

DESCRIPTIONS OF NEW SPECIES OF CHITONS FROM THE PACIFIC COAST OF AMERICA.

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In reviewing the West American Mollusca for the purpose of completing a checklist of Pacific coast Gastropoda, a large number of Chitons which appeared to be undescribed were found in the collection. Part of these were minute, and in the fear that with more thorough study than it was in my power to give at this time they might prove to be young of species already known, and in view of the well-known variability of many groups of these animals it was thought best to omit them from consideration at present. The others are now described. I have intentionally referred them to the larger groups on account of the difficulty in determining the value of subdivisions which have been proposed by recent writers. As the specimens were all dry it has been impossible in a number of cases to determine the extent of the gill rows, but this has been stated whenever practicable. The dried specimens, being in various stages of contraction, it will be understood that the measurements given merely approximate those of the living animals.

There is little doubt that the west coast of America is the richest Chiton region in the world, that many new forms remain to be discovered and that a satisfactory classification will in time be worked out. The present paper is a small contribution toward that end.

LEPIDOPLEURUS (LEPTOCHITON) AMBUSTUS, new species.

Chiton with a rather high but rounded back, the valves reddish-brown with numerous blackish flecks, giving the interspaces a somewhat vermicular aspect; anterior valve semicircular, simple; posterior valve smaller, shorter, with a subcentral prominent mucro behind which the surface is concavely excavated; intermediate valves subequal, dorsally rounded with hardly any trace of lateral areas; sculpture of the valves nearly uniform fine equal grooves, axially on the dorsal area, oblique on the lateral areas and cut by still finer transverse striae into microscopic granulations; the distal ends of the middle valves in the adult shell with concentric undulations; in-

sertion plates short, entire; girdle with crowded arenaceous, short spinules, interspersed near the valve margins with sparse longer white spines, the body of the girdle partaking of the colors of the shell, with a silvery reflection in certain aspects; extreme edge of the eaves finely striated in accordance with the exterior sculpture; interior whitish, the jugal sinus obscure, the sutural laminae narrow, arcuate, widely separated; a conspicuous median excavation bordered behind by two winglike, radially grooved, narrow callosities on the internal face of the valve under the central area of the posterior valve. Length of valves, 17; width, 8; height, 3 mm.

Habitat.—Santa Barbara Channel in 20 to 40 fathoms; F. A. Woodworth. Cat. No. 274120, U.S.N.M.

This has somewhat the aspect of the European *Chiton asellus* Spengler, which, however, has a differently clothed girdle and is proportionately wider and shorter.

It has been known for some years under the above manuscript name, having been by inadvertence omitted from a paper in which other chitons were described in 1902.

LEPIDOPLEURUS (LEPTOCHITON) LYCURGUS, new species.

Chiton minute, white, with touches of brown on either side of the jugal area; dorsum rather angular with flattened sides; anterior valve less than semicircular, its edge excavated behind, simple; posterior valve axially longer, with a prominent smooth subcentral mucro over a concave posterior slope; central area axially grooved, minutely granulose; posterior area with radial granulose very minute sculpture; intermediate valves with no marked jugal area, that and the pleural tracts with oblique minute reticulations; lateral areas distinct, radially minutely striate-punctate, with some obscure concentric undulations distally; girdle spiculose with minute white spinules of uneven length; interior whitish. Length of valves, 4.5; width, 3; height, 1 mm.

Habitat.—Catalina Island, California, between tides, collected by W. H. Dall. Cat. No. 274119, U.S.N.M.

LEPIDOPLEURUS (LEPTOCHITON) OLDROYDI, new species.

Chiton white, with a blackish spot on either side of the jugal area, strongly sculptured; back moderately arcuate, anterior valve semicircular, sculptured with irregularly disposed small prominent round pustules; posterior valve with subcentral prominent mucro, the central area granulose, the periphery pustulose; intermediate valves with axially puncto-striate jugal area, lateral areas prominent by reason of the conspicuous pustules which are relatively large for the size of the animal; the pleural tracts coarsely axially grooved, the grooves more or less distinctly punctate; girdle with crowded minute spines of equal length, giving an arenaceous effect; interior whitish,

the jugal sinus wide with a straight edge, the sutural laminae small, subtriangular. Length of dry animal, 5; width 2; height, 0.7 mm.

Habitat.—Monterey, California. Cat. No. 218767, U.S.N.M.

This species was discriminated by Dr. Paul Bartsch some years ago, but not published.

LEPIDOPLEURUS (LEPTOCHITON) AGESILAUS, new species.

Chiton small, with a rounded back and very narrow girdle, the valves white, but coated with a black deposit (manganese?) which obscures the sculpture; anterior valve nearly semicircular, with almost microscopic radial striation decussated by concentric even finer striae; posterior valve with a moderately prominent mucro slightly in front of the center, the central area finely axially puncto-striate, the posterior area radiately striate, the ridges more or less granulose from intersection by concentric striation; intermediate valves with obscure concentric undulations which make the posterior edge irregularly denticulate; pleural tracts and undifferentiated jugal area axially minutely puncto-striate; girdle minutely densely spinose, the ends of the spinulae forming an arenaceous even surface except at the outer margin which has a short fringe of slightly longer whitish spinules; interior whitish, the jugal sinus obsolete, the sutural laminae small, narrow. Length of animal, 8; width, 5; height, 3 mm. Gills ambient.

