Palæontologie. — *Rudistids from Southern Santa Clara, Cuba.* By A. THIADENS. (Communicated by Prof. L. RUTTEN).

(Communicated at the meeting of September 26, 1936).

The material here described has been collected in 1933 by the Utrecht geological survey-party and by Dr. TSCHOPP of the "Bataafsche Petr. Mij.". Fig. 1 shows the localities. All the specimens are in the Geol. Inst. of the Utrecht University. The Rudistids belong to the Maastrichtian, all but one — *Radiolites macroplicatus* — being associated with maastrichtian Foraminifera. Generally one locality yielded only one or two species; H 627, however, yielded: *Barrettia sparcilirata, Bournonia* n.s., *Bournonia* sp., *Titanosarcolites giganteus* and Caprinid fragments; L 549: *Parastroma sanchezi, Bournonia thiadensi* and *Tampsia rutteni.*

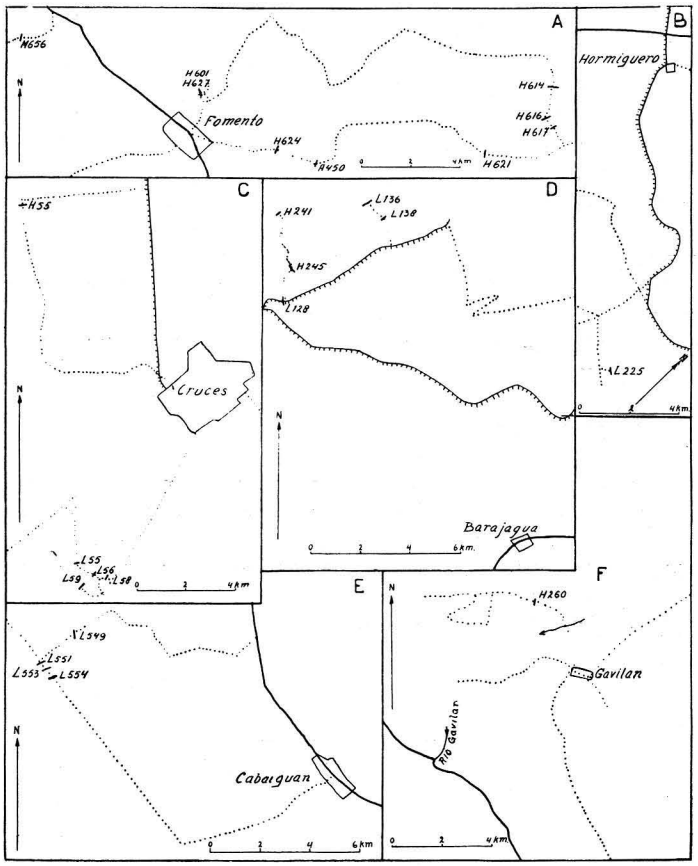

Fig. 1.

Caprinid fragments. Textf. 3 (13, 14).

There are several fragments of Caprinids of which no sure generic determination can be made. At H 617 we found a *Coralliochama*-like fragment. Nothing can be seen of ligament or dental apparatus. Inside of a 3 mm broad marginal layer with pyriform canals in a single row follows an, at least 40 mm thick layer with very regular, small, polygonal and roundish canals (diameter: 0.6—0.75 mm). The canals are tabulate, the tabulae 1—1,5 mm apart. Associated with *Bournonia* and *Orbitoides*.

At H 616 we found the remarkable form fig. 3, 13, drawn after a photo of a thin section. Inside of a marginal single or double row of pyriform canals follows a row of flat, oval canals, and then a row of roundish, oval canals. Associated with the maastrichtian *Camerina vermunti* (in litt.).

H 627 yielded, together with *Lepidorbitoides* the form figured on fig. 3, 14 which possibly is a fragment of *Antillocaprina*.

Barrettia sparcilirata WHITF. Pl. f. 2; textf. 2 — (KÜHN, Foss. Catal. pars 36. 1932, with previous literature; — BOISSEVAIN and MAC GILLAVRY, these Proc. XXXV, 1932, p. 1303—1308, fig. 1—3).

