New and less known Barremian-Albian ammonites from Colombia

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Key words: Ammonites, Early Cretaceous, Barremian, Aptian, Albian, systematics, Colombia.
Twenty-two species (among which six new ones) of the following Early Cretaceous ammonite genera are described: *Crioceratites* (*C. leivaensis* sp. nov.), *Pedioceras* (*P. asymmetricum* sp. nov.), *Paracrioceras*, *Hamulinites*, *Karsteniceras* (*K. multicostatum* sp. nov.), *Hamiticeras* (*H. chipatai* sp. nov.), *Tonohamites*, *Ancyloceras*, *Pseudocrioceras*, *Pseudoaustraliceras*, *Ptychoceras*, *Colchidites*, *Protanisoceras* [*P. (P.) creutzbergi* sp. nov.]. One new genus is proposed: *Monsalveiceras* gen. nov. (*M. monsalvense* sp. nov.). The Barremian and middle Aptian heteromorph assemblages show close affinities with synchronous assemblages of the Mediterranean Faunal Region.

Contents

Introduction

Early Cretaceous ammonite palaeobiogeography as well as zonal correlation between the Caribbean, Meditteranean, and Middle European provinces still needs perfection.

A very rich collection of Early Cretaceous fossils from Colombia was acquired by the National Museum of Natural History of Leiden, The Netherlands. These fossils were collected by Peter Hans Creutzberg during the years 1967 to 1976. In the present paper only a part of Creutzberg's collection is published, viz. only the Early Cretaceous heteromorph ammonites. The results form a continuation of the palaeontological research of the Early Cretaceous of Colombia, as known from the publications of Forbes, 1844, Karsten, 1858, 1886, Gerhardt, 1897, Basse, 1928, 1948, Royo y Gomez, 1945, Bürgl, 1954, 1957, Etayo Serna, 1964, 1968, 1983, Kakabadze & Thieuloy, 1991, etc.

Unfortunately, Creutzberg did not study the precise stratigraphy of the localities from which he collected the fossils; only stages are indicated on the specimens' labels. Therefore, this collection cannot be used to improve the zonal subdivision of the Early Cretaceous of Colombia. Nevertheless, some of the ammonites are zonal guide species. The studied collection may therefore be of importance to the correlation between the Caribbean and Mediterranean regions, to future biostratigraphic research in Colombia and to the reconstruction of Early Cretaceous palaeobiogeography.

Among the heteromorph ammonites from Colombia described here and by Kakabadze & Thieuloy (1991) four palaeogeographic groups can be distinguished:

1) Species that are common in the Barremian and Aptian of only the Mediterranean region, or in both the Mediterranean and transitional regions (= regions transitional between the Tethyan and Boreal realms). These are:
Crioceratites thiollierei (Astier) - early Barremian (southern France, Caucasus, Bulgaria, Roumania, Italy, Switzerland, Spain);
Crioceratites emerici Leveille - early Barremian (southern France, Caucasus, Crimea, Bulgaria, Rumania, Hungary, Spain, Italy, Yugoslavia, Austria, Switzerland);
Karsteniceras beyrichi (Karsten) - early Barremian (Spain, Austria);
Moutoniceras cf. *moutonianum* (d'Orbigny) - early Barremian (SE France, Crimea, Spain);
Ancyloceras vandenheckii vandenheckii Astier - late Barremian (SE France, Spain, Italy, Georgia);
Hamulinites munieri (Nicklés) - Barremian (SE France, Spain);
Paracrioceras sp. ex gr. *barremense* (Kilian) - representatives of this group are commom in the late Barremian of SE France, Bulgaria, Georgia;
Heteroceras cf. *astieri* d'Orbigny - late Barremian (SE France, Bulgaria, Georgia, Northern Caucasus);
Pseudocrioceras anthulai (Eristavi) - late Barremian to ? early Aptian (Georgia, Dagestan);
Pseudoaustraliceras pavlowi Wassiliewskyi - middle Aptian (SE Europe, Northern Caucasus, Mangyshlak, Bolshoi Balkhan);
Pseudoaustraliceras sp. ex gr. *ramososeptatum* (Anthula) - middle Aptian; representatives of this group are common in Northern Caucasus, Dagestan and Bulgaria.

2) Species that are known only from the Aptian of the regions transitional between the Tethyan and Boreal realms:
Tonohamites sp. ex gr. *koeneni* Casey - early Aptian (England, North Germany);
Hamiticeras pilsbryi Anderson - middle Aptian (Northern Caucasus, California).

3) Species that are characteristic for the Barremian and Aptian of the Caribbean and adjacent regions only:
Crioceratites tener (Breistroffer) - early Barremian, Colombia;
Crioceratites leivaensis sp. nov. - ?early Barremian, Colombia;
Crioceratites aff. *emerici* Leveille - ?early Barremian, Colombia;
Acanthoptychoceras triumphyi (Breistroffer) - ?early Barremian;
Pedioceras ubaquense (Karsten) - Barremian, Colombia;
Pedioceras asymmetricum sp. nov. - Barremian, Colombia;
Ancyloceras vandenheckii velezianum Kakabadze & Thieuloy - Barremian, Colombia;
Pseudocrioceras simitiense (Breistroffer) - ?late Barremian, Colombia;
Colchidites apolinari (Royo y Gomez) - late Barremian, Colombia;
Colchidites breistrofferi Kakabadze & Thieuloy - late Barremian, Colombia;
Macroscaphites yvani disjuncticostatus Kakabadze & Thieuloy - ?late Barremian-early Aptian, Colombia;
Karsteniceras multicostatum sp. nov. - Barremian, Colombia;

Monsalveiceras monsalvense sp. nov. - Aptian, Colombia;
Hamiticeras chipatai sp. nov. - Aptian, Colombia;
Pseudoaustraliceras columbiae (Basse) - middle Aptian, Colombia;
Ptychoceras aff. *puzosianum* d'Orbigny - Aptian, Colombia;
Protanisoceras (Protanisoceras) creutzbergi sp. nov. - early Albian, Colombia.

