

NOTES ON THE GENUS SONORELLA, WITH DESCRIPTIONS OF NEW SPECIES

By PAUL BARTSCH

In the *Proceedings* of the Academy of Natural Sciences of Philadelphia for 1900 [1901], pp. 556-560, Dr. H. A. Pilsbry defined the genus *Sonorella* and referred to it the following species: *Epiphragmophora hachitana* Dall, *Helix (Arionta) magdalenensis* Stearns, *Helix (Arionta) coloradoënsis* Stearns, *Epiphragmophora arizonensis* Dall, *Helix rowelli* Newcomb, *Helix (Arionta) carpenteri* Newcomb variety *indioensis* Yates, *Helix lohrii* Gabb, and probably *Helix carpenteri* Newcomb.¹ Since then *Sonorella granulatissima* Pilsbry and *S. wolcottiana* Bartsch have been described.

The shells of the various species of *Sonorella* bear close resemblance to each other, with perhaps the exception of *S. dalli* n. sp. and *S. lohrii* Gabb. The ephebic portion of all is polished, marked by lines of growth and in some of the species by raised papillæ—never by incised spiral lines. A careful examination of the nuclear whorls shows variations along several lines, and these variations may be utilized in grouping the species. The first or nepionic stage is always small, embracing only a fraction of a turn; it appears to be similar in all the species, varying only slightly in extent and in the strength of the transverse wrinkles which constitute its sole sculpture. It is in the second or neanic stage that we find variations. These may be defined as follows:

I.—Group of *S. wolcottiana*

(PLATE XXVIII)

In this group there are many narrow, low, raised lines or wrinkles which coincide with the lines of growth; and in addition to these there are numerous prominent, distinct, elongate-oval papillæ, the long axis of which is at a right angle to the lines of growth. These papillæ are so arranged that alternate series fall in the same spiral line, i. e., the papillæ of each succeeding series point toward the middle of the space between the papillæ of the series preceding, the complete effect being interrupted papillose lines which extend from the summit of the whorls obliquely forward and downward toward the suture.

¹ *Epiphragmophora carpenteri* Newcomb is not a *Sonorella*; incised spiral lines are never present in this genus.

II.—Group of *S. hachitana*

(PLATE XXIX)

This group is characterized by having the neanic portion marked by wrinkled growth-lines, over which pass many slender, more or less continuous, irregular, wavy threads which extend from the summit of the whorls obliquely downward and forward to the suture; in addition to these a second set of raised lines, somewhat less strong and distinct, and equally irregular, pass in an opposite direction, i. e., obliquely downward and backward from the summit to the suture. These two sets of lines frequently meet, forming acute angles at their junction. The general effect might be termed subareolate.

III.—Group of *S. magdalenensis*

In this group the neanic portion is found to be marked by one set of fine, distinct, raised lines which extend from the summit of the whorls in a very oblique curve downward and backward to the periphery; while another set of the same character extends in a very oblique curve upward and backward to the periphery, where they meet the first set, forming acute angles. These raised lines are quite regularly spaced, and the spaces between them appear minutely pitted.

IV.—Group of *S. fisheri*

(PLATE XXX)

In this group the transverse wrinkles or lines of growth are stronger than in the preceding groups. No raised lines are present; only here and there do we find traces of a few distant, irregularly scattered, low, oval, raised papillæ, the long axis of which is at right angles to the lines of growth.

GROUP OF *S. wolcottiana***SONORELLA WOLCOTTIANA** Bartsch

(PLATE XXXI, FIGURE 4)

Sonorella wolcottiana BARTSCH, Proc. Biol. Soc. Washington, vol. XVI, pp. 103-104, 1903. (Typographical error.)

Sonorella wolcottiana BARTSCH, Proc. Biol. Soc. Washington, vol. XVII, p. 101, 1904.

S. wolcottiana B. is the largest member of this group. The type (No. 170,007, U. S. Nat. Museum) measures: maj. lat. 23.5 mm., min. lat. 18.5 mm., alt. 15.5 mm.; aperture: maj. lat. 14 mm., alt. 12.7 mm. The fact that the broadly expanded and decidedly reflected columella almost conceals the umbilicus will readily differentiate it

from the next two species, which are rather openly umbilicated. The type locality is Palm Springs, Riverside county, California; other localities are Palm valley and vicinity, Colorado desert, San Diego county, California.

SONORELLA INDIOENSIS (Yates)

(PLATE XXXIII, FIGURE 1)

Helix (Arionta) carpenteri NEWC. var. *indioensis* YATES, Nautilus, vol. IV, p. 63, 1890.

Arionta var. *indioensis* DALL, Proc. U. S. Nat. Museum, vol. XIX, p. 337, 1896.

Epiphragmophora indioensis PILSBRY, Man. Conch., vol. IX, p. 199, 1894.

Epiphragmophora indioensis PILSBRY AND JOHNSON, Nautilus, vol. XI, p. 59, 1897.

Sonorella indioensis PILSBRY, Proc. Acad. Nat. Sci. Phil'a for 1900, p. 506, 1901.

The type is said to measure: maj. lat. 18 mm., alt. 12 mm.; it comes from Indio, Riverside county, California. *S. indioensis* is larger but more depressed than the next species. A specimen, here figured, in the U. S. National Museum collection (No. 108,530), from the type locality, measures: maj. lat. 17.8 mm., min. lat. 14.3 mm., alt. 10.5 mm.; aperture: maj. lat. 9.9 mm., alt. 8.5 mm.; umbilicus about 1.8 mm.

SONORELLA COLORADOËNSIS (Stearns)

(PLATE XXXII, FIGURE 3)

Helix (Arionta) coloradoënsis STEARNS, Proc. U. S. Nat. Museum, vol. XIII, p. 226, pl. xv, figs. 6, 8, 12, [not 7], 1890.