12 specimens; the small and flat ones being young. For measurements see the table. All important features show a rather strong variability.

	a	b	c	d	e	f	g	h	i	j	k	l
Diameter in cm.	6.75	9.1	6.8	8.1	11	7.1	15	8.2	11.5	9.6	7.2	7.6
Height in cm.	4.2	6.0	4.5	7	7.3	6.15	16	3.5	14	3.8	>4.5	9.6
Number of infoldings	2x14')	34	26	29	36	26	35	33	34	2x20'')	18	15
Ligamental crest r(ight).b(curved).	r	b	?	b	b	b	r	b	b	b	b	?
Part of circumference between E and L. Ratio LS to SE	1/2.4 LS<SE	1/2.6 LS<SE	1/3.6 LS=SE	1/3.4 LS<SE	1/4 LS<SE	1/4.5 LS<SE	1/4.5 LS<SE	1/5 LS<SE	1/4 LS<SE	1/4 LS<SE	1/3 LS?SE	1/4 LS?SE
Dental inclination in degrees	75	80	?	70	?75	?	60	60	40	60	?	?
Angle AII-PIV/PIV-mp.	150	140	?	125	?135	?	155	130	150	130	?	?
Position mp a,b and c''')	a	c	?	b	a	a	b	b	a	c	?	?
Distance between tabulae in mm.	2	3-3.5	5	2-4	2.5-5	3	5	3.5-5.5	4	4-5	?4	3-5

') ½ circumference has 14 infoldings
'') ½ circumference has 20 infoldings
''') a:on the side of S
b:centrad from S
c:between a and b

We regard the specimens a and b of the table as most typical: L and E wide apart, great dental inclination and great angle between the lines A II—P IV and P IV—mp. j and i differ from the preceding ones by having the distance L—S (along the circumference) much longer than S—E (indicated on the table: $\langle\langle$). l and k are aberrant by having only 18 and 15 infoldings. In spite of these differences we reckon all to the same species: the infoldings are vermiculate and the dental inclination 60° or more (exc. i). The number of infoldings is rather large. We counted them on the outer surface and not in the sections, where the smallest are not visible. Some rests of the upper valves show nothing remarkable. Near the

S the inner shell-layer often forms a marked protuberance into the body cavity (d, e, h, i, j). The surface is marvellously preserved with fine longitudinal ribs (Pl. f. 2), measuring from ridge to ridge 0.75 mm. Tabulae 2—5 mm apart.

