

THE RECENT AND FOSSIL MOLLUSKS OF THE GENUS
BITTIUM FROM THE WEST COAST OF AMERICA.

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The first *Bittium* known from the west coast of America was reported by A. A. Gould¹ in 1849, when he described *Cerithium filosum* from the northwestern coast. Unfortunately, Philippi had used this name for a different species the year previous, thus pre-occupying the above combination. The same year A. T. von Middendorff² described the same species as *Turritella eschrichtii*.

Bittium eschrichti Middendorff remained the unique representative until 1857, when Dr. P. P. Carpenter³ published *Cerithiopsis decusata* from Mazatlan, Mexico. To these William M. Gabb⁴ added *Turbonilla aspera*, a fossil species from the Lower Pleistocene of Santa Barbara, California, in 1861. *Bittium nitens*, a fourth species, was described by Doctor Carpenter⁵ in 1864, from Cape St. Lucas, Lower California.

A large number of new forms were listed in the Supplementary Report on the Present State of our Knowledge with Regard to the Mollusca of the West Coast of North America, by Dr. P. P. Carpenter⁶ in 1864. In this report Doctor Carpenter gives a list of the shells known to him and adds a few words of diagnosis to the new forms, which are later fully described in various journals. The species here listed are:

Cerithiopsis munita, pages 628 and 660. *Bittium* ? var. *esuriens*, page 655.

Bittium attenuatum, page 655.

Bittium filosum Gould = *Eschrichtii* Middendorff, page 655.

¹ Proc. Bost. Soc. Nat. Hist., vol. 8, p. 120.

² Beitr. Mal. Ross., vol. 2, 1849, p. 68, pl. 11, fig. 1.

³ Cat. Mazatlan Shells, 1857, p. 368.

⁴ Proc. Acad. Nat. Sci. Philadelphia, p. 368.

⁵ Ann. Mag. Nat. Hist., ser. 3, vol. 13, p. 479.

⁶ Rep. Brit. Ass. Adv. Sci. for 1863, published in 1864.

- Bittium quadrifilatum*, page 655. *Rissoa interfossa*, page 656.
Bittium asperum, page 655. *Cerithiopsis purpurea*, page 660.
Bittium armillatum, page 655. *Cerithiopsis fortior*, page 660.
Bittium fastigiatum, page 655.

Of these, *Bittium*?, var. *esuriens* Carpenter has proved to be a synonym of *Bittium attenuatum* Carpenter, and *Cerithiopsis fortior* Carpenter is synonymous with *Rissoa interfossa*, while *Bittium asperum* was later diagnosed by him as *Bittium rugatum*, and *Bittium fastigiatum* is now referred to the genus *Diastoma*.

In 1865 we find no additional species added to the *Bittium* fauna, but a more complete diagnosis for—

- Bittium* ? var. *esuriens* Carpenter. *Cerithiopsis purpurea* Carpenter.
Bittium attenuatum Carpenter. *Cerithiopsis fortior* Carpenter.
Bittium quadrifilatum Carpenter. *Cerithiopsis munitum* Carpenter.

Reference to these descriptions can be found under each species in the present text.

The following year we find the complete diagnosis of—

- Rissoa interfossa* Carpenter, *Bittium armillatum* Carpenter,
and a full description of the species listed in 1864 as *Bittium asperum* Carpenter, which he now names *Bittium rugatum* Carpenter. Here also he refers *Turbonilla aspera* Gabb properly to the present genus.

The genus *Bittium* breaks up into several convenient groups, on the west coast of America, which may be considered subgenera. These are characterized in the following key:

KEY TO THE SUBGENERA OF BITTIUM, OCCURRING ON THE WEST COAST OF AMERICA.

Nuclear whorls with two spiral lirations.

Postnuclear whorls having varices. *Bittium* Leach s. s.

Postnuclear whorls without varices *Lirobittium*, new subgenus. Type *B. (L.) catalinense* Bartsch.

Nuclear whorls smooth.

Spiral sculpture predominating over the axial. *Stylidium* Dall.

Spiral sculpture not predominating over the axial. *Semibittium* Cossmann.

Bittium s. s. is represented by two species only in the area under discussion, namely *B. panamense* Bartsch and *B. johnstonæ* Bartsch, the first coming from Panama, the last from Lower California, while of *Stylidium* but one species, *B. (S.) eschrichtii* Middendorff, and two subspecies, *B. (S.) e. icelum* Bartsch and *B. (S.) e. montereyense* are known.

To *Semibittium* I refer the following thirteen forms:

- | | |
|--|--------------------------------------|
| <i>armillatum</i> Carpenter. | <i>attenuatum latifilum</i> Bartsch. |
| <i>purpureum</i> Carpenter. | <i>subplanatum</i> Bartsch. |
| <i>vancouverense</i> Dall and Bartsch. | <i>rugatum</i> Carpenter. |
| <i>attenuatum</i> Carpenter. | <i>quadrifilatum</i> Carpenter. |
| <i>attenuatum boreale</i> Bartsch. | <i>nicholsi</i> Bartsch. |
| <i>attenuatum multifilum</i> Bartsch. | <i>nitens</i> Carpenter. |

Three, *B. armillatum*, *purpureum*, and *vancouverense*, are placed here with some doubt because the nuclear whorls are somewhat worn and it is barely possible that they may possess sculpture when perfect.

Lirobittium has nine forms on the west coast. Of these, two only are placed here of which I have not seen the nucleus in perfect condition, namely, *B. (L.) munitum* Carpenter and *B. larum* Bartsch. However, since *B. (L.) munitum munitoides* Bartsch belongs here, there can scarcely be any doubt about placing *munitum* in this position.

The species of *Lirobittium* are:

<i>interfossum</i> Carpenter.	<i>munitum munitoide</i> Bartsch.
<i>catalinense</i> Bartsch.	<i>asperum</i> Gabb.
<i>catalinense inornatum</i> Bartsch.	<i>asperum lomaëense</i> Bartsch.
<i>ornatissimum</i> Bartsch.	<i>cerralvoëense</i> Bartsch.
<i>munitum</i> Carpenter.	<i>larum</i> Bartsch.

Of the following seven species, I have not seen the nuclear whorls; their subgeneric position must, therefore, remain doubtful until more perfect material has been examined. They will probably prove to be *Semibittium* or *Lirobittium*.

<i>oldroydæ</i> Bartsch.	<i>giganteum</i> Bartsch.
<i>fetellum</i> Bartsch.	<i>casmaliense</i> Bartsch.
<i>decussatum</i> Carpenter.	<i>arnoldi</i> Bartsch.

Five species, *Bittium (Stylidium) eschrichtii*, *Bittium catalinense*, *Bittium catalinense inornatum*, *Bittium attenuatum*, and *Bittium quadrifilatum*, occur both recent and fossil. The first, *Bittium (Stylidium) eschrichtii*, has been reported by Doctor Dall¹ from Fossil Rock at Coos Bay, Oregon (Pliocene), but so far has not been found fossil in any Pleistocene strata.

Bittium catalinense Bartsch is known from the Lower Pleistocene of Santa Barbara and San Pedro (Lower San Pedro series), and is found living in rather deep water. The subspecies *Bittium catalinense inornatum* Bartsch is known from the Lower Pleistocene of San Diego and recent. *Bittium attenuatum* Carpenter is the most abundant recent *Bittium* and has been found fossil in the Lower San Pedro Series at San Pedro (Pleistocene). *Bittium quadrifilatum* Carpenter is a common recent species also found in the Lower Pleistocene of Santa Barbara, California.

Of the seven species known as fossils only, *Bittium casmaliense* Bartsch and *Bittium arnoldi* Bartsch are from the Lower Pliocene of Santa Barbara County, California, while *Bittium asperum* Gabb has

¹ Prof. Paper 59, U. S. Geol. Surv., 1909, p. 76.

been reported from the Upper Pliocene, Fernando Formation, at Bath-house Beach, Santa Barbara, and the Pleistocene of Santa Barbara, San Pedro, and San Diego, California.

The remaining four—

Bittium armillatum Carpenter, *Bittium giganteum* Bartsch, and
Bittium ornatissimum Bartsch, *Bittium rugatum* Carpenter,
 are from the Pleistocene of California. Their distribution is noted after their description in the text.

The illustrations accompanying this paper¹ are after photographs made by Mr. T. W. Smillie, and were retouched by Mr. R. Weber.

BITTIUM (BITTIUM) PANAMENSE, new species.

Plate 53, fig. 5.

Shell large, elongate-conic, brown, variegated with whitish areas. Nuclear whorls small, partly decollated, a little more than one, smooth, the remaining portion with two spiral lirations. Post-nuclear whorls marked by feeble spiral cords which are a little stronger on the early whorls than on the later ones. Three of these cords occur upon each of the first five whorls, while on the sixth turn a fourth makes its appearance at the summit; this rapidly increases in strength and soon equals the other three. In addition to the spiral cords, the whorls are marked by axial ribs which are much more strongly developed on the early whorls than on the later ones. On the later whorls they are merely indicated by the tubercles resulting from the junctions of the cords and ribs. The tubercles are truncated anteriorly and slope gently posteriorly. Moderately strong varices occur at irregular intervals. On the last two whorls a slender spiral thread makes its appearance in the middle between the median tubercles and also in the space between the two anterior cords. Sutures weakly impressed. Periphery and base of the last whorl moderately long, well rounded, marked by ten spiral cords which are truncated posteriorly and slope gently anteriorly. These cords decrease regularly in size from the periphery to the columella, over which the last three extend. In addition to this sculpture, the entire surface is marked by numerous fine lines of growth and exceedingly fine, spiral striations. Aperture moderately large, irregularly ovate, decidedly channeled anteriorly; posterior angle obtuse; outer lip thin, showing the external sculpture within, which renders the margin sinuous; columella short, stout, twisted, and very strongly reflected; parietal wall glazed with a thin callus.

¹ In the preparation of the present diagnoses the following terminology is used:

"Axial sculpture," the markings which extend from the summit of the whorls toward the umbilicus. The axial sculpture may be—

"Vertical," when the markings are in general parallelism with the axis of the shell.

"Protractive," when the markings slant forward from the preceding suture.

"Retractive," when the markings slant backward from the suture.

"Spiral sculpture," the markings following the directions of the coils of the whorls.

The type (Cat. No. 32271, U.S.N.M.) comes from Panama. It has twelve post-nuclear whorls and measures: Length 14 mm., diameter 4.1 mm.

BITTIUM (BITTIUM) JOHNSTONÆ, new species.

Plate 53, fig. 6.

