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V

LANDSHELLS OF THE GALAPAGOS ISLANDS¹

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INTRODUCTION

Numerous visitors have collected on the islands of the Galapagos Group and each expedition has added some species to the list of their molluscan fauna; but none other has had the advantage of such a prolonged opportunity as had the members of the 1905-1906 Expedition of the California Academy of Sciences, and none other has obtained so large a series of known species, or added so many undescribed forms to the list. It is a curious fact that no expedition has collected all the forms previously described. It is probable that numerous others still remain to be discovered by future explorers.

SUMMARY OF ENVIRONMENTAL CONDITIONS

A brief summary of the conditions under which the fauna and flora of the Galapagos Islands exist will make it easier for the reader to comprehend the data given in connection with

¹ Previous reports on the Expedition to the Galapagos Islands of 1905-1906 have been published as Proceedings of the California Academy of Sciences, 4th Ser., Vol. 1; Vol. 2, Pts. 1, 2, Nos. 1-18; and Vol. 17, No. 4.

² We are indebted to Mrs. Ida S. Oldroyd for assistance in preparing the collection for study and to Dr. V. Sterki and Dr. H. Pilsbry for advice in identifying some of the Pupillidae.

June 22, 1928

the several species. The information utilized in this summary is chiefly derived from the field notes made while collecting the landshells; other sources are enumerated in the general discussion contained in the monograph of the fauna published in 1896³ by the senior author.

The Galapagos Islands lie in the path of the southeast trade winds and of ocean currents from the east and southeast. The trade winds bring moisture and the distribution of the moisture precipitated as rain or dew governs the distribution of vegetation and indirectly that of the land Mollusca.

Since the winds come from the southeast and thus strike the southeastern islands of the group first, their southeastern slopes benefit by receiving a greater part of the conducted moisture than the northern and northwestern slopes. Variations are caused by the height of the islands, the highest peaks reaching cooler air and a greater amount of moisture, and by some of the leeward islands being more or less sheltered by those to windward. There is also a wet and a dry season, the period from December to June having less precipitation than the rest of the year. The conditions, therefore, are very complex and require for a permanent explanation the cooperation of meteorologist, zoologist and botanist. The arid zone, which on the southeastern shore of an island may extend from high water mark to a height above the sea level of 50 to 60 feet, on the northern side of the same island may ascend to a thousand. It is obvious then that the mere statement of the elevation can convey no information as to the surroundings of the specimen unless we also know, first, the exact locality and, second, the disposition of the zones of vegetation on the particular island and the meteorological conditions. These zones, summarized from the field notes taken on Indefatigable Island, may be characterized as follows:

I. The arid or dry zone, 0 to 100 feet elevation on the south side of the island. Rough fragments of lava with scanty dust of disintegration under and between them, forming a scanty soil and thin vegetation; scattered cactus, thorny

³ Dall, W. H., *Insular landshell faunas, especially as illustrated by the data obtained by Dr. G. Baur, in the Galapagos Islands*, <Proc. Acad. Nat. Sci., Phila., August, 1896, pp. 395-459, pls. XV-XVII. Also supplementary data in the same periodical for 1900, pp. 88-96, pl. VIII.

bushes, and a prickly vine most in evidence; many of the shrubs with narrow leaves, at a distance resembling leafless branches or thorns; generally dry.

On Chatham Island this zone on the south side has a dusty soil, the lava being much disintegrated; it rises to 500 feet, but on the northwest side much higher. On Tower and Bindloe islands this may be said to be the only zone; on Barrington and Duncan, the upper zones are hardly indicated; on Abingdon the arid zone rises to 700 feet. Species of the type of *B. chemnitzoides* are characteristic of this zone, and the minute heliciform species and *Pupilla* are found here when there is no other landshell present.

II. The transition zone, on Indefatigable Island, southern exposure, reaches from 100 to 350 feet elevation. Here there is more soil though still scanty moisture; small ferns, long grass, some shrubs, and tall cacti appear.

III. Forest zone, or dense green zone; receiving not only its own rainfall but more or less drainage from above. Here are no cacti, but many trees, tall bushes, ferns and grass; umbrella trees and wild plantains abundant. There is much rain, disintegrating the lava into a rich soil which covers most of the rocks. Elevation 350 to 1500 feet.

IV. Grassy zone, elevation from 1500 feet to top. Open grassy country with few shrubs, absence of ferns, tall grasses and trees. This region prevalently misty with frequent rains, which, however, drain away quickly to the forested zone below, is probably really dryer than the latter.

These data refer especially to Indefatigable Island. On Narborough and some of the other islands, ferns and shrubs are noted as occurring on the very rim of the crater up to 4000 feet, in the grassy zone.

On Gardner Island more annual plants were noted on the east and southeast side and a greater number of perennials on the opposite or lee slope.

Chatham is one of the oldest islands of the group geologically. In the southern part the cones and craters have broken down into grassy hills with a well-watered, rich, red, volcanic

soil, except near the shore. On this island the arid zone on the south side rises to 500 feet with the soil dry and dusty. There is then a transition zone of 150 to 200 feet, then grassy up to 2100 feet. On the northwest or lee side the arid zones reaches much higher, the transition zone to 1100 feet, above which it is grassy. On the northern side there are some more recent lava flows with scanty vegetation.

James Island, on the other hand, is one of the geologically newer islands. The soil, though fertile, is dusty.

On James Island December 23 to January 4, *Bulimulus darwini* was hibernating on the smooth bark of a Eucalyptus-like tree, and also on dry compositæ, always near the top of the herb and shaded by the plume of the top.

On Barrington the rainy season was setting in October 20. On Chatham, October 17 the soil was like dust. January 24 to 29 the wet season had set in, but at this time Hood Island was entirely dry! On Abingdon the beginning of the wet season was about September 19.

On Albemarle Island in the southern part, the arid zone reaches to 350 feet elevation; the transition zone from 350 to 400 feet, when the forest zone begins, reaches to 1000 feet and above this gradually merges into the grassy zone 1300 to 3100 feet elevation. During the wet season the slope at Iguana Cove, at the southwest corner of the island, is green from the water's edge upward.

On Albemarle the green zone is divided near Vilamil into two regions conchologically, the lower 480 to 700 feet with *B. tortuganus*; the upper 700 to 1300 feet with *B. simrothi*, the species being most abundant at about 1000 to 1300 feet, associated with *Pupilla*, *Helicina*, *Vitrea*, and *Tornatellina*.

Tower Island is a great lava field, relatively low; only *Pupilla* was found there. Bindloe is somewhat similar; only *Pupilla* was found although other collectors have reported a few *Bulimuli*.

On Abingdon Island the arid zone reaches to 700 feet, the next above from 700 to 1600 feet with herbage and bushes; the grassy zone follows from 1600 to 1950 feet.

Another factor influences the distribution of the vegetation on some of the islands, where on an old disintegrated surface

new lava flows have been ejected. On the still solid surface of these new flows few plants find wherewithal to sustain existence. Yet between these flows wedge-shaped areas of the old soil extend upward bearing a vegetation more profuse, since drainage from the lava surface, if any, naturally flows into them. This is another case where the datum of elevation taken by itself is relatively meaningless.

RAINFALL AND WET PERIODS

There seemed to be almost as much variation in respect to wet and dry periods on particular islands, as there was in regard to elevation of the floral zones. At Gardner it was noted that the southeast trade winds set in about July 1, with showers. October 2, on Champion Island all was dry and the landshells in hibernation. At Hood Island, January 31 to February 7, everything was still dry, and all shells hibernating. Showers began June 23 to July 3, and the hibernators were soon roused to activity especially in the wetter upper region. During hibernation the *Bulimuli* and other species often seek the most retired places under blocks of lava, more or less buried in the volcanic dust, or clustering in the cavities of rotten wood or in the dry crania of tortoises or cattle. Specimens thus collected must not therefore be supposed normally to inhabit such a situs. After the rains began the shells vanished from such places, so that no live individuals were seen where multitudes had hibernated. They attach themselves to their situs whether rock, twig, or bark of a tree, by a membranous and rather thick epiphragm, then retire a short distance and form another thinner epiphragm further within the shell, the two effectually preventing desiccation.

On Indefatigable Island October 23 the dry season was prevalent, no water in the pond; dead shells were plentiful, 200 to 600 feet; living ones in hibernation were noticeable at about 450 feet above the southeast anchorage. November 6, *Tornatellina* was resting under bark of dead trees, near Academy Bay. *Bulimuli* were attached to the smooth bark of a Eucalyptus-like tree at 450 feet but none was seen on other trees. They reached from 10 to 35 feet above the ground; at 550 feet elevation no more were seen.

On Chatham in July all species were hibernating. On Charles Island May 14 to 17 everything was dry, the mollusks hibernating.

HABITS AND HABITAT OF LANDSHELLS

On Hood Island at the east and southeast much driftwood was seen and a new patch of mangrove was evidently started by sea drift. On Albemarle the dark soil of mangrove swamps on the south coast is the haunt of *Auricula*. It was found on the ground at the edge of a fresh-water lagoon and all around it to a distance of four or five feet away from the water. It also occurred near salt lagoons and above the water, on the stems of mangroves growing there, and occasionally under dead logs in the vicinity.

On James Island *Bulimulus darwini* was seen active on the leaves of a small vine. The Succineas seemed to prefer the upper levels where they were taken from ferns growing on tree trunks, also under bark of dead trees and on grass blades.

It was noted that the larger specimens of *Succinea* were found at the higher levels, a fact probably correlated with the greater amount of moisture. The animal in some of the species is black and almost invisible when hibernating attached to blackish lava. A greenish species appears at the upper level, 2100 feet, probably *S. brevior*, and hibernates attached to twigs of shrubs, where they have somewhat the aspect of buds.

On Barrington the brownish, *Bulimulus eschariferus* was found hibernating mostly on brown twigs; the olivaceous *B. cucullinus* on grayish lava blocks.

On Albemarle near Tagus Cove the first living *Bulimulus* was found at 1500 feet elevation with *Pupilla*. *Pupilla munita* seemed to prefer the lower levels, the larger species the higher altitudes. Corrugated Bulimuli were found at 2400 feet; toward the rim of the crater they were larger and rougher, but at the rim a nearly smooth whitish species occurred. Brownish Bulimuli hide under cactus bark, the grayer kinds under dead leaves and on rocks. *Succinea bettii* is found sparingly at 1100 feet and upward, the larger specimens at the higher altitudes.

On Charles Island the same rule applied to the Succineas. *Bulimulus unifasciatus* was more abundant, hiding under rotten wood. One specimen was found in the lemon grove on a fungus. The Croton and Castella bushes at 675 feet altitude were clustered with hibernating shells May 14 to 17; they seemed in greatest abundance between 900 and 1100 feet. *Tornatellina* was found only near the "lower spring" under damp stones, at 1000 feet, active on May 25. The animal shines through the apex and early whorls of the translucent shell, almost black. They frequent only damp places and, as previously noted by Dr. Baur, are partial to ferns.

The following quotations are from the field notes, only slight emendations having been made.

"May 25, 1906. Some attention was given to the shells of the first two (dry) zones. The specimens were all found hibernating under loose lava blocks, higher up under and in old rotten logs. The real belt of distribution (*Bulimulus eschariferus* and *rugulosus*) seems about 200 to 450 feet. Shortly below 200 feet a few are in evidence, all under shrubs; at 450 feet only a few of them remain and most of them are in rotten wood. It seems marvelous, indeed, that within 50 feet of altitude these first (arid) zone shells should disappear and the upper (transition zone) forms have their beginning, at first sparsely and from 700 to the limit of 1000 feet wax profusely abundant.

"June 1, 1906. Just after the disappearance (of the arid zone forms up to 625 feet) the species of the upper (transition) zone come in (*Bulimulus nux*, *B. asperatus* Albers, *Succinea betti*). The lower forms lack the bright coloration of the higher shells. . . . Those shells reposing on the upper stalks of a bush were almost invariably of the lighter colored and rougher surface, while those species living at the base of the bush on the ground had a pretty brown color and some polish. At first the shells were noticed singly, then in pairs, and finally in small clusters, showing the rapid changes.

