

SCANNING ELECTRON MICROGRAPHS OF THE GENUS *KOKIA* (INCERTAE SEDIS)

Brigitta van Niel, Institute of Oceanographic Sciences, Brook Road, Wormley, Surrey. GU8 5UB

Introduction

Kokia is a genus of flat, rosette shaped Early Cretaceous (Ryazanian to Hauterivian) nannoliths. Specimens were described by Kok (1985), as UFO 2, and subsequently by Perch-Nielsen (1988), who formally described the genus *Kokia* including two new species, *K. borealis*, and *K. curvata*.

During examination of Ryazanian (Berriasian) North Sea sediments *Kokia* was found to be common and the opportunity was taken to examine it in the LM and SEM using the technique developed by Gallagher (1988). This genus has previously only been illustrated in cross-polarised light (Kok, 1985, Pl. 1 figs 11-13 and Perch-Nielsen, 1988, Pl. 1, figs 8-14). This short note illustrates *Kokia* spp. from NW Europe in the LM and SEM showing detail of the construction of the plates. Tentative affinities for this genus are discussed.

Observations

Kok (1985, p. 38) noted the presence of "a narrow axial depression" in specimens of *Kokia*. In the generic diagnosis, Perch-Nielsen (1988, p. 31) stated that "there is no central hole". Observation on the central part of *K. borealis* implies that there is a small central opening which appears to be covered by a thin diaphragm of calcite which can easily be damaged (Pl. 1, figs 1c-e). This feature may give the appearance of no central hole in the LM.

Most specimens observed had 8 rays although some specimens were constructed of 10 rays (Pl. 1, fig. 5). In the LM two apparently superimposed specimens were sometimes observed, however, no similar structures were found in the SEM, possibly due to the fragile nature of the structure. In the SEM the specimens are clearly shown to be rather flat and about 1 µm thick (Pl. 1, fig. 2c).

When specimens are observed in crossed polars the individual rays show straight extinction. Use of a gypsum plate (cf. Moshkovitz & Osmond, 1989; Young, 1992) shows that this is due to them having tangential crystallographic orientation, in contrast to the radial orientation observed in most coccoliths.

The rays appear to be constructed of a single plate giving a smooth appearance, with the free part of the rays being short or elongate, truncated or pointed. Isolated paired rays show some similarities to broken segments from *Micrantholithus* (Pl. 1, fig. 3). However, in the LM each ray can be clearly observed in *Kokia* specimens whereas in *Micrantholithus* specimens the segments form a complete unit. A second cycle of very thin plates can be observed around the central opening (Pl. 1, figs 1c & d). It is uncertain whether these plates form a thin diaphragm around the central area.

Possible Affinities

The biological affinity of this genus has been tentatively assigned to Ascidian spicules, in particular to the family

Didemnidae, by Varol & Girgis (1994, in press) and Varol & Houghton (in prep). The taxon, *K. borealis*, previously only observed in the LM, was inferred to resemble the SEM illustration of *Lissoclinium argyllense* in Monniot (1970, Pl. 2). The SEM micrographs illustrated in this paper clearly illustrate dissimilarities between the three-dimensional Ascidian spicules and the flat genus *Kokia*. Moreover, ascidian spicules show radial crystallographic orientations.

Structurally the specimens appear similar to the calcareous pentolith genera of the Braarudosphaeraceae. These genera are constructed of flat pentoliths of variable shape, sometimes with a central opening. In some genera e.g. *Pentaster* the segments may bear rays. Moshkovitz (1987, p. 1120) observed that in proximal view, *Bukryaster hayi* has a very thin calcitic layer beneath which lies a star-shaped body. This construction appears similar to that observed in plate 1, figs 1c & d). However, the large number of rays in the genus *Kokia* means it must still be considered 'incertae sedis'. The tangential crystallographic orientation of the rays would support affinities with either the Braarudosphaeraceae or the Polycyclolithaceae, both of which characteristically have tangential c axes (Moshkovitz & Osmond, 1989).

Taxonomic Combinations

Kokia borealis Perch-Nielsen (1987)

Kokia curvata Perch-Nielsen (1987)

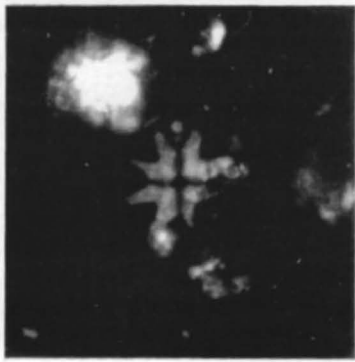
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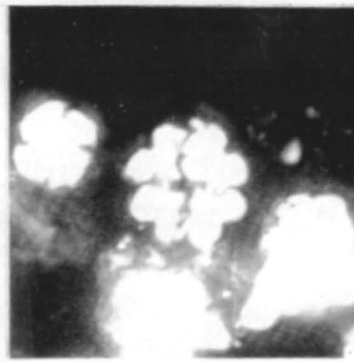
PLATE 1

- 1-4:** *Kokia borealis*. Upper Ryazanian. Danish Central Trough, North Jens-1, 7950 m. Figs 1 a-d, 2 a-c and 4 a- c are same specimen photographs.
- 1a:** Cross-polarised light.
1b: Scanning electron microscope.
1c: Detail of the central area and base of ray.
1d: Detail of the central pore which appears to be covered by a thin, damaged diaphragm.
- 2a:** Cross-polarised light.
2b: Scanning electron microscope.
2c: Oblique view illustrating the thin, flat nature of this genus.
- 3a:** Pair of broken rays.
4 a: Cross-polarised light.
4 b: Scanning electron microscope.
4 c: Detail of the central pore and diaphragm.
- 5:** *Kokia* sp. A 10-rayed specimen. Overgrowth of the specimen has obscured some of the structural detail. Upper Ryazanian. Danish Central Trough, North Jens-1, 7950 m.