Helix coloradoënsis PILSBRY, Man. Conch., vol. VIII, p. 225, pl. 56, figs. 1, 2, 3, 1893.

Epiphragmophora coloradoensis PILSBRY, Man. Conch., vol. IX, p. 199, 1894.

Epiphragmophora (Arionta) coloradoensis DALL, Proc. U. S. Nat. Museum, vol. XIX, pp. 340-341, 1896.

Epiphragmophora coloradoensis PILSBRY AND JOHNSON, Nautilus, vol. XI, p. 59, 1897.

Sonorella coloradoensis PILSBRY, Proc. Acad. Nat. Sci. Phil'a for 1900, p. 560, 1901.

Sonorella coloradoënsis Stearns is the smallest member of this group. The type (No. 104,100 U. S. Nat. Museum) measures: maj. lat. 16.4 mm., min. lat. 13.8 mm., alt. 10 mm.; aperture: maj. lat. 8.5 mm., alt. 8.2 mm., umbilicus about 1.8 mm. The shell of this species is more elevated than in *S. indioensis* Yates, and the aperture is more circular in outline. The type locality is Grand Cañon of the Colorado, opposite the Kaibab plateau, altitude 3,500 ft. Pilsbry and Johnson (loc. cit.) also cite this species from Inyo and San Diego

counties, California, but the specimens from these two localities should be reëxamined as it seems probable that the one from Inyo county may belong to *S. baileyi* B. or *S. fisheri* B., while those from San Diego county may belong to *S. indioensis* Yates.

GROUP OF *S. hachitana*

SONORELLA ASHMUNI new species

(PLATE XXXI, FIGURE 5)

Shell like *S. hachitana* Dall, but larger in every way. General coloration light isabelline above and whitish below; a broad chestnut band, bordered on each side by a light zone, encircles the whorls somewhat above the periphery and may be seen above the suture on all the ephebic whorls; the band gradually diminishes in breadth from the aperture toward the apex. The nepionic stage embraces the first half turn, is somewhat flattened, and slopes outward; it is marked by a few transverse wrinkles and passes without distinct separation into the neanic stage, which is described in the definition of the group. The neanic portion consists of one and one-quarter turns; its termination is marked by several strong, transverse wrinkles. The ephebic stage consists of three and one-eighth moderately rounded, polished whorls which are marked by numerous lines of growth and here and there by a few obsolete, very distantly and irregularly scattered, rounded papillæ. Last whorl considerably deflected at the aperture, which is large and oblique and has the outer edge expanded and somewhat reflected; columella broadly expanded at base, reflected only slightly over the umbilicus, which is moderately large and open to the very apex; parietal wall covered by a thin callus. The type (No. 151,450, U. S. Nat. Museum) was presented by the Rev. E. H. Ashmun, after whom the species is named. It was collected at Richinbar, south of Prescott, Arizona, at an altitude of 3,500 ft. It measures: maj. lat. 28.2 mm., min. lat. 23.2 mm., alt. 16.9 mm.; aperture: maj. lat. 15.2 mm., alt. 13 mm.; width of umbilicus, about 4 mm.

Another lot (No. 152,125, U. S. Nat. Museum), collected at Jerome, Arizona, was received from the same gentleman.

SONORELLA HACHITANA Dall

(PLATE XXXI, FIGURE 2)

Epiphragmophora hachitana (in part) DALL, Proc. U. S. Nat. Mus., vol. XVIII, p. 2, 1895.

Epiphragmophora hachitana (in part) DALL, Proc. U. S. Nat. Mus., vol. XIX, pp. 338-339 [not pl. xxxi, figs. 7, 10, which is *S. dalli* Bartsch].

Epiphragmophora hachitana (in part) PILSBRY AND JOHNSON, Nautilus, vol. XI, p. 59, 1897.

Sonorella hachitana PILSBRY, Proc. Acad. Nat. Sci. Phil'a for 1900, pp. 556-560, 1901.

The type (No. 130,004, U. S. Nat. Museum) and many other specimens were collected by Major Edgar A. Mearns, U. S. A., in the Hachita Grande mountains, southwestern Grant county, New Mexico, at an altitude of 8,271 ft. The type measures: maj. lat. 23.7 mm., min. lat. 19.5 mm., alt. 13.4 mm.; aperture: maj. lat. 12.1 mm., alt. 10 mm.; umbilicus about 4 mm.

Additional localities represented by specimens in the U. S. Nat. Museum are: (No. 130,005) On top of two peaks near Carrizollilo Springs, at the Mexican boundary, Grant county, New Mexico. (No. 126,596) Doubtful cañon, Peloncillo mountains, southwestern Grant county, New Mexico. (No. 151,445) Chiricalhua mountains, northwestern Cochise county, Arizona; altitude 3,500 ft. (No. 105,385) Santa Rita mountains, Pima county, Arizona. (No. 130,006) Black mountains, right bank of San Bernardino river, 12 miles south of boundary monument 77, northern Mexico.

SONORELLA NELSONI new species

(PLATE XXXI, FIGURE 3)

Shell similar to *S. hachitana* Dall, but larger and more depressed, with the aperture larger and more circular in outline. General coloration (our specimens appear to be bleached) flesh color, with a moderately broad light-chestnut band bordered by a lighter zone on each side, encircling the whorls a little above the periphery, showing as a narrow band above the sutures. The nepionic stage consists of about one-half of a turn and is rather strongly and closely transversely wrinkled. The neanic stage embraces about one and one-half volutions and is typically sculptured, the lines of growth appearing a little stronger and more undulated than in *S. hachitana*. The ephelic stage consists of two and one-half moderately rounded whorls, the last of which is deflected somewhat below the rounded periphery at the aperture. Base of the whorls more convex than the portion between the sutures. The entire surface of the ephelic stage is marked by many incremental lines and a few rather narrow, elongate, irregularly spaced, low subobsolete papillæ which are better defined on the early portion than the last where they appear to be entirely absent. Aperture large, subcircular, with the lip expanded but not reflected; columella moderately expanded at base and slightly reflected, but not obscuring the umbilicus, which appears open to the

apex. The type and several additional specimens (No. 174,934, U. S. Nat. Museum) were collected by Messrs. Nelson and Goldman in the mountains near Lake Santa Maria, Chihuahua, Mexico. The type measures: maj. lat. 25.5 mm., min. lat. 20.3 mm., alt. 13.4 mm.; aperture: maj. lat. 12.8 mm., alt. 11.1 mm.; umbilicus about 4 mm.

