to know if this people in contradistinction to the Sumerians [1]) were subbrachycephalic. If the ancient Assyrians and the present Aissori (or Suriani) as well as the Kohtan Arabs contain descendants of the Akkads the latter may have had the subbrachycephalic type and then the Kohtan Arabs might rightly bear the distinction of "el ariba" they give themselves, thus denoting their origin from the most ancient Semitic speaking group known in history.

The hyperbrachycephalic mixture added to the Armeno-Khaldean Assyrian groups probably came from Anatolia and may be due to Hittite influence, the earliest centre of which is probably to be looked for in Turkey.

In connection herewith it is an interesting fact that the ancient Hittite monuments more than the Assyrian reveal that peculiar post-auricular shortness of the head, which is the only means by which we can distinguish in profile projection brachycephalics and especially hyperbrachycephalics, of which only the postauricular shortheads are of hereditary predominance (FRETS) [2]).

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[1]) The exquisite dolicho- and mesocephalic Sumerian skulls from El-Ubaid (Ur of the Chaldees) and those from Kish have a totally different aspect from the Kohtan skulls. According to SIR ARTHUR KEITH they show a greater resemblance to the (Adnan) Arab type or rather a stock common among the (Adnan) Arab and Southern Indo-European as found in Afghanistan and Beluchistan up to the anthropological watershed of the Indus. Cf. Publications of the joint expedition of the British Museum and of the museum of the University of Pennsylvania to Mesopotamia, Vol. 1. Al-Ubaid by H. R. HALL and C. L. WOOLLEY. Oxford University Press, 1927.

For the description of the Sumerian skulls found at Kish, see L. H. DUDLEY BUXTON in: Excavations at Kish by S. LANGDON, Oxford University Press, 1924, Vol. 1. BUXTON, however, emphasized that at Kish in addition to the prevailing dolichocephalic skulls some distinctly brachycephalic skulls were already found, which may show that the brachycephalic race made a very early appearance in this region (c.f. also DUDLEY BUXTON. The peoples of Asia, Alfred Knopf, New York, 1925, p. 103). —

[2]) FRETS. Nouvelles observations sur l'hérédité de l'indice céphalique. 3ième Session de l'institut anthropologique de Paris, tenue à Amsterdam, 1927 (publié 1928). The praeauricular shortness of the head is regressive in heredity.

Geology. — *The Seroe di Cueba limestone from Curaçoa.* By M. G. RUTTEN and L. W. J. VERMUNT. (Communicated by Prof. L. RUTTEN.)

(Communicated at the meeting of February 27, 1932.)

Geology:

The Seroe di Cueba, a flat hill about 70—90 m. in height lies in Northern Curaçoa near the Eastern shore. The geology of the Seroe di

Cueba and its surroundings has been described by G. J. H. MOLENGRAAFF [1]), who also published a detailed map of this region. The hill consists of tertiary limestone, dipping slightly (till ± 15°) to the S.W. in the N.E. part of the hill and to the S.E. in the S.W. part. The limestone is transgressive over diabase. On the Southern side it begins with a conglomerate consisting of chert-fragments from the Kniplayers and of fragments of igneous rocks. This conglomerate bears sparse foraminifera. Higher up conglomeratic limestones alternate with white limestones, whilst the number of foraminifera increases. On the Northern side the Seroe di Cueba limestone is overlain by horizontal pleistocene coral-limestones. These begin in certain spots with a basal conglomerate of Seroe di Cueba Limestones. On the Northern side the basal Seroe di Cueba beds do not carry constituents of the older rocks. The thickness in the section we examined on the Northern escarpment is about 140 m.

MOLENGRAAFF found the following fossils:

Molluscs.
Serpula clymenoides Guppy.
Eupatagus grandiflorus Cotteau.
Eupatagus cf. depressus Jackson.
Oligopygus curasavica G. J. H. Mol.
Peronella martini G. J. H. Mol.
Peronella kloosi G. J. H. Mol.

The foraminifera where described by R. KOCH [2]) and L. RUTTEN [3]). KOCH found:

Polylepidina sp. common.
Pliolepidina panamensis Cushman very common.
Isolepidina cf. *raulini* Lem. & R. Douv. rare.
Isolepidina macdonaldi Cushman very common.
Isolepidina trinitatis H. Douv. common.
Isolepidina pustulosa H. Douv. common.
Isolepidina cf. *hubbardi* Hodson common.
Nephrolepidina tournoueri Lem. & R. Douv. rare.
Nephrolepidina morgani Lem. & R. Douv. rare.
Nephrolepidina yurnagunensis Cushman common.
Nephrolepidina sumatrensis Brady common.
Lepidocyclina curasavica Koch common.

He considers the limestone as lower oligocene.

L. RUTTEN some months later also described a series of foraminifera from the Seroe di Cueba. He found the following forms:

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[1]) G. J. H. MOLENGRAAFF. 1929. Geologie en Hydrologie van het eiland Curaçao. Dissertatie. Delft. p. 25—28.

[2]) R. KOCH. 1928. Tertiärer Foraminiferenkalk von der Insel Curaçao. Eclogae geol. 22. 1. p. 51—56, Pl. III.

[3]) L. RUTTEN. 1928. On tertiary Foraminifera from Curaçoa. These Proc. XXXI. Nº. 10, p. 1061—1070. Plate.

Pliolepidina tobleri H. Douv. very numerous.
Pliolepidina tobleri var. sparse.
Isolepidina trinitatis H. Douv. rather numerous.
Lepidocyclina brachiofora L. Rutten sparse.
Lepidocyclina curasavica Koch not common.
Nummulites striatoreticulatus L. Rutten not common.

He points out that the material of KOCH contained eocene forms besides the oligocene species, and as he has only found eocene forms he puts the limestone into the eocene.

In a second paper KOCH [1]) discusses this result. As his material came from the Western side and L. RUTTEN's from the Southern side of the hill he postulates that the building of coralreefs has been continuous from the upper eocene till the lower oligocene.

MOLENGRAAFF is of opinion that L. RUTTEN's results are to be more trusted than those of KOCH, as RUTTEN's material was by far the best. He doubts whether KOCH's definite conclusions on the quantitative number of the different species may be trusted, as the latter had only some small pieces of limestone at his disposition.

During our stay in Northern Curaçoa in 1930 we collected fossils at the Seroe di Cueba. One day was spent in collecting everywhere on the slopes and on the mountain itself. Should there have been only small areas of oligocene limestone, it was more likely to encounter oligocene forms in the dry rivers around the hill, than on the vast reef itself. A second day we collected samples from various layers from the section at the Northern escarpment, where nearly the whole formation is to be found. If there had been a continuous reefbuilding throughout eocene and oligocene time, this should be indicated by the samples. As the forms found in the section where quite the same as those collected on the first day (with the exception of *Operculina floridensis* Cushman, found only on the Southern flank),

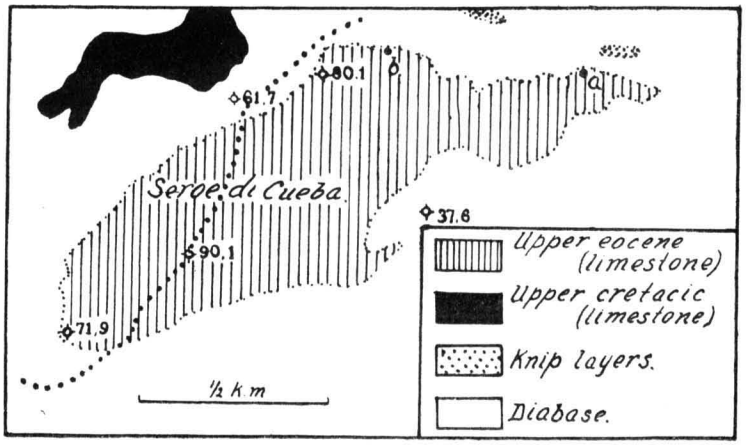
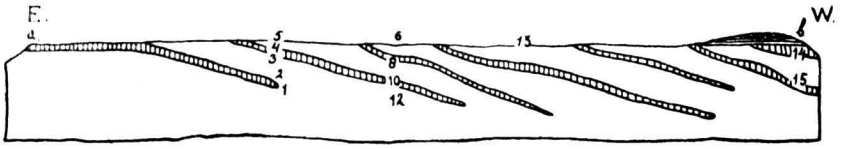


Fig. 1.

