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CYCLOLOBUS FROM THE PERMIAN OF EASTERN GREENLAND

BY

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WITH 3 FIGURES IN THE TEXT
AND 1 PLATE

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In 1937 arrangements were completed for the Greenland Permian faunas collected under the supervision of LAUGE KOCH to be studied in America. It was decided to have reports on the various biological units prepared by specialists under the direction of C. O. DUNBAR. The few ammonoids obtained were submitted to us and we here acknowledge our indebtedness to Drs. KOCH and DUNBAR for this favor. The specimens that we are studying were collected by OSKAR KULLING in 1929, DAVID MALMQVIST in 1931, and WOLF MAYNC and EIGIL NIELSEN in 1937.

The presence of marine Permian in eastern Greenland has been known for some time, and fossils of this age have been found there at several localities (KOCH, 1935). Most of these are from the region of Gael Hamkes Bugt. From this vicinity FREBOLD (1932) has described two Permian ammonoids. These came from the upper part of the so-called *Martinia* beds on Mt. Brinkley, southern Clavering Ø. There the *Martinia* beds are overlain by Lower Triassic conglomerates.

In addition to ammonoids, the following forms have been recorded from the *Martinia* beds: *Martinia* cf. *M. triquetra*, *Chonetes* spp., *Arctacanthus uncinatus*, *Agassizodus groenlandicus*, and *Fadenia crenulata*. FREBOLD named the ammonoids described by him *Medlicottia malmqvisti* and *Godthaabites kullingi*, and he recognized their Permian affinities. The additional material now available makes it clear that the ammonoid-bearing beds on Mt. Brinkley are comparable to the *Cyclolobus* beds of India, and are, therefore, uppermost Permian in age. It should also be mentioned in this connection that FREBOLD has recorded Upper Permian fossils from boulders found near-by at Kap Stosch in a Lower Triassic conglomerate. Probably these boulders came from the upper part of the *Martinia* beds. Among the specimens sent to us for study are a few poorly preserved nautiloids from the *Posidonomya* beds and the *Grammysia* sandstone. These serve to show that orthoceratoids occur in the former and that coiled nautiloids of the type of *Endolobus* occur in the latter.

The single representative of *Medlicottia*, *M. malmqvisti*, known from the southern coast of Clavering Ø has been well described by FREBOLD

(1932). This specimen portrays the sutures, but it has been laterally compressed and, therefore, does not reveal the true shape of the conch. Forms that are practically indistinguishable from it are known from all of the Permian areas of the world that have yielded important ammonoid faunas, and stratigraphically they range throughout the Middle and Upper Permian. The only congeneric form known from the *Cyclolobus* horizon is *Medlicottia primas* of the Salt Range in India. It is essentially identical with *M. malmqvisti.*

In addition to the holotype of *Medlicottia malmqvisti*, FREBOLD described only one ammonoid from the Permian of Clavering Ø. It is

Fig. 1. Diagrammatic representation of an adoral suture of the holotype of *Medlicottia malmqvisti* FREBOLD at a diameter of about 90 mm, × 2.

a small specimen, which he recognized might be immature, but he proposed a new generic name, *Godthaabites*, for it. The new collections now available from the type locality contain several large mature specimens of *Cyclolobus* and they appear to be conspecific with the immature genoholotype of *Godthaabites*, *G. kullingi.* This genoholotype is well preserved and uncrushed. It is septate throughout and attains a maximum diameter of about 19 mm and a maximum width of conch of some 12 mm. In the block from which this specimen was removed there are crushed portions of one or two more volutions of the conch. The umbilicus is moderately large, and at least the internal mold bears prominent rounded transverse constrictions, of which there are five in the outer volution of the holotype. At a diameter of about 18 mm, the sutures (text fig. 2) are similar to those of adolescent stages of other cyclolobids, indicating a relationship to *Shumardites*, as recognized by FREBOLD, and to "*Marathonites*" [= *Peritrochia*], as pointed out by SCHINDEWOLF (1933, p. 138). As in *Cyclolobus walkeri* [VALLIANT-COUTURIER TREAT, 1933] the adolescent sutures appear to have developed slowly in comparison to those of most other cyclolobid and popanoceratid genera. We have an uncrushed fragmentary specimen of some 10 mm diameter, which we removed from the center of a large individual, and it shows

sutures that resemble those of the holotype but are in a *Peritrochia* stage of development. In general physiognomy our small specimen is similar to the holotype, and it also bears transverse constrictions. The early adolescent sutures of many cyclolobids, perrinitids, and popanoceratids have similar sutures, and therefore it was impossible to determine the generic affinities of *Godthaabites kullingi* until the mature characters were known.

