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A COLLECTOR'S NOTES ON VARIATION IN SHELLS, WITH SOME NEW VARIETIES.

(With Plate X.)

BY HENRY HEMPHILL.

The following notes and observations on the variations of some of our West Coast shells may be useful to those interested in the study of these little creatures, may help correct some errors, explain some facts connected with their history that seem to be little understood, and perhaps also may interest some who are pursuing the study of other branches of natural history. The discussions that have followed the question of variation and its causes testify to its importance, and all facts that tend, in any way, to throw light upon it should be given out, so that we may in time arrive at a trustworthy solution of this knotty problem.

In the study of variation among shells it is necessary to fully understand the relations existing between the shell and animal, its mode of growth and the purpose it serves these creatures, in order to have a good foundation on which to base our conclusions.

The shell has often been compared to a house in which the animal lives; but while this is true in one sense, the comparison is not good from another point of view, because animals do not carry their houses around with them on their backs.

The shell bears the same relation to the mollusk that a suit of clothes does to the man, and is constructed and worn by the animal for protection against its enemies and atmospheric changes.

The habit of constructing the shell, I believe, has been acquired by the animal; and as there are some, probably quite a number, who may differ with me and call the shell a secretion and not a construction, I will point out briefly the differences, and draw the line between a secretion and a construction as I understand them. This

will perhaps serve some good purpose by directing closer attention to the relations existing between the shell and the animal, if it does not settle the question in the minds of all.

The matter that enters into those parts of the body of an animal, which we call secretions, such as bones, teeth, nails and hair, is never under the control of the will of the animal, and these organs are closely connected with the venous system of the body; consequently they possess an inherent power of repair, and when fractured or broken they grow or knit together by force of this inherent power. No mechanical action whatever takes place by the other organs in manipulating, forming or moulding their shape—their form and size being determined by inherent laws, or by a principle that might be compared to that possessed by seeds of plants which determines their forms.

On the other hand, the secreted matter which enters into the formation of shells is thrown out on the surface of the body and mantle, and then becomes an excreted secretion, bearing the same relation to the animal that all excretions or even foreign substances do, for it has become separated from and lost that inherent power that always remains with bones and other secretions.

Right here, then, I draw the line between a secretion and a construction. This excreted matter is now subject only to the control of the will of the animal, and it is accordingly used in suspending and renewing construction of the shell at its convenience, and in repairing fractures.

The shell possesses no inherent principle which determines its form or growth, but on the contrary its growth is effected by irregular deposits, and its form is determined by the mechanical manipulations of this deposited matter by the mantle of the animal.

"The shell, as before stated, is formed by the mantle." Woodward's Manual of the Mollusca, page 34.

"The edges of the mantle are often developed into fringes at certain periods, and form the spines and other irregularities seen on the surface of the shell." Genera of Recent Mollusca, H. & A. Adams, page 14.

"The shell being extravascular has no inherent power of repair." Carpenter, Woodward, Tryon.

The above quotations fully indicate the mechanical action of the mantle of the animal in forming and moulding the shell. If the

shell has no inherent power of repair, then all repairs which are frequently performed on shells must be mechanical or constructive. In order to show how completely the shell is under the control of the will of the animal, I quote again from Woodward's Manual of the Mollusca, pages 35–36:

"The power which mollusks possess of dissolving portions of their own shell is exhibited by the murices in removing those spines from their whorls which interfere with their growth."

"The young cowry has a thin, sharp lip, which becomes coiled inwards and enormously thickened and toothed in the adult; the Teroceras develops its scorpion-like claws only when fully grown; and the land snails form a thickened lip or narrow their apertures with projecting processes, so that it is a marvel how they pass in and out and how they exclude their eggs. Yet at this time they would seem to require more space and accommodation in their houses than before, and there are several curious ways in which this is obtained. The Neritidæ and Auriculidæ dissolve all the internal spiral column of their shells, the cone removes all but a paper-like portion of its inner whorls; the cowry goes still further, and continues removing the internal layers of its shell wall, and depositing new layers externally by its overlapping mantle, until, in some cases, all resemblance to the young is lost in the adult."

I quote the following from Tryon's Structural and Systematic Conchology, pages 31 and 32, which, it seems to me, is conclusive evidence that not only is the shell a construction, but that its formation is an acquired habit:

"The question of the parasitism of the animal of the Argonaut in its shell, originally assumed by distinguished naturalists, has been so long debated that quite a literature upon the subject has accumulated. The want of attachment of the animal by adductor muscles, and the fact that the shell itself is not moulded on the animal's body and does not correspond to its shape, were considered such strong evidences of parasitism that the animal itself was described as Ocythœ and the shell as Argonauta."

"The observations of Madame Jeanette Power first set this vexed question at rest by showing that the animal builds its shell by the exudation of material from the expanded velamentous arm of the female, instead of from the mantle, as in true shells."

The Argonauta is born without a rudimentary shell; while the

male never possesses one, the female builds (constructs) one of the most delicate and beautiful found in the sea, for a nest, in which she deposits her eggs and hatches her young. This shell is not attached to the animal, and is an undoubted construction. From all the above quotations it will be seen we cannot call the shell a secretion, because secretions possess an inherent power of repair; their form and size are determined by an inherent principle or law over which the animal has no control. We cannot call it an excretion, for excretions are simply waste matter and without form. Construction, then, it seems to me, is the only term we can apply to it, because it is extravascular, possessing no inherent power of repair, no inherent power that determines its form or size, and is put together and moulded by the mechanical action of the mantle of the animal; and a thing thus put together should be considered the object of the process that gives it its distinguishing character and name—shell.

Our West Coast shells, with few exceptions, seem to present a greater amount of variation, or are in a more active state of transition from one form to another, or perhaps our collectors are more lynx-eyed and push their investigations further in that direction than their co-laborers on the other side of the continent, for we hear but little about the variations of our Eastern shells, unless perchance some collector from this far-off but glorious land straggles into that field of research, while our West Coast shells are under consideration a greater part of the time.

An exception, however, to some of the above remarks is found in the Unionidæ and the Strepomatidæ — two large families of freshwater shells "that form the special glory of North America," on the east side of the Rocky Mountains, where the streams abound in species and varieties, and are fairly overcrowded with individuals, while the entire water system west of that great range and extending from Arizona to Alaska — an immense area — has rewarded the researches of the collector, so far, with a dozen or two forms of doubtful specific value, belonging to these great families. When we consider the great variety of forms and number of individuals of these classes of freshwater shells inhabiting the streams on the eastern side of the great divide, the paucity of species and individuals of the same classes inhabiting the water-courses on the western side becomes one of the most striking features of the study of American conchology, and an explanation of its causes would be one of

the most interesting contributions to our knowledge that has been offered in many years. With the small number of species and individuals found over this area, we cannot look for many varieties. A few, however, occur, and I now offer description of two varieties of Anodons, and add some notes and discuss the probable origin of our most and best marked species.

Anodonta angulata var. *subangulata* (plate X, figs. 1 and 2). In general outline this form recalls at once its nearest relative, *A. angulata* Lea. Compared with that species, it is more oval in outline; the ridge or angle radiating from the umbones to the anterior ventral margin of the shell is nearly or quite obsolete in the specimens before me; the anterior margin of the shell is more produced on its dorsal edge, while its ventral edge is more rounded at the point where the angle terminates, and the intervening space between the angle and front margin of the shell is less concave in form. The shell is also less pointed and more rounded in its posterior outline, and is much less inflated in general form. In color and lines of growth the two shells agree fairly well.

Compared with *Anodonta Oregonensis* Lea., its next nearest relative, one variety is just the reverse in outline. It is broader in front from its dorsal to its ventral margin, and narrower behind, while *A. Oregonensis* is narrower in front from its dorsal to its ventral margin and broader behind. *A. Oregonensis* is also much more inflated, and some of its varieties inclined to be cylindrical, while our variety is flat and compressed.

Habitat: Russian River, Putah Creek and Upper San Joaquin River, California.

Length, from the anterior to posterior end, 3½ inches. Height, from the dorsal to the ventral margin, 1¾ inches. Breadth, between valves, ⅞ inch.

From the examination and study of quite a number of specimens of both *A. angulata* and *A. Oregonensis*, I am strongly impressed with the idea that the former has evolved from the latter, although there is considerable difference in the form of the shells as well as in the habits of the two animals; but when the streams and lakes in the northern part of our State are thoroughly explored, I feel confident these gaps will be closed.

Anodonta Oregonensis is a pond or lake, and not a river mussel, although it is sometimes found in our rivers. In ponds and lakes,

however, it attains its greatest size as well as number. I have found it as far south as Los Angeles, but it cannot be said to be an abundant shell south of the Oregon line — at least I have not found it so. In the ponds and lakes of Washington, however, it is quite plentiful and leads an active life, as it can be traced by the deep furrows it plows through the soft mud and sediment in seeking its food and companions, or moves on, perhaps, by mere force of habit.