Shell very elongate-conic, chestnut brown with strong white varices at irregular intervals. (Nuclear whorls decollated.) Post-nuclear whorls well rounded, the early turns ornamented with four spiral keels, all of which, except the anterior one, which is at the summit, are of equal size and about as wide as the spaces that separate them; the one at the summit being much more slender. On the last three whorls the keel at the summit divides into two slender threads, which occupy the same amount of space as the single keel does on the earlier turns. In addition to the spiral keels, the whorls are marked by strong, well-rounded, axial ribs which are about two-thirds as wide as the spaces that separate them. These ribs render the spiral keels tuberculate at their intersection. There are 12 ribs upon the third, 14 upon the fourth, 16 upon the fifth and sixth, and 18 upon the seventh turn. On the last two whorls, four axial ribs occur between each pair of varices. Varices very large and conspicuous. Sutures strongly constricted. Periphery of the last whorl well rounded, marked by a slender spiral cord which is not tuberculate. Base rather prolonged, well rounded, marked by four equal and equally spaced spiral cords, of which the last is immediately behind the columella. Entire surface of base marked by numerous, rather strong lines of growth. Aperture ovate, decidedly channeled anteriorly; outer lip thin at the edge, rendered sinuous by the external sculpture which is visible within; columella very short, curved, and covered on its entire surface by a strong callus, which also extends over the parietal wall.

The type (Cat. No. 196208, U.S.N.M.) was collected by Mrs. E. E. Johnston in Lower California. It has ten whorls and measures: Length 7.9 mm., diameter 2.6 mm.

Named for Mrs. E. E. Johnston.

BITTIUM (STYLIDIUM) ESCHRICHTII Middendorff.

Plate 58, fig. 4.

Cerithium filosum GOULD, Proc. Boston Soc. Nat. Hist., vol. 3, 1849, p. 120, not of Philippi, Zeitschr. für Mal., 1848, p. 143.

Turritella eschrichtii MIDDENDORFF, Beitr. Mal. Ross., vol. 2, p. 68, pl. 11, fig. 1, 1849.

Bitium filosum CARPENTER, Rep. Brit. Ass. Adv. Sci. for 1863, 1864, p. 655.—ARNOLD, Pal. and Strat. San Pedro, 1903, p. 292.

Bitium (Stylidium) eschrichtii DALL, Proc. U. S. Nat. Mus., vol. 33, No. 1564, p. 178, Oct., 1907.

Bitium (Stylidium) eschrichtii DALL, Prof. Paper 59, U. S. Geol. Surv., p. 76, pl. 14, fig. 2, 1909.

Shell broadly elongate-conic, rather coarse, varying in color from white to chestnut brown. The nucleus consists of a single, smooth, white whorl, well rounded. Post-nuclear whorls well rounded, marked by four strong, somewhat flattened, spiral keels between the sutures, which are separated by deep, strong, spiral grooves about two-thirds as wide as the keels. In addition to this spiral sculpture, the whorls are marked by numerous fine, spiral striations and fine lines of growth. Periphery of the last whorl marked by a sulcus as wide as the sulci between the keels on the spire. Base well rounded, marked by eight equally spaced spiral cords, which grow successively weaker from the periphery to the umbilical area. In addition to these cords the base is marked by fine spiral lines and fine lines of growth. Aperture oval, somewhat effuse anteriorly; posterior angle obtuse; outer lip thin, rendered wavy by the external sculpture; columella short, very broad at base, somewhat twisted and reflected; parietal wall glazed with a thin callus.

The specimen described and figured (Cat. No. 122558, U.S.N.M.) has nine post-nuclear whorls and measures: Length 14 mm., diameter 5 mm., and was collected on the beach at Sitka, Alaska.

Specimens examined.

Catalogue No.	Locality.	Number of specimens.
151626	Killisnoo, Alaska.....	3
73218	Sitka, Alaska.....	5
122558	Sitka, Alaska (described and figured).....	1
195117	Sitka, Alaska.....	1
195118	.....do.....	10
160565	Biorka Island, Sitka Sound, Alaska.....	1
193687	Cormorant Island, Alert Bay, Alaska.....	1
195120	Barelay Sound, British Columbia.....	19
152909	Neah Bay.....	29
23332	.....do.....	73
3935	Puget Sound.....	9
5575	Puget Sound (type of <i>Bitium filosum</i> Gould).....	1
133690	Tacoma, Washington.....	4
195119	Port Ludlow, Washington.....	4
FOSSIL.		
153992	Fossil Rock, Coos Bay, Oregon (Pliocene).....	1

BITTIUM (STYLIDIUM) ESCHRICHTII ICELUM Bartsch.

Plate 57, fig. 3.

Bitium (Stylidium) eschrichtii icelum BARTSCH, Proc. U. S. Nat. Mus., vol. 33, 1907, p. 178.

In *B. eschrichtii* only the early whorls show axial ribs. In the present form they are well developed on all the turns, weakening only on the last. The type, Cat. No. 15209a, U.S.N.M., was collected by J. G. Swan at Neah Bay, Washington. It has nine whorls (the nucleus being lost) and measures: Length 15 mm., diameter 5.5 mm. Another specimen, Cat. No. 32209, U.S.N.M., belongs to the Stearns collection and comes from Monterey, California.

BITTIUM (STYLIDIUM) ESCHRICHTII MONTEREYENSE Bartsch.

Plate 5S, fig. 5.

Bittium (Stylidium) eschrichtii montereyense BARTSCH, Proc. U. S. Nat. Mus., vol. 33, 1907, p. 178-179.

This form is a southern race of *B. eschrichtii*. It differs from the typical form in being less strongly spirally keeled, much more smooth, more slender, and in every way more elegant than *eschrichtii*. The typical form varies in color from brown to white, and is very rarely spotted. In *montereyense* the variegated forms predominate—that is, the shells are whitish mottled with rust brown. The type, Cat. No. 32221, U.S.N.M., has ten whorls, and measures: Length 13.8 mm., diameter 5 mm.

Specimens examined.

Catalogue No.	Locality.	Number of specimens.
104135	Cresson City, California.....	1
¹ 32221	Monterey, California.....	9
32211	.....do.....	14
32214	.....do.....	3
32228	.....do.....	15
55992	.....do.....	65
56443	.....do.....	1
56849	.....do.....	4
202662	Pescadero, California.....	4
55994	San Pedro, California.....	2
194387	San Diego, California.....	3
32279	Gulf of California.....	1
55993	Cape St. Lucas, Lower California.....	2
FOSSIL.		
162610	Deadmans Island, California (Lower San Pedro Series).....	2

¹ Type.

KEY TO THE SPECIES OF THE SUBGENERA SEMIBITTIUM, LIROBITTIUM, AND THOSE OF UNCERTAIN SUBGENERIC POSITION.

Since the nuclear whorls of seven species (probably *Lirobittium* or *Semibittium*), described in the pages which follow, are unknown, I have deemed it wise to embrace the members of these two subgenera, as well as the seven of uncertain position, all in one artificial key.

Spiral sculpture consisting of three strong cords between the sutures, between which intercalated slender cords may occur.

Nodulose spiral keel at the summit less strong than the other two.

Base with two very strong sublamellar keels *interfossa*.

Base with slender spiral cords.

Peripheral cord exposed as a smooth band in the suture..... *catalinense*.

Peripheral cord not apparent in the sutures *c. inornatum*.

Nodulose spiral keel at the summit equal to the other two.

Axial ribs and spiral cords comparatively weak, always narrower than the squarish pits inclosed by them.

Junctions of axial ribs and spiral cords forming sharp cusps.

Whorls with a strong shoulder *oldroydæ*.

Whorls not shouldered..... *fetellum*.

Junctions of axial ribs and spiral cords forming well-rounded tubercles.

Shell large, unicolor, rusty-white (fossil).....*armillatum*.

Shell small, wax-yellow, variegated with chestnut, usually with a broad, chestnut, basal band.

Adult shell more than 6 mm. long.....*purpureum*.

Adult shell less than 5 mm. long.....*decussatum*.

Axial ribs and spiral cords always strong and wider than the spaces inclosed by them.

Shell very large, with strong intercalated spiral cords.....*ornatissimum*.

Shell smaller, without, or with very weak intercalated spiral cords only.

Shell dark purplish-brown.....*vancouverense*.

Shell wax-yellow, banded with brown.

Shell robust, with 25-30 axial ribs on its last whorl.....*munitum*.

Shell smaller, with as many as 40 axial ribs on its last whorl.....*m. munitoide*.

Spiral sculpture, consisting of four strong cords between the sutures, between which intercalated slender cords may occur.

Axial ribs becoming obsolete on the last whorls of the adult shell.

Summit of the whorls appressed.

Intercalated spiral cords absent.

Shell slender, sculpture weak.....*attenuatum*.

Shell robust, sculpture strong.....*a. boreale*.

Intercalated spiral cords present.....*a. multifilosum*.

Summit of the whorls slopingly shouldered.....*a. latifilosum*.

Axial ribs strong on all the whorls.

Nodulose spiral cords at the summit less strong than the others.

Spiral cords sloping gently anteriorly until fused with the body of the shell; posteriorly they are suddenly truncated.

Axial ribs on the last whorl 12-15.

Shell of 10 post-nuclear whorls 8.1 mm. long.....*asperum*.

Shell of 10 post-nuclear whorls 7.1 mm. long.....*a. lomaense*.

Axial ribs on the last whorl about 25.....*subplanatum*.

Nodulose spiral cord at the summit equal to the rest on the last whorl.

Adult shell more than 17 mm. long.

Shell slender.....*giganteum*.

Shell stout.

Intercalated cords when present very feeble.....*casmaliense*.

Intercalated cords always present, at times more than one between the strong cords and almost equal to them in strength.....*arnoldi*.

Adult shell less than 13 mm. long.

Whorls decidedly overhanging.

Base well rounded.....*rugatum*.

Base flattened.

Early post-nuclear whorls with 4 spiral cords.....*larum*.

Early post-nuclear whorls with 2 spiral cords.....*cerralvoense*.

Whorls not overhanging.

Shell large; adult shell more than 11 mm. long.....*quadrifilatum*.

Shell small; adult shell less than 7 mm. long.

Whorls shouldered at the summit.....*nicholsi*.

Whorls appressed at the summit.

Axial ribs on last whorl 15.....*mexicanum*.

Axial ribs on last whorl 32.....*nitens*.

BITTIUM (SEMIBITTIUM) ARMILLATUM Carpenter.

Plate 52, fig. 6.

Bittium armillatum CARPENTER, Rep. Brit. Ass. Adv. Sci. for 1863, 1864, p. 655.*Bittium armillatum* CARPENTER, Ann. Mag. Nat. Hist., ser. 3, vol 18, 1866, p. 276.

Shell broadly conic, rust brown. Nuclear whorls at least 3, apparently smooth. Post-nuclear whorls shouldered at the summit, marked by three strong spiral keels which are considerably narrower than the three spaces into which they divide the whorls between the sutures. In addition to the spiral sculpture the whorls are marked by slightly retractive axial ribs, which are about as strong as the spiral keels. Of these, 16 occur upon the fourth, 18 upon the fifth, 20 upon the sixth, 24 upon the seventh, and 32 upon the penultimate turn. The junctions of the axial ribs and the spiral cords form well-rounded tubercles, while the spaces inclosed between are well-impressed squarish pits. Sutures strongly constricted. Base moderately long, ornamented by six low, well-rounded, subequally spaced spiral cords. Aperture channeled anteriorly; posterior angle obtuse; outer lip rendered sinuous by the external sculpture; columella moderately long, oblique, curved, and reflected; parietal wall covered with a moderately thick callus.

