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UPPER CRETACEOUS CEPHALOPODA FROM OFFSHORE DEPOSITS OFF THE NATAL SOUTH COAST, SOUTH AFRICA

by

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ABSTRACT

Dredge samples off the Natal South Coast yielded an Upper Cretaceous cephalopod fauna consisting of *Eutrephoceras sphaericum geinitzi* Wiedmann, 1960, *Phylloceras (Hypophylloceras) woodsi woodsi* Van Hoepen, 1921, *Partschiceras umzambiense* (Van Hoepen, 1920), *Saghalinites nuperus* (Van Hoepen, 1921), *Saghalinites cala* (Forbes, 1846), *Baculites bailyi* Woods, 1906, *'Bostrychoceras' indicum* (Stoliczka, 1865), *Hyphantoceras (Madagascarites?) amapondense* (Van Hoepen, 1921), *Desmophyllites diphylloides* (Forbes, 1846), *Hauericeras* sp. cf. *H. gardeni* (Baily, 1855), *Kossmaticeras (Natalites) africanus* (Van Hoepen, 1920), and *Kossmaticeras (Kossmaticeras)* sp. cf. *K. (K.) inornatum* Collignon, 1966.

This fauna is similar to that of the onshore Mzamba Formation of Natal and Transkei (Pondoland), and is dated as Middle Santonian to Lower Campanian.

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INTRODUCTION

During a recent cruise of the South African research vessel, *MEIRING NAUDE*, a number of Upper Cretaceous invertebrate fossils were dredged off the Natal South Coast at a depth of between 400 and 500 metres, presumably at 30° 45′ 0″ S, 30° 37′ 7″ E. (Figure 1). These were presented to the South African Museum by Dr. R.N. Kilburn of the Natal Museum, Pietermaritzburg. This donation is gratefully acknowledged.

MATERIAL

All the specimens are preserved as ferruginous internal moulds, with only traces of the shell preserved. The bulk of the material consists of ammonoid phragmocones, in addition to two nautiloid nuclei, part of a belemnite phragmocone, five gasttropods, three ahermatypic corals, one inoceramid bivalve and a terebratulid brachiopod. Most of the specimens show encrustation by recent epizoans, mainly serpulids and bryozoans. Apart from the general absence of external shell, most of the specimens show few signs of abrasion. The surface of most specimens, however, is pitted due to the boring activities of endolithic organisms. Some of the ammonite phragmocones are crushed or broken, and partially filled with rounded faecal pellets. The preservation of the material suggests relatively long subaqueous exposure, the ferruginous mineralogy is probably due to alteration of material originally preserved in pyrite.

Traces of the fine-grained, ferruginous matrix adhere to some of the specimens. Unfortunately no other data on the lithology of the area are available. Bathymetric data in Birch (1981) show that the material was dredged from the upper slope of the shelf break. This part of the slope is very steep in this region, with a maximum gradient of 15,6°, and is dissected by several submarine canyons.

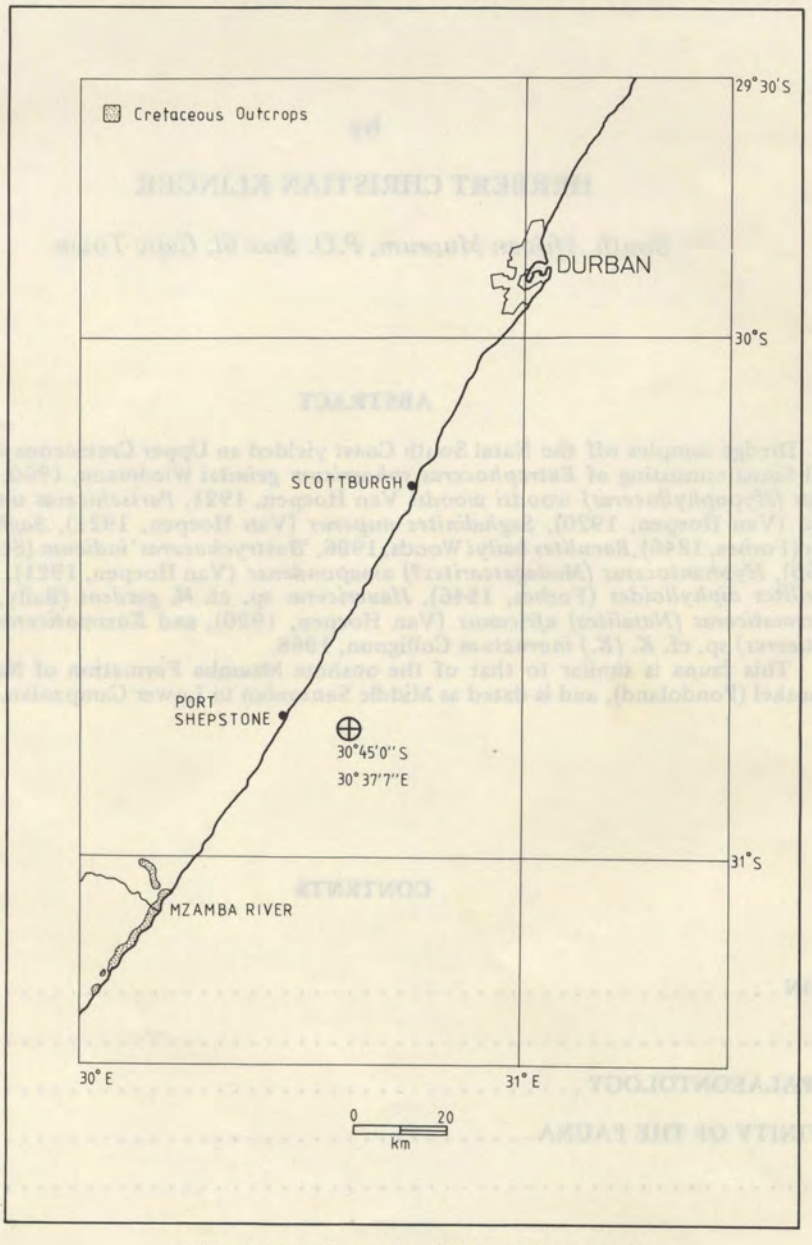


Fig. 1 Locality map of the dredge samples.