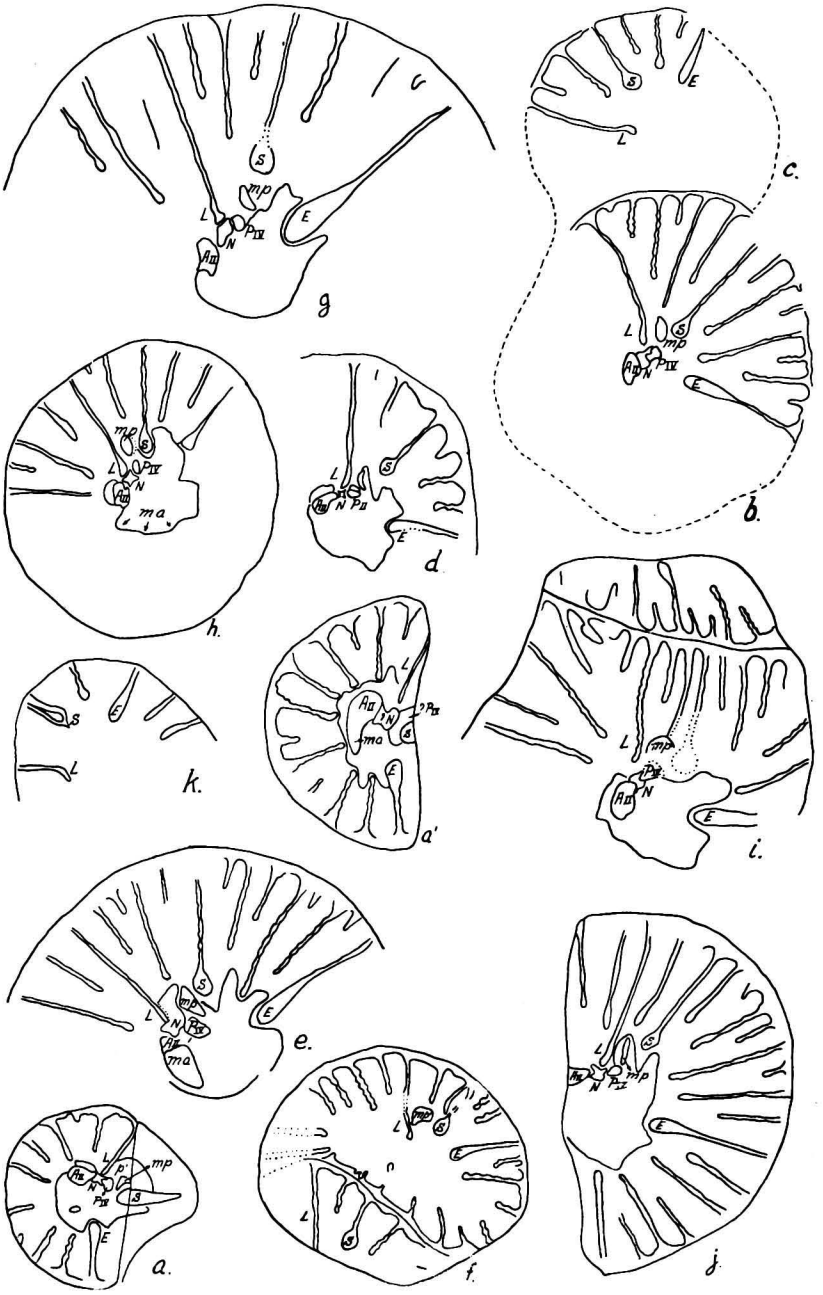

Fig. 2. *Barrettia sparcilirata* WHITF. Drawings from sections. L: ligament, S, E: siphonal pillars, N: tooth of lower valve, AII, PIV: teeth of upper valve, ma, mp: anterior and posterior myophore.

With BOISSEVAIN and MAC GILLAVRY I think it unjustified to create a new genus for *B. sparcilirata,* as TRECHMANN (11) and PALMER (8) have done. *B. sparcilirata* is related to the other species of *Barrettia* by transitional forms. PALMER (8) describes *Praebarr. porosa* with a fine "estructura porosa" (tabulae 1—2 mm apart) and *Praebarr. sparcilirata* var. *cubensis* (tabulae 5—12 mm apart). If the space between the tabulae is a specific feature, our specimens, having spaces from 2—5 mm, belong to *B. sparcilirata* as described and photographed by WHITFIELD, which has 4 mm tabular space (13, pl. XXXVI).

Localities: L 128 with *Lepidorbitoides* and *Orbitoides palmeri*; H 627 with *Lepidorbitoides* and *Vaughanina cubensis.*

Parastroma sanchezi H. DOUV. Pl. f. 1 — (H. DOUVILLÉ, Bull. Soc. Géol. Fr. 4, XXVI, 1926, p. 133—134, pl. VIII, f. 1—4; — MAC GILLAVRY, these Proc. XXXVIII, 1935, p. 559, 560; — *Orbignya sanchezi*: PALMER, Rev. Agr. Habana, 14, 1933, p. 97, pl. I, f. 2; pl. II, f. 1; pl. III, f. 2).

9 specimens: 8 fragments of lower valves and 1 almost complete specimen. They show the shell structure as photographed by DOUVILLÉ. Sections in tangential and radial direction show innumerable, small, sharp folds of the tabulae, mostly arranged above one another in the different tabulae. The little folds in the tabulae appear therefore to be dome-like. On horizontal section small circles, marking the section of these dome-like folds are arranged on irregular lines (pl. f. 1). In my opinion these small circles have induced DOUVILLÉ and PALMER to describe the existence of resp. "columns" and "tubos verticales capilares". Apart from the dome-like mikro-folding the tabulae show large, gentle, radial folds, measuring from upfold to upfold about 8 mm, each large fold containing about 12 mikro-folds. There are 76 of these undulations. Five large specimens measure: diameter near the top 26, 39, 37, 39, 35 cm; and height resp. 19, 18, 31, 37 and 27 cm. The diameter of the body-cavity of the last mentioned specimen is 8 cm; distance from E to S along the circumference 20 cm, being $^1/_5$ of the whole circumference. Dental apparatus not well discernible in our section. Upper valve almost entirely eroded, only the lower part of it preserved in the centre and showing equally 76 undulations.

Localities: L 554, L 553, L 550 and L 549, in the last one with *Pseudorbitoides* and *Camerina vermunti.*

Radiolites macroplicatus WHITF. Pl. f. 4, 5; textf. 3 (4, 5). — (WHITFIELD, Bull. Am. Mus. N. H. ix. 1897, p. 190, 191, pl. XII, f. 2; pl. XIII, f. 8; pl. XIV, f. 2).