The type (Cat. No. 15653, U.S.N.M.) comes from the Lower Pleistocene deposits of Santa Barbara, California. It has nine post-nuclear whorls and measures: Length 9.5 mm., diameter 3.2 mm. Another specimen, also fossil (Cat. No. 195160, U.S.N.M.), comes from San Pedro, California.

BITTIUM (SEMIBITTIUM) PURPUREUM Carpenter.

Plate 52, figs. 1 and 3.

Cerithiopsis purpurea CARPENTER, Rep. Brit. Ass. Adv. Sci. for 1863, 1864, p. 660.*Cerithiopsis purpurea* CARPENTER, Ann. Mag. Nat. Hist., ser. 3, vol. 15, 1865, p. 337.

Shell broadly elongate conic, wax-yellow, variously mottled and banded with chestnut brown. Nuclear whorls a little more than one, apparently smooth. Post-nuclear whorls marked by three strong spiral cords, which divide the space between the suture and the summit into three almost equal areas. The cord at the summit is very slightly below the summit and renders this strongly shouldered. In addition to the spiral sculpture, the whorls are marked by almost vertical, axial ribs which are nearly equal to the spiral cords in strength. Of these, 14 occur upon the first, 16 upon the second, 18 upon the third, 20 upon the fourth, 22 upon the fifth, and 25 upon the penultimate turn. The intersections of the spiral cords and the axial ribs form well-rounded tubercles, while the spaces inclosed between them are well-impressed squarish pits on all but the last; on this they are oblong, their long axes coinciding with the axial sculpture. Sutures strongly constricted, showing the peripheral cord on the later

whorls. Periphery of the last whorl marked by a slender, smooth cord, the space between which and the first supraperipheral cord is about as wide as that which separates the next two cords posteriorly and is crossed by the continuations of the axial ribs which terminate at its posterior border. Base marked by five subequally spaced spiral cords, of which the strongest is immediately below the periphery and is equal to the peripheral cord, while the next two in strength are at the columella; the two intervening are slender threads. Entire surface of spire and base crossed by numerous, rather strong lines of growth. Aperture broadly oval, decidedly channeled anteriorly; posterior angle obtuse; outer lip rendered sinuous by the external sculpture; columella short, somewhat twisted, curved and reflected; parietal wall covered with a thick callus.

Doctor Carpenter's cotypes, four specimens (Cat. No. 14823, U.S.N.M.), come from Monterey and Santa Barbara, California. The best preserved has seven post-nuclear whorls and measures: Length 7.3 mm., diameter 2.5 mm.

Specimens examined.

Catalogue No.	Locality.	Number of specimens.
14823	Monterey and Santa Barbara, California	4
56010	.....do.....	3
32396	Monterey Harbor, California	2
32394	Monterey, California	5
56851	.....do.....	6
56004	.....do.....	17
56377	.....do.....	8
56016	North side of Catalina Island, California (15 fathoms, gravel) ..	2
56681	San Miguel Island, California	2
195166	San Pedro Bay, California	13
165487	San Diego, California	4
32302	West Coast	1

BITTIUM (SEMIBITTIUM) VANCOUVERENSE Dall and Bartsch.

Plate 53, fig. 3.

Bittium vancouverense DALL and BARTSCH, Dominion Geol. Survey, Memoir No. 14 N, 1910, p. 10, pl. 1, fig. 8.

Shell elongate-conic, grayish white outside and dark, purplish brown within. Nuclear whorls at least two, apparently smooth, worn in all specimens. Post-nuclear whorls slightly rounded, ornamented with three strong, equal, and equally spaced, nodulose, spiral keels, the first of which is a little below the summit. The spaces separating the spiral keels are of equal width. Immediately below the third keel is a strong, peripheral sulcus, which equals those between the spiral keels. In addition to the spiral sculpture, the whorls are marked by almost vertical, axial ribs which are not quite as wide as the spiral keels. These render the keels nodulose at their intersections. Of these ribs, 12 occur upon the first, 14 upon the second and third, 16 upon the fourth, 18 upon the fifth, 24 upon the sixth, and 30 upon the penultimate turn. The spaces inclosed between the spiral keels and the axial ribs are well-impressed, rounded pits. All

the tubercles are truncated on the posterior margin and slope gently anteriorly. Base of the last whorl moderately long, ornamented with seven spiral cords, of which the two immediately below the periphery are the strongest and broadest, while the two bounding the umbilical area are wider than those intervening. Sutures channeled. Aperture irregular, channeled anteriorly; posterior angle obtuse; outer lip thin, sinuous, showing the external sculpture within; columella stout, short, twisted, and reflected; parietal wall glazed with a moderately thick callus. The specimen figured has eight post-nuclear whorls and measures: Length 7.8 mm., diameter 2.7 mm.

Specimens of this species were dredged in 8 to 27 fathoms from Ucluelet to Ship Channel, Barclay Sound, Vancouver Island, British Columbia. Part of these are in the collection of the Dominion Geological Survey, and others are in the U. S. National Museum collection, Cat. No. 211545.

BITTIUM (SEMIBITTIUM) ATTENUATUM Carpenter.

Plate 54, figs. 1, 2, and 5.

Bittium attenuatum CARPENTER, Rep. Brit. Ass. Adv. Sci., 1864, p. 655;

=*Bittium* ? var. *esuriens* CARPENTER, Rep. Brit. Ass. Adv. Sci., 1864, p. 655;

=*Bittium* (? var.) *esuriens* CARPENTER, Ann. Mag. Nat. Hist., ser. 3, vol. 15, 1865, p. 181;

=*Bittium* (? var.) *esuriens* CARPENTER, Journ. Conch., vol. 12, 1865, p. 242;

=*Bittium attenuatum* CARPENTER, Journ. Conch., vol. 12, 1865, pp. 242-243.

Shell elongate-conic, varying in color from plain white to brown, variously banded or maculated. Nuclear whorls two, moderately rounded, smooth. Post-nuclear whorls slightly rounded, ornamented with weak spiral bands which are best developed on the early whorls. These spiral bands are truncated anteriorly and slope gently to the posterior boundary. The early whorls have three spiral bands, of which the posterior, at the summit, is less strongly developed than the other two, which divide the remaining space between the sutures equally. On the middle whorls the posterior keel has a tendency to become divided, while on the later turns it becomes obsolete. In addition to the spiral sculpture, the whorls are marked by poorly developed, rounded, protractive, axial ribs which render their intersections with the spiral cords nodulose. Of these ribs, 12 occur upon the third and 14 upon each of the remaining turns upon which ribs are discernible. The spaces inclosed between the ribs and spiral bands are shallow, impressed, rectangular pits. In addition to the axial ribs, the whorls are marked by numerous fine lines of growth. Periphery of the last whorl marked by a spiral band, which is separated from the first band above the periphery by a sulcus as wide as the sulci on the spire. Base short, well rounded, marked by six

spiral keels, of which the first below the periphery is much larger than the rest, which are subequal and subequally spaced. Aperture ovate, somewhat effuse anteriorly; posterior angle acute; outer lip thin, showing the external markings within; columella short, very broad at base, oblique, and reflected.

Doctor Carpenter based his description upon two co-types (Cat. No. 15584, U.S.N.M.) collected at Monterey, California, and Neah Bay, Washington. One of these has ten post-nuclear whorls and measures: Length 10.2 mm., diameter 3 mm. The other has eight post-nuclear whorls and measures: Length 8.8 mm., diameter 2.9 mm. Doctor Carpenter's type of *B.* (? var.) *esuriens* is a young shell in a good state of preservation (Cat. No. 14832, U.S.N.M., fig. 2).

Bittium attenuatum is a quite variable form, the color ranging from white to chestnut brown at times, variously banded or maculated. The sculpture at times is quite feeble, at others very pronounced. The posterior truncation of the spiral cords and their gentle sloping anteriorly is characteristic of the species. The number of ribs is variable; in some specimens as many as twenty-four occur upon the last turn. There is also an occasional tendency to an intercalation of slender, spiral threads between the prominent keels.

Specimens examined.

Catalogue No.	Locality.	Number of specimens.
32200	Vancouver Island.....	1
15584	Neah Bay and Monterey (cotypes).....	2
23261	Monterey, California.....	6
23361	do.....	6
23728	do.....	1
32207	do.....	7
32224	do.....	3
55996	do.....	3
55997	do.....	4
55998	do.....	4
55999	do.....	3
56000	do.....	2
56844	do.....	5
56850	do.....	5
56852	do.....	5
56001	do.....	2
14832	Monterey or Santa Barbara, California (type of <i>B.</i> (? var.) <i>esuriens</i>).....	1
56677	San Miguel Island, California.....	1
56907	Catalina Island, California.....	15
56908a	do.....	3
158773	do.....	1
160076d	do.....	1
160077a	do.....	2
14849	San Pedro, California.....	3
153443a	do.....	3
185363	do.....	1
195122	do.....	13
195123	do.....	3
195124	Whites Point, San Pedro, California.....	180
109513	Terminal Island, San Pedro, California.....	1
120678	San Diego, California.....	4
56665	do.....	2
160078	do.....	4
195121	Foot of Ash Street, San Diego, California.....	2
FOSSIL.		
212023	Lower San Pedro series, Deadman's Island, California.....	2

BITTIUM (SEMIBITTIUM) ATTENUATUM BOREALE, new subspecies.

Plate 54, fig. 4.

Shell similar to *Bittium attenuatum*, but in every way larger and more robust. Sculpture very much stronger than in the typical form; the tubercles well developed on the last whorl, but much weaker than on the earlier ones.

The type and fourteen specimens (Cat. No. 211586, U.S.N.M.) come from Barclay Sound, 8-27 fathoms, Vancouver Island. The type has eight post-nuclear whorls and measures: Length 10.1 mm., diameter 3.5 mm. Eighteen additional specimens from the same locality are in the Dominion Geological Survey.

BITTIUM (SEMIBITTIUM) ATTENUATUM MULTIFILOSUM Bartsch.

Plate 54, fig. 3.

Bittium esuriens multifilum BARTSCH, Proc. U. S. Nat. Mus., vol. 33, 1907, p. 179.

Shell similar to *B. attenuatum*, but having seven spiral keels between the sutures on the whorls of the spire instead of four; that is, a strong, intercalated spiral cord between each of the four primary keels.

The type (Cat. No. 127051, U.S.N.M.) comes from Whites Point, San Pedro, California. It has ten whorls and measures: Length 9.2 mm., diameter 3 mm.

Specimens examined.

Catalogue No.	Locality.	Number of specimens.
56002	Monterey, California.....	1
32235	.....do.....	3
56907b	Catalina Island, California.....	7
56908	.....do.....	1
195126	San Pedro, California (50 fathoms).....	1
¹ 127051	Whites Point, San Pedro, California.....	1
195125	.....do.....	7

¹ Type.**BITTIUM (SEMIBITTIUM) ATTENUATUM LATIFILOSUM**, new subspecies.

Plate 54, fig. 6.

Shell similar to *Bittium attenuatum*. Whorls a little higher between the sutures than in the typical form, with four spiral cords between the sutures, which are much broader than in typical *attenuatum*. The axial ribs are strong on the early whorls, but scarcely indicated on the last volutions. Shell usually mottled.

