



The oldest tylosaurine mosasaur (Reptilia; Lacertilia) from the Late Cretaceous of Belgium: Hermann von Meyer (1860) revisited

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Abstract

A mosasaurid parietal from the Late Cretaceous of Belgium, originally described by Von Meyer (1860), turns out to be assignable to the tylosaurine *Hainosaurus* cf. *bernardi* Dollo 1885. A small sediment sample, extracted from the bone, was analysed for coccoliths and revealed its early Late Campanian age. This is thus the earliest record of a tylosaurine mosasaur from Belgium.

Introduction

Mosasaurs were marine monitors that inhabited the world's seas during the Late Cretaceous, at the end of which they became extinct. Fossil evidence shows their successful development, which is reflected by a rapid evolutionary adaptive radiation into numerous species and by a worldwide distribution (Russell 1967, deBraga & Carroll 1993, Bell 1997a). Dollo described a rare tylosaurine mosasaur species from the Late Cretaceous (Early Maastrichtian) of the 'La Malogne' region, near the city of Mons, southern Belgium (Figure 1), as *Hainosaurus bernardi* (Dollo 1885a, b¹; see also Nicholls 1988, Lingham-Soliar & Nolf 1989, and Lingham-Soliar 1992). More recently, a more extensive description of this species was given by Lingham-Soliar (1992), who had, in addition to the holotype, a previously undescribed fragmentary specimen at his disposal. Dollo's original description was based on a nearly complete, but rather poorly preserved skeleton, now on exhibit at the Institut Royal des Sciences Naturelles de Belgique at Brussels.

As it turns out now, Dollo was not the first scientist, however, to present a tylosaurine mosasaur from Belgium. Hermann von Meyer had published a paper on

tetrapod remains from two northwest European Late Cretaceous tuffaceous chalk outcrops already some decades earlier; in his paper (Von Meyer 1860: plate 26, Figure 1) he had described and depicted – in addition to an elasmosaur tooth and cervical vertebra – a tylosaurine parietal. This parietal, which turns out to be assignable to *Hainosaurus* cf. *bernardi* Dollo 1885, is detailed in the following.

Systematic description

Order Squamata Oppel 1811

Suborder Lacertilia Owen 1842

Family Mosasauridae Gervais 1853

Subfamily Tylosaurinae Williston 1895

Genus *Hainosaurus* Dollo 1885 a

Species *Hainosaurus* cf. *bernardi* Dollo 1885a

Material

The material described here consists of a parietal (Figure 2) of the tylosaurine mosasaur *Hainosaurus* cf. *bernardi* Dollo 1885. The identification of the bone is based on its close resemblance to the parietal in the holotype (Figure 3) of *Hainosaurus bernardi*. Its size is two thirds of the size of the holotype parietal.

¹ Dollo's (1885b) 'première note sur le Hainosaure' is, although somewhat extended, in fact a copy of his earlier paper (Dollo 1885a) on this tylosaurine mosasaur.