Sonorella nelsoni resembles *S. hachitana* in general shape, but is more depressed and has a much larger aperture, in which latter respect it approaches *S. ashmuni*.

SONORELLA GOLDMANI new species

(PLATE XXXII, FIGURE 6)

Shell decidedly elevated, with the last whorl very much deflected. General coloration: light isabelline above, white below, with a moderately broad, light-chestnut band, bordered by a lighter zone on each side, encircling the whorls a little above the periphery. This band is completely exposed above the suture on all the ephebic whorls. The nepionic stage is extremely small, embracing less than one-fourth of a turn, and it appears almost smooth. The neanic stage consists of one and one-half volutions bearing the characteristic sculpture of the group, but very feebly developed. The ephebic stage embraces three and three-fourths well rounded whorls, the summit of each of which falls a little below the dark band. This is particularly true of the last two and one-half volutions where the light-colored zone below the dark band is exposed. The periphery and the base are well rounded; the latter is of about the same convexity as the space between the sutures. The entire ephebic portion is marked by incremental lines only. The whole last whorl is deflected, but more rapidly at the aperture, which is small, expanded, and slightly reflected; columella expanded at base and reflected, its margin scarcely encroaching upon the umbilicus; parietal wall covered by a rather strong callus; umbilicus open to the summit. The type (No. 174-933, U. S. Nat. Museum) and another specimen were collected by Messrs. Nelson and Goldman in the mountains near Lake Santa Maria, Chihuahua, northern Mexico. The type measures: maj. lat. 22.5 mm., min. lat. 19.4 mm., alt. 14.9 mm.; aperture: maj. lat. 11 mm., alt. 9.4 mm.; umbilicus about 3 mm.

Sonorella goldmani differs from all the other species in its proportionately greater elevation and its much deflected last whorl.

SONORELLA MERRILLI new species

(PLATE XXXII, FIGURE 5)

Epiphragmophora hachitana (in part) DALL, Proc. U. S. Nat. Museum, vol. XIX, p. 340, 1896.

Epiphragmophora hachitana (in part) PILSBRY AND JOHNSON, Nautilus, vol. XI, p. 59, 1897.

Shell resembling *S. arizonensis* in shape, but larger, with proportionately smaller aperture. General coloration: pale flesh color; a narrow pale-chestnut band encircles the whorls a little above the periphery, but is visible above the suture only in the last one and one-half turns. The nepionic stage embraces about half a volution, is somewhat flattened, slopes outward, and is marked by rather coarse, wavy, transverse wrinkles; there is no abrupt demarcation between this stage and the neanic. The neanic portion consists of one and a fourth turns and is marked by rather strong incremental lines upon which is placed the rather feebly developed sculpture characteristic of the section. The ephelic portion consists of three and one-half moderately rounded volutions which are marked by numerous incremental lines and by very dense, exceedingly minute granulations, both on the upper and the lower surface. The last whorl is decidedly deflected at the aperture, which is of medium size, subcircular, only slightly expanded, and not reflected. Columella moderately broad and expanded at base, not reflected over the rather wide umbilicus, which appears open to the apex. The type (No. 125,260, U. S. Nat. Museum) was collected by Dr. G. P. Merrill below San Quentin, Lower California. It measures: maj. lat. 22 mm., min. lat. 18 mm., alt. 12.5 mm.; aperture: maj. lat. 10.5 mm., alt. 9.5 mm.; umbilicus about 1 mm.

SONORELLA GRANULATISSIMA Pilsbry

(PLATE XXXII, FIGURE 4)

Sonorella granulatissima PILSBRY, Nautilus, vol. XVI, p. 32, 1902.

Sonorella granulatissima Pilsbry resembles *S. hachitana* in form but is smaller in every way, with a decidedly smaller umbilicus, and densely, evenly granulose. The type locality is Huachuca mountains, Arizona. The measurements given by Dr. Pilsbry are: alt. 10 mm., diam. 19 mm.; oblique alt.: aperture 9.7 mm., width 11 mm. Another specimen is said to measure: alt. 9.8 mm., diam. 18 mm.; oblique alt.: aperture 8.5 mm., width 9.8 mm.

The U. S. National Museum has two lots (Nos. 130,007, alt. 9,382 ft., and 130,008) from Huachuca mountains, and one (No. 124,479 a) from Tucson, Arizona.

SONORELLA DALLI new species

(PLATE XXXI, FIGURE 1)

Epiphragmophora hachitana (in part) DALL, Proc. U. S. Nat. Museum, vol. XVIII, p. 2, 1895.

Epiphragmophora hachitana (in part) DALL, Proc. U. S. Nat. Museum, vol. XIX, pp. 339-340, pl. xxxi, figs. 7, 10, 1896.

Epiphragmophora hachitana (in part) PILSBRY AND JOHNSON, Nautilus, vol. XI, p. 59, 1897.