"At 500 feet, the lower limit and for 100 feet upward the shells were almost entirely confined to the small shrubby *Scoparia*. Higher up they also frequent taller bush, *Leptochatea*.

"*Bulimulus nux* was taken in large numbers from the great lemon groves, south and southeast from Spring Mountain and on the mountain slopes. They were (May 31, 1906) hibernating in the cavities of rotten wood and were most numerous in the deepest shade of the lemon groves at about 800 feet, though extending to 1650 feet; they usually keep well hidden under moss on rocks and about the bases of shrubs.

"June 2, 1906. Charles Island. A few Bulimuli were taken from the stems of *Leptochatea*. At the upper limit of this vegetation, about 1600 feet, the grassy zone begins; here the *B. nux* nearly disappear, but *B. unifasciatus* are present and *B. calvus* becomes very numerous. This station is generally under the few loose lava blocks which dot the grassy top of the mountain; a few were

found at the base of grass tufts. A few *Succinea bettii* were taken from under the moss and lichens hanging from a few *Heliotropium* bushes which reach the top on the inside of the crater. In the same situs were found *Pupilla munita*, *Helicina nesiotica* and *Succinea*.

"April 6, 1906. Narborough Island. Mr. Beck of the expedition succeeded in reaching the rim of the great crater from the east side, directly inland from Mangrove Point. He brought specimens which occurred from 2000 feet upwards. The first to be noticed were *Bulimulus unifasciatus*, in old cactus, later *B. calvus*. The vegetation of this island for about 3000 feet is scant. The first 1000 feet is completely barren recent lava. The next 2000 feet there are islands and long strips of green vegetation framed in the lava. The second region has been the last to be visited by lava streams, but in part has suffered disintegration sufficiently to nourish vegetation. This at first is thin, then as the level of the fog condensation is reached, more abundant. The last 1500 feet comprises a terrace-like country and the rim of the crater itself. This is covered with a dense growth of tall grass, ferns and bushes of which the thickest growth forms a narrow belt about and on the great rim. It was in this area that most of the shells were taken, the altitude being estimated at about 4500 feet.

"The north coast of the island was visited April 18 and 19. It presents a rough barren recent lava surface with scattered islands of vegetation, growing on disintegrated older lava and in ensemble approaching the intermediate green zone of the other islands. All the collecting here was confined to the arid zone which in the largest "vegetation island" extends a long distance inland. The specimens were all taken from under loose lava fragments, from the roots of small bushes and under the loose damp leaves of the compositæ which had gathered in depressions of the surface. From the latter situation active individuals were taken; most of the others were hibernating. They comprised *B. unifasciatus*, *B. calvus* and *Pupilla munita*.

"October 3. On Gardner Island near Charles, there was a profusion of dead landshells. After climbing about 250 feet live ones in a state of hibernation began to be encountered. They were glued to old cactus leaves or in the hollow stems of decayed cactus. The situs and environment of the shells was of extreme dryness. The whole surface of the island is volcanic. Little soil has formed and it is of a dry dusty nature. The dry dusty situs of the shells is reflected in their sculpture, it being rough and much corrugated. The whole surface of the island is strewn with dead shells which are also found in profusion in the 740 feet high crater. Champion Island is of a similar character. The crater has about 150 feet elevation, and all the living shells (*B. planospira*) were hibernating in crevices. A few large dead shells of *B. verrucosus* Pfeiffer, were picked up but no living were found. Near Academy Bay, Indefatigable Island, at about 400 feet, it was noticed that the species of *Bulimulus* which resorted to the smooth-barked tree for hibernation, harmonized very closely with their surroundings and were not easily detected.

"At Jervis Island at about 500 feet the first dead shells were seen, but no live ones until about 900 feet were ascended. Between this level and the 1000-foot summit all the live specimens were taken, hibernating on the lower surface of loose blocks of lava. The relation of the peculiar crenulation of these shells with their dark dusty color to the environment was an interesting feature.

"It should be noted that the lava blocks were reposing upon and sometimes imbedded in a loose volcanic dust resembling in color the shells themselves. At times the shells were hardly to be detected when the under side of the rock was dusty. The highest summit which is grassy with a few ferns and bushes is often decked with fog and a slight rain fell on the day of collecting, December 2.

"On James Island, directly back of the lagoon and parallel with the coast, is a rather steep ridge two miles long and rising about 1600 feet. On ascending this ridge many dead but no living *Bulimuli* were seen. At this date, December 22 to 26, the living forms were concealed in hibernation. Those near the coast were *B. calvus*, *cinerarius*, and *jacobi*, but at about 500 feet the elevated corrugated *B. sculpturatus* and *rugiferus* began to appear and continued up to about 1600 feet. *Succinea* came in at 900 to 1000 feet and up to the summit where a few live shells of *S. bettii* were taken from the leaves of the wild heliotrope and other shrubs and grass. They were the only living shells obtained December 28, notwithstanding there was plenty of green vegetation kept fresh by the condensing fogs; it seems that the hibernating instinct restrains the species until the rainy season arrives. Between the 1000 and 1600 foot levels a few *Bulimuli* were taken from the underside of small loose blocks of lava. The soil, though fertile, is dusty and the shells were not easily distinguished from their similarly colored background. James was thought to be one of the newer of the islands.

"The present position of a much crenulated shell in the wet zone, may be a vestigial character of the old rough conditions which certainly were present in the early time of the disintegration of the rocks. The eastern portion of the island is one great chaos of recent lava flows, and here the upper limit of shell life is probably about 600 feet. The floral zones on this island are more or less confused and indistinct.

"Duncan Island, December 2, was very rough and dry, with myriads of dead shells above 900 feet, but scarcely a living one to be found, especially of the *Bulimuli*. A few *Succineas* and *Guppya* were found among the roots of grass and small bushes at the summit, about 1275 feet elevation.

"On Chatham Island in the arid zone near shore, between 25 and 60 feet above the sea, the slender *Bulimulus chemnitzioides* and *B. habeli*, accompanied by a few dead *Succinea brevior*, were found under blocks of lava. In this zone the light reddish volcanic rock is weathered to form a dusty soil which fills the interstices between the basaltic blocks of lava and partly accounts for the half corrugated and half polished surface of some of the *Bulimuli*. Two specimens of *Succinea wolffi* were taken near Wreck Bay, January 29, from the stems of *Croton* about 250 feet above the sea, but no more live ones were collected. At Finger Rock, February 12, *Bulimuli* were found hibernating, head downward, under the loose bark of standing dead trees.

"On Charles Island *Bulimulus unifasciatus* Albers, was the predominating form at the summit, 1780 feet, slowly diminishing with the altitude."

Similar data could be multiplied almost indefinitely from the copious field notes.

In general it may be said that the habits of these species correspond with those with which we are familiar in more northern climes.

The minute heliciform species are found on the earth in the moister regions or where the shelter of a lava block retains moisture in the soil. For the most part, altitude has little significance for them.

The Auriculids frequent the shores near the sea or about the mangrove swamps, fresh or brackish. *Helicina* is often associated with them, or may be found on the rim of a high crater provided the place is moist.

The Succineas have their range indirectly governed by the moisture and its correlative vegetation. They are larger and more abundant in the upper or moister regions but may occur near the beach.

The Pupillidæ range, not only over the majority of the islands arid or otherwise, but also from near the sea beaches up to the rim of a 4000 foot crater cone.

The Bulimuli, the most prominent factors in the landshell fauna of the islands, as in other regions, may be grouped into ground-dwellers and tree lovers. The latter as usual are the most elegantly colored and usually smooth; the former dull-colored, often hairy, and seem to associate a dusty situs with peculiar corrugations in the growth of the shell. The forms which are prevalent on the moist, grassy region of the upper summits are usually smooth and thinner than the corrugated forms of the lower levels.

The great variety of forms, some of which have attained and others seem only on the way to specific equilibrium, may be regarded as due to long development from small and insignificant ancestors, absence of competition in the struggle for existence and isolation of small communities through meteorological or geological changes. No indication of any former land connection with the continent to the eastward, is afforded by the study of these shells. Analogous cases are the Achatellinidæ of the Hawaiian Islands and the Achatinoid and Buliminoid snails of St. Helena.

The whole problem has been discussed in the senior author's monograph of 1896, and to the principles there enunciated nothing in the present collection is opposed; in fact, the hypothesis of the connection between the corrugated Bulimuli and their dusty situs receives a certain amount of corroboration from the Academy expedition's observations.

That much remains to be done before we can discuss with any finality the question of inter-island distribution is evident, and it seems quite probable that the future will add largely to the present faunal list. Every successive expedition has made substantial additions to it, and it seems certain that abundant rewards await future exploration.

NAMES OF THE ISLANDS

The well known British names given by the first surveyors, nearly a century ago and familiar to navigators and explorers, have been changed by an Ecuadorian Congress as shown in the following list. It is regrettable if the new names are to be adopted that distinctive ones were not chosen, such names as Fernandina, Santa Cruz, San Salvador, Santa Fé, having been used many times for well known geographical features, to the great confusion of geographers. To conform to previous publications on the fauna and flora of the islands and to avoid the confusion which would result from any other course, the established names will continue to be used in this paper. It will be noticed on an inspection of the chart issued by the Hydrographic Office that there are two Gardner islands, one at Gardner Bay of Hood Island and the other southeast of Charles Island.

The names applied to the respective islands are as follows:

<i>English</i>	<i>Ecuadorian</i>
Abingdon.....	Pinta
Albemarle.....	Isabela
Barrington.....	Santa Fé
Bindloe.....	Marchena
Brattle.....	Tortuga
Charles.....	Santa Maria
Chatham.....	San Cristobal
Duncan.....	Pinzon
Hood.....	Espanola
Indefatigable.....	Santa Cruz
James.....	San Salvador
Jervis.....	Rabida
Narborough.....	Fernandina

GROUPS OR SECTIONS OF THE BULIMULI

The species of *Bulimulus*, subgenus *Næsiotus*, may be arranged in groups of species apparently more nearly related to one another than to those of the other groups, though hardly forming subgenera.*

Rhaphiellus Pfr. 1855Group of *Bulimulus achatellinus* Forbes

The Academy collection contains none of this arboricolous species, which no collector seems to have found abundant. Quite probably, if attention is especially directed to the trees, other members of this group will be found. The axis in this species is quite simple and tubular.

Næsiotus Albers, 1850Group of *Bulimulus nux*

- Bulimulus nux* Brod. type
- Bulimulus* var. *perchloris* Dall & Ochsner
- Bulimulus* var. *monotænius* Dall & Ochsner
- Bulimulus* var. *nuciformis* Petit
- Bulimulus* var. *verrucosus* Pfeiffer
- Bulimulus* var. *basiplicatus* Dall & Ochsner
- Bulimulus asperatus* Albers, not Reibisch
- Bulimulus bauri* Dall

Granucis Dall & Ochsner, new sectionGroup of *Bulimulus planospira*

- | | |
|---|-------------------------------------|
| <i>Bulimulus planospira</i> Ancey, type | <i>Bulimulus invalidus</i> Reibisch |
| <i>Bulimulus rugulosus</i> Sowerby | <i>Bulimulus approximatus</i> Dall |

Nuciscus Dall & Ochsner, new sectionGroup of *Bulimulus ustulatus*

- Bulimulus ustulatus* Sby. type
- Bulimulus* var. *venustus* Reib.
- Bulimulus* var. *phlegonis* Dall & Ochsner
- Bulimulus* var. *pallescens* Dall & Ochsner
- Bulimulus calvus* Sby.
- Bulimulus* var. *caryonis* Dall & Ochsner
- Bulimulus elæodes* Dall.
- Bulimulus hemærodes* Dall
- Bulimulus pallidus* Reibisch
- Bulimulus rugatinus* Dall (*acutus* R.)
- Bulimulus cinerarius* Dall (*cinereus* R.)
- Bulimulus jacobii* Sby.
- Bulimulus tanneri* Dall
- Bulimulus perrus* Dall

* The several groups have been designated as sections following Pfeiffer and Albers, in order to maintain uniformity, the species after which the group is named being in all cases the type of that section.

