carrying off in his hand, with an air of great satisfaction, a string of the intestines. This and other serpents are eagerly sought by the natives for food.

I have seen two other individuals in the course of the present year. They were captured by natives who were clearing up their land for rice farms. They were much mutilated by transverse gashes from these "bill-hooks." Three more, I was informed, were found upon the same piece of land, which led the individual to abandon it, from the superstitious notion that it could not yield a crop.

The next specimen is the one before me. It measured ten feet in length; is young, and was captured on the 22d February, by my associate, the Rev. Joshua Smith, on the premises of one of our *out-stations*. His account, in answer to my inquiries, is as follows.

" I had retired for the night, but was wakeful and unable to get to sleep. About twelve o'clock, I heard *Fanny* (a favorite dog) barking violently in the girls' school-house. The barking soon ended in a cry of distress. I thought it probable that a leopard had attacked her, as they often do carry off dogs and other domestic animals. I went down and walked around the house where there was a hole, affording Fanny ingress and egress. The moon shone brightly, but I could not see the cause of trouble, nor hear any noise. I called the dog by name, but she did not appear, nor could I hear any thing except what I thought to be the hiss of some ducks, that were shut up there. I opened the door, but still I could see nothing. I then went back to my chamber for a lantern, and returning, opened again the door, when I discovered the dog in the folds of a serpent, with her back downwards, and seemingly motionless. I went back to my chamber for a weapon, and finding only a country dagger, I returned accompanied by some men, and entered the school-house again with the lantern in my hand. The serpent was coiled twice or thrice around the dog, his tail grasping the foot of a bench, and his jaws fastened to her throat. His motion in compressing his prey may be compared to that of a cord when tightened around any thing, and some one pulling first at one end and then at the other. I thought it best to thrust the dagger into the snake as near the head as possible; but as that was hidden by the bench, I could not see it, and I made a thrust through the lungs. It started and Fanny was thrown from its folds with a jerk, when its object was to retreat by the way it had entered. I then withdrew the dagger and thrust it into the snake further back, so as to hold him till the men on the outside could disable him. As his head appeared they beat him with sticks so as to prevent him from running away entirely."

To the above I will add, that Mr. Smith displayed great fearlessness on the occasion; for though there were on the spot a number of men, both colonists and natives, yet not one could be induced to follow him into the house. An attack from the serpent might have been apprehended, for he was evidently in a state of extreme hunger.

The general habit of this serpent in seeking for its prey, is to lie in ambush near a frequented path, or watering place, and suspended from a tree or with its tail fixed to some other object, suddenly dart upon the unwary animal. The attack is so sudden and violent that the victim is often prostrated and stunned, and then begins the dreadful process of constriction. A bullock was so much injured in a recent attack as to be supposed beyond the possibility of recovery.

In making the onset, it is not always necessary that the tail should be coiled around a fixed object. The hooks or claws near the anus are sometimes protruded, it is said (and the evidence is wholly satisfactory) and inserted in the ground or under roots, thus affording a fulcrum which gives inconceivable force to the blow.

These horny processes or rudimental feet, as they have been called, are also serviceable in ascending trees. They are inserted into the ground, and bark of the tree, constituting fixed points which greatly facilitate the ascent. We have satisfactory testimony also in proof of another habit that I have never seen mentioned, in which these hooks must be highly serviceable. It is said that in fields more or less open, they often raise their heads above the surrounding grass and shrubbery, in search of prey; their application then in this act, must be evident; protruded and penetrating the ground beneath the roots, they must afford great support to the body. In this position birds have been known to attempt to alight, mistaking it, in its motionless attitude, for a stick or stump, and thus to have fallen unwarily within its distended jaws.

Instances of its attack upon man are very rare, and never, probably, except when it is in a state of extreme hunger.

The natives fear them single handed, but not in numbers. They seek them for food, esteeming them very highly on their *bill of fare.*

Its places of resort are streams and damp places. Almost all animals constitute its prey. It is not poisonous, as is well known. Its constrictive power is all that renders it formidable.

Art. XX. — OBSERVATIONS ON THE CHARACTERS AND HABITS OF THE OCELLATED TURKEY, (*MELEAGRIS OCELLATA*, Cuv.) By Samuel Cabot, Jr. M.D. (Read June, 1842.)

During a recent residence of eight months in Central America, having had many opportunities of learning much that is new and, I think, worthy of attention, with regard to this and other rare and interesting birds, both from personal observation and the accounts of others well acquainted with their habits, I take this means of communicating it to those who may be interested in this branch of Natural History.

I find three plates of this bird, accompanied with descriptions; one in Griffith's edition of Cuvier's Animal Kingdom, Vol. VIII. p. 164, and another in the work of Temminck, Pl. 112, and a third in the Naturalist's Library, Vol. III. p. 143. The plates are very imperfect and do not give a true idea of the bird; but the description annexed to the plate in the Naturalist's Library is tolerably correct, as far as it goes; although being taken from a dried skin, of course, in some points it is imperfect. The writer says, " This splendid and curious bird was first described by Baron Cuvier in the Memoires du Muséum, from the specimen which graced the collection of Mr. Bullock, and which, at the dispersion of that valuable museum, was purchased by the French government; and we believe that it is still the only specimen known to exist in any collection." This specimen still exists in the collection of the Jardin des Plantes, at Paris, and is in a fine state of preservation. I believe that there exists also another in the collection belonging to the Earl of Derby; although I did not see it myself, when I visited that fine collection, in the spring of 1841. But when at the Havanna, I was assured by Mr. Kennedy, one of the gentlemen on the commission for the adjudication of slavers, taken by English cruisers, that such a specimen did exist in the possession of the noble Earl. The bird which is now in the collection of the Garden of Plants, was taken by some wood-cutters at the Bay of Honduras, from three which they saw. The specimen was sent alive to England, to Sir Henry Halford, but having been injured, died before it reached him, and was presented by him, to Mr. Bullock, and as the writer in the Naturalist's Library says, "*Nothing* was recorded of its *habits*, and it is *not known* whether the tail is *capable* of being *expanded* as in the common species."

This bird inhabits, as nearly as I can learn, all the country to the south of Texas, as far as the Isthmus of Panama, and seems to replace, in those countries, the common wild Turkey, (*Meleagris gallipavo*,) which inhabits the countries north of this as far as Canada.* Latham says, that it is found in South America, but does not give his authority, and indeed could have had no such authority, as the only specimen which had then been seen by naturalists, was the one above mentioned, which, as we have seen, was taken by log-cutters in the Bay of Honduras; and indeed, if I am not mistaken, this is the only specimen known to naturalists up to the present day. Messrs. Stephens and Catherwood met with these birds on their former expedition, as far south as they went, and in immense numbers, along the shore of the Pacific.

* I think it very probable that the common Turkey is found in Mexico, as we learn that the first Turkeys were sent to Spain from Mexico, and I think it very certain that they were not Meleagris ocellata.

Latham says, " How far it may be right to notice this bird as distinct in species, we cannot determine, but most certainly the brilliancy of colors throughout, as well as the distribution of them, encourages an appearance of propriety in so doing; as we can scarcely suppose that the mere difference of climate, in the warmer and colder parts of America, is sufficient to account for the great difference of plumage." He is undoubtedly right, and if he had seen the bird alive, even without knowing any thing of its habits, the suggestion of such a doubt, as having any possible foundation, would never have occurred to him.

The form, and motions of the bird are almost as distinct from those of the common Turkey, as is the difference of the plumage; its form is more slender and delicate, it does not strut in the manner of our turkey, its cry is very different, not having the least resemblance to the gobble; it is a weak, squealing sound, and occasionally a sort of yelping, or rather sudden, loud, cooing sound. When they fight, which they do frequently, with the domestic turkeys and other poultry, they seize their antagonist by the head, with their bill, and strike with their long spurs in the manner of the game cock. They are a more courageous bird than the common turkey. They do not go in flocks, except while the old bird has charge of her young, keeping generally in pairs or singly; and although one may sometimes start a large number together, from the same cornfield, it is merely accidental, they having assembled on account of the abundance of food accumulated in one spot, and when leaving the field, to go to roost, they go off in pairs, or singly, and when met with in the woods, they are never found in numbers together; all which is different from the habit of the common turkey, which is rarely found singly, and *almost*, if not *quite*, always roosts in flocks, in certain roosting places,* to which the same individuals appear to resort every night, unless disturbed. Their food is pretty much the same as that of the common turkey, as far as the country affords it; of course they cannot eat acorns, or beech nuts,

* Nuttall says, of the common Turkey, that "they are not gregarious, except accidentally, or from the necessity of seeking food."

which are amongst the favorite articles of food to our turkey, because their native country does not produce them, but they eat Indian corn, berries, ants, &c., of all which our turkey is very fond. Their manner of flight is the same; alternate quick flapping their wings, and soaring. Their flesh has the same appearance, but I think that the flavor is not so good as that of the common turkey.

There is another occasional habit of theirs, which I state on the authority of others, but the truth of which I cannot well doubt, viz.; that of building their nests in trees. Mr. Catherwood, when at Palenque, shot an old female turkey from her nest, placed at a considerable height from the ground; and the Indians, who were with him at the time, caught four of the young, (several of which Mr. C. observed to fall from the nest soon after the old one,) which they took home with them to rear. Now, in this case, one might say that it is very possible, Mr. C. might have been deceived by the fact of the turkey being, when shot, on or near the nest of some other large bird; but on the other hand, it is hardly possible that Indians, accustomed from childhood, to observing natural objects, and the habits and appearance of animals about them, could have been deceived in the appearance of the young of a bird, forming so important an item in their articles of food, and of which they had undoubtedly seen a great number. Besides which, I was told, by persons likely to know, that this bird did occasionally build its nest in trees to their certain knowledge, and giving as a reason for it that it was in situations liable to be flooded by the heavy rains. Now as we know that there are very well authenticated instances of other birds, whose usual habit is to place their nest on the ground, doing this same thing, one of which instances rests upon the authority of Mr. Audubon, viz.; that of the gulls on one of the small islands near the coast of Labrador, in consequence of the persecution which they have met with; why may not the same be the case with this bird, and for a similar cause? The woods about Palenque abound with tigers, wild cats, snakes, &c., and are also very liable to be over-

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flowed during the rainy season; and is it not possible, that in order to guard herself against surprise, while sitting, and in a measure to protect her eggs, and young, from the attacks of ravenous animals, and also to secure them from the flooding caused by the rain, she may, in some places, and under some circumstances, have resorted to this way of placing her nest, instead of the usual manner? The eggs, I have been told by the Indians and others, are marked like those of the common turkey, but I have never seen them myself.

The male bird is about three feet six inches in length from the tip of the bill to the tip of the tail. Bill formed as in the common turkey. Head and neck, to two and a half or three inches below head, bare, except a few scattered hairs and a row of feathers which surround the external orifice of the ear. This bare skin is of a rich stone blue, except immediately around the eyes, where it is red. At the base of the bill there is an erectile appendage of one and a quarter inches long, stone blue except the apex which is of a bright orange. From each side of this part, two rows of round knobs, of a bright orange, running backward over the superciliary ridges as far as the back part of the red circle which surrounds the eye; there is one very small similar knob, at about three lines in front of each external ear. At about a line behind the principal appendage, at the base of the bill, is another of about three and a half lines in height, and two and a half lines through at the base, of a stone blue color, having seven or eight of the above mentioned orange knobs on different parts of it, principally on the summit; immediately behind, and in fact joining on to this appendage is another, of about one line in height, and having three of the orange knobs on the top of it. Behind each angle of the lower jaw is a row of three small red knobs, and at the lower part of the bare skin on the under side are seven or eight more small red knobs. Feathers of neck and upper parts of back and breast in scollops of rich crow-color margined near the tip with black, and tipped with golden green. Feathers of lower parts of back, rich varying green, margined near the tip with black, and tipped with rich golden bronze.

Feathers of the lower parts of the breast of a deep crow-color, and tipped with rich golden bronze. No pectoral appendage. Flank and thigh-coverts rich golden green, margined with a line of black near the tip, and tipped with golden bronze. Feathers on shoulder of a rich golden green, fringed with black. The greater wing coverts are of rich golden bronze. The outermost secondaries have the principal part of the outer webs pure white, the bands in the centre not appearing when the wings are closed; the undermost are crossed with glossy greenish black bands, the shafts are black. The primaries are black, marked obliquely with white, the marks running in the course of the barbs on each side of the shaft. The first of the primaries is the shortest, and the sixth longest. The tail consists of eighteen feathers rounded at the tips, and beautifully marked in their whole extent with alternate white and black wavy lines, and having an eye in the end of each, somewhat like those in the tail of the Peacock; each of the tail feathers is tipped with a band six-eighths of an inch wide, of golden bronze. The length of the longest tail feather is about 15 inches, and that of the shortest is about 11 inches: the tail is cuneiform. The tail coverts are beautifully marked with the same wavy lines as the tail itself, and at the tip of each feather is a beautiful spot formed by first a scolloped line of black, then a beautiful patch of golden green, six-eighths of an inch deep, then another line of black, and then a broad tip of golden bronze five-eights of an inch deep. These eyes in the tip of the tail, of the tail coverts, and on the coverts at the root of the tail, form three curved rows, which give a very beautiful appearance to the tail. The feet and tarsus are stout, and of a purplish red color. Tarsus five inches and three-eighths long. Middle toe two inches and six-eighths long. Spur strong and sharp, one inch and three-eighths long, (sometimes longer.) The anatomy much the same as in the common turkey. Female smaller, and much less brilliant.

Art. XXI. — ON THE EXISTENCE OF SILICEOUS? SPICULÆ IN THE EXTERIOR RAYS OF ACTINIA; AND MEMORANDA CONCERNING THE SILICEOUS ANIMALCULES OF BOSTON. By G. W. Bailey, Prof. Chem. Min. and Geol., U. S. Military Academy. (Communicated June, 1842.)

During a recent visit to Boston, in April, I eagerly embraced the long wished for opportunity to examine the marine siliceous infusoria of our coast; for I hoped to be able to detect, in a living state, some of those elegant forms which occur so abundantly in the fossil infusorial strata of the marine tertiary of Virginia. I was aware that Ehrenberg had detected many of these forms in a living state, in the sea at Cuxhaven and elsewhere, and I felt confident that our shores must abound in similar forms. In company with Dr. Gould, I visited the docks near the Chelsea ferry, and collected from the immersed logs, &c., a quantity of filamentous Algæ, among which I knew that many of the objects of my search were likely to be entangled. On subjecting them to a microscopic observation I detected a number of very interesting and beautiful forms, although the season was not the most favorable. The first objects which attracted my attention were great numbers of siliceous spiculæ, precisely similar to those found fossil in the infusorial stata above referred to; these I found among the Algæ, and also more abundantly in the mud of the docks. These spiculæ resemble those found in some species of Spongia and Tethya, and I believe that Ehrenberg refers the fossil ones to these genera; but an observation which I made leads me to suspect that some of them, at least, are derived from the exterior rays of Actinia. On examining, with a high magnifying power, the rays of a large species of Actinia which had an orange colored base and olive rays (A. *marginata*, Lesueur?) I found that the white rays, which form the exterior circle, appeared to differ from all others, being filled with spiculæ, arranged with great regularity, and in countless numbers, radiating from the axis of each arm, (See fig. 1, *b* and *c*.) Each of the spiculæ was perforated with a longitudinal cavity, from which was protruded a very long and delicate fibre (See fig. 1, *a.*) These spiculæ resembled so much, in their form, perforation, and general appearance, some of the fossil siliceous spiculæ above referred to, that, like the fossil ones, they must be siliceous. This question I had not the means of deciding, but I hope it will be settled by some of the Boston naturalists. It is only necessary to burn one of the rays and examine the ashes ; the siliceous spiculæ will of course, retain their form after ignition. It would be an interesting fact, if, by means of these spiculæ, we could obtain evidence of the existence of species of Actinia during the epoch of the Eocene tertiary ; for who would expect that such soft and perishable creatures could leave, for such a length of time, any trace of their existence.

The annexed sketches (See fig. 1, *a, b, c,*) were made merely as memoranda as I hoped to have further opportunities for observation. They will serve to indicate the form and position of the spiculæ although they have no pretensions to accuracy.

The siliceous Bacillaria, of Boston Harbor, appear to be numerous and elegant.

The following is a list of the chief species noticed by me in April, 1842.

Ceratoneis fasciola, } motions very active. These spe-
Ceratoneis closterium, } cies were recently discovered by Ehrenberg. Figures may be found in a late number of the Berlin Transactions.

Coscinodiscus radiatus, fragments only were observed.

Coscinodiscus ,or *Actinocyclus ?* Toriform-siliceous bodies were observed in the living state containing a yellowish brown matter disposed in 5 or 6 radiant portions, each of which was repeatedly branched.

Gallionella sulcata.

Gallionella moniliformis.

Navicula viridis, living in salt water, but differing in no respect from the fluviatile species.

Navicula ———, Plate II. fig. 18, of Bailey's sketch of American Bacillaria.

Fragillaria ———, a marine species with very flexible filaments, very abundant in Algæ at Boston, and near Marblehead.

Cocconeis scutellum? adhering in great quantities to Zostera and other marine plants.

Echinella flabellata.

Synedra ———, parasitic in vast quantities on filamentous algæ covering them with a glistening envelope of a brownish color.

Tessela arcuata.

Achnanthes brevipes.

Gomphonema clavatum.

Naunema ——, immense quantities of one or more species of Naunema were observed growing on the flats, near the Common. The greater part of the brown matter attached to the marine plants at this situation, consists of long tubes filled with siliceous animalcules of the genus Naunema. Tons of them might be collected here.

Emersonia elegans. I propose to give this name to a beautiful siliceous animalcule found in Boston harbor, and which appears to belong to a new genus. This genus I wish to name Emersonia, if the President of the Boston Society of Naturalists will accept so small a tribute of respect. It may be characterized as follows;

Genus. Emersonia.

Family Bacillaria, Section Naviculacea.

Carapace siliceous, compressed, central portion oblong, separated by deep lines of constriction from the two terminal, bicuspidate or auricled portions, forming chains, which open in a zig-zag manner.

Emersonia elegans (See fig. 2, *a*, *b*, *c*. *d*.) Central portion nearly square, containing yellowish globules disposed in a circular group. Hab. Boston harbor.

Emersonia antiqua, (Bailey's sketch of Bacillaria, Pl. 2, fig. 25.) Central portion much broader than long. Fossil in the infusorial stratum of Richmond, Va.

I presume that a more careful examination of the infusoria of Boston harbor, if made at a later season, would add greatly to the above list.

Fig. 1.

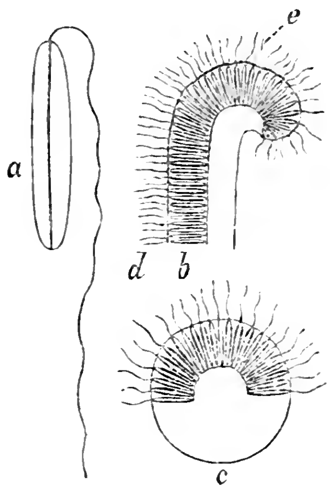
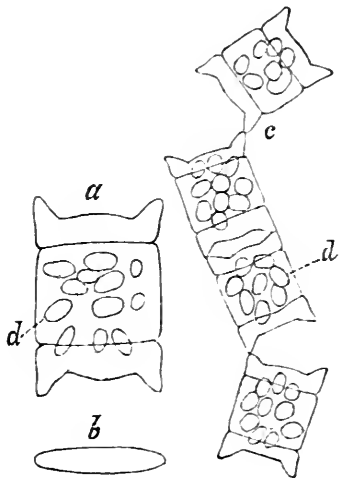


Fig. 2.



EXPLANATION OF THE FIGURES.

Fig. 1. *a.* One of the spiculæ from a white external ray of Actinia marginata? showing its longitudinal perforation and the long projecting filament, much magnified.

b. Ideal longitudinal section of a ray of Actinia to show the manner in which the spiculæ are arranged; at *d* are seen the vibrillæ, and at *e* the long filaments.

c. Ideal cross section of the ray.

Fig. 2. Emersonia elegans.

a. single individual.

b. cross section of the same.

c. chain of several individuals.

d. group of ovules? of a yellowish brown color.

ART. XXII.—ENUMERATION OF THE FISHES OF BROOKHAVEN, LONG ISLAND, WITH REMARKS UPON THE SPECIES OBSERVED. BY WILLIAM O. AYRES, of East Hartford, Connecticut. (Communicated January 12th, 1842.)

During a residence of three years on Long Island, I have endeavored to improve the opportunities occurring to me of observing our fishes, and of ascertaining their habits; some of the results of these observations, I now take the liberty of presenting. My location has been at Miller's Place, a village in the township of Brookhaven, sixtytwo miles from New York. About a mile west of the village, a sheet of water enters from the Sound, called Old Man's Harbor. This harbor and the parts of the Sound adjacent, have afforded most of the marine species recorded. The fresh water species have been derived from different places which will be found noted in connection with the fishes. Enjoying the advantage of gathering specimens in waters in the neighborhood of those whose Ichthyology was illustrated by Dr. Mitchill, I believe that I have been able to identify many of his species, including one or two in which, it appears tome, an error has been committed, in the Report upon the Fishes of Massachusetts. Such an error, from the looseness and inaccuracy of many of Dr. Mitchill's descriptions, is very natural, and in certain cases unavoidable.

In the course of my researches, I have obtained several species which appear to me as yet undescribed; of these I propose to offer descriptions and drawings.

Perca flavescens. Mitch.

In many of the fresh waters of the island, the *Yellow Perch* is not uncommon. In one or two ponds, stocked with them within a few years, they have increased very rapidly, and have almost entirely destroyed the Trout, which before were abundant. Corwin's Pond, near the centre of Brookhaven, was supplied with the spawn of this species about four years since. The pond is more than half a mile in length, and previously contained no fish but Pickerel; now Perch may be taken of good size, in any part of it. The largest specimen I have seen, was caught in the Ronckonkama pond; it weighed about two and a half pounds.

It appears to me that too great importance is attached, by most naturalists, to the number of fin-rays, as constituting a specific character. Cuvier even gives, as one of the few distinctions between the *Perca granulata* and P. *fluviatilis*, a difference of one ray in the second dorsal. If this character is ever constant, surely it will be in the present genus. I have however, two specimens of the *flavescens* which number fourteen rays in the first dorsal, several which give thirteen, and one of twelve in the same fin. Dr. Storer states the number at thirteen; Dr. Mitchill, at twelve. In fish of other genera, I have even found the pectorals, on opposite sides of the same specimen, giving a different number of rays; I will mention such examples when arriving at the species in their order.

Etheostoma Olmstedi. Storer.

This species I have seen, on the island, only in the Connecticut — a stream emptying into Fireplace Bay. They are commonly found lying on the bottom, and if disturbed, they dart forward a few yards and drop again on the sand. I have not found them more than four inches in length.

Labrax lineatus. Cuv.

The *Striped Basse* is common on both the north and south sides of the island. On the north side they are seen in the Sound as early as the first of May, and remain till November. Owing to the waters being shallow and very clear, I have not succeeded in taking them with the hook; they are caught exclusively with nets. They do not commonly exceed four pounds in weight, and the largest I have known, weighed but forty. On the south side, however, they are taken both in the bays and in the ocean, in much larger numbers and of greater size. Fifty thousand weight have been drawn by a single net in five weeks; and the largest weigh from a hundred to a hundred and twenty pounds. The food of this species, while with us, appears to consist of small fish, chiefly Ammodytes and Atherinas, Cuttle Fish, Shell Fish (Mytili and Myæ, mostly) and young crabs, or, which seems to be a greater delicacy to them — soft crabs.

Of three specimens, two have nine rays in the first dorsal, while the other has but eight.

Labrax mucronatus. Cuv.

This *Basse* is not common; I have met with them in only three localities, a small pond and creek at Setauket, another at Greenport, and Great Pond, near Riverhead. The largest I have seen were less than a pound in weight.

Pomotis vulgaris. Cuv.

This species, I believe, does not occur within the bounds of Brookhaven; in all the streams and ponds which I have examined, I have been unable to find it. It has been sent to me, however, from Great Pond, and I have been informed that it is found also at Oyster Bay. The specimens from Riverhead were of good size, the largest being seven and a quarter inches in length.

Prionotus strigatus. Cuv.

This is much less common than the succeeding species and does not arrive so early; the first one taken, the last season, (1841) was caught the 13th of August. Both this and the following species, are sometimes used as food, but are not esteemed.

Prionotus Carolinus. Cuv.

This species is abundant, and often very troublesome in taking the bait designed for better fish. Their usual food consists of shrimps, small crabs, both hard and soft, and not unfrequently the sand-launces; but they often bite at the hooks used in fishing for Porgees, for which the bait consists of soft clams (Myæ.) They arrived the last season, May 7th, and left us about the second week in August. The eggs of the female are deposited about the last of June. When at rest, they lie on the bottom, with their broad pectorals sometimes spread, and sometimes closed: in swimming, however, the pectorals are closed and laid flat upon the body. If alarmed by the approach of a boat or any other object, they bury themselves so completely in the sand that a very close observation is necessary to detect them. This concealment is effected by a rapid, lateral movement of the body, which displaces the sand from beneath, and causes it to fall upon their sides and back, covering them entirely, except the eyes and top of the head. Probably they often resort to this manœuvre when approached by the large fish which feed upon them.

I have found the two dorsals of this species numbering for fin rays 10 — 14; in others, 10 — 13; and once 9 — 15; in one instance I found the pectorals giving 14 on one side of the fish, and 15 on the other, thus affording fair exemplifications of the remarks made while speaking of the *Perca flavescens*.

COTTUS VARIABILIS. Nobis.

This species, which I believe, is as yet undescribed, is not common. They are seen around wharves, &c., in the harbors, and I have known them, in one or two instances, taken in the Sound. The largest one I have seen was six and a half inches in length.

GASTEROSTEUS NOVEBORACENSIS. Cuv.

The *New York Stickleback* is very common in Old Man's Harbor, in the parts least affected by the running of the tide. They live chiefly among the eel-grass, but I have taken the young ones swimming in companies near the surface in clear water.

GASTEROSTEUS MILLEPUNCTATUS. Nobis.

In similar situations with the last. This is perhaps the most abundant species in the harbor; it appears as yet undescribed. I have specimens, taken from the freshwater of the Connecticut River, on the south side of the island, which differ from these only in being a little stouter, and perhaps a trifle darker in color.

OTOLITHUS REGALIS. Cuv.

Fifteen or twenty years ago, the *Weak-Fish* were abundant in the Sound, and were taken readily with the hook; now, however, they have almost entirely disappeared. Only stragglers are caught with the nets, and they are small; the largest I have met with weighed only about a pound and a half. On the south side of the island they are more common, and are occasionally found of ten or twelve pounds weight.

UMBRINA NEBULOSA. Mitch.

The *King-Fish* is not uncommon, being often caught in the nets; and in certain situations they bite very readily. I do not consider them equal in flavor to many other of our species; by some persons, however, they are very highly esteemed.

POGONIAS GIGAS. Mitch.

The fishermen have told me, that about ten years since the *Drum-Fish* made their appearance in the Sound, but remained only a short time. On the south side they are often caught.

SCOLOPSIDES SAYANUS. Gilliams.

This species appears to be rare; I have met with it in but one stream — the Connecticut. In general, it lies hid among the grass, with which the river abounds, and is seldom seen except when started from its hiding place. It is described in the fourth volume of the Journal of the Academy of Natural Sciences.

SARGUS OVIS. Mitch.

The *Sheeps-head* is now very rare, much more so than formerly. In three years I have been unable to obtain a single specimen, though I have seen one or two while fishing. In the South Bay, near Fire Island Inlet, they are still taken in some numbers, and a few also in Gardiner's Bay, near the end of the Island.

PAGRUS ARGYROPS. Lin.

The *Porgee* is in general very abundant through the summer, and takes the hook readily: they are caught in great numbers, and are much used as food. With few exceptions, they do not exceed nine inches in length; and in September I have seen hundreds of young ones, not more than two inches long, brought in at one haul of the net. They arrived the last season about the first of June, and remained till October. The dorsal fin-rays of this species I have found to be sometimes 25, and sometimes 26; Dr. Storer states them at 24, Dr. Mitchill at 26.

SCOMBER VERNALIS. Mitch.

Several years ago this *Mackerel* appeared in the Sound and for a few weeks was very abundant on the north side of the

Island; but the occurrence was only accidental, as they have not been seen there since.

Cybium maculatum. Mitch.

I consider this species one of the rarest of those which I have met with; several years frequently pass without one being seen. Such had been the case for the last few years, but this season no less than four were taken in the nets drawn for Blue-fish; I could obtain but one of them; it was twenty and a half inches in length. The fishermen call them *Horse Mackerel* and *Spanish Mackerel.* Dr. Mitchill's figure of the species is very correct.

Temnodon saltator. Cuv.

No fish is more highly prized by the fishermen, or of more importance to them, than the *Blue-fish.* They are very abundant, and are taken with nets, in great numbers, sometimes three or four hundred at one haul. The greater part are sold while fresh, though a few barrels are salted every year. They may be caught also very readily with the hook, and, provided the bait is only in motion, it matters but very little of what it consists. I have used most commonly, and with very great success, a hollow cylinder of bone, about four inches in length. The average weight of the fish taken is not far from a pound and a half; few are found exceeding two pounds, and the largest one I have met with weighed about three and a half. On the south side they are sometimes caught, weighing 12 or 14 pounds. Their chief food, on their first arrival, and for the greater part of the summer, is the Sand-Launce; later in the season they feed on the Spearings (*Atherina Boscii,*) the small species of Herrings, and on Shrimps. They seldom, however, commence feeding on Shrimps till just before their departure in October. The first were caught this season, June 26th. When in their prime, which is in August and September, the flesh of this species is superior in richness and flavor to that of any other fish inhabiting our waters, excepting perhaps, the Sheeps-head; their abundance, however, renders their market price less than that of others which are much inferior.

Vomer setapinnis. Mitch.

The only specimen of this species that I have seen, I picked up dead, upon the beach, Nov. 21, 1840; it had apparently just been left by the tide, and was very little injured. It agrees well with Dr. Mitchill's description of the *Zeus setapinnis;* his figure, however, gives too little depth compared with the length; Swainson's figure of the *Argyriosus Mauriceii* more nearly resembles my specimen in its form. The species must be, I suppose, very rare.

Peprilus triacanthus. Peck.

Though not uncommon, according to Dr. Storer, on the coast of Massachusetts, this species is, in the waters of Long Island, very rare. May 22d, 1841, I saw three of them, of which I succeeded in taking one. The fish is scarcely known to the fishermen, though one or two of them told me that they had seen it.

Atherina Boscii. Cuv.

The *Atherina notata* of Mitchill, A. *Boscii* of Cuvier, is a species rather abundant through the summer. They arrive in the harbor in May, and remain till November; and I have picked them up on the beach, driven ashore by storms, through the whole winter. They form no small amount of food for the Blue-fish and Basse, and may be used with success as bait for either.

Lophius piscatorius. Lin.

The *Fishing-Frog* is very rare; I have met with but one specimen and heard of another. The one which I saw (Dec. 28th, 1840) had been left by the tide on the meadows of the harbor; it was in length about fortythree inches.

Batrachus variegatus. Le Sueur.

The *Toad-Fish* is not uncommon; during the warm weather they lie hid among the eel-grass, and are seldom seen. One which I caught the last summer, and kept for some time, would snap very fiercely at the finger or a stick held towards him, and would sometimes allow himself to be lifted out of the water before he would loose his hold. On the approach of cold weather, they bury themselves in the mud and remain torpid; and are very frequently brought up with the spear while striking in the mud for eels. One was brought to me which had been taken in this manner, Oct. 27th, 1840; it was torpid and lived nearly twentyfour hours without water.

LABRUS AMERICANUS. Bloch.

The *Black-Fish* is here less common than in most parts of the Sound, owing doubtless to the absence of rocky bottom and shores. Those which I have met with are also of inferior size, the largest I have seen weighing but little over two pounds. Toward the east end of the island, at Sagharbor and Greenport, and in Gardiner's Bay, they are much more numerous.

CRENILABRUS BURGALL. Schoepp.

Here, as on other parts of the coast, the *Burgall* is extremely abundant. They are seen as early as the middle of May, and remain till the last of October, and in storms are washed up on the beach of the Sound, through the whole winter. Among their numerous varieties of color, I, the last season, saw several specimens which had their entire surface banded with alternate vertical lines of black and light brown, presenting an appearance so singular, that at first I supposed them to be of a distinct species. I have found the dorsal fin rays sometimes 18—10, at others 18—11 and at still others 17—11.

LEUCISCUS CHRYSOLEUCAS. Mitch.

This fish I have received from the Peconic river, near Riverhead, and am not aware that it is found in any other of the streams on the island.

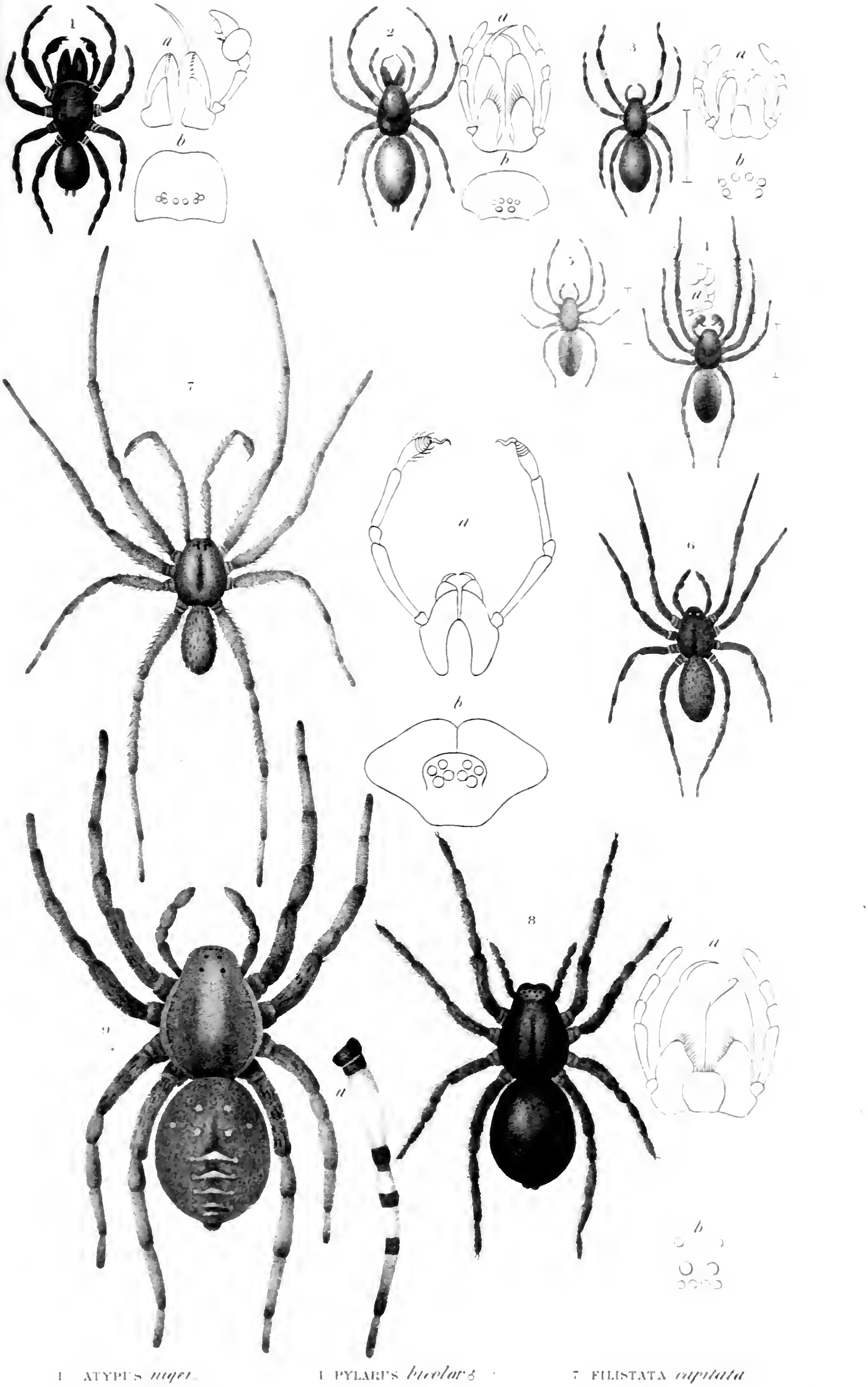
FUNDULUS FUSCUS. Ayres.

I have met with this Fundulus, only in the Connecticut; it appears to be somewhat uncommon there, living chiefly among the grass with which the river abounds. The species is, I believe, undescribed.

LEBIAS ELLIPSOIDES. Le Sueur.

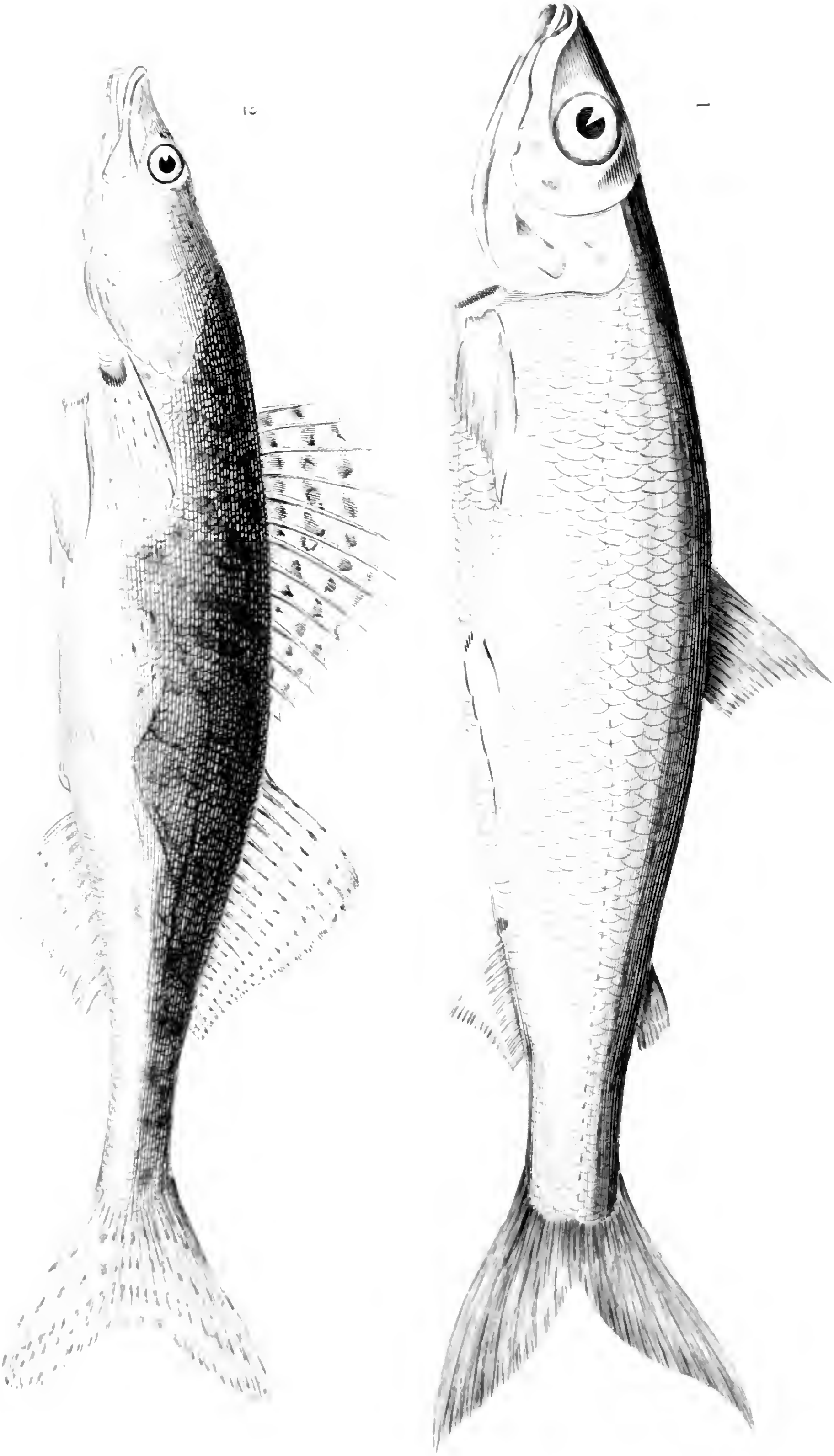
This fish, described by Le Sueur from specimens received from Florida, is found in Old Man's Harbor, though never in great numbers. They make their appearance in May, and are at that season of the year commonly seen in pairs, in the shallow creeks of the harbor. Their motions are very peculiar; owing to the thick and almost inflexible structure of their body; the only parts available for swimming are the caudal fin and the extreme posterior portion connected with it. These are vibrated with great rapidity, and the movements of the fish appear consequently to be performed with much vigor, though their speed is rather small. They are tyrannical in their disposition, attacking and pursuing whatever other species come near them. The back of the male presents reflections like those of polished steel, and when exposed to the rays of the sun in clear water, their appearance is very brilliant. Le Sueur in his description, which in other points is most beautifully accurate, says, that the ventrals extend to the anal. This cannot be relied on; I have one specimen in which they extend so as to touch the anal, another, in which they extend nearly to it, and others in which they reach hardly half the distance from their origin to the origin of the anal. His conjecture, as to the scales on the operculum, is correct; they exist, but are very deciduous. His description must have been drawn from a full grown specimen. The young of this species is Mitchill's *Esox ovinus;* it differs from the adult in color (being lighter) and possibly also in being a little more plump and rounded. It, however, shows plainly the remarkable teeth which characterize the genus. The only point in which it does not agree with Dr. Mitchill's account of the L. *ovinus* is in respect to the lateral line; he says, this is plain and straight; these fish show no traces of any lateral line whatever, in which they agree with Mitchill's figure.

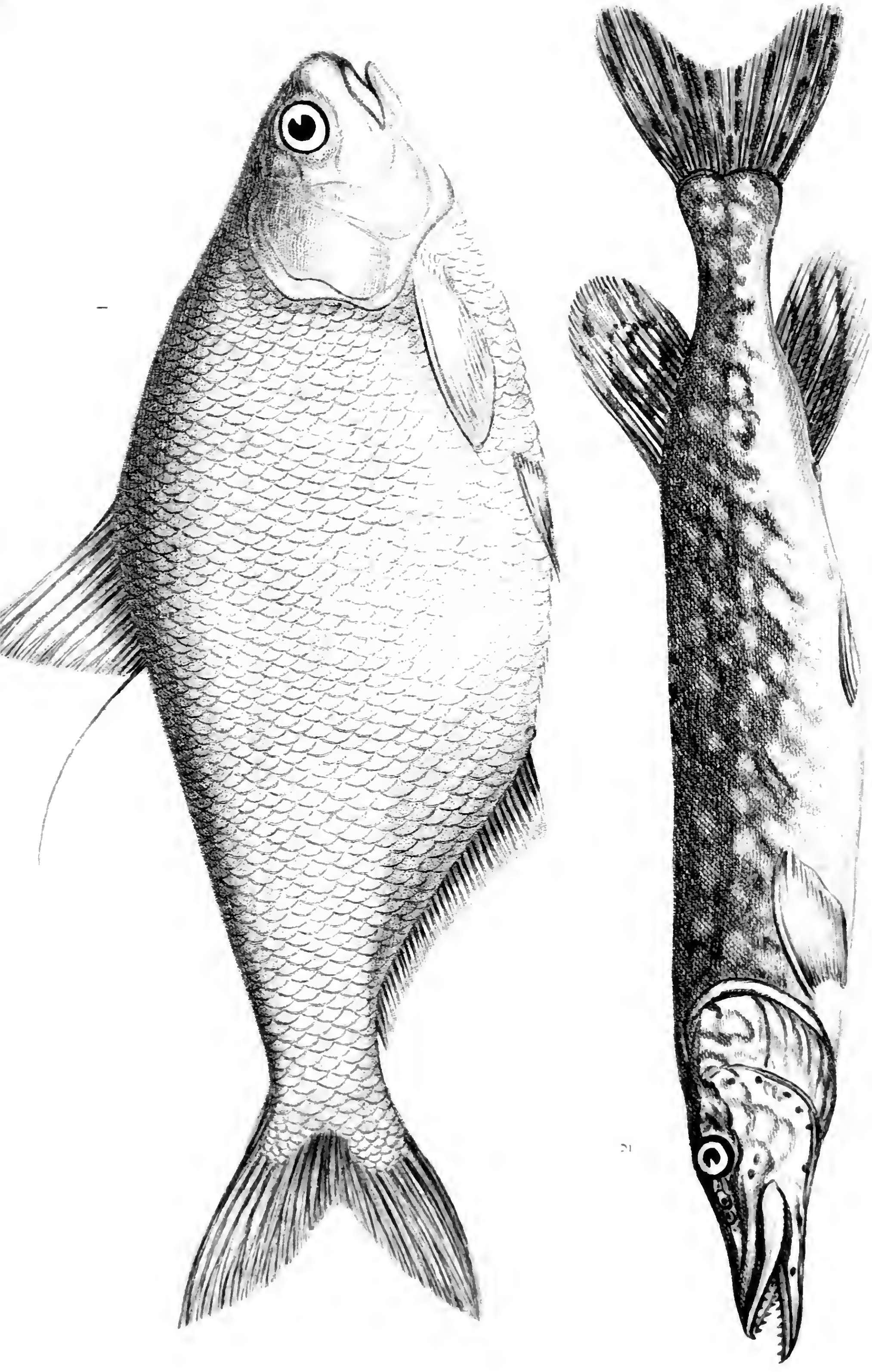
[To be Continued.]



1 ATYPUS *niger*
2 DYSDERA *interrita*
3 PYLARUS *bicolor* ♀
4 PYLARUS *bicolor* ♂
5 *pumilus*
6 FILISTATA *hibernalis* ♀
7 FILISTATA *capitata*
8 LYCOSA *latifera*
9 *Tarantula Carolinensis*

Hentz del.





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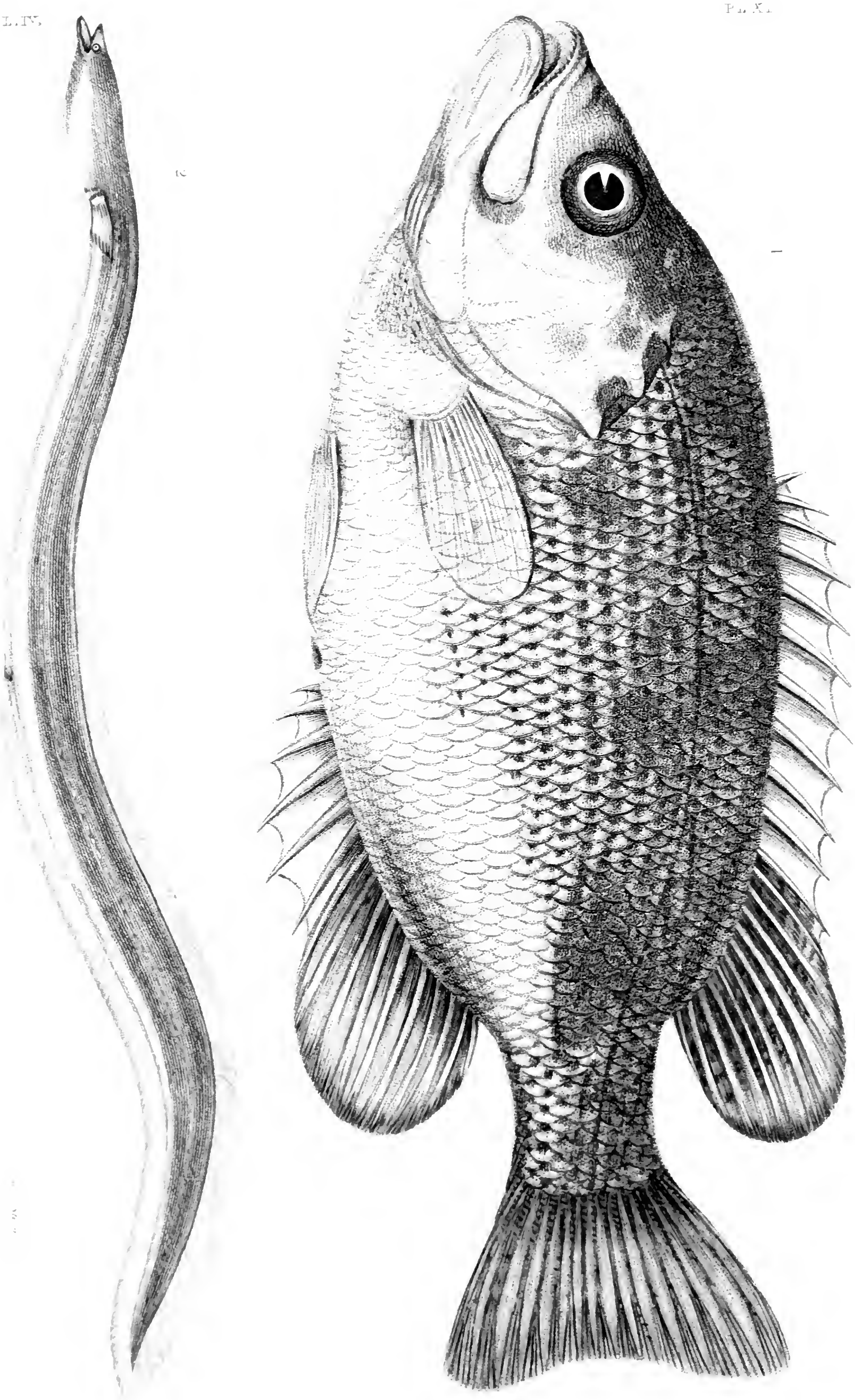

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ART. XXIII.—ENUMERATION OF THE FISHES OF BROOKHAVEN, LONG ISLAND, WITH REMARKS UPON THE SPECIES OBSERVED. By WILLIAM O. AYRES, of East Hartford, Connecticut.

(Continued from page 264.)

MUGIL LINEATUS. Mitch.

Plate XII. Fig. 1.

A DESCRIPTION of this species with a figure, was prepared for insertion in its regular order in the last number of this journal. The engraving of the figure, however, could not be completed in season, and the whole was omitted, with the intention that it should appear in the present number. The recent publication of Dr. Dekay's Report on the Fishes of New York, in which this species is described and figured, renders any further account unnecessary, and my description is accordingly suppressed. As the figure, however, was engraved on the same plate with that of other species, it must appear with them. This species appears to be somewhat uncommon in Brookhaven; I have seen them in but a few instances, and then not in very great numbers. They are seldom larger than the one figured.

LEBIAS ELLIPSOIDES. Le Sueur.

Since the publication of the last number of the Journal I have had the opportunity of examining numerous living specimens of this species. I find that the lateral line, though by no means conspicuous, can be traced without difficulty running in nearly a straight course to the caudal fin. So that in the only point in which there appeared to be any discrepancy between our fish and Mitchill's *Esox ovinus*, there is in fact a perfect coincidence. When the specimen, however, has been kept in alcohol for a time, this lateral line becomes almost imperceptible; it was from a too careless examination of the living fish that my former error arose.

Dr. Dekay, in his recently published Report on the Fishes of New York, calls this fish *Lebias ovinus*, placing *ellipsoides* among the extra-limital species. This appears to me unnecessary. I am unable to see in what Le Sueur's account differs from our northern fish, or from the description and figure given by Dr. Dekay. The only point of the slightest variation is in the shape of the caudal fin. Le Sueur says, "caudal mostly unequal, enlarged and elongated posteriorly and obliquely." Dr. Dekay says, "caudal fin nearly even." So that the only difference is a difference of degree in this inequality. I have never seen any in which the caudal fin was so much uneven as in Le Sueur's figure; but this, entirely unsupported by any other character, seems to me not sufficient to separate the species.

Mitchill's description was published before that of Le Sueur, but as the former was imperfect and drawn from the young fish, while the latter gave us a complete representation of the adult, I judged it better to adopt the name given by Le Sueur. Perhaps in this I was wrong, and according to the rule of priority the name *ovinus* should be retained, but we scarcely need both *ovinus* and *ellipsoides*.

Hydrargira fasciata. Schn.

This I regard as the *Esox pisciculus* of Dr. Mitchill, but not his *Esox zonatus*, which is incorrectly referred to it by Cuvier. Both this and the following species are subject to changes in color which can be learned only by watching them at different seasons of the year. Dr. Mitchill says that the abdomen of this fish is yellow; it is a brilliant golden yellow in June and July, (at which time, being its spawning season, all its other colors are in the greatest perfection), but during the rest of the year the abdomen is white. The species may, however, be at all times distinguished by the light colored vertical bands on its sides, and by its dorsal fin being marked with oblique, waving lines, alternately light and dark.

Hydrargira pisculenta. Mitch.

This species is even more variable than the last. Dr. Mitchill's description was taken from one of rather large size, in which the sides are plain olive green, while the fish is alive. As we descend to those a little smaller, black vertical bands appear, which become more apparent in still smaller specimens, until at the length of an inch we have Mitchill's *Esox zonatus,* which is simply the young of the *pisculenta.* On the approach of cold weather this and the preceding species (*fasciata*) leave the other parts of Old Man's Harbor and gather in immense numbers in one or two narrow creeks. In January and February, 1841, I found them in one of these places collected so densely, that when the tide left them, nothing was visible but a mass of fish completely concealing the whole muddy bed of the creek. On dipping a common hand-net among them, I have repeatedly taken up more than three thousand of them at once; they were nearly torpid with the cold, but still able to swim.

The great tenacity of life in this and the kindred species is certainly well worthy of remark. They are capable of remaining out of the water four hours without receiving any apparent injury. On being replaced after such a time, they swim about with as much ease as though they had never been removed, and give, by their motions, no token of being in pain. The only species in which I have observed this, are *pisculenta, fasciata,* and *multifasciata;* it is, however, very probably common to the whole genus.

Hydrargira flavula. Mitch.

The *flavula* is much less common than the last two species, and, with solitary exceptions, is not seen during the winter. The longitudinal bands upon this fish I do not find to present a character by any means constant. They are very variable in their number, and in young specimens are not found at all. I have seen very many in which no traces of them could be discerned, and in these the whole side is commonly marked with bright vertical black bands. In others one longitudinal line is partly developed, and in others still, one line complete and the rudiments of another, and thus increasing till we reach four complete lines, which are commonly found only in full grown specimens. But even when these lines are wanting, there is no danger of confounding the species with *pisculenta*. The vertical bands are always brighter, the color of the fish is lighter, and the shape of the head is different.

I have thus mentioned the only three species of *Hydrargira* which I was able to find on the island, and which I am inclined to believe are the only species occurring on the coast of New York. In this I am confirmed by Dr. Mitchill and Dr. Dekay. They both describe these three species and no others; by Dr. Dekay, however, they are placed in the genus *Fundulus*, and he gives them different specific names. In this I think he is in error. I have called them by Mitchill's names because they agree in all points with his descriptions, and as they were found in waters neighboring to those in which his specimens were collected, I saw no reason to doubt that they were actually his species. Dr. Dekay, however, has described two of them as new. His *Fundulus zebra* is what I have called *Hydrargira fasciata*. His *F. viridescens* is identical with *H. pisculenta*; it appears to me he is decidedly wrong in saying his *viridescens* may be Mitchill's *Esox pisciculus*. "Sides marked by parallel pale or yellowish narrow zones," does not at all correspond with Dr. Dekay's description. His *zebra* is what I regard as Mitchill's *pisciculus*.

His *F. fasciatus* is the one here mentioned as *H. flavula*. In applying the name *fasciata* to Mitchill's *pisciculus* I followed McMurtrie's Cuvier, and was perhaps led into error. Dr. Dekay quotes Valenciennes and applies the same name to *flavulus*.

As to the genus *Hydrargira* I cannot forbear a few remarks. There are several of our small fishes which we are not able to include in any of the genera mentioned by Cuvier, as *Fundulus*, *Pœcilia*, &c. They form an exceedingly natural group, and as that group had been distinguished by Le Sueur under the generic name *Hydrargira* I saw no reason for not adopting it. To that group the three species here mentioned belong. Dr. Dekay has retained the genus *Hydrargira*, though he speaks of it as defective, and if the genus is retained, these species seem to me necessarily included in it. They certainly must be placed with *multifasciata*, which in the peculiar form of the mouth, teeth in the throat, &c., agrees entirely with them ; and this *multifasciata* is by Dr. Dekay still called *Hydrargira*.

Esox reticulatus. Le Sueur.

The *pickerel*, incorrectly called *Esox lucius* by Dr. Mitchill, is very abundant in the ponds and streams on the south side of the island, but is commonly of small size, those of half a pound weight being very rare ; in Great Pond, however, they are found much larger.

I examined these *pickerel* with much care, and was unable to perceive sufficient differences to warrant my considering them distinct from Le Sueur's *reticulatus ;* and this opinion I have not since found occasion to alter. Dr. Dekay has given a very fine figure of them, and described them under the name *fasciatus*. Of this I cannot see the necessity or propriety ; for though by taking two extreme instances of this fish and a larger *pickerel*, a pound weight for instance, we may find differences apparently enough to prove them distinct, yet the interval between the two is filled up by others which so blend together that no line of separation can be drawn. In the smaller fish we find the part of the head anterior to the eyes proportionally shorter, the body often deeper and commonly the colors darker. But, as before remarked, these characters are by no means permanent. As we examine other specimens we find the head become longer, and the body more slender, while the colors vary exceedingly. In this latter respect particularly, the differences are very striking. I have seen some which were of a fine, light, olive green above, with five or six broad bars of the same descending on the side; others which were almost entirely black on the back and sides; others which had the colors as in Dr. Dekay's figure; and others which were reticulated like the larger *pickerel.* Yet all had the black vertical band at the eye distinctly marked. July 27, 1842, I had an extensive series of these fish before me, and after a very careful examination of them I could not but feel convinced that they were identical with Le Sueur's *reticulatus.* I have never found any in which the position of the ventral fins perfectly agreed with Dr. Dekay's figure, but the difference has been very slight, and apparently not sufficient to be of any value as a specific character.

It may be urged that the size to which these pickerel are limited, is a strong argument against their being of the same species with the larger fish of our ponds and streams. But if we proceed on this principle we shall be forced to separate fish whose identity *has* never been questioned, and apparently *can* never be. The small size of the *pickerel* is not peculiar to Long Island. There are one or two places in Connecticut in which the same thing occurs. In one of these places the difficulty appears to be a want of suitable food; in the others the food is abundant.

But let us take one or two similar cases. It is well known that our common *trout* (*Salmo fontinalis,* Mitch.) sometimes attains the weight of four or five pounds. Why then in our smaller streams do we find the very great majority only six or seven inches long, while one of a pound weight is considered very uncommon? It cannot be the effect of age; for they are often prevented by dams from descending, and must of course remain in the stream during their whole lives. Neither does it seem to be from a deficiency of food, for of that they obtain an abundance.

But to be more definite still, let us refer to Mr. Carman's pond at Fireplace, Long Island. In the pond a *trout* of a pound is considered large, most of those taken being less than this; below the pond, in the stream which runs from it, a *trout* of less than two pounds is not counted of the average size, while those of three, four, and five pounds are frequently taken. Why is this? It may be said that in the pond there must be a deficiency of food; well, if so it should be remembered that this is one of the places in which we find the small *pickerel*. But I can scarcely believe that want of food causes the difference. It certainly appears to me that the pond affords a supply fully as abundant as that to be obtained in the one next above on the same stream, which is the property of James Weeks, Esq. And yet this latter has always been noted for the great size of its *trout;* a few years since seventeen were taken in it in one day which weighed thirty-four pounds.

Let us take another species, *Perca flavescens.* M. In the Hockanum River, which enters the Connecticut a little below Hartford, *perch* are very abundant, but so far as I am aware one weighing more than a pound has never been taken there; and yet probably no stream affords the food of the *perch* in greater profusion. In other apparently less favored places, however, *perch* are often found of two or three pounds.

Again, on the north shore of Brookhaven, Long Island, a *black-fish* (*Tautoga americana,* Bloch) of two pounds is esteemed large, while beyond the weight of five pounds they are entirely unknown; yet in the Vineyard Sound they are taken of fourteen or fifteen pounds.

It appears, therefore, that a difference in size alone is not sufficient for a distinguishing specific character, even though we may be unable to account for the difference.

Before leaving this species I cannot forbear making the following mention of a specimen which, though it had no connection with Long Island, is yet worthy of being recorded on account of its great size.

Feb. 28, 1842, I examined a *pickerel* which had been caught in a net in the Hockanum River, about two miles east of Hartford, Conn.; it was an undoubted *reticulatus* of Le

Sueur. It was thirty-eight inches in length, and weighed fourteen pounds. In its stomach was found a *dace* (*Leuciscus pulchellus*, Storer) ten inches long. This is the largest instance of this species which has ever come under my own observation, and with one exception the largest of which I have ever heard as occurring in the Eastern States. That one was taken in the spring of 1842, near Greenfield, Mass., and weighed twenty pounds.

Dr. Kirkland says, however, that the *pickerel* of Ohio are taken occasionally four feet in length, which would make their weight much greater than that of either of those above-mentioned.

Belone truncata. Le Sueur.

I had been two years on the island before I was aware of the existence there of the *garfish*, which, however, is not at all uncommon in Old Man's Harbor. The reason was, that they are never or very seldom seen by day; my first knowledge of them was derived from men who were in the habit of spearing eels by firelight. During the day they lie hid in the eel-grass and seek their food only in the night, at which time the specimens in my possession were caught. Their food consists of small fish.

This species sometimes ascends rivers, many miles above the reach of salt water. In August, 1842, I saw seven or eight at different times in the Connecticut river, near Hartford; one I succeeded in obtaining.

Pimelodus catus. Lin.

The *horned pout* is found in Great Pond, and Peconic river; it is called there *bullhead* and *catfish*. I have followed Dr. Dekay in adopting the specific name given by Linnæus, in place of Le Sueur's *nebulosus*.

Salmo fontinalis. Mitch.

The *trout*, for which the streams and ponds of Long Island are famous, are often taken of very considerable size; those of three or four pounds are not uncommon; and eight or ten years since a *trout* was caught at Fireplace, which weighed fifteen pounds. It must, I suppose, have been this species. It was called by many who saw it a *salmon trout*, on account of its great size or perhaps some peculiarity in the coloring, but the most experienced fisherman who was engaged in taking it (it was caught with a seine) considered it only a very large individual of the common *brook trout*. I may here remark, that on that stream, and possibly in other parts of the island, the name *salmon trout* is often applied to any specimen very strongly tinged with red on the abdomen, and it may have been so in this instance.

