

Cretaceous faunas from Zululand and Natal, South Africa. The ammonite Subfamily Stoliczkaiinae Breistroffer, 1953

William James Kennedy

Oxford University Museum of Natural History, Parks Road, Oxford OX1 3PW, and
Department of Earth Sciences, South Parks Road, Oxford OX1 3AN, U.K.
E-mail: jim.kennedy@oum.ox.ac.uk

&

Herbert Christian Klinger

Natural History Collections Department, Iziko South African Museum,
P.O. Box 61, Cape Town, 8000 South Africa
E-mail: hklinger@iziko.org.za

(with 23 figures)

Received 6 May 2013. Accepted 18 September 2013

The representatives of the ammonite subfamily Stoliczkaiinae Breistroffer, 1953, from the Upper Albian and Lower Cenomanian part of the Mzinene Formation of northern KwaZulu-Natal are described, and the following species recognized; *Neophlycticeras* (*Neophlycticeras*) *brottianum* (d'Orbigny, 1841), *N. (Protissotia) itierianum* (d'Orbigny, 1841), *Stoliczkaia* (*Stoliczkaia*) *clavigera* Neumayr, 1875, *S. (Lamnayella) tetragona* Neumayr, 1875, *S. (L.) crotaloides* (*Stoliczka*, 1864), *S. (L.) sanctaecatherinae* Wright & Kennedy, 1978, *S. (L.) chancellori* Wright & Kennedy, 1984, *S. (Shumariaia) australe* sp. nov., *Cenisella bonnetiana* (Pictet, 1847), *Zuluscaphites orycteropusi* van Hoepen, 1955, *Z. grandidieri* (Boule, Lemoine & Thévenin, 1907), and *Z. cf. helveticus* Kennedy & Delamette, 1994b. Relevant representatives of the subfamily described from Madagascar are also discussed and illustrated.

Key words: Cretaceous, ammonite, Albian, Cenomanian, Stoliczkaiinae, KwaZulu-Natal, South Africa.

CONTENTS

Abstract	1	<i>Neophlycticeras</i> (<i>P.</i>) <i>itierianum</i>	3
Introduction	1	Genus <i>Stoliczkaia</i>	4
Conventions	2	<i>Stoliczkaia</i> (<i>S.</i>) <i>clavigera</i>	4
Ammonite Zones	2	Subgenus <i>Lamnayella</i>	6
Systematic palaeontology	2	<i>Stoliczkaia</i> (<i>L.</i>) <i>tetragona</i>	6
Family LYELLICERATIDAE	2	<i>Stoliczkaia</i> (<i>L.</i>) <i>crotaloides</i>	7
Subfamily STOLICZKAIINAE	2	<i>Stoliczkaia</i> (<i>L.</i>) <i>sanctaecatherinae</i>	8
Genus <i>Neophlycticeras</i>	2	<i>Stoliczkaia</i> (<i>L.</i>) <i>chancellori</i>	9
<i>Neophlycticeras</i> (<i>N.</i>) <i>brottianum</i>	2	Subgenus <i>Shumariaia</i>	9
Subgenus <i>Protissotia</i>	3	<i>Stoliczkaia</i> (<i>S.</i>) <i>australe</i>	9
		Genus <i>Cenisella</i>	10
		<i>Cenisella bonnetiana</i>	10
		Genus <i>Zuluscaphites</i>	11
		<i>Zuluscaphites orycteropusi</i>	12
		<i>Zuluscaphites grandidieri</i>	12
		<i>Zuluscaphites</i> cf. <i>helveticus</i>	13
		Acknowledgements	14
		References	14
		Figures 1–23	15

INTRODUCTION

The first record of the ammonite subfamily Stoliczkaiinae in northern KwaZulu-Natal dates from the work of Spath (1921, p. 286), who recorded a fragment (SAM-PCZ19046, formerly Spath's no. 4939), from the south side of the Manuan Creek. The preservation is that of the Mzinene Formation on the Skoenberg, and although indeterminate to species level, the generic assignation is clear. In 1955, van Hoepen described an enigmatic ammonite from the north bank of the lower reaches of the Mzinene as *Zuluscaphites orycteropusi*, and interpreted it as a scaphitid – a heteromorph ammonite of the family Scaphitidae. Wright (1957) placed *Zuluscaphites* in the Scaphitidae with a query. It is, in fact a

member of the Stoliczkaiinae (Kennedy & Klinger, 1993), and one of 12 species of the subfamily now recognized from northern KwaZulu-Natal:

Neophlycticeras (*Neophlycticeras*) *brottianum* (d'Orbigny, 1841)
N. (Protissotia) itierianum (d'Orbigny, 1841)
Stoliczkaia (*Stoliczkaia*) *clavigera* Neumayr, 1875
S. (Lamnayella) tetragona Neumayr, 1875
S. (L.) crotaloides (*Stoliczka*, 1864)
S. (L.) sanctaecatherinae Wright & Kennedy, 1984
S. (L.) chancellori Wright & Kennedy, 1984

S. (Shumariaia) australe sp. nov.

Cenisella bonnetiana (Pictet, 1847)

Zuluscaphites orycteroposi van Hoepen, 1955

Z. grandidieri (Boule, Lemoine & Thévenin, 1907)

Z. cf. helveticus Kennedy & Delamette, 1994b

Of these, ten (83%) are also known from Western Europe.

We also illustrate and discuss relevant material from Madagascar described by Boule, Lemoine & Thévenin (1906–7), Besairie (1936) and Collignon (1949, 1963).

UPPER ALBIAN AND LOWER CENOMANIAN AMMONITE ZONES

The Stoliczkaiinae described below can in most cases be placed in the detailed ammonite zonation developed in western Europe, and this is used below where appropriate:

Substage	Zone
Lower Cenomanian	<i>Mantelliceras dixoni</i> <i>Mantelliceras mantelli</i> <i>Praeschloenbachia briacensis</i> (part)
Upper Albian	<i>Praeschloenbachia briacensis</i> (part) <i>Mortoniceras perinflatum</i> <i>Mortoniceras rostratum</i> <i>Mortoniceras fallax</i>

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.

BMNH: The Natural History Museum, London.

SAM: The South African Museum, Cape Town.

OUM: Oxford University Museum of Natural History.

SYSTEMATIC PALAEONTOLOGY

Suborder **AMMONITINA** Hyatt, 1889

Superfamily **ACANTHOCERATOIDEA** de Grossouvre, 1894

Family **LYELLICERATIDAE** Spath, 1921

Subfamily **STOLICZKAIINAE** Breistroffer, 1953

(=Neophlycticeratinae Cooper, 1992, p. 31)

Genus **Neophlycticeras** Spath, 1922

(= *Faraudiella* Breistroffer, 1947, p. 88 (72); *Eotropitoides* Casey, 1965, p. 462, footnote 1)

Type species

Ammonites brottianus d'Orbigny, 1841, p. 290, pl. 85, figs 8–10, by the original designation of Spath, 1922, p. 107.

Diagnosis

'Small to medium-sized, with moderately involute phragmocone, compressed to depressed, with subparallel to strongly rounded flanks and fastigate venter. Ribs arise singly or in groups from umbilical bullae or not, and may increase by branching and intercalation; ventrolateral and

siphonal clavi are present throughout part or all of the septate stage. Body chambers may retain ribbing and tuberculation, or not. A siphonal ridge may link clavi in compressed forms. Suture with incipient adventitious lobe, may simplify in progenic dwarf species referred to subgenus *Protissotia*.' (Kennedy & Delamette, 1994a, p. 6).

Discussion

Neophlycticeras is reviewed by Kennedy & Delamette, 1994a), and we have no new information to add to their account.

Occurrence

Lower Upper Albian, southern England, France, Switzerland, Morocco, KwaZulu-Natal, South Africa, Madagascar, Colombia, Venezuela, Peru, Texas and, possibly, Japan.

Neophlycticeras (Neophlycticeras) brottianum

(d'Orbigny, 1841)

Figs 1A–L, 2Q–V, 3, 4, 5
 1841 *Ammonites Brottianus* d'Orbigny, p. 290, pl. 85, figs 8–10.
 1936 *Budaiceras madagascariensis* Besairie, p. 199, pl. 21, fig. 14, text-fig. 13.
 1936 *Budaiceras spathi* Besairie, p. 199, pl. 21, figs 15–16.
 1949 *Neophlycticeras sexangulatum* Seeley; Collignon, p. 17, pl. 1, figs 1, 2.
 1949 *Neophlycticeras hirtzi* Collignon, p. 18, pl. 1, figs 3–5.
 1963 *Neophlycticeras hirtzi* Coll.; Collignon, p. 180, pl. 315, fig. 1336.
 1963 *Neophlycticeras madagascariense* Besr.; Collignon, p. 181, pl. 316, fig. 1337.
 1963 *Neophlycticeras spathi* Besr.: Collignon, p. 181, pl. 316, fig. 1338.
 1963 *Neophlycticeras brottianum* d'Orb.; Collignon, p. 183, pl. 317, fig. 1342.
 1994a *Neophlycticeras (Neophlycticeras) brottianum* (d'Orbigny, 1841); Kennedy & Delamette, p. 7, figs 3b–d, 5a–c, g–i, 6a–s, 7a–f, 8y, z (with full synonymy).
 1994b *Neophlycticeras (Neophlycticeras) brottianum* (d'Orbigny, 1841); Kennedy & Delamette, p. 1267, figs 4.1, 4.2, 4.4, 4.5, 4.10–4.16.
 1996 *Neophlycticeras (Neophlycticeras) brottianum* (d'Orbigny, 1841); Wright, p. 147, fig. 114, 1.
 1998 *Neophlycticeras brottianum* (d'Orbigny, 1841); Matrion, Dubus & Touch, p. 19, pl. 1, figs 1–3; pl. 2, figs 1–5; text-figs 3, 4.
 2005 *Neophlycticeras brottianum* (d'Orbigny, 1841); Bulot, Kennedy, Jaillard & Robert, p. 458, fig. 6a, b.
 2006 *Neophlycticeras brottianum* (d'Orbigny, 1841); Kennedy & Juignet in Gauthier, p. 107, pl. 46, fig. 8.

Type

The holotype, by monotypy, is MNHP R4274, d'Orbigny Collection 5757, the original of d'Orbigny, 1841, pl. 85, figs 8–10, illustrated here as Fig. 1C–E, from the condensed Albian of Perte du Rhône, Ain, France.

Material

SAM-PCZ22198, from the lower Upper Albian Mzinene Formation on the Mzinene River close to locality 51 of

Kennedy & Klinger (1975, p. 288), 27°53'43"S, 32°19'22"E. SAM-PCZ22199 and 22200, imprecisely localized, but from the Mzinene Formation on the lower reaches of the Mzinene River.

Description

SAM-PCZ22198 (Fig. 2Q–S) is almost wholly septate, and retains traces of the original aragonitic shell. The maximum preserved whorl height is 21.7 mm, the whorl breadth to height ratio 0.76, the flanks broadly convex, subparallel, the ventrolateral shoulders broadly rounded, the venter feebly convex in intercostal section, and fastigate in costal section. Ornament is only visible on the adapertural 90° sector of the specimen. Blunt bullae perch on the umbilical shoulder, and give rise to pairs of recti- to feebly prorsiradiate ribs that are straight on the inner flank, broadening progressively, and sweeping slightly forwards and broadening more markedly on the outer flank and ventrolateral shoulder, where they bear blunt ventrolateral clavi. A coarse transverse rib extends across the venter and bears a sharp siphonal clavus. SAM-PCZ22199 (Fig. 2T–V) is a more compressed fragment, with a maximum preserved whorl height of 22.3 mm. Coiling is involute, the umbilicus small and of moderate depth, with a flattened, outward-inclined umbilical wall and narrowly rounded umbilical shoulder. Feeble bullae perch on the umbilical shoulder, and give rise to groups of two or three low, broad ribs, while additional long ribs intercalate. All ribs bear blunt, poorly differentiated ventrolateral tubercles, linked over the venter by a broad coarse rib that bears a sharp siphonal clavus. SAM-PCZ22200 is a fragment only of a larger individual.

The partially exposed sutures are deeply incised, with E/A subtrifid and A deep and trifid.

Discussion

The present specimens fall within the wide variation showed by topotype material from Perte du Rhône in Ain, France, described and figured by Kennedy & Delamette (1994a). These authors described large phragmocones, examples of which are illustrated here as Fig. 3A–F, that link the previously known small individuals from western Europe to comparably large phragmocones and adult body chambers described from Madagascar. The holotype of *Budaiceras spathi* Besairie, 1936 (p. 199, pl. 21, figs 15–16; see also Collignon, 1963, pl. 316, fig. 1338), from Mont Raynaud is illustrated here as Fig. 4. It is the phragmocone of a macroconch *brottianum* of moderate inflation. The holotype of *Budaiceras madagascariensis* Besairie, 1936 (p. 199, pl. 21, fig. 14; see also Collignon, 1963, pl. 316, fig. 1337), and also from Mont Raynaud, is illustrated here as Fig. 1F, J. It is a more compressed variant like the Perte du Rhône individuals shown in Fig. 3, and is interpreted as a macroconch *brottianum*. It retains a 90° sector of body chamber.

A typical *brottianum* was described from Andranofotsy by Collignon (1963, p. 183, pl. 317, fig. 1342), and is illustrated here as Fig. 1A, B, for comparison with the holotype (Fig. 1C–E). The holotype of *Neophlycticeras hirtzi* Collignon, 1949 (p. 18, pl. 1, fig. 3), also from Andranofotsy, is reproduced here as Fig. 1G–I. It differs in no respect from the holotype of *brottianum* (Fig. 1C–E), with which it overlaps in

size. Collignon's larger, worn specimens (1949, pl. 1, figs 4, 5) are illustrated here as Figs 1K, L and 5A, B, G, H, and are simply complete macroconch *brottianum* with body chamber.

The *Neophlycticeras sexangulatum* Seeley of Collignon, 1949 (p. 17, pl. 1, figs 1, 2; see Fig. 5C–F herein) are interpreted as compressed variants of *brottianum*; they occur with the other Andranofotsy specimens, and find a match in the Perte du Rhône specimens shown in Fig. 3. *Neophlycticeras sexangulatum* (Seeley, 1865) is a much younger and smaller, *Mortoniceras fallax* Zone species (see Wright & Kennedy, 1984, p. 567, text-figs 5c, f; 6a–c, g–l; 8s–t).

Occurrence

Lower Upper Albian, *Dipoloceras cristatum* and *Mortoniceras pricei* Zones, southern England and France, there are also records from Switzerland, Morocco, Tunisia and Venezuela. In Madagascar the species occurs at a comparable horizon in the *Dipoloceras cristatum* Zone of Andranofotsy and the succeeding *Hysteroceras binum* Zone of Mont Raynaud. Records of a higher, *Neophlycticeras madagascariense* Zone of Diego Suarez and Betaitra are problematic. The preservation of the present material indicates it to be from the lower Upper Albian, the lower part of Albian V of Kennedy & Klinger (1975).

Subgenus *Protissotia* Collignon, 1932

Type species

Tissotia (Protissotia) madagascariensis Collignon, 1932, p. 12, pl. 1, figs 12–16; text-figs 8–12, from the lower Upper Albian of Mont Raynaud, Madagascar; = *Ammonites itierianus* d'Orbigny, 1841, p. 367, pl. 112, figs 6, 7, from the condensed Albian of Perte du Rhône, Ain, France.

Diagnosis

'Progenic dwarf offshoot of *Neophlycticeras (Neophlycticeras)* with simplified sutures and adult body chamber with coarse simple ribs bearing strong umbilical bullae, ventrolateral and siphonal clavi' (Kennedy & Delamette, 1994a, p. 18).

Discussion

Reasons for treating *madagascariensis* of Collignon as a junior synonym of *itierianum* are discussed by Kennedy & Delamette (1994a). We have failed to locate Collignon's material in the Paris museums.

Occurrence

Lower Upper Albian, southern England, southeastern France, KwaZulu-Natal, South Africa, Madagascar, Peru and Venezuela.

Neophlycticeras (Protissotia) itierianum

(d'Orbigny, 1841)

Fig. 2A–P

1841 *Ammonites Itierianus* d'Orbigny, p. 367, pl. 112, figs 6–7.
 1932 *Tissotia (Protissotia) madagascariensis* Collignon, p. 12, pl. 1, figs 12–16; text-figs 8–12.
 1963 *Protissotia madagascariensis* Coll.; Collignon, p. 181, pl. 316, fig. 1340.

1963 *Neophlycticeras itieri* d'Orb.; Collignon, p. 181, pl. 316, fig. 1339.

1994a *Neophlycticeras itierianum* (d'Orbigny, 1841); Kennedy & Delamette, p. 18, figs 4a-d, 8a-x, 9a-u (with full synonymy).

Type

The holotype by monotypy is the original of d'Orbigny, 1841, p. 367, pl. 112, figs 6, 7, said by d'Orbigny to be in the collection of a Monsieur Itier of Belley, Ain, France, and from Perte du Rhône, Ain, France. It has not been traced.

Material

SAM-PCZ22201-4, from the lower Upper Albian Mzinene Formation at locality 51 of Kennedy & Klinger (1975, p. 288, text-fig. 4), stream bed and bank exposures extending around the eastern limb of the broad bend on the Mzinene north of Hluhluwe, at 27°53'43"S, 32°19'22"E.

Dimensions

	D	Wb	Wh	Wb:Wh	U
SAM-PCZ22202c	15.0 (100)	5.3 (35.3)	7.1 (47.3)	0.75	3.6 (24.0)
SAM-PCZ22204c	17.1 (100)	6.3 (36.8)	9.0 (52.6)	0.7	4.5 (26.3)
SAM-PCZ22203c	17.2 (10)	6.2 (36.0)	8.0 (46.5)	0.78	4.6 (26.7)

Description

Three of the specimens retain their original aragonitic shell material. They range from 12.6 to 17.2 mm in diameter. Coiling is moderately involute, the umbilicus comprising 24–26.7% of the diameter, shallow, with a low rounded wall and broadly rounded umbilical shoulder. The intercostal whorl section is compressed, with feebly convex inner flanks, convergent outer flanks, broadly rounded ventrolateral shoulders and a feebly convex venter. The costal whorl breadth to height ratio is 0.7 to 0.78, the greatest breadth at the umbilical bullae. There are a total of 18–20 ribs per whorl at the ventrolateral shoulder. The ribs arise either singly or in pairs at the umbilical shoulder, some with well-developed bullae. There are occasional short intercalated ribs. The ribs are coarse, feebly convex and prorsiradiate, and all bear strong rounded ventrolateral clavi. A broad transverse wedge-shaped rib connects the clavi across the venter, and bears a strong siphonal clavus. The ventral costal section is fastigate, and concave between ventrolateral tubercle and siphonal clavus.

Discussion

The species is comprehensively described and discussed by Kennedy & Delamette (1994a).

Occurrence

Lower Upper Albian, southern England, France, Venezuela, northern KwaZulu-Natal, South Africa, and Madagascar.

Genus *Stoliczkaia* Neumayr, 1875

Type species

Ammonites dispar d'Orbigny, 1841, p. 142, pl. 45, figs 1, 2, by the original designation of Neumayr, 1875, p. 179.

Diagnosis

'Rather involute, umbilical seam egresses in adult; whorl section high and compressed to subquadrate; straight or slightly curved rounded primaries and numerous intercalatories or branched secondaries, normally fine in young and coarsening, in some cases suddenly, with age, then may weaken or disappear on body chamber or persist; venter in young flat, fastigate or rounded, with one, two or three tubercles; later the ribs tend to cross and thicken on venter and tubercles weaken or disappear. Suture with well-rounded folioles, tending to simplify.' (Wright & Kennedy, 1984, p. 76).

Occurrence

Upper Albian to Lower Cenomanian, Europe, north, east and west Africa, Madagascar, South India, Japan, Brazil, Mexico, Cuba, Texas, Arizona, California.

Stoliczkaia (Stoliczkaia) clavigera Neumayr, 1875

Figs 6A-U, 7A-I, 8A-C, F-H, 9-11, 14K,L, 15D,E

1864 *Ammonites dispar* Stoliczka, p. 85, pl. 45, fig. 1 only.

1875 *Stoliczkaia clavigera* Neumayr, p. 933.

1972 *Mantelliceras saxbii* (Sharpe); Thomel, p. 15 (pars), pl. 1, figs 8, 9, 10, 11, ?12.

1963 *Stoliczkaia clavigera* Neum.; Collignon, p. 182, pl. 316, fig. 1341.

1963 *Stoliczkaia notha* Seeley var. *crassa* Collignon, p. 183, pl. 317, fig. 1345.

1980 *Submantelliceras martimpreyi* (Coquand); Thomel, p. 147, fig. 291.

1988 *Stoliczkaia (Stoliczkaia) clavigera* Neumayr, 1875; Delanoy & Latil, p. 755, pl. 2, figs 1, 3; pl. 5, fig. 1.

1993 *Stoliczkaia (Stoliczkaia) clavigera* Neumayr, 1875; Atabekian, p. 205, pl. 118, fig. 1; pl. 119, fig. 1; pl. 120, figs 1, 2

1994 *Stoliczkaia (Stoliczkaia) clavigera* Neumayr, 1875; Wright & Kennedy, p. 576, figs 5b; 11k-m, q-r; 12e-h, k-n; 13a-c; 14a-c (with full synonymy).