Habitat.—Straits of Magellan in 61 fathoms sand, bottom temperature 48° Fahrenheit. United States Fish Commission steamer *Albatross*. Cat. No. 96227, U.S.N.M.

One of the specimens has only half the seventh valve developed, the vacant space being covered by a widening of the sixth valve on that side.

LEPIDOPLEURUS (LEPTOCHITON) NICOMEDES, new species.

Chiton of moderate size, yellowish white, with a moderately wide girdle covered with an even pavement-like series of nearly rectangular subequal ivory-white smooth scales set in radial lines; back almost keeled, the mucrones of the intermediate valves prominent and whiter than the rest of the surface; anterior valve semicircular with faint granular minute radial threads, and a general sculpture of very minute reticulation; posterior valve with a small mucro at the anterior third, the central area narrow and faintly concentrically sculptured; the posterior area somewhat concave, sculptured like the anterior valve; intermediate valves without distinct jugal area, that and the pleural tracts sculptured only with a microscopic decussation; lateral areas conspicuous, with about three radial low coarsely granular ribs; interior whitish; jugal sinus inconspicuous, the sutural laminae long, narrow. Length of shell, 10; width, 6.5; height, 4 mm. Gill rows about two-thirds as long as the foot.

Habitat.—Off Nelson Strait, southern Chile, in latitude south 51° , $52'$, in 348 fathoms, mud, bottom temperature 49.9° ; United States Fish Commission steamer *Albatross*. Cat. No. 96935, U.S.N.M.

NUTTALLINA ALLANTOPHORA, new species.

Chiton with the broad flattish valves of *N. magdalena*, feebly mucronate, black, with the girdle set with black, white, and brown slightly curved stout sausage-shaped spines, smaller toward the margin, some over a millimeter long; the interior of the valves a very dark green with a very wide shallow sinus; anterior valve semicircular with a white ray, covered with minute pustules, partly ocular, and a microscopic decussation; posterior valve small and axially narrow with a posterior mucro and sculpture like that on the head valve; intermediate valves with the jugal area not distinct from the pleural tracts and the lateral areas indicated only by a faint elevation above the pleural tracts and sculptured like the rest of the shell. Length, 25; width of valves, 15; height, 6 mm.

Habitat.—Los Animas Bay, W. J. Fisher. Cat. No. 110360 a, U.S.N.M.

The armature of the girdle is quite sufficient to distinguish this from any of the related species.

NUTTALLINA MAGDALENA, new species.

Chiton of moderate size with a wide dusky girdle covered with dense microscopic spinules so as to form a velvety surface with a few long white spines, more abundant toward the edge of the girdle, which with a very narrow strip crosses the region between the valves; the general color is greenish or purplish black, with whitish streaks along the dorsal ridge; the interior is greenish, or white with green in the jugal sinuses; anterior valve with 7 to 9 slits, the outer side of the insertion plates striated; posterior valve with seven slits, the insertion plates smooth; the intermediate valves with one slit at each end; anterior valve semicircular with irregularly scattered globular pustules and a microscopic fine decussation; posterior valve wide, short, with terminal mucro, the central area with axial beaded threads with wider interspaces, the posterior tract pustulate; the intermediate valves mucronate, with the jugal area simply axially threaded; the pleural tracts with more or less oblique beaded threads merging laterally into rows of pustules; the lateral areas smooth, not ribbed, with sparsely scattered pustules; internally with the jugal sinus very wide and shallow, the sutural laminae long and wide. Length, 26; width, 12; height, 7 mm.

Habitat.—Magdalena Bay, Lower California, C. R. Orcutt. Cat. No. 217924, U.S.N.M.

This species has very much wider and less interrupted valves than either of those previously described, while it is destitute of the strong ribbing which they display and has different minor sculpture.

ISCHNOCHITON MARMORATUS, new species.

Chiton small, elegantly marbled with white, gray, and brown, with a velvety girdle covered with mottled gray, white, and brown densely set spinules; anterior valve with about 12 radial rows of prominent pustules, the rows sometimes bifid, and the ground microscopically decussate; slits 8-10; posterior valve smaller, with 8-9 slits, the mucro slightly behind the center with a peripheral irregularly double row of pustules while the central area is coarsely axially reticulate; intermediate valves with one slit, hardly mucronate, the jugal and pleural tracts axially sculptured with beaded threads finer on the jugum; lateral areas with two or three radial rows of prominent pustules which near the girdle project like little cylinders in an irregular manner; interior whitish, with hardly perceptible jugal sinuses and very narrow sutural laminae. Length, 7; width, 4; height, 1.5 mm.

Habitat.—Pacific Grove, Monterey Bay, California; Mrs. Blood. Cat. No. 218735, U.S.N.M.

Remarkable for its unusually projecting pustular sculpture. *Chiton marmoratus* Gmelin, belongs to another genus.

ISCHNOCHITON BRYANTI, new species.

Chiton of moderate size, flattish, with dorsal keels, a girdle with oval smooth small imbricating scales mottled with light and dark brown, the valves light olivaceous brown with blackish flecks; anterior valve less than semicircular, with about 13 rather irregular, sometimes bifurcate, thread-like beaded radial riblets, the whole surface covered by a microscopic reticulation; internally there are 13-14 slits, the insertion plates radiately striated; posterior margins denticulate, the jugal sinus shallow and small; posterior valve smaller, the general sculpture on the posterior area like that of the anterior valve, internally with 11 slits, the sinus shallow, the sutural laminae narrow, the insertion plates striated; intermediate valves axially short, slightly mucronate, keeled; the jugal area minutely decussate; pleural tracts with 8-10 prominent axial threads and 6-8 finer transverse threads in the interspaces, the whole valve covered with the minute decussation; lateral areas with two strong radial minutely nodulous ribs bifurcate distally, the posterior rib annulate, denticulating the margin; internally whitish, with a shallow jugal sinus and one slit in each end. Length, 9; width, 5.5; height, 2 mm.