Group of *Bulimulus hoodensis**Bulimulus hoodensis* Dall

This species seems an intruder into the fauna of the Galapagos, having none of the insular characteristics but rather those of the continental *Bulimuli*.

Reclasta Dall & Ochsner, new sectionGroup of *Bulimulus unifasciatus**Bulimulus unifasciatus* Sowerby, not Reibisch, type*Bulimulus olla* Dall*Bulimulus* var. *jacobinus* Dall**Adenodia** Dall & Ochsner, new sectionGroup of *Bulimulus eschariferus* Sowerby*Bulimulus eschariferus* Sowerby, type *Bulimulus* var. *subconoidalis* Ancey*Bulimulus* var. *ventrosus* Reibisch *Bulimulus perspectivus* Pfeiffer**Stemmodiscus** Dall & Ochsner, new sectionGroup of *Bulimulus snodgrassi**Bulimulus snodgrassi* Dall, type *Bulimulus galapaganus* Pfeiffer*Bulimulus cucullinus* Dall**Olinodia** Dall & Ochsner, new sectionGroup of *Bulimulus amastroides**Bulimulus amastroides* Ancey, type *Bulimulus trogonius* Dall*Bulimulus nucula* Pfeiffer**Særonia** Dall & Ochsner, new sectionGroup of *Bulimulus simrothi**Bulimulus simrothi* Reibisch, type *Bulimulus albemarlensis* Dall*Bulimulus tortuganus* Dall**Ochsneria** Dall, new sectionGroup of *Bulimulus wolffi**Bulimulus akamatus* Dall*Bulimulus alethorhytidus* Dall*Bulimulus adelphus* Dall*Bulimulus cymatias* Dall*Bulimulus wolffi* Reibisch, type*Bulimulus ochsneri* Dall*Bulimulus lycodus* Dall*Bulimulus særonius* Dall**Granitza** Dall & Ochsner, new sectionGroup of *Bulimulus duncanus**Bulimulus duncanus* Dall, type*Bulimulus darwini* Pfeiffer*Bulimulus jervisensis* Dall**Granella** Dall & Ochsner, new sectionGroup of *Bulimulus sculpturatus**Bulimulus sculpturatus* Pfeiffer, type *Bulimulus nesioticus* Dall*Bulimulus rabidensis* Dall*Bulimulus reibischi* Dall*Bulimulus rugiferus* Sowerby*Bulimulus nudus* Reibisch

Pleuropyrghus von MartensGroup of *Bulimulus chemnitzoides*

- Bulimulus chemnitzoides* Forbes, type
- Bulimulus habeli* Stearns
- Bulimulus* (*habeli* var. ?) *terebra* Reibisch
- Bulimulus indefatigabilis* Dall

Pelecostoma ReibischGroup of *Bulimulus canaliferus*

- Bulimulus canaliferus* Reibisch, type

CHECK LIST AND DISTRIBUTION OF GALAPAGOS LANDSHELLS

- Auricula stagnalis*—Indefatigable, Albemarle, and Bindloe islands.
- Bulimulus achatellinus*—Chatham and Hood islands.
- Bulimulus adelphus*—Indefatigable Island.
- Bulimulus akamatus*—Indefatigable Island.
- Bulimulus albemarlensis*—Albemarle Island.
- Bulimulus alethorhytidus*—Indefatigable Island.
- Bulimulus amastroides*—Chatham Island.
- Bulimulus approximatus*—Hood Island.
- Bulimulus asperatus*—Charles Island.
- Bulimulus bauri*—Chatham Island.
- Bulimulus calvus*—Chatham, Charles, and James islands.
- Bulimulus canaliferus*—Chatham Island.
- Bulimulus chemnitzoides*—Chatham Island.
- Bulimulus cinerarius*—Albemarle and James islands.
- Bulimulus cucullinus*—Hood, Charles and Barrington islands.
- Bulimulus cymatias*—Indefatigable Island.
- Bulimulus darwini*—Jervis Island and, possibly, Bindloe.
- Bulimulus duncanus*—Duncan Island.
- Bulimulus elaeodes*—Albemarle Island.
- Bulimulus eschariferus*—Chatham, Charles and Barrington islands.
- Bulimulus galapaganus*—Charles Island.
- Bulimulus habeli*—Chatham Island.
- Bulimulus hemærodes*—Albemarle and Narborough islands.
- Bulimulus hoodensis*—Hood Island.
- Bulimulus indefatigabilis*—Indefatigable and James islands.
- Bulimulus invalidus*—Charles Island.
- Bulimulus jacobi*—Albemarle, Narborough, James and Abingdon islands.
- Bulimulus jervisensis*—Jervis Island.
- Bulimulus lycodus*—Indefatigable Island.
- Bulimulus nesioticus*—Indefatigable and James islands.
- Bulimulus nucula*—Chatham and Charles islands.
- Bulimulus nudus*—Charles Island.
- Bulimulus nux*—Chatham, Gardner, Charles and Champion islands.

- Bulimulus ochsneri*—Indefatigable Island.
Bulimulus olla—Barrington, Indefatigable and Duncan islands.
Bulimulus pallidus—Albemarle and Abingdon islands.
Bulimulus perrus—Narborough Island.
Bulimulus perspectivus—Chatham and Charles islands.
Bulimulus planospira—Gardner, Charles and Champion islands.
Bulimulus rabidensis—Jervis Island.
Bulimulus reibischi—Indefatigable Island.
Bulimulus rugatinus—Chatham and Albemarle islands.
Bulimulus rugiferus—James Island.
Bulimulus rugulosus—Charles and, possibly, Chatham islands.
Bulimulus sacronius—Indefatigable Island.
Bulimulus sculpturatus—James Island.
Bulimulus simrothi—Albemarle Island.
Bulimulus snodgrassi—Hood, Gardner and Charles islands.
Bulimulus tanneri—Indefatigable, Albemarle and Daphne islands.
Bulimulus terebra—Chatham Island.
Bulimulus tortuganus—Tortuga and Albemarle islands.
Bulimulus trogonius—Albemarle Island.
Bulimulus unifasciatus—Chatham, Charles and James islands.
Bulimulus ustulatus—Charles Island.
Bulimulus wolfe—Indefatigable Island.
Endodonta helleri—Albemarle, Narborough, and James islands.
Euconulus galapaganus—Chatham, James and Abingdon islands.
Guppya bauri—Hood, Duncan, Albemarle and Abingdon islands.
Helicina nesiotica—Chatham, Charles and Albemarle islands.
Helicina ochsneri—Chatham and Albemarle islands.
Melampus trilineatus—Hood Island.
Onchidella steindachneri—Charles and Albemarle islands.
Onchidium lesliei—Charles and Albemarle islands.
Pedipes angulatus—Bindloe Island.
Pupilla clausa—Albemarle Island.
Pupilla munita—Charles, Duncan, Albemarle, Narborough and Tower islands.
Pupilla reibischi—Albemarle Island.
Siphonaria gigas—Charles Island.
Succinea bettii—Chatham, Charles, Indefatigable, Duncan, Albemarle, James and Abingdon islands.
Succinea brevior—Chatham and Charles islands.
Succinea corbis—Charles, Albemarle, Narborough islands.
Succinea producta—Chatham, Charles, Duncan, Albemarle, Narborough and James islands.
Succinea wolfe—Charles and Albemarle islands.
Tornatellina chathamensis—Chatham, Charles and Albemarle islands.
Tralia panamensis—Hood Island.
Vitrea actinophora—Chatham and James islands.
Vitrea chathamensis—Chatham, Albemarle, James and Abingdon islands.
Williamia galapagana—Chatham, Hood and Charles islands.

DESCRIPTIONS OF SPECIES

In the following descriptions the reference "Dall, 1896" is intended to refer to the senior author's monograph of that year; "Dall, 1900", to the supplementary report; "Reibisch, 1892", to the publication by that author of 1892. It is intended to give a reference to the original place of publication of a given name and if possible to a good figure. For full synonymy the reader must refer to the monograph of 1896, since it would serve no good purpose to republish the data. If changes are made, due to the receipt of more information, these will be duly noted. The complete fauna will be found in the foregoing check-list. Species not collected by the Academy's Expedition will be referred to among the descriptions only when new data require it. A full bibliography will be found in the 1896 monograph; it only lacks the supplementary paper of 1900, and the preliminary descriptive paper based on the present collection.⁵

Group of *Bulimulus nux*1. *Bulimulus (Næsiotus) nux* Broderip

Plate 9, figures 1-10

Bulimulus nux BROD. P. Z. S. Lond. 1832, p. 125 (Charles Island) Sowerby, Conch. Ill., p. 6, figs. 37, 37*, 1833; DALL, 1896, pl. XVI, fig. 6 (genitalia) pl. XVII, fig. 10 (dentition), 1900.

This species which seems to occur in great numbers where found at all, is confined, with its varieties to the islands Charles and Chatham, with two islets, Champion and Gardner, near Charles. The Academy collection consists of a remarkable series of several thousands which enables us to fix the range of variation and to reestablish as a distinct species *B. asperatus* Albers (not of Reibisch). The typical form is dark brown when fresh, and was collected on bushes at Charles Island at altitudes between 800 and 1000 feet. It was associated with the pale, streaky, straw-colored variety (*perchloris* Dall & Ochsner, new subspecies, Figs. 1 and 2), and the

⁵ Dall, W. H. Expedition of the California Academy of Sciences to the Galapagos Islands, 1905-1906 XI. Preliminary descriptions of new species of Pulmonata of the Galapagos Islands. Proc. Calif. Acad. Sci., 4th ser. Vol. 2, pt. 1, No. 11, 1917, pp. 375-382.

banded form (*unifasciatus* Reibisch not Sowerby, = *monotænius* Dall & Ochsner, new name, Figs. 3, 4, 5, 6, 7, 8). There were also specimens of the variety *nuciformis* Petit, brown with whitish axial wrinkles and yellow streaks, in the same area and in a lemon grove at the same elevation. The full grown examples of *B. verrucosus* Pfeiffer which we have seen are larger than the *B. nux* but are all dead. Their sculpture is the same as that of *B. nuciformis* and they were mistaken for *B. asperatus* Albers by Reibisch. At present we feel inclined to regard them merely as a large variety of *B. nux*. They were found in the lemon grove on Charles Island above referred to. A curious variation with a strong plication on the pillar (*basiplicatus* Dall & Ochsner, new subspecies, Figs. 9 and 10), was found sparsely on the grassy zone of Chatham Island, at 1900 to 2500 feet elevation. It does not differ otherwise from *nuciformis*.

The axis in *B. nuciformis* is shown by a section to be simple, slender and hardly twisted. That portion of it contained in the last whorl is pervious but not greatly enlarged. The part in the earlier whorls appears solid.

2. *Bulimulus* (*Næsiotus*) *asperatus* Albers

Bulimulus asperatus ALBERS, Mal. Blatt., IV, p. 98, 1857; Nov. Conch. IV, p. 145, pl. 133, figs. 8, 9; (not of Reibisch).

Bulimulus incrassatus var. *sulcatus* REIBISCH, 1892, figs. 4b, 4c.

The fine series collected during the Academy's work enables us to positively separate this form specifically from *B. nux*. The specimens are extremely uniform in color and sculpture, destitute of the rugosities found in *B. nux* and characteristically, spirally sulcate anteriorly. The color is chestnut brown, axially, closely streaked with a lighter shade in fine lines, giving a somewhat violaceous tint in paler specimens, or very rarely pure chestnut.

The axis is like that of *B. nux* except that the tubular part in the last whorl is larger in diameter.

The area occupied by this species is wider than that of *B. nux* according to the field notes. It is found on bushes at Charles Island, between altitudes of 500 to 1000 feet.

June 22, 1928

3. *Bulimulus* (*Næsiotus*) *bauri* Dall

Bulimulus (*Næsiotus*) *bauri* DALL, Nautilus, VII, p. 54, September, 1893; Proc. Acad. Nat. Sci. Phila. for 1896, p. 441, pl. XV, fig. 12; pl. XVII, figs. 9, 15 (dentition).

