

Three New Species of *Lepidozona* (Mollusca: Polyplacophora) from the Gulf of California

by

ANTONIO J. FERREIRA¹

Research Associate, Department of Invertebrate Zoology, California Academy of Sciences,
Golden Gate Park, San Francisco, California 94118

Abstract. The number of species of *Lepidozona* endemic to the Gulf of California, Mexico, is raised to nine with the descriptions of three new ones, *L. laurae*, *L. macleaniana*, and *L. stohleri*, from the subtidal zone. A diagnostic key to the species of *Lepidozona* in the Gulf of California is given.

THE GENUS *Lepidozona* Pilsbry, 1892, is remarkably well represented in the northeastern Pacific. To the eight species already recognized in the temperate region (FERREIRA, 1978), and six others in tropical waters (FERREIRA, 1974), three new ones are added here to the fauna of the Gulf of California, raising to nine the number of *Lepidozona* species in the Panamic Province, and to seventeen the number in the northeastern Pacific.

Class Polyplacophora Gray, 1821

Order Neoloricata Bergenhayn, 1955

Suborder Ischnochitonina Bergenhayn, 1930

Family Ischnochitonidae Dall, 1889

Genus *Lepidozona* Pilsbry, 1892

Type-species: *Chiton mertensii* Middendorff, 1847, by original designation (PILSBRY, 1892).

Lepidozona laurae Ferreira, spec. nov.

(Figures 1 to 5)

Diagnosis: Small (largest, 14.5 mm long) chitons, rusty brown, carinate, not beaked. Anterior valve, lateral areas of intermediate valves, and postmucro area of posterior valve with very faint radial riblets, and minute, round tubercles (up to 80 μ m in diameter); central areas with longitudinal rows of granules coalescing into riblets, par-

allel to jugum, vaguely latticed; mucro anterior. Girdle with imbricate, striated scales. Radula with unicuspid major lateral teeth.

Type material: **Holotype** and one **paratype** at the California Academy of Sciences (CAS 050245 and CAS 050244, respectively); six other **paratypes** at the Los Angeles County Museum of Natural History (LACM 2003), United States National Museum of Natural History (USNM 820460), Academy of Natural Sciences of Philadelphia (ANSP 358901), and in the private collections of Laura and Carl Shy, Seal Beach, California, and Antonio J. Ferreira.

Type locality: 3.2 km southeast of San Antonio, Guaymas, Sonora, Mexico (27°57'N, 111°06'W), at 73-91 m (*leg.* Laura and Carl Shy, dredged Oct. 1977 and Oct. 1979).

Other material: 5 km south of Tetas de Cabra, Sonora, Mexico, dredged at 60-90 m, 2 specimens, largest 14 mm long (Skoglund Coll., *leg.* C. & P. Skoglund, Nov. 1979); 5 km southeast of Punta San Antonio, Guaymas, Sonora, Mexico, dredged at 100 m, 1 specimen, 14.5 mm long (Poorman Coll., *leg.* F. & L. Poorman, Apr. and Oct. 1983).

Description: **Holotype** (Figure 1), preserved flat in alcohol, 11.0 mm long, 6.5 mm wide (including girdle), 2.0 mm high; valves carinate, moderately elevated, posterior edge straight, not beaked; tegmentum microgranular. Lateral areas slightly elevated with 5-6 very faint radial riblets with minute (60-80 μ m in diameter), round tubercles

¹ For reprints: 2060 Clarmar Way, San Jose, California 95128.



Explanation of Figures 1 and 2

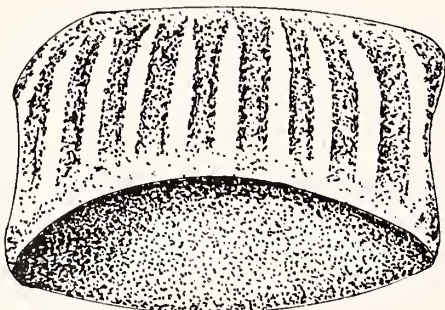
Figure 1. *Lepidozona laurae* Ferreira, spec. nov.: Holotype (CAS 050245).

Figure 2. *Lepidozona laurae* Ferreira, spec. nov.: Paratype, 13 mm long (Shy Coll.); close up of lateral areas of intermediate valves.

