1. Never rest satisfied until you have found the best examples of a species which your time and opportunities will afford.

2. Never collect imperfect or immature specimens, unless they exhibit some character making such a step desirable.

3. Having found a station which produces the finest specimens, study it carefully, that you may the more easily recognize such surroundings again.

4. If specimens are abundant collect plenty, & the work on that species will be done at once, save as you meet with desirable varieties.

5. Remember that it is always well to have your specimens good and clean.

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Land Shell Faunas.

1905 Hood Island

Sep 25 Go ashore in Gardner Bay. Take a rocky ridge leading inland & begin a slow ascent. Evidently the dry season. for everything is dry & crisp. Look in vain under the rocks for shells. At noon on the high rocky pinnacle which overlooks the Bay I found the first shells. Diligent search soon brought many to light. They were in a state of hibernation – glued fast to the under surfaces of the rocks. Their favorite location seems in the rock crevices where one stone overlaps the other. Working about this high rocky elevation Mr. Williams & I secured a nice bunch of specimens.

At first observation & with the limited number of specimens they seemed :–

Bulimulus hoodensis
" approximatus.

During P.M. I gather marine shells in Gardner Bay. Very poor territory – only get a number of specimens of Purpura platula the same as the Cocos Island form. Secured ½ doz. of the Chitons which are here especially large.

Sep. 26.

Head straight for the high rocky ground where I had yesterday's success. Spend the whole day here searching under the rocks and take more than 400 specimens. The species continue to be the same two reported on yesterday's collecting. Mr. Stewart joins me at noon — his barometer reading gives an altitude of 300 ft. Just now it seems that the shells do not occur on any elevation less than about 300 ft. At best I was not able to obtain any less than this.

Sep. 27.

Works on Gardner Island. Inland at an elevation of about 150 ft — the highest point on the island — I took about 25 specimens of land shells. They were all of one species — quite like "B. hoodensis" and approaching "B. Snodgrassi". It may be possible that with a sufficient number of species I can find variation enough to construct a sub-species.

Mr Beck returns from a long inland trip on Hood. He brings back a number of specimens. Among them is a questionable fluid species very like "B. approximatus."

~~Among~~ Besides this ~~the~~ there are a

number of very minute forms. They are quite spiral in shape, but may be only minature forms of the ~~two last~~ mature forms secured. He reports a great abundance - some in the roots of old grass, but all at an altitude of 1300 ft & upward.

Sep. 28.

During the middle of the day I collect some more of the land shells of Gardner. Still on time the single species cited on yesterday. Mr. Stewart takes the altitude as 175 ft.

I now have quite a series of these from which I may be able to build a sub-species. The forms seem just a little lighter in color than the Hood counterpart - which character may be attributed to the slightly less altitude. Again, they seem slightly dwarfed - due to the same reason.

Generally speaking there is little or no difference in the vegetation between the ~~S~~ E. & S.E. side & the Northern - North West. Mr. Stewart however reports a slight difference in favor of the ~~Southern side~~ E. & S.E. side. On this flatter side are the more Annuals; on the opposite are the Perennials. Most Perennials do occur on the E. are much bent, ~~over~~

some of them quite prostrate, their heads & branches turned inland toward the N.W. Mr. Stewart attributes this difference to the direction of the prevalent winds & the greater pt. of moisture on the E. & S.E. side. This character is best seen on Gardner, but Hood, bears out the same idea.

Of course, owing to the low altitude, the life zones are not strongly marked. The probable fresh leafing in the spring will show a more marked difference - at least in appearance.

Sep. 29.

Go a long distance inland on Hood. - No new species found. All the forms taken were above 300 ft. in altitude. Thus far I have been unable to take any at any lower elevation than this - with of course the exception of Gardner Island.

An important observation concerning the probable derivation of the island life was: on the E & S.E. coast of Hood I found quite suggestive quantities of drift - there were cocoa-nuts, large pieces of the ~~st~~ light bamboo, large worm eaten trunks of trees etc. It was at this point that I found the only patch of mangrove on the island - evidently a recent ~~acquis~~ acquisition. The beach marine shell specimens are also the most numerous here.

Must also note that I took shell specimens from the bottom of the large depression in the inner part of the island - a depression which evidently forms the little pond during the wet season. Heller & Snodgrass make mention of this pond in their bird paper. The forms were the same as formerly taken.

Gardner Island.

Oct. 3. Go ashore on Gardner Island, near Charles, difficult landing. Notice a great number of dead land shells. Worked up until I reached an altitude of 250 ft. or more when I began to secure the live shells. They were in a state of hibernation glued to the dead tissues of old cactus leaves. The ~~bases~~ best sheltered place seemed a small pile of old cactus leaves. Another excellent place was the interior of the old rotten recumbent stems of the cactus. In the last named conditions they were glued to the outer bark. The status & environment of the shells was one of almost extreme dryness. The whole surface of the island is intensely lava & volcanic. But little soil has formed, & it is of a dry, sandy, large-rough-pebble nature.

The dry, dusty nature of the situs is reflected in the sculpture of the shell, it being rough & much effiseled.

The whole surface of the island is completely covered with the dead shells. The crater, 740 ft high, was especially filled as reported by Mr. Hunter & King who visited it. The specimens taken will be placed in a jar & sealed for safe keeping.

Oct. 3. Champion Island - (Near Charles.)

Spent about 1½ hrs. on this small volcanic island. Numerous dead shells found all about. Took quite a nice bunch of shells from the old crater, about 150 ft. elevation, the ~~biggest~~ highest point on the island. They were taken from their retreat deep in the crevices & under the light lava blocks. The living forms were in a state of hibernation, glued fast to the stones. The forms were all like those of Gardner, but may be noted as a ~~color variation~~ coloration variation.

Secured one large dead shell of another species. Unable to get any live forms of this. Situs same as Gardner.

Hood Island.

Jan 31 – Feb. 7, 1906

1. Bursera
2. Opuntia
3. Croton
4. Parkinsonia.
5. Acacia
6. Cryptocarpus

} List of characteristic genera to be used in general description of the island

Hood island at this time of the year presents a completely dried aspect. Everything is crisp & dry. even the salt-loving, waxy-leaved bush of the beach is nearly destitute of leaves. A single tree the bursera, was beginning to leaf out & lent some green to the otherwise barren appearance.

Began collecting on the Lichens directly opposite Gardner Bay, at an elevation of 200 ft. Numerous specimens taken – of apparently two species, the long [illegible], banded one, & its [illegible] slender companion of a light color. As would be expected from the extremely dry condition of the

vegetation. all the specimens were found in a state of hibernation - their umbilicus securely glued & sealed with a thin film like membrane. to the under surface of the lava blocks.

Visited the 5 ro ft. elevation to the S. Collected abundant specimens of the two species noted & possibly a third - a small, stout. smooth. dark brown form. The specimens showed an interesting tendancy to variation from those just across the valley to the N. - the first taken. Should be further studied.

Will probably be shown geologically that these peaks are the remnant of the old crater & since its breaks have been allowed to set up a slight variation. It is true however that the higher alt. of the S. peaks & its more S.E. position may supply more moisture & thus acct. for the apparent tendancy toward the darker shades;

~~The~~ all the specimens taken show a fairly good tendancy to respond to their environment - (expand.) collect in Gardner.

Hood.

June 23 – July 3, 1906.

At the time of this visit the island still presents the dried appearance, in spite of the fact that for entire time of stay there have been frequent squalls of light rain, occurring daily often several times in the day. There was enough moisture ppt. to form little pools in the hollows on the upper sides of the rocks. This moisture, probably the result of the recent setting in of the S. E. trades seems to have awakened the hibernating mollusks to active life. The rocks which afforded so many specimens on former visits, now have much less, & most of the specimens are quick to fall from the stone & move slowly off. This condition is true mainly of those shells on the higher altitudes. - Span. due to the greater ppt. of moisture high up & the drying effect of the winds on those higher

levels.

Mr Beck takes a picture of a typical block of lava with the three species of B. attached. Photo also shows the nature of the territory.

A notable acquisition is a number of specimens of Pupa. They were taken by Mr. Beck & myself at about 1,500 alt. - amid dry surroundings. under bark of dead wood Mr. Beck took his from the old tortoise bones.

Indefatigable Island

Oct. 23-27, 1905

The fresh water pond which during the wet season attains some size was at this season quite dry except along the W. border where a grove of mangroves still retains a pool. This pool was perhaps 25 yds. long by 4 wide. In the open where the lagoon had been there was a light coating of salt. Observed dead Auriculae like forms in the mud of the dried lagoon. Investigation of the pool showed quite an abundance of live forms. They were collected from the pool where their favorite position was under dead leaves, adhering to the roots of the mangrove and perched upon the young mangrove shoots. The surroundings are: cool brackish water, long grass & young shoots, continuous shade.

As no such form is reported from this island a large series has been taken ~~with the idea~~. Such an isolated island, it's size & age would indicate that the shell will prove to be an entirely new species.

Walking inland from the coast

dead shells were observed about one mile inland and at an alt. of about 200 ft. No collection made until at alt. 450 ft. where the specimens of bottle No. 36 were taken from under lava bluffs. In a complete state of liberation. The live forms were very scarce but dead ones equally numerous. The dead ones were traced to an alt. of 600 ft. where they became rather few.

Beginning with about 400 ft. alt. a small Septimania like form, dead, accompanied the one first cited.

At about 450 ft. alt. a great many dead Succinia were also observed. At this alt. ~~they~~ the Bulimulus (No. 36), Septimania & Succinia are all together. All

All three may prove to be new species. ~~for~~ Both the Septimania & Succinia are noteworthy.

This S. E. anchorage is one little visited because of its danger, and the general inaccessibility of this territory.

The rainy season will probably permit of the collection in a live state of all the forms seen dead.

Oct. 28, 1905

A long trip of exploration inland. Worked about W. of the first big hill (tortoise). In ~~the~~ this direction there were three ones lying in a direct line W. from the first (big hill) These hills extended from the lower 400 ft. level to the ~~6~~50 ft. - just a second level & a transition into the 3rd or dense tree growth zone ~~grassy~~, which began at about the 3rd. hill (alt. about 800 ft.) Owing to the dense walking territory only the second hill could be reached. Began collecting here. Picked up a series of the large B. ~~form~~ (crenulated) forms reported before. They were fairly abundant. (Bottle No. 36). These were accompanied by dead Succinia, the Leptinaria like forms, a small B. form, and the thin forms of bottle No. 37. ~~These~~

Bottle No. 37 represents another species not reported & therefore important.

Bottle No. 38. a Leptinaria like form - crenulated. Not reported & therefore important.

The vegetation of this alt. (650 ft.) is fairly thick. Ferns, orchids and

the trees have some considerable size, say 15-20 ft. tall. The margin may be very productive during the raining season when the Succinia at least should be alive. Noticed a number of these fast in a fairly good state of preservation under the lava blocks accompanying those of No. 36, 37, & 38.

Mr. Bifford reports that he saw a number of live Purpura on a slight elevation quite close to the mangrove swamp where the Auriculae were taken.

Indefatigable Island

Nov. 6, 1905. Academy Bay. South Side.

A long trip inland blazing a trail. No collecting done except a few shells taken by Mr. Williams. He secured a few of the Septinaria like forms of Bottle No. 138 under the barks of dead, ~~erect trees~~ trees still standing. The shells were in a condition of hibernation. Alt. 300 ft.

Specimens of the same as the species enclosed in Bottle No. 36. were taken from under the barks of dead logs lying on the ground. Just a few too, were found under the barks of dead, erect trees. 200 - 300 ft. alt.

This is evidently the dry season, the same observation made at the other anchorage.

During the trip inland considerable moisture fell - enough to wet the bones & bushes.

This side of the island is especially marked for the great abundance of vegetation at the low levels, and the occurrence of plants characteristic of high ~~grounds~~ alts. on other islands. Noticeably the ferns, lichens and

orchids many ~~&~~ putting in their first appearance as low as 200 ft. alt. Even at 200 ft. the lava rocks begin to be quite completely covered with vines, mosses, bushes etc. The surroundings of the few shells taken are far from the rather dry ~~and~~ conditions of the other anchorage. These conditions may offer something interesting by way of variation in response to environment. — Shells perhaps as a lessening of the corrugated base of the forms taken at the more eastern anchorage.

Nov. 8 & 9.

A long trip inland.
No collecting until near the end of the trail of Nov. 6's cutting. Here at an altitude of 450 ft. the small forms of No. 44 were taken. They were reposing openly in the damp leaves and leaf mold of this rather damp level. Beginning with the 300 ft. level the vegetation became quite abundant; lichens, orchids & the prickly tree became in evidence; & the cactus had completely disappeared at the elevation of 400 ft. The ferns became more numerous & the trees attain

a very considerable size (50-75 ft. high) & spreading over quite an area.
Beginning with the 450 ft. level just a few of the forms of No. 45 were taken. Those taken were the smaller specimens. No. 45 specimens became more numerous with the continued advance inland until they accompanied the Succinea of No. 42. on the leaves of the abundant vegetation of the higher levels. It will be noticed that their shell walls are very thin like those of Succinea.— Another response to environment.

After passing No. 44. ~~~~coll~~~~ station the forms of No. 43 put in their appearance. They were taken from the trunks of a peculiarly smooth barked, tall, Eucalyptus like tree which was first ~~~~ob~~~~ observed here. The shells were not strongly adhering to the bark and ~~~~in~~~~ considering the damp surroundings & altitude of frequent fogs they were in an active state of life. They attained quite a height on some of the trees, ~~~~sa~~~~ from 10 to 35 ft. & in some cases higher on the large trees. ~~~~A peculiar~~~~

It is remarkable, too, that the shells do not inhabit other varieties of trees, for none were taken from any but the smooth barked species. The station of No. 43 continued until the collecting was carried into the more open, vine-encumbered, rich vegetation, which began at about 550 ft. alt. in its densest degree.

About where the tall trees of the habitat of No. 43, became less numerous & the terrain became rather open the whole region is covered with a mass of almost impenetrable vines, nettles, tall ferns & thick brush; in the midst of this jungle the Succinia & those of No. 45 thrive & are taken from the leaves of the plants.

The few dead specimens of the other stopped bottle No. 46. were taken by Mr. Williams at an alt. of 750 ft. They are here entered because of a marked difference from the other large shells, like one of the accumulated base which they resemble. At this point it should be noted that the specimens identical with those of No. 36. of the other anchorage had many dead forms from the beach inland to about 750 ft. at this

last level the dead shells lacked the bleached condition of the lower level shells, thus showing that they had lived there the more recently — the longest — in the damper upper level.

It will be plainer if a summary be given of the different zones limited at in the shell habitat discussion:

0 – 100 ft. alt. first zone.
Plenty cacti, both species, the thorny locust like legume tree, ~~the~~ the prickly green vine Euphorbacea. Very rocky fissures

100 – ~~300~~ 350 ft. alt. 2nd. zone
Lichens, long grass, cacti growing to greatest height in addition to the characteristic forms of the first zone. The upper part of this zone marks the beginning of the orchids & the disappearance of the cacti.

ferns are small
little more soil

350 – 1500 ft. alt. 3rd. zone.
This is the dense green zone of the island. The trees attain great heights. There are no cacti, a tall grass & ~~grasses in~~ bushes grow in profusion. Orchids are not numerous. ~~The~~ The upper ~~part of the zone~~ limits of the zone

the ferns are tall, umbrella trees & plantains are plentiful, there is a rich soil of light leaf mold which completely covers all the lava blocks.

A region of almost constant rainfall. Three or four heavy rains fell during the single night & day spent in this alt.

1500 – upward. the zone.

Absence of trees, tall coarse grass, & tall ferns.

Some of the peaks seem quite barren. not visited.

It must not be imagined that there is an abrupt change between these zones. It is far from this. for there is a slow intergradation from one into the other with certain characteristic plants & conditions predominate. together with the absence of former conditions.

This gradual transition is more prominent on this, the windward side, because of its ~~be~~ ~~more~~ facing in the path of the moisture laden winds.

Zones are not nearly as abrupt

Chudefatigable

as on Charles. It will be further noticed that the altitude & situs of shells on this side is relatively lower than those of the S. E. anchorage. A fact explained by the greater ppt. on this side.

Did some collecting in the salt lagoons directly inland from Academy Bay. The lagoons are now almost dry and there are numerous dead shells but no live ones were taken. From the dead mist would seem that there are two distinct species here, one being entirely different from those of the S. E. anchorage.

Nov. 16; 05 Among some shells handed me by Mr. Miller I find the minute Suppya like form of bottle No. 37. which he found on the leaves of the wet zone accompanying Succinia. This is the same form that I secured from lava blocks at the S. E. anchorage.

Also a few Auriculae shaped forms (No. 47) taken from the wet zone.

Nov. 20.

At N.E. anchorage. A marked change in the vegetation. The dry, pasty grass zone extends well toward the top, probably does not begin until an alt. of 2000 ft.
The soil is a soft reddish dust, the breakdown of the latest lava flow. No shells collected to none reported by the other observers.

Nov. 23. Stopped two days at Seymore low & day but there are no land shells.

Nov. 25.
Stopped for a few hours at Daphne.
(Description of the rocks under Geology)
Mr. Williams handed me the few specimens of bottle No. 51. Station is the day inside of the crater, under lava blocks

Nov. 25 – Dec. 1.

Two of these days were spent in a ~~week~~ march inland toward the high land. In all about 6 miles direct inland, and an alt. of 1100 ft was attained.
This area of country crossed was a rather par. ~~[illegible]~~ There were numerous meadow like patches of tall dry grass

Indefatigable

The common grayish bush, Croton. the Cotton, & ~~the~~ a few cacti. & some of the prickly acacia in general comprised the vegetation. Rather an abundance of the sweet scented bush, Bursera. This zone reached an alt. of some 1700 ft. where the light green began to merge into the dark green, which began probably at about 2000 ft. alt.

At about 500 ft. alt. the first dead land shells were observed. At an alt. of 1100 ft. on the sides of a high crater a great number of dead forms, the same species as the one at 500 ft, were seen. They were abundant under lava blocks, but no ~~dead~~ live specimens were taken.

Bottle No. 50. is a fair example of the forms.

Jan. 12-13.

Academy Bay

Worked inland to "lunch tree", (400 ft. alt) collected some of the small corrugated pink apex shells reposing on the dead leaves in the rather damp. & fairly

dense vegetation. Then proceeded a little further inland (5 or 6 ft. about), where the larger rough corrugated, pale, forms had their stations on the smooth bark of the peculiar eucalyptus like tree. In regard to these last, it was observed that the shell rather harmonized with its background of light brown barks, flecked & speckled with small & large silvery patches. With this background the added complication of silvered boots & branches the shell is not so easily detected. Again the smooth barts ~~of the tree~~ offers a fine surface for travel & a good surface for the hibernating season.

Jan. 15–18

A four days trip inland in an effort to cut through the green zone. The region up to Camp No. 1. has been described in former notes on the first trip of two days.

Beginning at this point, the party worked toward the top in a slow ascent over the gently sloping country. The volcanic rock has completely broken down to form a heavy reddish, clay soil, and this together with the part granitic of dense vegetable has formed a soft, highly productive soil, through

Indefatigable Island.

which only occasional rocks protrude. Through this territory it is almost impossible to force a trail unless one be armed with a machete and cut each step of the way. The nettles, small bushes, ~~wild~~ heliotrope, tall fern-like brakes, long heavy vines, some trees and the clinging vines of the ~~wild~~ morning glory all combine to form an almost impenetrable thicket - a green zone indeed. Campsetare continued

Soon after leaving the 600 ft. ~~level~~ alt. the rough, corrugated, pale B. [illegible] were collected from a new station - on the vines and leaves of the green vegetation. They were fairly numerous & were taken up to the highest alt. reached, 1100 ft. but during the last two hundred feet of ascent they seemed to grow much less numerous.

Beginning at 550 ft. the first live Succineas were taken. They continued through the whole green zone.

The brown zone - a low bush to bush of a brownish color & hung with moss.

bad a rather abrupt beginning at about 1200 ft. From this alt. it continued in alt. ~~but~~ *formed an unbroken brownish cap for the entire upper levels of the island. As nearly as could be determined it ~~appears that~~ the brown brush decreases in height and the whole forms a brown grassy area

(Mention the "occurrence of the ~~green~~ green Canna like ~~bush~~ plant - beginning at 700 ft. alt. in patches - height 6-9 ft. - large leaves etc.)

At 350 ft. elevation a few Pupa & Helicidae were discovered under the moss & old bark of a dead tree trunk. The Helicidae (a number of which were collected & are enclosed in No. 58) were of a light gray, figured in black characters, probably the same as taken from the E. anchorage, Punta Delarguada. Now while in the green zone & at an altitude of 1000 ft. one or two specimens of Helicidae were taken from the leaves. These Helicidae were of a pronounced ~~completely~~ .. [illegible] brown, without.

Indefatigable

marking. - the two ~~species~~ shells are undoubtedly different species and due notice should be taken of this. There are probably a few additional specimens of the genus some Helicidae in some other package. - for Mr. Williams handed me a few on our first trip inland ✓

Indefatigable.

July. 23, -'06. "Dove ~~Pie~~ Roads".

This is the due west side of the island and thus on a right angle with the trail inland from Academy. This point offers a good point of observation for the observation of the altitudinal ~~start~~ slant of the life zones.

~~The~~ First orchids begin at 550 ft. alt.

Compositae at 700 ft. alt.

The name of the long vine or runner in the green zone is "cissampelos".

The name of the red bean tree is --- "erythrina" 150 ft. alt. small bush 2½ ft. high.

Noticed quite a number of dead specimens of the large, brown, basal corrugated B. Jones near the shore, but no live specimens. Also some dead specimens of Pupa - probably "Pupa clathra"

Jervis Island

Dec. 20, 1905

Jervis is a small, roughly circular islet of some 1¼ miles length of the greatest diameter. The whole surface is covered with ~~the~~ loose lava blocks of a basaltic nature but very vesicular. About the centre of the island & forming a divide, from east to west is a series of three high points. The middle one being slightly the higher its alt is 1000 ft. The first zone consisting of a ~~space~~ a few cactus & a sparse growth of small bushes. This zone extends to an alt. of some 450-500 ft. where it leaves of quite abruptly for the second zone. The second zone is marked by a thicker growth of bushes, an abundance of the pale green moss clinging to the bushes & the absence of cactus. This zone extends nearly ~~entirely~~ to the highest summit, where the bushes become scarce & some grass & ferns are to be seen. During the stay ~~At~~ ~~ab~~ in this neighborhood it was observed that this highest summit is often fog decked. During the day of collecting Dec. 20. a slight rain fell.