[1]) R. KOCH. 1929. Berichtigung und Ergänzung zu der Notiz „Tertiärer Foraminiferenkalk....." Eclog. geol. Helv. Vol. 22, N°. 2, p. 159—161.

we have only to discuss the first. In the accompanying figures a geological map of the Seroe di Cueba and a rough sketch of the Northern escarpment,



Escarpment of Seroe di Cueba, as seen from the North.

Fig. 2.

such as it is to be seen from a little hill to the North of it are given. Some limestonebanks are weathered out and show the gentle dip towards the W. The numbers in the section correspond with those of the samples below, *a* and *b* in the section corresponding with *a* and *b* in the map. On the Western side of the section the overlying Seroe Domi Limestone has been sketched diagramatically.

Sample 1. Ochre lithothamnia-limestone with rests of molluscs and a few foraminifera.
Lepidocyclina canellei Lem. & R. Douv. var. *hieronymi* n. var. rare.
Lepidocyclina maracaibensis Hodson rare.
Nummulites sp. rare.

Sample 2. Ochre, fine grained limestone without foraminifera.

Sample 3. White limestone, rich in lithothamnia and foraminifera.
Lepidocyclina curasavica Koch very common.
Lepidocyclina macdonaldi Cushman common.
Lepidocyclina canellei var. *hieronymi* n. var. rare.
Lepidocyclina trinitatis H. Douv. rare.
Polylepidina vanslobbeni n. sp. rare.
Nummulites sp. rare.

Sample 4. White lithothamnia-limestone with many rests of shells. Of foraminifera only:
Lepidocyclina trinitatis H. Douv. rare.

Sample 5. White porous lithothamnia-limestone with many rests of shells. Of foraminifera:
Lepidocyclina r. douvillei Lisson rare.
Nummulites sp. rare.

Sample 6. Fine grained, soft, ochre lithothamnia-limestone with many foraminifera. Chiefly nummulinids. Some *lepidocyclines* occur, that are, however, not to be determinated specifically.
Operculina nummulitiformis L. Rutten common.
Operculina curasavica n. sp. common.
Nummulites vanderstoki n. sp. common.

Sample 7. Soft, white, granular lithothamnia-limestone with many foraminifera.
Lepidocyclina trinitatis H. Douv. common.
Lepidocyclina weeksi Hodson common.
Lepidocyclina hubbardi aurarensis Hodson rare.
Lepidocyclina maracaibensis Hodson very common.
Lepidocyclina schotborghi n. sp. rare.
Lepidocyclina r. douvillei Lisson rare.
Nephrolepidina morgani Lem. & R. Douv. rare.
Pliolepidina tobleri H. Douv. very common.
Polylepidina zuliana Hodson rare.
Nummulites sp. rare.

Sample 8. White lithothamnia-limestone with foraminifera.
Lepidocyclina macdonaldi Cushman common.
Lepidocyclina trinitatis H. Douv. common.
Lepidocyclina weeksi Hodson rare.
Lepidocyclina schotborghi n. sp. rare.
Pliolepidina tobleri H. Douv. rare.
Nummulites vanderstoki n. sp. rare.

Sample 9. Soft, white, granular lithothamnia-limestone with many foraminifera.
Lepidocyclina curasavica Koch common.
Lepidocyclina canellei var. *hieronymi* n. var. rare.
Lepidocyclina macdonaldi Cushman rare.
Lepidocyclina trinitatis H. Douv. common.
Lepidocyclina weeksi Hodson common.
Lepidocyclina r. douvillei Lisson rare.
Pliolepidina tobleri H. Douv. rare.
Polylepidina vanslobbeni rare.
Polylepidina zuliana Hodson rare.
Helicolepidina spiralis Tobler rare.
Nummulites sp. rare.

Sample 10. White lithothamnia-limestone with many foraminifera.
Lepidocyclina trinitatis H. Douv. common.
Lepidocyclina weeksi Hodson very common.
Lepidocyclina maracaibensis Hodson rare.
Lepidocyclina r. douvillei Lisson common.
Pliolepidina tobleri H. Douv. rare.
Polylepidina vanslobbeni n. sp. rare.
Polylepidina zuliana Hodson rare.
Operculina curasavica n. sp. rare.

Sample 11. White, crumbling lithothamnia-limestone with many foraminifera.
Lepidocyclina macdonaldi Cushman rare.
Lepidocyclina trinitatis H. Douv. rare.
Lepidocyclina weeksi Hodson rare.
Lepidocyclina maracaibensis Hodson common.
Pliolepidina tobleri H. Douv. rare.
Operculina sp. rare.
Nummulites vanderstoki n. sp. common.

Sample 12. Ochre lithothamnia-limestone with foraminifera.
Lepidocyclina trinitatis H. Douv. rare.
Lepidocyclina weeksi Hodson rare.
Lepidocyclina maracaibensis Hodson rare.
Lepidocyclina r. douvillei Lisson rare.
Operculina curasavica n. sp. rare.

Sample 13. Ochre, fine grained limestone with foraminifera.
Lepidocyclina weeksi Hodson rare.
Helicolepidina spiralis Tobler rare.
Operculina curasavica n. sp. rare.
Operculina sp. sp. rare.
Nummulites vanderstoki rare.

Sample 14. Brown lithothamnia-limestone with foraminifera.
Pliolepidina tobleri H. Douv. common.
Operculina sp. common.
Nummulites sp. common.

Sample 15. Greyish white, porous lithothamnia-limestone with foraminifera.
Pliolepidina tobleri H. Douv. rare.
Operculina curasavica n. sp. rare.
Operculina sp. rare.
Nummulites sp. rare.

The occurrence of: *Lepidocyclina macdonaldi* Cushman, *Lepidocyclina trinitatis* H. Douv., *Lepidocyclina weeksi* Hodson, *Lepidocyclina aurarensis* Hodson, *Lepidocyclina maracaibensis* Hodson, *Lepidocyclina r. Douvillei* Lisson, *Pliolepidina tobleri* H. Douv., *Helicolepidina spiralis* Tobler, and *Operculina nummulitiformis* L. Rutten, puts the Seroe di Cueba limestone in the eocene, whereas the occurrence of *Lepidocyclina macdonaldi* Cushman, *Lepidocyclina trinitatis* H. Douv., *Pliolepidina tobleri* H. Douv. and *Helicolepidina spiralis* more precisely defines it to be upper eocene.

We must conclude that *Nephrolepidina morgani* Lem. & R. Douv. and *Operculina floridensis* Cushman occur already in the upper eocene; and have to attribute an upper-eocene age to the new forms: *Lepidocyclina curasavica* Koch, *Lepidocyclina canellei* Lem. & R. Douv. var. *hieronymi* n. var., *Polylepidina vanslobbeni* n. sp., *Operculina curasavica* n. sp. and *Nummulites vanderstoki* n. sp.