Shell large, depressed, light-brown horn color above, lighter below, with a broad brown band bordered on each side by a lighter zone encircling the whorls a little above the periphery. This band can be seen on all the ephebic whorls above the suture. Nepionic portion a little less than half a whorl, somewhat flattened and outward-sloping, marked by a few moderately strong transverse wrinkles. The neanic stage embraces one and one-half turns; the incremental lines are moderately well marked, very wavy, and closely placed; the characteristic supersculpture of this part is extremely fine, with the lines placed so closely that the complete effect at first appears granular. The ephebic stage consists of three depressed, moderately rounded whorls, which are less convex above than below and are marked by many strong incremental lines and numerous microscopic granulations. The last whorl is considerably deflected at the aperture and shows a tendency to become angular at the periphery. The aperture is moderately large, subcircular, very oblique, expanded, and slightly reflected; columella moderately expanded at base and scarcely reflected over the rather large umbilicus, which appears open to the summit. The type (No. 130,009, U. S. Nat. Museum) and five additional specimens were collected by Maj. E. A. Mearns, U. S. A., at Tamers cañon, Huachuca mountains, Arizona. The type measures: maj. lat. 26.5 mm., min. lat. 21.1 mm., alt. 12 mm.; aperture: maj. lat. 11.8 mm., alt. 10.5 mm.; umbilicus about 4 mm. Two additional lots (Nos. 129,136, 125,598) come from the same mountains, the latter from Fort Huachuca.

SONORELLA MEARNSI new species

(PLATE XXXII, FIGURE 2)

Epiphragmophora magdalenensis (in part) DALL, Proc. U. S. Nat. Museum, vol. XIX, p. 339, 1897.

Shell similar to *S. dalli* in shape and coloring, but only two-thirds as large. The nepionic stage consists of about one-half of a volution, is moderately rounded, and is crossed by a few prominent transverse wrinkles. The neanic stage embraces one and one-fourth turns, and is marked by irregular, fairly strong incremental lines and the characteristic sculpture of the section, which is extremely fine and closely placed as in *S. dalli*. Ephebic whorls two and one-third rather depressed, moderately rounded, considerably more convex be-

low than above, with the periphery of the last whorl somewhat subangulate. The entire surface of this portion is marked by quite prominent incremental lines and numerous very fine and closely placed granulations. The last whorl is considerably deflected at the aperture, which is very oblique, suboval, and but slightly expanded. Columella rather broad, expanded at base and partly reflected over the rather narrow umbilicus. The type (No. 130,003, U. S. Nat. Museum) and three additional specimens were collected by Major E. A. Mearns, U. S. A., in the San José mountains, Sonora, Mexico, about four miles south of the Arizona boundary and a few miles east of San Pedro river. The type measures: maj. lat. 16 mm., min. lat. 13 mm., alt. 8 mm.; aperture: maj. lat. 8.4 mm., alt. 7.3 mm.; umbilicus about 2 mm.

SONORELLA BAILEYI new species

(PLATE XXXIII, FIGURE 4)

Epiphragmophora magdalencensis (in part) DALL, Proc. U. S. Nat. Museum, vol. XIX, p. 339.

Epiphragmophora magdalencensis (in part) PILSERY AND JOHNSON, Nautilus, vol. XI, p. 59, 1897.

This is the smallest member of the group, approaching *S. fisheri* in size. Shell rather depressed; general coloration light flesh color with a moderately broad pale brown band encircling the whorls a little above the periphery. This band is only partly visible above the suture, above the last volution. The nepionic stage is rather small, embracing only about one-fourth of a turn; it is sparingly marked with transverse wrinkles. The neanic portion consists of one and one-half volutions, which are ornamented by incremental lines upon which are placed the characteristic sculpture of the section, the lines seeming to consist of fused attenuated papillæ. This species therefore shows a tendency toward the group of *S. wolcottiana*. Ephebic whorls a little more than three, moderately rounded, less so between the sutures than on the base, marked by many incremental lines, and somewhat distant regularly disposed rows of small oval papillæ which have an arrangement similar to that found on the neanic portion of the *S. wolcottiana* group, i. e., alternate series fall in the same spiral plane and this lends the whorl the appearance of being crossed by interrupted curved lines of papillæ passing from the summit of the whorls very obliquely forward and downward to the suture. These papillæ are best developed between the sutures on the early whorls; they appear to become gradually lost on the last half of the last whorl. The last whorl is moderately de-

flected at the aperture, which is of medium size, very oblique, almost circular and scarcely expanded. Columella only slightly expanded at base; parietal wall covered by a thin callus; umbilicus moderately wide and open to the apex. The type (No. 123,907, U. S. Nat. Museum) was collected by Mr. Vernon Bailey on the Death Valley expedition at Resting springs, Inyo county, California, among rocks on a dry hill 900 ft. above the spring. The type measures: maj. lat. 15.1 mm., min. lat. 13.2 mm., alt. 7.5 mm.; aperture: maj. lat. 6.6 mm., alt. 7.2 mm.; umbilicus about 2 mm.

SONORELLA BAILEYI ORCUTTI new subspecies

(PLATE XXXIII, FIGURE 5)

A lot of specimens collected by Mr. Orcutt in the Colorado desert agree in nuclear character and in many other respects with *S. baileyi*, but differ in the deflection of the aperture which is greater, and in its shape which is more oval; the umbilicus is also larger. This variety may be called *Sonorella baileyi orcutti*. The type (No. 175,082, U. S. Nat. Museum) measures: maj. lat. 16 mm., min. lat. 13.7 mm., alt. 9.1 mm.; aperture: maj. lat. 7 mm.; alt. 6.8 mm.; umbilicus about 3.5 mm.