One other species, *Anodonta angulata* Lea. (figs. 5 and 6), is decidedly a river mussel, and is as rarely found in ponds or lakes as *A. Oregonensis* is found in swift-running streams. Some years ago I found two specimens of this shell on the shores of Blue Lakes, Lake County, California, and the only ones I have found of this species in ponds or lakes. It is somewhat gregarious in its habits, and from its position when burrowing in the sand and mud I am strongly impressed with the thought that it seldom leaves its situation in swift-running streams, unless compelled by force of adverse circumstances.

About twelve or fifteen years ago I found a colony of *A. angulata* in the San Joaquin River, California, by wading out into the stream to where the water was waist deep. This colony had located itself in a bed of stiff clay on the edge of a steep bank that led into the channel of the river. By working my feet into this clay I could feel the edges of the valves, and then, reaching down, dig them out with my hands. The depth and muddy state of the water prevented me from making observations on their habits further than noting that they were gregarious, as I found them burrowing in close proximity to one another in the stiff clay, with the anterior end of the shell up.

In the fall of 1889, after rather a hard summer's trip through the northern mountains collecting shells, I reached Weiser City, on the banks of the small river bearing the same name, at its junction with Snake River in Idaho, early in the month of October. The summer and fall had been excessively dry, and many of the springs and small streams in that section of the country had dried up and Snake River had fallen almost to the proportions of a creek, exposing many of the low bars and portions of the river's bed that had not been uncovered for years. This low stage of the water offered a good opportunity for taking notes and making observations on the habits of this class of fresh-water shells, which very fortunately I found abundant.

Anodonta angulata I found burrowing in beds of compact gravel and sand, in an upright or perpendicular position, with the small posterior end of the shell down and the broader or anterior end just level with or a little above or below the surface of the surrounding gravel beds. They seemed to prefer the steep sides of banks that led into deep water as burrowing places, rather than the flat bars, although some were found in the latter places. I did not find them living in such large colonies as those in the San Joaquin River, yet their habits in that respect agreed fairly well. My previous impression that they were somewhat sedentary was greatly strengthened by their burrowing habits and position in these gravel beds, and their somewhat gregarious habits here, especially when we remember that all sedentary mollusks are gregarious.

With the knowledge of its habits and the factors in its environment that act upon the shell, it is not difficult to recognize the causes that produce the remarkable angles or ridges which radiate from the umbones to its anterior ventral margin, and at the same time mould the concave form of that part of the shell between its anterior margin and these ridges.

It will be readily seen by their upright position in the gravel beds that the anterior or upper portion of the shell would be subjected to the continual friction of the current, sand, gravel and debris brought down the stream by the water, which in times of floods would be excessive. Freshets occur quite often in these mountain streams, especially in the spring or early part of the year—the season when mollusks construct the greater part of their shell—and consequently at this time these external conditions would have a greater moulding influence on the form of the shell than at any other time. This rasping and wearing-away process, then, would require constant efforts on the part of the animal to rebuild and keep that part of shell in repair, and this constant direction of its energies to the upper or anterior end of the shell, if continued for a great length of time and through successive generations, would eventually result in a greater development of the organs of the anterior part of the body and a corresponding enlargement of the shell, probably at the expense of the posterior or lower end, and more especially would this be the case when the shrinkage of the posterior end of the body and shell would be found to be an advantage in burrowing in the compact gravel beds.

The moulding influence of the currents, sand and gravel, is plainly seen on the upper portion of the shell (fig. 6), which is admirably adapted to the purpose it serves and is strong evidence of its sedentary habits, and to its incurving form is largely due the prominence of those remarkable ridges or angles that constitute the principal or distinguishing characters of the shell. This incurving then, of the upper part of the shell, would press down and crowd the anterior portion of the body and compel its lateral expansion, then a corresponding enlargement of the shell would follow, while the compact gravel on the outside acting as a sort of fulcrum would bring the pinch just about where these angles occur.

To sum up the matter then, we must suppose that *Anodonta Oregonensis*, for some cause, has changed its habitat and station, from the quiet or still waters of the pond or lake, to the rapid flowing mountain stream.

Being unable to contend against the force of the current, it burrows in the compact sand and gravel for safety. The flowing waters bring it an abundance of food, dispensing with the necessity of moving around to secure it, and thus by force of circumstances it becomes a sedentary river mussel, while the factors in its environment contending with the organic energy of the mollusk result in a modified shell.

Anodonta Nuttalliana var. *Idahoensis* (figs. 3–4).

In general outline this variety is more oval than any of the other forms of our West Coast Anodons. It occupies a position between *A. Californiensis* and *A. Oregonensis*, and is one of those intermediate forms that are constantly occurring and shake our faith in what we call species.

In the proportions of its length and height and its rounded posterior outline, it resembles *Anodonta Californiensis*. In its breadth between valves, and the smaller and more pointed anterior end of the shell, and more especially in the less developed dorsal prolongations of the valves, it resembles *A. Oregonensis*.

In color and lines of growth it agrees fairly well with both of the other species. In the young state the shell is higher in proportion to its length, while the wings or dorsal prolongation of the valves are a little more produced. The umbones of the very young of all our West Coast forms, until they have attained about a-half inch in length, present a peculiar wavy or corrugated appearance, a

constant character, so far as I have observed, and one that seems to have been overlooked by writers upon our Anodons.

Habitat, Spokane River, above Post Falls, Idaho.

Length, from the anterior to posterior end, $2\frac{1}{4}$ inches.

Height, from dorsal to ventral margin, $1\frac{5}{8}$ inches.

Breadth, between valves, $\frac{7}{8}$ inch.

Mr. R. E. C. Stearns has published an excellent paper on our West Coast Anodons, in which he shows by logical arguments and illustrations that the forms we know as *Anodonta Nuttalliana*, *A. Wahlamatensis*, *A. Oregonensis* and *A. Californiensis* are but varieties, or "expessions of one form," and closely connected with the European *A. anatina* and *A. cygnea*.

I would commend a close study of the facts this paper presents to those who believe in the immutability of what they are pleased to call species.

However, I cannot agree with all my friend Stearns writes under the head of "Variability and Uniformity," when he says: "Those species which have the widest distribution exhibit the greatest diversity and *vice versa*. Those which are confined, restricted to, or occupy limited areas exhibit little if any variation."

"The latter often show a remarkable persistency, and adhere with most rigid tenacity to a single aspect of color and form."

"Nevertheless there are exceptions to this, for uniformity and wide distribution are sometimes exhibited."

I formerly held the opinions on variation expressed above, and they seem to be the general opinion of most of those who write upon this subject, but my experience as a collector of American shells does not confirm them.

From observations made in the field the past twenty years, and the study of accumulated data, collected and selected for the special purpose of investigating and illustrating these very points, I find the the tendency to vary to be the general condition, and rigidity the exception among this class of animals, whether the species has a wide geographical range or is limited to restricted areas. Generally, and I may say invariably, where we find the most vigorous colonies and the largest number of individuals, there we also find the greatest diversity, but we sometimes find almost the extremes of variation known to a species in localities where individuals are

extremely scarce, so scarce that the researches of the collector would not be rewarded by twenty-five specimens in a whole day's search.

"Facts are stubborn things." I now offer measurements with notes on sculpture and color variations of some of our West Coast land shells restricted to limited areas, and collected by myself, which will, I think, confirm my opinion that species restricted to limited areas often exhibit great variation.

Helix intercisa Binney.—San Clemente Island, California. This species, by its sculpturing and form, stands at the head of a small group of shells restricted in their range to the islands off the coast of California. In its wanderings among this group of islands it has become somewhat modified in its sculpturing, form and color, and on these modifications conchologists have made two other species which we know as *Helix Ayresiana* Newc., and *Helix Tryonii* Newc. I may also add here that this group of shells is very closely connected through varieties of *H. Ayresiana* with the form we know as *H. Traskii*, and was perhaps evolved from the group of *H. fidelis* through *H. Traskii*.

Measurements of *Helix intercisa*, restricted to the Island of San Clemente. Largest specimen: greatest diameter, 27 mm.; altitude, 18 mm.

Var. *minor*. Smallest specimen: greatest diameter, 18 mm.; altitude, 11 mm. Uniform light-yellowish chestnut color, with and without a band, and varies very much in form and elevation or depression of spire.

Var. *elegans*. Uniform ashy-buff color, faintly banded and variable in form.

Var. *nepos*. Uniform ashen-white; spire horn color, variable in form and sculpturing.

Var. *albida*. Uniform milk-white, sometimes with a faint band at the periphery; sculpture nearly obsolete.

Helix Ayresiana Newc., San Miguel Island.

In sculpturing this shell stands next to *H. intercisa* in the group. The revolving lines are less crowded and more regular in their arrangement, while the transverse striæ or lines of growth are somewhat rib-like on the body whorl. The umbilicus is open or half-covered, while in *Helix intercisa* it is sealed up.

Largest specimen: greatest diameter, 28 mm.; altitude, 13 mm.

Smallest specimen: greatest diameter, 17 mm.; altitude, 13 mm.

Color, ashen buff or grayish, with a broad or narrow band, frequently bandless.

