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A REVISION OF THE GENUS *ASTARTILA*.*

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(Plates xxv-xxix.)

INTRODUCTION.

In his preliminary notes¹ on the fossils collected during the Wilkes Expedition, Dana gave specific descriptions of *Astartila intrepida* (which has to be regarded as the type species of the genus), *cyprina*, *cytherea*, *polita*, *transversa*, and *corpulenta*.

This species was separated from his *Astarte gemma* by being "more transverse and inequilateral than is characteristic of that genus, and the ligament is longer, occupying the whole cardinal area. The beak of an interior cast has the summit obliquely truncate, and the lateral surface just posterior to the middle is more or less flattened. The large muscular impressions are broad sub-elliptical or suborbicular, with the upper side often straight. The smaller anterior is situated under the beaks as in *Astarte*. The external surface is concentrically striate. The valves at middle are quite thin, hardly one-sixtieth of an inch in the first of the following species (*A. intrepida*), and they thicken below towards the margin, where the same species is half a line thick. Although we have not yet made out the teeth of the hinge, we propose to describe the species under the generic name *Astartila*."

He remarks that he has not seen teeth in *Astartila*, but (p. 154) he states "The impression of two divergent teeth is finely preserved."

In his completed memoir² he defines *Astartila* as "Equivalve, inequilateral, transverse, throughout convex, externally marked with concentric striæ. Ligament external, extending to the posterior extremity of the cardinal area; umbos of moderate size. Palleal

* Unless otherwise designated, all specimens are from the Varney Parkes Collection.

¹ Dana.—Amer. Jour. Sci., (4), ii, 1847, p. 155.

² Dana.—U.S. Explor. Exped. during the years 1838-42 under the command of Charles Wilkes, U.S.N., Vol. x, Geology. Philadelphia, 1849.

impression entire. Muscles two anteriorly and one posteriorly; the smaller interior under the beaks, and directed inward; the larger broad, subelliptical, or^r suborbicular; the posterior also broad. Valves having the interior surface, from the umbos obliquely downward, flattened or a little raised (producing a flattened or excavate area on the lateral surface of a cast)."

He also says that "this genus has many of the characters belonging to *Astarte*, and perhaps should be considered as only a subgenus in that group. The form is more transverse; the beaks are more to one side, the anterior portion of the shell varying from one-quarter to two-fifths of the whole length; and the ligament is much longer. Besides the cast has the beak obliquely truncate at apex, and is flattened laterally on the side of the beak. There is usually one or two folds or lines extending from behind the beak obliquely downward, so as to pass near the anterior side of, or across, the posterior muscular impression. The valves are very thin at middle, being hardly one-sixtieth of an inch in the first of the following species (*A. intrepida*), and are thickened below towards the margin, a short distance from which the same species is half a line thick. The palleal impression stops abruptly just before reaching the posterior muscular impression. Our specimens show well the exterior and interior of different species; but the teeth of the hinge have not been made out. The exterior surface is unevenly marked with concentric striæ of growth, and is convex quite to the anterior margin."

In both the generic diagnosis and the descriptions of the species Dana makes no reference to the presence of teeth.

John Morris in 1845 described Strzelecki's collection from New South Wales³ and proposed the genus *Pachydomus* for a series of forms which are now known to belong to several genera. His *Pachydomus* was to replace *Megadesmus* of Sowerby,⁴ which is a toothed form. Sowerby remarks: "The teeth have hitherto only been observed in imperfect casts of some of the species, from which it would appear that the one in the left valve is the largest, and thickened posteriorly." The presence of teeth, therefore, takes this form away from the genus *Astartila*. The only other form figured by Sowerby⁵ which may be an *Astartila* is that on plate x, fig. 4, which is not mentioned in the text.

At almost the same time McCoy described⁶ specimens sent to Cambridge by W. B. Clarke. His descriptions were published in November, 1847, and he refers a number of specimens collected from Wollongong to *Pachydomus* of Morris, identifying his species and

³ Strzelecki.—Phys. Descrip. of N.S.W. and Van Diem. Land, 1845, pp. 271-273.

⁴ Mitchell.—Three Exped. into Inter. of East. Aust., 1838, Vol. 1, p. 15.

⁵ Strzelecki.—Phys. Descrip. of N.S.W. and Van Diem. Land, 1845, pl. x, fig. 4

⁶ McCoy.—Ann. Mag. Nat. Hist., Vol. xx, 1847, pp. 301-302.

perpetuating his nomenclature. Of these *Pachydomus* (? *pusillus* McCoy), pl. 16, figs. 1 and 2, and *Pachydomus ovalis* McCoy (pl. 14, fig. 4), are regarded as *Astartila*, and from his descriptions it is inferred that both these species are edentulous.

De Koninck⁷ accepts *Pachydomus* for these shells, and describes and figures *Astartila polita* Dana as *Pachydomus* (pl. 19, figs. 4, 4a), and *Pachydomus danai* De Kon (pl. 19, figs. 5, 5a). Both these forms are from Wollongong, and from the figure the former is evidently toothless as well as Dana's *cyprina* (pl. 18, figs. 6, 6a) and McCoy's *ovalis* (pl. 19, fig. 3).

Stoliczka⁸ takes *intrepida* as the type species of *Astartila* and separates it from *Pachydomus*, remarking that "the examination of the hinge-teeth is required for the correct determination of the family to which these shells belong."

Laseron⁹ describes as *Astartila* (*Pachydomus* types A, B, C, and probably D). These are thick shelled forms and toothed and are therefore rightly referred by Laseron to *Pachydomus*. *Astartila polita* is referred to but not figured; and, if it is a typical specimen of that species, it is toothless and therefore belongs to the genus *Astartila*.

DESCRIPTIONS OF SPECIES.

ASTARTILA DANAI De Koninck.

(Plate xxv, figs. 8-11.)

Pachydomus danai De Kon., Mem. Geol. Surv. of N.S.W., Palæontology, No. 6, 1898, p. 218, pl. xix, fig. 5.

Observations.—In the above journal De Koninck described a species found in a greyish sandstone at Wollongong as *Pachydomus danai*, remarking, "Of all the species of *Pachydomus* known to me there is only *P. intrepida* (*Astartila intrepida*) Dana, of which the surface folds bear any resemblance to those of the shell in question. But this species is larger, more elongated, and relatively thinner."

A comparatively large series of specimens in the Varney Parkes collection agree both with the description and the figures of this species. They are edentulous, and, as no mention of teeth is made in De Koninck's description, I have referred his species to the genus *Astartila*.

⁷ De Koninck.—Mem. Geol. Survey of N.S.W., Pal. No. 6, 1898, pp. 216-218.

⁸ Stoliczka.—Cret. Fauna of Sth. India, Pal. Indica, Ser. vi, Vol. ii, p. 275.

⁹ Laseron.—Journ. and Proc. Royal Soc. of N.S.W., Vol. xlv, pp. 212-215, and plates.

The following description has been derived from the series of specimens examined. Unfortunately in almost every instance the specimens are distorted, and the following description has been more or less compiled from the specimens as a whole.

Description.—The shell is medium sized and in general outline is more or less obliquely sub-oval, attaining a maximum length of about 30 mm. Equivalve but inequilateral. The two valves are in close apposition and are comparatively thin and compressed. The beaks are conspicuous, anteriorly placed and recurved anteriorly in a regular curve, which extends from the tip of the beak to the posterior extremity of the shell. The profile of the valve between the tip of the beak and the most anterior lateral portion of valve strongly concave. The interior cast possesses a flattened area anterior to the beak, and anterior again to this a distinct groove or sinus, which extends just short of the tip of the beak, to the anterior muscle scar. Posterior to the beak a groove extends obliquely downward, passing the posterior portion of the posterior muscular impression. These grooves would be represented by ridges on the interior of the external shell. The anterior muscular impression is almost reniform in shape, slightly excavate, and is marked with 4-5 vertical striæ. There is no trace of a smaller anterior muscular impression which served for the attachment of the pedal muscles. The posterior adductor muscle scars are large and broadly oval in outline. Two deep furrows, portion of the internal marking of the valve, traverse this scar. The pallial line is entire, well marked, and slightly curved. The hinge line is arched and the shell is edentulous. Ligament external and short.

The external sculpture of the valve consists of approximately fifteen growth folds or lamellæ separated from one another by distinct furrows. On well preserved specimens a series of numerous and fine striæ are superimposed on the growth plates or lamellæ. These are narrower in the centre of the shell and become broader near the beaks and the ventral margin. The growth folds are represented on the interior casts by furrows. The test is medium in thickness.

The dimensions of the figured specimens are approximately as follows:

	Plate xxv			
	fig. 9.	fig. 8.	fig. 11.	fig. 10.
Length	18 mm.	29 mm.	22 mm.	30 mm.
Height	15 mm.	24 mm.	22 mm.	25 mm.
Thickness ..	9 mm.	11 mm.	11 mm.	11 mm.

Localities and horizon.—Wollongong (De Koninck); Gerrin-gong; Jerrawanglo; Schnapper Point, Kioloa. Permo-Carboniferous, Upper Marine Series.

Collection.—The Australian Museum, Sydney.

ASTARTILA CYTHEREA Dana.

(Plate xxv, figs. 12-15, and pl. xxvi, fig. 1.)

Astartila cytherea Dana, Amer. Journ. Sci., (4), ii, 1847, p. 155.
Id., Dana, Wilkes' U.S. Explor. Exped., Geology, 1849, pp. 689-690, pl. iv, fig. 1, 1*a*, *b*, *c*, *d*, *e*. *Id.*, Dana, Eth. and Jenk., Geol. and Pal. of Q'ld. and New Guinea, 1892, p. 277, pl. xiv, figs. 3 and 4.