Habitat.—"California," F. W. Bryant. Cat. No. 253826, U.S.N.M.

This species has the gill rows ambient, and the striated insertion plates are peculiar. It came to the United States National Museum with the Bryant collection and without any more definite locality than that above given, but most of his shells were from the southern part of the State.

ISCHNOCHITON BRUNNEUS, new species.

Chiton of moderate size, flattish, of a yellowish brown with a few black flecks on the girdle, which is armed with smooth oval slightly imbricating scales; anterior valve with 11, posterior with 14, intermediate with single slits; anterior valve with about 16 beaded radial ribs sometimes bifurcate, the posterior margin denticulate, the interspaces microscopically reticulate; posterior valve flattish, the mucro slightly behind the center, with about 14 sometimes bifid rows of pustules with the same reticulate ground; the central area is sculptured like the pleural tracts of the intermediate valves; the latter valves have a nearly smooth mucro and feeble dorsal carination; the pleural tracts have 8 or 10 axial undulated threads on each side, beneath which are more closely set coarser transverse threads with deeply punctate interstices; the lateral areas have three or four radial ribs, the posterior annulate, denticulating the posterior margin, the others beaded, the substratum everywhere with the minute reticulation. Length, 18; width, 12; height, 3 mm.

Habitat.—San Diego, California, Henry Hemphill. Cat. No. 58734 *a*, U.S.N.M.

ISCHNOCHITON LISTRUM, new species.

Chiton of moderate size, straw color, with occasional black blotches on the girdle, which is densely minutely scaled; though the shell is flattish, the dorsum is nearly keeled, but the valves are hardly mucronate; the gill row lacks one-fourth of being ambient; the anterior valve has 12, the posterior 11, the intermediate single slits; the anterior valve has about 16 thread-like beaded radial riblets, the two marginal ones are large with half a dozen sharp denticles on the edge; the whole shell is covered under its stronger sculpture with very minute reticulation; the posterior valve is smaller and has 14 riblets like those on the anterior valve; the central area is smaller, the mucro being low and behind the center; it is sculptured like the pleural tracts; intermediate valves with a small nearly smooth jugum, the pleural tracts with about a dozen axially straight slender threads on each tract, with subequal and closer transverse threads in the interspaces with deep interstices; the lateral areas have two or three slender beaded radii on a flat substratum anteriorly, but on the posterior side there is a wider rib with five or six widely spaced annulations, which are projected backward like the teeth of a comb, beyond the margin; internally the valves are whitish. Length, 12; width, 8; height, 2.3 mm.

Habitat.—San Diego, California, Henry Hemphill. Cat. No. 58734 *b*, U.S.N.M.

The peculiar sculpture of the lateral areas is the most conspicuous character of this species.

ISCHNOCHITON RITTERI, new species.

Chiton of moderate size, brownish, darker on the prominences, with a rather wide girdle set with smooth oval convex whitish imbricating scales, the valves nearly mucronate, almost keeled; anterior valve with about 20 flattish radii with narrower interspaces, the whole covered with a minute oblique decussation; internally whitish, with 16 slits, the insertion plates smooth, the eaves very narrow; posterior valve with a nearly central low mucro, the posterior tract sculptured like the anterior valve but more faintly, the central area punctate-reticulate; internally whitish, with 12 slits, the sinus defined by small notches at each end, straight edged, the sutural laminae narrow, elongate; intermediate valves (the first larger than the others) with no defined jugal area, but deeply punctate-reticulate, the punctations coarser toward the margins of the pleural area, lateral areas with three flattish radii with narrower interspaces, all covered with the minute reticulation; internally white with two slits at each end, one sometimes obsolete; the sinus wide, concave, shallow, between two faint notches, the sutural laminae narrow; gill rows ambient. Length, 22; width, 15; height, 5 mm.

Habitat.—Channel at Juneau, Alaska, Harriman Alaska Expedition, collected by Professor W. E. Ritter. Cat. No. 218759, U.S.N.M.

? ISCHNOCHITON EXANTHEMATUS, new species.

Chiton of moderate size, of dark yellowish brown color, lighter on the jugum, the girdle covered with densely set short spinules whose ends form a minute tessellation on the surface; anterior valve less than semicircular, sculptured with concentric incremental lines and over the entire surface with very minute granular pustules; internally with about 18 slits, with very short smooth insertion plates and rather spongy eaves; the posterior valve has similar sculpture on the posterior area, the low mucro at the anterior fourth of the valve and the narrow central area merely transversely striated; internally there are 14 slits, the insertion plates faintly striated in part, the sutural laminae very narrow, the sinus hardly perceptible, the color white; intermediate valves hardly mucronate, the jugal area smooth except for microscopic punctations, the pleural tracts with seven or eight axial thread-like lines with wider interspaces, minutely punctate, on each side; the lateral areas feebly concentrically ribbed and granulate like the end valves; internally with one or two slits indifferently on the same valve, the sinus wide, very shallow and ill-defined, the sutural laminae narrow, arcuate. Length, 10; width, 7; height, 4 mm.

