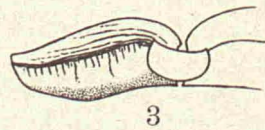
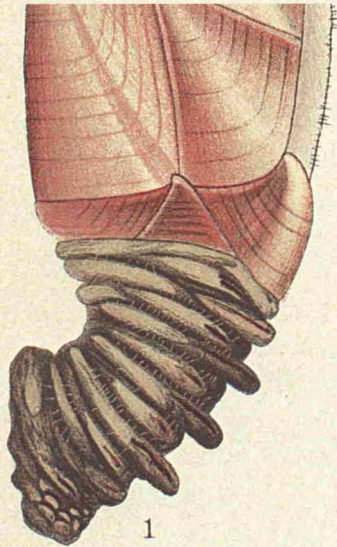
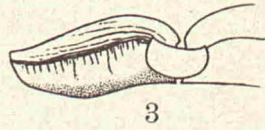
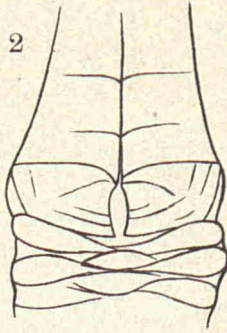
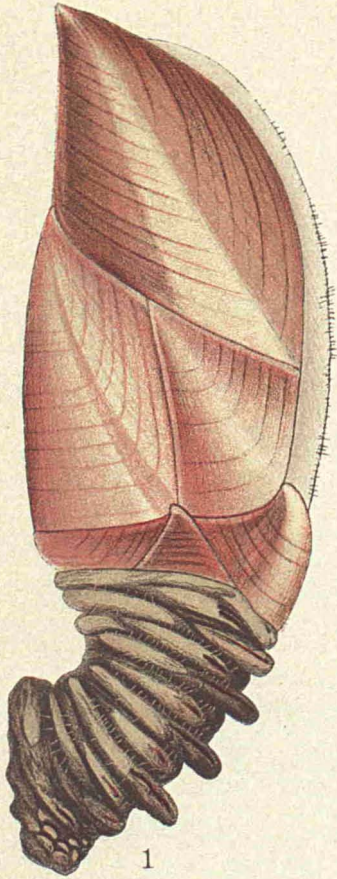

BARNACLES OF JAPAN AND BERING SEA



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The Cirripedia described herein were collected by the United States Fisheries steamer *Albatross* during the expedition of 1906. With a single exception, all are from Japanese waters and Bering Sea. The stations occupied are described in Bureau of Fisheries Document No. 621.

Little has been published on the barnacles of the northwest Pacific and adjoining seas; our knowledge of littoral and deep sea forms alike is scant. If the profusion of other invertebrates has any significance, we may expect a rich and varied fauna of Cirripedia off the Japanese east coast. Yet it must be admitted that the work of the *Challenger* and that of the *Albatross* have given no evidence of unusual richness in this cirripede fauna. An interesting feature brought out by the work of the *Albatross* is that a number of species of *Scalpellum* and *Pachylasma* live upon the stalks and pinnules of crinoids.

In Japan, acorn barnacles (*Balanus* sp.) are extensively used as manure. Bunches of bamboo collectors, similar to those used for oyster spat, are planted in the tide flats of Ariake Bay. After sixty to one hundred days they are taken up and the barnacles are beaten off. The annual yield is 400,000 bushels, valued at 30,000 yen.^a

Family SCALPELLIDÆ.

Genus MITELLA Oken.

Mitella mitella (Linnæus).

1851. *Pollicipes mitella* Linnæus, Darwin, Monograph on the Cirripedia, Lepadidæ, p. 316.

Locality, Matsushima, on shore.

Genus SCALPELLUM Leach.

GROUP OF S. SCALPELLUM.

Scalpellum stearnsii Pilsbry. [Pl. IX, fig. 1 (young).]

1907. *S. stearnsii*, Pilsbry, U. S. National Museum Bulletin No. 60 p. 14.

1907. *S. stearnsii*, Hoek, Siboga Expeditie, Monographie xxxix, Cirripedia, p. 69, with var. *gemina* and *robusta*.

This species was originally described from the Pacific coast between the Bay of Tokyo and the Inland Sea. The *Albatross* has taken specimens at the following stations:

Museum number.	Station number.	Locality.	Depth in fathoms.
38663	4940	Kagoshima Gulf	115
38665	4941do	117
38664	4942do	118
38677	4943do	119
32875	3704	Senou Umi, off Hondo I.	94

^a K. Mitsukuri, Bulletin of the Bureau of Fisheries, vol. xxiv, p. 287.

A specimen taken at Nagasaki by Lischke has been figured by Hoek. The same author has described a variety *robusta* from the Malay Archipelago. This form has a broader capitulum and is said to have a longer peduncle. In the latter character, at least, the Japanese form does not differ from the Malaysian, as will be seen by the following measurements:

Station number.	Length of capitulum.	Breadth of capitulum.	Length of peduncle.	Number of rings of scales.	Remarks.
	<i>mm.</i>	<i>mm.</i>	<i>mm.</i>		
4942	50	32	64	20	Very plump.
4942	44	28.5	55	22	
4940	40	26	35	17	
4941	47	33	58	30	

A dry specimen in the collection of the Academy of Natural Sciences of Philadelphia has a very short peduncle; length of capitulum 44, width 28.5, length of peduncle, 20 mm. with 14 close scale rings. In dry specimens the peduncle contracts a good deal, bringing the spaced scale rings close together. The type originally figured by me was a dry specimen, which probably had originally a peduncle fully as long as any of the variety *robusta*. It has about 26 rings of scales.

Scalpellum stearnsii var. *gemina* Hoek (= *Scalpellum inerme* Annandale) I regard as a distinct species.

A young specimen (pl. ix, fig. 1) from station 4942 shows some suggestive features. The capitulum is 8.5 mm. long, 4.5 wide. The umbo of the scutum is apical, and that of the carina is nearly so, being within 1 mm. of the apex, the total length of the carina being 7 mm. The inframedian latus is comparatively much narrower than in adult individuals, and is somewhat contracted in the middle, the umbo being situated below the middle near the rostral border. In shape this plate reminds one of that of *S. idioplax* and its allies. The carinal latera project very little below the carina. No rostrum is visible. The plates are closely juxtaposed, without the wide chitinous sutures of the adult stage. These several characters, especially the positions of the umbones and the shape of the inframedian latus, approximate to the structure of *Arcoscalpellum*, and inasmuch as they probably represent an ancestral condition, they indicate that the typical group of *Scalpellum* is a divergent phylum, *Arcoscalpellum* being a more conservative group. The specimen figured is no. 38678 U. S. National Museum.

SUBGENUS ARCOSCALPELLUM HOEK.

GROUP OF SCALPELLUM VELUTINUM.

This group was defined in Bulletin 60, U. S. National Museum, page 26, where the American species are described. The following species belong here, all being deep-water forms:

<i>Scalpellum velutinum</i> Hoek.	<i>S. rubrum</i> Hoek.
<i>S. regium</i> Wyville Thomson.	<i>S. antarcticum</i> Hoek.
<i>S. regium latidorsum</i> Pilsbry.	<i>S. sociabile</i> Annandale.
<i>S. regina</i> Pilsbry.	<i>S. alcockianum</i> Annandale.
<i>S. darwini</i> Hoek.	<i>S. pedunculatum</i> Hoek.
<i>S. gigas</i> Hoek.	<i>S. indicum</i> Hoek.
<i>S. giganteum</i> Gruvel.	<i>S. hirsutum</i> Hoek.
<i>S. moluccanum</i> Hoek.	<i>S. hawaiiense</i> Pilsbry

Scalpellum rubrum Hoek. [Pl. VIII, fig. 1, 2, 3, 4.]

1883. *S. rubrum* Hoek, Challenger Report, Zoology, vol. VIII, p. 91, pl. 4, fig. 18.

This species was described from one specimen with the capitulum 5 mm. long, taken by the *Challenger* at station 204, near Luzon, in 100-115 fathoms. This specimen is described as "beautifully red and white colored", but without details as to the pattern. Its valves are "not covered by distinct membrane," and nothing is said of cuticular hairs. The internal organs were not examined.

A series of ten specimens was taken by the *Albatross* at station 4934, Eastern Sea, off Kagoshima Gulf, $30^{\circ} 58' 30''$ N., $130^{\circ} 32'$ E., 152 fathoms, rocky bottom. (No. 38680 U. S. National Museum.) These show that the *Challenger* example was a very young one. I have therefore thought it well to describe the adult stage.

The occludent margin of the scutum is slightly convex, that of the tergum a trifle concave. The plates are crimson, passing into a dull yellowish tint. The pattern varies somewhat, but there is usually a ray of the paler tint down the middle of each of the three larger plates, while the borders have crimson rays. In some examples nearly the whole scutum is yellowish. The plates of the lower whorl are generally crimson. The narrow sides and rounded ribs bordering the roof of the carina are milk white. The flat, sunken roof has a crimson stripe bordering each lateral rib, the middle being pale. The plates are covered with a very thin cuticle which is most minutely downy.

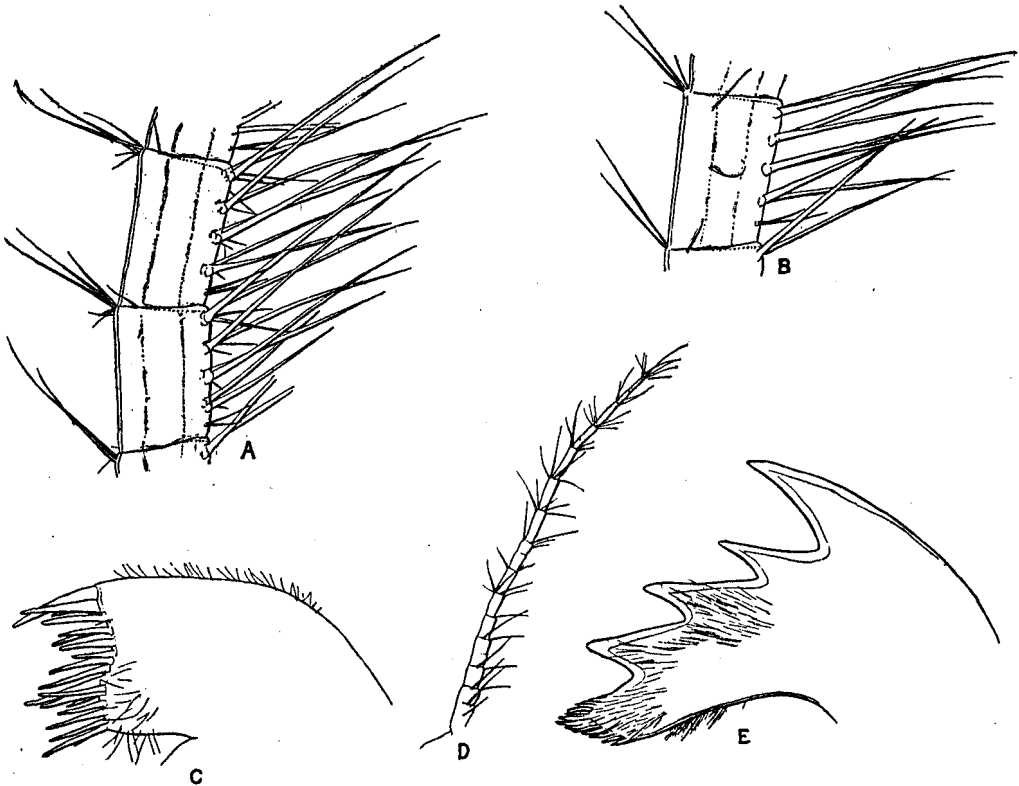


FIG. 1.—*Scalpellum rubrum* Hoek. A, 15th and 16th segments of outer ramus of cirrus v; B, 11th segment of inner ramus of cirrus v; C, maxilla; D, terminal appendage; E, mandible.

The scutum and tergum each has a low median diagonal riblet running from umbo to the baso-carinal angle. On both sides of this the surface is sculptured with low, irregular growth-wrinkles, and extremely minute growth-striae; and weak fine radial striae may be seen in suitable lights. A low rib runs along the scutal border of the upper latus, which is sculptured with growth-wrinkles and indistinct radial striae, like the other plates.

The carina is very long, reaching upward beyond the upper fourth of the length of the carinal border of the tergum: and its apex is thrust between the terga, which diverge at the tips. On the roof the fine growth-striae are broadly V-shaped.

The visible portion of the rostrum is small and triangular or oblong (pl. VIII, fig. 2).

A dissected specimen shows that the true shape of the rostrum is very unlike its externally visible face. It is wider than high, with concave upper and convex lower margin, as shown in figure 3, an inside view of rostrum and rostral latera.

The inframedian latus is triangular, the base slightly longer than the sides.

The peduncle is short, with six rows of large erect scales, five to seven scales in each row. It is rather copiously hairy. The scales are dull olive-yellowish, those of the carinal and adjacent rows edged with crimson.

The measurements of three individuals follow:

Length of capitulum.	Breadth of capitulum.	Length of carina.	Diameter of carina.	Length of peduncle.
<i>Mm.</i>	<i>Mm.</i>	<i>Mm.</i>	<i>Mm.</i>	<i>Mm.</i>
16.0	9.7	17.0	3.1	9.0
17.0	9.2	17.0	3.0	8.0
17.0	10.0	18.5	3.0	12.0

The mandible (fig. 1, E) has four teeth and a multispinose lower point. There is a very small beard on the lower edge.

The maxilla (fig. 1, C) has a slightly sigmoid edge, closely spinose.

The first cirrus has very unequal rami of 8 and 11 segments, which are densely hairy. The other cirri are of the usual slender form. The second cirrus has many spines on the inner faces of the cirri, and five pairs on the anterior side. The third and fourth cirri have a row of about 3 small spines on the inner face. The fifth cirrus has rami of about 27 segments, the median ones with four pairs of large and one of small spines, and the usual tufts at the posterior sutures (fig. 1, A, 15th and 16th segments of outer ramus cirrus v); besides these, the inner ramus has 1 to 3 small spines on the inner face of some of the median segments (fig. 1 B, 11th segment). The terminal appendages have 17 segments (fig. 1, D).

The penis is extremely long and slender, with some short, very sparsely scattered hairs.

GROUP OF SCALPELLUM ALBUM.

A group of *Arcoscalpellum*; rostral latera rather high; inframedian latus narrowly triangular with apical umbo; carinal latus high, with incurved apical umbo. Scales of the peduncle well developed, in few (5 or 6) regular longitudinal rows. Small forms, living so far as we know on the pinnules of crinoids. The following species belong here:

a. Rostrum well developed; carina extending downward V-like between the carinal latera.