Chatham Island, at 1600 feet, on the under side of leaves of plants, Dr. Baur. This was not collected by the Academy's expedition. A section shows the axis tubular and stout in the last whorl; above it is slender, solid, and markedly twisted.

Group of *Bulimulus planospira*

4. *Bulimulus* (*Næsiotus*) *planospira* Ancey

Bulimulus rugulosus var. *planospira* ANCEY, Bull. Soc. Mal. de France, IV, p. 294, 1887; DALL, 1896, p. 432, pl. XVI, fig. 3.

This species was collected at the northwest end of Charles Island, at about 200 feet, by Dr. Baur, and by the Academy party at about 150 feet, hibernating under blocks of lava on Champion and Gardner islands near Charles. Its station is in the arid zone near the sea. The axis is shown by a section to have in the last whorl a tubular form and in the upper whorls a considerable twist.

5. *Bulimulus* (*Næsiotus*) *rugulosus* Sowerby

Bulimulus rugulosus SOWERBY, Conch. III, pt. 142, fig. 37a-b, 1839; DALL, 1896, pl. XVII, fig. 1 (jaw).

This species was collected on the northwest side of Charles Island, by Dr. Baur, under stones near the shore. The Academy collectors found it on the north side of the same island at between 200 and 500 feet elevation under stones and rotten wood; also at 700 feet on Abingdon Island. An original specimen obtained from Sowerby by Dr. Isaac Lea, shows the entire surface to be covered with almost microscopic, beaded, close-set, spiral lines. Most of the specimens obtained are bleached, but fresh ones are of a dark brown color, sometimes with a paler peripheral band. Fresh young individuals have short hairs seated on the beads.

This species is also reported from Chatham Island by Darwin, Kellett and Cuming, but, owing to the very slight discrim-

ination among the closely allied species shown by the earlier describers, we do not feel confident of the identity. We have seen no specimen from Chatham, though the species might be expected to occur there.

6. *Bulimulus* (*Næsiotus*) *invalidus* Reibisch

Bulimulus invalidus REIBISCH, 1892, p. 5, pl. 1, fig. 6.

This form is of somewhat doubtful status. It differs from *rugulosus* by the absence, or almost complete absence of the beaded sculpture, by its usually larger size, and by the extension of the axial wrinkling over the greater part of the shell. A few spiral incised lines sometimes appear on it. Fresh specimens are brownish; a variety exists in which the shells appear of an ashy yellow, but this may be due to bleaching.

This has about the same distribution on Charles Island as *B. rugulosus*, in the arid zone. Reibisch's figure seems to resemble a slender form of *B. nux* but specimens received under his name from Dr. Wolf are as above described. The axis is like that of *nuciformis*.

Bulimulus approximatus Dall, 1900, by form and habit seems to belong to this group, but has a smooth and polished surface and olivaceous tint. It inhabits Hood Island but was not among the shells collected by the Academy.

Group of *Bulimulus ustulatus*

7. *Bulimulus* (*Næsiotus*) *ustulatus* Sowerby

Plate 9, figures 11-17

Bulimulus ustulatus SOWERBY, P. Z. S. Lond. 1833, p. 72; Conch. Ill., *Bulinus*, p. 6, fig. 42, 1833.

This is a Charles Island species. The typical form, from some of the original lot, is a nearly smooth shell, with a very distinct suture and feeble, axial wrinkles; yellowish with peripheral pale band and usually a darker brown band on each side of the pale one; the coloration is variable. The typical form has not appeared in any of the later collections. A large series of varieties was collected by the Academy expedition.

The most conspicuous and attractive variety is that described by Reibisch under the name *venustus*. This when fresh is bright yellow, peripherally banded with two blackish spirals, and with narrow, blackish or dark brown, axial, streaks between narrow, yellow, axial wrinkles. The yellow fades to straw-color in the cabinet. These were found under stones at 1500 to 1750 feet elevation. Another variety (*phlegonis* Dall & Ochsner, new subspecies, Figs. 11, 12, 15, 16, 17), is somewhat larger and heavier, burnt sienna, dark brown, not banded, but with axial, lighter threads between dark interspaces. This was found in the lemon grove, on bushes at 1650 ft. elevation together with the next variety.

The latter is ashy white, slightly larger, with livid, flesh color or light brownish, axial streaks or nebulous bands, but rarely distinct peripheral banding. This merges into the largest and most rudely wrinkled variety (*pallescentis* Dall & Ochsner, new subspecies, Figs. 13, 14), of a light brown or straw-color, a peripheral band sometimes indicated by two narrow brown spiral lines, but usually wanting. This was collected in an open pasture land near a stream southwest of Spring Mountain. This has an axis like that of *B. nux*.

8. *Bulimulus* (*Næsiotus*) *calvus* Sowerby

Bulinus calvus SBY., P. Z. S. Lond. 1833, p. 72; Conch. Ill., *Bulinus*, p. 6, fig. 41, 1833.

James Island, Cuming; Chatham Island, Kellett; Charles Island, under stones at 750 ft. elevation, Ochsner; also Cuming and Wolf. Dark brown with paler streaks and peripheral band, surface polished. A variety (*caryonis* Dall & Ochsner, new subspecies), from the same station is pale pinkish brown, the shell longer and with more distinct sutures, peripheral band absent or obsolete, surface of the shell not polished, with rather rude axial wrinkles but no granulation visible with an ordinary lens.

Length about thirteen millimeters. This with a larger amount of material may prove distinct. It is more or less intermediate between *calvus* and *nucula*. The axis in both these forms is like that of *asperatus* Albers.

9. *Bulimulus (Næsiotus) elæodes* Dall

Plate 8, figures 1, 2

Bulimulus (Næsiotus) elæodes DALL, Proc. Calif. Acad. Sci., 4th Ser., Vol. 2, pt. 2, No. 11, 1917, p. 376.

"Albemarle Island, on leaves, hibernating, at 1500 to 2300 feet elevation, near Banks Bay." (W. H. O.)

The specimens vary a good deal in height, the one selected as type being of about the greatest length while some others are much shorter. The axis is similar to that of *planospira*.

10. *Bulimulus (Næsiotus) hemærodes* Dall

Plate 8, figure 3

Bulimulus (Næsiotus) hemærodes DALL, Proc. Calif. Acad. Sci., 4th Ser., Vol. 2, pt. 2, No. 11, 1917, p. 376.

Hibernating under dead wood on Cowley Mountain, Albemarle Island, between 2100 and 2300 feet elevation, in the grassy zone; and hibernating on the grassy rim of the crater of Narborough up to 4500 feet. (W. H. O.)

This species, except for its apertural characters, might serve as a weak imitation of *B. simrothi*. It illustrates remarkably well the vicissitudes due to the action of alkaline volcanic dust upon the delicate shell-forming margin of the mantle, thus indirectly inducing rugosities, as suggested in the monograph of 1896. By breeding one of these species in a vivarium from rugose ancestors it would be quite possible in a few generations to test this hypothesis and incidentally the hypothesis of the non-inheritance of acquired characters. The association of rugose and distorted species with the presence of such dust, was often noted in the field.

11. *Bulimulus (Næsiotus) pallidus* Reibisch

Bulimulus pallidus REIBISCH, 1892, p. 6, pl. 1, fig. 9.

Albemarle Island, on bushes and stones, 200 to 800 feet altitude, Wolf; on rim of crater in grassy zone, near Tagus Cove, at 4000 feet elevation; also on Abingdon Island in the verdant area at 700 feet under stones. (W. H. O.)

The axis in this species is tubular and simple as in the last species. The range in altitude of station is notable. We have thought it best to recognize this form as a species although some individuals range very close to the following species.

12. *Bulimulus* (*Næsiotus*) *rugatinus* Dall

Bulimulus acutus REIBISCH, 1892, p. 8, pl 1, fig. 13; not of LEACH, Zool. Misc. 1815.

Bulimulus rugatinus DALL, Proc. Biol. Soc. Wash., XXX, p. 10, January, 1917.

Chatham Island, Wolf; Albemarle Island, near Tagus Cove, 3000-4000 feet elevation in grassy zone; also hibernating under stones at 1600 feet, Ochsner and Snodgrass.

The axis is simple, slender, tubular and hardly twisted.

13. *Bulimulus* (*Næsiotus*) *cinerarius* Dall

Bulimulus jacobi var. *cinereus* REIBISCH, 1892, p. 7, pl. 1, fig. 10; not *B. cinereus* of REEVE, 1848.

Bulimulus jacobi, var. *vermiculatus* DALL, Nautilus, VII, p. 53, September, 1893; not *B. vermiculatus* BECK, 1838; DALL, 1896, p. 439, pl. XVI, fig. 14.

Bulimulus cinerarius DALL, Proc. Biol. Soc. Wash., XXX, p. 10, January, 1917.

James Island, Wolf. Albemarle Island, near Iguana Cove, hibernating under tortoise bones at 200 to 250 feet, and also at 600 to 700 feet. (W. H. O.)

The axis of this species is like that of *B. asperatus* Albers.

14. *Bulimulus* (*Næsiotus*) *tanneri* Dall

Bulimulus tanneri DALL, Nautilus, VIII, p. 127, March, 1895, and index, p. iii; Proc. Acad. Nat. Sci. Phila. for 1896, p. 438, pl. XVI, fig. 5.

Indefatigable Island, Tanner. Albemarle Island near Tagus Cove; at rim of crater in grassy area, at 4000 feet altitude; and inside the crater of Daphne Island, at 250 feet, verdant area. (W. H. O.)

The axis of this species is like that of *B. cinerarius*.

15. *Bulimulus* (*Næsiotus*) *perrus* Dall

Plate 8, figure 4

Bulimulus (*Næsiotus*) *perrus* DALL, Proc. Calif. Acad. Sci., 4th Ser., Vol. 2, pt. 2, No. 11, 1917, p. 376.

Narborough Island, in the grassy area at the rim of the crater, 2000 to 4500 feet elevation. (W. H. O.)

Group of *Bulimulus unifasciatus***16. *Bulimulus* (*Næsiotus*) *unifasciatus* Sowerby**

Bulinus unifasciatus SBY., P. Z. S. Lond. 1833, p. 37; Conch. Ill., *Bulinus*, fig. 55, 1833; DALL, 1896, pl. XVII, figs. 6, 11 (dentition and jaw).
Not *Bulimulus unifasciatus* REIB., 1892, p. 20, pl. 1, fig. 1,
(= *B. nux* var. *monotænius*).

James and Charles islands; Cuming. Chatham Island; Kellett and Baur. Charles Island, on *Croton* bushes, 500 to 1650 feet, also in lemon grove on bushes, 800 to 1200 feet elevation; (W. H. O.)

By its thin shell and general aspect this species is readily distinguished from any other of the Galapagos species. The variations are chiefly from the purplish brown of fine fresh specimens to a more or less dingy olive, and the absence or presence of the pale peripheral band. The axis is simple and tubular. The species was collected abundantly on Charles Island but it was not found elsewhere. We do not feel confident that the following species is closely allied to *unifasciatus*.

17. *Bulimulus* (*Næsiotus*) *olla* Dall

Bulimulus jacobii REEVE, Conch. Icon. Vol. V, *Bulinus*, pl. XXI, fig. 135, 1848; not of SOWERBY, 1833.

Bulimulus olla DALL, Nautilus VII, September, 1893, p. 53; DALL, 1896, p. 427, pl. XVI, fig. 2.

Duncan Island, 600 feet, under stones, mostly dead; (W. H. O.) James Island; Cuming. Duncan, Barrington and Indefatigable islands; Baur. Variety *jacobinus*, James Island, 200 to 1800 feet, under stones, mostly dead; (W. H. O.)

The variety differs only in size but there are practically no intermediate sizes, as follows:

B. olla Length 15.5; diameter 9.0 mm.

var. *jacobinus* Length 13.0; diameter 7.5 mm.

var. *jacobinus*. Length 14.5; diameter 7.5 mm.

