

Cretaceous faunas from Zululand and Natal, South Africa. *Texasia cricki* Spath, 1921 (Cephalopoda: Ammonoidea) an early Santonian marker fossil from the Mzamba Formation of the Eastern Cape Province

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Received 29 July 2013. Accepted 29 October 2013

The type material of 'Gen. nov. (*Muniericeras*?)' *cricki* Spath, 1921, from the Santonian part of the Mzamba Formation, Eastern Cape Province, is revised, and referred to *Texasia* Reeside, 1932, of which *Lehmaniceras* Collignon, 1966 is a subjective junior synonym. *Lehmaniceras sornayi*, *L. acutum*, *L. macer*, *L. pingue*, *L. ultimum* and possibly *L. gracile* of Collignon, 1966, originally described from Madagascar, are further synonyms, as is *Barroisiceras umzambiensis* van Hoepen, 1968, which is based on a single specimen from Mzamba. The species occurs in the lower part of the Zone of *Texanites hourqi* in Madagascar, confirmed here as lower, rather than middle, Santonian.

Keywords: Ammonites, *Texasia*, Cretaceous, Santonian, Mzamba Formation, South Africa, Madagascar.

INTRODUCTION

In 1921, L.F. Spath described a small (38 mm diameter) ammonite from the Mzamba Beds of Pondoland (now Eastern Cape Province), referring to it as 'Gen. nov. (*Muniericeras*?)' *cricki* (Spath, 1921, p. 44, pl. 7, fig. 4). He discussed possible affinities, including comparison with representatives of *Muniericeras*, *Barroisiceras* and *Pseudoschloenbachia*. Nearly fifty years later, E.C.N. van Hoepen (1968, p. 161, pl. 6) described *Barroisiceras umzambiensis* from the lower part of the Mzamba Formation south of the Mzamba River. He did not compare it with Spath's *cricki*, and commented that it was of note in being 'remarkable for the fact that it is the only *Barroisiceras* to occur later than the Middle Coniacian: it is an Upper Santonian fossil.' Writing in 1975, we suggested that *cricki* and *umzambiensis* were synonyms, and indicated a Coniacian date for the base of the Mzamba Formation (Kennedy & Klinger, 1975, p. 270). Restudy of the section led to the conclusion that base of the Mzamba Formation was Santonian in age, and that *cricki* (= *umzambiensis*) was not a Coniacian *Barroisiceras*, but a representative of the genus *Lehmaniceras* Collignon, 1966, a Santonian homoeomorph of *Barroisiceras*. No further specimens have been collected from the Mzamba Formation, but we have re-examined the Madagascan type material of *Lehmaniceras*, and conclude that the majority, if not all, of the Santonian *Lehmaniceras* described by Collignon (1966) are but a single variable species, and a synonym of *cricki* of Spath. We follow Wright (1996, p. 107) in regarding *Lehmaniceras* as a junior synonym of *Texasia* Reeside, 1932. The South African, Madagascan and other relevant type material is described and figured below.

SYSTEMATIC PALAEOLOGY

Superfamily Desmoceratoidea von Zittel, 1895

Family Muniericeratidae Wright, 1952

Genus *Texasia* Reeside, 1932

(= *Lehmaniceras* Collignon, 1966)

Type species

Ammonites dentato-carinatus Roemer, 1852, p. 33, pl. 1, fig. 2, by the subsequent designation of Wright (1957, p. L432).

Texasia cricki (Spath, 1921), Figs 1A–F, ?G, I–L; 2A,B, ?C, D–F; 3A–G

1921 'Gen. nov. (*Muniericeras*?)' *cricki* Spath, p. 44, pl. 7, fig. 4.

1922 Gen. nov. (*Muniericeras*?) *cricki* Spath, p. 141.

1932 *Schloenbachia* (*Pseudoschloenbachia*) *pseudofournieri* Collignon, p. 65, pl. 4,

1966 *Lehmaniceras sornayi* Collignon, p. 50, pl. 475, fig. 1933.

1966 *Lehmaniceras acutum* Collignon, p. 51, pl. 475, figs 1934, 1935; pl. 476, fig. 1938.