17 specimens, 14 collected by Dr. TSCHOPP at T 1384 (12 km S 30 W from S. Spiritus), 2 at T 1526 (San Diego de los Baños, prov. Pinar del Rio) and 1 by us at H 802 (same locality as T 1526). Almost all specimens, eroded, only sometimes showing their surface.

This species belongs to *Radiolites,* having: 1. a well established, deep,

ligamental infolding, 2. no proper bands in the siphonal zone, 3. strong, wide folds in the funnel plates of the lower valve throughout, 4. on hor. section a reticulate structure with radial orientation, as known from several *Radiolites*, easily discernible from the strongly reticulate structure of *Sauvagesia* and *Durania*. My material agrees well with the incomplete description and figures of WHITFIELD [exc. pl. XII, f. 3, which probably is another species; TRECHMANN (11, p. 405) wrongly thought pl. XIII, f. 8 to be a young *Coralliochama*]. Cuban specimens mostly solitary, upright, of small to medium size, long, cylindrical, in the youth conical, sometimes slightly curved, nearly circular in cross section. Only one specimen is broader than high: 65 × 40 mm. The other ones range from 40 × 60 to 90 × 160 mm. Shell of medium thickness, max. 18 mm. Body-cavity subcircular, diam. up to 70 mm. In one specimen some traces of lamellar cortex. Outer shell layer with funnel plates and prisma cell-walls. Corresponding to the down-folds in the funnel plates there are rather acute ribs, 15—18 in number. The prisma cells mostly wider than high, sometimes reverse, always convex on the lower side. Funnel plates more or less crowded, there being in 3 mm 4—15. They form an angle with the axis of the animal in the downfolds of 110° and in the upfolds of 75°. The outer surface gives the impression of „lames externes en cornets emboités" (TOUCAS). S and E on the ventral side, slightly excavated, easily discernible formed by slight upfoldings of the funnel plates, which are flatroofed and broader than the other folds. Mostly E somewhat larger than S. Interbande consisting of two regular downfolds and one upfold (textf. 3, no. 4). Upper valve convex, covering the whole lower valve. Apex subcentral to slightly excentral toward the dorsal side. Ligamental crest long (3—12 mm), in two specimens very thick, pathological. In one of these the ligamental crest is 9 mm long and 5 mm thick! Hinge apparatus of the Radiolitidae-type, myophores rather broad. On both sides of the ligamental crest secondary body-cavities.

In the TOUCAS-groups we should place this species at the end of the second (*Rad. sauvagesi*) group, near *Rad. styriacus* and *Rad. aurigerensis*. These seem, however, to have only one interbande-fold (lit. 17, 10). *Rad. jovis* ASTRE (1, p. 94, 95) has a coarser siphonal zone with one interbande fold.

Bournonia planasi THIADENS n.s. Pl., f. 3, 6, 8; textf. 3 (1).

Larger and smaller fragments of lower valves, with very thick outer shell layer, badly delimited S and E, without distinct interbande-rib and without ligament, therefore belonging to *Bournonia*. Only the type-specimen (Pl., f. 3) is well-preserved. It is large, oval; diameter dorso-ventrally 31 cm and perpendicular to it 19 cm. Height 16 cm. Body cavity broad-oval, 14 × 11 cm. Shell very thick, at the dorsal side 11,5 cm, at the anterio-ventral side 9,5 cm. Outer shell layer with very fine, typical structure, consisting of many funnel plates (15 μ thick), separated by

