

LAMINOPLAX, A NEW GENUS OF CHITONS AND THE TAXONOMIC
POSITION OF *HANLEYA DALLI* KAAS, 1957
(POLYPLACOPHORA: AFOSSOCHITONIDAE).

Antonio J. Ferreira, M.D.

2060 Clarmar Way
San Jose, California 95128

ABSTRACT

The examination of the holotype of Hanleya dalli Kaas, 1957 [new name for Lepidopleurus carinatus Dall, 1927 (not Leach, 1852)] revealed that this species, with its elongated body, thick valves, granulo-vermicular tegmentum, spiculoid girdle, posterior gills, and well-developed, unslit insertion plates in all valves belongs in the family Afossochitonidae. A new genus, Laminoplax, is proposed to accommodate the species. Laminoplax dalli is known only from the type material, off Eastport, Maine.

In 1927 Dall described, but did not illustrate, a new species of chiton, *Lepidopleurus carinatus*, based on material from Eastport, Maine. In 1957 Kaas pointed out that Dall's name had been preoccupied by Leach (1852), and proposed the name *Hanleya dalli* for the taxon. In the course of a review of the family Lepidopleuridae (Ferreira, 1979), I have had the opportunity to examine the holotype, and only known specimen, of this taxon. The purpose of this paper is to redescribe and illustrate this species, reassign it to a different family and a new genus, and to discuss the classification of the Lepidopleurina. The holotype and other comparative material were made available through the courtesy of Dr. Joseph Rosewater, National Museum of Natural History, Washington, D.C. [USNM].

Systematic Treatment

POLYPLACOPHORA Blainville, 1816

Order **Neoloricata** Bergenhayn, 1955

Suborder **Lepidopleurina** Thiele, 1910

Definition: Valves without insertion plates, or with insertion plates without slits (Van Belle, 1975:135).

Remarks: In the classification of chitons, articulatory features, and, in particular, the presence or absence of insertion plates and slits have been considered characters of fundamental importance (Pilsbry, 1892-1894; Knorre, 1925;

Ashby, 1929; Thiele, 1929; Bergenhayn, 1955; Smith, 1960; Van Belle, 1975-1978). Thus, the orders Paleoloricata Bergenhayn, 1955, and Neoloricata Bergenhayn, 1955, were defined, respectively, by the absence or presence of sutural laminae in the articulamentum. The Lepidopleurina, generally recognized as the most primitive of Recent chitons [present since the Ordovician], has been divided, on the basis of the insertion plates, into four families (Van Belle, 1975): Lepidopleuridae Pilsbry, 1892 (all valves devoid of insertion plates), Protochitonidae Ashby, 1925 (insertion plates absent in the end valves but present, although unslit, in the intermediate valves), Hanleyidae Bergenhayn, 1955 (unslit insertion plate present in front valve, but absent, or only vestigial, in posterior valve; intermediate valves without insertion plates), and Afossochitonidae Ashby, 1925 (unslit insertion plates present in all valves).

Afossochitonidae Ashby, 1925

Definition: Unslit insertion plates present in all valves (Van Belle, 1975:147).

Type genus: *Afossochiton* Ashby, 1925 (Type species: *Afossochiton cudmorei* Ashby, 1925 [fossil, Oligocene], by original designation).

Remarks: Ashby (1925) established the taxon Afossochitoninae as a subfamily of Acanthochitonidae Pilsbry, 1893 [erroneously attributed to

Hedley, 1916], with a single genus, *Afossochiton* Ashby, 1925, and two fossil species, *A. eudmorei* Ashby, 1925, and *A. rostratus* (Ashby & Torr, 1901), of the Oligocene of Victoria, Australia. Bergenhayn (1955) considered the taxon Afossochitonina as one of the four suborders in his Neoloricata, in view of its lepidopleurid configuration, achantochitonid sculpture, and an articulation represented only by sutural plates (Bergenhayn, op. cit., pp. 38-40). Smith (1960) adopted the same interpretation. However, Bergenhayn's view was incorrect. As Van Belle (1975) pointed out, Ashby (1925) did describe insertion plates in the intermediate valves of the type species, *Afossochiton eudmorei*, in addition to the fact that, later, the description of several other species of *Afossochiton* by Ashby & Cotton (1939) [*A. sulci*, *A. dendus*, *A. iscus*, and *A. magnicostatus*] left no doubt about the presence of insertion plates in all valves of the specimens under consideration. Thus, Van Belle (1975:143) concluded that "Bergenhayn's [and Smith's] position is untenable", and that Afossochitonidae should be classified in the Lepidopleurina.