Scalpellum album Hoek, Malay Archipelago, 500 fathoms.

S. weltnerianum Pilsbry, off southern Japan.

S. pentacrinarum Pilsbry, off Havana, Cuba.

b. Rostrum minute or wanting; carinal latera enormously long, united in a suture below the carina

Scalpellum balanooides Hoek, 5° 42' S., 132° 25' E., 126 fathoms.

S. gonionotum Pilsbry, Goto Islands, Japan.

***Scalpellum weltnerianum* Pilsbry.** [Pl. IX, fig. 5, 6, 7.]

Type no. 32679 U. S. National Museum.

Type locality: Albatross Station 4918, 30° 22' N., 129° 08' 30'' E., 361 fathoms, about 90 miles WSW. of Kagoshima Bay, Japan; one specimen on a crinoid pinnule.

The capitulum is fully twice as long as wide; the ocludent border is straight, the dorsal border arched. The plates are white, with an extremely thin, not hairy, cuticle, and those of the upper whorl are separated by distinct but rather narrow chitinous spaces which isolate the carina and upper latus except at their bases. All of the plates are sculptured with radial striæ or fine riblets, which are weaker and worn near the apices; and there are some spaced impressed lines indicating growth periods.

The scutum is narrow, with the beak reaching over the base of the tergum. The basal margin makes a right angle with the occludent margin, and is less than half its length. The diagonal ridge is acute in its lower part.

The tergum is about three times as long as wide, with straight occludent and basal margins. The carinal margin is straight except near the lower angle, where it becomes convex. The apex of the carina lies in the middle of the carinal margin. The surface of the plate is lightly concave near the occludent margin.

The carina is regularly and strongly arched throughout, with rounded roof. In section it is U-shaped. The sides are wide near the base, pass gradually into the roof and taper regularly toward the apex, near which an extremely narrow intraparietal area is visible through the cuticle. The lines of growth descend V-like on the roof.

The upper latus is quadrangular, more than twice as long as wide. The scutal border is much the longest and is concave; tergal border straight, somewhat serrate; carinal border slightly convex; basal border very oblique and straight. The lower angle of the plate is concealed under the apex of the inframedian latus. The umbo is terminal above.

The visible part of the rostrum is lozenge-shaped or rather narrowly pointed-oval, with regularly convex sides and a ridge down the middle.

The rostral latus is about as high as wide, with straight and equal scutal and lateral borders meeting at an angle of about 60°. The basal margin is very short, and the rostral margin is concave.

The inframedian latus is narrowly triangular, the height more than double the basal width. It is longer than the adjacent edge of the rostral latus, and toward the apex it curves slightly toward the carina.

The carinal latus is higher than wide, with the acute apical umbo curving scutad and situated at the suture between carina and upper latus. The carinal border is longest, strongly arched; upper border concave; the lateral margin is somewhat concave. The surface of the plate is divided by a curved diagonal line from the apex to the baso-lateral angle separating the sunken lateral area from the strongly convex carinal area. In carinal view, the carinal latera meet at the base, their carinal edges forming a long V.

The peduncle tapers strongly toward the base. It is closely covered with strongly imbricating and laterally interlocking subtriangular white scales, which under a high power are seen to be finely striated from summit to base. The scales form six regular longitudinal rows, of fourteen scales each.

Length of the capitulum 11 mm.; greatest width 5 mm. Length of the carina 8.2 mm.; width near the base 1.5 mm. Length of the peduncle about 4 mm.

A single example was taken. In order to preserve this entire, I was compelled to forego examination of the internal organs. It is closely related to *S. album* Hoek described from the Malay Archipelago in 500 fathoms, but that species seems from the description and figure to be smoother, more compressed, and larger. Hoek writes of *S. album*: "surface smooth * * * when studied with the microscope the beautiful striation of the valves distinctly appears". In *S. weltnerianum* the costation is distinctly visible to the naked eye. *S. weltnerianum* is also related, though rather distantly, to *Scalpellum pentacrinarum* Pilsbry,^a a West Indian species also living on the pinnules of crinoids. The peculiar armor of the peduncle is the same in the two species, which further agree in the structure of the carina and the general shape of the other plates; but the sculpture and proportions of the individual plates are quite diverse. The very sparsely scattered hairs mentioned in my preliminary description are, I am now disposed to think, foreign growths.

This species is named in honor of Herr W. Weltner of the Museum der Naturkunde in Berlin, author of several useful papers on cirripedes.

Scalpellum gonionotum Pilsbry. [Pl. IX, fig. 2, 3, 4.]

Type no. 38678, U. S. National Museum.

Type locality: Albatross station 4901, 32° 30' 10" N., 128° 34' 40" E., 10-20 miles southwest of the Goto Islands.

^a U. S. National Museum Bulletin no. 60, p. 55, fig. 20.

The capitulum is narrow and long, widest near the middle, tapering toward both ends, with no perceptible cuticle or pubescence. Occludent margin straight, carinal margin obtusely angular in the middle. The plates are white, everywhere closely juxtaposed, with sculpture of rather widely spaced grooves indicating former growth-periods.

The scutum is long, with straight, subparallel occludent and lateral margins; basal margin straight, at a right angle with the occludent margin.

The tergum is longer and larger than the scutum, with slightly convex basal and carinal margins, the apex erect.

Carina very short, nearly straight, with apical umbo at the upper fourth of the carinal margin of the tergum. Roof flattened; sides rounded, narrow, of nearly equal width throughout. Upper latus triangular, the sides and angles subequal.

Rostrum very narrow, separating the rostral latera in the upper half of their length.

Rostral latus somewhat wider than high, quadrangular, divided into triangular areas by a low diagonal ridge.

The inframedian latus is triangular, the apex curving toward the occludent margin. The basal width is about half the height.

The carinal latus is enormously lengthened, as long as the carina. The two latera meet behind in a straight suture, diverging only near the apices, which curve ventrad. The carinal outline of the plate is convex; the lateral border is divided into two concave arcs, a point between them projecting toward the occludent margin.

The peduncle tapers rapidly to the small base. It is densely covered with ivory-like scales arranged in five regular longitudinal rows, of which one is carinal, two on each side lateral. The carinal row has 14 scales, which are not so wide as those of the other rows. In the largest specimen a few additional scales are interposed between the lateral rows near the base of the capitulum.

Length of the capitulum 7.3 mm.; breadth 3.5 mm. Length of the carina 3.5 mm.; length of the peduncle 4.2 mm. A second specimen is slightly smaller; length of the capitulum 6 mm.

This curious little species is closely related to *S. balanoides* Hoek, taken by the *Challenger* in 5° 42' S., 132° 25' E., in 129 fathoms. A number of specimens were seated on a crinoid arm, none of them so large as *S. gonionotum*, the capitulum being only 4.5 mm. long, peduncle with five rows of seven scales each. *S. balanoides* has no rostrum; the dorsal margin is regularly curved, not hunchbacked like *S. gonionotum*, and the inframedian latus is very much narrower. Moreover, the roof of the carina is flat in *S. gonionotum*. The two species seem therefore to be quite distinct. The two specimens of *S. gonionotum* were detached when received, but from the shape of the impression near the base of the peduncle, they were attached to some narrow object, probably a crinoid pinnule.

GROUP OF SCALPELLUM JAPONICUM.

The species of this group have one or more longitudinal rows of spines on the segments of the posterior cirri, besides the usual pairs on the anterior and along the posterior margins. The posterior side is also minutely spiculate. The somewhat allied *S. imperfectum* Pilsbry has similar segments.

This group seems to be rather richly developed off southeastern Japan. The species are variable; and many more forms probably await the dredge.

Scalpellum japonicum Hoek. [Pl. x, fig. 1 to 5, 9.]

1883. *Scalpellum japonicum* Hoek, Challenger Report, VIII, Cirripedia, p. 67, pl. 3, fig. 9, 10 (type locality, Challenger Station 235, lat. 34° 7' N., long. 138° E., in 565 fathoms).

1907. *Scalpellum japonicum metapleurum* Pilsbry, Proc. Acad. Nat. Sci. Phila., 1907, p. 360 (type locality Albatross station 4972).

This species was based upon a single example with the capitulum 13.5 mm. long, taken in the Pacific off Japan south of the middle of Hondo Island in deep water.^a Since the published drawing does not show clearly the shape of the calcified portion of the upper latus, I have given a view of the right side

^a The shell upon which this barnacle is seated was thought by Hoek to be perhaps a species of *Rissoa*, but from its size and shape, as shown in Hoek's drawing, I think it may be a *Bathybembix* (*Turcicula*).

(pl. x, fig. 9) from a camera lucida sketch of the type which I owe to the kindness of Mr. W. T. Colman, of the British Museum. These show the calcified area to be irregularly oblong, with subparallel scutal and basal borders, and with two short subequal, straight facets opposed to the carina and the carinal latus, respectively. The peduncle is described as 4.5 mm. long, with about 8 longitudinal rows of 7 scales each. The two sides of the type are alike.

The *Albatross* took two specimens of *Scalpellum* at station 4972, south of Hondo, $33^{\circ} 25' 45''$ N. $135^{\circ} 33'$ E., in 440 fathoms, which agree in the main with *japonicum*, but differ a little in shape of the upper latus. These specimens may be referred to as no. 38684 and no. 38685.

No. 38684 (pl. x, fig. 1, 2, 3) has a capitulum 17 mm. long, 9.5 wide, peduncle 5 mm. long. The calcified portion of the upper latus on the right side (fig. 1) forms a quadrangular band transverse to the length of the capitulum, with an oblong tongue projecting beyond the umbo. There is no calcified lobe along the scutal margin, and it differs from the type of *S. japonicum* in having no straight face opposed to the carinal latus. On the left side, the upper latus has a slightly waved lower margin, approaching in a slight degree to the condition in specimen no. 38685, and to typical *S. japonicum*. The other

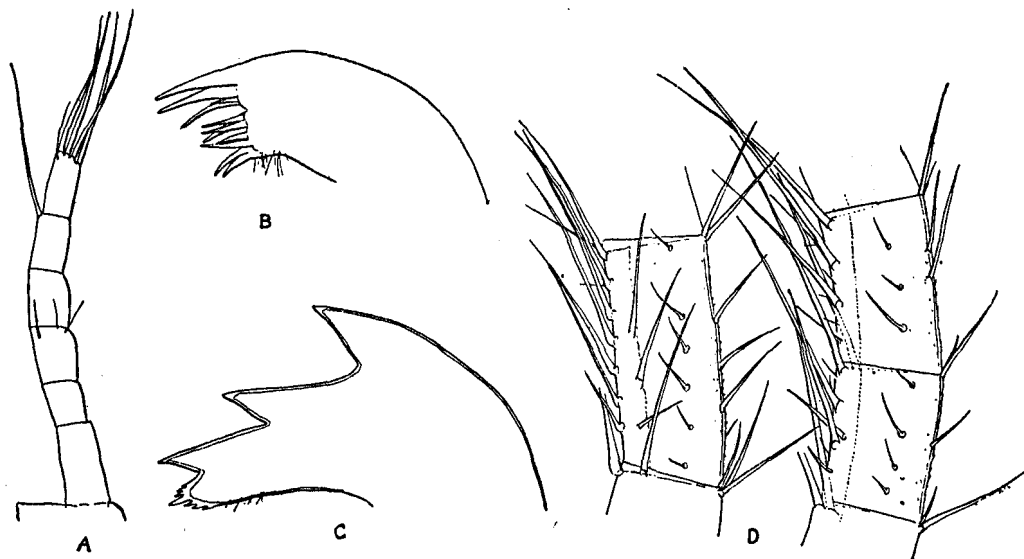


FIG. 2.—*Scalpellum japonicum*. A, terminal appendage; B, maxilla; C, mandible; D, segments from both rami of cirrus v.

plates are substantially as in the type of *S. japonicum*. The peduncle has 8 longitudinal rows of about 7 large scales each, therefore like that of *S. japonicum*. This is the specimen I called var. *metapleurum*, which name will now become a synonym of *japonicum*.

Specimen no. 38685 measures, length of capitulum 15, width 9, length of peduncle 6 mm. On the left side the upper latus is shaped substantially as in no. 38684, but on the right it is narrower, and abruptly attenuated near the carinal end (pl. x, fig. 4). The rostrum is a trifle smaller (pl. x, fig. 5). The scales of the peduncle are less numerous, only 4 or 5 in each longitudinal row. Both of the above specimens are clothed with a very thin, finely pilose cuticle, which has been mainly ignored in the figures, in order to show the outlines of the calcified valves more clearly.

Specimen no. 38684 was opened. The mandible (fig. 2, C) has three acute points and a seven-spined lower point. There are a few scattering hairs below, but elsewhere the borders are very smooth, simple, and clear-cut.

The maxilla (fig. 2, B) has very few spines, a few hairs below but none on the upper margin.

The first cirrus has unequal rami of about 7 and 12 segments, but they are not distinct in my preparation. The second cirrus has subequal rami, is profusely bristly, with 6 or more pairs of large spines

on the anterior margin of each segment. The fifth cirrus has branches of 33 and 27 segments. The posterior edges are set with minute spines. The outer branch has three pairs of large and one of small spines along the anterior border. There are two or three very unequal spines posteriorly at each suture, and one or two between the sutures. There is also a row of short spines along the inner face of the ramus. The inner branch has longer segments, with more spines along the anterior border—as many as 6 or 7 pairs. There are two rows along the inner face of the ramus (fig. 2, D, 12th segment of inner ramus and 13th and 14th segments of outer ramus of cirrus v).

The terminal appendages (fig. 2, A) have 6 segments, with very few bristles except for a group of long ones at the apex. Its length, not measuring the apical bristles, is 2.25 mm.

At Albatross station 4901, southwest of the Goto Islands, Eastern Sea, 139 fathoms, a minute barnacle was taken, which I believe to be the young stage of *S. japonicum* or some closely related form. It is figured on plate x, figures 6, 7, 8. The capitulum is 6.3 mm. long. The carina is separated from the tergum and upper latus by a narrow chitinous space, the other plates being closely juxtaposed. There is a narrow rostrum. The umbo of the inframedian latus is near the lower third. The carina has a rather broad roof. The peduncle has rather large scales, sparse except on the dorsal side. If mature this barnacle would be thought a member of the group of *Scalpellum idioplax*; but its characters are just what one would expect in young of the *S. japonicum* group. The specimen is no. 38688, U. S. National Museum.

Scalpellum japonicum biramosum. New subspecies. [Pl. XI, fig. 1, 2, 3.]

