ON *WAISIUTHYRINA*, A NEW ARTICULATE BRACHIOPOD GENUS FROM THE UPPER-OLIGOCENE OF BUTON (S. E. CELEBES), DUTCH EAST INDIES

BY

C. BEETS, Leiden.

PREFACE.

About one year ago the present writer started the investigation of some mollusca, belonging to the remarkable, apparently Upperoligocene fauna of the asphalt-rocks of the island of Buton, near the south-eastern extremity of Celebes. Later on he received a rich fauna (till then in its asphalt-matrix), thanks to the kindness of Dr Ir F. J. NELLENSTEYN, director of the „Rijks-wegenbouw-Laboratorium", the Hague. When I treated the asphalt-fragments with CS_2, a very recommendable method, many molluscs were freed, and besides the shells of one and the same interesting brachiopodal species, described below. When I compared these shells with other brachiopods it was clearly visible they represent a member of a group hitherto unknown. This is, however, hardly surprising, as the Upperoligocene fauna of Buton shows a striking endemic character, as I could ascertain after identifying the mollusca: this conclusion is in perfect conformity with former investigations of the late Prof. K. MARTIN (1933, 1935). Besides numerous new species among the examined gastropods, scaphopods and lamellibranchiates, and some new genera, subgenera or sections, only known from the Oligocene deposits of Buton, the brachiopod dealt with in this paper leads to the proposal of a new genus.

From the Dutch East Indies we know but few Tertiary brachiopoda; the reader may find a brief list in MARTIN's valuable compendium of 1919 (p. 55—56) and in the one given by PANNEKOEK (1931, p. 432—433). There are only few descriptions of species from the Neogene of Java and Madura, and of one species from the Eogene of Borneo.

Investigation of brachiopods is rather difficult to-day, not the least as the literature about this subject is very extensive; fortunately SCHUCHERT and LE VENE (1929) and THOMSON (1927) focussed the light of their great experience on valuable compendiums, which enable the student to search his way in literature with less difficulty.

DESCRIPTION.

Classis *Brachiopoda* CUVIER
Subclassis *Articulata* HUXLEY
Ordo *Telotremata* BEECHER
Superfamilia *Terebratulacea* WAAGEN
? Familia *Terebratulidae* GRAY

Genus *Waisiuthyrina* gen. nov.
Genotype *W. margineplicata* spec. nov.

WAISIUTHYRINA MARGINEPLICATA spec. nov.
Plate XXXIII, figs. 1—7, plate XXXIV, figs. 8—18.

Material: one well-preserved entire shell and another one, of which the ventral valve was destroyed for the greater part for the sake of chemical analysis in the „Rijkswegenbouw-Laboratorium".

Dimensions: the ventral valve of the holotype (fig. 9) has a length of 48.2 mm from the posterior or cardinal to the anterior border; the dorsal valve (fig. 8) is 45.2 mm long. The dorsal valve of the paratype (fig. 16) has a length of 53.8 mm. The breadth of the type is 49 mm, the thickness 32.6 mm. The habitus is more rhynchonelloid than terebratuloid, as e. g. in *Gryphus Cubensis* (POURTALÈS) or *Abyssothyris* THOMSON, 1927, or in some cretaceous groups (cf. SAHNI, 1925). The shell is exactly bilaterally symmetrical, the ventral (pedicle-) valve being somewhat larger than the dorsal one, with more prominent umbo, but the dorsal valve is more convex than the ventral (figs. 11—12). This type of shell-shape was named dorsi-biconvex by SCHUCHERT and COOPER (cf. MCEWAN, 1939, p. 617—618: follow the evolution-line on the right in the diagram, the line of dorsi-tumid shells). As MCEWAN has pointed out, this and other types of the shape of brachiopodal shells may serve as reliable bases for systematical division (as was also recommended by other students); in the key to families given by MCEWAN (l. c., p. 620) we come, in combination with the characteristics of hinge, deltidium, foramen, shape and sculpture, to the place II-A-1-b among the Telotremata; we cannot reach the finest division as the branchial skeleton of this species is not visible.