The type (Cat. No. 109509, U.S.N.M.) comes from Terminal Island, California. Two additional specimens (Cat. No. 153086, U.S.N.M.) come from San Pedro, California.

BITTIUM (SEMIBITTIUM) SUBPLANATUM, new species.

Plate 57, fig. 5.

Shell broadly elongate-conic, milk white. Nuclear whorls a little more than one, well rounded, smooth. The first of the post-nuclear whorls well rounded, marked by three spiral cords, one of which is at

the summit, another on the middle of the whorl, while the third is a little above the suture. The succeeding turns show four spiral cords, of which the one at the summit is a little less strong than the rest; the remaining three divide the space between the sutures into four equal parts. Beginning with the fourth whorl, intercalated cords make their appearance between the primary ones, so that on the last whorl we have an intercalated cord and sometimes two between all the primary cords; these, however, are never quite as strong as the principal ones. In addition to the spiral cords, the whorls are marked by decidedly curved, slender, well-rounded, almost vertical, axial ribs, which are scarcely indicated on the first turn, while 14 of them occur upon the second and third, 16 upon the fourth, 18 upon the fifth and sixth, 22 upon the seventh, 24 upon the eighth, and 26 upon the penultimate turn. The intersections of the spiral cords and axial ribs form weakly developed, rounded tubercles which are truncated on their posterior margin, while the spaces enclosed between them are very shallow quadrangular pits. Sutures strongly constricted. Periphery and base of the last whorl well rounded, marked by slender, spiral cords of which those immediately below the periphery are the strongest and are truncated on the posterior margin, sloping gently anteriorly. Of these cords, seven occur on the base of the type. Aperture rather large, irregularly oval, channeled anteriorly; posterior angle acute; outer lip thin, rendered sinuous by the external sculpture; columella decidedly oblique, strongly curved, and reflected.

The type (Cat. No. 160076, U.S.N.M.) is one of fifty specimens from Catalina Island, California. It has ten post-nuclear whorls and measures: Length 10.9 mm., diameter 3.8 mm.

Specimens examined.

Catalogue No.	Locality.	Number of specimens.
¹ 160076	Catalina Island, California.....	50
213013	U.S.B.F. station 2902, off Santa Rosa Island, California (53 fathoms, temperature 45°; sand and mud).....	59
213014	U.S.B.F. station 2901, off Santa Rosa Island, California (48 fathoms, temperature 55°; mud).....	157
213015	U.S.B.F. station 4552, off Point Pinos Light, California (66-73 fathoms; mud and rock).....	5
160077 ^d	Catalina Island, California.....	3
14935 ^a	San Diego, California.....	1
195154	U.S.B.F. station 4309, 9 miles off Point Loma Light, California, (67-78 fathoms; fine sand and broken shell bottom).....	2
195155	U.S.B.F. station 4340, off South Point, San Coronado Island, California (46-87 fathoms; fine gray sand).....	1
213016	U.S.B.F. station 4343, off San Coronado Island, California (55-155 fathoms; sand).....	28
213017	U.S.B.F. station 4348, 6 miles off Point Loma, California, (59-113 fathoms; sand).....	10
213018	U.S.B.F. station 4350, off Point Loma, California (81 fathoms; sand; temperature 50°).....	6

¹ Type.

BITTIUM (SEMIBITTIUM) RUGATUM Carpenter.

Plate 56, figs. 4 and 5.

Bittium rugatum CARPENTER, Ann. Mag. Nat. Hist., ser. 3, vol. 17, 1866, p. 276;
=*Bittium asperum* CARPENTER, not Gabb, Ann. Mag. Nat. Hist., ser. 3, vol. 17,
1866, p. 276.

Shell elongate-conic, white. Nuclear whorls a little more than one, well rounded, smooth. Post-nuclear whorls appressed at the summit, decidedly overhanging, the early ones marked by two strong spiral cords on the anterior half between the sutures, and a third less strongly developed cord at the summit. On the third whorl a fourth spiral makes its appearance between the one at the summit and its neighbor; this fourth spiral soon increases in size, so that on the middle of the shell all four cords are practically of equal strength and spacing. On the last whorl a slender, intercalated cord appears between the anterior two. In addition to the spiral sculpture, the whorls are marked by strong, well-rounded, axial ribs, which are merely indicated on the first two whorls; on the third to sixth turn there are 14, on the seventh there are 16, on the eighth 18, and on the penultimate whorl there are 24. The intersections of the axial ribs and spiral cords form elongated tubercles which have their long axes parallel with the spiral sculpture. The spaces between the spiral cords and axial ribs are elongated, squarish pits. Sutures strongly constricted. Periphery of the last whorl marked by a channel which bears a slender cord. Base well rounded, marked by six spiral cords which grow successively weaker and more closely spaced from the periphery to the umbilical area. Aperture oval, channeled anteriorly; posterior angle acute; outer lip thin, rendered sinuous by the external sculpture; columella short, twisted, and reflected.

The specimen described and figured has ten post-nuclear whorls and measures: Length 10.5 mm., diameter 3.5 mm. It is one of six specimens (Cat. No. 7971, U.S.N.M.) from the post-Pliocene of Santa Barbara, California. Doctor Carpenter's type (Cat. No. 7154, U.S.N.M.) does not quite represent the norm of this species, the spiral cord at the summit being only feebly developed on the later turns and the basal sculpture being less strong than usual.

Specimens examined.

Catalogue No.	Locality.	Number of specimens.
17154	Lower Pleistocene, Santa Barbara, California.....	1
16258	Fossil, Santa Barbara, California.....	4
7971	Lower Pleistocene, Santa Barbara, California (described and figured).....	6
213019	Lower Pleistocene, Santa Barbara, California.....	24
109515	Lower Pleistocene, Terminal Island, California.....	1
186001	Lower San Pedro Series, Deadman's Island, California.....	27
	Pleistocene, San Pedro, California.....	6
195127	Pleistocene, San Pedro Bay, California.....	3
198761	Pleistocene, Southern California.....	2
148645	Lower Pleistocene, San Diego, California.....	20

¹ Type.

BITTIUM (SEMIBITTIUM) QUADRIFILATUM Carpenter.

Plate 58, figs. 2 and 3.

Bittium quadrifilatum CARPENTER, Rep. Brit. Ass. Adv. Sci. for 1863, 1864, p. 655.

Bittium quadrifilatum CARPENTER, Journ. Conch., ser. 3, vol. 5, 1865, p. 143.

Shell rather large, elongate-conic, chestnut brown, dull. Nuclear whorls two, well rounded, smooth, the first obliquely tilted. Post-nuclear whorls shouldered at the summit, moderately rounded, ornamented with four equal and subequally spaced spiral cords, which divide the space between the sutures into four subequal parts. The first of these cords is at the summit of the whorl. In addition to the spiral cords, the whorls are marked by moderately strong, rounded, vertical, axial ribs, of which 12 occur upon the first, 14 upon the second to fifth, 16 upon the sixth, 18 upon the seventh and the penultimate turn. The spiral cords cross the axial ribs as regular bands, their junctions forming elongated rounded tubercles, having their long axes parallel with the spiral sculpture, while the spaces inclosed between them are well impressed quadrangular pits with their long axes also parallel with the spiral sculpture. On the last whorl very faint, intercalated spiral threads appear between the cords. Sutures channeled, showing a faint trace of the subperipheral cord. Periphery of the last whorl marked by a rather broad channel which shows several faint spiral lirations. Base moderately long, somewhat concave, ornamented with seven subequal and subequally spaced, spiral threads. Aperture irregularly oval, channeled anteriorly; posterior angle obtuse; outer lip thin, showing the external sculpture within; columella moderately long, somewhat twisted, and reflected.

The specimen described and figured is one of a lot (Cat. No. 46929, U.S.N.M.) from San Diego, California. It has the nucleus and nine post-nuclear whorls and measures: Length 11.5 mm., diameter 3.6 mm. Doctor Carpenter's type of this species (Cat. No. 14849, U.S.N.M.) which was collected by Doctor Cooper at San Diego, California, is a young specimen having seven post-nuclear whorls, measuring: Length 7 mm., diameter 3 mm. The fossil members of this species

in our collection average a little larger than the recent shells and have the base a little more strongly sculptured. Equivalentents of these, however, occur among the host of recent shells examined.

Specimens examined.

Catalogue No.	Locality.	Number of specimens.
¹ 14849	San Diego, California.....	1
32223	Monterey, California.....	3
56003	.....do.....	1
160893	.....do.....	1
195157	San Pedro Bay, California.....	6
160080	San Diego Bay, California (in mud on flats at low tide).....	7
73724	San Diego, California (in mud adhering to sponges).....	14
55995	San Diego, California.....	49
32210	.....do.....	14
46929	San Diego, California (described and figured).....	43
195158	San Diego, California.....	1
194388	.....do.....	2
32220a	.....do.....	2
55612	.....do.....	30
109364c	.....do.....	2
105569	San Ignacio Lagoon, Lower California (mud flats, between tides).....	5
FOSSIL.		
22819	Santa Barbara, California (Lower Pleistocene).....	1
7154a	.....do.....	1

¹ Type.

BITTIUM (SEMIBITTIUM) NICHOLSI, new species.

Plate 57, fig. 1.

Shell moderately large, broadly conic, light brown. Early nuclear whorls decollated, the last one smooth. Post-nuclear whorls strongly shouldered at the summit, well rounded, ornamented on the early turns by four spiral cords. Beginning with the third whorl, a fifth cord makes its appearance, halfway between the one at the summit and its neighbor, which rapidly develops until it equals the others in strength. In addition to the spiral sculpture, the whorls are marked by numerous, strongly retractive, axial ribs, of which 14 occur upon all the turns. The spiral cords pass over the axial ribs as bands and render the junctions of the cords and ribs tuberculate, the tubercles being elongate with their long axes coinciding with the spiral sculpture. The spaces inclosed between the spiral cords and axial ribs are very elongate, rectangular pits, with their long axes parallel with the spiral sculpture. Sutures strongly channeled. Periphery of the last whorl marked by a broad channel which shows several slender, spiral threads and the feeble continuations of the axial ribs. Base somewhat concave in the middle, marked by nine spiral cords, of which the two immediately below the periphery are equal and much stronger than the rest, which are also equal and equally spaced. Entire surface of spire and base crossed by numerous, slender lines of growth. Aperture oval, channeled anteriorly; posterior angle acute; outer lip thin, showing the external sculpture within and some-

what wavy at the edge; columella very oblique, slightly twisted, and reflected; parietal wall glazed with a thin callus.

The type (Cat. No. 195163, U.S.N.M.) is a young specimen having six post-nuclear whorls and measures: Length 6.1 mm., diameter 2.8 mm. It comes from the Gulf of California.

BITTIUM (SEMIBITTIUM) NITENS Carpenter.

Plate 57, fig. 2.

Bittium nitens CARPENTER, Rep. Brit. Ass. Adv. Sci. for 1863, 1864, p. 618.

Bittium nitens CARPENTER, Ann. Mag. Nat. Hist., ser. 3, vol. 13, 1864, p. 479.

