

Cretaceous faunas from Zululand and Natal, South Africa. New records of Maastrichtian ammonites of the Family Kossmaticeratidae

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(with 2 figures)

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Records of two ammonite species *Pseudokossmaticeras pacificum* (Stoliczka, 1866) and *Brahmaites* (*Brahmaites*) *mikobokensis* Collignon, 1971, from the St Lucia Formation of northern KwaZulu-Natal are dated as Late Maastrichtian on the basis of associated inoceramid faunas. These records suggest that the Madagascan 'Early' Maastrichtian 'Zone à *Pachydiscus neubergicus* et *Pachydiscus gollevillensis*', in which these species also occur, is in part Late Maastrichtian.

Key words: Cretaceous, Maastrichtian, ammonite, *Pseudokossmaticeras*, *Brahmaites*, KwaZulu-Natal, South Africa.

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INTRODUCTION

The present note complements our revision of the Kossmaticeratidae from KwaZulu-Natal and Eastern Cape Province (Kennedy & Klinger, 1985) with records of two additional species. *Pseudokossmaticeras pacificum* (Stoliczka, 1866) was originally described from South India, and subsequently recorded from Madagascar (Collignon, 1938, p. 104, pl. 8, fig. 5; 1971, p. 38, pl. 647, fig. 2398; pl. 655, fig. 2418). *Brahmaites* (*Brahmaites*) *mikobokensis* Collignon, 1971 was previously known only from Madagascar. The interest of the present records is the light they shed on the age of both taxa. The occurrence of *P. pacificum* in South India is not precisely dated. In Madagascar, both species were recorded by Collignon (1971) from his Zone à *Pachydiscus neubergicus* et *Pachydiscus gollevillensis*, which he attributed to the Lower Maastrichtian. But the fauna of the zone contains many taxa that are exclusively Late Maastrichtian in western Europe and elsewhere, *Pachydiscus gollevillensis* (d'Orbigny, 1850), *P. jacquoti* (Seunes, 1890), and *Menuites fresvillensis* (Seunes, 1890), typical of the lower Upper Maastrichtian *fresvillensis* Zone in the expanded Biscay sections (Ward & Kennedy, 1993). However, this zone is in fact upper Lower and lower Upper Maastrichtian in Ward & Kennedy 1993,

e.g. fig. 14; *gollevillensis*, *jacquoti* and *fresvillensis* range into the lower Maastrichtian in the same figure. That the present species are of Late Maastrichtian age is confirmed by the associated inoceramids (see revision in Walaszczyk, Kennedy & Klinger, 2009). These document that *P. pacificum* occurs in association with the late Early and early Late Maastrichtian *Trochoceras radiosus* assemblage, and *B. (B.) mikobokensis* with the late Early Maastrichtian 'Inoceramus' *ianjonaensis* assemblage. However, in Walaszczyk *et al.* (2009) the *radiosus* assemblage was assigned to Lower Maastrichtian and *ianjonaensis* to the Upper Maastrichtian. In Walaszczyk *et al.* (2010, fig. 1) the *T. radiosus* zone spans the Lower/Upper Maastrichtian boundary. We conclude that the Madagascan Zone à *Pachydiscus neubergicus* et *Pachydiscus gollevillensis* is in part at least Late Maastrichtian, given that *P. (P.) neubergicus* ranges into the Upper Maastrichtian in the Biscay sections (Ward & Kennedy, 1993, fig. 14).

CONVENTIONS

Dimensions are given in millimetres: D = diameter; Wb = whorl breadth; Wh = whorl height; U = umbilicus; c = costal dimension; ic = intercostal dimension. Figures in brackets are dimensions as a percentage of the diameter.

The suture terminology is that of Korn *et al.* (2003): E = external lobe; A = adventive lobe (= lateral lobe, L, of Kullmann & Wiedmann 1970); U = umbilical lobe; I = internal lobe.

SAM: South African Museum, Cape Town.

OUM: Oxford University Museum of Natural History.