I am unable to perceive any necessity for the genus *Baione* which Dr. Dekay has separated. Even if I had never seen the fish, and judged merely from his description, the genus would appear to me not needed. His characters are as follow: "A range of even teeth on the maxillaries; a shorter range on the intermaxillaries and the anterior part of the vomer. A series of long recurved teeth around the margin of the tongue. Branchial rays ten. Adipose fin posterior to the anal. Scales microscopic." Now the whole of this so far as "margin of the tongue," that is, all which relates to the teeth, applies in the most minute particular to *salmo*. "Branchial rays ten;" but in *salmo* we find the branchial rays "more than eight," which certainly may mean "ten," without any violence to the language. The number of rays, however, here given by Dr. Dekay, seems peculiarly unfortunate, for in his own specific description, he says, "branchial rays ten and eleven on opposite sides." With what propriety, then, does he introduce "ten" as a generic character? Again, "adipose fin posterior to the anal;" surely this is of small importance in marking a genus, but such as it is, we may afford to give it its full value, for it is the only difference to be found. "Scales microscopic;" this is true, but it is of no weight, for scarcely one of our American *trout* and *salmon* can be mentioned, in which, when the specimens are of no greater size than this little fish, (two inches in length), the scales are not microscopic.

I think Dr. Dekay is not only in error in attempting to establish this as a new genus, but he has simply described the young of a species already well known. "The orbits large" and "eyes very large in proportion to the size of the fish;" these, of themselves, give us partial proof that the fish is immature, for in such cases the eyes are, almost invariably, very large in proportion to the size of the head and of the body. But, fortunately, we are not left to judge merely from the description. This *baione!* is very common; it is found in great numbers in many streams in Connecticut, and doubtless in other states also, wherever the adult fish occurs. By a somewhat singular coincidence, Dr. Dekay has applied to his *baione* a specific name (*fontinalis*) which will not need to be changed. When we restore it to the old genus, it will be *Salmo fontinalis, Mitch.*; or in other words, the *baione* is simply the young of the common brook trout.

The spots on the side represented in Dr. Dekay's figure, and which often remain distinctly visible on our trout till the fish are six or seven inches long, Mr. Yarrell says he has reason to believe are common to all the species of the genus *Salmo* in the earlier stages of their growth.

Comparing carefully Dr. Dekay's two descriptions of *Salmo fontinalis* and *Baione fontinalis,* the only differences I can find are in the rays of the dorsal fin, and in the color. He says, in the *trout* these rays are thirteen, and in the *baione* eight. But of the latter the rays are "so far cloven down as to render them difficult to enumerate;" and is it not possible that in a fish so very small, the number of the rays was not ascertained with perfect correctness? As to the colors, the description of the *troutlet* applies perfectly to the young of the *trout*. Of the vertical bands mention has already been made. From the descriptions therefore, and from an examination of recent specimens, I cannot come to any other conclusion than the one given above; that is, that the *baione* is only the young of *Salmo fontinalis.*

Scopelus humboldtii? Cuv.

I introduce this species, though with doubt of its occurrence. October 31, 1840, I picked up on the beach a fish which had been rolled and chafed by the tide, and which I am consequently unable to determine with certainty. Apparently it is the species here mentioned.

Clupea minima. Peck.

Early in the fall, commonly by the first of September, a small species of *herring* arrives in the Sound in great numbers, which is, I think, the *brit.* It does not agree altogether with Dr. Storer's description, or with any other which I can find, still it does not appear advisable at present to separate it as a distinct species. It is the only one of the genus, of which I was able to learn anything during a residence of three years on the island.

Alosa mattowacca. Mitch.

This species, called by the fishermen, *green back*, is common during the latter part of the season, arriving sometimes by the last of August. They are caught in numbers in the nets drawn for *bluefish* and *basse,* and are used for food, though very bony.

I am gratified to perceive that the fish, which from Dr. Mitchill's brief description I had supposed to be his *Clupea mattowacca,* has been described by Dr. Dekay under that specific name. He has given us a very good description, accompanied by an excellent figure.

Alosa menhaden. Mitch.

On the north shore of Brookhaven, for the last few years, this fish has been found in but comparatively small numbers, but at the east end of the island and on the south side they come in boundless multitudes. They are almost exclusively used for manure, though occasionally they are eaten. The nets employed in catching them, at the east end of the island particularly, are of very great length, and a million have been taken at a single haul. The number noticed by Dr. Dekay (168,000) would not be considered an uncommonly large haul. The price which he mentions is too great; they are often sold for fifty cents a thousand.

MORRHUA PRUINOSA. Mitch.

The *tomcod* is exceedingly rare, though on the north side of the sound it is common. The only specimen I obtained in Brookhaven was picked up on the beach. I am very happy to have it in my power to mention this species under a better name than "*tomcodus*," which it has borne so long. The one adopted by Dr. Dekay *(pruinosa)* appears well selected and entirely unobjectionable.

MERLUCIUS VULGARIS. Cuv.

February 1, 1841, I picked up on the beach a small specimen of this fish; it is the only one I have seen.

PHYCIS AMERICANUS? Schn.

It is with much hesitation that I introduce the name of this species. I have three specimens, all of which were picked up on the beach during the winter of 1841 and 1842; the largest is only about three inches in length. They differ much from the account given of the *Americanus*, but as I am acquainted with that species only through descriptions, and these apparent differences may arise merely from the size of my specimens, I do not venture at present to consider my fish distinct.

PLATESSA PLANA. Mitch.

The *flat-fish* is very abundant in the harbor during the whole year, though in the winter they are not seen, having then retired into the mud and become torpid. They begin to move in the spring, commonly in April, but on their first appearance they are very little esteemed; during the summer they are commonly taken with the spear. They are often found buried in the sand so completely that the only parts of them visible are their eyes. They are then apparently watching for their prey, of small fish, among which the *sand launces* are perhaps most frequently taken by them.

PLEURONECTES MACULATUS. Mitch.

As the name *Rhombus* cannot be retained in this family, I follow Dr. Dekay in adopting the old name *Pleuronectes*, to designate the same genus. The present species, called by the fishermen *sand-flounder*, is somewhat common in the sound during summer, but is comparatively rare in the harbor. Their habits and food are much like those of the *flat-fish*. One which I had examined, had swallowed two large *sand-launces*, one small *hydrargira*, and more than a dozen *shrimps*. They are remarkable for their semi-transparent appearance, and on account of their thinness, and consequent small weight, are seldom eaten. They are often taken in the nets, but are commonly neglected by the fishermen. This is not the species described by Dr. Storer under the name *Rhombus aquosus*, and considered by him to be identical with the *Pleuronectes aquosus*, (or more correctly *maculatus*) of Mitchill. I think he was in error, and that the error arose from his not having seen Mitchill's species. On Long Island both are found, and to one examining the true *aquosus*, the difference from Dr. Storer's description is at once manifest. The proportions of length and breadth given in the two descriptions show us two fish of very different shapes; the difference in size also is great. But in treating of the next species I propose to exhibit the points of contrast between the two; my largest specimen of Mitchill's *maculatus*, to which some reference will be made, is ten and a quarter inches in length.

Dr. Dekay has given a most admirable figure of this species, and a good description; he calls it *maculatus*, and gives as a synonym, *aquosus* of Storer. But how he could reconcile the two accounts, I cannot imagine. Indeed the differences were so apparent, that he could not overlook them. He says, "I cannot reconcile the radial formula of my own, and other describers;" and again, "has been known to weigh twenty pounds." I have never seen them, except in two instances, larger than the dimensions stated above, (five inches in length). These discrepancies, however, are very easily explained, if we suppose Dr. Dekay and Dr. Storer referring, as appears almost certain, to two distinct species.

PLEURONECTES . . . .

This is the fish considered by Dr. Storer to be the *Pleuronectes aquosus* of Mitchill; the differences of the two we will now consider.

Pleuronectes aquosus Mitch.	*Rhombus aquosus.* Storer.
"Measured nine inches from nose to tail, and when the dorsal and anal fins were expanded, five and three quarters across." In my specimen, length ten and three quarters, breadth, exclusive of the fins, five and a quarter.	"Length of the fish eighteen inches, depth across the middle, exclusive of the fins, seven inches.
"Another of the largest magnitude, was eleven inches long."	"Specimens have been caught the last season weighing twenty pounds."
"Eyes yellowish;" in my specimens, eyes bright yellow.	"Irides silvery."
Lower jaw the longer in my specimens; "teeth small, though sharp."	"Jaws equal in length, and armed with a single row of separated, quite large, sharp teeth."
"Dorsal fin commences between the right eye, and the upper lip." In my largest specimen, the dorsal rises four-tenths of an inch anterior to the orbit of the upper eye, and one-fourth of an inch posterior to the point of the upper jaw.	"The dorsal fin arises over the anterior half of the orbit of the eyes."
The rays of the anterior part of the dorsal, are free for nearly half of their length, presenting a digitate appearance. Mitchill's figure in this respect is inaccurate.	The corresponding rays are much shorter, and but slightly free at their extremities.
Length of caudal rays, in my specimen, two and three-tenths inches, making the proportionate length for a fish of eighteen inches, nearly three and eight-tenths.	"Length of caudal rays, two and a half inches," in a specimen eighteen inches long.
Fin rays, "D. 65; A. 54."	Fin rays, "D. 89; A. 68."

The two fish appear thus, manifestly distinct. Of the species recorded by Dr. Storer, I have been unable to find any previously published description; and as I cannot satisfy myself, that it ought to be referred to any one of those described by Dr. Dekay, I believe that it is as yet destitute of a specific name. If this, however, shall prove to be true, the conferring of the name belongs of right to the one by whom the fish has been already most carefully and accurately described.

The present species is not uncommon on Long Island, and is often called the *sea-flounder*.

Achirus mollis. Mitch.

This fish is very rare; I saw but three specimens during a residence of three years on the island. It occasionally ascends fresh water streams, as in October, 1841, a very fine specimen was obtained near Hartford, Conn., forty miles from salt water. It was presented to the Hartford Natural History Society, by Mr. C. H. Olmstead, and is now in their collection.

Anguilla bostoniensis. Le Sueur.

This eel, the only one which I was able to find on the island, inhabits the creeks and bays in myriads; a vast supply is sent from the South Bay to the New York markets. On the approach of cold weather, commonly in November, they retire into the mud and become torpid, remaining so till May, in which condition many of them are caught with spears. During the whole summer they are active, but much more so by night than by day. Advantage is therefore often taken of this habit to spear them by fire-light, and in this manner great numbers are caught. Their food consists chiefly of various small fish, for which they lie in wait, concealed in the mud or eel-grass, and they in their turn, furnish a large and excellent amount of food for the inhabitants of the island.

This is unquestionably the species referred to by Dr. Mitchill as the *Anguilla vulgaris*, though his description is very short. It is with equal certainty the *tenuirostris* of Dr. Dekay; but as Dr. Storer assures me that Dr. Dekay's species is identical with the common eel of Massachusetts, of course the name *bostoniensis* has the precedence. The species appears very closely allied to the *acutirostris* of Yarrell. I subjoin the following notes taken from a specimen seventeen inches in length. Color above dark olive green; below white somewhat stained with yellow. The greatest circumference of the body, near the origin of the dorsal fin, is three inches. The pectorals arise at 2 1-10 inches from the point of the lower jaw; the dorsal at 5 6-10; and the anal at 7 1-10.

Is there not an error of the press in Dr. Storer's description in substituting "pectorals" for "dorsal?" "From the lip of the snout to the base of the pectorals, eight inches" does not seem to be in proper proportion to the length of the fish; but if in place of "pectorals" we insert the word "dorsal," the proportion is perfect.*

Ammodytes lancea. Cuv.

The *sand-launce* is met with in the Sound from the first of May to the first of November, and, during the early summer months more particularly, no other species occurs in such boundless numbers. They constitute for some months the chief food of the *blue-fish* and the *basse*, and are also eaten largely by eels, *flat-fish*, *gurnards* and indeed almost every species which is of sufficient size to destroy them. During the stay of the *cuttle fish* (*Loligo illecebrosa*) in the harbor, which is only three or four weeks in May, they also afford a large amount of food for them. They are indeed almost in the condition of the *flying fish* within the tropics, exposed to numerous enemies from beneath and to no less certain and perhaps as continual danger from above. For the terns, which frequent this shore in great numbers, derive their chief and probably we may say sole support from these *sand-launces*, during the two months that they remain with us before proceeding north to rear their young. This species, though of no direct use to man, is yet of great importance in affording

* Dr. Dekay has satisfied himself of the correctness of Dr. Storer's observations upon this species by a personal examination of specimens in Boston market since this paper was placed in the hands of the publishing committee. — Pub. Com.

support to those larger fish which from their size and flavor are in demand for the table, and which yield us no small portion of our food.

I have often watched with much pleasure the peculiar habits of these fish, from which they derive their generic name. In pushing my boat along the shallow creeks of the harbor, each thrust of the setting-pole would send them darting forth from their hiding places in the sand, so that where none were to be seen before, the water would become suddenly alive with them. They would in general spring rapidly forward for a few yards or rods, and in an instant disappear in the sand. They may be noticed also in companies of all numbers, from one hundred to several thousands, swimming slowly backward and forward in the creeks. On passing over a favorable spot of sand, two or three will be seen separating from the main body and inclining gently downward, as if selecting a spot for entrance; when near the bottom they dart forward, and, striking the sand head-foremost, disappear instantly. Sometimes, however, when the sand is harder the impetus of their plunge buries but little more than their head, and the body is then forced in with a waving motion, one or two seconds being occasionally consumed in effecting an entrance. I have often noticed them, while swimming, partially coil their bodies and strike upward as at some object in the water; probably they were then taking some one of the insects which constitute the chief portion of their food.

I believe that this species is the *lancea*, and as Dr. Storer has described the *tobianus* as occurring on the coast of Massachusetts, it is reasonable that I should give the grounds for this belief. My notes and measurements are taken from a specimen four and a half inches in length, which is the largest one in my possession; the largest one I ever saw was not quite five and a half inches long.

One of the marks distinguishing the *lancea* from the *tobianus* is the relative length of the head. Yarrell says "the length of the head compared to the length of the fish is less than as one to five;" in my specimen the length from the tip of the lower jaw to the posterior angle of the operculum is seventeen twentieths, in *tobianus* the corresponding length would be an inch. Again, " the posterior margin of the eye is less than half way between the point of the lower jaw and the posterior projecting angle of the gill-cover ; " the distance from the posterior margin of the eye to the tip of the lower jaw is decidedly, though slightly, less than the distance from the same point to the angle of the operculum. " The dorsal fin commencing in a line over the middle of the pectoral fin ; " the dorsal commences over the last third of the pectoral. In Yarrell's account of the *lancea* the length of the pectorals is not mentioned, in *tobianus* it is said that their length is one third of that of the head ; in my specimens their length is half that of the head. The lower jaw is not so much elongated as in the figure given of *tobianus,* agreeing in that respect perfectly with the figure of *lancea ;* the size also is in favor of the latter. I have examined very great numbers of specimens, but have been unable to find more than one species ; that species is, I believe, the *lancea.*

Dr. Dekay has described an *Ammodytes* which he calls *americanus,* but it can scarcely be the present species. In his *characteristics* he says " length six to twelve inches." But perhaps this is not what it ought to be, for at the end of his description he says, " length, 4.0 — 6.0." He does not mention the length of the head, but the origin of the dorsal, the situation of the nostrils, the length of the pectorals seem to indicate that it is not the species which I have called *lancea.*

Syngnathus peckianus. Storer.

In the waters of the island I was able to find but one species of *Syngnathus ;* that one is, I have no doubt, the *peckianus.*

They commonly remain at the bottom among the eel-grass, but in warm days they sometimes come to the surface ; at such times I have taken them up with the hand without their making any attempt to escape. July 3, 1840, several were thus found, floating in a vertical position, with the head bent at a right angle to the body so as to remain horizontal near the surface. Three of them were males; in one the abdominal pouch was filled with eggs; in another, with the young just ready to be set at liberty; while in the other the pouch was almost empty, only very few of the young remaining in it.

These fish are sometimes caught in seines whose meshes are more than an inch in diameter. This happens from their habit of very frequently lying perfectly still when touched on the side by any object which alarms them. The net strikes them in this manner, and from the great length of their body, reaching across many meshes, they are brought in by it, though if they attempted to pass through, it would present to them no obstacle whatever. When confined in a vessel of water I have found them generally little inclined to move; but if aroused, their motions are exceedingly rapid.

This species is subject to very great variations in color. I have seen some, especially small specimens, which were almost perfectly black both above and beneath; others which were very light brown without bands; and others which were banded with dark brown. In some the abdomen is bright yellow; in others it is very light, almost white.

I have called this species *peckianus;* I am perfectly confident that it is also the *fasciatus* and *viridescens* of Dekay. In comparing the former with *peckianus,* Dr. Dekay says the body of his species in front of the dorsal fin is heptangular; this is equally true of Dr. Storer's species; "head and rostrum proportionably longer;" but this is by no means a constant character, the head and rostrum vary very greatly in length in fish of the same size. "The greatest depth of the rostrum scarcely exceeding twice the greatest depth of the head," evidently means nothing; perhaps it is owing to an error of the press. But not to confine ourselves to these few points, the whole of Dr. Dekay's description is perfectly applicable to the species which I found on Long Island, and which Dr. Storer says is his *peckianus;* his figure also is a very beautiful and perfect representation of the same fish.

And if *fasciatus* is a synonym for *peckianus*, *viridescens* must also be referred to the same, for it seems impossible to point out any differences in the two descriptions given by Dr. Dekay. Of his *viridescens* he says, "in recent specimens, it is hexangular before the vent or anal fin ; but in cabinet specimens, a slight carina is observed in the middle of the belly." Now this character is at the most of very slight value, for it is far from being constant. In some instances the two series of plates along the abdomen meet so as to form a strongly marked angle, and of course the body is heptangular ; while in others the two series are in the same plane and the body is hexangular. I have specimens which show every gradation from a very prominent angle to a perfectly flat surface. If we take now the whole remaining part of Dr. Dekay's description, what was written for *viridescens* applies with equal correctness to *fasciatus*. The number of plates, the carina on the head, the eyes, the opercula, the jaws, the mouth, the fins, the anal pouch all vary so slightly that I cannot regard *viridescens* as even a variety of *peckianus*. Dr. Dekay indeed gives to *fasciatus* three more caudal rays than to *viridescens*, but that is the greatest difference which I can find between them. The colors as before remarked, are of very little importance.

Diodon Maculato-striatus. Mitch.

I had described this as a new species, supposing that it was distinct from Mitchill's fish, but since the appearance of Dr. Dekay's report, I have been induced to suppress my description, for the fish is there recorded under the name given above. How it can, however, possibly be Dr. Mitchill's species, I cannot conceive, unless there are very great errors in his description. "Length four inches ; breadth about three ;" "eyes two inches asunder" are very far from applying to my specimens. But these proportions can scarcely be correct ; that a fish of this family should have the breadth equal to three-fourths of the length, and the distance between the eyes equal to half the length, is almost impossible. There may be an error of the press or in copying. But the color also differs from my specimens and from Dr. Dekay's description, though this is not of so much importance.

Dr. Dekay says the species is not rare; but on the north shore of Brookhaven it is very seldom seen. In three years I was able to obtain but two specimens, and the fishermen always spoke of it as an extremely rare fish. The only other specimen I have ever seen, is in the cabinet of the Yale Natural History Society, New Haven; it was probably taken somewhere in Connecticut.

The food of the species consists, in part at least, of crustaceous animals; the stomach of one of those which I procured, contained fragments of what is commonly known as the *spider-crab* or *sea-spider* (*Libinia canaliculata*, Say). Dr. Dekay says, that the stomach of one which he examined was filled with fragments of shells. That they feed much on fish is not probable, their movements being too slow to allow of their securing food of that kind.

The natatory bladder is uncommonly large and bifurcated anteriorly, somewhat like that of a *Batrachus*, which, however, it greatly exceeds in its relative size.

TETRAODON TURGIDUS. Mitch.

The *swell-fish* is very common, and frequently very troublesome in taking the bait used in fishing for *blackfish* and *porgees* while their own flesh is considered of no value. They arrive as early as the first of June and remain till October. I have found the fin rays in this species differing almost constantly. The most common number for the pectorals appears to be sixteen; in one instance I found them fifteen; in another seventeen; in four specimens, fifteen in one pectoral and sixteen in the other; and in one instance, sixteen on one side and seventeen on the other. The anal fin gives sometimes seven rays, and at others eight; Dr. Storer and Dr. Dekay say that in the specimens described by them the number was six.

These fish possess, in a remarkable degree, the power of changing their color at will. If alarmed while lying on the sand, at a time when they do not choose to escape by swimming, they fade instantly so that they show no tints but a dingy white scarcely distinguishable from the sand on which they lie ; if the alarm ceases, their original color returns and they are again easily discernible. Many other fish possess this faculty, but I have not met with any species which equalled the swell-fish in the extent and rapidity of the change.

This species, in common with the others of the genus, has the power of inflating itself with air, or distending itself with water. In regard to this habit, Cuvier and others have made a most singular mistake. Yarrell quotes Dr. Roget in the first volume of the Bridgewater Treatises as follows : "The abdominal region being thus rendered the lightest, the body turns over, the stomach being the uppermost part, and the fish floats upon its back, without having the power of directing itself during this state of forced distention." How can such an error have arisen ? Possibly it may have been from seeing the fish only when out of the water. If after being caught, and while still out of the water, it inflates itself, it then, being filled with air, is of course lighter than the water, and if thrown on the surface floats away with the back downward, until expelling the air it turns over and dives to the bottom. But how different is the case when we consider the fish in its natural position, at the bottom, the situation contemplated in the above quotation. If it then distends itself, whence is the air to be derived which is to render the fish so light ? Has the fish the power of mechanically separating it from the water which contains it, so as to swallow the one and reject the other ? The truth is, that if distended while beneath the water, they are of course filled with water and not with air, so that their specific gravity is neither increased nor diminished perceptibly. Often, on catching them while fishing, I have held them in my hand over the side of the boat so as to bring them some inches beneath the surface ; and by irritating the abdomen slightly with the fingers, they begin to distend themselves, and soon become hard and round, as usual. If liberated in this condition, they are able to swim, though more sluggishly than at other times; their first movement commonly is to come up till their head is above the surface, when they spout out the water in a continued stream, and being thus relieved, dive to the bottom. And why is not the purpose, attributed to this faculty by most naturalists, that of self-defence, as well secured by a distention with water as by an inflation with air? The spines are equally erect and fixed, and the whole fish presents to all outward observation the same appearance in the one case as in the other. But that defence is really the object appears by no means certain, and, in fact, rather improbable, from the slowness of the operation. In this species eight or ten seconds is the shortest time in which it is completed, and it frequently consumes a minute or more, a period far too great to be of service in affording security against a danger so sudden as that of an attack from a larger fish. Probably the true design of so singular a faculty is yet unknown.

Acipenser oxyrhincus. Mitch.

This *sturgeon* is very common in the Sound during summer, arriving as early as the middle of June, and remaining until October. They are most usually taken by harpooning them, though many are caught in nets. Specimens not unfrequently are seen seven or eight feet in length, but the smaller ones are much more esteemed for the table.

Respecting the *sharks*, the account which I can give is, I regret to say, very imperfect. They are, most of them, fish which swim singly, are difficult to take, and in some cases occur at any given place only once in the course of several years; so that a long time is requisite to determine what species ought actually to be included. I saw but three during my residence on Long Island, though I received information in regard to several others. The three are all that I shall notice here.

Carcharias griseus. Ayres.

This *shark* I have met with in but one instance; it was taken in a net August 11, 1841.

It cannot, I think, be referred to any one of the species described by Dr. Dekay, and I have been unable to find any description with which it agrees. With its habits I am unacquainted.

Mustelus canis. Mitch.

This is the most common, and in fact the only common, species of this family found in these waters; they are frequently taken in nets drawn for other fish, though never, I believe, more than one or two at a time. The largest one I have seen, measured fifty-one inches in length. They are universally called by the fishermen, *dog-fish*, which, according to Dr. Mitchill and Dr. Dekay is the name by which they are distinguished near New York. Indeed their general resemblance to the *dog-fish* is very striking, and an inexperienced observer may be readily excused for confounding the two. From the form of their teeth we may naturally suppose that their food does not consist of fish. The stomach of one which I examined contained shrimps, a small crab, and the fragments of a specimen of *Mactra ovalis*.

As this species is not mentioned in Dr. Storer's Report, it seems probable that it does not inhabit so far north as the coast of Massachusetts; how much beyond New York it extends to the south we cannot at present determine.

Spinax acanthias. Lin.

The *dog-fish*, though said by Dr. Storer to be at some seasons very common on the coast of Massachusetts, is in Brookhaven very rare. I saw but one specimen; it was taken in Old Man's Harbor, May 21, 1841.

Raia diaphanes. Mitch.

Plate XII. Fig 2.*

A *ray*, which I am inclined to consider the same as the *diaphanes* of Mitchill, is frequently taken in nets during summer. It agrees with Dr. Mitchill's account in almost every thing, except the spines on the tail. Unfortunately I neglected to take a description from recent specimens; I prepared, however, a drawing, which is annexed. Dr. Dekay's figure agrees much more nearly than mine does with Mitchill's account, in regard to the spines on the tail. I examined several fine specimens, and these spines were always much more numerous than Dr. Dekay has represented them. Whether the two can belong to the same species may perhaps be questioned. In my fish the dorsals are not adipose, but contain distinct rays; the ventrals also are smaller. The very remarkable peculiarity, however, of the translucent portion before the eyes induced me to suppose that I had found Mitchill's *diaphanes*.

Pastinaca hastata? Dekay.

The *rough-tailed sting ray*, as this is called by the fishermen to distinguish it from the following species, is by no means uncommon after the middle of July; fifteen to eighteen of them being sometimes taken at one haul of the net. Their lengths vary from five to ten feet.

That this is the *Raia centroura* of Dr. Mitchill I have no doubt. It agrees perfectly with the few characters mentioned by him, and as it abounds in waters so near to those in which his specimens were obtained, it appears almost certain that it is the species to which he alludes. I think that it is also the *hastata* of Dr. Dekay, though the spines on the tail, as described by him, differ from what I have ever found them. I have examined great numbers of specimens, and have invaria-

* This plate was prepared before the publication of Dr. Dekay's work, otherwise, it would not now appear.—Pub. Com.

bly found *two* of these spines and no more. They vary indeed in length but not in number, and are always placed in close connection, one immediately over the other. Dr. Dekay, however, describes his specimen as having three spines, of which the first is three inches from the second. But as in his characteristics, he says the tail is "armed with two or more spines," it is possible that the number "three" is only an accidental variation.

It appears to me that Dr. Dekay has not acted wisely in rejecting Mitchill's name, especially as he has adopted many of his specific names where there is no more to guide us in determining the species than we have in this instance. But as he has given a description, accompanied by a good figure, of his fish, I have judged it better to adopt the name, *hastata*, proposed by him.

Myliobatis bispinosus. Storer.

Plate XIII. Fig 1.

This species, the *smooth-tailed sting ray* of the fishermen, is much less common than the last, and may indeed be considered very rare. I have seen but one specimen; this was caught July 17, 1841, and was three feet eleven inches in length. It is a very clearly marked species, and as Dr. Storer was obliged to draw up his account from imperfect materials, I have prepared a description and drawing, taken from the specimen which I obtained on Long Island.

Entire length three feet eleven inches; length exclusive of the tail one foot six inches; breadth across the pectorals two feet five inches. Distance between the eyes four and a quarter inches; eyes vertical, elliptical, greatest diameter one inch, least diameter three quarters. On the summit of the orbit of each eye is a hard, blunt, vertical projection, about one eighth of an inch in height, nearly white at the extremity.

Body above, smooth, entirely destitute of spines, even on the dorsal ridge. Color of the whole body and head above, reddish brown; tail lighter at the base, but nearly black towards the tip; color beneath, whitish.

The head is rounded anteriorly, and extends backward, widening but little, for four and a half inches, until opposite the eyes where it joins the body. Mouth two inches in breadth, situated four inches posterior to the snout; jaws lined with numerous blunt, tesselated teeth. Nostrils about an inch and a half anterior to the mouth, each provided with a valve, and having a depression or channel leading back almost to the corner of the mouth. Branchial apertures five on each side; distance between the anterior pair four inches. Spiracles situated behind the eyes, elliptical, one and a half inches in length.

On the tail are two reversely serrated spines, one situated directly above the other, of which the upper one is the shorter; their lengths are two and three fourths, and three and three fourth inches. Their insertion is at about five and a half inches from the origin of the tail; in color they are dingy white.

Immediately before them is a small dorsal fin, one and a half inches in length, and one inch in height. Tail very slender, smooth to the tip, the inferior surface presenting no vestige whatever of fins. Anus beneath the origin of the tail; immediately posterior to it are two cylindrical, or slightly conic, appendages, three and three fourth inches in length.

As the specimen here described is the only one which has fallen under my notice, I am of course unable to determine whether all the characters which have been stated will prove to be constant. With respect to one, the relative length of the two spines upon the tail, variation may probably be expected. The upper spine will, in some instances, doubtless be the longer of the two. The specimen figured was apparently a male; it was obtained at the same place with the preceding species.

I have thus completed my notice of the fishes occurring in Brookhaven. That it is a complete list I am very far from believing. I was there but three years, and I have confined my remarks, with two exceptions, to those which I myself observed during that time. Those two, the *drum-fish* and the *mackerel*, are species so well known that I thought myself safe in admitting them from the accounts of the fishermen. If I had been willing to include those of which I had received satisfactory information, but of which I had not seen specimens, a few more species might have been added. In two instances fish were described to me as having been taken, one at Greenport and the other at Miller's Place, which attracted attention from the singular structure of the head, and which were evidently *Remoras*, but of what species I could not of course determine. *Lampreys* also are taken every year in the Connecticut River at Fireplace; they are, I suppose, the *Petromyzon americanus* of Le Sueur. I heard also of two or three species of *sharks* which I did not see; and of a fish called in the South Bay, *Lafayette*, but which I should judge to be not identical with the one mentioned by Dr. Dekay under that name, the *Leiostomus obliquus*. Since I left the island also one species has been added to the list. During the summer of 1842, the *Pelamys sarda* appeared on the north shore of Brookhaven, and quite a number of them were taken. They were entirely new to the fishermen, who had never seen there any species like them. While on a visit to the island in August, 1842, I saw two specimens, of which I obtained one; they weighed about four pounds each. It appears to me, therefore, not improbable that a residence of a few more years would have enabled me to double the number of species here recorded.

In some instances my observations may seem to vary from the assertions of others, or even to contradict them. In regard to these I may be allowed to mention that what I have stated has been what, in almost every case, has come under my own notice, and that these apparent discrepancies may be only local peculiarities of habit. Thus the *Belone truncata* I found to move only or chiefly in the night. Several species I have mentioned as very rare while on other parts of our coast they are common, as the *Scomber vernalis*, *Morrhua pruinosa*, and others. I have simply, however, recorded the facts as I found them. In other cases I have named as common what Dr. Dekay calls very rare. A remarkable example of this is the *Prionotus carolinus*. There can be no question that the fish to which we both refer is the same; his description and figure agree perfectly with my specimens. And yet he says, "This is a very rare species. In the course of twenty years, I have not met with more than six or eight individuals." While at Miller's Place scarcely any species is more common; I have seen many hundreds taken in the course of a single afternoon.

In the last number of this Journal a *Cottus* was mentioned by me, with the specific name *variabilis*, supposing that it was undescribed. It is, I think, the one intended by Dr. Dekay as the *Cottus æneus;* the name proposed by me must, of course, be suppressed.

ART. XXIV.—DESCRIPTIONS OF FOUR SPECIES OF FISH FROM BROOKHAVEN, L. I., ALL OF WHICH ARE BELIEVED TO BE NEW.

BY WILLIAM O. AYRES, OF EAST HARTFORD, CON.

CARCHARIAS GRISEUS.

Plate XII. Fig. 4.

Length forty-one inches; greatest depth five and a quarter inches. Color above light bluish gray, sides lighter, beneath white. Branchial orifices five on each side, the posterior one being above the origin of the pectoral fin. Eyes oval and vertical, two and a quarter inches posterior to the snout, their length half an inch. Mouth on the inferior surface, about two and a half inches behind the snout. Teeth numerous in both jaws, but not arranged in regular rows; in the upper jaw, however, two indistinct rows may be traced. Teeth in both jaws similar in shape; they are long and pointed, (with spreading roots), and in some instances are furnished with a small projection on each side near the base, like those of the genus *scyllium;* in others these appendages are wanting; edges of the teeth smooth. Nostrils oval, immediately anterior to the mouth. No spiracles discernible on the closest examination.

The pectorals arise about nine inches from the snout; they are horizontal, and their height, measuring along the edge to the tip is five and a quarter inches. The first dorsal arises fifteen inches from the snout, is four and three fourth inches in length, three and a half in height, nearly straight on the anterior edge and concave behind; the posterior portion is free. The ventrals arise twenty-one and a quarter inches from the snout, are horizontal and measuring as in the pectorals, are three and a half inches in height. The second dorsal arises eight inches posterior to the origin of the first, is three and a half inches in length, two and a quarter in height, shaped much like the first. The anal arises twenty-six and a quarter inches from the snout, is two inches and a half in length, an inch and a half in height.

At the origin of the caudal fin is a rather shallow depression crossing the body, nearly half an inch in breadth; the distance from this depression to the termination of the vertebræ is nine and three-fourth inches. The inferior portion of the tail presents two lobes; the first is at the anterior extremity of the fin, the height of which is three and three-fourth inches; the other is two inches from the end of the tail, the height of the lobe being an inch and a quarter.

I am not acquainted with any species to which this can be considered very nearly allied. It differs in respect to the teeth from almost all others of the genus and indeed corresponds in this point more nearly with the characters of *Scyllium*. That it cannot, however, belong to this latter genus is apparent from the position of the first dorsal and from the structure of the nostrils.

Though the specimen from which my description was taken was only forty-one inches in length, I am yet confident that the species attains a much greater size. I have several teeth which were taken from a shark caught on the south side of the island; they belong evidently to a fish of this species, and judging from their relative size, the individual could not have been less than seven feet long.

The specimen figured was caught in the Sound, on the north shore of Brookhaven, L. I.

Gasterosteus millepunctatus.

Plate XII. Fig. 3.

Entire length one inch and eight tenths; greatest depth four tenths of an inch; depth at the insertion of the caudal fin three twentieths; depth, one fifth of an inch anterior to the caudal fin, only a little more than one twentieth. Body very thin on the back, but widening toward the abdomen, where it is in some specimens three tenths of an inch in thickness; posterior to the origin of the anal fin the body is somewhat compressed.

In color the sides show a ground of greenish olive, thickly clouded over with brown ; this latter, however, does not consist of a plain shading of that color, but of a very vast number of small, blackish spots, not dispersed uniformly, but gathered in clouds and waves, and sometimes in tolerably well-defined vertical bands. Lower portion of the sides somewhat lighter, abdomen silvery. Colors of the head like those of the body, the top and upper part of the sides being greenish, clouded with brown, while the lower portions of the operculum and preoperculum and the throat are lighter. In one specimen in my possession, the spots on the sides are nearly confluent, so that the whole upper part of the fish appears almost black.

Eyes near the summit of the head, one tenth of an inch in diameter, distance between them a little less than their diameter. Mouth rather small, inclining upward, teeth numerous in both jaws. Lateral line arises above the operculum, ascends slightly, then descends until past the origin of the dorsal fin, whence it proceeds in nearly a straight course to the tail. Sides entirely destitute of the plates which characterize most species of the genus.

The dorsal fin arises eight tenths of an inch from the point of the upper jaw, is half an inch in length and one tenth of an inch in height. Anterior to the fin are four spines, three of which are free. The first is one sixth of an inch in height, the second a very little shorter than the first, the third about one eighth of an inch high, the fourth, which is connected with the dorsal fin, of the same height with the second.

Each ventral fin is represented by a single serrated spine, one fifth of an inch in length. In some of the younger individuals this spine is bright red, but I have not found it so colored in any case where the fish was more than an inch long. The pectorals arise about one tenth of an inch from the operculum, are three twentieths of an inch in length, one fifth of an inch in height, rounded. Anal three twentieths of an inch in height, half an inch in length, terminating on the same plane with the dorsal fin. Immediately preceding the origin of the anal is a spine, a little less in height than the height of the fin. Caudal fin square at the extremity, one fourth of an inch high.

This species inhabits both the salt and fresh water; in Old Man's Harbor it is very abundant, and I have found it also in the Connecticut river on the south side of the island, and in the Hockanum river, about two miles east of Hartford, Connecticut. The specimen figured was one from the fresh water; they are a little deeper in proportion to their length than those from the salt water.

In the want of armature on the sides, this species resembles the *G. lœvis* of Cuvier, and apparently the *apeltes*. If Mr. Swainson's arrangement were to be adopted, this character would place it in his subgenus *Leiurus*. The specimen from which my description was drawn was about as large as any I have seen.

Fundulus fuscus.

Plate XIII. Fig. 2.

Entire length two and one tenth inches; greatest depth nine twentieths. Body rather rounded, somewhat compressed toward the tail. Color above and on the sides very dark brown, striped longitudinally with narrow lines, which are lighter. Abdomen, lower jaw, preoperculum, and lower part of the operculum very light brown, almost white. Near the origin of the caudal fin a black vertical band crosses the body. Mouth rather small; teeth numerous and arranged in the following order. Those in the lower jaw are in a double row, which however is not perfectly regular. In the upper jaw, the intermaxillaries are densely crowded with teeth, while on the maxillaries are none. On each palatine bone is a double row, and on the vomer are a few. The superior pharyngeals are thickly covered; the same is true of the inferior pharyngeals, the lower part of the last pair of branchial arches, and the posterior one of the chain of small bones, which extend backward from the tongue and connect the arches. The tongue is smooth.

The eyes are three twentieths of an inch from the termination of the upper jaw, and one tenth of an inch in diameter. The scales extend over the body and head; they are large but not prominent, and when the fish is alive are scarcely discernible. A number of very distinct mucous pores are scattered on the top and sides of the head. The lateral line arises at the upper angle of the operculum, and runs in nearly a straight course to the tail; it is not apparent without close observation.

The dorsal fin arises one inch from the point of the upper jaw, is half an inch in length, three tenths of an inch in height, rounded, rays all flexible. The anal fin arises one fifth of an inch posterior to the origin of the dorsal, is three twentieths of an inch in length, seven twentieths in height. Origin of the ventrals three tenths of an inch anterior to that of the anal; they are one tenth of an inch in length, three tenths in height. Pectorals rounded, arising immediately posterior to the termination of the operculum, a little more than one tenth of an inch in length, one fourth of an inch in height. Caudal fin one fourth of an inch in length, four tenths in height, rounded.

Branchial rays four.

Fin Rays, D. 15; P. 14; V. 6; A. 9; C. 13.

This species appears to me correctly referrible to the genus *Fundulus*, as it agrees with it in all points. It is, indeed, very distinct from the fishes placed in that genus by Dr. Dekay; still I think it ought to be called *Fundulus*, while those which he has included under that name I should arrange with *Hydrargira* of Le Sueur. To this latter genus, the species which I have described, evidently does not belong; but before mentioning the points of difference it is necessary to notice one or two of the peculiarities of *Hydrargira*.

Le Sueur describes his genus as having the "jaws protractile," and the structure of the mouth which renders them protractile, is somewhat peculiar. The whole of the mouth, so far as the upper jaw is concerned, is formed by the intermaxillaries, which are very large. The pedicels of these intermaxillaries are uncommonly long, thus enabling the whole to be thrust far forward, and rendering the mouth protractile. And as the body of the intermaxillary turns off at nearly a right angle to the pedicel, it follows that the mouth is transverse, scarcely opening backward at all. It should not be inferred, however, from this, that the maxillaries are small; they are in fact rather large, about as long as the intermaxillaries, and yet they form no part of the opening of the mouth. Their upper termination is immediately behind the angles of the intermaxillaries, and they descend on each side to a point below the corner of the mouth and posterior to it, being covered in part by the anterior sub-orbitar bone. They lie therefore entirely posterior to the intermaxillaries, and are not connected at all with them. When the jaw is thrust forward to its greatest extent, the maxillaries remain unmoved. Nor is this confined to a single species; I have four, *fasciata*, *multifasciata*, *pisculenta* and *flavula*, and in all these the structure of the mouth corresponds perfectly to what I have here mentioned. It will probably be found, therefore, common to the whole genus. Another thing in which all the species seem to agree, is in the scales on the top of the head. These are large, with one in the centre, covering the others near it, all its edges being free.

Now in neither of these particulars does the species which I have described *(fuscus)* correspond with the account here given. The intermaxillaries are very short, and the sides of the upper jaw are formed by the maxillaries. The anterior frontal bone extends forward to the very extremity of the head; under the tip of it are the short intermaxillaries studded with teeth, and extending from them downward are the maxillaries destitute of teeth. The scaling also on the top of the head does not differ materially from that of ordinary fishes. This species, therefore, is apparently very distinct from *Hydrargira;* and if it is not a *Fundulus*, I do not know where to arrange it. The structure of the mouth would indeed appear to separate it from the family of the *Cyprinidæ*, in which, Cuvier says, the whole border of the upper jaw is formed by the intermaxillaries, and yet it seems necessarily included in that family.

I have not been able to find it except in the Connecticut river, and a stream in the southern part of Brookhaven. That it exists, however, in other parts of Long Island is not at all improbable.

Leuciscus nasutus.

Plate XIII. Fig. 3.

Entire length three and a half inches; greatest depth six tenths of an inch; depth at the insertion of the caudal fin, three tenths; length of the head, three fourths; depth of the head, four tenths.

Color above, and on the sides, dark blackish brown. All beneath, from the tip of the upper jaw to the caudal fin, nearly white. The dark brown of the sides becomes a little lighter as it descends, still the transition to the white beneath is very abrupt. The dorsal and caudal fins are light brown, lighter than the back; ventrals and anal nearly transparent; pectorals a little darker than the ventrals.

Eyes three tenths of an inch from the extremity of the upper jaw, three twentieths in diameter; iris silvery, clouded with dark dots.

Mouth semicircular, situated beneath the projecting snout, small, toothless; lips not corrugated, perfectly smooth.

Head destitute of scales; those on the body, small. The lateral line commencing at the upper angle of the operculum bends slightly downward, and then runs nearly straight to the caudal fin. When the specimen becomes dry it may be traced passing forward from the angle of the operculum till it almost reaches the eye, then turning abruptly downward at nearly a right angle it descends till it is below the level of the eye; turning again it passes forward until bending upward and backward it terminates at the anterior side of the nostrils.

Nostrils situated in an oval depresssion anterior to the upper part of the eye; the posterior aperture the larger.

The dorsal fin arises one inch and nine twentieths from the tip of the head, is seven twentieths in length, eleven twentieths in height, trapezoidal in form. The anal arises nine twentieths of an inch posterior to the origin of the dorsal, is similar to that fin in shape, one fourth of an inch in length, eleven twentieths in height. The ventrals arising six tenths of an inch anterior to the origin of the anal, are three twentieths of an inch in length, half an inch in height, rounded. The pectorals are situated very low down, almost beneath the body; their origin is opposite to the termination of the operculum, they are eleven twentieths of an inch in height, three twentieths in length, rounded. The caudal fin is beautifully lunated, being six tenths of an inch in height at the extremities, three tenths in the height of the central rays.

Branchial rays three, flat and broad.

Fin rays, D. 10; A. 8; V. 9; P. 16; C. 19.

The abdominal anatomy bears a striking resemblance to that of *L. pulchellus*, Storer. The stomach differs from the other parts of the alimentary canal only in being a little larger; it diminishes very gradually as it passes backward rather more than half the length of the abdomen, and terminates at a tolerably well defined pylorus. From the pylorus the canal is reflexed and extending forward almost to the anterior extremity of the abdominal cavity it turns backward and proceeds straight to the anus. Its size from the pylorus is nearly uniform. Cæca none.

The liver is unequally divided into three lobes. The first, which is largest, is situated on the right side; the second lies beneath the folds of the intestinal canal, and is longer than the first but more slender; the third, which is short, is on the left side.

The air-bladder is double, being divided by a transverse stricture so that it appears formed of two sacs united by a slender neck; the posterior division is much the larger. From the anterior part of this latter division proceeds a slender tube which enters the æsophagus, thus forming a communication with the external air.

The ovaries in the female are double, oval in form, occupying, when fully developed, nearly the whole length of the abdomen ; the eggs, being large, are comparatively but few in number.

It appears to me unquestionable that this species ought to be placed in the genus *Leuciscus.* The singular position of the mouth seems at first sight to render it so very unlike any known species of the genus, that we can scarcely believe it should be so referred. An examination of the anatomy of the fish, however, apparently removes every difficulty. The structure of the abdominal organs, as already noticed, is in perfect accordance with what we find in other species of the genus, but a still more remarkable resemblance remains yet to be mentioned ; it is in respect to the armature of the throat, the inferior pharyngeal bones. These in *Leuciscus* are large, very strong, curved, and furnished on their inner and posterior edge with several stout, conic, bony processes which appear like teeth, and are the only organs answering the purpose of teeth with which the fish is provided. These bones are furnished with several pairs of muscles. In order to afford attachment for one of these, a pair which passing inward and backwark is designed to bring the bones together, and cause them to act one against the other, we find that the basilary bone is prolonged, turns downward, and ends in a plate flattened vertically, to which the muscles are attached. This basilary prolongation forms one of the most remarkable peculiarities of the skull. Now all these characteristics are found perfectly in the present species. The strong curved pharyngeals with their teeth, the muscles, the elongated bone with its flattened plate for the insertion of these muscles, all occur in perfect conformity with the structure of other species of the genus. The formation of the mouth also, though externally so singular, is yet precisely similar to that of the well known species of *Leuciscus.* The whole border of the upper jaw is formed by the intermaxillaries, which are broad and stout ; immediately behind these and closely applied to them are the maxillaries, broad, and furnished with their own separate muscles, but apparently capable of little motion independent of that of the intermaxillaries. These bones in this species, however, are very peculiar in their position. Instead of lying obliquely (thus forming the opening of the mouth as in ordinary fishes) they are perfectly horizontal, and as the integuments covering them are thick and project forward in the form of a pointed snout, the mouth becomes, of course, situated beneath the head, almost as in the sharks and other cartalaginous fishes. *Leuciscus atronasus* of Mitchill approaches more nearly to it in this respect than any other species of the genus with which I am acquainted. To *atronasus* also it appears otherwise somewhat allied.

The first information we had in regard to this species was obtained from Mr. Charles P. Turner, of Hartford, Ct., who found it in a small stream in West Hartford. It appears there, however, to be rather rare, and the only specimen I have been able to procure from that locality is the one which he first presented to me. But it has since been ascertained to exist in Massachusetts. Mr. C. H. Olmstead recently found it very abundant in some of the streams in Blandford, and to his kindness I am indebted for numerous specimens. According to his account of them they inhabit rapid streams, hiding most commonly under stones, from which they often dart out with great speed. All those which he procured were caught with the hook. They struck at the bait with all the quickness and vigor of trout, and might be taken in almost any numbers. The largest which he saw, and which is now in my possession, is five and one fourth inches in length.

Art. XXV. — DESCRIPTIONS OF THE FISHES OF THE OHIO RIVER AND ITS TRIBUTARIES. By Jared P. Kirtland, M. D.

(Continued from page 240.)

Acipenser. Lin.

A. rubicundus. Le Sueur. The Lake Sturgeon.

Acipenser rubicundus.	Les. Trans. Am. P. S., n. s., i. 3.
" "	Kirtland's Report, p. 170.
" *maculosus.*	Les. Trans. Am. P. S., n. s., i. 3.
" "	Kirtland's Report, p. 170.
" *Ohioensis.*	Raf. Ichth. Ohioensis, p. 80.
" "	Kirtland's Report, p. 170.
" *scrotinus.*	Raf. Ichth. Ohioensis, p. 80.
" *macrostomus.*	" " " "
" *nudus.*	Kirtland's manuscript.

Plate XIV. Fig. 1.

Head one fifth the total length of the fish ; *nose* attenuated, slightly recurved at the tip ; forehead broad between the eyes ; sulcated longitudinally, a slight elevation on each side, situated upon a line between the eyes, also a larger elevation on each side of the sulcation in the centre of the forehead. *Cirrhi* four, on a line transverse to the head. *Nostrils* double, superior and anterior smaller and more circular ; *eyes* oblong, large ; irids yellowish. *Operculum* radiated, tuberculated, imperfectly closing the branchial openings. *Mouth* projecting, pendulous, oblong, lobed.

Body armed with 15 plates anterior to the dorsal fin, all except the posterior, carinated and terminating posteriorly in a spine. Six osseous scales between the caudal and dorsal fins, the posterior plate elongated, the two preceding in pairs, — all are simple and armed with spines.

Lateral rows furnished with 36 spinous plates.

Abdominal rows with 9 simple plates.

Two simple plates between the vent and the anal fin, the anterior larger.

Four plates between the anal and caudal fins, the two middle in pairs.

Pectoral fins large, falcate ; the *dorsal, abdominal* and *anal* trapezoidal ; and the *caudal* lunate.

Color. Head and body olive-brown above, white beneath. Fins reddish. Younger specimens maculated on the body and sides.

Length 2 feet.

Hab. Ohio river and Lake Erie.

Observations. The description and drawing were made from the same specimen, which was procured in the Cincinnati market. The varieties occasioned by age, sex, locality and other circumstances have occasioned me much perplexity, but after five years close examination I feel a great degree of confidence in throwing the whole group into one species, though it presents a formidable list of synonyms.

The color and form of the fish, and the number, size, and position of the plates vary extremely in specimens of apparently similar age, taken in the same locations. Two out of five specimens lying in the Cincinnati market on the 23d of December, 1840, presented characters different from any included in the descriptions above referred to, and if variations in the number and appearance of the shields, and in the forms of the head and body constitute essential specific characters, we must add several more new species to the list. These characters are not however permanent, and therefore are not to be relied upon. If the *maculosus* of Le Sueur be not the young of the others, their young have never been discovered. The extreme old, shed entirely their shields, the surface of the body becomes naked and they lose some of their essential generic characters. It was a drawing and description of an individual in this condition, that I formerly communicated to the Boston Society of Natural History under the name of *A. nudus.* I have since seen several individuals of this character taken in Lake Erie and in the Ohio river.

Salmo. Lin.

S. fontinalis. Mitch. The Common Brook Trout.

Salmo fontinalis.	Mitch. Trans. Lit. et Philosop. Soc. vol. i. p. 435.
" "	Richardson's Fauna, p. 176.
" "	Storer's Report on the Fishes of Massachusetts, p. 429.
" "	Kirtl. Rep. on the Zool. of Ohio, Catalogue, p. 169.
" *nigrescens.*	Raf. Ichthyol. Ohioensis, p. 45.

Plate XIV. Fig. 2.

Observations. A full description of this species has been furnished by Dr. Storer, in vol. ii. page 429 of this journal, to which we would refer the reader.

The specimen before us was taken in the Sault St. Marie. Among half a dozen from that locality there is considerable difference in the size and colors.

The only localities in which it is found in the state of Ohio, is Chagrin river, in Geauga county, and a small stream that enters Lake Erie at Kingsville, in Ashtabula county. It abounds in the Sault St. Marie in such abundance, that it is taken for exportation. We are indebted to Charles M. Giddings, Esq., of Cleveland, for a number of fine specimens from St. Marys.

Leuciscus. Klein.

L. crysoleucas. Mitch. Gold-shiner.

Leuciscus crysoleucas.	Mitch. Trans. Lit. et Philosop. Soc. N. Y., vol. i. p. 459.
" "	Storer's Rep. on the Fishes of Massachusetts, p. 405.
Luxilus crysocephalus?	Raf. Ichthyol. Ohioensis, p. 48.

Plate XV. Fig. 1.

Observations. I consider the fish represented in the sketch as the *Leuciscus crysoleucas* of Mitchill which has already been amply described by Dr. Storer, vol. ii. p. 405 of this journal. I shall not attempt to make any additions to his description, but would observe that our western fish is usually of a deep pea-green on its back, and not black. The specimen before me was taken in a bayou of the Cuyahoga river, near

Cleveland, where it never attains a greater size than is represented in the plate, but it abounds in some of the small lakes in Portage and Summit counties in this state, and there frequently is as large as those found in the waters of the Atlantic states.

It is a matter of uncertainty what fish Rafinesque had in view when he described his *Luxulus crysoleucas.* His description does not apply to this species nor to any with which I am acquainted.

In strict conformity to Rafinesque's arrangement, this species should, perhaps, have been placed under his genus *Rutilus.*

L. compressus. Raf. Fall-Fish.

Rutilus compressus. Raf. Ichthyol. Ohioensis, p. 51.
" " Kirtl. Rep. on the Zool. of Ohio, p. 169.

Plate XV. Fig. 2.

Head small, compressed laterally, mouth diagonal, upper jaw rounded at the tip; the lower slightly projecting. Nostrils small, on a line with the superior edge of the eye. Eyes large, circular.

Body more compressed than in any other species of this family, scales medium size, closely appressed. Back gibbous behind the base of the head, thence rectilinear to the dorsal fin; abdomen slightly carinated at the base of the anal fin. Fins thin, delicate and diaphanous.

Color. Iris gilt, pectoral fins yellow, and abdominal, bright orange; head and back yellowish-brown, sides and beneath silvery.

Length from 2 to 4 inches.

Hab. Mahoning river.

D. 9; C. 30; A. 9; P. 14.

Observations. This species in its contour resembles somewhat the *Leuciscus crysoleucas* of Mitch. but its color, the number of rays in the caudal fin, and its more compressed form, will readily distinguish it.

Alosa. Cuv.

A. *chrysochloris.* Raf. The Gold-Shad. Gold-Herring. Skip-Jack.

Pomolobus chrysochloris. Rafinesque. Ichthyologia Ohioensis, p. 39.

Plate XV. Fig. 3.

Head triangular, laterally compressed nearly one fifth the entire length of the fish ; *lower jaw* obtuse at its end, projecting ; *upper jaw* the shorter, emarginate and slightly retuse, so that the mouth apparently opens above and behind its usual place in other fishes ; *maxilla* loosely attached at their lower extremities, which permits them to turn upon the closer attachment at their upper extremities, when the mouth is extended ; *both jaws* armed with minute teeth, which are larger in the upper jaw, but hardly evident to the eye without the aid of a glass ; *operculum* three-parted, scaless ; *iris* golden. The lateral line is nearly obsolete.

Body sub-cylindric, compressed on the sides ; *abdomen* slightly carinate and serrate ; *back* rounded ; base of the *anal fin* sub-carinate.

Dorsal fin trapezoidal, elevated anteriorly, acute at its angles.

Caudal fin acutely and deeply bilobed, the base of the rays covered with scales.

Anal fin long, narrow and diaphanous.

Ventral fin also diaphanous, small and delicate, situated beneath the posterior half of the dorsal.

Pectoral small, short, clear and falcate.

Length from 12 to 18 inches.

Color. The top of the head and back bluish purple, iridescent, the gill-covers and sides of the jaws golden and purple, sides of the body and the abdomen pure white.

Hab. Ohio river.

D. 18 ; C. 34 ; A. 18 ; V. 9 ; P. 16 rays.

Observations. Rafinesque instituted a genus which he called *Pomolobus,* to receive this species. The generic characters do not, however, appear sufficiently obvious to be acknowledged. In one of his characters, Rafinesque is evidently incorrect; he speaks of the "jaws without teeth;" when the specimen is somewhat desiccated, or is examined by the lens, both jaws are seen to be furnished with minute teeth.

This delicate and beautiful species, which is occasionally seen in the market of Cincinnati, is one of the most graceful and active fish that inhabits the Ohio. In pursuit of food or in sport, it frequently leaps from the water, from which circumstance it has received the name of Skip-Jack. It is a great annoyance to the angler, as it drives away most other kinds of fish; but it will itself often take a baited hook. It is esteemed as a good pan-fish.

Art. XXVI. — CATALOGUE OF THE MARINE, FLUVIATILE AND TERRESTRIAL SHELLS OF THE STATE OF MAINE AND ADJACENT OCEAN. By J. W. Mighels, M. D. Portland, communicated March, 1843.

This catalogue is offered in the hope that it may be useful, not only in extending a knowledge of the geographical distribution of the species, but that some of the facts recorded may be made available hereafter, in the investigations of geology. I regret that it is not in my power to give more certain information respecting the anatomy and habits of the molluscous animals. Owing to the fact that a large proportion of the marine shells are pelagic, and, therefore, rarely found containing the living animals, it must be a long time before much accurate information can be obtained respecting them. Indeed, many of the commonest species of the mollusca are far from being perfectly understood. This is especially true in regard to most of the *minute* species, and certainly not *untrue* in respect to many of the larger ones. Not having had sufficient opportunities to study the mollusca successfully, I have confined my remarks, mostly, to such facts as are most available and obvious.

As to the species of shells enumerated in this catalogue, most of them are satisfactorily identified; but in respect to some, there is still much uncertainty. This is owing, in part, to a want of the necessary books and plates, and partly to a want of European shells for comparison. It becomes more and more known, every year, that many of our species are identical with those of northern Europe, and it is reasonable to conclude that more extended observation will detect many more coincidences:—exchanges are, therefore, solicited with European naturalists, interested in this subject.

In citing authorities it will be noticed that I have dropped Professor Adams's name, in nineteen of the species which were described under his name in connection with mine, in Vol. iv., No. 1, of this Journal. In justice to him and to myself, this correction should be made, which accords with the original paper, but which was overlooked by the publishers. I, however, most cheerfully acknowledge my indebtedness to Professor Adams for the assistance he afforded me in preparing that article for the press. In respect to the numerous errors to be found in it, I will take this opportunity to remark, that they were partly derived from precipitancy and want of care in the original manuscript, and partly from errors of the press, neither Mr. Adams nor myself having had proof sheets in season to make the necessary corrections. However much disgrace should attach to me for those mortifying blunders, none can be laid to the charge of professor Adams, as it was *all re-written* by myself, and several of the species were never seen by him.

In compiling this catalogue, I have the pleasure to acknowledge my indebtedness to Dr. Gould's "Report on the Invertebrata of Massachusetts," as well as to many personal favors from that gentleman, pertaining to the same subject. I have, also, derived much information from the papers of Mr. Couthouy and Professor Adams. In my explorations I have received much valuable assistance from my friend Captain Walden, of the United States Revenue Cutter, Morris,—who by his zeal in dredging in deep water, and exploring along the eastern shores, and among the islands, has procured many rare species. Could the officers of the several Revenue Cutters in commission in the United States be induced to imitate his example, a vast amount of valuable matter would be added to the natural history of this country. I would also acknowledge my obligations to Dr. Ray, principal of the Insane Hospital at Augusta, Dr. Milliken of Unity, and Mr. True, principal of the academy at Monmouth, for many valuable species.

I have omitted synonyms excepting in instances where it was necessary to introduce them for the purpose of identifying certain species.

Several species of *naked mollusca* occur here, but not having had opportunities to study them, so as to designate them accurately, I have omitted them.

Genus Balanus. Lam.

B. geniculatus, Conrad. This is a pelagic shell, and is, therefore, never found in place. As remarked by Dr. Gould, I have never found it in any other situation than in its attachment to the valves of *Pecten magellanicus*. It is rare in Casco Bay, but is probably plenty at Passamaquoddy and the Bay of Fundy. It is much the largest of all our species of Balanus; I have one specimen two inches across the base, and one and three quarters inch in height.

B. eburneus, Gould. Pelagic. This species is frequently found attached to the backs and claws of the larger *crustacea*, bits of wood, &c. in Casco Bay; but I presume its more congenial habitat is farther south, where it is more abundant and more perfect. We obtain our best specimens from ships' bottoms, from the West Indies.

B. rugosus, Donovan, Montagu. This species occurs in great abundance and perfection in Casco Bay. It is sometimes found above low-water mark, attached to rocks, but it prefers deeper water, and attains the greatest perfection when attached to other shells, and sunken timbers.

B. ovularis, Lam. Littoral. This species occurs in the greatest profusion imaginable, covering rocks and wooden fixtures of every sort, on the whole line of coast, east and west.

B. elongatus, Lin. This is found in company with the preceding species, and is also very plenty. It is probably a mere variety of it, as they are often grouped together in such a manner and in such imperceptible gradation that it is impossible to determine where one species begins or the other ends. It is most abundant, and attains the greatest perfection, in still water, and seated upon wooden fixtures.

B. tintinnabulum, Lin. Lam. I found four or five stinted specimens of this species, near fort Preble, situated in a deep excavation in a ledge, near low-water mark, covered by marine plants, in which situation they were always under water.

Genus ANATIFA. Lam.

A. lævis, Lin. This species is occasionally found in some of the old docks in Portland harbor, fixed to sunken timbers.

A. striata, Lin. Bruguière. This is found in company with the preceding.

A. dentata, Wood. This is always found in company with the two preceding species, but is much less abundant than either. The three species are found in the greatest profusion on the bottoms of vessels, arriving from the West Indies. I have no doubt I have seen twenty bushels of them on the bottom of a single vessel. Neither of the above species can be, properly, regarded as indigenous to this State, but they have all, probably, been imported from the south, and without fresh importations, none of them would be maintained through many generations.

There is much good reason for doubting the propriety of separating the above into distinct species. We often find them all grouped together within the space of a square inch, and I have frequently found each of them adhering to the pedicles of the others; and as to the form of the valves, the color of the pedicles, &c. these are constantly varying and interchanging, so that they afford no certain data on which to establish specific distinctions.

A. vitrea, Lam. Pelagic. This is a good species, and, probably, is the only one that is truly indigenous. It is occasionally found dead and bleached on our shores after storms. In 1840, it was found on one of the islands in Casco Bay, in great numbers, alive, attached to sea-weed that had been thrown up a short time previous by a violent storm.

Genus PHOLAS. Lin.

P. crispata, Lin. Pelagic. This species is probably plenty in its proper station, but owing to its habit of boring into hard clay and mud, to great depths, in deep water, it is difficult to obtain, and therefore rare in collections. Imperfect specimens are often thrown upon our beaches, and it is sometimes brought up on the flukes of anchors in Portland harbor in a state of great perfection. I have one specimen, thus obtained, which is four and a half inches in length and two and one eighth inches in width.