SYSTEMATIC PALAEONTOLOGY

Class CEPHALOPODA Cuvier, 1797

Subclass TETRABRANCHIATA Owen, 1832

Order NAUTILOIDEA Agassiz, 1847

Suborder NAUTILINA Agassiz, 1847

Family NAUTILIDAE De Blainville, 1825

Subfamily NAUTILINAE De Blainville, 1825

Genus *EUTREPHOCERAS* Hyatt, 1894

Eutrephoceras sphaericum geinitzi Wiedmann, 1960

Figs 2A-F

1846 *Nautilus laevigatus* d' Orbigny, pl. 6, figs 1-2.

1874 *Nautilus sublaevigatus* d'Orbigny; Geinitz: 5, pl. 32, fig. 1.

1960 *Eutrephoceras sphaericum geinitzi* Wiedmann: 171. (with synonymy)

Type: Holotype is the specimen figured by Geinitz (1874, pl. 32, fig. 1) by monotypy.

Material: SAM–PCO 6007 a-b.

Description & Discussion: Two internal moulds of nautiloid nuclei belong to this species. The whorl section is distinctly depressed, wider than high with an occluded umbilicus.

Occurrence: The species is long ranging, occurring in the Lower Turonian of Germany, Utatur Beds of India (Cenomanian to Upper Senonian) and tentatively in the Senonian of Madagascar. This is the first record of the species from southern Africa.

Order AMMONOIDEA Zittel, 1884

Suborder PHYLLOCERATINA Arkell, 1950

Superfamily PHYLLOCERATACEAE Zittel, 1884

Family PHYLLOCERATIDAE Zittel, 1884

Subfamily PHYLLOCERATINAE Zittel, 1884

Genus *PHYLLOCERAS* Suess, 1865

Subgenus *HYPOPHYLLOCERAS* Salfeld, 1924

Phylloceras (Hypophylloceras) woodsi woodsi Van Hoepen, 1921

Figs 2G-H

1921 *Phylloceras woodsi* Van Hoepen: 3, pl. 2, figs 1-6; text fig. 1.

1977 *Phylloceras (Hypophylloceras) woodsi woodsi* Van Hoepen; Kennedy & Klinger : 366, pl. 13, figs 3–5, text-figs 4–6. (with synonymy).

1982 ?*Phylloceras (Hypophylloceras) velledaeforme* (Schlüter); Immel, Klinger & Wiedmann: 8, pl. 1, figs 3–4.

Type: Holotype, by original designation, is the specimen figured by Van Hoepen (1921, pl. 2, figs 3– 4) Transvaal Museum nr. 537, from the type section of the Mzamba Formation, Mzamba Estuary, Pondoland, Transkei, of Middle Santonian to Lower Campanian age.

Material: SAM-PCO 5995

Description & Discussion: The specimen, with a diameter of 30 mm shows the typically compressed oval whorl section with nearly parallel flanks characteristic of the species. Ornament is most prominent on the outer third of the flanks.

A phylloceratid from the Santonian of Brandenberg, Austria described by Immel et al., (1982: 8, pl. 1, figs 3-4) as *Phylloceras (Hypophylloceras) velledaeformis* may also belong to this species. According to Birkelund (pers comm., 1982), the Austrian specimens certainly do not belong to *P. (H.) velledaeformis*. That species has a much more inflated whorl section.

For further discussion the reader is referred to Kennedy & Klinger (1977a) who have recently reviewed the species.

Occurrence: The type material is from an unspecified horizon in the Mzamba Formation of Middle Santonian to Lower Campanian age. It also occurs in the Lower Santonian of Madagascar, and possibly also in the Lower Santonian of the Austrian Gosau Beds. As yet the species is unknown in Zululand.

Genus *PARTSCHICERAS* Fucini, 1920

Partschiceras umzambiense (Van Hoepen, 1920)

Figs 2I-K

1920 *Phylloceras umzambiense* Van Hoepen: 142, pl. 24, figs 1-3.

1977 *Partschiceras umzambiense* (Van Hoepen); Kennedy & Klinger: 370, pl. 13, fig. 2, text-fig. 7 (with synonymy).

Type: Holotype, by monotypy, is the specimen figured by Van Hoepen (1920, pl. 24, figs 1-3) Transvaal Museum nr. 524 from the type section

of the Mzamba Formation at the Mzamba Estuary, Pondoland, Transkei, of Middle Santonian to Lower Campanian age.

Material: SAM-PCO 5993

Dimensions:

D	Wb	Wh	Wb/Wh	U
17,2	7,4 (43,0)	8,3 (48,3)	0,89	–

Description: The specimen is wholly septate. The umbilicus is filled with sediment, but appears very narrow, as in the holotype. The whorl section is inflated, higher than wide, with a broadly rounded venter and maximum whorl width on the dorsal half of the flanks. Part of the ornament is preserved, consisting of very fine ribs, which flex forwards on the dorsal half of the flanks and then backwards over the ventral half and straight over the venter. Intercalating or bifurcating ribs originate at about mid-flank.

Discussion: Despite the poor preservation, the specimen is of importance in that the species is very rare, having only once been recorded from Pondoland (Van Hoepen 1920, Kennedy & Klinger 1977a), and twice from Madagascar (Collignon 1956, 1966).

Occurrence: The holotype is from an unlocalized horizon at the type locality of the Mzamba Formation of Middle Santonian to Lower Campanian age. In Madagascar the species occurs in the Lower Santonian Zone of *Texanites 'oliveti'*. As yet, the species is unknown in Zululand.

Order LYTOCERATIDA Hyatt, 1889

Superfamily TETRAGONITACEAE Hyatt, 1900

Family TETRAGONITIDAE Hyatt, 1900

Genus *SAGHALINITES* Wright & Matsumoto, 1954

Saghalinites nuperus (Van Hoepen, 1921)

Figs 2N-S, 3A-C

1921 *Tetragonites nuperus* Van Hoepen: 13, pl. 3, figs 3-4, text-fig. 8.

1977 *Saghalinites nuperus* (Van Hoepen): Kennedy & Klinger: 177, figs 16A-E, A-B, 18 (with synonymy).

?1982 *Saghalinites aff. nuperus* (Van Hoepen); Szasz: 55, pl. 4, fig. 5.