Habitat.—Straits of Magellan in 61 fathoms, sand, bottom temperature 48°, United States Fish Commission steamer *Albatross*. Cat. No. 96226, U.S.N.M.

ISCHNOCHITON OPHIODERMA, new species.

Chiton oval, dull flesh color, with greenish flecks, internally bluish green, girdle with oval white convex smooth scales of about equal size, the back low, rounded; anterior valve less than semicircular, with impressed incremental lines, the surface covered with flat rectangular or lozenge-shaped scalelike sculpture resembling snake skin, internally with nine slits, and smooth insertion plates; posterior valve with the mucro moderately prominent, in front of the center, the posterior tract sculptured like the head valve, the central area with extremely fine, somewhat oblique axial threadlets crossed by incremental lines; internally with nine slits, a rather wide straight-edged sinus and quite narrow sutural laminae; intermediate valves with no differentiated jugum, that area and the pleural tracts continuous, sculptured with a very fine oblique reticulation; lateral areas with the "snake-skin" sculpture, without ribs; internally with one slit at each end, a wide straight-edged sinus and arcuate sutural laminae. Length, 15; width, 12; height, 4 mm.

Habitat.—Panama, James Zetek (No. 574). Cat. No. 332145. U.S.N.M. The "snake-skin" sculpture recalls that on *Acanthochitona*, but is more compact.

ISCHNOCHITON ACELIDOTUS, new species.

Chiton whitish, of moderate size, with high but not keeled back, the entire surface except the lateral areas covered with a microscopic oblique reticulation; the girdle provided with densely set small spinules, whose distal ends appear at the surface to form a regular pavement of small lozenge-shaped scales; the gill rows advance to the second valve; anterior valve smooth, except for the microscopic decussation, internally with 14 slits; posterior valve with the same number, the mucro in front of the center, the posterior tract sculptured like the anterior valve, the central area like the intermediate valves; the latter have a smooth space in the mucronate jugal area, the pleural tracts have six to eight widely spaced slender axial threads; the lateral areas incremental lines and extremely minute pustulation. Length, 14; width, 9; height, 5 mm.

Habitat.—Magellan Straits in $77\frac{1}{2}$ fathoms, ooze, bottom temperature 46.9° , United States Fish Commission steamer *Albatross*. Cat. No. 122731, U.S.N.M.

ISCHNOCHITON MARIPOSA, new species.

Chiton small, profusely marbled with red, white, green, and gray, the pattern different in each specimen, the anterior and second valve conspicuously longer axially and somewhat higher than those succeeding them, the girdle maculated with alternate lighter and darker patches; the back rather low, not forming a ridge at the jugum;

anterior valve with 9, posterior with 8, intermediate valves with 1 slit at each end; the anterior valve is less than semicircular and is obscurely granulose; the surface of all the valves is polished; posterior valve is small, with low subcentral mucro, the central area axially grooved, the posterior area with low granules interspersed with punctations; intermediate valves with the jugal area nearly smooth or with faint punctations, but not definitely differentiated from the pleural tracts, which are sharply grooved in a generally axial but more or less vermicular manner; the lateral areas are denticulate on their posterior edges and irregularly divaricately strongly ridged; the armature of the girdle is composed of minute densely imbricated scales; the gill rows are ambient; the jugal sinus shallow, with a straight edge, the sutural laminae subrectangular, wide apart. Length of shell, 8; width, 4.5; height, 3 mm.

Habitat.—Gulf of California, W. J. Fisher. Cat. No. 58865, U.S.N.M.

This is another of Dr. Paul Bartsch's manuscript species.

ISCHNOCHITON BERRYI, new species.

Chiton of moderate size, deep crimson with irregular blotches of brown and white on its lateral slopes, and a crimson girdle of rounded densely imbricated small scales; gill rows ambient; anterior valve with a nearly smooth mucro, from which radiate about 20 more or less corrugated, sometimes bifurcating threads, the whole overspread like the rest of the shell by an almost microscopic decussation; anterior slits about 12; posterior valve much smaller with a subcentral mucro, from which radiate threads, like those on the anterior valve, in all directions; posterior slits 11; intermediate valves with one slit, jugal area minutely decussated, almost carinate; lateral areas with usually three corrugated ribs, the nodulation of the posterior rib undulating the margin of the valve, but there may be one or two minor intercalary ribs; the pleural areas are axially ribbed with deep decussated interspaces, the ribs growing stronger as they recede from the jugal region; interior pink, the jugal sinus hardly marked, axially striated, merging laterally into narrow sutural laminae. Length of shell, 11; width, 7; height, 2.5 mm.

Habitat.—Pacific Grove, Monterey Bay, California. Cat. No. 193375, U.S.N.M.

This is one of Dr. Paul Bartsch's undescribed species.

ISCHNOCHITON (STENOPLAX) AETHONUS, new species.

Chiton narrow and elongate, of deep rose pink, with or without whitish mottling along the dorsal ridge, which is evenly rounded; girdle brownish, covered with a dense coating of short, even, minute spinules of a grayish-white color, giving a smooth arenaceous surface; anterior valve more than semicircular, sculptured with equal,

regularly spaced concentric fine threads with wider interspaces and covered by a microscopic decussation which is found over the whole surface of the valves; anterior slits 11 or 12; posterior valve with a low, nearly smooth mucro, slightly in advance of the center and uniform concentric sculpture, as in the anterior valve; there is no defined central area; posterior slits 10 or 11; intermediate valves with one slit at each end, the lateral areas slightly convex but not sharply delimited, with the jugal and pleural tracts not separated or limited, the sculpture the same as on the other valves, but the concentric threads slightly wavy; interior pink, the jugal sinus very shallow, wide, indicated by a small notch at each end, straight edged, smooth; the sutural laminae narrow, elongated; length of shell, 11; width, 6.5; height, 4 mm.

