

A REVIEW OF SOME BIVALVE SHELLS OF THE GROUP ANATINACEA FROM THE WEST COAST OF AMERICA.

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This group of bivalves contains species which are in general very similar, and often possess analogues in different faunal regions which have been confounded under a single specific name. Like most genera, when the specific characters are rigorously analyzed, the species separate into distinct groups arranged geographically in accordance with the general laws governing the distribution of mollusks.

Not a single Atlantic species of the temperate regions has so far been found on the Pacific coast of either American continent. Even the species which inhabit the western Arctic Ocean are mostly distinct from those of Greenland and Europe.

Family THRACIIDAE.

Taking up the Thracia family, we find that *Cyathodonta* is a very ancient group and species are found in the Antillean Oligocene. Typical *Thracia* seems to have come in in Eocene time. If, as claimed by Zittel, the Triassic *Corimya* of Agassiz is a *Thracia*, the group had its inception in the Mesozoic.

The earliest name for the latter is *Rupicola*, Fleury de Bellevue, 1802. This name, however, is preoccupied for a genus of birds, dating from 1760. Récluz¹ has described as existing between *Thracia* and *Rupicola* anatomical differences in the gills, foot, and siphon, which, if confirmed, would separate the two groups generically if not more widely. But I am unable from an examination of the literature of the subject to find satisfactory confirmation of these differences, which may have been due in the case of the Récluz specimen to mutilation or abnormality. *Ixartia* Leach, *Rupicilla* Schaufuss, and possibly *Pelopia* H. and A. Adams are synonymous with *Rupicola* Fleury. For the true *Thracia* Blainville, in the errata to his Manual (p. 600), restricts his group to that typified by *T. corbuloidea*, removing his division B, typified by *T. pubescens* to the genus *Osteodesma* Deshayes.

¹ Journ. de Conchyl., vol. 4, p. 120, 1853.

The Pacific coast species have mostly been confused together, their supposed variability is largely due to confounding different species under one name. The nestling species, like *T. curta*, however, are naturally modified by their *situs*.

Genus THRACIA (Leach MS.) Blainville, 1824.

Type.—*T. corbuloidea* Deshayes.

(For full synonymy and discussion, see Trans. Wagner Free Inst. of Science, vol. 3, pt. 6, p. 1522, 1903.)

THRACIA CURTA Conrad.

Thracia curta CONRAD, Journ. Acad. Nat. Sci. Phila., vol. 7, p. 248, pl. 19, fig. 8, 1837. Type locality, Santa Barbara, California.

The shell, when normal, has much the shape of *T. corbuloidea* Deshayes, or *T. conradi* Couthouy, but never grows as large as the latter. It is frequently found nestling in rock cavities and borings, when young, and in such cases its general aspect conforms to the walls of the cavity, and so we have specimens simulating the profile of *Petricola*, *Lithophaga*, or a pholad. One such was that Conrad originally figured. The large series in the United States National Museum enables me to connect the various mutations with the normal form. This species is chalky white with a dehiscent brownish periostracum, and is densely coarsely granulose. A well grown specimen measures: Length, 53; height, 42; diameter, 22 mm.; with the vertical from the beaks falling 26 mm. in front of the posterior end. A larger fragment when complete must have measured over 60 mm. in length. I have not found a lithodesma, which perhaps is present in the young. The pallial sinus is linguiform and nearly reaches the vertical from the beaks. Cat. No. 74216a, U.S.N.M.

This species ranges from Icy Cape, Arctic Ocean, to Bering Strait, Plover Bay, the greater part of Bering Sea and the Aleutians, and southeast to San Diego, California. The more southern specimens do not attain the size of those from Alaska, judging by those which have been collected. The fossil *T. trapezoidea* Conrad is a more elongated shell.

THRACIA BERINGI, new species.

Thracia beringi (Dall) J. G. COOPER, Cat. shells in State Mining Bureau, 1894. (Name and distribution only. List not paginated.)

Shell of moderate size, white, with a dehiscent yellowish periostracum (usually lost), and looking much like a *Macoma sabulosa*. Valves nearly equal, nearly equilateral, with low beaks and a conspicuous external ligament enfolding the resilium. Surface with incremental irregularities and in the periostracum numerous small wrinkles, but without perceptible granulation. Pallial sinus large, rounded, not reaching the vertical from the beaks. Valves rounded at both ends, the posterior dorsal area inconspicuous, not bounded

by a rib, and there is no indication of a lithodesma. Length, 35; height, 25; diameter, 12; vertical, from the posterior end, 16 mm. Maximum length 40, height 30 mm.

Distribution.—Arctic Ocean north of Bering Strait? Bering Sea and Aleutian Islands, south and east to Sitka, Alaska. (Type locality, Commander Islands.) Cat. No. 221555, U.S.N.M.

THRACIA CHALLISIANA, new species.