GROUP OF *S. magdalenensis*

SONORELLA MAGDALENENSIS Stearns

(PLATE XXXIII, FIGURE 2)

- Helix (Arionta) magdalenensis* STEARNS. Proc. U. S. Nat. Mus., vol. XIII, pp. 207-208, pl. xv, figs. 7, 11, 13 [not 12, which is *S. coloradoensis* Stearns].
- Helix magdalenensis* PILSBRY, Man. Conch., vol. VIII, pp. 226-227, pl. lvi, figs. 4, 5, 6, 1893.
- Epiphragmophora magdalenensis* PILSBRY, Man. Conch., vol. IX, p. 199, 1894.
- Epiphragmophora magdalenensis* (in part) DALL, Proc. U. S. Nat. Mus., vol. XIX, p. 339, 1896.
- Epiphragmophora magdalenensis* (in part) PILSBRY AND JOHNSON, Nautilus, vol. XI, p. 59, 1897.
- Helix magdalenensis* E. V. MARTENS, Biol. Cent. Am., pp. 144, 624, 1901.
- Sonorella magdalenensis* PILSBRY, Proc. Acad. Nat. Sci. Phil'a, p. 560, 1901.

This species is the sole representative of this group in our collection, and the type and type lot are the only true *S. magdalenensis*, all the other forms referred here belonging to different species. The type was collected in the mountains above the town of Magdalena, Sonora, Mexico, at an altitude of 1,000 ft. It measures: maj. lat. 12.3 mm., min. lat. 10.2 mm., alt. 6.5 mm.; aperture: maj. lat. 6 mm., alt. 5.5 mm.; umbilicus about 1.8 mm.

GROUP OF *S. fisheri***SONORELLA FISHERI** new species

(PLATE XXXIII, FIGURE 3)

Epiphragmophora magdalenensis (in part) DALI, Proc. U. S. Nat. Mus., vol. XIX, p. 339, 1896.*Epiphragmophora magdalenensis* (in part) PILSBRY AND JOHNSON, Nautilus, p. 59, 1897.

Shell small, depressed, horn-colored, with a moderately broad chestnut band edged by a scarcely perceptible lighter zone encircling the whorls a little above the periphery. This band is covered by the succeeding turns in all but the last one and one-half volutions. The nepionic stage embraces about one-half of a whorl, is rather depressed, and quite strongly transversely wrinkled. The neanic stage consists of one and one-third turns, which have been described in the definition of the section. Ephebic whorls two and one-half, depressed, moderately well rounded, a little more convex below than above, marked by many strong, wavy, and wrinkled incremental lines and numerous almost round, raised papillæ which form oblique, curved, interrupted lines extending from the summit of the whorls forward and downward, and are equally strong between the sutures on the periphery and the base; in the umbilicus, however, they are much heavier, assuming a warty appearance. The last whorl is gradually but considerably deflected at the aperture. Aperture moderately large, rounded oval, very oblique, scarcely at all expanded. Columella slightly expanded at base and but slightly reflected over the umbilicus. The type (No. 123,579, U. S. Nat. Museum) and type lot and another lot (No. 123,578) were collected by Dr. A. K. Fisher and E. W. Nelson on the Death Valley expedition at Johnson cañon, Panamint valley, California, at an altitude of 6,000 ft. The type measures: maj. lat. 15.5 mm., min. lat. 13 mm., alt. 8 mm.; aperture: maj. lat. 7 mm., alt. 6.5 mm.; umbilicus about 1.8 mm.

SONORELLA LOHRII (Gabb)

(PLATE XXXII, FIGURE 1)

Helix lohrii GABB, Am. Journ. Conch., vol. III, p. 336, pl. xvi, fig. 2, 1867.*Helix lohrii* COOPER, Am. Journ. Conch., vol. IV, p. 235, 1868.*Helix rozeelli* (in part) G. W. BINNEY AND T. BLAND, Land and Fresh-water Shells Am., pt. 1, pp. 185-186, 1869.*Helix lohrii* (in part) PILSBRY, Man. Conch., vol. IV, p. 172, pl. 15 [fig. 13], 1888.*Helix lohrii* PILSBRY, Man. Conch., vol. VIII, pp. 226-227, 1893.*Epiphragmophora lohrii* PILSBRY, Man. Conch., vol. IX, p. 199, 1894.*Helix lohrii* FISCHER AND CROSSE, Miss. Scient. Mex., vol. II, p. 152, 1900.

Sonorella lohri PILSBRY, Proc. Acad. Nat. Sci. Phil'a, 1900, p. 560, 1901.

Sonorella lohri PILSBRY, Nautilus, vol. XVI, p. 32, 1902.

Our specimens of this species are either bleached or badly worn; a single individual only is fairly perfect, the neanic whorls of which indicate that it probably belongs to this group. The very strongly expanded and reflected aperture forms a quite strong peristome which readily distinguishes this species from all the other *Sonorellas*. All our specimens are from Lower California. One measures: maj. lat. 21.4 mm., min. lat. 16.4 mm., alt. 8.8 mm.; aperture: maj. lat. 11.6 mm., alt. 10.6 mm.; umbilicus about 4.4 mm.

SONORELLA LOHRII LIODERMA Pilsbry

Sonorella lohrii lioderma Pilsbry, Nautilus, vol. XVIII, p. 59, 1904.

The shell is similar to *lohrii*, but the last whorl is a little more convex and evenly rounded, and the last two whorls are glossy, with no granulation, being marked with faint growth-striae only. The spire is sometimes a little more elevated than the type of *S. lohrii*.

Near Moleje, Lower California, cotypes No. 58,107 and No. 88,367, A. N. S. P., the latter from Lower California without special locality.

The type specimen of *S. lohrii* Gabb is finely granulated throughout.

[The above description came to hand while this paper was going through press.]

SEDIS INCERTÆ

SONORELLA ARIZONENSIS (Dall)

(PLATE XXXIII, FIGURE 6)

Epiphragmophora arizonensis DALL, Proc. U. S. Nat. Mus., vol. XVIII, pp. 1-2, 1895.