Throughout the section the occurrence of foraminifera is rather constant. There is a strong increase in number towards the middle of the section, which may be due to facial differences of the various beds. The same may count for the fact that in the samples **6** and **14**; the greater part of the foraminifera are nummulinids.

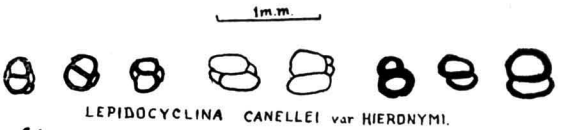
Our result is quite different from KOCH's, and also from his second paper. We find the whole Seroe di Cueba Limestone to be of upper eocene age, with perhaps a very little spot on the Western side — where KOCH's material was collected — being lower oligocene. This, however, is not likely, for the youngest parts of the limestone must lie in the middle of the mountain (our samples 14, 15) if there is no intricate tectonic anomality at the Westernmost part of the hill. KOCH's material was kindly submitted to our examination by Dr. RUSCH, curator for pal. of the Basel Mus. for Nat. Hist. KOCH's results differed mainly from ours, as he found *Pliolep. panamensis* and four species of *Nephrolepidines*. As will be discussed under *Pliolep. tobleri*, *Pliolep. panamensis* does not occur in KOCH's material, the pliolepidines being for the greater part *Pliolep. tobleri* and a few *Pliolep. sp.*, that are not identical with *P. panamensis*.

Owing to the extreme resemblance in some sections of many isolepidine and nephrolepidine forms we only made a difference on good horizontal sections. With KOCH's scanty material this brings us towards a difficulty. In his material not one horizontal section of a *Nephrolepidina* is to be found. It may be possible, however, that *Nephrolepidina* occurs in uncharacteristic sections, thus giving the fauna at the Western side a different aspect than that of the rest of the hill.

KOCH mentions the occurrence of Seroe di Cueba Limestone near Poos

fig. 1. fig. 2

Lepidocyclina curasavica



LEPIDOCYCLINA CANELLEI var HIERONYMI.

fig. 3.

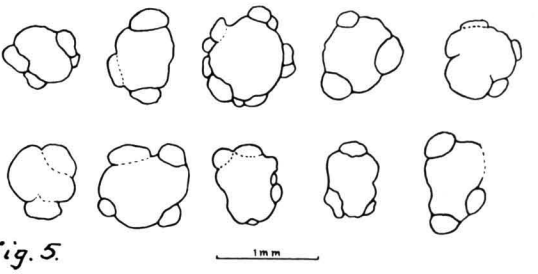


fig. 5.

L.(Pliolepidina) tobleri.

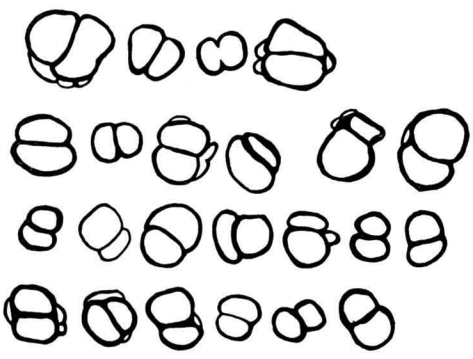


fig. 4. LEPIDOCYCLINA TRINITATIS

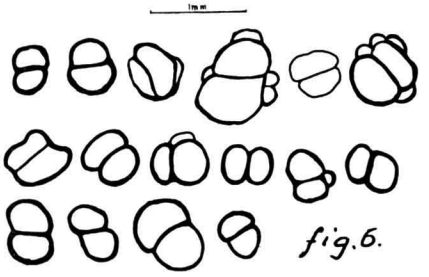


fig. 6.

LEPIDOCYCLINA WEEKSI

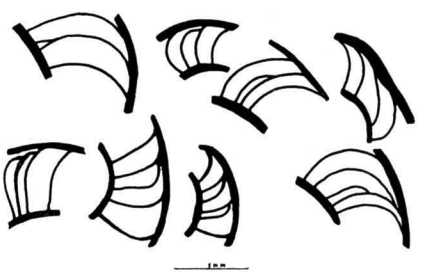


fig. 7.

Operculina nummulitiformis.

fig. 8a.

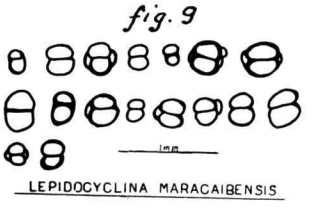


fig. 9

LEPIDOCYCLINA MARACAIBENSIS

fig. 10.

Operculina peruviana.

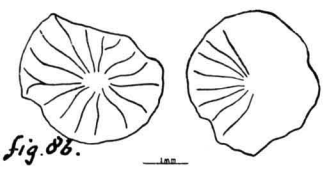
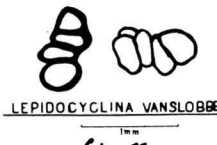


fig. 8b.



LEPIDOCYCLINA VANSLOBBENI

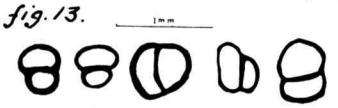
fig. 11

fig. 12.

L.(Isolepidina) hubbardi aurarensis x14.

Nummulites vanderstoki

fig. 13.



LEPIDOCYCLINA MACDONALDI

fig. 14. LEPIDOCYCLINA SCHOTBORGHI

fig. 15.

L.(Isolepidina) schotborghi x28.

Monton [1]) near the Southern boundary of the Plantation Savonet. This is situated on the boundary of diabase and non-typical Kniplayers. The limestone has been found in a heap of detached rocks. Throughout the Northern Curaçoa run low walls built of stones, indicating boundaries of plantations etc. Moreover on the plantation Savonet large dikes have been built through the dry rivers to prevent the water from flowing rapidly away. We frequently observed how on those dikes detached material is to be found of beds lying far away. Near a "Poos" or waterhole human activity is of course concentrated, and, with the Seroe di Cueba in the neigbourhood, this occurrence has not the least certainty.

Paleontology:

Genus Lepidocyclina Gümbel.

Lepidocyclina curasavica Koch. (Pl. I, fig. 1, 2; Pl. II, fig. 5).

Lepidocyclina curasavica Koch. Eclogae geol. Helv. 1928, Vol. 21, N°. 1, p. 54, fig. 1—4.

This large, rotund microspherical form is to be found in great quantities on the slopes of the Seroe di Cueba, and in the dry rivers that "flow" away from it. In the rock itself it is by far not so common. It occurs only in certain horizons, other parts of the section being completely bare of it. The macrospherical form is unknown. There occurs on the Seroe di Cueba a variety of *Lepidocyclina canellei*, which shows the same arrangement of pillars and also the small square median chambers. This, however, is not so rotund, and, whilst *L. curasavica* is very common in the horizons, where it occurs, the variety of *L. canellei* always is rare. This is against the rule that the macrospherical form should be the commonest. KOCH mentions the possibility that *L. curassavica* is the microsphere form of *Pliolepidina panamensis*. As in the section, and also in the detached specimens of the slopes of the hill we did not find a single specimen of *P. panamensis* itself this is not probable. KOCH says that: "das Lumen der Lateralkammern ist gleich gross oder — besonders in den peripheren Teilen — kleiner als die Wanddicke." This is only true for the height of the lateral chambers. A tangentional section shows large, irregular lateral chambers with thin walls. Moreover KOCH says: "Im Zentrum treten zahlreiche spindelförmige Pfeiler auf. Sie erreichen die Oberfläche nicht." This is not accurate. The pillars reach the outer side of the test, and in worn specimens they form with the chamberwalls a fine network on the surface. As a fact the pillars are not "spindelförmig". Their thickness is constant or only a little greater at the top than at the base. The tangentional section shows the numerous small pillars, measuring about 50 μ, an arrangement which is quite the same as in *L. canellei*. What KOCH has taken for pillars in the vertical section are mostly rows of walls of lateral chambers, as will be clear by comparing vertical sections with tangentional horizontal sections.