Habitat.—Near Cape San Lucas, Lower California, in 10 fathoms. Cat. No. 218814, U.S.N.M.

This is of the same general type as *I. limaciformis*, but has a sculpture totally different from that of that species or *I. fallax*.

ISCHNOCHITON COOPERI ACUTIOR Carpenter, MS.

On comparing specimens named by Carpenter in the collection of the United States National Museum, the only differences I could perceive were that the specimens of the variety *acutior* were lighter and brighter in color, more emphatic in sculpture, and apparently younger shells. In a group where color is often without systematic value, these differences seem hardly worthy of a name, analogous mutations being most common among Chitons.

ISCHNOCHITON (RADSIELLA) AETHALOTUS, new species.

Chiton small, flattish, wide, both valves and girdle of an olivaceous tint, the latter densely covered with small oval imbricating scales; anterior valve with about 18 irregularly spaced slits, less than semi-circular, sculptured with fine, close, minutely divaricating incised lines, among which are sparsely scattered relatively large brownish (ocular ?) pustules; this sculpture is extended over the whole surface of all the valves, the pustules showing no regularity, except a somewhat radial arrangement on the posterior valve; there is no segregated jugal tract and the lateral areas are feebly indicated; posterior valve with 11 slits, the mucro very obscure, subcentral, the insertion plates smooth, the sutural laminae small, the jugal sinus shallow, straight-edged, smooth inside; intermediate valves with 2 slits, the first valve axially wider than the second, all with the jugal sinus not defined; the sutural laminae rather wide, the valves not mucronate; interior color greenish; gill rows ambient. Length, 12; width, 6; height, 2 mm.

Habitat.—Gulf of California, W. J. Fisher. Cat. No. 58806c, U.S.N.M.

The absolutely irregular distribution of the brown pustules if characteristic of the species is quite remarkable. They are not polished.

ISCHNOCHITON EUCOSMIUS, new species.

Chiton small, back high but rounded, surface without eyespots; the surface variegated with white and sage-green with a tendency to white spots on the posterior edge of the intermediate valves as in *C. dentiens*, the interior apple-green; anterior valve with 10 slits, somewhat more than semicircular, obliquely decussated with extremely fine striae, which on the intermediate valves give an effect of divarication, this sort of sculpture covers the whole shell; posterior valve with 9 slits, and a low blunt mucro in front of which the valve is depressed; girdle white or maculated with white and gray, covered densely with flattish lozenge-shaped, pavement-like scales; intermediate valves with 1 slit at each end, the lateral areas feebly marked without distinctive sculpture, the sutural laminae narrow, the jugal sinus very shallow, defined by a slight notch at each end. Length, 10; width, 5.5; height, 3.3 mm.

Habitat.—Magdalena Bay, Lower California, C. R. Orcutt. Cat. No. 218194, U.S.N.M.

The coloration of the specimens in hand is especially neat, though doubtless in a large number the variations would be extreme.

ISCHNOCHITON VENEZIUS, new species.

Chiton small, warm yellow-brown with a whitish "bloom," the girdle mottled with brown and white, covered with a pavement-like coating of minute rounded scales; anterior valve with 14; posterior with 12; and the intermediate valves with 1 slit at each end; anterior valve nearly semicircular, with over 20 radial rows of small pustules, for the rest covered with a very minute oblique decussation; posterior valve smaller, with mucro low and slightly behind the center, the posterior tract decussated minutely and with a few scattered pustules near the margin, the central area reticulate; intermediate valves mucronate, minutely decussate; pleural tracts with fine low axial threading and punctate interspaces; lateral areas with 2 or 3 somewhat irregular radial rows of pustules on a minutely decussated ground. Length, 7; width, 3.5; height, 2 mm.

Habitat.—Near Venice, Los Angeles County, California. University of Southern California. Cat. No. 216792, U.S.N.M.

This is one of the most elegant of the smaller species of the coast. The jugal sinus is straight edged and the sutural laminae narrow.

? CHAETOPLEURA LACTICA, new species.

Chiton small, cream-colored, often maculated with pale green, with high almost carinate back, the girdle spongy with a few small spinules and sparse hairs on a leathery basis; anterior valve with 8 or 9

slits, posterior with 2 slits, intermediate valves with single slits; anterior valve with about 10 feeble radii, otherwise minutely punctate-reticulate; posterior valve small, with subcentral mucro and similar sculpture; intermediate valves with the jugal and pleural tracts not separated, mucronate, sculptured with obliquely axial very fine threads with punctate interspaces; the lateral areas bounded by a slender, sometimes beaded rib in front and a marginal thickening behind, otherwise sculptured like the rest of the valve; internally whitish with a wide and shallow jugal sinus and prominent sutural laminae. Length, 8; width, 4.5; height, 2 mm.

Habitat.—Catalina Harbor, California, W. H. Dall. Cat. No. 172900, U.S.N.M.

CALLISTOCHITON ACINATUS, new species.