Helix Ayresiana, var. Santa Cruz Island.

Largest specimen: greatest diameter, 30 mm.; altitude, 17 mm.

Smallest specimen: greatest diameter, 17 mm.; altitude, 10 mm.

This variety is of a uniform light chestnut color, with closer and finer sculpturing then the typical or San Miguel Island specimens. The form is generally more depressed and approaches *H. Traskii*.

Helix Tryonii Newc. Santa Barbara Island.

By its sculpturing, as well as its general form, this shell is closely connected to *H. intercisa*, but is quite different in its pattern of coloring, and is generally a coarser and heavier shell. The revolving lines so prominent in *H. intercisa* and *H. Ayresiana* are nearly obsolete in *H. Tryonii*, but they can be easily traced by a common pocket lens. By its coloring the shell is divided into two zones, the upper one being variously clouded with blotches of chestnut on a ground of dirty white. Below it is generally uniform in its dirty white color, but uniform cream and milk white individuals also occur. The young are more acutely carinated at the periphery than the young of either *H. intercisa* or *H. Ayresiana*, but the angle dies out on the body whorl as it approaches maturity.

The columella portion of the peristone in fully adult specimens very often has an obtuse tooth-like callosity, which also occurs in adult specimens of *H. intercisa*.

Largest specimen . greatest diameter, 26 mm.; altitude, 25 mm.;

Smallest elevated specimen : greatest diameter, 20 mm.; altitude, 18 mm.

Smallest depressed specimen : greatest diameter, 20 mm.: altitude, 15 mm.

The following varieties indicate its different patterns of coloring and are arranged to show a connected series from the darkest colored to the milk-white albinos.

Var. *varius*. The upper or dark zone is of a lighter shade of bluish brown or chestnut than the preceding, and is flecked and sprinkled with ashen white; band at the periphery, dirty white beneath.

Var. *nebulosa*. Lighter colored above than var. *varius*, marbled and clouded with various patterns of dark brown and dirty white ; dirty white beneath.

Var. *fasciata.* Uniform light chocolate above and beneath, with a dark band at the periphery.

Var. *Californica.* Creamy buff color, darker above than below the periphery, very faintly banded.

Var. *albida.* Uniform creamy, and sometimes milk white above and beneath, and without band.

Helix Tryonii var. *subcarinata* Hemphill. Among the sub-fossils that occur on Santa Barbara Island we find a form of *H. Tryonii*, which adds an interesting link to its history and to its present form, may be characterized as follows:

Shell depressed-globose, consisting of about 5½ whorls, the last subcarinated at the periphery; in other respects it closely resembles the recent form of *H. Tryonii.*

Largest specimen: greatest diameter, 23 mm.; altitude, 15 mm.

Smallest specimen: greatest diameter, 20 mm.; altitude, 11 mm.

The occurrence of this subcarinated form on this small island seems to indicate that species restricted to limited areas do vary very much.

Helix ruficincta Newc. Santa Catalina Island. I unite with this shell *H. Gabbi* Newc. and *H. facta* Newc. The only differences between the three shells, so far as I can see, are these: *H. ruficincta* is larger than either of the other two; it has an open umbilicus, and very fine crowded microscopic revolving lines. *H. Gabbi* is subperforate, and has a finely-granulated surface, while *H. facta* has a closed umbilicus. In size the smallest *ruficincta* cannot be separated from the largest *facta* or *Gabbi.* In all other respects the shells agree.

Largest specimen: greatest diameter, 21 mm.; altitude, 15 mm.

Smallest specimen: greatest diameter, 15 mm.; altitude, 8 mm.

Very constant in coloring; but white albinos, with narrow chestnut bands, occasionally occur, which are rare.

Helix ruficincta var. *Gabbi* Newc. San Clemente Island.

Largest specimen: greatest diameter, 14 mm.; altitude, 10 mm.

Smallest specimen: greatest diameter, 7 mm.; altitude, 4 mm.

Rigid in its coloring, but very variable in size.

Var. *facta* Newc. Santa Barbara Island.

Largest specimen: greatest diameter, 11 mm.; altitude, 8 mm.

Smallest specimen: greatest diameter, 9 mm.; altitude, 5 mm.

The lot collected shows a great deal of variation in the elevation

and depression of the spire; color is rigid, but the band is frequently absent.

Helix Kelletti Fbs. Santa Catalina Island.

This species has a greater geographical range than the preceding, including *Helix Stearnsiana* Gabb, as a variety.

I refer all the specimens I have collected on the main land from San Diego south to the variety *H. Stearnsiana.*

The following measurements and color varieties refer to the typical form which is restricted to Santa Catalina Island, and represents the varying conditions and character of an isolated island colony.

Judging by the texture and the characters and form of the shell, it seems to have evolved from the *Nickliniana-Californiensis* group.

Largest specimen: greatest diameter, 30 mm.; altitude, 23 mm.

Smallest specimen: greatest diameter, 22 mm.; altitude, 16 mm.

A.—Var. *castaneus.* Uniform, plain, somewhat shining chestnut color, dirty white around the umbilical region, and a poorly defined whitish band at the periphery.

Var. *nitidus.* Uniform, translucent, shining dark horn color, with a poorly defined dark band, coalescing with a poorly defined whitish band below it, at the periphery; spire faintly flecked with ashen gray.

Var. *multilineatus.* Shell marked by alternate shades of ashen white, chestnut or brown, arranged in an irregular series of revolving and sometimes wavy lines, with a broader and poorly defined band at the periphery; markings finer beneath than above.

Var. *frater.* Shell of a beautiful uniform horn-buff color, sometimes fading into lighter horn-color, with a darker band at the periphery, and numerous faint, alternate revolving lines of ashen and dark-horn color above and below; generally, not always, lighter colored beneath, and sometimes with a whitish zone beneath the band at the periphery.

Var. *Californica.* The shell is colored with a darker shade of uniform buff than the above, dark band at the periphery, generally uniform in coloring above and below; sometimes flecked with squarish dots.

Var. *Forbesi.* Ground coloring whitish buff, with a revolving series of poorly defined and coalescing lines, bands and blotches.

Var. *bicolor*. Color very dark horn or brownish, flecked with numerous revolving very fine dots or irregular lines, with or without a very faint band at the periphery.

Var. *tricolor*. Irregularly painted with numerous revolving, whitish, brownish and chestnut flecks, blotches and stains, with and without a band at the periphery.

Var. *albida*. Shell of a beautiful translucent milk white, without stain or blotch.

Var. *albida* a. Milk white ground color, very faintly stained with light horn, and with poorly defined and fading lines.

Helix Kelletti var. *redimita* Binney. San Clemente Island.

I call this a variety of *H. Kelletti* on account of the similarity in the form and sculpture of the two shells. Mr. Binney, however, calls it a variety of *H. intercisa*. I believe he bases his opinion on the dentition and genitalia.

Color, reddish brown. It is restricted in its range to San Clemente Island.

Largest specimen: greatest diameter, 25 mm.; altitude, 20 mm.

Smallest specimen: greatest diameter, 16 mm.; altitude, 11 mm.

Colored varieties of *H. redimita*.

B.—Var. *castaneus*. Uniform polished chestnut color, darker band at the periphery, spire sprinkled with fine ashen specks.

Var. *hybrida*. Uniform ash-white color, and a dark band at the periphery, flecked with transverse markings and specks of dark brown and light chestnut.

This closes the list of species and varieties restricted in their geographical range to the islands. I now add the measurements of two species inhabiting the main land and restricted in their distribution to the immediate vicinity of Monterey, California:

Helix Dupetithouarsi Desh.

Largest elevated specimen: greatest diameter, 27 mm.; altitude, 20 mm.

Largest depressed specimen: greatest diameter, 27 mm.; altitude, 15 mm.

Smallest specimen: greatest diameter, 19 mm.; altitude, 12 mm.

Rigid in its dark chestnut coloring, but the band is sometimes absent, and in its place a broad fulvus zone encircles the shell at the periphery. One of the most variable of our Californian shells in size.

Helix Californiensis Lea.

Largest specimen : greatest diameter, 25 mm.; altitude, 28 mm.

Smallest specimen : greatest diameter, 16 mm.; altitude, 19 mm.

Color rigid, band frequently absent.

I might continue this list almost indefinitely by showing that colonies of widely-distributed species existing in the very metropolis often exhibit the extremes of variation known to it, but enough has already been given to show that variation has no geographical bounds, and that the causes of this phenomenon of nature are active in limited as well as in extended areas.

I will now briefly allude to another point closely connected with the study of variation. The origin of some of our largest groups of land snails seems to be a mystery to some of the writers upon our conchology, and more especially the group found in California, which they are pleased to call "Arionta." The history and origin of that group of shells, as I have traced it from the north, is as plain to me as a well-worn road at midday.

The northern portion of the Rocky Mountains, so far as I have been able to trace, seems to be the region that has sent out colonies of shells, which have spread over nearly the entire country to the south, east and west; and there exist to-day, in the mountains of Idaho and Montana, active and vigorous colonies of shells that seem to me to be the progenitors of our present shell fauna, or at least of the larger part of it.