SYSTEMATIC PALAEONTOLOGY

Suborder **AMMONITINA** Hyatt, 1889

Superfamily **DESMOCERATOIDEA** von Zittel, 1895

Family **KOSSMATICERATIDAE** Spath, 1922

Subfamily **KOSSMATICERATINAE** Spath, 1922

Genus *Pseudokossmaticeras* Spath, 1922

Type species

Ammonites pacificus Stoliczka, 1866, p. 160, pl. 77, fig. 9, by the original designation of Spath (1922, p. 126).

Pseudokossmaticeras pacificum (Stoliczka, 1866)

Fig. 1A–C

1866 *Ammonites pacificus* Stoliczka, p. 160, pl. 77, fig. 9.

1922 *A. pacificus* Stoliczka; Spath, p. 126.

1938 *Pseudokossmaticeras pacificum* Stol.; Collignon, p. 104, pl. 8, fig. 5.

1953 *P. pacificum* Stoliczka sp.; Spath, p. 23.

1954 *P. pacificum* Stoliczka; Collignon, p. 48.

1955 *P. pacificum* Stoliczka; Collignon, p. 44.

1957 *Pseudokossmaticeras pacificum* (Stoliczka); Wright, p. L375, fig. 491.2 (copy of Stoliczka).

1971 *Pseudokossmaticeras pacificum* Stol.; Collignon, p. 38, pl. 647, fig. 2398; pl. 655, fig. 2418.

1989 *Pseudokossmaticeras* cf. *pacificum* (Stoliczka, 1865); Cooper, p. 252, text-fig. 1a–b.

1996 *Pseudokossmaticeras pacificum* (Stoliczka); Wright, p. 93, fig. 72.1 (copy of Stoliczka).

Type

The lectotype, here designated, is the original of Stoliczka (1866, p. 160, pl. 77, fig. 9), from the Arrialoor Group of Vencataramapooram, South India. There are also two paralectotypes, from north of Camarapolitam.

Material

SAM-PCZ22195, from the Upper Maastrichtian St Lucia Formation at locality 133 of Kennedy & Klinger (1975, p. 298), cliff section and beach platforms below Charter's Creek Rest Camp, Lake St Lucia, 28°12' 38"S, 32°28'08"E.

Description

SAM-PCZ22195 is a well-preserved composite mould with an estimated maximum preserved diameter of 70 mm. Coiling is very evolute, the shallow umbilicus comprising an estimated 50% of the diameter, the umbilical wall low, and broadly convex, the umbilical shoulder narrowly rounded. The whorl section is compressed reniform, the whorl breadth to height ratio 0.9, with the greatest breadth just outside the umbilical shoulder. The flanks are feebly convex, convergent, the ventrolateral shoulders broadly rounded, and the venter very feebly convex. The adapertural 60° sector of the penultimate whorl bears 12 ribs, most of them

narrow, weak, straight, prorsiradiate primaries that weaken and efface over the venter. Two develop a feeble umbilical bulla. There is a single narrow, prorsiradiate constriction. It is preceded by a strong, bullate collar rib, and succeeded by a much weaker rib that lacks a bulla. The preceding, adapical section of whorl is only partially exposed, with a single constriction and several bullate primary ribs. An approximately 120° sector of body chamber is preserved, with a maximum whorl height of 23.4 mm. Eighteen ribs are preserved on the fragment. All but one of the ribs are primaries. They arise at the umbilical seam and strengthen across the umbilical wall. They are straight and recti- to feebly prorsiradiate across the flanks, strengthening progressively, and passing straight across the venter where they reach their maximum strength. At the adapical end of the fragment the very regular ribbing is interrupted by a constriction that is flanked by simple ribs, the adapical one stronger than the adapertural one. The adapical collar rib is preceded by a single short intercalated rib.