Shell large, chalky, subquadrate; almost equivalve, the posterior end longer, surface covered with a coarse, almost imbricating granulation, without radial elevations or defined dorsal areas. Both ends are rounded, there is no distinct posterior truncation, though that end is blunter than the anterior; resilium and ligament marginal, inconspicuous, with no indication of a lithodesma; pallial sinus wide, shallow, reaching only halfway from the posterior end to the vertical of the beaks. Length, 45; height, 33; diameter, 20; vertical from the beaks 25 mm. in front of the posterior end.

Distribution.—Type locality, San Juan Island, Gulf of Georgia. Cat. No. 272096, U.S.N.M. Also at Forrester Island, Alaska.

This species, which is allied to the fossil *T. condoni* Dall (1909), is named in honor of Miss Bertha M. Challis of the State Museum, Seattle, Washington, who has exhibited much interest in the mollusca of the region.

THRACIA DIEGENSIS, new species.

Shell very thin and small, whitish or brownish, usually with a deposit of rusty orange color about the margin; valves moderately subequally convex, the anterior end longer, the posterior end attenuated and squarely truncate; posterior dorsal area defined by a raised thread on each valve; surface smooth, except for incremental irregularities; beaks rather prominent; no perceptible granulations; hinge linear and very feeble, the resilifer not projecting; in the cavity of the beak a short line of brown matter resembling cement extends downward, which indicates the attachment of a widely V-shaped lithodesma which is usually lost; pallial sinus deep, reaching beyond the vertical of the beaks; base of valves nearly straight. Length, 9; height, 7; diameter, 4 mm.; vertical of the beaks 3 mm. in front of the posterior end.

Distribution.—Type locality, San Diego Bay, in 1 to 5 fathoms sandy mud, very abundant. Cat. No. 73604, U.S.N.M.

This little species resembles *T. fabula* Philippi, from Sicily. It is one of the few species which seem to flourish on the muddy bottom of the bay.

THRACIA COLPOICA, new species.

This is a species belonging to the same type as *T. diegensis* but larger, more rounded, with a more irregular surface; the posterior

dorsal area is relatively narrower, bounded by a rib, beyond which is another more anterior rib, while in the left valve there is an obscure ray about the middle of the disk, but hardly visible in the opposite valve; at the posterior end the truncation is but obscurely indicated; the base is prominently arcuated. Length, 17; height, 13; diameter, 9 mm.; vertical of the beaks 7 mm. in front of the posterior end and barely reached by the pallial sinus.

Distribution.—Type locality, Gulf of California. Cat. No. 73639, U.S.N.M.

THRACIA SQUAMOSA Carpenter.

T. squamosa CARPENTER, Proc. Zool. Soc. London, for 1855, p. 229. Type locality, Mazatlan, Mexico.—REEVE, Con. Icon. *Thracia*, pl. 3, fig. 16, 1859.

This species has much the form of *T. phaseolina*, but the surface is densely granulose; ligament inclosing the resilium on the hinge margin; there is a vertical scar under the beaks, very large and more conspicuous than in most bivalves if, as seems probable, it denotes the attachment of the lithodesma. No lithodesma was noticed in the specimens.

Distribution.—Magdalena Bay, Lower California, to the Gulf of California. Cat. No. 15885, U.S.N.M.

Genus CYATHODONTA Conrad.

Cyathodonta CONRAD, Proc. Acad. Nat. Sci. Phila., vol. 4, p. 156, 1849. *Type.*—*C. undulata* Conrad.

CYATHODONTA UNDULATA Conrad.

C. undulata CONRAD, Proc. Acad. Nat. Sci. Phila., for 1849, vol. 4, p. 156.

C. granulosa GOULD, Boston Journ. Nat. Hist., vol. 6, p. 407, 1852, name only.

Cited by Carpenter in Rep. British Assoc. Adv. Sci. for 1856, p. 231.

C. plicata CARPENTER and others, not of Deshayes.

This shell is large, elongate, with a very flat left valve and more convex right valve; the plaits are hardly oblique, and as usual are obsolescent on the part of the valve behind the anterior ray. They number 18 to 20. There are three faint rays on the left valve and two on the right. The surface is covered with minute granules definitely arranged in lines radiating from the umbones. The pallial sinus is rounded and high, reaching the vertical from the beaks, which are subcentral. Length, 48; height, 35; diameter of right valve, 10; left, 4 mm. The vertical from the beaks is 26 mm. in front of the posterior end of the valves.

Distribution.—La Paz and other localities in the Gulf of California. Cat. No. 73602, U.S.N.M.

This fine species is the largest of the West Coast species and the analogue of the *C. magnifica* Jonas, from the Atlantic coast of Honduras. Still larger single valves are in the collection.

CYATHODONTA DUBIOSA, new species.

Shell in general resembling *C. undulata* on a smaller scale. The left valve is nearly as convex as the right valve. The plaits are less regular, becoming obsolete behind and toward the basal margin. The left valve has only two very faint rays, the right valve also two, of which the dorsal one is strong. The granulation is in somewhat irregular concentric lines and not radially distributed; the pallial sinus is not so high relatively and falls short of reaching the vertical of the beaks. Length, 38; height, 29; diameter of right valve, 9; of left valve, 7.2; vertical, 15 mm. in front of the posterior end.