In neither form is the peripheral band noticeable when fresh, but most of the specimens are dead.

Group of *Bulimulus eschariferus*

18. *Bulimulus* (*Næsiotus*) *eschariferus* Sowerby

Bulinus eschariferus SBY., Conch. Ill., *Bulinus*, figs. 85a, 85b, 1833; DALL, 1896, p. 434.

Chatham Island, Darwin, Kellett, Baur, and Snodgrass. Charles Island; H. M. S. Peterel. Barrington and Chatham Islands; (W. H. O.)

The typical form, brown with pale peripheral band, was obtained by the Academy expedition on Barrington Island, hibernating under blocks of lava at 200 to 500 feet elevation. The variety *ventrosus* Reibisch, differs only by its olivaceous tint without peripheral band; it was obtained on Chatham Island under stones of the dry zone from near shore to 300 feet elevation; also at the "north middle" of the island in similar situations at 450 to 500 feet. A completely very dark brown variety, with no peripheral band was also collected at the "north middle" of the island. Ancey noted a form which has developed a plication on the pillar, similarly to *B. nux* var. *basiplicatus*, which he called *subconoidalis*, but we have not found any such among the Academy's specimens. He rightly remarked that it is not a character of great importance. The axis of this species is simple and tubular, rather more widely so than in most of the perforate species.

19. *Bulimulus* (*Næsiotus*) *perspectivus* Pfeiffer

Bulimulus perspectivus PFR., P. Z. S. Lond. 1846, p. 43; REEVE, Conch. Icon. *Bulinus*, pl. 63, fig. 435, 1849.

Chatham Island, 300 to 600 feet; Wolf. Typical form, dark brown without band, found hibernating under blocks of

lava in the arid zone on Charles Island, 50 to 300 feet above the sea; a pale variety without peripheral band on Chatham Island, hibernating at 350 feet; and a banded, dark brown variety on Charles near Flamingo lagoon, at 75 feet, and at Muck Bay, 25 to 60 feet elevation. It is thus a consistent inhabitant of the arid zone like many of the granulose species. The axis is simple, slender, and hardly twisted.

Group of *Bulimulus snodgrassi*

20. *Bulimulus* (*Næsiotus*) *snodgrassi* Dall

Bulimulus snodgrassi DALL, 1900, p. 90, pl. VIII, fig. 2.

Hood Island; Snodgrass and Heller. Hood Island, under stones, 180 to 600 feet elevation, including an albino specimen; also on Charles Island near the lagoon; and on Gardner Island at 150 feet in similar situations; (W. H. O.) A species of the arid zone.

A character remarkably distinguishing this and the following species from any other of the known Galapagos forms except *B. canaliferus*, is furnished by the modification of the axis. This in the upper whorls of the shell is simple and tubular as in many of the Galapagos species, but in the first half of the last whorl, and invisible from the aperture, a semi-circular, disk-like flange projects at right angles to the axis into the lumen of the whorl and about half-way toward the outer wall of the whorl. This dwindles in front and behind into a short plait-like ridge on the axis which does not enter the penultimate whorl or become visible from the aperture. This arrangement recalls the lamina in *Phenacotaxus umbilicatellus* Pilsbry, of Peru, except that it is confined to the first half of the last whorl, while in the Peruvian shell the lamina occupies part of three whorls and has its major expansion in the penultimate whorl.⁶

This species passes through the usual series of color variations, lighter or darker color, presence or absence (in melanitic specimens) of the peripheral spiral bands, etc., but in other respects preserves a general uniformity.

⁶ See Smithsonian Misc. Coll., Vol. 59, No. 14, 1912, p. 9, figs. 1, 2.

21. *Bulimulus (Næsiotus) cucullinus* Dall

Plate 8, figures 5, 6

Bulimulus (Næsiotus) cucullinus DALL, Proc. Calif. Acad. Sci., 4th Ser., Vol. 2, pt. 2, No. 11, 1917, p. 377.

Found hibernating on Hood Island under stones between 200 and 600 feet elevation; a variety with faint indications of a peripheral band, with the others; also on Charles Island in the moist area under moss and grass at 1650 feet; and on Barrington Island under stones in hibernation at 200 feet; lastly a paler variety on Hood Island at 380 feet elevation.

The axial flange in this species is shorter, rounder, and less prominent than in *B. snodgrassi*, but occupies the same position in the shell. In the associated *B. galapaganus* Pfeiffer, the projection is thick and rounded.

Group of *Bulimulus amastroides***22. *Bulimulus amastroides* Ancey**

Bulimulus amastroides ANCEY, Bull. Soc. Mal. de France, IV, July, 1887, p. 293; DALL, 1900. p. 441, pl. XV, fig. 2.

Chatham Island from 1500 to 2500 feet elevation, California Academy of Sciences; also the U. S. Bureau of Fisheries.

The axis in this species is simple, slender and twisted.

23. *Bulimulus (Næsiotus) trogonius* Dall

Bulimulus trogonius DALL, Proc. Biol. Soc. Wash., XXX, p. 10, January, 1917.

Collected by the U. S. Bureau of Fisheries on Albemarle Island. The shell is very small, and the axis unusually thickened in the last whorl, but simple.

Group of *Bulimulus simrothi***24. *Bulimulus (Næsiotus) simrothi* Reibisch**

Bulimulus simrothi REIB., 1892, p. 11, pl. II, fig. 1.

Found by the Academy expedition on Albemarle Island near Vilamil under leaves, at 500 to 1200 feet elevation; and by Baur at 1000 to 1200 feet.

The axis in this species is thickened by a continuation of the tubercle over the pillar in a spiral manner in the last whorl; the portion of the axis in the upper whorls is thin, slender and twisted. There is a purple stain on the pillar in the last whorl, not visible from the aperture.

25. *Bulimulus* (*Næsiotus*) *tortuganus* Dall

Bulimulus tortuganus DALL, Nautilus, VII, p. 54, 1893; DALL, 1900, p. 440, pl. XVI, figs. 11, 12, 13; pl. XVII, fig. 2 (jaw); as of *B. simrothi* in error.

La Tortuga, off southeast Albemarle, in the grassy zone; Dr. Baur. Albemarle Island on bushes near Vilamil at 486 to 700 feet; (W. H. O.)

On the evidence of a photograph of *B. simrothi* in 1900 this form was referred to it as a synonym. By means of the full series collected by the Academy expedition we are able to establish it specifically. It is extremely similar to *B. simrothi* in general characters but is uniformly larger, with a more elevated spire and much rougher on the surface of the last whorl. In the adult *B. simrothi* the tubercles on the pillar and outer lip are relatively more prominent, the general tint is light brown, white *tortuganus* is whitish on the last whorl and with distinctly pink apical whorls. In many of the specimens of *tortuganus* the tubercles of the aperture are hardly noticeable. The axis is more slender and hardly twisted in the upper whorls, while in the last whorl there is no continuation of the pillar tubercles on the axis, though the dark stain of color is there.

The figures supposed to be of *B. simrothi* in the monograph of 1900, are really all taken from specimens of *B. tortuganus*.

These forms initiate the series of species with apertural armature, which render the group of *Næsiotus* so peculiar.

26. *Bulimulus* (*Næsiotus*) *albemarlensis* Dall

Plate 8, figures 7, 8

Bulimulus (*Næsiotus*) *albemarlensis* DALL, Proc. Calif. Acad. Sci., 4th Ser., Vol. 2, pt. 2, No. 11, 1917, p. 377.

On bushes and grass near Vilamil at 2300 to 3300 feet elevation; (W. H. O.) The pillar tubercle is not prolonged around the axis which is slender, tubular, and simple.

Measurements of average specimens of the preceding species are as follows in millimeters.

- B. simrothi* Length 10; last whorl 7; diameter 6.
B. tortuganus Length 13; last whorl 9; diameter 7.
B. albemarlensis Length 15; last whorl 12; diameter 9.

There is the usual amount of variation among individuals.

The three species above noted form a group peculiar to Albemarle Island and its associated islets, as far as yet known.

27. *Bulimulus* (*Næsiotus*) *akamatus* Dall

Plate 8, figure 9

Bulimulus (*Næsiotus*) *akamatus* DALL, Proc. Calif. Acad. Sci., 4th Ser., Vol. 2, pt. 2, No. 11, 1917, p. 378.

Found by the Academy expedition on Indefatigable Island, under blocks of lava, at 200 to 650 feet elevation, in the arid zone.

This is a very characteristic and well defined species, but apparently not abundant. It has no indication of a peripheral band.

28. *Bulimulus* (*Næsiotus*) *adelphus* Dall

Plate 8, figure 10

Bulimulus (*Næsiotus*) *adelphus* DALL, Proc. Calif. Acad. Sci., 4th Ser., Vol. 2, pt. 2, No. 11, 1917, p. 379.

Found with the preceding species by the Academy expedition in the arid zone.

29. *Bulimulus* (*Næsiotus*) *lycodus* Dall

Plate 8, figures 11, 15, 16

Bulimulus (*Næsiotus*) *lycodus* DALL, Proc. Calif. Acad. Sci., 4th Ser., Vol. 2, pt. 2, No. 11, 1917, p. 379.

Found by the Academy Expedition on Indefatigable Island on tree trunks at 450 to 550 feet elevation.

At first this was suspected to be a variety of *B. wolffi* Reibisch, which belongs to the same section, but a comparison with a specimen of *wolffi* received from Wolf himself, showed

that the latter is a larger and more slender shell with less emphasized sculpture and a more prominent tubercle inside the outer lip.

30. **Bulimulus (Næsiotus) alethorhytidus** Dall

Plate 8, figures 17, 18

Bulimulus (Næsiotus) alethorhytidus DALL, Proc. Calif. Acad. Sci., 4th Ser. Vol. 2, pt. 2, No. 11, 1917, p. 379.

Indefatigable Island, in the moist area on the south side at 350 to 400 feet, and at all attitudes in the interior; (W. H. O.)

This almost comically small and wrinkled species is one of the most interesting finds of the Academy expedition. It is usually pink tipped, with white corrugations and the indentations more or less darkened by volcanic dust.

31. **Bulimulus (Næsiotus) cymatias** Dall

Plate 8, figure 19

Bulimulus (Næsiotus) cymatias DALL, Proc. Calif. Acad. Sci., 4th Ser., Vol. 2, pt. 2, No. 11, 1917, p. 380.

Indefatigable Island, under lava blocks in a moist area between 400 and 650 feet elevation; (W. H. O.)

A very well marked species with a unique axial armature.

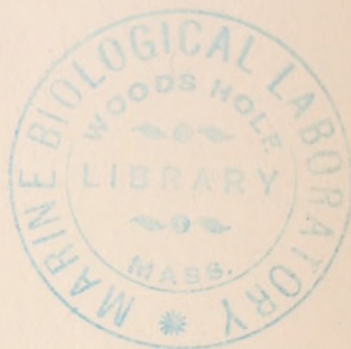
32. **Bulimulus (Næsiotus) ochsneri** Dall

Plate 8, figures 20, 21

Bulimulus (Næsiotus) ochsneri DALL, Proc. Calif. Acad. Sci., 4th Ser., Vol. 2, pt. 2, No. 11, 1917, p. 380.

Indefatigable Island, under lava blocks at 200 to 650 feet altitude; (W. H. O.)

This fine species might easily be taken for a dark variety of *B. cymatias* if one considered only the external appearance, but the interior armature is totally different. With *B. særonius* it completes the peculiar group of dentate species from Indefatigable Island, to which the Academy expedition has added so many.



33. *Bulimulus* (*Næsiotus*) *særonius* Dall

Bulimulus (*Næsiotus*) *særonius* DALL, Proc. Biol. Soc. Wash., XXX, p. 9, January, 1917.

Indefatigable Island, U. S. S. Albatross.

Group of *Bulimulus duncanus*34. *Bulimulus* (*Næsiotus*) *duncanus* Dall

Bulimulus duncanus DALL, Nautilus, VII, p. 52, September, 1893; DALL, 1900, p. 438, pl. XVI, fig. 7.