At about 500 ft. or where the 2nd ~~green~~

zone begins the first dead shells were seen. No live ones were collected here. From this level upward great numbers of dead shells flaked the ground with white. Search did not reveal any live specimens until at about 900 ft. From the 900 ft. level to the summit all the specimens of the series were obtained. They were found glued to the lower surface of loose lava blocks. Though quite truly hibernating they soon became active on removal from their hiding places.

The peculiar coloration of the dark dusty like color compared with the environment proves an interesting feature. It should be further stated that the ~~rocks~~ lava of blocks were reposing upon & sometimes imbedded in a loose dust much in color like the color of the shells themselves. At times the shells were hardly to be detected when the underside of the rock had a sprinkling of the dust.

James Bland

Dec. 26, 1905 James Bay.

Dec. 22 & 23, these two days were spent in a expedition inland. The line of march beginning at the N. end of lagoon and extending nearly directly E. Directly back of the lagoon & running from the N.W. corner parallel with the coast in a southerly direction for about 2 miles is a rather steep rise of ground. Its average height is about 1,000 ft. Ascending this high bank the numerous white bodies of dead shells were scattered all about the ground. The forms near the coast were the rather short, plump, B. forms. They were numerous but no live forms were obtainable. At an altitude of 500 ft. the first of the elongated, spindle crenulated L. form were seen. The two forms [illegible] continued together, when at about 900–1000 ft. the Succinea began to put in appearance. The tree species became quite numerous & continued up to the highest alt. attained ~~some~~ 1600 ft. But no live forms were obtained probably

due to the fact that this is the dry season. This side being somewhat in the lee of the direction of the moisture laden winds the shells are permitted to live during the ~~dr~~ wet season & then during the dry they are killed the few remaining adult & young forms going into hibernation.

This condition of favorable & unfavorable season of collecting is augmented by the peculiar & altogether different arrangement of the vegetation. The whole rise of ground first mentioned, extending entirely to the sea level presents a real density growth of vegetation. Here are large prickly trees, small bushes, numerous tufts of a long grass, and abundant growths of long slender vines & trailing roots. In such protected spots ferns were still green. Cactus is surprisingly scarce; only one here and there standing quite ~~without~~ ~~alone~~ ~~quite~~ alone in the ~~quite~~ forest. Their presence ~~being~~ seeming entirely out of harmony with its surroundings.

On the same days Mr. Williams & Mr. Jeffrey went inland to a point some ~~miles~~ 1½ miles to the S. of the point reached by the writer. They

James

Found a few live specimens of the two ferns ~~which appe~~ (give names) which ~~appear~~ were as low as the coast.

Dec. 26.

Went inland from the S. end of the lagoon. Found the banks to be 1300 ft high. That ferns begin at 1100 ft. The The green topped tree a Compositae began at 950 ft. Same conditions for ~~dead~~ dead specimens as to the N. A few more ~~Found~~ low green leafed bushes, than the same heights to the N. Some prickly acacia.

That the zone which appears so green from the vessel is really only the increased number & greater growth of the Compositae.

Noticed also that there were just a few large trees (4-6 in. diam) of the green leaved shore bush which grew in the higher altitudes - 1200 - 1300 ft.

Dec. 27 - 28

Two days trip inland - camped at 1650 ft. alt. - much the same condition of vegetation as already noted. Some

few green ferns are present.
North toward a light rise of ground bearing directly E. from the vessel. At 1,800 ft. the tall, smooth-barked, eucalyptus like tree is abundant, numbers of green ferns are seen & a few bunches of a short, sharp edged grass. ~~Ascended the~~ Quite a number of dead shells were seen. The much crenulated B. species, similar to the one on Indefatigable which adheres to the smooth barked trees, pitted, were plentyful & seemed to have increased very perceptibly in size. Some dead Succinia also present.

This condition of things persisted until the summit, 2,000 ft alt, was reached when the summit together with the whole S. exposure was a beautiful tropical green vegetation. Bushes were all leafed out, ferns of several species were abundant, wild heliotrope grew everywhere, & the coarse grass, so short on the N. slope only behind the rise, here grew more than a foot ~~high~~ tall. Fair sized forest trees were rather numerous. There were but few rocks protruding through the soft leaf-mold soil. Altogether it was a striking example of the influence of the prevalent winds.

During the past few days numerous cloud & fog banks were observed to be rolling in against the elevations from the S. &

James

S.E. Going down the elevation in a S. direction search was made for shells. The two ~~li~~ dead species cited for the N. side of the ~~sse~~ elevation continued, ~~and~~ but the only live forms taken was a single adult S. Bettii with some half dozen S. seemingly of another species, but possibly immature Bettii. Rather surprised at this, but ~~It~~ It may be that - though the fogs keep this elevation green like the others it awaits the rainy season.

Mr. Beck handed me one specimen alive of the B. crenulated form, which he took from the inside of a bird's nest. ~~he was.~~

The S. specimens taken were resting on the leaves of small bushes & grass, such for example as the wild heliotrope.

Jan. 2-3-4, 1906

Go inland on the accustomed path - an old stream bed to the south of the lagoon. Made camp just to the E. of the elevation reached in the preceding notes, at an elevation of 2100 ft. This region seems one of perpetual green - long grass, bushes, fairly large trees (30-40 ft. high), an abundance of ferns etc.

Quite close the camp a number of Succinia were taken from the grass. They occupied both the upper & under side of the blade. At this point too the first live specimens of the No. 56 species were taken. This last shell was found in quite an active state of life on the leaves of some small trailing vines.

Ascended the highest mountain. As the higher altitudes were reached the vegetation changed very perceptibly. The trees & bushes dwindled in size and number, the grass was more plentyful & taller, ferns were plentyful in some cases they ~~almost~~ quite clothed the trunks of the small trees & bushes in a thick growth; without going into the more truly botanical details of this vegetation can surely say that compared with the 2300 ft level, or the 2100 ft, the vegetation presented an entire change. Taking it in all it presented the appearance of the formation of the fern or grassy zone. Tree ferns were quite abundant.

As the gradual ascent was made, it was observed that Succinia became less & less in evidence until at the summit none were obtained from the old station = the grass.

An investigation of the loose, ~~bark~~ fern decked bark of the dead bushes a number of S. were taken. They were found on the inner side of the

James

barks, and sometimes intwined between the stems of the ferns. The form seemed a specifically different one from the lower (alt 2100 ft.) They possess an unmistakably greenish hue & seem in average size to be smaller than the S. Bettii, which is marked by its hazel brown & sometimes golden color. Unfortunately the two forms have been placed in the same vial, but that of the higher alt. may be easily separated from those of the lower. The difference may not be well defined enough to build a species, but if not, is an important observation of altitudinal & environmental changes & influences.

Along with the S. under the barks of the trees, there occurred a minute, disk shaped shell much like the Guppya of Cocos. They presented quite a well marked specific coloring, and maintained an almost exactly equal size. The form looks much like the one taken from Chuchupatagable, a few from the leaves; and those from Duncan.

It should certainly form a new species.

alt. 1800

On the N. side of one of the S.W. eminences, in rather an open growth of vegetation, a long, slender bush (some 6 to 8 or 10 feet) of compositae, were quite numerous, ~~the~~ almost all the specimens of No. 56 were taken. This large, muscle[?] crenulated shell, was attached to the ~~bushes~~ compositae, always at a height of the top of the bush & partly shaded by the plume of the top. They were in a state of hibernation, the thin membrane covered the mouth of the shell ~~not protected~~ by the stem of the bush & filled the little interstices formed by the irregular surface of the bark of the stem.

About between the altitudes 1000–1600 ft. The specimens of Nos. 55, 53, & 54 were taken from the under side of small loose lava blocks. The ~~ground~~ soil though quite fertile was dusty, and the shells were not easily distinguished for their similarly colored background. Just a few of the specimens of both No. 55 & that of No. 53 were taken from under the loose bark of dead logs lying on the ground. All were in hibernation.

~~An important impression~~

~~It seems~~

James

Important Impression.

It has been cited in the notes that a few cacti & a few of the salt-marsh green bushes persist in reaching a very considerable height 1000 – 1,~~500~~ ft. and in surroundings not at all in keeping ~~with its surround~~ with its customary station. Again it has been cited that with the alt. & the present condition of the upper zone it would seem that the grassy zone is in formation.

~~Again it~~ From these features there is evidence that the definite zones are now in the transition of formation.

Again it will be geologically shown that James is one of the newer of the islands.

The present position of the crenulated shell in the well zone may be a vestigial character of the old rough conditions which certainly were present in the early time of the rocks break down.

James.

Aug. 1-06. — N. of Sulivan Bay.

This east & S.E. side of the island is one great chaos of recent lava flows. A great number of large & small craters dot the landscape & the region of their disturbance extends upward to about 1,000 ft. alt. Some few plants notably Bursera, Croton, scattered & numerous plants of both [costella & lat. zmia.] species of cactus have gained a foot hold — increasing in density & with the addition of other forms with increased alt. It is remarkable that in this extremely arid, rough territory the little mollusks should have found a station here.

The specimens of No. 111 were taken at about 750 ft. alt. at the base of a barren lava cone. They were buried under loose lava blocks — & deep in the lava cracks where they were exposed to view when the overlying lava blocks were torn away. 600 ft. alt. probably marks the lower limit of shell life at this point.

The long, slender, corrugated specimen

is undoubtedly the same species as the one taken from Indefatigable.

Aug. 7-8 '06 --- James Bay. --

The vegetation of the lower altitudes has a marked gray. & faded appearance, with the evidences of the passage of the limited period of unusual greenery. The abundance of the large trees ✓ and some others - (Erythrina,) ferns etc. & grass gives the first zone quite a different aspect from the general typical first zone.

From about the 800 ft. alt. upward ~~the ground is quite~~ there are great numbers of dead shells scattered over the ground. The rather narrow based. corrugated form - No. 113. is especially numerous This species ~~extends~~ is found more abundant with increased alt. - seeming to reach their maximum at about 1500 ft. alt. Probably the only live specimen of this species is the one taken at 2200 ft. alt. from the leaf of a climbing vine and enclosed in bottle No. 112 - is the smaller of the two B. specimens in that bottle.

The larger & smooth surfaced B. spec.

James.

of bottle No. 113 were taken at 800 ft. alt. under old wood. Some others were seen below & only a few above, so that this species is probably best at this point, & the dead specimens here probably mark the old station.

Must look up an examination of the literature on these shells to determine the species.

At 1800 ft. alt. in a ~~valle~~ fine grass & fern grown valley. search under the dead leaves & at the bases of the grass tufts was rewarded by finding a number of specimens of Pupa. & ~~also~~ a least ~~of~~ 2 species of Heliciform.

These forms are new records for the islands & goes to prove that these inconspicuous species have quite a general distribution through the islands.

The alt. of 1500 ft. marks the lower limits of these species & they would not be found here if it were not for the increased

vegetation ~~due to~~ in valleys - due to the drainage. they would not reach this low level. Properly speaking the limits of these small species are 2000 - 2850, top.

The large B. specimen in bottle No. 112. was taken at 2200 ft. alt. from the stem of Compositaea. ~~This point~~ ~~Dat... 2400 ft. marks the limit of these particular bush like Compositaea~~

This same species was taken ~~at~~ the former visit from the same station but much lower down - at about the lower limit of this particular plant which this species seems confined.

limits of this bush - 900 ft - top.

~~Though~~ The bush ~~does not~~ extends to the top & the beetle follows it & its belt of occurrence seems marked by the limits of the ~~bush~~ plant.

James.

Generally speaking the vegetation zones of this island are very poorly marked. The general intermingling of some of the characteristic high forms with the lower ones - and again the low forms extending upward. Examples of this is the occurrence of the largest forest trees & ferns near the sea level - & that of cactus high above in the green.

Roughly estimated there is about two zones - the second beginning at about 1300 ft.

Barrington Island

Oct. 20-1905

Go inland at the N. E. end of island. Working inland land shells are first taken at 200 ft. alt. At this alt. they were well hidden under lava blocks clinging to the hardened soil and in the interstices of the smaller rocks. Their state of hibernation was not complete for on being collected & brought to the light they immediately showed activity. In many cases they were so lightly attached that a slight jolt in the rocks caused them to fall off. No doubt this condition is due to the setting in of the rainy season. During the two days outside there was a good deal of light drizzle & heavy mists.

Continuing upward from the 200 ft. level the number of shells steadily increases. At about 300, it is observed that a number of the darker, thinner forms are in evidence. These with the light grayish ones of the lower level may prove to be the two ~~species~~ species reported from this island. The short, squat, one may be an immature

Jour.

The surroundings are particularly barren. — lava blocks imbedded in & upon the surface of red volcanic ash. Cactus & a few of the white dry bushes comprises the entire vegetation. No sharp thorned acacia. no grass 40 plants on isle.

Oct. 23.

Work inland. Follow the valley like depression to the N. toward the high rise of ground at that end of the isle. Nearing the N. end the collecting territory became poor because of an almost complete surface layer of lava blocks. Retracing & working on the right hand side of valley. The steep hill joining the side made excellent collecting ground. The lava blocks were large, loose. There was enough of the red, broken, lava dust to form a soil. — an important note in site & habitat.

The specimens were attached to the under side of the lava blocks — not especially firm; and when removed, some became active. The second phase of hibernation, though, was observed in all. In some instances the shells were attached to old dead twigs & leaves which lay immediately close the rock or partly under it. This last is particularly true of the brown species which the gray or greenish were more closely attached to the lava — an important note in color variation & adaptation to closest surroundings — perhaps for protection

Bottle No. 34.

Duncan Island.

Dec. 2, 1905.

Duncan island is nearly circular in form (see map). the diameter is about .
The surface is extremely rough; the whole being loose. rather rounded lava blocks of the black basaltic family. To the westward the top is broken down into two large craters. The E. side of the craters is the highest point. alt. ~~1275~~ 1300. The sides of the island are generally ~~abu~~ rather steep; & the height of 1275 is reached within a horizontal distance of $\frac{3}{4}$ of a mile inland.

The sides of the island are very sparsely covered with vegetation. The small dry brush, a few cotton bushes & some cacti but rather a good deal in proportion to the other plants of the prickly acacia? Castella. Near the top say at 900 ft. the lichens & Spanish mosses begin to put in appearance & increase in abundance toward the summit. At the summit there is quite a fine growth of ferns, orchids, grass & bushes. On the inside of the

top rim of the crater the ferns formed a dense networks of moss like height & texture. The grass & general surroundings were exceedingly dry at this time of year.

At about 900 ft. alt. - the first dead shells were seen. No live ones. Up to the top the dead ones became more numerous. The three reported forms, Succinea, B. olla & B. duncanus, were recognized among the dead.

Ascending to the top the collecting was live there. Bottle No. 47. contains 3 specimens of the largest shells, in a fairly good state of preservation. No. 48. the only two live specimens of the large shells taken. ~~[illegible]~~ Intertwined among the roots of the grass & [illegible] which ~~[illegible]~~ lined the rim of the opening left by an overturned rocks were the minute Bulimus like forms contained in Bottle No. 49. It will be remembered that these occurred on [illegible] ~~[illegible]~~ in a similar station in the dry zone. In the wet zone of the S. side they accompanied Succinea on the leaves

Duncan Island

of the bushes & grasses. This species is not reported from this island, due perhaps to its minute size. It will be valuable in species building & a determination of some relation between this island & Indefatigable.

Aug. 14, 1906.

Ascended to the top of the island. The first shells taken were at 550' alt. - some lower than at the time of the first visit. All the vegetation was in a dry, parched condition - the brief moist season having passed and generally it presents the aspect of the winter season.

It will be remembered that at the time of the other visit two this place that two light showers fell.

As in the former visit there was great difficulty in obtaining live specimens. Collected a number of well preserved dead specimens of Succinea "Bettii" & the two B. "olla" & "duncanus". Mr. Williams

found one live specimen of the large
B. probably B. "duncanus" of
Made the important collection of a
few specimens of Pupa. They are
like the common Pupa of Albemarle, and
upper Indefatigable. Miller the
minute Helix. Some specimens taken
at the time of the ~~first~~ first visit
makes two genera & species to be
added to the list of the islands
molluscan life.

Chatham.

Oct. 17-05.

Wreck Bay.

Worked in the lower level, just in land from Wreck Bay. Live land shells are scarce but plenty of dead ones. Secured the specimens in the two vials labeled No. 32. These forms were taken from the under side of lava blocks at an altitude varying between 25 - 60 ft. The situs was that of the dry surrounding characteristic of the first zone. According to Dr. Baini's works two forms are recorded from this level, but both of them are Bulimulus. The long spiral then may prove to be a new species for this level.

It is to noted also that these specimens were accompanied by a few dead Succinia. Observing the water courses & the general "lay" of the land it is not likely that they were carried here by waters and as no Succinias are reported from this low level it may prove of interest. Perhaps the rainy season may show some Succinia at this low level.

Chatham Island

Jan. 24.-29. Wreck Bay.

1. Bursera
2. ~~H Pho~~ Pollygalla - small herb
3. ~~Gobob~~ Borhaavia
4. Maytenus
5. ~~C~~ Cereus - Opuntia
6. Desmodium
7. Amaranthus.
~~8.~~ Croton. ~~Cotton.~~

About 500 ft.

Characteristic plants of the first zone.

When this region was visited about Oct. 17. 05 the first zone of this island presented quite the dry zone aspect. The Bursera, Pollygalla, Maytenus & Croton all small bushes & herbs were quite ~~destitute~~ of leaves. ~~About~~ the little green in the region was given it by the sea-island cotton ~~plant~~ multifts large green maple-like leaves. and the pinnated ~~leo~~ sprigs of the tall bush, locust-like legumes. The light, reddish volcanic rocks

~~were~~ are well weathered to form a clayey soil which fills the interstices between the well worn basaltic lava blocks. The absence of ~~the~~ underbrush. characteristic of the dry zone. and the general dust like condition of the slight soil. gives things a barren aspect. This condition of things partly accounts for half polished surface of the shells

First zone 0-500 ft. alt.

Jan. 24-29.

On this visit the whole lower portion of the island, in the neighborhood of Wreck Bay, presented an entirely changed condition - all was fresh and green. All the bushes named as characteristic of the first zone. were leaved out. The small herbs, and vines were in blossom and ~~barring the~~ from barring the barren condition of the soil - its rocks & absence of grass. the whole looked like the green zone of other islands. This change was due to the advent of the rainy season.

During the first 3 days near to the island there was almost constant showers. coming in quick succession. The little water courses were like small creeks. This condition of affairs continued for the time mentioned then it became calmy & remained clear the rest of the visit. According to the natives the rain falls for perhaps a week ~~at without~~ with only slight intermission between

Chatham

showers, when it ~~clears up~~ ceases to be ~~fine~~ fair
for an ~~equally~~ equal length of time.
~~Then~~ From ~~as stated~~ the lack of rain experienced
before arriving here & observations during
our visit and in adjacent territory
it is evident that Chatham is especially
favored with moisture precipitation.

1. (Bring in the fact that at this time)
(Hood is entirely dry

2. (Investigate what the Blue Book)
(may suggest

3. (Bring in the testimony of the abundant rains
(as a factor in the environment & its)
effect on sculpture

Collected five series of the two species accredited this first zone, the B. & the L. Johns. The animals were quite active & beside being under the stones were frequently taken along its outer loose edge of contact with the soil.

Made the important collection of two specimens of Succinea, taken alive from the stems of the small

bush Croton. Their altitude was about 250 ft. only half the alt. of the first zone. They were taken in a neighborhood where the Temp'g. land shells were the most ~~numerous~~. No more specimens were taken. (Ought to show that this S. is diff. species from the one occurring higher up. which will probably be seen from the intended collecting high up.)

Basa~~ss~~t Point Anchorage

Feb. 8, 1906

"This region is very rough. abundant & broken flows of ~~la~~ basaltic lava, the vegetation is thick. ~~bu the characteristic~~. few cacti. and in many places the growth is cut up into small islands by the lava flow. First zone extends to about 1100 ft. alt. Owing to rather steep slope, and loose condition of soil the territory is poor for land shells. ~~The soil has been passed~~ Those rocks not the part of a flow, are half buried in the loose clayey soil. The few land shells taken were all under & in rotten logs and limbs lying prostrate on the ground. ~~Only the single~~ The same two species (B. & T.) were taken, but only a few. No Succineas - lack of rain.

Chatham

Finger Rock
Sappho Cove
Bassa Pt.
Wreck Bay
Progreso.
720
Region of Recent Flow.
" " " "
Rather lower say 450 ft.
1927
2490
011.28
N.
E.
W.
S.
Grass zone 5 species taken
S. P. H. 2(B).
First zone 500 ft. alt. 2 species (B) possibly a 3rd. long spire + Succinia
1st. z. 1100 ft. alt. " " . Fairly recent lava
Old crater. - 620 specimens of possibly 2 species (New?)

Feb. 12, 1906

Finger Rock represents a old insular condition. The whole is a great volcanic cone, about ½ mile in diam. & circular in form. On all sides from the rim the rocks mass drops away in almost perpendicular walls. Access to the interior is only by means ~~of a narrow cleft~~ up the slightly loose eroded S.E. side through a small cleft in the rim. The rim itself is ~~generally speaking~~ on the average about 200 ft. above the recent lava fields below. ~~Within the rim~~ within the floor of the crater is some 12-20 ft below the general rim, except on the N.W. side where the rim rises up into a high pinnacle, 640 ft in total height, giving the whole mass its name of "finger rock". The whole mass is composed of ~~tufa~~ the reddish, yellow sandstone like tufa. Inside the basin this ~~rock~~ easily eroded material has broken down & form a ~~nice~~ fertile soil, well grown over with long grass, small bushes, & trees of considerable size. ~~Numerous~~ Numerous old ~~trees~~ dead trees are standing about in the basin. By pulling off the loose barks one finds abundant numbers of land shells, glued fast to the

bark & the rotten wood of the tree, head downward. The rather fertile surroundings, soil & vegetation, would suggest that the shells be polished which they are, rather prettily. If the species be but one, then the series taken illustrates different stages of shell development. The large shells have a ~~blue~~ bluish tinge.