Type: Holotype, by original designation, is the specimen figured by Van Hoepen (1921, pl. 3, figs 3-4) Transvaal Museum nr. 532 from an unlocalized horizon in the type section of the Mzamba Formation at the Mzamba River Estuary, Pondoland, Transkei, of Middle Santonian to Lower Campanian age.

Material: SAM-PCO 6000a-c

Dimensions:

	D	Wb	Wh	Wb/Wh	U
PCO 6000b	13,4	5,2 (38,8)	4,3 (32,1)	1,3	6,3 (47,0)
PCO 6000a	17,6	6,6 (37,5)	6,2 (35,2)	1,1	8,2 (46,6)
PCO 6000c	27,8	8,8 (31,7)	8,1 (29,1)	1,1	c.13 (c.47)

Description: Preservation in all three specimens is poor, but their identity is readily established by the rounded whorl section and nature of the constrictions: straight and prorsiradiate on the flanks and peaked over the venter.

Discussion: The closely allied *S. cala* (Forbes) differs in having a more polygonal whorl section and more sinuous constrictions.

Occurrence: The species is known from the Upper Santonian at the type section of the Mzamba Formation, where it is relatively scarce. A single specimen is known from the Lower Santonian of Zululand; in Madagascar the species is known from the Lower and Middle Santonian and possibly from the Upper Santonian or Lower Campanian. The species is also tentatively recorded from the Upper Campanian of Romania. The Japanese occurrence (Yabe 1915: 16, pl. 1, fig. 7, pl. 3, fig. 2) is not dated more precisely than Senonian.

Saghalinites cala (Forbes, 1846)

Figs 2L-M, 3G-H

1846 *Ammonites cala* Forbes: 104, pl. 8, fig. 4.

1977 *Saghalinites cala* (Forbes); Kennedy & Klinger: 168, figs 10A-B, 11A-B, 12D-G, 13A-B, E-K, ?C-D, 14A-F, 15A-F (with synonymy).

Type: Lectotype is the specimen figured by Forbes (1846, pl. 8, fig. 4) British Museum (Natural History) nr. C51057 from the Valudayur Beds of Pondicherry, southern India.

Material: SAM-PCO 5992a-b.

Description & Discussion: Preservation is poor, but both specimens show the typically depressed, polygonal whorl section, which distinguishes it from *S. nuperus* (Van Hoepen). In addition, the smaller of the two specimens (fig. 3G-H) shows a faint, but distinctly sinusoidal constriction which is characteristic of the species.

Occurrence: This species is common in Zululand, ranging from the Upper Campanian to Lower Maastrichtian. Only one specimen has been recorded from an unlocalized horizon at the type section of the Mzamba Formation of Middle Santonian to Lower Campanian age. The lectotype is from the Lower Maastrichtian of southern India. Howarth (1958) records the species from the Campanian of Antarctica, whereas the Tunisian occurrence (Pervinquière 1907) is doubtfully dated as Santonian. As yet it has not been recorded from Madagascar.

Suborder ANCYLOCERATINA Wiedmann, 1966

Superfamily TURRILITACEAE Gill, 1871

Family BACULITIDAE Gill, 1871

Genus *BACULITES* Lamarck, 1799

Baculites bailyi Woods, 1906
Figs 4E-H

1906 *Baculites bailyi* Woods: 341, pl. 44, fig. 5.

1963 *Baculites bailyi* Woods; Matsumoto & Obata: 35, pl. 20, figs 1-2, pl. 2l, fig. 5, text-figs 88-89, 116-120, 140-142 (with synonymy).

1969 *Baculites bailyi* Woods; Collignon: 21, pl. 520, fig. 2051.

Type: Holotype, by original designation, is the specimen figured by Baily (1855, pl. 11, fig. 5a-b, *non* 5c as *Baculites sulcatus*) British Museum (Natural History) nr. C11372, from an unspecified horizon at the type section of the Mzamba Formation, Mzamba Estuary, Pondoland, Transkei, of Middle Santonian to Lower Campanian age.

Material: SAM-PCO 5994a-c.

Description & Discussion: The species can easily be identified by the total lack of ornament, rapid tapering, and a whorl section with a broadly rounded dorsum and narrowly rounded venter.

Occurrence: The precise horizon at which the species occurs at the type section of the Mzamba Formation is unknown, as it has only been collected from fallen blocks, but it is presumably near the Santonian/Campanian boundary. Collignon (1969) records the species from the upper part of the Lower Campanian, Zone of *Menabites boulei* and *Anapachydiscus arrialoorensis* of Madagascar.

In Japan Matsumoto & Obata (1963) record the species from the Upper Santonian.

Genus *'BOSTRYCHOCERAS'* Hyatt, 1900

Discussion: The generic name *Bostrychoceras* is used in quotation marks as the status and validity of the genus has still not been resolved satisfactorily (see e.g. Matsumoto 1977: 324 et seq.). The present material does not warrant a discussion of the complex synonymies involved.

'Bostrychoceras' indicum (Stoliczka, 1865)
Figs 4L-M

1962 *Cirroceras (Cirroceras) indicum* (Stoliczka); Wiedmann: 200, pl. 9, fig. 4 (with synonymy).

1976 *Didymoceras (Didymoceras)* sp. gr. ex *indicum* (Stoliczka); Klinger: 64, pl. 24, figs 2-4, text-fig. 10c (with synonymy).

Type: Lectotype by subsequent designation of Wiedmann (1962: 202) is the specimen figured by Stoliczka (1865, pl. 86, fig. 1) from the Coniacian or Santonian of southern India.

Material: SAM-PCO 5991, 6003.

Description: The smaller of the two specimens (fig. 4M) consists of three contiguous, helical whorls. Ornament consists of about forty slightly rursiradiate, fine ribs which commonly branch near the adapical side of the whorls. Deep constrictions are conspicuous and abundant and seem to occur at regular intervals. In the smaller specimen they occur every 180°, thus causing the constrictions of successive whorls to be more or less aligned on the side of the helix. The larger of the two specimens (fig. 4L) is crushed, but has the same ornament of fine ribbing and marked constrictions.

Discussion: Apart from the fact that the status of the genus is unresolved, the validity of the majority of species referred to *'Bostrychoceras'* is in even greater doubt The author here again follows Wiedmann's (1962) classification as on a previous occasion (Klinger 1976).