Subgenus Lepidocyclina (s.s.).

The isolepidine lepidocyclines of the Seroe di Cueba vary rather strongly. This is not only true for outer features such as diameter and thickness of test, but also for the diameter of the median chambers, the number and arrangement of pillars and last not least for the embryonal apparatus. At first glance one is inclined to think that many of the isolepidine embryons are intermediate between *Lepidocyclina* and *Nephrolepidina*. We have drawn therefore the embryonal apparatus of a great number of isolepidines, omitting the regular median chambers, but indicating irregular greater chambers eventually lying in the immediate neighbourhood of the embryon itself. Under *Lepidocyclina trinitatis*, where this variation is of peculiar interest in relation with the species *Nephrolep. kochi* a full discussion will be given. As many species of this subgenus are nearly related we

[1]) Poos Monton lies 800 m. to the N.N.E. of L. 371. See our map of Northern Curaçoa in these Proceedings, Vol. 34, p. 1029.

have tabulated the measurements of some of them. These show in each case that the different species are well established, as usually even the extreme variations do not overlap each other. Determinations of microspheric forms were not made.

Of rare occurrence is a quite baffling *Lepidocyclina*. It has all the features of *L. weeksi* Hodson. Its layer of lateral chambers, however, is not an even plane, but branched. Pl. II, fig. 4 shows clearly the even, slightly convex layer of median chambers with a third branch going out from the embryon. Pl. III, fig. 1 shows another individual in a differently orientated section. To the left is the one of the branches sectioned in its equatorial plane, whereas to the right another branch is seen vertically. As we have only four specimens, scattered over the whole section, we do not know, wether they are mere monstruosities of *L. Weeksi*, or wether they belong to a different species.

Lepidocyclina (Lepidocyclina) macdonaldi Cushman. (Pl. I, fig. 13).

Lepidocyclina macdonaldi Cushman. U. S. Geol. Surv. 1919. Prof. paper 125-*D*, p. 77, Pl. XXXIV, fig. 1—3.

KOCH found this species rather common. In our section it occurred only in certain horizons, being rather common, however, in two of them. The thin margin, encircling the test has always a thicker collar. Now and then the thin marging was rather wide, and the test was very much alike that of *Pliolepidina panamensis*. Always, however, the embryon was distinctly isolepidine, as is to be seen in the accompanying drawings.

Lepidocyclina (Lepidocyclina) canellei Lem. & R. Douv., var. hieronymi, n. var.
(Pl. I, fig. 3; Pl. II, fig. 10).

This form occurs throughout the whole Seroe di Cueba section, but is always rather rare. It is quite alike *L. canellei* s.s. This is true for the general appearance, the diameter of test and embryon, the isolepidine form of the embryon and also for the irregular lateral chambers with thin walls and a great many small pillars, not attaining 50 μ. The diameter varies from 2.3—4.5 mm. The diameters of the embryon from 400 × 350 μ to 300 × 200 μ. H. DOUVILLÉ [1]) gives for the embryon 490 μ, but figures three embryons measuring 300 μ. 350 μ and 400 μ; the type specimen of LEMOINE and R. DOUVILLÉ [2]) having an embryon of 400 μ. The only difference of the new variety with the species s.s. is that the median chambers are square throughout the whole equatorial plane. They are small, measuring about 50 μ.

Diameter in mm.:	2.3	2.8	3.0	3.0	3.1	3.1	3.3	4.5
Embryon in μ:	300 × 200	350 × 200	350 × 250	400 × 350	400 × 300	300 × 200	400 × 350	350 × 350

Lepidocyclina (Lepidocyclina) trinitatis H. Douv. (Pl. I, fig. 4).

Isolepidina pustulosa A H. Douv. 1917 C. R. Ac. Sc. t. 164, p. 844, fig. 3.

Isolepidina Trinitatis H. Douv. 1924. Mém. Soc. Géol. de France. Mém. 2, t. 1, pp. 34, 35, figs. 7—12. Pl. 1, fig. 1.

Lepidocyclina trinitatis caribbeanensis Hodson. Bull. Am. Pal. Vol. XII. Bull. 47, p. 20. Pl. 4, fig. 5.

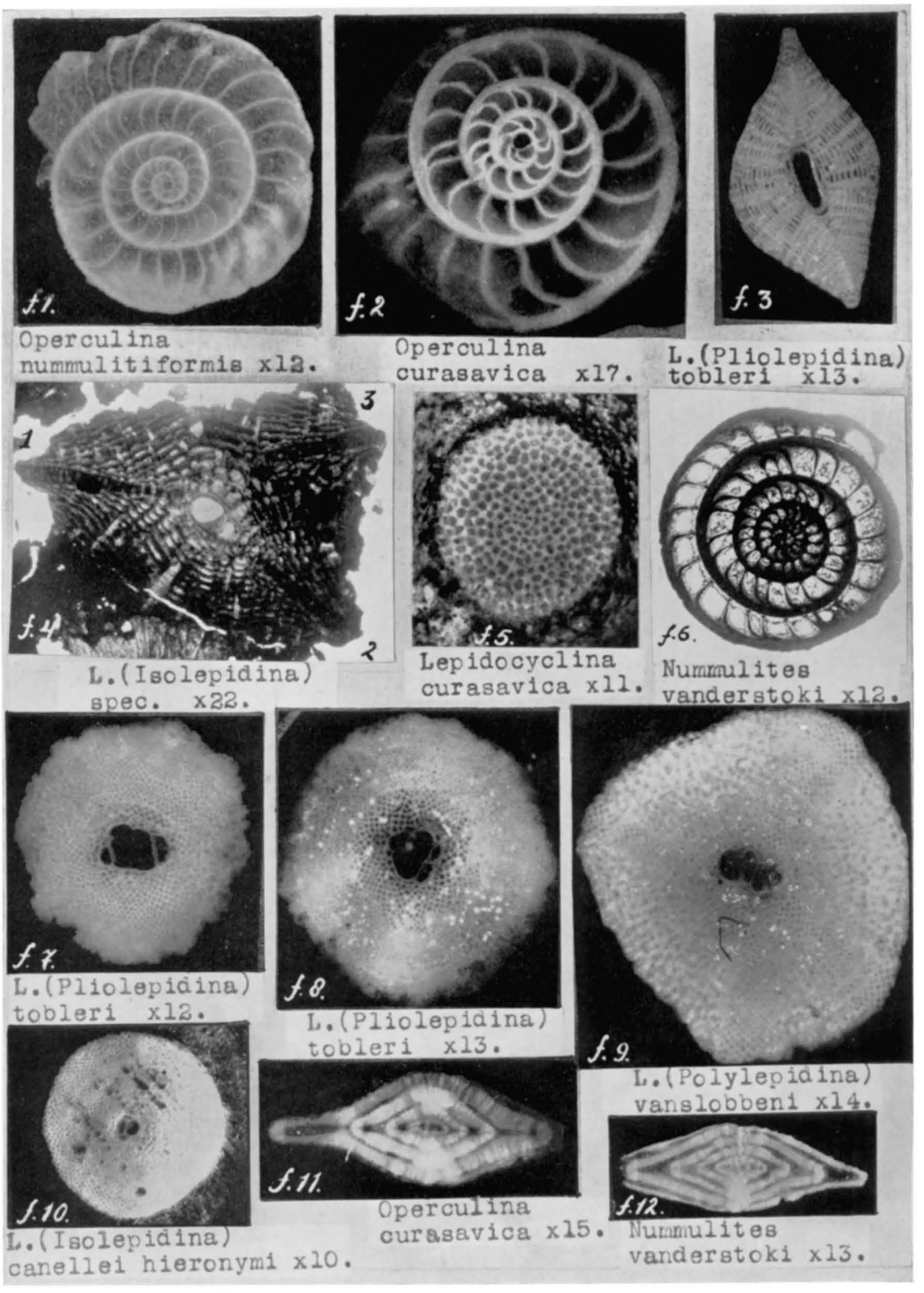
Lepidocyclina trinitatis venezuelana Hodson. Ibid. p. 20, Pl. 4, fig. 9.