We have several large topotypes of *Cyclolobus kullingi* available for study, but all of them are crushed and poorly preserved. Nevertheless, they show that at full maturity the conch attains a diameter of at

Fig. 2. Diagrammatic representation of an adolescent suture of *Cyclolobus kullingi* (FREBOLD) in a *Stacheoceras* stage of development, × 6; based on the holotype at a diameter of about 18 mm. Even at this stage of development the first lateral saddle is incipiently divided.

least 150 mm, the living chamber is probably about a volution in length, and the sutures are in general similar to those of the genotype of *Cyclolobus*, *C. oldhami*. During adolescence the conch bears prominent transverse constrictions (pl. 1, figs. 3, 4). These become less pronounced as maturity is reached, though they are quite distinct on a specimen of some 40 mm diameter (pl. 1, fig. 2). Other specimens of about the same size do not show constrictions and apparently did not bear them, and no trace of constrictions is present on any of the large mature specimens we are studying. In the representatives on *Cyclolobus* that have been described previously, the transverse constrictions are variable. At full maturity they are present on the umbilical portions of the conch of *C. oldhami*, they extend across the ventral portions of the conch of *C. insignis*, but in *C. walkeri* they are obsolete. The growth-lines, which are in general parallel to the constrictions, are almost straight during early adolescence, but they develop first a ventral and then lateral sinuses. It should also be noted that the growth-lines become less conspicuous throughout ontogenetic development. Representatives of *Cyclolobus* are known from Madagascar which preserve the apertural margins. These show a prominent apertural constriction parallel to the deep ventral and lateral sinuses of the margins. The mature external sutures of *C. kullingi* form a large prominently divided ventral lobe, and there

appears to be some twelve lateral lobes on either side of it. All of the lobes are strongly digitate. As in other representatives of this genus, the general course of the sutures is arcuate but becomes less so at full maturity. The sutures are somewhat more primitive than are those of typical representatives of *Cyclolobus*, but their general complexity and their divided first lateral saddles indicate that this species is referable to *Cyclolobus* rather than to some less advanced member of the same family.

The genus *Cyclolobus* was established by WAAGEN (1887, p. 21—23)

Fig. 3. Diagrammatic representation of a portion of a mature suture of *Cyclolobus kullingi* (FREBOLD), × 2; based on the specimen represented by figure 5 on plate 1.

for a single specimen, the holotype of *C. oldhami*, from the uppermost Permian Chideru group of the Salt Range in India. Additional representatives of the genus have since been found in approximately contemporaneous strata at other localities: the Kuling shales and the Chitichun beds of the Himalayas, and the Ambilobé beds of Madagascar. Other forms that have been referred to *Cyclolobus*, for example those from Timor, are older and belong in more primitive genera. All of the known representatives of *Cyclolobus* are closely related. However, DIENER (1903, p. 162) stated that at least some of the Himalayan cyclolobids differ from the genotype, *C. oldhami*, in that the first lateral saddle of their sutures appears to be larger and more strongly subdivided. Although in his opinion these differences were "of too little value to justify a generic separation", he proposed the name *Krafftoceras* to be used for these forms if their deviation from the genotype "should be considered as of sub-generic importance". On a succeeding page of the same publication (p. 167), DIENER pointed out that the ventral portions of the type specimen of *Cyclolobus oldhami* are very poorly preserved, and therefore this part of WAAGEN's suture drawing is not accurate. It now seems

most probable that the first lateral saddle of typical *Cyclolobus* does not differ essentially from that of typical *Krafftoceras*, and therefore there is no need to retain the term *Krafftoceras*. The genera *Timorites* and *Waagenoceras* are closely related to *Cyclolobus*, but their sutures are distinctly more primitive. Typical *Waagenoceras* occurs in the Middle Permian, and typical *Timorites*, which presumably arose from *Waagenoceras*, is characteristic of a slightly higher horizon. *Waagenoceras*, *Timorites*, and *Cyclolobus* thus appear to represent a continuous phylogenetic sequence that has a great deal of stratigraphic significance. Throughout the upper half of the Permian, the cyclolobids show a progressive development in that the conch becomes more compressed and the sutures add more lateral lobes and become more strongly digitate. In typical mature representatives of *Waagenoceras* there are about five to seven external lateral lobes on each side of the conch, in *Timorites* there are about eight to ten similar lateral lobes, and in *Cyclolobus* there are some twelve to fourteen. Also, *Cyclolobus* differs from the other two genera in that the external first lateral saddle of its sutures is prominently subdivided medianly.