(see Figure 2, **paratype**); anterior valve with some 25 similar radial riblets and tubercles; central areas with longitudinal rows of granules, mostly coalesced into 12 riblets per side, vaguely latticed, and parallel to, but obsolete at jugum; on valve ii, few jugal riblets diverge in manner similar, although attenuated, to the wedgelike pattern seen in other species of *Lepidozona* (FERREIRA, 1974); mucro anterior; postmucro slightly concave with radial riblets and tubercles. Gills holobranchial, extending along 90% of foot's length, 20 plumes per side.

Paratype, 10.5 mm long, disarticulated: articulamentum white; slit formula, 10-1-11; insertion teeth sharp;

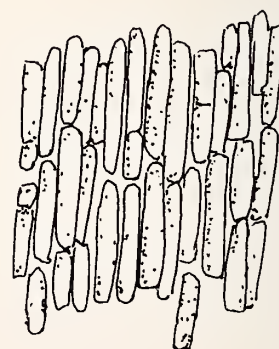
eaves solid; sutural plates subrectangular; sinus well defined; on valve viii, relative width of sinus (width of sinus/width of sutural plates), 0.4. Width of valve i/width of valve viii, 1.1. Girdle's upper surface covered with imbricate scales, up to 160 μm in length (smaller at inner and outer margins), with some 10 shallow striations (Figure 3); girdle's undersurface covered with elongate, transparent, rectangular scales, 40-80 μm long, 12 μm wide, arranged in columns as if articulated end-to-end (Figure 4). Radula (very similar to that of *L. mertensii* and other *Lepidozona* species [cf. fig. 34 in FERREIRA, 1978]), 3.5



100 μm

Figure 3

Lepidozona laurae Ferreira, spec. nov.: Paratype (Ferreira Coll.); scale of girdle's upper surface.



100 μm

Figure 4

Lepidozona laurae Ferreira, spec. nov.: Paratype (Ferreira Coll.); scales of girdle's undersurface.

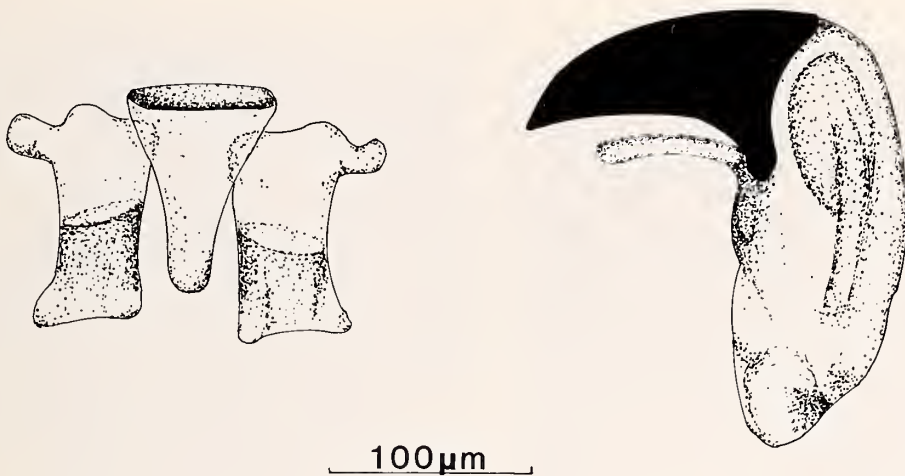


Figure 5

Lepidozона laurae Ferreira, spec. nov.: Paratype (Ferreira Coll.); radula's median, first lateral, and major lateral teeth.

mm long (33% of specimen's length), with 25 rows of mature teeth; median tooth enlarged at anterior blade, 80 μm wide, narrowing sharply posteriorly; first lateral teeth subrectangular, with explicit knob at antero-outer corner; major lateral teeth with unicuspid head, 70 μm wide, and unusually long and thin subcapital tubercle (Figure 5); outer marginal teeth elongate, 110 \times 70 μm .

Distribution: *Lepidozона laurae* is known only from the general locality of Guaymas, Sonora, Mexico, and depths of 60–100 m.