Type no. 38686, U. S. National Museum.

Type locality: Albatross station 4972, south of Hondo Island, Japan, 33° 25' 45'' N., 135° 33' E., 440 fathoms.

This form was associated with the two specimens of *S. japonicum* described above. It differs from them in the following respects: The umbo of the carina is nearer the upper end of the plate. The upper latus has a lobe extending down along the scutal border; this lobe is bifid on the right (fig. 1), simple on the left side (fig. 2). The hour-glass-shaped inframedian latus is less excavated along its upper border than in *japonicum*. The rostral latus is much higher. The rostrum is reduced to a punctiform vestige. The peduncle has 10 longitudinal rows of about 7 scales each. Length of capitulum 17.5 mm., width 9.3 mm., length of carina 17 mm., diameter at base 2 mm. Length of peduncle 4 mm.

Whether this form will prove to be within the range of normal variation of *S. japonicum* or not remains to be determined by future collections.

Scalpellum molliculum. New species. [Pl. XI, fig. 4, 5.]

Type no. 38687, U. S. National Museum.

Type locality: Albatross station 4967, south of Hondo Island, Japan, 33° 25' 10'' N., 135° 37' 20'' E., in 244 fathoms.

A species allied to *S. curiosum* and *S. japonicum*. The oblong capitulum is widest in the middle, tapering toward both ends, the occludent and carinal margins about equally arched. The calcified portions of the valves are white, the chitinous portions yellowish. The very thin cuticle is nowhere hairy.

The scutum has an arcuate occludent margin, and a short projection at the tergo-lateral angle. The baso-lateral margin is rounded.

The tergum is V-shaped, the occludent limb narrower and much shorter than the carinal.

The carina is regularly and strongly arcuate, with a flat roof and slightly projecting angles. The sides are narrow, a little wider above; they meet above the umbo, which is removed a very short distance from the upper end of the plate.

There is no externally visible rostrum.

The upper latus is triangular, the umbo quite near the apex. The carinal margin is very short, the basal margin irregular.

The rostral latus is oblong, the lateral margin longer than the rostral; upper and lower margins subparallel.

The inframedian latus is fan-shaped, wide in the upper part, tapering from the middle to the very narrow base, where the umbo is situated.

The carinal latus is triangular, the umbo projecting a little at the baso-carinal angle. There is a short, straight face opposed to the upper latus and a long, slightly concave margin opposed to the inframedian latus.

The peduncle is closely covered with rather small scales in about 15 rows of 12 to 15 scales each. Some of the longitudinal rows do not reach to the base of the peduncle, the scales being somewhat irregularly arranged in places.

Length of the capitulum, 19.5 mm.; width, 11 mm.; length of the carina, 19 mm.; diameter at base, 3 mm.; length of the peduncle, 6.5 mm.

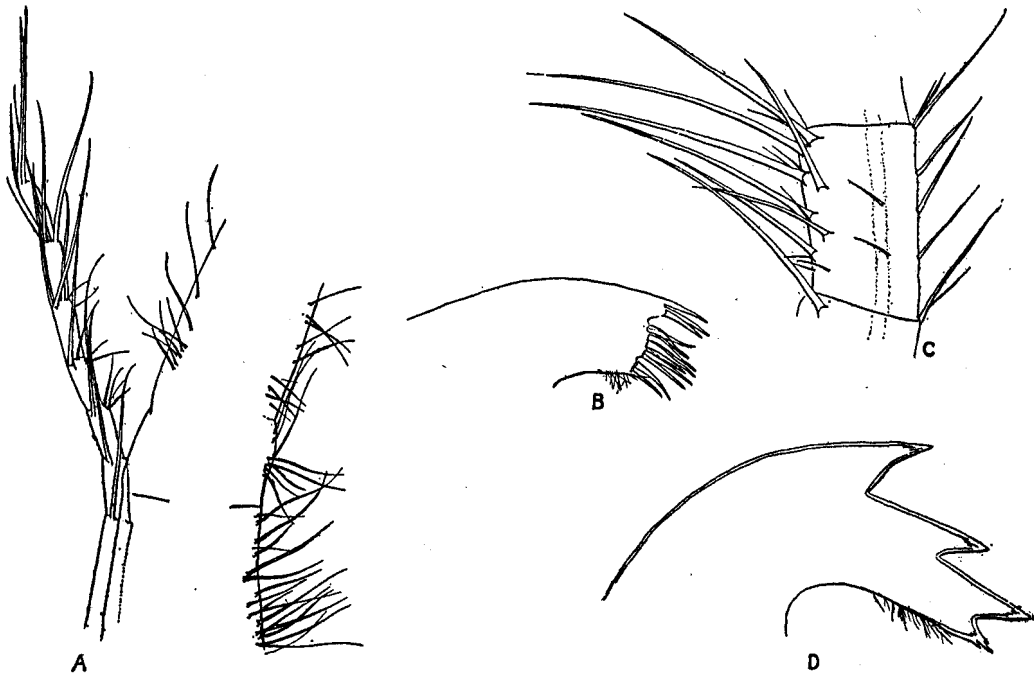


FIG. 3.—*Scalpellum molliculum*. A, basal segments of cirrus vi with terminal appendage; B, maxilla; C, 16th segment of cirrus v; D, mandible.

The type specimen was dissected. The mandible is very similar to that of *S. japonicum*, differing only in being a little more slender, with fewer spines at the lower point (fig. 3, D).

The maxilla (fig. 3, B) is also like that of *S. japonicum*. As in that species, the upper spine stands alone, then two great spines diverge from a common base.

The first cirrus has unequal rami of 8 and 11 segments. The later cirri have segments with four pairs of large and one of minute spines at the anterior edge. They do not differ materially from those of *S. japonicum* (fig. 3, C, 16th segment of cirrus v).

The terminal appendages consist of 9 segments, the last 6 copiously spinose at the articulations. The total length, exclusive of the terminal spines, is nearly 4 mm.

This species differs from *S. japonicum* by the shapes of the upper, inframedian, and rostral latera, and especially by the more numerous scales of the peduncle. The plates are also more fully calcified,

although the specimen is larger. In *S. japonicum* the larger specimens have the calcified portions comparatively more reduced than the smaller ones. The internal organs closely resemble *S. japonicum* except that the terminal appendages are quite unlike. *S. molliculum* has also much in common with *S. curiosum* Hoek, from the Malay Archipelago; but that barnacle has the carina less arched, with the umbo farther from the apex, the scales of the peduncle are far larger, the shape of the carinal latus differs, and there is a small rostrum. *Scalpellum subflavum* Annandale is also related, but it has far larger scales on the peduncle, a more broadly triangular tergum, etc. Only one specimen of *S. molliculum* was taken.

Family LEPADIDÆ.

Genus LEPAS.

Lepas anserifera Linné.

Locality: Albatross station 4920, near Kusakaki-jima, about 90 miles WSW. of Kagoshima Gulf, surface, on pumice.

Lepas anatifera Linné.

Locality: Albatross station 4758, 70 miles W. of Cape St. James, Queen Charlotte Island, surface.

Lepas pectinata Spengler.

Locality: Albatross station 4897, 10-20 miles southwest of Goto Islands, Japan, surface.

A much inflated and unusually smooth variety of this species occurs at Bering Island. It has been figured in Bulletin 60 of the U. S. National Museum, plate VIII, figures 5, 6. This form may be known as *Lepas pectinata beringiana*, n. subsp.

Genus OCTOLASMIS.

Octolasmis orthogonia (Darwin). [Pl. XI, fig. 6 and 7.]

1851. *Dichelaspis orthogonia* Darwin, Monograph on the Cirripedia, Lepadidæ, p. 130, pl. 2, fig. 10 (locality unknown.)

1907. *Dichelaspis orthogonia* Darwin, Hoek, Siboga-Expeditie, Monographie xxxia, Cirripedia, p. 25, pl. 2, fig. 14-18; pl. 3, fig. 1, 1^a, 1^b, 10^b, Malay Archipelago.

The type locality of this species was unknown, but the typical form was rediscovered in the Malay Archipelago by the Siboga Expedition, where it was taken at several stations, in 40 to 112 meters. Two other forms very closely related to *orthogonia* were taken by the Siboga, *Dichelaspis weberi* Hoek and *D. versluysi* Hoek. Three specimens of *O. orthogonia* were taken by the Albatross at station 4936, off Kagoshima Gulf, in 103 fathoms, seated on *Heteralepas*. Two of these are figured (pl. XI, fig. 6, 7, no. 38676 U. S. National Museum) to show the variation in shape of the plates, chiefly of the terga. In the larger specimen (fig. 7), length from apex to base of carina 10 mm., the median and occludent lobes of the base of the tergum are rather short and acute on the left side, as figured, but noticeably longer and less acute on the right side. The other example figured (fig. 6) has a capitulum 9.3 mm. long. The basal lobes of the tergum are very long and finger-shaped. The third example of the group has a tergum intermediate in shape between the two extreme forms figured. The basal disk of the carina is formed about as Darwin figures for *D. orthogonia*.

The variations observed among these three individuals, which clung in a group to the peduncle of an *Heteralepas*, show that there is considerable variation in the shape of the terga among adult egg-bearing individuals. It seems not impossible that the three described species of this type, *orthogonia*, *weberi* and *versluysi* might better be looked upon as variations or local races of a single widely distributed species.

The terga in these specimens are pink-tinted, and the valves are not much covered by cuticle.

Genus **CONCHODERMA**.**Conchoderma auritum** (Linné). [Pl. VIII, fig. 5, 6, 7.]1767. *Lepas aurita* Linnæus, Syst. Nat., ed. XII, p. 1110.1851. *Conchoderma aurita* Linnæus, Darwin, Monograph on the Cirripedia, Lepadidæ, p. 141.1907. *Conchoderma auritum* Linnæus, Pilsbry, Bull. 60 U. S. Nat. Mus., p. 99, pl. IX, fig. 2.

Specimens adhering to *Coronula* were taken from the throat of a humpback whale in Plover Bay, Siberia, by Dr. W. H. Dall in 1865, and are now in the U. S. National Museum. Color sketches made by Doctor Dall from life are reproduced on plate VIII. In Atlantic *C. auritum* the stripes and spots are dark purple, but these examples are striped and mottled with deep rose color and rose-pink. In structural characters they agree with Atlantic *C. auritum*. Small scuta and a very minute carina are developed.

The Californian specimens described by Doctor Dall (1883) as *Otion stimpsoni* were marked with purple, like the Atlantic *C. auritum*.

Genus **HETERALEPAS**.**Heteralepas japonica** (Aurivillius).

Alepas japonica Aurivillius, Kongl. Sv. Vet. Akademiens Handlingar, bd. 26, no. 7, p. 28, Hirado Strait, Japan, 80 fathoms.

Locality: Albatross station 4986, off Hokkaido Island, Japan; 43° 01' 40" N., 140° 22' 40" E. in 103 fathoms. No. 38683 U. S. National Museum.

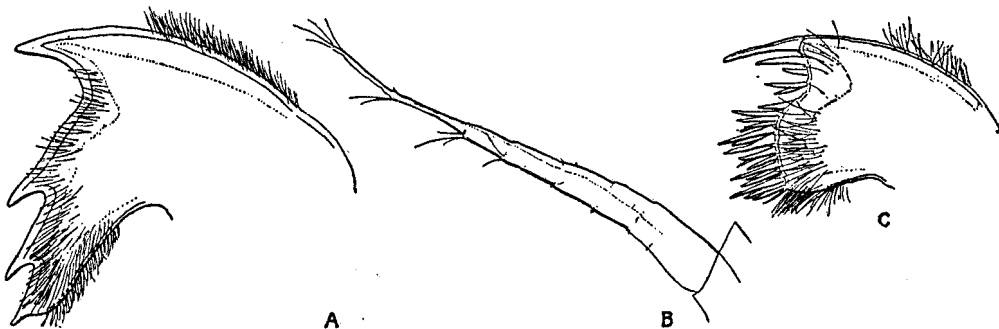


FIG. 4.—*Heteralepas japonica*. A, mandible; B, terminal appendage; C, maxilla.

Two specimens taken agree in the main with the above-named species, but differ in certain details noticed below. The extent of individual and local variation in species of this group is unknown, since a majority of the species are known from one lot from a single place, or at best from very few lots.

The size of two apparently mature specimens is somewhat smaller than *japonica*—length of capitulum 10 mm., width 8.5 mm.; length of peduncle 4 mm., length of orifice 3.5 mm. The capitulum is plump, with only the weak trace of a carina toward the summit. There are three low dorsal tubercles, two on the back of the capitulum and one on the peduncle at the base of the capitulum. The peduncle is shorter than in *japonica*.

The mandible (fig. 4, A) has three slender teeth and a lower point below which the border protrudes. Near the edge it is hairy, and both upper and lower margins are bearded.

The maxilla (fig. 4, C) is deeply excavated below the two great upper spines.

The first cirrus has about 11 and 23 segments, though the rami are not very unequal in length. The second, third, and fourth cirri are long with subequal rami, of about 70 segments in the fourth cirrus. The fifth and sixth cirri have the inner rami very small, less than half the length of the outer rami, and composed of 17 segments.

The terminal appendages (fig. 4, B) are very short, 2.75 mm. long, of 7 segments.

The penis is very long, sparsely hairy, with a small terminal tuft.

The principal differences of these specimens from the types of *H. japonica* are that while the animal is somewhat smaller, there are more joints in the cirri, and the teeth of the mandible are more slender.

Heteralepas vetula, new species. [Pl. XII, fig. 1, 2, 3.]

Type no. 38689, U. S. National Museum.

Type-locality: Albatross station 4934, off Kagoshima Gulf, in 152 fathoms.

The capitulum is oval, plump, somewhat tubular toward the orifice, which is more than one-third the length of the capitulum, and has thin, flaring lips, but slightly crenulated. Along the back a subacute and rather high keel runs from peduncle to summit. The crest of the keel, while irregular, shows no tubercular prominences or nodes. A stout cord-like ridge runs along each side. These ridges meet at the baso-carinal extremity of the capitulum, and converge again at the apex, defining a broadly lanceolate dorsal area, which is somewhat smoother than the slightly wrinkled surface in front of the ridge. No scuta are visible. The capitulum passes rather gradually into the short peduncle, which is transversely wrinkled.