The valves are nearly smooth; the only sculpture consists of fine, close-set concentric growth-lines. Radial sculpture is entirely absent and radial folds are only weakly developed and are practically absent on the dorsal valve. The commissure lies almost in a single plane and is slightly waved in the frontal region (fig. 10); as far as I can see the type of folding of these shells must be called weakly sulciplicate (THOMSON, 1927, p. 58—59).

Colours, which have sometimes been mentioned for fossil brachiopods, are not preserved in this case; in the gastropods of the Oligocene collections of Buton, however, we sometimes see coloured shells.

The well-developed shell-structure may be studied in thin-sections (plate XXXIII). As is common in the Telotremata (Articulata) the shell is formed of two mainly calcareous layers. The inner prismatic layer (figs. 6—7), by far the thickest, possesses — like the outer layer, but more clearly pronounced — a fibrous character, produced by an almost parallel arrangement of abundant fine prisms of calcite of considerable length, set very obliquely to the surface of the shell (chitinous membranes, in which the prisms were cased, have disappeared in these fossils). The second, (middle), outer layer (figs. 6—7) is thinner and finely lamellated, not very clearly separated from the inner layer and again dominantly calcareous.

In this case the magellania-stage in shell-structure (THOMSON, l. c., p. 97) seems to be represented, as the shells are finely punctate (so *Waisiuthyrina* cannot belong to the Spiriferacea or Rhynchonellacea); the deltarium must be punctate too, but this I could not prove without damaging the type-specimens. The shell is wholly traversed by very fine, nearly parallel tubes of a simple type, which at the somewhat thickened outer margin of the shell don't run perpendicular to the surfaces, but very obliquely, also obliquely to the direction of the prisms: this is clearly shown by horizontal sections (figs. 1, 2, 5) and seems to be a new element round about the magellania-stage, which forms almost a bridge to the conditions in the Cambrian to Ordovician genera *Syntrophia* and *Huenella* (THOMSON, l. c., p. 98). The minute canals don't always run parallel, but their direction may vary. In these sections mentioned we see the prisms almost as in vertical sections owing to their oblique arrangement. The canals never unite with one another, nor do they branch before the outer or inner surface of the shell is reached, nor does their diameter increase towards the exterior. They are arranged in more or less clearly developed rows and stand at the angular points of rhombs; their diameter may slightly vary.

The part of the shell outside the marginal zone is occupied by less clearly visible pores; in vertical sections they show an oblique arrangement (often nearly perpendicular) as is visible in the best vertical section (figs. 3—4); we can see three rows of pores cut of by the slide, one near each surface of the shell. As far as I can make out, the pores near the border of the shell are much more numerous and more regularly arranged than in the body of the shell; as to the „density" of the canals similar observations have been made e. g. by THOMSON (l. c., p. 106, fig. 34). Another fact, namely the peculiarity, that in the only vertical section of the marginal zone (figs. 6—7) and in some horizontal sections of the older part of the shell the pores are nearly invisible (in the case of the vertical section perhaps owing to a parallel arrangement of slide and pores, as well as of pores and prisms?) and those of the last-mentioned part seem to have smaller diameters than the marginal ones, leads me to the conclusion, that a further study of shells of *Waisiuthyrina* is needed.