Genus SOLEN. Lin.

S. ensis, Lin. Littoral. This species is found in great abundance in some of our bays, near low-water mark. We sometimes find dwarfish specimens upon our sandy beaches, after storms, but they attain the greatest size and perfection in quiet bays, near the mouths of rivers, where the mud is soft and deep. They sometimes bury themselves to the depth of two feet. I have been informed, by intelligent fishermen, that they have found them near the mouths of the Kennebec and Penobscot rivers, a foot in length! but I have never yet seen one quite seven inches long.

Genus SOLECURTUS. Blain.

S. caribæus, Chemnitz, Lam. Con. This is a pelagic shell, and of very rare occurrence in Maine. I have only found it in a bleached state and in fragments. It is unquestionably one of the most widely distributed species known to conchologists. I have received it from nearly every Atlantic state from Maine to Alabama, and not long since, specimens exactly similar, from Senegal, through Mons. Largilliert, of Rouen, France.

Genus Machera. Gould.

M. nitida, Gould. Pelagic, — taken rarely by fishermen, on the banks of Newfoundland, from the stomachs of cod-fishes. (*Morrhua Americana,* Storer.) I have never yet found it in the waters of Maine.

M. costata, Say, Gould. I have never known of this species being found above low-water mark, but whether it should be regarded as properly pelagic or not, I am unable to say. Dr. Gould thinks it inhabits the sand in *shallow* water; this is probably true, as I frequently find it thrown upon our sandy beaches by moderate seas. I am not aware that it ever inhabits muddy bottoms.

Genus Solemya. Lam.

S. velum, Say. Pelagic. This species is occasionally found on the shores of Maine, after heavy easterly storms.

S. borealis, Totten. Pelagic. Single valves and fragments of this fine species are sometimes found on Saco beach, after violent storms. The only perfect specimen in my collection, I took from the stomach of a cod-fish, which was taken in deep water in Casco Bay, several miles from land.

Genus Panopæa. Menard.

P. arctica, Lam. Pelagic. The question is yet to be settled whether this interesting shell is to be regarded as properly belonging to the State of Maine, as I am not aware that it has ever been found this side the Gulf of St. Lawrence. I have never obtained but four or five specimens of it, all of which were taken from the stomachs of cod-fishes caught on the coast of Labrador. The young shell is very thin and fragile, and is covered with a thin, semi-transparent epidermis, of a dirty white color, which extends considerably beyond the margin of the shell.

Genus Glycymeris. Lam.

G. siliqua, Chem. Pelagic. This is a rare shell on the coast of Maine, but abundant on the Newfoundland Banks and in the Gulf of St. Lawrence. I am assured by fishermen that it is no uncommon thing to find half a dozen in the stomach of a single cod-fish, and when recent, as they frequently are, they use them for bait. The finest specimens I have seen were taken in the Gulf of St. Lawrence. In many of these, the epidermis is very perfect to the beaks, and in some individuals extends nearly an inch beyond the margin.

Genus Mya. Lin.

M. arenaria, Lin. This species abounds in Maine in the greatest profusion imaginable, and is found in every nook and corner throughout the whole line of coast, where it can find sand or mud in which to bury itself. Through veracious and intelligent fishermen I have traced it as far north and east as the Gulf of St. Lawrence and Labrador, where it is said to be of dwarfish dimensions. On the authority of Dr. Ray, however, it maintains its maximum size and perfection as far north and east as Passamaquoddy Bay and Bay of Fundy.

M. truncata, Lin. Pelagic. Immature specimens of this species are rarely taken from the stomachs of fishes caught in Casco Bay. Its more congenial habitation is further north and east, where fine specimens are occasionally taken from the stomachs of cod-fishes, caught in very deep water.

Genus Pandora. Brug.

P. trilineata, Say. Pelagic. I have occasionally taken this shell by dredging in Portland harbor, where the bottom is covered with a great depth of soft mud. Capt. Walden has dredged it in Penobscot Bay, in ten to fifteen fathoms of water. It occurs, *fossil,* at Westbrook, in the post-tertiary formation, in company with *Nucula portlandica,* &c.

Genus Osteodesma. Desh.

O. (Lyonsia,) hyalina, Con. Couth. Pelagic. I have occasionally found specimens of this shell in the stomachs of haddock, taken in the open sea, many miles from land, in very deep water, but I have never found a single fragment of it upon any of our shores.

Genus Cochlodesma. Couth.

C. (Anatina,) leana, Con. Couth. I have found a few specimens of this species in the stomachs of fishes, but never in any other situation. That it inhabits the coast there can be no doubt, as I once took a specimen from the stomach of a haddock that was caught in the harbor, within a mile of Portland.

Genus Thracia. Leach.

T. conradi, Couth. Pelagic. This rare and interesting species is occasionally picked up on our sandy beaches after violent easterly storms. I have a single valve which was dredged by Capt. Walden, near the Fox Islands, off the mouth of the Penobscot river, in very deep water.

T. truncata, Mighels. Pelagic. Hab. Casco Bay. I have never found more than half a dozen specimens of this interesting species, all of which were taken from the stomachs of haddock, caught in very deep water several miles from land.

Genus Mactra. Desh.

M. gigantea, Lam. This huge species abounds on all our sandy beaches, above and below low-water mark; it however attains its greatest size and perfection below that line. Cart-loads are sometimes thrown upon Saco beach by easterly storms. It is used by a few as an article of food, but it is not generally esteemed. It is tough and indigestible, and I have known some to be seriously injured by eating it. In a strong, hardy man, it produced a severe colic, accompanied with terrific spasms and entire loss of consciousness, which lasted several hours, and only ended with the ejection of the undigested mass. I am not aware that it ever inhabits muddy bottoms.

M. grandis, Desh.? (*ovalis*, Gould.) This is probably a true pelagic species, as it has not been obtained anywhere in New England, but from fishes' stomachs, taken in deep water. Although this name, *grandis*, is applied to another species by Deshayes, I prefer to retain it until the identity of our shell is better settled.

Immature specimens are frequently obtained from fishes' stomachs taken in Casco Bay; but, probably, its more congenial habitat is much further north and east. Fine, large specimens are sometimes obtained from the stomachs of cod-fishes taken in the Gulf of St. Lawrence, but it must be regarded as a rare shell.

Genus Mesodesma. Desh.

M. arctata, Con. Pelagic. Full grown specimens of this species are occasionally found upon Saco beach, but I am not aware that it is anywhere abundant in Maine. Never having obtained it from the eastward, I am inclined to suspect that this is nearly its utmost northern limit.

M. jauresii, Joannis. Pelagic. I am not aware that this rare species has ever been found in the waters of Maine, but it is occasionally found in the stomachs of cod-fishes caught in the Gulf ot St. Lawrence, in very deep water.

Genus Saxicava. Lam.

S. distorta, Lin. Say. This species, although often found alive on our shores, cannot, properly, be regarded as a littoral shell. Its proper habitation is, doubtless, in deep water. I have, occasionally, found dwarfish and very distorted specimens adhering to pebbles and valves of dead shells in deep cavities in the ledges near Fort Preble, where the water never entirely leaves them. The finest specimens I ever saw, I found attached to the inside of some dead specimens of *Pecten magellanicus*, dredged by Capt. Walden in deep water near Machias. The largest of them are one and a half inch in length. When recent and perfect, the epidermis is continuous from one valve to the other.

Genus Petricola. Lam.

P. pholadiformis, Lam. Only a few imperfect valves and fragments of this species have, as yet, been found in Maine. These were picked up on Old Orchard beach, near Saco.

Genus Sanguinolaria. Lam.

S. fusca, Say, Con. This shell abounds in all our still, muddy bays, especially near the mouths of rivers and streams, where the mud is deep, both above and below low-water mark. It would also seem that it must be plenty in deep water, as I have often found it, in considerable numbers, in the stomachs of haddock.

Genus Tellina. Lin.

T. sordida, Couth. Pelagic. Dwarfish specimens of this shell, about the size and appearance of those noticed by Dr. Gould, (*Invert. Mass.* p. 67,) are very frequently obtained from fishes' stomachs taken in Casco Bay, but its more congenial residence is much further north, where its generic characters are more distinctly developed, and where it attains a much larger size. A specimen now lies before me which was taken, with many others of equal dimensions, in the Gulf of St. Lawrence, which is 1.8 inch in length, 1.1 in height, and .5 in breadth.

Dr. Gould thinks "this shell belongs to the same genus as Say's *Psammobia fusca*," and remarks that "the slight wave along the posterior margin is no more conspicuous than in that shell." This remark will not apply even to the small specimens found in Casco Bay, the flexure being much more conspicuous than in any of the specimens of Say's shell, which I have seen; and in the St. Lawrence specimens it is as fully developed as in most of the species of *Tellina*, and much more so than in some species that are unhesitatingly referred to that genus by other writers. I cannot hesitate, therefore, as to the propriety of restoring it to the place where Mr. Couthouy originally placed it.

Genus Lucina. Brug.

L. (*Cryptodon,*) *flexuosa*, Mont. Turton, Gould. Pelagic. This delicate little shell is often obtained from the stomachs of haddock, taken in deep water, in Casco Bay.

L. radula? Mont. (Gould's *Invert. Mass.* p. 69 and 70.) I am indebted to Capt. Walden for a perfect specimen of a shell which I suppose may be identical with that referred to by Dr. Gould. Capt. W. obtained it with some other species which gave me equal surprise, at Nashe's island, near Machias. It was thrown on shore by the sea. I do not perceive that it differs, essentially, from West Indian specimens of *L. tigerina*, Lam. It nearly accords with Dr. G.'s description of *L. radula*, but differs in the hinge margin being slightly curved, in having two cardinal teeth in each valve, and a distinct, lateral tooth, anterior to the beak, in each valve. The nymphal and umbonial margins in my specimen, are colored by a slight stain of pink, which is not noticed by Dr. G. This, however, may be owing to the fact that his specimens were dead and bleached, — and it may, also, be owing to this circumstance, that the specimens differ so much in the number and perfection of their teeth.

Genus Cyclas. Lin.

C. similis, Say. This species is found burrowing in mud and sand, in great abundance and perfection, in ponds and brooks, in all parts of the State west of the Kennebeck river. I know nothing of it further east, although I have no reason to doubt that it occurs all over the State. Little stagnant ponds and bayous, where the water is shallow and the mud deep and soft, seem to be the favorite habitations of this species.

C. partumeia, Say. This also occurs in great profusion all over the State, so far as I am acquainted. It differs in no respect from Massachusetts specimens. It differs considerably from the preceding species in its habits, seeming to prefer wet places rather than the open water. I have found it in the greatest profusion in the crevices, and under the bark of decaying timber, floating in ponds.

C. calyculata? Drap. That this is, in reality, identical with *C. calyculata* of Europe, I cannot positively aver,—this much, however, it will be safe to say, so far as the *shells* are concerned, they are perfectly alike. I have found it plenty in running brooks, under stones.

C. minor, Adams and Migh. I have found this delicate little species abundant in a spring, within the limits of this city. In its habit of burrowing, it differs from other species with which I am acquainted. It is often found six inches under ground, under stones, one or two feet from the water. I have received specimens from Monmouth, (forty or fifty miles from Portland.) It is also abundant in Vermont.

C. nitida, Migh. This is, doubtless, a rare species, as I have never detected it but at one locality, (Norway, Oxford county,) where I obtained about half a dozen specimens. It was in company with *C. partumeia.*

Genus Astarte. Sow.

A. undata, Gould. Pelagic. Immature specimens are frequently obtained from the stomachs of haddock taken far out at sea, in very deep water, in Casco Bay. I have obtained many fine mature specimens of it by dredging in Portland harbor, where the water is from four to six fathoms in depth, and the mud very deep and soft.

Not doubting that this is distinct from all the known species of Europe, I have not hesitated to adopt the name proposed for it by Dr. Gould, (*Invert. Mass.* p. 80.)

A. castanea, Say. Pelagic. Rare, but occasionally found on some of our sandy beaches, after heavy easterly storms.

A. quadrans, Gould. Pelagic. This is found sparingly in fishes' stomachs, taken in very deep water in Casco Bay. I have found several specimens considerably larger than that described by Dr. Gould. I am of opinion that all the specimens yet found are immature.

A. lactea, Brod. and Sow. Pelagic. Through a fisherman I have recently had the good fortune to obtain three fine specimens of this rare species, the largest of which is 1.6 inch in length, 1.3 in height. In one of the specimens, (the smallest,) the epidermis is of a straw color, in both the others it is black. The fisherman took them from the stomachs of codfishes captured in the Gulf of St. Lawrence. I know not that it has ever been found in the waters of Maine.

A. portlandica, Migh. Pelagic. I found a single specimen of this species in the stomach of a haddock, in the spring of 1842. The fish was taken in Casco Bay, many miles from land, in deep water. Besides other obvious characteristics, it is readily distinguished from its congeners by its chocolate-colored interior.

Genus Cyprina. Lam.

C. islandica, Lin. Pelagic. Fine, large specimens of this shell are frequently thrown upon Old Orchard beach, near the mouth of Saco river. Very young specimens are found in great abundance in fishes' stomachs, taken all along the coast.

Genus Cytherea. Lam.

C. convexa, Say. Pelagic. I have occasionally taken this shell by dredging in Portland harbor, and it is occasionally thrown upon our beaches by the sea, but it is extremely rare.

Genus Venus. Lin.

V. mercenaria, Lin. This species is rarely found in Casco Bay, but it occurs in great abundance and perfection at Harpswell, from whence it is brought to Portland market and sold at ten or twelve cents per dozen. The specimens are much larger than those which are brought here by the oystermen from Wellfleet, Mass.

V. notata, Say. I have one specimen of this shell, which was given me by a gentleman, who found it in a *bucket of* *clams,* which were dug up somewhere in the vicinity of this city. It differs in no respect from Massachusetts specimens.

V. fluctuosa, Gould. Pelagic. I have had the good fortune to obtain three or four specimens of this species, which were obtained in the Gulf of St. Lawrence by a fisherman, from stomachs of cod-fishes. It has not been found in Maine.

V. gemma, Tott. Littoral, and plentiful in muddy bays, all along the coast.

Besides these species, Capt. Walden has recently given me a specimen of a *Venus* which he obtained at Nashe's Island, which much resembles *Cytherea dione,* Lam., without the spines. Whether this is truly an inhabitant of the waters of Maine or was imported in some way, is a question not easily settled. Capt. Walden, however, is very certain that it inhabits that locality.

Genus Cardium. Lin.

C. islandicum, Lin. Pelagic. Immature specimens are found, plentifully, in fishes' stomachs taken in Casco Bay. In the Gulf of St. Lawrence and on the coast of Labrador, fine, large specimens are occasionally taken from the stomachs of a species of fish called by the fishermen, *sand-dab,* which, from their description, I suppose to be some species of *Platessa,* of Cuvier.

C. grœnlandicum, Chemn. (*Aphrodite Columba,* Lea.) Pelagic. Found rarely, in fishes' stomachs, in the Gulf of St. Lawrence and on the Grand Banks; I do not know that it has been found in Maine.

I have deemed it best, under present circumstances, to place this shell under *Cardium,* — nevertheless, I am much inclined to the opinion of Mr. Lea, respecting its generic characters, and have very little doubt that it will eventually be restored to the place to which he assigned it, with universal consent.

C. pinnulatum, Con. Pelagic. This is found plentifully, in Casco Bay. It seems to be the favorite food of the haddock, as it is rare to find that fish without more or less of this shell in its stomach. I think I have taken more than one hundred out of a single individual. It occurs on all the coast, and as far north as Labrador.

Genus CARDITA. Lam.

C. borealis, Con. Pelagic. I have taken this species by the dredge in Portland harbor, and immature specimens are common in fishes' stomachs taken in Casco Bay. Capt. Walden has dredged it as far east as Lubec, and Dr. Ray has found it at Eastport. I have, also, found it among the shells from the Gulf and the Banks.

Genus ARCA. Lin.

A..... *(Species unknown.)* A single valve, of a species strongly resembling *A. staminea*, Say, was brought to me with other well known species, by a fisherman, from the Gulf of St. Lawrence. I am not aware that any species of this genus has ever been detected, before, north of Cape Cod. Having found only this odd valve, I have hesitated as to the propriety of describing it, or of affixing to it a specific name, — if, however, future researches should establish its northern habitat, and it should prove to be distinct, I would name it *A. glacialis*.

Genus NUCULA. Lam.

As will abundantly appear, this genus is numerously represented in Casco Bay. The species are all pelagic, and for all, with the exception of *N. limatula*, we are dependent on the stomachs of fishes, and of this *(N. limatula,)* even, immature specimens are not unfrequently found in company with all the other species.

N. limatula, Say. This fine species occurs in Portland harbor in great perfection, though not so *abundant* as might be inferred from an incidental remark by Dr. Gould (*Invert. Mass.* p. 98.) Three men, with a good dredge and boat, by working hard a whole summer's day, would do well to obtain thirty specimens. I doubt not that the shells are plenty enough, but owing to their habit of boring deep into the mud, the dredge slips over them, capturing those only which happen to be near the surface.

The whole animal is of an uniform, light flesh color — it is very active and sprightly, — is very tenacious of life, and will often leap about in an astonishing manner, for half an hour or more, after being removed from its shell. When at rest, the foot is nearly lancet shaped. In making a leap, it suddenly thrusts forward this *living stiletto* to the extent of an inch or more, — when extended to its utmost, the beholder for the first time, is astonished to see it suddenly transformed into a kind of *parasol,* and his astonishment instantly merges into admiration, when, at that moment, he sees the shell darting forward with the rapidity of an arrow. When the animal is undisturbed, these evolutions are performed very rapidly and for a considerable length of time. It is thus manifest how perfectly it is adapted to its situation, and with what facility it is capable of cutting its way through its muddy habitation.

N. thraciæformis, Storer. This species is very rarely found. I have obtained a few small specimens from haddock's stomachs taken in Casco Bay, but have never had the good fortune to find it full grown.

N. proxima, Say. Plentiful.

N. minuta, Gmelin, Turt. Considerably plentiful.

N. tenuis, Mont. Turt. Common.

N. myalis, Couth. This species is often found, but is not plentiful in Casco Bay. In the northern part of the Gulf of St. Lawrence it is more abundant and considerably larger.

N. navicularis, Couth. Very rare in Casco Bay.

N. sapotilla, Gould. Often found, but not in plenty.

N. rostrata, Mont. I have detected this species among other shells from the Gulf of St. Lawrence. It is readily distinguished from *N. minuta,* Turt., by being shorter, and more inflated anteriorly. It is rare.

N. jacksonii, (*fossil,*) Gould. This rare species is occasionally found in the post-tertiary formation at Westbrook, and Mr. True informs me that he has found it in a clay bank at Gardiner.

N. antiqua, (*fossil*,) Migh. This is found, sparingly, in company with the preceding species.

N. delphinodonta, Migh. I am not aware that this species has been found anywhere but in Casco Bay. In the spring of 1841, I found it for the first time plenty, subsequently it has been rarely seen.

N. cascöensis, Migh. Hab. Casco Bay. I detected a single fine specimen of this species in the spring of 1840.

N. portlandica, (*fossil*,) Hitchcock. This species occurs somewhat plentifully at Westbrook. I have also received it from Saco, and Brunswick, and am informed that it occurs at Gardiner. The geological formation is identical at all the localities.

Genus Unio. Brug.

U. complanatus, Soland. This variable species occurs in very great abundance in this State. In small collections of still water where the bottom is muddy, it attains the greatest magnitude and perfection. It sometimes occurs in running water, in pebbly beds, where it is observed to be much compressed, distorted, and eroded. In open lakes, in sandy beds, it is usually diminutive, and much compressed.

U. radiatus, Gmel. Barnes. This species is plenty at some localities, but is far less common than the preceding. A *variety?* is occasionally found, which differs so much from the common type that I have supposed it must be the *siliquoideus* of Barnes. Recent observations, however, would seem to show that the specific distinctions between *radiatus* and *siliquoideus* are by no means definitely settled. I therefore prefer to regard it at present as a mere variety of *radiatus*. Professor Adams remarks, that he is at a loss in distinguishing between Vermont specimens of *U. siliquoideus* and *U. radiatus*. However this may be, there is no difficulty in discovering the difference between what he regards as *siliquoideus* of Vermont, and what I regard as *radiatus* of Maine.

U. ochraceus, Say. This species occurs in the Kennebeck river. Rare.

Besides the above, I have received several specimens of an *Unio* from Monmouth, concerning whose specific characters I am much perplexed ; it may prove to be new.

Genus Alasmodon. Say.

A. arcuata, Barnes. This species is plentiful all over the State. The largest and best specimens are found in small sluggish streams, in muddy places. Dr. Gould remarks that he has never found it near the sea-board. I have. It occurs plentifully at Cape Elizabeth, near the sea.

Specimens from different localities differ much among themselves, being more or less curved, or elongated, and some are perfectly straight, differing in no respect from *U. sinuosa* and *elongata* of Lamarck, from Germany and France. With Mr. Lea, I believe them to be identical.

A. undulata, Say. This is extensively distributed over the State, and plentiful.

A. marginata, Say. Often found, but not plentiful.

An extraordinary variety of this, or (which is more probable to me) a new species, occurs at Eastport. The late Dr. C. J. Ward thought it *might be A. radiata*, Con. Not having had an opportunity to compare it with that species, I am still compelled to leave it in doubt.

Genus Anodon. Brug.

A. cataracta, Say. Widely distributed over the State. In ponds it is large and comparatively thick, resembling specimens from South Carolina. In sluggish, muddy streams, it is more abundant, but of a smaller size, and much thinner.

A. marginata, Say. Elongated specimens of this species, resembling, externally, *A. ferussaciana*, Lea, occur at Norway, Oxford county. I doubt the propriety of separating it from the preceding species. It differs no more from it than many established species differ among themselves, nor half as much as acknowledged varieties of *U. camplanatus*.

A. implicata, Say. The only locality where this species is known to exist in the State, is in a pond near Eastport. This is the variety (if indeed it is a variety,) which Mr. Lea described as a new species, under the name of *A. newtonensis.* It is plentiful at the place referred to.

Genus Mytilus. Lin.

M. edulis, Lin. This is the only species of the genus that occurs north of Cape Cod. It is distributed over the whole coast of Maine from Piscataqua to Passamaquoddy; and in some of our quiet bays it congregates in countless millions, whence it is often carted off by our farmers, in the winter season, deposited in heaps, and in the spring distributed over their fields for manure. It is not used as food in Maine.

The variety M. pellucidus of Pennant is abundant. I have observed it to be most so on the unprotected coast, near low-water mark, attached to ledges and pebbles with a shorter bissus than that which belongs to the more common variety.

Genus Modiola. Lam.

M. modiolus, Lin. This species is plentiful on all our shores. It is sometimes thrown up by storms in immense quantities, and is carted off by the farmers for manure. It is found abundantly on some of the islands in Casco Bay, above low-water mark, whence it is procured by the islanders and sold in the market as an article of food, which is highly esteemed by some. I once found it plenty near Fort Preble, in company with *Saxicava distorta,* just above low-water mark, during a spring tide. It is proper, however, to remark that they were so situated that they were never left by the water.

M. plicatula, Lam. This species does not occur in Casco Bay. I have inserted it on the authority of Dr. Jackson's "*Report on the Geology of Maine.*"

M. nexa, Gould. Pelagic. Extremely rare in Casco Bay. I have found it in no other situation but in the stomachs of haddock.

M. pectinula, Gould. I am indebted to a fisherman for a single specimen of this shell, which he took from the stomach of a cod-fish, caught in the Gulf of St. Lawrence.

M. (mytilus,) discrepans, Mont. Pelagic. A very few mature specimens have been taken with the dredge in Portland harbor. Small ones are frequently found in fishes' stomachs taken in Casco Bay.

M. glandula, Tott. This small species occurs plentifully on all the *fishing grounds* from Massachusetts Bay to the Gulf of St. Lawrence. It is a true pelagic species. I know not that it has ever been detected with the dredge.

Genus Pecten. Turt.

P. magellanicus, Gmelen. Pelagic. Capt. Walden has often dredged this species at Eastport and Machias. He informs me that it is made much account of by the inhabitants on the eastern shore as an article of food. He once honored my table with a liberal *mess* of them, which, according to his advice we fried in butter, from which I can testify that they are truly delicious, far exceeding (in my view) the oyster, in richness and delicacy of flavor. The *muscular* portion only is edible, the mantle and abdominal mass being very tough and indigestible. They sometimes occur in Casco Bay, but for many years they have been rarely found.

P. tenuicostatus, Nob., I am now fully convinced is nothing more than the very young of *P. magellanicus*. Capt. W. found them of all ages at Nashe's Island, with which I have been enabled to form a series, from the size of a dime to that of six or seven inches in width — from which it is plainly to be seen that they gradually and almost imperceptibly merge in each other.

P. islandicus, Muller. Pelagic. Rare in Casco Bay. The Gulf fishermen have furnished me with a few fine large specimens, which they say they took from the stomachs of *sand-dabs*. They accord perfectly with European specimens.

Genus Ostrea. Lin.

O. borealis, Lam. A few dwarfish specimens of this species have been found at the Green Islands, in Casco Bay. Never having been able to hear of it further northward, I am of opinion this is the utmost northern limit of the species. It however occurs in a fossil state, of a large size, in a post-tertiary bed, on the coast of Cumberland, ten or twelve miles east of Portland.

I am at a loss to conceive how any *living* species of oyster of the United States, should have been confounded with *Ostrea edulis*, Lin. I say *living* species, because I have received *fossil* specimens of *O. edulis*, from the banks of the Potomac, near Washington, which perfectly accord with those of Europe, but differ widely from all our living species.

Captain Walden has presented me with the lower valve of an oyster, (or *Etheria*) which he dredged somewhere east of Portland, which I cannot make out. It certainly cannot be confounded with the species found at the Green Islands. It is four inches long, one inch wide, and appears to have been fixed upon the convex surface of a stone of soft texture, perhaps limestone.

Genus Anomia. Lam.

A. ephippium, Lister. Lin. Distorted, dwarfish specimens of this species are occasionally found on our shores. Whether it has colonized our stormy coast from choice or accident, I am unable to say ; one thing is clear, however, whatever its motive has been, that it has found an *uncongenial* climate.

A. aculeata, Gmelin. Shell pelagic. This species is often found attached to the roots of marine plants, pebbles and other shells, which are thrown ashore by storms. I have, also, often found it fastened to the backs and claws of the larger crustacea.

Besides these, there are *several* others found in the State, which I doubt not are distinct species ; not, however, being able to ascertain whether they have been described, or indeed to separate them definitely, I have deemed it best to pass by them. They all occur as far north and east as Passamaquoddy Bay.

Genus Terebratula. Brug.

T. caput-serpentis, Lin. Pelagic. Diminutive specimens of this interesting shell are found rather plentifully in the stomachs of haddock taken in Casco Bay. The largest and finest specimens I have seen were dredged by Captain Walden near the Fox Islands. A specimen now lies before me 1.4 inch in height, 1.1 inch in width. It inhabits very deep water. A fisherman brought me a stone which he *fished* up with a cod hook, in (he says) 75 fathoms of water! It was covered with fine specimens of this shell.

T. psittacea, Gmelin. Pelagic. I am not aware that this species occurs in the waters of Maine. In the summer of 1841, a fisherman gave me twenty-seven specimens which he took from the stomachs of *sand-dabs* in the Gulf of St. Lawrence. A specimen now before me is .8 inch in height, .7 inch in length and .5 inch in breadth. This is the largest; most of them were much smaller.

Genus Chiton. Lin.

C. lævigatus, Flem. (*C. fulminatus,* Couth.) Small specimens of this species are found, sparingly, in fishes' stomachs caught in Casco Bay. Dr. Ray has found it on the rocks at Eastport, during spring tides, above low-water mark. A specimen of which, now before me, is 1.2 inch in length. Never having detected it here, (at Portland) in a similar situation, I infer that its more congenial habitat is further north. Having had an opportunity of comparing it with a specimen of *C. lævigatus,* in the cabinet of Dr. Gould, of Boston, from Sweden, where it is said to be common, I have no doubt of their identity.

C. ruber, Lowe. Pelagic. Taken from fishes' stomachs caught in Casco Bay. Rare.

C. albus, Mont. Pelagic. This, with the following species, is found in company with the preceding. Rare.

C. emersonii, Couth.

C. mendicarius, Migh. Pelagic. The only specimen of this species which has yet been found, I took from the stomach of a haddock in 1841.

Genus Patella. Lin.

P. candida, Couth. Pelagic. Rare. Although I have examined *several hundred bushels* of the entrails of fishes, I have never found more than eight or ten specimens of this shell. I have always found them in the stomachs of haddock taken in very deep water.

P. amœna, Say. Littoral, — and abundant on the whole line of coast, from Piscataqua to Passamaquoddy. It is very variable in its markings; some specimens are nearly white, others are black, and some are beautifully mottled, striped, speckled, &c. The largest and most beautiful specimens I have seen were sent me by Dr. Ray, from Eastport, — one now in my cabinet is $1\frac{1}{2}$ inch in length.

P. alveus, Con. This species is often found on the shores of Casco Bay, but is not common.

Genus Dentalium. Lin.

D. entalis, Lin. Pelagic. I have frequently found this species in fishes' stomachs taken in Casco Bay, and Captain Walden has dredged it in Penobscot Bay.

D. dentale, Lin. Pelagic. Having found only a single, imperfect specimen of this species, I conclude it is very rare. This was taken from the stomach of a haddock caught far out at sea in very deep water.

Genus Cemoria. Leach.

C. (*Patella,*) *noachina*. Pelagic. This species is frequently obtained from fishes' stomachs taken in Casco Bay.

C. princeps, Migh. Pelagic. This species inhabits very deep water. I have never obtained but four or five specimens, all of which were taken from the stomachs of fishes caught off the mouth of the Kennebeck, nearly one hundred miles from land, on fishing ground known by fishermen by the name of Monhegan Falls. The depth of water here, is from forty to seventy-five fathoms.

Genus Hipponix? Sowerby.

H. . . . . . (*species unknown.*) . . . Pelagic. The first, and only good specimen of this curious little shell, which I found, was in the spring of 1840. This I took from the stomach of a haddock, caught in Casco Bay. I have subsequently obtained another specimen, but too imperfect for description. I have but little doubt that they belong to the same genus as Sowerby's *Hipponix.*

Genus Calyptræa. Lam.

C. striata, Say. Pelagic. I have obtained several fine specimens of this interesting species by dredging in Portland harbor. I have always found them resting upon the valves of the *Astarte undata.* Captain Walden has dredged a few specimens near the Fox Islands.

Genus Crepidula. Lam.

C. (*Patella,*) *fornicata,* Lin. Pelagic. This species is often thrown upon our shores by storms. Captain Walden recently found it adhering to the *lower* valves of *Pecten magellanicus,* which he dredged near the Fox Islands.

C. plana, Say. I have never found but one individual of this species in Casco Bay; this had located itself within the mouth of a dead *Buccinum undatum.* It is much thicker than any one I have seen from Massachusetts.

Genus Bulla.

All the recent species of this genus, found in Maine, are pelagic, and have all been taken from the stomachs of fishes.

B. gouldii, Couth. Very rare. I have never found but one well marked individual.

B. debilis, Gould. Plentiful.

B. triticea, Couth. Found occasionally, but rare.

B. lineolata, Couth. I have never found more than five or six of this species.

B. oryza, Tott. Only one specimen has been found in the waters of the State, to my knowledge.

B. puncto-striata, Migh. I have found only a single individual of this fine species.

B. pertenuis, Migh. This minute species is found occasionally, but is rare.

B. occulta, (*fossil.*) Migh. This occurs in the post-tertiary formation at Westbrook, in company with *Nucula portlandica*, Hk. Rare.

Genus Helix. Lin.

H. albolabris, Say. This species occurs, solitary, in all parts of the State, and on some of the islands in Casco Bay, but I am not aware that it is anywhere in plenty. It is of rather smaller size than specimens from the Southern and Western States.

H. thyroidus, Say. I insert this species on the authority of Dr. C. T. Jackson, ("*Report on the Geology of Maine*.") I have not found it.

H. hortensis, Muller. Captain Walden has recently detected this species on a little island in Casco Bay. It must be very plenty, as he obtained more than five hundred specimens in a few hours, and says he could have obtained many more. He informs me that he found them buried deep in the loose soil, under fragments of wood, and at the roots of plants. Half a dozen or more were often found occupying the same burrow. This does not accord with the observations of Dr. Binney. He says, "it does not appear to burrow under stones or decaying wood and leaves, but is found on the surface of the ground." My specimens are much more beautifully banded than those of Massachusetts. Most of them have five dark brown bands on a yellow ground; some four, some two, and a few none. Some have light fawn-colored bands on a white ground; in others, in place of colored bands, the yellow ground is interrupted with nearly transparent zones. One beautiful specimen is heterostrophed.

The island is nearly covered by the sea at high water; only a few square rods are above high-water mark.

H. fraterna, Say. I prefer to retain Say's name for this shell, believing it to be distinct from *H. monodon*, of the Western States. It is quite common in forests, and on hill-sides in open pastures, under old logs and stumps and leaves, in damp places.

H. pulchella, Muller. This pretty little species may be found at any time during the warm season, in gardens and by the way-side in this city, wherever it can find a wet chip large enough to hide itself under.

H. alternata, Say. Shell gregarious, abundant. Several hundred, old and young, are frequently found within the space of a few inches, in old logs and stumps. It inhabits all parts of the State, including some of the islands in Casco Bay. It probably inhabits all the States in the Union, as I have received specimens of it from both sides of the mountains, and recently several specimens from Alabama, through professor Brumby.

H. striatella, Anthony. Found in great abundance in all parts of the State, in and about old decaying wood, and under damp leaves.

H. lineata, Say. Found in company with the preceding, but not plenty.

H. indentata, Say. Mr. True has found this species at Monmouth; it however appears to be rare.

H. arborea, Say. This is common everywhere, under stones, and about old stumps and logs. I cannot perceive any characters by which to distinguish this species from *H. lucida*, Drap. of Europe.

H. labyrinthica, Say. Found sparingly, in company with most of the small species.

H. electrina, Gould. Mr. True has found this species at Monmouth; it is, however, rare.

H. chersina, Say. I have found a few specimens of this species in company with *H. labyrinthica*. If not the same thing, it is certainly very nearly allied to *H. fulva*, Muller.

H. sayi, Binney. This fine species is found at Monmouth and at Bangor.

Genus PUPA. Lam.

P. contracta, Say. Through Mr. Blake, I have received a few specimens of this from Bangor.

P. modesta, Say. I have found a very few specimens of this species near the Cape Cottage at Cape Elizabeth. It has also been detected in the interior of the State.

P. curvidens, Gould, (*pentodon*, Say.) Found with *P. contracta*, at Bangor.

P. exigna, Say. Mr. True has found a few specimens at Monmouth. Through him I have also received several specimens of a *Pupa* which appear to me to accord perfectly with Say's description of his *P. ovata*.

Genus BULIMUS. Brug.

B. lubricus, Muller. Brug. Mr. True has detected this species at Monmouth, and I have found it under damp leaves at Cape Elizabeth, near the sea.

Genus SUCCINEA. Drap.

S. campestris, Say. Gould. Adams. I have found this species most abundant in forests, under heaps of damp leaves; it is, however, frequently found in cultivated fields. I once found it in plenty on a dry clay bank, larger than common, and with a remarkable obliquity of the spire, which, I presume, may be Say's *S. obliqua*. It probably inhabits all the States in the Union; and if Dr. Gould is right in his surmise, that it is identical with *S. amphibia*, Lam. of Europe, (of which, however, I am more than doubtful,) it surely has a wide range!

S. avara, Say. Found by Mr. True, at Monmouth.

S. ovalis, Say. I have often found this species on the margins of ponds, adhering to the stocks of aquatic plants and bits of floating wood, just at the edge of the water, where the surface is always wet.

Genus Planorbis. Mull.

P. trivolvis, Say. Dr. Milliken has found a few specimens in a pond at Unity.

P. lentus, Say. Found at Unity, in company with *P. trivolvis*. It differs in no respect from Vermont specimens, which Professor Adams has confounded with *P. corpulentus*, of the Western States, which is *certainly* distinct.

P. bicarinatus, Say. This species occurs in most of our ponds and brooks where the water is quiet, but I am not aware that it is abundant anywhere.

P. campanulatus, Say. This abounds in all parts of the State.

P. armigerus, Say. Mr. True has found this in plenty at Monmouth. It occurs at Bangor of larger size than at Monmouth.

P. elevatus, Adams. I have detected a few specimens of this *species?* in a spring within the limits of this city.

P. deflectus, Say. I have frequently found this shell in ponds, clinging to bits of floating wood, &c., but I am not aware that it is anywhere plenty.

P. exacutus, Say. Solitary specimens are often found in most of our collections of fresh water. At Norway, Oxford county, I once found it in plenty, ensconced in the crevices of old decayed oak logs, lying at the margin of a pond. I think it always prefers oak wood.

P. parvus, Say. This species is often seen in great numbers, resting upon the stocks of small aquatic plants, in shallow water, where it is still and warm.

Genus Physa. Drap.

P. heterostropha, Say. This species abounds in great profusion in all parts of the State. Quiet pools seem to be its favorite habitations; it however occurs abundantly in rapid streams.

P. ancillaria, Say. This has been found in various parts of the State. I am indebted to Mr. A. W. Longfellow for specimens from 2d Eagle Lake, Maine, in N. lat. 47°. In one specimen, the spire is not elevated above the penultimate whorl.

P. hypnorum, Drap. (*P. elongata*, Say.) There can no longer be a doubt as to the identity of this species. It occurs at Monmouth, and in a swamp near Bangor.

P. gyrina, Say. Mr. True has found this species at Monmouth. Among some specimens received from him, I find several that differ in no respect from *P. osculans*, Haldeman, from Mexico, which appears to me to be nothing more than an elongated variety of *P. ancillaria*.

P. fragilis, Migh. Found at Monmouth by Mr. True. Besides its extreme tenuity, it is readily distinguished from all its congeners by the elevated lamina upon the columellar lip. It inhabits the muddy bottom of a mill pond, in deep water, and is found only when the water is drawn off.

Genus Limnea. Lam.

L. columella, Say. This, and the variety *chalybea*, Gould, is found in most of the fresh water collections in the State. I have received the finest specimens from Brunswick. The black variety of Gould is uniformly more elongated than the usual type of *L. columella*, and appears to me to be much more worthy of a place as a distinct species than many others which are admitted without hesitation.

L. humilis, Say. Several varieties of this species are found in different parts of the State. I have observed an umbilicated variety in little *puddles* within the limits of the city, that entirely *dry up* and disappear in the drought of summer. How are the animals sustained during these seasons?

L. desidiosa, Say. Found in the counties of Cumberland and Kennebeck. Dwarfish, — rare.

L. decollata, Migh. Although I entertain the highest respect for the opinion of Mr. Haldeman, I cannot agree with him in regarding this as a variety of *L. catascopium*, Say. I do not think there is a striking resemblance between it and the specimens he has introduced to illustrate his opinion, (Monograph No. 5, Pl. 14, figs. 1, 4, and 5, excepting 4, "a distorted" specimen from Oregon, which *being distorted*, is entitled to no consideration whatever, *if indeed it belongs to that species.*) Entertaining these views, I cannot abandon it without more positive testimony. It inhabits a pond in the town of Unity, where I am informed by Dr. Milliken, its discoverer, it sometimes occurs in great numbers.

L. ampla, Migh. For a description of this fine species, the reader is referred to another part of this Journal. It inhabits the 2d Eagle Lake, Maine, N. lat. 47°. I am indebted to Mr. A. W. Longfellow for four specimens, no two of which are exactly alike.

Genus Amnicola. Gould and Hald.

A. lustrica, Say. Found sparingly, in small streams and springs, at several localities.

A. porata, Say. Found at Monmouth by Mr. True, to whom I am indebted for specimens.

Genus Paludina. Lam.

P. decisa, Say. This species occurs as far north as 2d Eagle Lake, lat. 47°, and is very abundant everywhere.

Genus Valvata. Muller.

V. pupoidea, Gould. Found at Monmouth by Mr. True. Rare.

Genus Ancylus. Muller.

A. rivularis, Say. Found in plenty, clinging to the under side of the leaves of the *yellow lily*, (*Nuphar advena*, Lin.) in ditches and sluggish streams.

Genus Natica. Brug.

N. heros, Say. Littoral, and abundant near low-water mark on all our sandy and muddy shores. I have traced it as far north and east as the Bay of Fundy.

N. triseriata, Say. Littoral, abundant, and found in company with the preceding.

N. immaculata, Tott. Pelagic, found in plenty in the stomachs of haddock taken in Casco Bay.

N. pusilla, Say. Pelagic, found sparingly, with the preceding.

N. clausa, Brod. and Sowb. (*N. consolidata*, Couth.) Found very plentifully, in company with the two preceding species.

N. flava, Gould. Pelagic, taken from fishes' stomachs, rarely, in the Gulf of St. Lawrence.

Genus Velutina. Blain.

V. lævigata, Lin. Pelagic, found somewhat plentifully in the stomachs of haddock taken in Casco Bay. When mature, it accords perfectly with European specimens. A specimen now before me, found by Capt. Walden, at Nashe's Island, is .7 inch in length, and .6 inch in width.

V. zonata, Gould. Found in company with the preceding species. Rare.

Genus Sigaretus. Lam.

S. haliotoideus, Lin. Pelagic. Very rare. Found in fishes' stomachs taken in very deep water, in Casco Bay. The animal is of a pure white, and entirely encloses the shell. It accords in most respects with Montagu's description, (*British Shells*, p. 212, 213) excepting in color.

Genus Skenia. Flem.

S. serpuloides, Mont. Littoral, — found occasionally clinging to the under side of wet stones, above low-water mark.

Genus Scalaria. Lin.

S. grœnlandica, Chemn. Pelagic, — very rarely found in fishes' stomachs caught in Casco Bay and Gulf of St. Lawrence.

Genus Margarita. Leach.

All the species of this genus are pelagic, and from numerous observations I am of opinion they all inhabit similar localities in the bosom of the great deep. Most of the small species of pelagic shells are found mixed with mud ; these are found, generally, mixed with sand, or gravel, or small pebbles.

M. cinerea, Couth. This occurs in Casco Bay, rarely. It is more abundant in the Gulf of St. Lawrence, where it is much larger.

M. obscura, Couth. Rare in Casco Bay, more plentiful farther north.

M. undulata, Sowb. This species was found rather plentifully in Casco Bay, in 1840, but very rarely since. It attains a much larger size in the Gulf of St. Lawrence. An imperfect specimen now before me is .7 inch across the base.

M. arctica, Leach. Mature specimens are rare. I have found very small specimens of a bright red color, (which I suppose to be the young) quite plentiful.

M. argentata, Gould. Frequently found.

M. acuminata, Sowb. Hab. Gulf of St. Lawrence. I have obtained only a single specimen.

M. varicosa, Migh. Only two specimens of this species have been found ; they accompanied the preceding.

Genus Trochus. Lin.

T. occidentalis, Migh. Pelagic. Hab. Casco Bay, in great depths of water. Very rare.

Genus Littorina. Ferus.

L. (Turbo) rudis, Donovan. *(Turbo obligatus*, Say.)

L. (Turbo) tenebrosa, Mont. *(Turbo vestitus*, Say.)

L. (Turbo) palliata, Say. These three species of *Littorina* occur in the greatest profusion, covering the rocks and marine plants on the whole coast from Piscataqua to Passamaquoddy, but how much farther north and east, I am uninformed.

Genus Lacuna. Turton.

L. vincta, Mont. Often found dead upon our beaches, but it is not plentiful.

L. neritoidea, Gould. I have obtained two specimens only, of this shell, — both from the stomachs of haddock taken in Casco Bay.

Genus Cingula. Flem.

C. (Turbo) minuta, Tott. Littoral. Plentiful in all our quiet coves and bays, in little pools above low-water mark.

C. aculeus, Gould. Littoral. Found plentifully near high-water mark, clinging to the under side of stones, on all our shores.

C. (Turbo) semicostata. Mont. Pelagic. Found, rarely, in fishes' stomachs taken in Casco Bay.

C. (Turbo) arenaria, Mont. Found in company with the preceding. Very rare.

C. latior, Migh. Found in the stomachs of haddock, caught in very deep water in Casco Bay. Very rare.

Genus Turritella. Lam.

T. erosa, Couth. Pelagic. Imperfect individuals are frequently found in haddocks' stomachs taken in Casco Bay. Perfectly fresh specimens, however, are very rare. It also inhabits the Gulf of St. Lawrence.

T. costulata, Migh. Pelagic. Hab. Casco Bay. I have obtained two specimens of this species; one from the stomach of a haddock, the other was dredged by Capt. Walden.

T. reticulata, Migh. Pelagic. Hab. Gulf of St. Lawrence. Several specimens were found in the stomach of a *sand-dab* by a fisherman in the summer of 1841.

Genus Pyramis. Brown.

P. striatula, Couth. Pelagic. Hab. Casco Bay. Found in fishes' stomachs. Very rare.

Genus Pleurotoma. Lam.

P. decussata, Couth. Pelagic. Rare in Casco Bay. Found in fishes' stomachs.

P. bicarinata, Couth. Found with the preceding. Very rare.

P. violacea, Adams and Migh. Professor Adams first found this species among loose sand and fragments of other shells, on the shore, east of Mount Joy, Portland harbor. It is, however, pelagic, never being found in a fresh state but in the stomachs of fishes. Rare.

Genus Cancellaria. Lam.

C. couthoyi, Jay. Pelagic. Hab. Casco Bay. Frequently taken from haddocks' stomachs caught in deep water.

Genus Fasciolaria. Lam.

F. ligata, Migh. Pelagic. Hab. Gulf of St. Lawrence. About a dozen specimens were taken from the stomach of a *sand-dab* by a fisherman in 1841. This is the only species of the genus that has been detected north of New York.

Genus Fusus. Lam.

All the species of this genus, found here, excepting *F. islandicus* and *F. decemcostatus,* are pelagic, and are obtained only from the stomachs of fishes.

F. decemcostatus, Say. Found rather plentifully at Passamaquoddy, during spring tides, burrowing in the mud near low-water mark. I have recently received good specimens from the island of Mount Desert. Dead specimens are occasionally found on the shores of Casco Bay, and I have frequently found very young ones in fishes' stomachs. It occurs fossil at Topsham.

F. islandicus, Penn. Gmel. Found at Passamaquoddy, in company with the preceding. It is also taken from cod-fishes' stomachs caught in the Gulf of St. Lawrence. I am not aware that it is anywhere abundant.

F. pygmæus, Gould. Having been familiar with this shell for several years, and having found thousands of specimens, I cannot entertain the slightest doubt that it is distinct from *F. islandicus.* It is uniformly much smaller than that species, rarely exceeding an inch in length; the epidermis is uniformly of a light, horn color; in *F. islandicus* it is uniformly of a reddish brown, even in young specimens, not larger than this; the transverse lines in this species are more numerous, and the ultimate and penultimate whorls are proportionally smaller, consequently it is more subulate.

F. tornatus, Gould. Hab. Grand Banks. Taken from the stomachs of cod-fishes. It occurs, fossil, in a post-tertiary formation at Peak's Island, Casco Bay. Very rare.

F. scalariformis, Gould. I have found several in fishes' stomachs taken in very deep water, in Casco Bay. It also occurs in the Gulf of St. Lawrence, but is rare everywhere.

F. bamffius, Flem. This elegant little shell is often found in Casco Bay, — fresh specimens, however, are very rare.

F. rufus, Mont. Gould. (*F. pleurotomarius,* Couth.) This species is occasionally found, but it is scarce.

F. harpularius, Couth. Rare.

F. turriculus, Mont. Not unfrequently obtained from deep water in Casco Bay. I once detected it with the dredge in Portland harbor. Capt. Walden has dredged it near the Fox Islands.

F. cancellatus, Migh. Hab. Casco Bay, in very deep water. I have never found more than four or five specimens.

Genus Rostellaria. Lam.

R. occidentalis, Beck. Pelagic. This curious species occurs in Casco Bay, but I have never found perfect specimens. I once took twenty specimens, mostly mature, from the stomach of a *cat-fish,* (*Anarrhichas lupus,* L.) but so comminuted as to be of little or no value. I am indebted to the fishermen for several fine specimens taken in the Gulf of St. Lawrence.

Genus Trichotropis. Brod. and Sowb.

T. borealis, Sowb. (*T. costellatus,* Couth.) Pelagic. Some years, I have found this shell considerably plentiful in the stomachs of haddock taken in Casco Bay, but during the last two years it has been rarely seen.

Genus Purpura. Lam.

P. lapillus, Lin. Littoral. Inhabits the whole coast of Maine, in vast numbers. I have placed in my cabinet, at least eight varieties of this species, all inhabitants of Maine. The only variety that occurs at Eastport, is of a chocolate color, — externally and internally. European specimens are a little more ponderous than our shells, in other respects they are the same.

Genus Buccinum. Lin.

B. undatum, Lin. Littoral, — occasionally found, during ordinary tides, considerably above low-water mark, in great numbers. The largest and most beautiful I ever saw, I found at Clapboard Island, in Casco Bay. They very soon disappeared, and have not been noticed since. Our shell differs in no respect from European specimens. A sailor gave me a specimen which he says he picked up on the coast of Chili; it accords perfectly with ours.

B. trivittatum, Say. Found in considerable numbers in fishes' stomachs, and by dredging in Portland harbor. I once found it alive, in the mud, during a spring tide, at low-water mark, at Clapboard Island.

B. obsoletum, Say. Littoral. Abundant on muddy flats in all our quiet bays, especially near the mouths of rivers.

B. rosaceum, Gould. Pelagic. Found sparingly, in haddocks' stomachs in Casco Bay.

B. ciliatum, Oth. Fab. Pelagic. Hab. Gulf of St. Lawrence and Grand Banks. Very rare.

B. donovani, Gray. Pelagic. Obtained from fishes' stomachs, accompanying the preceding. Also rare.

B. plicosum, Menke. A few specimens of this species have been found in Back Cove, near this city; they accord perfectly with Massachusetts specimens.

Genus Columbella. Lam.

C. avara, Say. I found a single specimen of this species in a haddock's stomach taken in Casco Bay.

Genus Terebra. Lam.

T. (Cerithium,) dislocata, Say. (*T. petitii,* Keiner.) Through Dr. Ray I have received a specimen of this shell. He found it with several more, on the shores of Passamaquoddy Bay, near Eastport. He informs me he has found it at several places in that vicinity, and has no doubt that it inhabits that locality.

It thus appears that there are seventy-nine genera, represented by two hundred and twenty-five species, to which might be added with propriety, all the northern species included in Dr. Gould's Report, (*Invert. Mass.*) with twenty-five or thirty fossil species noticed by Dr. Jackson in his 2d Annual Report on the *Geology of Maine,* and six or eight others which have come into my possession through fishermen, who found them on some of the eastern islands.

The occurrence of several species on this coast, that inhabit the south shore of Cape Cod, and not Massachusetts Bay, is a fact worthy of notice. How is this to be explained? Does the Gulf Stream have anything to do with it? Is there a current flowing around that cape, in an easterly direction, connected with or independent of the Gulf Stream? and if so, where does it terminate? Would it not, more probably, terminate on the coast of Maine than on the coast of Massachusetts? If such a current does exist, either constantly or periodically, would it not be a satisfactory solution of the problem? I have but little doubt of the existence of such a current, and that it acquires a mighty energy during the prevalence of southerly winds. The effect of it in transplanting marine productions will readily occur to every mind. It is well known among naturalists that several species of tropical shells occur on the coast of Great Britain and Ireland, whither they have, probably, been transported by the Gulf Stream. If this is true, although it does not prove, it certainly adds some strength to the supposition, that the species of shells above alluded to have been transported across Massachusetts Bay by a current not hitherto observed, from some region south of Cape Cod.

I would by no means be understood as recording this as my settled opinion, I merely throw out these hints in the hope of eliciting the opinions of others.

Since writing the above I have had an interview with Capt. Walden, who confirms my conjecture. He says there are two periodical currents, — one sets eastwardly around Cape Cod, and extends into the Bay of Fundy; it frequently flows at the rate of two miles an hour, and continues for several weeks in succession. The westerly current is also periodical, and continues to flow during longer periods than the easterly one. It commences where the other ends, in the Bay of Fundy, and he thinks it generally becomes exhausted on the westerly part of the coast of Maine, though sometimes he has felt its influence as far south and west as Cape Ann.

Art. XXVII. — DESCRIPTIONS OF SIX SPECIES OF SHELLS REGARDED AS NEW. By J. W. Mighels, M. D., Portland, Maine. Communicated March, 1843.

Astarte portlandica.

A. testâ parvâ, solidâ, per-inequilaterali; umbonibus elevatis, approximatis, recurvis; lunulâ angustatâ; intus lividâ; marginibus simplicibus.

Plate XVI. Fig 2.

Shell small, solid, rather compressed, very inequilateral, upper part of the anterior margin moderately curved, anterior, basal and posterior margins regularly rounded; beaks elevated, approximate, pointed and eroded; lunule narrow, lanceolate, and rather superficial; external surface slightly undulating, occasioned by the incremental striæ, which under a magnifier appear to be interrupted and rather coarse; the epidermis is of a dark, yellowish brown color; the interior is smooth, of a dark brown, inclining to a chocolate color; the hinge margin is thin, the posterior side of the left valve is sharp, which fits into a slight groove in the opposite valve, a short distance behind the beak; there is one cardinal tooth in the right valve which is received into a subtriangular space between two unequal teeth in the left valve; muscular impressions superficial, reniform; margins simple.

Length $\frac{2}{5}$, height $\frac{9}{20}$, breadth $\frac{1}{5}$ inch.

Habitat. Casco Bay.

Remarks. I have obtained only a single specimen of this species; this I found in the stomach of a haddock, in 1842. It is readily distinguished from all the other species of the genus by its extraordinary obliquity, and by the livid color of the interior.

Bulla pertenuis.

B. testâ minutâ, cylindraceâ, albidâ, hyalinâ; anfractibus quatuor; spirâ elevatâ; labro superne recto, infrâ rotundato; aperturâ supernè augustatâ, infrâ latâ.

Plate XVI. Fig. 3.

Shell very small, cylindrical, of a dingy white color, very thin and fragile; whorls four, rounded, all lying in the same plane; suture distinct, as seen under the microscope; spire elevated; labrum nearly straight at the posterior part, rounded anteriorly, returning into the shell it forms a delicate, slightly elevated lamina, which, under the microscope, is seen to occupy nearly the whole length of the columellar region; aperture very narrow posteriorly, broad and rounded anteriorly.

Length $\frac{8}{100}$ inches, breadth $\frac{4}{100}$ inches.

Habitat. Casco Bay.

Remarks. When greatly magnified this shell resembles *B. Gouldii*, Couth. but besides being much smaller, it is proportionally longer, — it is also entirely destitute of the revolving lines, which are seen on that shell. It is the smallest species of the genus that has hitherto been found on the American coast. I first detected it in sifting sand and mud taken from the stomachs of haddock, in the spring of 1842. It is scarce and difficult to obtain.

Limnea ampla.

L. testà amplà, subovatà ; anfractibus quinque, convexis, supernè geniculatis; suturà valdè impressà ; spirà brevi ; aperturà latà ; umbilico profundo ; columellà valdè plicatà.

Plate XVI. Fig. 1. *a. b. c.*

Shell large, much inflated, suboval, rather thin, composed of five convex whorls, prominently shouldered at the upper part ; epidermis of an obscure, olivaceous green color ; lines of accretion very fine and compact ; transverse lines obscure, appearing serriform under a magnifier, giving the surface the appearance of very delicate lace work ; suture deep, and in one specimen, (fig. *c*,) subcanaliculate ; spire short and pointed when present ; aperture oblong, very wide at the posterior part, but narrowing rapidly anteriorly, and occupying rather more than two thirds the length of the shell ; labrum thin and somewhat reflected ; labium broadly reflected, forming and partially covering an open and very deep umbilicus ; columellar fold very prominent ; within, it is of a light yellowish fawn color, with an obscure purplish zone, one line in breadth, and about two lines within the aperture.

Length 1.3 inches, breadth 1 inch, height .8 inches.

Divergence of the spire very variable.

Habitat. Second Eagle Lake, Maine, N. lat. 47°.

Remarks. This extraordinary and beautiful species was discovered by Mr. Alexander W. Longfellow, civil engineer, while engaged with other gentlemen of the scientific corps, in the exploration and survey of the north-eastern boundary, in the summer of 1842. He informs me they were very abundant on the shore of the lake, but he had no means of preserving any more than four specimens, all of which are in my collection. No two of the specimens are exactly alike; but notwithstanding this, and the remarkable difference between those represented in the plate, I doubt not they are specifically the same.

It is allied to *L. decollata*, Nob. but it is readily distinguished from that shell by its amplitude, by a proportionately larger penultimate whorl, by the reflected labrum, by a much broader labium, and by the open umbilicus, which is always entirely closed in *L. decollata*.

I regard that represented by fig. *a*, as the prevailing type of the species. Fig. *b* is a little shorter, and rather more tumid; fig. *c*, represents a distorted specimen.

Phasianella sulcosa.

P. testâ minutâ, ovato-conicâ, lævi; anfractibus quatuor, subconvexis, transversim sulcatis; suturâ impressâ; aperturâ ovato-oblongâ, intus transversim fasciatâ.

Plate XVI. Fig. 4.

Shell very small, ovate-conical, smooth and white; whorls four, slightly convex, with six or seven transverse grooves on the body whorl, and three on each of the two next above; spire smooth and pointed; aperture ovate-oblong, with three, slightly apparent transverse bands within, as seen under a strong magnifying power.

Length $\frac{1}{10}$ inch, breadth about $\frac{1}{20}$ inch.

Habitat. Casco Bay.

Remarks. Examined with the unassisted eye, this shell would be likely to be mistaken for some species of *Cingula*, but its true character is revealed with even a moderate magnifying power, — the lip being *incontinuous* posteriorly. I have never discovered but one specimen of this curious little shell; this I found in the stomach of a haddock, in company with several other minute species of shells, in the summer of 1842. I presume it is the only representative of the genus that has been hitherto discovered on our Atlantic coast.

Margarita minutissima.

M. testâ minutissimâ, globoso-subovatâ; anfractibus tribus, convexis, longitudinaliter sulcatis; spirâ brevi, obtusâ; suturâ valdè impressâ; aperturâ orbiculari; umbilico magno et profundo.

Plate XVI. Fig 5.

Shell very minute, subdiscoidal, globular-ovate, of a dull ash-color; whorls three, convex, with distinct longitudinal, approximate sulci, running obliquely, and disappearing as they approach the umbilical region; spire very low and obtuse at the apex; suture deep; aperture circular; lip sharp and nearly continuous posteriorly; umbilicus large and profound.

Length about $\frac{1}{50}$ inch, breadth about equal to the length.

Habitat. Casco Bay.

Remarks. I have never found but a single specimen of this shell, which I took from the stomach of a haddock. It is not very nearly allied to any of the other species found on the coast. Under a magnifier, it somewhat resembles *M. varicosa*, Nob. in the ultimate whorl. It is, however, readily distinguished by its very depressed and obtuse spire.

Delphinula? coarctata.

D. testâ parvâ, subdiscoideâ, imperforatâ; anfractibus tribus, convexis, longitudinaliter minutissimè striatis; ultimo anfractu maximo; suturâ canaliculatâ; aperturâ integerrimâ, circulari, intus flavidulâ.

Plate XVI. Fig. 6.

Shell small, subdiscoidal, much depressed, imperforate; whorls three, convex, minutely striated longitudinally; last whorl very large, composing a large proportion of the entire shell; spire much depressed and obtuse; suture very deep, being canaliculate above the body whorl; aperture uninterrupted, circular, of a wax color within; epidermis yellowish.

Length $\frac{1}{5}$ inch, breadth $\frac{1}{5}$ inch.

Habitat. Casco Bay.

Remarks. I have hesitated much in characterizing this shell. In examining the contents of fishes' stomachs, I have frequently found specimens of it, but regarding them as mere accidental varieties of some of our species of *Littorina*, I have heretofore thrown them away as worthless. But, on careful examination and comparison, I am persuaded it is distinct from *Littorina*. The *entire* margin, and *perfectly circular* aperture bring it nearer to *Delphinula*, if, indeed, it is not a species of that genus. Although I have not had an opportunity to examine the animal inhabitant, nor even the opercle, I am constrained to separate it from *Littorina*, and place it under *Delphinula*, with a doubt, for the present.

Art. XXVIII. — MONOGRAPH OF THE SPECIES OF PUPA FOUND IN THE UNITED STATES: With Figures. By Augustus A. Gould, M. D.

(Continued from Vol. III. p. 404.)

In the preceding part of this paper I remarked, that there were two or three described species of the genus Pupa, which I had not then seen, or had failed to identify them with their descriptions. During the long interval which has since elapsed, through the kindness of my friends I have succeeded in obtaining all of them. These I shall now proceed to describe, and also to communicate such facts respecting the species previously noticed, as a more extended observation has disclosed.

PUPA OVATA.

Plate XVI. figs. 7, 8.

P. ovatâ, umbilicatâ, castaneâ; anfractibus quinque, convexis; apertura subcordatâ, dentibus 5 ad 9 lamellosis armatâ, quorum 1-3 posticè, duo ad columellam, 2-5 ad labium inflexum adnatis.

"Shell dextral, subovate, brown; apex obtuse; whorls five, glabrous; suture not very deeply impressed; body whorl indented near and upon the labrum; aperture semioval; labium five toothed, of which three are situate on the transverse portion of the lip, parallel to each other, equidistant, the superior and inferior ones being small, the latter sometimes obsolete, the intermediate one lamelliform, prominent, and the two other ones situate on the columella, approximate, extending at right angles to the three preceding ones, the superior (inferior ?) one oblique and smaller; labrum reflected but not flattened, bidentate, teeth lamelliform, prominent; umbilicus distinct.

Length less than $\frac{1}{10}$ inch, breadth nearly $\frac{1}{20}$ inch.

The smallest teeth of the labium are sometimes obsolete." (Say, *Journ. Acad. Nat. Sc.* II. 375.) See also Adams, Catalogue of Mollusca, *in Thompson's Hist. of Vermont, and Silliman's Journ.* XL. p. 271.