Chiton small, yellowish white, strongly sculptured; the anterior valve with nine nodulous ribs with narrower interspaces, a minutely granulose surface and about 12 inconspicuous slits; posterior valve with 18 slits and 6 nodular ribs; this valve is much smaller, the central tract is narrow and coarsely reticulate; intermediate valves somewhat mucronate with 1 slit at each end; the sculpture on the lateral areas consists distally of two very prominently pustulate ribs, toward the dorsal ridge there are only crowded minor pustules; the jugal and pleural tracts are coarsely reticulate, the interspaces deep; the girdle yellowish with densely crowded microscopic imbricating scales; length, 6; breadth, 3; height, 1.5 mm.

Habitat.—Shore at San Pedro, California. Cat. No. 218773, U.S.N.M.

Though very minute, this does not seem to fit in with the adult of any of the other species.

CALLISTOCHITON CELETUS, new species.

Chiton of moderate size, pale brownish, with a mottled white and brownish girdle scaled like the preceding species; anterior valve with 11 nodulous ribs, which, except the closer set posterior pairs, have about equal interspaces; this valve has 9 slits, each corresponding to a rib, the posterior valve has 24, but only 6 ribs which are mostly split for a short distance distally; this valve is conspicuously convex, with about 6 large smooth nodules to each rib, the central tract is narrow and coarsely axially threaded; in the intermediate valves with 1 slit at each end, the lateral areas comprise two strong ribs with vertically compressed nodules, 8 or 9 to a rib, there is a very narrow smooth spot on the hardly mucronate jugum, the pleural tracts have near the jugal area 6 or 7 close-set axial threads and beyond them about the same number of sharp straight axial threads with wider interspaces crossed by much finer, closer, transverse threadlets; internally the valves are whitish and the sutural laminae

appear to join each other in front of the obsolete jugal sinus. Length, 10; width, 6, height, 2 mm.

Habitat.—Shore at San Pedro, California. Cat. No. 218770, U.S.N.M.

CALLISTOCHITON AEPYNOTUS, new species.

Chiton yellowish white, with a keeled back, the girdle as usual in the group; anterior valve with 10 annulate ribs and a slit for each rib; posterior valve small, low, with only about 5 feeble ribs, and 5 slits, the central area reticulate; intermediate valves with a narrow smooth line at the jugum, and single slits; the pleural tracts sharply obliquely reticulate with deep interspaces; the lateral areas bounded by 2 strong annulate ribs, the posterior rib wider, the interspaces regularly punctate-reticulate; interior white, the jugal sinus almost obsolete. Length, 15; width, 7; height, 5 mm.

Habitat.—Puget sound, in 37 fathoms rocky bottom, temperature 46°. United States Fish Commission. Cat. No. 225448, U.S.N.M.

One of the specimens has the distal nodule of a black color on each rib, all round the border.

CALLISTOCHITON CYANOSUS, new species.

Chiton of moderate size, rounded back, and rather low dorsum, the color pale blue with interrupted bands of straw-color, the girdle armature as usual, but rather finer and pale in color; anterior valve with 11 keeled ribs, a slit to 9 of them; these ribs are crossed by fine concentric threads with about equal, not punctate, interspaces; posterior valve low, with subcentral mucro similarly sculptured, the central area rather larger than the ribbed portion with 10 or 11 prominent axial threads on each side, the interspaces crossed by similar threads, making a conspicuous reticulation; in the posterior portion are 8 carinate ribs each with a slit; the intermediate valves with one slit on each end, the lateral areas bounded by 2 strong keeled ribs crossed by small equal threads, not punctate in the interspaces, denticulating the posterior edge of the area; jugal areas showing a narrow triangular smooth space, on each side of which are 15 or more strong straight axial threads, the subequal interspaces reticulated by smaller threads and the interstices deep; interior bluish white with a wide straight-edged jugal sinus and rather broad sutural laminae. Length, 13; width, 8; height, 3 mm.

Habitat.—Long Beach, San Pedro, California, Mrs. Hartwell. Cat. No. 109317, U.S.N.M.

This has somewhat the characters of *Ischnochiton*, toward which it makes a partial approach.

CALLISTOCHITON CIITHONIUS, new species.

Chiton of moderate size and dark reddish brown color, including the girdle which exhibits small lozenge-shaped imbricating scales

uniform over the surface; anterior valve with 11 subcarinate radial ribs, the two posterior tending to bifurcate, and nine slits; the ribs are hardly nodulous, and in the type the interspaces are reticulated only on the left side of the axis; posterior valve with 13 slits, nine nodulous riblets, the mucro subcentral, the central area axially threaded with a median smooth keel; intermediate valves with a smooth narrow keel at the jugum, the pleural tracts with a strong rectangular reticulation; the lateral areas with two strong keeled ribs, the posterior rib bifurcate for most of its length and the distal ends sometimes divided; these ribs are more or less nodulous, denticulating the posterior edge of the valve; the interspace between the main ribs is deep and angular; the insertion plates have a single slit; the interior of the posterior valve in dark green, of the other valves greenish white; the jugal sinus is very shallow, straight edged and wide, the sutural laminae rather narrow. Length, 21.5; width, 10; height, 5 mm.

Habitat.—San Pedro, California. Cat. No. 109488, U.S.N.M.

This is another species which verges toward *Ischnochiton*.

CALLISTOCHITON FISHERI, new species.