Horizontal scale bars: 10 μm for the light micrographs (shown in fig. 4a) and 1 μm for all scanning electron micrographs.



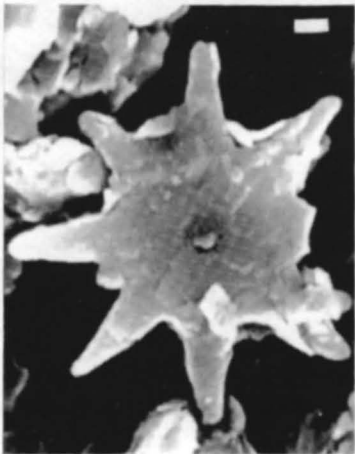
1a



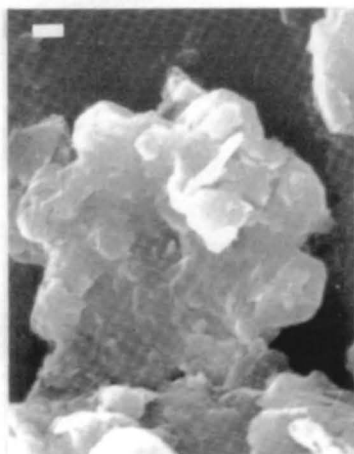
2a



4a



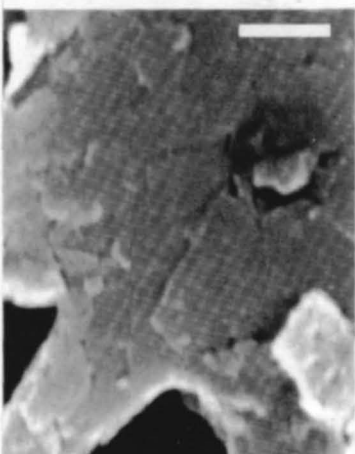
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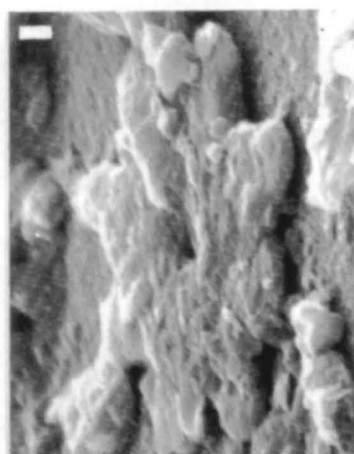
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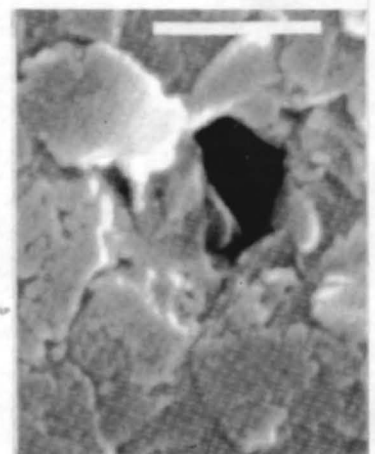
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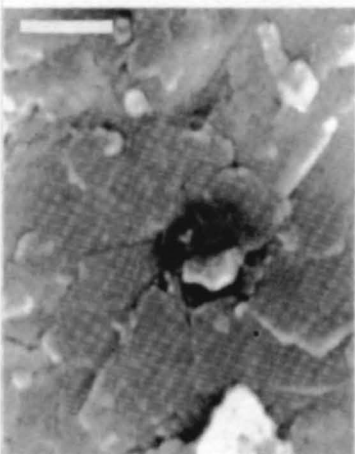
1c



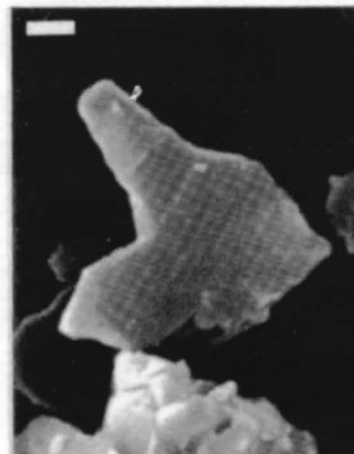
2c



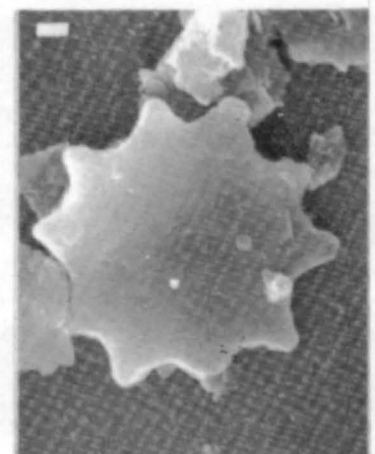
4c



1d



3



5