Among these *Helix Townsendiana* var. *ptycophorus* Brown, is the form from which have evolved the two groups we know as Mesodon on the eastern slope, and the group we call "Arionta," on the western slope. This shell is quite variable in size and coloring in its metropolis, and in its travels southward it assumes a slightly modified form, color and sculpturing, as new conditions require.

In the moist and heavy timbered regions of Oregon it becomes larger and more strongly wrinkled in sculpture, and is known as *Helix Townsendiana* Lea. When this reaches its southern limit near Humboldt Bay, California, it has again become somewhat modified in form, and is then known as *H. arrosa* Gld. Continuing its march southward it eventually reaches Sonoma and Marin counties, and here, under the influence of climatic and geological changes, it branches out and sends off colonies in several directions, which we know under the following names:

Var. *cypreaphila* Newc.
Var. *ramentosa* Gld.
Var. *exarata* Pfr.
Var. *Nickliniana* Lea.

I have these forms so closely connected with *H. arrosa* that no doubt can exist as to their relations.

Var. *cypreaphila*, passes to the eastward and occupies the foothills of the Sierra Nevada Mountains, and evolves in turn the darker and more wrinkled form known as *H. tudiculata* Binney, which in turn sends off numerous varieties into the adjacent mountains, and at San Diego completely seals up its umbilicus, while the mountain colonies keep their umbilicus open or only partially closed.

Var. *ramentosa*, var. *exarata* and var. *Nickliniana*, have spread over the Coast Range as far south as Monterey Bay, which is also the southern limit, so far as we know at present, of the typical *H. arrosa.* In this small area, however, these forms have sent out almost innumerable varieties, and all have become interwoven like a piece of lace-work. On the south side of Monterey Bay an extremely elevated form of var. *Nickliniana* appears, which we know under the name of *H. Californiensis;* and, unfortunately, this form was the first one described of this group, and we are compelled to observe the unnatural arrangement of grouping the other members around it. Var. *Nickliniana*, does not appear to the southward again on the mainland, but it has been transplanted in some way onto Santa Catalina Island, where it has become thoroughly established, though somewhat changed in form and very variable in coloring, and is known to conchologists as *H. Kelletti.* On the mainland south of Santa Catalina Island the form again becomes slightly modified, and passes under the name of var. *Stearnsiana.*

If the shells themselves are a guide or an index to their relations, I have this record so complete that but little doubt can exist as to its truth.

In closing, I may add that my impressions: are variation is inherent in matter, the primary cause being chemical action or affinity.

The conditions of the environment, such as food, heat, light, air and moisture, etc., act as aids or checks to the primary cause. Perhaps imperfect fertilization of the ovaries, through what we call close blood relatives, and chemical changes affecting the vital

fluids, and defective working or modification of the secretory organs, together with the conditions to which the eggs are subjected during incubation, are more fruitful sources of variation in this class of animals than any other, for the perfection, vigor and strength imparted to the offspring must be powerful factors in the matter, and it is not necessary to look far to find these conditions, for old mother nature has stamped upon every particle of matter, the legend—change.

EXPLANATION OF PLATE X.

Figs. 1—2. Anodonta angulata var. subangulata.
Figs. 3—4. A. Nuttalliana var. Idahoensis.
Figs. 5—6. A. angulata.

GEOGRAPHICAL DISTRIBUTION OF LAND BIRDS IN CALIFORNIA.

BY CHARLES A. KEELER.

IV. THE ISLAND FAUNA.

Having now, in a general way, considered every faunal area of the State, no region still remains to claim our attention, except the Coast Islands. Peculiar interest is always attached to the distribution of life on islands, and our California groups form no exception. There are but two island groups worthy of consideration, the Santa Barbara Islands and the Farallones. The latter situated directly opposite San Francisco harbor about thirty-five miles from the coast, consists of three small rocky islands, the largest not over a mile in length, and the number of land birds resident upon it is, of course, reduced to a minimum; but the former group comprises seven islands of considerable size, the nearest being about twenty miles off the coast, and the whole group lying between thirty-two and thirty-four degrees north latitude. It is this Santa Barbara group which is of especial interest in relation to the geographical distribution of life. Prof. Joseph Le Conte has published * a very interesting discussion concerning the distribution of plant life upon these islands, which has a direct bearing upon the distribution of bird life. In the first place, as he

* See Proc. Cal. Acad. Sci., v, p. 152, 1873.

has pointed out, the islands formed a part of the mainland at the beginning of the Quaternary Epoch. This has been proved in various ways, particularly by the discovery of mammoth remains on one of them, indicating that the separation must have occurred during or just previous to the glacial period; showing, in fact, as Prof. Le Conte has said, that these islands are all that remains of what once constituted the Coast Range, the intermediate land having been lost by subsidence. In pre-glacial times all California, apparently, was inhabited by forms from the Sonoran Province, which were isolated upon these islands at the time of subsidence, and thus kept distinct from the northern horde driven south by the ice, which spread over all other parts of the State. Isolation would thus, to a considerable degree, tend to preserve these pre-glacial forms to the present day, as to a vastly greater degree it has preserved the primitive forms of Madagascar. The botanical basis for this theory is as follows: The flora of these islands consists largely of peculiarly Californian species, together with a considerable number of endemic forms, and is characterized by the absence of northern and eastern species found on the mainland.

The most conspicuous feature of the flora is its distinctively southern character, as compared with the adjacent coast. Since Prof. Le Conte's paper was written, the flora of the islands has been more fully and carefully examined, and Mr. T. S. Brandegee has shown* that the number of species peculiar to the islands is much less than was formerly supposed. This, however, does not in any way alter Prof. Le Conte's theory, but merely shows that the isolation has not been sufficiently long continued, or sufficiently complete perhaps, to produce the degree of differentiation at first ascribed to them. Mr. Brandegee has also called attention to the fact that the temperature of the islands is higher than that of the adjacent coast†, which would be another factor in accounting for the presence of southern forms. This much at least remains, that the flora of the islands is southern in character, and possesses certain peculiar features; moreover, that it has not to as great a degree that admixture of northern forms characteristic of the mainland floras. All these facts are in complete accord with the theory that the present flora is the remnant of an earlier and more widely distributed one which has been preserved by isolation.

* Zoe, i, p. 129. † Zoe, i, p. 109.

It will now be of interest to see whether or not the distribution of bird life upon the islands can be explained in the same manner. First, in order to have a foundation to work upon, it will be well to give as complete lists as possible of the birds of the different islands. These lists have been compiled from the following articles: Description of a New Jay from California,[1] by H. W. Henshaw; Summer Birds of Santa Cruz Island,[2] by Eli Whitney Blake, Jr.; Notes on the Birds of Santa Barbara Islands,[3] by Clark P. Streator; and Birds from the Coasts of Western North America and Adjacent Islands, Collected in 1888-89, with Description of New Species,[4] by Chas. H. Townsend. Such species as are obviously migratory, or probably so when no summer record appears, have been omitted:

SANTA CRUZ ISLAND.

Zenaidura macroura.
Haliæetus leucocephalus.
Ceryle alcyon.
Colaptes cafer (?).
Trochilus rufus.
Sayornis nigricans.
Empidonax difficilis.
Otocoris alpestris strigata.[5]
Aphelocoma insularis.
Corvus corax sinuatus.
Sturnella magna neglecta.
Carpodacus mexicanus frontalis.[6]
Spizella socialis arizonæ.
Melospiza fasciata samuelis.
Pipilo maculatus megalonyx.
Chelidon erythrogaster.
Lanius ludovicianus gambeli.[7]
Helminthophila celata lutescens(?)[8]
Thryothorus bewickii bairdi.
Salpinctes obsoletus.

SANTA BARBARA ISLAND.

Carpodacus mexicanus frontalis.
Melospiza fasciata samuelis (?).[9]

SANTA ROSA ISLAND.

Otocoris alpestris strigata.[10]
Carpodacus mexicanus frontalis.
Melospiza fasciata samuelis (?).[11]
Pipilo maculatus megalonyx.
Helminthophila celata lutescens(?)[8]

[1] Auk, iii, 4, pp. 452–453.
[2] Auk, iv, 4, pp. 328–330.
[3] Ornithologist and Oölogist, xi, 4, pp. 52–54.
[4] Proc. U. S. Nat. Mus., xiii, pp. 131–142.
[5] Recorded as O. alpestris rubea by Henshaw.
[6] Recorded as C. frontalis rhodocolpus by Blake.
[7] Recorded as L. ludovicianus excubitorides by Blake.
[8] Recorded as H. celata sordida by Townsend.
[9] Recorded as M. fasciata graminea by Townsend.
[10] Recorded as O. alpestris insularis by Townsend.
[11] Recorded as M. fasciata clementæ by Townsend.

SAN MIGUEL ISLAND.

Haliæetus leucocephalus.
Falco mexicanus.
Otocoris alpestris strigata.[1]
Corvus corax sinuatus.
Sturnella magna neglecta.
Clivicola riparia.
Salpinctes obsoletus.