Chiton light greenish gray, small, strongly sculptured, the girdle covered with minute closely crowded gray scales giving a velvety aspect; anterior valve with 12 strong annulate radial ribs with narrower interspaces, internally with 11 slits; posterior valve with the mucro behind the center, the central area coarsely irregularly reticulate, the posterior area elevated, with six strong annulate ribs, a slit to each rib, a roundly excavated jugal sinus and narrow rectangular sutural laminae; the interior is dark green; intermediate valves with one feeble slit at each end, excavate rather than mucronate at the jugal area which is obliquely reticulate, passing into the pleural tracts which are small, axially threaded, the interstices with minute transverse threads; lateral areas with two annulate ribs, the posterior stronger, denticulating the posterior edge of the valve; internally pale greenish with a wide shallow straight edged jugal sinus and narrow sutural laminae. Length, 10; width, 5; height, 3 mm.

Habitat.—Glory of Russia Bay, Tanaga Island, Aleutians, on a sponge thrown up by the surf; W. J. Fisher. Cat. No. 110353, U.S.N.M.

CALLISTOCHITON DUNCANUS, new species.

Chiton small, yellowish white, strongly sculptured, with a velvety girdle densely covered with minute whitish spinules, fringed a little at the outer margin; anterior valve with nine strong annulate ribs with subequal interspaces and seven slits; posterior valve with subcentral mucro, the central area axially threaded, the posterior tract

with six slightly elevated ribs, the anterior pair bifurcate, internally with seven slits, the sinus shallow and rounded, the sutural laminae rather wide and not rounded; intermediate valves slightly mucronate, the jugal area axially striate and rounded, the pleural tracts axially threaded with transverse minuter threads in the interspaces, the lateral areas very narrow with two strong nodulous ribs (sometimes bifurcate) and the posterior margin minutely denticulate: Length, 10; width, 4.5; height, 2.2 mm.

Habitat.—Duncan Island, Galapagos Islands, United States Fish Commission steamer *Albatross*. Cat. No. 218772 U.S.N.M.

MOPALIA CHLORIS, new species.

Chiton low, wide, of moderate size, of a dark bronze green, with leathery girdle which when fresh had a few slender, sparsely distributed hairs upon it (lost in the dry specimen); anterior valve with eight slits, externally with about ten radiating conspicuous threads with a few feebler shorter intercalary threads, over the whole of which is a faint very minute oblique decussation; posterior valve small, with a very low subcentral mucro and a faint concave wave medially behind, over which is a white ray; it has two slits and a narrow rounded jugal sinus with wide sutural laminae, the finer sculpture is like that of the anterior valve with one or two radial threads; intermediate valves with one slit, the jugal tract acute, with the pleural tract sculptured with oval punctures between oblique almost obsolete minute threads; the lateral areas defined by a single cord, otherwise similarly sculptured; interior bluish-white, the jugal sinus narrow, rounded, the sutural laminae broad, the insertion plates smooth; gill rows ambient. Length, 19; width, 11; height, 3 mm.

Habitat.—San Diego, California; Mrs. N. Davie. Cat. No. 293686 U.S.N.M.

This at first sight recalls *M. hindsii* or *lignosa* but the sculpture is quite different.

MOPALIA GONIURA, new species.

Chiton of small size with a high arched back, of a yellowish color flecked with scarlet; the girdle red, velvety, with numerous sparsely scattered large brown spines (broken off in the type) chiefly near the inner border, and smaller ones scattered near the outer part; gill rows about two-thirds the length of the foot; anterior valve with 8 slits, posterior with 4, intermediate valves with single slits; anterior valve with 10 radii, the two marginal wider, otherwise the surface is covered with punctate reticulation; posterior valve small, the mucro at the posterior third, sculpture of the posterior tract in radial lines of pustules, the central area has very similar ornamentation; the posterior sinus is narrow Λ -shaped, the apex reaching

the mucro, the anterior sinus also narrow and acute, the sutural laminae broad; jugal and pleural areas of the intermediate valves not separated, the sculpture of oblique reticulation with emphatically punctate interstices; lateral areas similarly sculptured, bounded on each side by a slender rib, internally whitish with a narrow notch-like sinus. Length, 12; width, 6; height, 4 mm.

Habitat.—Granite Cove, Port Althorp, Alaska, in 16 fathoms, gravel, collected by W. H. Dall. Cat. No. 208703, U.S.N.M.

None other of the northern species has such a deep angular posterior sinus.

MOPALIA CELETOIDES, new species.

Chiton with sculpture almost exactly like No. 218770, except that the latter has more globular nodules on the lateral ribs and the pleural tracts are less coarsely and evenly reticulated. In the present species the anterior valve has 10 radial ribs with wider channeled interspaces minutely reticulated; the posterior valve, however, entirely different, having a posterior mucro with a small rounded sinus below it, and no ribs, the surface being taken up by the central area which has very straight axial threads minutely annulated, with much finer and closer transverse threads visible in the interspaces; gillrows extending forward as far as the fourth valve; posterior valve with 2 slits, anterior with 8, intermediate with one at each end; intermediate valves with the lateral areas bounded by two strong ribs, the posterior wider, denticulating the posterior margin; the interspaces minutely reticulated; jugum minute with a small smooth mucro, the back slightly keeled in front of it, the pleural tracts with about 11 strong axial threads with wider interspaces crossed by regular equal minute threads. Length, 12; width, 5.5; height, 2.5 mm.

Habitat.—Forrester Island, Alaska; G. Willett. Cat. No. 218771, U.S.N.M.

This at first glance looks very unlike a *Mopalia*. Compare *Calistochiton celetus*.