The specimens were in a complete state of hibernation. The mouth is securely held by the thin membrane which is slightly elastic & often allows the shell to be drawn a dist. of 1/8 of an in. from the ~~tree~~ supporting wood before it is finally torn, to leave some of its tissue fast to the wood & to the mouth of the shell.

The animal was at rest behind a second membrane built across the tube about the dist. of the first whorl back from the mouth.

It will be geologically shown that the whole Pinnacle Rocks mass was the elevation of a former

of much older insular conditions.
This will be important as a environmental & derivative nature of the molluscan life.

Feb. 22, 1906

Worked into the interior of the island, — the upper levels beginning with the hacienda at 1000 ft. alt. From this point the old volcanic cones rise in gentle slopes to form the most beautiful rounded, grassy hills, ~~much like~~, much like the rolling hills of the Northern States of our own country. The great age of the island is here easily apparent. The lava formation is completely broken down to form a fine, rich, reddish-clay soil. The depressions & rims of the old craters are completely gone, ~~so~~ indeed ~~it~~ one would hardly ~~imagine~~ guess that at one time volcanoes spouted here, covering all with a fiery flow. ... (Mention the well watered country describing it)

The zonal arrangement of the vegetation is peculiar to this island; ~~and~~ it lacks a counterpart in any of the other islands. (A somewhat lengthy & involved description may be avoided by the use of the plate).

Chatham

~~bad~~ Going inland by way of the road, the characteristic plant formation of the first zone continues to a height of 500 ft. (stated previously; compare) where for ~~the~~ a short distance, of about 150 ft. alt. ~~a transition~~ a slight change ~~to~~ is noticeable, the change being principally the presence of orchids, a few ferns. The native growth has been supplemented at this altitude by the introduction of lemon, orange + fig trees etc. These fruit trees have flourished. ~~[illegible]~~ This last change in the vegetation forms a sort of transition between the first & the second grassy zone, which covers the whole upper levels; Thus there are only the two zones; the first, a transition & the second.

On the E. & S. E. where the moisture laden winds first impinge the first zone middle & transition does not reach so high as - possibly no higher than 400 - to 450 ft. Conversely stated the grassy zone extends down the lowest on this side. ~~Within~~

The second zone is best described by the word "grassy" — great plaines of a luxurient growth of tall grass. Toward the highest points a few tall ferns are observed. Club mosses & finally a few tree ferns stand out above the grass at the summit of the highest point. (Stewart took the alt. as 2100 - map gives 2420)

The figure (or plate) represents the actual vegetation belts as viewed from the top & verified by the actual figures of investigation.

It will be observed that the Barra Pt. region being in the lea of the ~~[illegible]~~ prevalent weather exposure the 1st zone & transition reach their highest altitude.

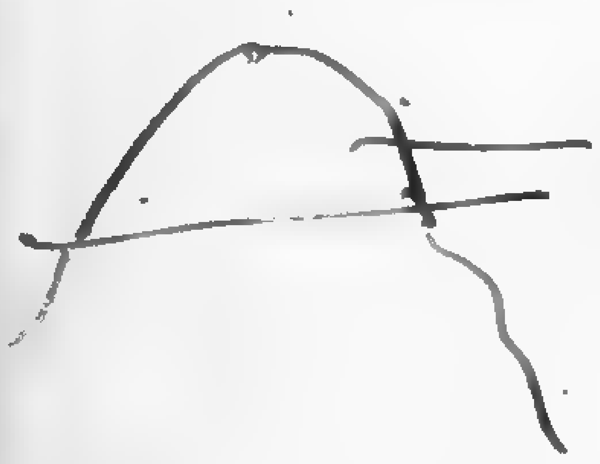
The N.E. end. is marked therein. (as cited in notes best merged here) This region ~~is +~~ having so recently passed through volcanic activity etc. ~~the~~ only the hardier plants of first zone - cactus etc have found it possible to survive

Better ~~[illegible]~~ develope 4 plates. of zone, - the lateral view from W:- same from E: the view from top; the view from S.W. giving slope & belt arrangement

~~All~~ The collecting began at about 1,200 ft. when the first specimens ~~were~~, Succinea. taken from under the moss which covered the top part

of the weather side of fence posts. Continuing the ascent, the Succineid were soon joined by the smaller B. (bottle No. 64) ~~station in~~ ~~station in~~ higher up in the same station the two were joined by the large turreted B. (bottle No. 64). The S. became more abundant the higher they were taken; always in the same station.

On a area described as the frustrum (took up this term) of the highest hill, having a vertical axis of 30 ft. the best collecting was experienced. 5 species



frustrum (?)

S. P. H. & 2 B. were all taken here. Their ~~station~~ were collected from the ~~bottom~~ base of the stems of the matted grass & weeds, which must be torn aside before the specimens could be seen or taken.

State ~~here~~ that this region must always be green. That there are numerous slumes here that do not reach the levels of even the hacienda, as found on the actual key of collecting. State this in description of the 2nd zone. & in a modified form here

Mention also that going down toward the E. & S.E. in grassy areas that the small B. persisted after the others had disappeared.

Chatham.

July 3 – 7. – 06

Collected for a short time in the first of the tall fern patches which grow in little ravines in the open country of the grassy zone just above the hacienda: The specimens taken were the small B. ferns of No. 108. They were taken from the bottom of the fern stalks quite on the ground – at an altitude of about 1450–1500 ft.

Beginning at the hacienda and following the trail about E.S.E. in the direction of Fresh-Water Bay, the first 300 ft. of descent is taken up by the great coffee & banana fields. No shells were found in this considerable area & I believe that some of the many species reported from this island have be crowded out by the cutting away of the native forest and supplanting it by cultivated fields. in this direction

At about 700 ft. alt. the cultivated fields discontinue & the dense tropical growth begins. Even this growth presents a slightly changed condition from the primitive growth –

having a large admixture of coffee trees. But the tropical nature prevails & it was in this territory that the large B. & long spiral forms were taken. All were found at the base of grass tufts & under loose brush & fallen wood. Unfortunately no live specimens were secured. The range of the long spirals, so similar or possibly identical with those taken near Neels Bay, agrees ~~with the general idea of greater height~~ will be an interesting consideration.

During the visit the upper levels were quite dry, & the colonists report an exceptional absence of rain, though there were frequent heavy fog clouds which precipitated water enough to wet the grass, but not heavy enough to wet the soil.

Notice the temperature lists – this is the island's winter season: Most yes quite all of the live shells were in a condition of hibernation.

Notice the record of a number of specimens of Pupa. No. 110.

Albemarle Island.

Nov. 1, 1905 Turtle Cove

Just back of the group of houses on the point of land extending into Turtle Cove ~~is~~ are a number of lagoons. Their extent some distance inland, forming ponds in the lava depressions. In some places there is quite an abundant growth of mangroves along the shores & in the pools. Most of them (pools) have a thick bottom of heavy muck & sand. The lagoons are made possible by the vesicular & cracked nature of the lava flow through which the abundant water of the highlands has easy seepage. When this water reaches the sea - above the back water of the tide flow forms the lagoons. It was in these lagoons that a large number of dead Auriculae like forms were observed. Two species were identified & probably the two or three accredited to this island.

About 3 miles inland on beside the trail some half dozen

Bulimulus-like land shells were taken under lava blocks. They were in a state of hibernation; most of them immature. Quite a number of dead, mature shells were noticed in the same locality. The exposed position of these dead forms suggests that during the rainy season they are found on the few low bushes of this rather barren district.

Nov. 3,

Collected in the salt lagoons already described on the ~~first~~ lagoon just west of the first farm. The specimens of Bottle No. 41. were taken much like those of Bottle No. 40, if not exactly the same species. The specimens of Bottle No. 39. were taken in the first lagoon going inland - on the left. Bottled separately for the difference they show. The two lagoons are about 1 mile apart. Those of Bottle No. 40. were handed me by Mr. Beals who secured them in a salt lagoon some eight miles to the westward of this anchorage. They also suggest a variation or another species. Their relation to the species accredited this isl. will be interesting if may serve to correct an error in determination made by the first collectors.

Albemarle.

Villa Mills -

March. 5-10, 1906.

The important part of this visit was the complete ascent to the summit of the great crater situated directly inland from the anchorage. Owing to the ~~[illegible]~~ generosity of Senor Gill, the owner of the Plantation the writer was provided with a good saddle mule & guide

For the first 3 or 4 miles inland the trail leads mid the almost level lava fields, dotted only by a sparse growth of cacti & small bushes. After this distance the gradual rise begins. Cacti become more numerous & larger; bushes become more plentiful & small trees are in evidence, until at ~~about~~ 350 ft. alt. the cacti begin to disappear. Then for some 50 ft. rise in alt. there is a sort of transition between the cacti grown dry belt into the truly green and wooded zone.

From the 400 ft. level ~~the~~ upward the lava takes on a more and more complete character of breakdown to

form a rich black soil. This is in fact the wooded zone; the deep rich green belt which looks so restful from the ocean. Bushes & trees grow in great ~~profusion~~ luxuriance. The prickly, waxen-leaved castilla and the wild heliotrope are everywhere. At about 700-800 ft. alt. one finds the best growth of the ~~tall~~ great spreading forest trees. (Mention vines of morning glory & mistletoe

At 1000 ft. the dense growth of the wooded zone begins to dwindle. At 1200 ft. only a few large bushes of heliotrope persist & at 1300 ft. one is well into the grassy zone.

The grassy zone is characterised by a tall, heavy bladed grass which covers the whole upper ~~plains~~ ~~lands~~ territory with a beautiful coat of light green. In some places there are a few low bushes, mostly of heliotrope, and again large patches of isolated plants of tall ferns. This zone extends to the edge of the rim of the great crater & completely hides the harsh, rocky nature of its interior. Indeed to look at this fertile grassy fields with only an occasional small rock one would hardly imagine

Albemarle

that just over the apparent ridge, ~~the rim~~ of the ~~crater~~ is a great crater, with two large solfataric fumes still in action. Extending down into the crater is a dense growth of grass & tree ferns, the ferns seeming to flourish best on the very steep inclines of the inside of the rim.

To recapitulate:-

0 – 350 ft. 1st.
350 – 400 ft. transition.
400 – 1300 ft. 2nd. or wooded.
1300 – 3100 ft. 3rd. or grassy.

A few shell specimens have been taken from the first zone, needed on later visit.

From 500 – 700 ft. a number of specimens were taken. They were found adhering to the bases of a small bush like plant, probably a heliotrope. All the specimens taken were taken from this particular plant.

(These forms are enclosed in the cheese cloth bag in tip of Bottle No. 66).

At 2000 ft. alt. the first

shells of the grassy zone were taken. They were the large hazel-brown Succinia. From this level to the rim of the crater the shells steadily increased in number & in species until the very rim itself where they were perhaps the most numerous. All species contained in Bottle No. 6b. were found here. All of them on the ~~tw~~ blades of the tall grass, with the exception of the little Gupprya or Vertigo like forms which ~~was~~ were taken from the loose soil at the roots of the grass.
A peculiar circumstance was observed in the occurrence of the corrugated-base B. forms at about 2400 ft. alt. The first of them were taken. Their color was brownish with a distinct stripe & usually a pink apex. As the top was approached other similar forms were taken. These latter were larger & the ~~[illegible]~~ roughness of the base more pronounced until the almost white colored, large. ~~B~~ forms ~~seemed to be~~ were abundant on the very rim of the crater & seemed almost confined to it.

(Subsequent work here may yield some good environmental variation ideas.)

Albemarle.

March. 12, 1906

For several miles along the S. coast of the island W. of Villa Mills is an almost continuous mangrove swamp. It was in the dark, cool recesses of this swamp that a number of large Auriculidae like pulmonates were taken. They were found reposing on the young shoots of the mangrove & under the dead leaves which covered the soft mud along the margin of the lagoon. Their station was confined to the strip of territory beginning at the water's edge & ~~extending~~ back for about 4 or 5 ft. in the ~~leaves & resting on top of the moist soil~~ around the whole border of the lagoon. The water of the marsh was entirely fresh and drinkable.

The species may be different from the specimens given me by Mr. Beck when he came within a few miles of this point the last visit.

This same day I collected a few dead specimens of B. [illegible] from under stones. They look

like the specimens taken from the first zone some dist. inland from Villa Mills.
~~The~~ Though the dead specimens were numerous no live ones were obtained.

March. 15, 1906.

Visit country in the neighborhood of district 3 miles west of Cape Rose. Flow of lava is fairly recent. but quite covered with a growth of fine large. apple bearing trees, cacti. & vines. at this time everything is green & fresh. Vegetation has come in from mt. to W.
Noticed a number of dead shells under stones they are the same as those taken on Feb. 12. at landing some miles E. of this point.
No live ones. taken.

Should be mentioned here that for the past two weeks this S. & S.E. end of the island has been visited by a number of rain showers, quite heavy, though of short duration.

March. 17. 1906 Iguana Cove.

The great mountain which backs up this cove rises in one mass of tropical green, beginning at the very water's edge. The vegetation is the typical "green zone" of the other islands.
Only a short distance from the canal, just so close as the single narrow rocks of the actual coast will permit, one finds a

Albemarle.

tall grass, similar to our own timothy hay. Then the green bushes so characteristic of the high altitude began to grow in abundance, the vines were green & plentyful, ferns were in abundance both as to species & number - even the delicate "maiden-hair" grew in profusion. Everywhere is the marks of luxurious vegetation. The soil is deep & rich, though often spiked with protruding rocks. (& soil & weather seem to attribute these strange growths of green)

The land shell which was neither important. All the collecting was done at 200-250 ft. alt. The shells taken were obtained under the loose dead leaves lying on the ground, & were especially numerous in the shade of bushes & rock crevices where the soil remained almost continually damp.

The species taken were a small Bulimulus, one specimen of Succinea, ~~and~~ specimens of Pupa - & possibly 3 species of the [illegible] or Helix like form! Of these last. There is the brown-tan colored one, then a dark

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elevated apex, then a small many sided flat variety. Species determination should be carried along these ideas.

The Bulimulus is remarkable for its epidermis structure: the little hairy points, like the epidermis of a Cornuta. Specimens are in Bottle No. 69.

March, 19, 1906.

Go up the mt. side to alt. of 700 ft. Same green conditions prevail. A few cacti & some of the Bursera, characters of the usual dry zone are mixed in the green. The specimens taken are much the same as those of the 17th. inst. ~~except that~~ The station gradually changes the higher we go up the mt: more & more the shells come out from under the leaves, first to move over the exposed surface of the dead & higher on the green leaves of low plants. This is true of all the specimens taken, (Bottle No. 70.) and may be accounted for in the greater precipitation of water higher up. During the middle of the day, 3-5 hrs. a slow, light rain fell. From the 700 ft. level upward the ~~[illegible]~~ S.E. side is almost continually ~~[illegible]~~ cloud bedecked. This

Albemarle.

altitude & region of fog is one of almost constant misst precipitation. This last statement may be true for the whole year, for Mr. Beck's reports that the summit & much of the upper regions are almost constantly hidden in fog — quite true of our own sojourn in this neighborhood, but must be partly attributed to the rainy season.

The excellent condition of advanced lava break-down may be used as an reason for excellent green here, & some particular ~~altitude~~ property of the high mt. in producing the necessary storm centre or area of low barometer. This idea may be further expanded by an inquiry into the effect of the evident meeting points of the warm & cool currents very close to this region; — shown by the first great drop in the temp. of water to air, and at the same time varying in degree during the day. (Refer to marine temp. list.)

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March. 21, 1906. Iguana Cove.

Investigation of the lower levels yielded an important observation on station variation according to environment. Collecting was confined to altitudes varying from 15-60 ft. and on the very steep slope of the mountain escarpment where it dropped off to the cove & small horizontal area bounding the cove on the S.E. & E. Owing to the ~~steep~~ large angle of slope, & the rocky nature of this ~~part~~ territory the vegetation was very thin, consisting mainly of a few bushes, trailing vines and grass. The specimens taken are identical with those of the higher elevations, but were all secured from under loose lava blocks. This ~~observation~~ example is a fine illustration of a actual choice in station in response to the limitations & exactions of the particular environment they would inhabit. This also agrees with the condition first cited that with the gradual rise in elevation they left their secluded position under the leaves, becoming more & more exposed until they were found on the leaves of the grasses & small bushes. This last station may be considered the true one.

It was noticeable that in their station under the stones the colorings of the shells were eminently protective. (Grade No. 71.)

Albemarle

Tagus Cove.

March. 25, 1906.

Ascent of the mt. back of the cove. Beginning at the coast the country for a distance of 1½ miles directly inland is a level plain, ~~where~~ the trail being bounded on the N. & S. by two old tufa cones. The vegetation is thin, and characteristically of the first zone. The soil is the loose dust like formation resulting from the disintegration of the neighboring tufa cones. On the eastern margin of this level plain, where it ~~joins~~ meets the base of the mt. a number of specimens of Pupa were taken. These shells are probably the Pupa Wolfi taken by Heller & Snodgrass etc. & [illegible] taken from the leaves of Croton. The specimens taken [illegible] in this case, were found adhering to the under side of the dead leaves. ~~being about~~.

~~The way to the top~~. The whole western, Tagus cove side of the great mountain crater, is a ~~[illegible]~~ gravelly lava furrowed, thinly vegetated rise

The thin vegetation exists in the form of small vegetation islands. ~~& long strips~~ some circular, others long & narrow, but the whole is given a vegetated appearance from a distance, due to the merging in effects of the encroachment of vegetation and the more recent lava flows.

(At an altitude of 1500 ft. the first live B. were observed. They were found under the barks of prostrate ~~[illegible]~~ cacti, under dead leaves & in the loose leafmold. They were accompanied in the same stations by the Pupa Wolfi. ~~first~~) A number of the dead B. were first observed ~~at about~~ in the same territory from which the Pupa Wolfi were taken.)

From the 1500 ft. elevation the number of dead B. seemed to increase perceptibly, & the live ones were taken quite often, from ~~similar~~ stations to those just cited.

Also the first Helicidae — this form taken about 2200 ft. alt. with others.

With the ascent, there was little change in the vegetation; at ~~2000~~ 2700 ft. ~~tt~~ lichens became quite numerous, & ~~[illegible]~~ slightly higher a few orchids.

At the very rim of the crater a great & sudden change in the growth

there was

Albemarle

Togus One

Here there is a thick growth of bushes tall grass & cacti, all first zone plants, which forms a belt averaging 50-100 yds. wide & seeming to encircle the whole summit. It was in this thick felt that ~~so~~ all the collecting was done. The shells occur in abundance in the same relation that they occur in the specimen bottle with one exception
"They were all taken from under loose leaves, ~~stones~~ & most generally at the base of the tall tufts of grass. The large Succinia was taken from the leaves of trailing vines. All the specimens were in an active condition.

The surroundings were much like of the characteristic green zone. Dense fogs often cling about the summit. Heavy dews & very cool - almost cold nights ~~of~~ seem the rule. The night of our visit was chilly, - temperature at possibly 60° - 65° F.

Alt. of crater 4000 ft.

Simply a field analysis seems to yield the following species.

B. acutus. var. of jacobi.
B. tanneri, (possibly)
S. orbis.
S. Bettii,
Vitrea, actinophora.
Guppya,
Helix. – large. flat
Pupa.

The last two are the notable acquisitions & the specimens must be carefully searched to determine the species etc.

April. 2 – 3. 1906.

As already stated. ~~the~~ (there is a) B. form which occurs dead in large numbers in the 350 ft. elevation & then continues upward to the very top of the crater. The period of this date was given to an investigation of the limits of this form. No live specimens were obtained in the 350 ft. level where the first dead forms were observed., At 750 ft. the first were obtained. From this alt. upward the number of life shells increase as shown by the added ease in collecting.

Albemarle: Tagus Cove

At 1600 ft. considerable time was given to the territory. ~~Album~~ At this elevation the living forms are quite numerous, but their number in relation to the number of dead is small. They were taken from the under side of loose lava fragments, and seemed in a half hibernation half active state. Those actually attached to the lava blocks had the thin ~~[illegible]~~ aperture enclosing membrane. Some were quite loose in the thin leaf mold & others attached to little twigs scattered throughout the light soil. These latter specimens were in an active condition. From this it would appear that this is the closing time in the ~~[illegible]~~ damp season (better called "damp" rather than rainy) & that the shells are beginning to assume their hibernation stations. (No. 75)

Together with the Bulimulus specimens, a number of Pupa were taken. Bottle No. 74 contains the specimens taken low down. Now at 1600 ft. The Pupas taken were apparently of the two species

the one the blunt variety of the lower levels the other the longer & acute variety of the high elevations. (If it can be proven that they are in reality two species this elevation will mark the meeting place

The specimens of Pupa like the B. were found under stones, in the loose soil, and in addition were quite numerous under the leaves of ~~cacti~~ cactus, being scattered about the ground. Most of them were in a state of hibernation. Their number alive bears about the same relation to the dead that the B. do.

It was a surprise to find the live Succineas specimens which are enclosed with the Pupas (No. 76). A number of dead ~~shells~~ forms had been observed at 500 ft. alt. but no live ones. The specimens were glued fast to the under side of the lava fragments.

Their station would indicate that this is about their lower limit & that due to the more strenuous exactions of this lower level they were forced to take this more protected position.

Protective coloring

Regarding the idea of protective coloring the specimens taken at this alt. were especially noticeable for this feature.

Albemarle,

Tagus Cove.

Those B. hidden under the pahoehoe bark were usually of the easily distinguishable in specimen ✓ brownish tube. Those under leaves & rocks took on the variegated light gray ~~[illegible]~~ shading to dark in parts.

The Succinea forms with their dark ~~bodies~~ almost black bodies against the black of the lava were distinguished with difficulty - indeed the collector must needs look close & be patient to search each part of the rock with a close scrutiny.

Even the minute forms of the Pupa aside from their inconspicuous size were well chosen to deceive the eye.

Vegetation.

Beside the thin vegetation of the first zone some tall grass & other annuals covered the otherwise bare ground to relieve it somewhat of the barren aspect. (1600 ft.)

The added green of this alt. is made possible by the mixed tufa & lava origin of the thin soil.

April 7, 1906.