1966 *Lehmaniceras macer* Collignon, p. 51, pl. 475, fig. 1936; pl. 476, fig. 1937.

?1966 *Lehmaniceras gracile* Collignon, p. 53, pl. 476, figs 1939, 1940.

1966 *Lehmaniceras pingue* Collignon, p. 56, pl. 477, fig. 1942.

1966 *Lehmaniceras ultimum* Collignon, 1966, p. 56, pl. 477, figs 1943, 1944.

1968 *Barroisiceras umzambiensis* van Hoepen, p. 161, pl. 6.

1980a *Lehmaniceras cricki* (Spath, 1921); Klinger & Kennedy, fig. 5A.

1983 *Praemuniericeras boriesi* Collignon, p. 195, pl. 3, fig. 1.

1983 *Lehmaniceras rivierae* Collignon, p. 197, pl. 3, fig. 7.

1995 *Texasia rivierae* (Collignon, 1983); Kennedy, p. 408, pl. 13, figs 1, 5, 6, 9, 13, 14; pl. 18, figs 13, 14.

?2008 *Texasia gracile* (Collignon, 1966); Kennedy, Walaszczyk & Klinger, p. 283, text-fig. 9D–L.

Types

The holotype of 'Gen. nov. (*Muniericeras*?)' *cricki* Spath, 1921 (p. 44, pl. 7, fig. 4; Fig. 1A–D herein) is an unregistered specimen in the collections of the Durban Museum. It is from an unspecified horizon in the Mzamba Formation at