Dana's final description of this species is republished for reference.

"Thick, a little longer than high. Beak thrown a little forward. Exterior surface very coarsely concentric striate or costate; inner surface of valve smooth. Smaller anterior muscular impressions scarcely excavate, oblong sigmoid; larger strongly excavate and very abruptly so on the upper side, oblong sub-elliptical, crossed on the lower half posteriorly by a few (four or five) vertical lines, the transverse strong and neat. Posterior muscular impression a little excavate with neat transverse markings. Length $1\frac{3}{4}$ inches; height $\frac{89}{100}$ L; thickness $\frac{57}{100}$ L; apical angle about 100° .

Wollongong Point, district of Illawarra."

Observations.—This species is well represented in the Varney Parkes collection by a series of exceptionally well preserved specimens, which includes internal casts and complete testiferous shells. The entire series are smaller in size than the specimens figured and described by Dana, of which I possess plaster casts.

McCoy¹⁰ published a description of a small shell which he called *Pachydomus ? pusillus*. He remarks that he had his doubts as to the correct genus for this form but finally decided upon the latter on account of the thick shell, external ligament, and general habit. Dana several years later, when publishing his final descriptions, placed this species in the synonymy of his *A. cytherea*, apparently treating it as a small form. In the large collection I have examined there is a series of specimens which consistently agree with McCoy's *Pachydomus pusillus*. This species has therefore been reinstated, but under the generic name of *Astartila*, not *Pachydomus*, as it is an edentulous form.

Included with the plaster casts of Dana's type specimens of this species was an internal cast which differed noticeably in form from the typical specimens. It undoubtedly should be referred to *A. cyprina*, and it is figured under this species.

¹⁰ McCoy.—Ann. Mag. Nat. Hist., xx, 1847, p. 302, pl. xvi, figs. 1, 2.

The characteristics of *A. cytherea*, as well as its relationships, were dealt with by Dana in his final paper, from which the following description is quoted:

"The proportions of this species; its beak thrown a little forward in the exterior shell as well as cast, so that in the latter the profile of the front below it is strongly concave; the anterior muscular impressions, and especially the abrupt depression (in cast abrupt elevation of half a line) at the upper side of each larger, are striking peculiarities of this species. The lateral surface of the beak in the cast is flattened, and this flattened area extends evenly to the large muscular impression. The anterior part is hardly more than one quarter the whole length, while it is one-third in the *cyprina*."

The dimensions of the figured specimens, which include several casts of Dana's types, are approximately as follows:

	Pl. xxv, fig. 12.	Pl. xxv, fig. 15.	Pl. xxvi, fig. 1.	Pl. xxv, fig. 13.
Length	38 mm.	30 mm.	46 mm.	33 mm.
Height	35 mm.	30 mm.	45 mm.	34 mm.
Thickness ..	27 mm.	20 mm.	31 mm.	19 mm.

Localities and horizon.—Stonehumpy Ck., Bowen River (E. Edelfelt); Wollongong Point, district of Illawarra (Dana); Mt. Vincent (De Koninck); Jamberoo; Gerringong; Ulladulla; Braxton, Maitland district; Crooked River, Kiama. Permo-Carboniferous, Upper Marine Series.

Collection.—The Australian Museum, Sydney.

ASTARTILA COMPRESSA *sp. nov.*

(Plate xxviii, figs. 6-11.)

Description.—This is a medium sized shell, which attains a length of approximately 40 mm. The valves are relatively shallow and in general outline are almost circular. The profile of the shell immediately below the beak is slightly concave. The umbones are blunt, not prominent, and almost centrally situated. They are slightly recurved anteriorly, and are in contact with one another. The hinge line is strongly arched. The test or shell is comparatively thin. The internal cast possesses a flattened area on the anterior lateral surface of the beak, and this extends from the tip to the anterior adductor muscle impression. A slight depression or groove, which would correspond to a ridge on the inner surface of the valve, extends downwards from the beak, posteriorly, to the pallial line. The posterior muscle scar is indistinct, subquadrate in shape, not excavate and is large. The anterior muscle scar is the smaller of the two, oval in shape and strongly excavate posteriorly. The pallial line is distinct, curved, and entire.

The ornamentation of the valves consists of growth plates or lamellæ. These are approximately ten in number, separated by distinct grooves, and superimposed are closely crowded concentric striæ. The internal surface of the valve is smooth.

The dimensions of the holotype and co-types are approximately as follows:

		Plate xxviii				
		fig. 11.	fig. 8.	fig. 9.	fig. 6.	fig. 10.
Length	42 mm.	38 mm.	40 mm.	30 mm.	41 mm.
Height	42 mm.	42 mm.	40 mm.	34 mm.	37 mm.
Thickness	16 mm.	16 mm.	15 mm.	—	17 mm.

Observations.—This species is apparently a very common species in the Upper Marine beds at Schnapper Point, Kioloa, in the South Coast district, and to my knowledge has not been collected elsewhere. The gritty sandstone in which they are preserved does not, however, favour perfect preservation, and the specimens are in most cases distorted, and characters are fragmentary. At first glance this species would appear to have more affinities with the genus *Pachydomus* than with *Astartila*, because of the heavy surface folds and comparative thickness of the shell substance. The absence of teeth in all specimens is the main character on which this species has been placed in the genus *Astartila*. It is a very characteristic type and differs markedly from all other members of the genus.

In the series examined there appears to be two definite types, but owing to the bad state of preservation of the specimens I have been unable to separate them. Further specimens may yet, however, come to hand, and the following points of difference may be of value:

- (1) In Plate xxviii, figures 6 and 8, the shell is higher than long, figure 10 is longer than high, and in figures 7, 9 and 11 is as wide as long.
- (2) The beak in the former is considerably recurved, and causes the profile of the valve below the beak to be concave. In the latter this is practically straight, and the beak, if recurved, is only slightly so.
- (3) The test or shell substance in the former is thinner than in the latter.

Localities and horizon.—Jerrawanglo; Schnapper Point, Kioloa. Permo-Carboniferous, Upper Marine Series.

Collection.—The Australian Museum, Sydney.

ASTARTILA CYPRINA Dana.

(Plate xxviii, figures 1-5.)

Astartila cyprina Dana, Amer. Journ. Sci. (4), ii, 1847, p. 155.*Id.*, Geol. Wilkes' U.S. Explor. Exped., 1849, p. 689; pl. iii, figs. 6 and 7.*Pachydomus cyprina* De Koninck, Mem. Geol. Survey of N.S.W., Pal. No. 6, p. 217, pl. xviii, fig. 6.

Dana's description taken from his final paper is quoted for reference.

"Oblong, thick, length one-third greater than height. Exterior surface coarsely and unevenly concentric striate. Inner surface of valves minutely rugulose, and below the palleal impression vertically subplicate. Muscular impressions excavate; the smaller anterior oblong, sigmoid; the larger subquadrate, very convex, marked vertically with a few lines, the posterior hardly excavate. Length $2\frac{1}{12}$ inches; height $\frac{7}{10}$ L; apical angle 118° .

Wollongong Point, district of Illawarra."

Observations.—This species is represented by a small series of exceptionally well preserved specimens, which include both internal casts and testiferous valves. Two plaster casts of Dana's types of this species, one of an internal cast, and another showing portions of the external shell, have been used for comparative purposes. Also included with the above series is Dana's cast forwarded as *A. cytheria* but which possesses the characters of the present species. The majority of specimens I have examined are slightly smaller than those described by Dana, but in every other detail they agree perfectly with the typical species.

De Koninck has placed *cyprina* in the genus *Pachydomus*. After an examination of all specimens I can find no trace of teeth and therefore am compelled to refer this species back to *Astartila*, and to place *Pachydomus cyprina* De Kon. as a synonym.

The anterior adductor muscle scar is the larger of the two and is oblong with elongation in the direction of the striæ. The pallial impression has a slight curve, instead of the rather abrupt bend posteriorly which characterizes the members of the genus *Pachydomus*. These characters were pointed out by Dana, who also mentioned that the anterior muscular impression differs in form from that of *Pachydomus*.

Dana's remarks on this species are as follows:

"The vertical plications below the palleal impression are characteristic. It is also peculiar in the character of its larger anterior muscular impression and its proportional dimensions. Also, the

cast from the beak downward is but slightly flattened, and the space between the flattened area and the muscular impression is convex, owing to the continuation of the convexity of the muscular impression itself."

The dimensions of the figured specimens, chosen from the series examined, are approximately as follows:

	Plate xxviii			
	fig. 5.	fig. 4.	fig. 1.	fig. 3.
Length	45 mm.	35 mm.	48 mm.	55 mm.
Height	30 mm.	38 mm.	40 mm.	45 mm.
Thickness . . .	29 mm.	25 mm.	29 mm.	32 mm.

Localities and horizon.—Wollongong (McCoy); Flagstaff Hill, Wollongong (W. S. Dun). Permo-Carboniferous, Upper Marine Series.

Collection.—The Australian Museum, Sydney.

ASTARTILA OBLIQUA *sp. nov.*

(Plate xxv, figures 5-7.)