SAN CLEMENTE ISLAND.

Speotyto cunicularia hypogæa.
Otocoris alpestris strigata.[1]
Carpodacus mexicanus frontalis.
Melospiza fasciata samuelis(?)[2]
Pipilo maculatus megalonyx.
Amphispiza belli.
Helminthophila celata lutescens(?[3]
Thryothorus bewickii bairdi.

SAN NICOLAS ISLAND.

Haliæetus leucocephalus.
Speotyto cunicularia hypogæa.
Sayornis nigricans.
Otocoris alpestris strigata.[1]
Corvus corax sinuatus.
Scolecophagus cyanocephalus.
Salpinctes obsoletus.

Many of the above lists are, of course, fragmentary, and consequently of comparatively little value in drawing any general conclusions, but I think we are perfectly safe in regarding the following forms as characteristic of all the islands in the group: *Carpodacus mexicanus frontalis*, *Melospiza fasciata samuelis*, *Otocoris alpestris strigata*, *Helminthophila celata lutescens*, *Salpinctes obsoletus* and *Pipilo maculatus megalonyx*. To this list the following may be added with safety, it appears: *Speotyto cunicularia hypogæa*, *Sayornis nigricans*, *Sturnella magna neglecta*, *Corvus corax sinuatus* and *Thryothorus bewickii bairdi*. The first question to be asked is, are these characteristic birds, like the plants of the islands, markedly southern in character? On the contrary, in general these birds appear to be a tolerably even mixture of northern and southern forms. If the theory proposed in accounting for the distribution of plants upon the islands were to hold for the birds, we ought to find the Lower Californian race of the house finch, for example, instead of the form typical of the entire State. More remarkable is the fact brought to light from the collections made upon the islands by Mr. Townsend, that the race of horned larks — which is a common resi-

[1] Recorded as O. alpestris insularis by Townsend.

[2] Recorded as M. fasciata clementæ by Townsend.

[3] Recorded as H. celata sordida by Townsend.

dent, apparently, of all the islands — is identical with the variety characteristic of the coast region of Oregon and Washington.* Surely this is a piece of evidence quite out of harmony with the theory. To add to the difficulty of accounting for this race, so isolated from its proper habitat, the Santa Cruz Islands have a warm and dry temperature in summer, while the coast district of Oregon and Washington is very moist. Such species of powerful flight and wide distribution as the fish hawk, prairie falcon, American raven, barn swallow and bank swallow, of course, should not be taken into consideration in accounting for the distribution of birds, but aside from these we find a very considerable percentage of birds to be Sonoran in character. Such forms are the rock wren, Bell's finch, burrowing owl, California shrike and Baird's wren.

This latter bird, which was the only form of *Thryothorus* taken on the islands by Mr. Townsend, is a Mexican and Southern United States form, which has not been recorded, I believe, from any other point on the coast. On the other hand, we find such forms belonging to the Boreal Province as the western chipping sparrow, spurred towhee and lutescent warbler. We see, in fact, that forms characteristic of both provinces are abundant residents of the islands, and we are led to infer that the group belongs to the Transition Region.

This, of course, implies that the islands are not so completely isolated from the mainland, as regards the birds, as they appear to be with reference to the plants. Let us see, now, how completely isolated the birds are. The nearest islands of the group are not over twenty miles from the mainland, and the most distant not over a hundred, but with these more distant ones the nearer islands form stepping stones to facilitate the passage of transient species. Mr. Townsend records from Santa Cruz and Santa Barbara Islands the golden-crowned sparrow (*Zonotrichia coronata*) in February, which species is obviously a migrant there, while the western savannah sparrow (*Ammodramus sandwichensis alaudinus*), intermediate sparrow (*Zonotrichia intermedia*), and Hutton's vireo (*Vireo huttoni*), which appear on Mr. Townsend's winter list, are not recorded by Mr. Blake as summer residents, and undoubtedly are not found there at that season. Thus it will be seen that the nearest of these islands are easily accessible to our sparrows, and presumably to nearly all

* See Dwight on the Horned Larks, Auk, vii, 2, p. 151.

the small migratory birds; but if birds can reach the nearer islands they would have no difficulty in passing on to the more distant ones. In regard to the two varieties of the song sparrow and of the orange-crowned warbler, recently described by Mr. Townsend from the islands, it is too soon to pronounce upon their validity, although we should hardly expect to find recognizable races of these forms, which it would seem are as well capable of flying from the mainland as is the golden-crowned sparrow. Still more remarkable does it seem that the race of the song sparrow found upon San Clemente Island (*Melospiza fasciata clementæ*) should be the same as that upon Santa Rosa, which is very near the opposite extremity of the group, while on Santa Barbara, midway between the two, another race — *M. fasciata graminea* — should occur. Should more ample material confirm these races, it will only show that in these cases, as with the next to be considered, the isolation has been sufficient to produce slightly different varieties. It will be noticed that these new races of Mr. Townsend's are resident birds, which would account for their distinctive features, perhaps.

In 1886 Mr. H. W. Henshaw described, in the Auk, a new species of jay from Santa Cruz Island (*Aphelocoma insularis*). In Mr. Henshaw's own words—"the essential differences of the island bird from *californica* are its larger size, deeper colors (especially of the brown on back), and the blue under tail-coverts instead of white." In accounting for the origin of this insular form he says: "Individuals doubtless reached the island from the mainland, and being non-migratory their continued residence under new conditions has effected very considerable changes of size and coloration." This theory would seem to indicate that there was a time when the islands were destitute of an avifauna; but if the islands once formed a part of the mainland and were separated by a process of gradual subsidence, such species of birds as found a congenial environment there would be left upon it. The jay being non-migratory and with imperfect powers of flight, would gradually, through isolation, become changed from the mainland forms. We have here a most interesting example of the time required to produce this species. Prof. Le Conte has shown that the subsidence which formed these islands occurred just previous to the age of ice, so it is obvious that this species has become differentiated during the present geological age. It is highly probable, to say the least, that at the beginning of the glacial epoch, Woodhouse's, the California and the island jay were

all the same species. The affinity of the island form to Woodhouse's is shown by the blue under-tail coverts, by which both these two are distinguished from the California jay. In fact, all three forms seem to stand in almost perfectly parallel relations to one another, and to have been developed from the same stock. The most conservative estimates of the time which has elapsed since the age of ice, based upon the rate at which Niagara Falls has worked backward, place it at from seven to ten thousand years, which figures may perhaps give some idea of the length of time which these species have required for assuming their present comparatively slight differences.

To return from this digression, it appears that the theory applied by Prof. Le Conte in accounting for the distribution of plants will hold, to some extent, with birds. The facts seem to indicate that the fauna, like the flora, of the islands was, at the time of their subsidence, exclusively Sonoran in character, but that the isolation has not been so complete with regard to the birds as with the plants; consequently the number of peculiar species of birds is much less than of plants. Perhaps of even greater significance in confirmation of this theory is the fact told me by Dr. J. G. Cooper, that the shells of the island are mostly southern forms peculiar to Lower California. Such means of dispersal as effect the distribution of plants and birds not being at their disposal, it seems almost certain that they are the relics of the Sonoran fauna which once spread over the entire State. Ocean currents could not have carried them there, certainly, for the Japan current flows to the south.

With regard to the distribution of birds on the Farallones little can be said, as there is but one land-bird resident there—the rock wren (*Salpinctes obsoletus*)—and the island birds are apparently identical with the form found all over the State.* The absence of other resident land birds is to be accounted for solely by the barrenness of the rocks, which are not capable of affording food and shelter to them. Many stray migrants reach the islands, however, some of them being species which have never been recorded from any other locality in California. This brings us to the subject of accidental visitants to California, which will be discussed in the next paper.

*See Bryant on Birds and Eggs from the Farallon Islands. Proc. Cal. Acad. Sci., 2d Ser., i, p. 49.

ON REVIEW OF "STATE AND LOCAL FLORAS."

COLUMBIA COLLEGE, NEW YORK, January 14, 1891.

THE EDITOR OF "ZOE:" My Dear Sir—Enclosed please find a communication which I should be glad to have appear in an early issue of your journal.

Yours very truly, N. L. BRITTON.

ON MRS. BRANDEGEE'S REVIEW OF MY LIST OF STATE AND LOCAL FLORAS.

"Think you a little din can daunt mine ears?
Have I not in my time heard lions roar?
Have I not heard great ordnance in the field,
And heaven's artillery thunder in the skies?
And do you tell me of a woman's tongue,
That gives not half so great a blow to the ear
As will a chestnut in a farmer's fire?
Tush! Tush! fear boys with bugs."—PETRUCHIO.

The somewhat caustic review of my recent paper on "State and Local Floras," by Mrs. Brandegee, printed in the November issue of "Zoe," necessitates a word of explanation on my part. I only wish to say that no attempt was made to publish an index to the literature of North American Botany as she appears to infer, and at least endeavors to indicate. The idea was to admit nothing except the titles of what could fairly be called local lists or floras. As I have said, it was difficult to draw the line in some cases, and had the scope of the work been slightly extended, many papers could have been included. To criticise me for leaving out descriptive revisions of wide-spread genera or papers containing descriptions of new species from wide areas, is not to criticise my work, because I never intended to include them. The review is, therefore, illogical and unfair.