Part of the listed Barremian and middle Aptian (sub)species from Colombia are known from contemporaneous strata in the Mediterranean region. Therefore, a rather good connection seems probable between these areas during this time span. There are however comparatively few data on the palaeobiogeographic relations between Colombian and Mediterranean heteromorphic ammonite species during early Aptian and early Albian times.

Of course reliable palaeobiogeographical conclusions could be drawn only after a palaeobiogeographic analysis of all ammonite groups including the revised monomorphic ammonites of this time span. Nevertheless it is possible to support Kauffmann's view (Kauffmann, 1973) that the Colombian area belonged to the Caribbean province during the Early Cretaceous

Only a part of Creutzberg's collection has so far been investigated, viz. only the Early Cretaceous heteromorphic ammonites. The present paper contains only the descriptions of new species and of those that have not been described from Colombia before. The heteromorphic species that already have been described from Colombia earlier are merely identified and figured, but not described. Finally, the diagnoses of the genera *Hamulinites, Pedioceras* and *Hamiticeras* are revised and a description of the new genus *Montsalveiceras* is given.

Registration numbers preceded by RGM indicate the geological collections of the National Museum of Natural History (Nationaal Natuurhistorisch Museum) at Leiden; those preceded by ID indicate the geological collection from the 'Institut Dolomieu' in Grenoble. The fieldnumbers are between brackets.

The shell parameters used in this paper are explained in Fig. 1.

Systematic descriptions

Class Cephalopoda Zittel, 1884
Order Ammonoidea Zittel, 1884
Suborder Ancyloceratina Wiedmann, 1966
Superfamily Ancyloceratacea Meek, 1876
Family Ancyloceratidae Gill, 1871
Genus *Crioceratites* Léveillé, 1837

Type species: *Crioceratites Duvalii* Léveillé, 1837.

Crioceratites leivaensis sp. nov.
Pl. 1, fig. 1.

Holotype — RGM 352 533 (738), see Fig. 2 and Pl. 1, fig. 1.
Type locality — Monastery 'Santo Ecce Homo', Villa de Leiva, Colombia.
Type horizon — Barremian.

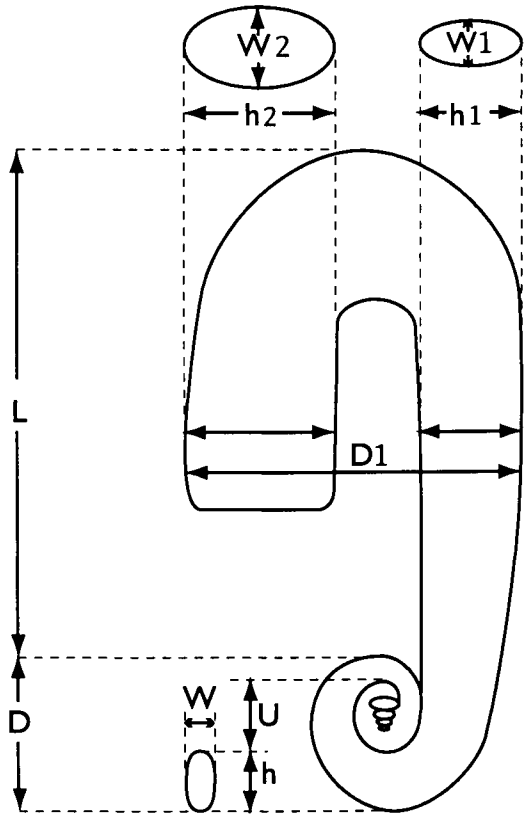

Fig. 1. The shell parameter indices used in this paper: D = diameter of the plane spiral, H = height of the planispiral whorl, W = width of the planispiral whorl, U = width of the umbilicus, L = length of the uncoiled shell (shaft with hook), H1 = height of the shaft section, W1 = width of the shaft section, H2 = height of the hook section, W2 = width of the hook-section, and D1 = transverse diameter of uncoiled shell (shaft with hook, or of two shafts).

Derivatio nominis — The species is named after the village Leiva.

Material — One specimen (holotype), with a perfect preservation of the sculpture.

Diagnosis — Rather open crioconic coiling (morphology of the early whorls not known). Ornamentation consists of thin trituberculate straight ribs, generally separated by 1-2, rarely 3 thin non-tuberculate intercalatory ribs. All ribs cross the venter straight and without interruption. In a late stage (from D = 85-90 mm) the umbilical tubercles become week, but the lateral and especially the thorn-shaped ventral tubercles remain well developed. On the dorsum all ribs are very thin and forwardly convex.