An opportunity having been afforded for a careful examination of the authentic specimens of this species placed in the Cabinet of the Academy of Natural Sciences at Philadelphia by Mr. Say, and also of his *Pupa modesta,* the latter proves to be merely a specimen of *P. ovata,* with the lip somewhat fractured, by which the aperture has received a somewhat modified form (fig. 8); and this circumstance has been the source of no little embarrassment. Mr. Say's description is as follows:

P. modésta. "Shell suboval, minutely wrinkled; apex obtuse; whorls six; umbilicus distinct; aperture obliquely subovate; labrum with a prominent, compressed, semioval tooth, equidistant from the extremities of the labrum, and a somewhat conic one rather below the middle of the columella; labrum not inflected, joining the preceding whorl at its upper extremity with a curve, bidentate, lower tooth placed opposite to that of the middle of the labium, the other smaller and placed a little above. Length $\frac{3}{20}$ inch." (Say, *Long's Second Expedition,* II. 260, pl. 15, fig. 5.) See also Gould's *Inverteb. of Massachusetts,* 188, fig. 119.

This species is constant in its external characters, but is somewhat variable in its aperture. It is seldom that three teeth are found on the transverse lip, the tooth on the left being almost always, and that on the right being frequently wanting. Sometimes there is a minute tooth at the base of the aperture, and sometimes a third tooth on the posterior part of the outer lip. It is more ventricose than any other American species, and of a darker color. It is shining, but distinctly marked with longitudinal wrinkles. The inflection of the outer lip is such as to render the aperture heart-shaped, and the flexure extends to a considerable distance round towards the back of the shell. Its true dimensions are, length $\frac{1}{10}$ inch, breadth $\frac{1}{16}$ inch.

It lives in damp places, around the borders of ponds, or in rich, moist fields under fragments of board, sticks, &c. Mr. Say found his *ovàta* in Pennsylvania and his *modésta* in the Northwest Territory. It is common about Boston, and I have received it from near Portsmouth, N. H., from Troy, N. Y., from Worcester County, Md., and from Jacksonsborough, S. C.; and Professor Adams found it near Middlebury, Vt., and Dr. J. W. Mighels near Portland, Me.

The animal is of a dark claret color above, lighter beneath; tentacles two, remarkably clavate or pestle-shaped; the front of the foot is trilobate, the central lobe being very small, and there is a constriction behind the two lateral ones.

PUPA GOULDII.

Pl. XVI. Fig. 9.

"Testâ minutâ, ovato-cylindricâ, sub-castaneâ; anfractibus pluribusquàm quatuor; apice obtuso; apertura subcordatâ, bilobatâ, dentibus quinque armatâ; labro subreflexo."

"Animal with two tentacles only, black above; foot gray, short posteriorly. Shell light chestnut, cylindrical ovate; whorls between four and five, rather ventricose, the last occupying nearly half the length of the axis; apex obtuse; aperture lateral, composed of two unequal curves, meeting in the centre of the outer lip, with five prominent white teeth, viz.: one upon the transverse margin, two upon the umbilical margin, and two upon the labial margin; lip thickened, not reflected; umbilicus a little open." (Binney, in *Proceedings of the Boston Soc. Nat. History*, p. 105, March 15, 1843.)

This very distinct species is unusually constant in its characters. Its shape may be more properly called elliptical. In size it is intermediate between P. *ovata* and P. *milium*, approaching more nearly to the latter in form and color. In adult specimens I have never found any variation in the number or situation of the teeth. At a little distance back of the outer lip, and answering to the two teeth within, are seen two indentations, showing that the parts within are folds rather than teeth; and this is very plainly seen to be the case in young specimens. Its length is about $\frac{1}{14}$ inch, breadth $\frac{1}{26}$ inch.

It was first sent to me by Dr. W. Newcomb, of Troy, N. Y., and subsequently by Prof. E. Foreman, from Baltimore and Worcester County, Md. Since then I have found it, in August, upon sticks and about the roots of trees in the woods in Cambridge and Roxbury. It seems to be abundant.

PUPA PENTODON.

Plate XVI. fig. 10. 11.

P. ovato-oblongâ, albidâ, umbilicatâ; anfractibus quinque, convexis, apice subacuta; aperturâ obliquè semiovatâ, dentibus 5-8 instructâ, quorum 1-2 posticè, 2 ad columellam, 2-5 ad labrum positis; labro expanso.

"Shell dextral, subovate, whitish horn-color; apex obtuse; whorls five, glabrous, convex; suture not very deeply impressed; aperture semioval; labrum two-toothed, of which a single very prominent one is on the middle of the transverse labium, and the other remote, much smaller, and placed on the basal angle of the columella; labrum regularly arcuated, tridentate, tooth nearest the base very small and placed near the smaller tooth of the columella; the two others larger, subequal; umbilicus distinct. Length less than $\frac{1}{10}$ inch.

Lower tooth of the labrum sometimes obsolete.

Animal, foot white, head and neck, as far as the mantle, black." (Say, *Journ. Acad. Nat. Sc.* II. 376.)

This is the most variable of all our species. While there is no doubt as to this being the shell intended by Mr. Say as his *péntodon*, it is unfortunate that he should have selected so inappropriate a name, inasmuch as the shell is never found with five teeth except in an immature state, when the number is even reduced to four. It is nevertheless true that five of the teeth are constant, viz.: one upon the transverse lip, two on the columella and two on the outer lip. Then there is sometimes an additional small one on the transverse lip, to the left of the constant one; and the teeth on the outer lip vary in many ways, as may be best exhibited by the following table of varieties which I have observed, intended to represent the teeth in succession as they occur, beginning at the outer posterior angle and going round to the left.

1	1	1	1	0	1	0	1	0	1	0
1	1	1	1	0	0	0	1	0	1	0
1	1	1	1	0	1	0	1	0	1	1
1	0	1	1	1	1	1	1	0	1	0
1	0	1	1	0	1	0	1	1	1	1
1	0	1	1	0	1	0	1	0	1	0
1	0	1	1	0	0	0	1	0	1	0

By this table it appears that there may be as many as even eleven teeth, though I have never seen more than eight on one individual. Of the two teeth which are shown by this table to be constant on the outer lip, the largest is situated nearly opposite the tooth on the transverse lip, and the other less than half the distance between it and the posterior angle. Such remarkable deviations have led to the proposal of two new species which may with propriety be noticed, and may be considered as the two extremes of the varieties, viz.:

P. Tappaniàna, ADAMS, a name adopted by him from the manuscripts of the late Dr. Ward of Roscoe, Ohio, and described in a supplementary sheet to the 40th volume of Silliman's Journal, and afterwards in Thompson's History of Vermont. The finest examples of the species come under this variety. They are such as occur in Ohio, of a very light color, quite translucent, without epidermis, and with the lip distinct and white. It is $\frac{3}{40}$ inch in length, and about half as broad, fig. 10.

P. cúrvidens, GOULD, (*Inverteb. of Massachusetts*, 189, fig. 120) is about one seventh smaller, has a very thin, greenish epidermis, and generally eight teeth, and the large one on the transverse lip decidedly curved to the left, (fig. 11.) Such are specimens usually found in Massachusetts; and though in size, exterior, and armature they are so different from the

Ohio specimens, yet as I have seen so many intervening varieties, I think this form should be abandoned as a species.

Notwithstanding all these discrepancies, there is a certain aspect about the shell which enables one to distinguish it without much difficulty. Its ovate form, its very small aperture, with the transverse portion so oblique that the inner lip is very short in proportion to the outer one, will serve to determine the species with a very small magnifying power.

Mr. Say found his specimens in Pennsylvania ; it is not infrequent in the vicinity of Boston, under fallen leaves in shady woods ; Professor Adams found it near Middlebury, Vt. ; Dr. Newcomb found it near Troy, N. Y. ; it is one of the most common species in Ohio, and has been sent me by Dr. Foreman from near Baltimore, and from Jacksonborough, S. C. Thus, with the exception of *P. contrácta* it has been observed over a wider region than any other species.

PUPA RUPICOLA.

Plate XVI. fig. 13.

P. ovato-conica, glabra, albida, umbilicata ; apice subacutâ ; anfractibus sex convexis : aperturâ obliquâ, semi-ellipticâ, dentibus quinque lamellosis armatâ, quorum unus posticè, duo ad columellam, duo ad labium expansum dispositi.

" Shell dextral, attenuated to an acute apex, white ; suture deeply impressed ; labrum bidentate, superior tooth lamellar, emarginate in the middle, and at the anterior tip uniting with the superior termination of the labrum ; inferior tooth placed on the columella, and extending nearly at a right angle with the preceding ; labrum tridentate, teeth placed somewhat alternately with those of the labium ; inferior tooth situated at the base and immediately beneath the inferior tooth of the labium. Length $\frac{1}{10}$ inch."

About the size of *P. corticària,* and considerably resembles that species, but is sufficiently distinguished by the circumstance of its gradually decreasing in diameter from the body whorl to its tip, and in the character of the mouth it is widely distinct. (Say, *Journ. Acad. Nat. Sc.* II. 163.)

Found by Mr. Say in Florida, and sent to me by Dr. Ravenel from Charleston, S. C., and by Dr. Foreman from Jacksonborough and Manchester, S. C., and from Savannah and Whitmarsh's Island, Georgia. It seems to be a southern species; and although I have very often received shells from Ohio under this name, yet no one of them has actually proved to be this species.

I have met with little or no variety in this species, and the above description can scarcely be amended, except to say that the teeth are compressed, and protracted for a considerable distance within the aperture. The place of the two teeth or folds on the outer lip is marked externally by two prolonged indentations. The distinctive marks between this species and *P. corticària* are clearly given ; but it has a much closer resemblance, in its armature especially, to *P. prócera.* It is, however, distinguished by its less cylindrical form, its lighter color, its smoother surface, its white instead of brown lip; the tooth on the transverse lip is less twisted, and that which is at the base is not so remote or so transverse in position. Its spire is also at least half a whorl shorter.

PUPA SERVILIS.

Plate XVI. fig. 14.

Testa ovato-elongatà, glabra, rufescens, umbilicatâ ; anfractibus quinque convexis; apertura semi-elliptica, dentibus quinque armata, quorum unus contortus posticè, unus ad basin, duo ad labium affixi ; labro reflexo.

Shell elongated ; tapering to a somewhat acute apex, of a pale chestnut or horn color ; whorls five and sometimes somewhat more, very delicately wrinkled ; suture well defined. Aperture semi-oval, nearly in the axis of the shell, the transverse portion slightly oblique, and the two extremities of the lip very nearly meeting behind. Revolving under the middle of the transverse lip is a contorted, lamellar tooth which arises near the junction of the outer lip ; on the middle of the columella is a large conical tooth ; at the base is a small tooth, then a third large tooth, placed so as to form a regular tripod with the other two, and above this is a fifth inconspicuous tooth. Lip slightly everted, not flattened, sometimes a little inflected at the right, umbilicus small. Length, $\frac{1}{10}$ breadth $\frac{1}{20}$ inch.

At first sight this species would be referred either to *P. rupicola* or *P. prócera.* But a closer examination shows that while it has the pale brown lip of the latter, it is a shorter and much more ventricose shell; and while the number and arrangement of the teeth are as in *rupícola,* the latter has a much more slender form, the aperture is more oblique and less elongated, the apex is obtuse, and the lip is white.

Notwithstanding the distinctions mentioned above, perhaps most observers, on ordinary inspection, would maintain that these three were merely local varieties of the same species. I will add, therefore, that by means of an excellent microscope, to which a camera lucida is attached, I have made accurate figures three inches in length, which render the differences in form unequivocal.

Found at Santa Cruz by Dr. R. E. Griffiths, and near Matanzas by John Bartlett, Esq.

I have inserted this species here, although it cannot strictly be considered as belonging to the United States, because of its proximity to the States, and more especially because it helps to illustrate two of our species.

PUPA FALLAX.

Plate XVI. fig. 15.

P. turrita, glabra, pallidè castaneâ, umbilicata; anfractibus sex convexis; apertura obliqua, subrotundata, edentula; labro albo, valdè reflexo, striato.

" *Cyclostoma marginata.* Shell turreted, pale horn color or dusky, obsoletely wrinkled across; suture rather deeply impressed; volutions six; aperture suboval, truncate transversely above by the penultimate whorl, nearly one third the length of the shell; labium nearly transverse, color of the exterior part of the shell; labrum equally and widely reflected, thick, white; umbilicus distinct. Length $\frac{1}{5}$ inch." (SAY, *Journ. Acad. Nat. Sc.* II. 172.)

This shell is clearly not a Cyclostoma, and on that account, as Mr. Say suggests, the specific name must be changed. As the shell afterwards described by him under the name of *Pupa fallax* (*Journ. Acad. Nat. Sc.* V. 121.) is only a finely developed shell of this species, that name may well be retained for the species. It was therefore adopted in the Report on the Invertebrata of Massachusetts, p. 192, fig. 123. Professor Adams also applied to it the specific term *albilabris*, in Silliman's Journal, XL. 271, and in his Catalogue of the Mollusca of Vermont in Thompson's History, a name suggested by the late Dr. Ward. Some doubt still remains as to whether it belongs to the genus Pupa, or to Bulimus, as the animal has not been described.

This shell is so well known as to require no more particular illustration. The lip, however, is not often equally reflected, but is much narrowed near the junction of the outer portion with the body whorl. There are also two or three deeply cut lines running parallel and near to its margin.

Mr. Say found his specimens in the North-West Territory, and it is not uncommon in Massachusetts, Vermont, New York, Maryland and South Carolina.

Its foreign analogue is *P. umbilicàta*, Drap.

Having recently had an opportunity, by means of one of Chevalier's large microscopes, of tracing off greatly enlarged figures of these minute shells, with great accuracy, I will now review the species described in the former part of this paper, and notice those points which were inaccurately stated, or which need further illustration, and add such further information as I may have since obtained respecting them.

P. CORTICARIA. The single tooth which Mr. Say describes as being on the pillar lip, should read on the transverse lip, to correspond with his subsequent descriptions of species. In the figure (Vol. III. pl. 3, fig. 19,) the body whorl is represented too long. I have received it from Worcester county, Maryland.

P. EXIGUA. In the figure of this shell (Vol. III. pl. 3, fig. 20,) the body whorl is represented proportionally too large.

Its length is .08 inch. The only additional locality from which I have received it is Troy, N. Y.

The animal is colorless, and has only two tentaculæ developed, which are stout, hyaline, about one third as long as the foot. See *Rep. on the Invertebrata of Mass.*, 191, fig. 122.

P. CONTRACTA. The aperture, in Vol. III. fig. 22, should be placed much farther to the right. It is probably common in all the States, as I have received specimens from the Island of Cuba. Found about rotten stumps or under stones in moist pastures. See *Invertebrata of Mass.* 186, fig. 117, and ADAMS, in *Thompson's Hist. of Vermont*.

P. MILIUM. The teeth on the outer lip are more properly folds, as indicated by the two elongated indentations on the exterior of the shell corresponding to them. I have a specimen from Mr. Anthony which he received from Louisiana. See GOULD, *Invertebrata of Mass.* 187, fig. 118. ADAMS, in *Silliman's Journ.* Vol. XL. 270, and *Thompson's Hist. of Vermont*.

P. PROCERA. Both the description and figure of this species are so incorrect that I reproduce an accurate figure, (fig. 12.) Its peculiar characters have been noticed under *P. rupicola*. It has not yet been sent me from any other locality than the vicinity of Baltimore.

On the cover of the Society's Journal, Vol. IV. No. 1, I indicated a species by the name of *P. carinàta* which I supposed to be new. But the examination of another specimen has satisfied me that it was merely an immature or a fractured specimen of *P. prócera*.

P. ARMIFERA. Professor Adams has found this species plentifully at Crown Point, and some other places near Lake Champlain. I have also received it from Maryland. See also ADAMS, *Catalogue of Mollusca* in *Thompson's Hist. of Vermont*.

P. SIMPLEX. Very few of these shells have as yet been found, and none, that I know of, in any other except the original locality. They are enough, however, to establish the validity of the species.

P. BADIA has been found by Dr. Newcomb near Troy, N. Y. See also ADAMS, *Catalogue of Mollusca* in *Thompson's Hist. of Vermont.*

Thus there are at present known, in the United States, thirteen species of this genus. They are remarkable, as compared with those found in other countries, for their minuteness; the two largest species, *armifera* and *badia*, scarcely exceeding in size the smallest of the European species. It is also singular that no species of the allied genus *Clausilia*, so abundant in Europe and Asia, should have been found, as yet, on the North American continent; and indeed I am not aware that any shell possessing a true *clausium* has been found in any part of America.

ART. XXIX.—DESCRIPTIONS OF TWO UNDESCRIBED SPECIES OF NORTH AMERICAN HELICES. By AMOS BINNEY.

HELIX TUDICULATA.

Plate XX.

H. testâ orbiculato-convexâ, imperforatâ, rufo-olivaceâ, fasciâ unicâ castaneâ cinctâ, et impressionibus squamatis undique signatâ; aperturâ transversâ; labro albido, sub-reflexo; basi convexâ.

DESCRIPTION.

Animal. Not observed.

Shell. Orbiculate-convex; epidermis olivaceous; spire a depressed cone; whorls between five and six, slightly convex; body-whorl voluminous, expanding somewhat towards the aperture; aperture transverse, rather circular; lip whitish, slightly reflected; umbilicus covered by a testaceous callus uniting with the reflected lip; base convex; a well defined, rather wide, dark chestnut band, margined with a lighter color above and below, revolves near the centre of the body whorl, and is more or less visible above the suture on the two whorls preceding the last; surface of the outer whorl covered with somewhat regular impressions or indentations with ridges between, causing it to look as if covered with scales; where these are not apparent it is marked with oblique wrinkles.

Transverse diameter one inch and a quarter.

Geographical Distribution. The only specimen I have seen, belonging to the cabinet of Andrew Belknap, Esq., was taken near St. Diego, California.

Remarks. This beautiful and well defined species is unlike any other which I have noticed; and no description has been met with, which corresponds with it. It resembles in its general appearance, *Helix Dupetitthouarsi* of Deshayes, (*Guerin. Mag. de Zool.* 1841, pl. 30,) but it is destitute of an umbilical opening which in that species is large. The singular indentations of the surface resemble very exactly the impressions of the hammer on the interior of silver vessels. The specific name is derived from the resemblance.

HELIX. DEMISSA.

Plate XVI. Fig. 16.

H. testâ depresso-convexâ, peforatâ, luteolo-corneâ, nitens; anfractibus sex, minuté striatis; apatura transversâ; labro simplici, acuto; basi glabrâ; umbilico parvo.

Description.

Animal. Not noticed.

Shell. Depressed-convex; epidermis yellowish horn color, shining; whorls six, with minute lines of growth; spire obtuse; suture impressed; body whorl expanding very little towards the aperture; aperture transverse, not large, a white testaceous deposit within; lip thin, acute; base rather flat, smooth; umbilicus very small, umbilical region a little impressed.

Greatest transverse diameter rather more than three eighths of an inch.

Geographical Distribution. The only specimens which I have yet seen were procured in the western part of Pennsylvania.

Remarks. This is a delicate and very pretty species, and is distinct from everything unless it be *Helix ligera.* The character of the surface and skin is the same in both, and the base is nearly the same. I have seen very depressed specimens of *Helix ligera*, but none approaching this. It may, however, be subject to still further reductions in the height of the spire, until it reaches the depression of the present shell. If it should be the same, it will exhibit very extraordinary variation in this respect, from a high conical to a planulate form. It resembles *Helix suppressa* externally in everything except size.

Art. XXX.—OBSERVATIONS ON THE EXTERNAL CHARACTERS AND HABITS OF THE TROGLODYTES NIGER, Geoff. By Thomas S. Savage, M. D., Corresponding Member of the Boston Society of Natural History—AND ON ITS ORGANIZATION, by Jeffries Wyman, M. D.

The specimens belonging to the Chimpanzée, Black Ourang, or *Simia troglodytes* of naturalists, from which the following descriptions are in part drawn, were presented to the Boston Society of Natural History by Thomas S. Savage, M. D., a missionary stationed at Cape Palmas, West Africa. To the enlightened zeal and liberality of Dr. Savage the society is also indebted for numerous other rare and valuable zoological specimens, especially of insects, from the same region. The specimens belonging to the Chimpanzée, consist of the skeleton nearly entire, the head covered with the integuments, the organs of respiration, and of generation of the male and female, and the anterior and posterior hands, all from adults; also, an entire specimen of a young male subject. Dr. Savage has transmitted notes of his own observations relative to the habits and external characters of this wonderful race of animals, which will be found in the following pages.*

* Dr. Savage's notes are divided into two parts: the first consisting of "observations on the external characters;" and the second, of "facts relative to the habits of the Chimpanzée." These will be distinguished from the remarks, which have been added, by inverted commas. The measurements have been reduced to a tabular form to facilitate comparisons. J. W.

The specific differences between the Chimpanzée or *Simia troglodytes* of Africa, and the Ourang Outang or *Simia satyrus* of Borneo, which were long indefinitely determined, have been so completely demonstrated by the labors of St. Hilaire,* Owen † and Vrolik that any remarks relative to this subject would seem superfluous.

Geoff. St. Hilaire ‡ had already established the differential characters of the Subgenera *Troglodytes* and *Pithecus*, but as they were drawn from immature specimens, they have been modified by the more recent and extended researches of Prof. Owen ; § and the characters of the first sub-genus now stand as follows:

Sub-genus Troglodytes. Geoff.

Muzzle long; truncated anteriorly; strong superciliary ridges, behind which the forehead recedes directly backwards; no cranial ridges.

Facial angle 35° — excluding the superciliary ridges.

Auricles large.

Ribs thirteen pairs; bones of *sternum* forming a single row.

Arms reaching below the knee-joint.

Feet wide, *hallux* extending to second joint of adjoining toe.

Canines large, overpassing each other, the apices lodged in the intervals of the opposite teeth.

Intermaxillary bones anchylosed to the maxillaries during the first or deciduous dentition.

Ex. The Chimpanzée — Black Ourang — Pigmy — (*Troglodytes niger*, Geoff. — *Simia troglodytes*, Blum.) Jocko, a name for the young Chimpanzée.

Height of adult about four feet.||

* Annales du Museum, Tom. xix. p. 81.

† On the osteology of the Chimpanzee and Orang-utan. By Richard Owen, F. R. S. Trans. Zoolog. Soc. Lond. Vol. I. p. 343.

‡ Annales du Museum, Tom. xix.

§ Op. Cit. p. 372.

|| It will be seen, however, from the measurements of Dr. Savage, that this estimate is too low — and that it should be nearly five feet.

Hab. Africa.

External characters. "All short of five feet in height. Thickly covered with coarse black hair varying from one to two and a half inches in length; most abundant on the back beginning at the ears, and on the arms at the shoulders, and increasing downwards; thinnest on the chest about the mammæ, upon the disc of the abdomen and on the inner side of the arms; thickest and at the same time shortest upon the anterior and superior portions of the cranium, (which is much flattened) and increasing in length as it descends posteriorly.

"The chin covered rather thickly with gray hairs from $\frac{1}{4}$ to $\frac{3}{4}$ inch in length; the face from the mouth superiorly as far as superciliary ridges almost entirely naked, and the skin remarkably shrunken and shrivelled, even in the youngest subjects, presenting, to a nearly equal degree in all, the aspect of extreme old age.

"One specimen was very old, a female; the most palpable marks of her age were a mottled appearance of the face — teeth very short, worn down by use — grayness and dryness of the hair generally, and the prominence and definiteness of the superciliary ridges.

"Upon the sides of the face were a few scattered hairs, increasing in number, length, and blackness, towards the ear, presenting in their contour the appearance of bushy whiskers. The nose was pointed and perfectly flat, lying on a plane with the adjacent portions of the face.

"The superciliary ridges in all, remarkably prominent. In the true representation of this feature every figure of the animal that I have seen has failed. It is a palpable characteristic constituting an important mark of difference between this, and the red or Asiatic ourang; the greatest projection rather exceeded 3-4 of an inch.

"The back of the fingers of the four extremities bare, excepting the first joint, where the hair commences and is directed upwards as far as the elbow. It takes the same direction along the back of the thighs; on all other parts of the body it is directed downwards.

"The neck exceedingly short, and hardly admitting of more than the simple rotatory motion, and that, apparently with difficulty. In the living subject, when at rest, the head seems to be set upon the shoulders. The freest motion given to this part, is backwards and forwards, projecting the chin in an upward direction to a remarkable degree, as is the case whenever it utters a cry. At such times the lips are contracted, and so far protruded, as to give them the form of a somewhat flattened tube, when a hoarse guttural sound is emitted, by quick and short expirations, something like 'whoo' 'whoo', not easily expressed. This sound, is induced by the approach of almost any object, agreeable or disagreeable, and accordingly is expressive of both joy and alarm. The cry of the young is coarse and shrill, and much like that of a pettish child; at such times the mouth is widely opened, the eyebrows strongly contracted, and teeth and gums strongly displayed.

"The color of the eyes is a light brown, perhaps approaching a pink hue, but not characterized by that redness of the sclerotica which usually appears in the colored plates of this animal.

"The length of the legs was strikingly disproportioned to that of the body and arms; more however in appearance, than in measurement, owing to the contraction of the legs from long use in climbing. When the recent subject is placed in the horizontal posture, the thighs are so flexed, as to form almost a right angle with the axis of the body, and the legs with that of the thighs; the lower extremities are greatly curved, and when the animal is in this position, lie more or less on their tibial surfaces. This strong tendency to flexion and contraction, is accounted for by the habits of the animal. In a sitting posture it takes a perfect *squat*, the body inferiorly touching the ground, and the posterior surface of the thighs resting upon that of the fore legs. The space comprised between the *ossa ischii*, is very great and flat, presenting in the horizontal posture a broad plane surface. Their arrangements and relative position of parts, are a wise provision in view of the habits of the animal, facilitating its movements, and enabling it to take a broad and firm hold in climbing trees, and in swinging from branch to branch, in obedience to their instinctive propensities.

"The adults cannot spread out their hands in the manner of man, their fingers being contracted, and curved, by long use in grasping. When this is the case it is impossible to extend them upon the palm. The contractions are such, as to render it necessary for them to rest on their knuckles, when they walk on all fours, instead of the palms of their hands; in consequence of which, the cuticle upon these parts is very much thickened and prominent.

"The number of specimens of which I give the description is four, viz., two males, and two females, one of which was pregnant, and the other having a young male about a year old. The latter was in my possession about two months, having a wound in the left fore arm, of which it died. From the adult specimens the following table of measurements has been drawn up:

Table of Measurements.

	I. Female.	II. Male.	III. Male	IV. Fem.
	ft. in.	ft. in.	ft. in.	ft. in.
Whole length, ...	4 6	4 6	5 nearly	5 nearly
From occiput to extremity of os coccygis, ...	2 8	2 2	2 0½	2 9½
From articulation of femur with pelvis to centre of knee joint, .	0 10	0 7	....	0 11½
From same to ankle, . . .	0 10	0 9	....	0 9½
Length of foot, ...	about 7	0 8	0 9½	0 8
From articulation of shoulder to the olecranon, ...	1 2½	....	1 1¼	0 11½
From olecranon to tip of longest finger, ...	1 8½	....	1 8½	1 8
Length of palm of hand, . .	....	0 4½		
" " longest finger, . .	....	0 4½	0 5¾	
" " thumb, ...	....	0 2	0 3	
Circumference of arm, largest part,	....	0 9½	0 10½	
" thigh, " "	....	1 2	1 2	
" chest, " "	....	2 6		
" abdomen, " "	....	2 8½	2 10	2 9½
Longest diameter of ear, . .	....	0 3		
Shortest " " . .	....	0 2		
Articulation of clavicle with sternum to symphysis pubis, . . .	....	....	1 9	
Os pubis to heel, . . .	....	....	1 8	

Additional Notes and Measurements of the above specimens.

"No. I. *Female. Teeth.* Incisors $\frac{4}{4}$, canines $\frac{2}{2}$, molars $\frac{8}{8}$, total 28. The canines in this individual were not fully developed, and the dentes sapientiæ had not yet protruded through the gums. This specimen, had obviously not arrived at maturity, as is sufficiently shown by the condition of the teeth. It was however pregnant, the uterus being sufficiently distended, to ascend above the brim of the pelvis. The abdomen presented no remarkable prominence, when compared with that of the males, neither did the mammary region when compared with the corresponding part of the other sex.

"The vulva and anus were surrounded by thick, flabby folds of skin of a light dingy yellow, which were very protuberant. The former was situated posteriorly to the centre of the body, and when the subject was placed in a sitting posture, could not be seen; the latter was but partially visible. This individual, though young, was thought by the natives to be in her second pregnancy.

"No. II. *Male. Teeth.* Incisors $\frac{4}{4}$, canines $\frac{2}{2}$, molars $\frac{8}{8}$; total, 28. Canines not fully developed; dentes sapientiæ had not protruded. This was also a young specimen. The skin was thicker, and much more tenacious than that of the female.

"No. III. *Male. Teeth.* Incisors $\frac{4}{4}$, canines $\frac{2}{2}$, molars $\frac{10}{10}$, total, 32. In addition to the measurements given in the table, the following additional ones were made. Width between great trochanters, $10\frac{3}{4}$ inches; from central point of chin to the centre of the superciliary ridges, 6 inches; posterior angle of lower jaw to the centre of chin, $5\frac{1}{2}$ inches; lip (mouth closed) 6 inches; circumference of mouth $10\frac{1}{2}$ inches.

"Penis $2\frac{1}{2}$ inches in length externally, tapering, small and short in proportion to the animal, nothing resembling the glans of human subject; terminal portion of penis covered with prepuce; scrotum large and thick, furnished with a few scattered hairs; testicles very large, compared with the size of the penis.

"This specimen had evidently arrived at maturity, though not materially differing in size from the preceding. All its teeth were fully developed, canines very prominent, and strongly falciform, in this respect resembling an animal of carnivorous habits. The superciliary ridges strongly projecting, leaving a deep and broad fossa at their base superiorly, about one third the distance from the outer angle. These fossæ exist in all specimens, but their depth and size, are strong indications of the age of the individual.

"No. IV. *Female. Teeth.* Incisors $\frac{4}{4}$, canines $\frac{2}{2}$, molars $\frac{10}{10}$; total, 32. The incisors were reduced, apparently to one half the natural length by long use, showing extreme old age. The skin of the face was very much shrivelled, of a darker hue than that of either of the preceding, and mottled with irregular dark purple spots. The breasts were flabby and slightly protuberant, the nipples measuring one inch in length. When shot she had two young ones, a male and female; the former was captured, and in my possession. Milk could be forced in drops from the breasts. The anterior angle of the vulva was situated at the distance of five and a quarter inches from the symphysis pubis, and in common with the anus surrounded by thick and very protuberent folds of yellowish skin, covered with hair. In the sitting posture the vulva was entirely concealed. This enlargement of the skin forms an elastic cushion, having a depth of more than three inches, forming in the female a substitute for nates, which are almost entirely wanting. The skin of the body generally, was of a thinner and softer texture than that of the other specimens. There is no great difference between the texture of the skin of males and females, that of the former being comparatively very thick and tough.

"In every specimen, the insertion of the great toe or thumb of the posterior hand, differed materially from the representation in all the figures which I have seen, being situated much more anteriorly. In Sir William Jardine's Naturalist's Library, it is placed much too near the heel. I have found it much more anteriorly, certainly two thirds the length of the foot from the heel. In this as in some other particulars, it would seem that the animal has been confounded with the Orang Outang, or Red Ourang of Asia. I am inclined to think that the insertion of the thumb will be found to be an important specific character in the Chimpanzée. It will be perceived also that the remark of Cuvier that 'the cranium retreats from the crest of the eyebrow' is incorrect; the great projection of the superciliary ridges in the Chimpanzée constituting a strong mark of difference between it and the Ourang."

Osteology.

The memoir of Professor Owen,* which has already been so frequently referred to, contains so full and complete a description of the osteology of the Chimpanzée, that it will be only necessary, to point out some of the peculiarities, in which the specimens which I have had an opportunity of examining, differ from the descriptions given by him. The differences which have been noticed, may without doubt, be for the most part attributable to age, yet, even in this point of view, they will unquestionably not be regarded as destitute of interest, inasmuch, as they detract somewhat from the value of the specific characters of secondary importance, established by Professor Owen.

Crania. The observations upon and measurements of the crania, are drawn from two adult specimens, one of which, forms a part of Dr. Savage's collection, and for the other I am indebted to the kindness of Dr. J. C. Warren. The third specimen was that of an immature subject, the skeleton of which was deposited in the Society's Collection by Dr. Winslow Lewis, Jr., by whom it was prepared.

No. I. Adult. In its general conformation corresponds with Professor Owen's description, the bony covering of the brain having an ovoidal form, broadest behind, smooth on its superior and lateral faces; the temporal depression which

* Op. cit. vol. i. p. 343.

forms the outline of the insertion of the temporal muscle, extending in a curved direction from the external orbitar process of the frontal bone, as far backwards as the posterior lateral portion of the cranium, then sweeping forwards and downwards, terminates in a bony protuberance, situated just above the external meatus anditorius. The space comprised superiorly between these two depressions, forms a slightly elevated ridge or belt on the coronal region, one and a half inch wide in the centre, but slightly increasing in width as it approaches the occiput behind, or the superciliary ridges in front. The latter, which form so striking a characteristic in the living animal, are still more conspicuous in the cranium when denuded of its soft parts, projecting to the distance of half an inch beyond the central portion of the frontal region, and at the superior external angle of the orbit in front of the temporal fossæ they project to the distance of an inch, so that, when the skull is viewed in front, they project beyond, and conceal the outline of, the lateral portions of the cranium.

Professor Owen, in describing the sutures, says, " the cranial sutures which are obliterated in the adults of the Ourang, the syndactylous apes, and frequently in the adult crania of the baboons, are for the most part, persistent in the Chimpanzée, and the coronal and sagittal sutures, have the true denticulated structure. The sagittal suture is not continued along the frontal bone. The squamous suture is partially lost, but sufficient remains to show that the anterior angle of the temporal joins the frontal, and separates the parietal bones from the sphenoidal, as in six out of seven skulls of the Chimpanzée which I have examined."* The sutures thus persistent, have been distinctly figured in the plate representing a lateral view of the cranium. In the present specimen scarcely any of the sutures, belonging to any portion of the cranium are persistent. Cöossification on the coronal and lateral regions has proceeded so far, as to render it almost impossible to trace even the position which the sutures formerly occu-

* Op. cit. vol. i. p. 346.

pied. The only one in the whole cranium which remains open, is the lambdoidal, and that only for the distance of about one inch from its commencement in the foramen for the exit of the great lateral sinuses. The petrous portion of the temporal bone, does not appear to be cöossified with the sphenoid or basilar portion of the occiput by which it is surrounded. All the bones of the face are completely united, not one suture remaining open — the ossa nasi are scarcely to be distinguished from the adjacent portions of the superior maxillaries, and the outlines of the lachrymal, malar, maxillary and palatine bones have entirely disappeared.

The foramina of the basis cranii correspond almost exactly with Professor Owen's drawing of this part. The infra orbitar foramina are said by him to be single,* but in the present instance there are two, quite distinct from each other, the one being a little above the other on each side of the face, and the superior foramen being a little nearer the median line than the inferior. The existence of a single infra orbitar foramen, is regarded by him as one of the characters by which the cranium of the Chimpanzée is distinguished from that of the Ourang of Borneo — there being generally three in the latter. Foramen incisivum single.

Dental formula. Incisors $\frac{4}{4}$; canines $\frac{2}{2}$; bicuspids $\frac{4}{4}$; molars $\frac{6}{6}$; total, 32.

The superior canines are separated from the incisors, by an interval for the admission of the canines of the lower jaw, but, in the lower jaw itself, no such interval exists, the canine being separated from the contiguous bicuspid and incisor, by a space less than half that which exists between the incisors. In the interval which separates the incisors of both the upper and lower jaw, the Chimpanzée presents a striking contrast with the conformation of the human cranium. The molars on each side, above and below, form an unbroken series, presenting no interval whatever. From the appearance of the teeth, it is perfectly obvious that they had suffered from long

* Op. cit. vol. i. p. 359.

usage, all being much worn, and the enamel having disappeared from the crowns of all, excepting the dentes sapientiæ. The incisors above and below, were so far worn, as to expose the pulp cavity, and the canines of the lower jaw so far truncated, as not to project above the contiguous incisors; upper canines also worn to nearly the same extent. Another very striking peculiarity exists, and which has been distinctly figured by Professor Owen as existing in the Ourang Outang,* viz. that of the central incisors of both jaws being more worn than the lateral ones, so that when the jaws are closed, an oval space is left between them.

Two anterior condyloid foramina exist on one side, and but one foramen on the other.

No. II. This cranium presented the same general characters as the preceding, except that the coronal belt or inter-parietal space was narrowest at its posterior portion near the occiput. The obliteration of the sutures was even more extensive than in the preceding, the lambdoidal only remaining open for the distance of a quarter of an inch — with this exception all the bones of the cranium were coössified into one inseperable mass.

Three distinct infra-orbitar foramina existed in this specimen, two of nearly equal size situated in the same horizontal line, instead of being one above the other, as in the preceding, and a third much smaller about half way between them and the lower margin of the orbit.

Foramen incisivum single, and *two* anterior condyloid foramina on each side. The lower jaw was wanting, and the incisors and canines had disappeared from the upper. The molars and bicuspeds as in No. I. presented a continuous series, and the enamel was worn through in many places on the surfaces of the crowns.

From the above observations, it will be obvious that the crania were those of aged individuals, and that in them an obliteration of the sutures takes place as in the Ourang of

* Trans. Zoological Society, vol. ii. p. 165.

Borneo—though, perhaps, at a later period of life. "The persistence of the cranial sutures," therefore, ceases to be a specific character of the Chimpanzée. The existence of two infra-orbitar foramina in one specimen, and of three in the other, would seem to show, that in this respect, the Ourang and Chimpanzée did not materially differ; and the same remark holds good with regard to the anterior condyloid foramina, which are enumerated by Prof. Owen, among the distinctive marks of the two species.

The adjoined table is intended to give the comparative measurments of the two crania, which will be found to coincide very nearly with each other, and if comparison be instituted between them, and the dimensions given by Prof. Owen, the correspondence will be found equally striking.

Table of Measurements of the two adult crania.

	No. I.	No. II.
	in.	in.
Length of head from most prominent part of occiput to end of incisor,	7.3	7.6
From same part of occiput to outer edge of superciliary ridge median line,	5.2	5.3
From same point of ridge to edge of incisor,	3.7	3.7¼
Vertex to condyle of occiput lowest point,	3.9	3.9
Diameter through post-auditory ridges,	4.6	4.7
" behind orbits,	2 7	2.7
Width of coronal belt, narrowest part,	1.5	0.9
Diameter of face at zygoma, most prominent point,	4.6	4 7
Length of zygomatic fossa,	1.8	1.6½
Breadth of " "	1.0	1.0
Diameter of face from outsides of orbits on level with lower edge,	4.0	3 9
Interorbital space, narrowest part,	0.7	0.8
Lateral diameter of orbit,	1 5	1.5
Perpendicular diameter of orbit,	1.2	1.4
Nasal aperture transverse diameter,	1.1	0.9½
" " perpendicular,	1.0	1.0½
Distance between infra orbital foramina (lower),	2.2	2.1
Breadth of maxilla superior,	2 4	2 4
Length of bony palate,	2.7	2.7
Anterior margin of intermaxillaries to foramen incisivum,	0.9	0.8½
Breadth of crown of first incisor,	0.4	
Space between canine and incisor (upper),	0.3	
" " " " " lower,	0.5	
Anterior margin of occipital foramen to posterior margin of palate,	2.1	2.3
Lower jaw from centre of condyle to symphysis on upper edge,	4.5	
Angle to symphysis lower edge,	3.1	
Angle to condyle,	2.3	
Between angles,	3 0	
Breadth of ramus,	1.5½	
Between mental foramina,	1 8	

No. III. Young. The skeleton to which this cranium belongs, was prepared by Dr. Winslow Lewis, Jr., and deposited in the Society's cabinet. Its entire length is twenty-seven inches, and it is supposed to be about twenty-two months old, and was born on shipboard while the mother was on her passage from Borneo to the United States. The mother was reported to have been born in Borneo, but I have learned from the officers of the vessel, that she was carried there from Africa. The skin which is now in the Boston Museum, has all the characteristics of the African Ourang, and the skeleton also conforms with it.

The frontal bone consists of a single piece, the suture between the two lateral portions having entirely disappeared. The superciliary ridges though less strongly marked than in the adult, contrast strongly with the same parts in two crania of the young satyrus, with which I have compared them. The squamous suture and its *additamentum* form a nearly continuous horizontal line, and the two extremities are nearly equidistant from the auditory foramen. A small *os triquetrum* exists at the union of the occiput with the parietals. Occipital bone approaches the quadrumanous type in having its lateral edges nearly parallel, so that the suture by which it is united with the surrounding bones has no longer the lambdoidal shape, and its inferior portion which is posterior to the foramen magnum is nearly quadrangular. Temporal bone reaches the frontal, separating the sphenoidal from the parietal.

Only one infra-orbitar foramen on each side; no supra-orbitar foramen existed. Ossa nasi were disunited, but there existed no trace of the intermaxillary sutures.

Dental formula, incisors $\frac{4}{4}$ canines $\frac{2}{2}$ molars $\frac{3}{3}$ total 18. The two central incisors of the lower jaw, if they had ever appeared, had fallen; no alveolus, however, was detected.

Vertebral column. In its general conformation the vertebral column does not differ materially from that of man, excepting in the length of the spinous processes of the cervical, and the comparative size of the lumbar and dorsal vertebræ. With regard to the vertebræ of the neck, Prof. Owen remarks, "the spines are simple and elongated, not short and bifurcated as in the human subject; that of the *third* vertebræ is the shortest with the exception of the atlas, where, as is usually the case, the spine is wanting." In the present case the atlas had been accidentally lost, but of the six remaining cervical vertebræ tbe spinous process of the dentatus or *second* was the *shortest*, and the extremity of which was distinctly bifurcated; those of the remaining vertebræ increased regularly in length and strength, from the third to the seventh, as will be seen from the following measurements taken from the inside of the spinal canal to the tip of the process.

	Cervical vertebræ.					
	2.	3.	4	5.	6.	7.
Length of spinous process of the . .	0 6	0.8½	0.9½	0.9½	1.0	1.1

The body of the 7th does not differ from the 2d so much in its transverse diameter as in man, in the Chimpanzée there being only a difference of 0.2½ of an inch, whereas in man it amounts to 0.4 of an inch. As is often the case with man the 7th presents only a notch instead of a foramen for the passage of the vertebral artery, a short spine projecting in front of the latter from either side.

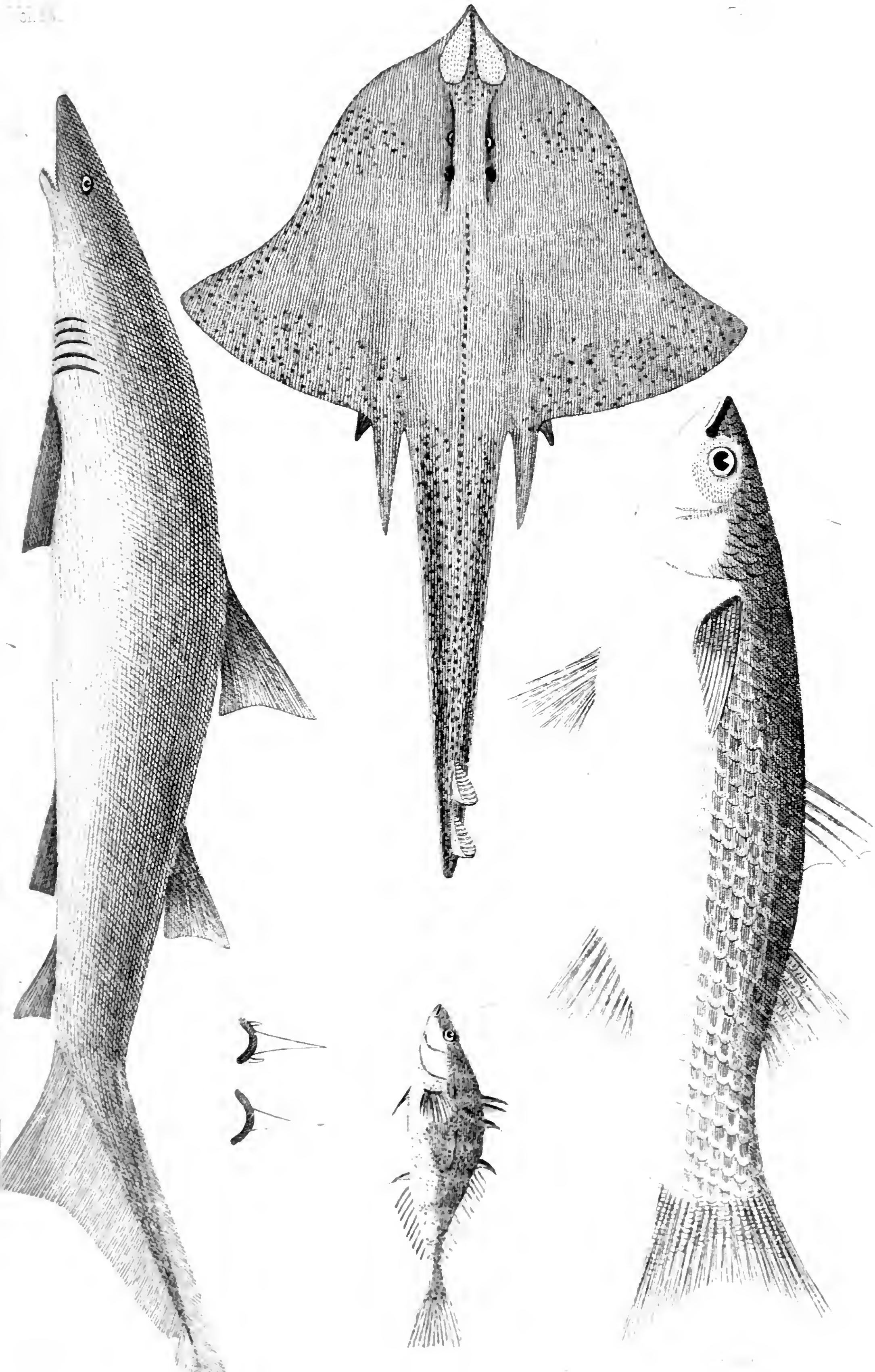
The dorsal vertebræ are thirteen, and the lumbar only four in number, the latter being proportionally smaller than in man, "where they are enlarged to afford a basis of support to the column above in reference to his erect position." The comparative size and strength, of different portions of the vertebral column in man, and the Chimpanzée, are sufficiently well shown by the following table of admeasurements.

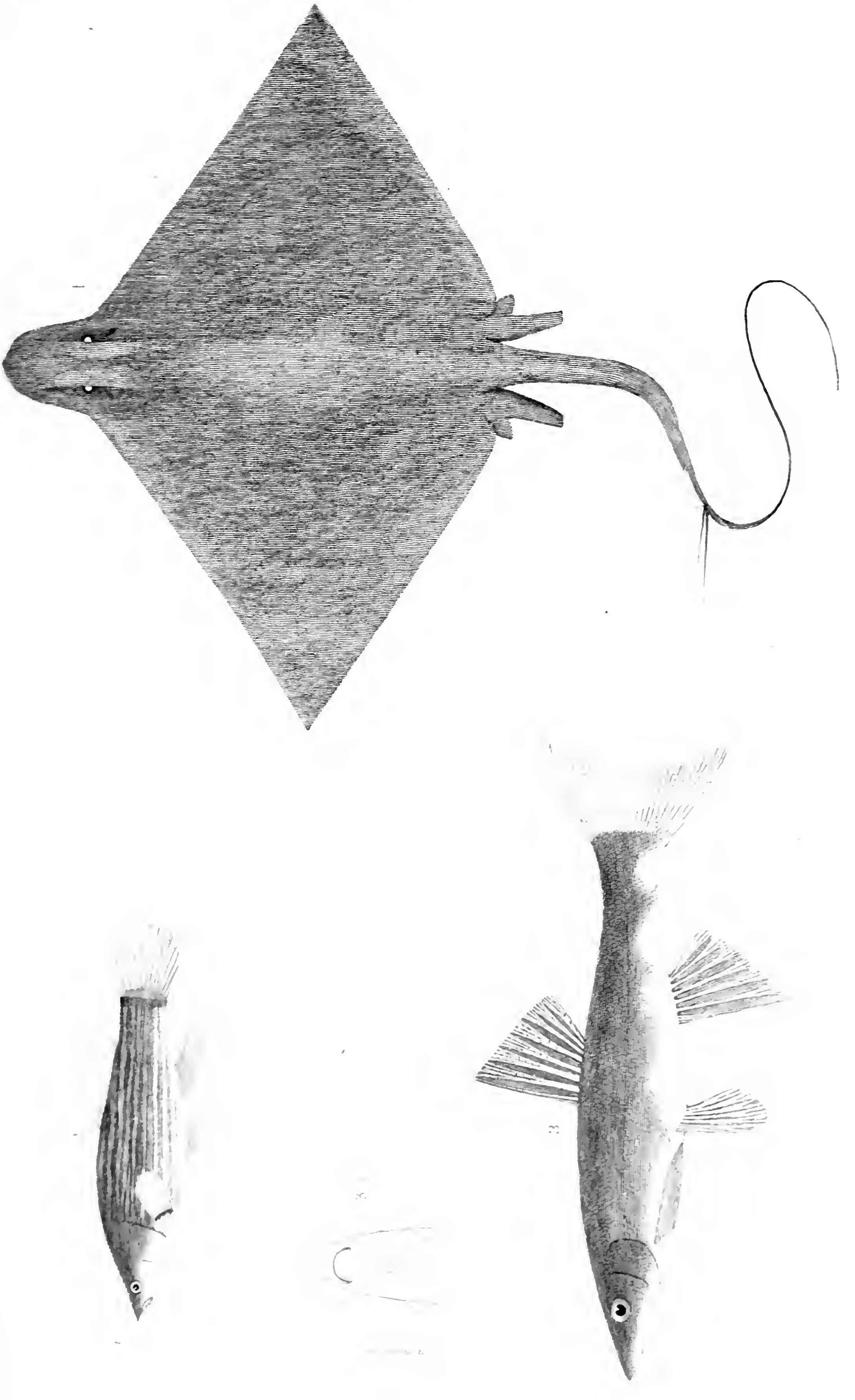
		Man in.	Chimp. in.	Diff. Man in.	Diff. Chimp. in.
Transverse diameter of the lower face of the . . .	1st dorsal	1.3	0.8½	0.5½	0.2½
	12th "	1.8½	1.1		
1st Lumbar or	13th "	1.9½	1.3½	0 2	0.1½
	3d lumbar	2 1½	1 5		
	4th "	1 7	1.1		

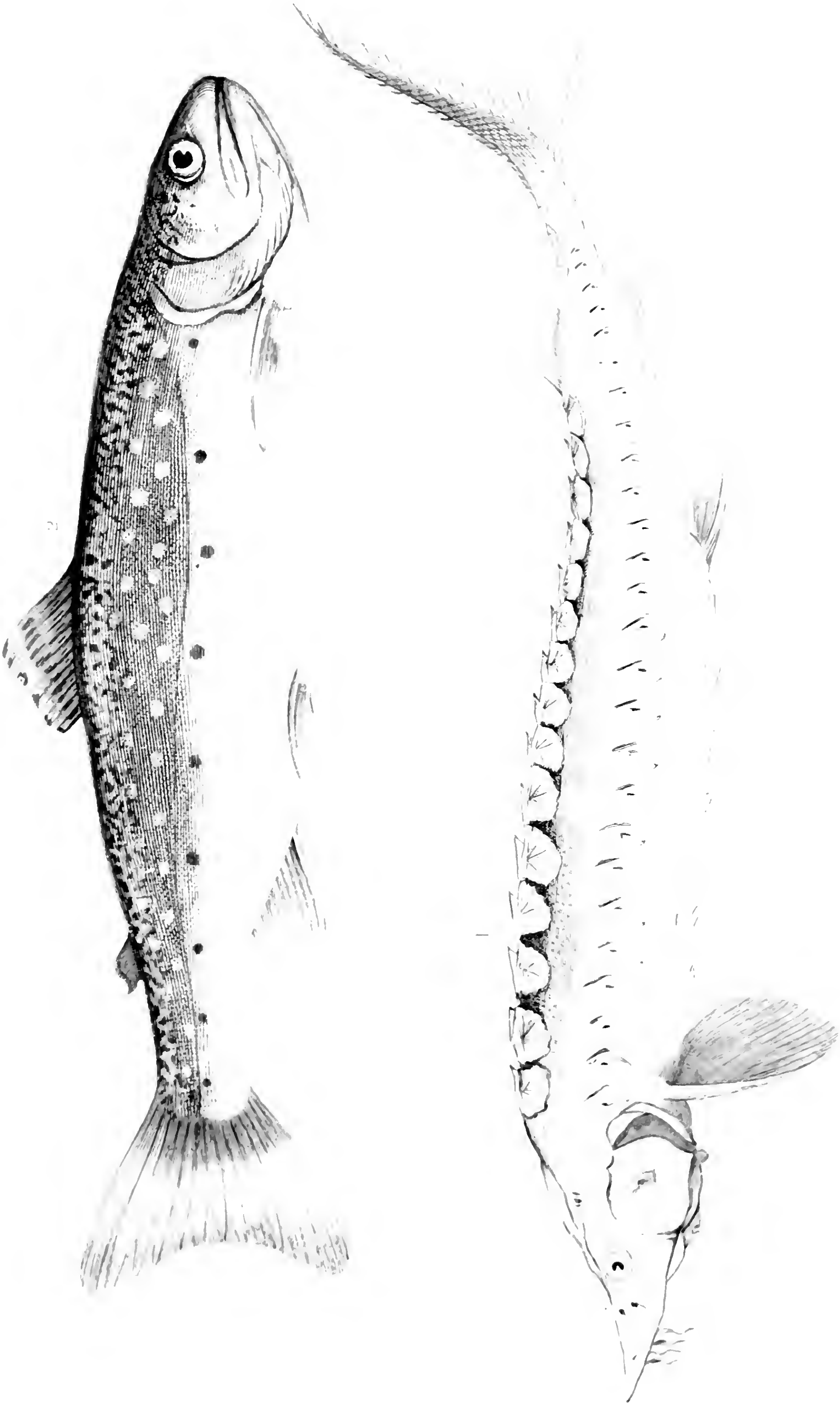
False vertebræ. The transverse portions of the first, second and third, articulate with the iliac bones. The spinal canal is complete as far as the sixth false vertebra, but is here very much compressed — the seventh, though intimately united with the preceding and forming with it an additional pair of sacral foramina, is not closed up behind, so that properly speaking there is no spinal canal. The eighth or terminal, was styliform, but it is probable, that one intermediate between it and the preceding may have been lost, so that the whole number would be nine.

Pelvis. "The pelvis of the Chimpanzée differs from that of man, in all those particulars, which characterize the quadramana, and which relate to the imperfection of their means of maintaining the erect position. The iliac bones are long, straight, and expanded outwardly above, but narrow in proportion to their length; the posterior surface is concave for the lodgment of the glutæi muscles; the anterior surface nearly flat, and stretching outward almost parallel with the plane of the sacrum. The whole pelvis is placed more in a line with the spine than in man; its superior aperture is elongated and narrow, so that the whole of the sacrum and coccyx is visible on a front view." "With this general conformity with the quadrumanous type, there is however a provision for a more extended attachment of the glutæi muscles, in a greater breadth of the ilia between the superior spinous processes, which also incline forwards more than is observable in the inferior Simiæ, and it may thence be inferred that the semi-erect position is more easily maintained in the Chimpanzée." *

* Owen, Op. cit. vol. i. p. 351.







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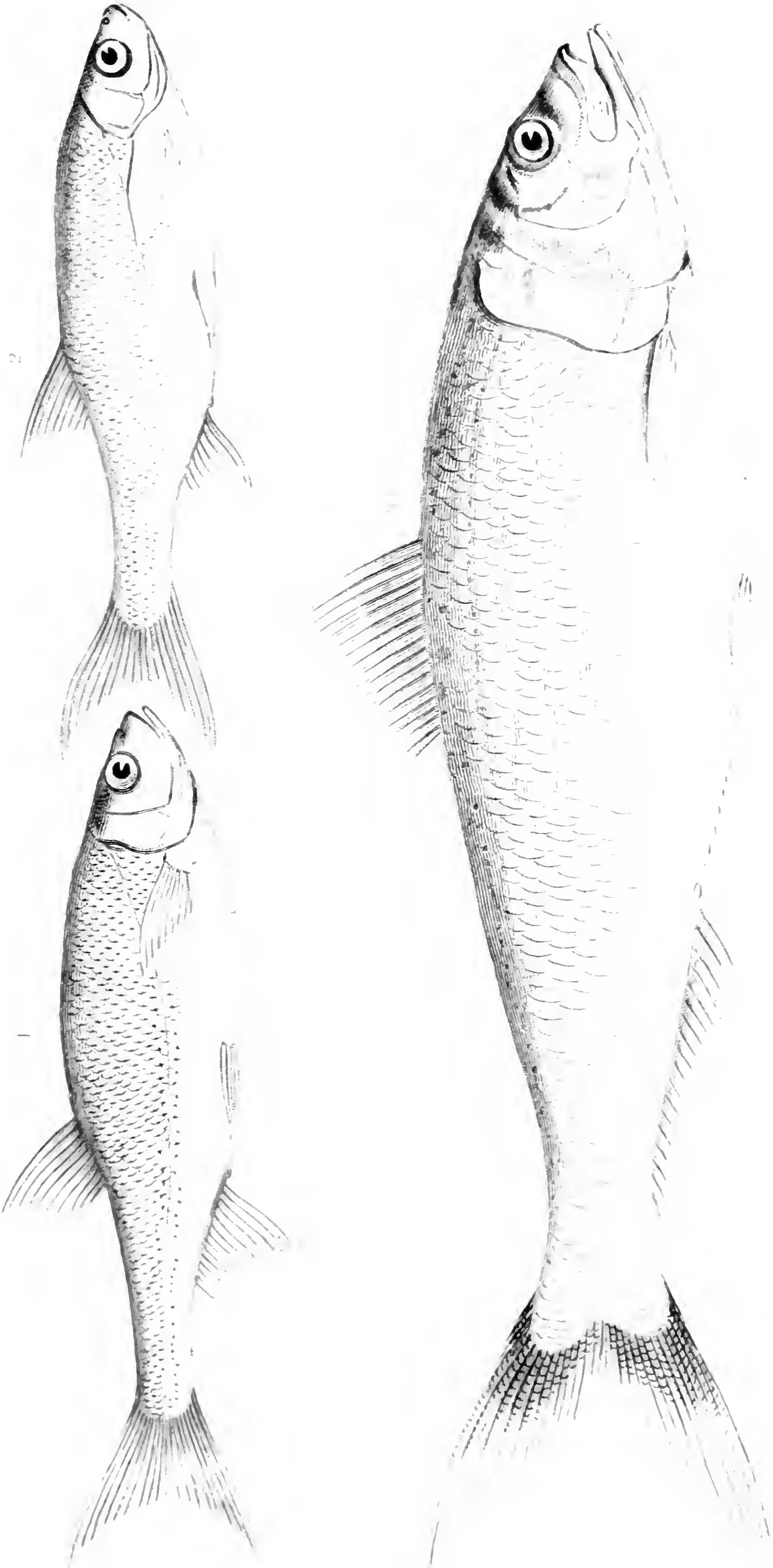

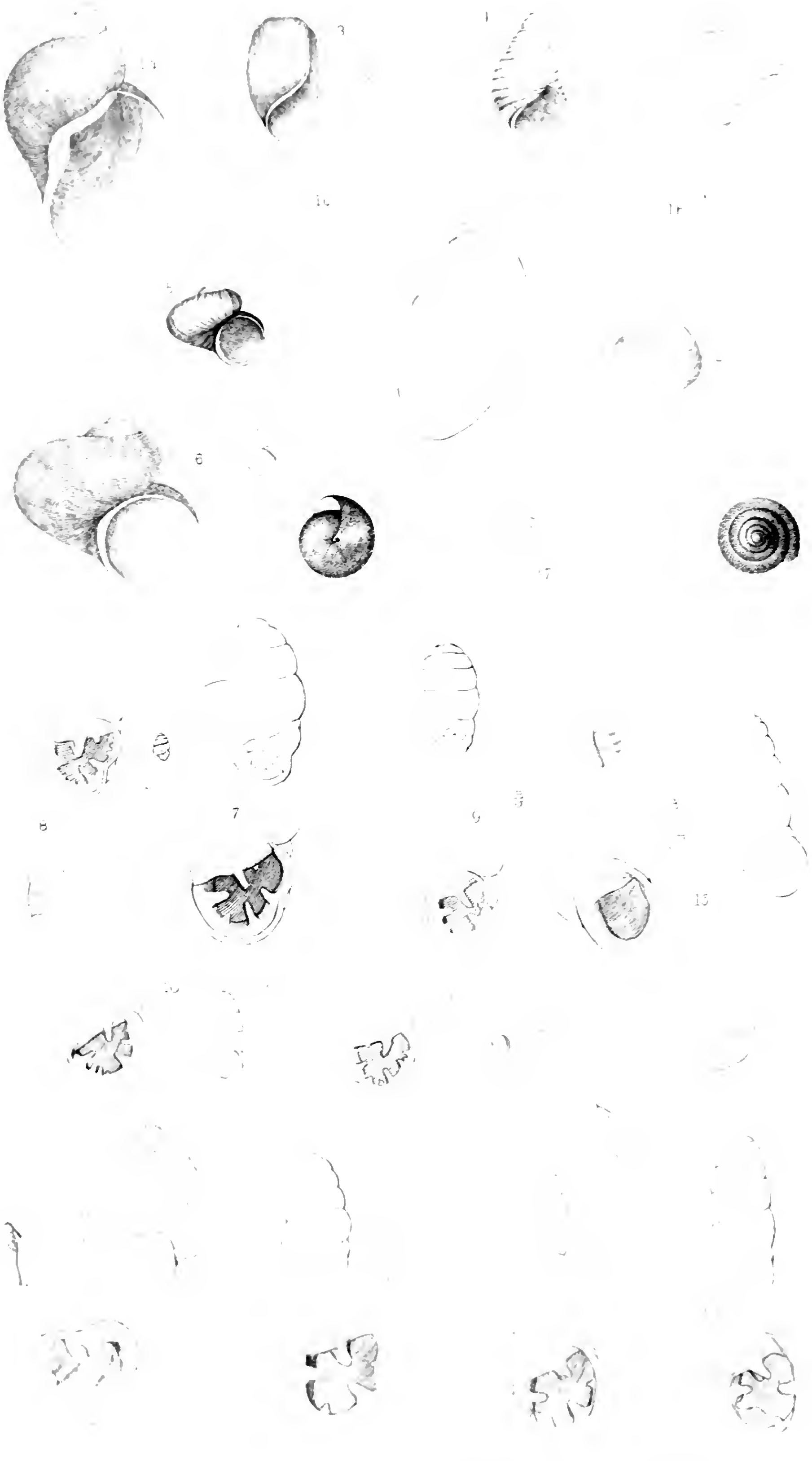

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CONTENTS OF NO. IV.