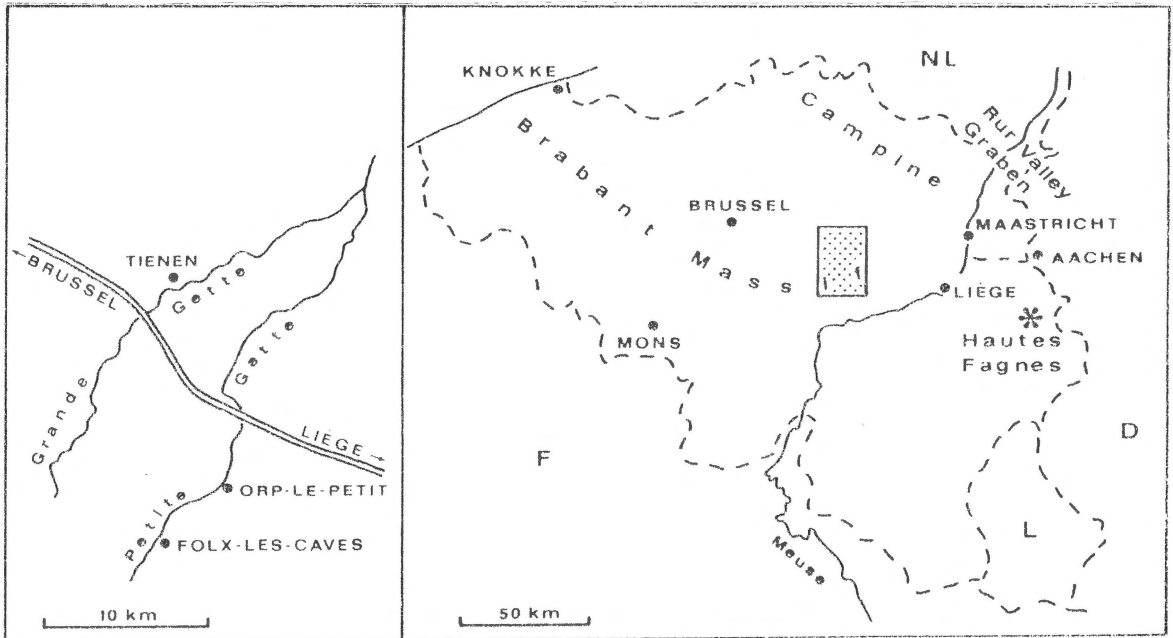


Figure 1. Map showing the location of the Late Cretaceous outcrops at Folx-les-Caves and nearby Orp-le-Petit. From Bless et al. (1991), with permission.



Figure 2. *Hainosaurus* cf. *bernardi* Dollo 1885. Parietal in dorsal view. Tuffeau jaunâtre (early Late Campanian, Zone CC 22 of Sissingh, 1977), Folx-les-Caves (Eastern Brabant Massif, Belgium). Naturkundemuseum of Humboldt University (Berlin) Collections, no. MB.R. 890 (ex Binkhorst van den Binkhorst coll.). Scale bar equals 6 cm. Dorsal view. See Von Meyer (1860 pl. 26, Figure 1) for comparison.

The present repository of the specimen is the Museum of Natural History (Naturkundemuseum) of the Humboldt University (Berlin), where it is kept under no. MB. R. 890. The Binkhorst van den Binkhorst Collection, to which the fossil originally belonged, was sold in 1878 to the Imperial Museum of Mineralogy (Kaiserliches Mineralogisches Museum) of Berlin University (Krutzler 1963). The blackish-grey specimen appeared to have been freed completely from the matrix. A sediment probe, extracted from the spongy bone, has now revealed its stratigraphic provenance, however, by means of an analysis of its calcareous nannoplankton contents.

Tylosaurine parietal features (notably the position of the parietal foramen, frontoparietal suture and parallelism of lateral margins of the dorsal surface) were outlined by Von Meyer (1860), Bell (1997b), Russell (1967) and Lingham-Soliar (1992).

Von Meyer's record: a historical account

The above-mentioned elasmosaur remains, as well as the present tylosaurine parietal, were put at Von Meyer's disposal by a Dutch amateur geologist and collector, J.Th. Binkhorst van den Binkhorst (1810–1876). According to Von Meyer, the parietal came