Duncan Island, dead, at 600 feet altitude; (W. H. O.)

This species appears to be extinct; at any rate no collector has obtained it living. It is notable for its nearly smooth surface devoid of spiral sculpture, thin shell and solitary parietal tubercle.

35. *Bulimulus* (*Næsiotus*) *jervisensis* Dall

Plate 8, figure 22

Bulimulus (*Næsiotus*) *jervisensis* DALL, Proc. Calif. Acad. Sci., 4th Ser., Vol. 2, pt. 2, No. 11, 1917, p. 381.

A few dead specimens were collected on Jarvis Island at an elevation of 900 to 1000 feet.

One or two of these were fresh enough to admit of the hope that living specimens may be secured by some future collector.

36. *Bulimulus* (*Næsiotus*) *darwini* Pfeiffer

Bulimus darwini PFR., P. Z. S. Lond. 1846, p. 29; REEVE, Conch. Icon. *Bulimus*, pl. XXI, fig. 136, 1848; DALL, 1900, p. 43.

Bindloe Island, *vide* Wimmer (?) James Island, on bushes and grass at 1800 to 2200 feet; (W. H. O.).

Some little doubt attaches to Wimmer's locality or his identification. Darwin has left no printed record of a landing on Bindloe Island though he collected this species; Dr. Habel's shells which were examined by the senior author before they were put into Wimmer's hands, were in a state of considerable confusion where labels might easily have been mixed.

At any rate, the Academy locality can not reasonably be questioned, and it is doubted if the species is found on more than one island, on account of its extreme specialization. The armature of the aperture is like that of *B. jervisensis* and very feebly developed, indeed absent in some (immature?) individuals. The upper part of the axis is slender and somewhat twisted.

Group of *Bulimulus sculpturatus*

37. *Bulimulus* (*Næsiotus*) *sculpturatus* Pfeiffer

Bulimus sculpturatus PFEIFFER, P. Z. S. Lond. 1846, p. 29; REEVE, Conch. Icon., *Bulimus*, pl. XX, fig. 125, 1848.

Bulimulus (*Næsiotus*) *sculpturatus* DALL, 1900, p. 443.

Found by the Academy expedition in the forest region of James Island, at an elevation of 1000 to 1800 feet.

The somewhat spare and undulated axial ribs crossed by sharp, coarse spiral striæ, and simple tubular hardly twisted axis, are characteristic of this species whose location was unknown until fixed by the Academy's collection.

38. *Bulimulus* (*Næsiotus*) *rabidensis* Dall

Plate 8, figures 23, 24

Bulimulus (*Næsiotus*) *rabidensis* DALL, Proc. Calif. Acad. Sci., 4th Ser., Vol. 2, pt. 2, No. 11, 1917, p. 381.

Obtained by the Academy in "a fairly dry" region on Jervis (or Rabida) Island, at an altitude of 900 to 1000 feet.

This form is markedly separated from *sculpturatus* by its ovoid instead of conical profile, and by the fact that the spiral sculpture is the most conspicuous, while the axial rugosities are as in the other species.

39. *Bulimulus* (*Næsiotus*) *rugiferus* Sowerby

Bulinus rugiferus SBY., P. Z. S. Lond. 1833, p. 36; Conch. Ill., *Bulinus*, fig. 40, 1833.

Bulimulus (*Næsiotus*) *rugiferus* DALL, 1900, p. 443.

James Island; Cuming.

In this and the two following species the axis is slender, unarmed and more or less twisted.

40. *Bulimulus* (*Næsiotus*) *næsioticus* Dall

Bulimulus (*Næsiotus*) *næsioticus* DALL, 1900, p. 443, pl. XVI, fig. 1.

James Island; U. S. Bureau of Fisheries. Indefatigable Island, at 350 to 1100 feet altitude; (W. H. O.)

41. *Bulimulus* (*Næsiotus*) *reibischi* Dall

Bulimulus (*Næsiotus*) *reibischi* DALL, Nautilus, VII, p. 126, March, 1895; DALL, 1900, p. 444, pl. XVI, fig. 4.

Indefatigable Island, U. S. Bureau of Fisheries. This species is not contained in the Academy collection.

Group of *Bulimulus chemnitzoides*42. *Bulimulus* (*Næsiotus*) *chemnitzoides* Forbes

Bulimus chemnitzoides FORBES, P. Z. S. Lond. 1850, p. 55, pl. IX, fig. 6.

Bulimulus (*Pleuropyrghus*) *lima* REIBISCH, 1892, p. 12, pl. II, fig. 4.

Bulimulus (*Næsiotus*) *chemnitzoides* DALL, 1900, p. 445, pl. XVII, fig. 4 (dentition).

Chatham Island; Wolf and Baur. Found by the Academy expedition under stones at Wreck Bay, Chatham Island, in the arid zone, at 25 to 60 feet above the sea.

The axis is solid, slender, and distinctly twisted. There is a broad brown peripheral color band.

43. *Bulimulus* (*Næsiotus*) *habeli* Stearns

Bulimulus (*Pleuropyrghus*) *habeli* (STEARNS MS.) DALL, Nautilus, V, January, 1892, p. 99; STEARNS, Proc. U. S. Nat. Mus., XVI. No. 942, 1893, p. 382, pl. 51, fig. 1.

Chatham Island; Habel, Cooper and Baur. Found by the Academy expedition in the dry zone, 0 to 300 feet above the sea, on Chatham Island.

Earlier specimens were more or less bleached, but the Academy's fresh ones are about the color of the preceding species, with a broad brown band just behind the suture, the upper half of the upper whorls and the base of the last whorl paler. The axis resembles that of the last species. The variety

terebra Reibisch, hardly differs except that the whole shell is reddish brown instead of banded. *Bulimulus indefatigabilis* Dall, of this section was not found by the Academy collectors.

Group of *Bulimulus canaliferus*

44. *Bulimulus (Næsiotus) canaliferus* Reibisch

Bulimulus (Pelecostoma) canaliferus REIBISCH, 1892, p. 13, pl. II, fig. 6.

Bulimulus (Næsiotus) canaliferus DALL, 1900, p. 442, pl. XV, fig. 14.

Chatham Island; in moss and on ferns, 900 to 2000 feet; Wolf. The Academy expedition collected it on Chatham Island in the dry zone, from near the beach to 450 feet elevation.

The numerous, flat-sided, short whorls, the basal attenuation, the large funnel-shaped umbilical pit, and the prominent flange on the pillar, give a peculiar aspect to this species. On sectioning the shell the flange is seen to continue as a strong concave plate surrounding the axis and continuing into the second whorl, gradually growing less prominent.

Reibisch's second species of *Pelecostoma* is *Tornatellina chathamensis*.

Genus *Pupilla* Leach

Subgenus *Gastrocopta* Wollaston, 1878

45. *Pupilla (Gastrocopta) munita* Reibisch

Pupa (Leucochila) munita REIBISCH, 1892, p. 15, pl. II, fig. 9.

Albemarle Island near the sea, on bushes; Wolf. Albemarle near Tagus Cove in rotten wood at 250 to 300 feet elevation and near Iguana Cove, 15 to 60 feet; Narborough at 50 feet, under stones; Charles, under dead wood and bones, at 750 feet; and Tower Island under wood at from 0 to 200 ft. above the sea; (W. H. O.).

This is the most common and widely distributed *Pupilla* of the islands. According to Dr. Pilsbry it is not the same as

P. wolffi Miller, from Guayaquil, as Reibisch suspected. *P. clausa* Reibisch, is a smaller shell and is regarded by Dr. Pilsbry as distinct. The latter did not occur among the Academy specimens but was found on Indefatigable Island near the sea on bushes, by Wolf and in similar situations on Abingdon Island by Snodgrass. It is highly probable that these and other small species of landshells, if carefully searched for, would be found on nearly all the islands. While hibernating attached to dead leaves, their distribution by high winds is easy.

46. *Pupilla (Gastrocopta) reibischi* Dall

Pupilla reibischi DALL, Proc. Biol. Soc. Wash., XXX, p. 10, January, 1917.

Shell subcylindric, blunt, five-whorled, of a dark brown color, whorls moderately inflated, suture distinct; aperture with a wide reflected margin which in well developed individuals is often of a reddish color; pillar lip reflected over a well marked umbilical chink; teeth after Sterki's dental formula but substituting figures for dots after his numeration:¹ A B 3 D 4 5. The parietal tooth (A) when fully developed is bifid anteriorly and somewhat produced behind into the whorl; the other teeth appear short, and none of them are white. Length of shell 2.5 mm.; diameter 1.0 mm.

Found on Albemarle Island, near Tagus Cove, under rotten wood at a height of 250 to 300 feet, mixed with *P. munita*; (W. H. O.).

This species is easily distinguished from both *P. munita* and *P. clausa* by its darker color. It is more slender and cylindrical than the former and larger than the latter. It has been submitted to Dr. Sterki who pronounces it distinct from *munita*. The accessory lamellæ are rather deeply ensconced in the aperture. The species seems to be considerably rarer than *P. munita*. *P. clausa*, by the results of collections made, is rare.

¹ Proc. U. S. Nat. Mus. for 1888, pl. XLII, fig. 5.

Genus *Guppya* Mörch47. *Guppya bauri* Dall

Zonites (Hyalinia) bauri DALL, Nautilus, V, January, 1892, p. 98.

? *Trochomorpha bauri* DALL, 1896, p. 447, pl. XV, figs. 8, 9.

South Albemarle Island, on tortoise bones; Baur. Hood Island at 300 feet in rock crevices; and under old bones, at 350 feet; also Duncan and Abingdon; (W. H. O.).

Genus *Euconulus* Reinhardt48. *Euconulus galapaganus* Dall

Conulus galapaganus DALL, Nautilus, VII, September 1893, p. 55; DALL, 1896, p. 448, pl. XV, fig. 11.

Southwest end of Chatham Island, under leaves at 1600 feet; Baur. James Island in the forest zone at 1000 to 1800 feet, and under stones at 750 feet; (W. H. O.).

This species appears to be rare.

Genus *Vitrea* Fitzinger49. *Vitrea actinophora* Dall

Vitrea actinophora DALL, 1900, p. 93, pl. VIII, figs. 11, 16, 17

Top of mountain near Tagus Cove, Albemarle Island; Snodgrass and Heller. Near Vilamil, Albemarle Island, under leaves at 500 to 1800 feet, and in similar situations on James Island at 2000 to 2750 feet; (W. H. O.).

50. *Vitrea chathamensis* Dall

Vitrea chathamensis DALL, 1896, p. 448, pl. XV, figs. 3, 10; DALL, 1900, p. 93.

Chatham Island, 1600 feet; Baur. Abingdon Island, 1700 feet; Snodgrass. James Island in the forest zone at 1000 to 1800 feet; near Iguana Cove, Albemarle Island, 200 to 700 feet; and near Tagus Cove, under cactus leaves, at 1600 feet; (W. H. O.).

Genus *Endodonta* Albers51. *Endodonta helleri* Dall

Endodonta helleri DALL, 1900, p. 93, pl. VIII, figs. 7, 8, 9

Near Iguana Cove, Albemarle Island, at 2000 feet; Snodgrass and Heller. Albemarle Island near Cowley Mountain on moist ground at 350 to 500 feet; on Narborough in grass and bushes at the rim of the crater at 4000 feet; and on James Island, in moist grass and bushes at 1800 to 2000 feet; (W. H. O.).

Genus *Succinea* Draparnaud52. *Succinea bettii* E. A. Smith

Succinea bettii E. A. SMITH, P. Z. S. Lond. 1877, p. 72, pl. XI, fig. 8; DALL, 1896, p. 448, pl. XV, fig. 6.

Succinea wolffi REIBISCH, 1892, p. 16, pl. 2, fig. 12a-b.