The definition of Afossochitonidae contains no statement concerning the gills, three of the genera being known only as fossils, and the only member of *Choriplx*, *C. grayi* (Adams & Angas, 1864), known only from the type specimen [and another questionable one reported by Ashby (1921)], has been cited only a few times in the literature (Adams & Angas, 1864:194; 1865: pl. 11, figs. 16, 17; Angas, 1867:222; Pilsbry, 1893:21-22, pl. 6, figs. 9-11, with notes from Carpenter's unpublished manuscript; Ashby, 1921:136-142, pl. 9; Iredale & Hull, 1925:99-100, pl. 11, figs. 24-28) with no mention of the gills. It is worth noting that although Ashby (1921) placed *Choriplx* in the Acanthochitonidae, Pilsbry (1893), Thiele (1910), Smith (1960), and Van Belle (1975) allocated it to the Lepidopleurina.

In the Afossochitonidae, Van Belle (op. cit.) recognized four genera: *Glyptochiton* Koninck, 1853 [Carboniferous], *Afossochiton* Ashby, 1925 [Oligocene], *Lirachiton* Ashby & Cotton, 1939 [Eocene], and *Choriplx* Pilsbry, 1894 [Recessed].

Laminoplax Ferreira *gen. nov.*

Definition: Elongated, carinated chitons, with thick valves. Obsolete lateral areas. Tegmentum with granulo-vermicular sculpture. Girdle covered with spiculoid processes. Gills posterior. Articulation with slitless insertion plates in all valves.

Type species: *Hanleya dalli* Kaas, 1957 [new name for *Lepidopleurus carinatus* Dall, 1927 (not Leach, 1852)] by original designation, herein.

Laminoplax dalli (Kaas, 1957)

(Figs. 1-6)

Synonymy:

Hanleya dalli Kaas, 1957:83

Lepidopleurus carinatus Dall, 1927:11 (non Leach, 1847, *nude name*; non Leach, 1852).

Type locality: Eastport, Maine [44°54' N, 67°00' W]. *Holotype:* (USNM 225149).

Original description: "Shell rather large . . . yellowish white, densely covered with minute pustules which are obscurely arranged concentrically to the mucro of the posterior valve, radially on the anterior valve and longitudinally on the intermediate valves; back subcarinate, the angle about 70°; eaves projecting, the insertion plates of the terminal valves not split but radially rugose, of the intermediate valves entire; girdle narrow, densely pilose, with extremely fine close minute spinules, with alternating darker and lighter patches; central, jugal and lateral areas not defined; length in dry, curved condition about 35, diameter 9; height, 12 mm." (Dall, 1927:11).

Expanded Description: The holotype of *Lepidopleurus carinatus* Dall, 1927 (USNM 225149) is accompanied by a museum label which reads "Eastport / type / 1870 / Maine / Verrill," with question marks pencilled in by unknown hand after the words "Eastport" and "Maine." Specimen preserved dry, tightly curled; all valves broken, mostly longitudinally, with loose fragments of valves i, ii, iv, and v. Uniform cream color. Strongly carinate. Lateral areas obsolete defined; tegmentum sculptured with vermicular, low profile rugosities disposed longitudinally in central areas, concentrically in valve i, postmucro area of valve viii, and lateral areas of intermediate valves (Figure 1). Valves



FIG. 1. *Holotype of Laminoplax dalli* (Kaas, 1957). Close-up of valves vi and vii to show tegmental sculpture.