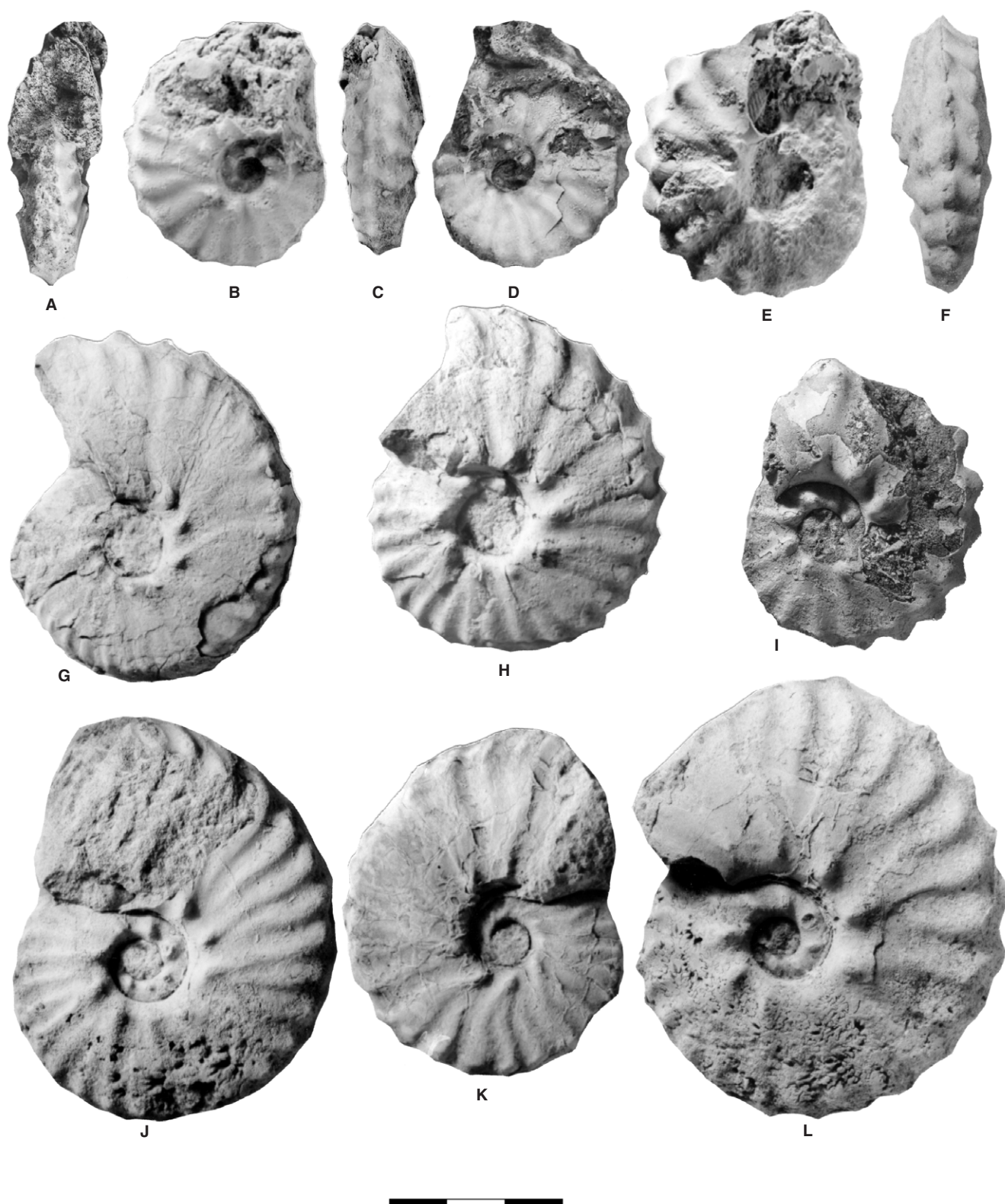


Figure 1. A–L, *Texasia cricki* (Spath, 1921). A–D, the holotype, the original of Spath, 1921, p. 44, pl. 7, fig. 4, an unregistered specimen in the collections of the Durban Museum. It is from an unspecified horizon in the Mzamba Formation at the mouth of the Mzamba River in Eastern Cape Province. E, F, I, the holotype of *Barroisicerus unzmambiensis* van Hoepen, 1968 (p. 161, pl. 6), SAM-PCP022448 from the lower part of the Mzamba Formation on the south side of the mouth of the Mzamba River, corresponding to locality C of Klinger & Kennedy (1980a, fig. 4). G, the holotype of *Lehmaniceras gracile* Collignon, 1966, p. 53, pl. 476, fig. 1939, from the *Texanites hourcq*i Zone at his locality 279 of the Ampolipoly-Antsirasira-Behamotra (Belo sur Tsiribihina section), Madagascar. H, the original of *Lehmaniceras acutum* Collignon, 1966, p. 53, pl. 476, fig. 1938, from the *Texanites hourcq*i Zone at his locality 279 of the Ampolipoly-Antsirasira-Behamotra (Belo sur Tsiribihina section), Madagascar. J, the original of *Lehmaniceras ultimum* Collignon, 1966, p. 56, pl. 477, fig. 1944, from the *Texanites hourcq*i Zone at his locality 280 of the Ampolipoly-Antsirasira-Behamotra (Belo sur Tsiribihina section), Madagascar. K, the original of *Lehmaniceras acutum* Collignon, 1966, p. 53, pl. 426, fig. 1937, from the *Texanites hourcq*i Zone at his locality 279 of the Ampolipoly-Antsirasira-Behamotra (Belo sur Tsiribihina section), Madagascar. L, the holotype of *Lehmaniceras acutum* Collignon, 1966, p. 51, pl. 475, fig. 1934, from the *Texanites hourcq*i Zone at his locality 758 of the Beantaly-Souroumaraino (Belo sur Tsiribihina) section. The originals of Figs G, H, J–L are in the collections of the Université de Bourgogne, Dijon. All figures are $\times 1$; scale bar in cm.

the mouth of the Mzamba River in Eastern Cape Province. The holotype of *Barroisiceras umzambiensis* van Hoepen, 1968 (p. 161, pl. 6; Fig. 1E,F,I herein) is SAM-PCP022448 from the lower part of the Mzamba Formation on the south side of the mouth of the Mzamba River, corresponding to locality C of Klinger & Kennedy (1980a, fig. 4).