Distribution.—San Pedro to San Diego, California, and to La Paz, Lower California. Cat. No. 96450, U.S.N.M. Type locality, off La Paz.

The most obvious distinction between this and *C. undulata* of the same size lies in the greater relative convexity of the left valve in *C. dubiosa*.

CYATHODONTA LUCASANA, new species.

Shell small, whitish, translucent, fragile, elongate-quadrate, the anterior end longer; hinge marginal, feeble, a half-ring-shaped lithodesma in front of the resilifer; posterior end truncate, with a rounded ridge from the umbo to the basal end of the truncation; plications few and sparse; no granulation perceptible, and the sinus invisible on account of the translucency of the shell. Length, 7.5; height, 5; diameter, 3.75; vertical, 3 mm. in front of the posterior end.

Distribution.—Type locality, Cape St. Lucas, Lower California, Xantus. Cat. No. 15910*b*, U.S.N.M.

Not identical with the young of any of the other species.

CYATHODONTA PEDROANA, new species.

Shell small, white, resembling *C. dubiosa* but more pointed behind, hardly truncate, anterior end longer; valves nearly equally convex; the plaits are more numerous (± 25), narrower, more close-set, and more regular, they reach the posterior dorsal margin; the rays are obscure; the granulations obscurely concentrically disposed; the sinus is small, shallow, and does not reach the vertical of the beaks. Length, 27; posterior end to vertical, 10; height, 21; diameter of right valve, 6; of left valve, 5 mm.

Distribution.—Type locality, in mud dredged from the channel of San Pedro Harbor, California. Also at Catalina Island. Cat. No. 207527, U.S.N.M.

This was quite abundant in the mud excavated by the Government dredgers, and is a particularly neat, compact, and pretty species.

CYATHODONTA GALAPAGANA, new species.

Shell small, elongate, white, the anterior end the longer; left valve rather convex, bearing a smooth narrow escutcheon, the remainder of the surface covered with very numerous (50–55) narrow, close-set, hardly oblique plaits; a single narrow ray borders the escutcheon; granulation not perceptible under an ordinary magnifier; the hinge linear, very weak; the truncation oblique, inconspicuous; the posterior end bluntly rounded below, the anterior end narrower, rounded; the umbo rather prominent; pallial sinus subquadrate, ascending, just reaching the vertical from the beak in the left valve. Length of left valve, 27; posterior end to vertical, 10; height, 18; diameter of left valve, 5 mm.

Distribution.—Type locality, near the Galapagos Islands at station 2813, in 40 fathoms, sand, dredged by Bureau of Fisheries steamer *Albatross*. Cat. No. 195029, U.S.N.M.

Only one left valve of this species was obtained.

The following unnamed Atlantic species may properly find a place here:

CYATHODONTA CRUZIANA, new species.

Shell small, thin, white, covered with a delicate straw-colored periostracum; valves unequal, moderately convex, the anterior end longer, the posterior end truncate, the whole covered with a coarse granulation irregularly, rather densely distributed; on the anterior dorsal slope of the right valve the plaits are obsolete, as they also are on the posterior dorsal area, which is not bordered by a distinct ray in front; between these areas the plaits (30–35) are continuous and fairly regular with subequal interspaces; on the anterior dorsal area of the left valve they reach practically to the margin; on this valve there are a median and a posterior obscure ray, the latter in front of the posterior dorsal area; hinge with a feeble ligament over a separate strong resilium, with a purse-shaped lithodesma in front of the resiliifer; pallial sinus small, rounded, not reaching the vertical from the beaks. Length, 25; posterior end to the vertical, 10; height, 13; diameter of right valve, 6; of the left valve, 3.5 mm.

Distribution.—Type locality, near Santa Cruz Island, West Indies, in 38 fathoms at station 127; dredged by U. S. S. *Blake*. Cat. No. 64429, U.S.N.M.

This very neat little species is analogous to *C. pedroana* in the Pacific fauna.

The following forms allied to *Thracia* are known from the Pacific coast:

ASTHENOThAERUS VILLOSIOR Carpenter, 1864.

Manuel Lagoon, Lower California, to Cape St. Lucas.

BUSHIA PANAMENSIS Dall, 1889.

Station 2805, in 51 fathoms, mud, Panama Bay, U. S. S. *Albatross*.

The following species of *Thracia* have been described from the Tertiary of the Pacific coast:

THRACIA TRAPEZOIDES Conrad, 1849.

Tertiary of Astoria, Oregon.

THRACIA MACTROPSIS Conrad, 1857.

Tertiary, Monterey County, California.

THRACIA DILLERI Dall, 1898.

Mid-Eocene, Arago beds, Oregon.

THRACIA SEMIPLANATA Whiteaves.

Eocene, Ventura County, California, according to Arnold.

THRACIA KARQUINEZENSIS Weaver, 1905.

Eocene, Contra Costa County, California.