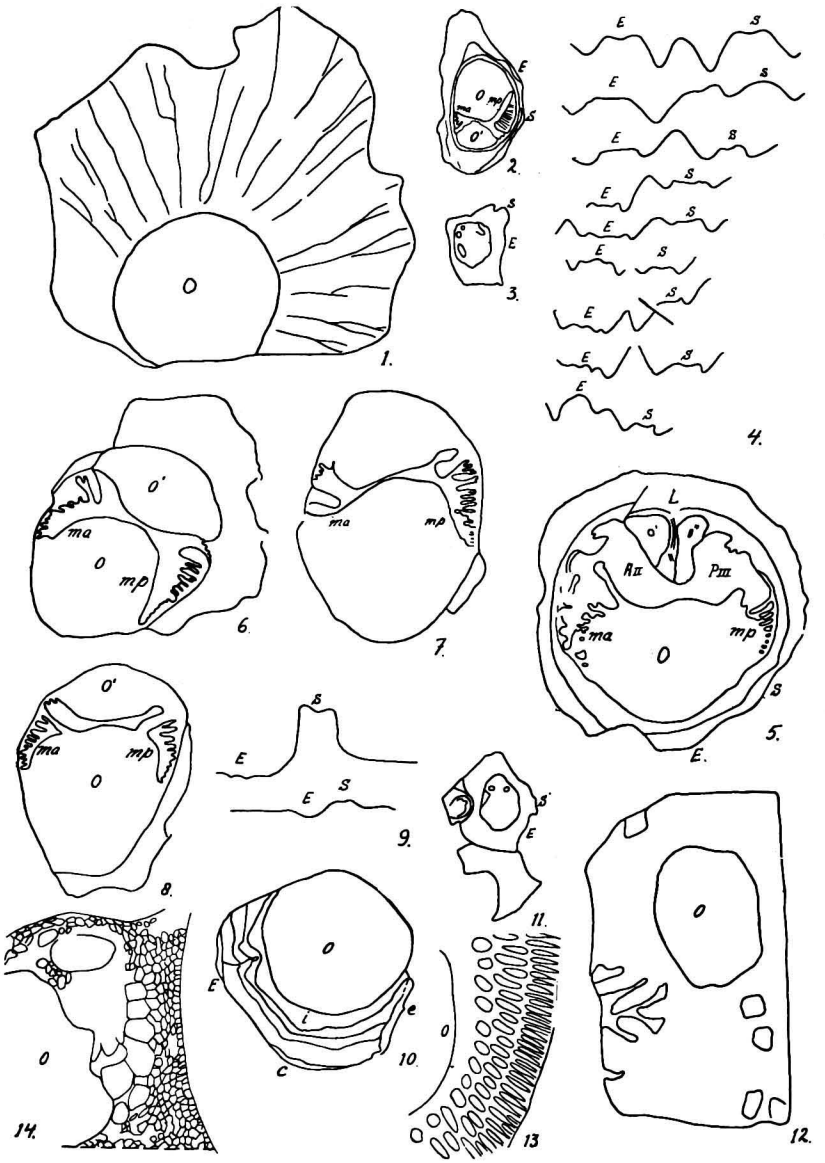

Fig. 3. 1. *Bournonia planasi* n.s. × ½. Hypotype; with vessel-impressions.
2, 6, 7, 8, 9. *Bournonia* n.s. Syntypes; × ½. S, E: siphonal zones; O: body cavity; O′ dors. acc. cavity; ma, mp: ant. and post. myophores. (9: two unrolled curves of siphonal zones).
3. *Bournonia* sp. × ½.
11. *Bournonia* sp. × ½. Hor. sect. of three specimens.
4, 5. *Radiolites macroplicatus*. × ½. O: body cavity; O′, O″: acc. body cavities; L: ligam. crest; S, E: siphonal zones; AII, PIII: teeth; ma. mp: ant. and post. myophores. (4: unrolled curves of siphonal zones of different specimens).
10. *Tampsia rutteni* VERMUNT (in litt.). × ½. c: cortex, E: fold.
12. *Titanosarcolites giganteus*. × ½. Showing origin of big canals.
13. Caprinid fragment. × 1,6.
14. Fragment of ??*Caprinula*. × 2.

spaces of about 40 μ or less. On tangential section they are straight lines with some slight, small foldings on regular distances; prisma cell-walls scarcely to be seen. On radial section (Pl. f. 6) the funnel plates are straight lines without folding; prisma cell-walls difficult to discern. On horizontalsection (Pl. f. 8) prisma cell-walls (37 μ thick) roughly radially arranged, showing a striate structure; prismacells 110 μ wide. Well-discernible vascular impressions on the limbe, concave at the upper side, bifurcating towards the exterior (textf. 3, no. 1). E corresponds with a 40 mm broad, low zone with horizontally arranged funnel plates; S higher situated on an obtuse rib, 25 mm broad; I asymmetrical, slightly downward tolded, 40 mm broad. Part between S and dorsal side with one, large undulation, between E and dorsal side with three undulations. Dorsal side corresponding with an upfolding, ventral with a downfolding. Interior of lower valve well-preserved with the two myophores, the tooth alveoles (a′, p′), the body-cavity and the dors. acc. cavity (Pl. f. 3). A second specimen, more eroded shows the same features.