Description

The holotype of *T. cricki* (Fig. 1A–D) has a maximum preserved diameter of 44 mm, and is a juvenile retaining recrystallized shell. It is part body chamber, and the adapertural part of the specimen is crushed. At a diameter of 41 mm, the apparent dimensions are:

Wb: 14.0 (34.1); Wh: 17.0 (41.5); Wb:Wh: (0.82); U: 11.0 (26.8)

Coiling is moderately involute, with over 50% of the previous whorl covered, the shallow umbilicus comprising 26.8% of the diameter. The flattened umbilical wall is slightly inclined outwards, the umbilical shoulder quite narrowly rounded. The intercostal whorl section is compressed, with the greatest breadth at the umbilical shoulder, the flanks flattened and convergent, with a fastigate venter. On the outer whorl, ten ribs arise at the umbilical seam, and give rise to well-developed bullae, perched on the umbilical shoulder. The bullae give rise to pairs of prorsiradiate ribs, with additional intercalated ribs, to give a total of 22–24 ribs per whorl. All ribs bear a strong ventrolateral clavus, the clavi are linked to strong siphonal clavi by a broad prorsiradiate rib, forming an obtuse ventral chevron with the siphonal clavus at the apex.

The holotype of *Barroisiceras umzambiensis* (Fig. 1E,F,I) is 53 mm in diameter, with recrystallized shell preserved, the same preservation as that of the type of *cricki*. It is a juvenile, and retains at least half a whorl of body chamber. Coiling is moderately involute, the umbilicus shallow, comprising 24% of the diameter. The flattened umbilical wall is inclined outwards, the umbilical shoulder broadly rounded, the whorl section compressed, the flanks flattened and convergent in intercostal section, the venter fastigate. There are nine strong, rounded umbilical bullae on the outer whorl, linked to the umbilical seam by a coarse rib. The bullae give rise to pairs of strong coarse prorsiradiate ribs, with a single long intercalated rib, to give a total of 19 ribs at the ventrolateral shoulder, where the ribs link to coarse ventrolateral clavi from which single very broad, low prorsiradiate ribs sweep forwards, producing an obtuse ventral chevron, and link to a strong, high siphonal clavus.

Discussion

Collignon (1966, p. 50) described a series of *Lehmaniceras* (= *Texasia* herein) from what he referred to as 'un niveau peu épais du Santonien moyen (niveau à *Lehmaniceras*)' [A thin horizon in the Middle Santonian (level of *Lehmaniceras*)] in his Middle Santonian 'Zone à *Texanites hourcqi*'. The associations at specific localities are as follows.

Gisement 758. Coupe de Beantaly-Souromarino (Belo sur Tsiribihina): *Lehmaniceras sornayi*, *Lehmaniceras acutum*,

Lehmaniceras macer.

Gisement 279 du km. 10, 100 de la coupe Ampolipoly-Antsirasira-Behamotra (Belo sur Tsiribihina): *Lehmaniceras acutum*, *Lehmaniceras macer*, *Lehmaniceras gracile*.

Gisement 278 du km. 9, 800 de la coupe Ampolipoly-Antsirasira-Behamotra (Belo sur Tsiribihina): *Lehmaniceras pingue*.

Gisement 280 du km. 10, 500–10, 700 de la coupe Ampolipoly-Antsirasira-Behamotra (Belo sur Tsiribihina): *Lehmaniceras ultimum*.

It is our view that all of the following taxa represent a single dimorphic species for which the name *cricki* of Spath has priority.

Lehmaniceras sornayi Collignon, 1966, p. 50, pl. 475, fig. 1933 (Fig. 2A) has, in the holotype, nine umbilical bullae and 18 ventrolateral and siphonal clavi per whorl. It differs in no significant respects from the holotype of *umzambiensis* of van Hoepen (compare Figs 1A–D and 2A).

Lehmaniceras acutum Collignon, 1966 (p. 51, pl. 475, figs 1934, 1935; pl. 476, figs 1938, 1941; Fig. 1H,K,L) has 10 strong umbilical bullae per whorl, described by Collignon as giving rise to groups of three ribs. This is certainly the case in places on the body chamber of the holotype (Fig. 1L), but not everywhere on the specimen, and in others referred to the species the pattern is of umbilical bullae giving rise to pairs of ribs with occasional intercalated ribs (Fig. 1H). The holotype may be an incomplete microconch; the original of Collignon's fig. 1941 (reproduced here as Fig. 2F) is a macroconch, showing eccentric coiling, weakening of umbilical bullae and weakening and crowding of ribs on the body chamber.