Description — The shell is represented by 1.3 moderately open, crioconic whorls with a worl-section varying from subcircular in the earliest preserved stage to subrectangular in the last whorl (Fig. 2).

The ornamentation consists of an alternation of rather weak, straight, thin, distant, trituberculate ribs and very thin, generally non-tuberculate intercalatory ribs.

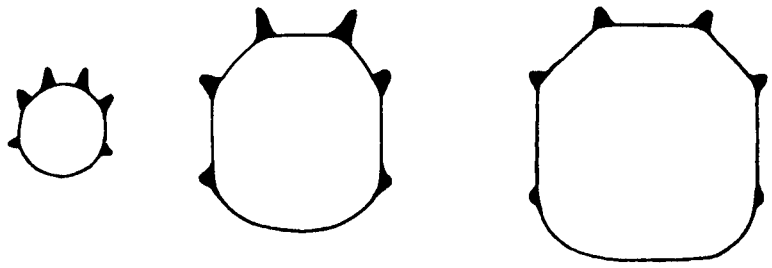

Fig. 2. Whorl section of *Crioceratites leivaensis* sp. nov. (RGM 352 533, holotype), × 1.

Some of the intercalatories bear ventral tubercles. On the early part of the whorl the number of intercalatory ribs between two trituberculate ones is 2, rarely 3, but reduces to 1 in the more adult part; in some cases there are no intercalatory ribs between two trituberculate ones. It is remarkable that the trituberculate main ribs remain thin also in the adult stage. On the dorsum all ribs are equal, very fine, and forwardly convex. These ribs are so thin that they cannot be distinguished from fine striae, which are well preserved on the holotype. The suture line is not preserved.

Measurements

no.	D	H	E	U
RGM 352 533	111.3	33.1	30.1	60

Comparison — *C. leivaensis* sp. nov. resembles *Crioceratites woeckeneri* (Koenen, 1902, p. 288, pl. XX, fig. 1 a-b; pl. XXII, fig. 3 a-b) from the Barremian of Germany in the type of coiling and in the ornamentation of the early whorl, but differs from the latter in the ribs being much thinner and in the smaller number of non-tuberculate intercalatory ribs in the adult stage.

Occurrence — Villa de Leiva; Barremian.

Crioceratites cf. *tener* Kakabadze & Thieuloy, 1991
Pl. 10, fig. 2.

1991 *Crioceratites tener* (Breistroffer in coll.) — Kakabadze & Thieuloy, p. 85, pl. 1, figs. 8-11, textfig. 4.

Holotype — ID 3010, from the Early Barremian of the Loma de Monsalve, Leiva (Bf 164).

Material — One poorly preserved specimen RGM 345 117 (M 6), represented by 1.5 crioconic whorls.

Occurrence — Loma de la Yuca; Barremian (? Early Barremian).

Distribution — Early Barremian of Colombia.

Crioceratites aff. *emerici* Léveillé, 1835
Pl. 2, fig. 1; Pl. 3, figs. 1-2.

Material — Two specimens RGM 345 118 (M 850) and RGM 352 529 (M 251); the first one being very large, represented by 3.5, not completely preserved (Fig. 3), crioconic whorls.

Description — The crioconic, rather rapidly expanding whorls are comparatively tightly coiled. The suboval whorl section is wider than high, at least on the preserved last two whorls. The ornamentation consists of simple, straight, trituberculate ribs, separated from each other by 3, rarely 4 thinner, straight, non-tuberculate intercalatory ribs on the early whorls, but later their number increases up to 5. All ribs cross the venter without interruption and without bending forward. On the dorsum ribs are equally thin and considerably forwardly convex. The ventral and lateral tubercles are larger than the umbilical ones. The suture lines are not preserved.

Measurements

no.	D	H	E	U
RGM 345 118	94.0	36.0	—	37.5
RGM 352 529	94.5	35.0	35.5	39.5

Comparison — The described specimens strongly resemble *C. emerici* in the type

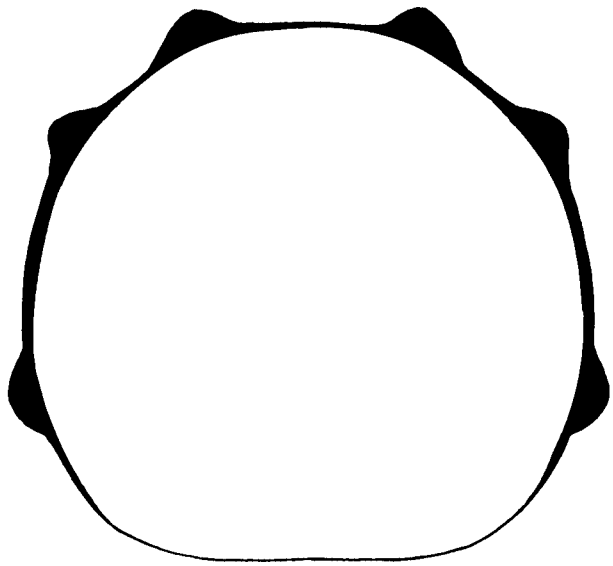

Fig. 3. Whorl section of *Crioceratites* aff. *emerici* Léveillé, 1935; in the mature stage (RGM 345 118), × 1.

of ornamentation and whorl section, but differ from it in their more tightly coiled crioconic whorls, which grow more rapidly in height than in *C. emerici*.