2004 *Stoliczkaia (Stoliczkaia) clavigera* Neumayr, 1875; Kennedy, p. 882, text-figs 15c,d, p-t, 16a-c.

2005 *Stoliczkaia (S.) dispar* (Neumayr) macroconch (morph *clavigera*); Reboulet, Giraud & Proux, fig. 3f.

2007 *Stoliczkaia (Stoliczkaia) clavigera* (Neumayr, 1875); Kennedy & Latil, p. 466, pl. 4, fig. 1; pl. 5, figs 1-7; pl. 6, fig. 1 (with additional synonymy).

2007 *Stoliczkaia (Stoliczkaia) clavigera* (Neumayr, 1875); Szives, p. 105, pl. 20, fig. 1 (with additional synonymy).

2009 *Stoliczkaia (Stoliczkaia) clavigera* (Neumayr, 1875); Kennedy & Bilotte, p. 55, pl. 3, figs 34-36; pl. 4, figs 5-23; pl. 5, figs 1-3.

2011 *Stoliczkaia (Stoliczkaia) cf. clavigera* (Neumayr); Szives & Barrágan in Barrágan, Rojas-Consuegra & Szives, p. 451, text-fig. 4a-c.

Type

The holotype, by monotypy, is the original of Stoliczka, 1864, pl. 45, fig. 1 only, no. 191 in the collections of the Geological Survey of India, Calcutta, and from the Utatur Group of Moraviatoor, South India. A cast of this specimen was figured by Delanoy & Latil, 1988, pl. 5, fig. 1.

Material

OUM KX11442, 11445, 11446, 11448, 11450, 11451, 11453, 11456, 11458c, 11458f; SAM-PCZ22213, from bed 2 of the upper Upper Albian Mzinene Formation at locality 61 of Kennedy & Klinger (1975, p. 289, text-fig. 6), hill slopes and gullies west of the western 'horn' of the Skoenberg, 27°52'19"S, 32°20'19"E, northern KwaZulu-Natal. SAM-PCZ 22206, 22211, 2218 and 22243, from the upper Upper Albian Mzinene Formation in the Ndumu area of northern KwaZulu-Natal. OUM KX11087 and SAM-PCZ22205, from locality 179 of Kennedy & Klinger (1975, p. 304), sisal fields north of the Msunduzi around the pumping station 2100 m SSW of Ndumu Store, 26°56'28"S, 32°14'55"E.

Dimensions

	D	Wb	Wh	Wb:Wh	U
OUM KX11458f	31.4 (100)	11.0 (35.0)	14.0 (44.6)	0.79	6.9 (22.0)
OUM KX11453	43.1 (100)	15.0 (34.8)	21.1 (50.1)	0.71	9.8 (22.7)
SAM-PCZ22211	50.8 (100)	19.0 (37.4)	26.8 (52.8)	0.71	9.2 (18.1)
SAM-PCZ22213	76.2 (100)	– (–)	30.6 (40.2)	–	19.5 (25.6)
SAM-PCZ22218	101.6 (100)	– (–)	44.1 (43.4)	–	21.5 (21.2)

Description

The early growth stages are well-known by OUM KX11446 (Fig. 6A,B), OUM KX11456 (Fig. 6C,D), OUM KX11458c (Fig. 7A–H) and SAM-PCZ22206 (Fig. 6L–N). These specimens range from 22.6 to 30.6 mm in diameter. Coiling is involute, the umbilicus small, comprising around 22% of the diameter, shallow, with a low, flat, outward-inclined wall and narrowly rounded umbilical shoulder. The whorl section is compressed, with feebly convex inner to middle flanks, flattened convergent outer flanks, quite narrowly rounded ventrolateral shoulders, and a feebly fastigiate venter. The greatest breadth is at the umbilical shoulder in costal section, with a whorl breadth to height ratio of around 0.73–0.79. There is great variation in rib density (compare Figs 7E,F and 7L–N). Primary ribs arise at the umbilical seam; some are incipiently to weakly bullate at the umbilical shoulder. The primary ribs are straight to very feebly flexuous across the flanks, and may bifurcate; there are up to three long or short intercalated ribs between successive primaries. All ribs bear small ventral clavi, connected across the venter by a low, broad rib, strengthened into the feeblest of siphonal clavi in some specimens.

OUM KX11453 (Fig. 6O–R) SAM-PCZ22211 (Fig. 8A–C) and 22243 represent the middle growth stages. SAM-PCZ22211 has a maximum preserved diameter of 52.8 mm. Coiling is involute, the umbilicus comprising 18.1% of the diameter, shallow, with a flattened wall, the umbilical shoulder more broadly rounded than on the previous specimens. The flanks are very feebly convex, subparallel, the ventrolateral shoulders broadly rounded, the venter feebly convex. The costal whorl breadth to height ratio is 0.71. Primary ribs, nine per half whorl, arise singly, or, exceptionally, in pairs on the umbilical wall and shoulder, and are straight on the inner flank, flexing very feebly back and very feebly

convex on the outer flank. They are narrow and widely separated on the inner flank, but coarsen markedly on the outer flank. There are one to three long and short intercalated ribs between successive primaries. All ribs strengthen across the ventrolateral shoulders, and pass straight across the venter. There are 24 ribs per half whorl at a diameter of 42 mm. The ventrolateral shoulders are rounded in this specimen, but remain angular in others (OUM KX11453: Fig. 6O–R; SAM-PCZ22205: Fig. 6S–U).

SAM-PCZ22213 (Fig. 14K,L) is an adult body chamber, with a maximum preserved diameter of 76.8 mm. The whorl section is compressed, with a costal whorl breadth to height ratio of 0.73. The flanks are very feebly convex and subparallel, the ventrolateral shoulders broadly rounded, the venter very feebly convex. There are 12 ribs on the 240° sector of body chamber. On the adapical 180° whorl sector, primary and secondary ribs alternate regularly. The primaries arise at the umbilical seam, and strengthen into incipient to weak bullae, perched on the umbilical shoulder. They are prorsiradiate on the shoulder, but flex back and are convex on the inner flank, and are straight and rursiradiate on the outer flank. The intercalated ribs arise low on the flank, and strengthen to match the primaries, all ribs strengthening and coarsening markedly across the ventrolateral shoulders and venter, which they cross in a shallow concavity. The last three ribs at the adapertural end of the fragment are all primaries, much weaker than those that precede them, and indicate the proximity of the adult aperture. SAM-PCZ22218 (Fig. 9) is a somewhat worn adult with a maximum preserved diameter of 102 mm. It has the same style of ornament as the previous specimen, but is a more coarsely ribbed variant, with a costal whorl breadth to height ratio of 0.7.

Discussion

SAM-PCZ22218 (Fig. 9) is strikingly similar to the holotype (Stoliczka, 1864, pl. 45, fig. 1; Delanoy & Latil, 1988, pl. 5, fig. 1). The smaller specimen figured by Stoliczka (1864, pl. 45, fig. 3) and described as 'front view of the inner whorls of a large specimen, like fig. 1 [the holotype of *clavigera*], to show the tubercles on the edge of the back in the first stage of growth' shows a near-flat venter with angular ventrolateral shoulders, a feature shown by some, but not all of the present specimens in middle growth (OUM KX11453: Fig. 6O–R).

Stoliczkaia (S.) dorsetensis Spath, 1931 (p. 337, pl. 31, figs 2, 3, 10, 13, 14; pl. 32, fig. 7; pl. 33, fig. 1 (including var. *compressa*), originally described from the condensed *perinflatum* Zone of south Dorset, was regarded as a synonym of *clavigera* by Wright & Kennedy (1994, p. 576), and some juveniles are very similar; however, the adult stages are not known from the type area. The holotype of *Stoliczkaia (S.) dispar* (refigured by Wright & Kennedy 1978, text-fig. 1; 1984, text-fig. 4; Kennedy & Juignet, in Gauthier, 2006, pl. 48, fig. 1) is distinct enough, reaching a larger size than the type of *clavigera*, with higher whorls, a fastigiate venter with ventral and siphonal tubercles extending onto the phragmocone of the outer whorl, and distant low, fold-like ribs on the adult body chamber, rather than the coarse ribs of *clavigera* that sweep back and strengthen over the ventrolateral shoulders and are markedly

concave across the venter. It should be noted that the specimen referred to as an adult *clavigera* by Wright & Kennedy (1984, p. 575): their text-fig. 14, is mislabelled as *S. (S.) dispar* in the explanation of the figure.

The *Stoliczkaia clavigera* of Collignon (1963, pl. 316, fig. 1341), from Mont Raynaud, Madagascar, is refigured here as Fig. 10. It is an adult, more closely and weakly ribbed than the holotype and the KwaZulu adults, but has the same ventral aspect. The *Stoliczkaia notha* var. *crassa* of Collignon (1963, p. 183, pl. 317, fig. 1345) from Mont Raynaud, Madagascar, is reillustrated here as Fig. 11. It is interpreted as a macroconch *clavigera* with coarse ribbing on the outermost flanks, ventrolateral shoulders and venter.

Occurrence

Upper Upper Albian *rostratum* to basal Cenomanian *briacensis* Zone, Southern England, southeast France, Selva de Bonansa, Huesca Province, and elsewhere in northern Spain, Switzerland, Hungary, Romania, Turkmenistan, Tunisia, Japan, Texas, Cuba, South India and northern KwaZulu-Natal.

Subgenus *Lamnayella* Wright & Kennedy, 1978

Type species

Stoliczkaia (Lamnayella) juignetii Wright & Kennedy, 1978, p. 398, pl. 37, figs 1–10; pl. 38, figs 1–12, by the original designation of Wright & Kennedy, 1978, p. 394.

Diagnosis

'Medium-sized *Stoliczkaia* with fastigate and feebly trituberculate venter in young, evenly rounded later. Feeble umbilical bullae give rise to single, rarely paired, strong, narrow, high, distant, feebly-flexed prorsiradiate primary ribs, with one to three shorter intercalated secondaries during early and middle growth; on body chambers most ribs are long, strong, narrow and distant, weakening, becoming irregular, crowding, and losing their bullae just before the adult aperture' (Wright & Kennedy, 1984, p. 77).

Discussion

See Wright & Kennedy (1978, p. 394; 1984, p. 77).

Occurrence

Upper Albian and Lower Cenomanian, southern England, France, northern Spain, Switzerland, Hungary, Romania, Turkmenistan, South India, Japan, Madagascar and northern KwaZulu-Natal.

Stoliczkaia (Lamnayella) tetragona Neumayr, 1875

Figs 7J–P, 12A–N, 13, 14D–F, 15A–C, H, 16G,H
 1865 *Ammonites dispar* d'Orbigny; Stoliczka, p. 85 (pars), pl. 45, fig. 2 only.
 1875 *Stoliczkaia tetragona* Neumayr, p. 932.
 1975 *Stoliczkaia (Stoliczkaia) tetragona* Neumayr; Matsumoto & Inoma, p. 272, text-fig. 7.
 1978 *Stoliczkaia (Lamnayella) tetragona* Neumayr, 1875; Wright & Kennedy, p. 396, text-fig. 3a,b.
 1978 *Stoliczkaia (Stoliczkaia) sp. aff. S. (S.) tetragona* Neumayr; Matsumoto & Inoma, p. 272, pl. 38, fig. 5; text-fig. 8.
 1979 *Stoliczkaia tetragona* Neumayr, 1875; Cooper & Kennedy, text-fig. 58.

1988 *Stoliczkaia (Lamnayella) tetragona* Neumayr, 1875; Delanoy & Latil, p. 756, pl. 3, figs 1–3; pl. 4, figs 1–4, 6; pl. 5, fig. 2.
 1992 *Paracalycoceras (Lamnayella) tetragona* Neumayr; Cooper, text-fig. 7a,b (copy of Stoliczka, 1864).
 1992 *Stoliczkaia (Stoliczkaia) cf. dispar* (d'Orbigny); Cooper, text-fig. 6.
 1992 *Stoliczkaia (Stoliczkaia) tetragona* Neumayr, 1875; Atabekian, p. 206, pl. 120, figs 3, 4; pl. 121, fig. 4.
 2009 *Stoliczkaia (Lamnayella) tetragona* Neumayr, 1875; Kennedy & Bilotte, p. 57, pl. 4, figs 24–28.

Type

The holotype, by monotypy, is the original of Stoliczka (1865, p. 85 (pars), pl. 45, fig. 2 only), from Moraviatoor, South India, no. 192 in the type collections of the Geological Survey of India, Calcutta. A cast was figured by Delamette & Latil (1988, pl. 5, fig. 2).

Material

OUM KX 11444, 11447, 11448 and SAM-PCZ22217, all from bed 2 of the upper Upper Albian Mzinene Formation at locality 61 of Kennedy & Klinger (1975, p. 289, text-fig. 6), hill slopes and gullies west of the western 'horn' of the Skoenberg, 27°52'19"S, 32°20'19"E, northern KwaZulu-Natal. SAM-PCZ22207, 22210, 22212 and 22215, from the Ndumu area of northern KwaZulu-Natal. OUM KX10473, 10474 and 10480, from the upper Upper Albian Mzinene Formation at locality 186 of Kennedy & Klinger (1975, p. 304), Makanes Drift, 7.7 km south of Ndumu, 26°59'28"S, 32°16'13"E.

Dimensions

	D	Wb	Wh	Wb:Wh	U
SAM-PCZ22217c	42.1 (100)	18.5 (43.9)	20.3 (48.2)	0.91	7.6 (18.1)
SAM-PCZ22210c	98.9 (100)	34.0 (34.40)	42.3 (42.8)	0.80	25.5 (25.8)

Description

The earliest growth stages are shown by the inner whorl of SAM-PCZ22207 (Fig. 7K,L) at a whorl height of 7.7 mm. This 120° whorl fragment has parts of four primary ribs preserved. They arise at the umbilical seam and strengthen across the umbilical wall and shoulder, and are narrow, prorsiradiate, and very slightly flexuous. They alternate with single short intercalated ribs. All ribs strengthen across the ventrolateral shoulder, and bear a small rounded-transversely elongated ventrolateral tubercle, from which a broad rib projects across the fastigate venter to form an obtuse chevron, the apex accentuated into an incipient siphonal tubercle. The succeeding fragment of this specimen (Fig. 7J,N) has a maximum preserved whorl height of 16.4 mm, and a slightly depressed reniform whorl section, with convex flanks, broadly rounded ventrolateral shoulders and a broad, feebly convex venter. There are four narrow, high primary ribs, alternating with single intercalated ribs, the ribs narrow, straight and feebly prorsiradiate on the inner flank, flexed back and very feebly concave on the outer flank, and transverse on the venter. Other fragments

of this size: OUM KX 11448 (Fig. 12A–H) have weaker, denser ribbing of alternating primaries and secondaries, the ventrolateral shoulders and venter rounded, with no indication of ventrolateral tuberculation. SAM-PCZ22217 (Fig. 14D–F) is 42.1 mm in diameter and has comparable ornament on the adapical part of the outer whorl, but with increasing size, the ribs are predominantly primaries, with a few long intercalatories. At one point two pairs of ribs arise together on the umbilical shoulder. The ribs are coarse and high over the ventrolateral shoulders and venter. OUM KX11444 (Fig. 15A–C) has comparably strong distant ribbing, but intercalated ribs are present to the maximum preserved diameter of 50 mm. Persistence of long and short ribs, the former strongly developed on the umbilical shoulder and innermost flank, with all ribs strong and transverse across the venter is shown by SAM-PCZ22215 (Fig. 16G,H), which has 7–8 primaries and a total of 16–17 ribs at the ventrolateral shoulder.

SAM-PCZ22210 (Fig. 13) and SAM-PCZ22212 (Fig. 15H) are interpreted as complete macroconchs, 100 and 102 mm approximately in greatest preserved diameter respectively. SAM-PCZ22210 is the better-preserved. The umbilical seam of the outer whorl is excentric, the umbilicus widening markedly towards the adult aperture, reaching a maximum of 25.8% of the diameter. The umbilical wall is convex and subvertical at the beginning of the outer whorl, but decreases in height and inclines outwards on the adapertural part. The umbilical shoulder is broadly rounded, the flanks flattened and subparallel, the ventrolateral shoulders broadly rounded, and the venter very feebly convex to flattened. There are ten primary ribs per half whorl at a diameter of 90 mm. They arise at the umbilical seam, and are well-developed across the umbilical wall and shoulder. Straight prorsiradiate and widely separated on the inner flank, they flex back and are feebly convex across outer flanks and ventrolateral shoulders. Single short ribs intercalate between successive primaries on the outer flank and ventrolateral shoulder, and all ribs pass undiminished across the venter in a shallow concavity. The ornament weakens rapidly on the adapertural 60° sector of the shell, which is near-smooth. SAM-PCZ22212 shows comparable ontogenetic changes, and is near-smooth for the adapertural 90° sector immediately before the aperture.

None of the specimens shows the sutures.

Discussion

The larger specimens match well with the incomplete holotype. A distinctive feature of that specimen is the form of the ventral ribs, which are shown as feebly convex on the ventrolateral shoulder at the beginning of the outer whorl, and feebly concave over the venter, changing to feebly convex over the venter on the remainder of the shell, the change occurring at a curious looped rib. A cast of this specimen was figured by Delanoy & Latil (1988, pl. 5, fig. 2), and shows feebly concave ventral ribbing, as in the KwaZulu adults. This same feature is shown in the sketch of the holotype in Matsumoto & Inoma (1975, text-fig. 7). The *Stoliczkai* (*Stoliczkai*) sp. aff. *S. (S.) tetragona* Neumayr of Matsumoto & Inoma (1978, p. 272, pl. 38, fig. 5; text-fig. 8) is a tiny fragment that closely resembles the inner whorl fragment of SAM-PCZ22207 (Fig. 7K–M).

Occurrence

Upper Albian, *perinflatum* Zone where well-dated. The geographic distribution extends from South India to KwaZulu-Natal, Japan, southern England, southeastern France, northern Spain and Turkmenistan.

Stoliczkai (*Lamnayella*) *crotalooides* (Stoliczka, 1864)

Figs 7Q,R, 8D,E, 14A–C, G–J, 15F,G

1864 *Ammonites crotalooides* Stoliczka, p. 88, pl. 46, fig. 3.

1979 *Stoliczkai* *crotalooides* (Stoliczka); Cooper & Kennedy, text-fig. 59 (copy of Stoliczka).

non 1979 *Stoliczkai* (*Stoliczkai*) *crotalooides* (Stoliczka, 1864); Young, p. 42, pl. 3, figs 1, 2, 4–6, 8, 12, 14, 16, 17; text-fig. 1 (= *S. texana* (Cragin, 1893)).

1992 *Paracalycoceras* (*Lamnayella*) *crotalooides* (Stoliczka); Cooper, text-fig. 7c,d (copy of Stoliczka).

1994 *Stoliczkai* (*Stoliczkai*) cf. *crotalooides* (Stoliczka, 1865); Wright & Kennedy, p. 578, text-fig. 11a, b.

Type

The holotype, by monotypy, is the original of Stoliczka, 1864, pl. 46, fig. 3, from the Utatur Group of Moraviatoor, South India, in the collections of the Geological Survey of India.

Material

OUM KX11435, 11440, 11441, 11443, 11449, 11452, 11454, 11458a–e, SAM-PCZ22208 (formerly A888) and 2209 (formerly A925), all from bed 2 of the upper Upper Albian Mzinene Formation at locality 61 of Kennedy & Klinger (1975, p. 289, text-fig. 6), hill slopes and gullies west of the western ‘horn’ of the Skoenberg, 27°52'19"S, 32°20' 19"E, northern KwaZulu-Natal.

Description

OUM KX11440 (Fig. 8D,E), KX11441 (Fig. 14I), KX11449 (Fig. 14J), KX11454 (Fig. 14H), KX11455 (Fig. 14A–C) are interpreted as microconchs. The inner phragmocone whorls are best shown by OUM KX11440 (Fig. 8D,E). Coiling is initially quite involute, but becomes less so through ontogeny. The umbilicus comprises an estimated 15% of the diameter, of moderate depth, with a convex, outward-inclined umbilical wall and broadly rounded umbilical shoulder. The whorl section varies from slightly compressed to slightly depressed, with feebly convex subparallel flanks, broadly rounded ventrolateral shoulders and a feebly convex venter. Fifteen primary ribs arise at the umbilical seam, and strengthen across the umbilical wall and shoulder, without developing into a bulla. One or two ribs intercalate, arising both low and high on the flanks. The ribs are straight and prorsiradiate on the inner flanks, feebly convex at mid-flank and feebly concave on the outer flank, where they strengthen markedly, passing straight across the venter. At the smallest diameters seen, there is a weak ventrolateral tubercle that is soon lost, leaving only a ventrolateral angulation. OUM KX11441 (Fig. 14I) is a body chamber 33.5 mm in diameter. There are 14–15 ribs in half a whorl, predominantly primaries, narrow, distant, straight and prorsiradiate on the inner flank, very feebly convex at mid-flank, and concave on the outer flank, where they strengthen and coarsen markedly. All ribs bear well-developed ventral tubercles. OUM KX11455 (Fig. 14A–C) is a near-complete body chamber,

with seven primary ribs and a total of ten ribs at the ventrolateral shoulder. At the adapical end the ventral costal whorl profile is feebly convex, with small, transversely elongated tubercles. The four adapertural ribs coarsen markedly into coarse transversely elongated tubercles at the ventrolateral shoulder producing a concave ventral costal section. SAM-PCZ22208 (Fig. 15F,G) is interpreted as an adult macroconch, with a maximum preserved diameter of 75.3 mm in diameter. Coiling becomes progressively more evolute around the last whorl, the umbilicus comprising up to 24% of the diameter, of moderate depth, with a convex outward inclined wall and broadly rounded umbilical shoulder. The intercostal whorl section is compressed, with feebly convex subparallel flanks, broadly rounded ventrolateral shoulders and a feebly convex venter. The costal whorl breadth to height ratio is 0.8, the greatest breadth below mid-flank. There are ten primary ribs on the adapertural half whorl of this specimen. At the beginning of the outer half whorl they are very coarse and distant, arising at the umbilical seam and strengthening across the umbilical wall and shoulder. They are straight and prorsiradiate across the flanks, strengthening and coarsening progressively, and developing into a coarse transverse ventral rib. The junction of outer flank and ventral parts of the ribs is a slightly rounded 90° angle in profile, without being differentiated into a discrete tubercle. The adapertural three ribs of the specimen weaken abruptly, crowd slightly, and the ventrolateral shoulders round.