Discussion

The ornament of the inner whorls matches well with the smaller lectotype, which has a maximum preserved diameter of an estimated 55 mm. It does not develop the coarser ribbing of the larger, adapertural sector of the outer whorl of the present specimen. The specimen from Ianjona, Madagascar, described and figured by Collignon (1938, p. 104, pl. 8, fig. 5) is 54 mm in diameter, shows a comparable change from finely ribbed inner, to progressively coarsening outer whorl, but not reaching the degree of coarseness developed by the present, larger specimen. Cooper (1989, p. 252, fig. 1a,b) figured a poorly preserved fragment from the same locality as the present specimen.

Pseudokossmaticeras galicianum (Favre, 1869) (p. 16, pl. 3, figs 5, 6; see revision in Kennedy & Summesberger, 1987, p. 28, pl. 2, fig. 6; pl. 3, figs 7–9; 1991, p. 93, fig. 1; Summesberger & Zorn 2012, p. 105), of which *P. tchihatcheffi* (Böhm, 1927) (p. 221, pl. 13, fig. 1; see Kennedy & Summesberger, 1987, pl. 2, fig. 7) is a synonym, has a higher expansion rate, quite unlike the serpenticonic coiling of *P. pacificum*, and more numerous intercalated ribs that persist at a stage where *P. pacificum* has primary ribs only.

Pseudokossmaticeras duereri (Redtenbacher, 1873) (p. 118, pl. 27, fig. 2; see revision in Reyment, 1958, p. 33, pl. 7, fig. 1; Ward & Kennedy, 1993, p. 30, text-figs 16.2, 16.3, 25.6; Summesberger & Zorn 2012, p. 105) is the species closest to *P. pacificum*. It has the same serpenticonic coiling, with ribs arising in groups of two or three from small umbilical bullae on the inner whorls, and numerous narrow crowded bullate primary ribs on the outer whorl.

Pseudokossmaticeras brandti (Redtenbacher, 1873) (p. 106, pl. 24, fig. 1), of which *P. aturicus* (Seunes, 1892) (p. 17, pl. 15 (6), figs 2, 3) is a synonym (see revision in Hancock & Kennedy, 1993, p. 155, pl. 2, figs 4–6; pl. 4, figs 1–5; pl. 5, figs 1–8; pl. 6, figs 1–9; pl. 7, figs 5–11; Summesberger & Zorn 2012, p. 105) also has a quite distinct coiling mode, the inner whorls with coarse bullate primary ribs that increase by branching and intercalation, the outer whorl with persistent coarse bullate ribs, predominantly primaries on the body chamber. Adults reach a much larger size (Hancock & Kennedy, 1993, pl. 4, figs 4, 5).

Pseudokossmaticeras tercense (Seunes, 1892) (p. 16, pl. 15 (6), fig. 4; see revision in Hancock & Kennedy, 1993, p. 157, pl. 7, figs 1–4; pl. 8, figs 1–6) has ribs arising either singly or in pairs from small umbilical bullae with intercalated ribs on the inner whorls, and distant bar-like ribs on the outer whorl. It reaches a much larger size than *P. pacificum* (Hancock & Kennedy, 1993, p. 191, pl. 8, figs 4–6).

Pseudokossmaticeras muratovi Mikhailov, 1951 (p. 77, pl. 13, fig. 52) is more coarsely ribbed, the ribs branching high on the flank.

Occurrence

Upper Maastrichtian of South India, Madagascar, and northern KwaZulu-Natal.

Genus and subgenus ***Brahmaites*** Kossmat, 1897

Type species

Ammonites Brahma Forbes, 1846, p. 100, pl. 8, fig. 1, by the original designation of Kossmat (1897, p. 44 (151)).

Brahmaites mikobokensis Collignon, 1971

Figs 1D–F, 2

1971 *Brahmaites mikobokensis* Collignon, p. 22, pl. 648, figs 2400–2401.

Type

The holotype, by original designation is the original of Collignon (1971, p. 22, pl. 648, fig. 2400, from 'Gisement 496-D, Ianjona-Ouest-Mikoboka (Manera), Madagascar', housed in the collections of the Université de Bourgogne, Dijon. It is reillustrated here as Fig. 2.