(p.p.) *Nephrolepidina kochi* Hodson. Ibid. p. 24, Pl. 6, Figs. 5, 9, 10.

KOCH and L. RUTTEN mentioned already the abundance of this form. Together with the closely related *L. weeksi* Hodson it is probably the most common fossil. As stated above there occurs with all isolepidines from the Seroe di Cueba a tendency to grow into nephrolepidine forms. Always, however, there are many true isolepidines, and the variations are gradually. The most prominent feature consists in a bending of the wall

[1]) H. DOUVILLÉ. 1924 l.c. p. 36, 37; figs. 13—16, Pl. I, figs. 4—7.

[2]) LEMOINE & R. DOUVILLÉ. 1904. Mém. Soc. Géol. de France Pal. Mém. 32, p. 20; Pl. 1, fig. 1; Pl. III, fig. 5.


f.1.
Operculina nummulitiformis x12.
f.2
Operculina curasavica x17.
f.3
L.(Pliolepidina) tobleri x13.
1
3
2
f.4
L.(Isolepidina) spec. x22.
f.5.
Lepidocyclina curasavica x11.
f.6.
Nummulites vanderstoki x12.
f.7.
L.(Pliolepidina) tobleri x12.
f.8.
L.(Pliolepidina) tobleri x13.
f.9.
L.(Polylepidina) vanslobbeni x14.
f.10.
L.(Isolepidina) canellei hieronymi x10.
f.11.
Operculina curasavica x15.
f.12.
Nummulites vanderstoki x13.

dividing the two chambers. This is usually accompanied by a difference in size between the two chambers. Whereas, however, in the true nephrolepidine forms the larger chamber always lies at the convex side of the dividing wall, with the lepidocyclines of Curaçoa no such rule is to be observed. The larger chamber may just as well lie at the concave side of the wall, and also a bended wall may occur with two embryonic chambers equal in size. These reasons led us to the conclusion that we have to do here with variations of the true isolepidine form, and not with variations toward nephrolepidianism.

According to H. DOUVILLÉ the test measures 3 to 4 mm. With our specimens it ranges from 2.5—3.6 mm., with a mean of 2.9 mm.

The embryon, which DOUVILLÉ found to be 500 μ, varies rather strongly, from 750 × 650 μ to 500 × 300 μ.

These characters apply equally well to the species figured by HODSON as *Nephrolepidina kochi*. This is not truly nephrolepidine, but also intermediate. HODSON mentions that the embryon measures 400—700 μ, which is the same as in *L. trinitatis*. An abrupt change in the measurements of our specimens of *L. trinitatis*, that might possibly indicate a mingling of two species, does not occur, as follows from our table, so that all belong to *L. trinitatis*, although there are variations that fall under HODSON's description.

The varieties *caribbeanensis* and *venezuelana* have been founded on very slight differences; they grade, moreover, gradually into the species s. str. We cannot regard them as valuable varieties.

As the specimens are in a bad state of conservation, this applying especially to the more minute outer features we have not attempted to separate *Lepidocyclina pustulosa* H. Douv.

Diameter in mm.:	2.5	2.6	2.6	2.6	2.6	2.6
Embryon in μ:	> 300	550 × 350	600 × 450	650 × 450	750 × 650	600 × 550
	2.7	2.7	2.8	2.8	2.8	2.8
	750 × 550	400 × 350	450 × 400	500 × 350	600 × 500	450 × 350
	2.8	3.0	3.0	3.0	3.1	3.1
	500 × 400	500 × 300	550 × 500	600 × ?	450 × 450	500 × 500
	3.2	3.4	3.4	3.6	3.6	
	600 × 600	550 × 500	550 × 500	500 × 350	600 × 500	

Lepidocyclina (Lepidocyclina) weeksi Hodson. (Pl. I, fig. 6).

Lepidocyclina weeksi Hodson. Bull. Am. Pal. 1926. Vol. XII. Bull. 47, p. 23, Pl. 6, figs. 6—8.

This species is very common on the Seroe di Cueba. It is readily recognized from its relative *L. trinitatis* by its outer features. These consist in the small diameter, the even discoidal test and the absence of an encircling thin margin. We found the diameter varying from 1.7—2.3 mm., with a mean of 2.05 mm. The embryon varies from 850 × 750 μ to 450 × 300 μ.

Measurements of horizontally sliced specimens:

Diameter in mm.:	1.7	1.7	1.9	1.9	2.0	2.0
Embryon in μ:	500 × 500	500 × 350	450 × 450	550 × 400	450 × 400	750 × 300
	2.0	2.0	2.0	2.0	2.1	2.1
	550 × 400	650 × 400	500 × 500	650 × 550	450 × 350	650 × 550
	2.2	2.2	2.2	2.2	2.2	2.2
	600 × 500	500 × 350	600 × 500	450 × 400	? ?	850 × 750
	2.2	2.3				
	750 > 500	500 × 350				

Lepidocyclina (Lepidocyclina) hubbardi aurarensis Hodson. (Pl. I, fig. 12).

Lepidocyclina hubbardi aurarensis Hodson 1926. Bull. Am. Pal. Vol. XII. Bull. 47, p. 23, Pl. 5, figs. 6, 8, 9.

Isolepidina cf. *hubbardi* Koch. 1928. Eclogae geol. Helv. Vol. 21. N°. 1, p. 52.

Lep. aff. ? ? *proteiformis* Vaughan, L. Rutten 1928. These Proc. Vol. XXXI. N°. 10, p. 1063, figs. 10—16, non fig. *E.*

L. RUTTEN mentioned the occurrence of small, very flat lepidocyclines, but did not find a good megalospherical section. He provisorily brought the fossils under *Polylep. proteiformis.* We got one good, decidedly isolepidine megalospherical individual, whereas in KOCH's material they are rather common. As the fossils always are flat, and never become as thick as *Lep. hubbardi* itself in HODSON's picture (Pl. 5, fig. 6), they must all be classed under *L. hubbardi aurarensis. L. hubbardi* s.s. does not occur on the Seroe di Cueba.

Lepidocyclina (Lepidocyclina) maracaibensis Hodson. (Pl. I, fig. 9 ; Pl. III, fig. 2).

Lepidocyclina maracaibensis Hodson 1926. Bull. Am. Pal. Vol. XII, Bull. 47, p. 24, Pl. 6, figs. 2, 3, 4.

Lepidocyclina R. Douvillei Lisson var. *armata* L. Rutten. These Proc. Vol. XXXI. N°. 9, 1928, p. 14, fig. 24, 1, m, 27, 28, 29.