The geography of my amiable critic is almost as bad as my own. She evidently believes that the Yellowstone National Park is a part of Wyoming, whereas authorities agree that it is a piece of United States property.

But the review has been of service to the botanists of the country in a way probably not planned by the writer, for it has given us further proof that the two supposed Brandegees are one, not alone matrimonially but literally. For otherwise it would be exceedingly

unlikely that my very phrase used in reviewing one of what we all supposed to be one of Mr. Brandegee's writings should be hurled back at me (although in an impossible application), by Mrs. Brandegee. And this almost leads one to speculate on how many other supposed individuals may be included in the same family.

N. L. Britton.

And so our friend the editor of *The Torrey Bulletin* was a warrior aforetime, and no doubt bore back honorable wounds from many a bloody field. We congratulate him on his heroic deeds and the continuance of

> "The stern joy which warriors feel
> In foemen worthy of their steel."

In regard to the grave accusations brought against Mrs. Brandegee we are constrained to admit that they are too true. She is a woman, but pleads in extenuation of the damning fact, that she was in no way consulted about the matter. We are under the impression that among gentlemen the *argumentum ad hominem* is considered to be extremely bad form, the *argumentum ad mulierem* is however apparently admissible.

The explanation "that descriptive revisions of wide-spread genera or papers containing descriptions of new species from wide areas" were not intended to be included, is perfectly satisfactory to us, but the feminine mind, as our old friend remarks, is illogical and unfair, and in spite of our best efforts we have been unable to convince Mrs. Brandegee that such papers as "No. 591, Catalogue of Plants Collected in Nevada, Utah, Colorado, New Mexico and Arizona * * 4to. pp. 404, 30 plates;" "No. 531, Descriptions of New Species and Genera of Plants in the Natural Order Compositæ, Collected in a Tour Across the Continent to the Pacific, a Residence in Oregon, and a visit to the Sandwich Islands and Upper California," etc., etc., do not contain "descriptions of new species from wide areas," or that the account of Mimulus, ranging from the Aleutian Islands to Mexico, from the swamps of New England to Guadalupe Island in the Pacific Ocean, contained in "No. 620," is not as much a descriptive revision of a widespread genus as Dr. Parry's Chorizanthe, Arctostaphylos or Alnus; Dr. Trelease's Ceanothus, or the numerous similar papers of Dr. Gray and Dr. Watson. We ourself were a little surprised to find that while Chapman's Flora of the Southern States, Coulter's Manual of Rocky Mountain

Botany, Torrey's Flora of the Northern United States, and even Hooker's Flora Boreali-Americana which embraces a region far larger than the United States, extending from Newfoundland to the Pacific and from the Arctic to Northern California, were included among "Local Floras," all mention of even the earlier editions of Gray's Manual was omitted.

We will endeavor to bring Mrs. Brandegee's mind to a proper understanding of the great truths of geography, instructing her on the authority of our learned friend that National Parks, Indian and military reservations, etc., are not to be classed with the States and Territories to which they are geographically allied, but must form part of an agglomeration labeled "Pieces of United States property."

We will also exert our authority to prevent her in the future from "hurling back" (at the risk of breaking) any of our friend's phrases upon which he may have filed a caveat.

It is perfectly natural for our friend to feel that there cannot be on the Pacific Coast of North America more than one person with such exceedingly bad taste as to dissent from any of his views, but a due regard for the truth compels us to admit that there are several.

We beg the learned editor to allow us to pass out of the shadow of his wrath, and receive our humble apology with the assurance that the gentle rebuke administered to Mrs. Brandegee has in no way diminished our regard for him.

EUPHORBIACEÆ COLLECTED BY T. S. BRANDEGEE PRINCIPALLY IN THE VICINITY OF TODOS SANTOS, BAJA CALIFORNIA, JANUARY AND FEBRUARY, 1890.

BY C. F. MILLSPAUGH.

PHYLLANTHUS *(Emblica)* POLYGONOIDES Spreng. (Syst. veg. 3, p. 23). Sierra de la Laguna, January 23.

PHYLLANTHUS sp. —— Sierra de la Laguna, January 21.

PHYLLANTHUS *(Menarda)* CILIATO-GLANDULOSUS Millsp. (Proc. Cal. Acad., Ser. 2, vol. ii, 219.) Todos Santos, January 19.

ACALYPHA sp. —— Sierra de la Laguna, January 26. Todos Santos, January 29. La Paz, February 4. Too young.

BERNARDIA MYRICÆFOLIA (Scheele) S. Watson (Bot. Cal., ii, 70). Sierra de la Laguna, January 27.

TRAGIA *(Eutragia)* NEPETÆFOLIA Muell. (D. C. Prod., pars. 15, 2, p. 933.) Todos Santos, January 20.

EUPHORBIA *(Anisophyllum)* BISERRATA sp. nov. Root.? Branches smooth, irregular, with short internodes. Leaves short-petioled, broadly ovate to reniform, cordate at the unequal base; obtuse, margin hyaline, sharply and deeply serrate, the larger often doubly serrate. Stipules deltoid, laciniate. Inflorescence solitary in the axils of the crowded upper leaves; involucres short-pedicelled, campanulate; lobes triangular, with a prolonged apex, entire; glands transversely reniform, dark red; appendages white, broadly ovate, their margin crenate-dentate. Stigmas bifid nearly to the point of juncture. Capsules smooth, strongly recurved upon their pedicels, carpels obtusely keeled; seed ovate, obtusely angled, salmon color, with shallow irregular anastomosing ridges marking the facets.

Branches (as collected) 16–24 cm.; internodes ½–1½ cm.; petioles 2–4 mm.; leaves 5–12 mm. long, 6–15 mm. broad; seed 1½ mm. long, 1 mm. broad. Rancho Tomate, January 18.

EUPHORBIA POLYCARPA Benth. (Bot. Sulph., 50.) La Paz, February 4.

EUPHORBIA VERSICOLOR Greene. Todos Santos, January 28. Todos Santos—La Paz, February 1.

EUPHORBIA HYPERICIFOLIA Linn. (Hort. Cliff., 198.) Todos Santos, January 29.

EUPHORBIA *(Zygophyllidium)* BIBLOBATA Engelm. (Mex. Bound., ii, 190.) Sierra de la Laguna, January 23.

EUPHORBIA *(Alectoroctonum)* WATSONII sp. nov. Frutescent; branches articulate, internodes irregular; bark gray, striate. Petioles short, very slightly puberulent; leaves oblong-oblique at the slightly cordate base; acute or emarginate; stipules where eviden triangular glanduliform with a slightly ciliate margin. Inflorescence on the young branchlets, and solitary in the axils of the leaves; involucre turbinate, smooth, on long recurved pedicels; lobes triangular ciliate; glands brownish, transversely oblong; appendages white, broadly ovate, entire; stigmas erect, bifurcate to the middle; capsule smooth, carpels obtusely carinate; seeds ovate, pointed, ob tusely angled, facets very slightly roughened longitudinally by very short interrupted ridges.

Branches 2–3 dm. long (as collected); petioles 1 mm. long; leaves 3 8 mm. long, 2–4 mm. broad; capsule 2 mm. long, 2½ mm. broad. Todos Santos, January 20, January 29. Named in recognition of the numerous species Prof. Sereno Watson has worked over so carefully and thoroughly in this genus from Northern Mexico.

EUPHORBIA XANTI Engelm. (in litt.) La Paz, January 5.

[EUPHORBIA *(Tricherostigma)* HINDSIANA Benth. (Bot. Sulph., 51.) The mark of doubt placed after this species (collected on Magdalena Island, in 1889, by Mr. Brandegee) in Proc. Cal. Acad., Ser. 2, vol. ii, 229, should be removed.]

EUPHORBIA CALIFORNICA Benth. (Bot. Sulph.. 49), var.? Todos Santos, January.

EUPHORBIA *(Poinsettia)* HETEROPHYLLA Linn. var. ERIOCARPA Millsp. (Proc. Cal. Acad., Ser. 2, vol. ii, 230.) Sierra de la Laguna, January 26.

RECENT LITERATURE.

In the January *Auk* notice is given of the Biological Survey which is now at work in Inyo County, Cal., in charge of Mr. T. S. Palmer, under the direction of Dr. C. Hart Merriam, Chief of the Division of Economic Ornithology and Mammalogy of the U. S. Department of Agriculture.