SAM-PCZ22209 (Fig. 14G) is a body chamber with an estimated original diameter of 49 mm, and a costal whorl breadth to height ratio of 0.79 at the adapical end, the flanks flattened and subparallel, the ventrolateral shoulders broadly rounded, the venter feebly convex at the adapical and adapertural ends, but asymmetrically fastigiate between, presumably as a result of injury. It bears five umbilical bullae that give rise to single ribs except for that in the middle of the fragment which gives rise to a pair of ribs. There are additional intercalated cribs, to give a total of 11 at the ventrolateral shoulder. The ribs are straight and prorsiradiate across the flanks, coarsening markedly on the outer flanks and venter. There is a slight ventrolateral angulation on the adapical rib. The specimen may be a juvenile macroconch

None of the specimens shows the sutures.

Discussion

Stoliczkaia (Lamnayella) crotalooides is distinguished by the striking distant ribs and the development of accentuated angular ventrolateral shoulders on the body chamber. It is immediately distinguishable from the other *Stoliczkaia* in the KwaZulu-Natal fauna, and can be recognized in fragments with only a few ribs preserved (OUM KX11458a; Fig. 7Q,R).

Occurrence

Upper Upper Albian, *perinflatum* Zone where well-dated. The geographic distribution extends from South India to KwaZulu-Natal and southern England.

***Stoliczkaia (Lamnayella) sanctaecatherinae* Wright & Kennedy, 1978**
Figs 16D–F, I–K

?1933 *Stoliczkaia dispar* d'Orb.; Collignon, p. 60, pl. 6, fig. 1.
1970 *Lyelliceratidae* gen. et sp. nov.; Kennedy, p. 622.
1978 *Stoliczkaia (Lamnayella) sanctaecatherinae* Wright & Kennedy, p. 402, pl. 38, figs 13–16, 22, 23; pl. 39, figs 9–11; text-fig. 4a–c.
1984 *Stoliczkaia (Lamnayella) sanctaecatherinae* Wright & Kennedy; Wright & Kennedy, p. 78, pl. 10, figs 12, 14, 15, 16?; text-fig. 11b.
1992 *Stoliczkaia (Lamnayella) sanctaecatherinae* Wright & Kennedy; Atabekian, p. 211, pl. 127, fig. 5; pl. 128, fig. 4.
1994b *Stoliczkaia (Lamnayella) sanctaecatherinae* Wright & Kennedy; Kennedy & Delamette, p. 1274, figs 10.1–10.17; 11.1, 11.21–26, 11.31–39.
1996 *Stoliczkaia (Lamnayella) sanctaecatherinae* Wright & Kennedy; Nishida et al., pl. 17, figs 1, 2.
2004 *Stoliczkaia (Lamnayella) sanctaecatherinae* Wright & Kennedy; Matsumoto, Nishida & Toshimitsu, p. 77, figs 13–17.

Type

The holotype is BMNH C88579, the original of Wright & Kennedy, 1978, p. 402, pl. 38, figs 13–16, from the Lower Cenomanian *Mantelliceras mantelli* Zone, *Neostlingoceras carcinanense* Subzone of the Glauconitic Marl at Rocken End, Gore Cliff, Isle of Wight. There are three paratypes.

Material

OUM KX11718, 11720a, and SAM-PCZ22216 (formerly D2938), from the Lower Cenomanian fauna of bed 6 of the Mzinene Formation at locality 61 of Kennedy & Klinger (1975, p. 289, text-fig. 6), hill slopes and gullies west of the western 'horn' of the Skoenberg, 27°52'19"S, 32°20'19"E, northern KwaZulu-Natal.

Description

The specimens range from an estimated 26 to 44 mm in diameter. Coiling is moderately involute, the umbilicus quite deep, the umbilical wall convex and outward-inclined, the umbilical shoulder broadly rounded. The whorl section is slightly depressed reniform, with a costal whorl breadth to height ratio of 1.12, the greatest breadth well below mid-flank in intercostal section and at the umbilical bullae in costal section. SAM-PCZ22216 (Fig. 16I–K) has eight primary ribs in half a whorl at an estimated diameter of 37 mm. They are sharp, narrow, and widely separated on the umbilical wall, strengthen across the umbilical shoulder, developing into a long, sharp bulla that extends onto the inner flank. The ribs are straight and prorsiradiate on the inner to middle flank, where they bifurcate, while single intercalated ribs arise at or above mid-flank to give an estimated 24–25 ribs at the ventrolateral shoulder. The ribs are very feebly convex across the ventrolateral shoulder, and pass straight across the venter without diminution. OUM KX11719 (Fig. 16F) is 44 mm in diameter, and is a slender-whorled individual, with 19–20 ribs at the ventrolateral shoulder. OUM KX11720a (Fig. 16D,E) is a juvenile of a delicately ribbed variant 26 mm in diameter.

Discussion

The sharp ribs, bifurcating on the flanks, with additional

intercalatories, link the KwaZulu-Natal material to the holotype. The closest species amongst the present material is *S. (L.) chancellori* (Figs 14M,N, 17A–R), which has blunter, rounded ribs and umbilical bullae. The *Stoliczkaia dispar* of Collignon (1933, p. 60, pl. 6, fig. 1) from the Lower Cenomanian of Antsatramahavelona, Madagascar, is a *Lamnayella* with sharp, long umbilical bullae giving rise to pairs of ribs, and may be a macroconch of the present species. The original is said to be in the Sorbonne Collections in Paris, but we have failed to locate it.

Occurrence

Lower Lower Cenomanian, southern England, Haute-Savoie in France, Kopet-Dag in Turkmenistan, Japan, northern KwaZulu-Natal and, possibly, Madagascar.

Stoliczkaia (Lamnayella) chancellori Wright & Kennedy, 1984

Figs 14M,N, 17A–R

1984 *Stoliczkaia (Lamnayella) chancellori* Wright & Kennedy, p. 78, pl. 10, fig. 11; text-fig. 11e.

Type

The holotype is BMNH C83582, the original of Wright & Kennedy, 1984, pl. 10, fig. 11; text-fig. 11e, from the Lower Cenomanian Beer Head Limestone of Shapwick Grange, Devon.

Material

OUM KX7502 and K10271, from the Lower Cenomanian Mzinene Formation at locality 181 of Kennedy & Klinger (1975, p. 304), hill slopes east of the road, 1 km south of Ndumu Store, 26°55'51"S, 32°18'29"E. OUM KX10393 is from the same horizon at locality 183 of Kennedy & Klinger (1975, p. 304), degraded quarry east of road and 300 m SW of Ndumu police post, 26°55'10"S, 32°15'45"E. SAM-PCZ 5484b, from the same horizon in the environs of Ndumu.

Description

OUM KX7502 and 10271 are interpreted as microconchs. OUM KX7502 (Fig. 17A–H) is a near-complete adult 27 mm in diameter. Coiling is initially involute, becoming increasingly evolute around the last whorl. The umbilicus is small and deep, with a feebly convex outward-inclined umbilical wall and a broadly rounded umbilical shoulder. The whorl section is depressed reniform on the phragmocone, with a whorl breadth to height ratio of 1.2, the greatest breadth around mid-flank, the flanks markedly convex, the ventrolateral shoulders broadly rounded, the venter broad and very feebly convex. Strong primary ribs, six per half whorl, arise at the umbilical seam and strengthen across the umbilical wall and shoulder, where they develop into blunt bullae. The bullae give rise to pairs of ribs, the adapertural of the pair only weakly linked to the bulla in some cases, with occasional intercalated ribs, to give a total of 12–14 ribs at the ventrolateral shoulder. The ribs coarsen across the outer flanks, ventrolateral shoulders and venter, and are straight to very feebly convex across the venter. The ornament effaces rapidly over the last sector of shell prior to the adult aperture, which is near-smooth. The ventral part of the apertural margin survives, and is feebly concave and very strongly prorsiradiate (Fig. 17B). OUM KX10271 (Fig. 17M–

O, Q–R) is essentially similar, and shows the same abrupt loss of ornament on an approximately 60° sector of whorl immediately prior to the adult aperture. The maximum preserved diameter is 33.5 mm. OUM KX10393 (Fig. 17I–L, P) is interpreted as an incomplete macroconch phragmocone, 35.1 mm in diameter, with seven bullae at the umbilical shoulder of the half whorl, and 16 ribs at the ventrolateral shoulder. The bullae give rise to pairs of ribs, with both long and short intercalatories, the ribs narrower and sharper than in the previous specimens. SAM-PCZ5484b (Fig. 14M,N) retains a fragment of phragmocone and half a whorl of body chamber, preserved to a diameter of 56.2 mm. There are an estimated nine umbilical bullae on the fragment. They give rise to pairs of ribs that branch low on the flanks, with one or two long or short intercalated ribs, to give a total of 15–16 ribs at the ventrolateral shoulder. The ribs are coarse, straight and prorsiradiate on the flanks, and pass straight across the venter.

Discussion

The whorls are less massive, and expand more slowly than those of *S. (L.) sanctaecatherinae*, and the ornament coarser and blunter. The type species, *Stoliczkaia (Lamnayella) juigneti* Wright & Kennedy, 1978 (p. 398, pl. 37, figs 1–10; pl. 38, figs 1–12; see also Wright & Kennedy, 1984, p. 77, pl. 10, figs 8, 1, 13; text-figs 10a–n; 11a, j) has compressed whorls, and does not develop the conspicuous umbilical bullae of *chancellori*, while the adult body chamber develops widely separated primary ribs only that lack a bulla.

Occurrence

Lower Lower Cenomanian of southern England and northern KwaZulu-Natal.

Subgenus *Shumariaia* Matsumoto & Inoma, 1975

Type species

Stoliczkaia (Shumariaia) hashimotoi Matsumoto & Inoma, 1975, p. 277, pl. 39, figs 1–3; text-fig. 10, by the original designation of Matsumoto & Inoma, 1975, p. 276.

Diagnosis

'Small, moderately evolute, compressed forms with early onset of distant, wider ribs, with or without earlier fine-ribbed stage. On early parts of body chamber ribs tend to be angulate or tuberculate on ventrolateral shoulders. Strong umbilical tubercles may be present. Suture simplified in detail.' (Wright & Kennedy, 1984, p. 78).

Occurrence

Upper Albian to Lower Cenomanian, Japan, Texas, Brazil, Nigeria, northern France, southern England, Tunisia, South India and northern KwaZulu-Natal.

Stoliczkaia (Shumariaia) australe sp. nov.

Fig. 18C–T

Derivation of name

Australe, southern.

Types

The holotype is OUM KX10315a (Fig. 18E–H), from the

Lower Cenomanian Mzinene Formation at locality 181 of Kennedy & Klinger (1975, p. 304), hill slopes east of the road, 1 km south of Ndumu Store, 26°55'51"S, 32°18'29"E. Paratype OUM KX10411a (Fig. 18C,D) and 10407a-b are from locality 185 of Kennedy & Klinger (1975, p. 304), hill slopes 500 m WSW of Ndumu police post, 26°51'18"S, 32°16'10"E.

Diagnosis

A compressed involute species of *Stoliczkaia* (*Lamnayella*) in which flexuous primary ribs arise in pairs from umbilical bullae, with additional intercalated ribs, the ribs strengthening on the outermost flanks and ventrolateral shoulders to form an obtuse ventral chevron.

Description

The holotype (Fig. 18 E-H) is a complete, or near-complete adult 17.8 mm in diameter, with a 240° sector of body chamber preserved. Coiling is initially involute, becoming less-so around the final whorl, where the umbilicus comprises 21% of the diameter, and is shallow, with a low, flattened subvertical wall and quite narrowly rounded umbilical shoulder. The whorl breadth to height ratio is 0.64, the inner and middle flanks flattened and subparallel, the outer flanks converging to broadly rounded ventrolateral shoulders, the venter flattened in intercostal section. On the adapical half of the outer whorl, five low, blunt bullae perch on the umbilical shoulder. They give rise to pairs of low, broad falcoid ribs, and additional ribs intercalate to give a total of 11-12 ribs at the ventrolateral shoulder of the half whorl. The ribs are straight and prorsiradiate on the inner flank, flexing back at mid-flank, broadening, coarsening, and concave on the outer flank. They project forwards over the ventrolateral shoulders and venter to form an obtuse ventral chevron. On the adapertural half whorl, the ribbing modifies progressively, the bullae narrow and crowd, and most give rise to only a single rib close to the aperture. Paratype OUM KX10411a (Fig. 18C,D) is 17 mm in diameter. The ornament of the inner whorls and adapical half of the outer whorl is weaker than in the holotype, but the ornament modifies in a comparable fashion beyond this. The suture of the holotype is little-incised, with a broad, plump E/A, narrow A, and large A/U2.

Discussion

OUM KX10411b (Fig. 18A,B) from locality 185 has flank ornament like that of *australe*, but the ribs terminate in small ventral clavi on the adapertural 240° of the outer whorl, and the specimen lacks the distinctive ventral chevron of *australe*. It may represent a variant, or second, undescribed species of *S. (Shumariaia)* from northern KwaZulu-Natal. *S. (Shumariaia) australis*, or a closely related species also occurs in South India. A suite of specimens presented to the Sorbonne, Paris, by the Geological Survey of India (currently housed in the Laboratoire de Paléontologie of the Muséum National d'Histoire Naturelle, Paris) are shown in Fig. 18I-T. It includes a feebly ornamented individual close to the present material (Fig. 18L,M), as well as coarsely ornamented forms, the ribs incipiently tuberculate on the ventrolateral shoulder (Fig. 18I-K, N-T).

Stoliczkaia. (*Shumariaia*) *australe* differs from *S. (S.)*

hashimotoi Matsumoto & Inoma, 1975 (p. 277, pl. 39, figs 1-3; text-fig. 10) in its compressed whorl, involute coiling, and the distinctive ventral chevron formed by the ribs. *S. (S.) asiatica* Matsumoto & Inoma, 1975 (p. 279, pl. 39, figs 4-7; text-fig. 11) is equally distinguished by the form of the ventral ribbing, which is coarse and transverse, and not projected forwards into a chevron. *S. (S.) africana* Pervinquière, 1907 (see revision in Wright & Kennedy, 1994, p. 578, figs 3d-h, l-n, r-w; 11c-g) is a larger species, which develops ventral clavi.

Occurrence

Lower Lower Cenomanian of northern KwaZulu-Natal. The South Indian material is imprecisely dated.

Genus *Cenisella* Delamette & Latil, 1989

Type species

Ammonites bonnetianus Pictet, 1847, p. 306, pl. 4, fig. 6, by the original designation of Delamette & Latil, 1989, p. 57.

Diagnosis

Medium-sized, compressed, involute. Numerous tiny umbilical bullae give rise to one or more delicate straight prorsiradiate ribs that may weaken on the inner flank but strengthen on the outer flanks and venter, and increase by branching and intercalation. Delicate ventral and siphonal clavi present on early whorls only.

Occurrence

The type material comes from a condensed unit of Albian age, as does the second specimen figured by Delamette & Latil (1989, fig. 4c) and that figured by Kennedy & Delamette (1994b, text-figs 12.4, 5) from Haute-Savoie in eastern France. A record from Hautes-Alpes, France (Kennedy in Gale *et al.*, 2011, p. 80, text-fig. 29I) is precisely dated to the *Mortoniceras fallax* Zone. The KwaZulu specimen described below is Upper, but not uppermost Albian.

Cenisella bonnetiana (Pictet, 1847)

Figs 19, 20

1847 *Ammonites bonnetianus* Pictet, p. 306, pl. 4, fig. 6.

1860 *Ammonites bonnetianus* Pictet: Pictet & Campiche, p. 343.

non 1860 *Ammonites bonnetianus* Pictet; Ooster, p. 136
 (= *Stoliczkaia* sp.)

non 1897 *Hoplites?* *bonnetianus* Pict.; Parona & Bonarelli, p. 95
 (43).

1898 *Cenisella bonnetiana* (Pictet); Delamette & Latil, p. 58,
 text-fig. 4.

1994b *Cenisella bonnetiana* (Pictet, 1847); Kennedy & Delamette,
 p. 1278, figs 12.10-12.16.

1996 *Cenisella bonnetiana* (Pictet); Wright, p. 148, fig. 114, 4.

2011 *Cenisella bonnetiana* (Pictet, 1847); Kennedy in Gale
 et al., p. 80, text-fig. 29I.

Type

The holotype, by monotypy, is MHNG 19215, the original of Pictet, 1847, pl. 4, fig. 6, from the condensed Albian of the Bornes Conglomerate of Les Bourgets, in the Bornes Massif, Haute Savoie, France, refigured here as Fig. 20A-C.

Material

SAM-PCZ22241 (formerly D785) (Fig. 19), from the Upper Albian Mzinene Formation on the north bank of the Mzinene River. The locality is given as 'Hill west of beacon 624.' Beacon 624 is a reference point frequently cited by E.C.N. van Hoepen in his publications, and as far as we can guess, it is somewhere in the environs of localities 54–56 of Kennedy & Klinger (1975, p. 288).

Description

The specimen lacks all of one flank as a result of recent erosion; the maximum preserved diameter is 98 mm approximately. Coiling is initially moderately involute, becoming progressively more evolute around the outer whorl, the adapertural 240° sector of which is body chamber. The umbilicus comprises 17% at a diameter of 77 mm, and is shallow, with a flattened, outward-inclined wall, and broadly rounded umbilical shoulder. The whorl section is compressed, although the precise proportions cannot be established. The flanks are flattened and subparallel, the ventrolateral shoulders broadly rounded, the venter feebly convex. Primary ribs, an estimated 12 per half whorl, arise at the umbilical seam, and strengthen across the umbilical wall and shoulder, without developing into a bulla. The ribs are strongly developed on the innermost flanks but then weaken briefly, strengthening progressively across the middle and outer flank, where they increase by bifurcation and intercalation to give a total of 36 ribs per half whorl on the outer flank. They pass straight across the venter, weakening slightly at mid-venter.

Discussion

The KwaZulu specimen differs in no significant respects from the holotype (Fig. 20A–C). There is variation in the species, and a topotype (Fig. 20D–E) lacks ornament on the umbilical wall, shoulder, and innermost flank, and has much more delicate ribbing. *Neophlycticeras rhodanense* Delamette, 1983 (p. 43, pl. 1, figs 1–5; see revision in Kennedy & Delamette, 1994b, p. 1267, text-figs 5.2, 6.15–6.18) may be better referred to *Cenisella*. A well-preserved example is shown in Fig. 22L–O. It differs from *Cenisella bonnetiana* in the smaller size, persistence of siphonal clavi to the end of the phragmocone, and the near-smooth body chamber.

Occurrence

Upper Albian, *Mortoniceras fallax* Zone where precisely dated in southeast France. Occurrences in eastern France and northern KwaZulu-Natal are Upper, but not uppermost Albian.

Genus *Zuluscaphites* van Hoepen, 1955

(= *Huescarites* Latil, 1990, p. 31)

Type species

Zuluscaphites orycteropusi van Hoepen, 1955, p. 359, fig. 6, by original designation.

Diagnosis

'Small, largest known individual 55 mm in diameter, and presumed to be a macroconch; presumed microconchs around 70% of this. Involute, with subcircular whorl section on phragmocone, expanding close to end of adult phragmocone, contracting and flat-sided on body chamber. Ornament

is of numerous long primaries that increase by branching and intercalation; prorsiradiate, straight to feebly concave, strongest on venter; fine in juveniles, coarsening on later phragmocone whorls and body chamber. Delicate siphonal tubercles present on all ribs on inner phragmocone whorls only. Suture moderately incised, with broad, bifid E/L, L small, narrow.' (Kennedy & Klinger, 1993, p. 64).