Occurrences — Villa de Leiva, monastery 'Ecce Homo'; Barremian (RGM 345 118); Loma Cabrera, west of Villa de Leiva; Barremian (? early Barremian) (RGM 352 529).

Genus *Pedioceras* Gerhardt, 1897

Type species — *Ammonites Caquesensis* Karsten, 1858.

Remarks — Gerhardt (1897) did not designate a type species for his genus, but Hyatt (1903) did and designated *P. cundinamarcae* Gerhardt, 1897 as such. Roman (1938) chose *Ammonites caquensis* (sic) as type species without any comment. Royo y Gomez (1945) considered the species *caquesensis* and *cundinamarcae* synonyms of *Crioceras (Pseudocrioceras) ubaquense* Karsten. He motivated his choice of *ubaquense* as the name of this species by stating that this name has priority and that Karsten's specimen shows the most constant characters. We also consider these 'species' varieties of one species (see below), but we call this species *P. caquesense* instead of *P. ubaquense*, because it has page priority, because it is the most adult specimen, and because it shows the characters of the most common variety. The morphotype *ubaquense* is not a good example because of its very small umbilicus, whereas the morphotype *cundinamarcae* is by the shape of its whorl section and broad venter not representative either. This means that the type species should be renamed *P. caquesense*, in accordance with Roman's choice.

In the Treatise on Invertebrate Paleontology (Arkell et al.,, 1957) the genus *Pseudocrioceras* Spath, 1924 is considered a junior synonym of *Pedioceras* Gerhardt, 1897. This problem was discussed in detail by Kakabadze (1978, 1981), who showed that the genera *Pedioceras* and *Pseudocrioceras* clearly differ in the ornamentation and type of coiling of the early ontogenic stages; viz. the early ontogenetic stage of *Pedioceras* is characterized by having only ventral and lateral tubercles, whereas the early stage of *Pseudocrioceras* is characterized by the presence of ventral and umbilical tubercles. Moreover, their mature stages differ in the mode of uncoiling and in the suture lines.

Distribution — Colombia, Barremian (?early Barremian); Mexico.

Pedioceras caquesense (Karsten, 1858)
Pl. 6, figs. 1-4; Pl. 7, figs. 1-2.

1858 *Ammonites Caquesensis* — Karsten, p. 104, pl. I, fig. 7a-b.
1858 *Ammonites Ubaquensis* — Karsten, p. 104, pl. I, fig. 8a-b.
1897 *Pedioceras Cundinamarcae* — Gerhardt, p. 172, pl. IV, fig. 7a-c.
?1925 *Pedioceras durangense* — Burckhardt, p. 13, pl. III, figs. 8-10
1938 *Pedioceras casquensis* — Roman, p. 395, pl. XL, fig. 376
1945 *Crioceras (Pseudocrioceras) ubaquense* — Royo y Gomez, p. 463, pl. LXXII, figs. 1a-d, 2a-e; pl. LXXIII figs. a-e.
1957 *Pedioceras caquesense* — Bürgl, p. 134, pl. VI, figs. 3a-b, 4a-b.
1957 *Pedioceras cundinamarcae* — Arkell et al., p. L208, fig. 237, 5a-b.
1996 *Pedioceras cundinamarcae* — Wright et al., p. 214, fig. 164, 2a-c.

Holotype — The specimen figured by Karsten (1858, pl. I, fig. 7a-b), from the Barremian of Caquesa, Cundinamarca, Colombia.

Material — Thirty-six well preserved specimens.

Diagnosis — Conch evolute, whorls just in contact. Inner whorls with straight simple uniform ribs each bearing a lateral and a ventral tubercle. The lateral tubercle rapidly shifts into a ventrolateral position. All ribs cross the venter. In more adult specimens umbilical tubercles appear, whereas non-tuberculate intermediate ribs appear between the tuberculated ribs. The trituberculate main ribs become markedly thicker than the intermediate ribs.

Remarks — We support the conclusion of Royo y Gomez that the morphotypes *caquesense, ubaquense,* and *cundinamarcae* belong to one variable species. Our material shows that the first appearance of intermediate ribs occurs at different diameters and that this variation cannot be correlated with other characters. Let us take two extremes of a series: the dimensions of specimen RGM 352 562 (Pl. 6, fig. 2a-b) and specimen RGM 352 563 (Pl. 6, fig. 3a-b) are almost the same, whilst in the former the first intermediate rib appears at D = 29 mm, in the latter at D = 43 mm; the first thick main rib appears at D = 32.5 mm and D = 46 mm, respectively. Another variable is the whorl section, which may vary between octangular, with a broad space between the ventral tubercles (morph *cundinamarcae*), to more rounded and oval, with a relatively narrow space between the ventral tubercles (see Pl. 6, fig. 1a-b and Pl. 7, fig. 1a-c). The ratio between H and E varies significantly: at H = 16.5 mm the E varies from 15 to 18.5 mm. Finally we measured a continuum in the ratio U/D from U/D = 0.29 (RGM 352 530, Pl. 6, fig. 4) to 0.38 (RGM 352 538, Pl. 7, fig. 2a-b) and a continuum in the ratio H/D from H/D = 0.36 to 0.44, both measured at a diameter of 39 mm.