Description.—This is an extremely equilateral shell, equivalve, thick and oblong. It is considerably inflated and is at least one-third longer than high. Valves are strongly convex. The beaks are thick, wide apart, and are situated so far forward as to overhang the antero-lateral margin of the valve. The anterior lateral surface of the beak is flattened, and this flattened area extends almost to the pallial line. The posterior portion of the shell is convex and slopes away towards the margins. The junction between these two areas is in the form of a ridge, noticeable on the umbo and merging with the shell before reaching the pallial line.

The ornamentation of the external surface consists of broad concentric growth plates, which mark the various growth stages of the shell. These are about eight to ten in number and give the valve a coarsely costate appearance. Superimposed on these are finer and very numerous striæ, concentrically arranged. The inner surface of the valve is marked with minute radiating striæ, which terminate at the pallial line. These are more or less anastomosing in character. Below the pallial line ornamentation is absent except for a few indistinct folds. The muscle scars are unequal in size. The anterior adductor muscle scar is the smaller of the two, subquadrate in outline, and is excavate. The posterior scar is exceedingly large, and is elongated oval in shape. It is marked with very fine striæ. Pallial line is entire and slightly curved. A deep lunule is present just anterior to the beaks. The ligament is external, broad and elongated.

The dimensions of the figured specimens are approximately as follows. These include the holotype and co-types.

	Plate xxv		
	fig. 5.	fig. 7.	fig. 6.
Length	40 mm.	27 mm.	24 mm.
Height	28 mm.	19 mm.	19 mm.
Thickness ..	28 mm.	19 mm.	16 mm.

Observations.—There is nothing, to my knowledge, in the *Astartilidæ* with which this species could be compared. The extreme anterior position in which the beaks are placed makes this an outstanding form, owing to its pronounced equilateral shape. Other strong characters are the median ridge and great length of the shell in comparison with its height.

Localities and horizon.—Cambewarra Mountains, near Jamberoo; Gerringong; Ulladulla. Permo-Carboniferous, Upper Marine Series.

Collection.—The Australian Museum, Sydney.

ASTARTILA CORPULENTA Dana.

(Plate xxvi, figures 2-5.)

Astartila (?) corpulenta, Dana, Amer. Journ. Sci. (4), ii, 1847, p. 155. *Id.*, Geol. Wilkes' U.S. Explor. Exped., 1849, p. 691, pl. 3, fig. 3.

Dana's final description of this species is as follows:

“Ventricose, oblong, a little inequilateral, sub-elliptical, prolonged in front, inferior margin arcuate; umbos elevated; surface concentrically subrugose. Length $1\frac{1}{2}$ inches; height $\frac{6.6}{100}$ L; thickness $\frac{5.4}{100}$ L; apical angle about 120° .

Wollongong Point, district of Illawarra.”

Observations.—This species was placed only provisionally in the genus *Astartila* by Dana, owing to the lack of characters exhibited in his specimens. It is represented in the Varney Parkes collection by a comparatively large series of specimens. There seems to be little doubt that *Astartila* is its correct genus, for it is an edentulous form, which, together with such external characters as general outline, dimensions, and ornamentation, seems to point conclusively to that genus.

The sculpture on the external surface of the shell is coarsely costate or lamellated, giving the shell a roughened appearance. In many specimens which were examined the coarse sculpturing had been removed by erosion, leaving a smooth surface which shows faint traces of fine concentric striae. The general outline and almost

equilateral form of this species are its most characteristic points. It may be separated from *A. cyclus*, which is also only slightly inequilateral and possesses the same type of sculpturing, by its length relative to height and its stoutness. *A. corpulenta* is much stouter than the former and is longer than high.

The dimensions of several of the better preserved specimens are approximately as follows:

	Plate xxvi		
	fig. 3.	fig. 2.	fig. 4.
Length	40 mm.	38 mm.	Dana's cast. 37 mm.
Height	23 mm.	23 mm.	24 mm.
Thickness ..	—	17 mm.	20 mm.

Localities and horizon.—Schnapper Point, Kioloa; Gerringong; Ulladulla. Permo-Carboniferous, Upper Marine Series.

Collection.—The Australian Museum, Sydney.

ASTARTILA PARKESI *sp. nov.*

(Plate xxvii, figures 12-14.)

Description.—The shell is small, broad and thick, strongly inflated in the umbonal region. Equivalve and inequilateral; valve about one-third longer than high. The beaks are situated anteriorly, are fairly prominent and widely separated. They are slightly recurved posteriorly. The anterior slope of the valve strongly convex; posterior surface of valve is elongated and narrows considerably towards the extremity. The external sculpture consists of coarse concentric growth plates, approximately 10 in number. Superimposed on these are minor costæ, which are more numerous but indistinct. Musculature is uncertain. The posterior adductor muscle scars are the larger and are excavate, whereas the smaller scars are not excavate. On the internal cast a flattened area extends laterally from the tip of the beak to the pallial line. Pallial line curved and entire.

The dimensions of the holotype and co-types are approximately as follows:

	Plate xxvii		
	fig. 14.	fig. 12.	fig. 13.
Length	27 mm.	16 mm.	21 mm.
Height	20 mm.	10 mm.	15 mm.
Thickness ..	18 mm.	—	14 mm.

Observations.—This species resembles *A. corpulenta* to a certain degree, but differs in being a much smaller shell, and being considerably stouter, when the different proportions of the two shells are taken into consideration. The beaks on *A. corpulenta* are almost median in position and divide the shell into practically even posterior and anterior portions. In this species the beaks are

anterior in position, and the anterior portion of the shell is only one-third the length of the valve. The lateral portion of the beak has a flattened surface in the latter, whereas in the former it is absent.

Localities and horizon.—Gerringong; Wyro, near Ulladulla. Permo-Carboniferous, Upper Marine Series.

Collection.—The Australian Museum, Sydney.

ASTARTILA CYCLAS Dana.

(Plate xxv, figures 1-4.)

Astartila cyclas, Dana, Amer. Journ. Sci. (4), ii, 1847, p. 155. *Id.*, 1849, Geol. Wilkes' U.S. Explor. Exped., p. 690, pl. 4, fig. 3.

Dana's final description of this species, published in 1849, is as follows:

"Rather thin, a little longer than high, nearly equilateral, apical angle large. Exterior surface marked unevenly with irregular concentric striæ. Anterior muscular impression strongly excavate; larger sub-orbicular, without vertical striæ; smaller narrow, oblong. Posterior muscular impression hardly excavate. Length $1\frac{1}{2}$ inches; height $\frac{90}{100}$ L.; thickness of cast $\frac{40}{100}$ L.; apical angle of shell 135° .

Wollongong Point, district of Illawarra."

Observations.—This species is represented by a series of casts and complete testiferous shells with the external marking well preserved. The internal cast of this species is one that is very characteristic owing to its extreme thinness, particularly on the antero-lateral and ventral margins. It has a distinct keeled appearance being swollen in the umbonal region and flattening out towards the margins. The lateral surface of the beak is flattened and extends from the tip of the beak to the pallial line. The anterior muscular scar is strongly excavate, vertical in position and faces obliquely inwards. Smaller anterior muscle scar is absent in specimens examined. The area between the flattened surface and the muscle scar is slightly concave or flat. The external sculpture or marking of the valve consists of broad, irregular, coarse, concentric growth plates. These are about 6-8 in number and are separated from one another by grooves or depressions. Finer striæ are also present superimposed on the growth plates. The internal surface of the valve is lightly marked with transverse rugosities above the pallial line. Several indistinct folds may be present beyond the pallial line. External ligament is rather well developed, external, and elongated.

Dana remarks:

"This is the thinnest of the species obtained. The beak of the cast is very thin, and the flattened area distinct; the surface between this area and the muscular impression is flattened or slightly concave. The cast has the margin thin as in *cyprina*. The smaller anterior muscular impression is vertical and faces very obliquely inward. The pallial impression is very distinct. The anterior portion of the shell is more than a third of the whole length."

The dimensions of several of the figured specimens are approximately as follows:

	Plate i		
	fig. 1.	fig. 3.	fig. 4.
	(Dana's cast)		
Length	34 mm.	38 mm.	34 mm.
Height	26 mm.	30 mm.	25 mm.
Thickness	15 mm.	9 mm.	17 mm.
		(one valve)	

The internal cast, possessing as it does the very flattened margins, bears a resemblance to *A. cyprina*, but differs in being much smaller and also in the fact that the beaks are not produced anteriorly as in the latter species. The complete specimen with the test preserved is almost equilateral in form and therefore an outstanding form and one that could hardly be mistaken for any other species in the genus *Astartila*.

Localities and horizon.—Gerringong; Schnapper Point, Kioloa; Cabbage-Tree, Jervis Bay; Conjola. Permo-Carboniferous, Upper Marine Series.

Collection.—The Australian Museum, Sydney.

ASTARTILA POLITA Dana.

(Plate xxvi, figures 9-12.)

Astartila polita Dana, Amer. Journ. Sci., (4), ii, 1847, p. 155. *Id.*, Geol. Wilkes' U.S. Explor. Exped., 1849, p. 690, pl. iv, fig. 2.

Pachydomus politus, De Kon, Mem. Geol. Survey of N.S.W., Pal., No. 6, 1898, p. 218, pl. xix, fig. 4.

Dana's description of this species is reproduced for reference:

"Rather thin, somewhat longer than high. Exterior surface smooth and shining, with faint concentric lines. Valves thin. Muscular impressions very slightly excavate, palleal faint. Large anterior muscular impression with transverse striæ, but none vertical. Length 1 to $1\frac{3}{4}$ inches; height $\frac{2\frac{1}{2}}{100}$ L.; thickness $\frac{50}{100}$ L.; apical angle 114° .