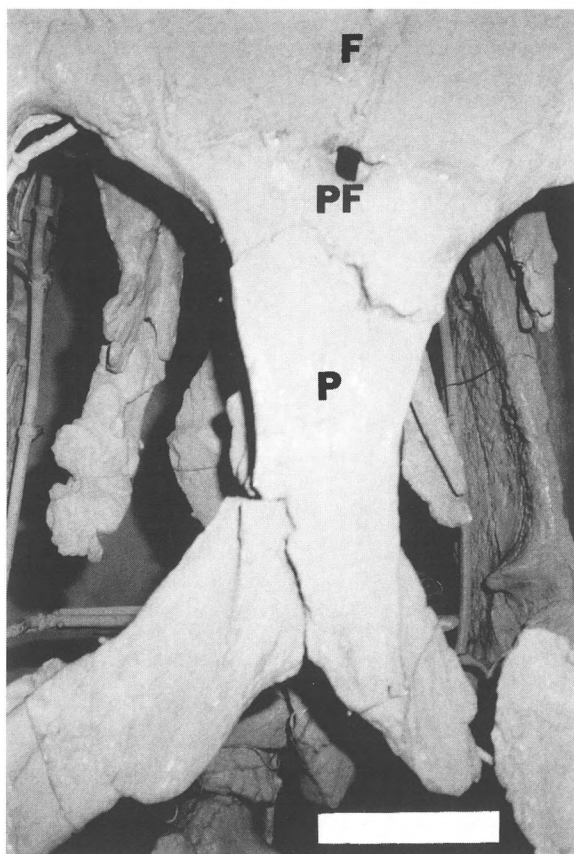


Figure 3. *Hainosaurus bernardi* Dollo 1885. Parietal of the holotype in detail, dorsal view. Ciplu Phosphatic Chalk (Early Maastrichtian), Mesvin-Ciply (Mons region, Belgium). Institut Royal des Sciences Naturelles de Belgique (Brussels) Collections, no. IRNSB HtR 23. Scale bar equals 10 cm. See Lingham-Soliar (1992, pl. 1 B) for comparison. F = frontal (*pars*), P = parietal, PF – parietal foramen.

from the tuffaceous chalk ('Tuff-Kreide') of Folx-les-Caves, in the eastern Brabant Massif, Belgium (Figure 1). Von Meyer immediately recognised the mosasaurid nature of the specimen. He was familiar with the famous fossil remains of *Mosasaurus hoffmanni* Mantell 1829 from the St. Pietersberg, south of Maastricht. Von Meyer (1832) referred to this species as '*Mosasaurus Camperi*'. It was unfortunate for Von Meyer that no parietal of *Mosasaurus hoffmanni* was known at the time when he was studying the parietal from the Binkhorst van den Binkhorst collection. He realised that 'his' parietal, without juvenile characters, was too small to have belonged to a mature individual of *M. hoffmanni*.

By comparing the specimen with the parietal of '*Mosasaurus Maximiliani*' Goldfuss 1845, which is considered to be a junior synonym of *Mosasaurus*

missouriensis (Harlan 1834) (see Russell 1967, Kuhn 1972), Von Meyer noted a striking difference. The parietal foramen in the latter species lay in a protrusion which penetrated the frontal, whereas the foramen in the parietal from Folx-les-Caves was very close to the frontoparietal suture, but did not penetrate the frontal (Figures 2, 3). Von Meyer reflected on the possibility that the European continent might yield a second mosasaur species, which, in his view, might be assignable to the English species '*Mosasaurus gracilis*' Owen 1850². Keeping the state of vertebrate palaeontology in Von Meyer's days in mind, it is obvious why he did not erect a new mosasaur genus.

Biostratigraphy

A small amount of sediment, extracted from the spongy bone, was prepared for scanning electron microscopy (SEM) and light microscopy (LM) analysis of calcareous nannoplankton. The preservation of the coccoliths is rather poor: they have a strong overgrowth and they are not numerous. The following species were identified:

- Ahmullerella octoradiata* (Górka 1957)
- Arkhangelskiella cymbiformis* Vekshina 1959
- Aspidolithus parvus* (Stradner 1963)
- Discorhabdus ignotus* (Górka 1957)
- Eiffellithus eximius* (Stover 1966)
- Eiffellithus turrisieffelli* (Deflandre 1954)
- Gartnerago obliquum* (Stradner 1963)

² The identity of *Mosasaurus gracilis* Owen 1850 has been confusing for a long time. Regarded as mosasaurian by Owen, this taxon was subsequently re-identified as the pachyrhizodontid teleost *Pachyrhizodus gracilis* (Lydekker 1888, p. 273; Woodward 1888, p. 314). Pectoral elements, teeth and caudal vertebrae of *Plioplatecarpus marshi* Dollo 1882, and mosasaurine vertebrae of indeterminate species were referred to it as well (Ubaghs 1879, pls. iii-v; Owen 1849–84: pl. 1, Figures 1–3, 6; Owen 1850, p. 384). The supposed pachyrhizodontid nature of the type specimen of '*Mosasaurus gracilis*' (a partial lower jaw) was recently supported by Lingham-Soliar (1994). Woodward re-examined the type specimen in 1901 and concluded on that occasion, however, that the fossil is truly part of the mandible of a Mosasaurian' (Woodward 1901, p. 45).

The type specimen (Figure 4) comprises a left and a right incomplete dentary. These are much larger than the dentaries of the British *Pachyrhizodus* species discussed by Forey (1977). Furthermore, the dentaries of the type specimen bear thecodont, symmetrically bicarinate teeth; the buccal sides being more convex than the lingual sides. The tooth roots show resorption pits of replacement teeth. Most probably, *Mosasaurus gracilis* can be assigned to the mosasaurine genus *Leiodon* Owen 1841.