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ART. XXX.—OBSERVATIONS ON THE EXTERNAL CHARACTERS AND HABITS OF THE TROGLODYTES NIGER, GEOFF. BY THOMAS S. SAVAGE, M. D., CORRESPONDING MEMBER OF THE BOSTON SOCIETY OF NATURAL HISTORY—AND ON ITS ORGANIZATION, BY JEFFRIES WYMAN, M. D.

(Continued from page 376.)

From the following table of measurements it will be found that the proportions are almost precisely the same as in that given by Professor Owen.

	inches.
Breadth of pelvis from one anterior spine of ilium to the other,	9.4
Breadth of ilium, ...	4.4
Length of os innominatum, ...	10.2
Antero-posterior diameter, ...	5.7
Transverse diameter, ...	3.5
Length of symphysis pubis from above downwards, .	1.4
Longest diameter of obturator foramen, . . .	1.8½
From anterior-superior spine of ilium to acetabulum, .	4.3
Outside of one tuber ischii to that of the other, . .	5.8
Anterior-superior spine of ilium to symphysis, . .	7.3½

Extremities. As regards the osteology of the superior and inferior extremities, their conformation corresponds so well with the descriptions given by Professor Owen, that no farther remarks seem necessary, except that the present specimen confirms his observations with regard to the existence of a depression for the insertion of the *ligamentum teres* into the head of the femur, a conformation which affords us a sure means of distinguishing the femur of the Chimpanzée from that of the Ourang Outang.*

Young skeleton. The pieces which compose the vertebral column were in all 33, viz.:

Cervical,	7
Dorsal,	13
Lumbar,	4
Sacral and Coccygeal,	9

The body of the *atlas* was still ununited to its wings, and the *dentatus* was already beginning to be bifurcated. The fourth lumbar had already reached the ilia, and its transverse processes were beginning to be flattened at their extremities, in the same manner as the sacral vertebræ. The number of bones united with the ilia independent of the fourth lumbar is in this instance four, differing in this respect from the description of the adult in the preceding pages, where the number is three, and still more from that of Professor Owen, who describes but two false vertebræ having any connection with the iliac bones. Professor Owen describes but seven false vertebræ, and in speaking of the last, says, "the seventh seems to be composed of two joined together; but this appearance may result from the partial ossification of the sciatic ligaments; and this is the more probable as in the skeletons of the young Chimpanzée preserved in the Hunterian Museum, after the four lumbar vertebræ there remain only seven for the sacrum and coccyx." From this it would appear that the entire number of pieces composing the vertebral column was but thirty-one, whereas in Dr. Lewis's skeleton it amount-

* Dr. John Jeffries, in the Boston Journal of Philosophy, Vol. II., has given a detailed account of the dissection of an Ourang Outang, and in describing the hip joint, says, "the articulation of the femur with the acetabulum is almost exactly like man's," which would naturally lead us to infer (as Professor Owen remarks, since nothing is said to the contrary) that a ligamentum teres really existed. The specimen in question still exists in the Cabinet of the Boston Society of Natural History, and by the kindness of Dr. Jeffries I have had an opportunity of making the examination necessary for deciding whether this is really the case. The skeleton being a ligamentary one, the hip joint had not been opened, and on softening the parts, and turning out the head of the femur, no ligament nor any depression whatever corresponding to that which exists in man and the Chimpanzée was found, the articulating surface being uniformly smooth and convex.

ed to thirty-three, precisely the same as in man. The number of sacral foramina in Dr. Lewis's skeleton was only four, whereas in Professor Owen's and Dr. Savage's there were five.

The sternum is composed of five bony pieces, all in the same line; the first of which is quadrangular, broadest above, the others very nearly circular. The coracoid bone is entirely unossified with the scapula. Ilium, ischium and os pubis ununited in the acetabulum, though the ischium and os pubis were perfectly co-ossified below the symphysis. The iliac crests ascend as high as the superior face of the third lumbar vertebra, the intervertebral substance being in a dried state.

Arms. The whole skeleton being extended in a straight line the tips of the longest fingers reached as low as the middle of the tibia. The forearm was about half an inch shorter than the humerus, and the hand and wrist were nearly as long as the radius. The tip of the thumb reached to the distal extremity of the first metacarpal bone.

Legs. Femur a little longer than the tibia, and the feet almost precisely of the same length as the hands. Thumbs longer than those of hands, and extending as far as the distal termination of the first phalanx of the first toe.

Anterior extremities from head of humerus to tip of the middle finger seventeen inches. Posterior extremities from head of femur to lower face of os calcis, twelve and a half inches. Entire length of skeleton, twenty-seven inches.

The above skeleton being entirely ligamentous, and the bones not having been in any instance detached from each other, there can be no question as to any error having arisen from this source, as to their number, &c. It will be obvious that the number of vertebræ is greater than in either the skeleton described by Professor Owen, or in that sent to the Society by Dr. Savage. The difference too in Dr. Lewis's skeleton as to the number of sacral foramina, and the number of vertebræ, which articulate with the ilia is also striking. Whether this may be a specific difference or not I will not pretend to say; if so, these are the only characters which I have been able to find, which distinguish it from the *Troglodytes niger*, Geoff.

Organs of generation in the male. The free and pendulous portion of the penis was two inches in length, the prepuce being capable of retraction as far as within an half inch of the pubes. Properly speaking there is no corona glandis, but the glans itself measures one and half inches in length, of an elongated conical shape, and is perforated in its axis by the urethra, the meatus externus of which is transverse instead of being vertical, as in man.* No appearance whatever of a frenum. Length of the whole organ from union of the crura to the tip of the glans six inches. Membranous portion of urethra one and half inch long and surrounded by an erectile tissue ; bulb very distinct. *Erectores* penis much more powerful than in man ; *ejaculatores seminis* still more remarkable, measuring three and a half inches in length, covering the membranous portion and the bulb of the urethra. The prostate has the same relation to the neck of the bladder as in man, except that it does not as in him encircle the urethra, but grows thinner as it extends up on the sides. In its general form it may be called funnel-shaped, having its larger portion directed backwards, and is perforated longitudinally for the passage of the excretory ducts of the testes.

Vesiculæ seminales. In comparison with man these acquire an enormous size, each of them measuring four and half inches in length, and one inch in the widest part — they converge and meet on the median line, and at the point of union are enveloped by the prostate gland. The scrotum which Tyson has very well described, "was not pendulous as in man, but more contracted, and pursed up by the outward skin, nearer to the os pubis, and seated by the sides of the penis," the testicles "being contracted up nearer to the body of the penis ; which seems to be a wise contrivance of nature ; for hereby these parts are less exposed to the injuries they might otherwise receive in climbing trees, or other accidents in the woods."

Female organs. The general appearance of the vulva cor-

* Tyson, in his description Op. cit. p. 45, says, the penis "had no frenum so that the prepuce could be retracted wholly down, and herein our pygmie is different from a man. The slit of the penis here was perpendicular as in man."

responds with Dr. Savage's descriptions on page 368, though the folds of the skin by which it is surrounded are less strongly marked, in consequence of the separation of the parts from the body, and long maceration. The most remarkablepeculiarity is the great size of the clitoris, which at first view resembles the glans penis of the human subject just projecting from the surrounding parts; it is somewhat flattened in its shape, measuring one and three fourths inch in its transverse and about three fourths in its vertical diameter, and supported on each side by a fold of the common integuments; this organ projects externally about three fourths of an inch. The nymphæ were not very strongly marked, that on the left side being the most prominent. At the orifice of the vagina, were seen three small triangular shaped prominences, which bore some resemblance to the carunculæ myrtiformes in the human subject. The vagina measured three and a half inches in length, and was of sufficient diameter to admit without difficulty two fingers. The uterus, in its general outline, resembles the human though less pyriform, and seems very small in proportion to the vagina, its transverse diameter is one and a half inch, and its longitudinal two and a half inches. Superiorly it is flattened, but cylindrical at its cervix. The anterior lip of the os uteri was the longest and slightly bilobed, the posterior being completely so. Round ligaments stronger than in the human female; broad ligaments not materially different; ovaries situated on the posterior face of the latter, the oviduct forming its upper border. Free extremity of the oviduct fimbriated; inner surface of the uterus folded longitudinally in its cervix; cavity of this organ less triangular than in the human female; relative position of uterus, rectum and bladder the same.

Larynx; this organ differs remarkably from that of man in being provided with a large membranous pouch communicating with the ventricles and capable of inflation at the will of the animal. In the young specimen, already spoken of, this pouch presented a conformation different from that described by Vrolik and other writers on the subject. Instead of being a simple pouch as usually described, it was bifurcated opposite the middle of the larynx, each branch having a pyriform shape and extending beneath the clavicle quite to the axilla. The hyoid bone projects anteriorly beyond the thyroid cartilage, more than in man. The platysma muscles serve as compressors of the laryngeal pouch, meeting on the median line from the chin to the top of the sternum, and leave no vacant triangular space as in man.

"*Facts illustrative of the habits* of the *Troglodytes niger*, or Black Orang of Africa.

"The face of the country around Cape Palmas is broken, but not to that degree in which it might be called *mountainous*. As we proceed into the interior, a constant succession of hill and dale is seen; the former, often with sides abrupt, and crowned with lofty trees; the latter bearing coarse grass, and shrubbery with numerous palm trees interspersed. The soil upon the hills is clayey, strongly colored with oxide of iron, and has often widely scattered upon the surface fragments of sienite and quartz, the latter in much less quantity. The valleys are not extensive. Their soil is sandy, abounding in *ferns*, and, when fertile is made so by a loose admixture of light vegetable matter, which is soon exhausted by cultivation, and the sweeping rains. Fruit trees of different kinds are found abundantly both on the hills and in the valleys. Their fruits, though crude, and mostly unacceptable to the human palate, afford a great variety to the Chimpanzée; coming to maturity at different seasons, their succession of crops yield an almost never-failing supply.

"In some localities, through extensive clearing of the land by the natives for the purpose of planting rice, a scarcity will exist at certain seasons. The tender foliage of particular trees then becomes a substitute. The trees from which their food is derived, are generally scattered, except perhaps the *Elais guiniensis*, which, if not cut down, will be found abundant everywhere. The *Palm nut* — its fruit, is freely eaten by the orang, as also the upper part of its stipe formed of the young, succulent leaves. This, vulgarly called the 'cabbage,' is considered a delicacy by the natives also, either in a crude or cooked state. Their knowledge of its edible quality, as well as that of the fruits generally, was obtained from the monkeys. It is a common saying among them, that, 'what is good for monkey is good for man.' I have found different fruits in the maw which are recognised as 'plums,' one of which only is known botanically — the *Parinarium excelsum.* The fruit of the *Carica papaya* would seem to be its greatest favorite — from its saccharine quality, as I suppose. The *Musa sapientium* and *paradisiaca* are also freely eaten, and, three species of *Amomum, A. azfelii, A. grandiflorum?* and a third undescribed. There are other fruits of which they are fond, but, not having obtained the flowers, I am unable to name them botanically; — one, called a cherry, is pleasantly acid; another, called a walnut, is not unlike the fruit of the *Juglans nigra,* both in the husk, in its green state, and the nut — these they crack with stones precisely in the manner of human beings.

"The strong development of the canine teeth in the adult would seem to indicate a carnivorous propensity; but, in no state save that of domestication do they manifest it. At first they reject flesh, but easily acquire a fondness for it. The canines are early developed, and evidently designed to act the important part of weapons of defence. When in contact with man, almost the first effort of the animal is — *to bite.*

"They avoid the abodes of men, and build their habitations in trees. Their construction is more that of *nests* than of *huts,* as they have been erroneously termed by some naturalists. They generally build not far above the ground. Branches or twigs are bent or partly broken and crossed, and the whole supported by the body of a limb, or a crotch. Sometimes a nest will be found near the *end* of a *strong leafy branch* twenty or thirty feet from the ground. One I have lately seen that could not be less than forty feet, and more probably it was fifty. But this is an unusual height.

"Their dwelling place is not permanent, but changed in pursuit of food and solitude, according to the force of circumstances. We more often see them in elevated places; but this arises from the fact that the low grounds being more favorable for the natives' rice-farms, are the oftener cleared, and, hence, are almost always wanting in suitable trees for their nests. The same remark holds also in respect to the fruit trees upon which they depend for subsistence; except perhaps the *Elais guiniensis* or '*Palm tree.*' This is protected from the destructive effects of the fire with which the land is cleared, by the peculiar arrangement of its leaf stalks. It is seldom that more than one or two nests are seen upon the same tree or in the same neighborhood; five have been found, but it was an unusual circumstance.

"They do not live in 'villages,' as stated by some in respect to other localities. They are more often seen in *pairs* than in *gangs*. They are more numerous in the months of September, October and November, when the natives '*leave the bush,*' that is, have gathered in their rice-crops, being the less exposed to interruption in their habits. Then, also, is the season when the greatest number of fruits come to maturity. The cherries and plums, both acid and sweet, are then obtained in abundance.

"When at rest, the sitting posture is that generally assumed. They are sometimes seen standing and walking, but when thus detected they immediately 'take to all fours,' and flee from the presence of the observer. Such is their organization, that they cannot stand erect, but lean forward. Hence, they are seen when standing, with the hands clasped over the occiput or the lumbar region, which would seem necessary to balance, or ease of posture.

"The toes of the adult are strongly flexed, and turned inwards, and cannot be perfectly straitened. In the attempt, the skin gathers into thick folds on the back, showing that the full expansion of the foot, as is necessary in walking, is unnatural. The natural position is upon '*all fours,*' the body anteriorly resting upon the knuckles. These are greatly enlarged, with the skin protuberant and thickened like the sole of the foot. They are expert climbers, as one would suppose, from their organization. In their gambols they swing from limb to limb, to a great distance, and leap with astonishing agility. It is not unusual to see 'the old folks,' (in the language of an observer) sitting under a tree regaling themselves with fruit and friendly chat, while 'their children' are leaping around them and swinging from branch to branch in boisterous merriment.

"As seen here, they cannot be called *gregarious*, seldom more than five or ten at most being found together. It has been said on good authority, that they occasionally assemble in large numbers, in gambols. My informant asserts that he saw once not less than fifty so engaged; hooting, screaming, and drumming with sticks upon old logs, which is done in the latter case, with equal facility by the four extremities.

"They do not appear ever to act on the offensive, and seldom if ever really, on the defensive. When about to be captured, they resist by throwing their arms about their opponent, and attempting to draw him into contact with the teeth. *Biting* is their principal act of defence. I have seen one man who had been thus severely wounded in the feet.

"They are very filthy in their habits. In a state of domestication they will eat their own excrements. It is a tradition with the natives generally here, that they were once members of their own tribe; that for their depraved habits they were expelled from all human society, and, that through an obstinate indulgence of their vile propensities they have degenerated into their present state and organization. They are, however, eaten by them, and, when cooked with the oil and pulp of the palm nut, considered a highly palatable morsel.

"They exhibit a remarkable degree of intelligence in their habits, and, on the part of the mother, much affection for their young. The second female described, was upon a tree when first discovered, with her mate and two young ones, (a male and female.) Her first impulse was to descend with great rapidity and 'make off' into the thicket with her mate and female offspring. The young male remaining behind, she soon returned alone to his rescue. She ascended and took him in her arms, at which moment she was shot; the ball passing through the fore arm of the young one in its course to the heart of the mother. Other instances have been known in which the mother, otherwise timid and fleeing from the presence of man, forsaken by her mate, has fallen a sacrifice to the force of natural affection. In a recent case, the mother, when discovered, remained upon the tree with her offspring, watching intently the movements of the hunter. As he took aim, she motioned with her hand precisely in the manner of a human being, to have him desist and go away. When the wound has not proved instantly fatal, they have been known to stop the flow of blood by pressing with the hand upon the part, and when this did not succeed, to apply leaves and grass.

When shot they give a sort of screech not very unlike that of a human being in sudden and acute distress. In their gambols, their cry is like the whoop of a native, varied as to volume and strength, which, with the drumming upon logs and other discordant noises and various uncouth movements, make up a scene perfectly unique, defying all descripti on.

ART. XXXI.—DESCRIPTIONS AND FIGURES OF THE ARANEIDES OF THE UNITED STATES. By Nicholas Marcellus Hentz, Florence, Alabama.

[Continued from page 231.]

3. LYCOSA LENTA.

Plate XVII. Figs. 1—4.

Description. Piceous, hairy; cephalothorax, with a waved fascia of a dark color and several pale marks. Abdomen with two longitudinal rows of indistinct black spots above, beneath with a large black spot, with a yellowish mark in the centre. A pale variety occurred in North Carolina, without the yellow mark.

Observations. This common and powerful species is found wandering in fields, attacking and subduing very large insects. The female carries her young on her back, which gives her a horrible appearance. If caught or wounded, the little ones escape rapidly in all directions; but the mother is faithful to her duties, and defends her progeny while life endures. It hides under stones, logs, &c.

Habitat. Pennsylvania, North and South Carolina, &c.

4. LYCOSA RURICOLA.

Plate XVII. Fig. 5, 6.

Description. Pale or livid testaceous, cephalothorax with black marks, two large ones at base; cheliceres black with yellow hair at base; abdomen varied with black marks and pale dots above, a large black spot underneath; feet with indistinct livid rings.

Observations. A male and a female of this species were found with a white spot in the middle of the black one on the venter, but as the marking differed somewhat from the above, they may constitute a different species. They are always found wandering on the ground.

Habitat. Carolina, Alabama. October, November.

5. LYCOSA SALTATRIX.

Plate XVII. Fig. 7.

Description. Piceous, cephalothorax with two darker longitudinal bands; abdomen plumbeous or mouse colored, with four dark points and a pale longitudinal line; legs hairy, with many dark bands. Male inclining to a rufous tinge.

Observations. This small spider, first found in South Carolina, runs about on the ground, the female carrying her cocoon attached to the hinder part of her abdomen. When deprived of it, she remains near; and, if allowed, she grasps it in her cheliceres and carries it off. The cocoon, of a slate color, is orbicular, and contains about fifteen eggs. This is probably related to *Aranea saccata* of Europe. I have found in Alabama a spider, which may not differ specifically from this, which was larger and of a mouse color, with very indistinct markings, except its legs, which agreed with the drawing accompanying this. Its cocoon, which it carried in the usual way, was also of a bluish pale slate color, but it was lenticular, being composed of two concave plates of strong texture, united loosely at the edge; and it contained about sixty yellow eggs — notwithstanding the apparent difference, I refer it to this species. It is probable, however, that future naturalists will define two or more species, which I may have confounded or referred to this description.

Habitat. The United States.

6. LYCOSA ERRATICA.

Plate XVII. Fig. 8.

Description. Brown or piceous; cephalothorax with one longitudinal blackish line each side; abdomen with a forked longitudinal fascia and several spots black, a large black spot underneath, sometimes a white spot surrounded with black; male the same.

Observations. This species, which becomes very large, I formerly supposed to be a variety of *L. lenta;* but it was always found wandering and never in holes; I therefore consider it as perfectly distinct, having been often seen, generally running in the grass.

Habitat. Massachusetts, Alabama.

7. LYCOSA LITORALIS.

Plate XVII. Fig. 9.

Description. Livid white; cephalothorax varied with livid gray markings; abdomen with a pale waved fascia; feet and palpi with some hairs, and with pale gray rings on all joints, 4. 1. 3. 2. the 1st visibly longer than the 3d, the 3d full as long if not longer than the 2d.

Observations. This distinct species is always found near water under boards, leaves, stones, &c., moving chiefly by jumps, when escaping. Often observed in the same localities.

Habitat. North Carolina. April.

8. LYCOSA MARITIMA.

Plate XVII. Fig. 10.

Description. Pale yellow, almost white; cephalothorax with faint indented lines; abdomen with two longitudinal rows of dots of a pale hue.

Observations. This spider was found on the beach of Bear Island in the bay of St. Helena, South Carolina. Dr. Charles Pickering sent me one from Salem, informing me that it is common in Massachusetts. It runs with great speed on the sand still wet with the ebbing water of the ocean.

Habitat. South Carolina, Massachusetts, and probably all the Atlantic coast.

9. LYCOSA ASPERSA.

Plate XVII. Fig. 11, 12.

Description. Greenish obscure; cephalothorax dark, obscure, varied with black marks and a few red lines about the eyes; cheliceres very large; abdomen obscure, with small black spots in three rows, varied with yellow and black in wrinkles underneath, feet with black rings.

Observations. Though it is excessively difficult to distinguish between species and varieties in this subgenus, yet I must consider this as distinct from L. *riparia.* It was found on a barren hill at a great distance from water.

Habitat. Alabama, September.

LYCOSA RIPARIA.

Plate XVII. Fig. 13—15.

Description. Brownish or greenish black; cephalothorax varied with blackish, with a narrowed yellowish line which reaches the trophi; abdomen above with triangular black spots more or less interrupted, and a row on each side of whitish dots more distinct towards the apex, a tuft of black and of white hairs at base in both sexes; beneath testaceous or yellow, speckled with dots, and a line and two spots near the base sometimes wanting, black; feet with black or greenish brown rings. 4. 1. 2. 3. In the male, the two rows of white dots on the abdomen are arranged in the form of interrupted lines, and the rings are obsolete on the feet, which are long, slender and hairy.

Observations. This common spider is aquatic in its habits, always found near or on water, and diving with ease under the surface, when threatened or pursued.

Habitat. North Carolina, Alabama. All seasons.

11. LYCOSA PUNCTULATA.

Plate XVII. Fig. 16, 17.

Description. Pale rufous: cephalothorax whitish or yellowish, with four longitudinal blackish lines; abdomen whitish or yellowish, with a longitudinal band, blackish, whitish underneath, with many black dots.

Observations. This spider captured at Germantown, was communicated to me by Dr. Charles Pickering. It was found also in Alabama, in November, agreeing in every respect with the description. It was a male also. A female was found September 28th agreeing with the design. The species is therefore well established.

Habitat. Pennsylvania.

12. LYCOSA SCUTULATA.

Plate XVIII. Fig. 2.

Description. Testaceous; cephalothorax with one longitudinal band and one line on each side, blackish; abdomen with a longitudinal broad band, blackish, with about four diagonal spots, and a narrow edge, each side of it yellowish;

same color underneath, with very minute black dots on the abdomen; legs brownish with some blackish lines. Male with the first pair of legs mostly black, and part of the fourth pair also black underneath.

Observations. This common and very distinct species attains a very large stature. It is most commonly found wandering in quest of prey, and like *Lycosa saltatrix*, carries its cocoon attached to the abdomen behind. The cocoon is very large, spherical and whitish, containing from one hundred and fifty to two hundred eggs, which hatch before the cocoon is opened. The yellow spots on the abdomen seem to be wanting in the young. *Habitat.* Alabama.

13. LYCOSA SAGITTATA.

Plate XVIII. Fig. 3, 4.

Description. Yellowish brown; cephalothorax with a pale longitudinal band; abdomen dusky also, with a pale band with angular edges, whitish underneath, with minute black dots and two curved black bands which join together at base and at the apex where they spread out; pulmonary region brownish; feet varied with blackish.

Observations. This species is distinct from any other. It was found wandering, and seems to be rare.

Habitat. North Alabama. April.

13. LYCOSA OCREATA.

Plate XVIII. Fig. 5.

Description. Obscure; cephalothorax, with a broad, pale longitudinal band, with a blackish edge; abdomen blackish at base, the black spreading each side, with a few black dots each side towards the apex; feet varied with brown or blackish; antepenult joint of the first pair large, black and hairy, the intermediate one and the thigh black at tip; feet, 4. 1. 2. 3. A male.

Observations. This species is not rare, in meadows, near water. *Habitat.* North Carolina.

14. LYCOSA VENUSTULA.

Plate XVIII. Fig. 6. 7.

Description. Cephalothorax yellowish, with two bands and edge black; abdomen piceous, paler in the middle towards the base, with a row of abbreviated black lines approximating towards the apex, pale gray underneath, with a row of minute black dots each side approximating towards the apex; feet, rufous. A middle size species.

Observations. This spider is common on the ground, but inasmuch as only males are found, it is likely it will ultimately be referred to some other species; which, I cannot tell.

Habitat. Alabama. April.

15. LYCOSA MILVINA.

Plate XVIII. Fig. 8.

Description. Pale yellowish; cephalothorax varied with brownish; abdomen brownish with a scolloped band, widening towards the base, and two lateral spots yellowish, pale yellowish spotless underneath; feet varied with brownish, hairy, particularly the third and fourth pair. A small species.

Observations. This is a very distinctly marked species, which occurred only once.

Habitat. Alabama. September.

16. LYCOSA SAXATILIS.

Plate XVIII. Fig. 9, 10.

Description. Pale bluish; cephalothorax varied with greyish; abdomen greyish or blackish, with pale bluish spots or dots, pale grey underneath; feet long and slender, hairy, with many black rings. 4. 2. 1. 3. or 4. 2. 3. 1. A small species.

Observations. This slender little *Lycosa* is a very distinct species. It runs with surprising agility and swiftness. It was found in the mountains of North Alabama.

Habitat. Alabama. August.

17. LYCOSA FUNEREA.

Plate XVIII. Fig. 11.

Description. Cephalothorax blackish; abdomen with four approximate spots and four bent lines yellowish; feet varied with rufous and blackish. A small species.

Observations. This species abounds on the ground. It has the habitus of a *Herpyllus*, and runs with great rapidity. The male and the female were often found agreeing with the description.

Habitat. Alabama. May.

Genus. Ctenus. Walck.

Characters. *Cheliceres large, fangs moderately large; maxillæ short, parallel, cut obliquely at tip; lip about half the length of the maxillæ, pointed; eyes eight, unequal, in three rows, two eyes of middle size form the lowest row, intermediate row composed of four eyes, the two middle ones largest, the two external ones smallest; last row formed of two large eyes, borne on tubercles and placed farther apart than those of the middle row; feet, fourth pair longest, then the first, then the second, the third being shortest.*

Habits. Araneïdes wandering for prey, making no web for a dwelling.

Observations. This subgenus seems to be related to Lycosa and Dolomedes.

1. CTENUS HYBERNALIS.

Plate XIX. Fig. 1—4.

Description. Deep rufous; cephalothorax black above with a longitudinal yellowish band; abdomen black, with a serrated longitudinal yellow band above, and with four diagonal lines of minute yellow dots beneath.

Observations. This was found in a cavity in the ground in the month of January.

Habitat. South Alabama.

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2. CTENUS PUNCTULATUS.

Plate XIX. Fig. 5, 6.

Description. Yellowish rufous; cephalothorax, with two longitudinal blackish lines and two fainter scalloped ones on each side; abdomen with two subobsolete lines of minute white dots, becoming more distinct towards the apex, where may be seen a few irregularly placed white dots on the outside of the lines, same color unspotted beneath; feet, $4.\ 1.\ \overbrace{2.\ 3.}$ or $4.\ 1.\ \overbrace{3.\ 2.}$

Observations. This spider was found at the foot of a tree in a moist place near a mountain stream, running through a forest.

Habitat. Alabama. August, September.

Genus. DOLOMEDES. Latr.

Characters. *Cheliceres moderately large; maxillæ short, parallel, somewhat wider above the insertion of the palpi; lip short, suborbicular; eyes eight, unequal, in two rows, the anterior one slightly curved, the posterior one wider and much curved from the base towards the anterior one; exterior eyes borne on tubercles; feet, the fourth, second, and first pair are nearly equal, the third being the shortest.*

Habits. Araneides wandering after prey, making no web, except during the rearing of the progeny, hiding under stones, sometimes diving under water; cocoon usually orbicular, carried by the mother.

Observations. The subgenus DOLOMEDES is the link between CTEMNUS and LYCOSA, and its characters are somewhat variable. In the first tribe, (the ARBOREÆ) which differ wholly from the SYLVARIA of Walckenaer, the arrangement of the eyes is almost that of LYCOSA; and in the Ripuaria, the arrangement of the eyes leads to MICROMMATA. The spiders of this genus differ in their habits also; those of the two first tribes dwell on trees, or in cavities; those of the third are found near water, and run on its surface with great rapidity; they can even dive, and have recourse to this when in danger.

Several, perhaps all species, construct on bushes a web somewhat like that of AGELENA, for the protection of the cocoon, and the rearing of the young. This is another resemblance to MICROMMATA.

Order of the species DOLOMEDES.

Tribe I. ARBOREÆ, *middle eyes much larger than the rest.*

Tribe II. TENEBROSÆ, *eyes subequal, lower row as much curved as the upper.*

Tribe III. RIPUARIA, *eyes subequal, lower row straight or slightly curved.*

(Arboreæ.) 1. DOLEMEDES TENAX.

Plate XIX. Fig. 7.

Description. Grayish ; cephalothorax edged with black, varied with blackish on the disk ; abdomen also edged with black near the base, varied longitudinally, with blackish on the disk, about three whitish dots on each side near the apex, pale beneath, with two obscure longitudinal lines ; feet, with blackish bands above, pale beneath. 4. 2. 1. 3. Never large.

Observations. This distinct species is always found on upright sticks, small trees, &c. turning round to avoid an attack in the same manner as OXYOPES *scalaris,* which it resembles so much that for a time I could not distinguish one from the other. It spreads its feet like THOMISUS. The form of its cephalothorax is peculiar, the *head* being elevated and well-defined from the thorax. It must not be taken for the young of D. *tenebrosus,* which resembles the old, and dwells in dark places, whereas this is quite a diurnal species, fond of broad daylight.

Habitat. North Carolina.

2. DOLOMEDES HASTULATUS.

Plate XVIII. Fig. 9.

Description. Pale or greenish gray ; cephalothorax varied with blackish ; abdomen with a blackish band, with rounded edges near the base, and terminating with a hastate point towards the apex; feet varied with gray or blackish. 2. 4. 1. 3.

Observations. This was found in September in a web, like that of ANGELENA. This can be readily distinguished from D. *tenax*, particularly by the form of its cephalothorax, in which the head is not elevated as in that species. The second pair of legs being sensibly the longest. This species could almost be referred to MICROMMATA. It was found in March upon the stump of a tree not far from a stream.

Habitat. Alabama. September.

(Tenebrosæ.) 3. DOLOMEDES TENEBROSUS.

Plate XIX. Fig. 10, 13.

Description. Livid brown; abdomen and cephalothorax varied with blackish angular markings; feet annulated with blackish; frequently measuring over four inches from the extremity of the first pair of legs to that of the fourth pair; male with legs 1. 2. 4. 3.

Observations. This spider, one of the largest of the whole family, is very common in dark, retired places, hiding in crevices during the day, and issuing at night from its retreat for the purpose of seeking for prey. It does not seek the vicinity of water near which it was never seen, but dwells generally in elevated dry places. The female does not make a web, but carries its cocoon, grasped with her cheliceres. The cocoon is orbicular whitish, and of the size of a common cherry. I have occasionally seen this Dolomedes in the daytime, but it seemed always inactive, and easily captured. It can be readily distinguished from D. *albineus*, by its having no yellowish spot under the abdomen, and by the white hairs on its legs.

Habitat. Carolina, Alabama, Massachusetts?

ART. XXXII.—DESCRIPTION OF AN AFRICAN BEETLE, ALLIED TO SCARABÆUS POLYPHEMUS, WITH REMARKS UPON SOME OTHER INSECTS OF THE SAME GROUP. BY THADDEUS WILLIAM HARRIS.

IN the year 1781, the Danish naturalist Fabricius published the first description of a large African beetle, preserved in the cabinet of Sir Joseph Banks in London, and gave it the name of *Scarabæus Polyphemus*. Olivier afterwards found this insect in the same collection, and described and figured it, as a species of *Cetonia*, in 1789. The specimen was a male: it remained without a mate, and, according to Mr. Hope* and Mr. Macleay,† it was the only one known for many years, and was long considered as "the chief ornament of the Banksian cabinet," from which, however, it disappeared a few years ago. In the "Monographie des Cétoines" of Gory and Percheron, which was published at Paris in 1833, there appeared a description and figure of a male of the same species, which these authors state was contained in their own cabinet; but we have no authentic account of any other specimen in European collections.

Dr. Thomas S. Savage has lately brought from Cape Palmas, in Western Africa, several males and the female of this rare and noble species, together with both sexes of another, which is scarcely inferior to it in size and beauty, and, having put them into my hands, has requested me to describe them.

As we are indebted to Dr. Savage for the first discovery of the female of the *Polyphemus*, which was before unknown, it may be proper to offer for publication a description of this insect, with that of the new species which now enriches his admirable collection.

The Boston Society of Natural History has received from the same gentleman a large number of the fine insects of Western Africa, among which are males and females of *Scara-*

* Coleopterist's Manual, p. 60.

† Illustrations of the Annulosa of South Africa, p. 33.

bæus torquata and *micans* of Drury, together with both sexes of the gigantic beetle called *Goliathus Cacicus* by Gory and Percheron,* but differing from the true *Cacicus* of Voet, in having a triangular black patch on the shoulder of each elytron. The cabinet of the Essex County Natural History Society, at Salem, contains these same species, together with a male and female of *Goliathus* or *Hegemon Drurii*, and other valuable insects, mostly brought, by Mr. George A. Perkins from Western Africa.

The writer of this article has enjoyed the rare opportunity of seeing all the Goliath beetles in these cabinets, as well as those in the private collections of Dr. Savage and Mr. Perkins. On this account, and not from any ambition to connect his own name with the description of a new foreign species, he has been induced to yield to the request of Dr. Savage in drawing up the characters of the *Polyphemus* and of the new species allied to it, and has ventured to prefix to them some observations on the remarkable group to which these insects belong.

Lamarck instituted the genus *Goliath*, or *Goliathus*, as it is now generally denominated, in the year 1801, for the reception of *Scarabæus Goliatus, Cacicus, Polyphemus*, and some other species.

Most of the insects included in this genus are large, and some of them are of gigantic proportions, and are much prized for their beauty and extreme rarity. The clypeus of the males is generally forked or armed with horns. The mentum is wide, deeply notched, and divided into lobes, and the origin of the labial palpi is concealed within a deep sinuated furrow in the outer edge of each lateral lobe. In the African species, the maxillæ are horny, and are furnished with teeth and a terminal brush or pencil of hairs; the mandibles end with a thin and horny lobe; the epimera or frusta are more or less conspicuous between the outer angles of the thorax and the shoulders of the elytra, and the latter are dilated and promi-

* It is surprising that these authors and subsequent writers have not noticed the difference between Voet's species and this insect.

nent; the mesosternum is wide, thick, and subacute, but is not much produced anteriorly; and supplementary claws and claw-joints (pseudonychia and plantulæ) are found between the nails of all the feet.

Mr. Macleay, in the "Illustrations of the Annulosa of South Africa," has referred some of the species to his genus *Coryphe* (*Gnathocera* of Gory and Percheron), and has distributed the others into several sections; and Mr. Hope* has reduced them to smaller groups, which may be called subgenera.

In a paper upon some of these African beetles, which was published in June 1839, in the "Journal of the Essex County Natural History Society," the name of *Hegemon* was proposed for the subgenus including the princely *Scarabæus Goliatus*† of Linnæus, together with the still more magnificent *Goliathus Drurii* of Westwood, and the *Cacicus* of Gory and Percheron, and also the females of the two latter, bearing the titles of *regius*‡ and *princeps*.§ Should this generical name be adopted, it will enable us to restore to the Linnæan species the specific name of which Lamarck and other naturalists have deprived it.

The subgenus *Hegemon* may be distinguished by the following characters. Clypeus of the male armed in the middle of its anterior edge with a short, recurved, forked horn, the diverging branches of which are broad, thin, and obtuse; and on each side of the head, above the antennæ, a broad and thin toothlike projection, truncated at the summit. Labrum wide, thin but horny, entire or rounded before, and entirely concealed. Mentum widest before the middle, divided into four lobes by a rounded emargination of the an-

* "Coleopterist's Manual," p. 116.

† Linnæus and Drury did not use the letter *h* in this name. It is to be regretted that Mr. Macleay, who is justly styled the prince of modern entomologists, has interchanged the names of this and the following species, in his "Illustrations," giving to the *Goliatus* the name of *Drurii*, and to the latter that of *Goliathus*. By consulting Mr. Westwood's valuable edition of Drury's "Illustrations of Exotic Entomology," he would have avoided this mistake.

‡ Described by Professor Klug in Erman's "Reise."

§ Described by Mr. Hope in the "Manual."

terior edge, and a deep sinus of the margin on each side, within which the labial palpi are inserted and nearly concealed. Maxillæ horny, the inner lobe very hairy, and armed at the tip with a small tooth; the terminal lobe not articulated at right angles with the base, but curved inwards beyond the middle, where it is armed with a sharp tooth, and tapering at the end, which is furnished externally with a long and thick pencil of tawny hairs.* Thorax orbicular or rounded behind; in the females indented before the middle, and elevated into a tubercle on the anterior edge. Epimera large and conspicuous above, between the outer angles of the thorax and the shoulders of the elytra. Body robust; back convex; elytra gibbous behind. Abdomen not indented or furrowed beneath, in either sex; the extremity densely fringed with hairs, and immaculate. Forelegs of the males elongated; anterior tibiæ unarmed, but covered with minute asperities on the inner side, and furnished with a downy pad beneath the base; three-toothed externally in the females. Claw-joints and claws of the forefeet very strong and robust in the males. Four posterior tibiæ fringed internally with hairs in both sexes, and armed with a spine on the middle of the outer edge in the females.

The subgenera, named *Dicronorhina* and *Mecynorhina* by Mr. Hope, are found in Western Africa. They differ from the foregoing in the form of the thorax, which is trapezoidal, or broad behind and narrowed before; moreover, the body is not so robust and convex; the shoulders of the elytra are not so prominent; and the epimera are not so large and conspicuous as in the subgenus *Hegemon*. In the males, the clypeus is horned, the forelegs are the longest, and always differ from those of the other sex, the claw-joints and claws of the forefeet are very strong and robust, and the middle of the abdomen is concave or furrowed beneath.

Scarabæus micans of Drury, *Goliathus splendens* and *Smithii*

* The trophi are correctly figured in Mr. Hope's "Manual," plate III., excepting the maxillæ, in which the articulation of the terminal lobe with the base is not shown.

of Macleay, *G. Grallii* and *Daphnis* of Buquet, *Cetonia quadrimaculata* of Olivier, and some other species, belong to the genus *Dicronorhina*. These splendid beetles are highly polished, and have almost the lustre of glass. In the males, the anterior edge of the square clypeus is produced, and ends with a short recurved horn, which is bifid, or suddenly dilated at the summit, in the form of the letter T; the top of the head is concave, with a sharp semicircular ridge overhanging the middle; the lateral angles of the clypeus are prominent, and more or less elevated. The mesosternum is longer and more acute than in *Hegemon* and *Mecynorhina*. The hindmost tibiæ, alone, are slightly fringed with hairs on the inner side of the base. The anterior and intermediate tibiæ are not toothed or spined externally, in the males, and the former have several very small denticulations, which are often obsolete, on the inner side. The forelegs of the female are three toothed externally, and the four hinder tibiæ are armed with a single spine on the middle of the outer edge. The extremity of the abdomen is immaculate. By these characters alone this subgenus may be distinguished easily from the following one, and it approaches more nearly to the genus *Coryphe* of Macleay.

Scarabæus Polyphemus is the type of *Mecynorhina*, which will also include the new West African species discovered by Dr. Savage. The *torquata** of Drury, the male of which was first described and figured by Mr. Waterhouse,† in the year 1838, should be referred to the same subgenus. The opaque and velvety substance, that covers the thorax and elytra, the two whitish spots on the extremity (podex or pygidium) of the abdomen, with the long-horned clypeus of the males, give a peculiar aspect to these large and beautiful beetles.

The head is quadrate, and more or less concave above, the semicircular concavity extending backwards to the edge of the thorax, in the males. In this sex the anterior margin of

* This is Drury's orthography; the name is usually written *torquatus* by other entomologists.

† In Charlesworth's "Magazine of Natural History," Vol. II. p. 635.

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the clypeus is produced in the form of a very long horn, and the elevated ridges on each side, above the antennæ, are also more or less produced and hornlike. Body more convex than in *Dicronorhina*, opaque and velvety above, and more or less covered with the same opaque substance on the breast. Thorax narrowed before and broad behind, with three shallow emarginations on the hinder edge. Scutel triangular. Elytra gibbous behind, and terminating in a spine at the sutural angle. Middle of the abdomen concave in the males. Podex marked with two large whitish square spots, and fringed with tawny hairs. Mandibles concealed, and ending with a thin horny lobe. Maxillæ horny, exposed at base only; the inner lobe very hairy, and armed with a minute tooth at the extremity; the terminal lobe slender and acute, not toothed in the middle, bearing on its outer side a thick brush of tawny hairs, and articulated to the back of the maxillæ nearly at a right angle. Mentum broadest behind the middle, four-lobed anteriorly; the middle lobes separated by an angular notch; the lateral lobes, as in the genus *Hegemon*, less prominent, and separated from those between them by a deep sinus in the margin on each side, designed for the reception of the palpi. Anterior tibiæ three-toothed externally; the teeth very irregular and unequal in the males, and in this sex the inner side of these tibiæ is armed with three or more teeth also. There are two spines on the middle of the intermediate tibiæ and one spine on the posterior tibiæ, in the females; but these spines are generally obsolete or wanting in the males. The hindmost tibiæ alone are fringed with hairs, but the fringe extends along the whole of the inner edge.

1. MECYNORHINA POLYPHEMUS.

Opaque velvet-green above; top of the head, five longitudinal stripes on the thorax, three rows of rounded spots on each elytron, a spot on the scutel, two large square spots on the podex, and the sides of the breast, pale buff-colored; margin of the clypeus, horns, antennæ, and tarsi black.

Male. Head three-horned; the anterior horn curved upwards, forked and denticulated at the end; the lateral horns elevated perpendicularly, compressed and denticulated. Intermediate stripe on the thorax abbreviated behind. Anterior femora six-toothed internally, and notched at the base. Body beneath, except the sternum and abdomen, covered with a yellowish velvet-like pile. Length, exclusive of the horns, $2\frac{1}{4}$ inches; central horn $\frac{3}{4}$ inch, or more.

Female. Clypeus narrowed before, and widely emarginated on the anterior edge. Thorax grossly punctured; the intermediate vitta obsolete. Body beneath entirely green, polished, grossly punctured, and scantily clothed with tawny hairs. Length $2\frac{1}{8}$ inches. (Pl. xxi. figs. 5–11.)

2. MECYNORHINA. SAVAGII.

Thorax opaque velvet-green above, with five broad yellowish stripes; scutel green, with a broad yellowish stripe in the middle; elytra velvet-black, with three rows of tawny spots on each elytron, and an indented stripe of the same color on the suture, the marginal and subsutural spots confluent from the base to the middle; head of the male and central horn above, two spots on the vertex of the female, two square spots on the podex, and sides of the breast, yellowish gray; sternum, abdomen, and legs, dark green and polished; horns and margin of the clypeus, anterior and intermediate tarsi, black; posterior tarsi pale rufous, with the articulations and claws black.

Male. Head three-horned; the anterior horn horizontally extended, and forked at the end; lateral horns smooth and tapering, extended forwards and outwards; anterior femora with three unequal robust teeth on each side, those on the outer edge abruptly bent downwards. Length, nearly 2 inches; horn more than $\frac{1}{2}$ inch.

Female. Clypeus quadrate, truncated before; sides of the breast covered with a yellowish gray substance, intermixed with coarse hairs. Length $1\frac{3}{4}$ inch. (Pl. xxi. figs. 1–4.)

It is possible that the species belonging to Sir William J. Hooker, and referred to by Mr. Hope and Mr. Macleay, may be identical with *M. Savagii.*

Dr. Savage informs me, that these two species of *Mecynorhina* feed upon a vine that climbs upon very lofty trees, and states that "they wound the bark of the vine and extract the juice. The vine is full of a fluid as tasteless and limpid as water; and the natives, when travelling in the woods, cut it off and drink the juice, when no water can be easily obtained." He collected two females of each of these species, and several males.

From his interesting manuscript notes it appears that the *Goliathi* of Western Africa inhabit various trees, and that different species have a predilection for different kinds of trees. In a letter to Mr. Hope, published by Mr. Westwood, in his Arcana Entomologica, Dr. S. says, "As to *Goliathus Cacicus*, these regions abound with them; and, after a year's watching, I have obtained the flower, and know, botanically, the tree from which they derive their food. It is a syngenesious plant, belonging to Jussieu's Compositæ Corymbiferæ. The *Cacicus* inhabits no other tree, as it is said. The *Mecynorhina torquata* inhabits two kinds of trees, one a magnificent Mimosa, a Goliath of its kind; I have not yet obtained the blossom, it is now in seed, which I have. The *Goliathus Drurii* is not found in the locality of Cape Palmas; it has been taken at Bassa, near Montserado, and at Cape Coast. I lately saw Professor Klug's *regius*, which is no more nor less than the female of *Drurii*. Of this I am as certain as that the *princeps* of Hope is the female of *Cacicus*. The *Gold* Coast would seem to be the locality of *Drurii*, and the *Grain* Coast of that of the *torquatus* and *Cacicus*."*

The males are much more numerous than the females. The black-shouldered *Cacicus* abounds on the Grain and Ivory Coasts, and many specimens have been procured at Cape Palmas. When in good condition, the black patch is always more or less conspicuous on the shoulder of each elytron in this species, and is never replaced by the pearly white

* This extract was furnished by Dr. Savage himself; who has informed me, since this article was sent to press, that Mr. Westwood's "Arcana" contains a figure of the female *Polyphemus*, with an account of all the known *Goliathi*. Unfortunately the information came too late to be of any use at this time.

color which appears on that part in Voet's figure and description. Hence it still remains uncertain whether Voet's *Cacicus ingens* be a distinct species, or merely an accidental variety of the black-shouldered species. The latter inhabits a tree that grows to the height of thirty or forty feet, with a diameter of six or eight inches, and can be taken in great numbers during the months of December, January, and February, when the tree renews its blossoms and leaves. The insects are roasted and eaten by the natives, who say "they are very fat and sweet." Dr. Savage thinks that the Gold Coast, or rather the interior of Guinea, will be found to be the proper locality for *Hegemon Drurii.* It is probable that *Hegemon Goliatus* may be obtained nearer the line, and particularly back of the Gaboon. *Mecynorhina torquata* is found at Cape Palmas, where many have been obtained within a few years. The tree upon which they live is supposed to be a species of Acacia by Dr. Savage. *Dicronorhina micans* has been taken at Cape Palmas also, but seems to be rare on that part of the coast.

It appears, from the observations of Dr. Savage, that the food of the Goliath beetles is fluid, like that of the *Trichii* and *Cetoniæ,* insects belonging to the same natural family; but the latter live chiefly on the nectar of flowers, and the former on the sap of plants. The long brushes on their jaws, and the diverging rows of hairs that line their lower lips, are admirably fitted for absorbing liquid food; while their horny teeth afford these beetles additional means for obtaining it, from the leaves and juicy stems of plants, when the blossoms have disappeared. Thus every new discovery in natural history, even when least expected, serves to increase the evidence of skilful contrivance and perfect adaptation of structure in all organized beings.

DESCRIPTION OF THE FIGURES ON PLATE XXI.

1. Mecynorhina Savagii, ♂.
2. Head of the same, in profile.
3. Clypeus of the female.
4. Anterior tibia of the same.
5. Head of M. Polyphemus, ♂, in profile.
6. The same, seen from above.
7. The same, seen from behind.
8. Anterior tibia of M. Polyphemus, ♂.
9. Clypeus of the female.
10. Maxilla; and,
11. Mentum, of the male, enlarged.

ART. XXXIII.—ON THE IMPORTANCE OF HABIT AS A GUIDE TO ACCURACY IN SYSTEMATICAL ARRANGEMENT, ILLUSTRATED IN THE INSTANCE OF THE *SYLVIA PETECHIA* OF WILSON, AND ALL SUBSEQUENT WRITERS. BY THOMAS MCCULLOCH, JR., of Halifax, Nova Scotia, Corresponding Member of the Wernerian Society of Edinburgh.

FEW things, perhaps, have a greater tendency to facilitate the attainment of any branch of knowledge, than accuracy of arrangement. In numerous instances, however, this is a matter of exceeding difficulty, more especially, in those sciences which have reference to organized objects. There, species belonging to different families, often approximate so closely, that it is almost impossible to ascertain their true position, if directed alone by external development. Unfortunately for the progress of science, this has been too frequently the only guide, and to this circumstance may justly be attributed the numerous and serious mistakes which have been committed, even by very accomplished systematists. Many of these errors, doubtless, might have been avoided by attention to internal structure, and until arrangement, in certain departments of science be based upon this, as well as upon external development, implicit confidence can never be placed in its conclusions. For investigations of this kind, however, there is requisite, not only a certain degree of manual dexterity, but also an amount of knowledge both diversified and extensive; and for the attainment of this, few persons possess either the time or inclination which is necessary. In the absence of these important qualifications, careful attention to habit will be found to form no mean substitute, for habit, in numerous instances, is an infallible index of internal arrangement. It is true, that even in habit, aberrations occur occasionally, where it might be difficult if not impossible to trace correspondence in structure, as in the extraordinary fly-catching propensities of the *Picus varius*, yet, in general, thorough acquaintance with habit will be found to contribute most materially to accuracy of conclusion. This branch of knowledge is not as yet sufficiently appreciated, though to it, doubtless, we are indebted for many of the judicious alterations which have been more recently introduced into different departments of science. Of its importance, particularly with respect to the subject mentioned at the commencement of this paper, the following notices of *Sylvia petechia*, I trust, will afford a very striking illustration.

Differing from the true *Sylvicolæ* in external development, less, perhaps, than some species of that genus do from each other, the bird just mentioned, has been passed unquestioned by every systematic writer with whom I am acquainted. In reality, however, it has no more claim to the position to which it has been invariably assigned, than any of the species which have been judiciously removed from this family. The *Sylvia petechia* properly belongs to the small genus *Seiurus* of Swainson. The characteristics of this genus are chiefly indicated by habit, and these, by the bird abovementioned, are exhibited just as forcibly, as by either of its congeners. But before adducing the evidence upon which this opinion is founded, it may be observed that in our fauna, this genus contains at present only two acknowledged species; it is, however, probable, that this number will yet be augmented, when the very material differences existing between the *Seiurus Noveboracensis* of the south and north shall have been fully ascertained.

It is well known that the true *Sylvicolæ* do not build upon the ground, nor do they resort there, except from necessity. This appears to occur so seldom, that in this situation, I have never noticed but one species — the *Sylvia coronata*. In spring, the *Sylvia petechia* and the warbler previously mentioned, arrive simultaneously in Nova Scotia. Subsequently, however, intervals of cold weather often intervene — the surface of the soil becomes frozen, insect life is retarded, and both the species abovementioned are forced to mingle with the robins and other birds while seeking food upon the accumulations of seawrack, upon saltflats, or along the margins of pools or streams. In situations of this kind, the movements of the *Sylvia coronata* and *Sylvia petechia* present a most striking contrast. The awkward, helpless motions of the former, instantly betray its utter inadaptation to such circumstances; but the latter hops about with the utmost ease, and often exhibits much greater rapidity of movement than I have ever noticed either the *Seiurus aurocapillus* or *S. noveboracensis* exemplify. The *Sylvia petechia* does not resort to the ground from necessity, for this, during its migrations in spring, is one of its most common habits. During the period just mentioned, I have frequently noticed it in the vicinity of Pictou, tripping about the little pools which occur in unbroken pasture land. Nor is it merely in search of food that this species resorts to the ground — they actually pair there, and though I have not succeeded in obtaining a nest, I am satisfied that that is the situation in which they build.

I have never seen the *Sylvia petechia* at Pictou during the period of incubation; but at St. Mary's, upon the southern coast of Nova Scotia, it surprised me not a little to find it pretty common in certain localities throughout the summer. In the vicinity last mentioned, I once enjoyed an excellent opportunity of observing the pairing of a considerable number of these birds, and the manner in which they adjusted the universally interesting preliminaries of this important connection, was no less singular than amusing. Near the village of Sherbrooke, there was a perpendicular cliff which contained a little sunny nook, partially refilled by fallen blocks. In this spot, at least twenty pair of the *Sylvia petechia* had assembled, and when first noticed, they were busily pursuing each other over or under the fallen blocks, or through the smallest lateral chink which admitted of a passage. These little manœuvres were performed in silence, but in perfect good fellowship. The males never evinced the least disposition to interfere with each other, but each constantly pursued the female which he had selected through all the windings of this curious courtship. The females usually kept a foot or two in advance of the males, and at times, it was really laughable to witness the weary, tortuous, and apparently capricious routes by which they led their patient followers. At one minute, a female might be observed tripping over some huge block, and at the next, diving into some crevice beneath it or one adjoining, and from the period which often elapsed ere she and her attendant reappeared, I sometimes feared that they had become inextricably involved. The females, I imagine, always managed to find some outlet, and not unfrequently at a very considerable distance from the spot at which they had entered. I am not aware that the *Sylvia petechia* habitually pairs in such numbers; the assemblage just noticed might, therefore, have been in some measure accidental. At the time in which it was noticed, one of those cold intervals previously mentioned occurred, and large numbers both of the *Sylvia petechia* and *S. coronata* were congregated with robins, blackbirds, and other species upon an adjoining salt-flat.

Though thus pairing together in such numbers, the *Sylvia petechia* breeds apart, and the localities which it seems to prefer for this purpose, are moist, mossy barrens or swamps, sprinkled with alder or stunted spruce trees. From the tops of the latter they usually emit their simple but feeble notes. These can scarcely be entitled to the name of song, for if uttered in a somewhat softer tone, they might readily be attributed to the common grasshopper. As the pairing of the *Sylvia petechia* occurs early in May, it is probable that two broods are raised during the season.

It might be supposed that the caudal vibrations, constantly exhibited by this bird, would have awakened some suspicion with respect to its present position. I am not aware, however, of anything of the kind having ever been expressed, even by those writers who have had the most favorable opportunities for observing its habits. There is one circumstance, connected with the habits of this bird, which is exceedingly curious. In spring, as I have already mentioned, it resorts freely to the ground, but in no instance have I ever observed it there during its autumnal migrations. During this period it seems to exhibit the habits of the true *Sylvicolæ*, gleaning among the branches of trees, and not unfrequently visiting the windows of dwellings, in search of spiders and insects. This may appear scarcely credible, yet, I have noticed, in other species of birds, during the breeding season, a temporary assumption of habits much more incongruous and unaccountable than the one abovementioned.

Alterations, such as have just been suggested, even when based upon incontrovertible evidence, are attended, I am aware, with serious inconveniences. Independently of an accumulation of synonymes, from which the student turns away in disgust, persons who have discovered, accurately described, and, probably, with no little toil, obtained almost all the information which science possesses of certain species, are thus liable to be deprived, in a great measure, of the credit justly due them, by some other person, whose sole claim to notice may consist in the mere rectification of some error respecting the position of the objects.

The preceding information has not been communicated from any desire of connecting a name with a species which has been long, though very imperfectly, known; but from a sense of the importance of accuracy of arrangement. Let the real position of the bird be acknowledged, and the person, by whom the alteration has been suggested, will be perfectly satisfied, though his name should never be mentioned in connection with the species. Those who love science, for its own sake, will feel but little regret, provided its progress be accelerated, should their claims to notice be occasionally overlooked, even in cases which are really of importance.

ART. XXXIV.—ON THE ANATOMY OF TEBENNOPHORUS CAROLINENSIS. By Jeffries Wyman, M. D.

(Communicated November 15, 1843.)

The peculiar characters of the most common slug of our forests, which was noticed by Bosc under the name of *Limax Carolinensis*, induced Dr. Binney, in his memoir on the

Limacidæ of the United States,* to propose for it a new genus under the designation of TEBENNOPHORUS. For the external characters of the animal, which is the subject of this paper, reference is made to Dr. Binney's description, and accurate figures of it may be found in his forth-coming volume on the terrestrial Mollusks. The object of this paper is to elucidate its anatomy, with a view of determining how far its structure differs from that of the other genera of the family.

The dorsal shield or cuirass, excepting as regards its size, in its external characters resembles that of the different species of *Limax*. On making a longitudinal incision, however, along the middle of the back, as in Pl. xxii. fig. 1, there is found to exist, between it and the viscera, a large cavity, occupying the whole extent of the dorsal and lateral regions; this cavity has no communication with the respiratory sack, no air passing into it when the latter was forcibly distended. It did not communicate externally with the air, being protected from it at all parts by the shield, except under the anterior extremity of the latter, where it was covered only by a thin membrane. The whole of its internal surface is lined by a thin, smooth, delicate membrane enveloping the viscera, so as to unite them into a single mass, and from them it is reflected upon the tegumentary parietes, like the peritoneum of the higher animals. In the different species of the genus *Limax* the membrane, by which the different viscera are invested, is attached by a loose cellular tissue to the parietes, so that no similar cavity can be said to exist. In *Tebennophorus* no cavity exists in the cuirass similar to that containing the calcareous body in the *Limaces*.

The different organs are represented, in fig. 1, as they appear when exposed by laying open the cavity which has just been described. At the anterior extremity is seen the buccal pouch, from the centre of which commences the œsophagus, and on each side the upper tentacles: *a*, is the respiratory sack; *b*, a part of the viscera; *c c*, the liver; *d*, testis; *f f*, integuments.

* See the present volume of this Journal, page 163.

ORGANS OF NUTRITION. The mouth, as in the genera *Limax* and *Helix*, consists of an ovoidal, hollow, muscular organ. On its inner and upper surface, near its orifice, it is provided with a horny beak, concave on its cutting edge, and slightly denticulated. The tongue is a firm, apparently cartilaginous organ, which, when retracted, occupies the lower portion of the cavity of the mouth, also forming a process which projects from its posterior face (fig. 3, *b*.) The upper surface of the tongue is deeply concave, and its lower convex, so that it has somewhat the form of a gouge, and it is covered by a cuticular membrane, which is easily detached from the body of the organ. When this cuticular covering is examined under a powerful microscope, its entire surface is found to be covered with an immense number of minute teeth, arranged in a transverse-linear series, and having a form more or less conical. These on the median line (fig. 4, *a*,) are readily distinguished from the lateral teeth, by their symmetrical form, and by being smaller than those nearest to them on either side. The lateral teeth (fig. 4, *b b* and *c c*,) are all more or less inclined towards the axis of the tongue. Those near the median line, have an obtusely conical form, and at the apex are surmounted by a sharper conical point. As they recede from the centre, this point disappears, and the teeth become regular cones, and at the same time gradually diminish in size, the extreme lateral ones being reduced to minute papillæ. (fig. 4, *c c*.) The mouth is protruded and retracted by two sets of muscular fibres acting in opposite directions, and attached to the anterior and posterior part of the foot.

The *œsophagus* opens into the mouth on its upper surface, (fig. 3, *c*,) and on each side of it are the terminations of the ducts of the *salivary glands*. These last are two in number, one on each side of the œsophagus, of an irregular flattened oval form, lobulated, each discharging its secretion into the mouth by a single tortuous duct, (fig. 2, *b*,) which passes through the ring formed by the union of the œsophageal ganglia. The œsophagus, having passed through the same ring, terminates posteriorly, (fig. 2, *c*.) in a thin membranous stomach. This last is of a nearly cylindrical form, gradually diminishing in size posteriorly (fig. 2, *d*,) and terminating in a very short cul de sac, as shown in fig. 5. The *intestine* (fig. 5, *b*, and fig. 2, *f f*,) which is at once distinguished from the stomach by its smaller size, and by coming off obliquely from the former near its termination, makes two or three turns through the substance of the liver and terminates in the anal orifice, at the entrance to the respiratory sack. *The liver* (fig. 2, *e e*,) has the same relative size as in the *Limaces*, forms the posterior portion of the visceral mass, and envelopes a large portion of the intestinal canal. It consists of two lobes of nearly equal size, each composed of numerous lobules. The biliary secretion is discharged into the stomach near its posterior extremity, by a single duct from each of the principal lobes, (fig. 5, *c c*.)

The respiratory cavity presents a very remarkable variation from that of the *Limaces*, in being attached to the viscera, and in having no connection whatever with the shield. In the *Limaces* the shield contains two cavities, one of which secretes and contains the calcareous body or rudimentary shell, and the other the organ of respiration, the heart, and kidneys.

In dissecting the *Limaces* these two cavities are always raised with the integuments, and the respiratory sack is only attached to the viscera by the different vessels going from and coming to it. The position of the respiratory organ in the animal here described is shown (fig. 1, *a*,) as it appears when inflated after removing the shield. The respiratory orifice is seen in a cleft on the edge of the dorsal shield, near its anterior extremity on the right side. The cavity itself consists (fig. 1, *a*,) of an exceedingly thin delicate, transparent membrane, is of an irregular triangular shape, and terminates posteriorly, on the left side of the visceral mass in a cul de sac. In the concavity of the posterior edge of this sack, are contained the pericardium, with the heart and kidney. As in *Limaces* and *Helices*, the heart consists of an auricle and ventricle, the former receiving the circulating fluid from the organs of respiration, and the latter distributing it over the body. The blood-vessels are thin and transparent and not easily traced.

The kidney is situated just behind the heart, is of elongated form, curved upon itself so as to form nearly a complete circle, leaving an open space in the centre, which is partly occupied by the heart.