Remarks: For its striated scales, *Lepidozона laurae* may be grouped with the sympatric congeners *L. serrata* (Carpenter, 1864), *L. allynsmithi* Ferreira, 1974, *L. crockeri* (Willet, 1951), and *L. subtilis* Berry, 1956, from which it differs in sculptural features, size, color, and habitat (see FERREIRA, 1974). Because of its small size, and relatively deep-water habitat, rusty brown specimens of *L. laurae*, with small round tubercles on lateral areas and end valves, may be confused with *L. retiporosa* (Carpenter, 1864) known from similar latitudes in the outer (Pacific) colder side of Baja California; however, the two species differ distinctly in the tegmental sculpture of the central areas (granulose longitudinal riblets in *laurae*; quincuncial, netlike pits in *retiporosa*).

The species is here designated *laurae* after Laura Shy, Seal Beach, California, who, with her husband, Carl L. Shy, collected and kindly made available specimens for study.

Lepidozона macleaniana Ferreira, spec. nov.

(Figures 6 to 10)

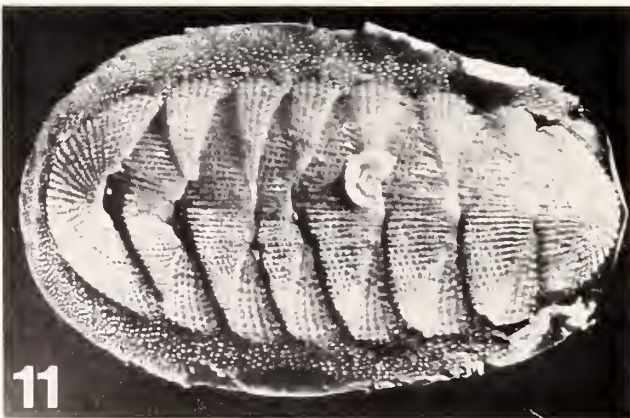
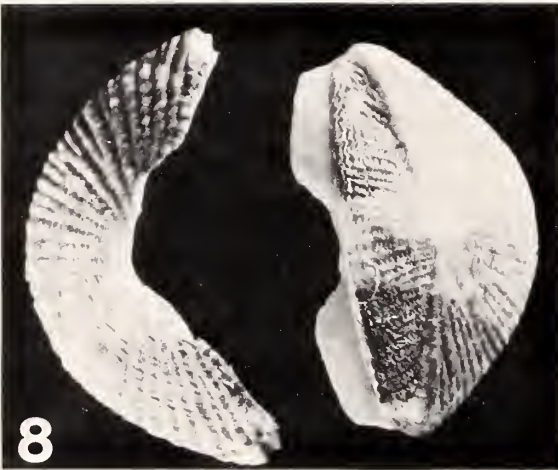
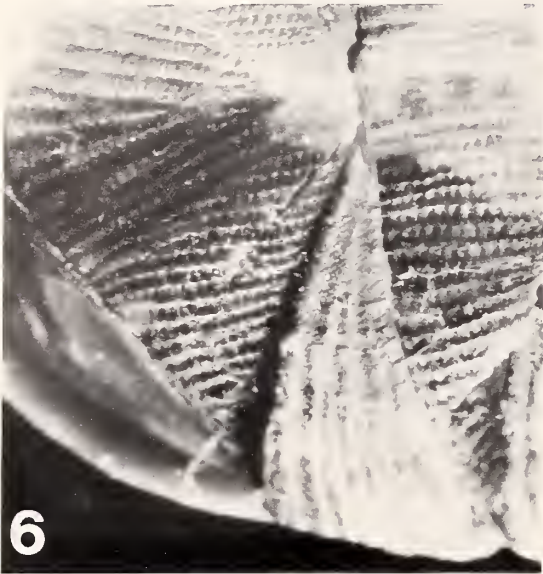
Diagnosis: Medium size (20 mm long) chiton, carinate, mottled cream-brown. Radial ribs flat, close together,

mostly smooth on lateral areas, irregularly granulose on end valves. Central areas with parallel, latticed, longitudinal riblets; jugum ribbed, with wedgelike pattern on valve ii. Mucro central. Girdle scales large, convex, smooth, nipped.

Type material: Holotype (LACM 2004).