The margin of both ventral and dorsal valves shows an interesting concentric zone, which is distinctly folded in the direction of the inner part of the valves. This additional zone disappears near the hinge-line, but close to this part of the shell it first broadens somewhat. In the dorsal valve (figs. 15—16) this zone is for the greater part equally broad and runs nearly horizontally (slightly bent outwards), but at some distance from the hinge-line it is bent inwards, then broadens, showing still clearer a median depression, which disappears close to the point of meeting of additional zone and umbonal margin of the shell. In the ventral valve (fig. 13) this additional zone is in every place more or less bent-outwards and has a median depression, in which fits the rounded margin of the dorsal valve; a narrow, nearly vertical zone along the inner margin of this ventral additional zone meets the inner margin of the dorsal valve: this ventral zone broadens less than the dorsal one (near the hinge-line); near the hinge it is convex and runs more horizontally, fitting perfectly into the weak depression of the dorsal additional zone.

As far as I know such a folded marginal zone has never been described in the Articulata (or other groups); in none of the textbooks of general or especially brachiopodal palaeontology, or in studies concerning recent brachiopods is it mentioned. Indeed there are some species showing an — always weakly „separated" — marginal zone, e. g. the recent *Dyscolia wyvillii* (DAVIDSON) [DAVIDSON, I, 1886, p. 32, pl. 3, fig. 1a-b; THOMSON, l. c., p. 199, textfig. 60] and *Gryphus vitreus* (BORN) [sometimes] or *Hemithyris psittacea* (GMELIN); the genus *Nipponithyris* YABE et HATAI (1934) also (?)

seems to have a weakly developed marginal zone, sometimes also visible in *Rhynchonella lucida* GOULD [? *Hemithyris*]. I could never observe an additional zone as in *Waisiuthyrina* or anything directly comparable; for the moment I therefore accept this feature as one of the more important points in the generic character of *Waisiuthyrina.*

The hinge-line is perfectly terebratulid (THOMSON, l. c., p. 53—54), short and strongly curved. The ventral valve has two rather small hinge-teeth, situated just outside the front-corners of the delthyrium (fig. 13); each tooth is attached to the side-wall of the shell by a swollen base (fig. 14), situated especially in umbonal direction; the tooth-points are directed towards the dorsal umbo. The teeth are separated above from the hinge-margin by a fairly deep groove, in which fits the dorsal socket-wall. There are no dental plates, so common in Terebratulidae older than Jurassic. This hinge is built like that in many terebratulid genera, showing a striking resemblance with, e. g., *Terebratula grandis* BLUMENBACH and *T. ampulla* BROCCHI from the European Tertiary. In the dorsal valve well-developed dental sockets correspond with the ventral teeth.

The ventral valve is curved into a beak, the curvature being erect (THOMSON, l. c., p. 80); this umbo shows that type of pedicle-opening which lies wholly within one valve and for which the term foramen is reserved. The opening is partly surrounded, in areal direction, by a crescent-shaped, weakly impressed marginal exterior zone (fig. 12). In the inside of the valve the round foramen is surrounded by a narrow support (fig. 14): a pedicle-collar or syrinx is not developed, as this concentric ridge is low. The character of beak and foramen is in all respects precisely like that of the above-mentioned European species (also agreeing with other Terebratulae or species, belonging to other genera). In „initial" development the foramen was mesothyrid or perhaps permesothyrid (THOMSON, l. c., scheme of p. 72), but during the development the opening assumed a position, which may be called epithyrid; the whole construction of foramen and surrounding parts of the valve pleads for maintaining the term mesothyrid; as far as I can understand this is what THOMSON meant by his generic diagnosis (l. c., p. 191) of *Terebratula,* this genus being „mesothyrid (?)".

The truncate-delta-shaped delthyrium is closed by deltidial development. The slightly concave deltarium (deltarium sectans) takes up almost the whole areal place (fig. 13) and consists of two plates, coalescing on the dorsal side of the pedicle, in the middle of the former delthyrium; a fine, irregular, shallow impressed line seems to indicate the junction, but the plates are firmly fused and this delthyrium-covering shows transverse rugosities, abundant growth-lines, which cross the median line without interruption (this especially terebratulid deltarium has been called symphytium by BUCKMAN: cf. THOMSON, l. c., p. 66—67). Two other grooves, but now clearly visible, one on each side nearly along the margins of the umbonal part of the valve, separate the deltidial plates from the narrow areal parts between the grooves and the cardinal ridges.