The present specimens are virtually identical to a specimen referred to this species from the Lower Campanian of the Nibela Peninsula, Zululand (Klinger 1976, pl. 24, fig. 4) in having constrictions at regular intervals. This in turn resembles *Turrilites saundersaurum* Stephenson (1941, pl. 83, figs 6-8) from the Campanian of Texas.

Occurrence: The species as interpreted by Wiedmann (1962) occurs world-wide, from the Turonian to the Campanian. The present variety with regularly spaced constrictions seems to occur mainly in the Lower Campanian and is known from Zululand and Texas.

Genus *HYPHANTOCERAS* Hyatt, 1900

Subgenus ?*MADAGASCARITES* Collignon, 1966

Hyphantoceras (?Madagascarites) amapondense (Van Hoepen, 1921) Figs 4I-K

1921 *Heteroceras amapondense* Van Hoepen: 17, pl. 4, figs 1-2.

1976 *Hyphantoceras (Madagascarites?) amapondense* (Van Hoepen); Klinger: 71, pl. 32, fig. 5, pl. 33, figs 2–3, text-fig. 10d-e.

1979 *Hyphantoceras (Madagascarites?) amapondense* (Van Hoepen); Summesberger: 123, pl. 3, fig. 19, text-fig. 13.

1980 *Hyphantoceras (Madagascarites?) amapondense* (Van Hoepen); Summesberger: 277, pl. 1, fig. 2, text-fig. 3.

1982 *Hyphantoceras* (?) *amapondense* (Van Hoepen); Lewy: 24, figs 1-6.

Type: Holotype, by original designation, is the specimen figured by Van Hoepen (1921, pl. 4, figs 1-2) from an unlocalized horizon at the type section of the Mzamba Formation, Mzamba Estuary, Pondoland, Transkei, of Middle Santonian to Lower Campanian age.

Material: SAM-PCO 5996

Description & Discussion: A septate fragment represents the early *'Bostrychoceras'*-like whorls of this enigmatic species. The species is questionably referred to *Madagascarites,* but probably requires separate generic or subgeneric rank.

Occurrence: In Pondoland and in Zululand the species is known to occur in the Upper Santonian to Lower Campanian. In Madagascar it is recorded from the Lower Campanian, Zone of *Anapachydiscus wittekindi* and *Eulophoceras jacobi,* in the Gosau Basin of Austria in the Upper Santonian, and from the Upper Santonian of Israel.

Suborder AMMONITINA Hyatt, 1889

Superfamily DESMOCERATACEAE Zittel, 1985

Family DESMOCERATIDAE Zittel, 1895

Subfamily DESMOCERATINAE Zittel, 1895

Genus *DESMOPHYLLITES* Spath, 1929

Desmophyllites diphylloides (Forbes, 1846) Figs 3D-F, L-T

1846 *Ammonites diphylloides* Forbes: 105, pl. 8, fig. 8a-c.

1921 *Desmoceras* simplex Van Hoepen: 19, pl. 3, figs 11-16, text-fig. 10.

1921 *Desmoceras crassum* Van Hoepen: 20, pl. 4, figs. 3-4, text-fig. 11.

1959 *Desmophyllites diphylloides* (Forbes); Matsumoto: 9, pl. 3, fig. 3a-c, text-fig. 2. (with synonymy).

Type: Lectotype, by subsequent designation of Spath (1953:21 footnote) (as holotype), is the specimen figured by Forbes (1846, pl. 8, fig. 8) British Museum (Natural History) nr. C22682 from Valudayur, Pondicherry, southern India.

Material: SAM-PCO 6002a-h.

Dimensions:

	D	Wb	Wh	Wb/Wh	U
PCO 6002e	11,7	5,9 (50,4)	6,4 (54,7)	0,92	–
PCO 6002d	14,3	7,0 (49,0)	6,7 (46,9)	1,04	1,2 (8,4)
PCO 6002b	15,5	6,9 (44,5)	8,6 (55,5)	0,8	1,2 (7,7)
PCO 6002a	15,8	–	8,9 (56,3)	–	–
PCO 6002c	22,1	9,5 (42,4)	12,3 (55,6)	0,77	1,6 (7,2)

Description: This is the most common species in the assemblage. The very narrow, pit-like umbilicus and oval, higher than wide whorl section with flattened flanks and broadly rounded venter are characteristic of the species, as are the constrictions. The latter are prorsiradiate, slightly sinusoidal over the flanks and curved sharply forwards over the venter. The suture line is complex as shown in the figures of Matsumuto & Obata (1955, text-fig. 1) and Matsumoto (1959, text-fig. 2).

Discussion: This is a very variable species as demonstrated by Matsumoto & Obata (1955) and Matsumoto (1959), but is distinguished by virtue of the whorl section and constrictions. The two species from Pondoland described by Van Hoepen as *Desmoceras simplex* Van Hoepen (1921: 19, pl. 3, figs. 11-16, text-fig. 10) and *Desmoceras crassum* Van Hoepen (1921: 20, pl. 4, figs 3-4, text-fig. 11) can be included in the synonymy of *Desmophyllites diphylloides.*

Occurrence: The species has a wide distribution, occurring in California, British Columbia, Washington, Japan, Saghalin, India, Madagascar and Poland. It apparently ranges throughout the Campanian, possibly into the Lower Maastrichtian.

Subfamily HAUERICERATINAE Matsumoto, 1938

Genus *HAUERICERAS* De Grossouvre, 1894

Hauericeras sp. cf. *H. gardeni* (Baily, 1855)
Figs 3I-K

cf. 1982 *Hauericeras gardeni* (Baily); Immel, Klinger & Wiedmann: 16, pl. 5, figs. 1-4, text-fig. 5.

Material: SAM-PCO 5999

Description & Discussion: The specimen is an internal mould and thus lacks the characteristic keel of the genus, but the very compressed whorl section and evolute coiling leave little doubt as to the generic allocation. It is most probably referable to *H. gardeni,* the most common representative of the genus in southern Africa, but on the basis of this limited material a definite identification is not possible.

Occurrence: *Hauericeras* is a cosmopolitan genus, ranging in age from Coniacian to Maastrichtian.