Type locality: Off San Pedro Nolasco Island, Gulf of California, Mexico (27°58'32"N, 111°23'37"W), at 100–104 m (ex LACM-AHF 1085-40, 6 Feb. 1940).

Description: Holotype (Figures 6, 7, 8, 9), preserved in alcohol, valves iii–vii broken but in place; estimated length 20 mm long, width 10 mm, height 4 mm; valves carinate, not beaked; jugal angle about 110°; tegmentum microgranular, mottled cream-brown. Anterior valve with 30 radial flattish to subgranulose ribs, close together. Lateral areas with 6–8 radial ribs, similar to those on anterior valve, except for appearing much more decidedly flat, not granulose. Central areas with longitudinal riblets, parallel to jugum, 16 per side, about 70 μm thick, 150 μm apart, clearly latticed near jugum, but only obsoletely so in pleural areas; jugal areas ribbed, with wedgelike pattern on valve ii. Mucro central, postmucro area slightly concave with some 30 radial, flattish ribs. Articulamentum white with brown discoloration at apex of valves. Insertion teeth sharp, well formed; slits 12-1-12, followed by slit-rays; sutural laminae relatively short, subrectangular; sinus well defined; on valve viii, relative width of sinus, 0.3; width of valve i/width of valve viii, 1.1. Gills holobranchial, about 30 plumes per side. Girdle's upper surface covered with imbricate, strongly convex scales, up to 200 μm in length, some displaying nipplelike formation on dorsal edge (Figure 10); undersurface paved with transparent, rectangular scales, 60–80 μm long, 12 μm wide, arranged



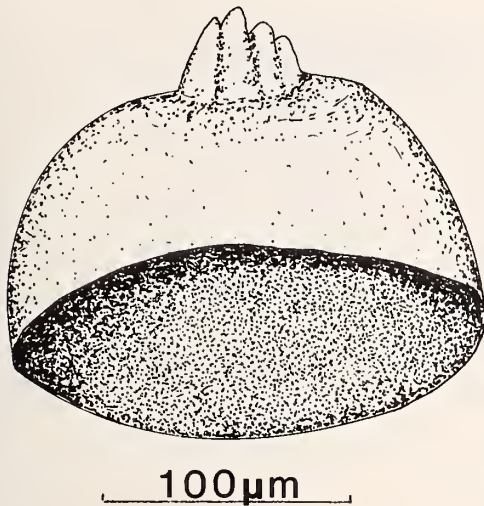


Figure 10

Lepidozonia macleaniana Ferreira, spec. nov.: Holotype (LACM 2004); scale of girdle's upper surface.

end-to-end, in columns (as in *Lepidozonia laurae*). Radula, not examined.

Distribution: *Lepidozonia macleaniana* is known only from the type locality.

Remarks: For its strongly convex girdle scales, *Lepidozonia macleaniana* resembles *L. formosa* from which it differs in tegmental sculpture (radial ribs of lateral areas flattish in *macleaniana*, distinctly tuberculate in *formosa*).

The species is here named *macleaniana* after Dr. James H. McLean, Los Angeles County Museum of Natural History, who has generously provided this and many other specimens for study.

Lepidozonia stohleri Ferreira, spec. nov.

(Figures 11 to 14)

Diagnosis: Medium size (largest, 26 mm long) chitons, carinate, mostly brown-orange colored. Lateral areas and end valves with radial rows of small (to 200 µm), round tubercles. Central areas with longitudinal, parallel riblets, latticed; jugum ribbed, showing wedgelike pattern of rib-

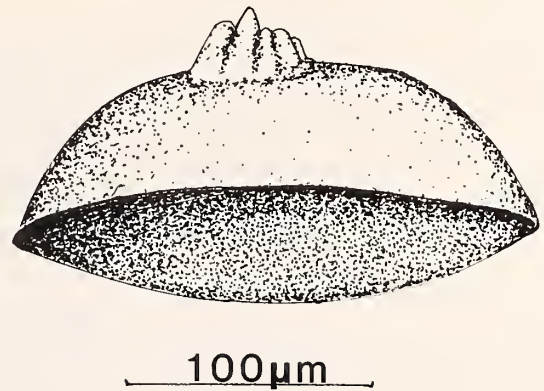


Figure 13

Lepidozonia stohleri Ferreira, spec. nov.: Paratype (Ferreira Coll.); scale of girdle's upper surface.

lets on valve ii; micro central. Girdle with large, smooth, convex, nipped scales.