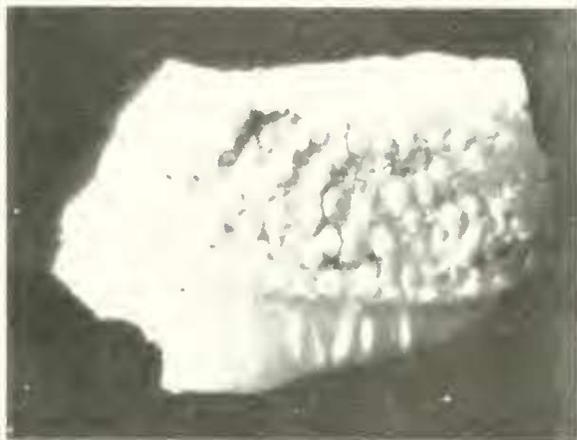


FIG. 3. *Holotype of Laminoplax dalli* (Kaas, 1957). Close-up of fragment of anterior valve to show tegmental sculpture, and insertion plate with its fluted rugosities.

remarkably heavy, up to 800 μm in thickness on valve iii. Insertion plates well developed in the anterior and intermediate valves, but limited to a ridge in the posterior valve (Figure 2), without slits or teeth, but with fluted rugosities on the outer surface (Figure 3). Sutural laminae relatively large, separated by a well defined sinus. Girdle pilose in appearance, covered uniformly with juxtaposed spicules (Figure 4), mostly straight, many broken (Figure 5) measuring up to 400 μm in length, 30 μm in thickness; under-surface covered with imbricated, flat, transparent, lanceolate scales, about $120 \times 15 \mu\text{m}$ in dimensions (Figure 6). Gills short, posterior. Radula, still in place, not examined.

Remarks: *Laminoplax dalli* is known only from the type specimen. Although Dall (1927) in-

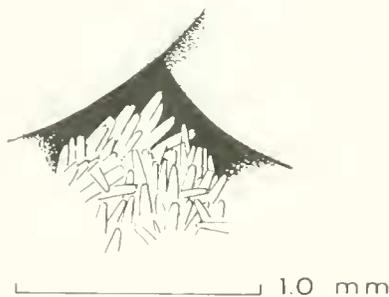


FIG. 4. *Holotype of Laminoplax dalli* (Kaas, 1957). Girdle spicules at junction of plates.



FIG. 2. *Holotype of Laminoplax dalli* (Kaas, 1957). Close-up of posterior valve to show (arrow) side view of insertion plate, here limited to a ridge.

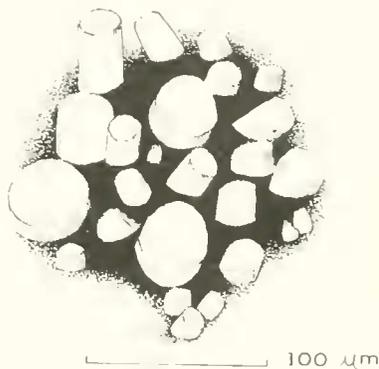


FIG. 5. *Holotype of Laminoplax dalli* (Kaas, 1957). Girdle fragment to show spicules, mostly broken, reduced to stumps only.

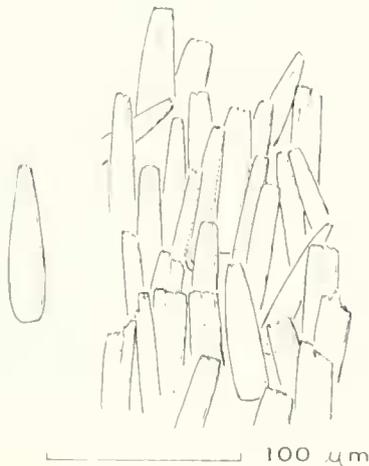


FIG. 6. Holotype of *Laminoplax dalli* (Kaas, 1957). Scales on the undersurface of the girdle.

indicated that more specimens of the species were available to him from Maine and Georges Banks, none were found. Three lots labelled "*Lepidopleurus carinatus* Dall" in the collections of the National Museum of Natural History, Washington, D.C. (USNM 10757; USNM 103477; USNM 34448), examined on a loan arranged through the kindness of Dr. Joseph Rosewater, proved to be misidentifications; no specimens so labelled were found in the Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts (Dr. Kenneth J. Boss, *in litt.*, 22 October 1979). There remains, also, some question about the depth at which the single specimen of *Laminoplax dalli* was collected. Dall (1927) did not include it in the original description of the species except for the ambiguous statement that "others" were found in 12 fathoms [22 m]; the accompanying museum label gives no indication of depth, either [the figure "1870" on the original label likely refers to the date of the collection, not to the depth].