THRACIA CONDONI Dall, 1909.

Miocene, near Eugene, Oregon.

THRACIA JACALITOSANA Arnold, 1909.

Miocene, Fresno County, California.

THRACIA VENTRICOSA Conrad,

Is a nude unidentifiable name, in Meek's Miocene Check-list, 1864.

There are species of *Cyathodonta* in the Oligocene marls of Panama, but these fossils have not yet been worked up.

Family PERIPLOMATIDAE.

Genus PERIPLOMA Schumacher.

Periploma SCHUMACHER, Essai d'un Nouv. Syst. Vers Test., pp. 40, 115, 1817.

Type.—*P. inaequalis* Schumacher.

Osteodesma A, BLAINVILLE, Man., vol. 2, p. 659, 1827.

PERIPLOMA PLANIUSCULA Sowerby.

Periploma planiuscula SOWERBY, Proc. Zool. Soc. Lond. for 1834, p. 87. Isla de Muerte, Guayaquil.

Periploma lenticularis SOWERBY, Proc. Zool. Soc. Lond. for 1834, p. 87. Isla de Muerte, Guayaquil.

Periploma argentaria CONRAD, Journ. Acad. Nat. Sci. Phila., vol. 7, p. 238, pl. 18, fig. 8, 1837. California.

Periploma obtusa HANLEY, Ill. Lamarck's Shells, pl. 2, fig. 50, 1842. "West America."

Periploma alta C. B. ADAMS, Panama Shells, p. 292, 1852.

?*Periploma papyracea* CARPENTER, Proc. Zool. Soc. Lond. for 1855, p. 229. Mazatlan; not of Say, 1822.

Periploma excurva CARPENTER, Proc. Zool. Soc. Lond. for 1855, p. 229; Mazatlan.

Periploma excurvata CARPENTER, Rep. Brit. Assoc. 1856, p. 287. (Error for *excurva*.)

Distribution.—San Pedro, California, and south to Panama and Guayaquil. Cat. No. 153307, U.S.N.M.

Doctor Stearns in reviewing the West American species of the genus¹ expressed the opinion that several of the above-mentioned species are synonymous with that of Sowerby. A considerable series having accumulated in the national collection, the present writer is of the opinion that the variations exhibited, taken in connection with the fact that many years' collecting has not discovered any other species of this type in the region referred to, cover fairly well the figures of the several nominal species, and in default of typically named specimens authorize the presumption that the names cited in the synonymy represent only individual mutations of one species. Until further information to the contrary shall have been received it will be best so to consider them.

The familiar and appropriate name *argentaria*, given by Conrad, will therefore have to be retired in favor of the earlier *planiuscula* of Sowerby.

PERIPLOMA DISCUS Stearns, 1890.

Distribution.—Type locality, San Pedro Bay, California. Cat. No. 126931, U.S.N.M.

PERIPLOMA CARPENTERI Dall, 1895.

Distribution.—Type locality, Panama Bay, in 210 fathoms. Cat. No. 106891, U.S.N.M.

PERIPLOMA STEARNSII Dall, 1895.

Distribution.—Type locality, Gulf of California, in 24 fathoms. Cat. No. 110548, U.S.N.M.

PERIPLOMA (HALISTREPTA) SULCATA Dall, 1904.

Distribution.—Type locality, San Pedro Bay; Terminal Island and vicinity, California. Cat. No. 109318, U.S.N.M.

Family **PANDORIDAE**.

Genus **PANDORA** Hwass, 1793.

Subgenus **KENNERLYIA** Carpenter, 1864.

KENNERLYIA GRANDIS Dall, 1877.

Distribution.—This species ranges from the vicinity of the Pribilof Islands, Bering Sea, south and eastward to Siletz Bay, Oregon. Cat. No. 171069, U.S.N.M.

This is the largest species of the genus, though sometimes nearly approached by the allied *K. wardiana* A. Adams, of Japan. It is also found fossil in the Pleistocene of Santa Monica, California.

KENNERLYIA GLACIALIS Leach, 1819.

Distribution.—Arctic Sea at Point Belcher, and south to Fuca Strait. Cat. No. 73514, U.S.N.M.

This is also reported from Spitsbergen and was originally described from Greenland seas.

¹ Proc. U. S. Nat. Mus., vol. 13, No. 813, pp. 222-224, 1890.

A variety *eutaenia* of this species with a more rostrate posterior end and averaging larger than the typical form was obtained at Port Etches and eastward at Sitka, in Alaska. Cat. No. 171062, U.S.N.M.

KENNERLYIA FILOSA Carpenter, 1864.

Distribution.—From the vicinity of Nunivak Island, Bering Sea, south and eastward to San Pedro, California. Cat. No. 4542, U.S.N.M.

KENNERLYIA BILIRATA Conrad, 1855.

+ *K. bicarinata* Conrad, 1864.

Distribution.—Forrester Island, Alaska, southward to Point Abrejos, Lower California. Cat. No. 1063, U.S.N.M.