Differences between mosasaur and *Pachyrhizodus* jaws were discussed in detail by Stewart & Bell (1994).

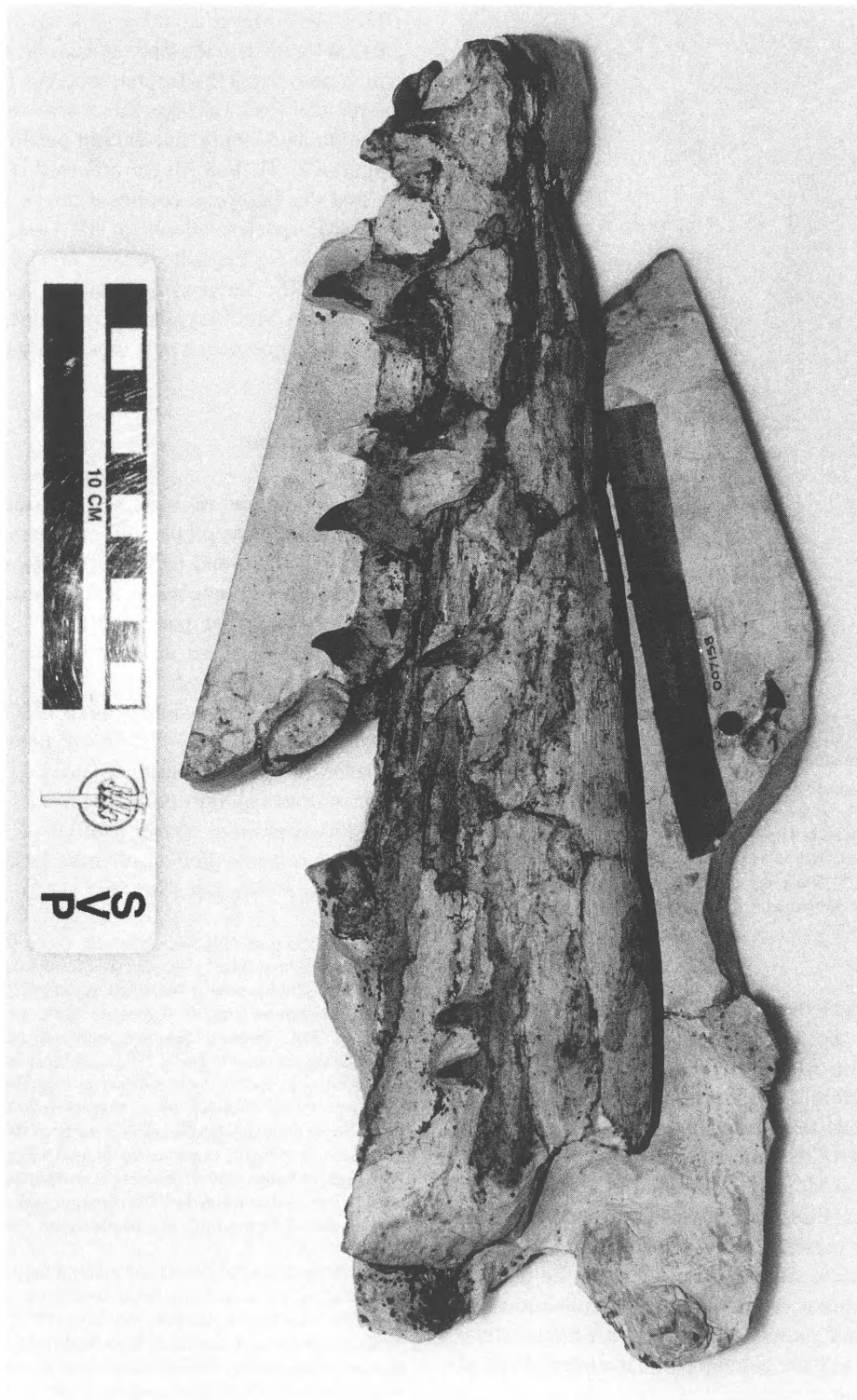


Figure 4. *Mosasaurus gracilis* Owen 1850. Type specimen. Upper Chalk Formation, Lewes Nodular Chalk Member (Turonian–Coniacian), Offham Chalk Pits near Lewes, East Sussex (U.K.). Booth Museum of Natural History Brighton Collections, no. 007158.