Epiphragmophora arizonensis DALL, Proc. U. S. Nat. Mus., vol. XIX, pp. 337-339, pl. xxxi, figs. 11, 12, 1896.

Epiphragmophora arizonensis PILSBRY AND JOHNSON, Nautilus, vol. XI, p. 59, 1897.

Sonorella arizonensis PILSBRY, Proc. Acad. Nat. Sci. Phil'a, 1900, p. 560, 1901.

The type of *Sonorella arizonensis* Dall was collected by Major E. A. Mearns, U. S. A., at Santa Cruz river, Tucson, Arizona. It measures: maj. lat. 17.2 mm., min. lat. 14.1 mm., alt. 11.3 mm.; aperture: maj. lat. 9.5 mm., alt. 8.6 mm.; umbilicus about 1.7 mm. The nuclear whorls of the type and only specimen (No. 130,002, U. S. Nat. Museum) are too much worn to enable a determination of the proper systematic position of this species in the genus.

SONORELLA ROWELLI (Newcomb)

- Helix rowelli* NEWCOMB, Am. Journ. Conch., vol. 1, p. 346, 1865. (Nomen nudum.)
- Helix rowelli* NEWCOMB, Proc. Acad. Nat. Sci. Cala., vol. III, p. 181, 1866.
- Aglaja rowellii* TRYON, Am. Journ. Conch., vol. II, p. 316, 1866.
- Helix rowelli* COOPER, Proc. Acad. Nat. Sci. Cala., vol. III, p. 337, 1867.
- Helix rowelli* W. G. BINNEY AND T. BLAND, Land and Fresh-water Shells Am., pt. 1, p. 185, fig. 326, 1869.
- Helix rowelli* FISCHER AND CROSSE, Miss. Scient. Mex., vol. 1, pp. 252-253, 1870.
- Helix rowelli* PILSBRY, Man. Conch., vol. IV, p. 72, pl. 15 [fig. 12], 1888.
- Helix rowelli* STEARNS, Proc. U. S. Nat. Mus., vol. XVIII, p. 207, 1890.
- Helix rowelli* E. VON MARTENS, Biol. Cent. Am., p. 144, 1901.
- Helix rowelli* PILSBRY, Man. Conch., vol. VIII, p. 226, 1893.
- Epiphragmophora rowelli* PILSBRY, Man. Conch., vol. IX, p. 199, 1894.
- Helix rowelli* DALL, Proc. U. S. Nat. Mus., vol. XIX, pp. 338-339, 1896.
- Epiphragmophora rowelli* PILSBRY AND JOHNSON, Nautilus, vol. XI, p. 59, 1897.
- Helix rowelli* FISCHER AND CROSSE, Miss. Scient. Mex., vol. II, p. 679, 1900.
- Sonorella rowelli* PILSBRY, Proc. Acad. Nat. Sci. Phil'a, 1900, p. 565 (1901).
- Sonorella rowelli* PILSBRY, Nautilus, vol. XVI, p. 23, 1902.

Sonorella rowelli is said to have been collected by Frick in Arizona. Dr. Dall (loc. cit.) gives the measurements of one of the specimens from the type lot as: maj. lat. 19 mm., min. lat. 14.5 mm., height 9 mm.

EXPLANATION OF PLATES

(The illustrations accompanying this paper are after photographs made from the specimens by Mr. T. W. Smillie, Chief Photographer, U. S. National Museum.)

PLATE XXVIII

Nuclear whorls of *Sonorella wolcottiana* Bartsch, enlarged about 21 diameters.

PLATE XXIX

Nuclear whorls of *Sonorella hachitana* Dall, enlarged about 21 diameters.

PLATE XXX

Nuclear whorls of *Sonorella fisheri* Bartsch, enlarged about 21 diameters.

PLATE XXXI

(Three views are given of each species—dorsal, profile, and ventral. The figures are natural size and the major latitude of the specimen figured follows the reference in each case.)

1. *Sonorella dalli* Bartsch; Type; 26.5 mm.; p. 193.
2. *Sonorella hachitana* Dall; Type; 23.7 mm.; p. 190.
3. *Sonorella nelsoni* Bartsch; Type; 25.5 mm.; p. 191.

4. *Sonorella wolcottiana* Bartsch; Type; 23.5 mm.; p. 188.
5. *Sonorella ashmuni* Bartsch; Type; 28.2 mm.; p. 190.