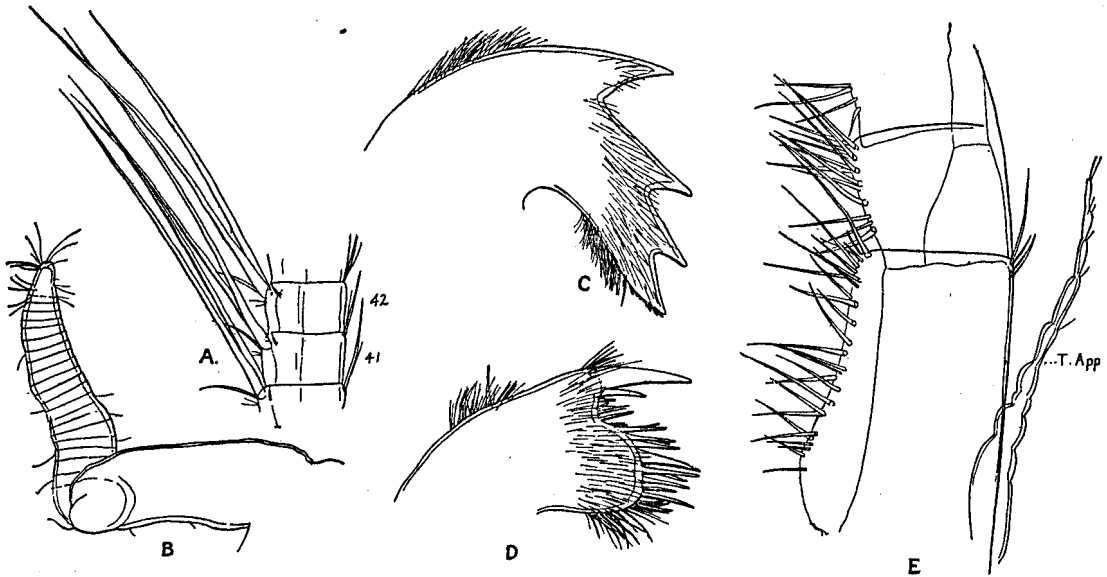


FIG. 5.—*Heteralepas vetula*. A, forty-first and forty-second segments of cirrus v; B, penis; C, mandible; D, maxilla; E, basal segments of cirrus vi and terminal appendage.

Length of the capitulum 11 mm.; breadth 8 mm.; length of the peduncle 5 mm.; breadth 4.5 mm.

The type specimen was dissected. The mandible (fig. 5, C) has three long conic teeth and a lower point, the latter with three short spines below the terminal point.

The maxilla (fig. 5, D) has a deep recess below the major spine. Its edge is profusely spinose, the spines giving place to hairs at the lower angle.

The first cirrus has very unequal rami of 13 and 23 segments, each with a distal circle of hairs. Cirri ii to iv have equal rami of very numerous segments, as usual in *Heteralepas*. Cirrus v has rami 11 and 4.5 mm. long, composed of 57 and 22 segments. The outer ramus bears a pair of long spines at the anterior distal angle of each segment, with several very small ones, and two delicate small spines at the posterior distal angle (fig. 5, A, forty-first and forty-second segments of cirrus v). The smaller ramus bears only a few very small and delicate spines. The sixth cirrus resembles the fifth.

The terminal appendage is very minute, not quite 2 mm. long, and consists of nine segments. There are a few small hairs at the distal articulations, and two at the end (fig. 5, E, t. app.).

The penis is very small, about 5 mm. long. It has comparatively few annuli, and is very sparsely hairy (fig. 5, B).

This species has an external recognition mark in the lateral cords, defining a dorsal escutcheon. Internally the few-jointed inner rami of cirri v and vi, the reduced terminal appendages, and the comparatively small number of annuli of the short penis, are characteristic.

A single small example from Albatross station 4892, southwest of the Goto Islands in 181 fathoms, seems to be referable to *H. vetula*. It is no. 38685 U. S. National Museum.

Heteralepas, species undetermined. [Pl. XI, fig. 8, 9.]

Locality: Albatross station 5049, off the east coast of Hondo Island, Japan, 38° 12' N., 142° 02' E., in 182 fathoms.

A single specimen, no. 38682 U. S. National Museum, externally perfect, but the internal organs wholly wanting, seems to represent an undescribed species.

The capitulum is oval; the carinal border is almost evenly arched and is rounded, with no trace of a keel; rostral border strongly convex below the orifice. There is a pair of minute narrow, yellowish scuta; elsewhere the surface is smooth and somewhat transparent. It is flattened laterally, the sides being even a little concave. The orifice is very small, about one-sixth the length of the capitulum, and not in the least tubular. Below it the rostral surface is smooth and rounded, not superficially slit as in *Alepa pacifica*. The peduncle is narrow, very short, and coarsely wrinkled transversely.

Length of the capitulum 11 mm.; width 8 mm.; length of the peduncle 4 mm.; width 3 mm.

The figures will serve to call attention to this species, which I refrain from naming on account of the imperfection of the single specimen.

Family BALANIDAE.

Genus BALANUS Da Costa.

SECTION D.

Balanus rostratus Hoek. [Pl. XII, fig. 6.]

1883. *Balanus rostratus* Hoek, Challenger Report, Zoology, vol. VIII, p. 152, pl. 13, fig. 16-22.

This species was described from off Kobe, Japan, in 8 and 50 fathoms. The type specimens were small, the largest 9 mm. high, 7 mm. in diameter of base. The types were not furrowed exteriorly, and the orifice is small. A series from Tokyo Harbor (no. 1814 collections of Academy of Natural Sciences of Philadelphia) shows that the species attains a far larger size, up to 27 mm. high and 37 mm. in basal diameter. Some notes on the adult examples may be useful. While usually almost smooth, or only irregularly roughened, the outer wall is sometimes ribbed in places. The walls and opercular plates are invariably white throughout, and the egg-shaped orifice is generally about half as long as the base, which is strong and flat. The basal ends of the parietes show square holes, exactly as figured by Darwin for *B. porcatus* of the north Atlantic. The large size of the rostral and diminution of the carino-lateral pieces has been duly emphasized by Hoek. The radii are deeply sunken below the parietes, appearing as small, narrowly triangular or wedge-shaped spaces, which are delicately and closely striated transversely.

The opercular plates agree with those described by Hoek, but are less transparent than his figures indicate, though still thin. The longitudinal striation of the scutum is very distinct and beautiful though fine, and the transverse ridges are almost lamella-like on the lower part of the plate. They project along the occludent margin. The terga show only weak traces of the depressor-muscle crests. Externally there are some very weak longitudinal striæ near the carinal margin. The band leading to the spur is smooth except for transverse growth-lines; and the surface on both sides of it has extremely weak oblique riblets, quite narrow and hardly raised above the level surface.

This species, I have little doubt, is identical with "some fine, brilliantly white specimens (without opercula) from the coast of China" which Darwin alludes to as possibly a species distinct from *B. porcatus* (Monograph on the Cirripedia, Balanidæ, p. 259).

B. rostratus agrees with *B. porcatus* Da Costa in the porose parietes, solid radii and base, but differs in having the adductor ridge of the scutum wholly free from the articular ridge, and by the absence of any distinct articular furrow. In *B. porcatus* and *B. nubilis* the articular furrow of the tergum is deep. The wholly white plates are a further distinguishing feature. In *B. porcatus* the tergum usually has a purplish spot on the inner face, and a purplish beak.

***Balanus rostratus apertus*, new subspecies.** [Pl. XII, fig. 4, 7; pl. XIII, fig. 1, 2, 8, 9.]

Cotypes no. 38667, 38668, 38669, U. S. National Museum, all from station 4778.

Type locality: Albatross station no. 4778, Bering Sea, N. lat. $52^{\circ} 12'$, E. long. $179^{\circ} 52'$ in 43 fathoms. Living embedded in sponges. Also stations 4777 and 4779, on Petrel Bank, Bering Sea, in 52 fathoms.

The shell is white, subcylindric or conic, with convex sides and a large, triangular-ovate orifice, frequently as large as the base. The parietes are marked with fine, waved, transverse striæ, and

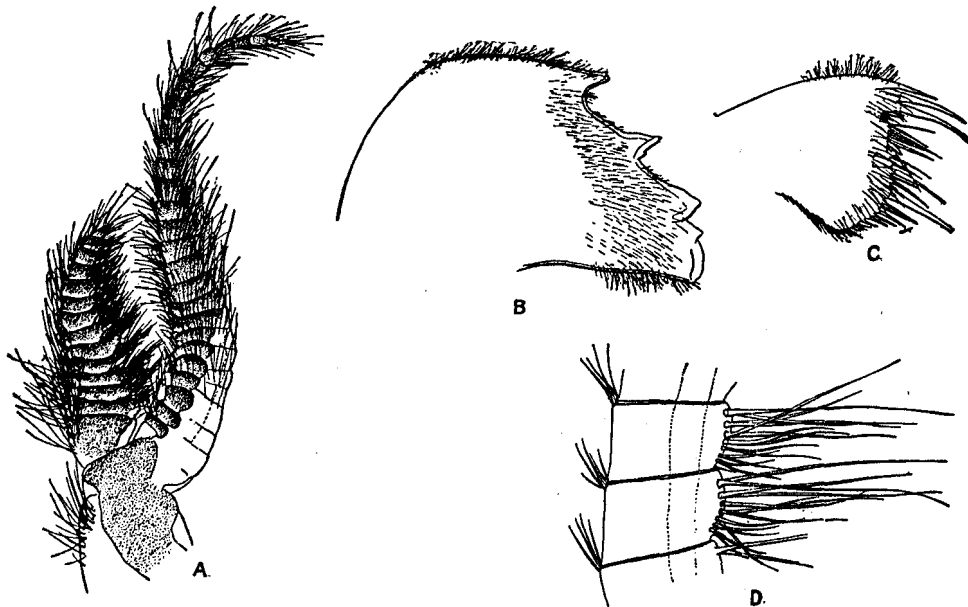


FIG. 6.—*Balanus rostratus apertus*. A, 1st cirrus; B, mandible; C, maxilla; D, 15th and 16th segments of cirrus v.

sometimes bear short, acute spines projecting outward and downward, each prolonged upward in a short rib. These spines appear in groups and are not numerous when present. The radii are much wider than in *B. rostratus*, transversely striated, with the upper edges parallel to the base. They are only very little sunken below the parietes. Internally the plates are deeply, closely, and sharply sulcate, and the bases of the parietes have square holes as in *B. rostratus*. The smooth sheath is nearly half the length of the shell. The stout, poreless, calcareous base is generally concave externally. The rostrum is very wide, about as wide at its summit as at the base. Two specimens measure, (a) height 46, greatest diameter 33, length of aperture 19 mm., length of tergum 22 mm.; (b) height 45, greatest diameter 31, diameter of base 24 mm., length of aperture 26 mm.

The scutum is extremely strongly ridged transversely, the ridges much narrower than the intervals; deeply and closely striated longitudinally, the striæ weaker near the edges. Inside there is a rather narrow, not very high, articular ridge, but only the trace of an articular furrow. The adductor ridge is rather well developed, long, and wholly free from the articular ridge throughout. The

adductor and depressor muscle scars are moderately deep. It differs from the scutum of *B. rostratus* only in being somewhat more solid, with the adductor ridge a little better developed.

The tergum is thin, rather fragile, narrow, its greatest width contained about $2\frac{1}{2}$ times in the length. Spur wide at the base, tapering to an obtuse, truncate end; situated close to the scutal margin; decidedly longer than that of *B. rostratus*. External sculpture of narrow oblique riblets, much stronger than in *B. rostratus*, the intervals faintly, weakly striate longitudinally. There is no groove from spur toward beak, only a flat, longitudinally and transversely striated band. The interior is white throughout. Articular ridge rather narrow, arched, not much more than half the length of the valve, stronger than in *B. rostratus*. Articular furrow only weakly indicated. Crests for the depressor muscles rather weak and irregular, but much stronger than in *B. rostratus*.

Both of the opercular plates have a thin, yellowish cuticle, whitish in young specimens.

The mandibles of no. 38667 have three rather stout short teeth, then a minute tooth and an obtuse lower angle. The upper tooth is minutely bifid at the tip. The upper and lower borders are densely and very finely hairy, as are also the intervals between the teeth (fig. 6 B).

The maxillæ do not differ materially from those of *B. rostratus* as figured by Hoek, except that there are several small spines above the two great spines (fig. 6 C).

The first cirrus (fig. 8 A) has very unequal rami of 15 and 27 segments, those of the posterior branch strongly protuberant at the anterior side, with dense hair-tufts. The second and third cirri also have unequal branches, the segments of both strongly protuberant, with dense tufts. Cirrus ii has 15 and 19 segments; cirrus iii, 12 and 19. Cirri iv to vi are of the usual slender and elongate shape, with subequal branches of about 35 segments. These segments are convex anteriorly, each with 6 or 7 pairs of spines, and having the usual posterior sutural groups of small spines. (Fig. 6 D, 15th and 16th segments of cirrus v.)

The penis is very long, over 20 mm., purplish, densely and conspicuously annulated, with a very few short hairs near the end. There is a blunt projection on the dorsal base. The cirri and mouth parts of the largest specimen in group no. 38670 agree fully with no. 38667.

In this race the radii are scarcely sunken below the parietes. In the type lot the walls form a subcylindric shell, but in a group of seven individuals seated on a scallop shell, from station 4779, 54 fathoms, the shell is more conic and smoother, the parietes yellowish or dirty white, the radii pure white. The largest specimen in this group measures 55 mm. high, 45 mm. in greatest diameter of the base. This group, no. 38670 U. S. National Museum, is figured in plate XII, figure 4.

The cirri of the types of *B. rostratus* are not fully described. The first cirrus as described by Hoek agrees with *B. rostratus apertus*, except in having fewer segments, probably owing to its immature condition or smaller size. The change in shape between the third and fourth cirri in *B. rostratus apertus* is quite abrupt.

Balanus crenatus Bruguière. [Pl. XIV, fig. 1-9.]

1853. *B. crenatus* Darwin, Monograph on the Cirripedia, Balanidae, p. 261.

Localities: Union Bay, Bayne Sound, British Columbia shore, specimens no. 38671 and 38672 U. S. National Museum; Albatross station no. 5008, Aniwa Bay, Saghalin Island, 24 fathoms, specimen no. 38674 U. S. National Museum; Albatross station no. 5038, near Urakawa Light, south coast of Hokkaido, 175 fathoms.

Two forms of this species were taken on shore in Bayne Sound, British Columbia: No. 38671, a smooth, conic form with triangular parietes and delicately striate opercular plates, the specimen illustrated having a basal diameter of 14 mm. (pl. XIV, fig. 1, 2, 3); and no. 38672, in which the shell is more prism-shaped, or columnar with prominent angles, the old ones generally supporting a crop of younger barnacles at the summit. The opercular plates are much worn and are rather strongly striate. The figured group is 42 mm. high (pl. XIV, fig. 4-9). The examples from station 5008 are small and conic, but more rugged than no. 38671.