Material

SAM-PCZ22196, from the Maastrichtian St Lucia Formation, of locality 20 of Klinger & Kennedy, 1975 (p. 283), the cliff section at the junction of the old course of the Mfolozi, the present river, and an unnamed stream draining south from Lake Mfuthululu, ESE of Mtubatuba, coordinates: 28°26'59"S, 32°16'36"E. A fragment, OUM KX9098, is from locality 134 of Kennedy & Klinger (1975, p. 298), foreshore outcrops in Makakatana Bay, east of the village, 28°13'51"S, 32°25'08"E.

Dimensions

	D	Wb	Wh	Wb:Wh	U
SAM PCZ22196	94.6 (100)	39.0 (41.2)	31.2 (33.0)	1.25	47.3 (50.0)

Description

SAM-PCZ22196 is a composite mould of a phragmocone 94.6 mm in diameter. Coiling is very evolute, the broad umbilicus comprising 50% of the diameter. The umbilicus is shallow, with a flattened, outward-inclined umbilical wall. The umbilical shoulder is narrowly rounded, the whorl section depressed reniform, with the greatest breadth at the umbilical shoulder. The whorl breadth to height ratio is 1.25. The flanks, ventrolateral shoulders and venter are broadly and evenly rounded. There are more than 40 narrow, blunt, crowded ribs that are well-developed on the ventrolateral shoulder, sweep forwards across the inner flanks, weaken

progressively, and are effaced on the ventrolateral shoulders and venter. There are six prominent prorsiradiate constrictions on the outer whorl. They sweep forwards across the flanks, and cross the ventrolateral shoulders in a broad convexity. They are interrupted at mid-venter by a narrow groove, corresponding to a low ridge on the interior of the shell, presumably marking the site of attachment of the ventral muscle. The suture is very deeply and intricately incised, the saddle E/A bifid with a very narrow, deeply dissected stem, a narrow and trifid A, and A/U₂ only slightly smaller than E/A.

Discussion

The present specimens differs in no significant respects from the Madagascan material (Collignon, 1971, p. 22, pl. 648, figs 2400–2401). *Brahmaites (Brahmaites) brahma* (Forbes, 1846) (p. 100, pl. 8, fig. 1) (see revision in Kennedy & Henderson, 1992, p. 410, pl. 7, figs 1–3; pl. 8, figs 1–11; pl. 9, figs 1–4, 8–16; text-fig. 5) has whorls that are slender when compared to those of *B. (B.) mikobokensis*, the innermost flanks smooth, with fewer ribs, coarsely developed over the venter rather than effaced, the constrictions with much stronger collar ribs, raised into a bulla at the ventrolateral shoulder at the same size as the present specimen. *Brahmaites (B.) kossmati* Henderson & McNamara, 1985 (p. 68, pl. 6, figs 11–14; pl. 7, fig. 1; text-figs 9a, b, 10) has very coarse, distant ribs at the same size as the present specimen.

Occurrence

Upper Maastrichtian of Madagascar and northern KwaZulu-Natal.