KENNERLYIA GRANULATA, new species.

Shell closely resembling in form the *bilirata*, but much smaller, more translucent, and of a greenish tint, with the base and dorsal margins more nearly parallel and with the elevated lirae of the posterior dorsal surface delicately granulated.

Length, 8.5; height, 4; diameter, 1; beaks behind the anterior end, 1 mm.

Distribution.—Santa Barbara, California, to Guaymas, Mexico, and especially abundant at the type locality on muddy bottom in the vicinity of La Paz, Lower California. Cat. No. 211348, U.S.N.M.

This minute species is extremely common in shallow water with a muddy bottom near the end of the Lower California peninsula. It shows on the flat valve hardly any trace of the brown radiating irregular lines so common in species of this group.

KENNERLYIA CONVEXA, new species.

Shell short, deep, with a very convex left valve and a nearly semi-circular outline; right valve flattish, concave near the basal margin, white, with a conspicuous velvety brownish periostracum, especially on the rostrate end; a few irregularly radiating lines on the disk; dorsal margins nearly straight, base evenly rounded, left valve slightly rostrate behind; exterior of the left valve with a few obscure slightly elevated radial lines on the disk and two posterior dorsal radial lirations. Hinge very feeble, resilium short, with a thick lithodesma; teeth in the right valve closely adjacent, small. Length, 21; height, 12; diameter, 3.5; beaks behind anterior end, 5.5 mm.

Distribution.—Type locality, Ballenas Lagoon, Lower California, in 48 fathoms. Cat. No. 171068, U.S.N.M.

This is a well-marked form, with the anterior area of the left valve not set off by an impressed line, but marked by a distinct inset at the basal margin.

KENNERLYIA PATAGONICA, new species.

Shell bearing a marked resemblance to the *K. bilirata* of the California coast; white with a dehiscent grayish periostracum; hinge line nearly straight, the posterior left dorsal margin sharply reflected outward, with two sharp radial lines below it; the surface of the disk anteriorly has a few obscure hardly elevated radial lines, with the anterior area feebly marked and only slightly interrupting the basal margin, which is evenly rounded; posterior end truncate above but hardly rostrate; right valve flat above, concave near the basal margin, with a few irregular radial impressed lines, and two grooves above, corresponding to the lirae of the opposite valve; basal curve meeting the anterior dorsal margin in a sharp angle; hinge very feeble, teeth very short, and adductor scars very small. Length, 14.5; height, 8; diameter, 2; beaks behind anterior end, 3.5 mm.

Distribution.—Type locality, west coast of Patagonia in 61 fathoms, mud; bottom temperature, 54° F. Cat. No. 96937, U.S.N.M.

This little species is surprisingly like the northern one. The only other one of the group yet found in the Patagonian region is a *Pandora*.

Subgenus CLIDIOPHORA Carpenter, 1864.

CLIDIOPHORA CLAVICULATA Carpenter, 1855.

Distribution.—From Scammon Lagoon, Lower California, to Panama. Cat. No. 15931, U.S.N.M.

Subgenus HETEROCLIDUS Dall, 1903.

HETEROCLIDUS PUNCTATUS Dall.

Clidiophora punctata (Conrad, 1837) CARPENTER, 1855.

Distribution.—Clayoquot, Vancouver Island, British Columbia, and south to the Gulf of California. Cat. No. 15794, U.S.N.M.

This species lacks the long posterior left lamina which is one of the characteristics of the typical *Clidiophora*.

Subgenus COELODON Carpenter, 1864.

COELODON RADIANS, new species.

Shell small, delicate, white, arcuate behind the beaks, compressed, with the anterior area defined by an impressed line but not interrupting the basal margin; posterior dorsal margin flat, with one sharp radial lira below its outer edge; anterior dorsal margin straight, short; surface of the valves smooth except for incremental lines, with a pale straw colored periostracum; basal margin evenly arcuate; right valve with three short diverging teeth, the central one shortest; left valve with two rather short diverging laminae with a short deck covering the angle at their junction, the resilium attached to the anterior face of the posterior tooth and carrying a thin lithodesma.

Length, 15; height, 8; diameter, 1.3; beaks behind the anterior end, 3.5 mm.

Distribution.—Type locality, near Ballenas Lagoon, Lower California, in $5\frac{1}{2}$ fathoms.

Cat. No. 171053, U.S.N.M.

Carpenter thought this group, which he regarded as a genus, was confined to oriental seas, but the discovery of this species adds it to the West American fauna. It may be that the supposed specimen of *C. ceylanica*, obtained by Cuming at Muerte Island, West Colombia, and referred to by Sowerby and Carpenter, belongs to the present species, which has the disk within the pallial line marked by radiating lines.

Subgenus FOVEADENS Dall, 1915.

Hinge with two diverging teeth in the right valve the posterior longer and higher; an obscure ridge reaching to the front edge of the anterior adductor scar may represent a third tooth; in the left valve are two short teeth close together, a long lamina in front of them carries the resilium on its posterior face; the top of this lamina is grooved and from its anterior edge a deck or sheet of shelly matter unites it with the margin of the valve leaving a hollow space beneath the deck and between the lamina and the margin.