Discussion

To the diagnosis quoted above it should be noted that the body chamber ornament effaces in some species referred to the genus: *Zuluscaphites helveticus* Kennedy & Delamette, 1994b (p. 1281, text-figs 6.9–6.11, 8.1, 9.3–9.7, 12.1–12.3, 12.6–12.9; Fig. 22G–I herein). We would also suggest that *Stoliczkaia grandidieri* Boule, Lemoine & Thévenin, 1907 (p. 14, (34), pl. 2 (8), fig. 8) is a *Zuluscaphites* (Fig. 21E–L), as is the *Stoliczkaia* cf. *rhamonota* Sheeley [sic] of Besairie, 1936 (p. 193, pl. 21, fig. 3; see Fig. 23E–G herein). In 1993 we suggested that *Huescarites* Latil, 1990, p. 31, type species by original designation *H. companyi* Latil, 1990, p. 32, pl. 1, figs 1–3, 5–7; text-figs 1–5, was a synonym of *Zuluscaphites*. A cast of the holotype is illustrated here as Fig. 22J,K. It is a near-complete adult 55 mm in diameter, with a 200° sector of body chamber preserved, and a maximum phragmocone diameter of 40 mm approximately. The strength and pattern of ribbing on the phragmocone is similar to that on the adapical half of the outer whorl of the holotype of *orycteropusi*, with feeble indications of a siphonal tubercle. There is a brief, expanded section to the whorls, followed by a contraction in whorl section, but this is not as prominent as in *orycteropusi*. The two differ in that the holotype of *companyi* retains fine ribbing throughout, and does not develop the coarse ribs developed in the holotype of *orycteropusi* on the adapertural parts of the outer whorl. In contrast, a second specimen referred to *companyi* by Latil (1990, pl. 1, fig. 3), reproduced here as Fig. 22A–D is inseparable from the fine-ribbed early stages of the holotype of *orycteropusi*. A third specimen referred to *companyi* by Latil (1990, pl. 1, fig. 7), illustrated here as fig. 22E–F has a fine-ribbed stage succeeded by a coarse ribbed stage, exactly as in *orycteropusi*. Latil regarded specimens with fine ribbed body chambers, as in the holotype of *companyi* and those with coarsely ribbed body chambers that are in our view inseparable from *orycteropusi* as intraspecific variants. It is conceivable that these co-occurring morphotypes may in fact represent different species, but whichever position is correct, we continue to regard *Huescarites* as a synonym of *Zuluscaphites*.

Zuluscaphites and *Cenisella* are closely allied, sharing delicate crowded ribbing and a minute siphonal tubercle in early ontogeny. They differ in the compressed whorl section of *Cenisella*, and the uniform ornament, compared to the near-circular whorl section of *Zuluscaphites* and its distinctive ontogenetic changes in ornament.

Occurrence

In Hautes-Alpes, France, the genus occurs in the lower Upper Albian *Mortoniceras inflatum* Zone. Most other records of the genus are imprecisely dated as lower Upper Albian, with records from Savoie and Gard in France, Switzerland, Hungary, southern Spain, Madagascar and northern KwaZulu-Natal.

***Zuluscaphites orycteropusi* van Hoepen, 1955**

Figs 21A–D, 22A–F, J, K

1955 *Zuluscaphites orycteropusi* van Hoepen, p. 359, fig. 6.
 1957 *Zuluscaphites orycteropusi* van Hoepen; Wright, p. L231.
 1983 *Salaziceras* Klinger & Wiedmann, text-fig. 1.
 1990 *Huescarites companyi* Latil, p. 31, pl. 1, figs 1–3, 5–7; text-figs 1–6.
 1993 *Zuluscaphites orycteropusi* van Hoepen, 1955; Kennedy & Klinger, p. 64, text-fig. 1g–j.
 1993 *Huescarites companyi* Latil, 1991; Kennedy & Klinger, p. 64, text-fig. 1a–f, k, l.
 1994b *Zuluscaphites orycteropusi* van Hoepen; Kennedy & Delamette, p. 1278, text-figs 13.1–13.14.
 1996 *Zuluscaphites orycteropusi* Hoepen; Wright, p. 151.
 ?2007 *Zuluscaphites orycteropusi* van Hoepen, 1955; Szives, p. 106 (pars), pl. 16, figs 4–6, 13–15.
 2011 *Zuluscaphites orycteropusi* Hoepen; Kennedy in Gale et al., p. 80, text-fig. 29G).

Type

The holotype, by monotypy, is SAM-PCZ22496 (formerly Z10), the original of van Hoepen, 1955, p. 359, text-fig. 6, from the Upper Albian part of the Mzinene Formation. The specimen came from the debris excavated by an Ant Bear (Aardvark: *Orycteropus afer*) at a locality described by van Hoepen as 'the foot of a sloping escarpment that has been called Krans West of Beacon 624 in former papers' (1955, p. 359); as noted above the precise location of Beacon 624 is lost, but it lay somewhere in the environs of localities 54–56 of Kennedy & Klinger (1975, p. 288). The horizon is most probably lower Upper Albian, given van Hoepen's records of *Deiradoceras* from the environs of Beacon 624 (1941, p. 81).

Description

The holotype (Fig. 21A–D) is a phragmocone 40 mm approximately in diameter. It shows a distinct expansion of the whorl section 90° before the adapertural end, on the late, but not final part of the presumed adult phragmocone. Ribbing is fine on the adapical half of the outer whorl, and coarse on adapertural half, the ribs increasing by branching and intercalation on the outer flank. A tiny siphonal tubercle is present on all ribs to a diameter of 36 mm approximately. The coiling departs from a logarithmic spiral, perhaps a result of, or accentuated by *post-mortem* deformation of the shell. The suture is only moderately incised, with a broad bifid E/A and narrow, trifid L.

Discussion

With only a single specimen from KwaZulu-Natal, the limits of the species remain uncertain as discussed above with respect to *Huescarites companyi*. Latil (1990, p. 33) referred *Salaziceras* (*Salaziceras*) *breistrofferi breistrofferi* Scholz, 1979 (p. 96, pl. 21, figs 21, 22, 25, 27, 28; text-figs 25, 27a, z) to *Huescarites* (e.g. *Zuluscaphites*) and raised *Salaziceras* (*Salaziceras*) *breistrofferi pseudonodosa* Scholz, 1979 (p. 96, pl. 21, figs 23, 24, 26; text-fig. 27r) to specific level, referring it to *Metascaphites* Wiedmann, 1962. Szives (2007, p. 106) placed both *breistrofferi breistrofferi* and *breistrofferi pseudonodosa* into the synonymy of *Zuluscaphites orycteropusi*. We do not accept this. The pattern of ribbing in *breistrofferi sensu stricto* is quite different in

these tiny specimens, the ribs apparently looping over the venter between bullae in some (Scholz, 1979, pl. 21, fig. 25), while in *pseudonodosa*, there are distinct ventrolateral tubercles (Scholz, 1979, pl. 31, figs 23, 26). The small specimens referred to *orycteropusi* by Szives (2007, pl. 16, figs 13–15) are smaller than the type, but may well belong here.

Zuluscaphites grandidieri (Boule, Lemoine & Thévenin, 1907) (pl. 2 (8), fig. 8 p. 14 (34); Fig. 21E–L herein) is more compressed and evolute, with a more prominent siphonal tubercle on the phragmocone of the holotype, the ribs bifurcating and flexing back on the outer flank of the phragmocone and adapical parts of the body chamber, and weakening and effacing on the adapertural part.

Occurrence

In Hautes-Alpes, France, the species occurs in the lower Upper Albian *Mortoniceras inflatum* Zone. Most other records of the genus are imprecisely dated as lower Upper Albian, with records from Savoie, and Gard in France, Switzerland, ?Hungary, southern Spain and northern KwaZulu-Natal.

***Zuluscaphites grandidieri* (Boule, Lemoine & Thévenin, 1907)**

Fig. 21E–L
 1907 *Stoliczkaia Grandidieri* (Boule, Lemoine & Thévenin, 1907, p. 14 (34). p. 14 (34), pl. 2 (8), fig. 8.
 1963 *Stoliczkaia grandidieri* Boule, Lemoine & Thévenin; Collignon, p. 183, pl. 318, fig. 1343.

Type

The holotype is the original of Boule, Lemoine & Thévenin, 1907 (pl. 2 (8), fig. 8 p. 14 (34)), illustrated here as Fig. 21I–L, from the Upper Albian of Mont Raynaud, Madagascar, in the Sorbonne Collections, and seen in the Collignon collection in the Université de Bourgogne, Dijon, in 1992.

Dimensions

	D	Wb	Wh	Wb:Wh	U
SAM-PCZ22244	48.6 (100)	21.0 (43.2)	23.0 (47.3)	0.91	8.5 (17.5)
Holotype	At 56.0 (100)	19.0 (33.8)	27.9 (49.8)	0.68	10.0 (17.8)

Material

SAM-PCZ22244 from the lower Upper Albian Mzinene Formation in the Ndumu area.

Description

The holotype (Fig. 21I–L) is somewhat distorted by *post mortem* crushing. It retains half a whorl of body chamber. Coiling is moderately evolute on the phragmocone, increasing markedly around the outer whorl, suggesting the specimen to be adult. On the phragmocone, the umbilicus is small, shallow, with a flattened subvertical wall and broadly rounded umbilical shoulder. The whorl section is compressed oval intercostally, with broadly rounded ventrolateral shoulders and a feebly convex venter. The greatest

breadth is at the umbilical bullae in intercostal section, the flanks feebly convergent. Ribs arise at the umbilical seam and strengthen across the umbilical wall. They are narrow, straight and prorsiradiate on the inner half of the flanks, bifurcate on the outer flank where short intercalated ribs arise. The pattern of branching and intercalation is irregular, the ribs feebly convex on the ventrolateral shoulders. They pass straight across the venter, and bear feeble bullate ventrolateral tubercles and a feebly clavate siphonal tubercle. Ribbing weakens markedly on the adapertural part of the phragmocone and on the body chamber, and consists of delicate prorsiradiate riblets that branch from the umbilical shoulder and intercalate, strengthening over the ventrolateral shoulder, but weakening on the venter. The ornament effaces on the final sector of the body chamber, which is near-smooth.

SAM-PCZ22244 (Fig. 21E–H) is 52 mm in maximum preserved diameter. It retains original shell material and is part body chamber, although the position of the final septum cannot be established. Coiling is involute on the phragmocone, becoming increasingly evolute around the outer whorl, the umbilicus reaching 17.5% of the diameter. The umbilical wall is flattened and outward-inclined, the umbilical shoulder broadly rounded, the flanks very feebly convex, flattened, the outer flanks feebly convergent, the ventrolateral shoulders broadly rounded, the venter feebly convex. The costal whorl breadth to height ratio is 0.91. An estimated 18–20 ribs arise at the umbilical seam on the outer whorl, and strengthen across the umbilical wall and shoulder, where many develop into a feeble bulla. Primary ribs arise singly or in pairs from the bullae, and there are additional non-bullate primaries. The ribs are narrow, straight and prorsiradiate on the inner and middle flank, and most bifurcate on the outer flank, the adapical secondary rursiradiate, the adapertural secondary prorsiradiate. There are additional short intercalated ribs, to give a total of 26 ribs per half whorl at the ventrolateral shoulder. The ribs pass straight across the venter without diminution. On the adapical part of the outer whorl there are barely detectable transversely elongated ventral tubercles and a very feeble siphonal tubercle on all ribs. The ornament reduces markedly on the final part of the shell immediately before the aperture.

Discussion

The uniform ornament on the phragmocone, and weakening of ornament on the adapertural part of the body chamber distinguishes the species from the holotype of *Zuluscaphites orycteropisi*. *Zuluscaphites helveticus* Kennedy & Delamette, 1994b (p. 1281, text-figs 6.9–6.11, 8., 9.3–9.7, 12.1–12.3, 12.6–12.9; Fig. 22G–I herein) has sparse flexuous ribs on the phragmocone that branch high and low on the flank, and a body chamber that is near-smooth but for distant irregular primary ribs and growth striae.

Occurrence

Upper Albian of Madagascar. The preservation of the KwaZulu specimen suggests it is from the lower Upper Albian in the environs of van Hoepen's Beacon 624: somewhere in the environs of localities 54–56 of Kennedy & Klinger (1975, p. 288) on the north bank of the Mzinene.

Zuluscaphites cf. helveticus Kennedy & Delamette, 1994b

Fig. 16A–C

compare

1994b *Zuluscaphites helveticus* Kennedy & Delamette, p. 1281, text-figs 6.9–6.11, 8.1, 9.3–9.7, 12.1–12.3, 12.6–12.9, non 2007 *Zuluscaphites helveticus* Kennedy & Delamette, 1994; Szives, p. 107, pl. 14, fig. 14; pl. 16, figs 1, 2; pl. 20, fig. 7.

Material

SAM-PCZ22242 (formerly D2678), from the lower Upper Albian Mzinene Formation, 'stream into Mzinene at beacon 624', that is to say somewhere in the environs of localities 54–56 of Kennedy & Klinger (1975, p. 288) on the north bank of the Mzinene.

Description

SAM-PCZ22242 is a well-preserved individual with a maximum preserved diameter of 33.8 mm. Coiling is moderately involute, the umbilicus comprising 17% of the diameter, the umbilical wall flattened and outward-inclined, the umbilical shoulder broadly rounded. The whorl section is as wide as high, with flattened subparallel flanks, broadly rounded ventrolateral shoulders and a feebly convex venter. Ten primary ribs per half whorl arise at the umbilical seam and strengthen across the umbilical wall and shoulder. They are straight and prorsiradiate on the inner and middle flank, some bifurcating on the outer flank, where additional ribs intercalate, to give a total of 20–22 ribs per half whorl at the ventrolateral shoulder. The ribs sweep forwards and are feebly concave across the ventrolateral shoulders and strong and transverse across the venter. The ornament weakens and effaces on the adapertural 60° sector of the shell, suggesting the specimen to be an incomplete adult.

Discussion

The whorl proportions, relatively low rib density and style, and the loss of ornament at the adapertural end of the specimen match those of the macroconch holotype of *helveticum*, illustrated here as Fig. 22G–I. There are also similarities to the original of *Stoliczkaia cf. rhamonota* Sheeley [sic] of Besairie, 1936 (p. 193, pl. 21, fig. 3). This specimen (Fig. 23E–G) is associated with a second, smaller individual of the same species in the Sorbonne Collections (Fig. 23A–D) with a spectacular disruption of the normal ornament as a result of non-lethal damage in life (Fig. 23A, C). The maximum preserved whorl height of these specimens is 21.2 mm, the whorl breadth to height ratio 0.74, the flanks feebly convex, the outer flanks converging to broadly rounded ventrolateral shoulders, the venter feebly convex. The feature suggesting these specimens are *Zuluscaphites* allied to *helveticus* is the pattern of the ribbing, with primaries that bifurcate at or above mid-flank, as in the holotype of *helveticus* (Fig. 22G–I), although there is no indication of the abrupt loss of ornament shown by that specimen at a comparable whorl height.

We are uncertain of the affinities of the material assigned to this species by Szives (2007).

Occurrence

The species is imprecisely dated as lower Upper Albian,

with records from Haute-Savoie, and Ain in France, and northern KwaZulu-Natal.

ACKNOWLEDGEMENTS

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 financial support from the NRF (South Africa) and logistic support from the staff of the Natural History Collections Department of the Iziko, South African Museum, Cape Town.

REFERENCES

ATABEKIAN, A.A. 1992. pp. 201–212, pls 113–128. In ZONOVA, T.D. & ROSTOVSEV, K.O. (eds) *Atlas of Leading Guide Fossils of the Southern and Eastern USSR*. St. Petersburg: NEDRA [in Russian.]

BARRAGAN, R., ROJAS-CONSUEGRA, R. & SZIVES, O. 2011. Late Albian (early Cretaceous) ammonites from the Provincial Formation of central Cuba. *Cretaceous Research* **32**: 447–455.

BESAIRIE, H. 1936. Recherches géologiques à Madagascar, première suite. *Mémoire de l'Academie Malgache* **21**:1–259.

BOULE, M., LEMOINE, P. & THEVENIN, A. 1906–1907. Paléontologie de Madagascar III Céphalopodes crétacés des environs de Diego-Suarez. *Annales de Paléontologie* **1**: 173–192 (1–20); **2**: 1–56 (21–76).

BREISTROFFER, M. 1947. Sur les zones d'ammonites dans l'Albien de France et d'Angleterre. *Travaux du Laboratoire de Géologie de la Faculté des Sciences de l'Université de Grenoble* **26**: 17–104 (1–88 in separates).

BREISTROFFER, M. 1953. Commentaires taxonomiques. In: BREISTROFFER, M. & VILLEOUTREYS, O. de. Les ammonites albiennes de Peille (Alpes-Maritimes). *Travaux du Département du Laboratoire de Géologie de l'Université de Grenoble*, **30** (for 1952): 69–74.

BULOT, L.G., KENNEDY, W.J., JAILLARD, E. & ROBERT, E. 2005. Late Middle–early Late Albian ammonites from Ecuador. *Cretaceous Research* **26**: 450–459.

CASEY, R. 1965. A monograph of the Ammonoidea of the Lower Greensand. Part 6. *Palaeontographical Society Monographs*: 399–546.

COLLIGNON, M. 1932. Les ammonites pyriteuses de l'Albien supérieur du Mont Raynaud à Madagascar. *Annales Géologiques du Service des Mines, Madagascar* **2**: 5–36.

COLLIGNON, M. 1933. Fossiles Cénomaniens d'Antsatramahavelona (Province d'Analava, Madagascar). *Annales Géologiques du Service des Mines, Madagascar* **3**: 53–79.

COLLIGNON, M. 1949. Recherches sur les faunes albiennes de Madagascar V. L'Albien supérieur d'Andranofotsy (cirque de Manja). *Annales Géologiques du Service des Mines, Madagascar* **19**: 7–41.

COLLIGNON, M. 1963. *Atlas des fossiles caractéristiques de Madagascar (Ammonites)*. X. Albien. xv + 184 pp. Tananarive: Service Géologique.

COOPER, M.R. 1992. Towards a phylogenetic classification of the Cretaceous ammonites: II Lyelliceratinae. *Neues Jahrbuch für Geologie und Paläontologie. Abhandlungen* **185**: 21–38.

COOPER, M.R. & KENNEDY, W.J. 1979. Uppermost Albian (*Stoliczkaia dispar* Zone) ammonites from the Angolan littoral. *Annals of the South African Museum* **77**: 175–308.

DELAMETTE, M., 1983. Ammonite nouvelle de l'Albien de la Perte-du-Rhône (Ain, France). *Neophlycticeras (Neophlycticeras) rhodanense* n. sp. (Lyelliceratidae). *Revue de Paléobiologie* **2**: 43–45.

DELANOY, G. & LATIL, J-L. 1988. Découverte d'un nouveau gisement Albien dans les environs de Drap (Alpes-Maritimes, France) et description d'une riche ammonitofaune d'âge Albien terminal. *Géobios* **21**: 749–771.

DELAMETTE, M. & LATIL, J.L. 1989. Révision de l'*Ammonites bonnetianus* Pictet, 1847 (Cephalopoda, Ammonoidea) Stoliczkaiae de l'Albien supérieur de la plate-forme hélvétique (Haute-Savoie, S.E. France). *Revue de Paléobiologie*, Special Volume **3**: 55–61.

GALE, A.S., BOWN, P., CARON, M., CRAMPTON, J., CROWHURST, S.J., KENNEDY, W.J., PETRIZZO, M.R. & WRAY, D. S. 2011. The uppermost Middle and Upper Albian succession at the Col de Palluel, Hautes-Alpes, France: an integrated study (ammonites, inoceramid bivalves, planktonic foraminifera, nannofossils, geochemistry, stable oxygen and carbon isotopes, cyclostratigraphy). *Cretaceous Research* **37**: 59–130.

GROSSOUVRE, A. de 1894. Recherches sur la craie supérieure, 2, Paléontologie. Les ammonites de la craie supérieure. *Mémoires du Service de la Carte Géologique détaillée de la France*, 1–264. [Dated 1893].

GAUTHIER, H. 2006. *Révision Critique de la Paléontologie Française d'Alcide d'Orbigny*, 6, Céphalopodes Crétacés. Leiden: Backhuys.

HOEPEN, E.C.N. VAN 1955. Turonian–Coniacian ammonites from Zululand. *South African Journal of Science* **51**: 361–377.

HYATT, A. 1889. Genesis of the Arietidae. *Smithsonian Contributions to Knowledge* **673**: xi + 239 pp.

KENNEDY, W.J. 1970. A correlation of the uppermost Albian and the Cenomanian of south-west England. *Proceedings of the Geologists' Association* **81**: 613–677.

KENNEDY, W.J. 2004. Ammonites from the Pawpaw Shale (Upper Albian) in northeast Texas. *Cretaceous Research* **25**: 865–905.

KENNEDY, W.J. & BILOTTE, M. 2009. A revision of the cephalopod fauna of the 'niveau rouge' of the Selva de Bonansa, Huesca Province, northern Spain. *Bulletin of the Moscow Society of Naturalists* **84**: 39–70.

KENNEDY, W.J. & DELAMETTE, M. 1994a. *Neophlycticeras* Spath, 1922 (Ammonoidea) from the Upper Albian of Ain, France. *Neues Jahrbuch für Geologie und Paläontologie Monatsheft* **191**: 1–24.