Type material: Holotype (CAS 050246), and 16 paratypes (CAS 050247; LACM 2005; USNM 820459; ANSP 358902; and in the private collections of Laura and Carl Shy, and Antonio J. Ferreira).

Type locality: Smith Id., Bahía de Los Angeles, Gulf of California, Baja California, Mexico (29°02'N, 113°30'W), at 12–36 m (*leg.* Laura & Carl Shy, dredging, west side and south side of Smith Id., May 1975 and May 1976).

Other material: Puerto Refugio, Angel de la Guarda Id., Gulf of California, Mexico, 1 specimen, at 20–40 m (LACM-AHF 1048-40); Danzante Id., Gulf of California, Mexico, dredged at 30–60 m, 3 specimens, maximum 18 mm long (Shy Coll., *leg.* L. & P. Shy, Oct. 1982); Bahía de los Angeles, Baja California, Mexico, dredged at 21–50 m, 4 specimens, largest 18 mm long (Skoglund Coll., *leg.* C. & P. Skoglund, May 1976; Poorman Coll., *leg.* F. & L. Poorman, May 1976).

Description: Holotype (Figures 11, 12), preserved dry, flat, 20.5 mm long, 13 mm wide, uniformly orange. Valves carinate, not beaked, jugal angle 120°. Tegmentum microgranular. Anterior valve with 35 radial rows of round, discrete tubercles, about 100 µm in diameter (smaller to

Explanation of Figures 6 to 9, 11, and 12

Figure 6. *Lepidozonia macleaniana* Ferreira, spec. nov.: Holotype (LACM 2004); close up of valves ii and iii.

Figure 7. *Lepidozonia macleaniana* Ferreira, spec. nov.: Holotype (LACM 2004); close up of lateral areas of intermediate valves.

Figure 8. *Lepidozonia macleaniana* Ferreira, spec. nov.: Holotype (LACM 2004); valves i and viii, tegmental surfaces.

Figure 9. *Lepidozonia macleaniana* Ferreira, spec. nov.: Holotype (LACM 2004); valves i and viii, articulamental surfaces.

Figure 11. *Lepidozonia stohleri* Ferreira, spec. nov.: Holotype (CAS 050246).

Figure 12. *Lepidozonia stohleri* Ferreira, spec. nov.: Holotype (CAS 050246); close up of lateral areas of intermediate valves.

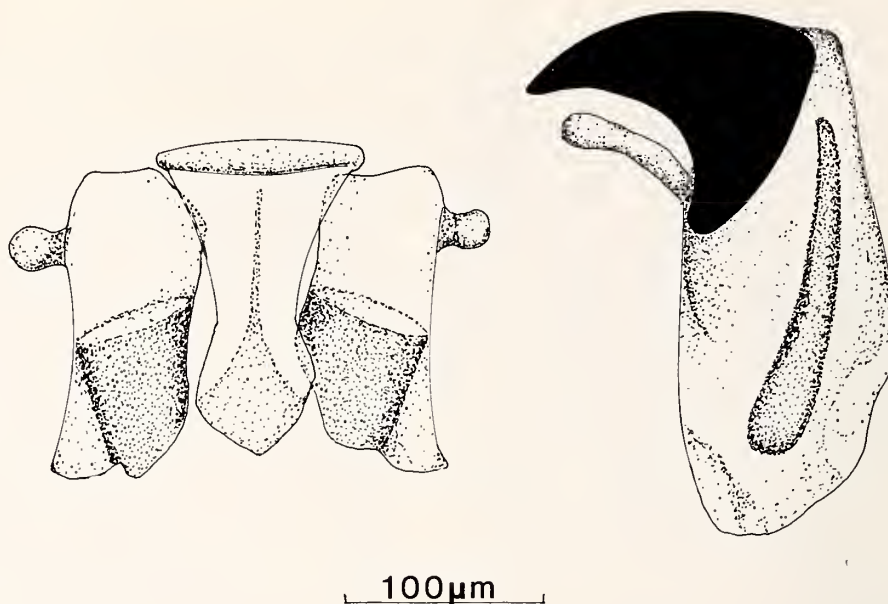


Figure 14

Lepidozona stohleri Ferreira, spec. nov.: Paratype (Ferreira Coll.); radula's median, first lateral and major lateral teeth.