Type.—*Foveadens panamensis* Dall.

FOVEADENS PANAMENSIS, new species.

Shell thin, white, compressed, anterior dorsal margin flattened, in the right valve a marked groove below its outer edge; the disk slightly concentrically undulate, sculptured with faint incremental lines, anterior area hardly defined; anterior dorsal margin slightly convex, posterior slightly concavely arcuate; left valve with a single liration below the edge of the dorsal margin and close to it; hinge as in the subgeneric diagnosis. Length, 18; height, 11; diameter, 1; beaks behind the anterior end, 4 mm.

Distribution.—Type locality, beach at Old Panama, Doctor Macdonald. Cat. No. 252276, U.S.N.M.

Only loose valves were found of this interesting form.

Subgenus PANDORA sensu stricto.

PANDORA CISTULA Gould, 1850.

Distribution.—Patagonia, U. S. Exploring Expedition. Cat. No. 5887, U.S.N.M.

While this species was obtained, according to the original label, somewhere in the eastern part of the Patagonian archipelago, it probably extends its range also to the western part, and so the reference to it here is not out of place.

Family LYONSIIDAE.

Genus LYONSIA Turton, 1822.

Pandorina SCACCHI, Osserv. Zool., p. 14, 1833; not of Bory St. Vincent, 1824, (*Polygastrica*.)

Magdala (Leach MS.) BROWN, Illus. Conch. Grt. Britain, 1827, expl. pl. 11, figs. 1, 2, 10.

Hiatella BROWN, 1827, not Daudin, 1802.

Myatella BROWN, Illus. Conch. Grt. Britain, 2nd ed., p. 111, 1844.

Osteodesma DESHAYES, Encycl. Méth., vol. 3, p. 552, 1830, in table. Type—*Mya norvegica* Gmelin.

LYONSIA STRIATA Montagu.

Mya striata MONTAGU, Trans. Linn. Soc., vol. 11, p. 188, pl. 13, figs. 1, A, 1815—TURTON, Conch. Dict., p. 105, fig. 99, 1819.

Lyonsia striata TURTON, Dithyra Brit., p. 35, pl. 3, figs. 6, 7, 1822. (*Syn. ex parte exclus.*)

?*Lyonsia bracteata* GOULD (as *Osteodesma*), Expedition shells, Proc. Boston Soc. N. Hist., vol. 3, p. 218, May, 1850; U. S. Expl. Expedition (Wilkes), p. 397, pl. 35, figs. 509, a, b, 1852.

Distribution.—Shetland Islands; Arctic Sea; on the Pacific from the Aleutian Islands south to the coast of Washington. Cat. No. 213722, U.S.N.M.

On the northern coast of Europe and the British Isles occur two forms of *Lyonsia*, one of which recurs on the Pacific coast of America. One of these is the *Mya norvegica* of Gmelin,¹ after Chemnitz,² and is the well known *Lyonsia norvegica* of northern Europe. The other, which was first named by Montagu *Mya striata*, differs by being a thinner, smaller, and more slender shell, with the posterior dorsal margin nearly straight and more sharply truncate, while in *norvegica* it is concavely arcuate; the test is almost translucent, the form less inflated, the dorsal, and in many cases the basal edges near the margin, conspicuously compressed, the umbones nearer the anterior end; and the surface with usually a much greater profusion of adherent sand grains than in the *L. norvegica*. The differences are fairly well indicated by Turton's figures in his Conchological Dictionary (figs. 99 and 100, 1819), and, though there is more or less variation, yet no one comparing adult and well preserved specimens can well avoid noting the distinctions.

The two have been generally regarded as mere mutations of the *norvegica* type, but the presence of one and not of the other on the Pacific coast would indicate a specific distinction. The fragments remaining of Gould's type of *bracteata* indicate that it belongs with the *striata* form, though his figure is not characteristic. Middendorff's synonymy includes practically all the northern species of *Lyonsia* under one name, but his figures relate only to the following form.

¹ Syst. Nat., vol. 7, p. 3222, 1792.

² Conchyl. Cabinet, vol. 10, pl. 170, figs. 1647-8, 1788.

LYONSIA ARENOSA Möller.

Pandorina arenosa MÖLLER, Index Moll. Grönl., p. 20, 1842; Beechey's Voy. to the Pacific, pl. 43, fig. 3, 1839 (not named in the text).

Lyonsia gibbosa HANCOCK, Ann. Mag. Nat. Hist., vol. 18, 1846, p. 238, pl. 5, figs. 11, 12.

Anatina striata GRAY (not Montagu), according to Hancock, Ann. Mag. Nat. Hist., vol. 18, 1846, p. 238 (not in Appendix to Ross's Voyage).

Lyonsia flabellata GOULD, Otia Conch., p. 162, 1861.

?*Lyonsia ventricosa* GOULD, Otia Conch., p. 161, 1861. N. Japan.