Visited the 250-300 ft. level which forms a sort of very gradual plane at the foot of the pptl grdtter, & being in direct path of the usual route to the sbt. Going inland for a distance of about 1¼ miles one arrives at an almost perpendicular wall of lava some 10 ft. high, which was formed by the sudden termination of the lava flow at this point. The territory just crossed is a brownish cinder, ~~to~~ almost completely barren tract, the result of a light tufaceous stratum decay.

~~If~~ Arriving at the lava wall, one finds that the flow is quite divided, in fact 2 flows of diff. age, one to the southward the other on the northward. Between the two flows is a peninsular like shaped island of vegetation which has escaped the ravages of the fiery flow. Climbing the flow and proceeding into this territory, the attention is quickly called to the light, sand soil of the area, & which seems responsible for the relatively fine growth of brush & low trees. The soil is that which has resulted from the breakdown of an older & differently constituted tufa one.

Albemarle

Tagus Cove.

This soil in comparison to that ~~first~~ first passed is decidedly good. (Old tufa) This territory thus particularly described marks a life area. Once into the ~~vla~~ ~~territory~~ one notices the great number of dead, bleached Bulimulus forms lying about. Some Succinia & Pupas are also to be noted. Thus in this abrupt elevation of but 10 ft. a change in soil, an increase of vegetation & we have the life zone on the one hand & the lack of it on the other.

Collecting in this area yielded numerous Pupas, a few Bulimulus & some dead Succinias. The live ones taken were all in a state of hibernation. Their station was in the rotten logs & branches lying scattered about. Snodgrass & Heller report these shells as taken from the leaves of Orton. This diff. in station is probably due to the fact that this is properly the beginning & well into the dry season. This is indicated by the condition of hibernation. Plum

the observations of the habits of the shells on other islands, especially Charles it is shown that during the dry season they leave their exposed stations to select more protected ones.

The sudden separation of the two life areas is worth developing. The lava does not end them off completely & the little vegetation of the first ~~territory~~ offers once ~~opportunity~~; fact that the Mention, too, that the Succineas are all dead, & B. numerously so, that there are probably changing conditions now in process.

Albemarle
Banks Bay.

April. 9-16-1906

Beginning at the coast & proceeding inland one finds the country divided: a ~~long~~ dusky, thinly vegetated, dry territory ~~about~~ 1½ - 2½ miles wide & extending inland 3 miles to the ~~foot~~ base of the great crater itself; a wide lava field bounding this vegetated area on the N: a similar lava field on the south. The vegetation of the middle are is a mixture of the first zone & a few plants usually found in the 2nd. or green zone; the probable additions are the large forest trees "Erythrina velutina" probed from James. & numerous Adiantum (species of), the common "maiden-hair" fern. The area had almost no rise, until it ~~plunged~~ suddenly neared & merged into the rapid slope of the crater mountain. Strange to note there was no shell life to be observed in this territory, until at an alt. of 325 ft. slightly up on the base of the mountain. The first specimens were collected. They were taken from under old logs, ~~at the roots~~ & under lava blocks

The vegetation of the mountain is nicely developed into three zones:-

1. First or dry zone 0 – 1500 ft.
2. 2nd. or green " 1500 – 3000 ft. about
3. 3rd. or brown " 3000 – 4300 ft. about

The first zone gradually becomes denser until at 1500 ft. the green zone is in full possession. This green belt is the not quite the ~~one~~ dense green of S. clusiofolia for instance, but has many of the plants & the general appearance characteristic of the green belt.

At 1500 ft. & from thence upward to an alt. of 2300 ft., the limit of actual exploitation, a number of B. & S. forms were taken. They were collected from the leaves & dry stem branches of the grasses & bushes. With the increase in altitude the more ~~abundant~~ numerous they became, until at 2300 ft. they were abundant. (Bottle No. 79.)

Though the brown zone was not visited it was approached closely enough to see its constitution & limits. It was observed to be a tall brown grass, interspersed with tall ferns & dwarfed bushes.

Steep slope, ~~the~~ great development of vegetation to be attributed to the particular soil – See Geology Notes

Albemarle, Cowley. Mt.

Aug. 10 & 11.

Land opposite the island & go inland over the great pumice fields. The light vesicular and acid composition of the pumice will not permit of vegetation growth until the higher altitudes are reached where the basaltic flows from above & the complete breakdown of the pumice together with the increased moisture precipitation, plant growth becomes plentyful. Real abundant vegetation begins at about 2100 ft alt. whence it increases to a complete density of the usual greenery of high old mountain tops.

The shell specimens of No. 114 were taken at 2100 to 2300 ft. alt. from under dead wood lieing prostrate on the ground.

The plant life of this zone is characterised by:-

1. Ferns, orchids, Castella. Burserae. Cissampelos (the long vine) and tall grass. Heliotrope.

From S or S.E. & N & NW. the angle of general slope is about 12°-14°.

Cissampelos

at ab. A ~~[illegible]~~ 1200 ft. D. with beginning of rall Dry portion

The species indicate the following genera: Succinea, Pupa, Vertigo, Helix, and Bulimulus. and in species they are much like those from the Villa Mir mountain.. if not identical.

Although the specimens were all taken from under dead wood - it is reasonable to assume that their true station is on the bushes & leaves of vines etc.

This conclusion is quite a logical one when we consider the same conditions as found to be true at Iguana Cove & the Villa Mil cut. - also at Banks's Bay & Tagus Cove cuts. Even two three specimens were taken from under the bushes protection of the festoons of orchids.

The specimens & their position illustrate the great adaptability of these animals to seek the position which will protect them from exposure ~~in the~~ during the inconvenient period of the dry & cool season. Dead ~~specimens~~ grass & dried plants generally shows the winter season on here now. Then the abundance of the delicate Succinea indicate its station here at this season.

Dead specimens of Helix were found [illegible]

at about 1200 ft alt. together with the beginning of the low brush. Compositaea! The dead specimens at this height were the single species of Bulimulus taken above. Their corrugated bases indicate the extreme hardihood & great adaptability of this species and particularly of this genera, in existing under the most strenuous conditions.

The comparison of the respective corrugation, that is its variation according to station, in this species will afford an interesting study. It ought to form the basis of an important generalization on "variation according to surroundings and environment", of which the whole study of the Galapagos molluscan fauna is noteworthy.

Albemarle, (Villamil.)

Aug. 20 – Sep. 5.

This is the winter season and all the shells have taken to their most obscure station and are ~~all~~ in a state of hibernation. At this time of the year the whole mountain elevation is visited by heavy fogs which produce a sort of thin rain like drizzle sufficient to wet the grass & trees, but not producing any running water.

The species of B. occuring in the dry zone is probably the "jacobi" so common to this island. Its range is from the sea shore to about 450 ft. alt. – near the upper limit of the cactus – which limit is approximately ~~550'~~. 525'. The small blunt pointed Pupa probably "wolfi", though a true dry zone shell does not extend so high, probably not more than 350' alt. The dry zone Succinea has its farthest lower limit in the sandy, ~~and~~ bush-grown soil of an old beach. The limits of this shell's ~~zone~~ are probably as narrow as the Pupa, but

312 the dead shells in station were all that could be obtained.

The green zone proper extends from about 550'-600' to 1200' alt. Of this alt. belt the lower is the dense brush, ferns etc. giving place higher up to the tall forest trees - with little underbrush; and at the upper limit the trees decrease in size and brush increases again - finally to merge into the almost tree-less grassy zone at about 1800' alt. The green zone is divided into two true molluscan life belts. The first is that represented by the specimens of bottle No. 117, ~~480'-800'~~ (480'-700' alt.) The second ~~zone~~ the belt represented by 480'-1300' alt. of which belt the specimens of No. 116. Thus the 2nd zone begins with the first & then continues to the upper limit of the green zone. The live specimens of No. 116 are most abundant at 1000'-1300' alt.

The large Succinea characteristic of the upper grassy zone has its beginning at about 1300'. Some few specimens were found as low as 1100' but it properly has its beginning at 1300'. The observed occurrence of this species

must be taken from the March notes. - this time being winter the specimens are quite generally hidden.

The rim of the great crater seems to afford the ~~[illegible]~~ proper conditions for shell life. here within the space of less than 100' alt. there are gathered at least 5 species: - S. B. & P. & Y. & H. etc.

As stated - this being the winter season almost all the shells were hidden and not to be found in their usual station

The single specimen of No. 119 was taken by Mr Williams just above the barranca at an alt. of about 1300'.

Charles Island.

Oct. 4. Goashore in Post Office Bay. Works S. on a steady rise. At 150 ft. elevation, find the first signs of land shells - all dead. Work up to the summit of 2nd. crater to the S. Quite a few dead shells are seen at 275 ft. but no live forms. Work upward to a height of c 75 ft.; all the way ~~find~~ upward plenty of dead forms were found under the stones, but no live ones. Mr. Slevin handed me some half doz. live shells, which he had taken from under a stone at an altitude of 300 ft. They were in a state of hibernation - glued fast to each other & to the stone. The forms are much like the ones taken on Gardner & Champion, but differ in being smaller, & lacking the banded appearance. It may prove a ~~same~~ different species from the Gardner & Champion forms.

Oct. 5. Visit the flamingo lagoon near Cormorant Bay. - search for salt marsh shells, but do not find any. In the evening Mr. Slevin & Mr. Williams hand me some 8 or 10 live shells secured on a rise of ground just back (S.) of the lagoon. These shells exhibit ~~the~~ two or perhaps three species. Are in a state of hibernation; were taken

from under the rocks & at an elevation of perhaps 75 to 90 ft. They report the shells as extremely scarce, for they worked all day turning over stones looking for "geckos" & these were all they found — something of my experience of the day before.

Oct. 6. Go ashore at the flamingo lagoon. Collect land shells in the territory just south of the east end of the pond. Here at an altitude of perhaps 75 ft. I secured about 40 specimens of fine live shells. Their station was under comparatively loose & shallow blocks of lava, glued to the under side. Sometimes they were found by scraping away the loose stones - glued in their retreat in the interstices of the loose pebbles. At the same time about 35 dead shells were taken from the same region & occurring along with the live ones. Taken for what they show.

Specimen numbers 13 & 14. Probably two species. It is to be noted that these shells occur in a exceedingly rough & arid station, & they are prettily polished.

Noticed quite an amt. of drift material in the grove at the sand dune (S.E) end of the lagoon.

Blackbeach Road - Charles Island.

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Oct. 7. Go ashore at the settlement. Follow the trail inland in a E. by S. direction. Beginning at the 100 ft. level shells were obtained under lava blocks. They were glued to the under surface after the manner of the other specimens in this station. Though similar to the P.O. Bay. species they show some difference which may result in one or two additional species. Continuing upward to about the 300 ft. level the same forms were obtained. Bot. 16.

From the 300 ft. level to about 500-675 ft. level there seemed only a few shells - almost none. All at once in this last named alt. Mr. Williams (& I) noticed some large shells ~~adhered~~ adhered to the stems of small bushes. Upon investigation it was seen that ~~the~~ at the base of the bush, just where it left the ground, great numbers of shells were clustered. All quite firmly glued together - as many as 5 or 6 in one bunch. From now on up the trail the shells were in a great abundance. They

seemed to be almost everywhere – under old rotten logs, stumps, stones, ~~even~~ on the stalks of small bushes; even on the under side of old cow skulls. (Can Rkg. No. 15)

At about the 900 ft. level the first Succineas were observed. They were small, dirty, black forms, glued to the under side of small loose lava blocks. (Bot. 19)

A short distance further up the trail the large, purplish Succinia was taken (Bt. No. 17) These were especially wide awake, though quite in a state of rest on the stems & leaves of the small trees & bushes. They immediately exhibited lively activity after being removed from the leaves. They were quite numerous at the 1000 ft. level & continued so on the rise of ground which formed a sort of divide between the N.W. & the S.E. depressions, & connecting the two high points, one on the W. (1780 ft. alt.) & the other on the E. At this same level another form was quite in evidence, attached to the stems & leaves of the bushes along with the Succinia.

~~No specimens were taken of this, but~~ will the appearance they are much like the ones taken from the rocks & rotten logs

~~No~~ No. specimens were taken of this. (~~but~~ Probably will be taken on Monday).

Mr. Stewart visited the crater on the top of the 1780 ft. elevation. In this crater he reports an abundance of shells & quite moist ground with ferns, heliotropes etc. in abundance. This will probably be an object point of another tramp inland!

He estimates about 4 zones of vegetation:–

~~ocean to 300 ft. – acacia & cacti~~
~~300 ft. to 600-700 ft. –~~

0 – 600 ft. – acacias & legumes.
600 – 1000 – compositae – euphorbacia & mistletoe.
1000 – 1400 ft. – larger growth,
~~1400~~ absence of euphorbacia
1400 – 1780 – no bushes, but grasses & ferns of crater.

This agrees in part with what ~~my~~ day's work has produced.

It is to be noted that these observations are taken from the N. & N.W. side – the lee side according to the direction of the ~~—~~ assumed prevalent winds.

Oct. 9.

Worked inland to E. by S. side of high point when I began to work the top. Began collect'g at 1200 ft. At this point I first noticed a number of Succinia upon the leaves of the small bushes. At this same alt. too. I found the first specimens of a smooth, light brown (hazel), uni colored, B. shaped shell (Bottle No. 22) These smooth forms (No 22) were scanty in number & occurred with the very common varied colored B. (~~Can~~ No. 15.) glued to the under side of loose lava blocks. They attracted my attention as being something quite different from the B. collected on the Sat. before. As I worked toward the high point the Succinia became more abundant & larger in size. Especially was this true on the S.E. side of the volcanic cone just at the margin of the breaks in the crater. the crater having it's side broken out on it's S.E. margin. About 1500 ft. alt. the S. seemed less abundant. but probably due to lack of proper vegetation. When I reached the summit I decended a short distance into the crater, this point being the ~~north~~ N. side of the crater. At this point the Succinia

were quite abundant, but seemed of a darker shade. These ~~do~~ were taken & placed in a ~~fac~~ special vial (Bottle No. 22) 23(?)
The altitude was about ~~1750~~ 1700 ft. - only a short distance from the highest point.
This alt. (~~1750~~ 1700 ft). is the extreme upper limit of vegetation - indeed the S. were repositing on the leaves of the small heliotrope, - the first of the rather dense growth of the ~~lower~~ inside of the crater.

The progress of my smooth B. (No. 22) was very interesting. Working slowly toward the summit it was observed that the number of these forms steadily increased while at the same time the vari colored B. (No. 15) it's accompanying member, in their home on the inside of the rocks, became less & less in number. At the summit (1780 ft.) the No. 22. type was the predominating form - indeed almost an absence of the other, & those still persisting had become very small.
These specimens the No. 22 type, with ~~it~~ its accompanying vari colored B. (No. 15)

are placed in the upper half of (Can No. 21)
It will be noticed that the small B. (No 15)
type are less numerous & occur at the ~~top~~
~~of the~~ bottom of the upper half of the can.
due to their being collected last.
All of the specimens though in a quiescent
state became immediately active when
removed from their fixed position. For
this reason it was necessary to fill them
with alcohol. Their means of fixation
to stems or leaves is very slender. In most
cases it is merely an extremely fine, web
like membrane. This film fills the small
~~interstices~~ interstices between the edge of the
shell & the small ~~irreg~~ irregularities of the
stone ~~or leaves~~.
The inside of the crater was indeed a surprise.
It was open down to the 1200 ft. level on the
S.E. side thus allowing the moist winds to come
in & make the crater a perfect little tropical
forest (like Cocos on a small scale.) During
the day large clouds of mist floated up
over the crater & summit. enough condensation
~~being formed to~~ to form rain drops from
the leaves of the plants.

Oct. 10

Worked on the mountain S. of the high point. At its northern side ~~is a~~ are ~~small~~ two small spring holes - formed by a seepage through the absorbitive & retentive rhyolite. This mt. is marked for its abundant vegetation - the green ~~appearance~~ of the foliage is apparent from the ocean. It was immediately in the neighborhood of this first water hole that Mr. Williams found a single dead specimen of a Leptinaria like shell (Pkg. 27.).

Beginning at the spring (alt. 1000 ft) actual collection began. There was an abundance of Succinia (Bottle No. 24) upon the leaves & stems of the small ~~[illegible]~~ bushes. They were quite active - due to the rather plentyful moisture which ppts. at this ~~time~~ place. During the actual time of collection a heavy fog hung over the place & its condensation made the leaves drip.

~~Beginning at~~ within the 1000 ft. level the Succinia were accompanied by a small B. like form (Bottle No. 25)

For 200 ft. upward the two forms were found side by side on the stems & leaves, when the B. forms ~~suddenly tapered off~~ became far less abundant. ~~Collection~~ In fact it seemed to disappear. Collecting was carried on to the summit (alt. 1650 ft.), when the two were again companions. At this point a striking illustration of variation was easily apparent; the B. forms were now very numerous and instead of the pale, almost white color of the lower forms they were quite colored; a great many being of a dark hazel brown. The Succinia & B. were found together under the edges of the small stones, under the moss, at the base of the small bushy grass tufts. It was further noticed that the B. forms deepest under the moss or wet leaves were the ones having the darkest color. This last seemed an invariable rule. For purposes of comparison the two alt. forms are separated in the bottles - the lower alt. being No 25 & the high alt. ~~1600 1650~~ (1,600) in No. 26. The forms of Nos. 25 & 26 will probably prove to be diff. from the ~~forms~~

species thus far collected.

Oct. 11.

Spent part of the A. M. in collecting on the lower level. The shells are rather rare. Only secured the few in Bottle 29. These were taken under the lava blocks, glued, & in an excellent state of hibernation. The surroundings were that characteristic of the first belt:- acacias & legumes, dry grass & a few small bushes. All taken within 50-~~10~~ 500 ft. altitude. There are probably three diff. species included & a few good shell specimens & further increase the series.

Proceeded to the 2nd. belt & spent the rest of day here. Segregated the very abundant B. forms by taking those on the stems & leaves of small trees (Bottle No. ~~20~~ 28) & those under the stones (Bottle No. 30). In working with the No. 28 types it was found that at the ~~lower~~ lower limit of the belt of collecting the forms were very pale & seemed to have something of bleached appearance:- probably due to their open open position

the lack of the bushes & the lee (N.W.) side of the high & broad 1780 ft. zone. It may be that they will lose this bleached appearance when placed in the bottle, but the apparent difference should be noted. Alt. 750–950–1000.

Bottle No. 30. was the result of collecting in the same zone. They were taken from under the rocks & were the most abundant at about 750 ft. alt. It may be that these forms may be shown to intergrade between No. 28. & No. 30. in which case there may be something in the situs; their selecting this means as a protection in the more open surroundings of the lower limit.

Collecting along with No. 28. the Succinia of Bottle No. 31. were taken alt. 800–1000.

During the days of this andamage it was observed that each morning & for a great part of the forenoon the high points were hidden & bathed in moist clouds. This is important as a reason for the shell life & plant life higher up.

~~(Chatham)~~

Charles

~~Should~~

Feb. 26. '06. Cormorant & Post Office Bay

The territory just back of these two bays is now quite green. due to the recent showers. During the past two days we have experienced two quite heavy showers of short duration. The vegetation seems entirely of the first zone, with perhaps a little tendency toward the 2nd. on the higher elevations. (It will be safe to leave it at this for the chart of zones) As well as being in the lee of the weather this side has some recent volcanic activity. The region just back of the salt lagoon exhibits recent action and much of the territory is a light cinder, like lava upon which the cactus & some of the other hardier members of the first zone are taking a foothold. The large bluff like promontory forming the N.E. projection is composed of the yellow tufa characteristic of outlying islands & points. The region just back of Post Office Bay extending inland some 400 or 500 miles & the promontory which forms the

western border of the bay, ~~xx~~ seems quite old, in fact much in harmony with the same elevations taken inland from Blacks Beach Road, allowing of course for the ~~protected~~ its retired position.

Feb. 26 – March 2, 1906

Blacksbeach Road.

Going inland over the trail & traversing the vertical altitude which put the first 3 life zones, a general scarsity of shell life was noticed. The same brushes which once formed the station for the shells were now barren of life except perhaps a single specimen or two. The old lodging places, such as the cow's skull & the old logs were almost entirely deserted. These last two stations held thousands of the little inhabitants in the hibernating condition at the time of the last visit. Only a few Succinia were taken. – the green leafed bushes were almost totally without the adornment of these pretty shells – and in places where numerous specimens were taken ~~to~~ only 5 months before.

A great increase in the number of dead, bleached shells ~~was~~ was noticed especially among the Succinia.

This is the rainy season, the spring time of this region. During the first few

Charles.

hours of ~~the~~ each day of the visit. a fairly heavy rain fell. The rest of the day was clear & warm. All of the zones showed the advent of spring; the little bushes were all leafed out; the acacias were green; some of the legumes were in blossom; small weeds had sprung up everywhere, quite often dotted with yellow & pinks flowers. The fourth or grassy level was in fact of grassy - a beautiful green cap on the mountain top.

While ~~[illegible]~~ exploring the territory to the S.E. a few specimens were taken from the under side of fungi, the plate [the plant] being grown to the base of a large [illegible] tree. The territory was a close growth of [illegible], heavy, dark soil ~~[illegible]~~ with no underbrush. The specimens seem different from any taken thus far & may prove to be new.

The same territory offered a great number of dead [illegible]. They were notable because of their great size - some of them fully twice

330

as large as any live specimens taken.
(In Bottle No. 65) Alt. 750 ft.

Charles

Blackbeach Rd. May, 14-17, 1906

At this season the country presents a dry & parched appearance. All the grasses and annuals were quite dry, with only a few of the pale green Crotons & Leguminacea to alter the prevailing brown. This is the dry season in general, the hibernating ~~season~~ time for the shell fauna.

At 675 ft. alt. where the shells were taken at the time of the first visit, I was greeted by some small bushes quite clustered with numerous shells. The shells of this level are noticeable for their general grayish colors & bleached appearance.

With the gradual rise in alt. the shells became more numerous. The Croton bushes seemed the favorite ~~station~~. On these bushes they were glued to the stem & leaves, in rows & clusters. At 900-1100 ft. they reached their maximum in numbers & in species. The under side of the loose lava blocks were liberally sprinkled. A few Succinea were present and also a few of the

332 smooth thin shelled species. Besides the Crotons a few were taken from the mossy stems of Castilla. At this higher elevation the specimens are marked for their greater brilliancy of coloring & color variation.