KENNEDY, W.J. & DELAMETTE, M. 1994b. Lyelliceratidae and Flickiidae (Ammonoidea) from the Upper Albian and Cenomanian of the Helvetic Shelf (Western Alps, France and Switzerland). *Journal of Paleontology* **68**: 1263–1284.

KENNEDY, W.J. & KLINGER, H.C. 1975. Cretaceous faunas from Zululand and Natal, South Africa. Introduction, stratigraphy. *Bulletin of the British Museum (Natural History) Geology* **25**: 263–315.

KENNEDY, W.J. & KLINGER, H.C. 1993. On the affinities of *Zulusaphites* Van Hoepen, 1955 (Cretaceous Ammonoidea) from the Albian of Zululand, South Africa. *Paläontologische Zeitschrift* **67**: 63–67.

KENNEDY, W.J. & LATIL, J-L. 2007. The Upper Albian ammonite succession in the Montlaux section, Hautes-Alpes, France. *Acta Geologica Polonica* **57**: 453–478.

KLINGER, H.C. & WIEDMANN, J. 1983. Palaeobiogeographic affinities of Upper Cretaceous ammonites of northern Germany. *Zitteliana* **10**: 413–425.

KORN, D., EBBIGHAUSEN, V., BOCKWINKEL, J. & KLUG, C. 2003. The A-mode ontogeny in prolecanitid ammonites. *Palaeontology* **46**: 1123–1132.

KULLMANN, J. & WIEDMANN, J. 1970. Significance of sutures in phylogeny of Ammonoidea. *University of Kansas, Paleontological Contributions* **42**: 1–32.

LATIL, J.L. 1990. *Huescarites companyi* nov. gen. nov. sp. a new Albian (early *dispar* Zone) Flickiidae Adkins, 1928 (Ammonoidea, Cephalopoda) from South-West Europe. *Mésogée* **50**: 31–35.

MATRION, B., DUBUS, B. & TOUCH, R. 1998. Le genre *Neophlycticeras* (Spath, 1922) dans l'Albien de l'Aube et du Boulonnais. *Bulletin Annuel de l'Association Géologique Aubeoise* **19**: 15–28.

MATSUMOTO, T. & INOMA, A. 1975. Mid-Cretaceous ammonites from the Shumarinai–Soeushinai Area, Hokkaido. *Memoirs of the Faculty of Science, Kyushu University, Series D, Geology* **23**: 263–293.

MATSUMOTO, T., NISHIDA, T. & TOSHIMITSU, S. 2004. The early Cenomanian (Cretaceous) ammonite fauna from the Soeushinai area of Hokkaido, North Japan. *Bulletin of the Geological Survey of Japan* **55**: 67–92.

MONOD, D.O., BUSNARDO, R. & GUERRERO-SUASTEGUI, M. 2000. Late Albian ammonites from the carbonate cover of the Teleoloapan arc volcanic rocks (Guerrero State, Mexico). *Journal of South American Earth Sciences* **13**: 377–388.

NEUMAYR, M. 1875. Die Ammoniten der Kreide und die Systematik der Ammonitiden. *Zeitschrift der Deutschen Geologischen Gesellschaft* **27**: 854–942.

NISHIDA, T., MATSUMOTO, T., YOKOI, K., KAWASHITA, Y., KYUMA, Y., EGASHIRA, N., AIZAWA, J., MAIYA, S., IKUJ, Y. & YAO, A. 1996. Biostratigraphy of the Cretaceous Yezo Group in the Soeushinai area of Hokkaido. *Journal of the Faculty of Education, Saga University* **44**: 65–149 (in Japanese).

OOSTER, W-A. 1857–1863. Pétrifications remarquables des Alpes Suisses. Catalogue des Céphalopodes fossiles des Alpes Suisses, avec la description et les figures des espèces remarquables, 1–5 (1857–60), 6, supplémentaire (1863). xxx + 376 pp. 1, 32 pp. (1857); 2, 34 pp. (1857); 3, 19 pp. (1858); 4, 160 pp. (1860); 5, 100 pp. (1860).

ORBIGNY, A. d'. 1840–1842. *Paléontologie française: Terrains crétacés*. 1. Céphalopodes. Masson: Paris. 1–120 (1840); 121–430 (1841); 431–662 (1842).

PARONA, C.F. & BONARELLI, G. 1897. Fossili Albiani d'Escragnolles, del Nizzardo e della Liguria occidentale. *Palaeontographica Italica* **2**: 53–107(1–55).

PERVINQUIERE, L. 1907. Études de paléontologie tunisienne. Céphalopodes des terrains secondaires. *Mémoire de la Carte géologique de Tunisie*: 438 pp.

PICTET, F.J. 1847. Description des mollusques fossiles qui se trouvent dans les Grès Verts des environs de Genève. *Mémoires de la Société de Physique et d'Histoire Naturelle de Genève* **11**: 257–412.

PICTET, F.J. & CAMPICHE, G. 1860. Description des fossiles du terrain Crétacé des environs de Sainte-Croix. 2. Matériaux pour la Paléontologie Suisse (Series 2): 209–380.

REBOULET, S., GIRAUD, F. & PROUX, O. 2005. Ammonoid abundance variations related to changes in trophic conditions across the Oceanic Anoxic Event 1d (latest Albian, SE France). *Palaios* **20**: 121–141.

SCHOLZ, G. 1979. Die Ammoniten des Vracon (Oberalb, dispar Zone) des Bakony-Gebirges (Westungarn) und eine Revision der wichtigsten Vracon-arten der Westmediterranen Faunaprovinz. *Palaeontographica* **A165**: 1–136.

SEELEY, H.G. 1865. On Ammonites from the Cambridge Greensand. *Annals and Magazine of Natural History* (3), **16**: 225–247.

SPATH, L.F. 1921. On Cretaceous Cephalopoda from Zululand. *Annals of the South African Museum* **12**: 217–321.

SPATH, L.F. 1922. On Cretaceous Ammonoidea from Angola, collected by Professor J.W. Gregory, D.Sc., F.R.S. *Transactions of the Royal Society of South Africa* **53**: 91–160.

SPATH, L.F. 1931. A monograph of the Ammonoidea of the Gault. Part 8. *Palaeontographical Society Monographs*: 379–410.

STOLICZKA, F. 1863–1866. The fossil cephalopoda of the Cretaceous rocks of southern India. Ammonitidae with revision of the Nautilidae etc. *Memoirs of the Geological Survey of India*. (1), *Palaeontologica Indica* **3**: (1), 41–56(1863); (2–5), 57–106(1864); (6–9), 107–154(1865); (10–13), 155–216(1866).

SZIVES, O. 2007. Albian Stage. In: Aptian–Campanian ammonites of Hungary. *Geologica Hungarica, Series Palaeontologica* **57**: 75–122.

THOMEL, G. 1972. Les Acanthoceratidae Cénomaniens des chaînes subalpines méridionales. *Mémoires de la Société Géologique de France*, (N.S.) **116**: 204 pp.

THOMEL, G. 1980. Ammonites. 227 pp. Nice: Editions Serre.

WIEDMANN, J. 1962. Ammoniten aus der Vascogotischen Kreide (Nordspanien). 1, Phylloceratina, Lytoceratina. *Palaeontographica*, **118A**: 119–237.

WRIGHT, C.W. 1957. [Cretaceous Ammonoidea]. In: MOORE, R.C. (ed.) *Treatise on Invertebrate Paleontology. Part L, Mollusca 4, Cephalopoda Ammonoidea*. xxii + 1–490 pp., New York and Lawrence: Geological Society of America and University of Kansas Press.

WRIGHT, C.W. 1996. *Treatise on Invertebrate Paleontology. Part L, Mollusca 4: Cretaceous Ammonoidea*. xx + 1–362 (with contributions by J.H. Calloman [sic] and M.K. Howarth). Lawrence, Kansas and Boulder, Colorado: Geological Society of America and University of Kansas.

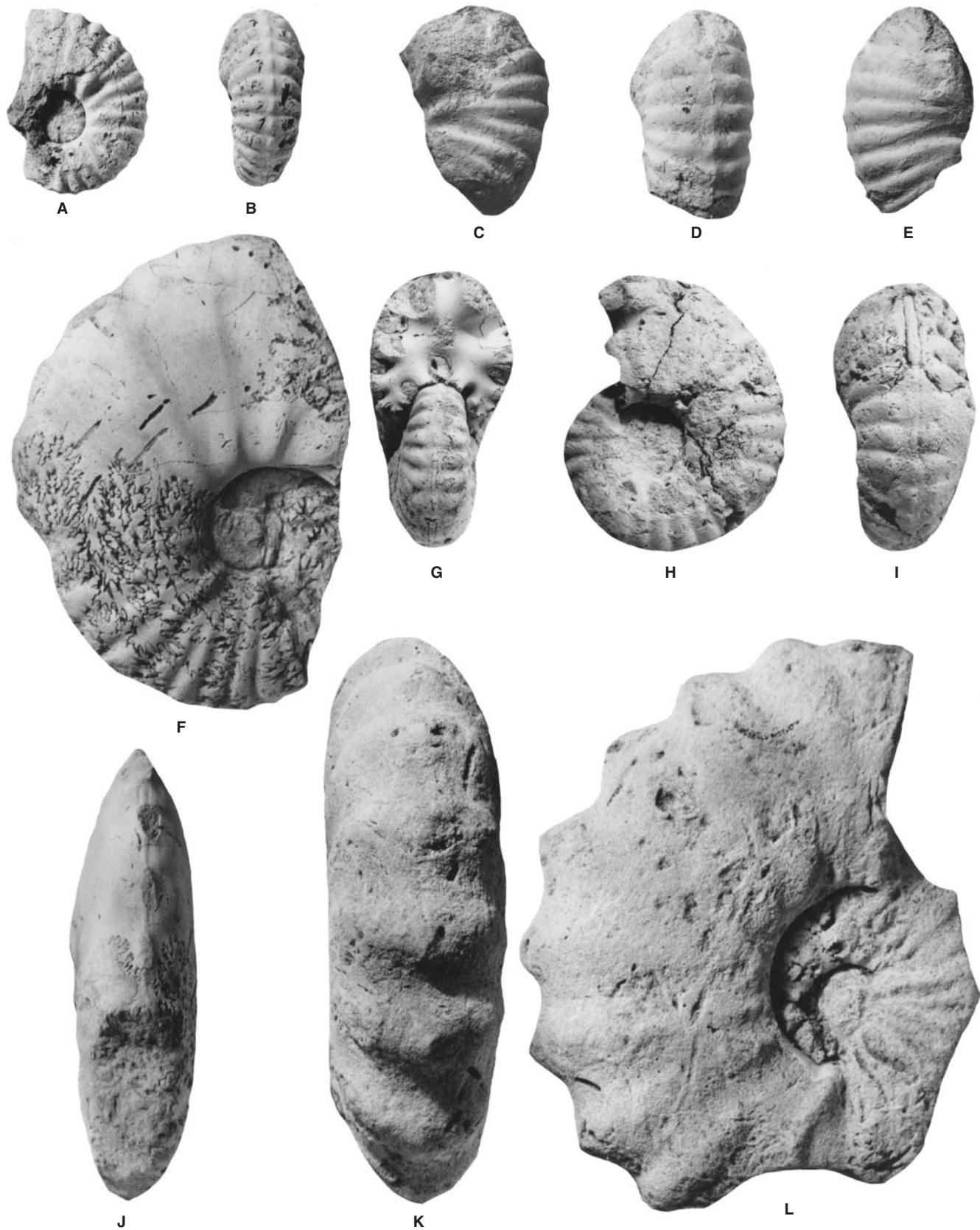
WRIGHT, C.W. & KENNEDY, W.J. 1978. The Ammonite *Stoliczkaia* from the Cenomanian of England and northern France. *Palaeontology* **21**: 393–409.

WRIGHT, C.W. & KENNEDY, W.J. 1984. The Ammonoidea of the Lower Chalk. Part 1. *Palaeontographical Society Monographs*: 1–126.

WRIGHT, C.W. & KENNEDY, W.J. 1994. Evolutionary relationships among Stoliczkaiinae (Cretaceous ammonites) with an account of some species from the English *Stoliczkaia dispar* Zone. *Cretaceous Research* **15**: 547–582.

YOUNG, K. 1979. Lower Cenomanian and Late Albian (Cretaceous) ammonites, especially Lyelliceratidae, of Texas and Mexico. *Bulletin of the Texas Memorial Museum* **26**: v + 99 pp.

Fig. 1. A–L. *Neophlycticeras (Neophlycticeras) brottianum* (d'Orbigny, 1841). **A, B**, the original of Collignon, 1963, pl. 317, fig. 1342, from the Upper Albian of Andranofotsy, Madagascar (UBD collections). **C–E**, the holotype, MNHP R4274, d'Orbigny Collection 5757, the original of d'Orbigny, 1841, pl. 85, figs 8–10, from the condensed Albian of Perte du Rhône, Ain, France. **F, J**, the holotype of *Budaiceras madagascariensis* Besairie, 1936, pl. 21, fig. 14, from the Upper Albian of Mont Raynaud, Madagascar (Sorbonne Collections, currently housed in the Université de Bourgogne, Dijon). **G–I**, the holotype of *Neophlycticeras hirtzi* Collignon, 1949, pl. 1, fig. 3, from the Upper Albian of Andranofotsy, Madagascar, École des Mines, Paris Collections, currently housed in the Université Claude Bernard 1, Villeurbanne. **K, L**, the original of *Neophlycticeras hirtzi* Collignon of Collignon, 1963, pl. 315, fig. 1336, from Andranofotsy, Madagascar (UBD collections). All figures are $\times 1$.



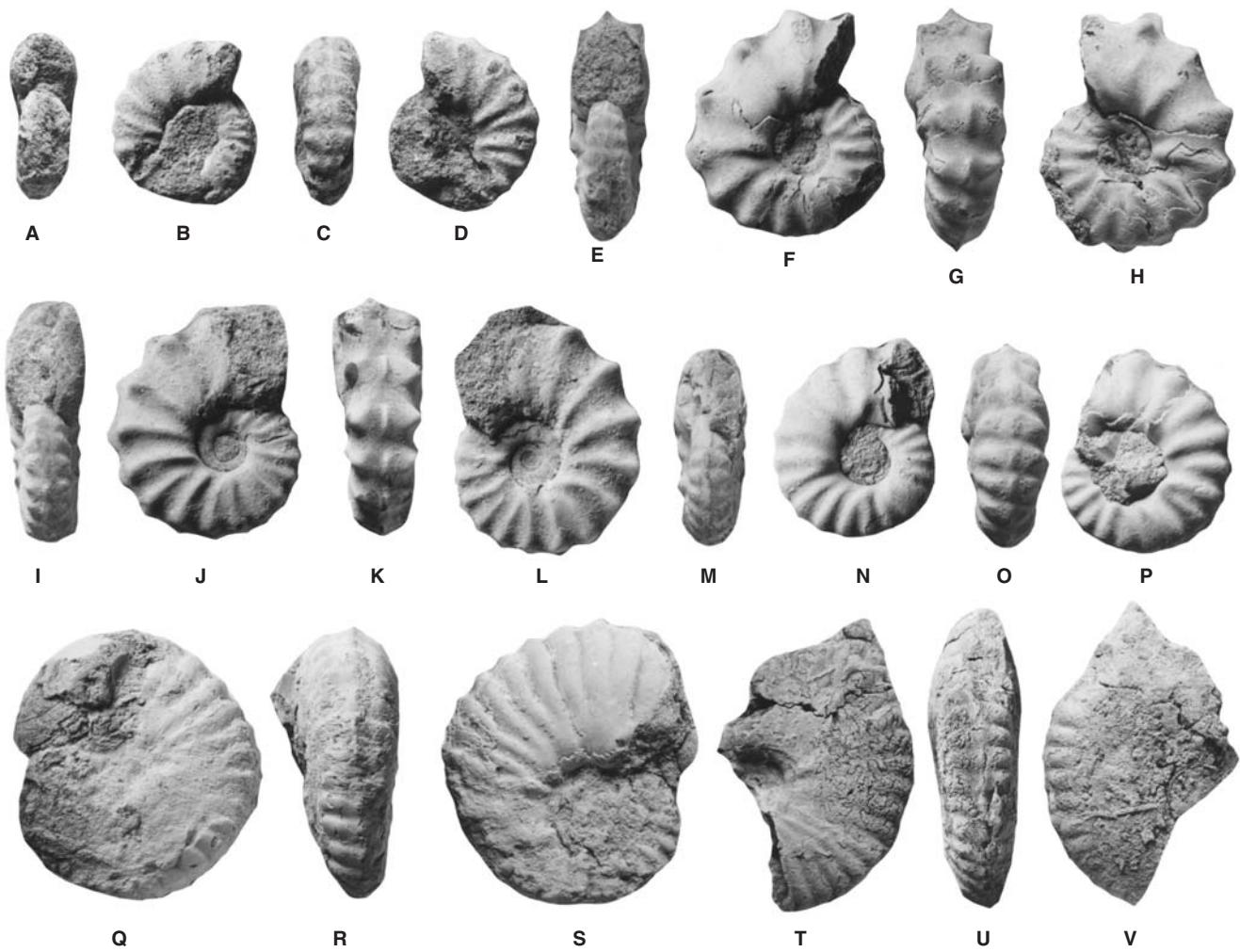


Fig. 2. A–P, *Neophlycticeras (Protissotia) itierianum* (d'Orbigny, 1841). A–D, SAM-PCZ22201; E–H, SAM-PCZ22204; I–L, SAM-PCZ22203; M–P, SAM-PCZ22202, all from the Upper Albian Mzinene Formation of locality 51. Q–V, *Neophlycticeras (Neophlycticeras) brottianum* (d'Orbigny, 1841). Q–S, SAM-PCZ22198, from the Upper Albian Mzinene Formation in the environs of locality 51. T–V, SAM-PCZ22199, from the Upper Albian Mzinene Formation on the lower reaches of the Mzinene. Figures A–P are $\times 2$; Figs Q–V are $\times 1$.

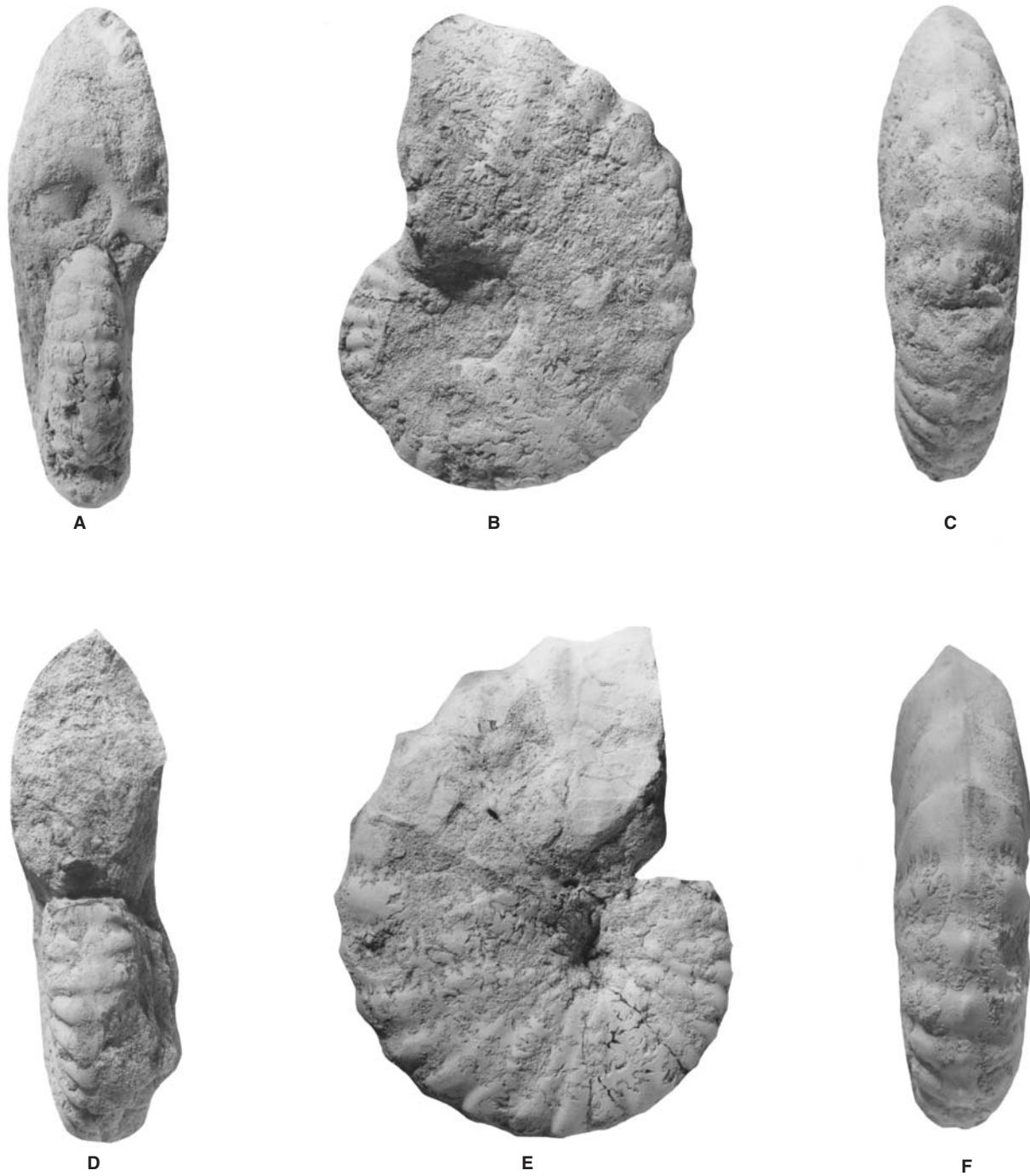


Fig. 3. A–F, *Neophlycticeras (Neophlycticeras) brottianum* (d'Orbigny, 1841). **A–C**, no. 54508, **D–F**, no. 19096 in the collections of Muséum d'Histoire Naturelle, Geneva, from the condensed Albian in the environs of Bellegarde-sur-Valserine, Ain, France. Figures are $\times 1$.