Nervous System. This system closely resembles that of the *Helices* and *Limaces;* its central portion consisting of a ganglionic ring, through which passes the œsophagus, salivary ducts, and some of the retractor muscles of the mouth. Fig. 6 represents the ganglia and nerves as seen when viewed on the posterior face. Above, the ring consists of two ganglia, from a process at the outer angles of which the nerves to the upper tentacles are given off. (fig. 6, *a*.) The pair of nerves going to the lower tentacles, and numerous minute filaments going to the parts about the mouth, are given off from the anterior face of the ganglia. The infra-œsophageal ganglia are four in number, but so united as to form a ring (fig. 6, *c* and *d*,) through which passes a large arterial trunk distributed to the parts about the mouth. The nerves arising from the supra-œsophageal ganglia appear to be, for the most part, nerves of sensation and those from the infra-œsophageal ganglia are almost if not entirely distributed to the organs of motion. These two sets of ganglia are united by commissures, from which last a few minute filaments are given off on each side.

Organs of Generation. The male organs consist of a testis, vas deferens and penis; the female of an ovary, oviduct, and spermatheca? or vesicle; both sets of organs terminate in a common receptacle, which opens externally by a single orifice just behind the upper tentacle on the right side. The testis (fig. 7, *a*,) has an irregular spheroidal form, is of an ash gray color, and composed of numerous lobules, each lobule consisting of minute granules. It is in part enveloped by the posterior lobe of the liver (fig. 1, *d*.) The vas deferens (fig. 7, *b*,) is a whitish duct, slightly convoluted at its commencement, and becoming more so as it approaches the ovary. It is closely united to the oviduct throughout the convolution of the latter, and as it separates from it (fig. 7, *c*,) it reaches the male organ in the form of a long and slender tube without convolutions. The penis, (figs. 7 and 8, *f*,) when retracted, has an irregular convoluted form in consequence of being folded upon itself. The ovary (fig. 7, *c*,) is a yellowish colored organ, very slightly lobulated, has a conical shape, its base resting on the oviduct. This last consists of two portions; the first, commencing at the ovary, is united with the vas deferens, and forms numerous folds upon itself, resembling an intestine; it terminates in the second portion *k*, which has a very small diameter, and without any convolutions. At fig. 7, *h*, and fig. 8, *a*, is a rounded vesicle, which is supposed to resemble in function the spermatheca of insects, and which is united with the oviduct at its termination, by a long slender duct (*i* and *b*.) At the termination of this duct is the small cœcum (fig. 7, *i*,) of which there is no analogue in the *Limaces*. Both the male and female organs terminate in a common sinus (fig. 7, *l*, and 8, *h*.) This sinus is provided with a yellowish glandular organ which nearly surrounds it externally. The external orifice of the organs of generation has already been described.

EXPLANATION OF FIGURES ON PLATE XXII.*

Fig. 1. The different organs represented in situ; *a* respiratory sack; *b* position of the stomach; *c c* liver; *d* testis; *f f* integuments.

Fig. 2. Digestive organs; *a* mouth or buccal pouch; *b* salivary glands and duct; *c* termination of œsophagus; *d* stomach; *e e* liver; *f f* intestine.

Fig. 3. *a* buccal pouch; *b* projection formed by the tongue retracted; *c* œsophagus.

Fig. 4. A. Teeth on the central portion of the tongue; *a* teeth on the median line symmetrical; *b b* lateral teeth oblique; B. *c c c* extreme lateral teeth.

Fig. 5. *a* terminal portion of stomach; *b* intestine; *c c* bile ducts.

Fig. 6. Œsophageal ganglia and nerves.

Fig. 7. *Organs of generation.* *a* testis; *b* vas deferens; *c* ovary; *d* oviduct; *e* continuation of vas deferens; *f* penis; *g* retractor muscle; *h* vesicle, and *i* its duct; *k* continuation of oviduct; *l* termination of genital organs; *m* cœcum; *o* tentacle; *p* anterior extremity of cuirass.

Fig. 8. *a* vesicle; *b* its duct; *c* and *d* oviduct; *e* vas deferens; *f* penis; *g* cœcum; *h* glandular organ surrounding the termination of the genital organs.

* The plates, referred to in this memoir, and in that on *Glandina truncata*, were executed for Dr. Binney's work, and are loaned by him for the use of this Journal.

ART. XXXV.—ON THE ANATOMICAL STRUCTURE OF GLANDINA TRUNCATA OF SAY. By JEFFRIES WYMAN, M. D.

(Communicated November 15, 1843.)

A KNOWLEDGE of the anatomical structure of this animal has been a desideratum, from the time when its external peculiarities were announced by Mr. Say, until now. The privilege having been lately allowed to me of examining one of the specimens which were forwarded to Dr. Binney, by J. Hamilton Couper, Esq. of Darien, Ga., to whose politeness and zeal for the advancement of natural science this Society and many individuals are indebted for similar favors, advantage was taken of it to make as minute an examination as time would permit. The result of the examination is embodied in the present paper. The opportunity of investigating the anatomy of *Bulimus ovatus* of Muller, and *Achatina perdix* of Lamarck having occured at the same time, the means were afforded of comparing the structure of the three genera.

When the animal is removed from the shell, the different organs remaining in the same position as when in the act of crawling, we have exposed anteriorly the head, protruded beyond the principal mass of the viscera, (Pl. xxiii. fig. 1.) The viscera are bordered anteriorly by the collar (*a a*,) behind which is the respiratory cavity, (*b b*,) occupying the larger portion of the upper and left lateral surfaces, and after making a single turn behind the viscera terminating on the right side at *d*. The respiratory and anal orifices are situated just beneath the right extremity of the collar at *a*. The genital orifice is farther forward, a little posterior to the upper tentacle. The liver, (*c c*,) forms nearly the whole of the posterior portion of the visceral mass.

In the general characters of its organization, *G. truncata* resembles the genera *Limax* and *Helix*, but differs from them in the existence of an additional pair of tentacles and a corresponding modification of the nerves distributed to them, in the arrangement of the teeth on the tongue, in the complicated form of the stomach, and in some other characters of less importance.

Nutritive System. In *Helix, Limax, Vaginulus, Achatina, Bulimus,* and nearly all other genera of the pulmoniferous *Gasteropoda,* the *buccal organ* is almost uniformly either of an ovoidal or spherical shape, its transverse being but little less than its longitudinal diameter.* In *G. truncata,* it is strikingly contrasted with that of the genera just mentioned by its remarkable size, and the muscular power of the tongue which it encloses. The parietes of the buccal cavity consist of a thin cylindrical muscular sack, slightly curved at its posterior extremity, (fig. 2, *a a,*) measuring an inch in length, and one fifth of an inch in diameter. The *tongue* occupies a large portion of the buccal cavity, is cartilaginous, concave above, convex below, and attached to the inferior and posterior surfaces of the cavity, by several very strong and distinct muscles; its anterior or free portion is buried in part in an excavation on the floor, immediately above which, is the entrance to the œsophagus. The teeth, on the surface of the tongue, are sharp pointed, elongated, and somewhat recurved, arranged in lines "en chevron," the apex being directed backwards. There are no teeth on the median line, corresponding to the axis of the tongue, and in this respect it differs from many of the *Pulmoniferous Gasteropoda,* in which a range of median symmetrical teeth is generally found to exist.

The salivary glands, though apparently forming but a single organ, resemble those of the other *Pulmonifera,* in having a single duct to each, terminating one on either side of the œsophagus at its origin from the mouth, (fig. 2, *c c,*) but differs from them, in being so arranged as to form a collar or ring through which the œsophagus passes.

The œsophagus, (fig. 2, *b,*) commencing on the upper surface of the buccal organ, having passed through the salivary gland, terminates in the stomach on one of its lateral faces. The stomach consists of two portions, a membranous, and muscular, *d* and *e.* The first or anterior portion, *d,* is

* See anatomical descriptions of the genera *Limax, Helix,* and *Tebennophorus.*

voluminous, of an irregular form, terminating anteriorly in a cul-de-sac; and posteriorly becoming very much contracted in its diameter, and ending in the second or muscular portion. This last, *e*, is very small, compared with the preceding, and is distinguished by its thick and muscular walls, which form an irregular triangular mass. Between the muscular portion and the intestine there is a third cavity, *i*, with very thin parietes, which appears to be nothing more than a dilatation of the intestine which commences here. The intestine is of an uniform size, slightly convoluted, and but a small portion of it enveloped by the liver; its terminal portion passing along the right border of the respiratory sack, terminates in the respiratory or face under the anterior edge of the collar, (fig. 1, *a*).

The *liver* is less voluminous than that of the *Helices*, is composed of a larger and a smaller lobe, (*g g*, fig. 2,) the first occupying the larger portion of the posterior whorls of the shell. Both lobes discharge their secretions into the muscular cavity of the stomach, by one and the same duct; in the genera *Limax*, and *Helix*, there are two.

The kidney, or depuratory organ, is attached to the superior walls of the respiratory sack, and is remarkable for its elongated form; a portion of it is shown in fig. 1, *c*, and in fig. 3, *a*, it is shown entire, with its excretory duct, (*b b*.) The glandular portion has a crescentic form, largest anteriorly, where the excretory duct commences. The excretory duct passes along the parietes of the sack, in a direction parallel to the gland, gradually diminishing in size for a short distance, (fig. 3, *b b*,) after which it passes to the rectum, to which it becomes loosely united, and with which it terminates at the respiratory orifice. Numerous vessels are seen on the surface of the respiratory sack, directed towards, and connected with the organ which we have denominated the kidney, on the authority of Blainville, and others, and where the blood is supposed to undergo the depuratory process.

The *respiratory sack* (fig. 1, *b b d*,) has the same position as in the *Helices*, from which it differs but little, excepting in being more voluminous. It occupies the whole of the anterior half of the surface of the viscera, and descending on the left side beneath them terminates on the right at *d*.

The heart and pericardium are enclosed in the respiratory sack, but are less closely attached to the kidney than in the *Helices*.

Nervous System. The nervous system (fig. 4,) consists of the supra and infra-œsophageal ganglia united by commissures and of two other ganglia much more minute, united to the first pair by very delicate filaments; if other ganglia exist, I have not been able to detect them. From the three pairs just mentioned, are given off nerves to the different organs of the body. From each of the supra-œsophageal ganglia are given off two nerves, of which the anterior and smaller is sent to the superior or occular tentacle, *a*, and the posterior much larger than the preceding to the third pair of tentacles *c*, but which in its course gives off a small filament to the second pair *b*. Other filaments more minute are given off from the superior ganglia to the parts about the mouth. The infra-œsophageal ganglion appears to be composed of several smaller ones united together so as to form a ring, in the centre of which is an open space through which passes a large arterial trunk to be distributed to the parts about the head and mouth.* The superior and inferior ganglia are united by long and slender commissures, *e*, each of which is composed of three filaments distinct from each other. The ring thus formed by the union of these two sets of ganglia embracing the buccal organ, is remarkably distinguished by its size, from the same part in *Helix*, *Limax*, *Tebennophorus*, *Bulimus*, and *Vaginulus*, where it simply embraces the œsophagus. The nerves derived from the lower ganglion are principally locomotive and are distributed to the foot and integuments. The third pair of ganglia (fig. 4, *g*,) are situated on the upper face of the buccal pouch, near the commencement of the œsophagus and are united to the supra-

* A similar conformation exists in the genera *Limax*, *Helix*, and *Tebennophorus*, but I have not seen it described in any treatise on the subject.

œsophageal ganglia, by two very delicate commissures, *f*; the nerves given off by these ganglia all appear to enter the walls of the buccal organ, and are all very minute.

Genital System. The testis (fig. 5, *a*,) is of an oval form, is not imbedded in the liver, but is loosely attached to its surface. The *vas deferens*, *b*, when it reaches the under surface of the ovary at *b′*, becomes convoluted, forming a species of *epididymis*; it is continued along three fourths of the whole length of the *oviduct*, forming a glandular looking band, attached to its side; at *k* it separates from the *oviduct*, in the form of a simple tube, *f*, which acquires a great length, and terminates in the base of the penis; this terminal portion of the *vas deferens* is slightly enlarged near its commencement, otherwise it is of a uniform size. The *penis*, *g*, is triangular at its base, and terminates by a small cylindrical tube, in the cavity common to it, and the female organs. The *ovary*, *d*, and the *oviduct*, *c c*, do not differ materially from the same organs in the *Helices*. The *vesicle*, *e*, or *spermatheca?* and its duct are closely connected with the *oviduct*, the *vesicle* itself being in contact with the ovary. The length of the duct of the *spermatheca*, is proportioned, or nearly so, to that of the male organ. The male and female organs terminate in a common receptacle, *i*, which opens externally at a short distance posterior to the upper tentacles.

Muscles. All the muscles except one, which, by their action, retract the different organs within the body of the animal, or the body itself within the cavity of the shell, have their origin from the columella, where they are all collected into one or two bundles. The buccal pouch is retracted by three or four slips attached to its posterior extremity, and protruded by two others (fig. 3, *a a*). The tentacles are each provided with a retractor muscle; also the male organ, the muscle of which, as in the *Helices*, *Achatinæ*, and *Bulimi*, is attached to the floor of the respiratory cavity?

The anatomical structure of *G. truncata* having been de-cribed and compared with some of the other genera of *Pulmonifera*, it still remains to institute a comparison between it and that of the genera *Bulimus*, and *Achatina*, to which it is more intimately allied, and with which it has been confounded. The means of making the comparison are derived from the dissection of *Achatina perdix*, from western Africa, and of *Bulimus ovatus*. In both *Bulimus* and *Achatina* the buccal pouch has the same ovoidal form which is found in nearly all the genera of *Pulmonifera;* in *Glandina* it is so much elongated that its longitudinal exceeds many times its transverse diameter. There exists no horny beak, at the entrance of the mouth of Glandina; in *Bulimus* and *Achatina*, it is large and denticulated on its concave or cutting edge. The teeth on the tongue of the two last genera, are arranged in transverse lines, extending from side to side without undulations, and of a uniform size, and obtusely conical shape, with a symmetrical range on the median line; in *Glandina* they are acute, recurved, smallest towards the centre and edges, arranged "en chevron," but wanting on the median line. The three genera are provided with a muscular stomach or gizzard, but *Glandina* alone has the membranous portion terminating anteriorly in a cul-de-sac. In *Glandina* the salivary glands form a distinct collar or ring, around the œsophagus; in the other two genera they are separate, as in the *Helices*. In *Bulimus* and *Achatina*, the anterior lobe of the liver is the largest; in *Glandina* it is smallest. There appears to be but one bile-duct in the last, and there exists two large ones in the former. The third pair of tentacles, which are so prominent in *Glandina*, are represented by two buccal fringed lobes in *Bulimus:* neither tentacle nor lobe exist in *Achatina;* in *Bulimus*, as in *Glandina*, these are provided with a special nerve. In *Achatina* the male organ is loosely enveloped in a large and muscular sheath, which does not exist in either of the other genera.

These are the most prominent differences between *Glandina* and the other genera, others of less importance also exist; but those which have been enumerated seem to be sufficient to demonstrate that the genus *Glandina* cannot be confounded with either of the others.

EXPLANATION OF FIGURES.

Fig. 1. Animal removed from the shell, organs in situ ; *a a* the collar ; *b b* respiratory sack ; *c* kidney ; *d* termination of the respiratory sack ; *e e* liver.

Fig. 2. *Digestive organs ; a a* buccal pouch ; *b* œsophagus ; *c c* salivary glands and ducts ; *d* membranous stomach ; *e* gizzard ; *f* bile-duct ; *g g* lobes of the liver ; *h h* intestine ; *i* dilatation at its commencement ; *k* retractor muscles of the mouth.

Fig. 3. *Kidney ; a* kidney surrounded by the vessels ramifying on the surface of respiratory sack ; *b* excretory duct ; *c* terminal portion of intestine.

Fig. 4. *Nervous system ; a* upper tentacle ; *b* and *c* middle and lower tentacles ; *d* supra-œsophageal ganglia ; *e* commissures between the last and infra-œsophageal ganglia ; *f* filamentary commissure uniting small ganglia *g* with the superior ganglia.

Fig. 5. *Organs of generation ; a* testis ; *b* vas deferens ; *c* oviduct ; *d* ovary ; *e* vesicle ; *f* continuation of vas deferens ; *g* penis ; *h* retractor muscle ; *i* common receptacle ; *k k* duct of the vesicle or spermatheca ?

ART. XXXVI. — BEAUMONTITE AND LINCOLNITE IDENTICAL WITH HEULANDITE. By Francis Alger. Read October 5, 1843.

There is a too prevalent disposition among mineralogists, as well as among the cultivators of other departments of natural science, to add something new to the catalogue of species. They make specific differences in many cases where, by a fuller investigation, or a nicer comparison of the object with that which most nearly resembles it, an identity might be at once established between them, and the science not be burthened with so many new names. The truth of what I now say, has been shown by the recent examination of several minerals, accredited as new, which have been found, by some of the German and Swedish chemists, to be varieties of other species, or in some cases, mere mechanical mixtures. A very frequent source of these mistakes, so far as mineralogy is concerned, is owing to a scrupulous regard not being paid to the chemical composition of the substance ; this being the essential basis of mineralogy as a true science. Another cause may be traced to the different appearances, which the same mineral, from different localities, assumes in some of its external characters; appearing, perhaps, under some new modification of its primary form.

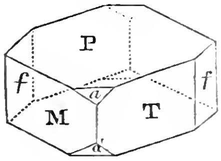
A remarkable instance of the latter, has recently been presented in the case of the mineral examined by M. Levy, and named Beaumontite.* This substance has long been familiar to our American mineralogists, as the associate of the Haydenite found near Baltimore.† It has now become exceedingly valuable, principally through the investigations of M. Levy, who has thus supposed it to be a new substance. It is a very beautiful mineral, and being extremely scarce, it will continue to be highly prized by mineralogists, both here and abroad, even if it should prove to be no new species, but only a rare modification of a well known one. I believe it has not been described in any of our late treatises on mineralogy, nor am I aware that any notice has been taken of it in the American Journal of Science.

On comparing the crystals of this substance, with several of those of the Heulandite of Nova Scotia, which presented a modification rather uncommon, I was satisfied that they were both derived from the similar replacement of the acute lateral edges, and obtuse solid angles, of the same primary right oblique angled prism; the planes *f*, which in most instances, are small, being now so extended as to reduce the length of the figure to nearly the same dimensions with its breadth; thus giving rise to what might, at first sight, appear to be a square prism, terminated by two obtuse four-sided pyramids, resting upon the opposite lateral faces of the crystal, as I have endeavored to represent by the subjoined figure 2. The

* M. Levy read his paper before the French Academy of Sciences, (L'Institut. 1839, No. 313, p. 455.) An abstract of his communication may be seen in the London and Edinburgh Phil. Mag. for February, 1840.

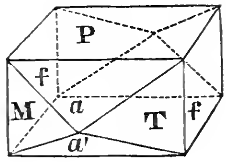
† M. Levy's examination of the *Haydenite*, has confirmed the more general opinion among mineralogists of its simple character. By some it had been allied with chabazie; but the early investigation of Dr. Hayden, showed a marked disagreement between them in chemical composition, and Professor Cleaveland has proved to be correct in the opinion which he gave of it in the first edition of his Mineralogy. Our knowledge of this mineral will soon be complete, by the analysis of Mr. B. Silliman, Jr. who now has it in hand.

Fig. 1.



P on M or T	90°
M on T	130
M on *a*	147 17′
M on *f*	114 20′
P on *a*	111 59′
T on *a*	148

Fig. 2.



planes *a a′*, being carried to the extreme, so as to entirely obliterate the edge formed by the planes M and T, of the right oblique prism, fig. 1, — the pyramids thus resulting are very beautiful in both minerals, particularly in the Beaumontite, and they present the same characteristic vitreous lustre, contrasted with the soft, pearly white reflection of the planes P, which we always observe in the crystals of this mineral from other localities. Both minerals, however, present shades of brown and yellow. On further comparing their hardness and pyrognostic characters, and failing also to obtain any other cleavage in the Baltimore specimens, than that well known in Heulandite, I could have but little doubt that M. Levy, (unless he had described some other very analogous mineral from this locality, which I have not seen,) had been misled by its unusual crystalline form, and, instead of making known a new species, had only given us the wrong characters of an old one. I am sure that he would not have been led into a mistake of this kind, had the crystals examined by him presented those *gradual changes* which have ultimately given rise to the figure which he supposed to be the primary right square prism of the Beaumontite, and which we so readily observe in the crystals from Nova Scotia.

This is the *only* respect in which the Heulandite from Nova Scotia, and M. Levy's mineral, differ from each other; and it is in reference to this single peculiarity in the approximation of the crystals of the Nova Scotia mineral to a right square prism, that it has hitherto commanded an especial interest among our mineralogists. I had never seen the decrement carried so completely out in the crystals from any other locality, until these beautiful specimens met my eye from Baltimore. The smaller replacements *b b′*, which are often seen in the crystals of this mineral from Faroe, I have never observed among the specimens from either of the localities here referred to, nor from any locality in the United States.*

To remove *all* doubt as to the identity of the two minerals, I requested Mr. J. E. Teschemacher to separate some of the best crystals from my Baltimore specimens, and subject them to measurement by the reflecting goniometer, as I well knew the public would have the fullest confidence in his use of that instrument. He has informed me that P on P gives 90°, M on T 130°, M on *a* 143° 17′, P on *a* 111° 58′, and adds that he has no doubt the mineral is Heulandite. The variation in the third measurement was owing to the imperfection of the surface. We have, therefore, every reason for believing that the specific nature of the Beaumontite of M. Levy, can no longer be maintained. It is proper to add, that the same name, in honor of a distinguished French naturalist, Elie de Beaumont, had already been applied to another mineral from Chessy, in France, described and analyzed by my friend, Dr. Charles T. Jackson.†

Lincolnite. — Prof. Hitchcock, in his *Final Report* ‡ *on the Geological Survey of Massachusetts,* has given the description of a mineral found in the vicinity of Deerfield, which he has named in honor of the late governor of this State. Unfortunately, it must share the same fate with Beaumontite, though it seems less entitled to the distinction of a new species; for in every respect but one, viz. its not being replaced on the obtuse solid angles by the planes *a*, as shown in fig. 1, it is impossible to discover any dissimilarity between this mineral and Heulandite; both exhibiting the same characters before the blowpipe, the same color, lustre, hardness, &c. The crystals of Lincolnite are very small, usually requiring a microscope in their examination, and they have their acute lateral edges replaced by very narrow planes *f*, corresponding in their measurement with Heulandite. But, according to

* See fig. 2 in Phillips's Mineralogy, Allan's edition, p. 25.

† American Journal of Science, Vol. XXXVII. p. 398.

‡ Final Report &c., p. 662.

Prof. Hitchcock, they differ from Heulandite in the proximate measurement of planes M on T about 10° (being 120° instead of 130°) as determined by the measurement of three different crystals with the common goniometer. It must be confessed, that the comparison of one set of characters alone, without some other corroborative evidence, — especially when, as in the present instance, the crystals are too small to admit of the accurate use of the common goniometer, does not authorize the making of a new species. Having received a few crystals of this mineral from Prof. Hitchcock, I also requested Mr. Teschemacher to measure them. The results showed the same agreement with the recorded measurements of W. Phillips, and have therefore established the true nature of this mineral beyond any doubt.

I would remark that crystals, precisely like those described by Prof. Hitchcock, have lately been found in gneiss on New York island, and apparently in the same rock, associated with phosphate of lime, at Suckasunny, New Jersey.* There can be no doubt, I think, that the radiated or fasciculated mineral accompanying these crystals is stilbite, and not a variety of Lincolnite or Heulandite, as Prof. Hitchcock supposes.

ART. XXXVII. — PROBABLE INFLUENCE OF ICEBERGS UPON DRIFT.

By John L. Hayes, Portsmouth, N. H.†

At a time when the attention of geologists is so generally directed to observing the phenomena of drift, and especially when the agency of ice is deemed so important to explain

* Among some specimens which I have lately received from Copenhagen, through a distinguished friend of science, Compte de Vargas Bedemar, I observed precisely the same modified crystals with those of Lincolnite, but no near approach to the form of Beaumontite. These specimens are from Faroe, a region which the Count has personally examined.

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these phenomena, it seems desirable that we should have more extended information upon the natural history of icebergs. To obtain the desirable information upon this subject, I have directed letters to various nautical gentlemen, from whom I was led to expect information. I visited New Bedford, the great centre of the American whaling business, and directed my inquiries to the masters of whaling ships, who frequently encounter icebergs in the southern latitudes. I visited Stonington, and consulted the hardy and intelligent men who have prosecuted the seal fishery in the Antarctic regions, and who have a more intimate knowledge of the south polar regions than any men living. Besides drawing from these sources of information, I have conversed with many masters of our merchantmen and Labrador fishermen, who often meet the ice upon the Banks of Newfoundland. I have also seen three or four individuals who were familiar with the ice in the Arctic Seas. The number of persons whom I have consulted is nearly a hundred. I have also collected such facts from the authentic published accounts as might bear upon the subject of my inquiries.

In making my investigations, I have been scrupulously careful to consult only those whose general reputation would entitle them to entire credit, and have principally directed my inquiries to the masters and officers of vessels. I have been influenced by no attachment to a particular theory, or desire to collect an imposing mass of facts. I have endeavored to discharge my task as one would execute a judicial commission to take testimony; placing down alike negative and positive evidence; rejecting only that which was impertinent or contradictory. Those who have attributed so many of the phenomena of drift to the action of icebergs, may be surprised at the small number of facts obtained from such ample sources of information. Yet the evidence will have the same scientific value as if many more positive facts were presented.

The present inquiry results from the attention which has been given, within the last three or four years, to the so called glacial theory. Within that period, the structure of ice, its mode of formation and progression in those mighty masses which hang upon the mountain sides at the limit of perpetual snow, its abrading and transporting influence, have attracted profound attention. A distinguished philosopher of Edinburgh, Prof. Forbes, who expresses the importance which has been attributed to this subject, remarks, that "the glacial theory, whether it regards the present or past history of those mighty and resistless vehicles of transport and degradation, yields to no other physical speculation of the present day in grandeur, importance, and interest." Since our last meeting, several of the most profound philosophers and geologists of Europe have encamped for weeks upon the glaciers of the Alps, to explore their various phenomena, and have filled the scientific journals with their acute, though, unfortunately, acrimonious discussions upon the glaciers.

The proper glacial theory, as originally proposed, which attributes the abrading and and polishing of rocks, the transportation of erratic blocks, and the formation of some of the peculiar accumulations or ridges of gravel and bowlders which occur in our drift, to the agency of mountain glaciers, has lost the favor which it originally received. A modification of this theory has been suggested by Mr. Murchison, the President of the London Geological Society, in his late annual address, whose views are nearly the same, if I mistake not, as those advocated by geologists in our own country. He supposes that icefloes, and their detritus, might be set in motion by the elevation of the Scandinavian continent, and the consequent breaking up of the great glaciers on the northern shores of a sea which then covered all the flat regions of Russia; that the bottoms of these iceberg s, extending to a great depth, must have, every here and there, stranded upon the highest and most uneven points of the bottom of the sea, and that the lower surface of the iceberg, like the lower surface of a glacier, would score and grate along the rock.

I may say, in short, that the effects which have been attributed to the agency of icebergs by the advocates of the aqueo-glacial theory, are, the transportation of earth and large fragments of rock, the abrading and furrowing of the rocks, the distortion and bending of strata of clay and sand, the formation of bowl-shaped cavities by the rotatory movement of the stranded berg, and the formation of accumulations, or ridges of bowlders and gravel, like the moraines which border the glaciers. We must reason from actual to ancient causes, and, to ascertain the soundness of these views, must study the phenomena of icebergs in our present seas.

I will now proceed to present the facts which I have collected.

I. As to the mode of formation of icebergs, their original position, and the manner in which they have been detached.

II. The magnitude and form of those floating at sea.

III. The direction, rate and nature of movement, the limits of their transport, their grounding and dissolution.

IV. Positive and negative testimony as to the transportation of fragments of rock, bowlders, mud, and earth.

I. The islands of ice which are seen at sea, and receive the name of icebergs, have been, without doubt, originally detached from the glaciers of the north and south polar shores. The term *Iceberg* was originally given to the glaciers of Spitzbergen and Greenland, and is now applied by the South Sea sealers and whalers to the glaciers of the South Shetlands, South Georgia, Sandwich Land, and Terra del Fuego. Scoresby, the most accurate writer upon the Arctic Seas, says that the greater part of the icebergs that occur in Davis's Strait are merely fragments of large glaciers which exist in great numbers on the coast forming the borders of Baffin's Bay. These glaciers fill immense valleys, and extend, in some places, several miles into the sea. In others, they form a precipitous edge at the general line that forms the coast.

In Greenland, according to Graab, the long narrow bays or fiords, like broad rivers, run far up amid the lofty mountains or table-lands of the interior. The vast plains of the interior abut upon these fiords; hence the greater number are closed by a glacier, close to which the water has often a depth of several hundred fathoms. Several of the inlets are now completely filled up, and at others the ice projects far out into the waves, forming a considerable promontory.

I have obtained from Mr. Fernald, of Portsmouth, a gentleman of great intelligence, and of remarkably accurate habits of observation, a statement prepared from a minute journal of the facts observed by him, in relation to ice, during a residence of fifteen months among the islands of South Georgia and Sandwich Land. He observes that "the Island of South Georgia, lying in latitude 54° 30′, is deeply indented with bays, some of them so deep on opposite sides as almost to meet in the centre. Many of the bays have large icebergs at their head, not yet free from the shores. During our stay there," he says, "I visited many of the icebergs. They were all formed in the valleys, at the head or sides of the bays, between the mountains, and make off into the sea. The snow falls to great depths on the mountains and valleys. The rays of the low summer sun, not reaching the snow in the valleys, melts it on the tops and sides alone of the mountains. The streams running down upon the great body of snow in the valleys, and congealing every successive year, add annually a new covering, until the whole space between the mountains inland, and on the side next the bay, presents a perpendicular and sometimes overhanging mass, several hundred feet high above the water, and a mile or two in length."

He further remarks, "In our cruise we searched some of the islands at Sandwich Land. In some places the ice made from the tops of the highest hills down into the sea. In one place, in particular, the sea had washed in under the ice as far as we could see, and this huge body of ice, four or five hundred feet in height on its face, and a mile or two in length, hung, not touching the beach by four or five feet, except at the sides of the mountains where it formed. The face next the sea was nearly perpendicular."

Nearer the south pole, the glaciers are not seen in the valleys and between the mountains alone, but along the whole shore. Captain Benjamin Pendleton, of Stonington, who cruised Palmer's Land for some hundred miles, and who, indeed, sent Palmer to explore the continent which has received his name, informed me that the ice rises from the shore, in some places, apparently 1500 feet; while, in the interior, the mountains rise like the Andes. The land is so concealed by the ice, that only a point is here and there seen. In the account of the Expedition of the Astrolabe, D'Urville says, that in passing along the newly-discovered continent of Adélie, they skirted, for twenty leagues, a perfectly vertical wall of ice, elevated 120 to 130 feet above the waves, whose surface was perfectly level. Here we have the source of some of the enormous level icebergs of which I shall hereafter speak. In other places, a coast was presented from 12 to 1800 feet in height, which was completely levelled upon its summit by the ice and snow, having only ravines and bays along the shores. Captain Ross describes the glaciers on the coast seen by him in the 70th degree of south latitude, as projecting many miles into a deep ocean, and presenting a perpendicular face of cliffs.

The fixed icebergs of the northern and southern polar regions being proper glaciers, we must expect to find them governed by the same laws, and exhibiting the same general phenomena, as the glaciers of the alpine summits which have been so thoroughly explored.

Like the glacier, the fixed iceberg is formed by the yearly accession of the winter's snow, which is transformed into *névé* or granular snow, or, as Mr. Emmons calls it, metamorphic snow, and then into glacial ice, by the absorption and congelation of the rain or water, which proceeds from the melting of the *névé* or snow. In the Antarctic regions, the annual accession must be very great. Mr. Davison, of Stonington, informs me that, when they first reach the South Shetlands, after seal, in the early part of the summer, the snow upon the islands is nearly twenty feet deep. Even as far north as

South Georgia, according to Mr. Fernald, the depth of snow from a single fall in winter is often over five feet.

Intelligent observers, as, for instance, the commander of the French Exploring Expedition, have found it difficult to account for the formation of the glacial ice, as no marks of stratification from the annual deposit were seen by him in the southern glaciers. But this appearance, as is shown by the observers of the Swiss glaciers, is replaced by a new structure which the glacial ice assumes in the course of its formation. This is a vertically-veined and ribboned structure of blue and white ice, resulting from an alternation of more or less compact bands of ice, their breadth varying from a small fraction of an inch to several inches.

The imbedding of bowlders and fragments of rock is a well-known phenomenon of the Swiss glaciers. De Martens, in his memoir upon the glaciers of Spitzbergen, says that blocks of rock exist at the surface and in the interior of the glaciers or fixed icebergs of that island. Mr. Fernald observes that, while at South Georgia, he visited an iceberg in a valley several hundred acres in extent. It was mostly covered with small stones, that appeared to have been washed down from the tops and sides of the mountains. This iceberg was nearly level, and about fifty feet above the surface of the sea. It was full of chasms, running in all directions, some thirty or forty feet deep. He remarked, at the time, that one of them was large enough to drive a cart through. The water was pouring down the mountain-sides, at the head of the iceberg, into the chasms, in streams large enough to turn a cotton-mill. This was in midsummer. He afterwards visited this glacier in winter; every chasm was filled up, and the whole iceberg had a new face.

Captain William Pendleton, of Stonington, remarked to me, before I called his attention to the subject, that there was something very singular about the ice of the South Shetlands. This was, that there would be often seen large rocks and pieces of stone projecting from the cliff of ice which formed the shores, some of them of many tons weight. These rocks had often particularly attracted his attention, and he could not account for their being so found. Mr. Thomas Davison, of Stonington, also informed me that he had seen rocks of several tons weight in the side of a fixed iceberg, where a portion had fallen off.

The glaciers of the South Shetlands and Sandwich Land are frequently covered with earth and sand, which appear to be often of a volcanic character.

Captains William and Benjamin Pendleton, Messrs. William Ash, and Thomas Davison, of Stonington, have separately described to me a singular phenomenon, which was observed upon the high glaciers of the South Shetlands, at the height of several hundred feet above the level of the sea. In many places, near the immense fissures which occur in those glaciers, are seen piles of black earth and sand. These piles or heaps of earth appeared precisely as if they had been carted and dropped in various places along the ice. Immediately below the earth, the hard blue ice could be seen, in the fissures, extending down hundreds of feet. This phenomenon, I think, must be peculiar to volcanic regions like the Shetlands. It would be difficult to account for the peculiar form and position of these piles of sand without the supposition of volcanic action.

The low glaciers would seem to be more thoroughly covered. Captain Benjamin Pendleton informed me that, in 1821, he lost a seaman at the South Shetlands, and, with a gang of twelve men, went ashore upon one of the islands to bury him in the earth. They dug in a great many places through the blue sand and earth; but, after digging six or eight inches, invariably came to the blue solid ice. They cut a hole in the ice, into which they placed the body, covering it with sand and ice, placing up a board, alas! the sailor's only monument, to mark the spot. In 1832, eleven years after, Captain Barnum dug the body from the ice, and found the body and clothes appearing as if they had been just deposited.

Mr. Fernald visited a volcanic island in Sandwich Land, whose centre was occupied by a very high peak covered with ice. The shores were covered with scoriæ and volcanic ashes, which appeared as if they had been recently deposited; for in some places smoke or gas was seen escaping. They dug into the scoriæ and sand to the depth of a foot or more, to find the source of the smoke, and found that the scoriæ and sand were but a superficial covering for the hard ice, which extended from the central peak to the sea.

If we review the facts now presented, we have exhibited the phenomena of fixed icebergs or glaciers, strewed with stones transported from the mountains, and covered with a new deposit of ice and snow; large blocks of stone, in the perpendicular wall of the iceberg, overhanging the sea; piles of sand on the high glaciers; sand and volcanic scoriæ covering the low glaciers upon the borders of the sea; and a body preserved for years from decay in the solid ice, and which might there remain thousands of years, like the elephant of Siberia. We have only to conceive of the increase of the low glaciers by the causes already indicated, and of the advance of all the ice which contains these extraneous materials into the deep seas which wash the polar coasts, of portions being detached, and floating into northern seas, to have in action, in our own day, the power which is supposed to have transported the materials of the drift from the ancient mountain-sides.

The supposition above made, that the glaciers, situated as those above described, might, in time, reach the sea, and be floated from the shore, will not appear improbable, when we consider the manner in which the glaciers advance, and the separation of the iceberg from the shore. Upon this difficult subject, the researches of Charpentier, Agassiz, Forbes, and others, on the glaciers of the Alps, have thrown much light. The glaciers of the Alps and Spitzbergen are filled with innumerable fissures, produced, as Agassiz conjectures, by the expansion of compressed bubbles of air within the ice. These fissures are generally parallel with the front face of the glacier; larger fissures or crevices are produced during summer. The innumerable fissures render the glaciers porous and permeable to water. The dilatation of the water freezing in the crevices, constantly tends to the enlargement of the glacier, which must advance in the direction where there is the least resistance. Although, in some cases, the weight will add to its progression, it is owing to this expansion, principally, that, at certain seasons, the glaciers constantly tend to advance. It would seem that fissures, precisely analogous to those of the Alps and Spitzbergen, are seen on the glaciers or fixed icebergs of the Antarctic regions.

Captains Pendleton, Messrs. Ash and Davison, and Captain Frederick G. Low, of Gloucester, all speak of the enormous fissures or chasms which are found on the surface of the glaciers, at the height of many hundred feet above the sea. These fissures are described as running parallel with the shore, and are often several miles in length. The observers have particularly noted their length and width, from being often obliged to walk along them for a great distance before finding a place narrow enough to be crossed in safety. Captain Barnham judged that they were sometimes over five hundred feet deep, as he has been unable to see the bottom when looking down. Captain Low informs me, by letter, that he measured the depth of one eighteen inches wide, into which he fell when the ice was covered with snow, although he saved himself by extending his arms, and found it seventy-five feet deep. The description given by all, of the extreme beauty of the azure light reflected from the walls of the fissures, strikingly reminds one of the accounts, given by Agassiz and others, of the same appearance in the fissures of the Swiss glaciers, a peculiarity of color which Agassiz says is witnessed only in the mountain waters.

Prof. Forbes says that these singular vaults on the Alps have all the grotesque varieties of outline which are so much admired in calcareous caverns, but which here show to far greater advantage, in consequence of their exquisite transparency and lustre, and from being illuminated, instead of by a few candles, by the magical light of a tender green, which issues from the very walls of the crystal chambers.

Men and dogs have often been lost in these fissures while crossing the glaciers, when they were covered with snow. The sealers use the precaution of passing a small rope around their waists, to be held by their companions when crossing the glaciers, which are covered with snow.

I may be pardoned for relating an anecdote of a remarkable escape, which was told me by several individuals who knew the fact. A young man from Stonington, who visited the South Shetlands on a sealing voyage, was anxious to explore one of the glaciers; as he could not induce his comrades to accompany him, he started alone. While walking on the surface of the glacier, which was then covered with snow, he fell into a fissure, to the depth, as was supposed, of over a hundred feet. He was so much bruised and injured by the fall, that he remained senseless, it was supposed, some hours. Upon reviving, he found himself wedged between the walls of the narrowing chasm. His first feeling was regret that he had not been instantly killed, as there appeared no mode of escape. But, as he thought of dying in such a manner that his friends would never know of the place or manner of his death, he determined to make an effort to save his life. Taking his jacknife, he began to cut steps for his feet in one side of the wall, while he pushed himself up with his back. He continued cutting until his fingers were completely lacerated by hard, sharp ice, and until the chasm became so wide that he could just reach the ice with his knife. However, he at length reached the surface, and was found by his comrades crawling along the glacier, twenty-four hours after he had fallen. Although he thus wonderfully escaped with his life, he was so lacerated and bruised that he was unfit for labor for several months. As my informant said, no one but a man of remarkable spirit and strength would have had the energy to save himself under such circumstances.

The same expansive power existing in the glaciers of the polar regions as in those of the Alps, they must be constantly advancing into the sea, as the glaciers of the Alps do along the valleys. It is well known that, on the Alps, these prolongations of the winter-world above are protruded into the midst of warm and pine-clad slopes and green sward, and sometimes reach even the borders of cultivation. As Prof. Forbes says, the very huts of the peasantry are sometimes invaded by this moving ice; and many persons now living have seen the full ears of corn touching the glacier, or gathered ripe cherries from the tree with one foot standing on the ice.

The deep seas, which are always found near such mountainous coasts, readily float away those masses which become detached. No one whom I have particularly examined has ever witnessed the actual separation of those vast islands which are found floating, and of which I shall hereafter speak. But, from the accounts of all those who have visited the southern glaciers, immense masses are constantly falling from the ice-cliffs, which are floated away by the sea. Captain Benjamin Pendleton informs me that he has seen the ice fall from a cliff for the length of half a mile. The noise made by the bursting of the glacier and fall of ice is compared to thunder. When the sealers first visited the South Shetlands, they supposed the noise made by the bursting of the iceberg was occasioned by shocks of an earthquake. The harbors and bays in which the sealers lie are often filled in this manner by the fall of ice. Mr. Curtis, of Portsmouth, who was with Mr. Fernald in South Georgia, stated to me, that on one occasion they put into Merry's Bay, on South Georgia. The sea and the harbor, when they put in, was entirely free from ice. The next morning, the bay was so filled with ice that fell during the night that they could not get out to sea. They went upon the hills at the head of the bay, and, although the weather was clear, could see ice as far as the eye could reach.

It is a fact, which should be remembered in connection with the object of our inquiries, that the greater portion of the ice falling from the glacier, consists of comparatively small masses; a large portion of the ice would be dissolved or broken up before being transported to a great distance from its source. For, though smaller masses would be tossed about by the winds and waves, and might be easily dashed to pieces on the shore, a large portion of the foreign materials of the glacier, being detached with the smaller masses of ice, would be dropped within a comparatively short distance from the glacier.

An interesting phenomenon, connected with the fall of ice in the glacial seas, is the formation of enormous waves by the sudden displacement of large masses of water. Captain Low informs me, in his letter, that the ice in the harbor where he lay, was from three hundred to a thousand feet high; and that, whenever there was a heavy fall of ice, it made so much swell that the ship would roll three or four streaks. Mr. Fernald says that, in one of the bays of South Georgia, where there was a large fixed iceberg or glacier, which he judged to be four hundred feet high, they landed from the boat to search the beaches for seal. The boat was hauled up on the beach, her stern just touching the water, when a large piece fell from the iceberg into the bay, and made such a sea as to throw the boat sixteen feet upon the beach. The bay was at this place a mile wide. This statement is corroborated by two other individuals of the same party, who well remember the fact. Mr. Darwin speaks of a great wave produced by the fall of ice in Terra del Fuego, which he witnessed, and justly remarks that the waves formed by the fall of ice must be a powerful agent in rounding and sweeping together large fragments of rocks, and likewise in wearing away projecting portions. They must also be powerful agents in lifting up and bearing away large icebergs already loosened, in breaking to pieces the smaller bergs, in purging the larger icebergs from the extraneous matters with which they may be loaded, and in loosening and detaching fragments of rock — effects which we shall hereafter see must often have been produced on ice, at no great distance from their place of departure.

II. As the aqueo-glacial theory of drift supposes the icebergs of the ancient seas to have been agents of enormous power, we may judge of the probability of these conjectures by inquiring as to the magnitude and form of those found floating in our present oceans.

Those which come from Baffin's Bay, although often of great height, appear to be of less extent than those seen south of the equator. Captain Crocker, of New Bedford, measured, with his sextant, one which was aground upon the Banks of Newfoundland, and found it to be two hundred and forty-four feet in height, and half a mile in length. Parry counted from his deck, at one time, no less than one hundred and three icebergs, some of them from one to two hundred feet in height. Captain Ross, in Baffin's Bay, saw seven hundred in sight at one time, and several aground together, in 250 fathom, 1500 feet. Those found in the Southern Ocean are of vast dimensions. Several have spoken to me of icebergs which they judged to be three or four miles long. Captain William Beck, of New York State, informed me that, in 1835, in latitude 46°, he saw an iceberg which must have been from five to ten miles long. His own impression, and that of the master of the ship, was that it was no less than ten miles in length; when they first saw it, they supposed it to be land. They were an hour and forty minutes in sailing by it with a good wind. Mr. Fernald and Mr. Curtis saw one near South Georgia which they judged to be from ten to fifteen miles in length, as they were several hours in rowing by it in a six-oared boat.

The estimates, made without actual admeasurement, cannot be much relied upon, although I am inclined to think those given by my informants have been rather within, than beyond the truth. It will be interesting to refer to admeasurements carefully made by the officers of the French Exploring Expedition. I found that ten icebergs, whose dimensions were given in one of the charts accompanying the account of the Expedition of the Astrolabe, were between 90 and 150 feet in height. Four were between 180 and 225 feet in height. Sixteen, which, with two exceptions, were over 100 feet high, were from about 4000 to 6500 feet in breadth. Captain D'Urville remarks that, in going towards the west, they had already seen some icebergs of fine dimensions, attaining from about two miles and a half to five miles in length, not to speak of their breadth. But, on the 20th of February, they passed one which, having been accurately measured, they found to be a compact mass, 11,000 toises, over 13 miles, in length, and 100 feet high, with walls perfectly vertical. When we remember that the submerged portions of these icebergs must be from six to eight times more considerable than the portion which is visible, — for the experiments upon the weight of ice give about these proportions, — we may be truly astounded at their magnitude. We may see in these floating ice-rocks, when fairly set in motion, an agency of almost resistless mechanical power. The ploughing up, or levelling and pushing along the loose materials composing the shoals, which their lower portions might touch, the piling up of sand and pebbles along their sides and extremities, and the grating and binding of rocks and beds of clay, are effects which we may readily conceive to have been produced by them.

We cannot omit to allude to the various and picturesque forms which icebergs exhibit, although, perhaps, no connection may be traced between their forms and the mechanical effects attributed to them. Every variety of form may be seen, from the huddled, peaked, and furrowed surface, to a uniform plain. To one observer, the marvellous spectacle which their fantastic forms present, recalls the palaces of crystal and diamonds, so common in fairy tales; another beholds merely an island, with level summit and vertical walls, resembling cliffs of chalk, in which he seeks in vain for the picturesque beauty which he has heard described. The remarkable resemblances, which have been noticed in these ice-islands, cannot exist merely in imagination; for the account given me by a rough, old whaler, who could see Amsterdam and Rotterdam, with their steeples, balconies, and porticoes, in the icebergs which beset his vessel, is repeated by the polished French navigator, who says that, as the sun shone upon the ice of the Antarctic, it appeared like an immense city, with its palaces, its domes, and its towers.

III. I will now proceed to examine the facts which will serve to explain the mechanical power of moving icebergs, and consider the nature and rate of their movement, their overturning and stranding.

All the observers whom I have examined, speak, without exception, of the extreme slowness and steadiness of the motion of large floating bergs. Nearly all say that they appear to be wholly unmoved by the winds or waves, although one or two say that they appear to be very slowly moved by the wind. Scoresby says that, in the strongest gales, they are not perceptibly moved. Mr. Fernald remarks that the motion of large icebergs is imperceptible. "I have seen them," he says, "in a heavy gale, with a tremendous sea running; they appeared as steady and motionless as the earth. The sea dashes on their windward side as upon a fixed rock, while under their lee a vessel may lie in perfect safety." Mr. Curtis remembers lying to in a small schooner, under a large ice-island, during a tremendous gale; yet the little craft lay perfectly safe, and made good weather. So great a portion of the large icebergs being below the surface, their motion must be principally influenced by the under currents, which have a regular and steady flow.

The irregularity and unsteadiness in the movements of icebergs has been considered an important objection to the theory which ascribes the ancient diluvial scratches and furrows to the scoring and grating of the iceberg along the rock. If the facts and testimony which I have presented can be relied upon, they show, in the icebergs of the present seas, precisely that regularity of movement which was required to produce the effects ascribed to the icebergs of the ancient seas.

I have carefully examined all those who have seen icebergs, as to the rotatory motion which has been attributed to them. No one of those whom I have examined ever saw any such motion, with, perhaps, the exception of Captain Barnum, who says that he has seen an iceberg move very slowly on its vertical axis. Captain William Howland, who was engaged in the seal fishery in the northern seas, and whose employment led him to land often on the icebergs to procure seals, says that it was impossible that such a motion should have occurred without his observing it. It is a well-known fact, that the Greenland whalers and sealers move their vessels to the floating icebergs, to protect themselves from the drift ice. According to this evidence, some other cause must be sought for the formation of the bowl-shaped cavities which occur in the drift, than the rotatory or semi-rotatory movement of icebergs.

The only remarkable movement which has been observed in floating icebergs is that occasioned by their overturn. This phenomenon has been noticed by all observers. The falling of portions of the mass, which is called the calving of the iceberg, or the wasting of the lower portions by warm water, destroys the equilibrium of the berg, and causes it either to overturn entirely, or so far as to bring a new surface to view. Although, from the descriptions which are given, the overturn of a huge iceberg in a calm sea, while the sun is shining upon its glittering peaks, with all the circumstances of the crushing of the fractured ice, the foaming and rolling of the disturbed water, the sudden change in the form and outline of the mighty mass, must form a scene of surpassing grandeur, the only effect which has interest in our inquiries is the production of enormous waves, equalling or surpassing those produced by the fall of ice, which are said to be so heavy as to endanger boats at the distance of several miles, and, in a perfect calm, to have dashed over the bows of a vessel of forty tons, at a distance of five miles. By this agency, Scoresby says, fields of ice are often broken up; and by the same agency the stranded bergs might be lifted up, and urged along the bottom upon which they are grounded.

Icebergs are often seen aground in great depths of water. I have already mentioned those seen aground by Ross in

1500 feet of water. The large proportion of the mass which is below the water, must cause them to be very easily and frequently stranded. None of those whom I have examined have ever witnessed any movement in the stranded bergs, with the exception of Captain Low, who, in his letter, remarks that icebergs, when aground, have the same laboring movement that a ship in shore would have, with a heavy cargo and a heavy swell. It is difficult, however, to conceive how a large iceberg, a great proportion of whose mass is below the influence of the swell, could have a movement analogous to that of a ship which is lifted by every wave. It would seem, therefore, that the formation of hollows in the drift cannot be explained by supposing the grinding and settling down of the stranded berg into the loose materials.

That an immense lateral force must often be exerted by the pressure of the iceberg upon the shore or shoals against which they may be driven, is shown by a fact stated by Dr. Richardson — that the icebergs in the Arctic seas are driven with such force against the shore, that they push before them, to the height of several feet, every pebble or bowlder which lies upon the bottom.

The length of time during which icebergs remain aground may have some bearing upon the subject of this inquiry. Captain Simpson, of New Bedford, saw an iceberg, half a mile in length, aground at the mouth of the River La Plata, in the winter, where it was wasting away during two months. Captain Benjamin Pendleton saw one aground in 80 fathoms, near the South Shetlands. Captain Barnum saw one aground in McFarlane's Strait, three or four miles in length. He saw it for two years, and several of his crew remembered it as one which was seen by Captain Pendleton's party eleven years before. Captain Matthew Luce, of New Bedford, saw one 100 feet high, aground in 48 fathoms, on the Banks of Newfoundland. The fishermen had fished around it for thirty days. Barriers of this magnitude, remaining for so long a period, must exert a strong influence upon the distribution and deposit of loose materials. Icebergs stranded where the detritus, borne down by rivers or moved by currents, are deposited, as the instances of this aground at the mouth of the La Plata or the Banks of Newfoundland, would be, in time, surrounded by the loose materials; the dissolution or foundering of the berg would present hollows like those seen in the drift; or the iceberg might protect the bank upon which it was aground, and prevent it from being washed away, while the materials all around might be carried away. The dissolution of the berg would leave a hill.

In connection with the subject of drift, it is interesting to observe the direction in which the present icebergs are carried from their source, and the northern and southern limits of their transport. Their general course, as is well known, is from the polar towards the equatorial seas, transported as they are by the currents which set from the poles towards the equator. If the northerly and southerly direction of these polar currents is due to the excess of evaporation in the warmer seas, and a flow of water from the colder oceans to supply the loss, a theory which has been proposed by the French philosophers, although I hardly dare to suggest any theory, similar currents must have prevailed in the ancient frozen seas, so that the ancient currents must have corresponded with the general course of the drift.

The facts collected, as to the northern and southern limits of the transport of ice, are as follows: Captain Crocker, of New Bedford, who has crossed the ocean in command of a packet ship one hundred and sixty-four times, says that he never saw icebergs south of the 40th degree of latitude, and his impression is that all seen south of the 46th degree are small. Captain Luce, of New Bedford, has seen them in 41° north latitude. They have been seen near the Azores, in latitude 42°. Captain Lane, of Portsmouth, informed me that, in the year in which the President was lost, in going to Marseilles, his ship came near striking an iceberg in about 41°, and as far east as the 19th degree of longitude. There is no evidence of their having been seen in the northern hemisphere, south of latitude 40°. In southern latitudes, icebergs have been seen at different points off the Cape of Good Hope, between latitudes 36° and 39°. One seen in those latitudes was two miles in circumference, and 150 feet high. They have been seen at the mouth of the Rio de la Plata, in latitude 36°. Captain Simpson informs me that he has several times heard of them off Cape Antonio near the same latitude.

These immense masses cannot owe their destruction alone to the melting of their surface by the sun or the heat of the water. Did their dissolution depend alone upon this cause, they might often be transported within the tropics. They seem to contain within themselves a principle of destruction, after they have been subjected to air or water of a certain degree of temperature. Captain William Howland informed me that the icebergs in northern seas, among which he cruised in pursuit of seals, would often founder, as he expressed it, during the summer weather. This foundering was produced by the bursting of the large bergs with a tremendous report, louder than that of a cannon. After the explosion, not a piece of ice larger than a hogshead would be visible.

Mr. Ichabod Goodwin, a merchant of high standing in Portsmouth, who was formerly a shipmaster, informed me that he was crossing the Atlantic in the ship Marion, in the month of May, 1827, when, in latitude 41° 30′, and in longitude 50°, they passed within a quarter of a mile of an iceberg which they judged to be about sixty feet high, and over a hundred feet in length. While all hands were below, they heard a report like the discharge of a cannon, and, upon rushing on deck, found that the iceberg had exploded, and had gone completely to pieces. The sea where it just before lay was in considerable agitation. Upon looking with a glass, an hour after, not a particle of ice could be seen. Captain Lake, of Portsmouth, has witnessed the same phenomenon off Labrador.

This explosion of the iceberg may be attributed to the same cause to which Agassiz attributes the fissuring of the glaciers, namely, the expansion of the air, compressed at the time of the freezing and formation of the berg. The comparatively small number of icebergs seen in lower latitudes, favor the conjecture that this must be a common mode of destruction. Without some such agency, our oceans would be completely obstructed with floating ice.

The fixed limits which appear to be thus assigned to the transport of icebergs is an interesting fact, and peculiarly so in connection with the aqueo-glacial theories of drift, if the statement made by Humboldt, and repeated by Darwin, is correct, that no angular fragments are found in the vast intertropical plains of South America, and that, within the southern and northern hemispheres, no fragments coming from polar regions or mountain groups arrive within any considerable distance of the limit of the tropics.

IV. The most important view in which icebergs are to be regarded is with respect to their influence in the transportation of bowlders and angular fragments of rock and earth. Most geologists unite in supposing that icebergs were important agents in lifting and distributing the enormous bowlders and erratic blocks which are found in the drift, at a distance from their parent rocks. I shall give all the positive and negative evidence which I have been able to collect upon this point.

Captain William Howland, who was in the constant habit of landing upon the icebergs in the northern seas, observes that he has often seen bowlders and fragments of rock from four to six feet in diameter, although not more than one in a hundred would have any foreign matters on it. Captain Sampson, of New Bedford, informed me that he once saw, on the sloping side of a large iceberg, upon the Banks of Newfoundland, a large quantity of earth. It appeared to be about a foot in thickness; near the water it had been washed away by the waves. The space thus covered seemed to him to be about fifty feet in width, and an eighth of a mile in length.

Captain Barnum, of Stonington, informed me that he saw, in latitude 55° south, five large islands, whose surface was black with an admixture of earth and stones. Being struck with the appearance of the icebergs, he landed upon one. Many of the stones were a foot in diameter. They had sunk in the ice, and small pools of water had formed around them.

It would seem that the occurrence of foreign materials upon the icebergs is to be observed principally near their source. Captain Benjamin Pendleton remarked that, upon a large number of the icebergs in the extreme southern latitudes, and especially near the South Shetlands, bowlders and fragments of rock of various sizes could be seen. He compared their magnitude to the boxes and bales of goods lying in a country store. It was as common, he said, to see rocks and bowlders in the icebergs at the South Shetlands as to see them at Stonington Point. Those seen at a distance from the Shetlands, near Cape Horn, for instance, rarely if ever contained them.

Mr. Low says, in his letter, that he has seen large rocks and earth attached to icebergs, but saw them near the shore. He never saw earth or rocks on floating icebergs far from the shore.

Dr. Gilchrist, of the navy, who was one of the surgeons of the Exploring Expedition, informed me that they saw no bowlders or fragments of rocks upon icebergs until near the great barrier of ice, and in close proximity with the land, at which time, as is well known from Mr. Wilkes's synopsis, they met with icebergs covered with mud and rock.

These facts are entitled to observation, in connection with the fact stated by our geologists, that the great mass of the drift will be found within fifteen or twenty miles from its original place.

Enormous blocks, however, are sometimes carried to a considerable distance from their original position.

Captain William Beck, formerly of Stonington, informed me that, in latitude 63° south, and about one hundred miles from the South Shetlands, he saw an immense mass of round rock attached to a floating iceberg. The diameter of the rock he judged to be at least twenty feet. It appeared to him of the size of a small house. The fact was so curious that he noted it in his journal.

Fewer facts of this kind are mentioned in the narratives of voyagers than might be supposed from the great transporting agency which geologists have ascribed to floating icebergs.

All the recorded facts of importance can be briefly presented.

The most striking is that mentioned by Scoresby, who speaks of five hundred icebergs, which he saw in the 70th degree north latitude. Many of them contained strata of earth and stones, and were loaded with beds of rock of great thickness, of which the weight was conjectured to be from fifty to a hundred thousand tons. This, it will be remembered, was so far north as to be, probably, at no great distance from the source of the iceberg.

Weddel says that, when in latitude 61°, longitude 31, with islands of ice his constant companions, he saw an island which he supposed to be rock, and fully expected to find terra firma in a short distance. It was not until passing within 300 yards, that they could satisfy themselves that it was not land; the north side was so thickly incorporated with black earth, that hardly any one would have hesitated to pronounce it land.

Mr. Bynoe, the surgeon of the Beagle, informed Mr. Darwin that, more than twenty miles from the head of Sir G. Eyer's Sound, they landed upon one of many floating masses of ice, which were only two or three feet above the surface. In the central part of the surface was a piece of granite, of an angular form, partly imbedded. The ice had melted so as to make a shallow pool of water around it. Mr. Sorrel, boatswain of the Beagle, said that he had seen, in the seas around South Georgia, small icebergs, with mud and gravel upon them, floating from the shore. Mr. Sorrel also saw, to the eastward of the South Shetlands, an iceberg with a considerable block of stone upon it.

Captain Hunter informed Mr. Darwin that he had seen numerous islands of ice in the neighborhood of South Georgia, many half black, apparently, with earth from the land to which they had adhered, or with mud from the bottom on which they had formed.

Dr. Mertens, in his memoir upon the glaciers of Spitzbergen, said that his colleague, Mr. E. Hobart, had seen floating ice in crossing Bell Sound, stained at the surface with earth, which, for the moment, was taken for islands.

The negative testimony upon this subject will, to many, appear remarkable; for, of more than sixty persons whom I have examined, only seven remember to have seen foreign materials upon the iceberg. Captain Crocker, who, as I have before remarked, has crossed the Atlantic one hundred and sixty-four times, and who says that he has seen thousands of icebergs, never remembers to have witnessed any such appearance. Captain Luce, who had seen hundreds of icebergs, never saw any stones or earth upon them. Mr. Fernald, a remarkably accurate observer, although he says that he has seen hundreds of icebergs between Georgia and Sandwich Land, never saw stones or earth on any of them afloat. The commander of the French Exploring Expedition makes no mention of his having seen extraneous matters on the numerous islands seen by him, although he had been particularly instructed to notice such phenomena. Dr. Mertens says that, in the voyages of the Récherche, in the Spitzbergen seas, he never saw blocks transported by ice. Captain Biscoe, who had extended his researches in the Antarctic, says, in a letter to Mr. Darwin, that he had never observed, in a single instance, mud or fragments of stone on the numerous icebergs encountered by him in his voyage. The evidence upon this subject has convinced me that islands of ice, floating at a distance from their source, are remarkably free from all impurities.

It must be remembered that the evidence upon this subject is negative, and not entitled to the same weight as positive testimony. The voyagers are so much occupied with the perils of navigation among the ice as to be inattentive to phenomena which would be observed by scientific men. Again, where mud or stones were attached to the bottom of icebergs at the time of their separation from the glacier or land, especially the level bergs, which are not liable to be overturned, the materials attached would never become exposed, while they would soon be loosened by the action of the water. Another consideration is to be observed. It cannot be questioned that the foreign materials are more abundant upon the icebergs near their source. Around the smaller stones and sand the ice is melted, so that they would be easily detached. Around the larger blocks, from the statements of Captain Pendleton, and the observations of Agassiz, the ice is melted, so that the large blocks project upon the ice; they might thus be easily detached by contact with other icebergs, the overturning of the iceberg, or the washing of waves produced by the fall or overturn of neighboring masses of ice.

I am so fully aware of the danger which exists of forming altogether too broad conclusions as to past phenomena, from the limited examination of actual causes, that I hesitate to present any more general inferences from the facts now exhibited than such as have been already hinted at. But, as there seems to exist a right to demand of every collector or observer of facts the conclusions which he has been led to form from their examination, I will briefly present the inferences which may be drawn from the facts which I have exhibited as to the mechanical and transporting agency of ice in the ancient seas.

1. The steadiness in the movement of the icebergs of our present seas, in the direction and under the influence of the great under currents, and the southerly course of these under currents in our northern hemispheres, from causes which must have prevailed, as well in the ancient as in our present seas, favor the theory that icebergs, with gravers of rock in their lower portions, or pressing the sand and gravel, by their immense weight, along the surface of the rocks, in the bottoms of the ancient oceans, might have scored and grated along the rocks, grinding off their salient points, and leaving the surfaces smoothed and striated in the fixed southerly direction in which now they occur.