The party comprises the most thoroughly equipped and largest scientific staff that has ever been placed in the field in this country. Notices of the "Death Valley Expedition" have appeared from time to time in the local press, and in some instances accompanied by illustrations. One article* tells us that "Death Valley is so called because of death and despair it is the very abode, the like of which is not to be found elsewhere in the world. Imagine a narrow strip of arid plain shut in between two mighty mountain walls, the peaks stretching up 10,000 feet into the burning sky. * * * * The surface of this plain is composed of salt and alkali * * * through which the animal you ride breaks up to his knees into a thick alkali paste which eats both hair and hide. * * * But the supreme horror of the place is the heat, which is unspeakable. * * Into this natural furnace the sun pours its rays, with never a

* Washington Star.

cloud interrupting, from one year's end to another. When the famous geologist, Prof. Gilbert, succeeded in crossing the valley, nearly twenty years ago, barely escaping death from thirst, the thermometer inside his saddle bag went up to 130 degrees and then burst. * * * Hundreds of people have lost their lives in Death Valley through starting off in the morning without knowing where they were going to find water at night. There will be no such foolishness as that indulged in by the expedition. With every precaution a sufficient amount of suffering will of necessity have to be undergone. Water is the great desideratum in that horrible place. * * * So rapid is this evaporation of the bodily moisture that three gallons of water a day are absolutely necessary for each individual. * * *" *(Sic.)* After reading columns of articles from week to week, of which the above is an extract, we can fairly imagine ourselves with Caliph Vathek as he journeyed to and into the Hall of Eblis.* "A deathlike stillness reigned over the mountain and through the air. * * * In the midst of this immense hall a vast multitude was incessantly passing. * * * They had all the livid paleness of death. Their eyes deep sunk in their sockets, resembled those phosphoric meteors that glimmer by night in places of interment. * * * Some, shrieking with agony, ran furiously about * * * whilst others, grinding their teeth in rage, foamed along more frantic than the wildest maniac. They all avoided each other * * * as if alone on a desert where no foot had trodden. * * * A funereal gloom prevailed over the whole scene." The friends and relatives of the adventurous scientists who may have seen the articles alluded to must feel more than uneasy regarding the fate of some or all of these intrepid explorers, who in the "cause of science" undertake to cross fifteen miles or less of dry waste land, but to Californians, some of whom have been there before, it is all very amusing and in some lights perfectly ridiculous. For the benefit of the anxious ones a few extracts are here given from the latest published articles on Death Valley. A reaction has evidently set in and it will be some months before the true facts are knowu. It may be some consolation, however, to hear what Mr. William B. Robertson says of the

* Willam Beckford.

region.* "Most of the articles about Death Valley which I have seen lately are gross exaggerations. There is a strange disposition among prospectors in that country to make Death Valley a more terrible place than it is and a terra incognita, and so make heroes of themselves In fact, every part of Death Valley has been thoroughly explored. Travel through it is dangerous in the summer, but in the fall, winter and spring it may be traveled as safely as any desert region. * * * The climate during part of the year is as pleasant as in San Francisco. During the fall, winter and spring it is about the climate of the San Joaquin Valley. The days are not hot and the nights are seldom extremely cold. I have known it to snow in winter and have seen ice an eighth of an inch thick formed during the night. * * * The weather is extremely hot between the middle of May and the middle of September. * * I have heard stories of prospectors perishing, but have no direct knowledge of any instances, though many have died on the Mojave desert."

Mr. C. W. Craig also writes† a cheerful account of Death Valley, and thanks are due him for lightening the load of care and misrepresentation under which the public have labored since the first news of the proposed exploration. He says: "To one who knows the locality of springs in the surrounding hills there is no difficulty in going from one to another, and there is no portion of Death Valley that cannot be safely crossed by a man on foot with an ordinary canteen of water. The greatest danger to be encountered in the desert waste is from dry bogs, appearing like ashes, but in reality composed of alkali, dry salt, soda and borax. In these a man or animal will sink as in quicksand; they lie in spots and may be readily avoided. The published tales of extreme and suffocating heat are largely without foundation in fact. In the winter water is plentiful, and the greatest drawback to a prospector is that he must charter an extra burro to carry blankets sufficient to keep him from freezing during the night." W. E. B.

Notes on Collections of Mammals made in Central and Southern Mexico by Dr. Audley C. Buller, with Descriptions of New Species of the Genera Vespertilio, Sciurus and Lepus. By J. A. ALLEN.

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* San Francisco Chronicle, January 25, 1891.

† San Francisco Chronicle, Jan. 23, 1891.

Bull. Am. Mus. Nat. Hist., iii, 1, 175–194. The new species described are *Vespertilio velifer*, *Sciurus cervicalis*, *Lepus sylvaticus aztecus*, *L. insolitus*, and *L. truei*. W. E. B.

Descriptions of a New Species and a New Subspecies of the Genus Lepus. By J. A. ALLEN. Bull. Am. Mus. Nat. Hist., iii, 1, 159, 160. *Lepus cinerascens* is described from one specimen from San Fernando, Los Angeles County, California, and *Lepus sylvaticus floridanus* from Florida. W. E. B.

List of Mammals Collected by Mr. Clark P. Streator in British Columbia, with Descriptions of Two New Subspecies of Sciurus. By J. A. ALLEN. Bull. Am. Mus. Nat. Hist., iii, 1, 161–168. An annotated list of 20 species (140 specimens), with descriptions of *Sciurus hudsonius vancouverensis* from Vancouver Island, and *S. h. californicus* from Placer County, California. W. E. B.

Notes on a Small Collection of West Indian Bats, with Description of an Apparently New Species. By J. A. ALLEN. Bull. Am. Mus. Nat. Hist., iii, 1, 169–173. One specimen *Artibeus coryi* from St. Andrew's Island. W. E. B.

Grevillea, December, 1890, contains, besides the usual number of new species, to which there seems no end, a continuation of British Thelephorei and of British Pyrenomycetes. Two new genera are proposed, one "Sclerodepsis" Cooke, for certain species of Trametes, in which the edge of the pileus and the dissepiments of the pores are acute; the other "Chainoderma" Mass. for an Australian species heretofore considered to belong to Secotium. By far the most interesting paper contained in the number is "Controverted Agarics," a paper read before the Woolhope Naturalists' Field Club, in which Mr. Cooke discusses certain points which have been raised concerning the validity of a goodly number of the species of Agaricini figured in his illustrations of British Fungi. With a frankness which does him the more credit, because it was somewhat unexpected, the author admits many of these errors, and even points out others, a proceeding which will make him many friends and go far to disarm his critics. The revision of the Handbook of British Fungi which has been for some time publishing as a supplement in Grevillea, has reached the end of the first volume, the index will follow soon. H. W. H.

PROCEEDINGS OF SOCIETIES.

CALIFORNIA ACADEMY OF SCIENCES. *January 5, 1891.* President Harkness in the chair.

The Report of the Board of Trustees was read by Charles F. Crocker. It summarized the acts of that body for the year, and stated that at this date $268,862.29 had been expended in the construction of the Society's new building.

The report of the treasurer was read by I. E. Thayer, and the report of the librarian by Carlos Troyer.

The director of the museum not being present his report was deferred till the next meeting.

Walter E. Bryant, Curator of Ornithology, read the report of his department.

Mrs. Eigenmann read the report of the Ichthyological department.

President Harkness read his annual report, giving a summary of the work carried on in the various branches of science, and congratulating the Society upon the fact that their building had reached such a degree of completeness as admitted of a meeting being held in their own hall.

The report of the election committee was read by Charles Stephens. 96 votes were cast, as follows:

President—H. W. Harkness,	87
1st Vice President—H. H. Behr,	90
2nd Vice President—George Hewston,	88
Corresponding Secretary—F. Gutzkow,	93
Recording Secretary—J. R. Scupham,	92
Treasurer—L. H. Foote,	90
Librarian—Carlos Troyer,	89
Director of Museum—J. G. Cooper,	87