Between the dental sockets of the dorsal valve, leaning upon the inner dental socket-ridges, a small, finely grooved, bi-lobed transverse cardinal process is developed (fig. 15); the lobes are divided anteriorly by a fairly broad groove, which also separates the knobs mentioned below (in the ventral valve a sinus of the cardinal area corresponds exactly with the prominent part of the dorsal umbonal region). Under the cardinal process, in the inner part of the dorsal umbonal region, two small, but well-developed knobs, one under each lobe of the cardinal process, very close together, are visible (although one of them was destroyed in cleaning).

The dental sockets (figs. 15—16) are separated from the internal part of this valve by radial ridges, each supported by two vertical ridge-like processes, running obliquely to and broadening on the inner surface of the valve (like the dental bases in the ventral valve); one pair is situated near the cardinal process, the other directed anteriorly (partly in damaged condition): the latter ones or perhaps the ridges leaning on these vertical supports, may have formed the crural bases, but neither this fact, nor the kind of branchial skeleton can be characterised, owing to the condition of the examined shell.

In the dorsal valve (figs. 15—16) a small, very low septal ridge separates the muscular impressions, but does not unite with the cardinalia; it disappears posteriorly already under the knobs below the cardinal process, anteriorly before the middle of the valve is reached.

The bases of attachment of the various muscles are — in general — not clearly developed; I can only mention those of the dorsal valve. The cardinal process served for the attachment of the divaricatores (diductor muscles); it possesses fine grooves on the anterior and narrow upper border and part of the posterior surface: the umbonal part of this surface is provided with callus; the grooves end posteriorly in a transverse, rather deep and winding groove nearly along the upper margin of the process.

Perhaps there were two pairs of divaricatores (as e. g. in *Magellania* BAYLE, 1880), one pair attached to the cardinal process itself (the divaricatores accessorii) and the other pair fixed to the above-mentioned knobs (divaricatores anteriores). Or the divaricatores were all fixed to the cardinal process and a pair of pedicle-muscles to the knobs.

The dorsal pedicle-muscles (adjustores, pediculares) were attached somewhere between the socket-ridges (in other genera to the hinge-plates or their homologues); in this case we may suppose they were fixed to the oblique supports of the inner socket-wall, or (and?) to the knobs under the cardinal process. More and better preserved material will probably show muscle-scars.

The floor of the dorsal valve shows only one pair of the four impressions made by the dorsally bifurcating adductores (occlusores); this pair has formed posteriorly situated, clearly limited impressions, converging in frontal direction and reaching nearly to the median line of the valve, shaped like foot-prints (without toes): figs. 15—18; perhaps the other pair of muscles formed two smaller impressions lying outside the hind part of the former impressions, but we can see only one of them on the right half of the valve. The arrangement of the muscle-impressions and their posterior situation show some resemblance with those in some cretaceous terebratulid genera (cf. SAHNI, 1925) and e. g. *Gryphus vitreus* and *Gryphus cubensis*, where I also saw one pair of adductores clearly developed, but always lying more or less parallel to the median ridge. In general there is in this respect more resemblance with the rhynchonellid genus *Hemithyris* D'ORBIGNY (cf. THOMSON, l. c., p. 150, textfig. 45 d; DAVIDSON, l. c., 1887, pl. 24, fig. 6). As BUCKMAN has stated, in Terebratulids the muscle-marks appear to be continuous,anteriorly widening tracks, developed during the growth of the shell: just like in the present shell; and because BUCKMAN stated, that in such cases the posterior muscle-marks are more often seen than the anterior ones, this *Waisiuthyrina*-shell perhaps shows the posterior muscle-tracks.

Locality: Buton, Upper-Oligocene of Waisioe (Holotype) and of Kaboengka (the entire material is kept in the Geological Museum of the University of Leiden).