This form occurs in certain horizons in a considerable quantity. Just as *L. schotborghi* it may easily be overlooked in collecting, so that it may be more common than our samples indicate. HODSON gives for diameter 1.6 mm. We found the diameter ranging from 1.0 to 2.2 mm., with a mean of 1.5 mm. Although our specimens are rather fat, they are not so extremely peaked at the center, as in HODSON's illustration (Pl. 6, fig. 4). The height of the test at the centre ranges from 1.0 to 1.4 mm. Pillars are heavy, but often difficult to be seen.

L. r. douvillei var. *armata* L. RUTTEN, described from the eocene of Peru corresponds with *L. maracaibensis* besides the fact that it is not so fat. As our specimens range from the true *L. maracaibensis* toward the upper range of *L. r. douvillei* var. *armata*, it is not possible to separate them, and all our specimens have to be included under *L. maracaibensis.*

Measurements of horizontally sliced specimens :

Diameter in mm.:	1.0	1.0	1.2	1.2	1.2	1.2
Embryon in μ:	250 × 200	300 × 200	300 × 200	300 × 200	250 × 200	200 × 200
	1.4	1.4	1.4	1.5	1.5	1.5
	250 × 200	300 × 250	300 × 200	250 × 150	300 × 200	350 × 250
	1.6	1.6	1.8	1.9	2.0	2.2
	200 × 200	250 × 150	400 × 200	300 × 250	250 × 200	250 × 150

Measurements of vertically sliced specimens :

Diameter in mm.:	1.6	1.6	2.0	2.1
Thickness in mm.:	1.0	1.1	1.0	1.4
Embryon in μ:	?	250	250	300
Number of layers of lateral chambers:	6	5	5	6

Lepidocyclina (Lepidocyclina) schotborghi n. sp. (Pl. I, fig. 14, 15. Pl. III, fig. 5, 7).

This species is rather rare. We found it in the middle and upper part of the Seroe di Cueba section in only seven individuals. These, however, agree very well inter se, and are not to be classed with any other species. It is possible that they are more common, for, owing to their smallnes, they are easily overlooked or crushed.

Test very small. Flat discoidal in form. No definite umbo. No thin encircling margin. The horizontal section shows the very large embryon, which is distinctly isolepidine. The equatorial chambers are square and arranged rather regularly on intersecting curves. Near the embryon the equatorial chambers measure between 50 and 100 μ: near the periphery they become gradually smaller, attaining 30—50 μ. A vertical section shows the large embryon, which has a small height. There are four or five layers of lateral chambers in the thickest portion of the test. The chambers are not arranged on distinct vertical columns, but alternate. A tangentional section shows rather great, irregular lateral

chambers with thin walls. There are many small pillars, not attaining 50 μ, only to be seen under favorable circumstances.

This species is closest to *L. weeksi*, from which it differs by being smaller, thinner, and by having small pillars. *L. maracaibensis* is thicker, with stouter pillars, and a smaller embryon.

Measurements of five horizontally sliced specimens:

Diameter:	1.3	1.4	1.4	1.5	1.5	m.m.
Embryon:	600 × 500	550 × 450	?	450 × 400	650 × 550	μ

Measurements of two vertically sliced specimens:

Diameter:	1.6	1.4	m.m.
Thickness:	0.7	0.6	m.m.
Embryon:	650 × 200	> 300	μ

Lepidocyclina (Lepidocyclina) r. douvillei Lisson.

Lepidocyclina r. douvillei Lisson Arch. Asoc. para el progr. de las Ciencias Lima. I. 1921. p. 52—55. Pl. III.

To this form we bring a number of very small and neat isolepidines without pillars. Their diameter varies from 0.5 mm. to 1.5 mm., the thickness being about one-third or one-fourth of the diameter. The embryon varies from 150 μ to 250 μ.

Subgenus Nephrolepidina H. Douv.

Lepidocyclina (Nephrolepidina) morgani Lem. & R. Douv. (Pl. III, fig. 6).

Lepidocyclina Morgani Lemoine et R. Douvillé, 1904, Mém. Soc. Géol. de France. Pal. Mém. 32, p. 17, Pl. I, fig. 12, 15, 17, Pl. II, fig. 4, 12, Pl. III, fig. 2.

We found one individual in the middle of the section; rare stragglers of this species must therefore occur already in the eocene. The measurements of our specimen are: diameter 2.2 mm., thickness 1.4 mm., embryon 600 × 500 μ.

The surface of the test is rather worn, but there are at least ten pustules, which corresponds with the figures (not with the text) of the authors.

Subgenus Pliolepidina H. Douv.

Lepidocyclina (Pliolepidina) tobleri H. Douvillé. (Pl. I, fig. 5. Pl. II, fig. 3, 7, 8).

Pliolepidina Tobleri H. Douvillé. Mém. Soc. Géol. de France Mém. 2. t. 1, 1924, p. 24, fig. 24, 35*a*, 35*b*.

Pliolepidina Tobleri H. Douvillé. L. Rutten, These Proc. 1928. Vo. XXXI, N°. 10, fig. 19—39, C.

Common in the whole section and in the detached material.

The aequatorial chambers are arranged somewhat irregularly around the embryon in consequence of the irregular form of the latter. Gradually they assume a square shape, measuring 110 μ. Towards the margin the chambers are smaller, measuring 70—80 μ. The vertical section shows a test with varying thickness. The embryon is long and flat with a large initial chamber and one or two smaller ones at its sides, as figured by H. DOUVILLÉ (l.c. p. 44, fig. 35). This bears a close resemblance to *P. panamensis* Cushman. This form, however, is characterized by a broad thin collar of 1¼ mm. and by the occurrence of a few strong pillars. Neither such a broad collar, nor the few strong, central pillars occur in Dr. KOCH's or in our material. The possibility that the outer margin has been lost before fossilization is rejected, as in the same rock very frail specimens are well preserved. All the pliolepidine forms of the Seroe di Cueba show numerous, thin pillars, not restricted to the central portion of the test. We therefore reckon them to be *P. tobleri*. The ratio of diameter and thickness is varying, as is proved by the following data:

Diameter (m.m.)	2	3.5	2.75	2.5	3.5	2.25	2.75	3.0
Thickness „	1.5	2.25	1.75	1.5	2 0	1.25	1.5	1.5

The gradual transition between these specimens does not allow to split up the forms into different species.

It should further be mentioned that in thin-sections of rock in which Pliolepidina tobleri occurs the probability of finding horizontal or transverse sections is small. One mostly finds oblique sections that are very characteristic. The embryonal apparatus is very great and consists of one large chamber with an irregular outline and some small irregular adjaçent chambers. The test always seems to be rather inflated. The lateral chambers are lossely built up.

Subgenus Polylepidina Vaughan.

Lepidocyclina (Polylepidina) vanslobbeni n. sp.

(Pl. I, fig. 11 ; Pl. II, fig. 9 ; Pl. III, fig. 3, 4).

We have only three specimens, but they agree very well inter se, and are quite different from all known polylepidines. The prominent feature of this species lies in the embryonal apparatus. Test rather small. Rather rotund, with an encircling thin margin. It resembles very much *L. trinitatis*. The worn surface has some pustules which mark the end of the pillars. The equatorial section shows an embryon of a series of four rather small cells. This is surrounded by the layer of equatorial chambers, which are of ogival or square shape, and regularly arranged on intersecting curves. Near the embryon they measure 50 μ, becoming a little smaller towards the periphery. The vertical section shows the general shape. Near the embryon the layer of equatorial chambers is about 50 μ thick, gradually widening to 150 μ at the periphery. A tangentional section shows in the umbonal region a number of fairly stout pillars, attaining 150 μ.