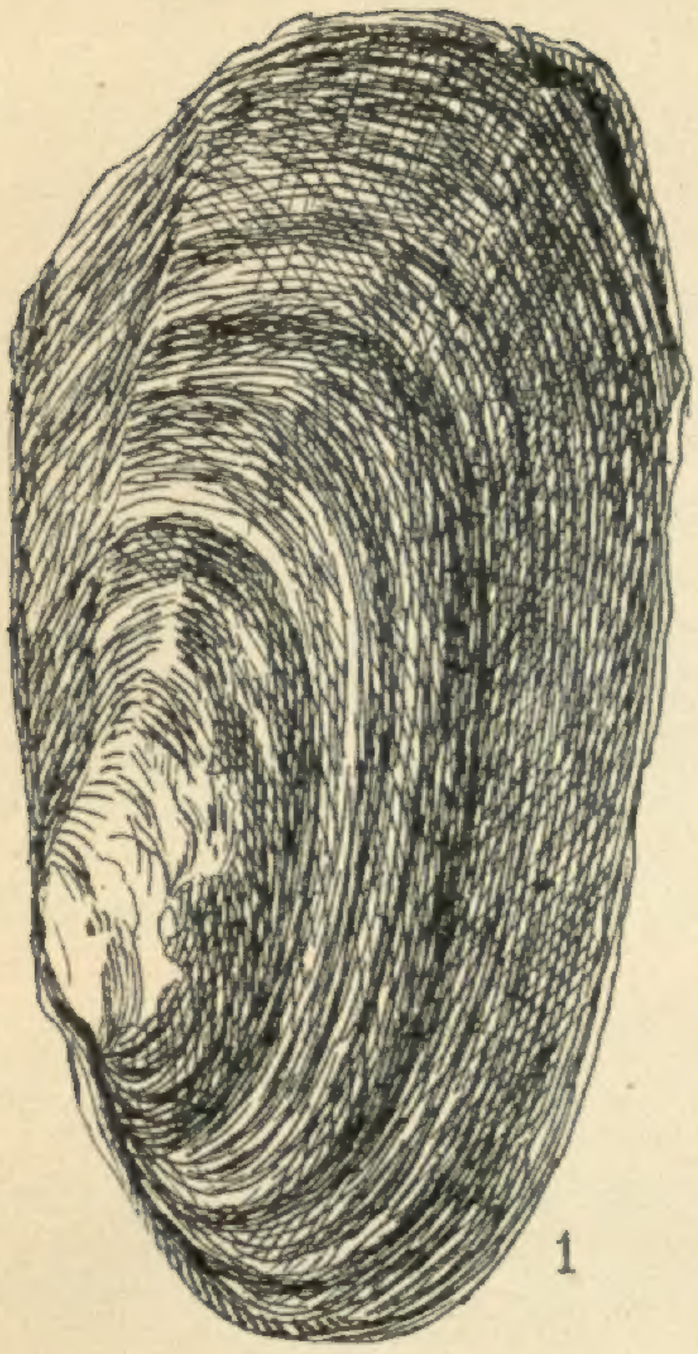
Trustees—

Charles F. Crocker,	93
D. E. Hayes,	95
W. C. Burnett,	94
George C. Perkins,	95
E. J. Molera,	95
Irving M. Scott,	95
John Taylor,	95

For the Amendment, 69.

Against the Amendment, 25.

The scattering vote, amounting to 19, was called for, and read by Mr. Stephens.



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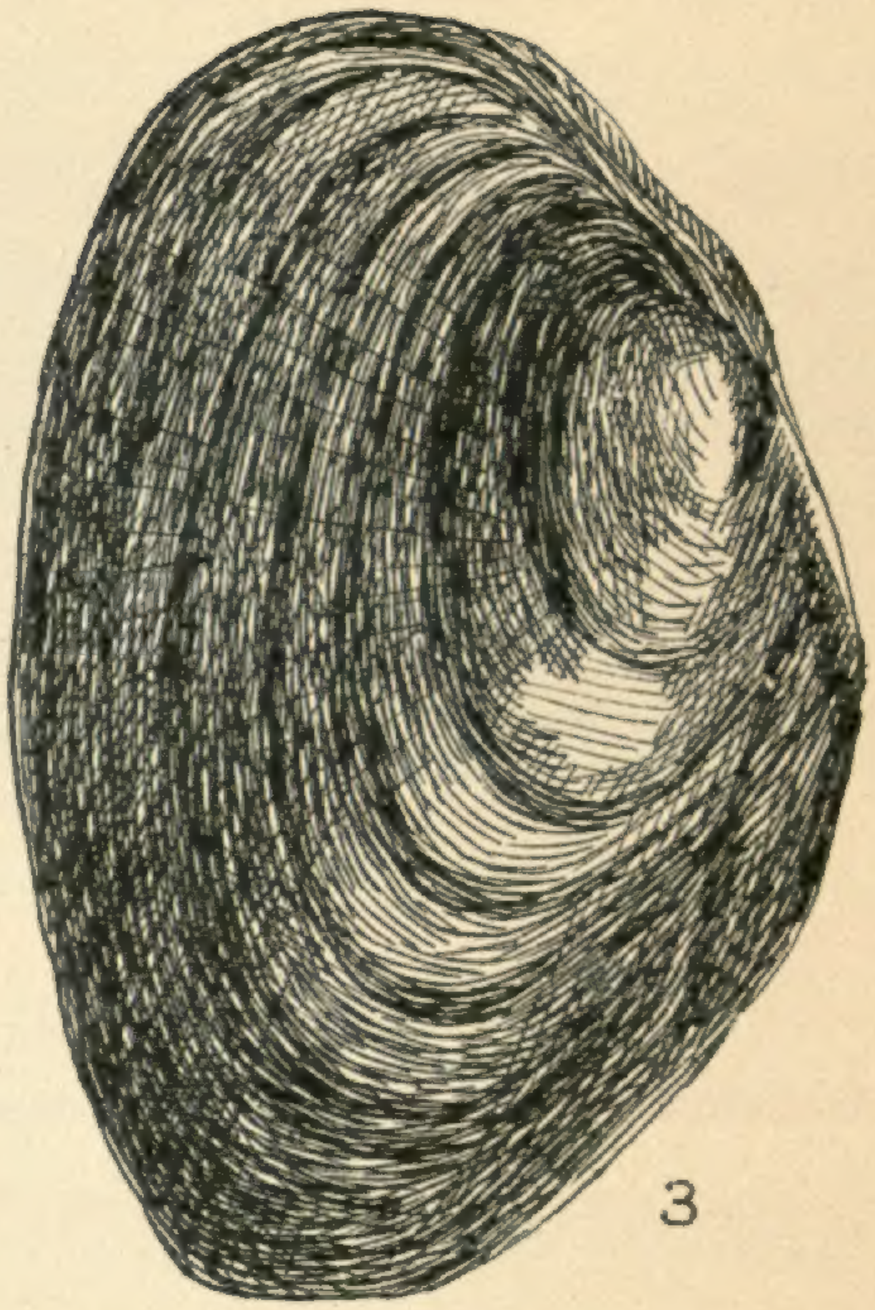

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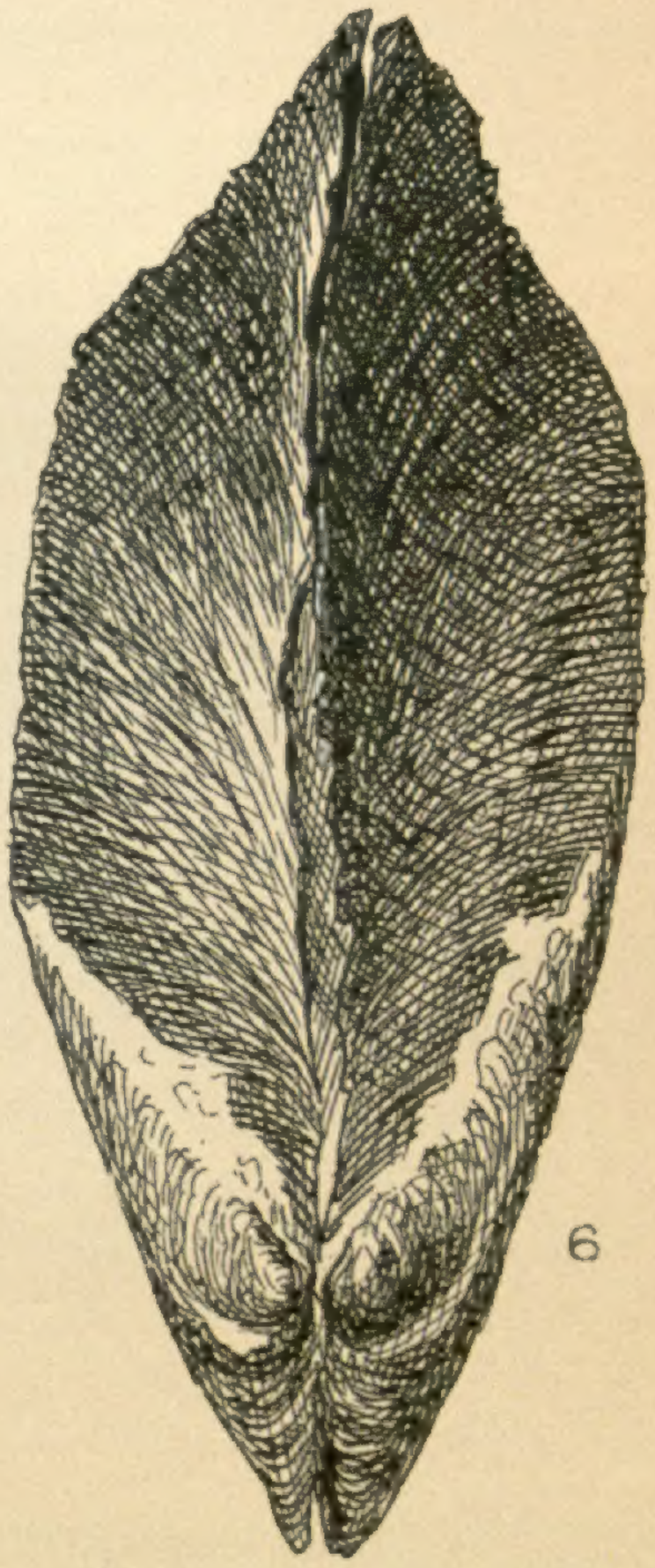

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