Family KOSSMATICERATIDAE Spath, 1922

Subfamily KOSSMATICERATINAE Spath, 1922

Genus *KOSSMATICERAS* De Grossouvre, 1901

Subgenus *KOSSMATICERAS* De Grossouvre, 1901

Kossmaticeras (Kossmaticeras) sp. cf. *K. (K.) inornatum* Collignon, 1966
Figs 4B-D

cf. 1966 *Kossmaticeras inornatum* Collignon: 9, pl. 458, figs 1872-1873.

Material: SAM-PCO 5998

Description: Coiling is rather involute, with successive whorls covering each other up to mid-flank. The inner whorls are sub-trigonal, but ovoid on the outer (phragmocone) whorl, with maximum breadth near the umbilical edge. No ornament at all is visible.

Discussion: The closest ally to this specimen seems to be *K. (K.) inornatum* from the Lower Santonian of Madagascar, but in that species distinct constrictions occur. In the present specimen only very faint traces of a constriction are visible near the apertural end.

Occurrence: Offshore deposits of Natal.

Subgenus *NATALITES* Collignon, 1954

Kossmaticeras (Natalites) africanus (Van Hoepen, 1920)
Figs 3U-W, 4A

1920 *Holcodiscus africanus* Van Hoepen: 146, pl. 26, figs 3-5.

1966 *Kossmaticeras (Natalites) natalensis* Spath; Collignon: 9, pl. 457, fig. 1867, pl. 458, fig. 1868.

Type: Holotype, by monotypy, is the specimen figured by Van Hoepen (1920, pl. 26, figs 3-5) Transvaal Museum nr. 578 from an unspecified horizon at the type locality of the Mzamba Formation, Mzamba Estuary, Pondoland, Transkei, of Middle Santonian to Lower Campanian age.

Material: SAM-PCO 5997a-b

Description & Discussion: The larger of the two specimens (Figure 3U-W) is crushed dorsoventrally but ornament is typical of the species. The prominent constriction at the apertural end shows the virgatotome style of branching of the adapical flanking collared rib. *Madrasites natalensis* Spath (1922: 134. pl. 5, fig. 3) is a clear synonym of *K. (N.) africanus.*

Occurrence: The holotype and other material in the collections of the South African Museum are all from unspecified horizons at the type locality of the Mzamba Formation. In Madagascar the species is recorded from the Lower Santonian, Zone of *Texanites 'oliveti'.*

AGE AND AFFINITY OF THE FAUNA

With the exception of *Eutrephoceras sphaericum geinitzi, 'Bostrychoceras' indicum* and *Kossmaticeras (K.)* sp. cf. *inornatum,* all the cephalopod species in the present collection are known from the onshore exposures of the Mzamba Formation along the Natal and Pondoland Coast; especially at the type locality (Klinger & Kennedy 1980).

The age of the Mzamba Formation at its type locality, at the Mzamba Estuary, has now been firmly dated as Middle Santonian to Lower Campanian on the basis of ammonites (Klinger & Kennedy 1980). Foraminiferal data (Makrides 1979) suggest the presence of Upper Campanian sediments at the type locality, but this is unsubstantiated on macrofaunal evidence.

The majority of specimens in the collection are either long-ranging, or the exact age of the

