

NEW LOWER CRETACEOUS CALCAREOUS NANNOFOSSIL SPECIES FROM ENGLAND

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During an investigation of calcareous nannofossils from the boreal Lower Cretaceous, several new species and a new genus were found which are described below. The zonal scheme proposed by JAKUBOWSKI (1987) for the Moray Firth area of the North Sea (NLK-Zones) is used for the age-assignment of the samples.

Genus *Ceratolithina* MARTINI, 1967

Since the introduction of the genus *Ceratolithina* from the Middle Albian *minus* layers in NW Germany by MARTINI (1967), it has hardly been recorded by others. Its generotype, *Ceratolithina hamata*, possesses a well developed apical spur and two horns of different length and curvature (Pl. 1, Figs. 1,2). The light microscope study of samples from Copt Point collected during the INA field-trip in 1987 (GALE et al., 1987) yielded two new species of the genus, *C. bicornuta* and *C. cruxii*. The latter might be considered the ancestor of *C. hamata*.

Ceratolithina bicornuta n. sp.

Pl. 1, Figs. 3,4.

Holotype: Pl. 1, Fig. 3.

Type level: Middle Albian; NLK 4B, *Watznaueria barnesae* Subzone.

Type locality: Copt Point, Folkestone, SE England; Bed VII.

Derivation of name: *bicornuta*, Latin for "with two horns".

Diagnosis: Species of *Ceratolithina* with two apical spurs and horns.

Description: *C. bicornuta* has two apical spurs of varying length and two horns of varying length and curvature. In some specimens, one horn is short and straight and the other longer and curved, in others both spurs and horns are of about equal length, run parallel and are connected by a bridge. Their ends are tapering or blunt.

Remarks: Between crossed nicols, flat lying specimens appear bright when oriented at 0° to the nicols.

Occurrence: Beds VI-VIII at Copt Point ; Middle Albian NLK 4B Subzone.

Ceratolithina cruxii n. sp.

Pl. 1, Figs. 5-7

Holotype: Pl. 1, Fig. 5.

Type level: Middle Albian; *niobe* ammonite Zone; NLK 4B, *Watznaueria barnesae* Subzone.

Type locality: Copt Point, Folkestone, SE England; Bed VII.

Derivation of name: After J.A. CRUX, nannofossil specialist with BP.

Diagnosis: Calcareous nannofossil with a straight to very slightly curved horn and one or several lateral blade(s).

Description: The straight to slightly curved rod has one to several blades. The form of the blades varies greatly from sickle-like to sail-shaped. The rod is yellow when oriented at 0° to the crossed nicols, while the thin blade only reaches grey.

Remarks: This form is tentatively assigned to *Ceratolithina*, since it occurs with and just below *C. hamata* in the Middle Albian at Copt Point and may be the ancestor of that species. Moreover, there is no better suited published genus available. It is unlikely that *C. cruxii* is related to the genus *Lithraphidites* which has a cruciform cross-section.

Occurrence: Beds I-IX at Copt Point; Middle Albian NLK 4B Subzone.

***Kokia* n. gen.**

Generotype: *Kokia borealis*

Derivation of name: After C. P. KOK, micropaleontologist with Shell.

Diagnosis: Flat to thick rosette-shaped body with more than 6 segments or rays and faint to strong birefringence.

Description: The proportion of the free ends of the segments or rays varies from none to ca. 2/3. Their ends are blunt or tapering. The sutures between the segments are straight or curved and there is no central hole. Very flat specimens show only weak birefringence while thicker ones are strongly birefringent.

Remarks: KOK (1985) illustrated and described a flat calcareous nannofossil as UFO 2 from the "Valanginian of the North Sea". This form, here named *Kokia borealis*, was since found by several colleagues in many other wells. The very big specimens of *Kokia* are somewhat similar to *Biantholithus sparsus* from the Danian. The latter is usually smaller and thicker than *Kokia* specimens and the number of segments varies in the same assemblage, while it stays the same in *Kokia*. *Rucinolithus* includes "calcareous nannofossils that have the appearance of a rosette of 5 or more **inclined** segments in plan view". In *Kokia*, the segments are not inclined.