The great lemon grove which covers the ~~upper~~ fertile part of the whole S.E. & S. & ~~S.W.~~ parts of the island does not offer much in the way of shell life. Great numbers of dead Succinea, however, are sprinkled over the ground. A few live specimens of this genus were taken from the bark & leaves of the trees.

In one or two spots ~~the~~ a thin, ~~shel~~ smooth shelled species of B. ~~was~~ is numerous. They were taken from under rotten wood. (This is the same as the one taken from fungi during the March visit)

May ~~2~~3. 1906

More specimens of Leptinaria were taken. Only found under damp stones at the lower spring, Spring Md., within a determined radius of a few yards. Shells were reposing on & in the soft, black, moist soil. Apex & 3 or 4 coils are dark, almost black. Almost all in an active state. (Enlarge on immediate environment) always damp; ferns, 1000 ft. alt.; etc. Mule & cattle trails interfere with spread & abundance.

Charles

May. 25, 1906.

Some ~~attention~~ given the shells of the first two dry zones. The specimens were all found hibernating under loose lava blocks & higher under & in old rotten logs. The real belt of distribution seems about 200–450. Shortly below 200 ft. a few are in evidence, all under stones. At 450 only a few remain of what was the real belt below and ~~all~~ most of them are in rotten wood. It seems marvelous indeed that within 50 ft. of alt. these first zone shells should disappear and the upper or more properly the middle zones have their beginning:— at first slow with a single species & then wax profuse at 700–800 — ~~1000~~ (limit)

Specimens in No. 92.

June 1. 1906

Beginning at about 500 ft. alt. just after the disappearance of No. 93. the specimens of No. 95

were taken - up to 625. These specimens illustrate the gradual increasing of the abundant life above that:-

1. they are pale & lack the bright coloration of the higher shells;

2. They are not common, but gradually become more numerous;

3. Their station begins with a obscure position at the base of small bushes & grasses close to & on the ground to positions more prominent higher on the stems.

4. there is probably but a single species.
5. there is a diff. in color according to prominence

To develope

(a.) The specimens present a pale & bleached appearance, quite generally the shells, but there seems a difference among in this respect, according as they have a prominent and exposed position, or are rather sheltered. Those shells reposing on the upper stalks of the bush were almost invariably bleached & additionally roughened while those at the very ground base of the bush, and thus sheltered, had a pretty brown color, and somewhat of a polish. These shells, taken collectively illustrate a tendency towards the dying of the form:-

Charles

- somber color - usually a dark brown
- and roughened surface

(b.) At first the shells were to noticed in scattering singles, then ~~little~~ pairs, and finally small clusters, showing the rapid change in zonal conditions.

At the lower limit (500) and for nearly 100 ft. of ascent the shells were almost entirely confined to the small, shrub-like ~~Capa~~ Scoparia (~~Capraria~~)

(c) Scoparia is ~~the~~ accompanied by a taller bush ~~Capraria~~ Lipochaeta. to which the shells adhere } with increased Lipochaetea alt.

(d.) For investigation.

(e.) Mentioned under (a)

May, 31, 06

Some interesting work on the color variation according to alt. of the small pale B. which inhabits the slopes & summit of Spring Mt.

While in the open pasture territory to the

336 "S. W. of Spring Mt. a small old dried water course was met with & the attention was taken by a number of dead shells. Investigation showed that the entire water course beginning at the mt. & extending down to 750 ft. alt. (and some below. although most of the specimens were taken from the 750 ft. alt.) was inhabited by numerous specimens of the small B. form already taken from the 1650 ft. elevation of the summit of Spring Mt. They were noticeable for their pale coloration, rough surface & obscure position, ~~(under rocks)~~ at the base of Castella bushes & of a few Croton plants which by their vegetation marked the sometime moist nature of this particular part of otherwise open country. All the specimens of 94 of this type were taken at about 750 ft. alt. — a few below, where they rapidly became less numerous.

These small B. were accompanied by a few of the large brown, thin shelled B. form found in 94. — perhaps a score of them.

The great remaining series of the large brown species were taken from the great brown zones to the S. & S.E. of Spring Mt. & on its slopes. They were found in a complete state of hibernation, resting

within the pocket like spaces of rotten logs & heavy branches. They were most numerous at approximately 800 ft. alt. - in the deepest shade of the bunion grove. This species is to marked as a shady station type - they extend to the top of the 1650 ft. but occupy a position generally well hidden in the moss of rocks & the moss & lichens of the bases of the small bushes.

This same condition is to be noted here from the collecting of June 2 when the summit of the 2750 ft. mt. was reached. Of course it may be shown that the two forms are diff. species but the relative shade loving propensities will not be destroyed.

The specimens of No. 93 were taken from the summit of Spring Mt. (1650 ft.) and are intended to bring out the idea of alt. color variation when compared to those of No. 94

The specimens enclosed in the cheese-cloth sac are from the sides of the Spring Mt. at about ~~1400~~ 1250 ft. The Succinea were on the leaves,

(upper sides) of the lemon trees.

An ~~important~~ observation was made while working in this S. & S.E. lemon grove ~~territory~~. The lowest limit of lemon groves is about 400 ft. Just ~~at~~ ~~about the~~ shortly before this alt. the conditions of vegetation became similar & indicate a general working toward the conditions of vegetation at 750-1000 ft. near the highest crater where the large. vari-colored B. have so great a growth. Now with this S.E. exposure for the lemon groves, to the moist winds from the prevalent direction made it possible for that growth, when introduced by the attempted settlement nearly 100 years ago. It spread & usurp the territory held by the native flora. The ~~spread~~ & growth of lemons has crowded out all native shrubbery to leave almost nothing else within its general confines. Under the old conditions the large B. sought it's counterpart in station and inhabited. With the coming of the lemon growth, however, it has been crowded out & perished. In support of this I discovered a few dead

shells of the large B. type. Two or three of these dead shells are enclosed in No. 94. At other times of other visits to this same zone territory some few specimens of this species were seen - always large - and dead.

Above is important in making the life zone belt charts & should be considered in dealing with the distribution of the large B. form.

June. 2, 1906.

At the time of the Oct. visit it was noticed, while taking the large B. form under a rotten log that there were a number of small, slender. B. forms with the large. It was believed then that they were a separate species & the work of today seems to prove that it is. The specimens taken are enclosed in No. 98. (Formalin)

All taken from a rotten log at 750 ft. alt. None were obtained higher until a similar one was taken from the E. side of the high mts at 1200 ft. alt.

June, 2, 1906,
Worked up the side of the high mt.
Began collecting at 1500 ft. alt.
A few large B. were taken from the
stems of the large composites, Lipochaeta,
accompanied by quite a number of the
small, slender, nicely colored B. At the
~~Comm~~ upper limit of this vegetation, about
1600, the grassy, or brown zone began.
Here the large ones nearly dropped, a
few large thin shelled brown forms are
present. The small ones became very
numerous, quite predominate. Their
station is generally under the few loose
lava blocks which dot the ~~~~ grassy
top of the mt. Some few specimens were
clustering at the bases of the largest of
the grass tufts.
All of the specimens of No. 99. were taken
from 1500 - the top. The few S. collected
were taken from under the moss & lichens
hanging from the few bushes of
Heliotropium which reached the top
on the inside of the crater

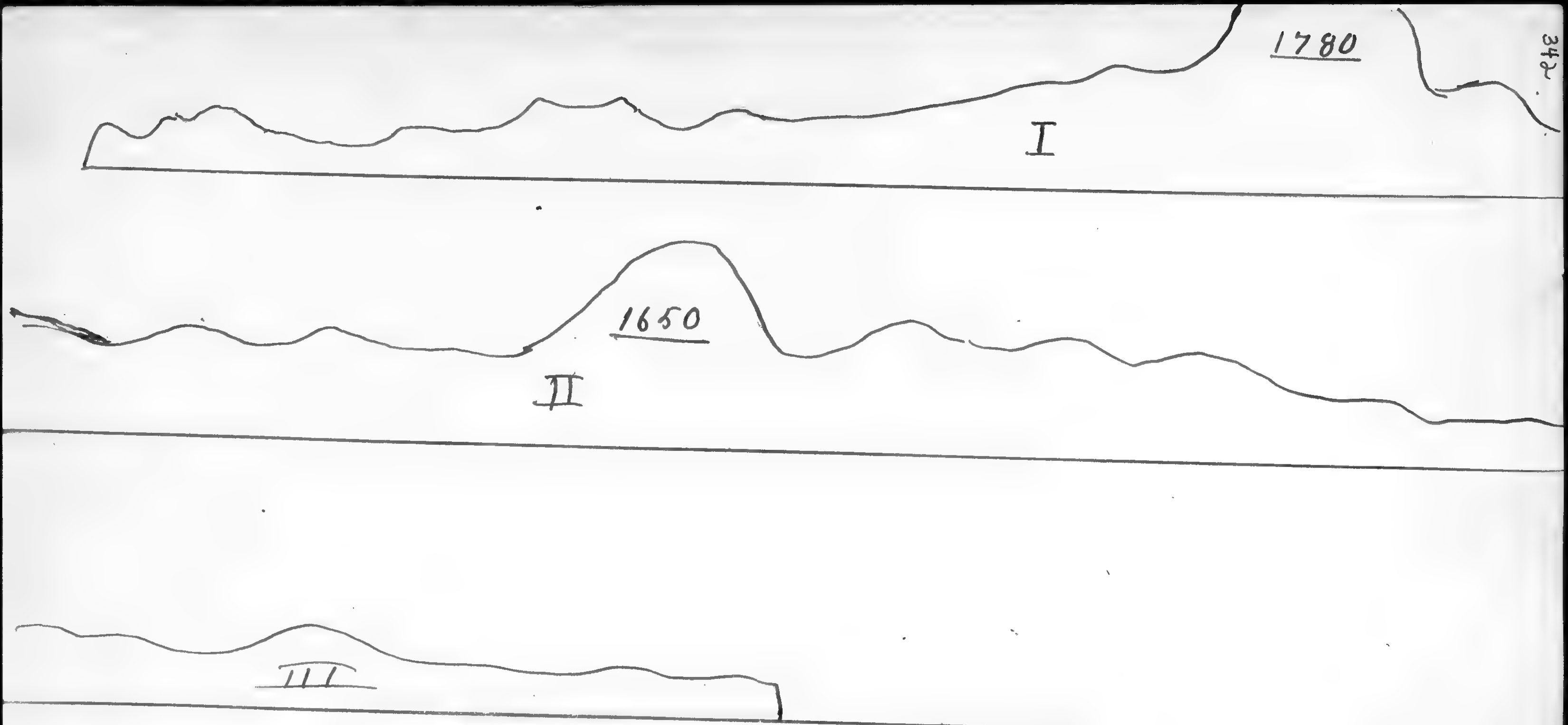
On this same date a nice
series of a new species to this island
were taken. They are the specimens

Charles.

of No. 104. The form is that of the Vertigo. They were all taken from under the moss ~~hanging~~ growing on the stems of Heliotropium, where they accompanied S.

Two or three specimens of Pupa were also taken at the same ~~station~~. They seem diff. from the forms taken at 7.50 & may prove a diff. species.

Same date. A series of Pupa taken from under old chunks & bones at 7.50 ft. alt. Never been taken here before. Specimens of No. 103.



Charles viewed from off Blackbeach Road.
For use in charting life zones.

Narborough.

April, 6, 1906.

Mr. Beck returns from Narborough after his successful attempt to reach the summit - rather the rim of the great crater, from the E. side; about the region of Mangrove Point directly inland. He brings me the specimens enclosed in No. 77. They were taken at 2000 ft. & thence upwards to the rim, where they were the most numerous as to species & specimens. Mr. Beck describes the stations as first: the brown B. forms coming first in old cactus; then the other forms appearing later in the rise & gradual progress into closer growths of vegetation; under old cactus, on grass & bushes. The specimens, though they will make new records for this island, seem to resemble some of the Albemarle species already taken - & may possibly be proven the same. However a sharp lookout must be held for possible new species for this is a portion of the island

not reached by any other collector.

Vegetation:-

The vegetation for about 3000 ft. of ascent is scant. The first 1000 ft. is completely barren lava, having had its recent origin in the several large monticular vents on the side of the great crater. Above the 1000 ft. elevation for about 2000 ft. of rise, the vegetation consists of green islands & long green strips set in the lava back-ground. This last designated territory next to that below the 1000 ft. altitude has been the last to be visited by the fiery flow, but has broken down to allow of plant growth. This growth is thin, then more abundant as the rise in altitude brings the lava ~~within~~ further & further within the level of fog condensation. The last ~~100~~ 1,000 ft. or thereabouts of elevation comprises a terrace like omitting to the rim of the crater itself. This region is rather densely grown with tall grass, ferns, bushes etc. The thickest of the growth, like that on the 4000 ft. elevation back of Tagus cove, is a narrow belt about ~~the~~ & on the great rim.

Most of the shells were taken from this last environment, & may be designated according to their other island counterparts.

~~State that in the isl~~

Narborough

~~State that as the height of the island has not been determined with accuracy, but comparing it with the nearby known elevation it will be considered as approximately 4500 ft. in alt.~~

April, 18-19, 1906

Visited the N. coast of the island. The whole island presents a rough, barren ~~to~~ recent lava surface, relieved only in spots by isolated islands of vegetation. This vegetation ~~roots~~ lives on a loose brown lava of somewhat older age than the general flows and under the influence of the greater weather erosion in the higher altitudes it has broken down & allow of more dense growth & a gradual development ~~of~~ approaching what would be called the green zone of other islands.

All the collecting was confined to the dry area, which in the largest vegetation island extends a long distance inland. The only specimens obtained were the series of Pupa, No. 81, ~~already taken~~ repeated from this island by Messrs. Snodgrass & H. ~~They~~ The specimens were all taken from

under loose lava fragments, from the roots of small bushes & under the loose damp loams ~~which~~ of the Compositae which had gathered in the little rock depressions & breaks in the lava surface. Nearly all were in a state of hibernation; ~~though~~ a few especially those under the damp loams were active

Tower Island.

Sep 13 & 14.

Tower presents a drear & barren aspect. The island is low, without any rising points or small craters to break the even, slightly curving skyline. The islands surface is one great, unbroken, lava field of recent date of activity. Away from the ~~crate~~ rimless crater, the lava streams have stretched over the whole island in so gentle a slope, and with such ~~of~~ evident quietude of activity that the flows are unbroken save by a few small fissures, vents & surface tunnels, leaving the present ~~surface~~ face of the island, a smooth easily passable area. The hardy sweet scented Bursera and Cactus forms the great part of the island's scanty vegetation. To ~~look~~ view these barren lava fields, one feels that all life, no matter how tenacious, must indeed bear strenuous demands.

~~A few live specimens of Pupa were taken~~ It is not strange that mollucan life is almost absent, and that the ~~scanty~~ minute forms have

escaped observers thus far.
Tucked away under dead wood & bunches of old leaves collected at the bases of small bushes in rocky depressions the collector is rewarded after patient searching with a few specimens of Pupa.
The species Pupa is the ~~common~~ form so common to the dry arid zones of the islands. Its minute form reason of transportation explains its presence.

Bindloe Island.

Sep. 17, 1906.

The general tufa structure and recent lava over-run, together with its low elevation (& other indications of the only recent cessation of volcanic activity) precludes the inference that Bindloe is poor territory for molluscan life.

In the low, dry, sparsely vegetated tufa region of the coast a few live specimens of Pupa were taken. They were found under & well into the crevices of rotten wood lying about the surface.

Unfortunately I could not reach the very highest elevations, where due to increased fog precipitation a few additional plants are found, such as ferns & lichens. Undoubtedly the two species of land shells recorded for this island are to be found in these upper levels.

Abingdon Island.

Sep. 19-22. 1906.

Generally considered in its relation to the other islands and its intrinsic life. Abingdon is one of the youngest islands. The plant life is fairly, but not highly developed into the usual prominent life zones cited for the other high islands of the group.

1st. 0 — 650'-700'
2nd. 700'-1600'
3rd. 1600-1950

The 1st. zone is characterized by the usual rocky, arid territory. The common plants being Burseraceae, Cacti & a number of species of low bush.

The 2nd. zone has an increase in the bushes, both in number & kind, grasses, ferns & vines & the common Compositae. The bushes are plentifully festooned with moss. The prominent feature of the 2nd. zone is the combination of cacti — especially on the E. & N.E. sides of the highest elevation.

(Insert at the beginning that the usual observations are taken from the

S. & S.E. ~~where~~ on windy side the zones are always developed & the best & occupy their true position.

The 3rd. zone is characterized by a great and predominating growth of ferns, giving to this ~~upper~~ part of the mts. a brownish cast.

The conditions of climate observed indicate this season to be the close of the winter & the opening of spring. Nearly the whole S.E. exposure of the island was bathed in a heavy drizzle like fog which precipitated ~~quite~~ enough water to amount to a fair rainfall. During the ~~sun~~ first half of the day this fog became so dense about the tops that a slow, soaking rain fell there during those hours.

Though the south side presented the belted green characteristic of the zones, the N.E. side though the same alts. up to 1700' – about the highest point of the island on this side, – was quite dry & all plant life seemed quite dead. (Mr. Beck)

~~at~~ as this time of the year is quite unfavorable to a study of land molluscan life it did not meet with great success, but enough shells were obtained to give their characteristic range & distribution.

"Pupa clausa", was taken from under stones just a short distance back from the beach. Their range is limited by the beginning of the green zone. Most of the specimens were dead.

"B. jacobi". from under stones is found soon after the beginning of the green zone. at a alt. of ~~750'~~ 700'. Some specimens were taken from under old cactus. Good numbers of dead forms ~~were~~ lying about. This species ~~continues~~ nearly to the upper limits of the green zone - being a characteristic semi-green zone species.

Accompanying P. jacobi, was a species of Pupa - unrecorded for this island. The form is larger than "clausa" & has a sharp apex. - Very like the few specimens taken at Villa niel. in the green zone. This shell continues into the fern zone. some were taken at

about 1750' alt.

"Succinea Bettii", was first taken at about 1300' alt. Its true station is on the bushes - being commonly hidden under the moss of the Castella. This form probably continues some distance into the uppermost - or "brown" zone, as we shall call it, but it is primarily a

A number of dead specimens of a species of Succinea, probably "S. corbis" were taken in the lower & middle green zone - at its upper limit being coexistant with "S. Bettii". Probably a new record for the island.

A number of minute dead forms probably "Guppya Bauri", "Conulus galapaganus", & "Vitrea chathamensis" were observed in the brown zone.
True station is at the base of grass tufts.

~~Snodgrass~~ & Heller naturally found all their ~~at~~ specimens assembled at 1700' alt. that being the highest point on the Cape Chalmers side, their side of exploration.

447

433 B. jacobi. 1700'
Guppya Bauri. 1700' dead.
Conulus galapaganus 1700' numerous.
Vitrea chathamensis 1700'
Pupa clausa - near sea level
Succinea Bettii variety Wolfi at 1700'

Photographs

1. Jervis - general view from James.
2. Chatham. 2 views of 1st. zone vegetation.
3. " distant view of Pinger Rocks.
4. Tagus Cove. valley back of spring and side of great crater.
5. Banks's Bay. distant view of crater
6. Charles. 3 photos of B. on bushes
" 1 of B. under stones.
" 1 of S. on bushes.
" 1 of vegetation 1100 ft. alt.
" 2 views of country to the N. of "Look-out-Point". - big crater included
7. Hood. - Mr. Beck's. Stone with 3 species of B. Up of 350 ft. alt.
8. Distant view of Barrington.
9. Land-shells of Barrington under stones.
10. General surface of island. showing environment characters.
11. James. - photo of large corrugated B. on bushes.
12. James. photo of smaller B. on bushes.
13. James. - general vegetation view.
14. Villa Mil. - photo at 3300' alt. - of B. on [illegible].
15. Villa Mil. - 600' alt. B. on Castella -

356 16. - General view of green zone at 600' alt. (Villa Nife.)

Occasional Ideas

Wallace, "Island Life"

p. 271. Reference to Juan Fernandez. Speaking of the peculiar land-shell species etc. the fact is cited that they indicate a remote introduction. Thus that in past time the conditions for introduction were much more favorable.

pps. 267 – 268. Speaking of the derivation of the Galapagos birds. The same point of remoteness of introduction is cited for the peculiar species according as they differ more or more from Am. genera & species. Thus that conditions in the past were more favorable for bird & life introduction.

Mentions that there may have been intervening islands to act as stepping stones.

Possibility here of introducing the idea of a former union of the whole group to form one large island. This would increase the chances of accidental introduction.

The necessary rise in elevation

To bring about this union might possibly bring above the surface of the ocean any undiscovered areas of subsidence.

Wallace p. 256.
Material on the land-shells of Bermuda illustrating the ~~relative antiquity~~ relative number of peculiar shells ~~related~~ to the remoteness of introduction — and peculiar species arising from unfavorable possibilities of introduction.

Wallace p. 243
Same consideration as above for the Azores.

In these references ~~it~~ is discovered the origin of Dall's idea of the relation of the island of nearer the mainland & those further away — He assumes that the nearer islands are the most abundantly furnished with peculiar forms.

Occasional Ideas

Wallace "Island Life"
p. 66 – 78
Important ideas on land
Shell faunas & their spread

North Am. Fauna. No. 3.
U. S. Dept. of Agriculture
Survey of San Francisco Mt.
Plates I & II. Excellent ideas
* be used in my own work on
maping lipe zones.

Good & important information
for seeing the adult form & lingual
ribbon for examination of number
& arrangement of teeth.
Tryon Vol. II pps. 96 – 97.
Pomula guam.

Tryon Vol. I pp. 198 etc.
Important information in land
provinces which should be studied to
determine the nearest relative to the
Galap. fauna.
Vol. I pps. 178, etc. ~~an important~~

Introduction to substance of Land Regions has important generalizations on the relation of tropical diversity & forms compared with arctic similarity — That the faunas of tropical, isolated, islands seem the remnants of great stocks swallowed up by the sea. — thus an important idea relative to subsidence in explaining certain difficulties.

Tryon. Vol. I. pps. 206 & seq.
Some good reference notes on the Hypsometrical, (Alt.) Distribution of Land & Fresh Water Shells.
Value in discussing Environmental Distribution & Laws of the Zonal Development.