50 μm centrally, larger to 200 μm at periphery), 100–150 μm apart. Lateral areas with 5–6 similar rows of tubercles; sutural edges irregularly crenulate by tubercles. Central areas with longitudinal riblets, 15–18 per side, parallel to jugum, 70 μm thick, 150 μm apart, latticed. Jugal areas, ribbed; riblets forming wedgelike pattern on valve ii. Mucro central; postmucral area somewhat convex, with some 20 similar radial rows of tubercles. Girdle's upper surface with imbricate, strongly convex scales, up to 200 μm in length, some showing nipplelike formation on dorsal edge (Figure 13); undersurface paved with transparent, rectangular scales, 60–80 μm in length, 10 μm in width, arranged end-to-end, in columns (as in *Lepidozona laurae*).

Paratypes uniformly brown-orange, except one with black pleural areas and white jugal stripe; none with red. Largest 26 mm long; width/length, mean = 0.63 ($n = 10$; $SD = 0.05$). Disarticulated paratype, 9.5 mm long; articulamentum, white; sutural laminae relatively short, subrectangular; insertion teeth well formed, sharp; slits 11–1–12, followed by slit-rays. On valve viii, relative width of sinus, 0.4; width of valve i/width of valve viii, 1.2. Gills holobranchial, about 20 plumes per side. Girdle, as in holotype. Radula, 4.2 mm long (44% of specimen's length), comprising 24 rows of mature teeth; median tooth 105 μm at anterior blade, narrowing posteriorly; first lateral teeth, subrectangular, 150 μm long, with large knob at antero-outer angle; major lateral teeth with unicuspid head, and subcapital tubercle long and thin (as in *Lepidozona laurae*, 37 \times 15 μm (Figure 14); outer marginal teeth, elongate, 150 \times 75 μm .

Other material as above; one specimen from Danzante Id., and three specimens from Bahía de los Angeles with same black-white color pattern seen in one of the paratypes.

Distribution: *Lepidozona stohleri* is known only from Bahía de Los Angeles (type locality), Puerto Refugio, Angel de la Guarda Id. (29°32'33"N, 113°33'57"W), and Danzante Id., Baja California, Mexico (25°46'N, 111°15'W), at depths of 12–36 m to 30–60 m.

Remarks: *Lepidozona stohleri* may be confused with *L. formosa* Ferreira, 1974, from which it differs in the characteristics of the tubercles on lateral areas and end valves (coarsely defined, coalesced, like varices on the radial riblets in *formosa*; well defined, discrete, round, only occasionally coalesced in *stohleri*); in addition, the reddish hues often present in *L. formosa* have not been seen in *stohleri*.

On account of its large, convex, nipped girdle scales, *Lepidozona stohleri* belongs, with *L. macleaniana*, in the group of *L. clathrata* (Reeve, 1847) (see FERREIRA, 1974). Articulamentum and radula being identical, it is the presence of discrete tubercles on lateral areas and end valves that distinguishes it from these congeners in the Gulf of California. It also resembles the warm-temperate *L. mertensii* (Middendorff, 1847) and *L. guadalupensis* Ferreira, 1974; differential characteristics are found in the radial rows of tubercles on the anterior valve (about 35 rows, close together in *stohleri*; about 20 rows, well apart in *mertensii* and *guadalupensis*) and, similarly, on lateral areas.

The species is here named *stohleri* after Dr. Rudolf

Stohler, Research Zoologist Emeritus, University of California, Berkeley, California, founder and former Editor of *The Veliger*, to whom Californian malacologists will be forever indebted.

DISCUSSION

In addition to the three species here described, six other species of *Lepidozona*—*L. clathrata* (Reeve, 1847), *L. serrata* (Carpenter, 1864), *L. crockeri* (Willett, in Hertlein & Strong, 1951), *L. subtilis* Berry, 1956, *L. allynsmithi* Ferreira, 1974, and *L. formosa* Ferreira, 1974—are recognized in the Gulf of California, all endemic to the region. To facilitate their identification, the following key is given.