In general shape, tegmental sculpture, girdle elements, and posterior gills, *Laminoplax dalli* is undoubtedly in the suborder Lepidopleurina. Despite assigning it to *Lepidopleurus*, Dall (1927:11) regarded the species as "intermediate between *Lepidopleurus* and *Hanleya*." Apparently based on this statement and Dall's description, and without examining the type

material, Kaas (1957) assigned *dalli* to the genus *Hanleya*, instead. However, neither Dall's (1927) nor Kaas' (1957) generic assignment is correct. Present understanding of these two genera [*Lepidopleurus* having no insertion plates; *Hanleya* having insertion plates in the terminal valves but not in the intermediate valves] indicates that *dalli*, for the presence of slitless insertion plates in all valves, belongs in the Afossochitonidae, in a new genus, *Laminoplax*, here proposed.

ACKNOWLEDGMENTS

I wish to express my appreciation to Dr. Joseph Rosewater, National Museum of Natural History, Washington, D.C., Dr. Kenneth J. Boss, Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, and Drs. Peter U. Rodda and Barry Roth, California Academy of Sciences, San Francisco, California, who generously helped me in several phases of this work. Credit is also due to Barbara Weitbrecht, California Academy of Sciences, for assistance with the drawings.

LITERATURE CITED

- Adams, Henry and G. F. Angas. 1864. Descriptions of new genera and species of Chitonidae from the Australian Seas, in the collection of George French Angas. *Proc. Zool. Soc. London*, pp. 192-194; 1865. *Proc. Zool. Soc. London*, pl. 11, figs. 16-17.
- Angas, George French. 1867. A list of species of marine Mollusca found in Port Jackson Harbour, New South Wales, and on the adjacent coasts, with notes on their habits, etc. *Proc. Zool. Soc. London*, pp. 185-233.
- Ashby, Edwin. 1921. The rediscovery of *Choriplx (=Microplx) grayi* Adams and Angas (Order Polyplacophora) with notes on its true place in natural systems and the description of a new sub-species. *Trans. & Proc. Roy. Soc. So. Australia* 45:136-142, pl. 9.
- . 1925. Monograph on Australian fossil Polyplacophora (Chitons). *Proc. Roy. Soc. Victoria* 37(N.S., 2): 170-205, pls. 18-22.
- . 1929. Taxonomic value of characters in the Order Polyplacophora. *Proc. Malacol. Soc. London* 18(1):159-164.
- Ashby, Edwin and Bernard C. Cotton. 1939. New fossil chitons from the Miocene and Pliocene of Victoria. *Rec. So. Australian Mus.* 6(3):209-242, pls. 19-21.