P. 74. Wallace "Island Life"
Reference is made to the great antiquity of Land Shells. Zittel pps. 495-499 has material on this point.
Also the table p. 501 (Zittel)

Land Shell Catalogue

Pkg. No.		No. Specimens
Bottle 5	B. hoodensis: B. approximatus: B. Snodgrassi(?)	75.
" 6	" " "	580.
" 7	" "	180.
	Form Gardner - may be designated as a sub-genus or an intermediary form between B. hoodensis & B. Snodgrassi.	~~180~~
" 7+	Same as above. Preserved dry.	30.
" 5 S.	A form taken among marine shells at high tide mark. In appearance it is much like the semi-aquatic ~~form~~ form (large) taken from the old log near the mouth of the creek at Cocos Island.	1.
" 8.	Shells taken from Gardner Island; near Charles, in the situs described in the notes.	115
" 9.	Champion Island living specimens.	20
Pkg. 10	Champion Island ~~dead~~ dead specimens - recently dead. Taken for their color variation. One large ~~dead~~ dead shell of another species	40

362

Pkg. No. | No. Specimens

Bottle 11. Specimens secured some 2 miles S. from Post Office Bay. At an altitude of 280 ft. Under stones. Scant vegetation. North side of volcanic cone 645 ft. high. 12

Darles

" 12. Taken just south of the flamingo lagoon near Cormorant Bay. Altitude of 75-90 ft. Scant vegetation. North side of high volcanic cone. Under stones. 20.

Darles

" 13. Five specimens taken from the region S. of the E. end of the flamingo lagoon. At a height of 75 ft. under loose lava blocks glued to the rocks. Surrounding were great piles of recent lava & small sharp pebbles of broken down lava. At foot (N.) side of the lava cliffs - no vegetation except a few scattering cacti & the white dry looking, burnt scented bush. Probably two species. 40.

Darles

Pkg. 14. Dead specimens taken from the same region & occurring in the same station with the living forms. 35

Darles

Land Shell Catalogue (Con.)

Package Number		Number of Specmens.
Can. No. 15	Specimens taken from under old logs, at the base of bushes, & on the stems of low bushes. Alt. 550-1000 Dormant and active.	1100
Bottle. 16.	Obtained from the under side of ~~lava~~ loose, lava blocks; glued; dormant. Alt. 50 - 300.	75
" 17.	Succinea on the leaves & stems of small bushes. Dormant. Alt. 1000.	35
" 18	Taken from the under side of ~~old~~ rotten logs. together with the ~~of~~ those in can No. 15. but selected because of their particular shape & species form. Dormant Alt. 550-1000.	20
" 19	Succinea Occurring along with those of can No. 15. - on the under side of ~~old~~ loose lava blocks	25

~~[illegible]~~ Charles. P. 306

Charles.

~~[illegible]~~

~~[illegible]~~ Charles.

364

Bottle No. 20. 125

Succinia with a few accompanying B. forms. on the leaves & stems of small bushes. Alt. 1200-1500 ft. Region of mists. Grass & small bushes. ~~Alt~~ only semidominant.

Can. No. 21.

Bottom half of can contains the 1200 common B. forms such as (Can No. 15) alt. 600-1100 ft. Lower limit of mists.

Upper half of can contains the newer (Oct. 7) B. form. Alt. 1200-1780 ft. Beginning in a fairly abundant growth of vegetation this form extends into the grassy zone of this island; beginning at about 1650-1700 ft. This form with its accompanying vari colored B. forms is the one which becomes the more abundant ~~of the~~ the higher it was taken, (as described in the notes). Under ~~s~~ stones.

Bottle No. 22 10

A few forms taken of the No 21. smooth B. style specimens, taken merely as a type & for ease of reference.

Land Shell Catalogue.

Bottle No. 23 — 30

Succinia. On bones. Alt. 1700 ft. the extreme upper limit of the vegetation of this island; in other words the flower margin of the grassy zone. Region of mists, breezes, & fairly cool temperature.

" " 24. Succinia — ~~50~~

Taken at ~~so~~ first mt. S. of the high point. Alt. 1000 – ~~1200~~ 1650 — 100

~~Accompanying~~ Succinia. On the stems & leaves of small bushes. Fairly abundant vegetation. Quite a deal of moisture. Region of fog condensation. Very active state.

" 25 — 50

Bulimulus. Same situs as No. 24. - Alt. 1000 – 1200 ft. Accompanying Succinia. Seeming to disappear after 1200. to reappear at 1650 in abundance.

Charles

" 26 — 350

Charles B. Alt. 1650. Under moss, the stems of small tufts of grass - and on

stems & leaves. Grassy surroundings. Cool breezes & some moisture. Quite a pt. of ~~moist~~ moisture during the time of collecting. Interesting thing in variation as cited in the notes.

Nos. 25 & 26 are probably diff. species from those thus far taken.

Pkg. 27. - 1
A single dead specimen taken near the first water hole on rut. S. of high. pt.

Bottle No. 28. - - - - - - - - - - - - - - - - - - 500
R. Abundant. On leaves & stems of small bushes. Alt. 750-950-1000. Lower limit of belt of fog condensation. Only semi dormant.

Charles

" No. 29 - 40
Collected in lower zone. Alt. 50-500 ft. Probably three species. Under lava blocks. Dry surroundings. Excellent state of hibernation.

" No. 30 - - - - - - - - - - - - - - - - - - 350
Alt. 750-950. Under stones. Characteristic of 2nd. zone.

" No. 31 - - - - - - - - - - - - - - - - - - - 60
Accompanying No. 28. On the leaves & stems. Same surroundings. Only semi dormant.

Land Shell Catalogue

Bottle No. 32. 150

Chatham Island.
Taken from under lava blocks near the sea shore: alt 25-60 ft. Dry surroundings. Characteristic first gone. Wreck Bay. Complete condition of hibernation: fast to under side of stones

" No. 33 Barrington Island. 380
Under lava blocks. Alt. 200-400 ft. Dry and surroundings. Not complete hibernation. N.E. end of island.

" No. 34.
Under lava blocks on dry twigs near under the blocks. Alt. 200-400 Situs same as No. 33. N.E. end of island. 320

" No. 32 Supplement Chatham Island 25
Same as No. 32

" No. 35 Indefatigable Island. 200
Auricula.
Taken from the salt lagoon at S.E. anchorage

" No. 36.
Under lava blocks. Alt. 200-~~450~~ 650 ft. 70
Dry surroundings. Hibernation ..

356

Bottle No. 37 Minute forms taken from under lava blocks. Alt. 650 ft. Fairly abundant vegetation & ferns orchids etc. Hibernation. 40

" No. 38 Leptinaria like form. Under lava blocks. Alt. ~~650 ft~~. 400 - 650 ft. Hibernation. 15

" No. 39 Albemarle Island. Turtle Cove
Auriculae like forms from the first salt lagoon going inland. 100

" No. 40 Salt lagoon some eight miles west of Turtle Cove. 200

" No. 41 Salt lagoon - 2nd. inland - near fruit farm. 125

Indefatigable Island South Side

" No. 42 Succinia. On leaves of Morning Glory etc. Damp. surroundings, plenty vegetation. Region of almost constant rainfall. Alt. 450 - 650 ft. 25

No. 43 B. forms. Take alive on tree trunks. Alt. 450 - ~~650~~ 550 ft. Damp surroundings, rather abundant vegetation. 100

44 B. forms. On ground. Damp surroundings. rather abundant vegetation. Alt. 350-500 25

Land Shell Catalogue

Bottle No. 45 Indefatigable Island South Side 10

Alive on leaves. Damp surroundings, rich vegetation. Alt. 500 – 650 ft.

" " 46 (Cotton Mouth) 5

Dead specimens. S. side. 750 ft. alt. damp surroundings, rich vegetation

" " 33+ Barrington Island - Same as No. 33 40

Cartridge Box

A few dead Auriculae found taken from the salt lagoons directly inland from Academy Bay. Indefat. Island. 6

Bottle No. 47 Duncan Island 3.

Alt. 1275. Under lava blocks. Rather ~~dry~~ green surroundings; lichens, ferns, orchids. (Dead)

" " 48 2.

Alt. 1275. Under lava blocks. Same station as above.

" " 49 ~~Alt. 1275.~~ 15

Alt. 1275. Same station as above. At the roots of the grass next the lava blocks.

" 50 Indefatigable

North anchorage, inland 5 miles. 3.

Alt. 1000. Under lava blocks. Very dry surroundings. (Dead)

370

No.51 Daphne Island. 5

Alt. 250 ft. Inside of crater. Under lava blocks. Completely dry station.

No.52 Jervis Island 200

Alt. 900 – 1000 ft. Under lava blocks. Last 100 ft. of highest point on the island. Rather dry surroundings now, (dry season), some mosses, ferns & small bushes. State of hibernation.

No.53 James Island 50

Alt. 1000 - 1800 ft. Under lava blocks. Tall trees and thick bush growth of this alt. on the S.W. quarter. Hibernation.

No.54 The same station as No. 53. & accompanying them. 60

No.55 Same station as those of No. 53 & 54 35

No.56 Alt. 1800 – 2750. Most of them at 1800. On bushes of compositae. Tall trees, bushes, green surroundings. Hibernation. 25

No.57 Alt. 2100 – 2750 200

On grass & bushes. Active life. Described in notes.

Land Shell Catalogue

Indefatigable

No. 58. About 6 species taken during the inland trip of Jan. 15-18 as described in the notes - in all altitudes from 350 - 1100 ft. - in stations described in the notes. 225

No. 59. Chatham 1 50
Under stones. B. L. & 2 S.
First zone. alt 0-300 ft.
Fairly green in rainy season

No. 60. Hood. 400
Under lava blocks. State of hibernation. Extremely dry! ~~dusty~~ environment - thus far!
Lower bunch from S.E. 500 ft. elevation, upper pkg. from N. 800 ft. elevation.

No. 61. Gardner
Under lava blocks. Hibernation. 90
Very dry surroundings. alt. 150 ft.

No. 62 Chatham
Under bark of erect dead trees. Fairly ~~618.~~
abundant growth. - plenty of long grass etc. 620
church of old crater. Finger Rock. N. Sappho 7
Cove

No.63 Chathan

North Middle Slevin

Under stones. Hibernation. characters of the first zone! + part of second. Partly under the influence of S.E. winds & moisture. During the time of collection Feb. 12, 1906, there were passing showers & the whole station was green. Succineas were taken from under the stones with the rest. Altitude probably 450-550-600 ft. 350

No.64 Chatham

Under moss & at the roots of grass tufts from the grassy, open, moist zone of the highest altitudes. 1900-2500 ft. alt. Succinea, Pupa, Helix, & 2 Bulimulus. 225

No.65 Charles

S.E. territory. Alt. 750 ft. Under fungi of the lemon grove. 5

No.66 Albemarle.

Taken along the trail from coast to rim of crater. These in sloth 500-700 ft. -wooded zone. Others: 2000 ft.-3100 ft. grassy zone. on leaves. 150

No.67. Taken from mangrove swamp some 12 miles west of Villa Mills: Fresh water in swamp 580

68 Dead specimens taken from under stones near coast at mangrove swamp 12 miles west of Villa Mills. 10

Land Shell Catalogue.

No. 69 Albemarle Iguana Cave. 110

Specimens taken on mountain 200-250 ft. alt. under dead leaves on damp ground. Possibly 6 species. B. S. Pupa. & 3 varieties of Helix or Bulimulus. Typical green zone surroundings.

No. 70. Albemarle. Iguana Cave. 150

Specimens taken on mt. back of cave. 600-700 ft. alt. On dead leaves & short green plants. Same species & surroundings as the foregoing

No. 71. Albemarle Iguana Cave. 50

Taken on mt. back of cave. at 15-60 ft. alt. Under Stones. Where slope is very steep & vegetation sparse, consisting mainly of trailing vines.

No. 72. Albemarle. Tagus Cave. ~~225~~

Alt. 4000 ft. Rim of crater. Thick belt of brush. Under leaves. & stems of grass tufts 250

550

Specimens in cheese cloth were taken at 1500 ft. alt. under leaves & barks of dead cacti.

No.73 Same elevation, same situs & notes as No. 72. 75

No.74 Pupa. Specimens taken under leaves at 200-250 ft. alt. Thin vegetation, first zone. Notes. 5

No.75. Bulimulus. Tagus Cove. 60
Under stones. First zone. Some grass & annuals. Alt. 1600 ft.

76. Pupa, Succinea etc. 60
Same as No. 75. Under cactus leaves on ground etc. 1600 ft.

77 Narborough. - Mr Beck #150
specimens from Narborough - taken from 2000 ft. up to summit on rim. most of them from cactus, on grass etc. This ~~st~~ situs will do. ~~ought to prove interesting~~ & valuable. Practically all from the green zone.

78 Albemarle Tagus Cove. 100
Pupa & Bulimulus. Specimens taken on 250-300 ft. elevation. In thin veg. of 1st. zone described in notes. Found hibernating in rotten wood.

Land Shell Catalogue.

No. of Pkg.		No. of specimens
79	Albemarle Banks Bay Mt. back of bay. Alt. 1500-2300 ft. On leaves! Typical green zone	250
80	Mt. back of bay. Alt. 325-400 ft. Under stones. Hibernation. Thin vegetation. Dry. First zone. Pupa. Succinea, Bulimulus	50
81.	Narboro N. Coast. Pupa. Taken from under stones, dead leaves etc. Alt. 50 ft. Dry, barren surroundings. Some active.	50
82.	Charles. Trail. Black B. B. & S. Hibernation Under stones. On bushes & tall weeds. 800-1100 ft. Alt.	1200
83	Same as above.	1200
84	" " "	1200
85	" " "	350
		4300

376

86 S. Lemon grove. On leaves & stems of trees. Some were hibernating. Alt. 800 ft. 50

87 -- 6
B. Under stones & occasionally on bushes. 1000 ft.

88 --- Under stones. Near spring. ---------------- 10

89 -- Under Rotten wood. Lemon grove. 500 ft. alt. -- 150

90. -- On Bushes 500-900 alt. (Croton). ------ 200

91 - Leptinaria, Under stones in damp spots - at the lower spring. Spring mt. Alt. 1000 ft. (Spring mt --- 1650 ft. alt.) 100

92 ---- Bulimulus ---------- 50

Specimens all taken from the two lowest zones. 200-500 ft. Under stones and rotten logs. Hibernation. Exceedingly dry at this season, May. 25, 1906. In size & surface sculpture, coloring they are typical dry zone forms.

93 ---- Bulimulus & Succinea ---------- 1500

In bottom of jar are from top of 1650 ft. (Spring) mt. Under the few scattering stones & at the bases of small bushes, such as heliotrope & Croton. Quite damp. cloud & fog swept environment. Intended to show color variation between this & the specimens of lower altitudes - as noticed first & mentioned in the notes of the Oct. visit.

93+ In cheese cloth sac. From lemon grove at base & on sides of 1650 ft. crater. Taken from (Succinea) leaves of lemons. B, from stalks of small bushes.

Land Shell Catalogue

No. of Pkg.		No. of Specimens.
~~94~~		
94	---- Charles ---------- Bulimulus. ----------	2500

Small, ~~wha~~ pale, B. were taken from the stems of small bushes growing along an old water course, S. the S.W. of Spring Mt. at 750 ft. alt. Hibernation. Taken to show altitudinal variation with regard to the same species taken from top of 1650 ft. crater.

Large, brown, smooth forms were taken from rotten wood in bunch grass on the S.E. slopes & directly from 1650 ft. crater. at alt. of 750 – 1200. Species continues to top of 1650 ft. elevation & has been traced from 1780 ft. crater - in Oct. notes. (Two old dead shells.)

95	---- Bulimulus ----------	350
		2850

Specimens of a very abundant species along the trail at 500 - 600 ft. alt. on low bushes of "Ceanothus dulcis" mostly. Hibernation. Taken for general & altitudinal variation. 500 - about the lower limit of these & the similar higher species.

96 ---- Bulimulus ---------- 350
500-600 Same as No. 95. In Formalin.

97 ---- Bulimulus ---------- 400
950-1000 ft. alt. Common species. Selected for brilliancy of color & polish, representing the maximum of development of these particular species & general type.

98 ---- Bulimulus ---------- 50
Taken from under old logs at 750 alt. They accompanied the species of No. 96 & 97. Probably the first of the species which becomes so common above 1500 ft. in the neighboring mts. open, dry surroundings - abundant bushes of Croton & Caparis & Lipochaeta.

99 ---- Bulimulus. (3) Succinea ---------- 1500
East side of 1750 ft. mt. on Lipochaeta & in the grassy (brown part) under stones. Succinea ~~found~~ taken only at 1700-1750 from under moss on rocks & bushes.
General phg. 1500 - Top.

100 ---- Bulimulus ---------- 150
300 ft. alt. Maximum height of the dry zone type. Under rotting fallen & ~~old~~ rotten logs. Numerous. Open surroundings. Small bushes same as No. 98. Just above the cactus & properly in the 2nd. zone. Hibernation. Very dry. Sandy under soil. (Formalin.)

Land Shell Catalogue

No. of Pkg. | | Number of Specimens

Charles - Con.

101 ---------B.------------------- 900

300 ft. alt. Increased series of No. 100. Same station, date etc.

102 --------B.------------------- 700

300 ft. Same as Nos. 100 & 101.

103. ------Pupa------------------ 50

750 ft. alt. Taken from under dead brush & old bones. Same conditions of station as No. 98.

104 ------Vertigo(?).-------------- 50

[illegible]

1700-1750 ft. alt. Top of 1750 ft. crater. Brown zone. Under moss clinging to bushes & under moss on low rocks. - Especially the few bushes of Heliotropium

June [illegible]

~~150~~

105 ----Bulimulus------------------ 150

Taken from under lava stones at the summit of 3880 ft. elevation. Active state. (Pomatia)

106 ----- Pupa ----- Hood ---------- 10
Specimens of Pupa taken by Mr. Beck from old tortoise track at about 350 ft. alt. Dry, usual. open surroundings characteristic of Hood.

----- Pupa ----- Hood ---------- 25
In paper package. kept for hibernation.

----- Barrington ---- Bulimulus ---------- 10
Specimens in paper package ~~put~~ kept for hibernation.
Usual conditions 2 species.

107 ----- Barrington - B. ---------- 50
Specimens of the two species of B. common to Barrington. Taken from under lava blocks 250 - 500 ft. alt.
In formalin.

108 ----- Chatham ---------- 25
Taken from under stones & bottom of grass tufts in the dense green, typical growth to E. & S.E. of Hacienda. Moist ground & frequent fogs.
500 - 700 ft. alt.
~~650~~ - ~~[illegible]~~
Little brown ones & B. forms are from fern tufts at 1500 ft. alt. Moist.

109 ----- Chatham ---------- 10
Grass near false. about 1800 - 1900 ft alt.

Land-Shell List.

110 ------ Chatham ---- Pupa -------- 40

Under stones in arid country at & only slightly above the sea-level. These specimens are particularly subject to the light dust of the lime-stone both in form of dust & compacted crust.

110 -------- Chatham ---------- 40

Taken from under stones. Alt. ranging from sea-level to 350 ft. almost entirely in the arid dry belt of island.

111 ------ James ---------- 10

Dead specimens taken from under stones at 750 ft. bald. Arid. barren surroundings. Country back & north of Sullivan Bay.

112 --- B. 2 species. Pupa, Helicidae etc. 30

Large corrugated specimens of B. taken from bushes. - large one from compositaea - smaller taken from vine. 2200 ft. alt. - Pine vegetation. Pupa & other small forms were

taken from under dead leaves & at the base of grass tufts. 1800 ft. alt. - merging into the deeper green of high levels.

113 ---- B. - 2 species ------------------ 10.

Dead specimens taken from under leaves etc. & scattered about the ground from 200 ft. to 1200 ft. alt. ~~They there~~

114 ----- Albemarle, Cowley Mt. ------------ 50

Pupa, Bulimulus, Vertigo, Helix etc.

Specimens taken from near the top of Cowley Mt. Albemarle island. From under dead wood lying on the ground Alt. 2100 - 2300 ft. Fairly abundant vegetation; [illegible] bushes & tall heavy growth of grass. Dry season. Hibernation.

---------- Duncan ---------------- 1

115 Single live specimen of B. probably B. "duncanensis". From under stones at 600 ft. alt.

----- Albemarle, --- Villa Mil ---------- 200

116 B.; P.; V.; S.; H.; all taken from under dead leaves at the bases of the bushes - slightly above the hacienda & below. Range ~~1300~~ ~~450~~ 500' - 1300'

Bulimulus has a probable range of 900' - 1400'

Few B. on bushes.

Land Shell List.

117 ---- Albemarle -- Villa Mil. - - - - - - - - - - 150

B. taken from the bushes of Heliotrope & Castilla.
480' – 700' alt. - green zone jasper. The above zone of collecting marks the range of this species 480' alt. about the beginning of cactus. 700' - meaning the upper margin of dense grass. Hibernation

118 ----- Villa Mil. - - - - - - - - - - - - - - - 1000

B. taken from the bushes of Heliotrope & the bases of grass at 2800' – 3300' Alt. – the rim of the great crater. They were found summers at the rim. Probable range is represented by 2800' – 3300' Alt. Hibernation.

119 ---- Villa Mil - - - - - - - - - - - - 1.

B. taken from under dead wood just above the hacienda, at 1300' alt.
Only the one specimen obtained.

120 ---- Tower Island ---------- ~~25~~ 10

A few live specimens of Pupa. Taken from under dead wood & collected bunches of leaves.

Probably never taken here before.

121 ---- Bindloe ---------------- 10

Pupa. Taken from under dead wood. in the dry tufa area near the coast on the W. side.

122 ------ Abingdon ---------- 25

About 6 species of the common shells of this island.

Taken from the stations & heights given in the notes.

July, 26 — Seymour.

Trochus

I) Monodonta, (Oxystele) patula Zittel p. ~~46~~ 451
Tryon Vol. II p. 313.

II) Turbo - approaching fig. 8 & 9 Zittel p. 448
Tryon Vol. II p. 304-305

III) Natica, - similar to Zittel p. 462
Tryon Vol. II p. 204-6 plts. 63 & 64.

IV) Turritella hoffmanni.

V) Bulla

Marine Shell Faunas.