Other species include *Kokia sp.* which occurs in the Hauterivian of Speeton and *Kokia curvata* from the Valanginian of the North Sea.

Kokia borealis

Pl. 1, Figs. 8-10

Holotype: Pl. 1, Fig. 8.

Type level: Upper Berriasian; NLK 19A, *Sollasites arcuatus* Subzone.

Type locality: Central North Sea; Shell/Esso Well 22/21-2.

Derivation of name: from boreal = northern.

Diagnosis: Flat body with 8 tapering rays which are free for about 1/4 or more of their length.

Description: *K. borealis* has 8 tapering to blunt rays. The free length can vary from about 1/4 to 1/2 of the total length of the rays. The sutures between the rays are more or less radial and straight. *K. borealis* appears in different shades of grey between crossed nicols and the rays become extinct in turn when the slide is rotated.

Remarks: *K. borealis* differs from *K. curvata* which often is thicker, by its longer free rays and the usually straight sutures between them. It differs from *Kokia sp.* by having only 8 rays against the latter's 10.

Occurrence: KOK (1985) had assigned a Valanginian age to the samples containing his UFO 2 from the North Sea. It can now be assumed that the samples including *K. borealis* are of Berriasian age, since they occur with or below *Sollasites arcuatus*, which seems to be restricted to the upper part of the Upper Berriasian (JAKUBOWSKI, 1987; CRUX, 1987). *K. borealis* was found in the Central and in the Northern North Sea.

Kokia curvata

Pl. 1, Figs. 11-13

Holotype: Pl. 1, Fig. 11.

Type level: Lower Valanginian; NLK 18 Zone.

Type locality: Northern North Sea; Shell/Esso Well 211/13-7.

Derivation of name: from *curvata*, Latin for curved.

Diagnosis: Flat body with 8 segments, of which less than 1/4 is free. The sutures between segments are curved and their tips are rounded.

Description: *K. curvata* is grey to yellow between crossed nicols.

depending on its thickness. Overgrowth often fills in the space between the ray-tips and obscures the sutures which, however, may still be recognised by careful focussing and by the overlap of the rays producing an inner rosette-shaped pattern (Pl. 1, Fig. 11).

Remarks: The curved sutures and the short free part of the rays distinguishes this species from the other species in the genus. Large specimens of *Micrantholithus* sp. can look similar but can be distinguished by their 5 instead of 4 or 8 units as in *K. curvata*.

Occurrence: *K. curvata* was found together with and below *M. speetonensis* in the Lower Valanginian (and Upper Berriasian ?) of the North Sea. The "calcite rosettes" of AARHUS et al. (1986) may in part represent *K. curvata*.

***Kokia* sp. 1**

Pl. 1, Fig. 14

Big specimen of *Kokia* consisting of 10 segments with tapering ends and curved sutures. The free ends of the 10 segments are less than 1/2 the total length of the segments and pointed to blunt. The sutures between the segments are strongly curved. *Kokia* sp.1 has more segments and is bigger than *K. borealis* and *K. curvata*. It was only found in a sample from Speeton, labelled "base of bed C2". This bed is generally assumed to be of Late Hauterivian age, but contains calcareous nannofossils of the upper Lower Hauterivian, without *Tegulalithus septentrionalis* and *Eprolithus antiquus*.

Genus *Micrantholithus* DEFLANDRE 1954

Micrantholithus hoschulzii and/or *M. obtusus* are often a common part of the lower Lower Cretaceous assemblages in the North Sea. Besides these forms there occur rare *Braarudosphaera regularis* and *B. africana* and rare to common *M. speetonensis*, *M. brevis* and *M. lambertii*, a new species described below.