PLATE XXXII

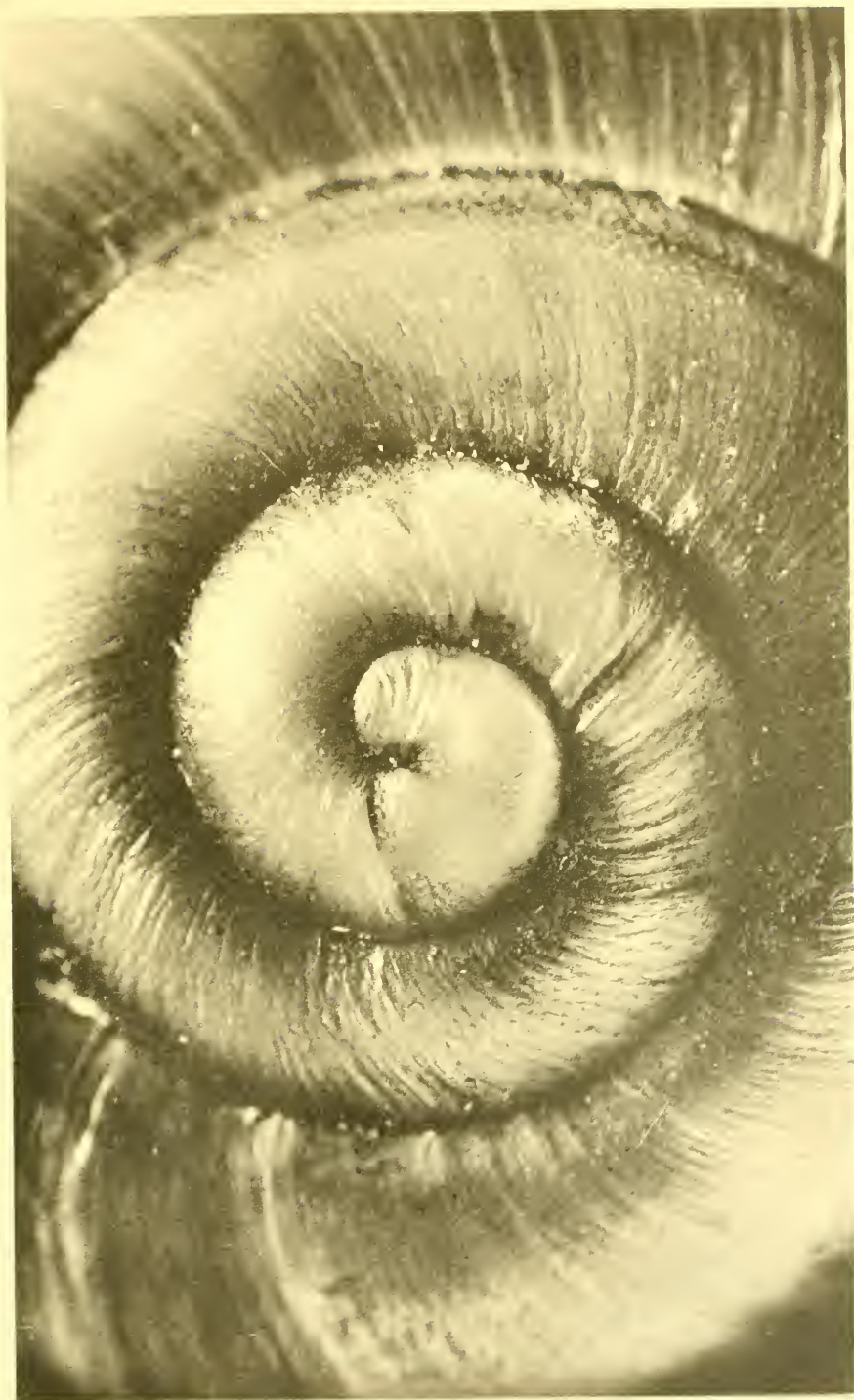
1. *Sonorella lohrii* Gabb; 21.4 mm.; p. 197.
2. *Sonorella mearnsi* Bartsch; Type; 16 mm.; p. 194.
3. *Sonorella coloradoensis* Stearns; Type; 16.4 mm.; p. 189.
4. *Sonorella granulatissima* Pilsbry; 19.7 mm.; p. 193.
5. *Sonorella merrilli* Bartsch; Type; 22 mm.; p. 192.
6. *Sonorella goldmani* Bartsch; Type; 22.5 mm.; p. 192.

PLATE XXXIII

1. *Sonorella indioensis* (Yates); 17.8 mm.; p. 189.
2. *Sonorella magdalenensis* Stearns; Type; 12.3 mm.; p. 196.
3. *Sonorella fisheri* Bartsch; Type; 15.5 mm.; p. 197.
4. *Sonorella baileyi* Bartsch; Type; 15.1 mm.; p. 195.
5. *Sonorella baileyi orcutti* Bartsch; Type; 16 mm.; p. 196.
6. *Sonorella arizonensis* Dall; Type; 17.2 mm.; p. 198.