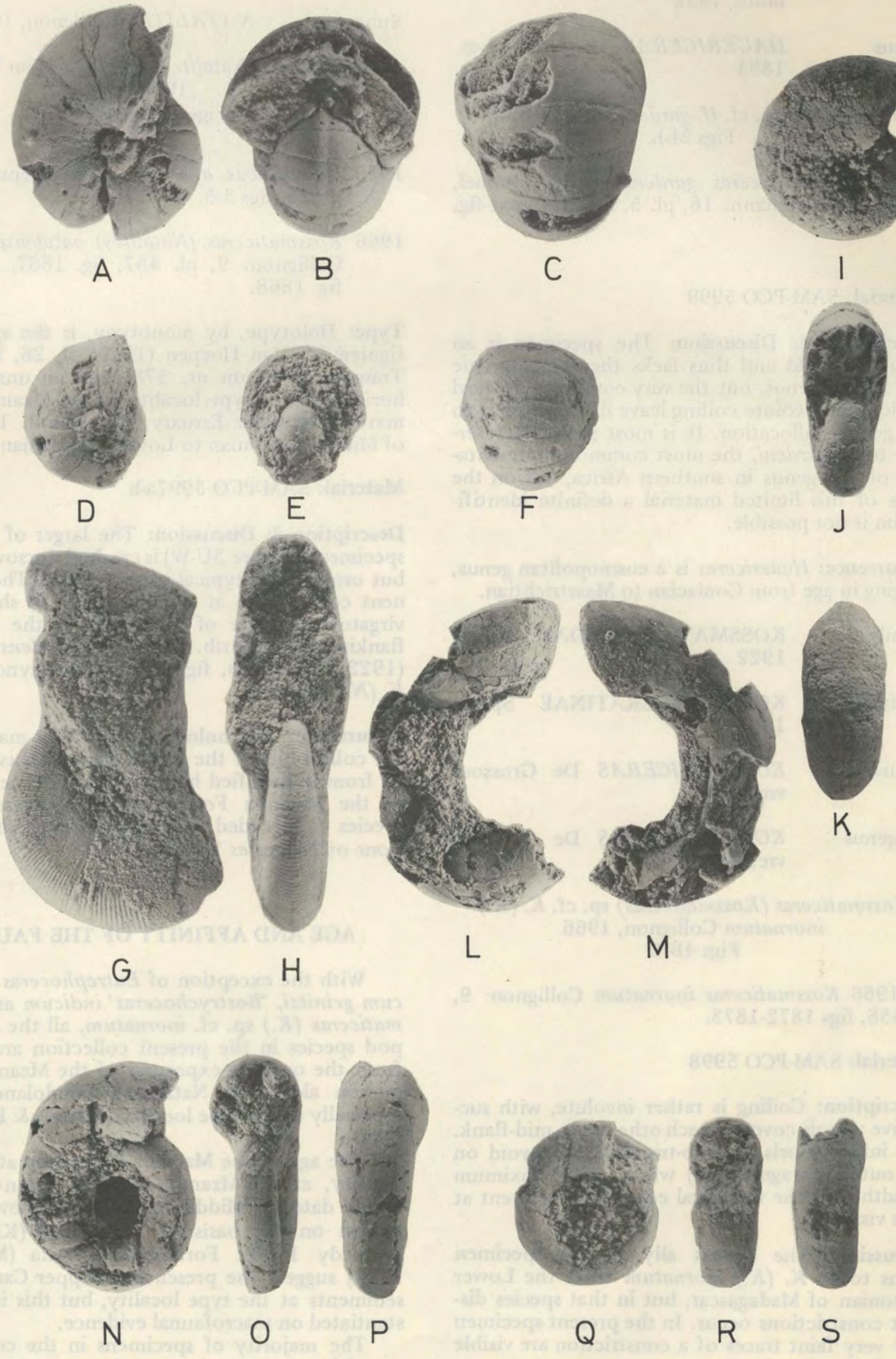


Fig. 2: A–F *Eutrephoceras sphaericum geinitzi* Wiedmann, 1960 A–C. SAM–PCO 6007A. D–F. SAM–PCO 6007b. Both x 2; G–H *Phylloceras (Hypophylloceras) woodsi* Van Hoepen, 1921. SAM–PCO 5995 x 2; I–K *Partschiceras umzambiense* (Van Hoepen, 1920). SAM–PCO 5993. x 2; L–M *Saghalinites cala* (Forbes, 1845). SAM–PCO 5992a x 1; N–S *Saghalinites nuperus* (Van Hoepen, 1921). N–P. SAM–PCO 6000a. Q–S. SAM–PCO 6000b. Both x 2.

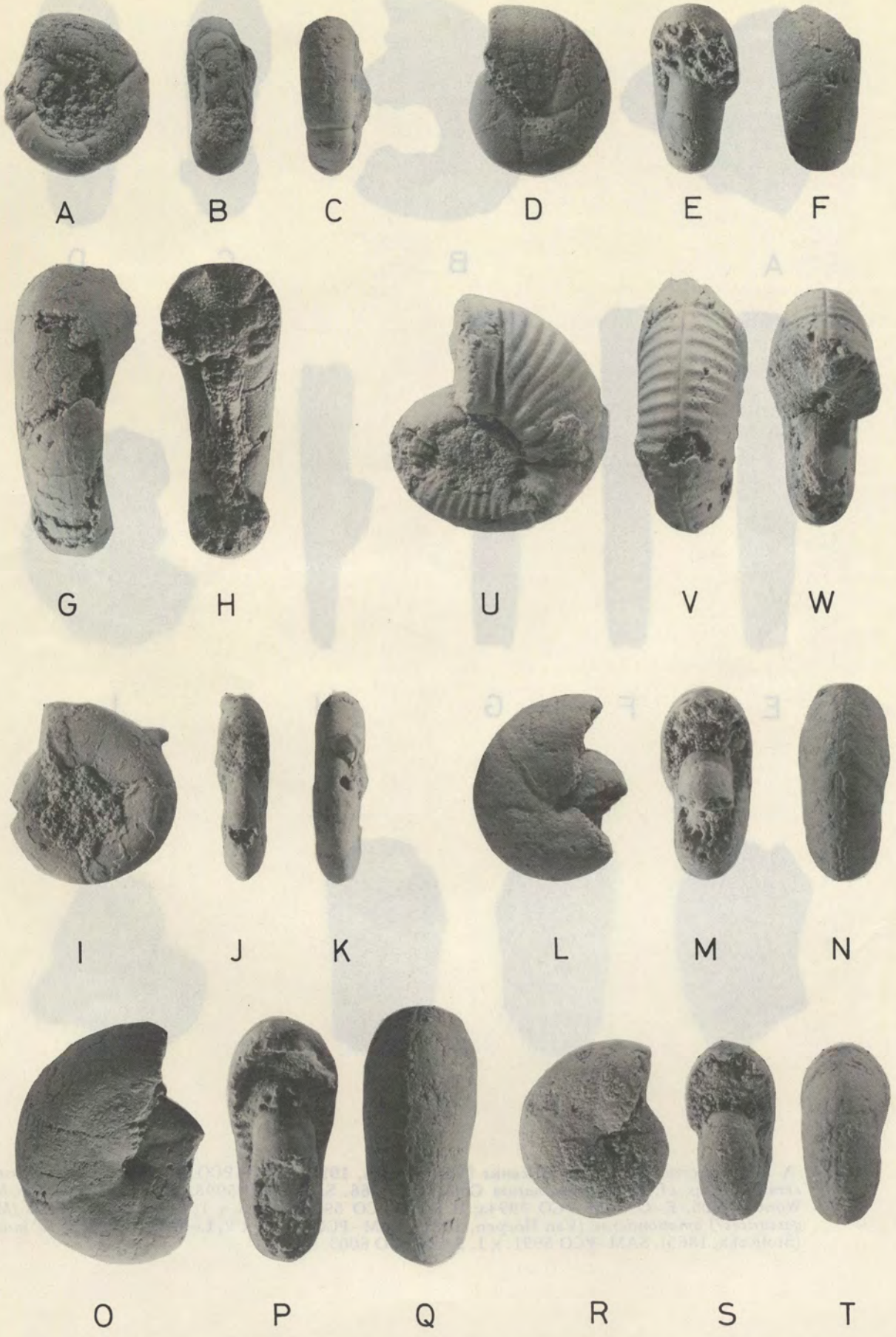


Fig. 3: **A–C** *Saghalinites nuperus* (Van Hoepen, 1921). SAM–PCO 6000c. x 1; **D–F L–T.** *Desmophyllites diphylloides* (Forbes, 1846). D–F. SAM–PCO 6002a. L–N. SAM–PCO 6002b. O–Q. SAM–PCO 6002c. R–T. SAM–PCO 6002d. D–F, L–Q x 2, R–T x 3; **G–H** *Saghalinites cala* (Forbes, 1846). SAM–PCO 5992b x 2; **I–K** *Hauericeras* sp. cf. *H. gardeni* (Baily, 1855). SAM–PCO 5999. x 2; **U–W** *Kossmaticeras (Natalites) africanus* (van Hoepen, 1920). SAM–PCO 5997a. x 2.