Key to the Species of *Lepidozona* in the Gulf of California

1. Girdle scales
 - large, convex, smooth, nipped 2
 - small, flattish, striated, not-nipped 5
2. Radial ribs in lateral areas and end valves
 - with tubercles 3
 - nearly smooth *L. macleaniana*
3. Tubercles
 - coalesced, like varices on rib 4
 - discrete, semispherical *L. stohleri*
4. Radial ribs (and color of specimens)
 - well apart, tubercles mostly elongate (specimens in dingy brown to greenish-gray tones) *L. clathrata*
 - close together, tubercles mostly round (specimens in bright, reddish tones) *L. formosa*
5. End valves and lateral areas
 - without tubercles 6
 - with tubercles 8
6. Radial ribs
 - of minute beads (5–8 riblets per lateral area) *L. subtilis*
 - flattened (2–4 per lateral area) 7
7. Central areas riblets
 - longitudinal, latticed *L. serrata*
 - crossed at oblique angles, forming lozenges *L. allynsmithi*
8. Tubercles
 - coalesced, like varices on rib *L. crockeri*
 - discrete, round *L. laurae*

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LITERATURE CITED

- BERGENHAYN, J. R. M. 1930. Kurze Bemerkungen zur Kenntnis der Schalenstruktur und Systematik der Loricaten. Kungl. Svenska Vetensk. Handl. (3)9(3):3–54, 5 text figs., 10 pls.
- BERGENHAYN, J. R. M. 1955. Die fossilen schwedischen Loricaten nebst einer vorläufigen Revision des Systems der ganzen Klasse Loricata. Lunds Universitets Årsskrift. Avd. 2, 5(8):1–43, Kungl. Fysiogr. Sällsk. Handl. N.F. 66(8):3–42, 2 tables.
- BERRY, S. S. 1917. Notes on west American chitons. I. Proc. Calif. Acad. Sci. (4)7(10):229–248, 4 text figs.
- BERRY, S. S. 1956. Diagnoses of new eastern Pacific chitons. Leaflets in Malacology 1(13):71–74
- CARPENTER, P. P. 1864. Diagnoses of new forms of mollusks collected at Cape St. Lucas by Mr. J. Xantus. Ann. Magaz. Natur. Hist. (3)13:311–315.
- DALL, W. H. 1889. Preliminary catalogue of the shell-bearing marine mollusks and brachiopods of the southeastern coast of the United States, with illustrations of many of the species. Bull. U.S. Natl. Mus. 37:3–271, 74 pls.
- FERREIRA, A. J. 1974. The genus *Lepidozona* in the Panamic Province, with the description of two new species (Mollusca: Polyplacophora). *Veliger* 17(2):162–180, 6 pls.
- FERREIRA, A. J. 1978. The genus *Lepidozona* (Mollusca: Polyplacophora) in the temperate eastern Pacific, Baja California to Alaska, with the description of a new species. *Veliger* 21(1):19–44, 3 text figs., 5 pls.
- GRAY, J. E. 1821. A natural arrangement of Mollusca, according to their internal structure. London Med. Repos. 15: 229–239.
- MIDDENDORFF, A. T. VON. 1847. Vorläufige Anzeige bisher unbekannter Mollusken, als Vorarbeit zu einer Malacozologia Rossica. Bull. Classe Phys.-Math. Acad. Imp. Sci. St. Petersburg No. 128, 6(8):113–122
- PILSBRY, H. A. 1892. Polyplacophora. In: G. W. Tryon Jr. (ed.), Manual of conchology, 14:209–350 + i–xxxiv, pls. 41–68.
- REEVE, L. A. 1847. Monograph of the genus *Chiton*. In: Conchologia iconica, or Illustrations of the shells of molluscos animals. London. 4:28 pls., 194 figs.
- WILLETT, G. 1951. In: L. G. Hertlein & A. M. Strong, Eastern Pacific expedition of the New York Zoological Society, XLIII. Mollusks from the west coast of Mexico and Central America. Part X. Zoologica. 36:67–120, pls. 1–10