Kamptnerius magnificus Deflandre 1959
Lithastrinus grilli Stradner 1962 (in LM only)
Micula staurophora (Gardet 1955)
Prediscosphaera cretacea (Arkhangelsky 1912)
Prediscosphaera spinosa (Bramlette & Martini 1964)
Rheinhardtites anthophorus (Deflandre 1959)
Rheinhardtites levis Prins & Sissingh 1977
Tranolithus phacelosus Stover 1966
Uniplanarius sissinghii Perch-Nielsen 1984
Watznaueria barnesae (Black 1959)

Since only a single sample was available for analysis, the biostratigraphical setting cannot be related to the first and last appearance datums of species, so that only the type of association is taken as an indication of the age of the parietal. The assemblage is typical of the early Late Campanian, zone CC 22 of Sissingh (1977), as based on the co-occurrence of *Lithastrinus grilli*, *Aspidolithus parvus*, *Rheinhardtites anthophorus*, *Eif-fellithus eximius* and *Uniplanarius sissinghii* (Plate D).

Discussion

Bless et al. (1991) noted the common presence of Tethyan elements amongst the Early Campanian and middle Late Maastrichtian faunas in Belgium and the SE Netherlands, whereas such elements are rare or even absent in sediments from the Late Campanian to early Late Maastrichtian interval in the same area. Bless et al. (1991) could not determine with certainty the age of the 'Tuffeau jaunâtre' at Folx-les-Caves (Figure 5).

The nannoplankton analysis presented here shows its early Late Campanian age. This means that the 'first major Tethyan incursion' (Bless et al. 1991: Figure 8) in the area, whether interrupted or not, lasted until the Late Campanian, *Hainosaurus* cf. *bernardi* being a Tethyan element. There was a small incursion during the Early Maastrichtian, only well developed in the Cibly Phosphatic Chalk of the Cibly-Mons area, Belgium (Bless et al. 1991, Figure 8). *Hainosaurus bernardi* Dollo 1885 is a Tethyan element here as well. The age difference between the Folx-les-Caves and Cibly specimens makes us assign the present parietal to *Hainosaurus bernardi* with a query.

The early Late Campanian age of the fossil falls within the Santonian–Maastrichtian stratigraphical distribution of the genus *Hainosaurus*, as suggested by Bardet (1990). She referred a French tylosaur,

FOLX-LES-CAVES

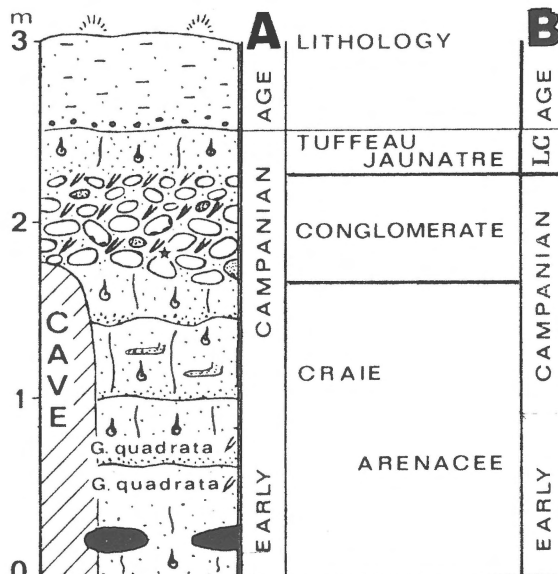


Figure 5. Campanian strata as exposed at the entry to former subterranean chalk/flint quarry, Folx-les-Caves (Belgium). Slightly modified from Bless et al. (1991), with permission. A = age according to Bless et al. (1991); B = age according to the present contribution; LC = early Late Campanian.

Mosasaurus gaudryi Thevenin 1896, to *Hainosaurus bernardi*. *Mosasaurus gaudryi* was based on a large incomplete skull from the Middle to Upper Santonian phosphatic chalk of Eclusier-Vaux, Somme region, northern France. It is kept under no. MNHN 1896–15 in the National Natural History Museum in Paris. Lingham-Soliar (1992) described this skull as a separate species, *Hainosaurus gaudryi* (Thevenin 1896). Unfortunately, it reveals only a very small anterior fragment of the parietal (Bardet 1990: fig. B). This poor preservation keeps us from a comparison with the parietal described by Von Meyer.