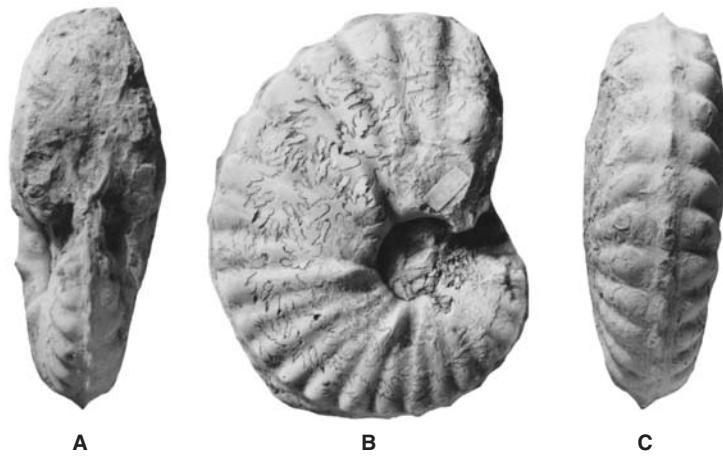


Fig. 4. A–C, *Neophlycticeras (Neophlycticeras) brottianum* (d'Orbigny, 1841). The holotype of *Budaiceras spathi* Besairie, 1936, pl. 21, figs 15, 16, from the Upper Albian of Mont Raynaud, Madagascar, in the collections of the Sorbonne, currently housed in the Université de Bourgogne, Dijon. Figures are $\times 1$.

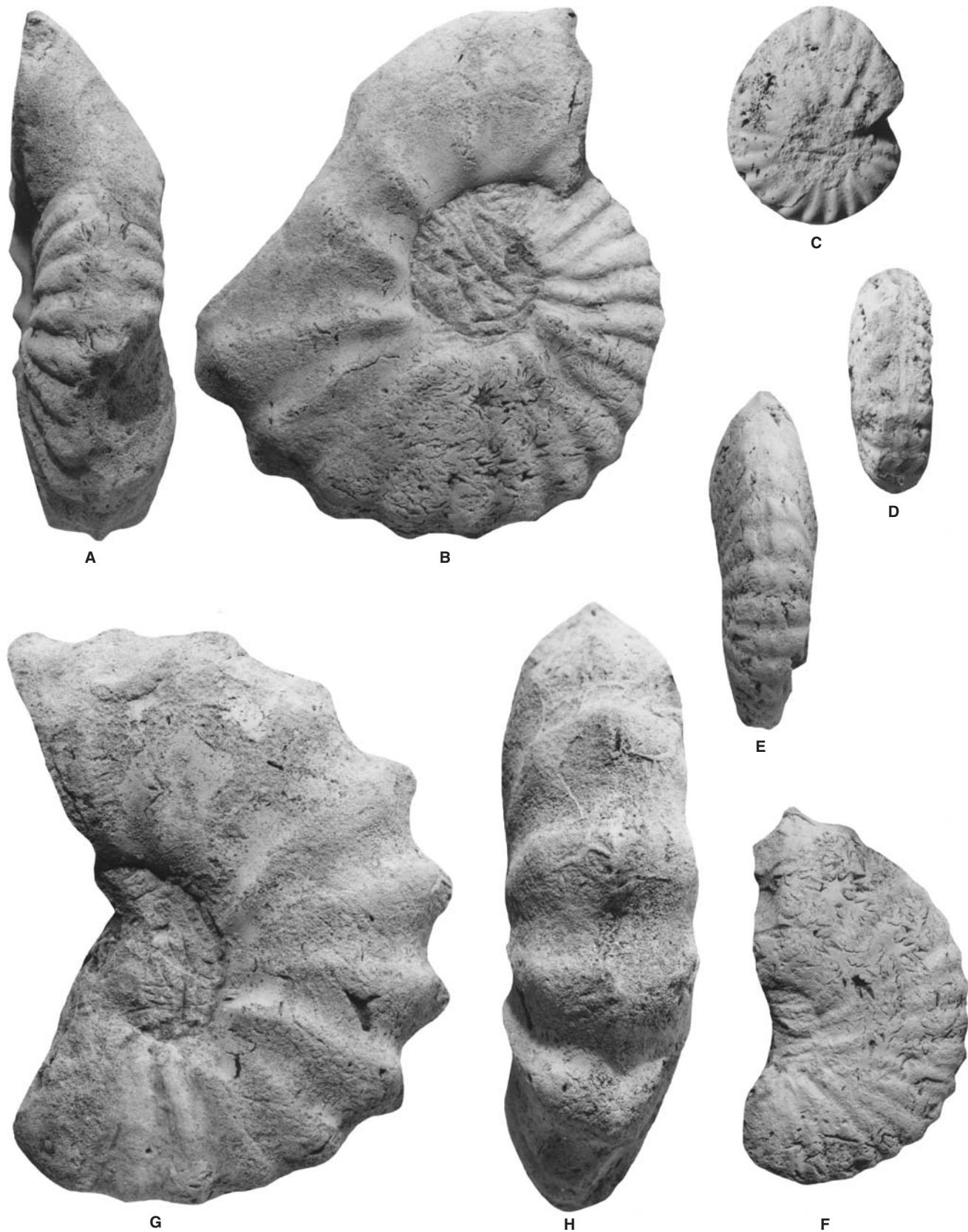


Fig. 5. A–H. *Neophlycticeras (Neophlycticeras) brottianum* (d'Orbigny, 1841). **A, B**, the original of *Neophlycticeras hirtzi* Collignon, 1949, pl. 1, fig. 5. **C, D**, the original of *Neophlycticeras sexangulatum* Seeley of Collignon, 1949, pl. 1, fig. 1. **E, F**, the original of *Neophlycticeras sexangulatum* Seeley of Collignon, 1949, pl. 1, fig. 2. **G, H**, the original of *Neophlycticeras hirtzi* Collignon, 1949, pl. 1, fig. 4. All specimens are from the Upper Albian of Andranofotsy, Madagascar, in the collections of the École des Mines, Paris, currently housed in the Université Claude Bernard 1, Villeurbanne. Figures are $\times 1$.

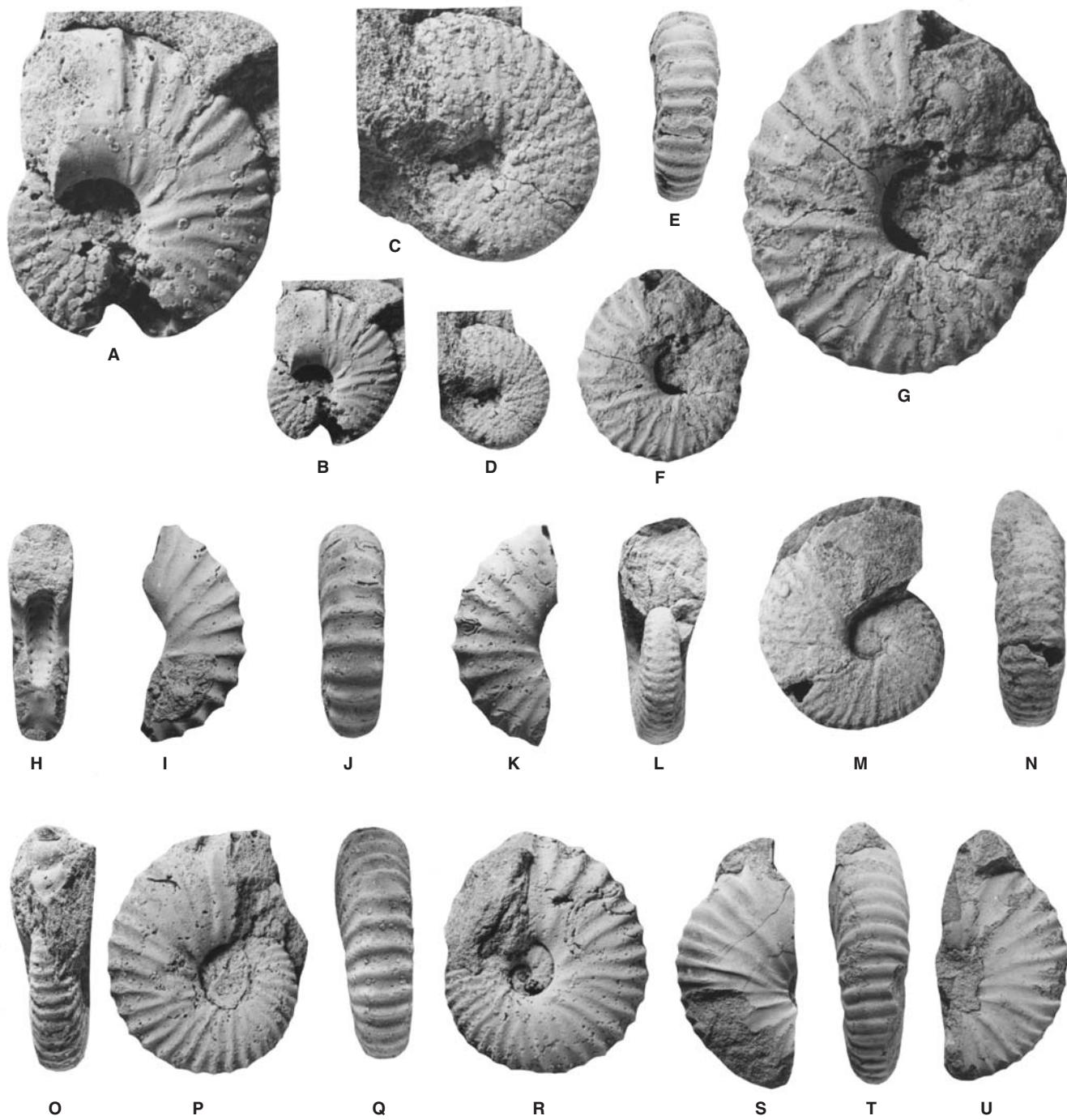


Fig. 6. A–U, *Stoliczkaia (Stoliczkaia) clavigera* Neumayr, 1875. A, B, OUM KX11446; C, D, OUM KX11456; E–G, OUM KX11458; H–K, OUM KX11447; O–R, OUM KX11453; all are from bed 2 of the Upper Albian Mzinene Formation at locality 61. L–N, SAM-PCZ22206; S–U, SAM-PCZ22205, from the Upper Albian Mzinene Formation in the environs of Ndumu. Figures A, G, are $\times 2$; Figs B, D, E, F–U are $\times 1$.

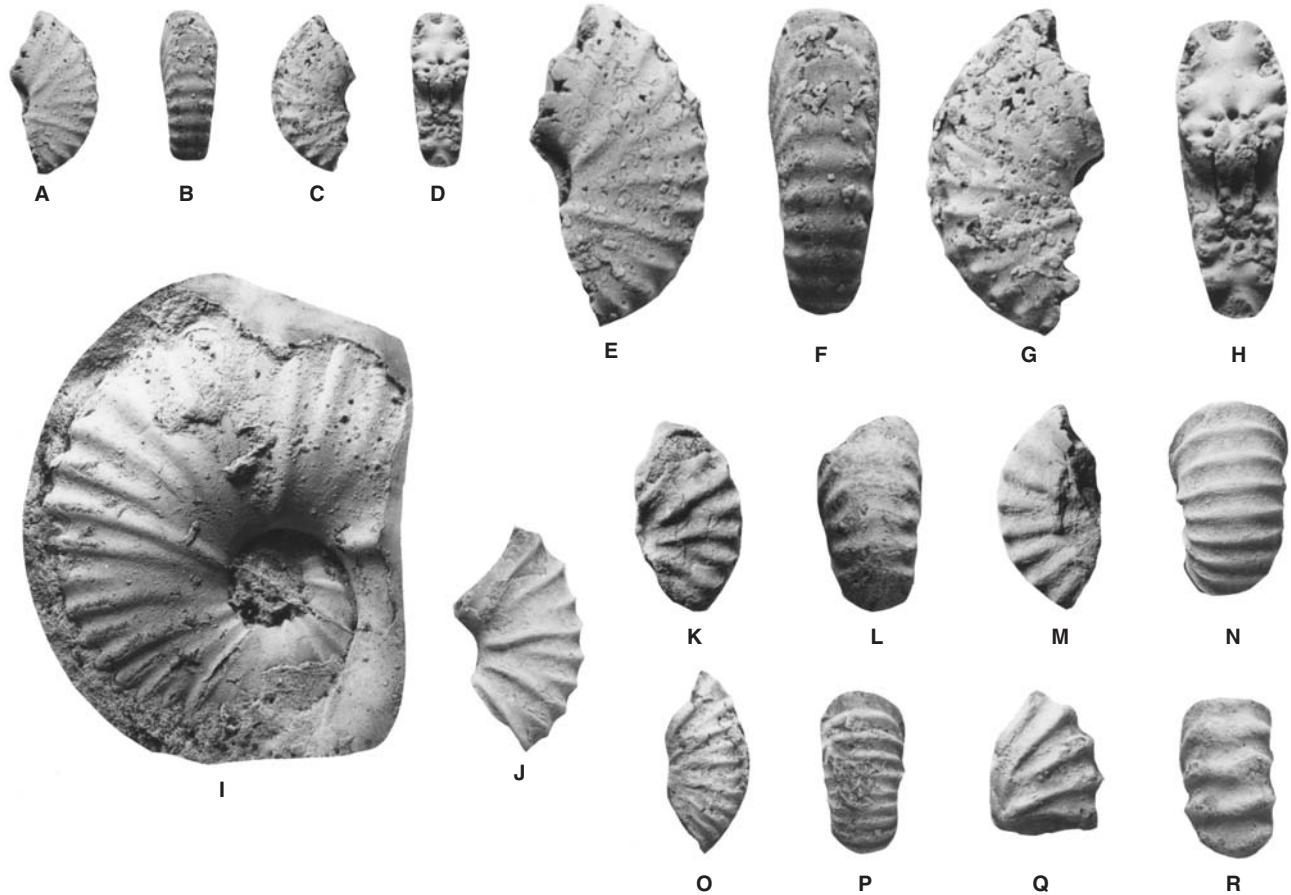


Fig. 7. **A–I**, *Stoliczkaia (Stoliczkaia) clavigera* Neumayr, 1875. **A–H**, OUM KX11458c; **I**, silicone squeeze of OUM KX11442; both are from bed 2 of the Upper Albian Mzinene Formation at locality 61. **J–P**, *Stoliczkaia (Lamnayella) tetragona* Neumayr, 1875. **J–N**, SAM-PCZ22207, from the Upper Albian Mzinene Formation in the environs of Ndumu. **O, P**, OUM KX11458e, from the same horizon and locality as A–I. **Q, R**, *Stoliczkaia (Lamnayella) crotalooides* (Stoliczka, 1864), OUM KX11458a, from the same horizon and locality as A–I. Figures A–D, I, J, N–R are $\times 1$; Figs G–H, K–M are $\times 2$.

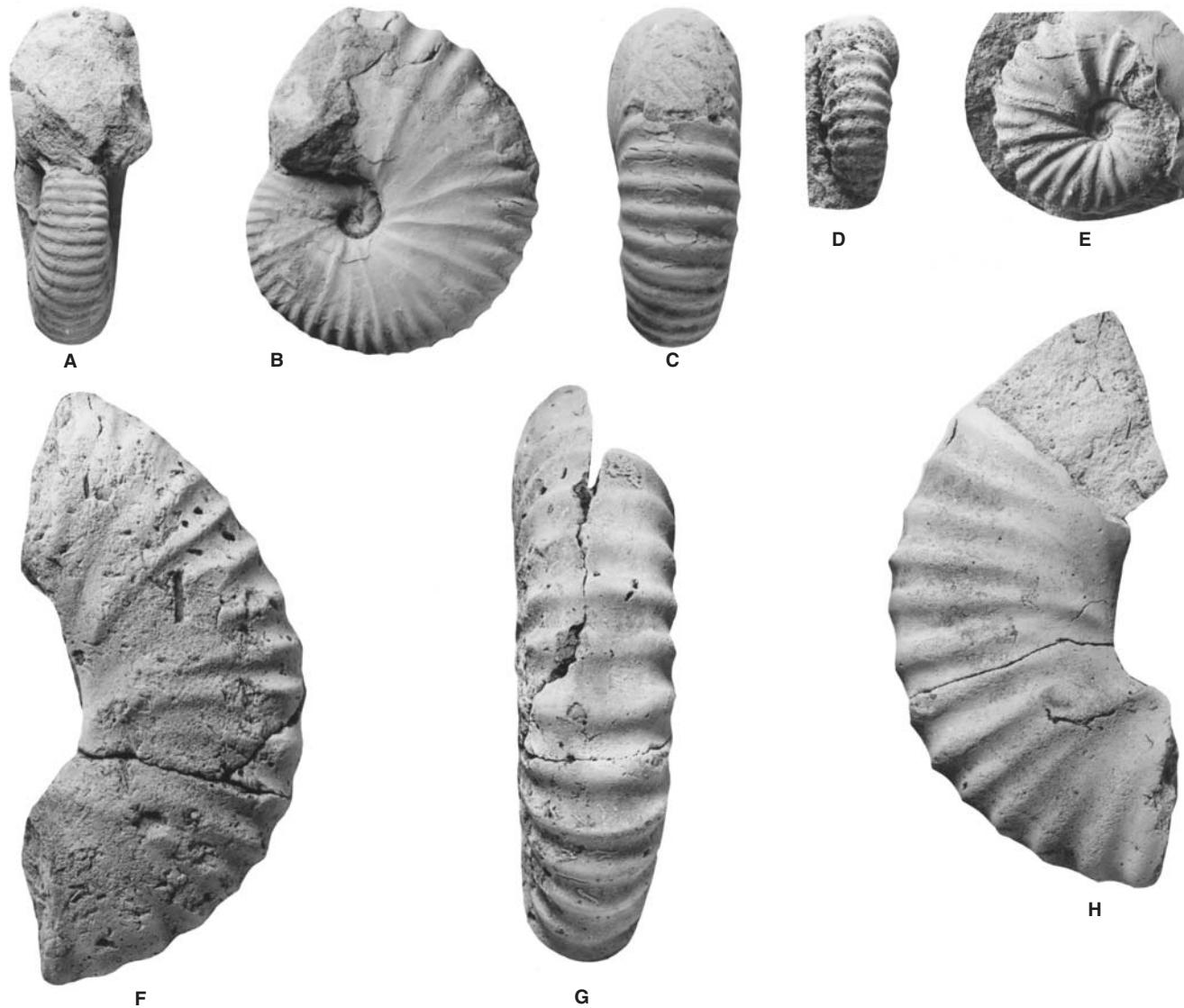


Fig. 8. A–C, F–H, *Stoliczkaia (Stoliczkaia) clavigera* Neumayr, 1875. A–C, SAM-PCZ22211, from the Upper Albian Mzinene Formation in the environs of Ndumu. F–H, OUM KX11450, from bed 2 of the Upper Albian Mzinene Formation at locality 61. D, E, *Stoliczkaia (Lamnayella) crotalooides* (Stoliczka, 1864), silicone squeeze of OUM KX 11440, from the same horizon and locality as F–H. All figures are $\times 1$.



Fig. 9. *Stoliczkaia (Stoliczkaia) clavigera* Neumayr, 1875. SAM-PCZ22218, from the Upper Albian Mzinene Formation in the environs of Ndumu. Figures are $\times 1$.



Fig. 10. *Stoliczkaia (Stoliczkaia) clavigera* Neumayr, 1875. The original of *Stoliczkaia clavigera* Neumayr of Collignon, 1963, pl. 316, fig. 1341, from Mont Raynaud, Madagascar. This specimen is also the original of *Stoliczkaia clavigera* of Boule, Lemoine & Thévenin, 1909, pl. 2, fig. 1, (9), where it is figured $\times 0.5$. The original is in the Sorbonne Collections, and is currently housed in the Université de Bourgogne, Dijon. Figures are $\times 1$.



Fig. 11. *Stoliczkaia (Stoliczkaia) clavigera* Neumayr, 1875. The holotype of *Stoliczkaia notha* Seeley var. *crassa* Collignon, 1963, p. 183, pl. 317, fig. 1345, from Mont Raynaud, Madagascar, in the collections of the Université de Bourgogne, Dijon. Figures are $\times 1$.