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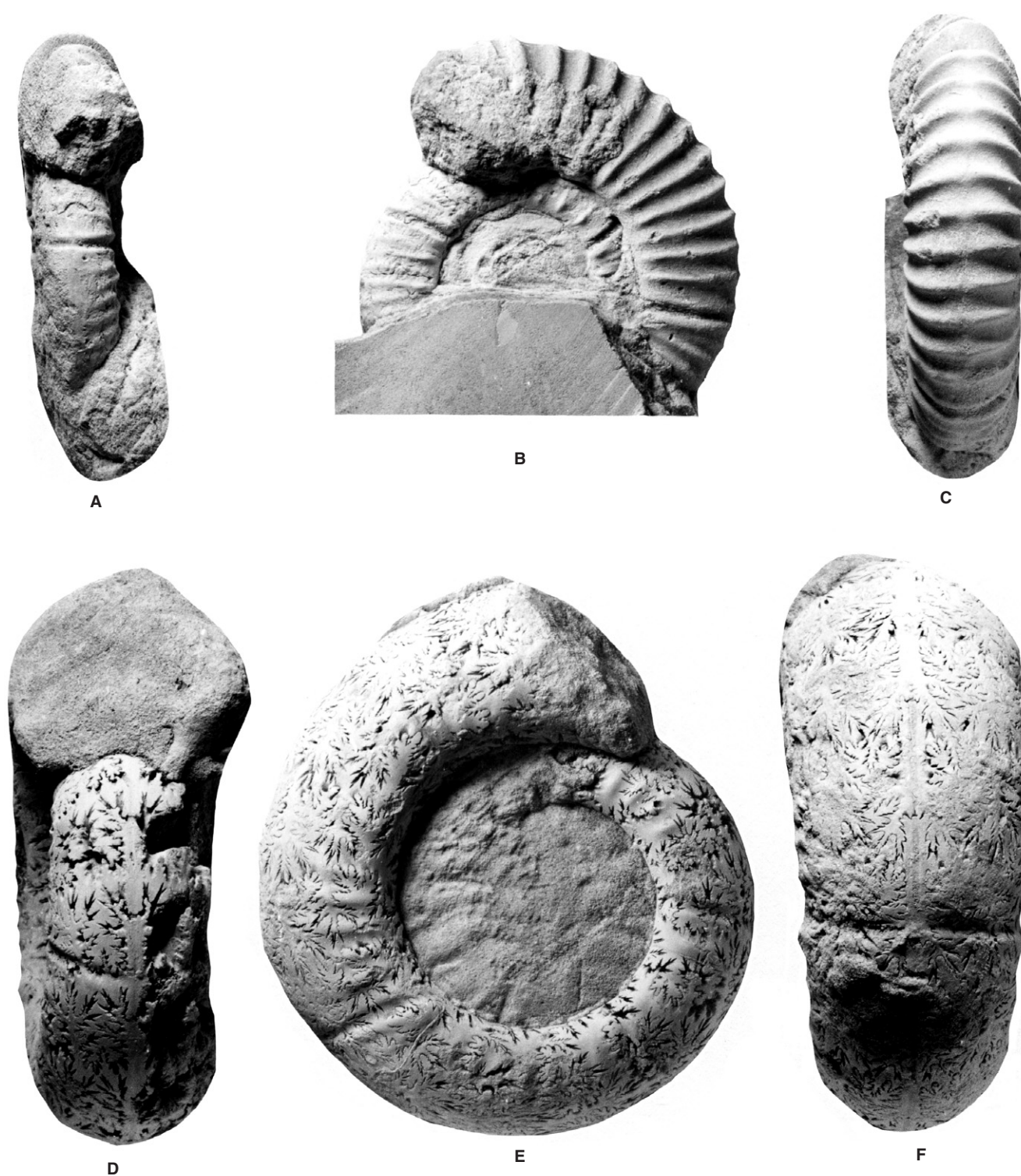


Fig. 1. A–C, *Pseudokossmaticeras pacificum* (Stoliczka, 1866). SAM-PCZ22195, from the Upper Maastrichtian St Lucia Formation at locality 133 of Klinger & Kennedy, 1975, p. 298, cliff section and beach platforms below Charter's Creek Rest Camp, Lake St Lucia, northern KwaZulu-Natal. **D–F,** *Brahmaites (Brahmaites) mikobokensis* Collignon, 1971, SAM-PCZ22196, from locality 20 of Klinger & Kennedy, 1975, p. 283, from the Maastrichtian St Lucia Formation, at the cliff section at the junction of the old course of the Mfolozi, the present river and an unnamed stream draining south from Lake Mfuthululu, ESE of Mtubatuba, northern KwaZulu-Natal. Figures are $\times 1$.



Fig. 2. *Brahmaites (Brahmaites) mikobokensis* Collignon, 1971, the holotype, the original of Collignon, 1971, pl. 648, fig. 2400, from Gisement 496-D, Ianjona-Ouest-Mikoboka (Manera), Madagascar, housed in the collections of the Université de Bourgogne, Dijon. Figures are $\times 1$.