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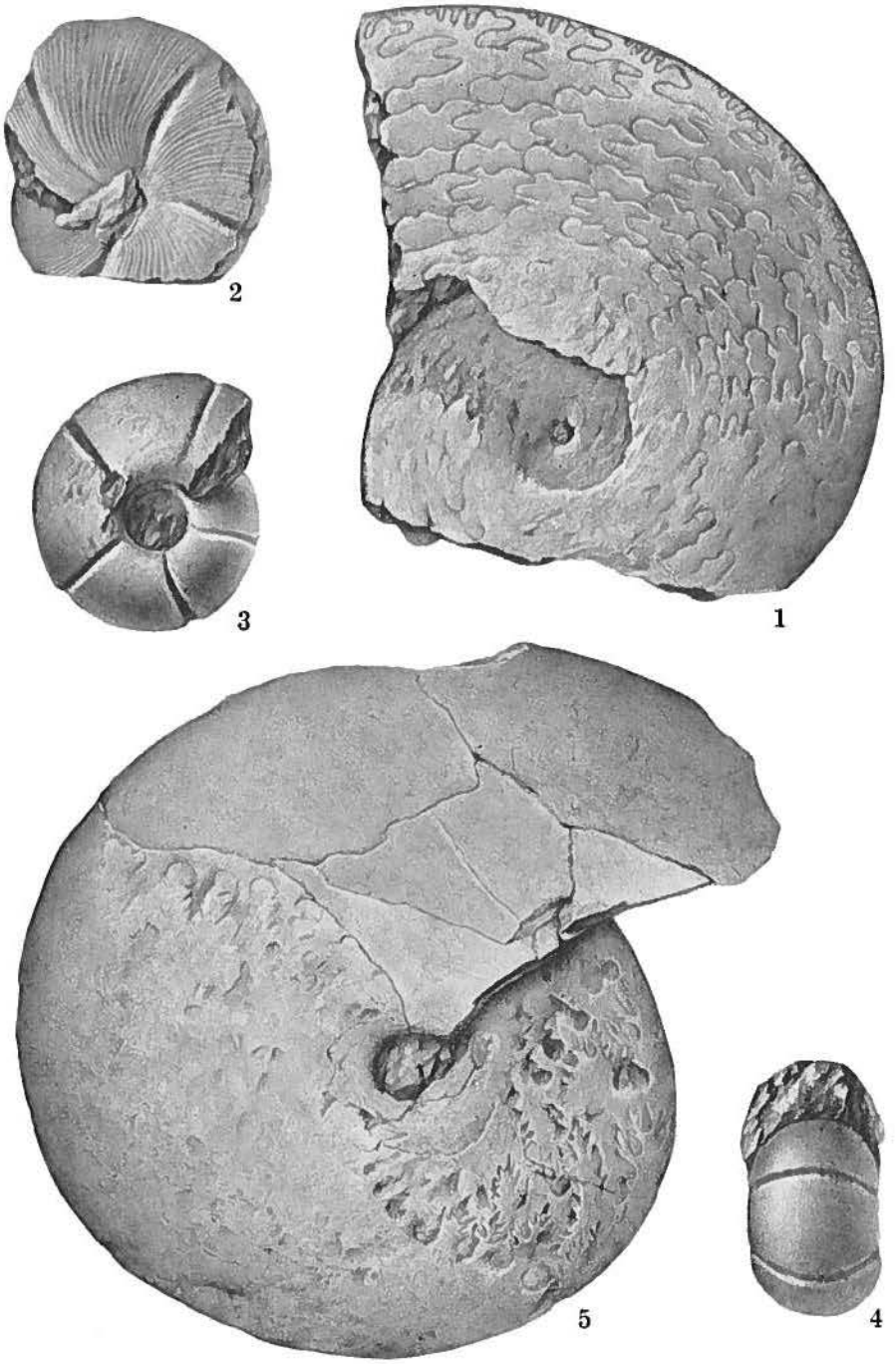
Færdig fra Trykkeriet den 5. April 1940.

PLATE

Explanation of Plate I.

All specimens illustrated on this plate came from the Upper Permian *Martinia* beds on Mt. Brinkley, southern Clavering Ø. The photographs have been retouched and slightly restored by HOWARD WEBSTER under the direction of the authors.

Fig. 1. *Medlicottia malmqvisti* FREBOLD. The holotype, × 1.
Figs. 2—5. *Cyclolobus kullingi* (FREBOLD).
2. An artificial cast, × 1.
3, 4. The adolescent holotype, × 2. [Adapted from FREBOLD.]
5. A crushed mature individual, showing part of the living chamber, × $^4/_5$.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