Black Head, district of Illawarra."

Observations.—This is an edentulous form and therefore must be referred to the genus *Astartila* and not to *Pachydomus* where De Koninck placed it. Dana in his observations remarks that “The shining exterior and thinness of the shell are peculiar and its texture in the specimens seen was usually rather soft and dark green in colour, like a compact chlorite. The lateral surface of the beak in the cast is flattened, nearly as in *cytheria*.”

Several of the above distinctions, such as the shining exterior, texture and colour appear to me to be rather vague characters, and would depend a great deal on the beds in which the specimens were preserved. Many of the specimens examined have these characteristics, but I would hesitate in saying that they were peculiar to the species. I have assumed that Dana in giving the dimensions of his specimens bases the height and thickness on the percentage of the length of the shell. For instance, a height of $\frac{50}{100}$ L. would be half as high as long. In his preliminary paper Dana gives the height of this species as $\frac{24}{100}$ L., but this is undoubtedly an error and should read $\frac{74}{100}$ L., which is the height given in his final paper in 1849.

In the series of specimens I have examined, there appears to be only very slight differences between *A. polita* and *A. transversa*. Dana in his description states that the valves as well as the shell are thin in the former and thick in the latter, but I fail to see marked difference in thickness, even when comparing the plaster casts of his types. The dimensions given in both of Dana's descriptions are also practically identical. Furthermore both these species possess the flattened lateral surface of the beak and it is equally prominent in *A. transversa* and in *A. polita*.

The main differences between these two species may be briefly summed up as follows:

- (1) The beaks in the cast of *A. polita* are more upright than in *A. transversa*, giving the latter species a more compressed and elongated appearance.
- (2) The distance between the tip of the beak and the anterior muscle scar is greater in *A. polita* than in *A. transversa*, and furthermore in the former the profile is concave, while in the latter it is more or less straight.
- (3) The anterior adductor muscle scar in *A. polita* has its long axis much more nearly horizontal in position than in *A. transversa*; the scar in the latter is practically vertical in position and is also more distinctly marked with vertical striae.

These characters, although seemingly definite, appear to vary in the series I have examined, and it is only after a very close

examination and comparison that these two species may be separated, unless extreme types are met with. There is a gradation between the two species and the characters vary considerably.

The dimensions of several specimens chosen from the Varney Parkes collection, and figured are approximately as follows:

	Plate xxvi			
	fig. 11.	fig. 12.	fig. 10.	fig. 9.
Length	35 mm.	30 mm.	32 mm.	40 mm.
Height	26 mm.	25 mm.	25 mm.	30 mm.
Thickness ..	18 mm.	15 mm.	20 mm.	21 mm.

Localities and horizon.—Wollongong (W. B. Clarke); Black Head, Illawarra (Dana); Gerringong; Jamberoo; Crooked River, near Kiama; Wyro, near Ulladulla. Permo-Carboniferous, Upper Marine Series.

Collection.—The Australian Museum, Sydney.

ASTARTILA TRANSVERSA Dana.

(Plate xxvi, figures 13-17.)

Astartila transversa, Dana, Amer. Journ. Sci., (4), ii, 1847, p. 155.

Id., Geol. Wilkes' U.S. Explor. Exped., 1849, p. 690, pl. 4, fig. 4.

Dana's final description of this species is as follows:

"Thick, oblong (length one-third greater than high). Posterior muscular impression faint; larger anterior sub-elliptical, somewhat excavate, without vertical striæ; smaller obliquely excavate, sigmoid. Length of cast $1\frac{1}{2}$ inches; height $\frac{7\frac{3}{4}}{100}$ L.; thickness $\frac{5\frac{5}{8}}{100}$ L. Apical angle of cast 105° , of shell 115° .

Wollongong Point, district of Illawarra."

Observations.—In my remarks on *A. polita* I pointed out that there is a very close similarity between that species and *A. transversa*, and enumerated the differences. Dana in his remarks on this species says: "This species is remarkable for being a third longer than high. It has the lateral surface of the cast, from the beak downward, strongly flattened, and between this area and the muscular impression, the surface (which is of the same width as the flattened area) is also flattened or a little concave. The pallear impression is faint."

The dimensions of *A. polita* and *A. transversa* are practically the same, and the flattened surface of the beak is also present on both species to the same degree. In this species the external marking of the shell is not as coarsely costate as in other species of *Astartila*. On the growth plates are superimposed numerous fine concentric costæ, which are very distinct after slight erosion has taken place. The internal surface of the valve is covered with

minute irregular rugosities and some indistinct folds below the pallial impression.

The dimensions of the figured specimens are approximately as follows:

	Plate xxvi			
	fig. 16.	fig. 13.	fig. 15.	fig. 14.
Length	35 mm.	40 mm.	34 mm.	Dana's cast. 37 mm.
Height	25 mm.	30 mm.	25 mm.	28 mm.
Thickness ..	19 mm.	20 mm.	18 mm.	23 mm.

Localities and horizon.—Gerringong; Wyro, near Ulladulla; Wollongong Point, district of Illawarra (Dana). Permo-Carboniferous, Upper Marine Series.

Collection.—The Australian Museum, Sydney.

ASTARTILA INTREPIDA Dana.

(Plate xxvi, figures 6-8.)

Astartila intrepida, Dana, Amer. Journ. Sci., (4), ii, 1847, p. 155.

Id., Geol. Wilkes' U.S. Explor. Exped., 1849, p. 689, pl. iii, fig. 5.

Pachydomus ovalis (?) McCoy, Ann. Mag. Nat. Hist., xx, 1847, p. 302, pl. xiv, fig. 4.

The final description of this species published by Dana in 1849 is as follows:

“Thick, length but little greater than height, anterior part about one-third whole length. Lateral surface evenly convex, marked quite neatly with concentric striæ. Anterior muscular impressions excavate; the smaller sub-quadrate, the larger transverse with a number of fine vertical lines on the posterior quarter. Length $1\frac{3}{4}$ inches; height $\frac{80}{100}$ L.; thickness $\frac{52}{100}$ L.; apical angle about 120° .

District of Illawarra, at Wollongong Point.”

Observations.—Several specimens from the Varney Parkes collection have been referred to this species. They agree exactly with Dana's description, which is as follows:

“This is a thick species distinguished by its anterior muscular impressions and general proportions. The cast from the beak obliquely downward is strongly flattened; and between this area and the large anterior muscular impression, the surface is somewhat convex, and moreover it is smooth without minute corrugations. The striæ of the exterior surface are strong and quite neat, although somewhat irregular, and the surface is a little shining.”

The dimensions of several specimens, including a cast of Dana's type of this species, are approximately as follows:

	Plate xxvi		
	fig. 8.	fig. 7.	fig. 6. (Dana's cast)
Length	41 mm.	42 mm.	43 mm.
Height	31 mm.	33 mm.	35 mm.
Thickness	23 mm.	21 mm.	23 mm.

Localities and horizon.—Wyro, near Ulladulla; Wollongong. Permo-Carboniferous, Upper Marine Series.

Collection.—The Australian Museum, Sydney.

ASTARTILA OVATA *sp. nov.*

(Plate xxvii, figures 1-5.)

Description.—The shell is of small size, oblong and longer than high. Its beaks are prominent, placed fairly wide apart and are anteriorly situated. Distance between the tip of the beak and the anterior muscle scar is short, and the profile is concave. The valve is strongly convex and flattens out only at the margins. The anterior portion of the shell is at least one-third the length of the valve. The anterior muscle scar is small and obliquely excavate. In outline it is subquadrate and marked with transverse striae. The posterior muscle scar is the larger of the two. It is broadly oval in shape, slightly excavate, and ornamented with concentric growth rings. The smaller anterior muscle scar is absent. The pallial line is entire, slightly curved and distinct. The lateral surface of the umbo is flattened, and this flattened surface extends downward to the pallial line. The area between the anterior muscle scars and the flattened surface is concave. The interior surface of the valve is smooth except for a few indistinct folds. External ornamentation unknown. The ligament is external, short, and narrow.

The dimensions of the holotype and co-types which have been figured are as follows:

	Plate xxvii		
	fig. 1.	fig. 2.	fig. 3.
Length	18 mm.	20 mm.	20 mm.
Height	15 mm.	18 mm.	16 mm.
Thickness	—	10 mm.	—

Observations.—This species, to my knowledge, has been collected only in the Wandrawandian Series and is always enclosed in a fine matrix of ferruginous sandstone which is literally crowded with pelecypod and brachiopod remains. It is a very handsome shell somewhat similar to *A. polita* but differing markedly in the small size and in the fact that the anterior muscle scars are strongly excavate and small in comparison with the size of the shell. The flattened surface of the umbo is also very wide. In the series of

specimens examined there appears to be two definite types, one which possesses the flattened umbo, and another in which it is absent or nearly so. The latter type has a narrow ridge extending from the posterior side of the beak to the back of the posterior muscle scar. This, in the internal cast, is present in the form of a slight groove. It is also more elongated than the typical species, but, owing to lack of material, the separating of these two forms must wait. I have no doubt that further material will prove this another species or at least a variety.

Localities and horizon.—Wandrawandian Series, Tianjarra, south coast of New South Wales. Permo-Carboniferous, Upper Marine Series.

Collection.—The Australian Museum, Sydney.

ASTARTILA QUADRATA *sp. nov.*

(Plate xxvii, figures 6-8.)