SECTION E.

Balanus cariosus Pallas.

Localities: Dutch Harbor, Alaska; Thyedin, on shore, June 13, 1906.

Balanus evermanni Pilsbry.

1907. *Balanus evermanni* Pilsbry, Bulletin of the Bureau of Fisheries, vol. xxvi, p. 203.

In 1906 this fine barnacle was taken at the following stations: Station 4792, near Bering Island, in 72 fathoms, museum no. 38661; stations 4803 and 4804, off Cape Rollin, Simushir I., Kuril Islands, in 229 fathoms, museum no. 38658, 38659, 38660, 38662. It has apparently a general distribution from Alaska to the Kuril Islands.

The specimens agree in essential features with those originally described, but show some variation in the shape of the cup, such as is to be expected in any lengthened acorn barnacle. In a few examples it flares toward the mouth, like some liliaceous corolla (fig. 7, A, mus. no. 38661). In others

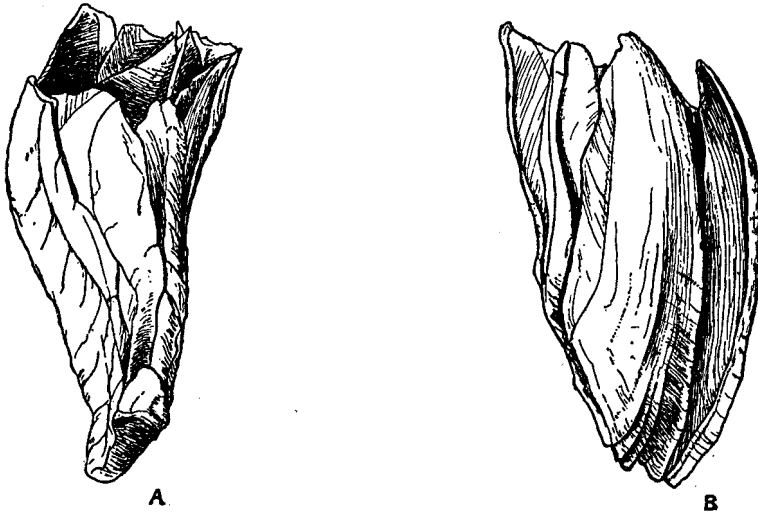


FIG. 7.—*Balanus evermanni*, $\times \frac{1}{2}$.

it is shortened and wide (fig. 7, B, mus. no. 38662). In these stumpy examples the rostrum or the carina may become longitudinally ribbed, the ribs rounded and not very prominent.

These specimens from the northwestern Pacific agree with those from Alaska in the characters differentiating the species from the North Atlantic *Balanus hameri* Ascanius.

SECTION G.

Plates of the wall solid, without pores and without radii; base membranous, sometimes with a calcareous peripheral rim, which is poreless.

This group was instituted by Dr. Hoek for two species, *Balanus hirsutus* from the Faroë Channel and *B. coralliformis* from near Kerguelen Island. Two more are now described from Bering Sea, greatly extending the range of the group.

In wanting radii these forms are more primitive than the typical *Balani*. The teeth of the mandible are longer and more slender than in most others of the genus. None of them are littoral barnacles.

Balanus hoekianus, new species. [Pl. XIII, fig. 3-7, pl. xv, fig. 1-2.]

Type no. 38666 U. S. National Museum.

Type locality: Albatross station 4778, Bering Sea, N. lat. $52^{\circ} 12'$, E. long. $179^{\circ} 52'$, in 43 fathoms, seated on a gastropod shell (*Buccinum*).

A species of the group G of Hoek; base excessively thin, partly membranous; plates of the wall solid, without pores; no radii.

The shell and opercular plates are white throughout. Shape shortly subcylindric, flaring outward at the large triangular ovate orifice. The parietes are slightly roughened but not distinctly ribbed or sulcate, with no chitinous cuticle and no hairs. The alæ are smooth, with extremely oblique upper margins, so that the peritreme is deeply serrate. Internally the walls have a long glossy sheath below which they are somewhat sulcate, chiefly at the base of attachment.

The rostrum (fig. 8, A, internal view) is much the largest plate. Externally, while it is finely indistinctly rugose longitudinally, there is no distinct costation, and no trace of radii. Inside the sheath is tripartite. The carina (fig. 8, B) is strongly concave. The rostro-lateral plate is wide, triangular, with a well-developed ala but no radius. The carino-lateral plate is narrow, recurved, with the ala wider than the parietal area. Inside the sheath is bipartite. The strongly recurved carina is V-shaped above, with wide alæ and smooth, undivided sheath (fig. 8, B, inside view).

The base is an excessively thin transparent film, calcareous at the edges, membranous in the middle.

Height of the shell 8 mm.; diameter of the base 8 mm.

Mandible (fig. 9, B) has four principal teeth. The upper two are rather long and acute, the second one in the middle of the edge. The third and fourth teeth are blunt, and there are two denticles between them. The lower point is short and slightly bifid. The lower edge of the mandible is heavily bearded. The two mandibles are exactly similar.

Maxilla (fig. 9, C) has an even edge except for a notch below the upper two large spines. There are six or seven large spines and a few smaller ones below the notch. A band along the edge of the maxilla and below the lower angle is bristly, and there are a few hairs along the upper edge.

The first cirrus (fig. 9, A) has unequal rami of 9 and 13 segments. Those of the longer ramus protrude slightly, and all are densely hairy. The second cirrus has rami of 9 and 11 segments which are convex on the anterior side but do not protrude; third cirrus has unequal rami with 12 and 13 segments. The other cirri are longer, the sixth with 23 segments, each with three pairs of spines, the lower pair rather small. (Fig. 9, D, 10th and 11th segments of cirrus v.)

The scutum (pl. XIII, fig. 3, 4, 5) is moderately thick. It flares outward and is twisted toward the apex. Externally it is indistinctly marked with fine, weak growth-striae and rather widely spaced growth-arrest lines which are scarcely raised. Inside there is a short but well-developed articular ridge, about one-third the greatest length of the plate. The articular furrow is narrow and distinct though not deep. There is no adductor ridge, though a noticeable thickening extends downward from the lower end of the articular ridge, representing a vestigial adductor ridge. A shallow oblong pit marks the insertion of the depressor muscle.

The tergum (pl. XIII, fig. 6, 7) is very thick for so small a plate, white, the scutal margin concave, carinal margin short, strongly convex. The spur is long and narrow, separated from the scutal margin

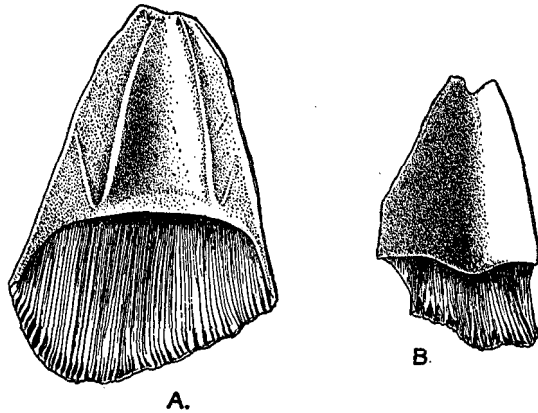


FIG. 8.—*Balanus hoekianus*. A, rostrum; B, carina. Internal views.

by nearly its own width. A smooth depressed band runs to it. The area on the scutal side of this band is marked with widely spaced, strongly arched, linear riblets. The wide area on the other side has very oblique linear riblets, and an interstitial sculpture of very weak, fine, longitudinal striae. There are some minute hairs on the cuticular riblets, along the scutal border, but none on the outer surface of the plate. Internally the upper or beak portion of the plate is transversely striated. The articular ridge is high and massive, arcuate; the articular furrow wide but not very deep. The crests for the depressor muscle are short and sharp.

This species is related to *B. corolliformis* Hoek and *B. hirsutus* Hoek, the former from southeast of Kerguelen Island, 150 fathoms, the latter from the Faroë Channel, in 516 fathoms. Both have a more or less hairy cuticle, while *B. hoekianus* has no noticeable cuticle on the walls. *B. corolliformis* has some resemblance in shape of the walls to *hoekianus*, but the sheath is shorter, only one-third the length of the plates, and the tergum is of quite different shape. In *B. hirsutus* the articular ridge of the tergum projects conspicuously beyond the scutal margin, in external view, being much larger than in *B. hoekianus*, and the spur is scarcely removed from the baso-scutal angle of the plate, whereas in *B. hoekianus*

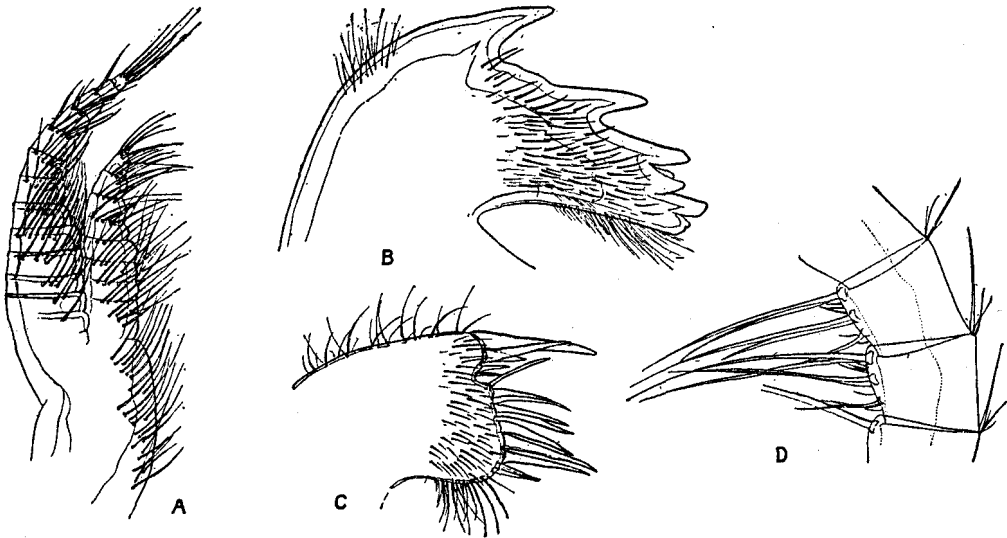


FIG. 9.—*Balanus hoekianus*. A, first cirrus; B, mandible; C, maxilla; D, 10th and 11th segments of cirrus v.

the baso-scutal angle is conspicuously produced, and the spur is separated from it by at least the basal width of the spur. The mandible of *B. hoekianus* has a smaller tuft of hairs on the upper margin, and the lower teeth are conspicuously obtuse, not acute as in *B. hirsutus*. This bluntness of the teeth is not the result of wear, since the unexposed teeth of the next moult, visible through the mandible, are equally obtuse. The maxillæ are also somewhat different in the two species. The number of spines on the segments of the posterior three pairs of cirri is smaller than usual.

B. hoekianus, named in honor of Dr. P. P. C. Hoek, is therefore quite distinct from its two antipodal relatives.

***Balanus callistoderma*, new species.** [Pl. XII, fig. 5, pl. xv, fig. 3-7.]

Type no. 38690 U. S. National Museum.

Type locality: Albatross station 5068, Suruga Gulf, Japan, in 77 fathoms.

A species of Hoek's Section G. Base in large part membranous; parietes solid; no radii. The shell is in form a broadly truncated cone, the orifice rather large, ovate, with deeply toothed border. Parietes lemon yellow, fading to whitish near the orifice; alæ whitish. Under a lens the exterior is

seen to be marked with rather regularly spaced transverse darker lines, those near the base bearing fine shining bristles in a single close series. These bristles are largely lost on the older part of the wall, and some specimens lack them entirely.

The rostrum is the largest plate, triangular in shape. Its sheath is tripartite, as usual. The rostral latera are nearly as large. Like the carinal latera and carina, it has a well-developed, distinctly sunken ala. The carinal latera are very narrow. The carina is V-shaped in upper view.

The sheath occupies more than half the total height. It is closely ridged transversely, the ridges narrow, not hairy. Its lower edge is continuous with the surface below it, not in the least overhanging.

The base has a calcareous rim at the edge, sometimes as much as 6 mm. wide. The central part is membranous.

Altitude of cup about 32 mm. greatest diameter of base 30 mm.; of orifice 16 mm.

The scutum (pl. xv, fig. 5, 6, 7) is curved, the outer side concave, covered with a dense golden olive cuticle. It is sculptured with well-raised transverse thread-like ridges, each bearing a close

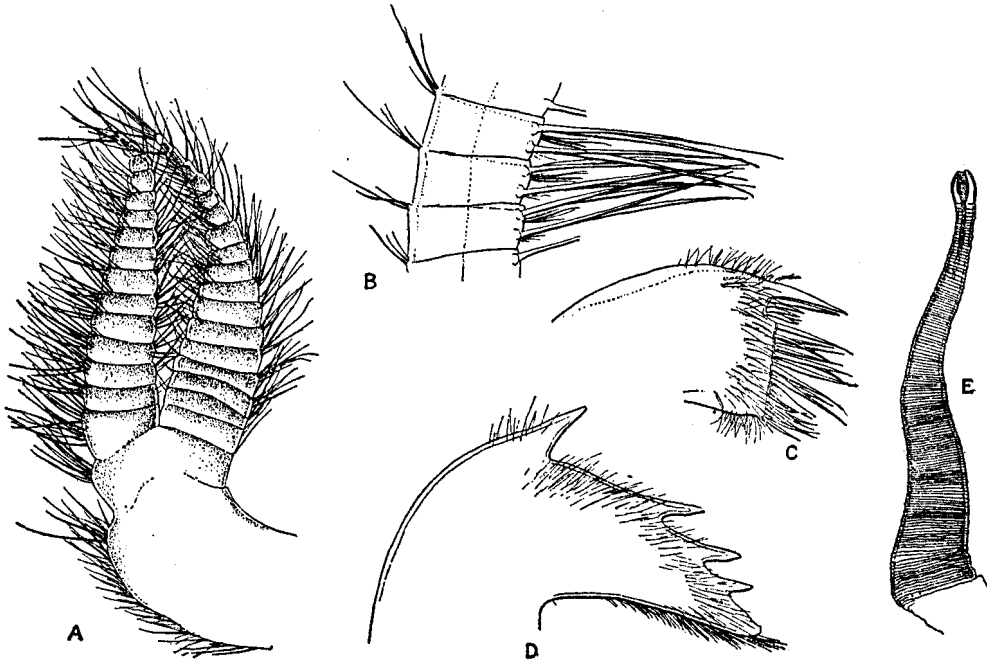


FIG. 10.—*Balanus callistoderma*. A, first cirrus; B, 32d to 34th segments of cirrus v; C, maxilla; D, mandible; E, penis.

row of minute shining spicules. Along the occludent edge there is a series of oblique nodes, formed by the enlarged extension of every alternate ridge of the outer surface (pl. xv, fig. 5). Internally there is a somewhat massive but low articular ridge extending along two-thirds of the scutal margin. The articular furrow is deep but very narrow. The adductor ridge is represented by a low callus only. The pit for the depressor muscle has several short but emphatic crests.