This form is different from all known species of *Bournonia*. It resembles *B. haydeni* DOUV. (3, p. 9—11), which is smaller and has a coarser structure. Typical for the new species are: the fine structure, the thick shell, the slightly undulated funnel-plates and the asymmetrical siphonal zone.

Localities: H 241 and H 245 near L 128 with *Lepidorbitoides, Orbitoides palmeri, Camerina vermunti*; L 223, with *Orbitoides browni*. Type locality is L 223.

Bournonia n.s. Pl. f. 7, 9; textf. 3 (2, 6, 7, 8, 9).

8 Specimens. All fragments of lower valves, sometimes with part of upper valve. Conical to flat conical. Height up to 55 mm. Body cavity oval, 30 × 23, 70 × 50, 53 × 38, 60 × 50 and 25 × 18 mm, the dorsoventral diameter being the largest. Shell very thick, up to 45 mm. Structure fine, sometimes reticulate to radially striate, always partly or wholly denticulate. Test consisting of many fine funnel plates (15 μ), max. 160 μ apart, whereupon fine spiculae and vertical, vermiculate prisma cell-walls (12½ μ). On three specimens S and E can be seen. They are very asymmetrical, S corresponding with a high upfold and a marked rib, I with a asymmetrical downfold, E with a very slight, broad upfold. I broader than S and E. Funnel plates scarcely folded along the rest of the circumference. This form belongs to *Bournonia* for the absence of ligamental crest, the rather badly delimited S and E, the thick shell, and the relatively small interbande. There is a very large dors. acc. body cavity, separated from the main body cavity by a long, narrow bridge, joining the teeth and myophores. Myophores large and triangular. Typical for this species are the structure, the large, accessory cavity and the asymmetrical siphonal zones. Structure different from *B. planasi* (Pl. f. 6, 7, 8, 9). The material is too poor for adequate specific description.

Locality: H 601, with *Lepidorbitoides* and *Vaughanina cubensis*.

Bournonia thiadensi VERMUNT (in litt.).

One specimen of this species, which will be shortly described by L. VERMUNT from Pinar del Rio, has been found at L 549, with *Pseudorbitoides* and *Camerina vermunti.*

Bournonia sp. Textf. 3 (3, 11).

Two small specimens; rectangular; without ligament; S on a rib; E "à fleur du test"; S and E on a long side of the rectangle. The opposite side is flat. Diameter 30 × 17 mm. Outer shell-layer up to 8 mm thick. Funnel plates 45 μ. Perpendicular to the funnel plates near the body-cavity many small, acute pillars. Towards the periphery they become vermiculate walls; at the dorsal and ventral side they pass into long, radial, anastomozing walls, causing a striate structure. So, here appear in one test together typical striate, reticulate and denticulate structures!

This form much resembles "*Parabournonia hispida*" (lit. 9).

Locality: H 627, with *Lepidorbitoides* and *Vaughanina.*

Biradiolites aquitanicus TOUCAS. (TOUCAS, Mém. Soc. Géol. Fr. Pal. 17, 1909, p. 107, Pl. XX, f. 20; VERMUNT, in litt.).

Two well-preserved specimens, about as large as TOUCAS' type or somewhat larger; length 65 and 100 mm; Diameter dors. ventr. × ant. poster. 70 × 55 and 100 × 75 mm. E, S and I agree well with TOUCAS' specimen; E corresponding with a broad, flat-bottomed downfold, S with a downfold on a broad rib (10 mm), and I consisting of a sharp downfold with, on both sides, an upfold. In the larger specimen (H 624) acc. dors. body cavity large; dental apparatus of normal type; myophores strongly developed; between S and dorsal side three sharp ribs (downfolds). Differing from TOUCAS' type by smaller siphonal zones. In the smaller specimen (L 549) the upper valve, partly preserved, consists of funnel plates, like the lower valve. Upper valve flat, convex. Structure of the outer shell layer denticulate.

Localities: H 624 and L 549, with *Pseudorbitoides* and *Camerina vermunti.*

Tampsia rutteni VERMUNT (in litt.). Textf. 3 (10).

Only one fragment of a lower valve, showing clearly the generic features on hor. section. The narrow infolding near E (11 mm) is closed at the periphery of the outer shell-layer. Growth-layers less undulated than in the types. The prismatic cells are slightly radially arranged. Funnel plates dipping 35° to the axis of the animal, on hor. section causing concentric circles.