Shell elongate-conic, white, semitranslucent, variegated with rust brown, shiny. Nuclear whorls a little more than one, smooth. Early post-nuclear whorls with a decidedly sloping shoulder which extends from the middle of the whorl to the appressed summit; the later ones well rounded. The early whorls are ornamented with three spiral cords, of which one is at the summit, the second at the angle of the shoulder, and the third a little posterior to the suture. On the third post-nuclear whorl a fourth cord makes its appearance at the summit, increasing rapidly in size until it equals the other three. In addition to the spiral sculpture, the whorls are marked by somewhat irregular, variously sloping, moderately rounded, axial ribs, of which 12 occur upon the second, 10 upon the third and fourth, 12 upon the fifth, 14 upon the sixth and the penultimate turn. The junctions of the axial ribs and the spiral cords form well-rounded tubercles, which slope more abruptly posteriorly than anteriorly, while the spaces inclosed between them are rectangular pits, having their long axes parallel with the spiral sculpture. Sutures somewhat constricted. Periphery of the last whorl marked by a slender sulcus. Base short, rounded, marked by three equal spiral cords, of which two occur immediately below the periphery, while the third encircles the base of the columella. Entire surface of spire and base crossed by numerous lines of growth. Aperture subquadrate, channeled anteriorly; posterior angle obtuse; outer lip thin, showing the external sculpture within, rendered sinuous by the external sculpture; columella oblique, slender, and somewhat revolute; parietal wall glazed with a thin callus.

The type (Cat. No. 4068, U.S.N.M.) comes from Cape San Lucas, Lower California. It has eight post-nuclear whorls, and measures: Length 5.7 mm., diameter 0.2 mm.

BITTIUM (LIROBITTIUM) INTERFOSSA Carpenter.

Plate 51, figs. 2 and 6.

Rissoa interfossa CARPENTER, Rep. Brit. Ass. Adv. Sci. for 1863, 1864, p. 656.*Cerithiopsis fortior* CARPENTER, Rep. Brit. Ass. Adv. Sci. for 1863, 1864, p. 660.*Cerithiopsis fortior* CARPENTER, Ann. Mag. Nat. Hist., ser. 3, vol. 15, 1865, p. 337.*Rissoina interfossa* CARPENTER, Proc. California Acad. Nat. Sci., vol. 3, 1866, p. 217.

Shell rather large and robust, white, sometimes light brown. Nuclear whorls small, two; the first obliquely tilted, smooth; the second with two strong spiral cords which divide the space between the sutures into three equal areas. Post-nuclear whorls appressed at the summit, strongly slopingly shouldered, ornamented with two strong spiral keels, which divide the space between the sutures into three equal areas, and very strong, vertical, axial ribs, 16 of which occur upon each of the turns. The intersections of the axial ribs and the spiral cords form strong elongated tubercles, the long axes of which coincide with the spiral sculpture. These tubercles slope more abruptly posteriorly than anteriorly. The intersections of the axial ribs and the spiral cords inclose shallow squarish pits. Sutures weakly impressed. Periphery of the last whorl marked by a strong keel to which the axial ribs extend feebly. This keel is a little nearer to the first post-peripheral keel than that is to its posterior neighbor. Base moderately long, marked by two very strong keels, which divide the space between the peripheral keel and the tip of the columella into three equal areas, the spaces between the keels being very deep and a little wider than the keels. Entire surface of spire and base, including the ribs and intercostal spaces, crossed by numerous, fine, closely spaced, spiral striations. Aperture irregular, channeled anteriorly; posterior angle obtuse; outer lip thick within, thin at edge, rendered sinuous by the external sculpture; columella stout, strongly twisted, and reflected; parietal wall glazed with a thick callus.

The specimen described and figured is one of a lot (Cat. No. 56906, U.S.N.M.) from Catalina Island, California, the type-locality. It has nine post-nuclear whorls, and measures: Length 8.3 mm., diameter 3.1 mm. The type is a much-worn young specimen having seven post-nuclear whorls, and measuring: Length 6.2 mm.

Specimens examined.

Catalogue No.	Locality.	Number of specimens.
46166	Monterey, California.....	3
160891	do.....	1
195177	do.....	2
203677	Santa Barbara, California.....	1
¹ 224860	Catalina Island, California.....	1
23756	do.....	3
56906	Catalina Island, California (described and figured).....	65
56907a	Catalina Island, California.....	3
160076b	do.....	3
153443	San Pedro, California.....	6
195104	Whites Point, San Pedro Bay, California.....	10
109516	Terminal Island, California.....	1
195165	Pacific Beach, California.....	1
162675	La Jolla, California.....	2
105591	San Diego, California.....	3

¹ Type.

BITTIUM (LIROBITTIUM) CATALINENSE Bartsch.

Plate 51, fig. 1.

Bittium catalinensis BARTSCH, Smiths. Misc. Coll. (Quarterly Issue), vol. 50, 1907, pt. 4, p. 28, pl. 57, fig. 13.

Shell elongate-conic, milk-white. Nuclear whorls a little more than one, marked by two strong spiral cords which divide the turns into three equal areas. Post-nuclear whorls shouldered at the summit, marked by three nodulose spiral keels; one of these, which is a little below the summit, is less strongly developed than the other two on all but the last turn; on this turn it is practically equal to the others. In addition to the spiral keels, the whorls are marked by rather strong, well-rounded axial ribs which are about two-thirds as wide as the spaces which separate them. Of these ribs, 16 occur upon the first to fifth, 18 upon the sixth and seventh, 20 upon the eighth, and 24 upon the penultimate turn. The intersections of the axial ribs and the spiral cords form strong cusp-like nodules, which are suddenly truncated posteriorly and slope gently to the succeeding cord anteriorly. The space between the summit and the truncated end of the first row of tubercles forms a strong shoulder. The spaces inclosed between the spiral keels and the axial ribs are moderately impressed rounded pits. Sutures strongly constricted, showing the greater part of the peripheral cord on all the turns. Periphery and base of the last whorl marked by five spiral cords which grow successively weaker from the periphery to the umbilical area. These cords are truncated on the posterior margin and slope gently anteriorly until they fuse with the general surface of the shell. Aperture irregular, channeled anteriorly; posterior angle obtuse; outer lip rendered sinuous by the external sculpture; columella oblique, somewhat twisted; parietal wall glazed with a thin callus.

The type (Cat. No. 165232, U.S.N.M.) comes from the Pleistocene at Santa Barbara, California. It has nine and one-half post-nuclear whorls, and measures: Length 7.5 mm., diameter 2.8 mm. The present species occurs both recent and fossil. The recent shells are slightly slenderer than the fossil form.

Specimens examined.

Catalogue No.	Locality.	Number of specimens.
¹ 165232	Santa Barbara, California, Lower Pleistocene.....	1
2557	.....do.....	2
213020	Deadmans Island (Lower San Pedro Series).....	1
23754	Catalina Island, California.....	2
195152	Off Catalina Island, California.....	1
4310	Eight miles off Point Loma Light, California.....	17

¹ Type.

BITTIUM (LIROBITTIUM) CATALINENSE INORNATUM, new subspecies.

Plate 51, fig. 3.

Shell similar to *Bittium catalinense*, but lacking the plain spiral keel in the suture.

The type (Cat. No. 195153, U.S.N.M.) comes from 40 fathoms off Catalina Island, California. It has ten post-nuclear whorls, and measures: Length 7.2 mm., diameter 2.3 mm. Another specimen (Cat. No. 193695, U.S.N.M.) is also from Catalina Island, while a third (Cat. No. 148649, U.S.N.M.) comes from the Lower Pleistocene deposits at San Diego, California.

BITTIUM (LIROBITTIUM) ORNATISSIMUM, new species.

Plate 52, figs. 4 and 5.

Shell elongate-conic, creamy white. Nuclear whorls one and one-half, marked by two slender threads which divide the space between the sutures into three equal parts. Post-nuclear whorls strongly shouldered at the summit, marked by three strong spiral keels which divide the space between the sutures into four almost equal parts. The space between the first of these keels below the summit and the summit is a little narrower than the rest. In addition to these three strong spiral keels, intercalated keels are present, the first of which is at the summit, while another occurs between each of the other keels. On the last whorl these attain a strength almost equal to that of the primary keels. In addition to this spiral sculpture, the whorls are marked by well-developed, slightly retractive, axial ribs, of which 14 occur upon the first and second, 15 upon the third, 16 upon the fourth, 18 upon the fifth and sixth, 20 upon the seventh, 22 upon the eighth, 28 upon the ninth and tenth, and 34 upon the penultimate turn. The intersections of the axial ribs and spiral keels form strong

cusps which are suddenly truncated posteriorly and slope gently anteriorly, the spaces inclosed between them being small, rounded pits. Sutures channeled. Periphery of the last whorl marked by a slender cord. Base moderately prolonged, ornamented by six spiral cords, of which the two immediately anterior to the periphery and the two at the base of the columella are decidedly stronger than the rest. Aperture rather large, channeled anteriorly; posterior angle acute; outer lip rendered sinuous by the external sculpture; columella stout, twisted, somewhat revolute, and reflected; parietal wall glazed with a moderately thick callus.

The type (Cat. No. 194413, U.S.N.M.) comes from Deadmans Island, San Pedro, California. It has lost the nucleus and probably the first two post-nuclear turns; the nine remaining measure: Length 12.1 mm., diameter 4 mm. A young specimen from the same lot, which furnished the description of the nucleus, has ten post-nuclear whorls, and measures: Length 9.2 mm., diameter 3.3 mm.

Specimens examined.

Catalogue No.	Locality.	Number of specimens.
¹ 194413	Deadmans Island, Lower San Pedro Series, San Pedro, California.....	8
195162	do.....	2
109517	Terminal Island, California.....	2
11803	Santa Barbara, California (Lower Pleistocene).....	1

¹ Type.

BITTIUM (LIROBITTIUM) MUNITUM Carpenter.

Plate 53, figs. 1 and 2.

Cerithiopsis munita CARPENTER, Rep. Brit. Ass. Adv. Sci. for 1863, 1864, p. 628 and p. 660.

Cerithiopsis munita CARPENTER, Ann. Mag. Nat. Hist., ser. 3, vol. 15, 1865, p. 31.

Shell elongate-conic, yellowish white. Nuclear whorls a little more than one (with the sculpture abraded in all our specimens). Post-nuclear whorls strongly shouldered at the summit, marked by three strong, equal and equally spaced spiral keels, which are a little wider than the spaces that separate them. In addition to the spiral keels, the whorls are marked by somewhat retractive axial ribs, of which 18 occur upon the second, 20 upon the third, 24 upon the fourth and fifth, and 28 upon the penultimate. The intersections of the axial ribs and spiral keels form strong tubercles, while the spaces between them are well impressed, rounded pits. Sutures subchanneled. Periphery of the last whorl marked by a strong channel, across which the feeble continuations of the axial ribs extend. Base moderately long, marked by six strong spiral cords which grow successively weaker from the periphery to the umbilical area. In addition to the

above sculpture, the entire surface of the spire and base is crossed by numerous fine lines of growth and exceedingly fine, spiral striations. Aperture subquadrate, channeled anteriorly; posterior angle obtuse; outer lip rendered sinuous by the external sculpture; columella short, stout, somewhat twisted, and reflected parietal wall glazed with a thin callus.