Micrantholithus lambertii

Pl. 1, Figs. 17,18

Holotype: Pl. 1, Fig. 17.

Type level: Upper Hauterivian; NLK 16A, *Speetonia colligata* Subzone.

Type locality: Central North Sea; Shell/Esso Well 30/11B-1.

Derivation of name: After B. LAMBERT, micropaleontologist with TOTAL, France.

Diagnosis: Species of *Micrantholithus* with long thorns on 4 of the 5 segments.

Description: *M. lambertii* has one segment like *M. hoschulzii* or a *Braarudosphaera regularis*, while the other 4 segments have an elongate thorn each along the sutures. The thorns are arranged in pairs.

Remarks: *M. lambertii* differs from other species of the genus by its unequal development of the segments of the pentoliths. Broken single segments constitute an unusual sight in some samples and can be quite common.

LAMBERT (1986) illustrated beautifully an Upper Albian coccosphere of *Braarudosphaera africana* with pentoliths belonging to different "species". It is possible that also *M. lambertii* should be assigned to *M. obtusus*/*M. hoschulzii* or *Braarudosphaera regularis*, the species with which it co-occurs. But the occurrence of *M. lambertii* over only a few million years in several wells in the North Sea suggests its spatial and temporal separation from the other species which occur intermittently over most of the Lower Cretaceous in this region.

Occurrence: Upper Valanginian to Upper Hauterivian of the North Sea.

Genus *Nannoconus* KAMPTNER, 1931

Well known Tethyan nannoconids such as *N. steinmannii*, *N. kamptneri*, *N. globulus*, *N. truittii* and *N. bermudezii*, but also some new species of *Nannoconus* have been found in the Lower Cretaceous of the North Sea. In their description, the width of the row of wedges (PERCH-NIELSEN, 1985: 377) is mentioned. Thin wedges of about 0.5 μm thickness are found in *N. abundans* and *N. concavus*. Medium-sized wedges measure about 1 μm and are seen in most nannoconids such as *N. steinmannii*, *N. kamptneri* and here in *N. alvus*, *N. longus* and *N. dislocatus*. Thick, coarse wedges are thicker than 1.5 μm and are found in *N. oviformis* and in *N. sabiniae*. One can also observe different angles of the wedges to the central canal: right angle to flat in *N. abundans*, *N. concavus*, *N. sabiniae* and *N. alvus*; low angle of about 10 - 30° in most nannoconids and here in *N. longus* and *N. dislocatus*; high angle of about 30 - 60° as here in *N. oviformis*; a steep angle of more than 60° has been observed in very rare undescribed forms.

Nannoconus alvus

Pl. 1, Figs. 19, 20

Holotype: Pl. 1, Figs. 19, 20.

Type level: Upper Berriasian; NLK 19A, *Sollasites arcuatus* Subzone.

Type locality: Central North Sea; Shell/Esso Well 29/7-1.

Derivation of name: From *alvus*, Latin for beehive.

Diagnosis: Beehive-shaped species of *Nannoconus* with no or a very narrow central canal and medium size, very low angle, rows of wedges.

Description: *N. alvus* is wider than high in side view. It has a concave base, more or less vertical sides and a dome-shaped apical part. The rows of wedges are of medium width and lie relatively flat.

Remarks: *N. alvus* probably often lies flat and then appears as a thick disc. Separate discs are common and can not be distinguished from separate discs of other species.

Occurrence: Upper Berriasian of the Central North Sea.

Nannoconus concavus

Pl. 1, Figs. 21-24

Holotype: Pl. 1, Fig. 22.

Type level: Upper Berriasian; NLK 19, *Nannoconus steinmannii* Zone.

Type locality: Central North Sea; Shell/Esso Well 29/7-1.

Derivation of name: From *concavus*, Latin for concave.