1905

Hood Island

Sep. 25. Collect in Gardner Bay during low tide. Very poor collecting - only secure a number of specimens of Purpura. the same species as the Cocos Island forms. On the coral ~~sto~~ sand beach, I noticed, a number of ~~bead~~ old specimens - most of them are Conuses & Cypraes & ~~one~~ a few other small pretty shells which I did not recognize.

Sep. 27. Work on the lee ~~(north)~~ (north) side of Gardner Island. Have fine collecting & take a nice series of about 4 species of Purpura. The large shell which looks like P. platulata. was especially fine. Secure a number of the large Chitons which are quite abundant. Walking along the south shore I secured a number of beach specimens which I shall keep as diagnostic ~~ole~~ forms of this region.

Sep. 28.

Spend all A. M. in making a complete coastal survey of Gardner Island. The specimens taken are the same as those of yesterday - but much less in number. The lack in number of shells collected is ~~due to~~ probably due to a certain characteristic of the ~~fauna~~ habitat: - ~~the most~~ favorite home is the large, smooth, water-worn, boulders; where the lava persists in a rough, jagged outcrop, only a few shells ~~were~~ are found. Thus the available territory for ~~gathering~~ collecting was much abbreviated by the fact that the whole eastern & northeastern part of the island is such a rough lava region. ~~On the~~

On the wide southern frontage of the island is a series of coral sand beaches. Like Gardner Bay on Hood. The shell life is rather scanty. On the high tide limit of the coral beaches I secured some fine dead specimens of the deep sea forms. The best of these are taken to appear in the diagnostic collection of this region.

Sep. 29.

Gather a few additional beach specimens - some especially fine Cypraeas etc. Secured one large shell which looks much like a Voluta. It will do as a scientific specimen for the animal was still decaying. ~~It was~~

Sep. 30

Works on the north side of ~~Isabela~~ Hood, just around the promontory from the anchorage. This is in the lee of the island from the usual current & S.E. wind. The rock is a smooth lava which makes collecting good. Secured a fine bunch of shells — many Conuses etc. & several of the forms ~~are~~ were the first taken alive of the many numerous beach specimens ~~taken~~ gathered. The life in this protected cove seems especially abundant & may serve as a key to future collecting.

Temperature Note.

Dana p. 47. — Notice thought placed on Dana's map & argument on temperature distribution. It is important as an explanation of the ~~to~~ cause for the similarity of the shell fauna of these islands to those of far northern latitudes.

The map is excellent & should surely be taken for

reference in paper building.
Read the complete argument in this chapter.

Oct. 3.
Landed on Gardner & Champion Islands near Charles. Noticed a few marine shells. but they were Purpuras such as taken on Hood.

Oct. 4.
Do just a little collecting in Post Office Bay. No ~~new~~ diff. forms from Hood taken. Shells are in better condition however - clean - due to a lack of the red deposit from red volcanic lava.

Oct. 5.
Do considerable collecting in P. O. Bay. Secure a nice bunch of shells. - especially a good series of Cerithium: a few Conus: all in fine condition. ~~Have~~ Take two new forms, only as hermit crab specimens. but taken for what they show.
Notice that where the sand drifts into a rocky region. the shell life is scarce - almost nothing except the hermit crab ~~specimens~~ shells.
No chitons observed or collected.

Oct. 17 Chatham Island.
Observe the rocks in Wrecks Bay to be almost destitute of shell life. but the sand banks are entirely shell remains.

Hood Island.

Feb. 1 – 7 - 1906

Do some marine beach specimen collecting. The special note is the condition of the lately dead Cypraea - it is noticed that along the lower border of the shell is a continuous rim of a leopard ~~spotted~~ enamel which seems to have been broken off over the dorsal surface to expose the bluish or pinkish striped area. Now one shell was taken showing the beginning of this break up of the ~~spotted~~ enamel & the question arises - is this a im-mature stage or are the beach specimens entirely worn.

Collected in bay to N.W. from anchorage - chitons to small forms all taken from under stones. Loose rounded lava blocks - region of coral & shell sand drift.

Temperature Note

Feb. 9, 1906.

When we arrived at Hood Sep. 24, 1905 the ocean temperature was 68° F. It remained at this point during the visit. As time passed & we proceeded northward the temperature slowly increased until 77° F. seemed the maximum. For some time past the temperature has remained about this height, no higher, sometimes 75° & 76°.

During the Feb. 1-7. 1906 visit to Hood, the ocean temperature was taken approximately at 77° F. Unable to account for this warming up effect.

Talks with Capt. Parker. during spring the westerly winds have piled up the warm waters in the bay of Panama, forcing the water in a westerly outlet to the bay bight at the S. border of the bay. After passing this extensive bight the warm current encounters the cold ant-

Temperature Note. (Con.)

arctic current. & The contact of the two gives them a general westerly direction, causing them to impinge on the Galapagos Group. The Gulf of P. is shallow & with the sun near the vertical now the waters of this region are the more easily heated. Again it is felt that the heat equator for this region is about 18° N.

It has been observed that during the past few weeks the daily temperature has been increasing very perceptibly. During the daylight hours the sun has seemed to burn with special violence. This may be due to the present nearly vertical position of the sun; & the cessation of the trade winds (S. E trades).

The air & ocean temperature remain continually at about the same temperature. At Wood when the water was 68° F the air was 68° & 70° F. Later in the trip when the water is taken at 76° & 77°, the

394.
air at the same time & place, was 76°F. ~~7~~ 77° & 78° F. Temperatures were taken in the morning about sunrise. Ocean water ~~samples~~ temperatures were taken from bucket fulls procured from on the side. This is surface water of course, but in most cases the water is kept in a constant state of movement ~~and~~ to ~~equalize its water temperature~~ by the varying speed of the currents & the rough configuration of the coast & sea-bottom, so that there is hardly a surface warm layer

1. Remember Dana's temperature vols. & ~~reflect on the possibility of the~~
2. Reflect on the possibility that the minimum temperature controls the marine shell life.

3. Investigate Tryons Life Zone (map in front of Manual)

Barrington Island

Oct. 21-1905

Anchorage at N. E. end of island is quite close to an almost enclosed shallow bay. This territory looked good for collecting so a small trawl was made. Nearly two hours work demonstrated that the trawl worked fairly well, but the bay is almost destitute of shell life - due perhaps to its shallow depth & quite an abundance of slowly shifting sand.

At low tide the shores of the bay were visited. Scarce in marine shell life. A few Purpura were taken, they were the common species taken at Hood etc. Secured one live specimen of the large Turbo which was so plentyful as hermit crab specimens on the beach at Cocos.

Two or three beach worn specimens of Murex were taken from the beach of the bay. Taken merely to add to the diagnostic list.

Indefatigable Island

Oct. 27, 1905

Marine life in the S.E. anchorage is rather scarce, due to the sandy bottom & the direction of the prevailing winds which sweep the otherwise good collecting rocks with sand. A notable example of the working of this observation is a deep bay in the W. of the ~~bay~~ larger bay indentation used as an anchorage. In this smaller bay the shells were quite numerous. It was interesting to notice the increase in number as passing along the N. shore we slowly came within the shelter of the projecting headland. The specimens collected were taken here.

Nov. 7. 1905.

Academy Bay offers the finest territory for marine shell collecting. It is well protected by headlands which extend to the eastward, thus guarding the cones from the prevailing winds and sand drift. The lava flows

extend outward & are so placed that numerous deep lagoons & tide water pools are formed thus offering excellent abiding places for marine life. Of the marine shell collecting the notable acquisition are a giant oyster, small oyster, & two of the large, beautiful cypraea.

Nov. 16-1905.

Worked in the fine lagoon like tide pools. A number of new acquisitions - Nerita, Turbo, & Cerithium. Nov. 14. worked in the lava blocks just opposite the hut. Find the large Cypraea by digging & prying away the heavy lava blocks where the shells are imbedded, within salt water always.

As favorable (protected) localities are found the list of species is steadily increasing.

Most of the shells leave an unsightly deposit of lime like crust. It yields to acid with a slight effervescence.

Nov. 20-'05 Secured some fine Cypraea & the small parish bird at N.E. anchorage. Quite satisfactory.

Two new beach specimens.

Nov. 21-'05. Seymore. Secured a few good beach specimens, among them one new form not yet taken.

Indefatigable Island

Nov. 24. 1905

At anchor in a fine cove on N. side of island about midway between Seymore & Conway Bay.

Just to the E. of this anchorage some 1½ miles is an excellent lagoon. It is formed by the peculiar points ~~of flowage~~ formed by the lava in it's flowage toward the ocean.

Fig. 1.

Fig. 1. illustrates the general arrangement of the lava flows which has made the lagoon possible. At low tide the narrow entrance is hardly passable in a small boat, being so shallow & protected by a barrier reef of lava. This shallow entrance

of course, makes the waters of the lagoon exceedingly quiet, thus offering an excellent resort for marine life. The bottom is quite rocky but has lost its harsh lava character due to the soft mud which fills the greater part of the interstices. The borders of the lagoon are densely grown with mangroves, which give a pleasant shadow from the direct rays of the sun. Among these borders and well among the mangroves themselves, at a depth of 2-6 ft. occurred an abundant shell life. Of course they were such forms as prefer a soft bottom; the Murex, Cerithium & Ostrea. It is remarkable that besides their station on the bottom the greater part of the specimens taken were found adhering to the mangrove stems both above & below the low water tide level. It was especially novel to see the numerous oysters in this position.

Scattered over the bottom of the lagoon were numerous star fish, sea urchins, & different sea mosses & anemonies.

Indefatigable.

July, 16-17, - 1906

Visited much of the collecting ground in the adjacent fine coves of Academy Bay. The same observation as that at Hood was made — a ~~gr~~ absence of a great number of the numerous species taken here on former visits. A few chitons, Purpura, Murex, Cerithium, & Bittium were observed in their old stations. As noted before, this is the cold season, the winter of the Southern Hemisphere :- the cloudy weather - setting in of the trade-winds and the sun's farthest north all work together to make the lowest temperature in the ocean waters.

The mollusks of the Californian coast are observed to go through the same change of station with winter. (Investigate whether this be a time for breeding etc)

July, 21-'06

Collect marine shells in the sand washed bay just S. of

Conway Bay. The rocks are smooth, large, & generally quite spherical. - the interstices are quite filled with loose sand. The beach is generally open to a heavy surf & the cited characters of the shore make it an undesirable place for marine shells. The only stations attainable by the mollusks are the high to entirely exposed rocks at low tide - naturally only those shells which occupy the very upper limit of the littoral zone are to be found. The specimens collected were:- 3 species of Purpura

1s. Cerithium

2s. Conus.

Numerous sea slugs

2s. Chitons

Observed two large Purpura just finishing the eating of a fair sized Chiton. The two mollusks seemed to have killed the Chiton in common ~~& then share~~. Both shells still held on to opposite ends of the torn & partly eaten ~~chiton~~ victim.

A large specimen of the brown colored many pointed star fish

was taken, having with its central depression an adult specimen of "Purpura patulla(?)" (wide mouth) & sucking the mollusks from its shell there by the use of its numerous & powerful suckers.

Thus mollusks prey & are preyed upon.

Should note here, that at Academy Bay a specimen of Murex was taken having just recently enclosed an oyster within its deadly grasp.
Probably one of the reasons why Muricidae are so numerous at "Murex Cove", N. Indefat.

oikampelos

July. 23.
Worked along on coast N. of Cove. Nothing particular except the taking of one live "Cypraea exanthema"!!

July, 26,
Worked in "Murex Lagoon"

during the low-tide period. The winter
season here is well marked by the great
scarsity of marine life. Cerithium were
few:- Only about ½ doz. Murex were
seen: - No Pinnaea were taken. - but
the Melampus in their tide-water lagoon
were as abundant as ever.

James

Important Idea

It appears from the marine shell thus far taken that many species occur here which ~~have~~ ~~are~~ intergrade between W. Atlantic species – at least a great many ~~in~~ a series may prove this in some cases. It is to be noted especially in the large bivalves Cypraea, etc.

The similarity is confined principally to the West Indian forms.

Nov. 27 – 30, 1905

Continued collecting in the lagoon of Sig. I. Acquired some valuable forms not yet taken, one being 3 specimens of the monster Pinna. The little crab noted in Tryon was found when the shell was cleaned. These specimens were taken from the mud along the mangrove borders of the lagoon. Another acquisition was some half dozen large bivalves, oyster like, which were adhering ~~so~~ so firmly to the rocks

that they could only be obtained after heavy pounding. Their station was an exposed lava flow, rather covered with mud & just above the extreme low water marks.

~~Dur~~ Mr. Beck discovered rather an extensive extension of the lagoon to the westward. Its waters are almost completely cut off from the main lagoon, & thus it lacks the tide flow, is quite & forms quite a typical salt lagoon. From the mud, under the bows & sticking to the stems of the mangroves I secured good numbers of a pulmonate, probably some species of Melampus. They show good variation & may be useful in species building.

It now occurs to me that the stuffed dead forms taken from the lagoon at Academy Bay is another species of Melampus

Duncan Island

Dec. 3-18, 1905

This island rises abruptly from the ocean on all sides, except in a small cove on the N.E. side, where the vessel was anchored. At first sight it seemed that these abrupt, rugle, basaltic shores would ~~be~~ offer but poor marine collecting. But the cove, just mentioned proved a pleasant surprise.

Fig. 2.

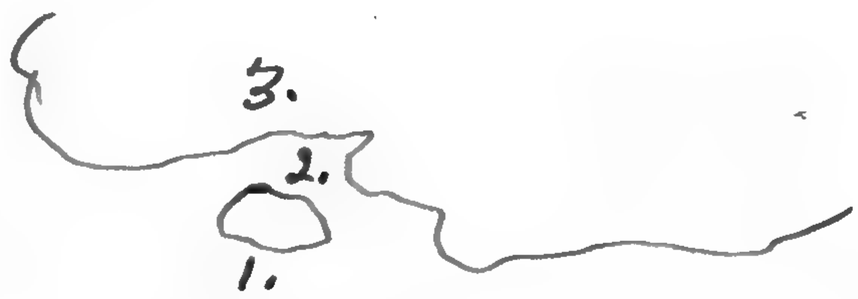


Fig. 2 represents the general outline of the coast at the anchorage. "1" a small rocky islet some 20 rds. long by 3-4 wide, "2" a shallow cove "3" the island itself. ~~The to~~ At low tide the islet is separated from the main island by water only 2-3 ft deep, & a nicely coral sand covered bottom in the cove "2" along the main~~land~~ island, in the direct lee of the islet, & in the quiet waters thus produced a fine collection of small marine shells were taken

Nearly all the forms were taken from under the loose lava blocks, which were ~~somewhat~~ quite smooth from surf action, & often imbedded & (loosely) in the loose coral sand.

Several new species were taken, among them the pretty Columbella (?), which latter species seemed to inhabit the coral sand — the sand always almost within the low tide level — thus continually ~~soaked~~ completely saturated with water.

The minute species of Chiton was quite common.

The small Cerithium may be a immature obustum, or another species.

Two large Chitons were taken. The small forms are surely not immature forms of the large ones taken, for ~~young~~ one or two specimens of ~~the~~ the large ones ~~[illegible]~~ young were observed.

James Island

James Bay ~~offers~~ & the adjacent coastal area offers but little opportunity for marine shell life. The bay itself ~~is an~~ has a loose ~~bar~~ sand bottom composed of the reddish lava sand, filled with little glittering crystals of feldspar & augite. To the N. the bay is bounded by almost perpendicular cliffs of tufa: on the south the recent lava flows make a rough jagged coast. Then around Sugar Loaf & the S.E. & E. the coast is the same rough, jagged affair produced by the recent flows. A few beach specimens were taken on the S. side, but not over two or three specimens of live shells were observed.

Aug. 8-'06:

Mr. Williams handed me two beach specimens of two species not yet taken - one is the Natica similar & almost identical with the one a [illegible]ing

410 as a fossil on Seymour. - The other was a pretty Cypraea with a undulated back - similar to a ~~Panama~~ Panama form.

Chatham

Sappho Cove.

Feb. 10, 1906

This cove is peculiarly favorable to marine life. The ~~shattered~~ structure is that of the terminations of lava flows which have taken the form indicated (See details of formation from the chart)

This side of the island being built in the lee of prevalent currents & winds & therefore is without disturbing currents. ~~This nature of things~~ ~~also~~ (Show the shallowness of water as a factor)

This nature of things causes the cove to become quite warmer than the ~~surf~~ adjacent ocean water. (Temp. this morning was 78° F)

The sand bottom, the loose blocks of lava in the jutting flows, the presence of kelp & sea weed are all factors in assisting marine mollusk life.

(absence of heavy surf)

This day's collecting was especially good. - Secured five

412

specimens & series of 2.S. Columbella;
2.S. Purpura; 1.S. Chiton; 4 specimens of small
Cypraea.; Gastropods-dorsal fleshy fossils
4.S; 2.S. Mitre. etc. & several species
of minute shells. among them several
specimens of ~~small~~ minute Cypraea
like shells. & possibly immature
Collected numerous species of
star-fish.

Feb. 13. 1906

Collect on the open coast just outside
of Sappho Cove. The jutting lava streams
& their general flow nature ~~allows~~ gives
forms many fine little pools. with
surf worn boulders. offers good
opportunities for marine collecting.
I had excellent success - Took several
Cypraea. Two new Columbellas, a few
Neritas, numerous Cnidiae etc. &
one or two unidentified forms.

Yesterday I collected in beach specimens
a. Trivia, Mexicana Isabella & a
Strombus. The latter is important because
this one is evidently one of the fossils
of this region.

Occasional Ideas.

Tryon. Vol. I pps. 166 – ~~169~~ – 171
Here reference is made, in speaking of marine provinces, to the possibility of proving that West Coast forms may be identical with or intergrade favorably toward East Coast or Atlantic species.

Aside from the chronological value, it is important for its geologic significance.

Some possibilities:

1. Cypraea exanthemina (large)
2. " (small)
3. The fossil bivalve of Seymour.
4. Purpura haemastoma.
5. " patula.
6. Tellina peronata.
7. Mactra alata.

~~P. 171. Tryon~~ Tryon Vol. I. p. 171
Slight reference to Galapagos.

Tryon Vol. I. pps. 96-97.
Good information on the odontophore & directions for securing the lingual

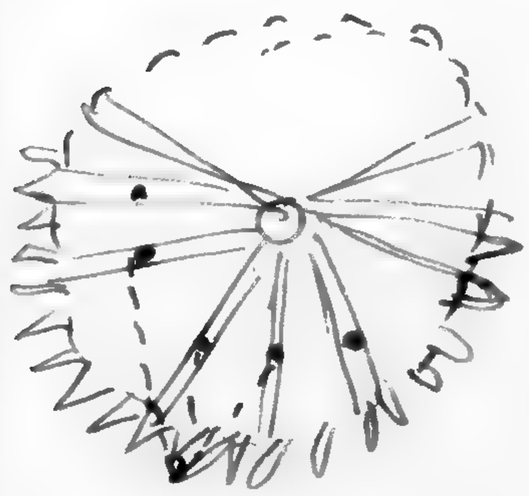
414 ribbon for examination:

Tryon Vol. I pps. 206 & seq.
Some good material on Hypsometrical
~~Distribu~~ (Altitudinal) Distribution
of Land & Fresh Water Shells.
May be made use of in Environmental
Work on Land Shells.

Feb. 19, 1906

While examining some large, many rayed, star-fish being prepared as dry specimens, my attention was taken by the somewhat glassy lustre appearing from within the openings in the outer borders of the water system of the animals. Examination showed that that these little glassy areas were small, thin shelled Molluscs. Several specimens were taken. They were obtained by tearing away a portion of the ~~arms~~ openings, & extracting with slight pliers. The shells were found partly covered with a light membrane like film which covered the aperture ~~of~~ end of the shell, & extended up into the shell itself. Whether they are parasitic & that they are a new ~~species~~ species or an unknown detail.

(See Fisher etc.)



The position of the shells was well within the arm channels indicated.

Location of shells.

(Possibly Stylifer Tryon Vol. 2 p. 135)

 March. 17-21, 1906 Albemarle, Iguana Cove etc.

During the past week exploration has been carried on along the S. coast. This part of the coast of this island is especially unfavorable for marine collecting. The whole coastal line is a lava flow so recent that there are no sand beaches or low sloping areas. The lava slope is very gentle (5-7°) and where it reaches the ocean forms perpendicular cliffs so high that only the spray of the high surf may wet the land above. The coastal rocks themselves are so rough that they offer poor facilities for abundant shell life. Where the roughness of the lava blocks has been somewhat eroded away by the action of the surf some few shells were seen - mainly the different common Purpuras & Chitons.

Iguana Cove & its rocks is a much older & firmer formation of a dense basaltic lava which even when specially broken off in the customary large, ~~and~~ cubical blocks of this structure, form a good foothold for marine forms. The cove has quite an abundant life (name some characteristic species) and even beach specimens

Albemarle

are fairly numerous.

(The absence of beach specimens along the other part of this S. coast should be cited)

(This change in the degree of marine life according to locality should be made use of & probably entered into in detail when speaking of the different islands, etc)

March. 28. 1906 Tagus Cove.

During the day some collecting was done along the brackish tide water rocks - the tufa layers of the old craters which form the cove & the contiguous territory & the S. in a little depression, well filled with a bright sea moss. A fine series of a marine shell, not yet taken, was secured. The shell is probably one of the littorina. The specimens have been placed in a vial in alcohol together with a few Patella.

At the same time some specimens

other minute littoral species were taken. These are placed with the others in the vial.

Made a notable discovery of another new species. This one was taken from the stems of leaf coral. Only four specimens were obtained, & are placed in a separate vial, in spirits.

April, 9, 1906.

Collected a few nine specimens of the small Cypraea form which basks stalked on the stems of leaf coral exposed at low tide. Observed that the mantle is prettily colored, a dark brown base with little circular yellow dots with red centres. Placed in vial with others.

~~A fast~~ Friday, April, 6. I collected a large series of the minute pink Cypraea of the sub-genus Trivia. They were exceedingly numerous with the large & small species. As beach specimens. Only some half dozen specimens of this genus have been taken elsewhere & their abundance here suggests something in the particular locality as favorable to this particular variety. Perhaps the cool water, & absence of currents, heavy surf & winds. The beach & evidently the sea-bottom here is a fine volcanic tuff sand. (Sample taken)

Also a large number of other beach specimens - some merely diagnostic.