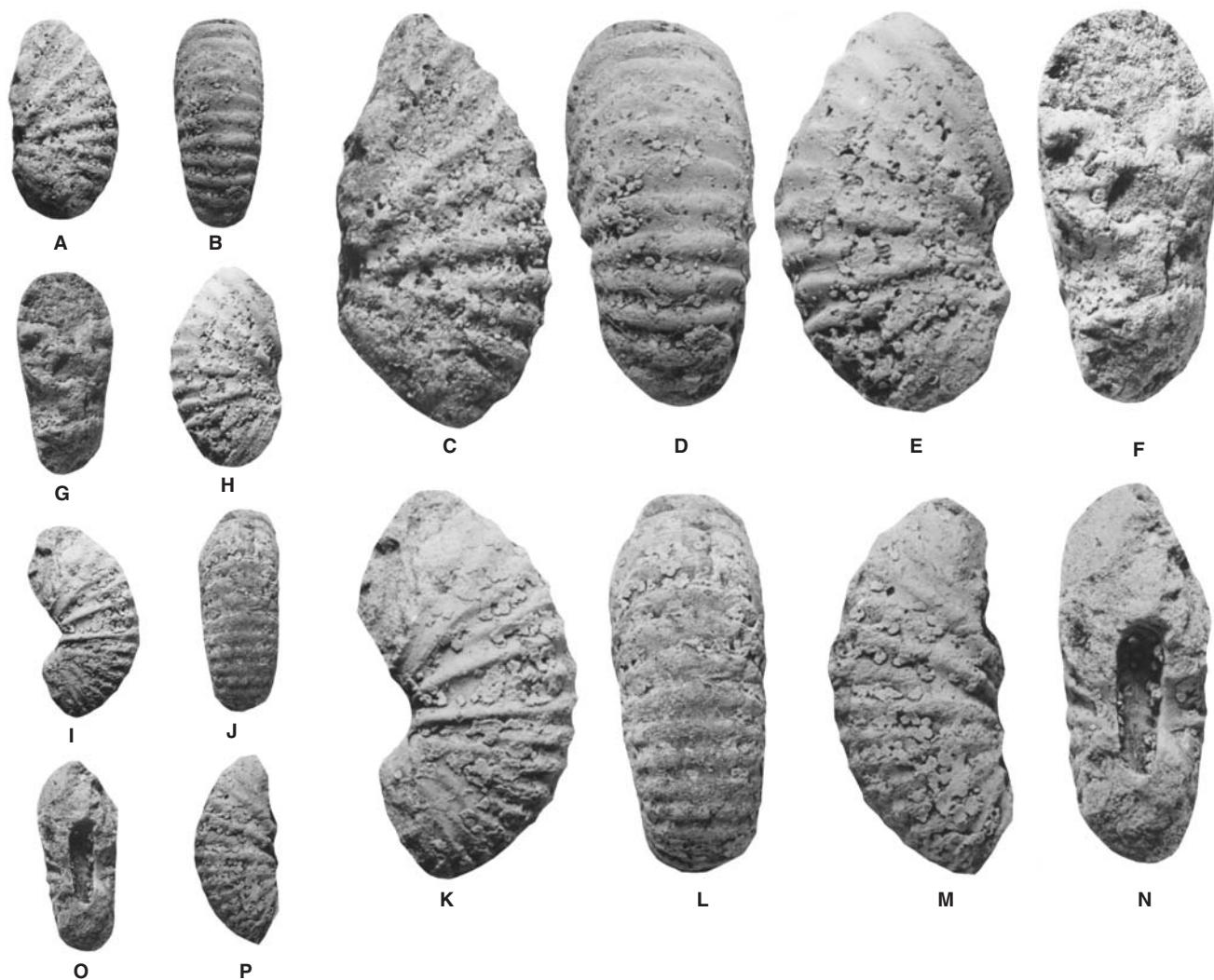


Fig. 12. A–N, *Stoliczkaia (Stoliczkaia) tetragona* Neumayr, 1875. A–H, OUM KX11448; I–N, OUM KX11457, both from bed 2 of the Upper Albian Mzinene Formation at locality 61. Figures A, B, G, H, I, J, O, P, are $\times 1$; Figs C–F, K–N are $\times 2$.

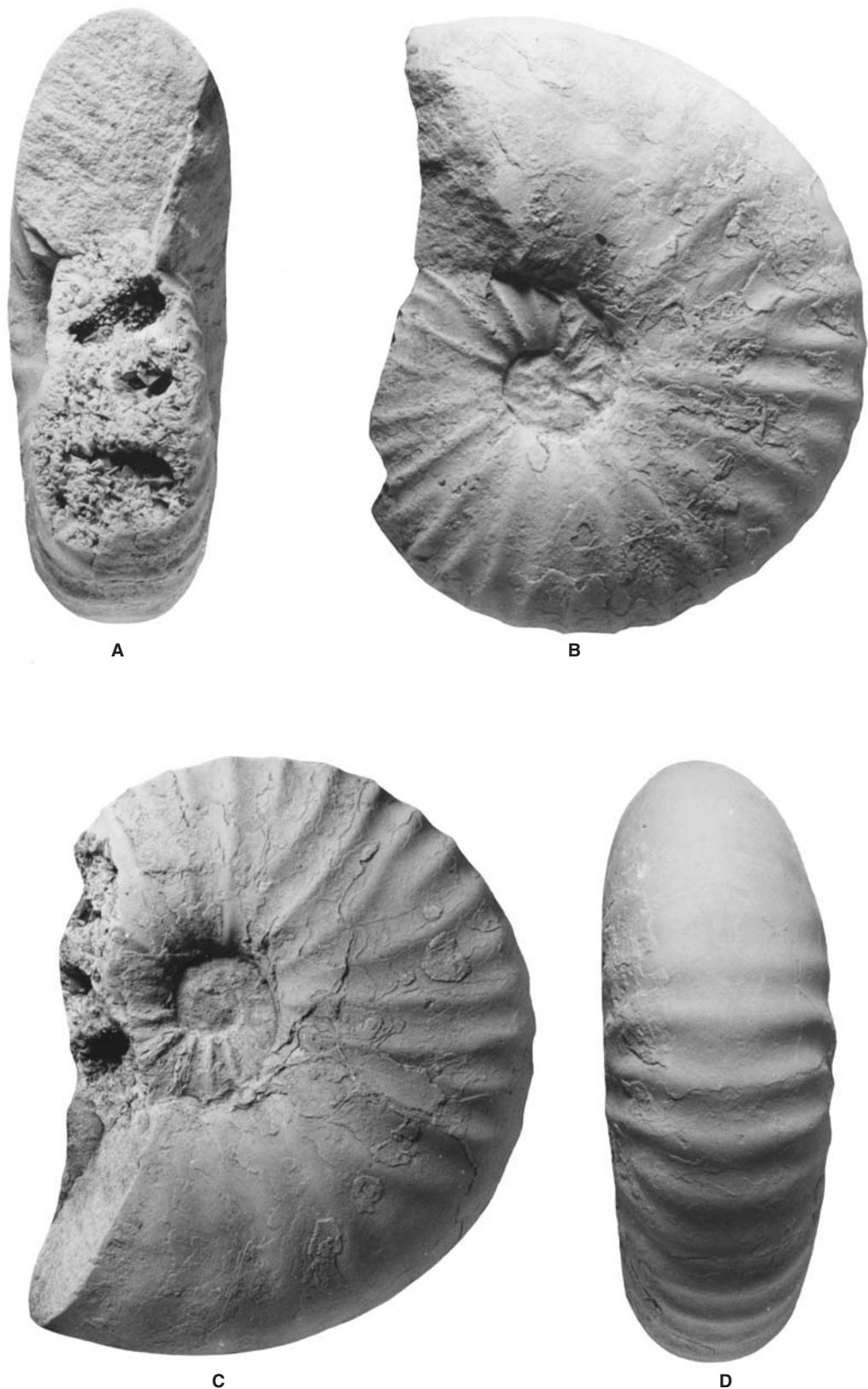


Fig. 13. *Stoliczkaia (Stoliczkaia) clavigera* Neumayr, 1875. SAM-PCZ22210, from the Upper Albian Mzinene Formation in the environs of Ndumu. Figures are $\times 1$.

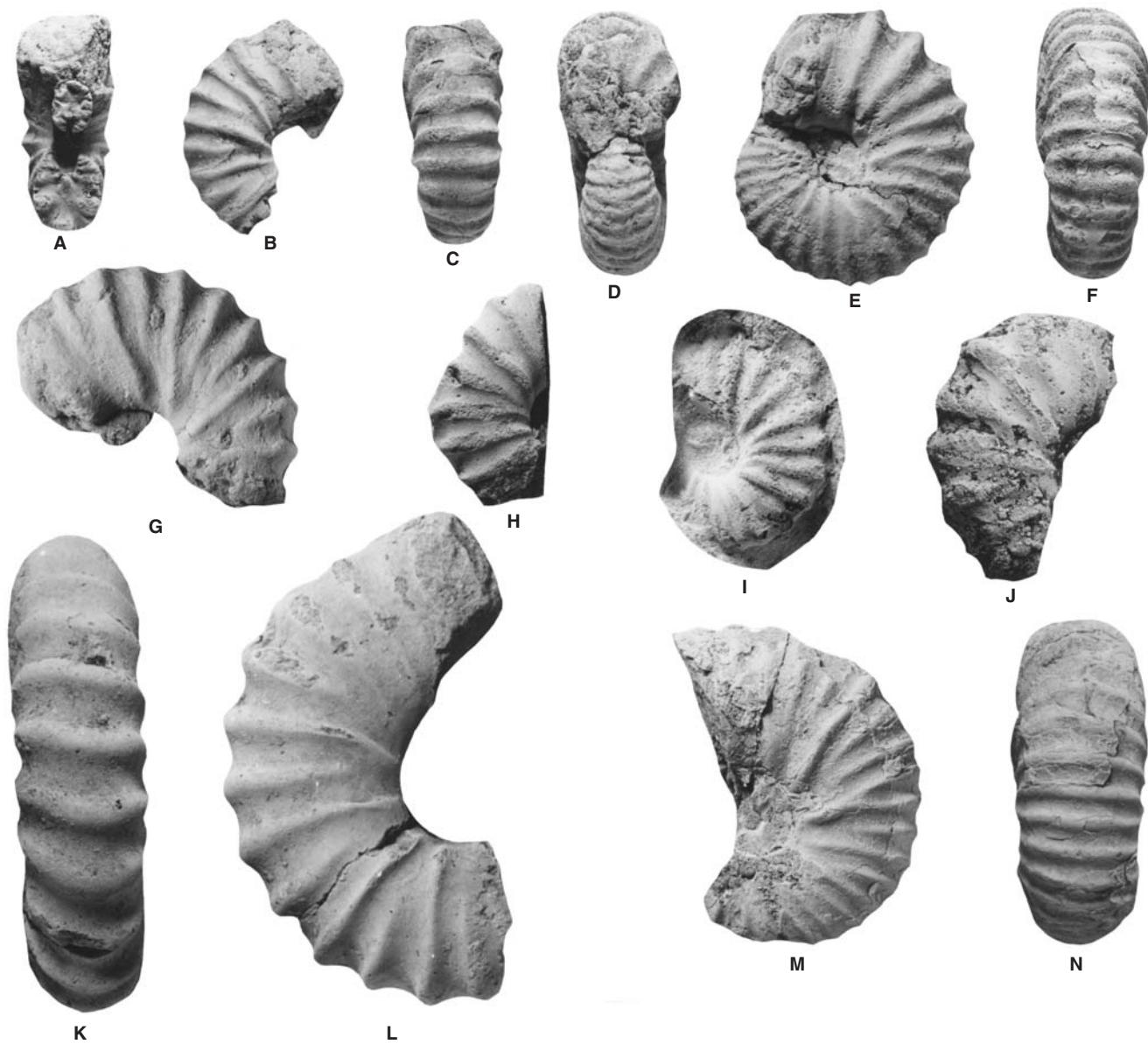


Fig. 14. A–C, G–J, *Stoliczkaia (Lamnayella) crotaloides* (Stoliczka, 1864). A–C, OUM KX11455; G, SAM-PCZ22209; H, OUM KX11454; I, silicone squeeze of OUM KX11441; J, OUM KX11449, all from bed 2 of the Upper Albian Mzinene Formation at locality 61. D–F, *Stoliczkaia (Lamnayella) tetragona* Neumayr, 1875, SAM-PCZ22217, from the same horizon and locality as the previous specimens. K, L, *Stoliczkaia (Stoliczkaia) clavigera* Neumayr, 1875, SAM-PCZ22213, from the same horizon and locality as A–J. M, N, *Stoliczkaia (Lamnayella) chancellori* Wright & Kennedy, 1984, SAM-PCZ5484b-check, from the Lower Cenomanian Mzinene Formation in the Ndumu area. All figures are $\times 1$.

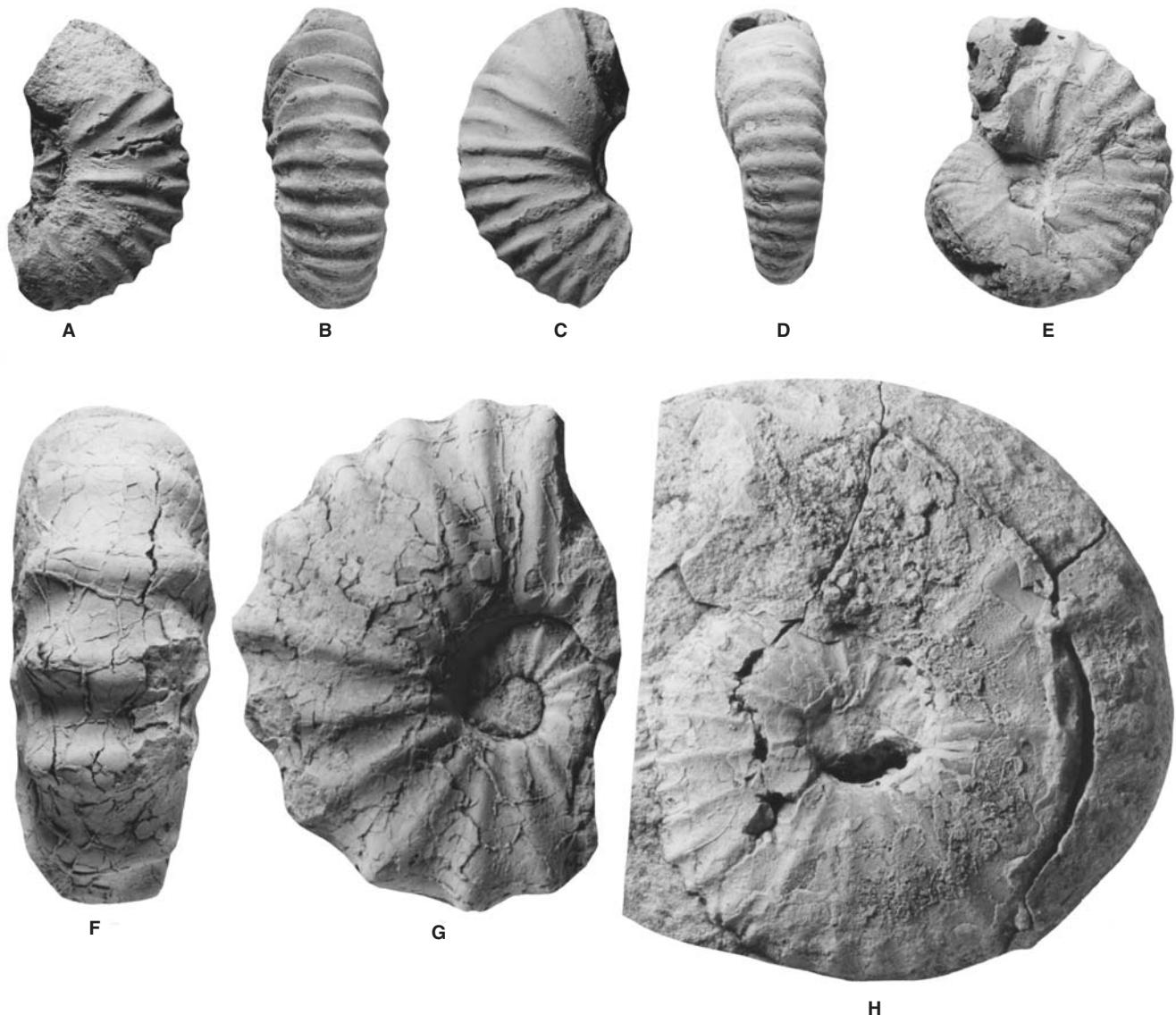


Fig. 15. A–C, H, *Stoliczkaia (Lamnayella) tetragona* Neumayr, 1875. A–C, OUM KX11444, from bed 2 of the Upper Albian Mzinene Formation at locality 61. H, SAM-PCZ22212, from the Upper Albian Mzinene Formation in the Ndumu area. D, E, *Stoliczkaia (Stoliczkaia) clavigera* Neumayr, 1875, from the same horizon and locality as H. F, G, *Stoliczkaia (Lamnayella) crotalooides* (Stoliczka, 1864), SAM-PCZ22208, from the same horizon and locality as A–C. All figures are $\times 1$.

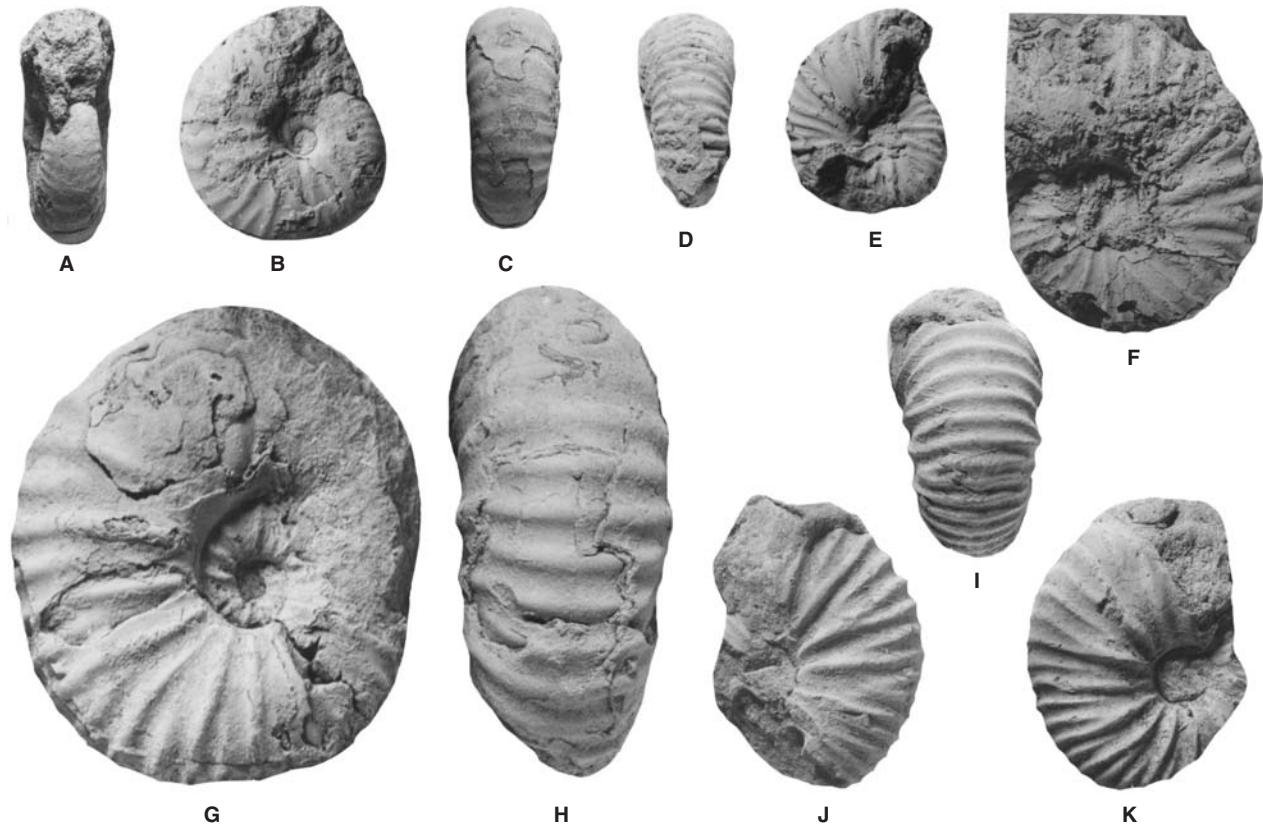


Fig. 16. A–C, *Zuluscaphites* cf. *helveticus* Kennedy & Delamette, 1984, SAM-PCZ22242, from the lower Upper Albian Mzinene Formation in the environs of localities 54–56 on the north bank of the Mzinene. D–F, I–K, *Stoliczkaia (Lamnayella) sanctaecatherinae* Wright & Kennedy, 1978. D, E, OUM KX11720a; F, OUM KX11719, I–K, SAM-PCZ22216; all from bed 6 of the Lower Cenomanian Mzinene Formation at locality 61. G, H, *Stoliczkaia (Lamnayella) tetragona* Neumayr, 1875, SAM-PCZ22215, from the Lower Cenomanian Mzinene Formation of the Ndumu area. All figures are $\times 1$.