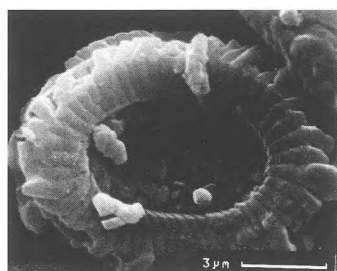
Acknowledgements

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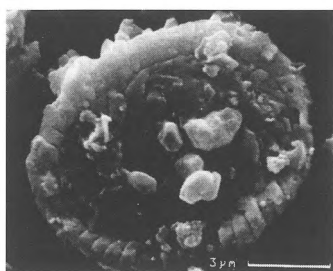
permission to use Figures 1 and 4: Dr M.J.M. Bless, Ing. P.J. Felder and Drs J.W.M. Jagt.

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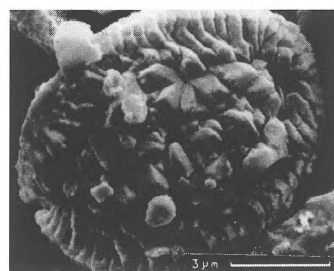
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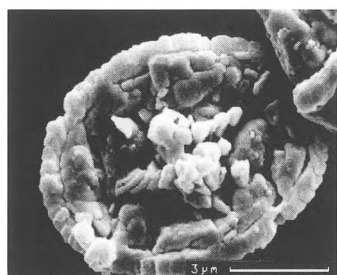
Aspidolithus parvus
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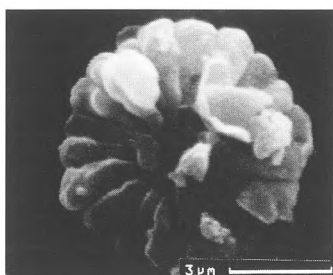
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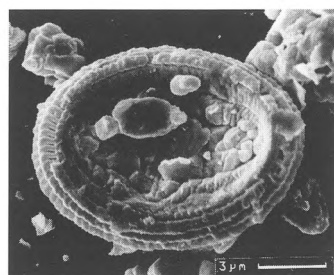
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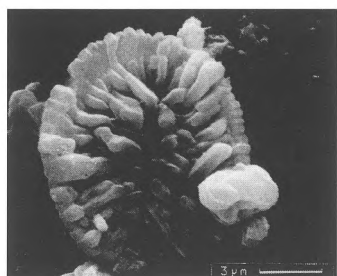
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distal



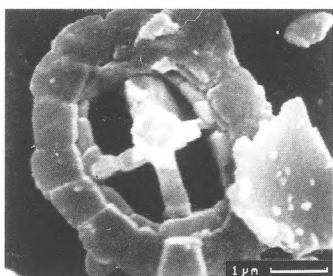
Discorhabdus ignotus
distal



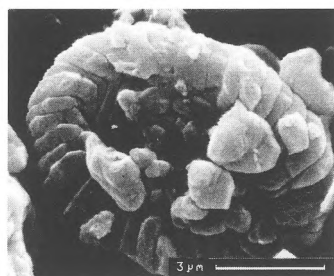
Gartnerago obliquum
proximal



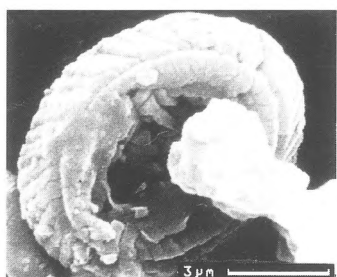
Kamptnerius magnificus
proximal



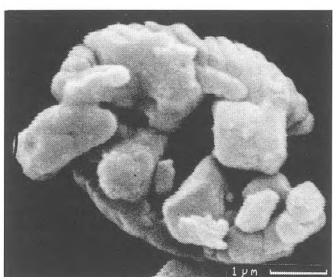
Prediscosphaera spinosa
distal



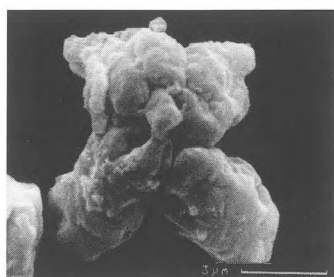
Reinhardtites anthophorus
distal



Reinhardtites anthophorus
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Tranolithus phacelosus
distal



Uniplanarius sissinghii
distal