APPENDIX.

The character of *Waisiuthyrina* agrees with the Telotremata and within this group it cannot be placed in the Spiriferaçea or Rhynchonellacea; all the features point to a terebratulid genus and perhaps it must be placed near *Terebratula* and *Gryphus,* but as the branchial skeleton, by far the most important factor for generic division, is unknown, the classification cannot be made with certainty, this being left as an object for further investigation.

SCHUCHERT (1911) regards the geologically old groups of Rhynchonellacea and Terebratulacea as morphologically young and plastic, constantly giving rise to new forms; this is again (cf. the faunal character of the Oligocene of Buton) in accordance with the fact of the appearance of a new genus in Eastindian Tertiary palaeontology. The molluscan fauna of the deposits of Buton clearly indicates shallow-water conditions during sedimentation, as I pointed out in my study about the mollusca; so *Waisiuthyrina* could live under these conditions; as SCHUCHERT (l. c., p. 265) stated, none of the articulate genera can be relied upon to indicate the litoral, more than 70 % being at home in the neriticum (90—600 feet); 67 % of the Terebratulids live in these waters. Further *Waisiuthyrina* shows a rather thick shell as well as considerable growth as indication of its shallow-water behaviour. As some gastropods of the same collection show healed shells, a litoral zone must have existed at a short distance, but the brachiopods do not show the slightest trace of healed or abraded shell, so we may assume that the fauna of Buton lived under conditions of rather calm waters too (as is also indicated by the well-preserved Pteropods and other delicate molluscan shells). In brackish water the brachiopods as a rule soon die, so *Waisiuthyrina* may be of value as an indicator of strictly marine circumstances, in accordance with the fact, that the molluscan fauna contains no brackishwater-forms at all.

As the molluscs of the Oligocene of Buton show a striking endemic character, we may suppose many difficulties for larval distribution for the brachiopods too, the more so as (especially articulate) neritic brachiopods often show a limited spreading (being of stratigraphical value only for local faunas), partly owing to the fact, that their larvae have no mouth and must settle quicker than those of inarticulate groups; we may assume therefore, that *Waisiuthyrina* will show a very restricted distribution, perhaps confined to the eastern part of the Eastindian Archipelago, as certain molluscan groups do, which are only known from the Oligocene of Buton and younger deposits or the recent fauna in the close vicinity.