Description.—This is a medium sized, oval shell very thick and almost equilateral. Valves strongly convex. The beaks are almost median in position, very blunt in the complete shell and slightly produced in the cast. Anterior and posterior lateral margins of the valve, between the beaks and the anterior muscle scars, straight. Anterior adductor muscle scars are obliquely excavate, broadly oval in outline and ornamented with fine transverse striæ. No trace of smaller anterior scar. Posterior adductor scar large and not excavate. Ligament external, broad, and narrow.

The external sculpturing of the valve consists of concentric growth plates separated by comparatively deep grooves or depressions. Superimposed on the growth plates are numerous fine striæ. The internal surface of the valve is quite smooth. The growth plates give the exterior of the valve a roughened appearance.

The dimensions of the figured specimens, which include the holotype and co-types, are approximately as follows:

	Plate xxvii		
	fig. 6.	fig. 7.	fig. 8.
Length	30 mm.	31 mm.	30 mm.
Height	27 mm.	27 mm.	24 mm.
Thickness	20 mm.	20 mm.	17 mm.

Observations.—There is no other member of the genus *Astartila* which possesses the same stoutness in comparison with length. It is an outstanding form in virtue of its almost equilateral form, its dimensions, and strong ligament.

Localities and horizon.—Wollongong; Gerringong. Permo-Carboniferous, Upper Marine Series.

Collection.—The Australian Museum, Sydney.

ASTARTILA DELICATULA *sp. nov.*

(Plate xxvii, figures 9-11.)

Description.—This is a small shell which attains a length of approximately 20 mm. only. It is inequilateral and equivalve, produced posteriorly, and slightly longer than high. The beaks are prominent, anteriorly situated and pointing anteriorly. The valves are convex anteriorly and flattened posteriorly. This flattened surface extends downward, parallel to the umbo, to the ventral margin. The line of demarcation between these two areas produces a ridge which gives the shell a very characteristic appearance. The larger anterior adductor muscle scar has its long axis vertical in position and in shape it is narrow and elongated. It is obliquely excavate. No trace of smaller anterior muscle scars. The posterior adductor scar is large and only faintly discernible.

The external valve ornamentation consists of about eight concentric growth plates. These are smooth and separated by shallow grooves. The whole surface is then traversed by numerous fine concentric striæ which is very characteristic and gives the shell a very delicate appearance. The internal surface of the valve is marked with four or five ridges, which appear in the internal casts as grooves.

The dimensions of the figured specimens are approximately as follows:

	Plate xxvii		
	fig. 9.	fig. 10.	fig. 11.
Length	21 mm.	16 mm.	19 mm.
Height	18 mm.	14 mm.	16 mm.
Thickness	6 mm.	6 mm.	8 mm.

Observations.—This species is represented by a small but excellently preserved series of specimens, which include examples of testiferous united valves and internal casts. In form they resemble *A. subcarinata* and also in the ornamentation, as both species possess the very accentuated fine external sculpturing. The differences may be briefly summed up as follows:

- (1) *A. subcarinata* is a large shell compared with the present species, which is only one-third to one-quarter the size of the former.
- (2) *A. subcarinata* has a flattened portion on the beak of the internal cast extending from the tip of the beak to the pallial line. This is absent in *delicatula*.

- (3) The shell of *A. subcarinata* is produced more posteriorly than in the present species.

Localities and horizon.—Gerringong. Permo-Carboniferous, Upper Marine Series.

Collection.—The Australian Museum, Sydney.

ASTARTILA PUSILLA (*McCoy*).

(Plate xxix, figures 8-12.)

Pachydomus pusillus McCoy, Ann. Mag. Nat. Hist., xx, 1847, p. 302, pl. xvi, figs. 1 and 2. *Id.*, De Kon., Mem. Geol. Survey of N.S.W., No. 6, 1898, p. 217, pl. xix, fig. 2.

Observations.—This species was originally described by McCoy in 1847 under the name of *Pachydomus pusillus*. In 1849 Dana placed it as a synonym of his *Astartila cytherea*, but De Koninck in 1898 restored it to its original genus, *Pachydomus*. This species is represented by a comparatively large series of specimens including both testiferous united valves and internal casts. They are all edentulous forms, and in McCoy's types, of which I have plaster casts, there is also no trace of teeth. As the genus *Pachydomus* is characterised by the possession of teeth, it is necessary again to place McCoy's species in the genus *Astartila*.

The following description has been compiled from the series examined, which as a rule are smaller in size than McCoy's type specimens.

The shell is small and globose; it is as high as long or higher, and slightly higher than thick. Valves are strongly convex, with a rounded ventral margin. The beaks are pointed, median in position, produced above the hinge line and recurved anteriorly. They are placed fairly wide apart. The lateral surface of the beak is flattened, and the flattened area extends from the tip of the beak to the adductor muscle scar. The larger anterior muscle impression is obliquely excavate, subquadrate in shape, and is placed parallel to the direction of the beaks. The posterior muscle scar is broadly oval and superficial. It is the larger of the two. Pallial impression is entire and gradually curved. The external valve ornamentation consists of rather coarse growth plates, with finer striae superimposed. Internal surface of valve smooth. Hinge line arched; test of shell thin.

The dimensions of the figured specimens are approximately as follows:

	Plate xxix			
	fig. 10.	fig. 11.	fig. 12.	fig. 9.
Length	19 mm.	16 mm.	20 mm.	17 mm.
Height	22 mm.	18 mm.	21 mm.	19 mm.
Thickness ..	18 mm.	13 mm.	18 mm.	14 mm.

This species may be separated from *A. cytheria*, the only other group of *Astartila* which it resembles in any way, by its small size and great thickness. Its sharp pointed beaks projecting well above the hinge line make it an outstanding type.

Localities and horizon.—Wollongong sandstone (McCoy); Jamberoo; Gerringong. Permo-Carboniferous, Upper Marine Series.

Collection.—The Australian Museum, Sydney.

ASTARTILA CENTRALIS sp. nov.

(Plate xxix, figures 4-7.)

Description.—This is a medium sized shell, fairly globose, and attains a length of approximately 22 mm. The valves are strongly convex in the umbonal region but flatten out towards the margins. The beaks are prominent, anteriorly situated, and point anteriorly. In the cast widely separated. The anterior lateral surface of the umbones is flattened, and this flattened surface, which is of considerable extent, extends from the tip of the beak to the pallial line. The surface between the adductor muscle scars and the flattened area is concave. The larger anterior scars are sub-quadrangular in shape and are marked with vertical striæ. The upper portion of the scar excavate. The posterior scar is sub-circular in outline, slightly excavate, and marked with three or four heavy curved striæ. Pallial line is distinct, entire and slightly curved. The external valve marking consists of fairly coarse concentric growth plates, separated by slight grooves. Test is very thin, the ligament external, short, and broad.

The dimensions of the figured specimens, which include the holotype and co-types, are approximately as follows:

	Plate xxix			
	fig. 7.	fig. 6.	fig. 5.	fig. 4.
Length	21 mm.	21 mm.	22 mm.	24 mm.
Height	20 mm.	20 mm.	21 mm.	23 mm.
Thickness ..	15 mm.	15 mm.	13 mm.	14 mm.

Observations.—This is a fairly common species and, so far as I know, has been collected only from the Gerringong beds. They have been excellently preserved, and include testiferous united valves and internal casts. It has a slight resemblance to *A. cytheria* but differs from that species in not having the beaks produced above the hinge line, and also in being smaller in size. The muscle scars in this species are strongly excavate, whereas in *A. cytheria* they are not so pronounced.

Locality and horizon.—Gerringong. Permo-Carboniferous, Upper Marine Series.

Collection.—The Australian Museum, Sydney.

ASTARTILA SUBCARINATA *sp. nov.*

(Plate xxix, figures 1-3.)

Description.—This is a thick and inflated shell, longer than high, and equilateral. The beaks are anteriorly situated and point anteriorly. A narrow groove extends from the anterior portion of the beak downwards past the anterior muscle scar, to the pallial line. This on the internal surface of the valve would be in the form of a ridge. The posterior portion of the shell is flattened, and the flattened portion extends from the tip of the beak to the ventral margin. The line of demarcation between the convex anterior portion and the flattened posterior portion of the shell is very pronounced. The large anterior muscle impression is only slightly excavate. It is sub-quadrangular in outline and the long axis is almost vertical in position. There is no trace of a smaller anterior muscle scar. The posterior muscular impression is not excavate, and is the larger of the two. It is broadly oval in shape. The external marking of the shell consists of growth plates which are comparatively smooth and numerous. Finer striæ are superimposed on these growth plates concentrically.

The dimensions of the figured specimens which include the holotype are approximately as follows:

	Plate xxix		
	fig. 1.	fig. 2.	fig. 3.
Length	40 mm.	31 mm.	33 mm.
Height	33 mm.	28 mm.	30 mm.
Thickness	34 mm.	20 mm.	19 mm.

Observations.—This species is an outstanding type of the members of the *Astartila* group and can be compared with only one species, *A. delicatula*. Both species bear a slight resemblance to members of the genus *Mæonia*, on account of the ridge which separates the flattened and the convex regions of the shell. The characters, however, entirely disassociate them from that genus. The main points of difference between the two species is that *A. delicatula* is a much smaller form than the present species, and is also not so inflated. It may be possible that *A. delicatula* is a small form of this species, but until further specimens come to hand showing a gradation between the two species they must be kept separate.

Localities and horizon.—Wyro, near Ulladulla; north of North Head, Ulladulla. Permo-Carboniferous, Upper Marine Series.

Collection.—The Australian Museum, Sydney.