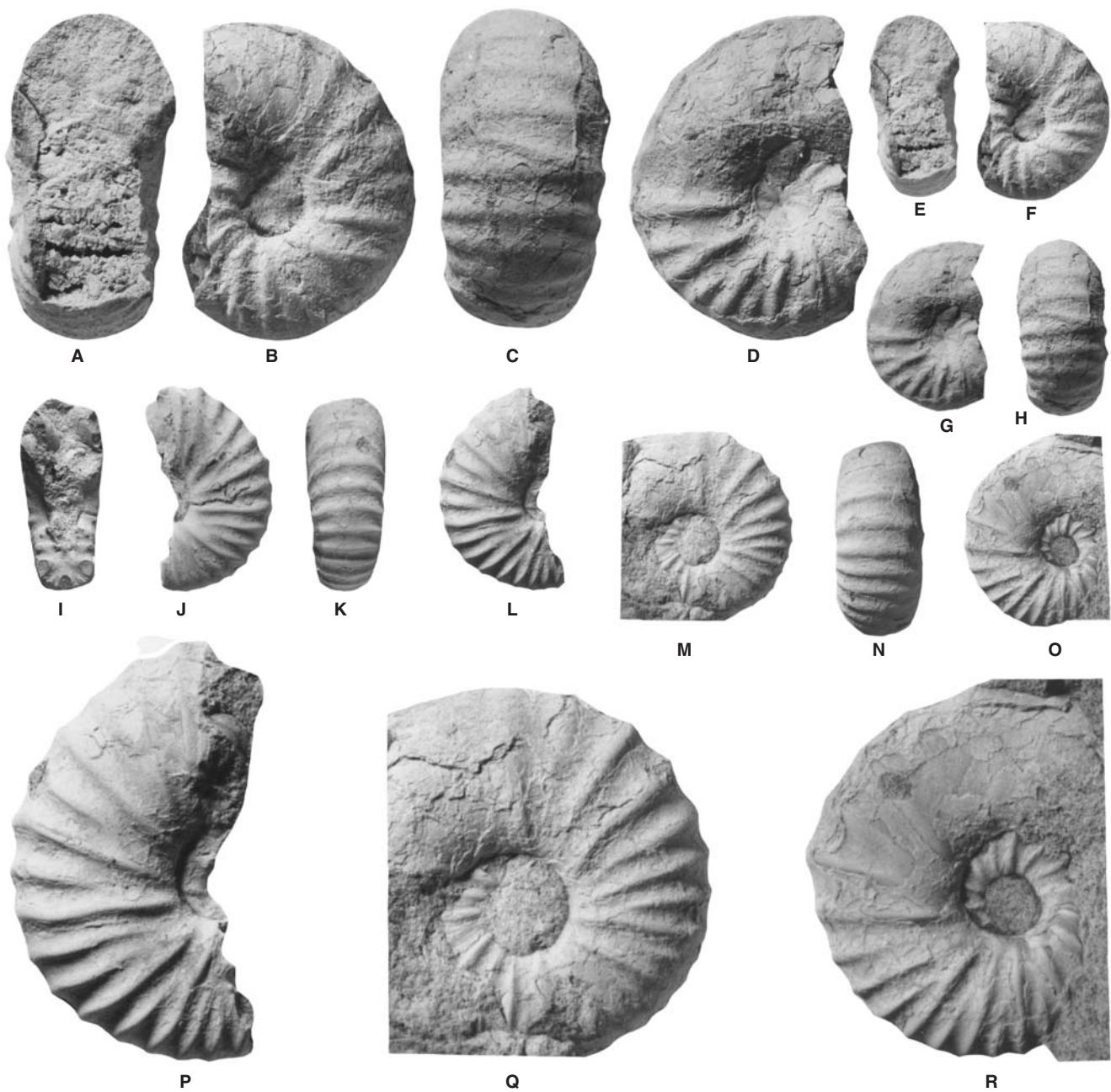


Fig. 17. A–R. *Stoliczkaia (Lamnayella) chancellori* Wright & Kennedy, 1984. **A–H.** OUM KX7502, from locality 181; **I–L, P.** OUM KX10393, from locality 183; **M–O, Q–R.** OUM KX10271, from locality 181; all from the Lower Cenomanian Mzinene Formation in the Ndumu area. Figures A–D, P–R are $\times 2$; E–O are $\times 1$.

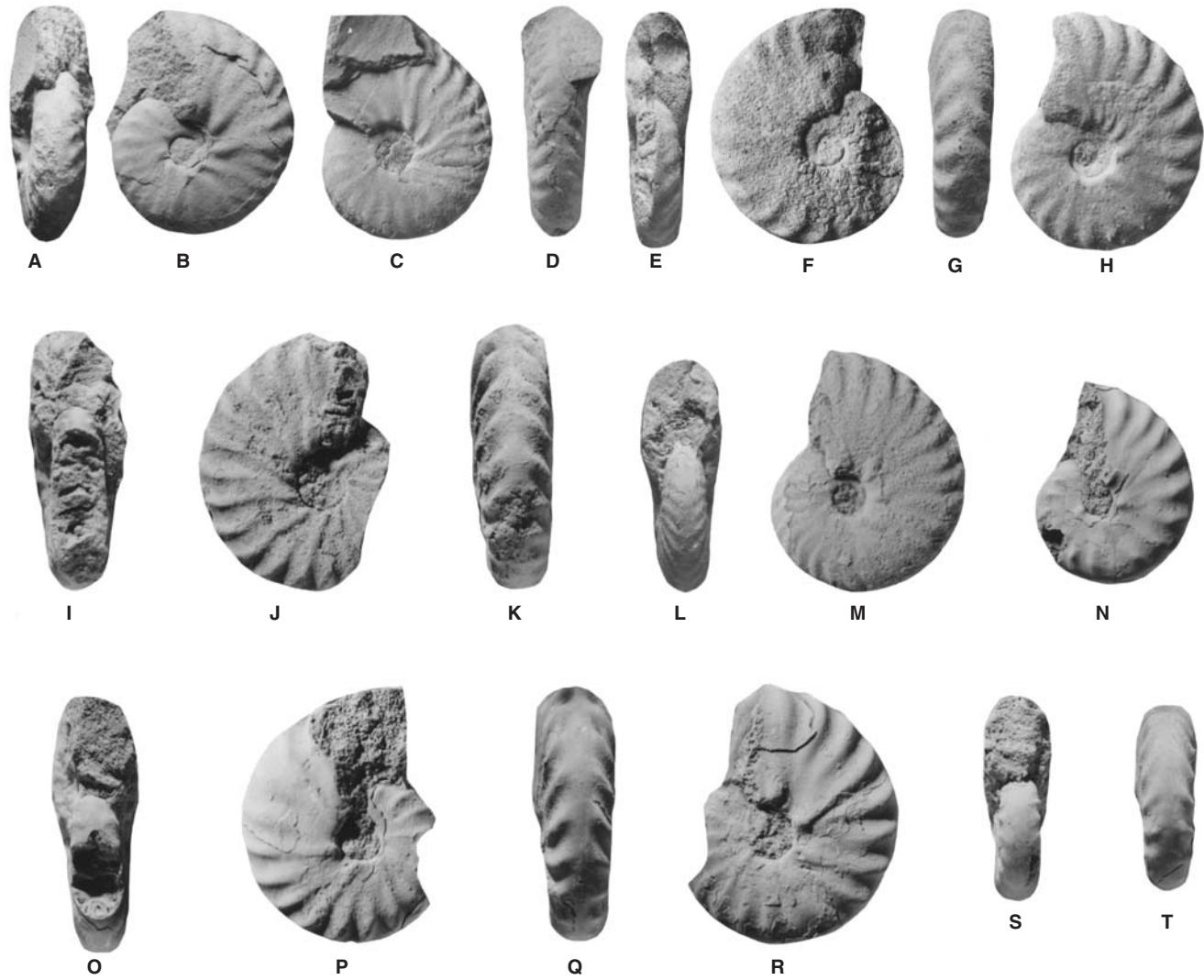


Fig. 18. **A, B**, *Stoliczkaia (Shumariaia)* sp. aff. *australe* sp. nov., from the Lower Cenomanian Mzinene Formation of locality 185. **C–T**, *Stoliczkaia (Shumariaia) australis* sp. nov. **C, D**, paratype OUM KX10411a, from the same horizon and locality as A, B; **E–H**, the holotype, OUM KX10315a, from the same horizon as A, B, at locality 181. **I–T**, a series of specimens from South India in the Sorbonne Collections, presented by the Geological Survey of India, and labelled *Ammonites navicularis*. The locality is given as 'Kolokomutton', probably a corruption of Kollakonutom, a locality mentioned in the Cretaceous volumes of *Palaeontologica Indica*. All figures are $\times 2$.



Fig. 19. *Cenisella bonnetiana* (Pictet, 1847), SAM-PCZ22241, from the lower Upper Albian Mzinene Formation on the north bank of the Mzinene in the environs of localities 54–56. Figures are $\times 1$.



Fig. 20. A–E, *Cenisella bonnetiana* (Pictet, 1847). A–C, the holotype, no. 19215; D–F, a topotype, no. 18434, both in the collections of the Muséum d'Histoire Naturelle, Geneva, from the condensed Albian of Bourget, Haute-Savoie, France. Figures are $\times 1$.

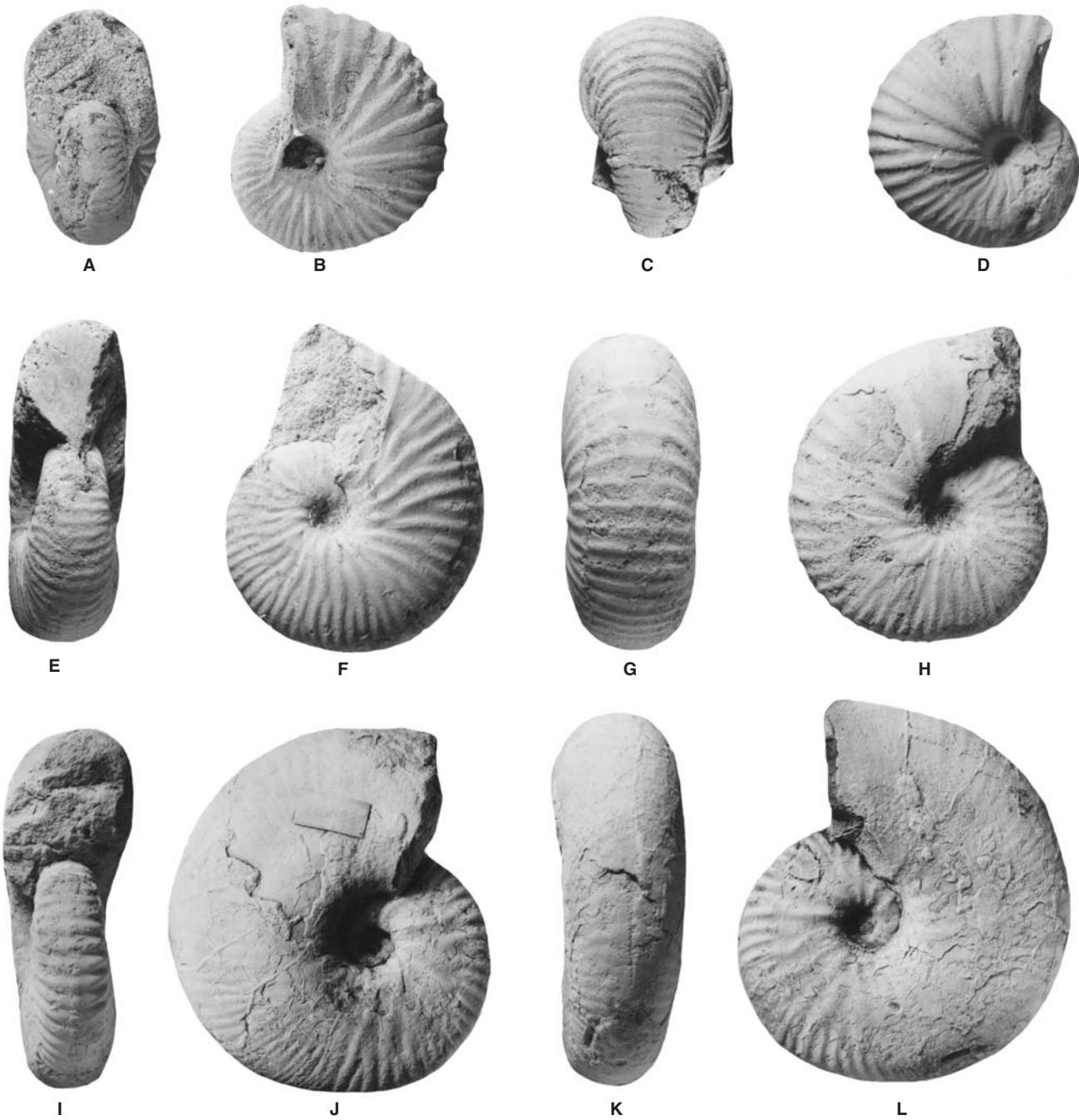


Fig. 21. A–D, *Zuluscaphites orycteropus* van Hoepen, 1955. The holotype, SAM-PCZ22496, from the lower Upper Albian Mzinene Formation on the north bank of the Mzinene in the environs of localities 54–56. E–L, *Zuluscaphites grandidieri* (Boule, Lemoine & Thévenin, 1907). E–H, SAM-PCZ22244 from the lower Upper Albian Mzinene Formation in the Ndumu area I–L, the holotype, the original of Boule, Lemoine & Thévenin, 1907, pl. 2 (8), fig. 8 p. 14 (34), from the Upper Albian of Mont Raynaud, Madagascar, in the Sorbonne Collections, currently housed in the Université de Bourgogne, Dijon. All figures are $\times 1$.

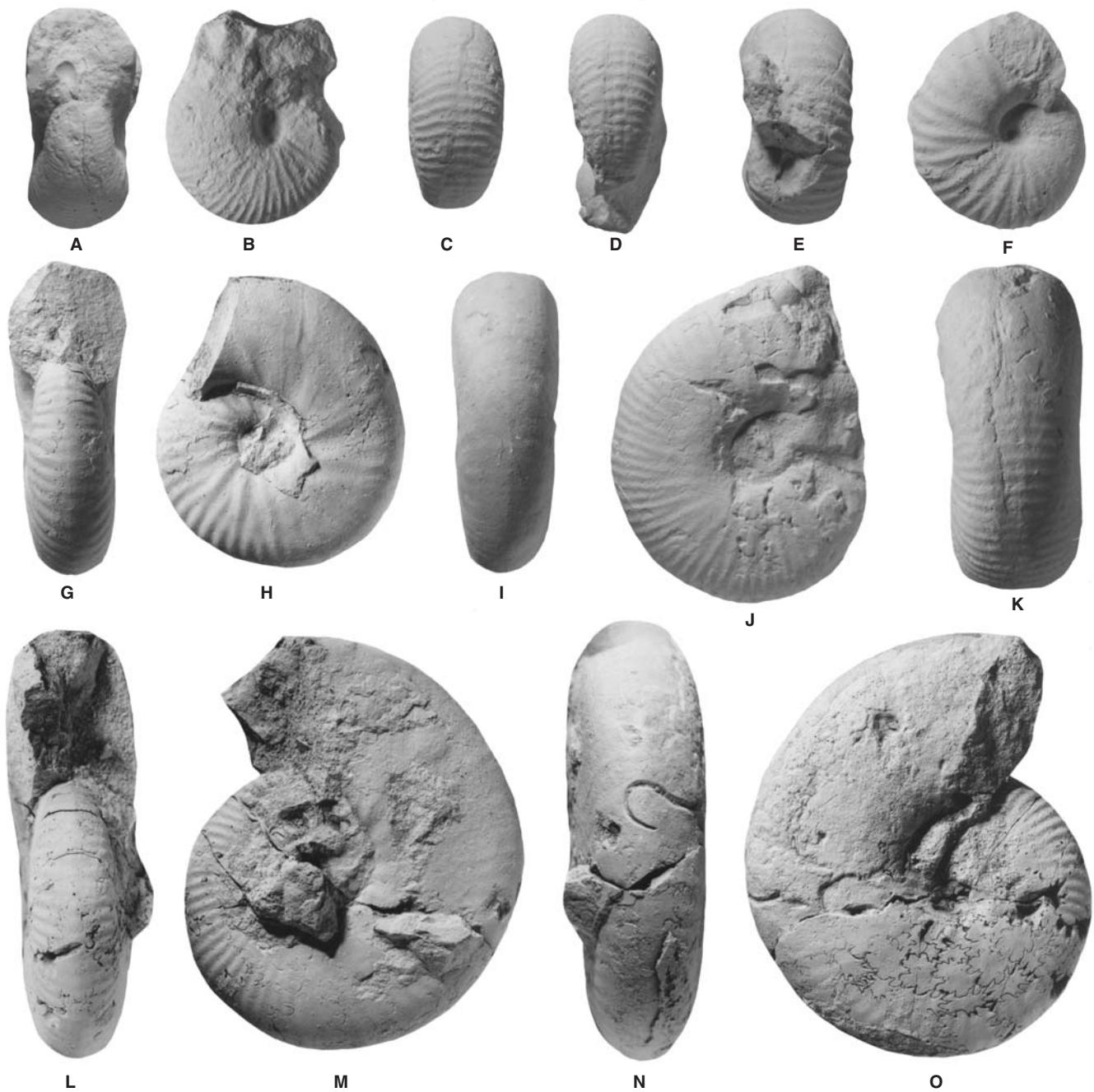


Fig. 22. A–F, J, K, *Zuluscaphites orycteropusi* van Hoepen, 1955. A–D, E, F, casts of topotypes of *Huescarites companyi* Latil, 1991, nos HH 1.100 and HH1.54; J, K, cast of the holotype, HH1.18; the originals are in the collections of the University of Grenada, and from Huescar, in southern Spain. G–I, the holotype of *Zuluscaphites helveticus* Kennedy & Delamette, 1994, MHNG 19115, from the condensed Albian of Bourgets, Haute-Savoie, France. L–O, *Neophlycticeras (Neophlycticeras) rhodanense* Delamette, 1983, MHNG 19118, from the same horizon and locality as G–I. All figures are $\times 1$.

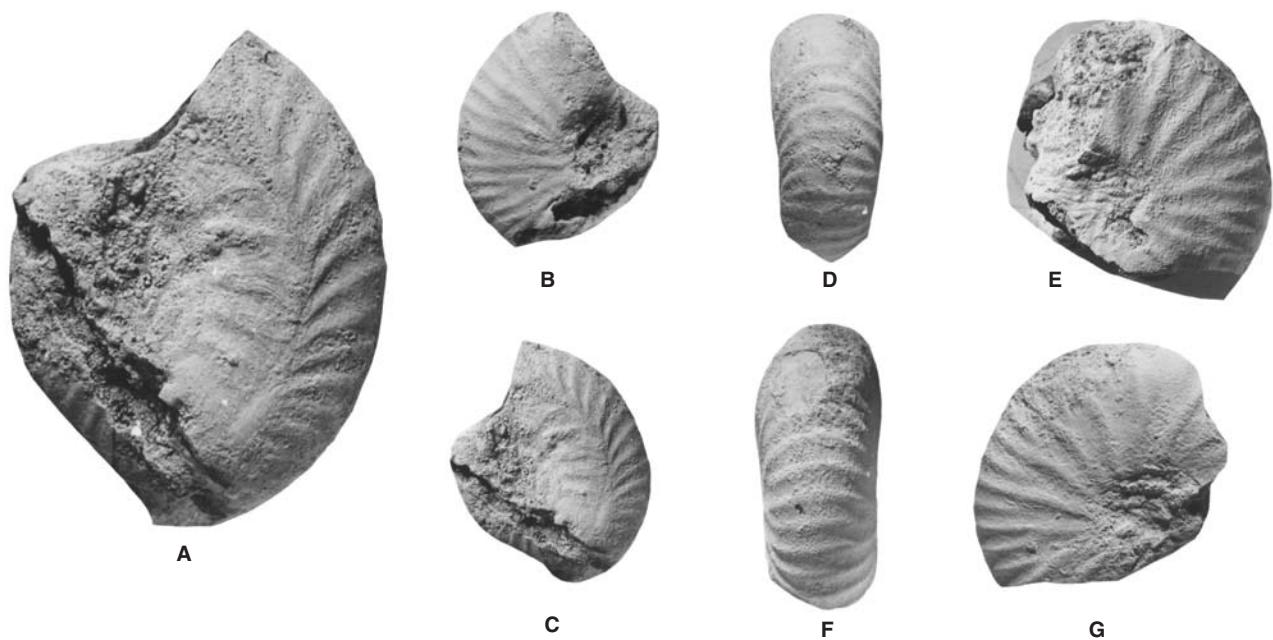


Fig. 23. A–G. *Zuluscaphites* sp. Unregistered specimens in the Sorbonne Collections, currently housed in the Laboratoire de Paléontologie of the Muséum National d'Histoire Naturelle, Paris, and from the Upper Albian of Maniamba-amba, Madagascar. The original of E–G was figured by Besairie, 1936, pl. 21, fig. 3 as 'Stoliczkaia cf. rhamonota Sheeley' [sic]. Figures are $\times 1$.