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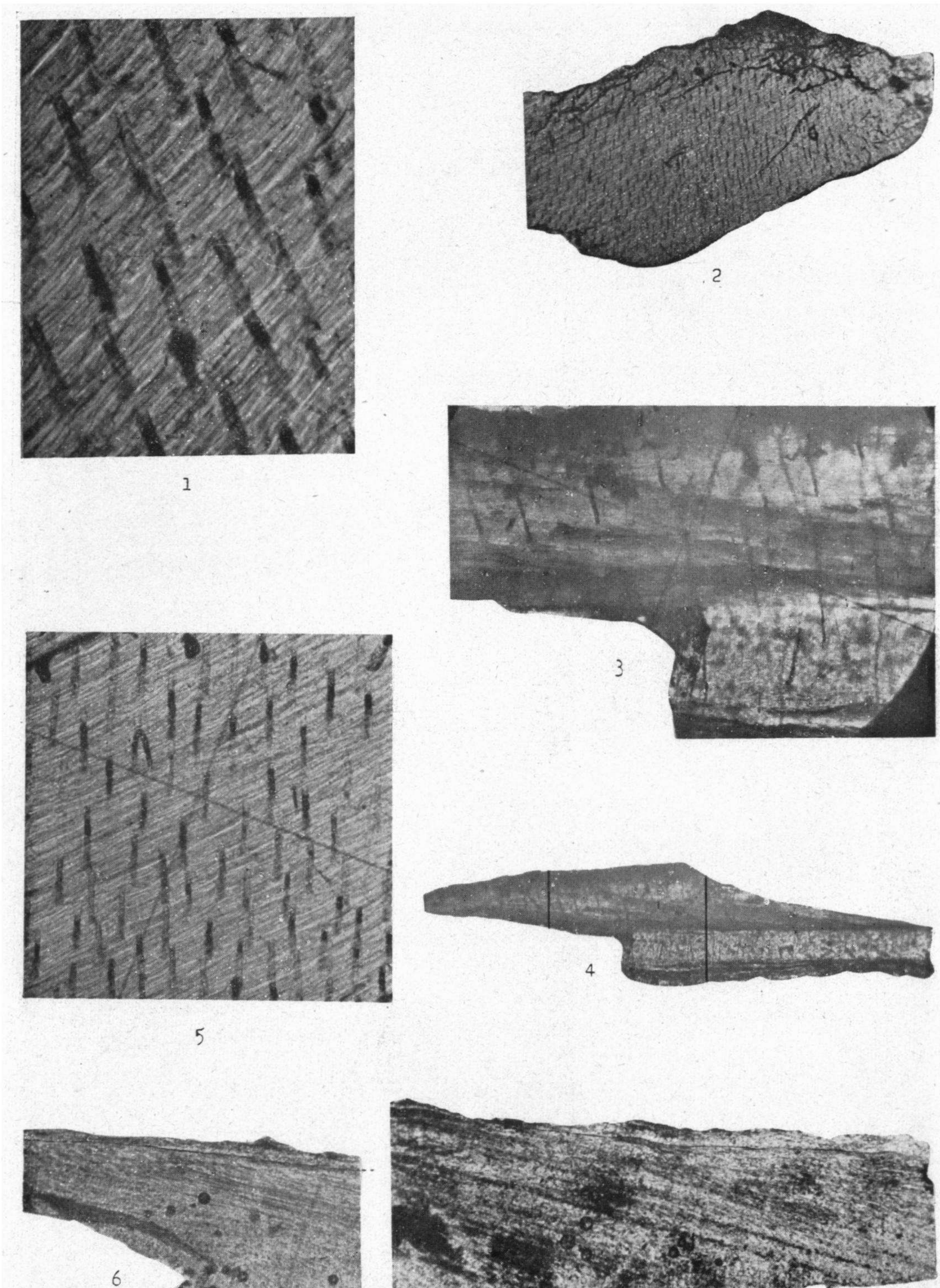
EXPLANATION OF FIGURES.

Plate XXXIII: thin-sections of the shell of *Waisiuthyrina margineplicata* spec. nov. (Paratype).

Fig. 1: horizontal section at shell-margin (part of fig. 2), magnified ± 220 ×.
Fig. 2: horizontal section at shell-margin (cf. figs. 1 and 5), magnified ± 22 ×
Fig. 3: vertical section (part of fig. 4), magnified ± 64 ×.
Fig. 4: vertical section outside the shell-margin (the vertical lines indicate the part magnified as fig. 3), magnified ± 21 ×.
Fig. 5: horizontal section at shell-margin (part of fig. 2), magnified ± 90 ×.
Fig. 6—7: parts of a vertical section at the shell-margin, magnified ± 35. ×

Plate XXXIV: the valves of *Waisiuthyrina margineplicata* spec. nov.