Diagnosis: Species of *Nannoconus* with concave sides and apex and flat to concave basal part. Central canal about 1/3 or less of the width in the central part. Thin, flat rows of wedges.

Description: The outline of *N. concavus* in side-view is concave at the sides and in the apical part, while the basal part seems flat to slightly concave. The central canal comprises about 1/3 or less of the width of the body at the middle. The height of *N. concavus* ranges from slightly shorter than wide to slightly higher than wide. The species has a crenulate outline in top-view (Pl. 1, Fig. 24). The wedges are thin and relatively flat lying to low-angle to the central canal.

Remarks: *N. concavus* has not as wide a central cavity as *N. quadratus* (Pl. 1, Fig. 25), a similar Tethyan species, which has more ruggedly concave sides and also occurs in the North Sea. *N. abundans* often has larger apical discs and has even thinner wedges than *N. concavus*. It has usually a narrower central canal. In top view it can only be distinguished from *N. concavus* in , when it features remnants of the wider apical discs.

Occurrence: Upper Berriasian and lowermost Valanginian of the North Sea, where it does not overlap with *M. speetonensis*.

Nannoconus dislocatus

Pl. 1, Figs. 26, 27

Holotype: Pl. 1, Figs. 26, 27.

Type level: Lower Hauterivian; NLK 17, upper part of *Corollithion silvaradion* Zone.

Type locality: Northern North Sea; Shell/Esso Well 211/29-8.

Derivation of name: From *dislocatus*, Latin for displaced.

Diagnosis: Elongate species of *Nannoconus* consisting of two parts that are offset relative to one another and a relatively wide central canal. Medium-sized, low angle rows of wedges.

Description: This cylindrical species is higher than wide and consists of an oblique basal part and a slightly dislocated apical part. The central canal is about as wide as the walls and has a kink approximately in the middle. The rows of wedges are of medium width and form a low angle to the central canal.

Remarks: *N. dislocatus* differs from *N. kamptneri*, which also has a relatively wide central canal, by its obliqueness and the kink in the middle of the former's central canal.

Occurrence: Hauterivian of the Northern North Sea.

Nannoconus longus

Pl. 1, Figs. 34, 35

Holotype: Pl. 1, Fig. 35.

Type level: Upper Barremian; NLK 11, *Nannoconus borealis* Zone.

Type locality: Central North Sea; Shell/Esso Well 22/26A-2.

Derivation of name: From *longus*, Latin for long.

Diagnosis: Very long species of *Nannoconus* with a total length more than two times the maximum width. Bulbous at the apex. Central canal about 1/3 of width. Medium-size, low angle rows of wedges.

Description: *N. longus* has one bulbous and one open end. The thick end is only slightly wider than the long, slightly flaring or parallel-sided body. The central canal is about as wide as the wall, which is built of wedges of medium width. There is no cavity in the bulbous part.

Remarks: *N. longus* is longer than most other species of *Nannoconus* and is the only species with a bulbous apex and a length to width ratio more than two as found in *N. borealis*. *N. boletus* and *N. bonetii* are shorter, *N. dauvillieri* has a flaring rather than bulbous apex, *N. kamptneri* has no distinct bulbous apex and *N. steinmannii* has a very narrow central canal and no bulbous apex.

Occurrence: Upper Barremian of the North Sea.

Nannoconus oviformis

Pl. 1, Figs. 32, 33

Holotype: Pl. 1, Figs. 32, 33.

Type level: Upper Berriasian; NLK 19A, *Sollasites arcuatus* Subzone.

Type locality: Central North Sea; Shell/Esso Well 29/7-1.

Derivation of name: From *ovum*, Latin for egg, and *forma*, Latin for shape.

Diagnosis: Large, ovoid species of *Nannoconus* with wide central cavity and few, thick rows of wedges at a high angle to the central canal.

Description: *N. oviformis* has an oval outline in side-view and is subcircular in apical view. The wall is of equal thickness over most of the body and built of few rows of wedges surrounding a wide central

cavity.