Osteodesma aeruginosa MIGHELS (ubi?).

Lyonsia arenosa var. *sibirica* LECHE, Vega Exp., vol. 3, p. 439, pl. 22, figs. 3, 4, 1882.

Distribution.—Greenland and Arctic Sea. On the Pacific from the Arctic south to Japan and the Okhotsk Sea on the west, and to the Aleutian chain and Kadiak Island on the east. Cat. No. 223476, U.S.N.M.

This yellowish, short and solid species is well distinguished from any of the others. Leche's variety is more elongate than the normal type. A full series of the form from north Japan would doubtless make clear the identity of Gould's *ventricosa* with the Arctic species.

LYONSIA GOULDII, new name.

Osteodesma nitidum GOULD, Mex. and Cal. Shells, p. 17, pl. 15, fig. 6, May, 1851.

Not *Mya* (= *Lyonsia*) *nitida* Fabricius, 1798.—*Osteodesma nitidum* GOULD, Otia Conch., p. 187, 1861. Type locality, Santa Barbara, California.

Distribution.—San Francisco Bay, California, and south to Point Abreojos, Lower California. Cat. No. 131739, U.S.N.M.

This small, slender, and very pearly species is different both in form and distribution from the preceding.

LYONSIA CALIFORNICA Conrad.

Lyonsia californica CONRAD, Journ. Acad. Nat. Sci. Phila., vol. 7, p. 248, pl. 19, fig. 20, 1837.

Distribution.—Puget Sound, Washington, and south to Todos Santos Bay and the Coronado Islands, Lower California. Cat. No. 253111, U.S.N.M.

This white and pearly species takes much the same place in the fauna that *L. coruscans* Scacchi does in the South European fauna. It is the most common species on the Californian coast and is usually more or less arcuate and very pearly. A variety with nearly cylindrical form without arcuation from San Francisco Bay has been named by me *L. var. haroldi* in honor of Mr. Harold Hannibal, of Stanford University, and a very thin, smaller, and translucent form from Catalina (type locality) and the Coronado Islands, with the beaks very close to the anterior end, may be called var. *nesiotes*. The latter may possibly, with more material, prove distinct. Cat. No. 206410, U.S.N.M.

LYONSIA PUGETENSIS Dall.

Lyonsia pugetensis DALL, Proc. U. S. Nat. Mus., vol. 45, No. 2002, p. 595, June, 1913.

Distribution.—Chignik Bay, Alaska Peninsula, and east and south to Puget Sound, Washington. Cat. No. 249966, U.S.N.M. Type locality near Quets River, Washington.

This is probably the largest described species of the genus. An immature specimen was used as a type for the description, because it was perfect and not eroded. It showed nothing which could be considered as a lunule or escutcheon. Adult specimens measure 52 mm. long by 28 mm. high and 16 mm. in diameter.

LYONSIA PANAMENSIS Dall.

Lyonsia panamensis DALL, Bull. Mus. Comp. Zool., vol. 43, No. 6, Oct. 1908, p. 427, pl. 18, fig. 12.

Distribution.—Type locality, Gulf of Panama, 556 fathoms. Cat. No. 110584, U.S.N.M.

This is closely allied to *L. arenosa* and to the following species.

LYONSIA FRETALIS, new species.

Shell small, thin, white, hardly pearly, subdonaciform, covered with a rather strong, smooth, brownish periostracum ornamented with sparse, distant, elevated, radial lines, about a dozen in number; beaks prominent, opisthogyrate, close to the anterior end; anterior end broadly rounded, posterior end narrower, rounded bluntly, not truncate; no lunule or escutcheon; periostracum extending slightly beyond the calcified margins; interior slightly pearly, pallial line with (for the genus) a rather well-marked sinus; hinge feeble, the resilium parallel with the margin, the lithodesma elongate-quadrate. Length, 10; height, 7; diameter right valve, 4, left valve, 3 mm.; beaks behind the anterior end, 2.5 mm.

Distribution.—Type locality, Straits of Magellan, in 20 fathoms. Cat. No. 96196, U.S.N.M.

This species has close relations with the Arctic *L. arenosa*.

I have not seen the *Anatina cuneata* of Gray, 1824, which has generally been referred by authors to *Entodesma*, but Hanley's copy of the original figure in his edition of the Index Testaceologicus, resembles a typical *Lyonsia* rather than an *Entodesma*. *E. chilense* Philippi which has been united with it is certainly a very different shell, as is *Entodesma pictum* Sowerby, although both were referred, in my Report on Peruvian Shells (1909), on the authority of other authors to *cuneata* Gray. The *Lyonsia patagonica* of Orbigny in the Voyage dans l'Amérique Méridionale, is from the Atlantic coast, at the Bay of San Blas, and is probably an *Entodesma*; his *L. alvarezii* from the same locality a true *Lyonsia*, but unlike either of the Pacific

species. It is probable that *L. brevifrons* of Sowerby, 1834, from Ecuador, is identical with *L. cuneata* Gray. *L. malvinensis* Orbigny, is probably not a *Lyonsia* but a member of the Leptonacea.