There are ten specimens of this species (Cat. No. 15501, U.S.N.M.) collected by Swan at Neah Bay, Washington, which bear the legend "type." One of these (fig. 1) has seven post-nuclear whorls, and measures: Length 7.8 mm., diameter 3 mm. Another (fig. 2) measures 7 mm. long.

BITTIUM (LIROBITTIUM) MUNITUM MUNITOIDE, new subspecies.

Plate 53, fig. 4.

This is the southern race of *Bittium munitum*. It differs from *B. munitum* proper in being smaller and in having many more ribs, as many as 40 occurring upon the last whorl. The type, one of 115 specimens (Cat. No. 152164, U.S.N.M.) from San Pedro, California, has ten post-nuclear whorls, and measures: Length 8.2 mm., diameter 2.8 mm. Another lot from Whites Point, San Pedro Bay, California, contains 106 specimens. Four specimens were dredged in 50 fathoms off San Pedro, California.

BITTIUM (LIROBITTIUM) ASPERUM Gabb.

Plate 56, fig. 3.

Turbonilla aspera GABB, Proc. Acad. Nat. Sci. Phila., 1861, p. 368;

= *Bittium asperum* GABB, Pal. California, ser. 2, p. 72, pl. 2, fig. 20, 1869;

= *Bittium barbarensense* BARTSCH, Smiths. Misc. Coll. (Quarterly Issue), vol. 50, 1907, pt. 4, p. 28, pl. 57, fig. 15.

Not *Bittium? asperum* CARPENTER, Ann. Mag. Nat. Hist., ser. 3, vol. 17, p. 276, 1866; = *Bittium rugatum* CARPENTER.

Shell elongate-conic, creamy white. Nuclear whorls small, a little more than one, marked by two moderately strong, spiral cords, one a little posterior to the periphery and the other on the middle of the whorl, otherwise smooth. Post-nuclear whorls appressed at the summit, strongly, slopingly shouldered, the first marked by two spiral cords like those on the nuclear whorls, the second showing an intercalated cord between the two, leaving the posterior half of the whorls free of sculpture and with a strong, sloping shoulder. On the succeeding whorls the shoulder is crossed by one and two spiral cords, less strong than those anterior to them. In addition to the spiral sculpture the whorls are marked by somewhat curved, almost vertical axial ribs, which begin on the second whorl and rapidly increase in strength. There are 12 of these ribs on each of the second to ninth turns. The intersections of the axial ribs and spiral cords form

prominent cusps which are suddenly truncated posteriorly, and slope gently anteriorly until they fuse with the general surface of the shell. Sutures well impressed. Periphery and base of the last whorl well rounded, marked by about nine feeble spiral cords of which the first two immediately below the periphery are the strongest. Aperture subquadrate, channeled anteriorly; posterior angle acute; outer lip rendered somewhat sinuous by the external sculpture; columella moderately long, twisted, and reflected; parietal wall glazed with a thin callus.

Gabb's type came from the Lower Pleistocene deposits at Santa Barbara, California. The specimen described and figured (Cat. No. 165231, U.S.N.M.) is a fossil from Santa Barbara. It has 10 post-nuclear whorls (having lost the nucleus and probably the first post-nuclear turn) and measures: Length 8.3 mm., diameter 2.9 mm.

Specimens examined.

Catalogue No.	Locality.	Number of specimens.
165231	Upper Pliocene, Fernando Formation, Bath-house Beach, Santa Barbara, California (described and figured).	1
7970	Lower Pleistocene, Santa Barbara, California.....	2
166051	.....do.....	10
213012	.....do.....	13
195129	Lower Pleistocene, Lower San Pedro Series, Deadman's Island, California.	1
148650	Lower Pleistocene, San Diego, California.....	1

BITTIUM (LIROBITTIUM) ASPERUM LOMAENSE, new subspecies,

Plate 56, fig. 2.

Shell similar to *B. asperum* Gabb, but differing in being uniformly smaller, more slender, and in having more ribs. A specimen of *B. asperum* with 10 post-nuclear whorls measures: Length 8.1 mm., while one of *B. a. lomaense* of the same number of whorls measures 7.1 mm. *B. a. lomaense* is a living representative of *B. asperum*, which is a post-Pliocene species.

The type (Cat. No. 195130, U.S.N.M.) and 21 specimens were dredged at U. S. Bureau of Fisheries station No. 4310, in 71-75 fathoms, off Point Loma Light, California, on gray mud and fine sand bottom. The type has ten post-nuclear whorls and measures: Length 7.1 mm., diameter 2.3 mm. Cat. No. 23744, U.S.N.M., contains 24 specimens dredged in 30 fathoms off Santa Catalina Island, California.

BITTIUM (LIROBITTIUM) CERRALVOENSE, new species.

Plate 55, fig. 1.

Shell elongate-conic, white. Nuclear whorls one and one-half, having two cords which divide the space into three equal parts. Post-nuclear whorls appressed at the summit, decidedly overhang-

ing, marked on the first whorl by a strong, median keel and a feeble cord halfway between this and the suture, the space between the median keel and the summit forming a strongly sloping shoulder. On the third post-nuclear turn two slender spiral cords appear, one of which is at the summit and the other halfway between this and the median cord. On the fifth whorl an additional spiral cord is intercalated between the two on the shoulder. The cords on the shoulder and also the one anterior to the median grow rapidly in strength until finally, on the last volution, they are practically all equal. In addition to the spiral cords, the whorls are marked by moderately strong, decidedly curved, almost vertical, distant axial ribs. These are quite absent on the early whorls, being first indicated on the third post-nuclear turn. On the fourth there are 12, on the fifth to seventh there are 14, on the eighth 18, and on the penultimate turn 20. The intersections of the axial ribs and spiral cords form weak, elongated tubercles; the long axes of which coincide with the spiral sculpture, while the spaces inclosed between the two appear as very elongated, narrow pits. Sutures moderately constricted, showing a portion of the peripheral keel. Periphery of the last whorl marked by a keel about as wide as the strong spiral cords between the sutures. Base short, slightly rounded, marked by five spiral cords which decrease in size and spacing from the periphery to the umbilical area. Aperture subquadrate, channeled anteriorly; posterior angle obtuse; outer lip thin, showing the external sculpture within, sinuous at the edge; columella moderately strong, oblique, somewhat twisted, and reflected; parietal wall glazed with a thin callus.

The type and 4 specimens (Cat. No. 96899, U.S.N.M.) were dredged at U. S. Bureau of Fisheries station No. 2828, in 10 fathoms, on shell bottom, off Cerralvo Island, Gulf of California. The type has nine and one-half post-nuclear whorls and measures: Length 7.9 mm., diameter 2.8 mm.

BITTIUM (SEMIBITTIUM) LARUM, new species.

Plate 57, fig. 4.

Shell very regularly elongate-conic, light brown. Nuclear whorls at least two, worn. Post-nuclear whorls appressed at the summit, decidedly overhanging. The early post-nuclear whorls are marked by four equal and equally spaced spiral cords, the first of which is at the summit; these cords divide the space between the sutures into four equal parts. On the sixth whorl intercalated spiral cords make their appearance in the middle, between all the primary cords; these attain a little more than half the strength of the primary cords on the last turn. In addition to the spiral sculpture, the whorls are marked by moderately strong, almost vertical, axial ribs, of which 14 occur

upon all but the penultimate turn, which has 18. The intersections of the axial ribs and spiral cords form elongate tubercles, which have their long axis parallel with the spiral sculpture. The spaces inclosed between the axial ribs and spiral cords are rectangular pits on the early whorls and broad, incised lines on the later ones. Sutures slightly constricted. Periphery of the last whorl angulated, marked by a spiral cord. Base short, slightly concave in the middle, marked by six spiral cords which grow successively weaker from the periphery to the umbilical region. In addition to the above sculpture, the entire surface of spire and base is marked by fine lines of growth and numerous exceedingly fine, spiral striations. Aperture quadrangular, channeled anteriorly; posterior angle obtuse; outer lip thin, showing the external sculpture within, rendered sinuous at the edge by the external sculpture; columella moderately strong, twisted, and reflected; parietal wall glazed with a thin callus.

The type and 2 specimens (Cat. No. 195156, U.S.N.M.) were dredged in 4 fathoms at San Pedro, California. The type has ten post-nuclear whorls and measures: Length 10 mm., diameter 3.3 mm.

BITTIUM OLDROYDÆ, new species.

Plate 51, fig. 5.

Shell very large, chestnut brown. (Nuclear whorls decollated in all our specimens.) Post-nuclear whorls moderately rounded, ornamented with three spiral keels, which are truncated on their posterior margin and slope gently anteriorly until they fuse with the general mass of the shell. These keels divide the space between the sutures into four almost equal parts, the space between the summit and the first keel being a little narrower than the rest. In addition to the spiral keels, the whorls are marked by slightly retractive axial ribs, of which 12 occur upon the second, 14 upon the third and fourth, 16 upon the fifth to seventh, 18 upon the eighth, 20 upon the ninth and tenth, and 22 upon the penultimate turn. These ribs extend from the summit to the suture. Their intersections with the spiral cords form strong, cusped nodules, which slope more abruptly anteriorly than posteriorly. The spaces inclosed between the spiral keels and the axial ribs are considerably wider than the ribs or cords and form squarish pits. Sutures strongly marked, showing a slender, smooth, peripheral cord (to which the axial ribs extend) on almost all the turns. Periphery and base of the last whorl well rounded, marked by six well-rounded spiral cords, which grow successively weaker, and a little more closely spaced from the periphery to the umbilicus. Entire surface of spire and base crossed by numerous slender axial lines of growth. Aperture moderately large, channeled anteriorly; posterior angle obtuse; outer lip rendered sinuous by the external

sculpture; columella stout, flexuose, and reflected; parietal wall covered with a thick callus.

The type (Cat. No. 196209, U.S.N.M.), which has lost the nucleus and probably the first two post-nuclear turns, has twelve whorls remaining, which measure: Length 13.3 mm., diameter 3.8 mm. The type was collected in drift in Lower California. Two other specimens (Cat. No. 195161, U.S.N.M.) come from Destruction Island, Washington. Cat. No. 198101, U.S.N.M., contains 2 specimens labeled "West Coast," without specific locality. The distribution of this species is rather peculiar.

Named for Mrs. Ida S. Oldroyd.

BITTIUM FETELLUM, new species.

Plate 51, fig. 4.

Shell moderately large, elongate-conic, light yellow. (Nuclear whorls decollated in all our specimens.) Post-nuclear whorls well rounded, slightly shouldered at the summit, marked by three slender, spiral keels, which divide the space between the sutures into four equal areas. (In addition to the three spiral keels, there is a tendency in many of the specimens to have feeble, intercalated cords between the stronger ones.) The axial sculpture consists of decidedly curved, slender ribs, of which 20 occur upon the fourth post-nuclear whorl in the type, 22 upon the fifth, and about 36 upon the penultimate turn. The spaces inclosed between the ribs and the spiral cords are large, shallow, squarish pits on all the turns but the last; on this they are much longer than broad, their long axes coinciding with the axial sculpture. The intersections of the ribs and spiral cords form slender, sharp cusps. Sutures strongly constricted. Base of the last whorl moderately long, slightly curved, marked by four spiral cords, of which the two middle ones are equal and stronger than the others. Entire surface of spire and base marked by numerous strong lines of growth. Aperture large, channeled anteriorly; posterior angle obtuse; outer lip thin, rendered sinuous by the external sculpture; columella very oblique, curved, and reflected; parietal wall glazed with a thick callus.