ASTARTILA SUBGEMMA *sp. nov.*

(Plate xxix, figures 13-15.)

Description.—This is a small shell, somewhat oval in outline and inflated. The valve flattens out towards the margins,

particularly anteriorly. The beaks are practically median in position, giving the shell an equilateral appearance, and are blunt. The anterior muscular impression is large, broadly oval in outline and is obliquely excavate. The posterior muscle impressions are oval, slightly excavate and ornamented with curved striæ. Pallial line is entire and slightly curved.

The dimensions of the figured specimens are approximately as follows:

	Plate xxix		
	fig. 13.	fig. 14.	fig. 15.
Length	18 mm.	14 mm.	16 mm.
Height	15 mm.	12 mm.	14 (?)
Thickness	10 mm.	8 mm.	—

Observations.—This small and dainty shell is one that could be readily mistaken for *Astarte gemma*. In the series of specimens examined there were found specimens which were edentulous while others possessed teeth. Externally the characters were identical, so that this species is, one might say, an *Astarte gemma* which is toothless.

Localities and horizon.—Gerringong. Permo-Carboniferous, Upper Marine Series.

Collection.—The Australian Museum, Sydney.

ACKNOWLEDGMENTS.

I herewith wish to express my indebtedness to Mr. W. S. Dun for his friendly criticism and discussion on many of the points raised during the compilation of this paper. To Mr. G. C. Clutton my thanks are due for the excellent photographs from which the plates were reproduced.

EXPLANATION OF PLATE XXV.

Unless otherwise mentioned illustrations are $\frac{2}{3}$ natural size.

Astartila cyclos Dana.

- Fig. 1. Internal cast of united valves. Lateral view, showing anterior adductor muscle impression and flattened area on umbonal region; A.M., Reg. No. L.648.*
- Fig. 2. Complete shell* showing external sculpturing; A.M., Reg. No. L.649. $\frac{3}{4}$ natural size.
- Fig. 3. Lateral view of a weathered valve, showing sculpturing and portion of hinge line; A.M., Reg. No. F.21080.
- Fig. 4. Internal cast. Lateral view, showing flattened area and excavate muscle scar; A.M., Reg. No. F.7859.

Astartila obliqua sp. nov.

- Fig. 5. Internal cast of united valves, showing marking on internal surface of valve, holotype; A.M., Reg. No. F.1288. $\frac{3}{4}$ natural size.
- Fig. 6. Complete shell. Lateral view with test still attached; A.M., Reg. No. F.21087.
- Fig. 7. Lateral view of a specimen with portions of test removed; A.M., Reg. No. F.16989. $\frac{1}{3}$ natural size.

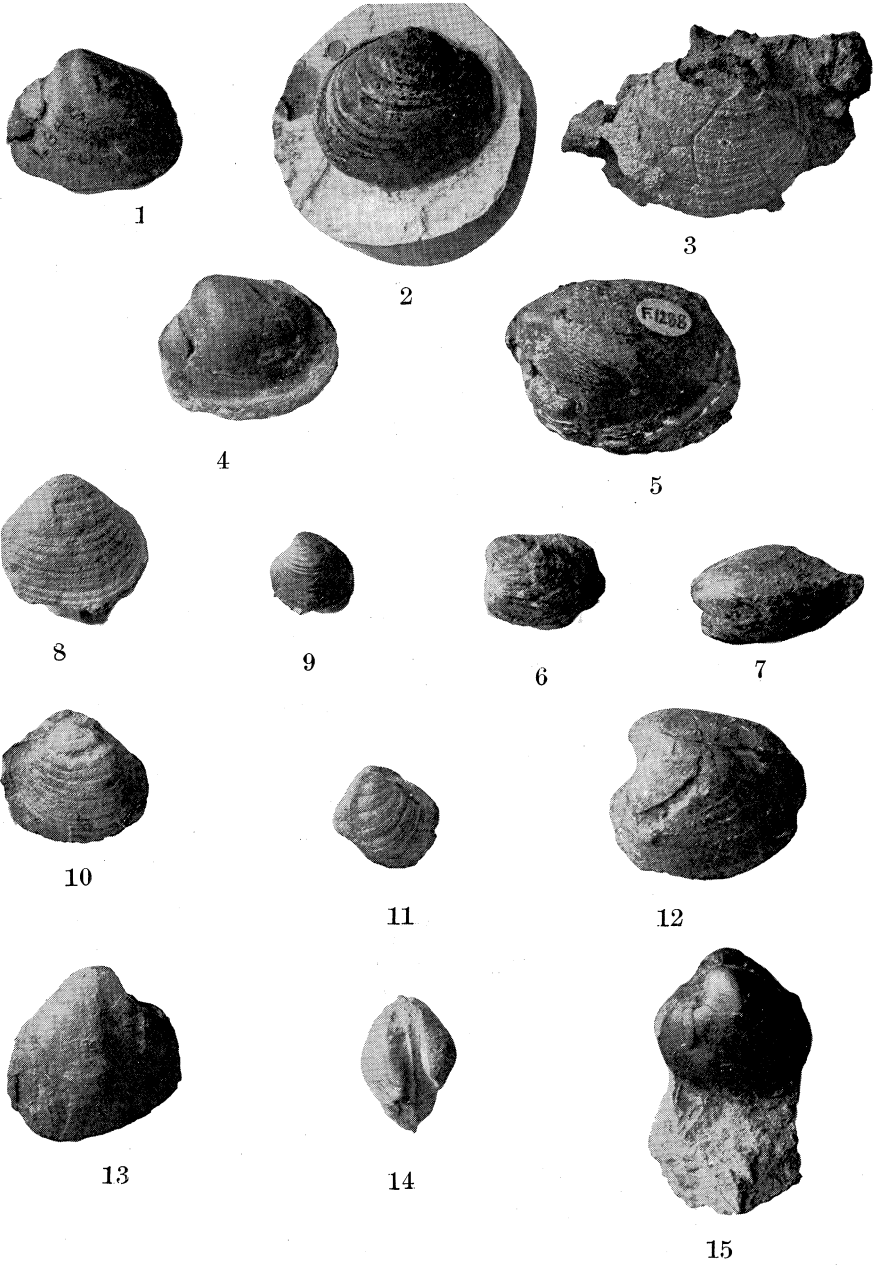
Astartila danai De Koninck.

- Fig. 8. Complete testiferous valve, showing ornamentation; A.M., Reg. No. F.20996.
- Fig. 9. Lateral view of a smaller specimen showing angle of beak; A.M., Reg. No. F.22015.
- Fig. 10. Complete specimen, slightly distorted; A.M., Reg. No. F.20994.
- Fig. 11. Lateral view of right valve; A.M., Reg. No. F.21001.

Astartila cytherea Dana.

- Fig. 12. Lateral view of a cast of the left valve; A.M., Reg. No. L.644. $\frac{3}{4}$ natural size.*
- Fig. 13. Lateral view of right valve, showing flattened area on internal cast; A.M., Reg. No. F.21102.
- Fig. 14. Profile of internal cast, showing distance between beaks and hinge line; A.M., Reg. No. F.21124.
- Fig. 15. Perfect internal cast. Lateral view of left valve, showing muscle scar and flattened area on umbonal region; A.M., Reg. No. F.21082.

* These specimens are plaster casts of Dana's types; many of the originals were published in Wilke's "United States Exploring Expedition during the years 1838-42," [Vol. x] Geology, Atlas (1849). As this publication is comparatively rare, the casts, which are perfect replicas, are figured herein.



EXPLANATION OF PLATE XXVI.

Unless otherwise mentioned illustrations are $\frac{2}{3}$ natural size.

Astartila cytheria Dana.

- Fig. 1. Complete testiferous specimen, showing heavy ornamentation; A.M., Reg. No. L.643. $\frac{2}{3}$ natural size.*

Astartila corpulenta Dana.

- Fig. 2. Slightly distorted specimen of right valve; A.M., Reg. No. F.21025. $\frac{3}{4}$ natural size.
Fig. 3. Right valve with portion of left valve; A.M., Reg. No. F.21066. $\frac{5}{8}$ natural size.
Fig. 4. Cast of internal left valve; A.M., Reg. No. L.635. $\frac{3}{4}$ natural size.*
Fig. 5. Lateral view of a right valve; A.M., Reg. No. F.21016. $\frac{3}{4}$ natural size.

Astartila intrepida Dana.

- Fig. 6. Specimen of left valve with portion of outer test removed, showing flattened portion of umbonal region and excavate adductor muscle impression; A.M., Reg. No. L.638.*
Fig. 7. An internal cast of left valve; A.M., Reg. No. F.2251.
Fig. 8. An example of the right valve; A.M., Reg. No. F.21035. $\frac{2}{3}$ natural size.