The tergum is covered with yellowish cuticle paler than that of the scutum. It has a concave scutal border, the adductor ridge not projecting beyond it. The convex carinal margin is equal in length to the basal margin. The spur is short, rather wide, and separated by about half its width from the baso-scutal angle. A slight depression, marked only with arcuate growth-lines, runs to the spur. On the scutal side of this band the surface has narrow arched thread-like riblets. The larger area on the carinal side of the spur-band has similar oblique riblets. There are no noticeable longitudinal striae. The articular ridge is arcuate, rather high; the articular furrow broad and shallow.

There are some acute crests at the insertion of the depressor muscle; and in old individuals the whole inner surface is slightly roughened. The spur is not thickened inside, but the scutal border, near the basal angle, is raised in a thin laminar flange (pl. VIII, fig. 3, 4). The inner faces of both scuta and terga are white.

The mandible (fig. 10, D) has four slender teeth and a lower point. The second tooth stands midway of the cutting edge. There is a copious beard along the lower margin, and there are some hairs near the cutting edge. The maxilla (fig. 10, C) has a notch at the upper angle and numerous larger and smaller spines; both upper and lower margins are bearded. The first cirrus (fig. 10, A) has subequal rami of 16 and 14 segments, which are rather densely spinose; and while convex at the sides, the segments do not protrude. The second cirrus has subequal rami of 18 and 22 segments, more copiously spinose than the first cirrus. Third cirrus, with 25 and 29 segments. The fourth to sixth cirri are longer and more slender, and are similar in armature. The fifth cirrus has rami of about 48 segments, several of the lower ones difficult to distinguish, as usual. Each segment is armed with two pairs of very long spines, with a group of quite small spines between and slightly below the large ones of each pair (fig. B, 32d to 34th segments of cirrus v). The posterior border of the cirri, in the basal half, is very minutely serrate or shortly spinulose. The penis (fig. 10, E) is remarkably short, only about 7 or 7.5 mm. long, very closely annulate, and wholly without hairs.

This handsome barnacle is readily distinguished from *B. corolliformis* and *B. hirsutus* by the shape of the tergum, which has a spur distinctly removed from the baso-scutal angle of the plate, and the articular ridge does not project beyond the regularly concave scutal margin of the plate. In these characters, *B. callistoderma* is more like *B. hoekianus*, in which, however, the cuticle of the opercular plates and walls is not hairy, the tergum is much narrower, and the smooth sheath has a free lower edge, as usual in *Balanus*. In *B. callistoderma* the sheath is transversely ridged and continuous below with the rest of the plate, with no overhanging ledge.

Genus ACASTA Leach.

Acasta spongites japonica, new subspecies. [Pl. XVI, fig. 1-9.]

Type no. 38681 U. S. National Museum.

Type locality: Albatross station 4936, off Kagoshima Gulf, in 103 fathoms.

A form more closely related to *A. spongites* than to any other described species. The deep basal cup is about half the height of the carina, broadly ovate in contour. Externally it has fine, uneven circular striæ and low, inconspicuous, narrow, longitudinal riblets, each terminating in a minute point on the upper margin. Inside there are no ribs and no teeth at the margin.

The plates of the wall are only loosely connected, and have a few calcareous points or spines. The radii are narrower than the parietes. The carina is decidedly larger than the rostrum, quite concave within. The carino-lateral plate has a narrow parietal area, its basal width contained 2 to 2.3 times in that of the rostro-lateral plate, thus being much wider than in *A. spongites*. The rostrum is the widest and shortest plate. Internally the plates of the wall show only the weakest traces of longitudinal ribs below the sheath, which is continuous with the surface below it and occupies more than half the length (pl. XVI, fig. 6, 7, 8, 9, interior views of rostrum, rostro-lateral, carino-lateral and carina). The sheath is glossy, and in the carina and carino-laterals is ridged across with smooth, thread-like riblets. The rostro-laterals are less strongly ridged, and in the rostrum the ridges are very weak and low.

The scutum (pl. XVI, fig. 4, 5) is concave outside, with sculpture of low transverse lamellæ and delicate radial striæ. The articular ridge is rather low and about half the length of the tergal margin. There is no adductor ridge.

The tergum (pl. XVI, fig. 1, 2) has a concave band from apex to the spur, and is sculptured elsewhere with transverse threads. The low articular ridge is continuous with a low ridge which continues upon the spur. The spur is united until near the end with the baso-scutal angle, in this respect being unlike *A. spongites*.

This form differs from *A. spongites* of the Mediterranean, etc., chiefly by the wider parietes of the carino-lateral plates, the absence of an adductor ridge in the scutum, and the different shape of

the spur of the tergum. It is apparently as distinct a form as several which are ranked as species, but without a large series the constancy of the differential characters can not be tested. I have therefore ranked the Japanese form temporarily as a subspecies. The type is a unique individual which had been wholly overgrown and filled up with the sponge-host, but with the walls and opercular plates complete and perfect.

Genus TETRACLITA Leach.

Tetraclita porosa (Gmelin).

Locality: Matsushima, on shore.

Genus PACHYLASMA Sowerby.

Pachylasma crinoidophilum, new species. [Pl. xvii, fig. 1-11.]

Cotypes no. 38675, U. S. National Museum.

Type locality: Albatross station 4934, off Kagoshima Gulf, in 152 fathoms.

A species somewhat related to *P. aurantiacum* Darwin. Base apparently membranous, walls solid, not porous. The basal contour is oblong, the ends elevated to conform to the shape of the supporting crinoid stem, on which the barnacle always sits lengthwise. The carina rises vertically, the other plates slope inward more or less. Rostrum and rostral latera white, carina, carinal latera and tips of the opercular plates pink tinted. All of the plates are thin and without radii. The parietes have a fine, indistinct sculpture of short, irregular impressions vertical to the faint lines of growth. The alæ have very oblique, wide-spaced grooves. The carina and the median latera are large plates, the others being much smaller.

The rostrum and rostral latera are narrowly triangular, united by linear sutures (pl. xvii, fig. 3, *r.*, *r. l.*). Internally the rostrum is glossy and slightly ridged transversely in the upper two-thirds (fig. 6). It has narrow alæ on both sides. The rostral latera are about as wide as the rostrum at their bases, and obliquely triangular, without alæ (pl. x, fig. 7, interior view). The median latera (pl. xvii, fig. 2, *m. l.*) are very large, with triangular parietes and an ala of irregular shape. Inside (pl. xvii, fig. 8) the apical portion of the plate is slightly ridged transversely, the ridges opaque-white; a radius is faintly indicated. The basal margin of the plate is sharp and smooth. The carinal latera (pl. xvii, fig. 2, *c. l.*) are quadrangular, about twice as long as wide, and externally are divided by a diagonal ridge into parietal and alar areas. Internally there is an obliquely ridged area near the beak (pl. xvii, fig. 9).

The carina (pl. xvii, fig. 2, *c.*) is recurved at the apex, V-shaped as viewed from above. Outside there is a rather narrow, triangular parietal area, and two much larger triangular alæ. Inside more than half of the plate is transversely ridged, the ridges white.

Length of base 9, width 6.2, height of carina 7 mm.

The scutum (pl. xvii, fig. 4, 5) is triangular, the width half of the length, marked externally with narrow, widely spaced transverse grooves. Inside the articular ridge is well developed, nearly as long as the tergal border of the plate. Articular furrow narrow but rather deep. The apical part of the plate is transversely ridged. The tergum (pl. xvii, fig. 10, 11) has a strong ridge along the scutal border, and is concave near it. The surface is marked with lines of growth and spaced grooves. Some radial lines are weakly sketched. Internally there is a very wide but short articular ridge and a deep articular furrow. There is a group of sharp crests for the depressor muscle, projecting as small teeth at the lower border of the plate. The tergum has a truncate shape at the apex, and is marked internally with arcuate ridges there.

The mandible (fig. 11, E) has three long, acute teeth and a blunter, multispinose lower point. It is somewhat profusely hairy, as shown in the figure, the hairs projecting below the lower point. There is also a patch of hairs on the upper margin.

The maxilla (fig. 11, B) has an irregular, step-like edge, with numerous spines, and is hairy on the upper and lower borders. The first cirrus (fig. 11, C) has short unequal rami of 9 segments, which are very profusely hairy on the inner face, much less so outside. The second cirrus is similar but larger. The rest of the cirri are quite long, with three pairs of long and one of very short spines on each segment, and a tuft of several spines at each suture posteriorly (fig. 11, A). Cirrus VI (fig. 11, F) has rami of 22

and 23 segments. The penis (fig. 11, F, *p.*) is very long, with indistinct traces of annulation. There is a pencil of hairs at the tip, and a few sparsely scattered elsewhere. Terminal appendages are very minute, about 1.25 mm. long, composed of 8 rather profusely bristly segments (fig. 11, D).

This species is known by seven individuals, all very similar. It is much smaller than *Pachylasma giganteum* (Philippi) of the Mediterranean and *P. aurantiacum* Darwin from New South Wales, the only species of the genus hitherto known, and differs from them in so many details that a comparison would be superfluous. The specimens had been removed from the crinoids before reaching me, and therefore the exact nature of the base could not be ascertained. From the thin, acute basal

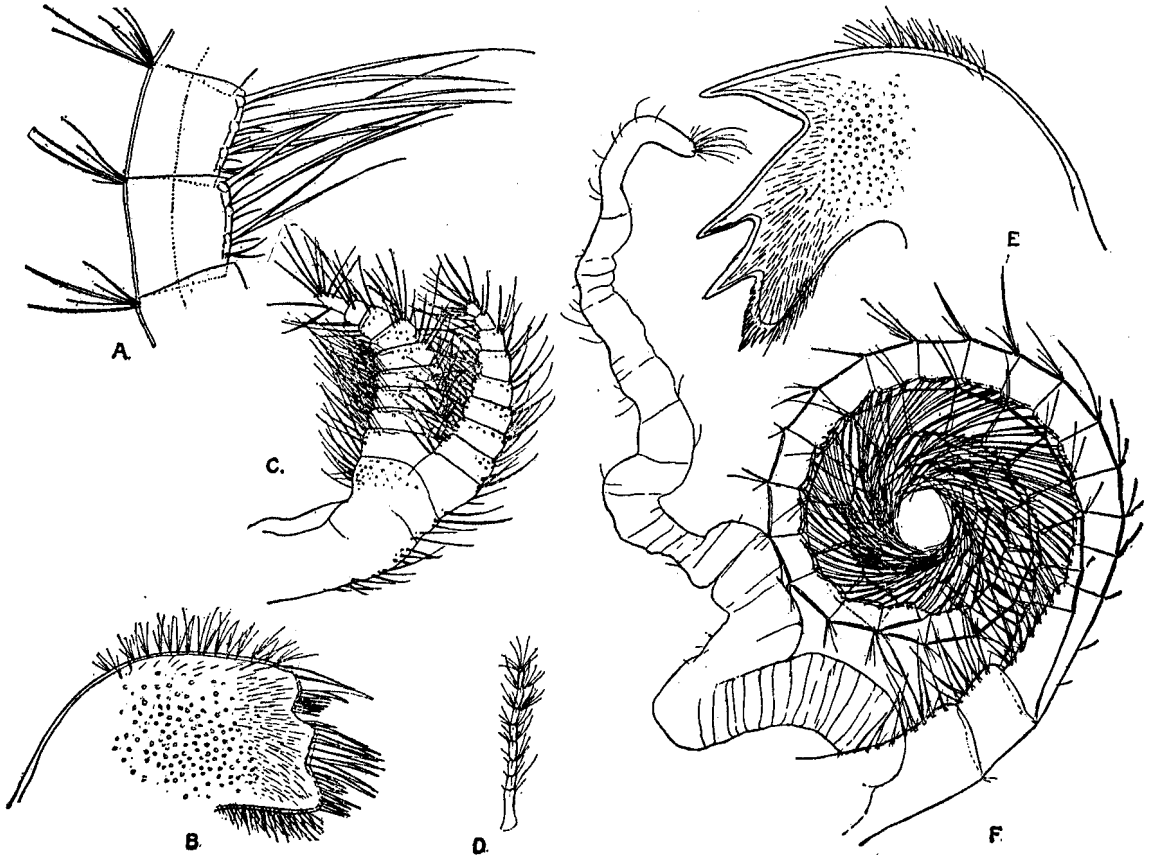


FIG. 11.—*Pachylasma crinoidophilum*. A, two segments of cirrus v; B, maxilla; C, 1st cirrus; D, terminal appendage; E, mandible; F, 6th cirrus and penis.

edges of the plates of the wall, and the nearly perfect condition of the soft parts, I presume that the base is wholly membranous. The base of the cup is hollowed to fit the stem of the crinoid, upon which all were seated in a longitudinal position.

Catophragnus (Chionelasmus) darwini Pilsbry.

1907. *Catophragnus darwini* Pilsbry; Bulletin of the Bureau of Fisheries, vol. xxvi, p. 188.

The Hawaiian barnacle described as *Catophragnus darwini* Pilsbry, and known by mutilated individuals only, has many points of resemblance to *Pachylasma crinoidophilum*. The mouth-parts, cirri, and penis are very similar, and the terga, scuta, and plates of the wall are alike in many respects. In

texture and finer sculpture the plates are similar; so that I can not doubt that the forms are related. Unfortunately the number of plates of the wall is not known in the Hawaiian species, since only fragmentary remains were preserved; yet so far as these go they indicate an octomerous wall, the median latera of which are still unknown. The development of an accessory basal whorl of plates in *C. darwini* indicates affinity to the genus *Catophragmus*. I am disposed to believe that when perfect individuals come to light, *C. darwini* will prove to belong to a distinct genus, or at least subgenus, intermediate between *Pachylasma* and *Catophragmus*, and distinguished from *Catophragmus* by the well-developed caudal appendages, the wall with a single series of accessory basal plates, part of them with alæ, and by the dense, porcellanous texture of all the plates. This group may be called *Chionelasmus*.

EXPLANATION OF PLATES.