The type and 28 specimens (Cat. No. 198617, U.S.N.M.) were dredged in 16 fathoms off Catalina Island, California. The type has lost the nuclear whorls; the seven remaining measure: Length 9.3 mm., diameter 3.5 mm.

BITTIUM DECUSSATUM Carpenter.

Plate 52, fig. 2.

Cerithiopsis decussata CARPENTER, Cat. Mazatlan Shells, 1857, p. 445.

Shell elongate-conic, yellowish-white banded with reddish-brown at the base. Nuclear whorls decollated. Post-nuclear whorls marked by three strong, spiral keels, of which the first is slightly

below the summit and renders this decidedly shouldered. In addition to the spiral keels, the whorls are marked by axial ribs, of which 14 occur upon the second, 16 upon the third, 20 upon the fourth, 24 upon the fifth and sixth, 26 upon the seventh, and 28 upon the eighth and penultimate turns. The intersections of the axial ribs and the spiral cords form well-rounded tubercles, while the spaces inclosed between them are squarish pits. Sutures strongly constricted. Base of the last whorl rather long, marked by three prominent spiral keels and a fourth slender thread at the columella. Aperture irregular, channeled anteriorly; posterior angle obtuse; outer lip rendered sinuous by the external sculpture; columella short, stout, twisted, and reflected; parietal wall covered with a thick callus.

The type is on tablet 2034, Liverpool collection, British Museum. It has nine post-nuclear whorls and measures: Length 4 mm., diameter 1.3 mm. Our figure is copied from a camera lucida sketch by Doctor Carpenter.

BITTIUM GIGANTEUM, new species.

Plate 55, fig. 2.

Shell elongate-conic, very large, white. Nuclear whorls decollated. Early post-nuclear whorls with a strongly sloping shoulder, marked by three spiral keels, one of which is at the summit, another median, and the other a little nearer the median than the suture. On the succeeding turns an additional cord makes its appearance, between the one at the summit and the median keel, soon gaining sufficient strength to equal the one at the summit. In addition to these spiral cords, the whorls are marked by strong, well-rounded, curved, retractive, axial ribs, of which 14 occur upon the second, 16 upon the third to fifth, 18 upon the sixth to tenth, and 22 upon the penultimate turn. The junctions of the axial ribs and spiral cords form well rounded tubercles, while the spaces inclosed between them are well impressed, squarish pits. On the last two whorls additional spiral cords make their appearance on either side of the median cord. Sutures very strongly impressed. Periphery of the last whorl marked by a channel across which the feeble continuations of the axial ribs extend. Base short, slightly rounded, marked by a cord immediately below the periphery and slender incised lines anterior to this. Aperture moderately large, subquadrate, channeled anteriorly; posterior angle obtuse; outer lip rendered sinuous by the external sculpture; columella short, almost straight, and reflected; parietal wall covered with a thick callus.

The type and additional specimens (Cat. No. 14935, U.S.N.M.) come from the post-Pliocene of San Diego, California. The type has 12 post-nuclear whorls (having lost the nucleus and probably

two of the first post-nuclear turns) and measures: Length 18.8 mm., diameter 0.5 mm. An additional specimen (Cat. No. 195128, U.S.N.M.) comes from the Pleistocene of San Pedro, California.

BITTIUM CASMALIENSE, new species.

Plate 55, fig. 3.

Shell very large and robust, white. Nucleus and early post-nuclear whorls decollated. Post-nuclear whorls marked by four equal and almost equally spaced, strong, spiral cords which divide the space between the sutures into four almost equal areas. The first of these cords is at the summit. In addition to the spiral cords, the whorls are marked by strong, well rounded, almost vertical, axial ribs, of which 14 occur upon the second, 16 upon the third and fourth, 18 upon the fifth, 20 upon the sixth, while upon the penultimate and last of the remaining turns they become obsolete and irregular. The axial ribs are fully twice as strong as the spiral cords and the intersections of the two form well rounded, elongate tubercles, the long axes of which coincide with the spiral sculpture. The spaces inclosed between the spiral cords and axial ribs are very deeply impressed, oval pits on the early whorls, while on the later ones they are shallow, rectangular pits. Sutures moderately constricted, showing a portion of the peripheral cord. Periphery of the last whorl well rounded, marked by a well rounded, slender, spiral cord. Base well rounded, marked by a single cord a little less strong than the peripheral, and a little nearer the peripheral cord than that is to the cord posterior to it. Aperture fractured, channeled anteriorly; posterior angle obtuse; columella stout and somewhat twisted.

The type (Cat. No. 165279, U.S.N.M.) has the last seven whorls and measures: Length 18 mm., diameter 6 mm. It comes from the Fernando Formation, Lower Pliocene, at the railroad cut, 1 mile north of Schumann, Santa Barbara County, California.

BITTIUM ARNOLDI, new species.

Plate 56, fig. 1.

Shell very large, broadly elongate-conic, white. (Nucleus and early post-nuclear whorls decollated.) The remaining whorls with appressed summit, marked by four strong, spiral cords which divide the space between the sutures into four equal parts. The first of these cords is at the summit. The spaces between the strong spiral cords are divided by intercalated spirals which are well developed, but not quite as strong as the primary cords. On the last turn two of these intercalated spirals occur between all but the third and fourth below the summit, where three are present. In addition to the spiral sculpture, the whorls are marked by moderately strong, curved, well rounded, axial ribs, of which 14 occur upon the third

and fourth, 16 upon the fifth to seventh, and 20 upon the penultimate turn. The intersections of the axial ribs and the spiral cords form narrow, elongate tubercles the long axes of which coincide with the spiral sculpture. The spaces between the spirals appear as broad, strongly incised lines. Sutures moderately impressed. Periphery of the last whorl marked by a spiral cord equal to the stronger cords between the sutures. Base well rounded, ornamented with 10 subequal and subequally spaced spiral cords. Aperture moderately large, channeled anteriorly; posterior angle obtuse; columella stout, twisted, oblique, and reflected.

The type (Cat. No. 165265, U.S.N.M.) has the last eight post-nuclear whorls, which measure: Length 16.8 mm., diameter 7 mm. It comes from the Fernando Formation, Lower Pliocene, at the Waldorf asphalt mine, 3 miles southeast of Guadalupe, Santa Barbara County, California.

Named for Dr. Ralph Arnold of Pasadena.

BITTIUM MEXICANUM, new species.

Plate 58, fig. 1.

Shell elongate-conic, brown. Nuclear whorls decollated. Post-nuclear whorls well rounded, appressed at the summit, marked on the first four turns by four spiral cords which divide the space between the sutures into four equal parts; the first of these cords is at the summit. The first basal cord becomes apparent in the suture of all the turns and gives the shell the appearance of having five cords between the sutures on the spire. Beginning with the fifth whorl, a slender, spiral cord appears immediately below the cord at the summit and increases rapidly in strength until, on the last whorl, it is about half as strong as the cord at the summit. Another intercalated cord begins on the sixth whorl, between the fourth cord and the basal cord. In addition to the spiral sculpture, the whorls are marked by slender, rounded, axial ribs, of which 20 occur upon the third, 16 upon the fourth to sixth, and 30 upon the penultimate turn. Intersections of the axial ribs and spiral cords form low, rounded tubercles, while the spaces inclosed between them are rectangular pits, having their long axes parallel with the spiral sculpture on all but the last whorl; on this they are squarish pits. Sutures strongly constricted. Periphery of the last whorl marked by a channel. Base moderately long, concave, marked by six feeble, spiral cords, grouped in two series of three, one of which is immediately below the periphery and the other surrounds the base of the columella. Aperture irregularly ovate, channeled anteriorly; posterior angle acute; outer lip thin, showing the external sculpture within, rendered sinuous by the external sculpture; columella oblique, somewhat twisted, and reflected.

The type (Cat. No. 126774, U.S.N.M.) comes from the Gulf of California. It has lost the nucleus. The eight remaining turns measure: Length 6.1 mm., diameter 2.1 mm.

EXPLANATION OF PLATES.

All of the figures are enlarged about eight times. The measurement cited after each species is the actual length of the specimen.

PLATE 51.

- FIG. 1. *Bittium* (*Lirobittium*) *catalinense*; type; 7.5 mm.; p. 402.
 2. *Bittium* (*Lirobittium*) *interfossa*; type; 6.2 mm.; p. 401.
 3. *Bittium* (*Lirobittium*) *catalinense inornatum*; type; 7.2 mm.; p. 403.
 4. *Bittium* (subgenus?) *fetellum*; type; 9.3 mm.; p. 409.
 5. *Bittium* (subgenus?) *oldroydæ*; type; 13.3 mm.; p. 408.
 6. *Bittium* (*Lirobittium*) *interfossa*; 8.3 mm.; p. 401.

PLATE 52.

- FIG. 1. *Bittium* (*Semibittium*) *purpureum*; Cat. No. 56004, U.S.N.M.; p. 391.
 2. *Bittium* (subgenus?) *decussatum*; type; 4 mm.; p. 409.
 3. *Bittium* (*Semibittium*) *purpureum*; cotype; 7.3 mm.; p. 391.
 4. *Bittium* (*Lirobittium*) *ornatissimum*; type; 12.1 mm.; p. 403.
 5. *Bittium* (*Lirobittium*) *ornatissimum*; 9.2 mm.; p. 403.
 6. *Bittium* (*Semibittium*) *armillatum*; type; 9.5 mm.; p. 391.

PLATE 53.

- FIG. 1. *Bittium* (*Lirobittium*) *munitum*; cotype; 7.8 mm.; p. 404.
 2. *Bittium* (*Lirobittium*) *munitum*; cotype; 7 mm.; p. 404.
 3. *Bittium* (*Semibittium*) *vancouverense*; cotype; 7.8 mm.; p. 392.
 4. *Bittium* (*Lirobittium*) *munitum munitoide*; type; 8.2 mm.; p. 405.
 5. *Bittium* (*Bittium*) *panamense*; type; 14 mm.; p. 386.
 6. *Bittium* (*Bittium*) *johnstonæ*; type; 7.9 mm.; p. 387.

PLATE 54.

- FIG. 1. *Bittium* (*Semibittium*) *attenuatum*; cotype; 8.8 mm.; p. 393.
 2. *Bittium* (*Semibittium*) *attenuatum* (type of *B. esuriens*.); p. 393.
 3. *Bittium* (*Semibittium*) *attenuatum multifilosum*; type; 9.2 mm.; p. 395.
 4. *Bittium* (*Semibittium*) *attenuatum boreale*; type; 10.1 mm.; p. 395.
 5. *Bittium* (*Semibittium*) *attenuatum*; cotype; 10.2 mm.; p. 393.
 6. *Bittium* (*Semibittium*) *attenuatum latifilosum*; type; 10 mm.; p. 395.