Lehmaniceras macer Collignon, 1966, p. 51, pl. 475, fig. 1936; pl. 476, fig. 1937 (Fig. 2D) was distinguished on the basis of its compression, eight to nine weak umbilical bullae giving rise to pairs of ribs to yield a total of 22 ribs at the ventrolateral shoulder, the inner whorls smooth.

Lehmaniceras gracile Collignon, 1966, p. 53, pl. 476, Figs 1939, 1940 (Figs 1G, 2C) is interpreted as possibly the most compressed and feebly ornamented end member of the *cricki* variation series. The holotype (Fig. 1G) has 12 umbilical tubercles per whorl and groups of flexuous ribs arising from these bullae. Collignon's smaller specimen (Fig. 2C) is even more compressed and weakly and finely ornamented.

Lehmaniceras pingue Collignon, 1966, p. 56, pl. 477, fig. 1942 (Fig. 2B) is based on a macroconch holotype of a particularly coarsely ribbed variant, and to us marks the other end of the *cricki* variation series.

Lehmaniceras ultimum Collignon, 1966, p. 56, pl. 477, Figs 1943, 1944 (Figs 1J, 3G) is based on a macroconch holotype (Fig. 3G). A distinguishing feature to Collignon was the enlargement of the umbilicus, and the weakening of ventral ornament on the body chamber. It has 11 umbilical bullae per whorl, giving rise to pairs of ribs, with single intercalatories. The coiling and weakening of ornament are a feature of the adult body chamber in our view.



Figure 2. A–F, *Texasia cricki* (Spath, 1921). A, the holotype of *Lehmaniceras sornayi* Collignon, 1966, p. 50, pl. 475, fig. 1933, from the *Texanites hourcqi* Zone at his locality 758 of the Beantaly-Souromaraino (Belo sur Tsiribihina) section. B, the holotype of *Lehmaniceras pingue* Collignon, 1966, p. 56, pl. 477, fig. 1942, from the *Texanites hourcqi* Zone at his locality 278 of the Ampolipoly-Antsirasira-Behamotra (Belo sur Tsiribihina) section. C, the original of *Lehmaniceras gracile* Collignon, 1966, p. 53, pl. 476, fig. 1940, from the *Texanites hourcqi* Zone at his locality 279 of the Ampolipoly-Antsirasira-Behamotra (Belo sur Tsiribihina) section. D, the original of *Lehmaniceras macer* Collignon, 1966, p. 51, pl. 475, fig. 1936, from the *Texanites hourcqi* Zone at his locality 758 of the Beantaly-Souromaraino (Belo sur Tsiribihina) section. E, the original of *Lehmaniceras acutum* Collignon, 1966, p. 51, pl. 475, fig. 1935, from the *Texanites hourcqi* Zone at his locality 279 of the Ampolipoly-Antsirasira-Behamotra (Belo sur Tsiribihina) section. F, the original of *Lehmaniceras acutum* Collignon, 1966, p. 54, pl. 476, fig. 1941, from the *Texanites hourcqi* Zone at his locality 758 of the Beantaly-Souromaraino (Belo sur Tsiribihina) section. The originals of Figs A–F are in the collections of the Université de Bourgogne, Dijon. All figures are $\times 1$; scale bar in cm.