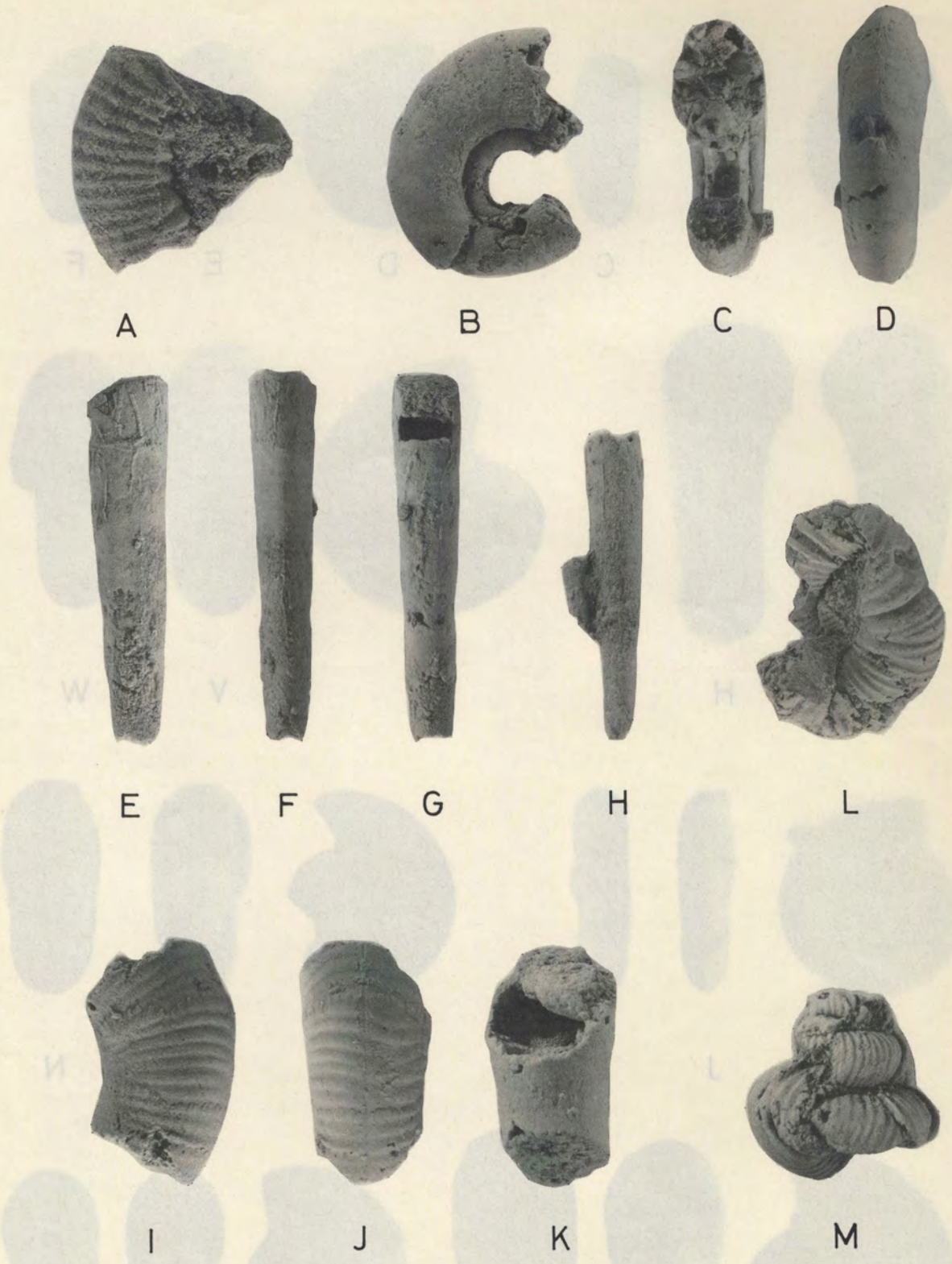


Fig. 4: **A** *Kossmaticeras (Natalites) africanus* (Van Hoepen, 1920). SAM–PCO 5997b x 2; **B–D** *Kossmaticeras (K.)* sp. cf. *K. (K.) inornatum* Collignon, 1966. SAM–PCO 5998. x 1; **E–H** *Baculites bailyi* Woods, 1906. E–G SAM–PCO 5994a; H SAM–PCO 5994b. Both x 1; **I–K** *Hyphantoceras (Madagascarites?) amapondense* (Van Hoepen, 1921). SAM–PCO 5996. x 2; **L–M** *'Bostrychoceras' indicum* (Stoliczka, 1865). SAM–PCO 5991. x 1. SAM–PCO 6003. x 2.

type material has not been firmly established. Consequently, the age of the offshore assemblage cannot be dated more accurately than the total time range of the Mzamba Formation, i.e. Middle Santonian to Lower Campanian.

Even though most of the species in the offshore assemblage are known from the onshore exposures of the Mzamba Formation, they represent the less common faunal elements. The most common faunal elements of the Mzamba Formation at the type locality, such as the pseudoschloenbachiids and texanitids, are conspicuously, absent. The dominance of weakly ornate, stratigraphically long-ranging phylloceratids, tetragonitids and desmoceratids suggests a deeper water depositional environment than at the type locality (see e.g. Wiedmann 1973).

Dissimilarities between the Pondoland and Zululand faunas have been discussed earlier (Klinger & Kennedy 1980). Similarities between the Pondoland fauna and that of the Gosau Beds of Austria have become obvious by renewed interest in the fauna of the latter (e.g. Immel et al. 1982, Summesberger 1979, 1980). Species in common to both areas include *Pseudophyllites latus, Hauericeras gardeni, Damesites compactus, Eupachydiscus isculensis, Hyphantoceras (Madagascarites?) amapondense,* and possibly *Phylloceras (Hypophylloceras) woodsi.* This faunal similarity may possibly be due to a circum-African current system as suggested by Summesberger (1979).

REFERENCES

BAILY, W.H. (1855). Description of some Cretaceous fossils from South Africa; collected by Capt. Garden of the 45th Regiment. *Q. Jl. geol. Soc. London,* 11, 454–465.

BIRCH, G.F. (1981). The bathymetry and geomorphology of the continental shelf and upper slope between Durban and Port St. Johns. *Ann. geol. Surv. S. Afr.,* 15/1 (1981), 55-62.

COLLIGNON, M. (1965). Ammonites néocrétacées du Menabe (Madagascar). IV.-Les Phylloceratidae. V.-Les Gaudryceratidae. VI.-Les Tetragonitidae. *Annls. géol. Serv. Mines Madagascar,* 23, 1-106.