Charles, James, Chatham and South Albemarle islands; various collectors, Charles Island on leaves and stems of grass and shrubs in the misty area, at 1200 to 1500 feet; also on leaves in the lemon grove on Spring Mountain, in the moist region, at 1600 feet; Indefatigable Island, rainy area, 450 to 650 feet, on leaves of *Ipomæa*; Albemarle Island near Vila-mil under leaves, 500 to 1800 feet, also in the grassy zone on leaves and stems, at 2000 to 3100 feet; (W. H. O.).

Attention is called to the protective color of the animal's mantle, seen through the translucent shell; in one case the creature appeared nearly black on a blackish lava background, though the shell itself is translucent yellow. The attractive appearance of some of the specimens when clinging like buds to slender stems of plants in the grassy zone was also noted. The variety (?) *wolffi* of Reibisch was found on leaves at Charles Island, elevation 1000 feet, and near the shore at Iguana Cove, Albemarle Island, under stones, at 15 to 60 feet above the sea.

53. *Succinea brevior* E. A. Smith

Succinea bettii, var. *brevior* SMITH, P. Z. S. Lond. 1877, p. 77.

Succinea brevior DALL, Nautilus, VII, September, 1893, p. 56; DALL, 1896, p. 449, pl. XV, fig. 4, pl. XVI, fig. 8 (jaw); pl. XVII, fig. 9 (dentition); DALL, 1900, p. 94.

Charles Island; Baur and Snodgrass. Charles Island, on leaves near rim of crater in the grassy zone at 1700 feet; and at roots of grass and shrubs at the top of Chatham Island in the moist area at 1900 to 2500 feet; (W. H. O.).

54. *Succinea producta* Reibisch

Succinea (Tapada) wolfi var. *producta* REIBISCH, 1892, p. 16, pl. 2, fig. 12 cz.

Succinea producta DALL, 1896, p. 449, pl. XV, fig. 7; pl. XVI, fig. 10 (jaw); pl. XVII, fig. 5 (dentition); DALL, 1900, p. 95.

Chatham and Narborough islands; on lichen covered rocks, 900 to 2000 feet elevation; Wolf, Baur, and Snodgrass. James Island at roots of grass and shrubs and on leaves of *Ipomæa*, in the moist, grassy zone at 2200 feet; Albemarle Island near Banks Bay, hibernating under stones in the dry zone, at 400 feet; and near the rim of the crater in the grassy zone on the leaves of shrubs, at 4000 feet; (W. H. O.).

Succinea corbis was not found among the Academy collections, and an examination of the original types after 20 years showed that the original lattice-like corrugation of the periostracum has entirely disappeared, probably due to contraction under the influence of desiccation.

Genus *Tornatellina* Beck**55. *Tornatellina chathamensis* Dall**

Leptinaria chathamensis DALL, Nautilus, V, January, 1892, p. 98; DALL, 1896, p. 451, pl. XVI, fig. 9, pl. XVII, fig. 16 (dentition).

Bulimulus (Pelecostoma) cymatoferus REIBISCH, October, 1892, pt. 3, p. 14, pl. II, fig. 7.

Tornatellina chathamensis DALL, 1900, p. 95.

Chatham Island, on ferns, 1600 to 2000 feet above the sea; Baur. Albemarle Island, near Iguana Cove, hibernating

under dead leaves at 200 to 250 feet; and near Tagus Cove, under cactus leaves at 1600 feet; (W. H. O.).

This species, according to Dr. Baur, is especially likely to be found on the fronds of ferns.

Genus *Helicina* Lamarck

56. *Helicina (Idesa) nesiotica* Dall

Helicina (Idesa) nesiotica DALL, Nautilus, V, p. 97, January, 1892.

Helicina wolffi REIBISCH, 1892 (October), p. 17, pl. II, fig. 13.

Helicina (Idesa) nesiotica DALL, 1896, p. 451, pl. XV, figs. 1, 2; pl. XVII, fig. 12 (dentition); DALL, 1900, p. 96.

Chatham Island at 1600 feet, on leaves; Baur. Albemarle Island, near Iguana Cove, under stones, 15 to 60 feet above the sea; under dead leaves at 200 to 250 feet; under moss at 600 to 700 feet; Charles Island, under moss at 1700 to 1750 feet; (W. H. O.).

57. *Helicina (Idesa) ochsneri* Dall

Plate 8, figures 12, 13, 14

Helicina (Idesa) ochsneri DALL, Proc. Calif. Acad. Sci., 4th Ser., Vol. 2, pt. 2, No. 11, 1917, p. 382.

Albemarle Island, eight miles west of Turtle Cove, near salt lagoon; and at Cowley Mountain on moist ground, 350 to 500 feet above the sea; (W. H. O.).

The dimensions of the average *H. nesiotica* as given by Reibisch are: height 2.6 and diameter 3.5 mm., although some individuals measure slightly more.

Genus *Auricula* Lamarck

58. *Auricula stagnalis* Orbigny

Auricula stagnalis ORB. Mag. de Zool. 1835, p. 23; Voy. Am. Mer. Moll. 1835, p. 325, pl. 42, figs. 7, 8.

Obtained by the Academy expedition on Indefatigable Island near the salt lagoon, inland from Academy Bay; and on Albemarle Island. Turtle Cove, near the first salt lagoon, and also at the second lagoon; also 12 miles west of Turtle

Cove at another salt lagoon; and in a fresh water mangrove swamp 12 miles west of Vilamil. Habel collected it on Bindloe Island and it is reported from the continental coast at Panama and Guayaquil by Orbigny and C. B. Adams.

This is a species native to brackish and salt lagoons and swamps. As it can stand long immersion in salt water without injury, and generally adheres to logs or mangrove stocks, its dispersion is easy, and it undoubtedly came to the islands on floating timber or uprooted trees much as the mangrove has.

The individuals vary largely among themselves; Orbigny's figured type was rather small and slender. Specimens can be found with short blunt spire and inflated body whorl or elevated spire and slender body. The color varies from pale straw to lead color, and in ferruginous waters it takes a tinge of reddish. However, it is perfectly obvious that none of these differences is specific.

This was the only Auriculid in the Academy collection. The others, together with the local species of *Siphonaria*, *Williamia*, and Onchidiidæ will be found enumerated in the distributional list.

59. *Williamia galapagana* Dall

Williamia galapagana DALL, Proc. Calif. Acad. Sci., 4th Ser., Vol. 2, pt. 2, No. 11, 1917, p. 382.

The genus *Williamia* Monterosato, is represented in the Galapagos Islands by a species which was identified by Wimmer with *Nacella subspiralis* Carpenter, and later, too hastily, from defective material, by the senior author as *Siphonaria peltoides* Carpenter, both California forms. The Galapagan form was later named *W. galapagana*, but without a description; this was supplied in 1917 as cited above.

Station; on floating seaweed at the Galapagos Islands; specimens collected on the beach at Hood and Chatham islands.

The species is less elevated and with a less produced and incurved apex than in *subspiralis*, of which *peltoides* is prob-

ably merely a mutation, and very much smaller than the Californian *W. vernalis*. It was not obtained by the Academy expedition.

It may be added that *Opeas juncea* Gould, has been collected on Hood Island and another species of *Opeas* on Charles Island; both having been introduced recently by man, they are not considered part of the fauna in this paper.

PLATE 8

- Fig. 1. *Bulimulus (Næsiotus) elæodes* Dall. Syntype No. 1650 (C. A. S. type coll.) from Albemarle Island, Galapagos group; length 12.5 mm.; p. 161.
- Fig. 2. *Bulimulus (Næsiotus) elæodes* Dall. Syntype No. 1651 (C. A. S. type coll.) from Albemarle Island, Galapagos group; length 11 mm.; p. 161.
- Fig. 3. *Bulimulus (Næsiotus) hemærodes* Dall. Holotype No. 1652 (C. A. S. type coll.) from Albemarle Island, Galapagos group; length 13.4 mm.; p. 161.
- Fig. 4. *Bulimulus (Næsiotus) perrus* Dall. Holotype No. 1653 (C. A. S. type coll.) from Narborough Island, Galapagos group; length 10.5 mm.; p. 163.
- Fig. 5. *Bulimulus (Næsiotus) cucullinus* Dall. Syntype No. 1654 (C. A. S. type coll.) from Hood Island, Galapagos group; length 18.9 mm.; p. 166.
- Fig. 6. *Bulimulus (Næsiotus) cucullinus* Dall. Syntype No. 1655 (C. A. S. type coll.) from Hood Island, Galapagos group; length 18.2 mm.; p. 166.
- Fig. 7. *Bulimulus (Næsiotus) albemarlensis* Dall. Syntype No. 1658 (C. A. S. type coll.) from Albemarle Island, Galapagos group; length 15 mm.; p. 167.
- Fig. 8. *Bulimulus (Næsiotus) albemarlensis* Dall. Syntype No. 1659 (C. A. S. type coll.) from Albemarle Island, Galapagos group; length 13.5 mm.; p. 167.
- Fig. 9. *Bulimulus (Næsiotus) akamatus* Dall. Holotype No. 1660 (C. A. S. type coll.) from Indefatigable Island, Galapagos group; length 14.5 mm.; p. 168.
- Fig. 10. *Bulimulus (Næsiotus) adelphus* Dall. Holotype No. 1661 (C. A. S. type coll.) from Indefatigable Island, Galapagos group; length 15 mm.; p. 168.
- Fig. 11. *Bulimulus (Næsiotus) lycodus* Dall. Syntype No. 1662 (C. A. S. type coll.) from Indefatigable Island, Galapagos group; length 11.4 mm.; p. 168.
- Fig. 12. *Helicina ochsneri* Dall. Holotype No. 1674 (C. A. S. type coll.) from Albemarle Island, Galapagos group; maximum diameter of shell 3.8 mm.; height, 2.5 mm.; p. 178.
- Fig. 13. Same as fig. 12. Basal view.
- Fig. 14. Same as fig. 12.
- Fig. 15. *Bulimulus (Næsiotus) lycodus* Dall. Syntype No. 1663 (C. A. S. type coll.) from Indefatigable Island, Galapagos group; length 10.9 mm.; p. 168.

Plate 8 continued on next page

PLATE 8—Continued from preceding page

- Fig. 16. *Bulimulus (Næsiotus) lycodus* Dall. Syntype No. 1664 (C. A. S. type coll.) from Indefatigable Island, Galapagos group; length 11.5 mm.; p. 168.
- Fig. 17. *Bulimulus (Næsiotus) alethorhytidus* Dall. Syntype No. 1665 (C. A. S. type coll.) from Indefatigable Island, Galapagos group; length 13 mm.; p. 169.
- Fig. 18. *Bulimulus (Næsiotis) alethorhytidus* Dall. Syntype No. 1666 (C. A. S. type coll.) from Indefatigable Island, Galapagos group; length 12.9 mm.; p. 169.
- Fig. 19. *Bulimulus (Næsiotis) cymatias* Dall. Holotype No. 1667 (C. A. S. type coll.) from Indefatigable Island, Galapagos group; length 13 mm.; p. 169.
- Fig. 20. *Bulimulus (Næsiotis) ochsneri* Dall. Holotype No. 1668 (C. A. S. type coll.) from Indefatigable Island, Galapagos group; length 12.4 mm.; p. 169.
- Fig. 21. *Bulimulus (Næsiotis) ochsneri* Dall. Syntype No. 1669 (C. A. S. type coll.) from Indefatigable Island, Galapagos group; length 16.6 mm.; p. 169.
- Fig. 22. *Bulimulus (Næsiotis) jervisensis* Dall. Holotype No. 1671 (C. A. S. type coll.) from Jarvis Island, Galapagos group; length 16.1 mm.; p. 170.
- Fig. 23. *Bulimulus (Næsiotis) rabidensis* Dall. Syntype No. 1672 (C. A. S. type coll.) from Jarvis Island, Galapagos group; length 14 mm.; p. 171.
- Fig. 24. *Bulimulus (Næsiotis) rabidensis* Dall. Syntype No. 1673 (C. A. S. type coll.) from Jarvis Island, Galapagos group; length 15 mm.; p. 171.
- Fig. 25. *Bulimulus (Næsiotis) calvus caryonis* Dall. Holotype No. 1686 (C. A. S. type coll.) from Charles Island, Galapagos group; length 10.6 mm.; p. 160.