SEMIMOPALIA, new subgenus.

Anterior valves slit, posterior valves with entire insertion plates.

MOPALIA (SEMIMOPALIA) GRISEA, new species.

Chiton of moderate size with pale olive-gray valves streaked with a darker shade and with a series of pale rays on the dorsal line; girdle leathery with sparse, rather long, often duplex hairs; anterior valve with 7 or 8 slits, posterior valve with no slits, anterior four intermediate valves with one slit and the fifth and sixth without slits, the insertion plates smooth; anterior valve with 11 or 12 radii, the surface minutely decussate; posterior valve much smaller with a feeble posterior sinus, the low mucro at the posterior fourth, the

surface microscopically decussate without other sculpture; internally greenish, with a rather narrow jugal sinus and prominent sutural laminae; intermediate valves polished, slightly mucronate, wholly microscopically decussate, without other sculpture except two slender simple ribs which border the lateral areas; internally greenish and white with wide and shallow jugal sinus and narrow arcuate sutural laminae. Length, 20; width, 11; height, 3 mm.

Habitat.—Between Cape Pillar and Cape Horn, Tierra del Fuego; Stokes. Cat. No. 218734, U.S.N.M.

In spite of its gloomy color this is a very elegant species.

ACANTHOCHITONA ANGELICA, new species.

Since the sculpture of all the species from the west coast is so very similar this form perhaps may be best indicated by comparison with the other known species. The valves are of a bright scarlet and mucronate; the tufts of bristles are white and only moderately profuse, the girdle otherwise is covered with short grayish spines of irregular length and plushlike aspect.

From *A. avicula* Carpenter, it is distinguished by its more central mucro in the posterior valve, its generally larger valves and narrower girdle. Nearly the same differences separate it from *A. diegensis* Pilsbry, and *aragonites* Carpenter. It has not the profuse silky bristles of Pilsbry's *A. exquisita*, nor the broad girdle and peculiar sculpture of Sowerby's *A. hirundiniformis*. None of these species has the intermediate valves so long axially in proportion to their transverse width. The form of the valves is almost semicircular, the jugal area axially striated and the remainder of the exposed surface has the scaly sculpture usual in this genus. Length, about 11; width, 5; height, 3 mm.

Habitat.—Angeles Bay, Gulf of California, W. J. Fisher. Cat. No. 110346, U.S.N.M.

TONICIA MIXTA, new species.

Chiton of moderate size, mottled or streaked with light brown, scarlet, gray, blackish and white, the back rounded, the valves mucronate but not keeled, the gill rows ambient, the girdle with a dense coating of short spinules with a few scattered longer spines; anterior valve with 8 or 9 slits, posterior with 11 or 12, intermediate valves with one or two, sometimes differing on opposite ends of the same valve, the insertion plates striated; anterior valve small, semicircular, more or less densely provided with small pustules and irregularly distributed polished brown eyespots; there are faint indications of five radial threads which in some individuals might become stronger; the surface of the whole shell is covered with microscopic punctation; posterior valve with low central or post central mucro, the central area with coarse axial nodulous threads, the posterior

tract pustulose; interior whitish with small narrow straight-edged jugal sinus, and rather wide arcuate sutural laminae; intermediate valves with the first axially wider than the rest, the jugal area wide, axially sculptured with interrupted axial threads or rows of elongated pustules, the lateral areas ill defined, with only very few irregularly scattered prominent pustules, more abundant in some specimens; internally whitish or pale greenish; the jugal sinus narrow, the margin in all the valves projecting tongue-like; the sutural laminae arcuate. Length, 16; width, 8; height, 4 mm.

Habitat.—Angeles Bay, Gulf of California, W. J. Fisher. Cat. No. 110345, U.S.N.M.

This belongs to the same group as *T. pustulifera*, to which it is nearly allied but separated by sufficient characters. The projection of the margin of the jugal sinus is most prominent in the seventh valve, but is found in all the intermediate valves. The inner surface of this feature is smooth. The coating of the girdle is less leathery than in the more southern *Tonicias*, but under the microscope even they show minute spinules more or less abundant.

TONICIA PUSTULIFERA, new species.

Chiton of moderate size, polished, yellowish mottled with dark green, dark brown and brown dots, the back rounded, the girdle yellowish, densely covered with minute short spinules giving a velvety aspect and with no fringe of longer spines at the border; anterior valve with 8, posterior with 11, intermediate valves with single slits, the insertion plates minutely radially striated; anterior valve more than semicircular with a profusion of minute pustules corresponding to sense organs and leaving a puncture when worn off; otherwise smooth; posterior valve smaller with the mucro much in front of the center, the central area narrow, sculpture as in the anterior valve, internally with a pink spot, the jugal sinus small and shallow, the sutural laminae long and narrow; intermediate valves with the first axially longer than the others, the valves slightly mucronate, the jugal area narrow and smooth except on the first valve which has a few axial grooves, the pleural tracts smooth except for a few very feeble wavy subaxial threads often obsolete on one side of the same valve, stronger near the jugum and on the posterior valves, and a few scattered very minute pustules; there are faint traces in spots, of a microscopic decussation; lateral areas without ribs, feebly indicated, bearing oblique rows of minute pustules; internally white, pinkish under the jugum, the jugal sinus narrow, deep, straight edged, the sutural laminae broad, arcuate; the gill rows ambient. Length about 19; width, 10; height, 5 mm.

Habitat.—San Pedro, California. Cat. No. 218736, U.S.N.M.