PLATE 55.

- FIG. 1. *Bittium* (*Lirobittium*) *cerralvoense*; type; 7.9 mm.; p. 406.
 2. *Bittium* (subgenus?) *giganteum*; type; 18.8 mm.; p. 410.
 3. *Bittium* (subgenus?) *casmaliense*; type; 18 mm.; p. 411.

PLATE 56.

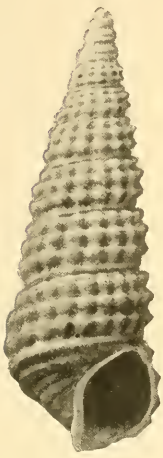
- FIG. 1. *Bittium* (subgenus?) *arnoldi*; type; 16.8 mm.; p. 411.
 2. *Bittium* (*Lirobittium*) *asperum lomaense*; type; 7.1 mm.; p. 406.
 3. *Bittium* (*Lirobittium*) *asperum*; 8.3 mm.; p. 405.
 4. *Bittium* (*Semibittium*) *rugatum*; type; 12 mm.; p. 397.
 5. *Bittium* (*Semibittium*) *rugatum*; 10 mm.; p. 397.

PLATE 57.

- FIG. 1. *Bittium* (*Semibittium*) *nicholsi*; type; 6.1 mm.; p. 399.
2. *Bittium* (*Semibittium*) *nitens*; type; 5.7 mm.; p. 400.
3. *Bittium* (*Stylidium*) *eschrichtii icelum*; type; 15 mm.; p. 388.
4. *Bittium* (*Semibittium*) *larum*; type; 10 mm.; p. 407.
5. *Bittium* (*Semibittium*) *subplanatum*; type; 10.9 mm.; p. 395.

PLATE 58.

- FIG. 1. *Bittium* (subgenus?) *mexicanum*; type; 6.1 mm.; p. 412.
2. *Bittium* (*Semibittium*) *quadriplatatum*; type; 7 mm.; p. 398.
3. *Bittium* (*Semibittium*) *quadriplatatum*; 11.5 mm.; p. 398.
4. *Bittium* (*Stylidium*) *eschrichtii*; 14 mm.; p. 387.
5. *Bittium* (*Stylidium*) *eschrichtii montereyense*; type; 13.8 mm.; p. 389.



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WEST AMERICAN MOLLUSKS OF THE GENUS BITTIUM.

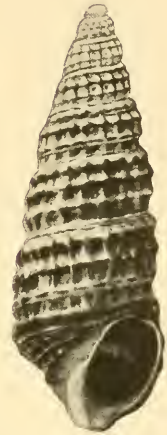
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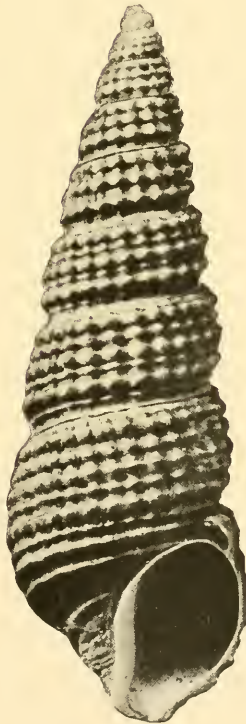
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WEST AMERICAN MOLLUSKS OF THE GENUS BITTIUM.

FOR EXPLANATION OF PLATE SEE PAGE 413.



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WEST AMERICAN MOLLUSKS OF THE GENUS BITTIUM.

FOR EXPLANATION OF PLATE SEE PAGE 413.



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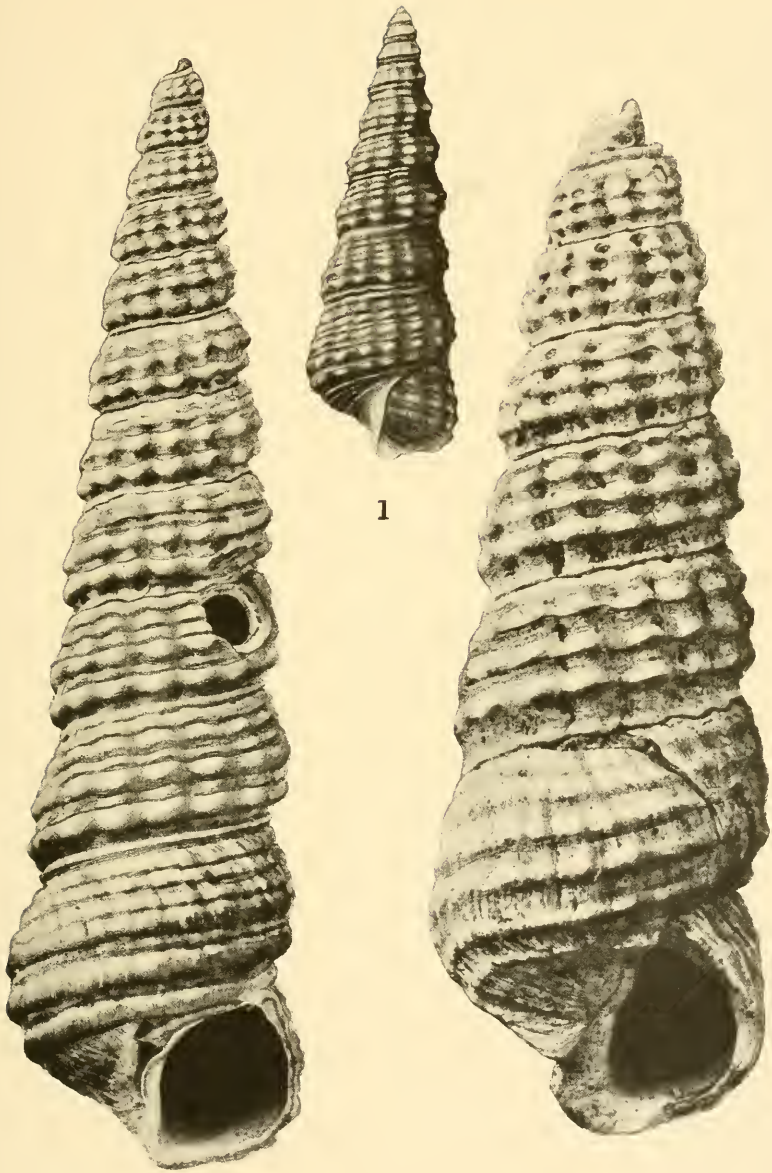


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WEST AMERICAN MOLLUSKS OF THE GENUS BITTIUM

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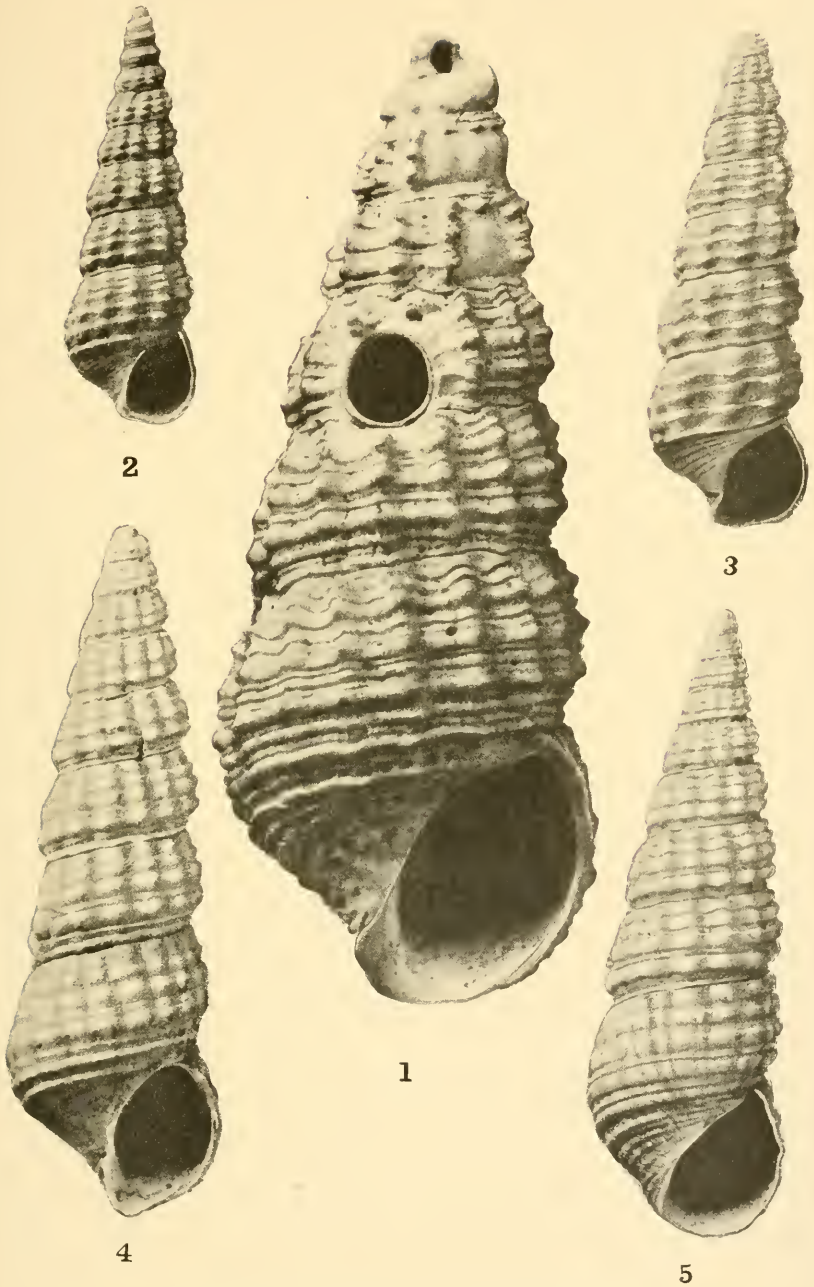
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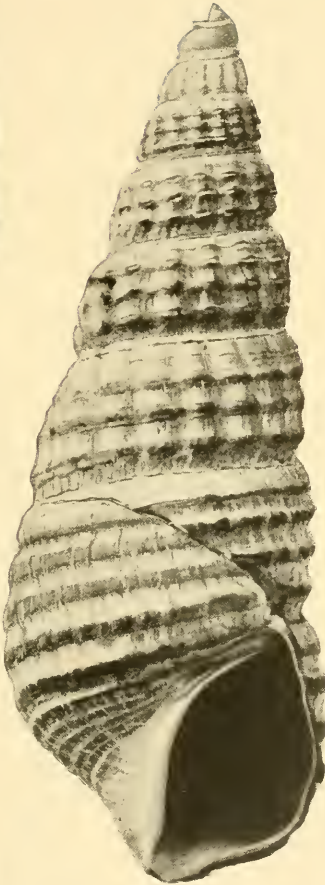
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FOR EXPLANATION OF PLATE SEE PAGE 414.



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WEST AMERICAN MOLLUSKS OF THE GENUS BITTIUM.

FOR EXPLANATION OF PLATE SEE PAGE 414.