Measurements of two horizontally sliced specimens :

Diameter in mm. :	2.3	4.0
Length of embryon in μ :	750	750
Breadth of embryon in μ :	400	400

Measurements of one vertically sliced specimen : Diameter in mm. : 4.0 ; Thickness in mm. : 1.6 ; Length of embryon in μ : 550 ; Height of embryon in μ : 300.

Lepidocyclina (Polylepidina) zuliana Hodson.

Polylepidina zuliana Hodson. Bull. Am. Pal. 1926. Bull. 47. Vol. XII, p. 25. Pl. 7, figs. 1—3.

Some specimens which may be brought to this species were found throughout the whole profile. There are no papillae on the test, as in HODSON's specimens, but this may be due to the pretty bad state of conservation, especially of the outer features of the fossils.

Subgenus Helicolepidina Tobler.

Lepidocyclina (Helicolepidina) spiralis Tobler.

Helicolepidina spiralis Tobler. 1922. Eclogae geologicae Helvetiae. Vol. XVII. N°. 3, p. 380—384.

We found some specimens of this form, both micro- and macrospherical. The pillars are not quite so thick as in the picture TOBLER gives. Also the fossils may exceed 4 mm., and attain 5 mm. For the rest there is no difference with TOBLER's description.

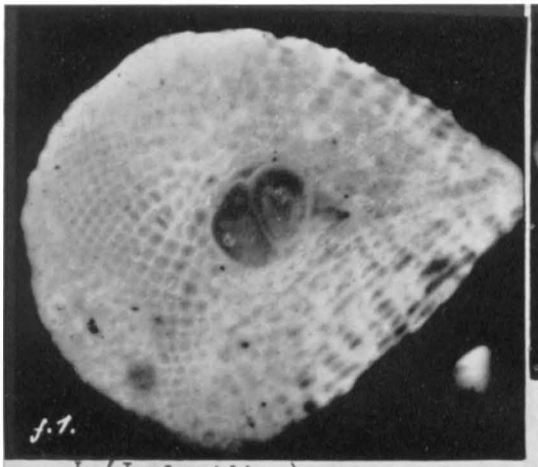
Genus Operculina d'Orb.

Operculina floridensis (Heilprin).

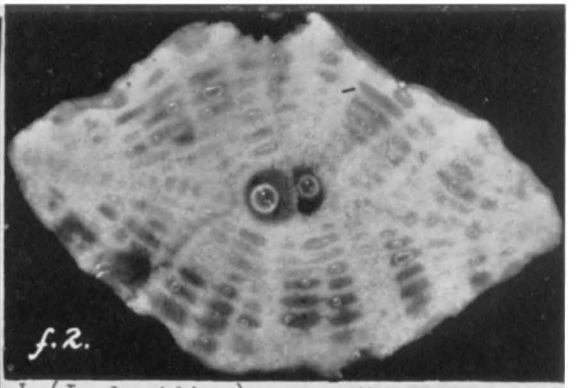
Nummulites floridensis Heilprin. 1884. Acad. Nat. Sci. Phil. Proc. pp. 321, 322.

Operculina floridensis Cushman 1920. U. S. Geol. Surv. Prof. paper 128-*E*, p. 130, Pl. XX, fig. 12.

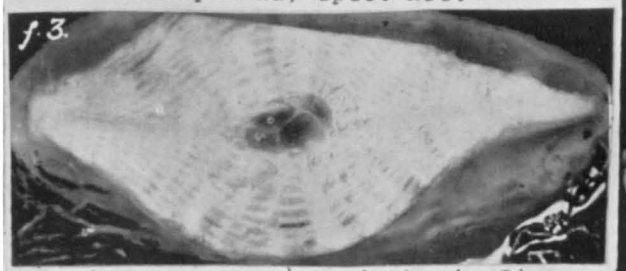
This fossil was found occurring in rocks collected at the southern side of the Seroe di Cueba. In these rocks it is not rare and is accompanied by *O. nummulitiformis*. Although



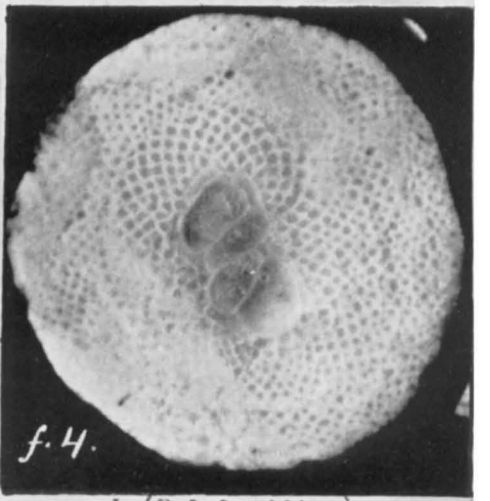
L.(Isolepidina) spec. x36.



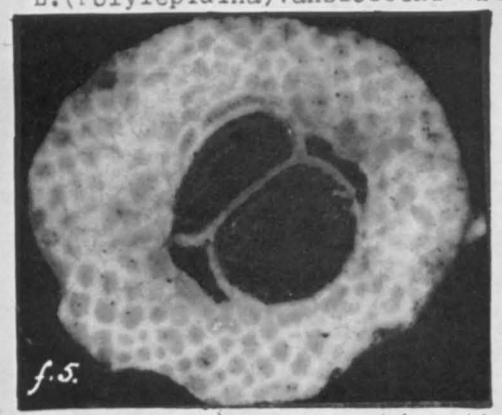
L.(Isolepidina) maracaibensis x52.



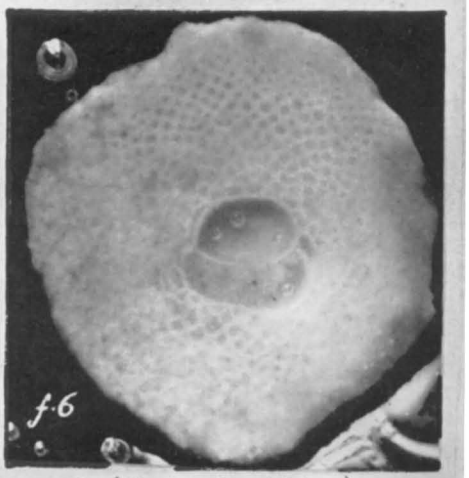
L.(Polylepidina)vanslobbeni x24.



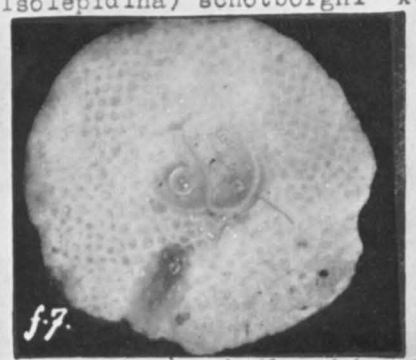
L.(Polylepidina)
vanslobbeni x32



L.(Isolepidina) schotborghi x44.



L.(Nephrolepidina)
morgani x24.



L.(Isolepidina) schotborghi x32.

in the section at the Northern side we found rocks (sample 6) quite alike the *O. floridensis* bearing rock from the southern side, it there contained only *O. nummulitiformis* and *O. curasavica.*

Operculina nummulitiformis L. Rutten (Pl. I, fig. 7, 10 ; Pl. II, fig. 1).