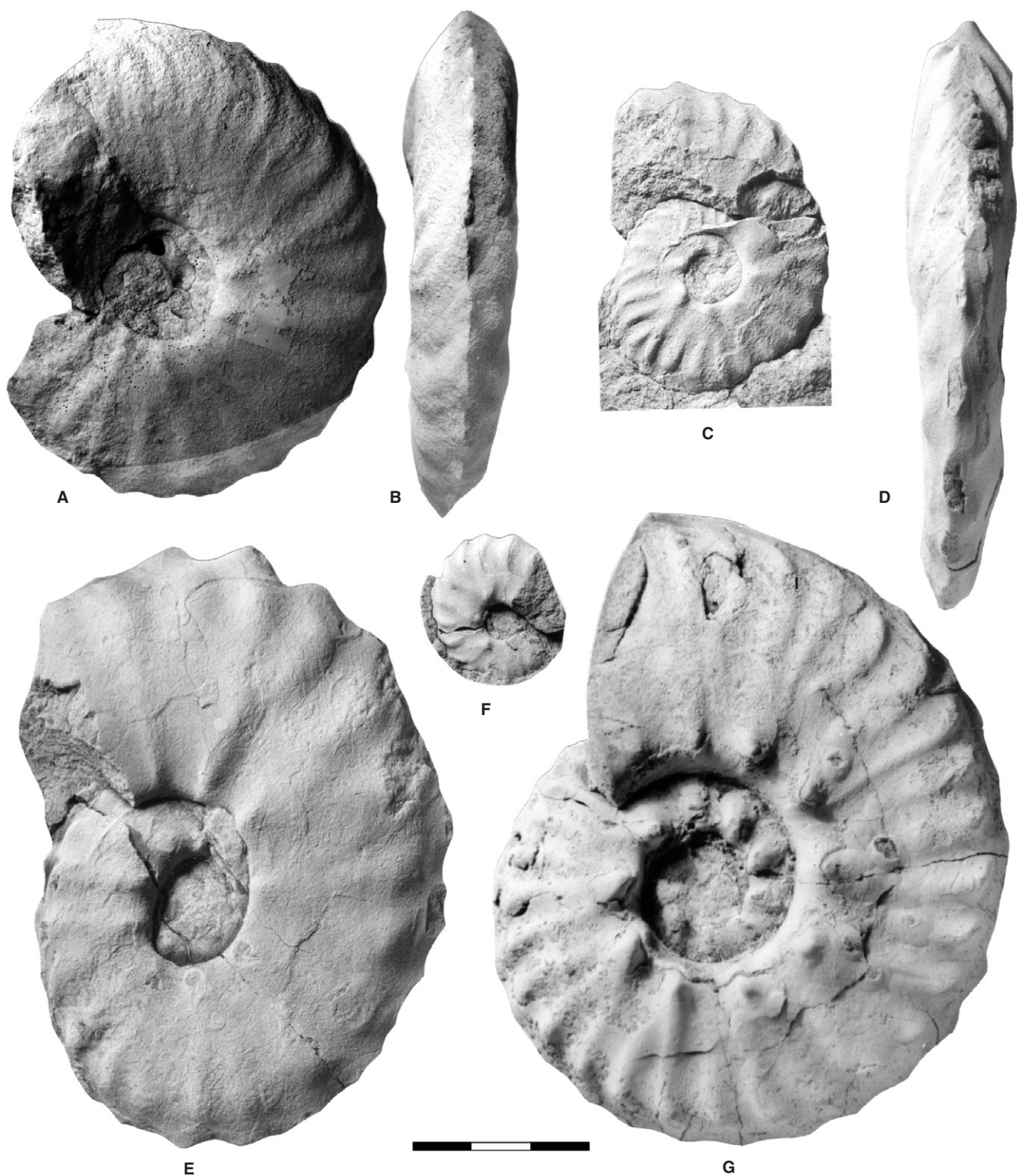


Figure 3. A–G, *Texasia cricki* (Spath, 1921). A, B, the holotype of *Praemuniericeras boriesi* Collignon, 1983, p. 195, pl. 3, fig. 7, specimen BO 02 in the collections of the Université Paul Sabatier, Toulouse, from the Lower Santonian *Nowakites carezi* Zone in the environs of Sougraine, Corbières (Aude, France). C, the original of *Praemuniericeras boriesi* Collignon, 1983, PM K2b47, in the same repository, the original of Kennedy, 1995, pl. 13, fig. 1, from the same horizon in the La Jouane section, Corbières (Aude, France). D, E, the holotype of *Lehmaniceras rivierae* Collignon, 1983, p. 197, pl. 3, fig. 7, UPST R02 in the same repository, from the same horizon at Clapeyrade, Corbières (Aude, France). F, the original of *Texasia rivierae* (Collignon, 1983) of Kennedy, 1995, pl. 13, fig. 9, PM K2b53, in the same repository, from the same horizon and locality as the original of C. G, the original of *Lehmaniceras ultimum* Collignon, 1966, p. 56, pl. 477, fig. 1943, in the collections of Université de Bourgogne, Dijon, from the *Texanites hourcqi* Zone at his locality 280 of the Ampolipoly-Antsirrasira-Behamotra (Belo sur Tsiribihina section), Madagascar. All figures are $\times 1$; scale bar in cm.