Figs. 8—12: Holotype (fig. 8: dorsal valve; fig. 9: ventral valve; fig. 10: anterior part of the valves; fig. 11: side-view; fig. 12: posterior part).
Figs. 13—18: Paratype (fig. 13: cardinal part of the damaged ventral valve, and fig. 14: inside of this part; fig. 15: showing muscle-scars and inner marginal folded zone of the dorsal valve as well as its cardinalia; fig. 16: dorsal valve; figs. 17—18: plasticene casts of the dorsal valve, 17 partly, 18 showing whole cast (horizontally).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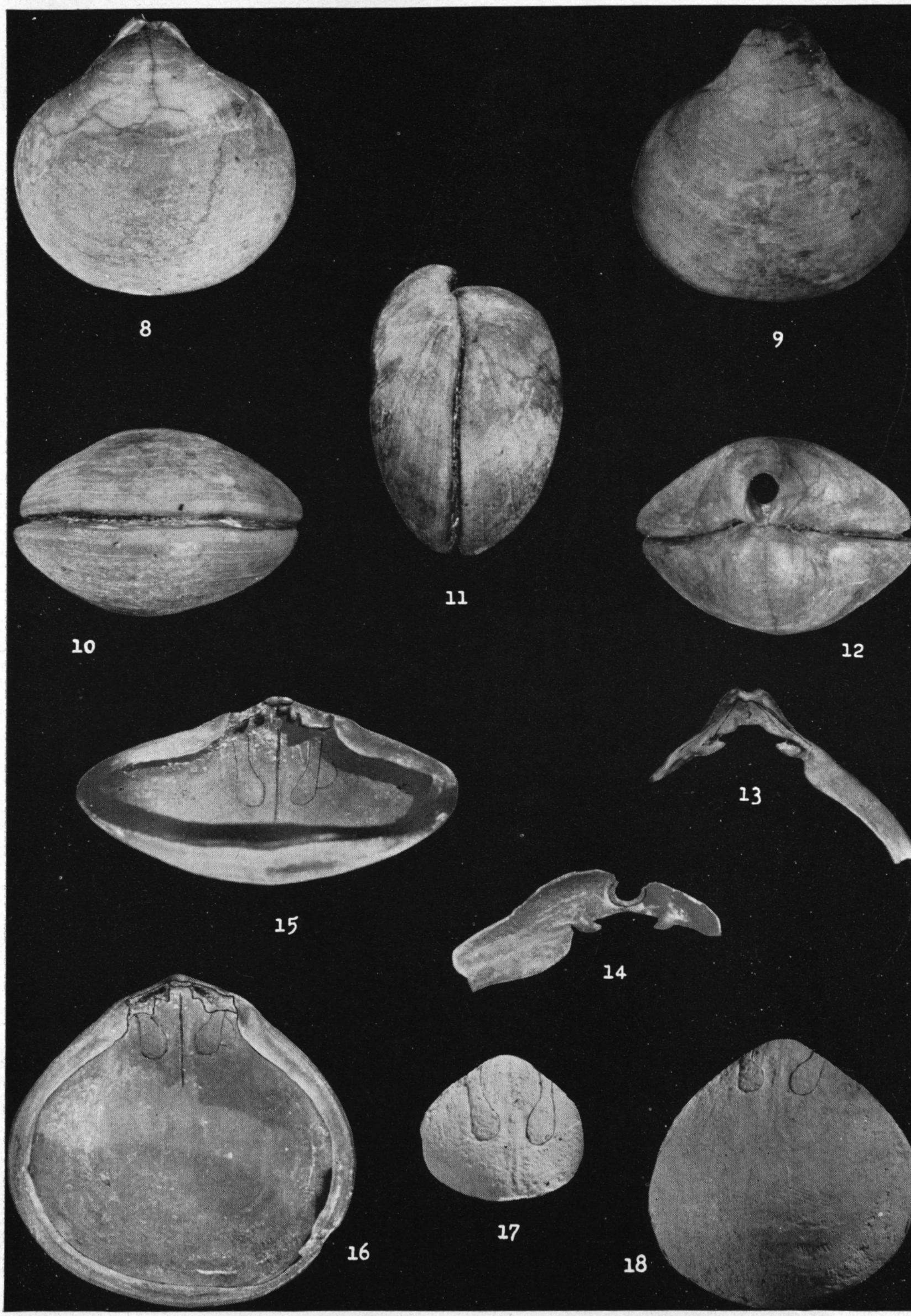
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