PLATE VIII.

- Fig. 1, 4. *Scalpellum rubrum* Hoek, lateral and dorsal views of an adult, no. 38680, U. S. National Museum, x 4.7.
 Fig. 2. *Scalpellum rubrum*, rostrum and adjacent parts.
 Fig. 3. *Scalpellum rubrum*, rostrum and adjacent latera seen from the inside.
 Fig. 5-7. *Conchoderma auritum* Linnaeus, posterior, ventral and lateral views of living specimens from Plover Bay, Siberia. Drawn by Wm. H. Dall.

PLATE IX.

- Fig. 1. *Scalpellum stearnsi* Pilsbry. Young individual, no. 38678, U. S. National Museum, x 6.
 Fig. 2, 3. *Scalpellum gonionotum* Pilsbry. Lateral and dorsal views of the type, no. 38678, U. S. National Museum x 10.
 Fig. 4. *Scalpellum gonionotum*. Rostrum and adjacent plates.
 Fig. 5, 6. *Scalpellum weltnerianum* Pilsbry. Lateral and dorsal views of the type, no. 32679, U. S. National Museum, x 9.
 Fig. 7. *Scalpellum weltnerianum*. Rostrum and adjacent plates.

PLATE X.

Scalpellum japonicum Hoek.

- Fig. 1, 2. Lateral and dorsal views, no. 38684, U. S. National Museum, x 4.
 Fig. 3. Rostrum of the same individual.
 Fig. 4, 5. Lateral view and rostrum of another individual from the same station, x 4, no. 38685, U. S. National Museum.
 Fig. 6, 7, 8. Ventral, dorsal, and lateral views of a very young *Scalpellum* of the *japonicum* type, x 12.7, no. 38688, U. S. National Museum.
 Fig. 9. Outline figure of the type specimen of *S. japonicum*, x 5 1/2.

PLATE XI.

- Fig. 1, 2. *Scalpellum japonicum biramosum* Pilsbry. Right and left lateral views of the type specimen, no. 38686, U. S. National Museum, x 3.
 Fig. 3. Rostrum and adjacent parts of the same individual.
 Fig. 4, 5. *Scalpellum molliculum* Pilsbry. Lateral view (x 3) and rostral detail of the type, no. 38687, U. S. National Museum.
 Fig. 6, 7. *Occlasmis orthogonia* Darwin, no. 38676, U. S. National Museum. Two varieties from off Kagoshima Gulf, x 8.6.
 Fig. 8, 9. *Heteralepas* sp. undet. Ventral and lateral views. x 6, no. 38682, U. S. National Museum.

PLATE XII.

- Fig. 1-3. *Heteralepas vetula* Pilsbry. Dorsal, lateral and ventral views of the type, no. 38689, U. S. National Museum.
 Fig. 4. *Balanus rostratus apertus*. no. 38670, U. S. National Museum, natural size.
 Fig. 5. *Balanus callistoderma* Pilsbry, walls of type, natural size.
 Fig. 6. *Balanus rostratus* Hoek, Tokyo Harbor, Japan, no. 1814, Academy of Natural Sciences, Philadelphia, natural size.
 Fig. 7. *Balanus rostratus apertus* Pilsbry, no. 38667, natural size.

PLATE XIII.

- Fig. 1, 2. *Balanus rostratus apertus* Pilsbry. Scutum of no. 38667; U. S. National Museum.
 Fig. 3, 4. *Balanus hoekianus* Pilsbry, scutum of type.
 Fig. 5. *Balanus hoekianus* Pilsbry. Profile of scutum of type.
 Fig. 6, 7. *Balanus hoekianus* Pilsbry, tergum of type.
 Fig. 8, 9. *Balanus rostratus apertus* Pilsbry, tergum of no. 38667, U. S. National Museum.

PLATE XIV.

- Fig. 1, 2. *Balanus crenatus* Bruguière. Top and lateral views of the walls of an individual of the solitary conic form.
 Fig. 3. Tergum of the same individual.
 Fig. 4. *Balanus crenatus*, columnar or colonial type. Profile of scutum. No. 38672, U. S. National Museum.
 Fig. 5, 6. Tergum of same individual.
 Fig. 7, 9. Scutum of same individual.
 Fig. 8. Colony of the columnar type.

PLATE XV.

- Fig. 1, 2. *Balanus hoekianus* Pilsbry. Lateral and top views of the walls of the type.
 Fig. 3, 4. *Balanus callistoderma* Pilsbry. Tergum of the type, no. 38690, U. S. National Museum.
 Fig. 5. Profile of scutum, occludent aspect, same individual.
 Fig. 6, 7. Scutum of same example.

PLATE XVI.

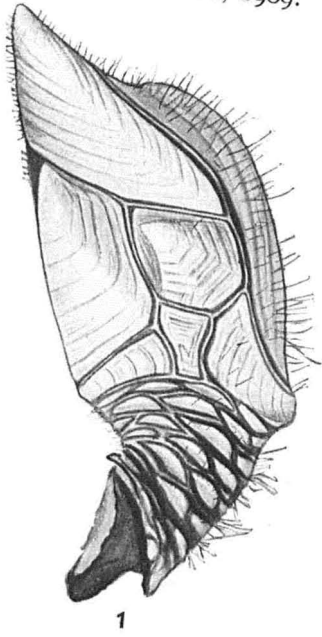
Acasta spongites japonica Pilsbry.

- Fig. 1, 2. Tergum of the type, no. 38681, U. S. National Museum.
 Fig. 3. Walls, lateral view.
 Fig. 4, 5. Scutum.
 Fig. 6-9. Plates of the wall, internal aspect. 6, rostrum; 7, rostral latus; 8, carinal latus; 9, carina.

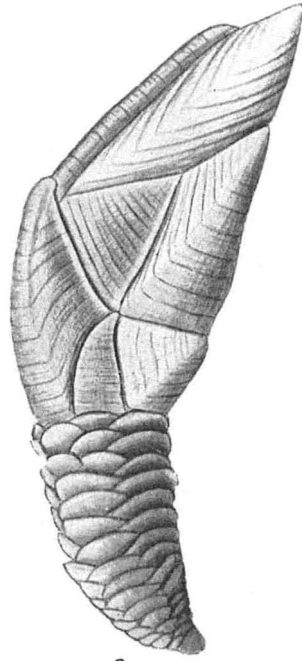
PLATE XVII.

Pachylasma crinoidophilum Pilsbry.

- Fig. 1-3. Top, lateral, and rostral views of the type.
 Fig. 4, 5. Scutum of same individual.
 Fig. 6-9. Plates of the wall. 6, rostrum; 7, rostral latus; 8, median latus; 9, carinal latus.
 Fig. 10, 11. Tergum, same individual.