Remarks: *N. oviformis* is bigger than *N. globulus* and has thicker, steeper rows of wedges than that species.

Occurrence: Upper Berriasian of the North Sea.

Nannoconus sabinae

Pl. 1, Figs. 28-31

Holotype: Pl. 1, Figs. 28, 29.

Type level: Upper Berriasian; *Nannoconus* sp. (discs) Zone of CRUX (1987).

Type locality: Central North Sea; Shell/Esso Well 29/7-1.

Derivation of name: After Sabine, my youngest daughter.

Diagnosis: Flat to high species of *Nannoconus* consisting of parallel lying wedges consisting of very thin parallel lying tiers and without a central canal.

Description: The holotype consists of 3 layers of wedges arranged parallel rather than spirally as usual in *Nannoconus*. In side-view, up to 8 layers of wedges have been seen (Pl. 1, Fig. 30), but specimens with fewer tiers are more common. Each wedge, in turn, consists of numerous very thin, slightly undulating tiers. No central canal is visible. Often, *N. sabinae* is seen in apical view and then appears, depending on its thickness, as faintly to strongly birefringent, large disc. The sutures are arranged radially in the single discs or rows of wedges.

Remarks: The assignment of this species to *Nannoconus* is not totally convincing, since typical representatives of *Nannoconus* have the rows of wedges arranged in a spiral rather than horizontally.

Large nannoconid discs were already mentioned from the Berriasian by JAKUBOWSKI (1987) in his Zone NLK 19 and CRUX (1987) based a zone on their range below the range of *Sollasites arcuatus*. They probably represent the single layers of *N. sabinae*.

Occurrence: Upper Berriasian of the North Sea and Speeton.

Genus ***Triquetrorhabdulus*** MARTINI 1965

The genus *Triquetrorhabdulus* includes calcareous rods with a triradial cross-section and occurs from the late Late Oligocene through the Late Miocene. Similar forms are also in the Lower Cretaceous.

Triquetrorhabdulus? shetlandensis

Pl. 1, Figs. 15, 16

Holotype: Pl. 1, Fig. 16.

Type level: Lower Valanginian; NLK 18, *Micrantholithus speetonensis* Zone.

Type locality: Northern North Sea; Shell/Esso Well 211/13-7.

Derivation of name: From the East Shetland Basin, where the well is situated.

Diagnosis: Elongate to diamond-shaped body with triradial cross-section.

Description: *T.?* *shetlandensis* has 3 blades which are usually widest towards about 1/4 to 1/3 of the length from the blunter end of the body. The 3 blades are not always equally well developed. The one standing vertically reaches blue birefringence colours at 45° between crossed nicols. The specimens are dark when oriented parallel to the crossed nicols.

Remarks: Although *T.?* *shetlandensis* most likely is not related to the Oligocene/Miocene genus *Triquetrorhabdulus*, it is tentatively included in this genus, since it seems even more unlikely that it is related to

the Eocene genus *Pseudotriquetrorhabdulus* which consists of up to eight laths, or the Cretaceous genus *Lithraphidites* which has a cruciform cross-section. The Upper Jurassic *Pseudolithraphidites* consists of 4 or 6 circular rods.

Occurrence: Lower Valanginian through Lower Hauterivian in Speeton and the North Sea.