- Ashby, Edwin and W. G. Torr. 1901. Fossil Polyplacophora from Eocene beds of Muddy Creek, Mornington (Schnapper Point) and Moorabool, Victoria, with definitions of nine new species, and notes on others. *Trans. Roy. Soc. So. Australia* 25:136-144, pl. 4.
- Bergenhayn, J. R. M. 1955. Die fossilen schwedischen loricaten nebst einer vorläufigen revision des systems der ganzen klasse Loricata. Lunds Universitets Arsskrift, N.F. Avd. 2, vol. 5, no. 8, Kungl. Fysiografiska Sällskapets Handl. N.F., 66(8):3-42, 2 tables.
- Blainville, H. M., Ducrotay de 1816-1830. Vers et Zoophytes. In: Dictionnaire des sciences naturelles. Pt. 2. Règne organisé. Paris. (not seen).
- Dall, William H. 1927. Diagnoses of Undescribed New Species of Mollusks in the Collection of the United States National Museum. *Proc. U.S. Nat. Mus.* 70(no. 2668):1-11.
- Redale, Tom and A. F. Basset Hull. 1925. A monograph of the Australian Loricates (Phylum Mollusca - Order Loricata). *Australian Zool.* 4(2):75-111, pls. 9-12. Reprinted: 1927. *Roy. Zool. Soc. New So. Wales*, pp. i-xiii, 1-168, frontis. & pls. 1-21, text figs. 1-4.
- Kaas, Piet. 1957. Notes on Loricata. 5. On some preoccupied names. *Basteria* 21:83-87.
- Knorre, Heinrich Von. 1925. Die Schale und die Rücken-sinnesorgane von *Trachydermon (Chiton) cinereus* L. und die ceylonischen Chitonen der Sammlung Plate. (Fauna et Anatomia ceylonica, III, Nr. 3) Jena. *Zeitschr. Naturwiss.*, 61 (n. ser., vol. 54):469-632, pls. 18-35, figs. 1-17.
- Koninek, L. G. de. 1883. Faune du Calcaire Carbonifère de la Belgique. Chitonidae. *Ann. Mus. Roy. Hist. Nat. Belg.* 8:198-213, pls. 50-53.
- Leach, William Elford. 1852. Molluscorum Britanniae Synopsis. A synopsis of the Mollusca of Great Britain arranged according to their natural affinities and anatomical structure. London. 376 pp., 13 pls.
- Pilsbry, Henry Augustus. 1892-1894. Polyplacophora. In: *Manual of Conchology* (G. W. Tryon, Jr., ed.). 14:i-xxxiv + 1-350, pls. 1-68; 15:1-132, pls. 1-10.
- _____ 1894a. Notices of new chitons, III. *The Nautilus* 7(12):138-139.
- Smith, Allyn Goodwin. 1960. Amphineura. In: *Treatise on Invertebrate Paleontology* (R. C. Moore, ed.), Part 1, Mollusca 1, pp. 47-76, figs. 31-45.
- Thiele, Johannes. 1909-1910. Revision des Systems der Chitonen. Stuttgart. 132 pp., 10 pls.
- _____ 1929. Handbuch der systematischen Weichtierkunde. Loricata: 1(1):1-22, figs. 1-22. Jena.
- Van Belle, Richard A. 1975. Sur la classification des Polyplacophora: II. Classification systématique des Lepidopleurina (Neoloricata) avec la description des Helminthochitoninae, nov. subfam. (Lepidopleuridae) et de *Mesochiton* nov. gen. (Helminthochitoninae). *Inform. Soc. Belge Malacol.* 4(6):133-145, 3 pls.
- _____ 1978. Sur la classification des Polyplacophora: VII. Errata, additions et rectifications. Résumé de la classification. Index alphabétique. *Inform. Soc. Belge Malacol.* 6(3):65-82.

FRESHWATER SNAILS OF THE SENEGAL RIVER BASIN, WEST AFRICA¹

Emile A. Malek and Jean-Paul Chaîne

Department of Tropical Medicine and International Health Program, Tulane University School of Public Health and Tropical Medicine, New Orleans, LA 70112

The Senegal River is the second largest river in West Africa. Its river system is about 1,800 kilometers long and drains an area of about 290,000 square kilometers. The Senegal River is formed by the union of the Bafing and Bakoye

rivers at the town of Bafoulabe, about 1,060 kilometers upstream from the Atlantic Ocean. These two rivers, along with the Faleme River, supply almost all the flow entering the Senegal River.

This study on the freshwater snails of the Senegal River basin was carried out to assess the situation before two dams are built. One dam, an antisalt dam about 30 km upstream of Saint-Louis at the village of Diama, and a high flow regulatory dam at Manantali in Mali. The

¹This study was carried out for the United States Agency for International Development, the State Department, and O. M. V. S., Dakar, through a contract with Gannett Fleming Corddry and Carpenter, Harrisburg, Pennsylvania. It is a part of a study on Assessment of Environmental Effects of Proposed Developments in the Senegal River Basin. Our thanks are due to Dr. Max Miller for encouragement.