Note. The measurements given in this explanation were obtained from the type specimens by L. G. Hertlein. (Editor.)

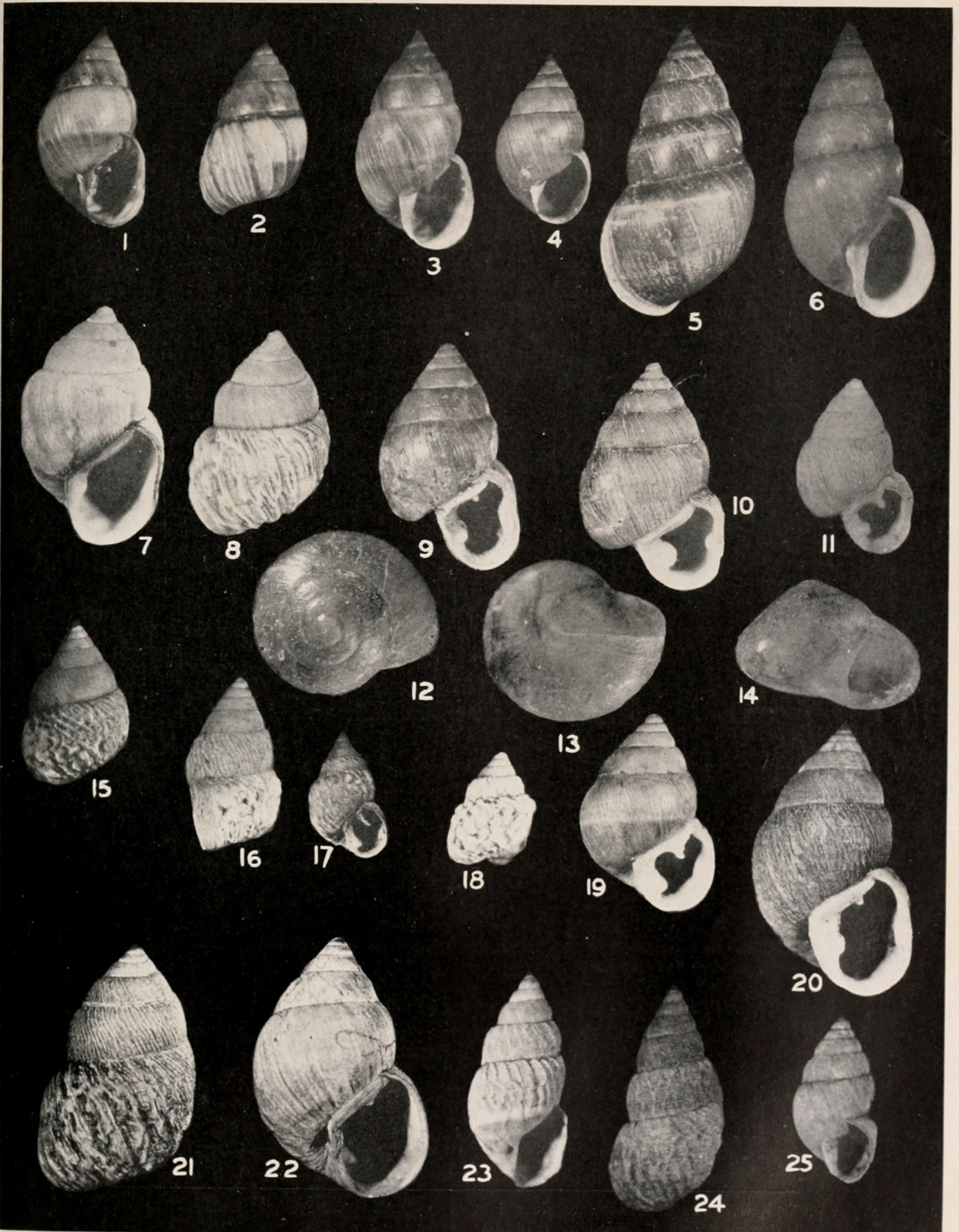
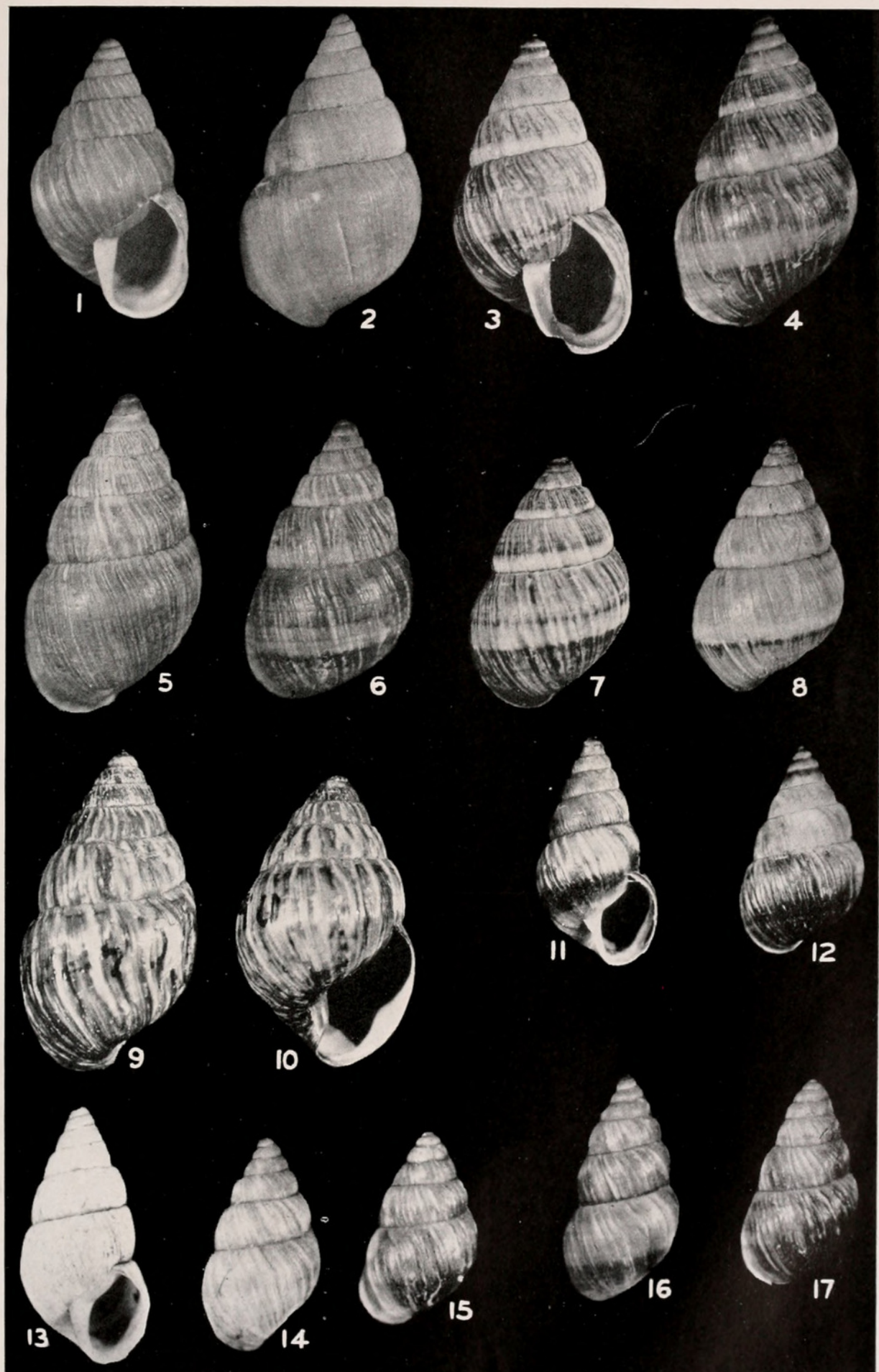


PLATE 9

- Fig. 1. *Bulimulus (Næsiotis) nux perchloris* Dall & Ochsner. Syntype No. 1675 (C. A. S. type coll.) from Charles Island, Galapagos group; length 16.5 mm.; p. 156.
- Fig. 2. *Bulimulus (Næsiotis) nux perchloris* Dall & Ochsner. Syntype No. 1676 (C. A. S. type coll.) from Charles Island, Galapagos group; length 18.5 mm.; p. 156.
- Fig. 3. *Bulimulus (Næsiotis) nux monotænius* Dall & Ochsner. Syntype No. 1677 (C. A. S. type coll.) from Charles Island, Galapagos group; length 19.5 mm.; p. 157.
- Fig. 4. *Bulimulus (Næsiotis) nux monotænius* Dall & Ochsner. Syntype No. 1678 (C. A. S. type coll.) from Charles Island, Galapagos group; length 18.9 mm.; p. 157.
- Fig. 5. *Bulimulus (Næsiotis) nux monotænius* Dall & Ochsner. Syntype No. 1679 (C. A. S. type coll.) from Charles Island, Galapagos group; length 19.9 mm.; p. 157.
- Fig. 6. *Bulimulus (Næsiotis) nux monotænius* Dall & Ochsner. Syntype No. 1680 (C. A. S. type coll.) from Charles Island, Galapagos group; length 16.9 mm.; p. 157.
- Fig. 7. *Bulimulus (Næsiotis) nux monotænius* Dall & Ochsner. Syntype No. 1681 (C. A. S. type coll.) from Charles Island, Galapagos group; length 15.9 mm.; p. 157.
- Fig. 8. *Bulimulus (Næsiotis) nux monotænius* Dall & Ochsner. Syntype No. 1682 (C. A. S. type coll.) from Charles Island, Galapagos group; length 15.2 mm.; p. 157.
- Fig. 9. *Bulimulus (Næsiotis) nux basiplicatus* Dall & Ochsner. Syntype No. 1683 (C. A. S. type coll.) from Chatham Island, Galapagos group; length 19.8 mm.; p. 157.
- Fig. 10. *Bulimulus (Næsiotis) nux basiplicatus* Dall & Ochsner. Syntype No. 1684 (C. A. S. type coll.) from Chatham Island, Galapagos group; length 17.6 mm.; p. 157.
- Fig. 11. *Bulimulus (Næsiotis) ustulatus phlegonis* Dall & Ochsner. Syntype No. 1687 (C. A. S. type coll.) from Charles Island, Galapagos group; length 13.6 mm.; p. 160.
- Fig. 12. *Bulimulus (Næsiotis) ustulatus phlegonis* Dall & Ochsner. Syntype No. 1688 (C. A. S. type coll.) from Charles Island, Galapagos group; length 12.5 mm.; p. 160.
- Fig. 13. *Bulimulus (Næsiotis) ustulatus pallescens* Dall & Ochsner. Syntype No. 1692 (C. A. S. type coll.) from Charles Island, Galapagos group; length 15.9 mm.; p. 160.
- Fig. 14. *Bulimulus (Næsiotis) ustulatus pallescens* Dall & Ochsner. Syntype No. 1693 (C. A. S. type coll.) from Charles Island, Galapagos group; length 13.1 mm.; p. 160.
- Fig. 15. *Bulimulus (Næsiotis) ustulatus phlegonis* Dall & Ochsner. Syntype No. 1689 (C. A. S. type coll.) from Charles Island, Galapagos group; length 12.1 mm.; p. 160.
- Fig. 16. *Bulimulus (Næsiotis) ustulatus phlegonis* Dall & Ochsner. Syntype No. 1690 (C. A. S. type coll.) from Charles Island, Galapagos group; length 14 mm.; p. 160.
- Fig. 17. *Bulimulus (Næsiotis) ustulatus phlegonis* Dall & Ochsner. Syntype No. 1691 (C. A. S. type coll.) from Charles Island, Galapagos group; length 13 mm.; p. 160.

Note. The measurements given in this explanation were obtained from the type specimens by L. G. Hertlein. (Editor.)





Dall, William Healey and Ochsner, Washington Henry. 1928. "Landshells of the Galapagos Islands." *Proceedings of the California Academy of Sciences, 4th series* 17, 141–185.

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