Narborough.

Mch. 22, 1906

Visited the mangrove growth on the E. shore of Narborough island. The mangroves have taken advantage of the little tide water depressions left by the recent lava flow where it reached the ocean & spread out in ramifying streams. These small depressions are ~~fairly~~ well filled with a mud [or else] detritus. ~~in which the mang~~

At the farthest end; i.e, the innermost [landward] end of one of the lagoons I observed a number of Cerithium [the small species identical with those taken from the Murex lagoon on N. side of Albemarle] they were found attached to the dead mangrove leaves lying on the bottom of the lagoon.

(Rather a unique ~~station~~, and one worth the noting in speaking of the station of this particular species)

June. 17, 1906.

Caught some fifteen specimens of Pteropoda floating on surface. They are probably of the class

Hyalea, Tryon Vol. II p. 89-90-91
with plate reference.
The two wing like organs had a swimming
motion much like the flapping of a pair
of wings - seeming much like the
swimming motion of the "sting-ray".
Preserved in formalin & in alcohol.

July, 1, 1906,
During the last few days of visit
to this island I spent the collecting
period of low water investigating the
marine stations on Gardner & Hood.
A notable observation was that hardly
any marine shells were to be had. ~~Only~~
in the same stations which last Sep.
afforded such excellent collecting.
Only a few chitons, & ~~[illegible]~~ some
few Cerithium & a few large
Purpura were obtained. The fleshy, sea-
slugs, were very numerous.
Very evidently the shells are in
deeper & quieter waters breeding.

[illegible]

Sep. 29, 1906. Temp. Note.

The sudden increase in water temp. with the N. voyage is shown in the tables. No extended collection was made to obtain any diff. in shells. – but I did observe that the "Purpura planospira" were very abundant – found everywhere on the rocks – while the S. only a few specimens were obtained. – and those larger & perhaps stronger & more able to stand the rigors of the colder waters.

9330	10	24070
25	50	150
15	300	10
100	150	25
30	1000	10
10	10	50
25	10	25
100	25	10
500	1455	40
60		40
50		10
150		30
150		25220
200		1455
11755	26675	26675
	11755	
	38430	

Marine Shell Catalogue.

Pkg. No.		Number of Specimens. ~~No. Species.~~
	Pupura	18
Box No. 4.	Large smooth spiral. Found at upper	
"	limit of tide level. Especially abundant	
	on N.W. cove of Gardner Island.	
"	Pupura	45
	Same type, but smaller - same situs.	
"	Pupura platulla (?)	140
	Sharp spined.	
"	Pupura planospira	25
	Gardner.	
	"	45
"	Conus	20
	North shore of Hood.	5
"	Mitre	
	- - - - -	35
"	Chitons	15
	- - - - -	50
Little	Minute marine forms taken from	
the land	a little pool in the rocks in tide level	
shells.	on the E coast of Gardner. Probably	
	young Pupuras. the envelope with land shells.	

Box No. 4.

Beach specimens. 170
Various species. found on Hood & Gardner

Box No. 5. ----- 3 Cracker Cans ... {Cocos 1 can. No. 1 / Galap. 3 " . No. 2}

Can No. 2. Charles Island -- P. O. Bay ------- 225
Conus, Cerithium, Mitre, & Purpura

Can No. 2
Barrington Island
Purpura etc ------------------ 50

Can No. 2
Indefatigable Island
Purpura, Turbo. etc. ----------- 25

(Can No. 3.
Cocos, Hood, Gardner, Charles &
Chatham
Land Shells.) taken out

Bottle No. A
Indefatigable Island
Species of Gastropod 8

Box No. 5. Can No. 3. Indefatigable Island
Conus (large) 35
" (small) 60
Purpura (pinks throat) 30
Murex 5
Cypraea 6

611

Marine Shell Calalogue

Box No. 5		
Can No. 3.	Certhium	40
"	Bivalves	35
"	Mitre	30
"	Others	25
"	Murex (small)	180
"	" (spiral)	200
"	Others. (Nov. 15-16-'05)	175
Box. No. 9.	Indefatigable	
	Murex	95
" " 10	Indefatigable	
	Murex	60
	Pinna	1
	Ostrea, branches.	4
" " 11	Indefatigable	
	Pinna	2
	Bivalves	6
	Turbo	10
	Conus	8
	Cypraea	8
	Ceritlium	250
	Melampus	800
13.		
" " ~~12~~	Indefatigable Beach Specimens	20
"	Duncan Island	
"	Bivalves	40

" 434	Fissurella	50
"	Conus etc	50
"	Cerithium	45
"	Columbella etc.	75
	Others	180
"	Chiton. large & small species	30
"	**<u>Hood Island</u>**	
	A number of beach specimens most of them of scientific value. - diff. species mainly Cypraea etc	250
	Chitons	10
	~~Cephalopods~~ Gastropods	20
	1 Pkg. Fissurella. Turbo, Lepidia etc	30
	" " Minute Columbella (?)	100
	<u>Chatham Island.</u>	
"	Gastropods	4
	2 small red ones	
	1 gray. speckled	
	1 red. dorsal. Patella like shell.	
"	Beach Specimens	15
"	Columbella - minute	225
	Small vial	25
	Glass stoppered bottle Gast. 35.	10
	Small vial. Littorina, etc	25
	Beach Specimens, Strombus etc.	5
	Gastropods	10
	Olividaea	8
	Littorina	350
	Cypraea	16

Marine Shell Catalogue
Chatham. Continued

Conus . large & small	60
Bivalves	25
Purpura	35
Olivella	200
" acute apex	15
Mitra	20
Turbo (small)	75
Fissurella	10
Nerita	20
Others	100

Small vial . marked ; taken from star . fish 15
(Fittonia) " " " " S. Albemarle 125

" " " Tagus Cove ~~4~~
Specimens taken from the 15
stems of leaf portal.

" " " Tagus Cove. 120
(Fittonia) Taken from small depression
in rocks within tide limits.
in alcohol.

Beach specimens N. of Tagus Cove. ~~80~~
Olivella . 2 sp. 80
Cypraea 60
12

436

Conus etc -------------------	7
Bulla -------------------	20
Bivalves. 9 pair & others -------------	✓15
Mitrae. etc. -------------------	15
Trivia, large -------------------	40
" small, -------------------	5 50
Cyprae, young: etc. ---------- ---	40
Cyprae, Trivia, in glass vial ----------	50
Bittium. " " " alcohol. -----	50
Littorina. in glass vial, alcohol, ----	100
Beach specimens, small bivalves, Strombus, Conus, etc.	10
Bank's Bay,	
Columbella etc. pkg. ----------	200
Conus, Cerithium etc. pkg. ----------	130
Charles. ---- Black Beach Road -----	80
Specimens in alcohol, for anatomical study.	
Glass-stoppered bottle -------	10
Several bright colored Gastropods or "sea slugs"	
Test tube -------------	20
	1380
Black "sea slugs", gastropods.	
June 5, 06. 9330	
Specimens in alcohol. S. Indef.	25
Oysters & Murex. S. Indef.	15

Marine Shell List.

Indefatigable. - Dove Roads.

Purpura - large & small	100
Cerithium	20
Mitra	5
Fissurella	5
Conus	10
Nerita. Cantharus. etc.	15
Cypraea exanthema	1
Chitons: large	12

Indefatigable - Murex Lagoon.

Cerithium.	50
Large rock bivalves	25
Melampus - in formalin & in alcohol.	1500

James. N. of Sulivan Bay.

Conus. Cerithium. Mitra etc. 1 Bivalve.	60
Columbella - tan spotted	50
" - small dark	150
Others - small	50
Uncommon Forms - in bottle with formal.	50
Sea slugs etc. & large Slugs were of a light brick-red before being placed in alcohol. The color is best shown in formalin hardened specimens of the Charles collecting.	20
One live Cypraea & one Pecten also form are preserved in alcohol in a screw-topped jar	2

438
Bottle.
422

Sea slugs in alcohol — old "curry powder bottle" — taken from upper limit of high tide on the rocks at Dove Roads, Indefat. 80

Miscellaneous forms - from N. of Sulivan Bay, James. 40

~~Pupa~~ Purpura planospira from Tower 75

Ocean Temperatures and Air.

Date	Water	Place	Air
Feb. 1. '06	77.° F.	Hood	78.° F.
" 2. "	76.5	"	76.
" 3. "	78.	"	78.
" 4. "	78.	"	78.
" 5. "	78.	"	76.
" 6. "	77.	"	78.
" 7 "	"	Sappho Cove "	77.
" 8 "	78.	"	".
" 9 "	76.	"	".
" 10 "	78.	"	".
" 11 "	"	"	78.
" 12 "	"	"	77.
" 13 "	"	Bassa Pt. "	74.
" 14 "	"	"	76.
" 15 "	"	North C. Ch. "	".
" 16 "	80.	"	78.
" 17 "	"	"	".
" 18 "	"	"	"
" 19 "	79	"	"
" 20 "	80	Wreck B.	"
" 21 "	79	"	77
" 22 "	79	"	78
" 23 "	"	"	79
" 24 "	"	"	77
" 25 "	78	Charles. C. B. "	76

Date	Water	Place	Air
Feb. 26.	79,	Cor. B. C. I.	77.
" 27.	78.	B. B. Rd.	78.
" 28	"	"	77.
Mch. 1.	77.	"	78.
" 2.	78.	"	77.
" 3.	"	S. Albemarle "	76.
" 4.	77.	"	".
" 5.	79.	"	72.
" 6.	78	"	76.
" 7.	"	"	"
" 8.	79.	"	77.
" 9.	78	"	".
" 10.	"	"	"
" 11.	"	"	76.
" 12.	76.	"	".
" 13.	78.	"	77.
" 14.	"	"	76.
" 15.	76.	"	75
" 16	73.	"	74.
" 17.	74	Iguana Cove	73.
" 18.	"	"	74.
" 19.	"	"	".
" 20.	80	"	76.
" 21.	"		".
" 22.	79	"	77.

Ocean & Air Temperatures

Date →	Water	Place	Air	Date →	Water	Place	Air
Mch. 23	80	Tagus Cove	76	April. 17	69	Tagus Cove	71
" 24	79.	"	75.	18	68	"	72
" 25	74.	"	73.	19	69	Ocean, off S. Albemarle	73.
" 26	70	"	72.	20	72	"	72
" 27	72	"	74.	21	"	"	73
" 28	75	"	76.	22	"	"	"
" 29	74.	"	"	23	71	"	"
" 30	73.	"	75.	24	72	"	74
" 31	74.	"	75.	25	71	"	"
April. 1	72.	"	73.	26	73	"	"
" 2	"	"	74.	27	72	"	"
3	74.	"	74.	28	74	"	"
4	73.	"	".	29	73	"	72
5	74.	"	76.	30	74	Villa Mil.	73
6	72	"	73	May. 1.	70	"	72
7	70	"	74	2	71	"	73
8	69	"	72	3	71	"	"
	70	a.m.	73			Ocean W. S. of Charles	
9	64	p.m.	74	4	72	"	72
10	63	"	71	5	70	"	72
11	66	"	70	6	73	"	73
12	"	"	"	7	72	"	74
13	"	"	"	8	76	"	75
14	"	"	71	9	72	"	74
15	"	"	70	10	74	"	"
16	65	"	71	11	73	"	"

Ocean and Air Temperatures

Date	Water	Place	Air
Sep. 25	22°C	Hood	22°C
26	"	"	22.5
27	22.5	"	23.
28	22.	"	22.5
30	"	"	"
Oct. 6	69°F.	Charles	69°F.
7	68	"	67
8	67	"	70
10	70	"	70
11	"	"	"
13	69.5	"	71
16	67.5	Chatham	70
17	66	"	71
18	66.5	"	70
21	70	Barrington	70
23	"	"	"
24	"	"	"
Nov. 10	73.5	"	67
11	73	"	68
13	71.5	"	72
14	72	"	71
16	72	"	"
17	"	"	72
22	72.	Seymore	74
23	73	"	74
25	73.5	"	71.5

Date	Water	Place	Air
Nov. 27	75.5	"	74
28	75	"	74.5
29	74	"	71
Dec. 3	69.	Duncan	73
4	70	"	70
5	"	"	"
6	71.5	"	71
13	72.5	"	73
14	72	"	72
15	"	"	"
22	73.	James Bay.	71
23	72.5	"	72
28	70	"	71
Jan 15	76	Academy B.	75

Ocean & Air Temperatures

Date	Water	Place	Air
May 12	72	Ocean S. & W. of Charles	73
13	"	"	72
14	71	"	"
15	68	(Near Hood) "	71
16	"	"	73
17	"	"	"
18	70	S. of Indefat. "	71
19	71	"	72
20	70	"	72
21	71	"	71
22	70	"	71
23	71	Black Beach "	71
24	72	"	72
25	70	"	71
26	69	"	71
27	70	"	71
28	71	"	72
29	71	"	72
30	70	"	71
31	71	"	72
June 1	70	"	71
2	70	"	71
3	69	"	70
4	69	"	70
5	70	"	71

Date	Water	Place	Air
June 6	70	"	70
7	"	"	"
8	72	S.W. Charles "	72
9	"	"	"
10	72	"	72
11	70	"	70
12	72	"	72
13	71	"	"
14	"	"	"
15	72	"	72
16	"	"	"
16	70	"	71
17	"	"	"
18	"	"	"
19	71	"	72
20	72	"	72
21	"	"	"
22	"	"	73
23	71	"	72
24	70	"	71
25	"	"	"
26	"	Hood.	"
27	"	"	"
28	71	"	"
29	"	"	"

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X1

Ocean & Air Temperatures.

Date	Water.	Place.	Air.	Date.	Water.	Place.	Air.
June 30	70	Hood	71	July. 25	68	W. Indefat.	66
July. 1	69	"	69	26	69	"	"
2	70	"	70	27	"	Seymour	68
3	70	"	69	28	68	James	67
4	68	Chatham	66	29	"	"	66
5	67	"	"	30	"	"	67
6	66	"	67	31	"	"	67
7	"	"	"	Aug. 1	67	"	67
8	64	"	66	2	"	"	"
9	65	Barrington	"	3	"	"	"
10	67	"	67	4	66	"	65
11	66	Academy Bay	66	5	"	"	"
12	69	"	67	6	"	"	"
13	67	"	66	7	67	"	66
14	"	"	"	8	68	"	68
15	68	"	67	9	"	Conley Mt. "	"
16	67	"	66	10	"	"	"
17	"	"	65	11	67	"	67
18	68	"	66	12	"	Duncan "	66
19	"	"	67	13	"	"	"
20	69	"	"	14	"	"	"
21	67	"	65	15	68	"	67
22	68	"	"	16	"	"	"
23	67	~~W. Indefat.~~ "	66	17	67	"	66
24	"	"	66	18	"	"	"

Ocean & Air Temperatures

Date	Water	Place	Air
Aug. 19	67	S. Albemarle	67
20	"	"	"
21	68	"	67
22	"	"	"
23	67	"	66
24	"	"	67
25	66	"	66
26	68	"	67
27	"	"	"
28	"	"	"
29	"	"	"
30	"	"	"
Sep. 1	67	"	66
2	"	"	"
3	"	"	"
4	68	"	68
5	"	"	"
6	63	Chatham "	62
7	63	"	62
8	63	"	63
9	63	"	64
10	65	Barrington	66
11	"	"	"
12	68	E. of Indef "	68
13	69	"	68
14	73	Torrer "	72

Date	Water	Place	Air
Sep. 15	73	Torrer	72
16	73		74
17	"	Bindloe "	72
18	"	"	"
19	73	Abingdon "	72
20	"	"	"
21	74	"	73
22	"	"	"
23	"	"	"
24	76	Wenman "	77
25	78	"	"
26	"	Culpepper "	78
27	"	"	"
28	80	N.W. of Calap. "	81
29	"	"	"
30	"	"	"

Water temp. at Chatham & [illegible] about 10° warmer [illegible] that Torrer some 60 ms. N. Currents - Humboldt The Panama.

	Water	Place N.W. of G.	Air
Oct 1	80	"	81
" 2	82	"	83
3	"	"	"
4	"	"	"
5	"	"	"

the eastern islands. Prudence strongly urges that we know too little of the mollusk fauna yet to intelligently discuss its inter island distribution. !!!

Taking the forms enumerated ~~above~~ in the table showing the distribution of the species and omitting the Onchidium and species of Auriculidae and Siphonariidae all of which are denizens of the salt marshes or beaches, we have 76, of which 15 are found on more than one island, 5 on more than two islands and 3 are found without material change on four islands; all of the latter are found in both the central and southeastern groups. One of the species, or perhaps two, are probably common to the mainland of South. Am. as well as the Is., & all of them doubtless have been derived from the fauna of the Panamic & South Am. regions.

A. Albatross; B. Baur; C. Coming; D. Darwin; H. Habel; K. Kellett; P. Peterel; W. Wolf

	Groups of the Galapagos Islands									
	Chatham	Charles	Hood	Barrington	Indf.	Duncan	Albemarle	James	Bindl	No. of Specimens Sech.
	Southeastern					Central			N.E.	
Bulimulus nux	K.A.B.W.	C.P.W.A								374
B achatellinus	K W B		H							2
B. Darwini									H	
B. Wolfi					W					1
B. duncanus						B				6
B. nugulosus	D K C	P A W B								64
B var nudus		W								
B. planospira		B								71
B. ustulatus		C						C		14
B. calvus	K	C W A								2
B. nucula	B									6
B. eschariferus	D K W A B	P		S. H.						66
B var ventrosus	A			W. B						4
B. var pileatus	A									6
B galapaganus		B								5
B. perspectivus	W									2
B. jacobi.	B W	C					B W	C		12
B. var. cinereus								W A B		4
B var acutus	W			B	B	~~B A~~		C		1
B. olla				B	B	B A				16
B Tanneri					A					4
B. amastroides	A									25
B. var. curtus	W A B									34
B. unifasciatus	K B	C P						C		22
B. Simrothi							W B			85
B. Bauri	B									16
B. Canaliferus	W									1
B. Sculpturatus								A		
B. Nesioticus								[illegible]		
B. frugiferus					A			C		
B. Reibischi					[illegible]					
B chemnitzioides	K H W A B									
B. Habeli	H W A B							[illegible]		
B. n. sp INDEFAT.					W			W		
Trochomorpha(?) Bauri	D (?)						B		[illegible]	1
Vitrea chathamensis	B								[illegible]	1
Conulus galapaganus	B						W B		[illegible]	3
Pupa Wolfii									[illegible]	4
(Bettii) Pupa clausa Bettii					W					
~~Succinea brevior~~	W	P A				A	B	B		
Succinea brevior										
S. producta	W B						B			86
S. corbis							B			21
Leptinaria chathamensis	W B						W			15
L. sp							W			15
Helicina nesiotica	W B								H	19
Auricula stagnalis										55
Melampus trilineatus			H							
Tralia panamensis			H							12
Pedipes angulatus									H	
Siphonria gigas		A								6
Williamia peltoides	H	H	H							3
Onchidium Lesliei		A					A A			3
Onchidella Steindachneri		A H					A A			7
Number of Forms ~~54~~	25	18 ~~8~~	4	2	6	3	11	9	3	1188

I.

Table of known distribution of the Galapagos landshells.

Name of species.	Chatham	Hood	Gardner	Charles	Champion	Barrington	Indefatigable	Duncan	Tortuga	Albemarle	Narborough	Jervis	James	Tower	Bindloe	Abingdon	Daphne
B. achatellinus	o	o															
B. nux ×××	o		o	o	o												
B. asperatus				o													
B. bauri	o																
B. planospira ×××			o	o	o												
B. rugulosus	?			o													
B. invalidus				o													
B. approximatus		o															
B. vstulatus ×××				o													
B. calvus	o			o									o				
B. elaeodes										o							
B. hemaerodes										o	o						
B. pallidus										o						o	
B. rugatinus	o									o							
B. cinerarius										o			o				
B. jacobi										o	o		o			o	
B. tanneri							o			o							o
B. perrus											o						
B. hoodensis ×××		o															
B. unifasciatus ×××	o			o									o				

(18.)

II.

Table continued.

B. olla						o	o	o				o		
× × × B. eschariferus	o			o		o								
B. perspectivus	o			o										
× × × B. snodgrassi		o	o	o										
B. cucullinus		o		o		o								
B. galapaganus				o										
× × × B. amastroides	o													
B. nucula	o			o										
B. trogonius									o					
× × × B. simrothi									o					
B. tortuganus								o	o					
B. albemarlensis									o					
× × × B. akamatus						o								
B. adelphus						o								
B. wolfi						o								
B. lycodus						o								
B. alethorhytidus						o								
B. cymatias						o								
B. ochsneri						o								
B. saeronius						o								
× × × B. duncanus							o							
B. jervisensis										o				

III. Table cont'd.

Name of species.	Chatham	Hood	Gardner	Charles	Champion	Barrington	Indefati-gable	Duncan	Tortuga	Albemarle	Narborough	Jervis	James	Tower	Bindloe	Abingdon	Daphne
B. darwini												o			?		
x x x B. sculpturatus													o				
B. rabidensis												o					
B. rugiferus													o				
B. nesioticus							o						o				
B. reibischi							o										
B. nudus				o													
x x x B. chemnitzioides	o																
B. habeli	o																
? B. terebra	o																
B. indefatigabilis							o						o				
x x x B. caniliferus	o																
x x x Pupilla munita				o				o		o	o			o			
Pupilla reibischi										o							
Pupilla clausa										o							
Guppya bauri		o						o		o						o	
Euconulus galapaganus	o												o			o	
Vitrea actinophora	o												o				
Vitrea chathamensis	o									o			o			o	
Endodonta helleri										o	o		o				
Succinea bettii	o			o			o	o		o			o			o	

IV.

Table continued.

? Succinea wolfi			o				o					
Succinea brevior	o		o									
Succinea producta	o		o			o	o	o		o		
Succinea corbis			o				o	o				
Tornatellina chathamensis	o		o				o					
Helicina nesiotica	o		o				o					
Helicina ochsneri	o						o					
Auricula stagnalis						o	o				o	
Melampus trilineatus		o										
Tralia panamensis		o										
Pedipes angulatus											o	
Siphonaria gigas				o								
Williamia galapagana	o	o		o								
Onchidium lesliei				o			o					
Onchidella steindachneri				o			o					

Bm
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