This form differs from *T. lopez-trigoi* (8) by the strong inclination of the funnel plates; the Mexican *Tampsia's* are much larger and coarser.

Locality: H 614, with *Pseudorbitoides, Orbitoides* and *Vaughanina.*

Durania sp.

Two fragments of the outer shell-layer of lower valve. Structure "franchement réticulée". In one specimen all the prisma cell-walls are broken. Prisma-cells measure in diam. in hor. section about 2.25 mm. The vert. prisma cellwalls are 150 μ thick. Small, rounded ribs on the surface, measuring from ridge to ridge 1 mm, separated by grooves, as broad as the ribs.

The fragments resemble *D. curasavica* (6); they are coarser reticulate.

Locality: H 260, with *Camerina vermunti.*

Titanosarcolites giganteus (WHITF.). Textf. 3 (12). (TRECHMANN, Geol. Mag. LXI, 1924, p. 392—400, pl. XXIII, f. 1, 2; textf. 1; — DOUVILLÉ, Bull. Soc. Géol. Fr. 4, XXVI, 1926, p. 131—133, pl. VIII, f. 5; textf. 1, 2).

Fragments, characterized by large and many small canals in the outer shell-layer. One specimen shows the origin of the big canals, as TRECHMANN described (textf. 3, no. 11).

Localities: H 627, H 624, H 245, L 138, L 128, A 450, T 835, at several localities with *Lepidorbitoides, Vaughanina* and *Pseudorbitoides.*

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EXPLANATION OF PLATE.

Fig. 1. *Parastroma sanchezi.* Horizontal section of the shell. × 6.
Fig. 2. *Barrettia sparcilirata.* × 0,32.

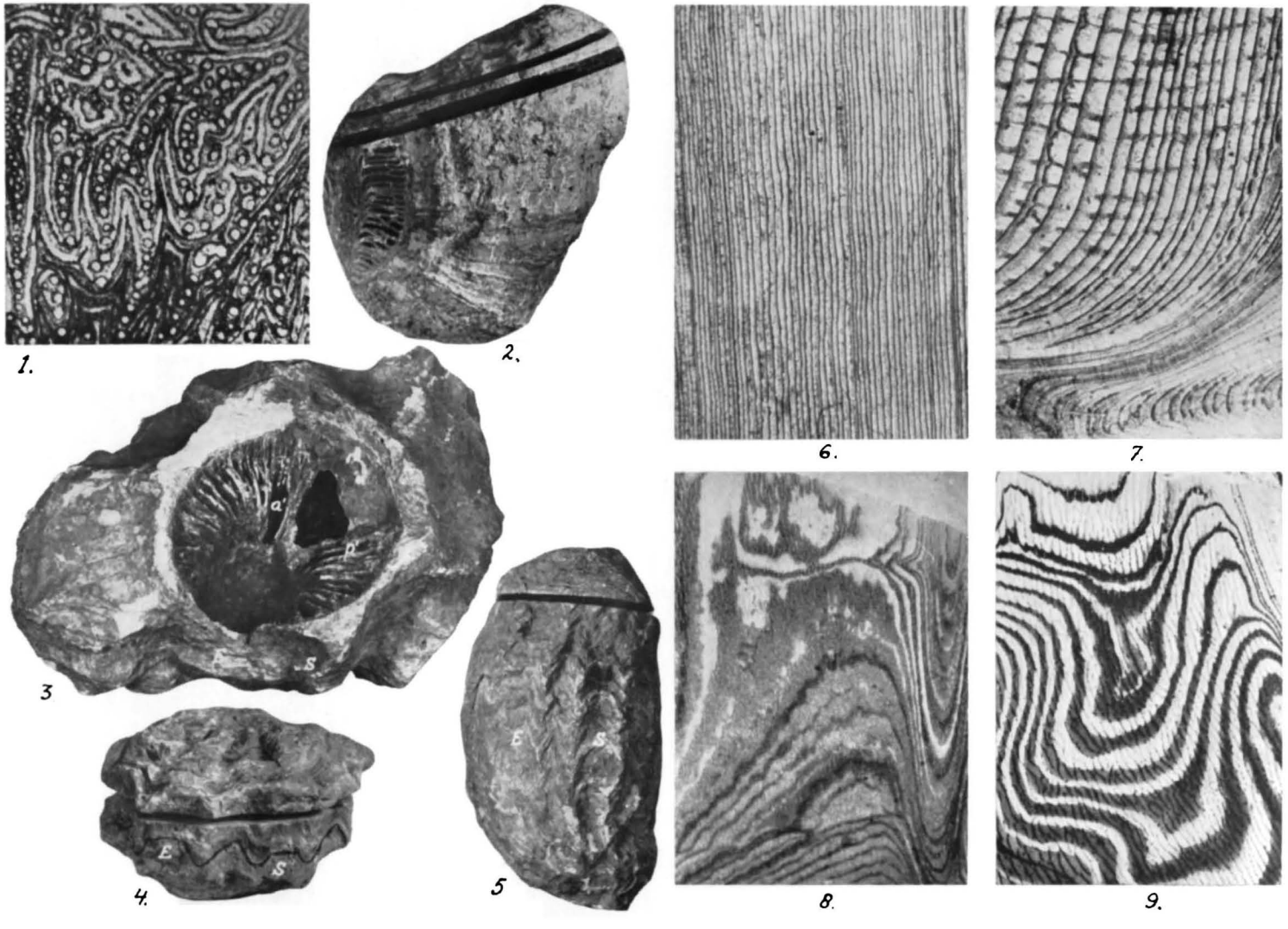
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Fig. 3. *Bournonia planasi.* Type specimen. × 0,27!
Fig. 4, 5. *Radiolites macroplicatus.* fig. 4: × 0,63, fig. 5: × 0,36.
Fig. 6, 8. *Bournonia planasi.* Fig. 6: vertical, radial section of the middle of the shell, × 21,5; fig. 8: horizontal section near the circumference. × 6.
Fig. 7, 9. *Bournonia* n.sp. fig. 7: radial section near body-cavity. × 21,5; fig. 9: horizontal section near the circumference. × 6.