P. durangense Burckhardt from central Mexico may be a separate species, because the umbilicus is wide and the whorl section very high and narrow. Both characters fall outside the ranges of our material. The drawing of the holotype of *P. ubaquense* (Karsten, 1958, pl. I, fig. 8) shows a very small umbilicus (on the figure U/D = 0.19), which also falls outside the range of our material, but in his text Karsten states that the umbilicus of *ubaquense* is only 'slightly smaller' than the one of *caquesense* (on the figure U/D = 0.32). It is possible that the drawings are not correct. Nevertheless we consider the former a synonym of the latter, because all other characters fall within the ranges of our material and because Karsten already suggested this.

Pedioceras asymmetricum sp. nov.
Pl. 5, figs. 2-3.

Holotype — RGM 352 537 (M 46/8).

Type locality — Monastery 'Santo Ecce Homo', Villa de Leiva.

Type horizon — Barremian.

Derivatio nominis — The species is named after the asymmetric coiling of the early whorls.

Material — Two specimens RGM 352 536 (917) and RGM 352 537 (M 46/8), with rather well preserved sculpture.

Diagnosis — The early whorls are crioconic and asymmetrically coiled, but later coiling becomes planispiral with crioconic features. The ornamentation of the earliest whorls is of the same type as in the early ontogenetic stages of *P. caquesense,* i.e. sim-

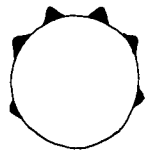

Fig. 4. Whorl section of *Pedioceras asymmetricum* sp. nov.; in the asymmetrical stage (RGM 352 537, holotype), × 1.

ple, straight ribs with ventral and lateral tubercles, very rapidly changing into the crioceratitic (alternation of trituberculate and 1-4 non-tuberculate ribs) trituberculate type of sculpture of the same type as adult *P. caquesense*.

Description — The early whorls deviate from the plane of symmetry of the late crioconic whorls. The whorl section of the asymmetrical stage (Fig. 4) is circular and subellipsoidal (wider than high), but then gradually becomes circular. The earliest whorls are adorned by distant straight simple ribs; tuberculate ribs appear slightly later: at first ventral and weaker lateral tubercles apppear, from about D = 9 mm, small umbilical tubercles appear. From a diameter of 18 mm the crioceratitic type of sculpture sets in (trituberculate ribs separated from each other by 1-4 thin non-tuberculate ribs). The umbilical tubercles are much smaller than the ventral and lateral ones. All ribs pass the venter straight without interruption; only the thick main ribs are depressed between the ventral tubercles. On the dorsum all ribs are equally thin and forwardly convex.

Measurements

no.	D	H	E	U
RGM 352 537	41.0	19.2	18.2	17.8
RGM 352 536	67.1	26.3	25.5	27.0

Remarks — *P. asymmetricum* resembles *P. caquesense* in its pedioceratic bituberculate type of sculpture on the earliest whorls and in its crioceratitic trituberculate type of ribbing, which appears later, but clearly differs from the latter by its asymmetric coiling of the early whorls (which are not contiguous) and by the much earlier appearance (D = 18 mm) of the crioceratitic trituberculate type of sculpture.

Basse (1949) also described an assymmetrically whorled *Pedioceras* from the Barremian of Chipatá near Velez, Colombia, viz. *P. apollinaria*, but the ribbing of this species is quite different from *P. asymmetricum*. *P. apollinaria* has only simple uniform ribbing up to a diameter of 50 mm, not differentiated into main and intermediate ribs.

Occurrence — Type locality only.

Genus *Paracrioceras* Spath, 1924

Type species — *Paracrioceras occultum* (Seeley, 1885).

Paracrioceras sp. ex gr. *barremense* (Kilian, 1895)
Pl. 4, fig. 1.

1992 *Emericiceras* sp. gr. *barremense* (forme 1) — Delanoy, p. 54, pl. 19, fig 3.

Material — One well preserved specimen RGM 352 596 (M 39), represented by 1.8 crioconic whorls.

Description — Moderately expanding crioconic whorls, with subrectangular whorl section (Fig. 5), becoming slightly higher than thick from D = 42 mm. The ornamentation of the preserved early whorl consists of strong, radial, straight, tuberculate ribs, separated by one thin non-tuberculate rib. On the earliest part of this whorl there are only ventral, rather prominant spines and lateral tubercules. In one case two thin ribs arise from one lateral tubercle. All ribs cross the dorsum without interruption and with a forwardly convex curve. Umbilical tubercles appear from about D = 25 mm; they remain weaker than the ventral and lateral ones. On the last whorl the number of non-tuberculate intercalatory ribs between two trituberculate ribs is generally 1, rarely 2. One of the intercalatories bears weak ventral tubercles.

Comparison — Our specimen resembles *Paracrioceras barremense recticostata* (Sarkar, 1955, p. 86, textfig. 13) in the type of sculpture, but differs from the latter in its more closed crioconic coiling and in its more compressed whorls.

Occurrence — Monastery 'Santo Ecce Homo', Villa de Leiva; Barremian.

Genus *Ancyloceras* d'Orbigny, 1842

Type species — *Ancyloceras matheronianus* d'Orbigny, 1842.

Ancyloceras cf. *vandenheckii vandenheckii* Astier, 1851
Pl. 1, fig. 3.