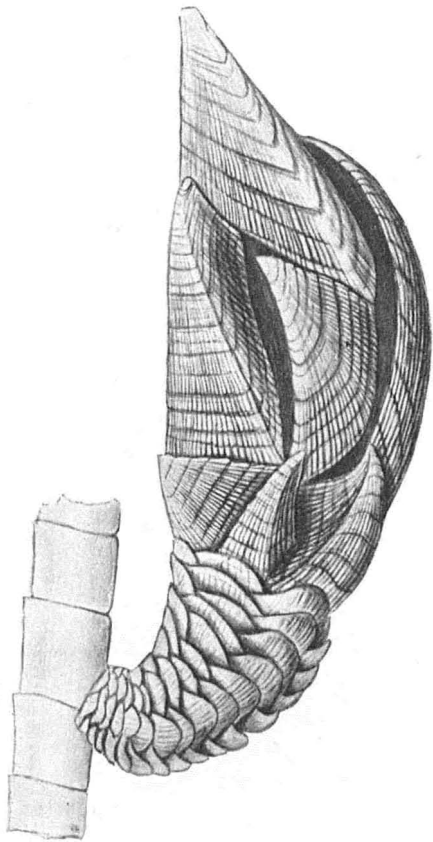
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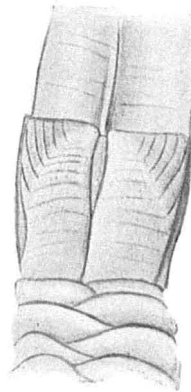
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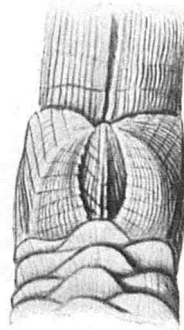
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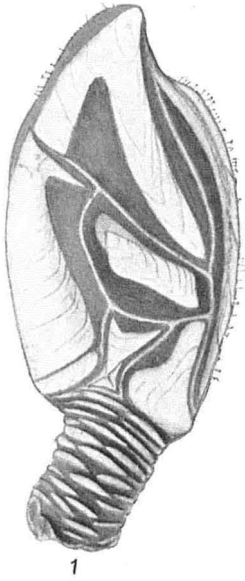
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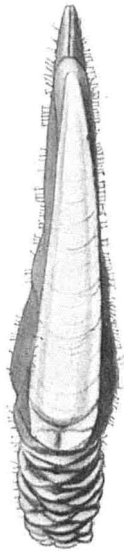
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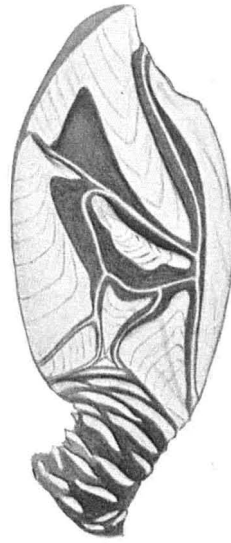
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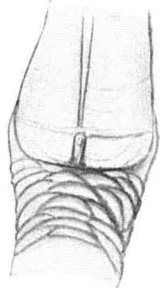
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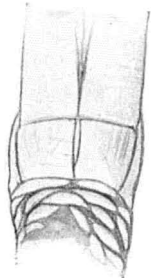
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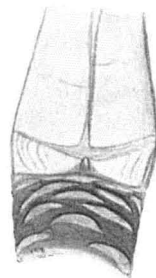
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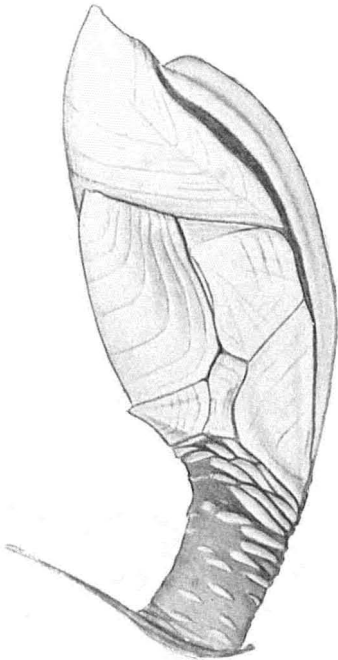
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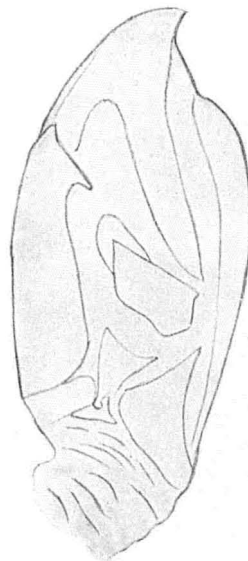
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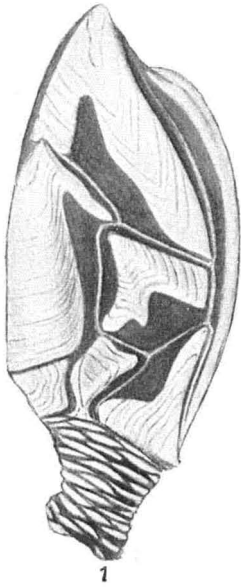
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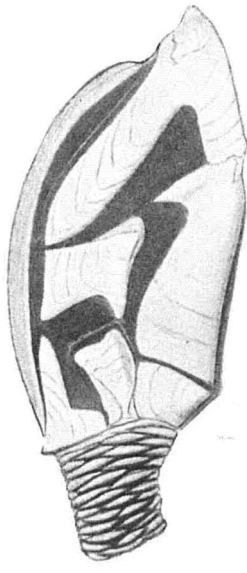
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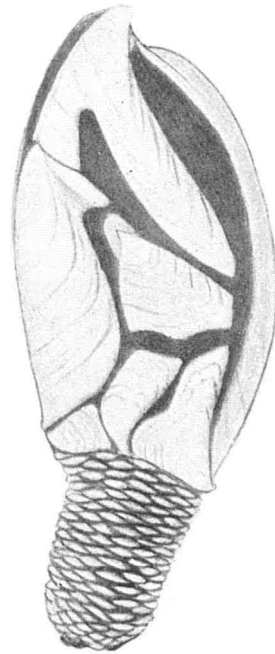
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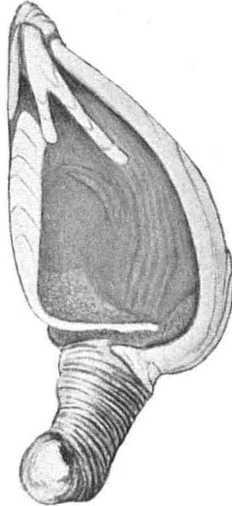
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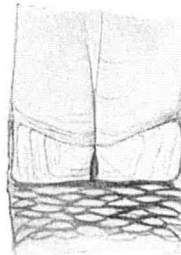
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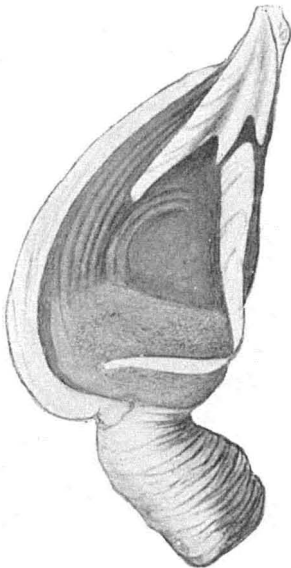
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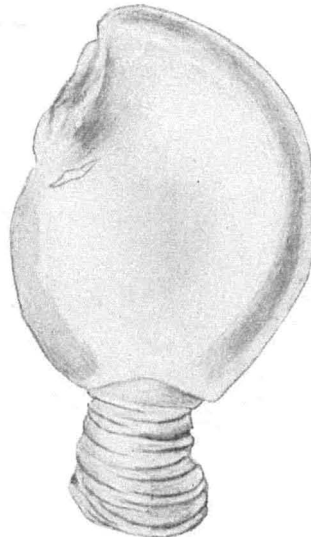
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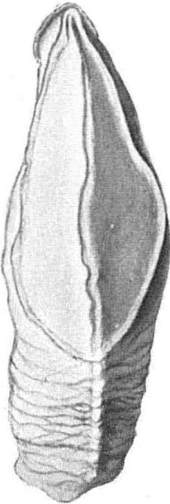
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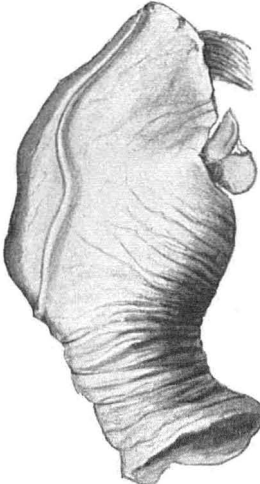
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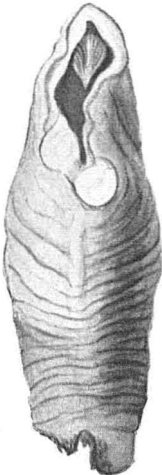
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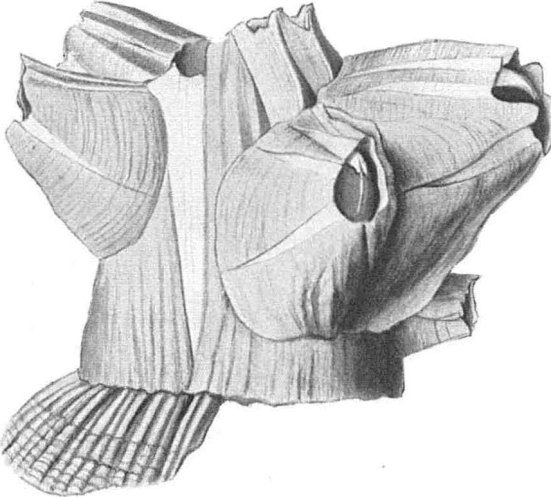
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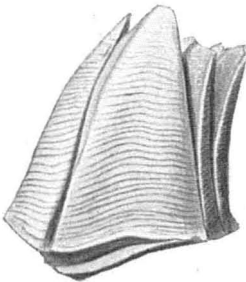
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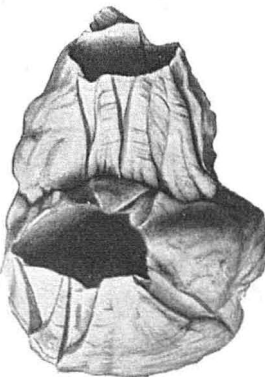
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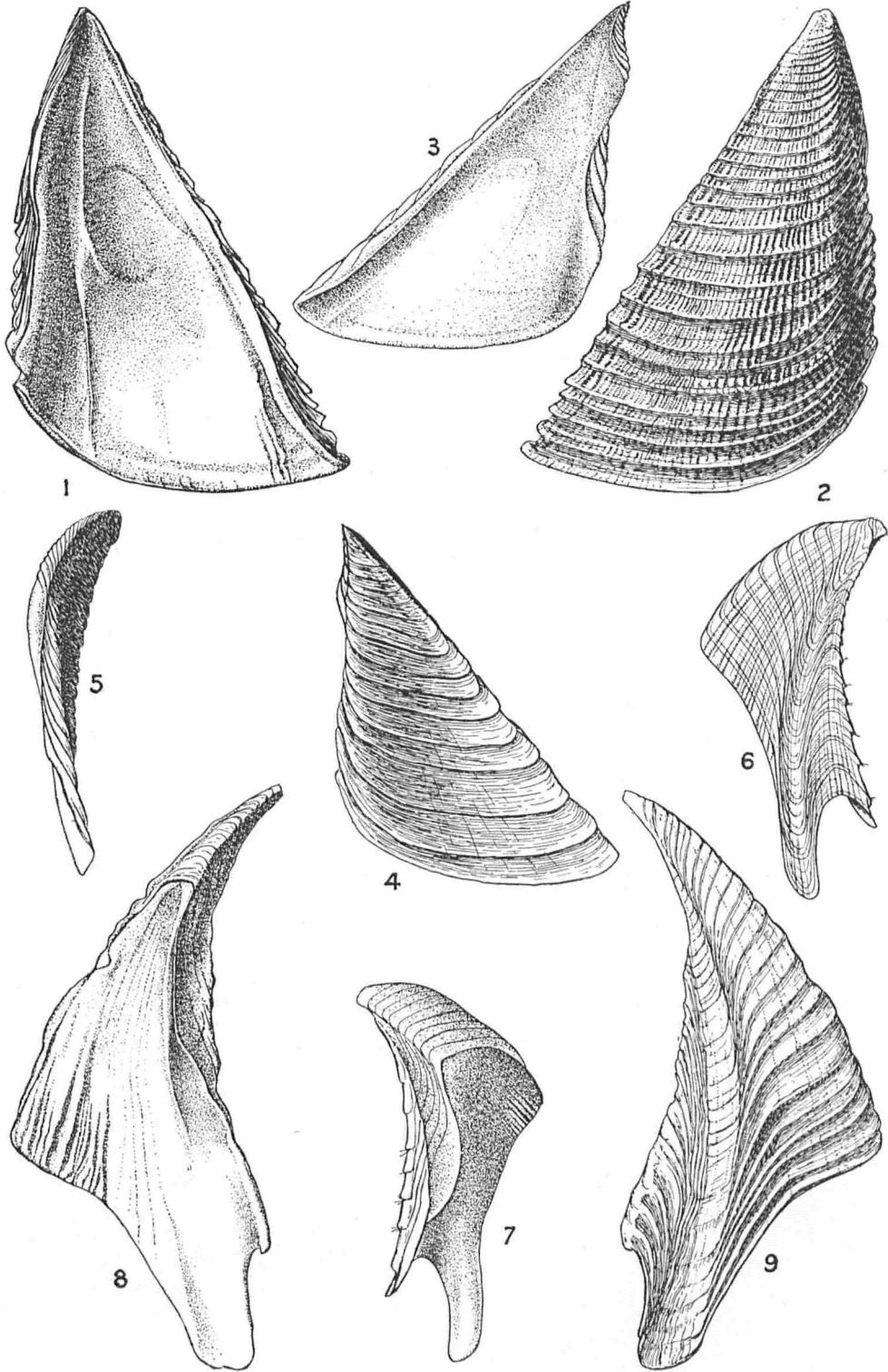
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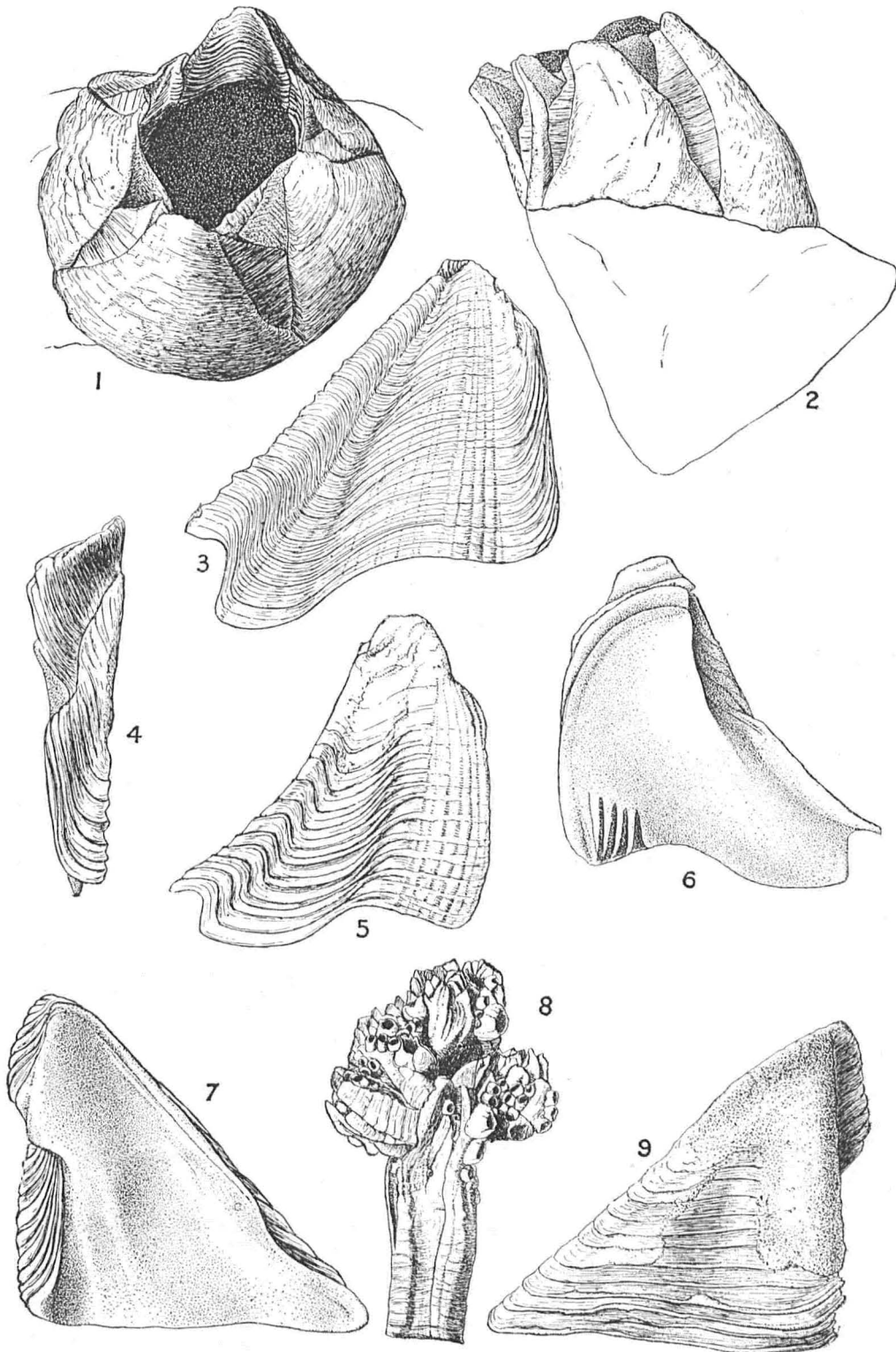


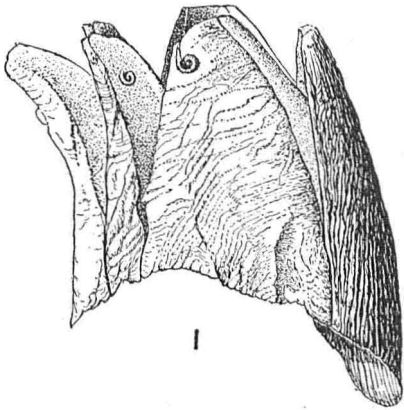
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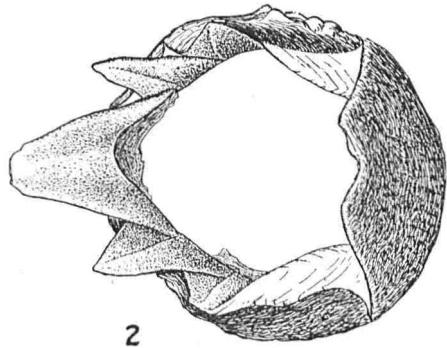
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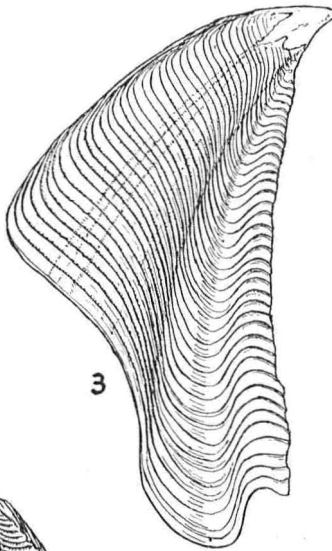




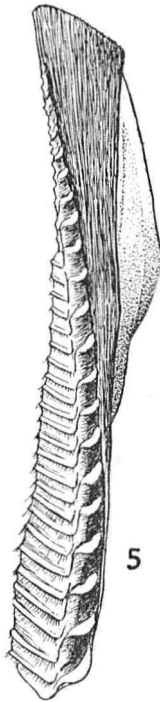
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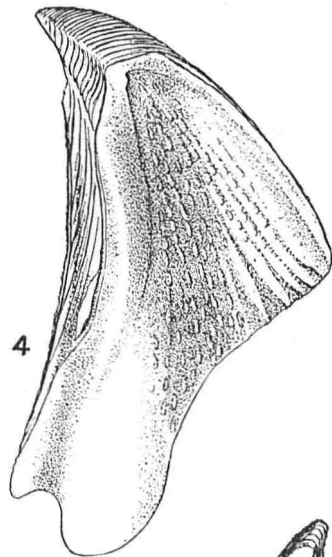
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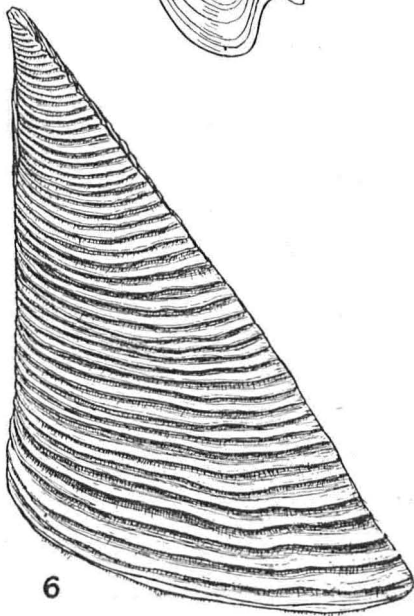
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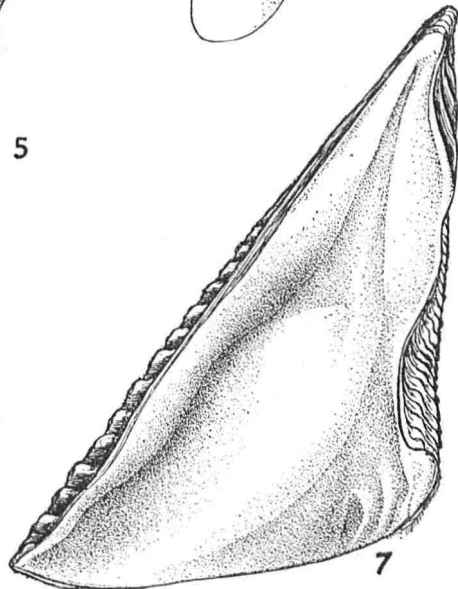
5



4



6



7