Anatomy. — *Brain-bodyweight relation in human ontogenesis and the "indice de valeur cérébrale" of* ANTHONY *and* COUPIN. By J. ARIËNS KAPPERS. (Communicated by Prof. C. U. ARIËNS KAPPERS).

(Communicated at the meeting of September 26, 1936).

In 1926 ANTHONY and COUPIN [1]) introduced an "Indice de valeur cérébrale" with the purpose of a somewhat more fertile study of brain-weight development during ontogenesis than could be achieved by merely studying the simple relation between body- and brainweight.

Their index is expressed as follows. In a certain stage of ontogenesis is calculated, with the brain-bodyweight relation formula of DUBOIS [2]), the weight which the encephalon should have possessed with the body-weight which the concerned individuum really has. As we know, the formula of DUBOIS is $E = k P^r$, in which E is the weight of the encephalon, k the cephalisation coefficient, a factor which indicates the relative quantitative complexity of the brain, P the bodyweight and r the relation exponent which is approximately 0.25 comparing animals of the same species and 0.56 comparing different species. 0.25, therefore, is called the ontogenetic [3]) or better the intraspecial relation exponent and 0.56 the phylogenetic or interspecial exponent [4]).

As they were comparing individuals of the same species, ANTHONY and COUPIN considered it appropriate to use the intraspecial relation exponent. Furthermore they gave the cephalisation coefficient (k) the value which holds good for the adult, calculated with the intraspecial exponent. Applying this method, they calculated the brainweight which an adult specimen of the species would have, if its bodyweight should be reduced to that of the concerned stage of ontogenetic development. Their "Indice"

[1]) ANTHONY, R. and COUPIN, F., Introduction à l'étude du développement pondéral de l'encéphale. L'indice de valeur cérébrale au cours de l'évolution individuelle. Zagreb (1926).

[2]) DUBOIS, E., On the relation between the quantity of brain and the size of the body in Vertebrates. Proc. Royal Acad. Amsterdam, **16** (1913). Idem, Phylogenetic and ontogenetic increase of the volume of the brain in Vertebrata. Proc. Royal Acad. Amsterdam, **29**, 230.

[3]) For the use of the word ontogenetic in this connection I refer to the Summary.

[4]) DUBOIS also calls the ontogenetic exponent homoneuric and the phylogenetic one heteroneuric.

The expressions intraspecial and interspecial relation exponents are introduced by ARIËNS KAPPERS, C. U. for DUBOIS' ontogenetic and phylogenetic exponents (see his Evolution of the Nervous System, Haarlem (1930), p. 203).