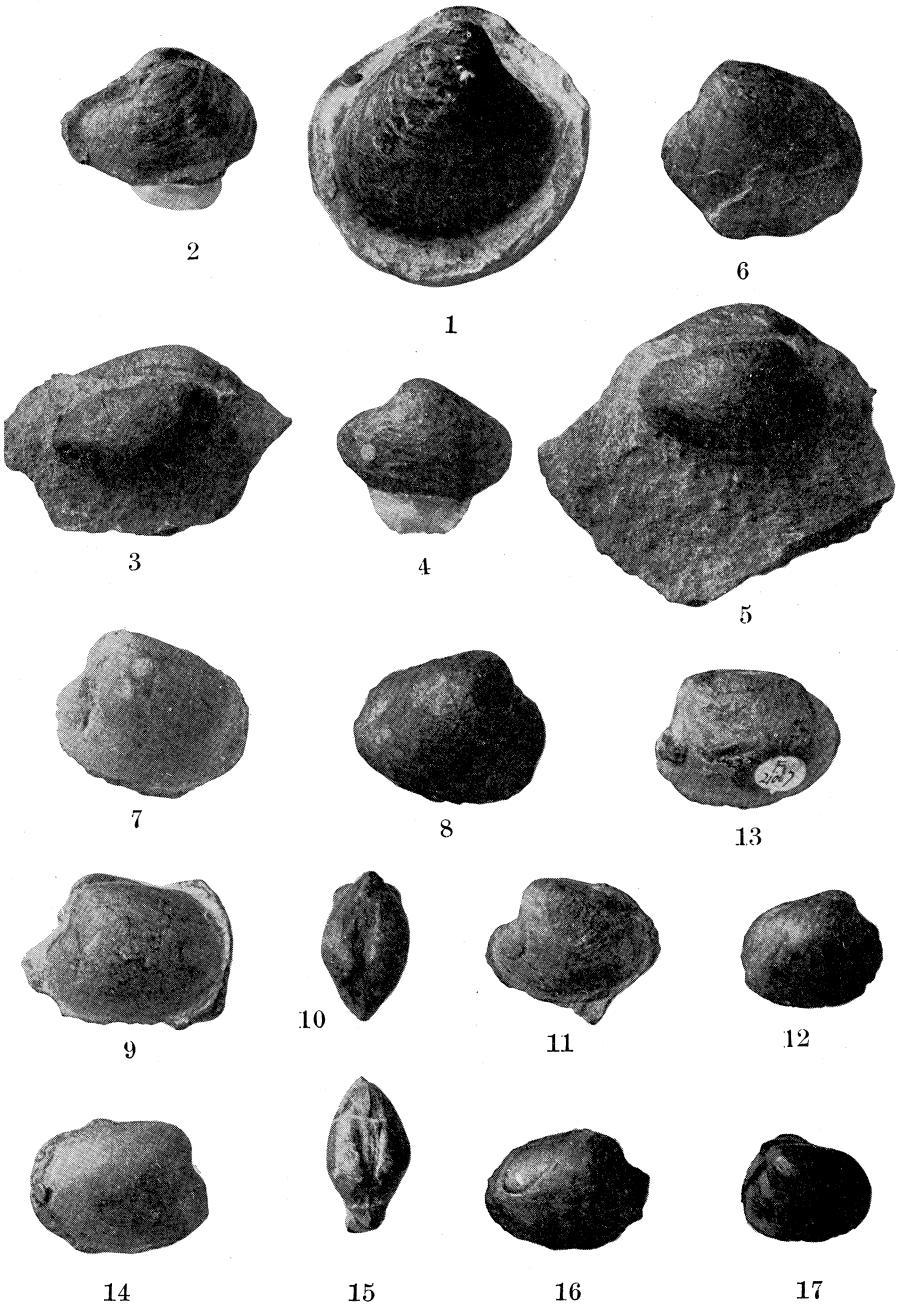
Astartila polita Dana.

- Fig. 9. An internal cast of the left valve; A.M., Reg. No. L.645.*
Fig. 10. Internal cast of both valves, seen in profile; A.M., Reg. No. L.646.*
Fig. 11. Internal cast of left valve. A lateral view showing the upright beak; A.M., Reg. No. F.1131.
Fig. 12. Internal cast of right valve; A.M., Reg. No. F.21047. $\frac{2}{3}$ natural size.

Astartila transversa Dana.

- Fig. 13. An internal cast of a left valve, showing excavate muscle scar; A.M., Reg. No. F.21067. $\frac{5}{8}$ natural size.
Fig. 14. An internal cast of a right valve, showing flattened portion of the umbonal region and depressed beak; A.M., Reg. No. L.650.*
Fig. 15. Internal cast of complete valves, seen in profile; A.M., Reg. No. F.21069.
Fig. 16. Internal cast of right valve, showing large posterior adductor muscle scar and depressed beak; A.M., Reg. No. F.21072.
Fig. 17. An internal cast of complete valves. Lateral view of the left valve; A.M., Reg. No. F.21151.

* See footnote to explanation of Plate xxv.



G. C. Clutton, photo.

EXPLANATION OF PLATE XXVII.

Unless otherwise mentioned illustrations are $\frac{2}{3}$ natural size.

Astartila ovata sp. nov.

- Fig. 1. Internal casts of a right and a left valve enclosed in matrix holotype; A.M., Reg. No. F.21126.
- Fig. 2. An internal cast of a right valve, showing the small excavate anterior adductor muscle impression; A.M., Reg. No. F.24300. $\frac{1}{2}$ natural size.
- Fig. 3. An internal cast of a right valve; A.M., Reg. No. F.21149. $\frac{1}{2}$ natural size.
- Fig. 4. An internal cast of right valve, showing faint flattened area on umbonal region; A.M., Reg. No. F.21143.
- Fig. 5. An example of the more or less depressed type, which lacks the flattened region. Showing posterior and anterior adductor scars; A.M., Reg. No. F.21040.

Astartila quadrata sp. nov.

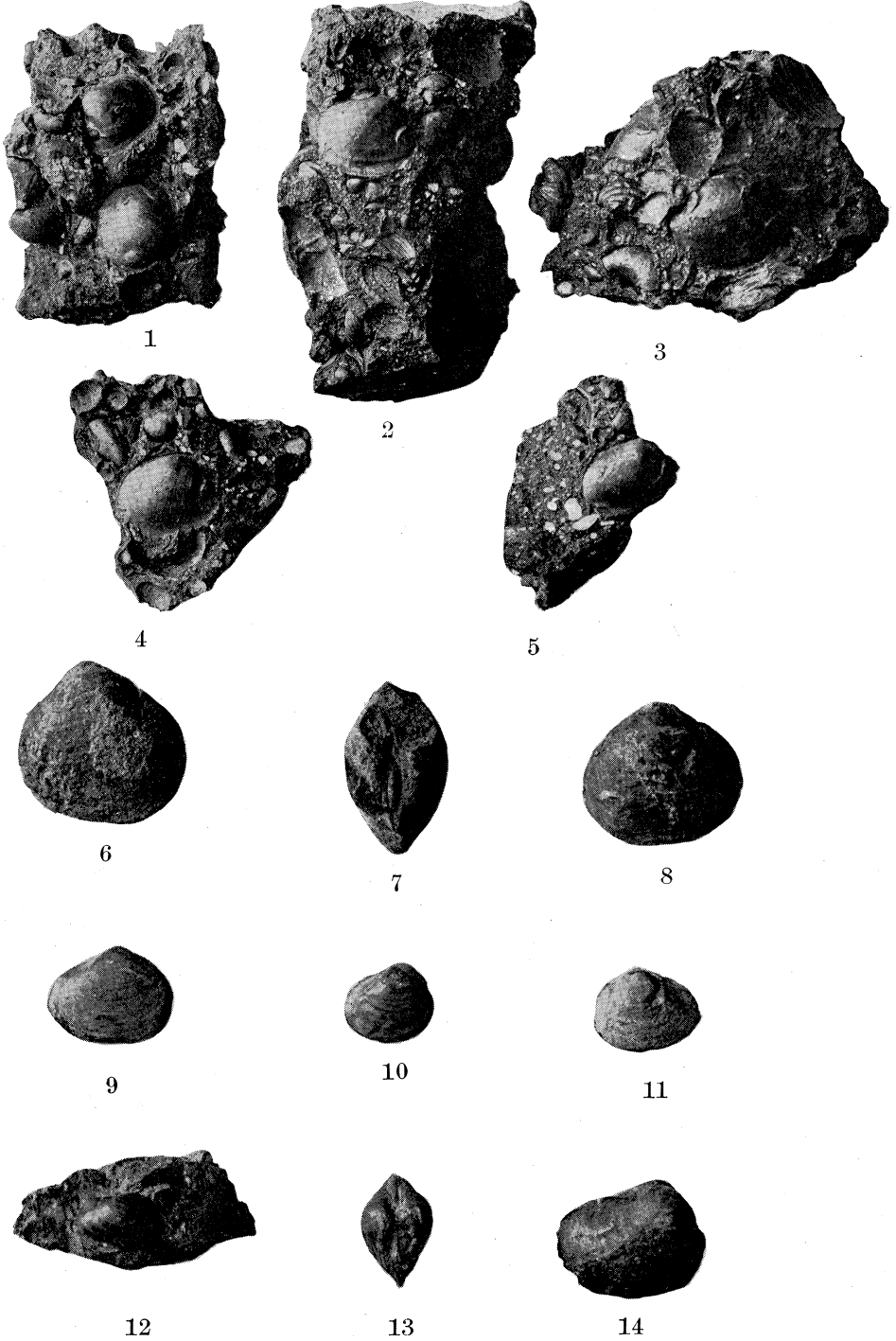
- Fig. 6. A complete specimen, showing external marking. A lateral view of the left valve; A.M., Reg. No. F.22017.
- Fig. 7. A specimen seen in profile, showing wide and pronounced external ligament holotype; A.M., Reg. No. F.21199.
- Fig. 8. A complete specimen, showing median position of beak; A.M., Reg. No. F.1130.

Astartila delicatula sp. nov.