Op. nummulitiformis L. Rutten. These proc. 1928. Vol. XXXI. N°. 9, p. 11, figs. 1—12.

Op. atascaderensis Berry. Eclogae geol. Helv. 1930. Vol. 23. N°. 2, p. 495. Pl. XIV, figs. 1, 5 ; Pl. XV, figs. 2, 3.

Op. peruviana Berry. ibid. p. 496. Pl. XIV, fig. 6 ; Pl. XV, fig. 7.

This fossil is fairly common in certain horizons of the section where it occurs together with other nummulinids and a very small number of lepidocyclines. L. RUTTEN found it only in rock-sections, and did not obtain a good horizontal section. The test is very flat, as follows already from RUTTEN's vertical section. The outer side is not ornamented. The sutures are not raised. They are to be seen in some places of the test by their different colour. In accordance with L. RUTTEN's material our specimens have 4—5 whorls, but they are a bit greater in size. The Curaçoan specimens rangs from 2.9—4.9 mm. The number of septa in the last whorl varies from 25 to 32. This variation is rather strong, but, as all variations between the two extreme stages occur, there is no possibility to divide the species into two new forms.

BERRY described from the Atascadero limestone of Peru two new species that are identical with this species and with each other. For *Operculina atascaderensis* he gives 3.5 mm. in diameter. In the sections on Pl. XIV, fig. 1 and Pl. XV, fig. 2 it measures 2.8 and 2.4 mm. These specimens however are distinctly fragments. According to him there are three coils. In the cited figures the number of coils is, however, 3½ and 3. Therefore in the complete fossil it must be greater, and may amount between 4 and 5. As the number of septa in the last whorl is equal to the number in the same whorl of *O. nummulitiformis*, as the general features, such as diameter, thickness, the slow increase in the breadth of the coils, the thin, recurved septa are the same as in *O. nummulitiformis*, there is no reason to make a new species. *O. peruviana* has the same general features as *O. atascaderensis*. Only it is smaller and lacks the dividing inward portions of the septa. Also it has only 21 chambers in the last whorl. Now as to the diameter, it is stated above that *O. nummulitiformis* varies rather strongly. As to the number of whorls and the number of septa in the last whorl, the picture BERRY gives (Pl. XV, fig. 7) is also of a broken specimen, so that no definite conclusions can be drawn therefore. The dividing of the inward portion of the septa is a common feature of *O. nummulitiformis* also. Its occurrence is very irregular. The dividing may take place at any distance from the inner wall, and even the divided septum may divide itself once more. On the other hand many places are to be observed, where two septa approach very near to each other without melting. This is to be seen also in BERRY's picture of *O. peruviana*, as will be seen by the accompanying sketch, copied from BERRY's figure (Pl. I, fig. 10). We regard the deviding of the septa as an irregularity in the structure, and by no means as an element for specific distinction.

Diameter in mm.:	2.9	3.5	3.8	4.0	4.1	4.2	4.7	4.9
Number of whorls:	4½	4	4	4½	4½	4½	4½	4½
Number of septa in the last whorl:	26	30	28	27	26	28	32	25

Operculina curasavica n. sp. (Pl. II, fig. 2, 11).

Test small. Distinctly umbonate which distinguishes this species at once from *O. nummulitiformis* and *Nummulites caribensis*. Entirely involute. The outer whorl in some specimens carries slightly raised sutures. This species varies rather strongly, as will be seen especially at an horizontal section. This shows two initial chambers, measuring together 300—450 μ. The number of whorls varies from 2½ to 3½. They widen gradually. The diameter varies from 2.6—4.5 mm. The septa are thick and set at rather long intervals. From the inner wall they start at an angle of about 90°, and at about one half of their length they curve strongly backwards. There are 16 to 23 septa in the last whorl.

It is nearest to *O. panamensis* Cushman, but it is larger.

Initial chambers in μ:	350	?	?	?	300	450	?	?	?	?	400	?	350
Diameter in mm.:	2.6	2.6	2.8	3.0	3.2	3.3	3.5	3.6	3.7	3.8	3.8	3.9	4.5
Number of septa in the last whorl:	16	16	18	22	18	16	16	18	22	23	18	21	20
Number of whorls:	$2^3/_4$	$2^1/_2$	?	$3^1/_2$	3	3	3	$2^1/_2$	$3^1/_2$	$3^1/_2$	$3^1/_2$	3	$3^1/_2$

L. RUTTEN pictured it by error under the name of *Nummulites striatoreticulatus* together with pictures of the last species in these Proc. Vol. XXXI, N°. 10. 1928, fig. *J*.

Operculina sp.

In the upper part of the section we found some small operculines, that resembled very much *O. marianensis* Vaughan. They differ however by being smaller (diameter 1.5 mm.), thicker (0.4—0.6 mm.) and by having the course granules of *O. marianensis* replaced by raised sutures.

Operculina sp.

Also in the upper part of the section were found some operculines resembling *O. panamensis* Cushman, differing by being larger ($\pm$ 2 mm. in diameter) and having only 16 or 17 septa in the last whorl.

Genus Nummulites.

Nummulites vanderstoki n. sp. (Pl. I, fig. 8 ; Pl. II, figs. 6, 12).

This new form belongs to the striated type ; there are 5 whorls : the diameter varies from 2.75—3 mm., the thickness from 1.125—1.2 mm. We only found megalispherical specimens, of which some numerical data are joined below :

Diameter in mm.:	3.5	3.5	3	3	3.5	3	2.25	2.50	$2^3/_4$	$2^1/_2$	$2^1/_2$	$2^3/_4$
Initial chamber diam. in mm.:	0.1	0.15	0.1	0.125	0.175	0.125						0.1
Number of whorls:	5.0	4.5	4.75	5	5	5	3.75	$\pm$ 5	5	4.5	4.5	5
Septa in 5th whorl:	23	24	20	20	22	21		$\pm$24	22	20	$\pm$20	18
„ „ 4th „ :	22	22	18	16	21	20	20	18	19	16	20	18
„ „ 3rd „ :	18	20		20	19	15	17	15	15	14	17	18
„ „ 2nd „ :	15	$\pm$13		$\pm$13	$\pm$14	$\pm$12	13	12	13	12	13	$\pm$12

Distinct pillars and granulae are not found. The septa arising from the inside of the outer wall at an angle of about 30° bend gradually, nearly, reaching the outside of the underlying spiral at an angle of abt. 90°. The septa are rather thick at the base, thinning in the middle and terminating in a knoblike end (fig. 8*a*). The chambers are higher than long.

Several smaller specimens occur with less whorls than mentioned above. Apart from the fact that the general appearance is the same as that of the bigger ones, the number of septa corresponds more or less with the number found in the conforming whorl of *Numm. vanderstoki*. We therefore reckon them to be youth forms of *Numm. vanderstoki*.

A minute comparison has been made with *N. striatoreticulatus* Rutten and, though they have common features, f.i. the number of septa in the 5th whorl and the general form of the septa, the differences are essential enough to justify the foundation of a new species. Apart from the fact that the anteriorly directed processes at the septa are entirely wanting the diameter of 5 whorls of *N. striatoreticulatus* exceeds the diameter of *N. vanderstoki*. *Nummulites vanderstoki* was found frequently in the detached material, whereas in the section it is chiefly found in the upper-beds.

Nummulites spec.

In the lower beds of the section a few very small nummulites were found. The 5 specimens have the following dimensions :

Diameter in mm.:	0.5	0.5	0.6	0.45	0.6
Thickness in mm.:	0.3	0.3	0.375	0.25	0.35?
Number of whorls:	3	3	3	2	3