1851 *Ancyloceras Vanden-Heckii* — Astier, p. 451, pl. XVI, fig. 11.
1861 *Ancyloceras van den heckii* — Ooster, p. 56, pl. 42, fig. 3.
non 1945 *Ancyloceras van den heckii* — Royo y Gomez, p. 465, pl. 71, fig. 2.
1964 *Ancyloceras (Ancyloceras) van den heckii* — Thomel, p. 54, pl. VIII, figs. 1-5.

Holotype — Specimen, described and figured by Astier (1851, p. 451, pl. XVI, fig. 11), SE France, Barremian.

Material — Only one fragment: a 0.5 crioconic whorl RGM 352 540 (M 35).

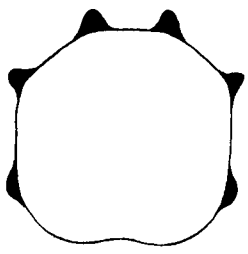

Fig. 5. Whorl section of *Paracrioceras* sp. ex gr. *barremense* (Kilian) (form 1 of Delanoy, 1992, pl. 19, fig. 3), RGM 352 596, × 1.

Fig. 6. Whorl section of the crioconic stage of *Ancyloceras* cf. *vandenheckii vandenheckii* Astier, 1851 (RGM 352 540), × 1.

Diagnosis — Very open crioconic whorls, which gradually pass into a long straight shaft. The ornamentation consists of trituberculate ribs separated by one, rarely two or three non-tuberculate intercalatory ribs. The umbilical tubercles are much weaker than the lateral and ventral ones.

Description — The preserved, planispiral half whorl with subcircular (higher than wide) cross-section has a very open crioconic coiling (Fig. 6). The ornamentation consists of alternating thick trituberculate and thinnner non- tuberculate ribs; the ribs are slightly inclined backward. Ventral and lateral tubercles are stronger than the umbilical ones. In general there is only one non-tuberculate intercalatory rib between two strong trituberculate ribs. On the dorsum all ribs are equally thin and slightly curved forward, whereas they cross the venter straight without becoming broader.

Measurements

no.	D	H	E	U
RGM 352 540	75.5	19.8	17.4	51.4

Comparison — The described specimen resembles *A. vandenheckii* by the open crioconic coiling and subcircular cross-section, but the latter is characterized by strong, simple, trituberculate, generally looped ribs, separated from each other by 2 or 3 (rarely 4 or 1) thin, non-tuberculate ribs.

Occurrence — Monastery 'Santo Ecce Homo'; Barremian (?Late Barremian).

Distribution — Late Barremian of France, Spain, Italy, Georgia; ?late Barremian of Colombia.

Ancyloceras vandenheckii velezianum Kakabadze & Thieuloy, 1991
Pl. 1, fig. 2; Pl. 5, fig. 1.

1936 *Paracrioceras* nov. sp. (gr. *Pavlowi Vasil.* sp.) — Breistroffer, p. 156.
1991 *Ancyloceras vandenheckii velezianum* — Kakabadze & Thieuloy, p. 88, pl. 3, fig. 1, textfig. 8.

Holotype — ID 3013, from the 'Barremian' of Velez, Chaquete,Santander, Colombia.

Material — Six specimens RGM 345 110 (M 36), RGM 345 111 (M 37), RGM 345 112 (M 38), RGM 345 113 (123), RGM 345 114 (589), RGM 345 115 (590), represented by crioconic whorls.

Remarks — A detailed description of this subspecies was published recently (Kakabadze & Thieuloy, 1991) and we can only repeat that our specimens have the same characteristic ornamentation (strong trituberculate ribs separated by one non-tuberculate intercalatory rib). The tuberculate ribs are characterized by almost equally large umbilical, ventral and lateral tubercles.

Occurrence — Monastery 'Santo Ecce Homo', Villa de Leiva; Barremian.

Distribution — Barremian, Colombia.

Genus *Pseudocrioceras* Spath, 1924

Type-species — *Scaphites abichi* Bacevitsch & Simonovitsch, 1873.

Pseudocrioceras anthulai (Eristavi, 1955)
Pl. 2, fig. 2.

1899 *Crioceras Orbignyi* (Matheron) — Anthula, p. 125, pl. XII, figs. 2a-c.
1938 *Ancyloceras Anthulai* Rouchadze (in coll.).
1955 *Ancyloceras anthulai* — Eristavi, p. 113.
non 1981 *Pseudocrioceras anthulai* — Kakabadze, pl. XVIII, fig. 1.
1991 *Pseudocrioceras anthulai* — Kakabadze & Thieuloy, p. 89, pl. 3, figs. 2-4, textfig. 9.

Holotype — The specimen figured by Anthula (1899, pl. XII, fig. 2), Institute of Palaeontology of Vienna University; Aptian, Akusha (Dagestan).

Material — One specimen, RGM 345 119 (M 570), represented by well-preserved planispiral whorls and the initial part of the shaft.

Remarks — The Colombian specimens of this species were recently described in fair detail (Kakabadze & Thieuloy, 1991) and therefore we refrain from repeating this description.

Occurrence — Chipatá Viejo - Chipatá (Santander), Colombia; Barremian - ?-Aptian.

Distribution — Latest Barremian - ?earliest Aptian of Dagestan, Georgia and Colombia.

Genus *Pseudoaustraliceras* Kakabadze, 1981

Type species — *Crioceras ramososeptatum* Anthula, 1899.