SCNORELLA WALDOTTIANA BARTECH: NUCLEAR WHORL, MUCH ENLARGED



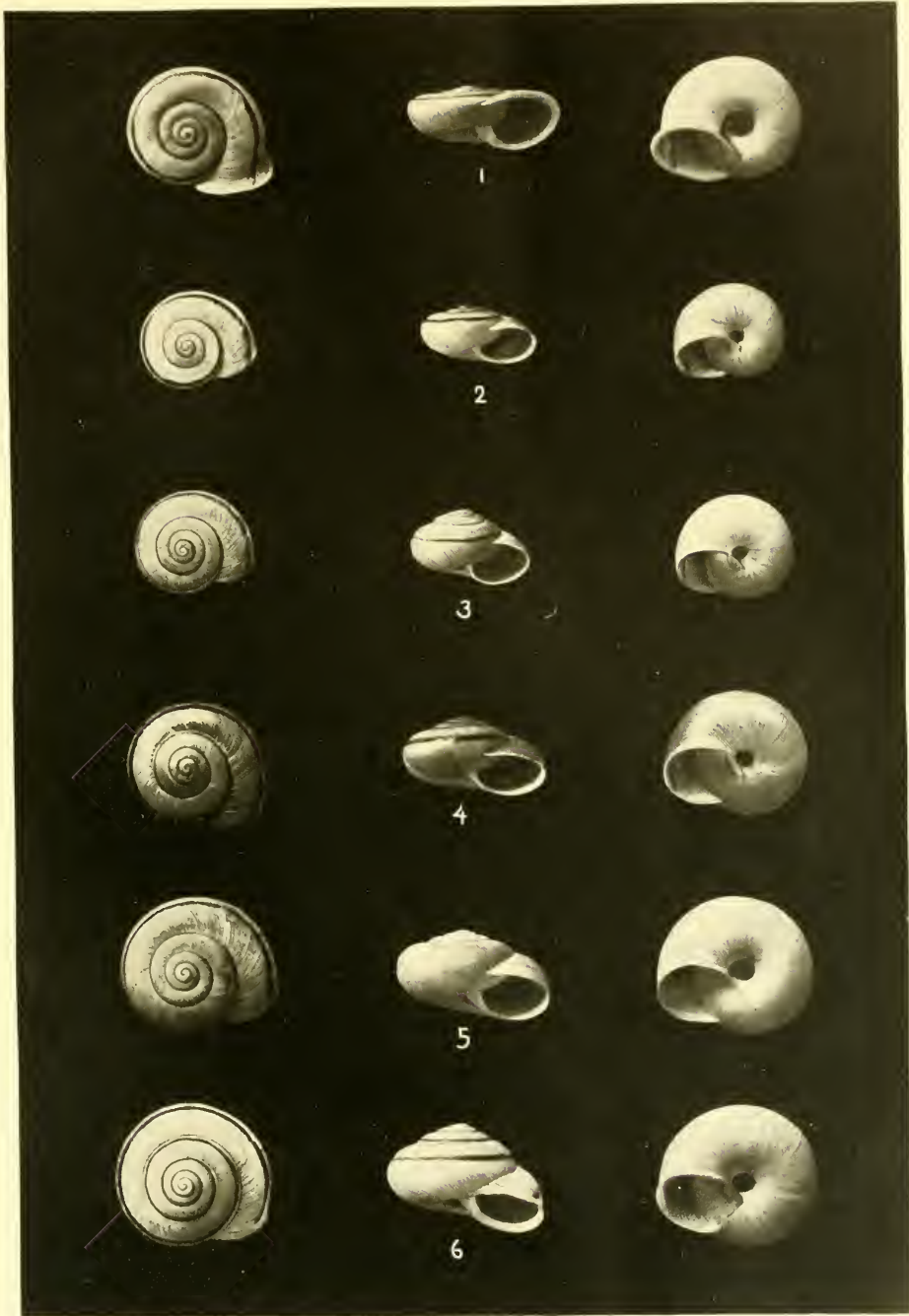
SPONDERELLA HACHITANA GALL; NUCLEAR WHORLS, MUCH ENLARGED



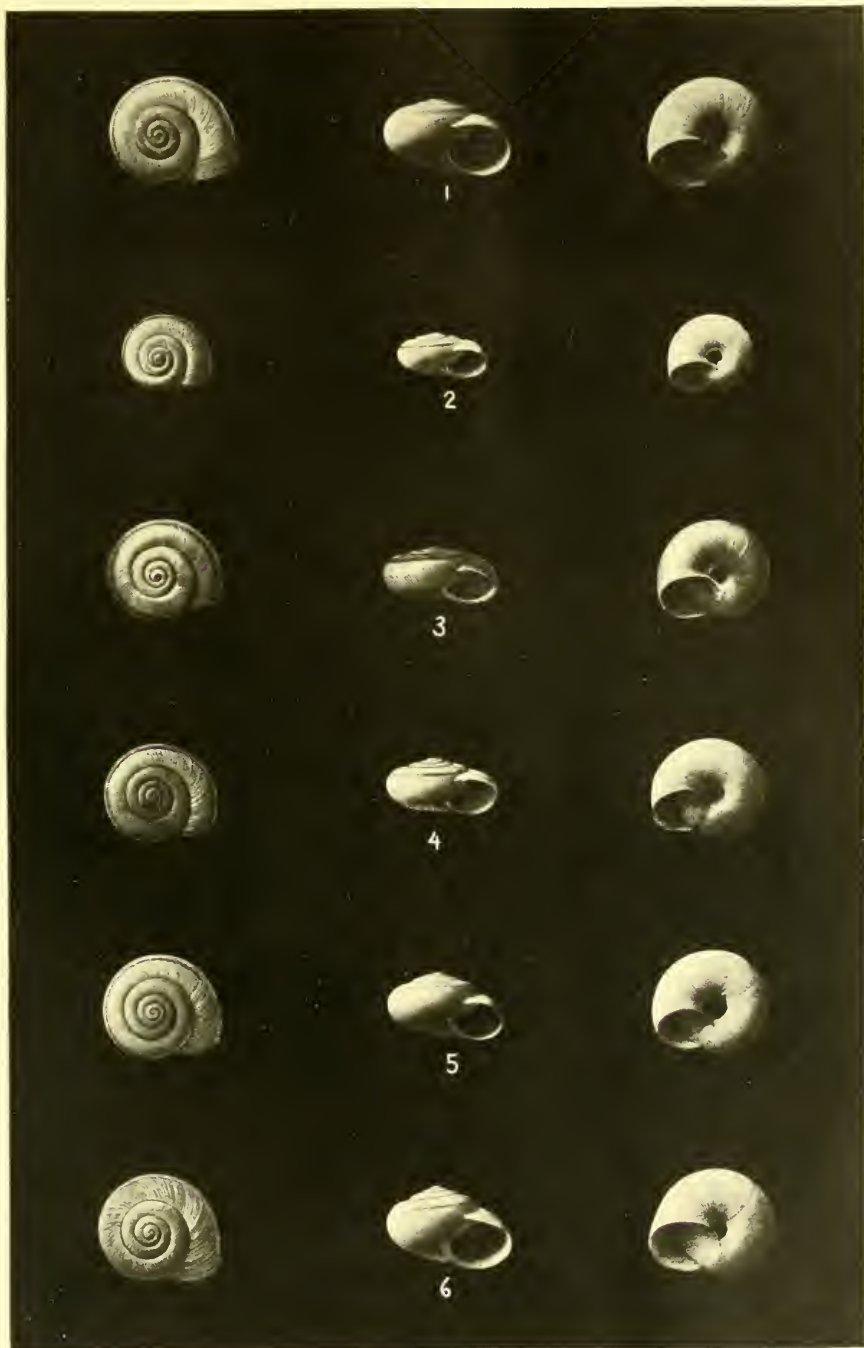
SONORELLA FISHERI BARTECH; NUCLEAR WHORLS, MUCH ENLARGED



SPECIES OF SONORELLA



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