The objections that the surfaces of the rocks must have been often protected from the action of the moving icebergs by intervening mud and sand, and that the lower portions of icebergs could not correspond with the uneven surfaces of the rocks, and leave the traces of their progress alike on the mountain-sides and in the valleys, cannot be met by any facts above presented, as to the form and nature of movement of icebergs. We may, therefore, conclude that they have not been the sole instruments in furrowing and grooving the rocks beneath the drift.

2. The immense magnitude of the icebergs in our present seas, and the evidence of their present mechanical power, when moved by strong currents, warrant the conclusion that they must have exerted a powerful influence in pushing and crowding along the sand and gravel which formed the bottoms of the ancient seas, and in thus forming accumulations somewhat analogous to the moraines of the glaciers.

3. The length of time during which large icebergs may remain aground, even when swept by rapid currents, which currents might surround them with sand and mud, or sweep away the loose materials, leaving hills or banks upon spots protected by the stranded icebergs, favor the idea that this agency had an influence in giving the present form to our drift.

4. The formation of glaciers or fixed icebergs, upon the present coasts, under such circumstances that fragments of rock, and detritus from the land upon which they form, become attached to them, the constant advance and separation of the glaciers from the land, and their floating into the sea as icebergs, with their loads of earth and rocks, lead to the conclusion that icebergs, breaking off from the shores of ancient seas, were important agents in the transportation of rocks and earth from their parent beds. The existence of immense fragments of rock, in situations where they could not have been carried by water alone, as on the sides of hills, with valleys intervening between them and their parent beds,

but where they might have been left by stranded icebergs, favors this conclusion.

5. The fact that a large part of the fragments detached from glaciers are of small size, and that these small fragments of icebergs or glaciers are dissolved and broken to pieces, at no great distance from the parent glacier, together with the fact that fragments of rock, although often seen near the source, are rarely seen at a distance, lead to the inference, that the same causes limited the transportation of the bowlders and larger fragments of the drift, to within the comparatively small distance from the parent rocks at which they now occur.

ART. XXXVIII.—DESCRIPTIONS OF LAND SHELLS FROM THE PROVINCE OF TAVOY, IN BRITISH BURMAH. By AUGUSTUS A. GOULD, M. D. Read September 6, 1843.

In correspondence with the Rev. Francis Mason, missionary of the Baptist Board for Foreign Missions at Tavoy, one of the provinces of British Burmah, I expressed a wish that he would send me some of the shells he might meet with in his journeyings. He very promptly interested some of the natives in the undertaking, and, by their assistance, soon forwarded me a collection, which I propose to notice in the present paper.

The province of Tavoy is situated between 13° and 14° 30′ north latitude, and between the Bay of Bengal on the west, and the kingdom of Siam on the east. It is traversed by a range of mountains, from 500 to 1500 feet high, and is well watered by large rivers. As it is out of the track of commercial enterprise, it has been little explored by Europeans.

The collection contained thirty-five species, out of which I have, as yet, been able to identify only four or five as described species. This is a very extraordinary proportion of new shells to be obtained from any part of the world, at the present day. In the present paper, I propose to confine myself to some of the land shells which I regard as new; reserving the fresh water species for another occasion.

HELIX PROCUMBENS.

Plate XXIV. Fig 1.

Testâ discoideâ, supra planulatâ, subtus convexâ, epidermide pallidè corneâ, latè umbilicatâ; anfr. quatuor, ultimo deflecto; aperturâ rotundatâ, labro reflexo, albo.

Description.

Shell depressed, discoidal, flat above, passing off below, from the periphery, by a convex slope, to the rounded verge of a broad, profound umbilicus, which distinctly exhibits all the whorls within; whorls four, the outer one deflected, so that the commencement of the lip is more than half way down towards the umbilicus; aperture rounded, rather wider than high; lip white, reflected, not flattened, the two extremities nearly continuous; surface slightly wrinkled, covered with a pale yellowish horn-colored epidermis.

Diameter $\frac{3}{4}$ of an inch; height $\frac{1}{4}$ of an inch.

Belongs to the group of which H. *planulata* is the type.

HELIX INFRENDENS.

Plate XXIV. Fig 6.

T. orbiculatâ, depresso-conoideâ, corneo-virescente, subcarinatâ, supra rugosè striatâ, infra glabrâ, nitidâ, regione umbilicali indentatâ; anfr. 7 convexis, suturâ impressâ; aperturâ coarctatâ, labro vix reflexo, dentibus tribus pliciformibus instructâ.

Description.

Shell small, orbicular, depressed-conical, of a greenish horn color; spire slightly elevated, composed of about seven convex, compact whorls, elegantly marked above by prominent, equal, and equidistant radiating striæ, which gradually disappear, till, beneath, it is quite smooth and shining; the periphery is slightly carinated; the under side is convex, but sinks, at the umbilical region, into a deep pit. The aperture was apparently intended to be lunate; but, in consequence of an inflection of the lip, beginning at about one third the distance from the carina, it is rendered almost linear, and is still farther contracted by three oblique, pliciform teeth, on the inflected portion; lip white, very slightly reflected.

Diameter $\frac{2}{5}$ of an inch; height $\frac{1}{5}$ of an inch.

Very closely allied to H. *Rangiana*, Fer.

HELIX (Caracolla) GABATA.

Plate XXIV. Fig. 9.

Testâ albido-corneâ, supra planulata, infra valdè convexâ, latè et profundè umbilicatâ; anfr. $4\frac{1}{2}$, leviter striatis, ultimo carinâ castaneâ circumdato; aperturâ subquadratâ, labro albo, reflexo.

Description.

Shell pale horn-color, shining, showing about four and a half whorls above, which compose a nearly discoidal spire; suture distinct; the last whorl somewhat channelled near the periphery, which consists of a prominent, obtuse, compressed, chestnut-colored carina, fully developed to the lip; beneath, greatly convex, descending suddenly into a broad, deep, tunnel-shaped umbilicus, passing nearly through the shell; surface faintly marked by the striæ of growth; aperture rendered somewhat quadrangular by the junction of the lips and the two angles at the keel, and the ridge at the umbilicus; lip white, reflected, commencing below the keel, then rising to a level with it.

Diameter $\frac{4}{5}$ of an inch; height less than $\frac{2}{5}$ of an inch.

Much like H. *scabriuscula* in form and aperture, but quite different as to surface, color, and umbilicus.

HELIX (Caracolla) ANCEPS.

Plate XXIV. Fig 4.

Testâ lenticulari, pallidè corneâ, acutè carinatâ, supra striatâ, subtus nitidâ, vix perforatâ; anfr. 6, suprâ planulatis, suturâ submarginatâ; aperturâ lunulari, labro simplici, angulatâ.

Description.

Shell depressed-conical above, somewhat more convex beneath, compressed, of a pale horn color, rather fragile;

whorls six, flattened above, and separated by an indistinct, margined suture; periphery prominently and acutely carinate, above regularly and closely costate-striate; beneath convex, with very minute striæ of growth, smooth and shining; centrally-excavated, and with an almost imperceptible umbilicus; aperture commencing a little below the carina, lunate, with a sinus or angle where the keel terminates; lip simple, sharp.

Diameter $\frac{7}{10}$ of an inch; height less than $\frac{2}{5}$ of an inch.

In general form, color, and sculpture, it resembles H. *acies*, Fer., (*acutimargo* Rosm.) but is much smaller, and not widely umbilicated.

HELIX (Caracolla) RETRORSA.

Plate XXIV. Fig 5.

Testâ orbiculatâ, sinistrorsâ, utrinque convexâ, pallidè castaneâ, arctè umbilicatâ; anfr. 5, lineis longitudinalibus et volventibus minutè rugosis, ultimo carinato; aperturâ rotundatâ, labro acuto.

Description.

Shell large, sinistral, orbicular, about equally convex above and below, but most rounded below; of a pale chestnut or fawn-color above, growing paler to the umbilicus, where it is pale horn-color. Surface somewhat undulated by the irregular lines of growth, and rendered minutely rugose by very fine, serpentine, revolving lines, forming conspicuous wrinkles near the carina; whorls five, forming a regular, moderately elevated spire, the suture slightly impressed, the periphery surrounded by a prominent, compressed, but acute keel, which becomes lost towards the aperture; aperture rounded, height and width about equal; lip simple, slightly everted in the umbilical region; some vitreous matter across the penultimate whorl; umbilicus rather large, but not deep.

Diameter $1\frac{3}{4}$ inches; height 1 inch.

This large heterostrophe Helix resembles an inverted specimen of one of that group of shells, so common and so varied, from the Philippine Islands, of which H. Lamarckii is one. Young specimens might, at first glance, be confounded with H. *Himalana*, Lea; but the *Himalana* is much more globular, the surface less striated, the carina quite indistinct, and the umbilicus smaller.

VITRINA PRÆSTANS.

Plate XXIV. Fig 2.

Testâ depressâ, fragili, nitidâ, stramineâ; anfr. tribus, striis incrementi et striis volventibus reticulatis; aperturâ sub-coarctatâ.

Description.

This shell has the usual ear-shaped form of other species of the genus. It is principally remarkable for its great size, being, perhaps, the largest species known. There are about three whorls, not rising into a spire, distinguished by a delicate suture, which has an adjacent impressed line. The surface is delicately marked by the lines of growth, and these are crossed by shallow, somewhat scattered, revolving furrows. The aperture is nearly circular, rather wider than high; the lip is very delicate, generally inflected near its posterior junction, and the final additions to the shell are such as to cause the outlet to be somewhat contracted, or pursed in. The color is dark straw-color, or amber-color, inclining to green. A thin layer of enamel unites the two extremities of the lip.

Greatest length $\frac{4}{5}$ of an inch; heighth $\frac{2}{5}$ of an inch.

HELIX (Streptaxis) PETITII.

Plate XXIV. Fig 7.

Testâ obliquè ovato-subglobosâ, albido-virescente, arctè umbilicatâ; spirâ anfr. 7, convexiusculis, apice obtusâ, supra striatâ, subtus lævigatâ; aperturâ subquadratâ, anticè rotundatâ; columellâ dente lamelloso instructâ; peristomate albo, undulato, reflexo, ad angulum posticum attenuato.

Description.

Shell obliquely ovate-globose, of a greenish white color, having a moderate, regular umbilicus; spire obtuse, of seven whorls, which, on the superior aspect, exhibit distinct and regular lines of growth; beneath. polished about the umbilicus; aperture semi-elliptical, rather large, having a single compressed tooth on the transverse portion, nearest to, and partially joining, the external lip; lip white, reflexed, and recurved, the external portion salient near the middle, and rapidly narrowed posteriorly.

Length $\frac{2}{5}$ of an inch; breadth less than $\frac{3}{10}$ of an inch.

In size and exterior, it closely resembles S. *aberrata*, Souleyet, but is rather larger. The aperture of the latter is, however, smaller, and ringent with teeth, besides having three folds near its channelled umbilicus. Its aperture is more nearly like S. *Souleyetiana* Petit; but the latter is described as having its umbilicus extending into a canal, and its peristome sub-continuous.

I dedicate it to M. Petit de la Saussaye, one of the most accomplished conchologists of the present day, who has added several species to this subgenus, and to whom I am under many obligations.

BULIMUS ATRICALLOSUS.

Plate XXIV. Fig. 3.

Testâ solidâ, imperforatâ, oblongo-ovatâ. vix striatâ, sulphureâ; anfr. 7 convexiusculis, ad suturam constrictis; aperturâ lunato-ovali, basi sub-effusâ, labro albo, reflexo, marginibus callo atro junctis.

Description.

Shell imperforate, elongated ovate, solid, smooth, and shining, of a sulphur-yellow color; whorls seven, moderately convex, somewhat girt in near the suture; last whorl nearly two thirds the length of the shell; aperture ovate-lunate, somewhat angular at base, and slightly effuse; lip white, widely revolute, not flattened; columella white, the callus uniting the extremities of the peristome, and, as far within the shell as can be seen, pitchy-black; from the midst of it, extending across the penult whorl, is a line of the same color, showing the termination of a former stage of growth.

Length $2\frac{1}{3}$ inches; breadth 1 inch.

Two specimens of this shell were received. They are of the same type as some of the shells from the Philippine Islands, as *vittatus*, *Dryas*, and *maculiferus*. The black or molasses-colored callus seems to be constant, and distributed as in B. *iostoma*; though I have a shell, probably from Singapore, which is somewhat shorter, more ventricose, and with one whorl less, and the entire aperture white.

CLAUSILIA INSIGNIS.

Plate XXIV. Fig. 8.

Testâ fusiformi, sinistrorsâ, solidâ, castaneâ; anfr. 9 convexis, leviter striatis; aperturâ purpureâ, rotundatâ, lamellis duabus fortibus posticè, et quinque tenuibus, per testam apparentibus, intus instructâ; labro valde reflexo.

Description.

Shell reversed, solid, large, fusiform, ventricose, of a dark chestnut brown; whorls eight, convex, very delicately and regularly striated, shining, summit mamillated; aperture ovate, broadly rounded in front, with a sinus behind, produced by one of the two large folds which are there found; on breaking away half a volution, we find five other very delicate lamina, which may be seen externally, by looking at the umbilical aspect of the shell; the posterior one is near the suture, and extends nearly a whole volution; the others intervene, at nearly regular intervals, between it and the umbilicus; throat purplish; lip very broad, flattened, white, tinted with purple.

Length 1 inch; breadth $\frac{1}{5}$ of an inch.

Resembles, in shape, color, and the arrangement of the external lamina, C. *Maccarana;* but it is larger and more ponderous than any other species with which I am acquainted.

CYCLOSTOMA PERNOBILIS.

Plate XXIV. Fig. 11.

Testâ depresso-conicâ, apice acutâ, latè umbilicatâ; anfr. 6 subdepressis, striis incrementi conspicuis et striis volventibus rugulosis, ultimo carinâ costali albidâ cincto; aperturâ magnâ, intus cærulescente, labro crasso, expanso, vividè sanguineo: supernè coloribus piceis et lutescentibus variè nubeculatâ; infra albidâ, lineis piceis volventibus interruptâ.

Description.

Shell depressed-conical, apex acute, solid; whorls six, rapidly increasing, and rising into a pyramidal spire, depressed near the suture. In the early stages, the whorls are acutely carinated; but, at maturity, the last whorl is rounded, and girt with an obtuse, whitish rib; the surface is rendered somewhat rugose, by rather conspicuous lines of growth, and coarse revolving lines, which, as they cross the finer longitudinal lines, seem to run in zigzag. Prevailing color above is dusky brown, clouded by yellowish spots of various sizes, which, on the posterior whorls, are arranged in radiating zigzag series; a broad space around the umbilicus, which is very large and deep, is light straw color, with occasional revolving black lines or bands; aperture ample, somewhat wider than high, bluish within; peristome moderately reflected, rounded, of a beautiful carmine, or bright cherry-red color; not continuous, but embracing less than one fourth the preceding whorl, across which space passes a callus of the same red color.

Diameter 2 inches; height 1 inch.

This superb species is a little larger than any one hitherto described. The C. *involvulus*, Sowb., is a miniature of it. I received six specimens, young and old, all of the same magnitude. I received with them a multitude belonging to other smaller species; but they were so variable in appearance, that I do not yet venture to pronounce them new species.

CYCLOSTOMA SECTILABRUM.

Plate XXIV. Fig. 10.

Testâ turritâ, spirâ acuminatâ, arctè umbilicatâ, brunneâ; anfr. 8 sub-ventricosis, vix striatis, penultimo sub-gibbo; aperturâ sub-orbiculari, intus rubescente, peritremate duplici, incrassato, albo, propè angulum posticum canali parvo interruptâ.

Description.

Shell elongated, spire acutely terminated, of a light reddish-brown color; whorls about eight, convex, nearly smooth, and shining; the penultimate whorl, on a profile view, somewhat gibbous; last whorl not conforming to the axis of the preceding whorls, but thrust forward, so that the plane of the aperture advances beyond a parallel with the axis; aperture colored as without; lip white, everted moderately, having a slight fissure or canal across it posteriorly, at the outer angle of the aperture; posteriorly the lip is double, the inner portion continuous, the outer terminating as it touches the shell; umbilicus small; operculum thin, horny.

Length 1 inch; breadth $\frac{1}{4}$ of an inch.

Closely resembles C. *altum*, Sowb., but has the fissure across the peritreme on the opposite side. C. *croceum*, Sowb., may be only a faded specimen of this shell.

ART. XXXIX.—DESCRIPTIONS AND HABITS OF SOME OF THE BIRDS OF YUCATAN. By SAMUEL CABOT, Jr., M. D. Read Nov. 1, 1843.

IN the number of the Annals and Magazine of Natural History for October, 1843, published in London, is an article containing a description of four species of Ortyx, said to be undescribed. Among them is one which Mr. Gould, the author of the article, calls "Ortyx nigrogularis," and of which he gives a description of the male only. This bird is the same as the Ortyx discovered by me in Yucatan, when on a visit to that country, in company with Mr. Stephens, and mentioned by me in a memorandum of the birds of Yucatan, which he published in the Appendix to his second volume of "Incidents of Travel in Yucatan," p. 474. The mention I there made of it is very slight,* and hardly sufficient to constitute any right of priority; besides which, I could not wish the name altered, as it is very well chosen, indicating the most marked feature in the appearance of the bird. But, as Mr. Gould has only met with one specimen of the bird, and that the dried skin of a full-plumaged male, I have thought it worth while to give as full a description of the history and habits of this bird, as a residence of seven months in their native country would enable me to do, together with descriptions of the plumage of the female and young.

In reading works relating to the discovery and conquest of Yucatan by the Spaniards, we see mention made of the sacrifices of quails, offered by the natives to their idols; sometimes the blood only was offered, and sometimes the whole body. The bird there alluded to is undoubtedly the Ortyx nigrogularis, as this is the only bird called *Codorniz* or Quail

* Of the genus Ortyx, one species was obtained, which, as far as plumage and size go, is undescribed; but it has the same note, habits, &c., as our quail or partridge. It is smaller; the throat of the male is jet black, and most of the markings are different, though having a general resemblance to the Ortyx or Perdix Virginianus. They are very numerous in all parts of Yucatan.

by the Spanish residents of the country.* The Ortyx nigrogularis, in its note and habits, is precisely similar to the O. Virginianus. They whistle the Bob White in the spring; their covey-call, in the autumn and winter, is so precisely the same, that they readily answered when I whistled the call of our quail; and, if I had previously scattered the covey, I could always find them in this way. They feed on similar food, and roost in the same way; they also sometimes alight on trees, as our quail. Their internal anatomy is the same, as nearly as one can judge without actual comparison, organ for organ. The flesh is the same in color and appearance, but it seemed to me not so good for the table as our bird; but that may have been owing to cooking. In short, I look upon this bird as giving some valuable hints with regard to the possibility of climate producing marked alteration in regard to color and size in the inferior animals, as well as in man.

These birds are taken, by the Indian boys, in traps similar to those used in taking our quail, and brought alive, in great numbers, to the markets of the large towns of Yucatan.

The throat of the young male is light colored, nearly white, and it resembles very closely the young O. Virginiana. It does not get its full plumage till late in winter. I have the skin of a young male among my specimens, which has light-colored feathers among the black of the throat; this specimen was killed in the latter part of the month of December, at which time I killed a great number, with more or less light color on their throats. The Maya or Indian name of this bird is *Bĕch*, the *e* pronounced with a guttural sound.

The dimensions given by Mr. Gould, being taken from a

* There is another species of Ortyx found in the country, which is called *Chibeloupe*, from its note, (which is very musical.) This bird is larger than the O. nigrogularis, being about the size of O. Virginiana; but in markings it is very similar. It is much more difficult to procure, both on account of rarity and habits, than O. nigrogularis, which is another reason for presuming that it could not be the bird spoken of as the one used in immense numbers, for various kinds of sacrifices, and as food, by the Indians, at the time of the conquest, under the appellation of quails. I saw but one specimen of the Chibeloupe, (a female) though I heard them several times, in the thick, tangled, and impenetrable underwood.

dried skin, do not agree exactly with mine. I did not measure any *male* so short as 8 inches, as given by Gould; the shortest was $8\frac{1}{8}$ inches; and I measured some of as much as $8\frac{3}{8}$ inches in length.

The female is from 8 to $8\frac{2}{8}$ inches long; tarsus, $1\frac{1}{8}$ inches long; middle toe, $1\frac{2}{8}$ inches; tail, $2\frac{1}{8}$ to $2\frac{3}{8}$ inches, consists of 12 feathers, rounded; bill, $\frac{9}{16}$ of an inch, nearly black; top of head, back of neck, back, rump, upper tail coverts, dark brown, with buff, reddish brown, and black, intermixed; edges of wing coverts, very light buff, almost white; throat, chin, line extending across the forehead, and between the bill and eyes to cheek, line over eyes, along superciliary ridges to nape, deep buff or yellowish brown; feathers of breast, flanks, and belly, not fringed with black, as in the male, but having light reddish color at the part next the quill, then a pointed mark of very dark brown, on some feathers almost black, then a large spot of very light buff, on some feathers white, and then a slight tip of dark brown on margin. The light spots on the breast are smaller than those on the abdomen. There are large spots of reddish and dark brown on flank feathers; under tail coverts, nearly white, with a lanceolate spot of dark brown or black along the middle of each; legs, light flesh-colored; primaries ash brown, 5 and 4 longest; eyes of both male and female, hazel.

FALCO PERCONTATOR. Calling Falcon.

Of this new and beautiful bird, I had the opportunity of observing only one pair, which I procured and brought home with me, and which were the only individuals seen by me while in Yucatan. I was one day standing, gun in hand, at the edge of the great senote, at Chichen Itza, awaiting the arrival of my companions, in order to take a bath, the place where I stood being about one hundred feet below the surface of the ground, and shaded from the vertical sun by a shelf of rock, with an overhanging fringe of shrubs and vines, which hung so low that I could only see to about six feet above the surface of the water. I had been listening to an occasional strange cry, which I thought must proceed from some species of monkey, from its sonorous character, sounding like a human tenor voice, repeating the word *hôw*, or *haou*, sometimes once, and then many times in rapid succession; when suddenly I heard the flapping of wings; and, looking out over the surface of the water, I saw a bird, looking like a heron, flying across the senote, directly toward me. I waited till it got within reach, and shot him dead. Almost before he reached the water, a hawk made his appearance, apparently pouncing upon him, when, with the remaining barrel, I laid the destroyer at the side of his intended victim; and, hastily stripping off my clothes, I plunged into the water, and brought to land a cinerous boatbill, and the female of this noble hawk. Every lover of nature, and particularly every ornithologist, can picture to himself, better than I can describe, the delight which I felt at procuring so valuable a prize. The next day, at the same hour, namely, midday, I was at the same spot, and for the same purpose; and, listening to the different notes of the birds above, I heard the same sound repeated which I had been listening to the day before. I determined that I would, if possible, find out from what sort of throat it proceeded, and, for that purpose, changed my position to one from which I could see the trees which overhung the mouth of the senote, and sat down to watch. After being seated a short time, the sound was repeated, and I was enabled to trace it as proceeding from the top of a gigantic tree which overhung the water; and, while straining my eyes to discover its author, a second hawk, like the one I had procured the day before, swooped down from the very spot on which I had fixed my eyes, in pursuit of a dove, and, in the chase, passed near enough to draw a shot from me, though an ineffectual one. Three or four hours afterwards, as I was returning from shooting, in consequence of a threatened shower,* my path led me near the mouth of the senote; and, hearing the cry

* This bird, as well as the Laughing Falcon, of which last there are a great number in Yucatan, cries a great deal more just before a shower, and the Indians say it is because its bones ache.

which had so much interested me repeated, I turned off, to make another trial to ascertain its cause; and, making my way through the tangled undergrowth, to the verge of the senote, I perceived, on the top of the same tree, the hawk, or one of the same species, in the act of uttering the cry which I have described, and from which I have named the bird. I crawled carefully round, till I got near enough, and shot him; and, on dissection, he proved to be the male.

Male. Bill strongly hooked, very obtusely toothed, robust, almost black; cere greenish yellow; nostrils large and round; iris hazel; feet and legs rather long and slender, yellow; claws horn-color, strongly hooked, and rather long; head, nape, back, outside of wings and wing coverts and tail dark brown, almost black; on head and upper part of back, chin, cheeks, collar round neck, all under parts and thighs, and four or five narrow bands on upper side, and six or seven on under side, and tip of tail, white.

Total length 23 inches; bill along ridge $1\frac{1}{3}$ inches; same along gape; nostril $\frac{3}{16}$ of an inch in diameter; wing from flexure $10\frac{3}{4}$ inches; tarsus $3\frac{1}{8}$ inches; middle toe $2\frac{5}{8}$ inches, of which $\frac{6}{8}$ of an inch is claw; hind toe $1\frac{7}{8}$ inches, of which $1\frac{1}{8}$ is claw; tail $11\frac{1}{8}$ inches, of twelve feathers, rounded; first primary shortest, fifth and sixth longest; outer tail feathers 8 inches, middle $10\frac{3}{4}$ inches.

Female. Much the same as male, white bands on tail broader.

Total length $25\frac{6}{8}$ inches; wing from flexure, 12 inches; tarsus $3\frac{7}{8}$ inches; hind toe $2\frac{2}{3}$ inches; tail $12\frac{1}{8}$ inches; lateral tail feathers $10\frac{1}{8}$ inches. Other dimensions in same proportion.

CORVUS VOCIFERUS, NOBIS. CLAMOROUS CROW.

I first saw these birds while residing in the ruins of Uxmal. Each evening, just at sundown, I observed five or six, and sometimes more, birds, which I knew, by their cry, must belong to the genus Corvus, though much louder, and more disagreeable, than any jay that I had ever heard before. They came and alighted, for a few minutes, on the branches of a dry tree, which stood on the lower terrace of the Casa del

Gobernador; but, before I could approach near enough to shoot them, they flew off, screaming, into the neighboring woods. At last, I determined, one evening, to follow them as long as I could see to shoot, and get a specimen, if possible. I accordingly did so, and succeeded, just at dusk, in shooting a female, after which the flock never appeared again in that neighborhood; but, subsequently, I procured two other specimens, both males, one near Yturbidé, and the other near Izamal. In both instances, they were procured from small flocks of from six to a dozen. They are very noisy and lively in their motions. Their food appears to consist of the small fruits and insects. They have a most peculiar formation in the trachea, being a membranous bag, coming off between the rings, about half way down, and intimately connected with the skin of the neck, which, together with the great muscularity of the larynx, may account for the great loudness and harshness of their voice.

Male. Dark brown on head, chin, neck, back, and upper part of tail; a steel-gray spot on cheeks; bill black; iris brown; under parts and flanks white; tail consists of twelve feathers, all tipped, for about one third their length, with white, except the central ones, which have merely a white mark on each side the shaft, near the tip; first primary shortest, fifth longest; nostrils rounded, partially covered with bristly hairs.

Total length about 16 inches; bill $1\frac{1}{2}$ inches along ridge, and $1\frac{3}{4}$ along gape, $\frac{1}{2}$ inch diameter at base; tarsus $1\frac{3}{4}$ inches; middle toe $1\frac{1}{2}$ inches long; tail $7\frac{1}{2}$ inches long.

Female. $15\frac{1}{4}$ inches long, has the brown lighter than in the male; bill yellow.

ORIOLUS MUSICUS. SINGING ORIOLE. *Nobis.*

Of this beautiful bird, I procured three specimens in Yucatan; two males at Ticul, and one female at Macoba. I had not much opportunity of observing their habits. Those that I saw were high up among the branches of trees, and called my attention by their charming song.

Male. Head, neck, cheeks, breast, belly, rump, tertiaries, and nearly the whole length of the two outer tail feathers, and the lower part of the third, and sometimes a stripe on the fourth, bright chrome yellow; face, throat, primaries, secondaries, back, and four, sometimes six, tail feathers, black; legs bluish; bill black, except base of lower mandible, which is bluish; iris hazel.

Total length $9\frac{1}{2}$ inches; tarsus $1\frac{1}{16}$ inches; bill $\frac{3}{4}$ of an inch along gape, $\frac{7}{8}$ along ridge; tail $4\frac{1}{8}$ inches long, consists of twelve feathers.

Female. Marked like male, but not so brilliant.

Total length $8\frac{7}{8}$ inches.

MOMOTUS YUCATACENSIS. Black-throated Motmot. *Nobis.*

This striking and beautiful bird was found throughout Yucatan, particularly about the ruined buildings. They appear to be of solitary habits. Although numbers of them were frequently seen near each other, yet it did not appear to be from gregarious habits, but from the locality being favorable to them. They generally, during the bright part of the day, if undisturbed, keep in dark places, as in the rooms of the ancient buildings, or in the thick underbrush of the overgrown court-yards, and do not appear to see well in a bright light. So much is this the case, that I caught one in my hand, which appeared to be bewildered by the light. Early in the morning, and in the dusk of the evening, they appear quite brisk, and at their ease. We found them in great numbers about the ruins of Chichen Itza, the halls of whose palaces and temples resounded continually to the melancholy croak of this strange bird. As one listens to it, and sees the bird perched on some branch in one of the dark, deserted court-yards, with its head drawn in, its tail drooping, its plumage ruffled, and its large dark eye fixed upon him, with a solemn, still expression, he might imagine it to be animated by the spirit of one of the Maya priests, who had come there to mourn over the ruined temples and desecrated altars.

Male. Bill and legs nearly black; eyes hazel; top of head, upper part of back, rump, cheeks, breast, and sides of neck, reddish green or olive. In middle of back is a spot of bay. A stripe of very light blue, like some of the salts of copper, passes from base of bill, along each side of head, almost to nape. A black stripe extends under each eye to neck. Another black stripe passes down middle of chin, to upper part of breast, growing broader as it descends, and mixed with light blue on chin, and bordered on each side with same color. Abdomen, under tail coverts, and flanks, bright rufous; primaries and tail light green, changing to blue in some lights, tipped, and more or less bordered, with black; the expansion at end of two middle tail feathers, about half bright pale green, varying to blue, and the other half black.

Total length $15\frac{3}{8}$ inches; *bill* $2\frac{1}{8}$ *inches along gape*, $1\frac{5}{8}$ *along ridge;* $\frac{1}{2}$ *inch broad,* $\frac{7}{16}$ *of an inch through at base. About* 50 *serrations can be counted on each edge of upper mandible, and* 32 *on each edge of lower. A strongly-marked ridge runs along roof of mouth,* to within $\frac{3}{8}$ of an inch of point of bill. Tarsus $\frac{7}{8}$ of an inch long; tail, consisting of 10 feathers, is $8\frac{1}{4}$ inches long; bare part of two central feathers is about $2\frac{1}{2}$ inches; first primary shortest, fourth longest.

I might here observe, that, had I as much desire of creating new genera and sub-genera as some of the ornithologists of the present day, and thus making scientific classification a study in itself, instead of an aid in the study of nature, I might make a new sub-genus of this bird. Although, in all its prominent markings and habits, it is properly a Motmot, yet it has some striking differences in the form of the bill, &c., as will be seen on comparing the description of this bird with the other species of Momotus. The female is like the male, only smaller.

ART. XL. — ENUMERATION OF THE RECENT FRESHWATER MOLLUSCA WHICH ARE COMMON TO NORTH AMERICA AND EUROPE; WITH OBSERVATIONS ON SPECIES AND THEIR DISTRIBUTION. By S. S. HALDEMAN, Professor of Zoology in the Franklin Institute, Philadelphia.

1. Paludina vivipara, *Lin.*
2. P. fasciata, *Müll.* achatina, *Lam.*
3. Physa hypnorum, *Lin.* elongata, *Say.*
4. Limnea palustris, *Müll.* elodes, *Say.*
   L. stagnalis? *Lin.* jugularis, *Say.*
   L. truncatulus, *Müller.*
5. Planorbis albus "
   P. nitidus? "
6. Cyclas calyculata, *Draparnaud.*
7. Pisidium appendiculatum, *Leach.*
   P. amnicum? *Müller.*
8. Alasmodon margaritiferus, *Lin.*

Mr. James Sowerby catalogues several other European freshwater species as found by Dr. Richardson, in the upper Canadian lakes; but I am unwilling to adopt these determinations on the present occasion, except that of Pisidium appendiculatum, which cannot well be mistaken for another species, and which is mentioned as occurring from Lake Superior to Saskatchewan.

It is difficult to determine the percentage of species common to the two continents, and the result will vary according to the point in which the facts are viewed. Paludina vivipara and fasciata, for example, appear to be the only European members of the restricted genus, and are found here, where the species are more multiplied. We count Unionidæ and Melaniadæ by the hundred, whilst the former family has but few species, and the latter but two recorded recent Melania in Europe.* Under these circumstances, I have deemed it

* I doubt much whether these will not be found, upon a closer scrutiny, to belong to Melanopsis, which appears to be as essentially a European — as Melania is an

better to leave those families out of the question, which present great discrepancies, and base my conclusions upon the genera nearly equally abundant in species upon both sides, which will be found to be the case in the Physadæ. Thus we have about 50 species of Physa, Limnea, and Planorbis, of which three, or 6 per cent. are European : but with Ancylus, the number of Physadæ is raised to 60, reducing the percentage to *five*. If we reject Ampullaria as a southern form not admissible into the fauna of Europe, the remaining portions of Lamarck's Peristomata will not cause the result to vary, so that we may safely assume the last named number as indicating the proper proportion.

In preparing lists like the foregoing one, we are met by several difficulties, the most important turning upon the identity or non-indentity of certain shells, apparently the same, but found upon different continents ; with no apparent existing means of traversing the intervening ocean. The question at issue resolves itself into two propositions: 1. Animals occurring in separate regions, which they could not have attained by crossing the intermediate space, however much they may resemble each other, are *distinct* species.

2. Similar animals, under whatever circumstances they may be found, constitute but *one* species.

At the very onset we are met by the question, What is a species ? and sides will be taken according to the answer each one is ready to adopt.* The definition of a species does not

American form. Some conchologists consider the two genera identical, an opinion which the characters and geographical distribution will not justify, notwithstanding the near alliance between some of the species. Melanopsis is not an American genus, the species referred to it by M. Deshayes, (Melania nupera *Say*,) constituting with several others a distinct form, of which Lithasia geniculata *Hald.* is the type.

* "We have agreed that a species shall be that distinct form originally so created, and producing, by certain laws of generation, others like itself. There is this inconvenience attending the use of it by naturalists, that it assumes as a fact, that which, in the present state of science, is in many cases a fit subject of inquiry ; namely, that species, according to our definition, do exist throughout nature. It is too convenient a term to be dispensed with. even as an assumption ; only care should be taken that we do not accept the abstract term for the fact." Bicheno, Lin. Trans. xv, 482. "There is no law whatever hitherto established, by which the limits of variation to a given species can be satisfactorily assigned, and until some such law be discovered,

necessarily include descent from a single pair, because the first male and the first female would, by the definition, be of different species.* If we assume that geographical position is of more value than specific character, it follows that we cannot name Physa hypnorum, until we know the locality of the specimen ; nor can it ever be ascertained whether this species inhabits both continents, if the very enunciation of the fact calls forth its denial.† Hence tables like that given become useless to the geologist ; for should he have reason to infer that certain regions were once united by a chain of islands, for example, he will expect a certain community of animal species ; but upon placing his specimens before a zoologist, he is compelled to abandon his view by being informed that no species is common to the two regions ; the assertion not being founded upon the positive evidence furnished by the objects themselves, but upon the mere opinion that they would have been unable to traverse the intervening ocean.‡

If the same species may inhabit distant regions, the fact may be accounted for in several ways, as by

we cannot expect precision in the details of systematic botany." Prof. Henslow, Mag. Zool. Bot. i. 116.

* See Mag. Nat. Hist. N. S. ii. 622. Will any one contend that when "grass" was first created, the meadows remained barren until covered by multiplication from a single plant ?

† In the same manner, if identity of species in the parents were a just deduction from the occurrence of a prolific offspring, the question touching prolific hybrids could never be settled ; and if two precisely similar shells are pronounced distinct merely because they are found in strata of very different ages, we can never determine whether a fossil species can occur in distinct formations. This point will be noticed further on.

‡ The circumstances of the existence of dissimilar forms of a common type are parallel to those of the (Ovis ammon) equally found identical or different in Asia, Africa, and the islands of the Mediterranean, which existed anciently in Spain, and at this moment is spread over a great part of western North America. In no case are these animals suspected to have been transported by human intervention, and yet they are located in some places where, without the aid of man, they cannot have migrated, unless we admit of changes on the surface of the earth, since the present zoology was in being, of such magnitude as to include the formation of the Mediterranean — the separation of the British Islands from the continent of Europe — of the Indian Islands from that of Asia — and the formation of a channel to cut America from connection with the Old World. — Col. Hamilton Smith, Nat. Hist. of Horses, p. 67.

1. Transportation.
2. Former connection of the regions.
3. Distribution from several original centres.
4. Transmutation.

Of these, the two first are the most obvious, but the third requires to be admitted with great caution, in practice, at least, if not in theory; for, if we suppose that certain physical conditions of the earth's surface require particular organic forms to develop the great ends of creation, we may conceive two distinct regions to exist, with physical characters so nearly alike, as to be better suited for the habitation of some single species than for two distinct ones; and, in the production of a new series of beings, after a geologic convulsion has swept a multitude from existence, it is not impossible that certain exterminated species may be revived, to demonstrate a partial similarity between the two epochs, like that indicated by the plentiful occurrence of genera, the identity of the members of which we seldom have occasion to doubt. But, although many animals are able to live under varying circumstances, such a multitude of conditions are requisite to demand the independent existence of the same species in the most distant localities,* that the probabilities against such an occurrence cannot be less than the proportion of ten thousand to unity.

It remains to notice the hypothesis usually named after Lamarck, certainly not because it owes its origin to him, but doubtless on account of his lucid exposition of it. Mr. Lyell gives a pretty full analysis of these views, for the purpose of disproving them, and he has apparently succeeded in the attempt; but, as several zoological views have been advanced since the publication of this philosopher's "Principles of Geology," which tend to invalidate some of the arguments brought forward, it is impossible to do justice to the hypothesis in question without alluding to them. Thus the cat mummies of Egypt were said to be indentical with the mod-

* See Dr. Weissenborn's remarks, in Charlesworth's Mag. Nat. Hist. ii. p. 623.

ern Felis domestica; and such was the general opinion, until the discovery, by Dr. Rüppell, of the genuine analogue of the embalmed species, in the Felis maniculata of Noubia. I believe Professor Bell to be correct in deciding that Felis domestica can neither be referred to this species, nor to the Felis catus found wild in the forests of Europe.* Again, great stress has been laid upon the contrasts presented by the so called varieties of the domestic dog; but the hint given by Pallas, that they are merely prolific hybrids,† accounts for the variations in a much more satisfactory manner than to suppose them identical with some single primary form. Col. Hamilton Smith, in his valuable treatise on the Canidæ,‡ has developed these views in a masterly manner, and, at the same time, has reduced the family to such perfect order, that I do not hesitate to adopt his views.§ The lamarckian hypothesis of appetency, as he left it, seems clearly untenable, but, in a modified form, affords room for further discussion. Thus it appears impossible that a bird, with detached toes, should ever acquire webbed feet by mere dint of swimming or desire to swim; but, as all animals are formed with a greater or less approximation to certain models, why may not the germ which would result in a swimming organ (as that to which the water dogs owe their partially webbed feet) be present in a terrestrial animal, just as the fœtal brain is successively that of a fish, reptile, and bird, before it is that of a perfect mammal? or as the mammary glands have been known to increase in number, and to occur by deviation, in the inguinal region of the human subject? ||

* British Quadrupeds, p. 185.

† Caldwell's Unity of the Human Race.

‡ Nat. Libr. See, also, Horses, p. 70, where he remarks, "It seems, therefore, more consonant with the distribution of several genera of animals on the earth's surface, to believe that osculating forms existed *ab initio* distinct, circumstanced to accomplish certain ends, such as the service of man, and therefore framed so as to render them fusible into one species." The same view had been previously taken by Mr. Eyton, a British ornithologist, Mag. Nat. Hist. (N. S.) i. 359.

§ If these prevail among zoologists, it will be necessary for the pseudo-lamarckians to remodel their arguments to some extent, as they will be reduced to such "facts" as are given in the next note but one.

|| In the eyeless fish and crustacean of the Kentucky cave, the germs of visual organs must exist, and only require light to cause the eyes themselves to appear in

Mr. Lyell endeavors to show that all our efforts to remove a species from its type are successful only to acertain extent, and that the maximum deviation is attainable in a few generations.* The lamarckian contends that the lapse of time and amount of physical revolution are not sufficient to cause any appreciable difference between the embalmed Egyptian remains and the forms now existing; but we are at liberty to step into the field of palæontology, and here, at least, we should be able to find proofs of a gradation of species, as I believe Cuvier remarks. If this view is sustained by facts, it becomes an important argument, and one which is generally regarded as final; but that it should not be received as absolutely conclusive, I will endeavor to show.

Let us, for a moment, suppose a transmutation of species possible, and then attempt to account for the asserted absence of the intermediate links. In the first place, the ability to produce these links would constitute the main ground, (the possibility of hybridity being commonly overlooked) for proving the *identity* of the two previously-admitted species — a mode now in use, and considered of great service, especially when it is well understood that there are distinct species, among the Unionidæ, for example, actually differing less from each other than the known varieties of certain variable species,† which a lamarckian might suppose to be of so recent an origin as not to have yet become settled in the possession of their proper diagnostic characters.‡ Indeed, notwithstand-

due time. Some insects, which are usually apterous, acquire wings under certain circumstances. Westwood's Introduction, ii. 468, 481.

* Entertaining the opinion that the color of the native American depends upon climate, it was not unusual for authors of the last century to affirm that the descendants of Europeans had already made some progress in a change of color. Azara states that the Russians are black. Marco Polo affirms that some of the distant Orientals had tails. Dr. Prichard asserts that the heads of the white race in the West Indies approach those of the original natives in form, independently, as he seems to suppose, of intermixture; and that the climate of Virginia, which was formerly said to darken the European, now bleaches the skin, and converts the wool of the blacks into hair in a few generations, when they are kept in the families of their employers, whilst the field laborers retain the original color.

† Mr. Lyell admits that, if this should be the case, it would have a tendency to cast an additional doubt upon the definite nature of species.

‡ See my Freshwater Univ. Mollusca. PLANORBIS, p. 26.

ing the assumption to the contrary, by authors who have little practical acquaintance with the details of natural history,* the proper discrimination between species and variety is one of the greatest difficulties which the naturalist has to encounter; and he who is successful in this department is entitled to a rank which comparatively few can attain.†

In the second place, although we may not be able, artificially, to produce a change beyond a definite point, it would be a hasty inference, to suppose that a physical agent, acting gradually for ages, could not carry the variation a step or two farther; so that, instead of the original, we will say four varieties, they might amount to six, the sixth being sufficiently unlike the earlier ones to induce a naturalist to consider it distinct.‡ It will now have reached the limit of its ability to exist as the former species, and must be ready either to develop a dormant organic element, or die; if the former is effected, the osculating point is passed, and the species established upon the few individuals that were able to survive the shock. If the physical revolution supposed to be going forward is arrested or recedes, the individuals which had not passed the culminating point remain as a fifth variety, or relapse towards their former station; whilst the few which have crossed the barrier remain permanently beyond it, even under a partial retrogression of the causes to which they owed their newly-developed organization. We may suppose some spe-

* This remark does not apply to Mr. Lyell, whose arguments indicate a knowledge of the subject seldom apparent in the writings of those to whom I allude generally.

† "In very extensive genera, the distinctions of species are so minute, that it requires the most practised eye to separate them; and, indeed, there are some groups, the species of which are so intricately blended together, that no two entomologists are agreed as to their distinctness." — WESTWOOD.

‡ This slight organic change might bring it sufficiently near a cognate species to allow of the production of a prolific hybrid, previously impossible; for, as Mr. Lyell remarks, (Principles, ii. 372, London, 1837,) "Hybrids have sometimes proved prolific, where the disparity was not too great." He asks, (p. 434) "if species in general are of hybrid origin, where are the stocks which combine in themselves the habits, properties, and organs, of which all the intervening species ought to afford us mere. modifications?" An answer may be partly found in the complaint of Professor Henslow, (Mag. Zool. Bot. i. 117,) that botanists describe certain species as "duabus prioribus *exactè* intermedia."

cies and individuals to be more able to pass than others, and that many become extinct, from inability to accomplish it. Under this point of view, a hiatus, rather than a regular passage, is required between a species and that whence it is supposed to be derived, just as two crystals may occur, nearly identical in composition, but without an insensible gradation of intermediate forms,* the laws, both of organic and inorganic matter, requiring something definite; whence the rarity of hybrids and monsters, themselves subject to established laws.

My meaning will, perhaps, be better understood by one or two illustrations. We all know that marine and fluviatile mollusca have their peculiar distinctive characters. Let us, then, suppose a species of Melania to inhabit a stream into which a salt lake effects a discharge, the saline mixture being, at first, so much diluted as not to occasion the animal much inconvenience, until by the gradual enlargement of the outlet of the lake, the amount of the foreign ingredient is so much increased, that the mollusk finds great difficulty in living, and must eventually perish, unless it can accommodate itself to the saline medium. The form, however, not being marine, the extreme case is presented, of a necessity to change into a different genus — Fusus, for example. Now there is a shell confined to the Holston River and its branches, which is, to all appearance, a Fusus, so that Say, the leading American conchologist of his day, called it Fusus fluvialis. According to the lamarckian hypothesis, this mollusk may have descended from individuals of the more widely-distributed and nearly-allied Melania armigera, *Say;* and its transmutation (though now a fluviatile species) may have been accomplished by the agency of salt water. Now, although we will not assert that the salt water they inhabit is the cause of the siphonal canal in a large proportion of marine univalves, or even insist that the want of this medium has some connection with its absence in the numerous freshwater species, we are

* The *same* mineral may crystallize with three, six, or twelve angles, but not with five or seven. Are the phases of organic morphism subject to less definite laws?

acquainted with, yet, when we find but a *single* exception among hundreds of species on both sides, I cannot think it unimportant to inquire whether we are to consider it a mere coincidence, that this anomalous Fusus fluvialis should occur in a stream which rises in a salt region.

I have noticed, in another place, the great analogy existing between the aquatic Paludina subcarinata and the terrestrial genus Cyclostoma. In the former genus, the rim of the aperture lies in close contact with the body of the shell, and the opercle is composed of concentric elements, whilst, in the latter, it has a tendency to disunion, and the opercle is constantly subspiral. In the species in question, "we find a true Paludina occasionally rounding its aperture, throwing it off from the body whirl, and not only assuming the physiognomy of Cyclostoma elegans, but actually departing so far from the normal character of its genus, as to construct a cyclostomoidal opercle, that of the young enlarging spirally. This, however, does not continue; the animal, as a Paludina, is not endowed with the elements necessary to produce the entire opercle of a Cyclostoma; so that, after continuing it to a certain point, the layers become normal or concentric, apparently indicating the impossibility of a departure from its generic type beyond a certain limit." * When I detected this peculiarity, I considered it as affording an excellent illustration of the theory of "representation;" and, although I still entertain the same opinion, I cannot close my eyes to the fact that representation itself must take its place as an argument in favor of Lamarck's views.

Some authors, having adopted certain views of species and varieti s almost at random, and independently of zoological or physiological considerations, call in the lamarckian principle as far as their notions render its assistance necessary, and chiefly that they may refer the members of the human race to one zoological species, whilst they will admit that the American Vulpes fulvus is distinct from its European

* Freshwater Univalve Mollusca, PHYSADÆ, p. 17. It will be remembered that Lamarck, at one period, confounded the genera Cyclostoma and Paludina.

analogue. This brings us to a result published by a practical zoologist, our associate, Professor Samuel George Morton, well known by his researches in anthropology. Finding it impossible to account for the variations in the races of men on the grounds usually brought forward, he contends that although they constitute one species, the five races were endowed with distinctive characters *ab initio*.* This view places a neutral ground between such as contend for the unity of the human species, and those of a contrary opinion; and is of such a nature that both parties may occupy it without compromising the conclusions each has respectively adopted. Yet it is only satisfactory in the study of the human species, of which we have records and monuments of great antiquity, for it is not very likely that naturalists will be ready to admit that certain shells are referable to a single species, although endowed with distinctive characters at the period of their creation.

The hasty assertion has been sometimes made, that if transmutation of species be possible, the study of natural history becomes useless; that is to say, a science is useless if its principles militate against our view of that science, and Avena sativa must not be studied by the botanist because it is asserted to change into Secale cereale under peculiar circumstances.† The lamarckian might with equal propriety insist that this constitutes the chief inducement to study; that without it every species would be isolated in creation; that there would be neither genus, order, nor family; no relation between the wings of a bird and the anterior limbs of a quadruped; and the seven cervical vertebræ, so constant in the mammalia, were accident. He might consider his views as the foundation of comparative anatomy, the key to the theories of representation and types, and the basis of the classification of organized bodies. Nor could he perceive that the study of geology would be affected by it to such a degree as to render the deductions from organic remains less useful than under the sup-

* See Swainson's Geogr. of Animals, (Cab. Cyc.) p. 2.

† See Charlesworth's Mag. Nat. Hist. i. 574 and ii. 670.

position that species alone are permanent, whilst everything else is subject to change; for were they transmutable, it would be in the course of the long periods, and during the progress of the important changes which the geologist notes; so that whether these fragments be regarded as formerly identical, but at present distinct from existing forms, or as distinct at all times, the general result and its applications remain undisturbed.

Mr. Lyell lays great stress (vol. ii. p. 369) upon the fact that Lamarck does not cite the appearance of any *new organ*, but I have endeavored to show, that the theory is not dependent upon the production of any organ not already existing in an undeveloped state. His remarks against appetency are well directed; but the idea, in the extent to which it has been carried, should be discarded as more detrimental than useful to those who maintain the instability of species; because whilst its connection with the subject is very slight, the discussion of it has a tendency to turn the unthinking inquirer aside from the true and philosophical basis of this important question, leading him to believe that if appetency be disproved, transmutation falls with it. The objection (p. 375) that numerous links in the animal series are wanting, has not much force, as there are many causes to remove them, or prevent them from becoming permanently established; and the original creation may have included a multitude of beings of all classes. Moreover, the species of the vertebrata and articulata may be comparatively stationary, and the molluscous division peculiarly liable to transmutation and hybridity. The reason why the lower orders still exist, is to be looked for in the fact that they are fitted for the circumstances under which we find them. The researches of Professor Forbes, in the Grecian archipelago, prove that whilst some species are gradually verging towards extinction, others, belonging to a more recent period, are gradually increasing in numbers.

I pretend not to offer an opinion for or against the lamarckian hypothesis, being more anxious to show the insufficiency of the standing arguments against it, and the necessity of a thorough revision of them, than to take a decided stand (upon a question which I regard as open to further discussion) before its facts have been carefully observed, or the resulting generalizations properly deduced; so that, whether it be admitted or not, it is entitled to the benefit of all the discoveries which can be brought to bear upon it; and, on this account, I have not hesitated to give a slight sketch of the theory of transmutation, as I conceive it to be modified by some of the results of modern science.*

I had intended to prepare a list of insects common to Europe and North America, to be presented on the present occasion; but, as our collections are not in a condition to admit of such an undertaking, and as such a list would have contained the names of a number of species which have probably been introduced through human intervention, (as Bruchus pisi or Dermestes lardarius) I resolved to take some family of nearly equal distribution upon both continents, and which had been pretty thoroughly studied. For this purpose, I have chosen the *Brachelytra*, most of the species of which are small, and of such habits as to prevent them from being readily introduced artificially.

Of this family, Erichson, the highest authority, enumerates 220 North American (exclusive of Mexican) species, of which 12, or five and half per cent., inhabit Europe. But recent discoveries raise our species to 250, of which none of the additional ones have been identified as European, (perhaps from inability to institute comparisons); on the strength of which, we may reduce the percentage to *five*, when a remarkable coincidence is apparent with that already assigned to the Physadæ. Of the genus Philonthus, 22 American species

* These views have been held by men of learning and piety at various times. Thus Ray and Swammerdam believed that the parasitic hymenoptera, to which a dead caterpillar apparently gives birth, may result from the division of its vitality into numerous portions, and no one finds fault with the "evil tendency" or "absurdity" of the idea. Now, the objection appears to rest not so much against the opinion as the source whence it comes; in other words, Ray was an Englishman, whilst Lamarck was a Frenchman.

are enumerated, (or 33, including Mexico,) of which no less than eight occur in Europe; and, of these eight, common to Europe and North America, but one has been detected in the West Indies. Erichson cites three species of Brachelytra, common to Europe, Asia, and America; another, as common to these countries and South Africa; three, as found in Europe and South America; and but a single species as appertaining to both divisions of the American continent.* The last fact is a curious one, and shows how very distinct the faunas of approximate regions may be. The author, to whom I have just alluded, remarks that northern species may be found in the mountains of temperate regions,† and cites Tachinus elongatus as occurring in Sweden, Unalashka, and the mountains of Switzerland.

Mr. Westwood states that a large species of Cybister (an aquatic coleopter) occurs at Senegal, Guinea, Cape Good Hope, Madagascar, Mauritius, and in the Indian archipelago; and Mr. Kirby, that Sphodrus terricola inhabits Great Britain and Valparaiso,‡ Carabus vietinghovii, Siberia and America, and a species of Isopleurus, India and the Rocky Mountains.§ M. Laporte affirms || that Nogrus griseus is found in the four quarters of the globe; and M. Guérin Méneville, that a crustacean, (Pontonia custos) found parasitic in bivalve shells at Rio Janeiro, is identical with individuals from the Morea. Probably Libiniacana, liculata *Say*, and certainly Cancer irroratus, *Say*, inhabit the Atlantic and Pacific coasts of North America; ¶ and, according to Professor Ehrenberg,** two thirds of the microscopic protozoa hitherto detected on our continent, inhabit Europe also.

Of the species indicated in the list at the head of this paper, Paludina vivipara is found in Ireland, England, Sweden, Germany, and Sicily; Physa hypnorum in the same,

* North and South America present us with entirely distinct groups of many animals, as in the order Rodentia.

† See Dr. Pickering's botanical map, in the Amer. Phil. Trans., vol. iv.

‡ Bridgw. Tr., Am. ed., p. 29.

§ Ib. p. 494, note.

|| Ann. Ent. Soc. Fr. i. 397.

¶ Journ. Acad. N. S. viii. 106, 116.

** Am. Journ. Sci. xlvi. 309.

except Sicily; Pisidium appendiculatum in England and Sweden; and Limnea palustris in Ireland, England, Scotland, Mona, Germany, Sweden, and Corsica.*

After the authorities I have cited in favor of a community of species between distant regions, I think it indicates a considerable degree of boldness to deny the identity of objects never seen, on the strength of a preconceived opinion, which, if true, (and I am far from making the remark as argument against it) will destroy much of the interest with which geographic zoology and botany are invested, and originate a more untenable theory than that of appetency; for, according to the latter, after a fish would have become a bird, it would be a bird; but, according to the former, it would still be a fish;† Cynthia cardui would be from three to seven species, according to the extent of country required to constitute a zoological region, as it inhabits North America, South America, Europe, Northern, Western, and Southern Africa, the Islands of Madagascar and Bourbon, Bengal, China, Java, and Australia; and Colias edusa, another frail butterfly, would, in like manner, become four species, on account of its occurrence in North America, Europe, Caffraria, and Nipal.

In connection with this subject, I wish to protest against the practice of making distinct species of similar organic remains, merely because they are found in different strata or formations — a proceeding which must end in the admission that a genus can contain more species than distinct forms, (which involves a contradiction) and, indeed, an infinite number of species. There must, however, be a limit to species, and the limit must vary with the genera; because an insect, having more organs than a worm, affords a greater

* Gray's Turton, p. 30. Mr. Lea has a beautiful and extensive series of Alasmodon margaritiferus, from various parts of Europe and America, including Columbia River.

† This inference is fairly deducible from the writings of Dr. Prichard, and others of the same school, some of whom are continually making attacks upon Lamarck, for the general or uncritical reader, in a manner ingeniously calculated to keep the merits of the question out of view. It is a matter of congratulation to the friends of the French philosopher, that he never produced anything approaching this in absurdity.

number of distinguishing points. Moreover, whilst we admit that there may be 500 species of Helix, we cannot allow the possibility of 200 Ancylus, with the usual amount of character, because the shell is of the most simple form, and deprived of a number of parts and modifications which afford good specific characters in the former genus. It may, indeed, be insisted, that, for all we know to the contrary, one, two, or fifty, *species* of Ancylus may be hidden under each distinct *form*, and that, in this manner, there may be as many Ancylus as Helix. To assert that two monomorphic animals, belonging to one of the families having uniform tints, are distinct, because, if we could metamorphose them into members of another family, having varying colors, the tints of the two (not being subject to the law of uniformity) might present a specific* variation, is to imagine an organic iso-morphism † of which we have hitherto had no evidence. Admitting, however, that, in an imaginary metamorphosis, two individuals (none of which are absolutely alike in every point) of a species of Melania, should result in two distinct species of Conus, of different markings and colors, I conceive that we would not be justified, either in assuming the specific difference of the former, or the identity of the latter, which we derive from them; because, although, as Conus, they would be distinct from the possession of a different modification of character, as Melania, they must be alike, the characters being identical. Let us now suppose our metamorphosis to take the opposite direction, the subjects being two species of Helix of the same size, form, color, and texture, of shell and ani-

* "SPECIFIC, that makes a thing of the species of which it is; designating the peculiar property or properties of a thing, which constitute its species, and *distinguish it from other things*. SPECIFIC CHARACTER, a circumstance or circumstances *distinguishing* one species from every other species of the same genus." — Webster's Dict. It is evident, from these definitions, that, where there is no specific character, there can be no distinct species; so that, to prevent confusion, it will be necessary for those whose views I am opposing, to adopt some other term, instead of *species*, to designate what they contend for.

† This term may be introduced into zoology to indicate the resemblance which a parasitic insect bears to another, into whose nest it must be able to penetrate unobserved.

mal; one with a columellar fold, a thickened outer lip, armed with teeth, and a wide umbilical depression; the other without a thickened lip, teeth, fold, or depression. In converting these dissimilar shells into Ancylus, they must produce but one species, notwithstanding the extent of their disagreement, because the latter genus never has a thickened lip nor teeth, and cannot possibly have the remaining characters which Helix presents. The same reasoning has a bearing upon higher divisions, and prevents us from setting aside a genus like Helicina, because there cannot be a corresponding genus allied to Patella; and it is fatal to the quinary, or any other numerical arrangement, because, in proportion to the simplicity of the form, and the reduction of the organs, must the number of groups and aggregates diminish, of whatever value or denomination they may be.* It appears needless to assert that the absence of characters upon which generic and specific distinction would depend, renders two forms identical; as, in natural history, we cannot admit "a distinction without a difference."

I am aware that species from distant localities, long confounded, have eventually been found to present distinctive characters; but, whilst this ought to teach us caution, it should not lead us to pronounce all such objects distinct, until similar diagnostic characters be detected, or we adopt a rule in the one case which we reject in the other; namely, that objects are distinct which appear identical, under the operation of a peculiar law, only when remote localities are concerned, which exerts no influence upon animals of the same region. Thus, if Cicada septendecim were to occur in Australia, it would be considered a distinct species, whilst the seventeen broods of our own country constitute but one; although it admits of a doubt whether all are the descendants of a single pair. The same remark will probably apply to all the species of this genus, the period required to bring them to maturity being unknown. Moreover, the very fact of a species living

* This idea is borne out by the fact that an ornithologist is the proposer of the quinary, and an entomologist of the septenary arrangement.

under modified habits, in distant localities, may produce a variation which, under the circumstances, would be considered specific, no intervening links being possible; so that, after all, such species may be founded upon *quasi* characters,* just as two mollusks have been described under separate names, because one lives in rough water, and has a strong shell, and the other in smooth water, with a thin shell, when the varying texture of the shells has depended upon the locality.† Now, as most of the species named in my list do not present appreciable distinctions, although found in regions widely separated, it remains for those who contend that localities indicate species, to inform us how far west of its present position Ireland should have been placed, to induce them to believe its Paludina vivipara another species; and, in case this island were to occupy the middle of the Atlantic, whether the analogous shell should be considered as appertaining to the American, the European, or to an entirely distinct species. The same question might be raised with respect to Rhinoceros sondiacus, found equally in Sumatra and Java; and Elephas maximus, because it inhabits some of the Asiatic islands, as well as the continent. Mr. Jenyns is inclined to doubt the validity of "many of the species found in distant latitudes, which, although presenting *the closest affinity* to some in Europe, have been considered distinct by naturalists, principally on the ground of their inhabiting such different geographical positions." — Mag. Zool. Bot., i. 25.

* They may be what Dr. Engelmann calls *geographical varieties*, "where no specific distinction can be discovered between the natives of both continents, but where the American and European variety can always be distinguished by some points of minor importance." — Am. J. Sci., vol. xlvi. p. 94. According to the same botanist, ten out of twelve American species of Equisetum are found in Europe. — Ib. p. 81.

† "We often regard a different habitation as a proof of a difference in species, while it may be the cause of the variation." — Gray's Turton, p. 240. Schlegel, a German herpetologist, after stating his belief that the American Rana halecina and sylvatica are identical with European species, remarks that it is "d'un intérêt infiniment plus puissant, de savoir que nos deux espèces de grenouilles communes d'Europe sont répandues à peu près sur le même degré de latitude dans tout l'hemisphère boréal, et qu'elles présentent dans des contrées aussi distantes et de nature diverse, comme le sont l'Europe, le nord de l'Afrique, l'Asie tempérée, le Yapon et l'Amérique septentrionale des differences si peu notables, que les naturalistes auront de la peine à les signaler, et qu'ils ne viendront pas à bout d'en énumérer de constantes." — Revue Zool., 1838, p. 321.

ART. XLI.—DESCRIPTIONS AND NOTICES OF SOME OF THE LAND SHELLS OF CUBA. By A. A. GOULD, M. D.

WITHIN the last two years, I have received several parcels of shells, many of them containing the living animal, collected by Mr. John Bartlett, on the island of Cuba, near Matanzas, accompanied by careful memoranda of the habits and stations of the animals. A few of them were briefly noticed on the cover of the first number of the present volume; most of these I have since ascertained to have been described by Dr. Pfeiffer, in "Wiegmann's Archiv für Naturgeschichte," for 1839–40, a work which had not then reached this country. As however, the study of conchology no longer consists in observing the external configuration and marking of shells, but embraces the study of the animals producing them also, it may not be amiss if I give a list of the shells, with such observations as were noted by Mr. Bartlett, and such as I have made upon the animals which reached me alive; all that relates to them as existing in Cuba, is, of course, derived from him.