———— (1966). *Atlas des fossiles caractéristiques de Madagascar (Ammonites). XIV (Santonien).* Tananarive, Service Géologique.

———— (1969). *Atlas des fossiles caractéristiques de Madagascar (Ammonites). XV (Campanien inférieur).* Tananarive, Service Géologique.

FORBES, E. (1846). Report on Cretaceous fossil invertebrates from southern India, collected by Mr. Kaye and Mr. Cunliffe. *Trans. geol. Soc. Lond.,* (2) 7, 97–174.

GEINITZ, H.B. (1874). Das Elbthalgebirge in Sachsen. II. Der mittlere und obere Quader. *Palaeontographica,* 20: 1-245.

HOEPEN, E.C.N. VAN (1920). Description of some Cretaceous ammonites from Pondoland. *Ann. Transv. Mus.,* 7, 142-147.

———— (1921). Cretaceous Cephalopoda from Pondoland. *Ann. Transv. Mus.,* 8, 1-48.

HOWARTH, M.K. (1958). Upper Jurassic and Cretaceous ammonite faunas of Alexander Land and Graham Land. *Scient. Rept. Falkld. Isl. Dep. Surv.,* 21, 1-16.

IMMEL, H., KLINGER, H.C. & WIEDMANN, J. (1982). Die Cephalopoden des Unteren Santon der Gosau von Brandenberg/Tirol, Österreich. *Zitteliana,* 8, 3–32.

KENNEDY, W.J. & KLINGER, H.C. (1977a). Cretaceous faunas from Zululand and Natal, South Africa. The ammonite family Phylloceratidae. *Bull. Br. Mus. nat. Hist. (Geol.),* 27, 347-380.

———— & ———— (1977b). Cretaceous faunas from Zululand and Natal, South Africa. The ammonite family Tetragonitidae Hyatt, 1900. *Ann. S. Afr. Mus.,* 73, 149-197.

KLINGER, H.C. (1976). Cretaceous heteromorph ammonites from Zululand. *Mem. Geol. Surv. S. Afr.,* 69, 1-142.

———— & KENNEDY, W.J. 1980. The Umzamba Formation at its type section, Umzamba Estuary (Pondoland, Transkei), the ammonite content and palaeogeographical distribution. *Ann. S.Afr. Mus.,* 81, 207-222.

LEWY, Z. 1982. A well-preserved Upper Santonian heteromorph ammonite from Israel. *Geol. Surv. Israel Current Research,* 1982: 24-27.

MAKRIDES, M. (1979). *Foraminifera of the Upper Cretaceous Mzamba Formation, Transkei, South Africa.* Unpublished MSc dissertation University Witwatersrand. 86 pp.

MATSUMOTO, T. (1959). Upper Cretaceous ammonites of California. II. *Mem. Fac. Sci., Kyushu Univ. (D) Geol., Special Volume,* 1, 1-172.

———— (1977). Some heteromorph ammonites from the Cretaceous of Hokkaido. *Mem. Fac. Sci., Kyushu Univ. (D) Geol.,* 23, 303-366.

———— & OBATA, I. (1955). Some Upper Cretaceous Desmoceratids from Hokkaido and Saghalien. *Mem. Fac. Sci., Kyushu Univ. (D) Geol.,* 5, 119-151.

———— & ———— (1963). A Monograph of the Baculitidae from Japan. *Mem. Fac. Sci., Kyushu Univ. (D) Geol.,* 13, 1-116.

ORBIGNY, A. d'. (1846). Voyage de l'Astrolabe et de la Zelee. I. Paléontologie. *In:* DUMONT D'URVILLE. *Voyage au Pol Sud et dans l'Oceanie méridionale, Géologie,* Paris.

PERVINQUIÈRE, L. (1907). Etudes de paléontologie tunisienne. 1. Céphalopodes des terrains secondaires *Mém. Carte géol. Tunis.,* 1907. 1-438.

PHILIPPI, R.A. (1895). *In:* STEINMAN, G. Die Cephalopoden der Quiri-quina-schichten. *N. Jb. Min. Geol. Paläont., Beil. Bd.* 10, 64-94.

SPATH, L.F. (1953). The Upper Cretaceous cephalophod fauna of Graham Land. *Rep. Falkland Isl. Dep. Surv. Sci. Rep.* 3, 1-60.

STEPHENSON, L.W. (1941). The larger invertebrate fossils of the Navarro Group of Texas. *Bull. Univ. Tex. Bur. econ. geol. Tech.,* 4101, 1-641.

STOLICKZKA, F. (1865). The fossil Cephalopoda of the Cretaceous rocks of southern India. *Mem. geol. Surv. India, Pal. Indica* 6-9, 107-154.

SUMMESBERGER, H. (1979). Eine obersantone Ammonitenfauna aus dem Becken von Gosau (Oberösterreich.) *Ann. Naturhistor. Mus. Wien.*, 82, 109-174.
———————— (1980). Neue Ammoniten aus der Sandkalkbank der Hochmooschichten (Obersanton; Gosau, Österreich). *Ann. Naturhistor. Mus. Wien.*, 83, 175-283.
SZASZ, L. (1982). Les ammonites hétéromorphes Campaniennes des Carpates méridionales (Roumanie). *D.S. Inst. geol. geofiz.*, 66 (1979), 45-56.
WIEDMANN, J. (1960). Zur Systematik jungmesozoischer Nautiliden. *Palaeontographica*, 115A, 144-206.
———————— (1962). Ammoniten aus der Vascogotischen Kreide. (Nordspanien). Phylloceratina, Lytoceratina. *Palaeontographica*, 118A, 119-237.
———————— (1973). The Albian and Cenomanian Tetragonitidae (Cretaceous Ammonoidea), with special reference to the circum-indic species. *Eclogae geol. Helv.*, 66, 585-616.
WOODS, H. (1906). The Cretaceous fauna of Pondoland. *Ann. S. Afr. Mus.*, 4, 175-350.
YABE, H. (1915). Notes on some Cretaceous fossils from Anaga on the Island Awajii and Toyajo in the Province of Kii. *Sci. Rep. Tohoku Univ. (Geol).*, (2) 4, 13-24.

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