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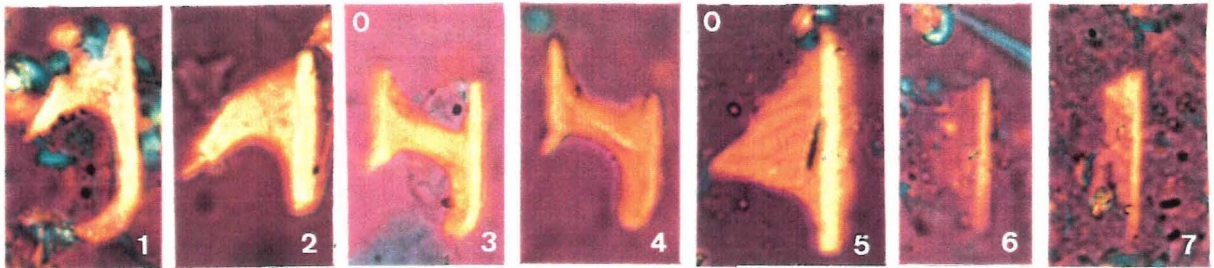
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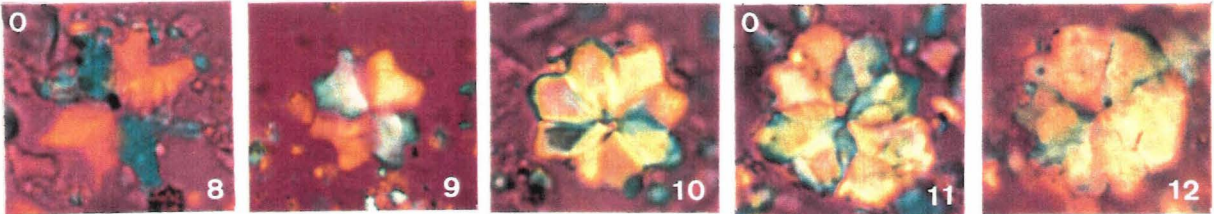
PLATE 1

Magnification ca. 1800x; x-nicols with gypsum plate; holotypes indicated by 0 in upper left corner of figures.

Figs 1,2	<i>Ceratolithina hamata</i>	Copt Point 13
Figs 3,4	<i>Ceratolithina bicornuta</i>	Copt Point 12
Figs 5-7	<i>Ceratolithina cruxii</i>	Copt Point 12,12,8
Figs 8-10	<i>Kokia borealis</i>	Shell/Eso 22/21-2
Figs 11-13	<i>Kokia curvata</i>	Shell/Eso 211/13-7
Fig. 14	<i>Kokia sp. 1</i>	Speeton, C2; RP 13
Figs 15,16	<i>Triquetrorhabdulus? shetlandensis</i>	Shell/Eso 211/13-7
Figs 17,18	<i>Micrantholithus lambertii</i>	Shell/Eso 30/11b-1
Figs 19,20	<i>Nannoconus alvus</i>	Shell/Eso 29/7-1
Figs 21-23	<i>Nannoconus concavus</i>	Shell/Eso 29/7-1
Fig. 24	<i>Nannoconus concavus</i>	Shell/Eso 30/6-3
Fig. 25	<i>Nannoconus quadratus</i>	Shell/Eso 29/7-1
Figs 26,27	<i>Nannoconus dislocatus</i>	Shell/Eso 211/29-8
Figs 28-30	<i>Nannoconus sabiniae</i>	Shell/Eso 29/7-1
Fig. 31	<i>Nannoconus sabiniae</i>	Shell/Eso 211/29-8
Figs 32,33	<i>Nannoconus oviformis</i>	Shell/Eso 29/7-1
Figs 34,35	<i>Nannoconus longus</i>	Shell/Eso 22/26-A2