The principal localities mentioned are La Carolina, Retiro, Mount Vernon, St. Cecilia, and Santa Ana, which are coffee estates, (cafetales) in the district of Sumidero, and in the neighborhood of Coliseo post office, a distance of twenty to twenty-five miles south east of Matanzas. San Jorge is a sugar plantation on Sagua la Grande river, about one hundred and fifty miles east of Matanzas.

Coffee trees are planted about six feet apart, and on a portion of most estates plantain trees grow in the spaces. When too exuberant many of the smaller ones are cut down, and when the fruit is mature the old trees are cut close to the ground; being full of sap they moisten the earth where they lie. Under these are found some of the Helices. and most of Helicina and Glandina, attracted, no doubt, by the shelter and moisture thus afforded.

HELIX AURICOMA, Fer., *Hist. des Moll.*, plate 46, fig. 7 to 9. *Prodr.* No. 80.

There is much variation in the color of the animal. In some it is reddish brown, in others slate-color. Of two specimens found in contact, one was light reddish brown on the sides, and dark brown on the back and tentacles. The other was slate-colored, dark on back and tentacles, and lighter at sides. It was never seen upon trees, nor upon a log, not even in the wet season ; but a specimen left at liberty crawled to the top of the room in the night, and remained fixed there until dislodged.

It is found on the coffee plantations under plantain leaves ; in the woods on the limestone knobs, among stones and under leaves, close upon the ground. In the dry months it forms a calcareous epiphragm over the aperture, and this is the only species which was observed to form a covering of similar material.

Found in plenty on the La Carolina and Retiro estates, and in the immediate vicinity of Matanzas. In the latter locality many dead ones were found in wild shrubbery, among rocks, near salt water, occupied by hermit crabs. They were smaller than those found in the interior. The variety brought from the region of St. Jago de Cuba is also small, solid, coarsely wrinkled, and somewhat distorted by the pursing in of the aperture. It is probably this variety to which Lamarck applied the term H. *microstoma*.

HELIX BONPLANDII, Lam.; *Feruss.*, *Hist. des Moll.*, plate 46 A. fig. 2.

Animal, dark slate-color, long, and finely granulated ; lives upon trees, and is rather rare and difficult to be obtained. Found at La Carolina, St. Cecilia, Retiro, and near Matanzas in September and March. Fine, fresh specimens are dark brown, and individuals vary much in the elevation of the spire.

HELIX MULTISTRIATA, Desh.; *Encyc. Meth. Vers.* II. 248. H. circumtexta, Feruss., *Hist. des Moll.* plate 27 A. fig. 4, 5, 6.

Animal, dark brown, with three black longitudinal stripes. It is rarely obtained alive. Most of the specimens were found under decayed leaves in the woods, on the limestone knobs, among stones, in the autumn. Collected at La Carolina and Mount Vernon.

HELIX POEYI, Petit; *Guerin's Mag. de Zool.* 1836. plate 74.

Two or three found about Sagua la Grande.

HELIX GILVUS, Fer., *Hist. des Moll.*, plate 21 B. fig. 1.

This shell, which I described under the name of H. *penicillata*, is pronounced by high authority to be the immature of H. *gilvus*. Mr. B. says, however, that he has collected them at all seasons of the year, and has never seen them exhibiting marks of further maturity.

The animal is of a light drab color; a delicate, dusky, fawn-colored median line, and a similar one along each tentacle, extending backwards. Below this, on each side, is a more delicate line, extending still further backwards. Neck finely granulated.

Found plentifully on shrubs in a pasture, where they were, of course, much exposed to the sun, at La Carolina.

HELIX CUBENSIS, Pfeif.; *Weigm. Archiv*, 1839–40. H. Lanieriana, D'Orb.; *Moll. de Cuba*, plate 7, fig. 7.

The shell I have in view accords accurately with Pfeiffer's description, and is unquestionably the shell figured in Sagra's work. Mr. Bartlett, however, with apparent good reason, regards it as merely a variety of the preceding species, H. *gilvus*. His description of the animal is as follows: "tentacles, dark slate-color, body nearly white, with a dull slate-colored line each side, and another on the back." This agrees very closely, with my description of H. *gilvus*; and having also seen the animal, I have detected no difference. The following are extracts from his notes: "Feb. 1843. I find on the bushes, on the side hill above the fort (Matanzas) some of this species. They are not so well marked as those found in the interior; these are a dun or cream-color, the bands and cross markings in most specimens quite obscure." Again, "these shells have no transverse marks like those found on the Carolina, but are evidently the same species. These are of various colors, some ashy-white, others dun; some have two obscure brown bands on the body whorl, while on others the bands are quite distinct."

Helix fragilis, Pfeif.; *Wiegm. Archiv*, 1839–40.

These appear somewhat immature, though they were found dead. They resemble the young of H. *auricoma* and H. *Bonplandii*, but are much more rough "like a file."

Found in the woods under leaves, and among stones on the limestone knobs, on the Carolina, Retiro, and Mt. Vernon estates.

Helix Boothiana, Pfeif.; *Wiegm. Archiv*, 1840.

Helix Ottonis, Pfeif.; *Wiegm. Archiv*, 1839.

Helix saxicola, Pfeif.; *Wiegm. Archiv*, 1839.

Found on trees, in the crevices of the bark, at La Carolina.

Helix septemvolva, Say. Near Matanzas.

Helix Ramonis, D'Orb., *Moll. de Cuba*, plate viii. fig. 1–4.

Animal, light horn-colored, with two darker lines behind tentacles. These are short, black, somewhat dilated near base; back beautifully granulated.

This belongs to the group named Polygyra by Say, and somewhat resembles H. *septemvolva*. Perhaps the peculiar form of the tentacles will be found constant in all species of the group.

Found near Matanzas.

ACHATINA FASCIATA, Mull., A. vexillum, Brug.

Sometimes found in the woods high on the trees, but most abundant, on abandoned coffee plantations. In dry weather they attach themselves to the body and largest limbs of the coffee trees so strongly that, in detaching them, the bark comes off with them. They form a strong parchment film over the aperture during the dry season. "None of these were found on the square of coffee with the green-banded ones; (var. *crenata*, Swains.) but on another square, not a quarter of a mile distant, there were plenty of this kind. On this square the coffee trees were not so old, and were more shaded. A few green-banded ones were found here also, but not one in twenty."

A few seen at Sagua were all of the spotted kind.

ACHATINA GRACILLIMA, Pfeif., *Wiegm. Archiv*, 1840.

ACHATINA OCTONA, Chem.

Animal, bright yellow, half the length of the shell. Found at La Carolina, under a heap of old corn husks, so plentifully that hundreds could be collected in a few minutes.

GLANDINA OLEACEA, Feruss., *Prodr.* No. 360.

"Animal, light reddish brown, with three dark stripes on the back and sides. It has six tentacles, the posterior pair is longest; the anterior ones are joined at the base, tapering to a point, in shape like a shark's tooth; the others terminate bluntly with knobs, &c." The third or anterior tentacles are merely dilatations of the angles of the hood, which, however, serve the purpose of tentacles. The animal accords generally with that of G. *truncata*, described by Dr. Wyman at page 416.

They are not plentiful, but are occasionally found under fallen plantain trees, and under leaves in the woods, under decayed wood, &c.

GLANDINA FOLLICULUS, Lam., Achatina solidula, Pfeif.

More rare, but found in the same localities as G. *oleacea*.

PUPA UNICARINATA, Lam., Bulimus Canimensis, Pfeif., Archiv, 1839.

Found on a small limestone knob on the Retiro, some in the woods and others on the side hill.

PUPA SERVILIS, Gould. See page, 356.

PUPA CONTRACTA, Say.

PUPA CHRYSALIS, Fer.

The animal is light greyish, the anterior tentacles very small; motions very sluggish. Found on the rocks on one side of Matanzas harbor, within reach of the spray, in company with Littorina angulifera, lineata, &c. Others of a much more stinted growth were found farther inland. When at rest, they secure the aperture by a firm, membranous epiphragm.

An entire revision of the large West India species of Pupa is requisite. They appear to have been but little studied; and the descriptions given are very indefinite. The above species, for instance, might be referred, with almost equal propriety, either to P. *uva*, P. *chrysalis*, P. *maritima*, Pfeif., and the small variety to P. *mumiola*, Pfeif. That varieties are broad and numerous does not admit of doubt.

PUPA (Cylindrella) ELEGANS, Pfeif., Wiegm. Archiv, 1840. Pupa (Siphonostoma) lituus, Gould.

Animal, nearly white, with a slight tinge of slate color above. The foot is very short, blunt behind, and in all respects like that of *Pupa chrysalis*. If it proves to belong to a new genus, the name Siphonostoma, (originally Brachypus, Guilding, Zool. Journ. iv. 167,) will have precedence over that of Cylindrella, Pfeiffer.

PUPA (Siphonostoma) PORRECTA, Gould. Plate xxiv. fig. 12.

Testâ gracillimâ, fusiformi, glabrâ, pellucidâ, maculis albis, subquadratis, obscurè tessellatis: anfr. ad 24, ultimo disjuncto et valdè porrecto: aperturâ campanulatâ, subquadratâ; peristomate albo, reflexo.

Shell very slender and delicate, fusiform, translucent, somewhat enlarged at tip ; surface faintly tessellated with subquadrate spots of opaque white: whorls about twenty-four, about eight of which are usually broken from the summit; the others are very slightly convex, smooth ; the last whorl is disjoined from the penultimate, and stretched out so as to take nearly the direction of the axis of the shell, and to bring the plane of the aperture nearly at right angles with it; this last whorl is also covered with minute, close-set ribs; aperture circular, with the peristome broadly and roundly everted. Length, $\frac{3}{5}$ inch ; breadth, $\frac{7}{100}$ inch.

This is the most interesting of the group to which it belongs. There is probably no land shell so slender, and made up of so many whorls. In fresh specimens it is beautifully flecked with spots of opaque white. It is most nearly allied to Cylind. *crispula*, Pfeiffer. Found at the Retiro, at the edge of woods, on a limestone knob, under a shelving rock.

Pupa (Siphonostoma) lactaria, Gould. Plate xxiv. fig. 13.

Testâ fusiformi, apice truncatâ, tenui, albidâ, sursum fuscescente, rivulis lacteis longitudinaliter undique notatâ : anfr. superstitibus 10, convexiusculis, concinné striatis ; ultimo carinato ; aperturâ circulari, amplo, expanso ; peristomate albo, modicè everso : collo brevi.

Shell fusiform, truncated at tip, thin and translucent, yellowish white, becoming dusky towards apex, and variegated with flexuous, milk-white, longitudinal lines. Remaining whorls about ten, slightly convex, elegantly sculptured by delicate, oblique, longitudinal striæ, of a uniform size on all the whorls ; the last whorl has a distinct keel skirting the region of the umbilicus.

Separation of the last whorl short, forming a large, rounded, trumpet-shaped aperture, turning outwards to form a narrow, white lip. The aperture stands at an angle of 45° with the axis of the shell. Length, $\frac{2}{5}$ inch ; breadth, $\frac{3}{20}$ inch.

In shape this species resembles C. *elegans*, Pf. ; though more nearly like *Clausilia subula?* Ferus. in size and sculpture, but it is more ventricose, has fewer whorls, a shorter neck, larger aperture, and less broadly reflected lip.

Animal, white, with a dark line along the back of each tentacle, one along middle of back, and a very fine one along each cheek.

Found in March, near Matanzas.

PUPA (Siphonostoma) SUBULA? Ferus., *Prodr.* No. 508. *Hist. des Moll.* plate 163, fig. 8.

I am not quite sure that this is Ferussac's species, but it must be very near it. The animal is a little rusty above, with a pale slaty line along each tentacle.

Found near Matanzas.

PUPA (Cylindrella) CRISPULA, Pfeif., *Wiegm. Archiv.*

Found under a high precipice of limestone, near Chapeau's Cave, on Mount Vernon estate.

HELICINA SUBMARGINATA, Gray, *Zool. Journal*, i. 68. Plate 6, fig. 2. *Sowerby Thesaur. Conchyl.* No. 10, plate 3, fig. 123, 137. H. rubra, Pfeif. H. crassa, D'Orb. *Moll. de Cuba*, p. 243.

Animal, entirely greenish black above, dusky beneath, length about one diameter of the shell, surface finely reticulated. Motions very sluggish. All the specimens procured alive were found buried an inch or two deep, under decayed plantain trees, at the Retiro, or in the vicinity of large rocks.

HELICINA SAGRA, D'Orb., Moll. de Cuba, p. 240. Sowerby, Thes. Conchyl. plate 1, fig. 10; plate 3, fig. 126.

Animal similar to that of H. *submarginata*, but was found in dry, open fields near Matanzas.

HELICINA PULCHERRIMA, Lea, Amer. Philos. Trans.; Sowb. Thes. Conchyl. No. 16, plate 3, fig. 112, 113.

The three last species vary somewhat in form and size, but more especially in the color of the aperture. In the first it is dark livid; in the second, bright lemon color, and in the last, white. Between the animals of the two first, I could make out no appreciable difference. It is most probable that they are only local varieties of the same species.

HELICINA ADSPERSA, Pfeif., *Wiegm. Archiv*, 1839. Sowb., *Thes. Conchyl.* plate 3, fig. 103, 115, 124, 125. H. variegata, D'Orb., *Moll. de Cuba*, plate 242.

Animal, when extended, one and a half diameters of the shell; tentacles, very long and slender; foot, drab colored; head, tentacles, eyes, and a linear spot on the median line of tail greenish black; lip, paler. The proportion of dark and light color, variable. Motions unusually brisk, nearly as much so as those of a Cyclostoma, and the animal is apparently much less timid. Found under leaves, and adhering high up the side of the precipice, near Chapeau's Cave, and never under ground like the other species. "Some are bright yellow without markings, others plain white, and then again with a white ground and beautifully marked."

HELICINA GLOBULOSA, D'Orb. *Moll. de Cuba*, p. 294. Sowb. *Thes. Conchyl.* plate 3, fig. 127, 128.

Animal, nearly white, tentacles dark. Found on La Carolina and Retiro, under leaves at the margin of woods.

HELICINA NITIDA, Pfeif., *Wiegm. Archiv*, 1839. Sowb. *Thesaur. Conchyl.* No. 68, plate 3, fig. 16. H. glabra, Gould.

La Carolina, St. Ana, Retiro, and Mt. Vernon.

HELICINA RUGOSA, Pfeif., *Wiegm. Archiv*, 1839. Sowb. *Thesaur. Conchyl.* No. 72, plate 3, fig. 132.

On the ground, among plantain trees, at Sagua la Grande.

HELICINA HISPIDA, Pfeif., *Wiegm. Archiv*, 1839. Sowb. *Thesaur. Conchyl.* No. 16, plate 3, fig. 112, 113.

La Carolina, Retiro, and Mt. Vernon estates; found just under leaves, in the woods, on the limestone knobs.

HELICINA RUPESTRIS, Pfeif., *Wiegm. Archiv*, 1839. Sowb. *Thesaur. Conchyl.* No. 46, plate 3, fig. 120.

Found at Retiro and Mt. Vernon estates, on side hills, among limestone rocks, under leaves.

Cyclostoma auriculatum, D'Orb., Sowb., *Thesaur. Conchyl.* No. 171, plate 31, fig. 277. C. bicolor, Gould.

Animal, small, of a cartilaginous color and aspect; the tentacles, bright scarlet; very sluggish.

Found on La Carolina, St. Ana, Retiro, and Mt. Vernon estates, in the woods and among recently planted coffee trees.

Mr. Sowerby regards specimens which I sent him, as belonging to this species. But I certainly never saw any with an aperture resembling his figure. It more nearly resembles his fig. 181, which he calls a variety of C. tortum. I rest for the present, however, on his authority.

Cyclostoma Sagra, D'Orb. *Moll. de Cuba*; Sowb., *Thesaur. Conchyl.* No. 166, fig. 279, 128. C. pictum, Pfeif. C. mahogani, Gould.

Animal, light dove color, smooth above, granulated at sides; tentacles, ferruginous; very active. This shell appears to vary much in size and form. Some are nearly cylindrical, while others are ventricose. Some specimens from Sagua la Grande are much larger than any I have seen figured or described. "They are widely diffused over all parts of the island I have visited. I do not think they climb trees, and have found them mostly about stones." The motions of the animal are so rapid that it seems almost to jump along.

Cyclostoma interruptum. Sowb., *Thesaur. Conchyl.* No. 141, fig. 150, 151. C. catenatum, Gould.

I was deceived in this shell by its aspect of maturity when possessed of only its single lip; which was the case with all the specimens collected for two years. Animal, light pea-green, neck reddish, tentacles bright ferruginous, nearly carmine. When in rapid motion, "instead of proceeding directly ahead, with the shell steady, it rests the shell on the ground until the body is extended as far as the shell will permit without dragging, then by a sudden jerk throws the shell forward, and so on alternately, much more rapidly than one would suppose possible. First one side of the animal moves and then the other, like an elephant."

Found in holes in the rocks, under stones, in the woods, on the hills, and in the same localities as C. *Sagra*.

Cyclostoma rugulosum, Pfeif., *Wiegm. Archiv*; Sowb., *Thesaur. Conchyl.* No. 155, fig. 166, 167. C. clathratum, Gould.

Animal, nearly colorless or tinged with violet; neck, orange; tentacles short, lemon-colored.

Found at La Carolina in the pastures under stones, or under ground by the side of stones. Thousands of dead ones are found in the hollows of the rocks.

Cyclostoma Candeanum, D'Orb.; Sowb., *Thesaur. Conchyl.* No. 151, fig. 283, 284.

Animal, emerald green; eyes black, surrounded by straw color; tentacles, green, darkest at tip; lip, light watery green.

About Matanzas.

Cyclostoma Auberianum, D'Orb.; Sowb., *Thesaur. Conchyl.* No. 150, fig. 285. C. crenulatum. Pfeif.

The animal does not appear to differ much from that of the preceding species, and the shell at first glance appears to be the same. But I think that, besides the double lip which the latter possesses, a more careful examination will satisfy any one that the sculpture is constantly different, being much more coarse and irregular in the latter, the longitudinal lines prevailing over the revolving ones, which is not the case in the former. They are found in company.

One species of Succinea was collected, which closely resembles S. *ovalis*, Say, and very possibly may be the same.

A few fresh-water shells were also obtained, among which were a small species of Limnea, resembling L. *umbilicata*, Adams, and which I have also received from Santa Cruz; one species of Physa, and several species of Planorbis, of which I think I have made out the following:

P. Havanensis, Pfeif. P. Cubensis, Pfeif. P. cultratus, D'Orb. P. Lanieriana, D'Orb.

A fifth species is one of much interest; inasmuch as its throat is armed with teeth, very much like P. *armigerus*, Say. The latter, Mr. Haldeman has proposed to consider as the type of a new genus, (Discus). Should this claim be confirmed, another species may be added to the genus. It may possibly be the species characterized by Pfeiffer under the name of P. *albicans*,* but if so, he has failed to notice its most interesting character, I therefore venture to propose for it the name P. *dentatus*.

Planorbis dentatus, Gould. Plate 24, fig. 14.

Testâ discoideâ, solidulâ, pallidè corneâ, utroque umbilicatâ; anfr. 3 leviter striatis, supra et infra subcarinatis; suturâ profundâ; aperturâ sublunatâ; labro intus callo albo incrassato; fauce dentibus sex, abditis, armatâ.

Shell discoidal, rather solid, pale horn-colored, about equally umbilicated on both sides; whorls three or a little more, feebly striated and slightly carinated above and below; aperture embracing about half the penultimate whorl, rounded lunate, the lip supported within by a rib-like, white callus; at a distance of about one fourth of a volution within the throat are six unequal, lamellar teeth, two on the inner, one on the upper, and three on the outer aspect of the throat; their place may be readily seen through the shell; diameter, $\frac{3}{20}$ inch; height, $\frac{1}{20}$ inch.

Found in a small lagoon at San Jorge.

If there is any one portion of the globe which would reward conchological research more than another, I believe it to be the West India Islands. Notwithstanding they have been so long known and so much frequented by all nations, a very small portion of the species, it is believed, have been collected, and those few have been poorly described and badly figured; so that it is not easy to determine them. One reason for the

* P. orbiculari, utrinque umbilicata, solidula, albicante vel pallide fulvicante; anfr. 3 teretibus; labro subincrassato, albo; apertura subovata.

latter difficulty is, the species are so variable, that their limits are almost conjectural. We have had examples of this, among the few shells here noticed, in the large species of *Helicina* and *Pupa*, and in *Helix gilvus*, *Cubensis* and *penicillata*. Nothing but careful and extensive observation of the shells with the animals and their distribution, in their actual habitat, by competent naturalists, can remove this difficulty.

Were it now a suitable opportunity, some of the animals of the marine species might also be here given. I cannot forbear, however to allude to one instance of confusion among authors.

Deshayes remarks, in his edition of Lamarck, (vol. ix. p. 206) that he has completed the synonymy of Littorina nodulosa, by uniting with it the Litt. tuberculata of Menke and the Turbo trochiformis of Dillwyn ; and says that these three names have been imposed upon the same species. But the truth is, two shells, generically different, have been confounded by all authors which I have consulted, the one a Trochus, and the other a Littorina. They live in company, and their external appearance is so nearly alike, that they would not be distinguished by a slight examination, though the distinctive marks are unequivocal when once observed. The one has a slightly developed columella, a thin lip, and a multispiral operculum ; the other has a broad, somewhat excavated columella, and a subspiral operculum. The former is figured by Wood as Turbo tuberculatus, and is evidently the shell had in view by Deshayes, and is a Trochus. The latter is a Littorina. D'Orbigny, in Sagra's Cuba, has figured both, with the opercula even, under the genus Littorina, with different specific names, and has added still further to the confusion by making a third species, Lit. dilatata, of superannuated specimens of the Littorina with a remarkably flattened and broad columella.

The Littorina is a more solid shell, lighter colored, and its tubercles are whitish ; the aperture is somewhat produced into a channel. The foot of the animal is oval, while that of the

Trochus is escutcheon-shaped, and its tentacles more delicate and shorter.

The true synonymy then would be as follows;

Trochus nodulosus, Gmel.

Littorina trochiformis, Dillw.; *Syn:* Trochus tuberculatus, Wood's Sup.; Litt. tuberculata, Menke and Desh.;

Litt. dilatata, D'Orb. (var.)

ART. XLII.—MINERALOGICAL NOTICES. By J. E. Teschemacher.

GLAUBERITE, brought from Tarapaca, Peru, by Mr. John H. Blake.

This mineral is found in small crystals, which are imbedded in a beautiful, silky, fibrous borate of lime, published in Alger's edition of Phillip's Mineralogy, under the name of *Hayesine*.

This Glauberite was analyzed by A. A. Hayes, and found to contain

Sulphuric acid,	57.220
Soda,	21.324
Lime,	20.680
Iron,	.444

It is essentially a compound of sulphate of lime and sulphate of soda. The first crystals I measured, the figure and measurements of which are in the last edition of Dana's Mineralogy, were extremely dull, so that I could only consider them as approximative. Mr. Hayes afterwards sent me some extremely brilliant crystals, the measurements of which coincided exactly with those of the Glauberite, from Villa Rubia, in Spain. The figure above named is that of the first crystals I found. Subsequently, others came to light, of very different forms, produced by other modifications.

It is stated, in Dana, that, if crystals of Glauberite are left in water, they will at length fall to pieces. This is probably true. Those from Tarapaca, if treated carefully with cold water, will permit nearly all the sulphate of soda to be dissolved out, leaving the form of the crystal unaltered, and the edges as sharp as ever. Their appearance before the microscope, after the loss of the sulphate of soda, is that of snowy-white, fine granular sulphate of lime (alabaster). From 15 grains of this Glauberite, I have obtained 6½ grains anhydrous sulphate of soda, and do not doubt that the whole quantity might, with care, be extracted. If some forms of these alabaster crystals had been first found and analyzed, they would have been pronounced to be pseudomorphous forms of an unknown mineral, of which sulphate of lime had taken the place.

Now, if the action of the solvent powers of various chemical solutions, as well as those of the gases which can be held by water, be studied with care, the natural decomposition of many minerals, as well as their replacement by other substances, in what are called pseudomorphous forms, will be very much illustrated.

PYRRHITE.

Prof. J. W. Webster, of Harvard University, has lately returned from the Azores, and brought with him some interesting minerals, several of which he has most kindly placed in my hands; amongst others, a beautiful Arragonite, at first sight much resembling the Needlestone.

He also favored me with two small specimens of a feldspathic mineral, probably albite, on which were several extremely minute but beautiful octohedral crystals, of a deep orange to a wine-yellow color, the smallest transparent, the largest translucent on edges.

At first, I considered this a new mineral, until, on comparing it with the account of Pyrrhite, in Jameson's Edinburgh Journal, vol. xxix., the resemblance struck me. I therefore sacrificed these crystals to the blowpipe; they gave the following indications: —

The minutest transparent crystals changed immediately, in the reducing flame, to a deep, dull indigo blue, perfectly distinct; the edges then rounded, and, after considerable exposure, fused without intumescence; on the application of borax, the fusion was immediate, and a small, transparent, light brown bead remained. The largest crystal was then exposed to the outer flame; it became opake, of a light grey color; before the reducing flame, it changed apparently to black; but the blue color is clearly seen, in a strong light, on the solid angles. Of this crystal, the edges alone could be rounded by long exposure.

The hardness is about equal to felspar, and the form is that of the regular octohedron. Although this form is unknown among titanic minerals, the experiments of Kersten lead me to suppose that it belongs to this family.

BUCHOLZITE AND XENOLITE.

In April, 1843, I read a paper before this Society, which was published among their proceedings, in which I asserted the identity of these two minerals. This has been confirmed by Rammelsberg, in his Supplement, published July, 1843, from a consideration of the similarity of their chemical constituents. This question may therefore be considered as settled; but it is not probable that Rammelsberg had seen the paper alluded to above.

On the singular Crystals of Galena, figured in Alger's and in Dana's Mineralogy.

A good explanation of the formation of these singular crystals may be given as follows: It is well known that a liquid globule of phosphate of lead, on cooling, from the action of the blowpipe, takes a polyhedral form, generally that of a rhombic or pentagonal dodecahedron.

A microscopic examination of this cooling process shows that, as the outer surface of the globule cools, the angles of the planes appear to start out from the circumference, the planes to flatten into their symmetrical shape; the uncooled liquid central portion pressed by the contraction of the cooling exterior, oozes out from the middle of the plane, and spreads in a thin, liquid plate, over part of the surface, taking nearly the form of the plane; contraction still continuing, a succession of thin plates ooze out, each, of course, spreading somewhat short of its predecessor, but retaining the same form. This is probably the mode of the formation of these crystals of Galena, all of which bear the appearance of having undergone fusion. On many crystals of Fluor spar, from England, successive plates of this kind may be observed; many of them, however, do not take their origin from the centre of the plane. If these, like those of phosphate of lead, are formed by the sudden cooling of heated solutions, this may easily be accounted for on the assumption that one side of the crystal was attached near the source of heat; the other side cooling more rapidly, the liquid inside oozed out nearer the more heated and still soft edge or plane. The crystals of phosphate of lead, on the contrary, cool equally on all sides. Forms of quartz, with these plates, are quite common; and I have recently found crystals of phosphate of lime, from Grafton, New Hampshire, with the same appearance. These plates have been considered as marks of cleavage lines; and it is evident that the cooling of each plate, previous to the superimposition of a fresh one, would cause less strength of adhesion between them than between other lines of the crystal.

PYROCHLORE. (*Microlite.*)

The close examination of above 200 crystals, of the mineral named Microlite by Prof. Shepard, and the comparison of them with about 50 crystals of Pyrochlore from the Swedish localities, and from the Ural Mountains, resulting in their agreement in color, cleavage, crystalline form and modifications, indicated to me, in 1841, the complete identity of the two minerals, although Wöhler's analysis had decreed the latter to be a titanate, while Shepard's had made the former a columbate of lime.

This identity, strenuously resisted by Prof. Shepard, although on grounds which show a very superficial knowledge of the whole subject, has been completely proved by subsequent analyses, particularly by that of A. A. Hayes, in Silliman's Journal, vol. xxxii. p. 341, and its station as a columbate of lime, according to one of Shepard's analyses, confirmed. Dana's Mineralogy, one of the arrangements of which is crystallographical, although in the last edition, entering into every other possible detail on these two minerals, singularly enough omits even an allusion to the above circumstance, notwithstanding its being so remarkable an instance of the power of crystallography to indicate error in chemical analysis, even in hands like those of Wöhler.

This mineral is an excellent exemplification of the difficulties which at present surround the natural arrangement of minerals, although chemical analysis is, unquestionably, hereafter destined to be its basis. The analyses of the dark-colored crystals give, as ingredients, columbic acid, lime, manganese, iron, tin, lead, uranium, &c.; whereas the minute transparent yellow crystals are probably pure columbate of lime, or, perhaps, even obtaining their color from a slight admixture of oxide of uranium, as this color differs much, in intensity, in crystals of the same size. These small transparent crystals are generally modified on the edges and solid angles of the octohedron; in the large, dark-colored crystals, these modifications are often nearly obliterated.

My largest crystal of Pyrochlore, from the Chesterfield locality, is $\frac{3}{8}$ of an inch at the base of the octohedral pyramid.

Columbite is usually described as of a dark, opake, submetallic, iron-black color. I possess a small crystal of this substance, from Chesterfield, of a brilliant, transparent, dark ruby red. I name this subject, because, as in the previous instance of Pyrochlore, the small, transparent crystals of minerals are usually most free from adulteration, and the fittest to produce the true atomic formula on chemical analysis. The excellent observations of Rammelsberg on this whole subject are well worth the attention of all mineralogists.

PYROPHYLLITE and VERMICULITE.

In the paper before alluded to, published in the proceedings of this society, I have stated the probability of the identity of these two minerals.

Vermiculite is imbedded in a decomposed, magnesian, probably steatitic mass, of a light mealy appearance; from this it is almost impossible completely to clear it. Thompson, no doubt, therefore analyzed a considerable proportion of this substance with his specimen of Vermiculite. Steatites contain but a mere trace of alumina; hence his analysis would naturally give much less of this ingredient than Herrman's of Pyrophyllite. Accordingly, we find, in Herrman, $29\frac{1}{4}$ per cent alumina, in Thompson, only $7\frac{1}{4}$ per cent. On the other hand, steatite contains about 30 per cent. of magnesia. And here the same coincidence takes place. Herrman finds only 4 per cent. magnesia, and Thompson 17 per cent. They also differ about 5 per cent. in the quantity of water. This is not surprising in a mineral whose singular character in heat is supposed to arise from the mechanical existence of water between the laminæ, although I do not consider it a fact by any means proved that it is water alone. The ingredients of both analyses are the same, only differing in quantity, except the iron, which, in one, is peroxide, in the other protoxide. The difference in these two analyses, I conceive far from being an objection to their identity. Among the vermiculite, I have recently observed several laminæ, of a light apple-green color, resembling the original description of Pyrophyllite by Herrman. Should future researches completely prove their identity, I believe Vermiculite was first described. This name ought, therefore, properly to attach to the mineral; but this is a subject of very trivial importance.

In the future progress of geology, when the lines and directions of paroxysmal action are better understood, a strict comparison of the inorganic ingredients of the elevated mountains and crystalline intrusions arising from periodical movements or convulsions of the central liquid mass, in places distant from each other, will certainly become a subject of considerable interest, and be invested with a character somewhat resembling that of the comparison of the organic ingredients of sedimentary deposits; nor is it impossible that such investigations may eventually elicit data of great importance in geology.

For the generalizations of some future master spirit on this subject, the mineralogist of the present day is storing up facts and materials; and it is from this prospect that a discovery of the identity of minerals from distant localities, and the purification of mineralogy from the numerous supposed new species with which the conceit or want of industry of its votaries have loaded it, becomes an object of some interest.

ART. XLIII.—ANALYSIS OF PINK SCAPOLITE, AND OF CERIUM OCHRE, FROM BOLTON, MASS. By CHARLES T. JACKSON. Read Jan. 3, 1844.

Pink Scapolite. This mineral occurs in abundance at Whitcomb's lime quarry, near the junction of the white granular limestone with Gneiss Rock, at the top of the quarry.

It is crystallized and massive. The crystals are in regular right square prisms, with their lateral edges occasionally replaced by planes, converting the crystal into an octagonal prism.

The crystallized specimens are generally of a lighter color than the massive, and frequently are only colored on the surface, presenting a translucent or transparent and glassy appearance in the interior.

Sp. Gr. 2.7138. Hardness 5.7 of Mohs scale. Color delicate pink, or rose red, or pale lilac.

Before the blowpipe alone, fuses into a blebby enamel, vitreous and white.

With soda, melts into glass.

With borax, melts into glass, light yellow while hot, but colorless when cold.

With salt of phosphorus, dissolves, and the bead is yellowish while hot, and colorless when cold. The analysis was conducted on separate portions of the same piece; enty-five grains being taken for the determination of the silica, alumina, lime, magnesia, and cerium, while fifty grains were operated upon for the alkalies. Each analysis was repeated on similar quantities. The water was determined by heating one hundred grains of the coarse powder to dull redness. In the analysis for the alkalies, the first process was by fusion with carbonate of barytes, and then another portion was decomposed by fluor spar and sulphuric acid. In the other operations, the analytical processes of Berzelius and Rose were followed. It will be unnecessary to detail them in this paper.

Results of the Analysis reduced to per centage.

	Cont's.			Ratio.
Silicic acid,	45.940	= ox. =	23.865	= 4
Alumina,	28.840	"	13.469	" 2
Lime,	14.811	"	4.160	
Soda,	5.430	"	1.389	=1
Lithia,	1.580	"	0.598	
Potash,	0.640	"	0.108	
Magnesia,	0.208	"	0.078	
Oxide of cerium,	2.000	"	1.586	
Water,	0.500	"	0.444	
	99.949			

Formula 2A Si + (Ca Na Li) Si^2.

The oxide of cerium, from its brown color after ignition, evidently contains the oxide of lanthanium combined with it. We have, as yet, no accurate process for their separation.

ANALYSIS OF CERIUM OCHRE.

The pink scapolite is frequently invested with a thin, sulphur-yellow powder, resembling, in appearance, the native oxide of molybdena. This I have analyzed, and find it to be the hydrous oxide of cerium and yttria, containing minute proportions of fluorine and uranium.

One grain of this powder, scraped from a specimen of the scapolite, yielded

Ox. cerium,	0.2 gr.
Yttria,	0.1 gr.
	.3

This mineral has the following characters:—

Before the blowpipe alone, on charcoal, it turns brown, but does not melt. With soda, it forms an opaque, greenish-yellow bead, which becomes almost white by cooling. With borax, it dissolves readily into a transparent glass, which is orange red while hot, and nearly colorless or pale green when cold. It retains this pale green color in Rfl.

With salt of phosphorus, dissolves into a glass, which is orange red while hot, and pale green when cold. In Rfl. it still retains this green color.

When the salt of phosphorus is saturated with this mineral, it becomes opaque when cold, and has a greenish tinge.

The mineral dissolves in warm hydrochloric acid, and forms a lemon-yellow solution, from which crystallized sulphate of potash throws down a white powder, which is sulphate of cerium, yttria, and potash. The yttria being separated, and the cerium precipitated from its solution in hot water by potash, and then heated to redness, becomes brown, and has the usual characters of a mixture of the oxides of cerium and lanthanium.

When the usual test is applied for the detection of fluorine, a slight etching of the glass is discovered.

From the above researches, it appears that we have several interesting combinations of cerium among the minerals of Bolton. I long ago suspected that the pink color of the petalite was due to the presence of cerium, having observed that color surrounding the Allanite which occurs in it. The circumstance that the pink scapolite does not become brown or black by exposure to the action of the atmosphere, caused me to suspect that its pink color was not due to the presence of oxides of iron or manganese; and the above remarks have proved that the cerium ore is its coloring matter.

In effecting the above analyses, I have been assisted by my pupil, Mr. Joseph S. Kendall, who has repeated every process in the analysis.

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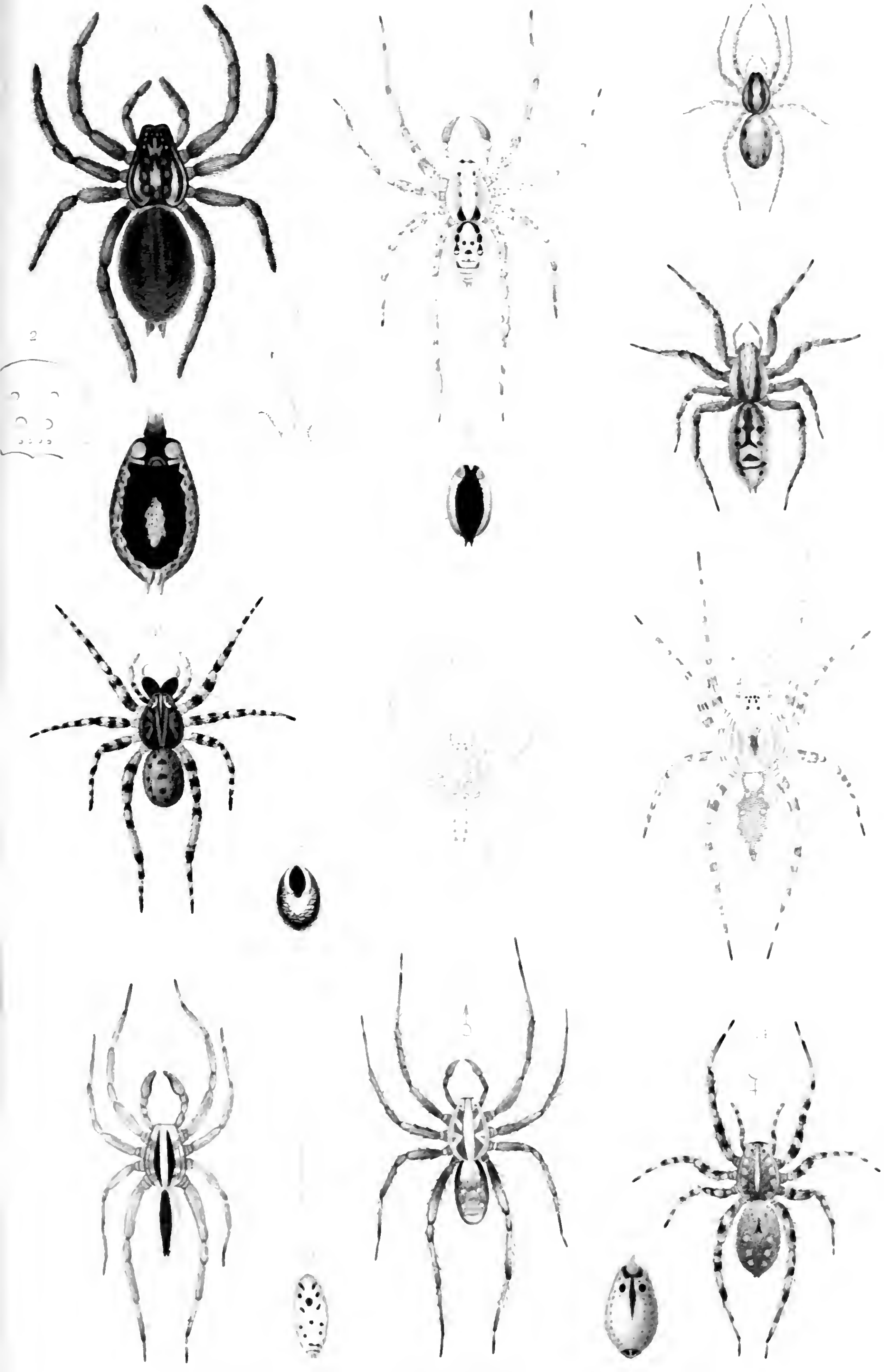

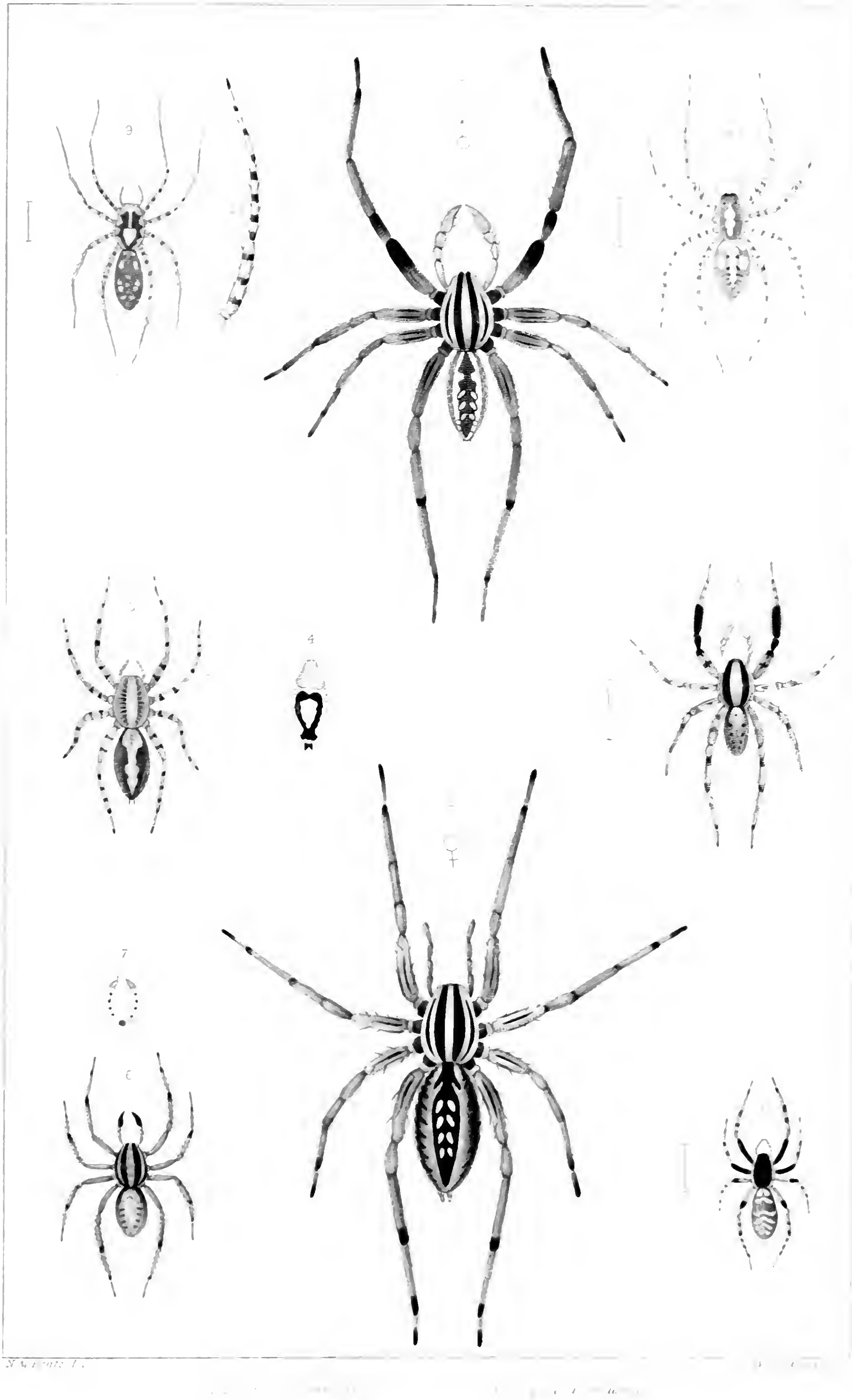
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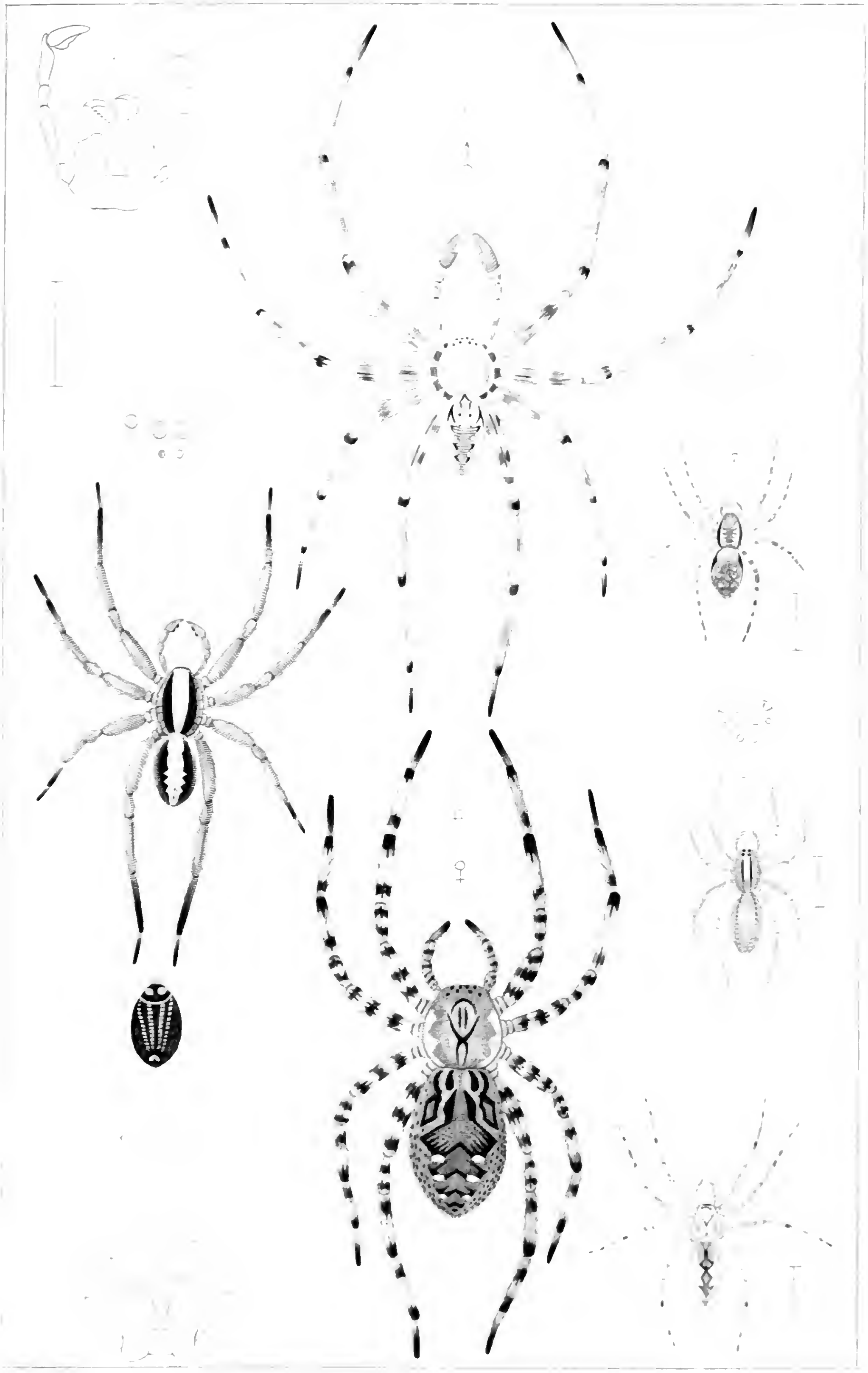
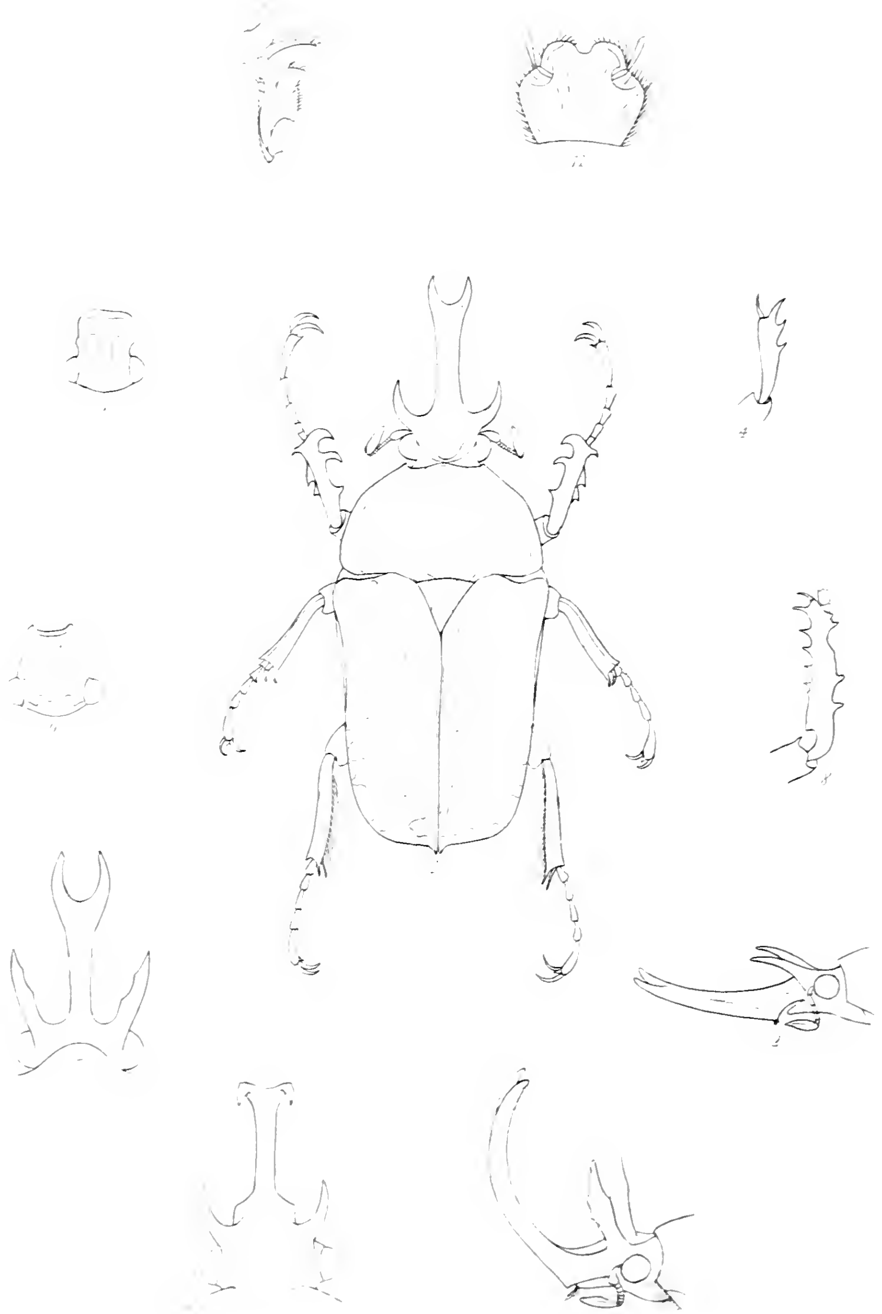
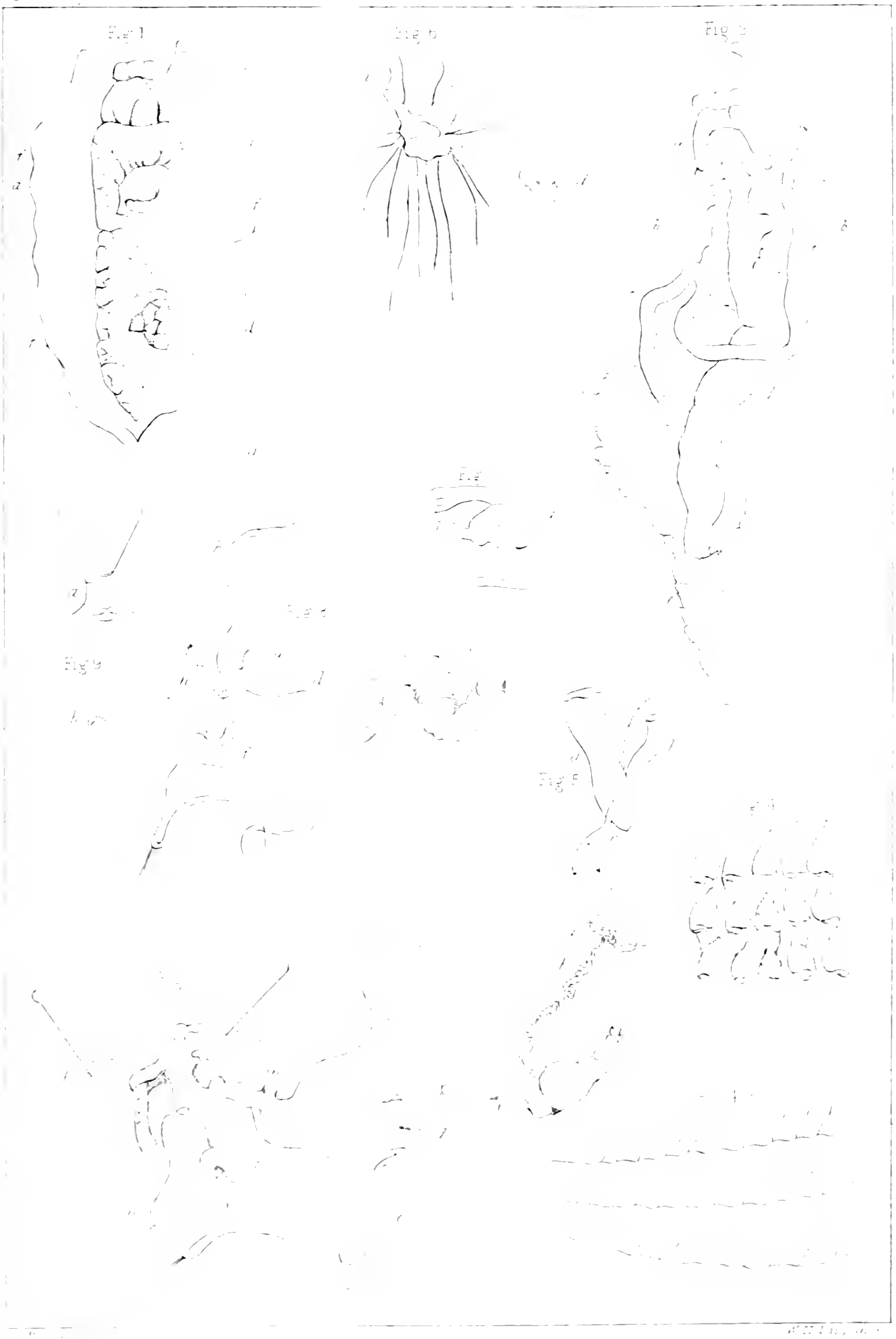
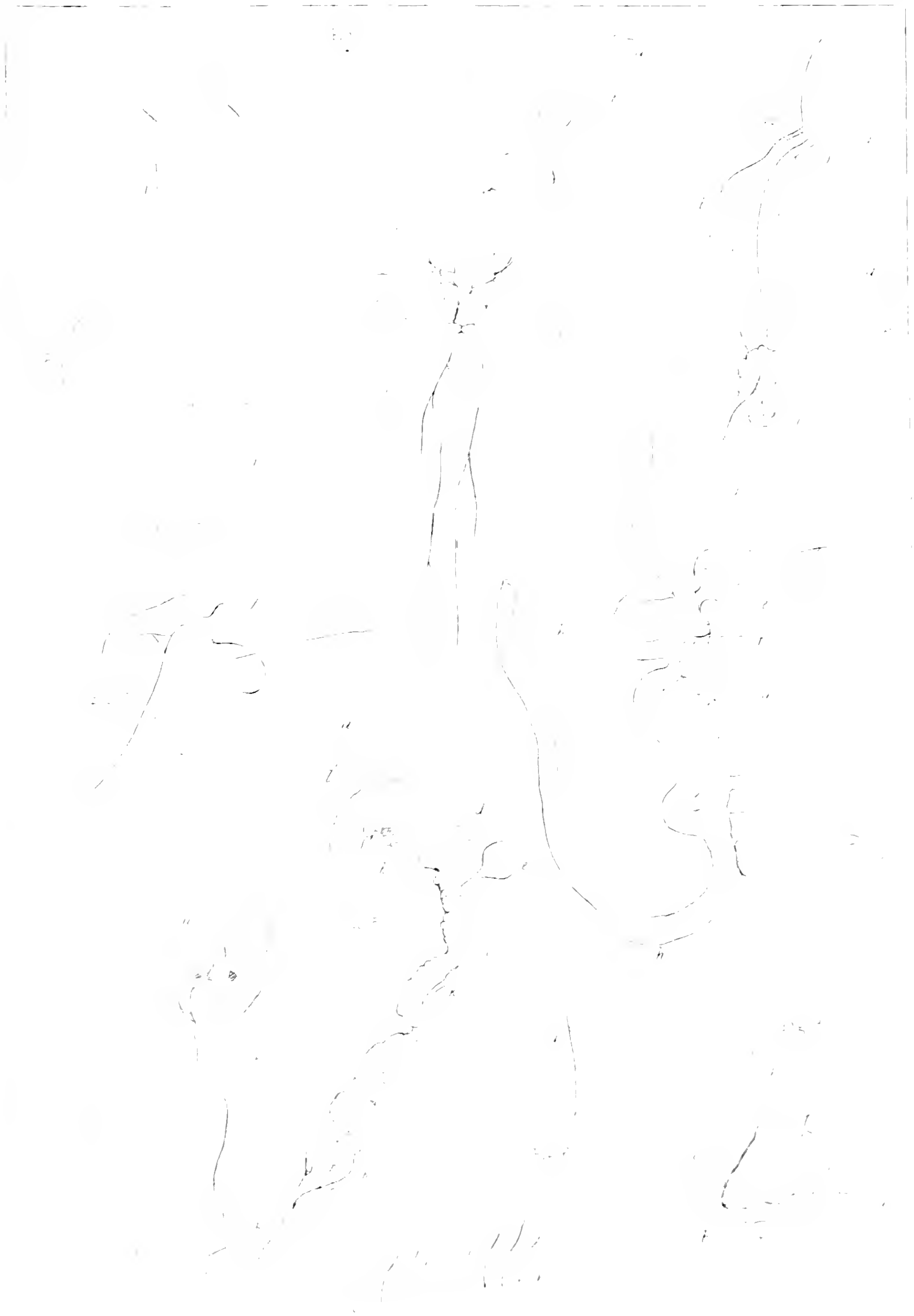


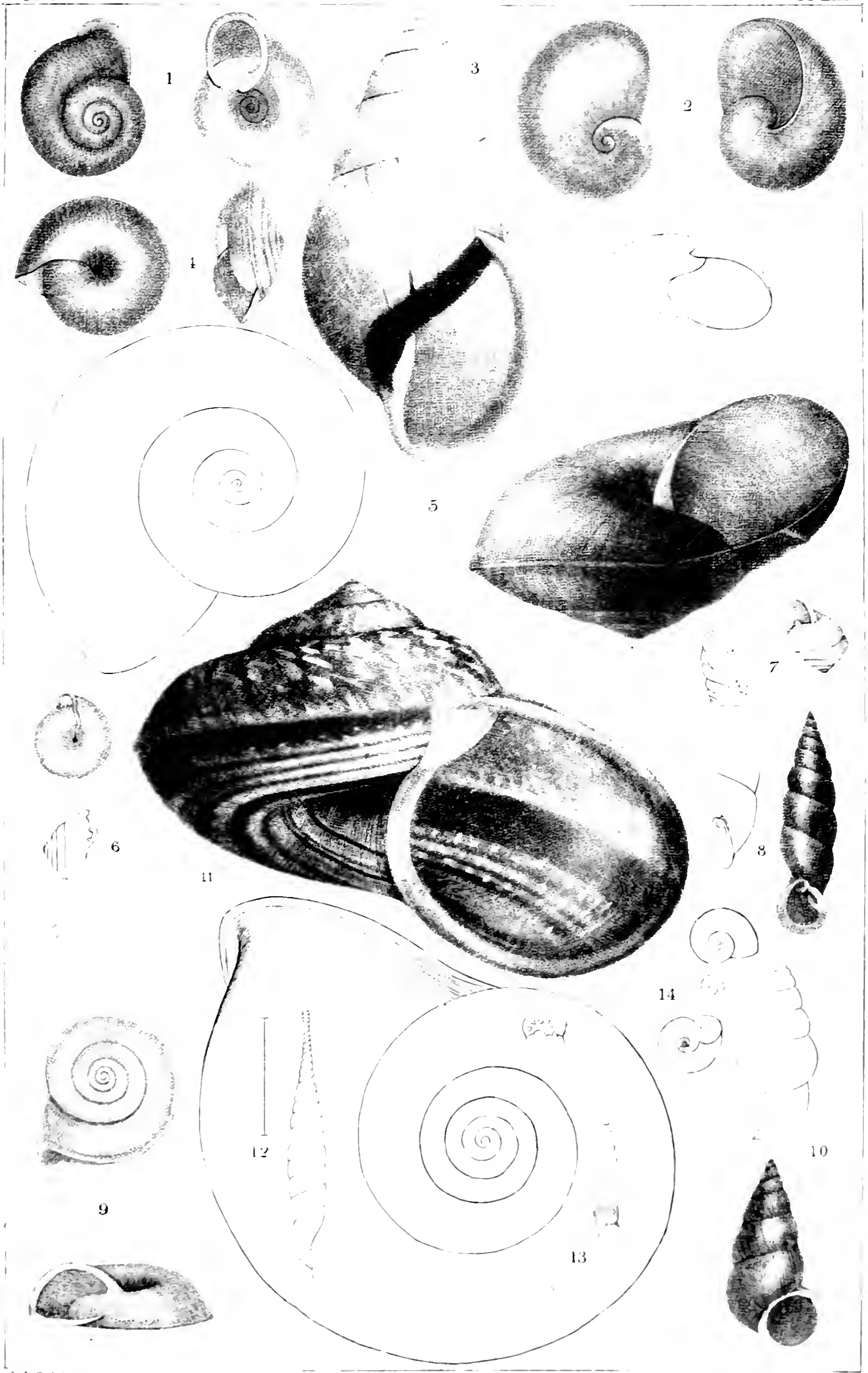
Helix indentata

Alex Lawson









A.A.G. del.　　　　W.H. Tappan Sc.

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