Pseudoaustraliceras columbiae (Basse, 1928)
Pl. 8, fig. 1; Pl. 9, fig. 1; Pl. 10, fig. 1; Pl. 11, fig. 1; Pl. 12, figs. 1, 2.

1928 *Ancyloceras Columbiae* — Basse, p. 142, textfig. 20, pl. 8, figs. 6, 7a-b.
1968 *Australiceras columbiae* — Etayo Serna, pl. 1.
1983 *Pseudoaustraliceras columbiae* — Etayo Serna, p. 7, text-figs. 3a-d, 4a-d; pls I, II.
1991 *Pseudoaustraliceras columbiae* — Kakabadze & Thieuloy, p. 92, textfig. 11, pl. 4, figs. 7-8, pl. 5, figs. 1-5,.

Lectotype — The specimen figured by Basse (1928, pl. 8, fig. 7a-b) and described by Etayo Serna (1983, fig. 3b-c); late Aptian of Villa de Leiva, Boyaca, Colombia.

Material — Seven specimens: four of them RGM 345 122 (M 836), RGM 345 126 (977), RGM 345 128 (793), and RGM 345 121 (M 819a) are represented by medium and mature stages, whereas the other ones RGM 346 037 (M 815), RGM 345 129 (527), and RGM 345 124 (772) represent fragments of planispiral whorls.

Occurrences — Loma Monsalve, Loma Catalina, village of Sachica, along the road east of Loma La Asomada and along the road Anapoima-Apulo; late Aptian.

Distribution — Aptian (?late Aptian) of Colombia.

Pseudoaustraliceras pavlowi Wassiliewskyi, 1908
Pl. 9, figs. 2a-c.

1908 *Crioceras pavlowi* — Wassiliewskyi, p. 46, pl. 3, fig. 1a-c.
1949 *Ammonitoceras pavlowi* — Luppov, in Luppov et al. p. 251, pl. 77, fig. 4a- c, text-fig. 81.
1960 *Ammonitoceras pavlowi* — Drushchits, p. 294, pl. XXXVIII, fig. 2a-b; pl. XXXIX, fig. 2.
1967 *Ammonitoceras pavlowi* — Dimitrova, p. 63, pl. 30, fig. 2.
1981 *Pseudoaustraliceras pavlowi* — Kakabadze, pl. 8, fig. 4a-c.

Holotype — The specimen figured by Wassiliewskyi (1908, pl. 3, fig. 1a-c), Saratow region, middle Aptian.

Material — One specimen RGM 345 123 (918), represented by early crioconic whorls.

Diagnosis — Non-contiguous, slowly expanding, crioconic whorls. The cross section of the early whorls is circular, but later it becomes subrectangular. The ornamentation of the early whorls is similar to that of *Pedioceras*, i.e. simple straight ribs with strong ventral and weaker lateral tubercles. In the latest preserved stage the ornamentation consists of strong trituberculate ribs separated by one thin, non-tuberculate intercalatory rib. Ventral and lateral tubercles are larger than the umbilical ones. On the dorsum the intercalatory ribs and the 3-4 thin rib-branches arising from the umbilical tubercles, are equally thin and curved forward.

Description — Only 1.5 whorls of the slowly expanding crioconic shell are preserved. The cross section of the early whorl (from D = 30 mm up to D = 68 mm) is suboctagonal (wider than high), but in a later stage its height and width become equal (Fig. 7). The ornamentation consists of alternating very strong, radiate, straight, trituberculate ribs, and very thin, non-tuberculate ribs. The latter pass straight and without interruption over the venter. Ventral and lateral tubercles are in fact rather large spines, whose bases are elongated in the direction of coiling, whereas the umbilical tubercles are weaker and have a circular basis. On the dorsum the intercalatory ribs and the ribs arising in a bunch (mostly in 3) from the umbilical tubercles, are equally thin and slightly curved forward. The suture line is not preserved.

Measurements

no.	D	H	E	U
RGM 345 123	60.0	19.1	19.4	30.0

Fig. 7. Whorl section of *Pseudoaustraliceras pavlowi* Wassiliewskyi, 1908 (RGM 345 123), × 1.

Comparison — *P. pavlowi* resembles *P. columbiae* (Basse) in the style of ribbing: alternating very strong, trituberculate and very thin non-tuberculate ribs, but it differs from the latter in the whorls being less high, in the more open crioconic coiling and in the bases of the lateral and ventral spines being elongated in the direction of coiling.

Occurrence — Sachica; middle Aptian.

Distribution — Middle Aptian of North Caucasus (Russia), Mangishlak (Kazakhstan), Bolshoi Balkhan (Turkmenistan), West Europe, Colombia.

Pseudoaustraliceras sp. ex gr. *ramososeptatum* (Anthula, 1899)
Pl. 8, fig. 2.

Material — Two fragments, RGM 345 127 (M 351), and RGM 345 120 (M 813), of planispiral whorls with rather well preserved ornamentation.

Description — The preserved 0.5 whorl of specimen RGM 345 127 rather rapidly increases in height and has a suboval section (Fig. 8). The ornamentation consists of alternating strong, trituberculate and thin non-tuberculate intercalatory ribs. The umbilical tubercles are smaller than the ventral and lateral ones. The bases of the ventral tubercles (spines) are slightly elongated in the direction of coiling, whereas the lateral and umbilical ones have circular bases. In a few cases looped ribs are developed between the ventral and lateral tubercles. On the dorsum the intercalatories and the ribs arising in pairs or in threes from the umbilical tubercles, are equally thin and curved forward.