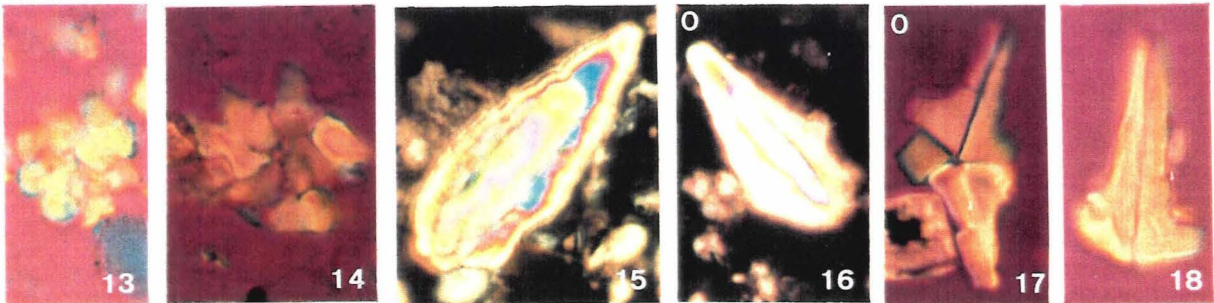


Ceratolithina hamata Ceratolithina bicornuta Ceratolithina cruxii

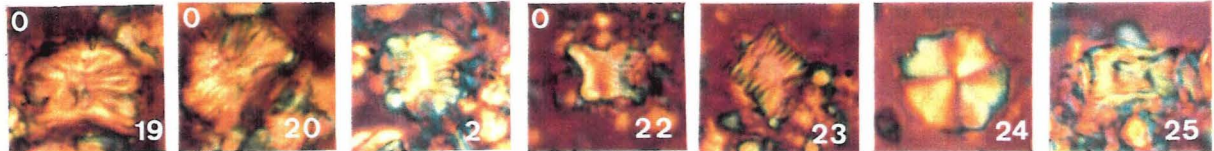


Kokia borealis

Kokia curvata



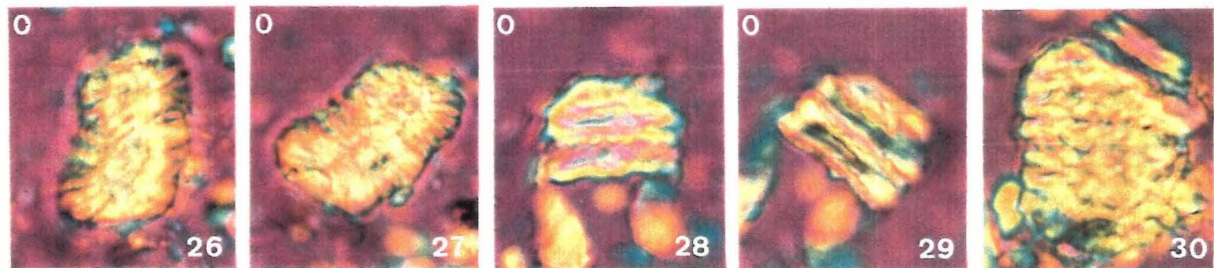
K.curvata Kokia sp.1 Triquetrorhabdulus shetlandensis M.lambertii



Nannoconus alvus

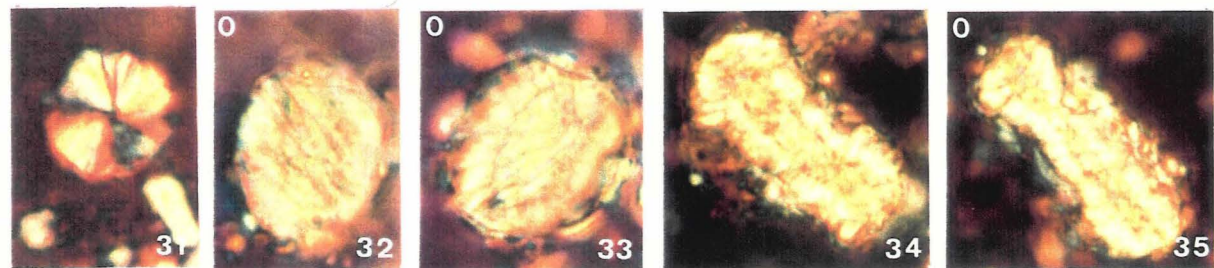
Nannoconus concavus

N.quadratus



Nannoconus dislocatus

Nannoconus sabinae



N.sabinae

Nannoconus oviformis

Nannoconus longus