- Fig. 9. A lateral view of a right valve, showing delicate ornamentation; A.M., Reg. No. F.23800. $\frac{3}{4}$ natural size.
- Fig. 10. An internal cast of right valve, showing internal ornamentation of shell; A.M., Reg. No. F.23801.
- Fig. 11. Internal cast of left valve, showing flattened region posteriorly; A.M., Reg. No. F.23802. $\frac{2}{3}$ natural size.

Astartila parkesi sp. nov.

- Fig. 12. Lateral view of right valve, showing heavy ornamentation; A.M., Reg. No. F.21022.
- Fig. 13. A specimen of complete valves, seen in profile holotype; A.M., Reg. No. F.22016.
- Fig. 14. Lateral view of a right valve; A.M., Reg. No. F.21031.



G. C. Clutton, photo.

EXPLANATION OF PLATE XXVIII.

Unless otherwise mentioned illustrations are $\frac{2}{3}$ natural size.

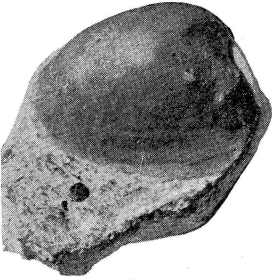
Astartila cyprina Dana.

- Fig. 1. A lateral view of an internal cast of a right valve, showing large anterior adductor muscle scar; A.M., Reg. No. L.641.*
- Fig. 2. An internal cast of complete valves, seen in profile; A.M., Reg. No. L.642.*
- Fig. 3. A specimen with portions of outer shell removed; A.M., Reg. No. L.639. $\frac{2}{3}$ natural size.*
- Fig. 4. Internal cast. A lateral view of left valve, showing muscle scar; A.M., Reg. No. F.7188.
- Fig. 5. An internal cast of right valve, showing faint internal ornamentation; A.M., Reg. No. F.21003.

Astartila compressa sp. nov.

- Fig. 6. A slightly distorted specimen of a left valve, showing angle of beak; A.M., Reg. No. F.20927.
- Fig. 7. Left valve, showing ornamentation. The beak in this specimen is not recurved; A.M., Reg. No. 20935.
- Fig. 8. Lateral view of a left valve, with recurved beak; A.M., Reg. No. F.20925.
- Fig. 9. Lateral view of a right valve, showing external ornamentation; A.M., Reg. No. F.20936. $\frac{2}{3}$ natural size.
- Fig. 10. A right valve with recurved beak; A.M., Reg. No. F.20910. $\frac{2}{3}$ natural size.
- Fig. 11. A lateral view of a left valve, showing ornamentation, holotype; A.M., Reg. No. F.20907.

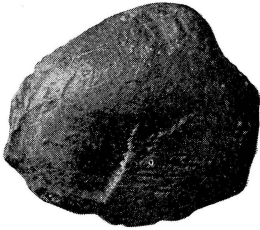
* See footnote to explanation of Plate xxv.



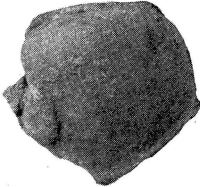
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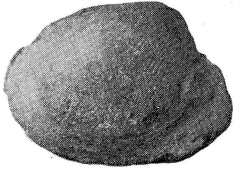
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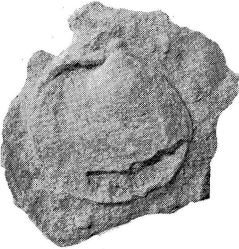
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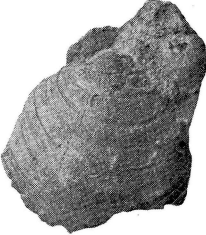
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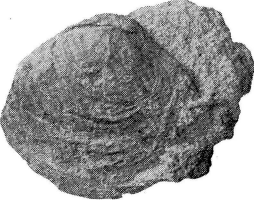
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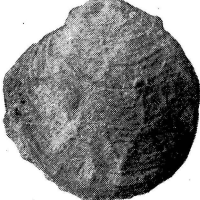
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9



10



11

EXPLANATION OF PLATE XXIX.

All illustrations are natural size.

Astartila subcarinata sp. nov.

- Fig. 1. A lateral view of a left valve, showing portions of ornamentation, and almost vertical adductor muscle scar, holotype; A.M., Reg. No. F.21098.
Fig. 2. Complete valves, seen in profile; A.M., Reg. No. F.21095.
Fig. 3. Lateral view of a right valve, showing flattened posterior region; A.M., Reg. No. F.23803.

Astartila centralis sp. nov.

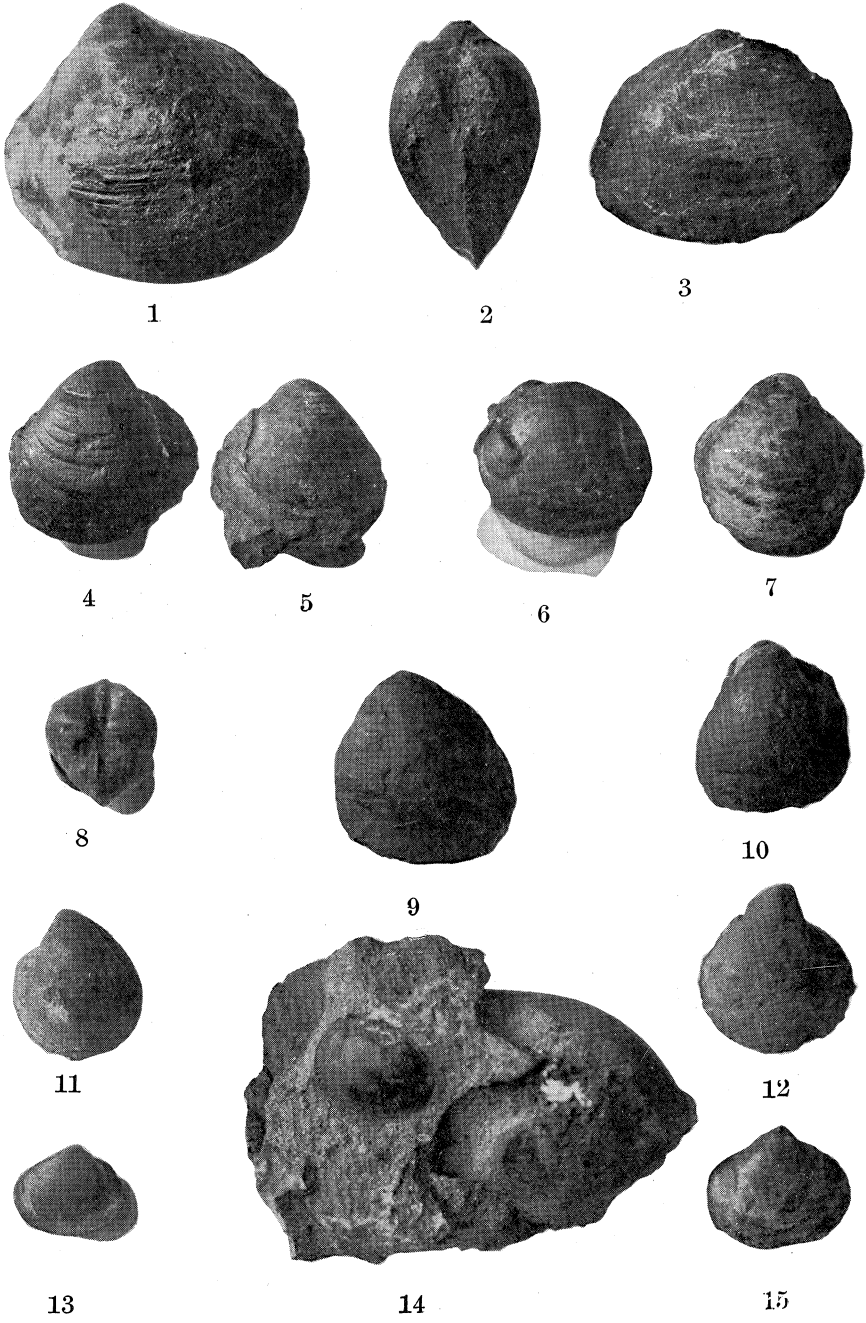
- Fig. 4. Lateral view of a right valve, showing external ornamentation; A.M., Reg. No. F.21120.
Fig. 5. An internal cast of a left valve, showing excavate anterior muscle scar; A.M., Reg. No. F.1133.
Fig. 6. Lateral view of an internal cast, showing excavate anterior and posterior adductor muscle scars; A.M., Reg. No. F.21140.
Fig. 7. Lateral view of a right valve, holotype; A.M., Reg. No. F.1133a.

Astartila pusilla (McCoy).

- Fig. 8. Internal cast of complete valves seen in profile showing the extreme width between beaks; A.M., Reg. No. F.3104.
Fig. 9. Complete shell. A plaster cast of McCoy's type; A.M., Reg. No. L.1424.
Fig. 10. An internal cast of a right valve. Plaster cast of McCoy's type; A.M., Reg. No. L.1425.
Fig. 11. Lateral view of an internal cast of the left valve; A.M., Reg. No. F.22019.
Fig. 12. Internal cast of a right valve. Lateral view; A.M., Reg. No. F.22018.

Astartila subgemma sp. nov.

- Fig. 13. Internal cast of right valve, holotype, lateral view; A.M., Reg. No. F.23804.
Fig. 14. Internal cast of a left valve, showing oval anterior adductor muscle impression; A.M., Reg. No. F.21190.
Fig. 15. Lateral view of an internal cast of a right valve, showing posterior and anterior adductor muscle scars; A.M., Reg. No. 23805.



G. C. Clutton, photo.