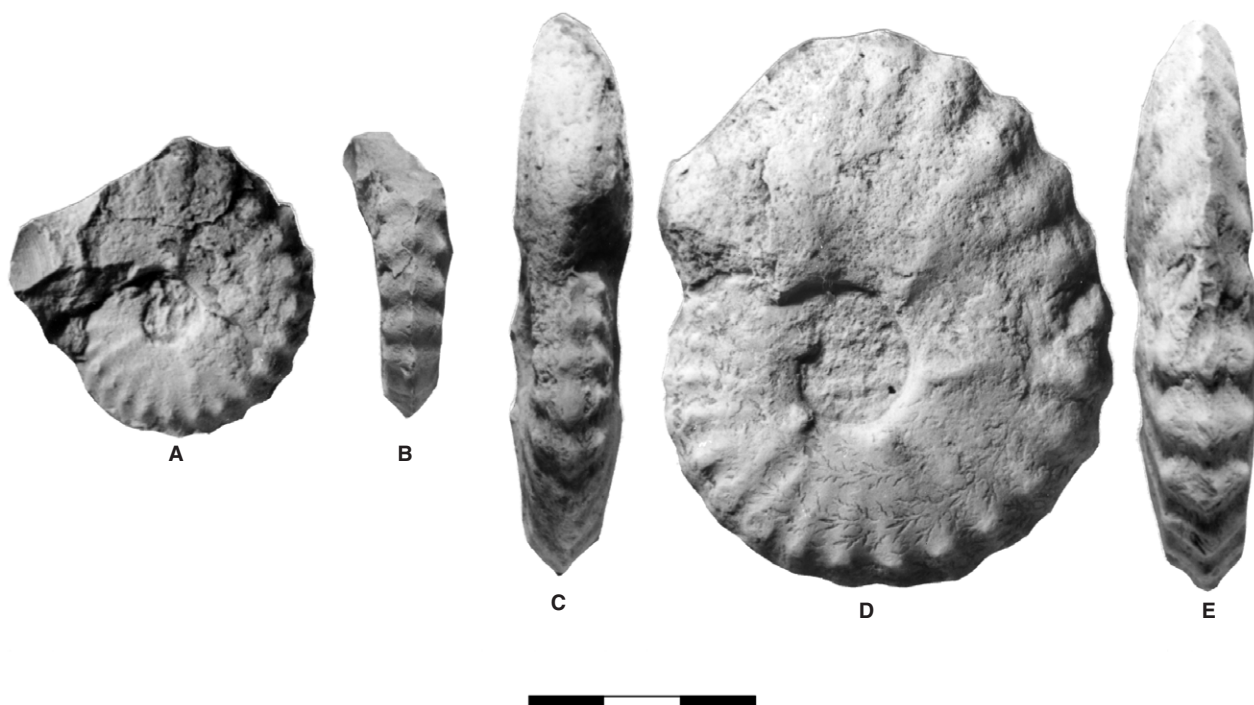


Figure 4. *Texasia dentatocarinata* (Roemer, 1852). A–B, paralectotype PIB 48; C–E, the lectotype, PIB 48a, both from the Austin Chalk at the rapids on the Guadalupe River below New Braunfels (Comal County, Texas). Both specimens are housed in the Paläontologisches Institut of the Rheinische Friedrich-Wilhelms Universität, Bonn. All figures are $\times 1$; scale bar in cm.

Re-examination of the Eastern Cape and Madagascan *Texasia* lead us to conclude that *Lehmaniceras rivierae* Collignon, 1983 (p. 197, pl. 3, fig. 7; Fig. 3A,B; see revision in Kennedy, 1995, p. 408, pl. 13, Figs 1, 5, 6, 9, 13, 14; pl. 18, Figs 13, 14) from the Lower Santonian *Nowakites carezi* Zone of the Corbières (Aude, France), is a synonym of *cricki*. The holotype of *rivierae* is interpreted as an incomplete macroconch, differing only in preservation from Madagascan examples (compare Fig. 3E and Figs 2E, 3G). The French material also includes a complete microconch in the form of the holotype of *Praemuniericeras borriesi* Collignon, 1983 (p. 195, pl. 3, fig. 1; see Fig. 3A,B).