Subgenus ALLOGRAMMA Dall.

Allogramma DALL, Trans. Wagner Inst., vol. 3, pt. 6, p. 1514, 1903. Type.—*Lyonsia formosa* Jeffreys.

ALLOGRAMMA AMABILIS Dall.

Lyonsia (Allogramma) amabilis DALL, Proc. U. S. Nat. Mus., vol. 5, No. 2002, p. 594, 1913.

Distribution.—Type locality, off Santa Barbara Channel, California, in 534 fathoms. Cat. No. 267171, U.S.N.M.

Subgenus ENTODESMA Philippi.

Entodesma PHILIPPI, Arch. f. Naturg., 1845, vol. 1, p. 52; 1847, p. 66. Type.—*E. chilense* Philippi.

Philippina DALL, Moll. Porto Rico, Bull. U. S. Fish Com. for 1900, p. 498, 1901. Type.—*Lyonsia beana* Orbigny.

ENTODESMA CHILENSE Philippi, 1845.

Distribution.—Type locality, Chiloë Island and north to Valparaiso, Chile. Cat. No. 73609, U.S.N.M.

This is very close to *Lyonsia inflata* Conrad, the only difference I can see is that in normally developed specimens the posterior part of the shell is more patulous, flatter, and less distinctly truncate in the Chilean shell. However, a large series of both might lead to a different conclusion. As these mollusks are nestlers, the valves are usually much distorted, taking the form of their situs. *E. navicula* Adams and Reeve, of Japan, is a very similar shell.

ENTODESMA INFLATUM Conrad.

Lyonsia inflata CONRAD, Journ. Acad. Nat. Sci. Phila., vol. 7, p. 248, pl. 19, fig. 10, 1837. Guayaquil.

Lyonsia diaphana CARPENTER, Proc. Zool. Soc. London, for 1855, p. 228. Mazatlan (young shell).

Entodesma spongiophila DALL (MS.), 1866, Monterey, California.

Distribution.—Vancouver Island to Salina Cruz, Mexico, and Guayaquil. Cat. No. 15522*b*, U.S.N.M.

These shells are usually found living in sponges or the mass of compound ascidians, and they differ from the rock nestlers in their polished smooth surface and normal shape.

ENTODESMA PICTUM Sowerby.

Lyonsia picta SOWERBY, Proc. Zool. Soc. London, 1834, p. 88. Type locality, Muerte Island, Ecuador.

This species is much the shape of *E. beana* Orbigny of the West Indies, but differs by its painting of radial black lines on the corneous ground of the periostracum.

Section AGRIODESMA Dall.

Agriodesma DALL, Proc. U. S. Nat. Mus., vol. 37, No. 1704, p. 284, Nov. 1909.
Type.—*Entodesma saxicola* Baird.

ENTODESMA (AGRIODESMA) SAXICOLA Baird.

Lyonsia saxicola BAIRD, Proc. Zool. Soc. London, for 1863, p. 70. Type locality, Vancouver Island.

Distribution.—Nestling like *Saxicava* in rock crevices from Unalaska, Aleutian Islands, eastward and southward to San Pedro, California. Cat. No. 88876, U.S.N.M.

This enormous rude species, sometimes reaching nearly 6 inches in length, is by all odds the largest species of the family. The coarse horny periostracum in drying always cracks the calcareous portion of the valves and I have never seen a perfect specimen except when preserved in alcohol. Its nestling habit results in an infinite variety of distorsion. The lithodesma is very large and strong and is inserted obliquely below the dorsal margin. The varietal name *cylindracea* Carpenter was given to specimens which had grown to fit borings of *Lithophaga*.

ENTODESMA (AGRIODESMA) SCAMMONI Dall.

Entodesma scammoni DALL, Amer. Journ. Conch., vol. 7, pt. 2, p. 142, pl. 16, fig. 3, 1871.

Distribution.—Type locality, Port Simpson, British Columbia (Scammon). Cat. No. 213713, U.S.N.M.

This species differs from all the others in its brilliantly pearly interior, its oval shape, and its permanently adherent periostracum without radiating lines. Only the original specimens collected in 1865 have so far been obtained.

Genus MYTILIMERIA Conrad.

Mytilimeria CONRAD, Journ. Acad. Nat. Sci. Phila., vol. 7, p. 246, pl. 19, fig. 5, 1837. *Type*.—*M. nuttallii* Conrad.

MYTILIMERIA NUTTALLII Conrad.

Distribution.—Vancouver Island and south to San Diego, California. Cat. No. 74234, U.S.N.M.

It is by no means certain that this genus is properly placed here, despite its conchological characters. The little that is known of its anatomy points rather in the direction of *Verticordia*. The animal lives surrounded by a mass of spongy texture which has been referred to as "sponge," but it is possible that the substance is a consolidated mucous exudation secreted by the animal itself. Further researches are needed to settle these questions.