The types of *Texasia dentatocarinata* (Roemer, 1852) are illustrated in Fig. 4. These specimens, together with those referred to the species by Reeside (1932, p. 15, pl. 3, figs 1–10; pl. 4, figs 1–3; pl. 5, fig. 1) and Young (1963, p. 119, pl. 72, figs 1–3, 5, 6; pl. 73, figs 1–3, 5, 6, 10; text-figs 10h,p,q; 11b), are preserved as composite moulds in chalk, and differ from material referred to *Texasia cricki* herein in having fewer umbilical bullae per whorl (six in the lectotype) that give rise to one rib or a pair of ribs with more numerous intercalated ribs to yield a total of up to 14 ribs per half whorl at the ventrolateral shoulder. An adult attributed to the species by Reeside (1932, pl. 3, figs 9, 10; pl. 5, fig. 1), presumably a macrococh, is incomplete at 210 mm in diameter, indicating that the species reached a larger size than *cricki*.

THE AGE OF *TEXASIA CRICKI*

There is as yet no formally designated Global boundary Stratotype Section and Point (GSSP) for the base of the Santonian Stage, but there is general agreement to the proposal that the first occurrence of the inoceramid bivalve *Cladoceramus undulatoaplicatus* (Roemer, 1852) is the

preferred candidate primary biostratigraphic marker (Lamolda & Hancock, 1996, pp. 99–100; see discussion in Gale *et al.*, 2007). *Cladoceramus undulatoaplicatus* does not occur in South Africa. Instead, dating of *T. cricki* depends on the occurrence of *undulatoaplicatus* in the Madagascan sequence. Here, Collignon (1966) recognized the following succession:

Upper Santonian: *Pseudoschloenbachia umbulazi* Zone.

Middle Santonian: *Texanites hourcq* Zone.

Lower Santonian: *Texanites oliveti* Zone.

The Niveau à *Lehmaniceras* (Collignon, 1966, p. 50) in which *Texasia cricki* as here interpreted is so common, marks a level some way above the base of the *hourcq* Zone. Restudy of the Madagascan sequence by Professor Ireneusz Walaszczyk (Warsaw) and others (in prep.) in a section between Mahatsinjo and Antsirasira, shows *Cladoceramus undulatoaplicatus* first appearing above an assemblage that includes abundant *Pseudoschloenbachia bidichotoma* Collignon, 1966, *Baculites capensis* Woods, 1906, *Texanites collignon* Klinger & Kennedy, 1980b, *Texanites pseudotexanus* (de Grossouvre, 1894) and *Texanites hourcq* Collignon, 1948. The level of first appearance of *Cladoceramus undulatoaplicatus* yields *Praemuniericeras proprium* Collignon, 1966 (p. 14, pl. 460, fig. 1882), a species referred to the *oliveti* Zone by Collignon. On this basis the base of the Santonian falls within Collignon's *oliveti* Zone. *Texasia cricki* appears well above the first occurrence of *C. undulatoaplicatus* in the Madagascan sequence and is thus a marker for a level above the base of the Santonian as defined by the first occurrence of *Cladoceramus undulatoaplicatus*, and within Collignon's *Texanites hourcq* Zone. Thus, this zone is low in the Santonian, rather than falling into the middle of the stage. This conclusion supports those reached in a previous

work (Kennedy *et al.*, 2008). The base of the Mzamba Formation at Mzamba is confirmed as lower Santonian on the basis the presence of *Texasia cricki*.

Kennedy acknowledges the support of the staff of the Geological Collections, Oxford University Museum of Natural History, and the Department of Earth Sciences, Oxford, and the financial assistance of the Oppenheimer Fund (Oxford). Klinger acknowledges the financial support of the NRF (South Africa) and logistical support of the staff of the Natural History Collections Department, Iziko, South African Museum. We are particularly grateful to I. Walaszczyk (Warsaw) for making his unpublished results on the inoceramid succession in Madagascar available to us.

ABBREVIATIONS

D: Diameter
Wb: Whorl breadth
Wh: Whorl height
U: Umbilical diameter

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