Comparison — The described specimens are similar to *P. ramososeptatum* (Anthula) in the type of ornamentation and the rapidly expanding whorls, but differ from the latter in having a subtrapezoidal (instead of suboctagonal) whorl-section.

Occurrences — Sachica, RGM 345 127, middle Aptian (Gargasian); Loma La Asmomada, RGM 345 120, Aptian.

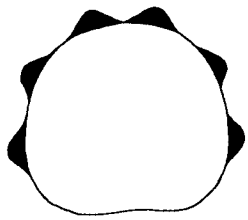

Fig. 8. Whorl section of *Pseudoaustraliceras* sp. ex gr. *ramososeptatum* (Anthula, 1899) (RGM 345 127), × 1.

Genus *Karsteniceras* Royo y Gomez, 1945

Type species — *Ancyloceras beyrichi* Karsten, 1858.

Karsteniceras beyrichi (Karsten, 1858)
Pl. 7, figs. 3-4; Pl. 16, fig. 3.

1858 *Ancyloceras Beyrichii* — Karsten, p. 103, pl. 1, figs. 4a-d.
1945 *Karsteniceras beyrichi* — Royo y Gómez, p. 461, pl. 71, fig. 1a-c, textfig. 1.
1957 *Karsteniceras beyrichi* — Arkell et al., p. L210, fig. 237 (4a-b).
non 1966 *Leptoceras beyrichi* — Breskovski, p. 79, Pl. 6, fig. 1 (= *K. hoheneggeri* Vašíček & Wiedmann).
non 1967 *Karsteniceras beyrichi* — Dimitrova, p. 38, pl. 12, fig. 6 (= *K. hoheneggeri* Vašíček & Wiedmann).
1968 *Karsteniceras beyrichii* — Etayo Serna, p. 54, pl. 1, figs. 1, 2, 3, 5, 7, textfigs. 5 (8 and 9).
1994 *Karsteniceras beyrichi* — Vašíček & Wiedmann, p. 209, pl. 2, figs. 1-2.
1994 *Karsteniceras ibericum* — Vašíček & Wiedmann, p. 212, pl. 1, figs. 4-5.
1996 *Karsteniceras beyrichi* — Wright et al., p. 226, fig. 177, 4a-d.

Holotype — The specimen figured by Karsten (1858, pl. 1, figs. 4a-c) from the Barremian of Vélez, Colombia.

Material — Two adult whorl fragments: RGM 352 548 (M613) and RGM 346 035 (M154); 2 fragments of inner whorls: RGM 344 995 (M153/2) and RGM 352 526 (M153/1); and 1 entire inner spire: RGM 352 525 (M177).

Diagnosis — Open crioconic whorl with subcircular cross-section. Ornamentation consists of sharp annular ribs with ventrolateral elevations between which the ribs may be more or less depressed. In the adult part the ribs are variable in height.

Description — The first part of the spire is smooth. The ornamentation of the second part consists of straight, sharp, radial to slightly retroradiate ribs with ventrolateral elevations separated by a siphonal depression. The depressions give rise to a ventral furrow of variable depth, but the ribs keep crossing the venter. The interspaces are twice as broad as the ribs. Weak constrictions appear at a diameter of 20 mm.

The adult ornamentation consists of sharp ribs of variable height and weak constrictions. In some specimens the variablity of the ribs is less prominent. The high ribs are separated by 2 to 5 low intermediate ribs (in one interval the 4 intermediate ribs are all separated by a still weaker rib). The constrictions are invariably adorally bordered by a high rib, but not all high ribs are accompanied by a constriction. Two loops are discerned: one formed by two intermediate ribs, the other by an intermedi-

ate rib and a high rib. The measure in which the siphonal part of the individual ribs is depressed varies considerably: several ribs show quite a deep depression, whereas others hardly show any depression.

Measurements

no.	D	H	E	U
RGM 352 548	38.6	9.0	8.5	24.0

Remarks — In our opinion the distinction between *K. beyrichi* (in which only some ribs have a ventral depression) and *K. ibericum* (with a ventral furrow) is not real, because the depth of the furrow in the non-adult part and the siphonal depressions of the ribs on the adult whorl vary considerably.

Occurrences — (?Early) Barremian, on the eastern slope of Loma la Yesera and at km 4 along the road from Vélez to Chipatá.

Distribution — Barremian of Colombia, Southern Spain, and Austria.

Karsteniceras multicostatum sp. nov.
Pl. 16, figs. 1a-b, 2a-c, 3a-b.

Holotype — RGM 344 990 (285).

Type locality —Monastery 'Santo Ecce Homo', Villa de Leiva, Barremian.

Type horizon — Barremian.

Derivatio nominis — 'Multi' (Latin) = many, 'costa' (Latin) = rib; from its ornamentation of numerous ribs.

Material — Two rather well preserved specimens: RGM 344 990 (285), RGM 352 527 (M 758).

Diagnosis — Hoplocrioconic coiling, with open crioconic early whorls. The ornamentation consists of fine, dense, straight to almost straight simple ribs, with constrictions on the last crioconic whorl and on the shaft.

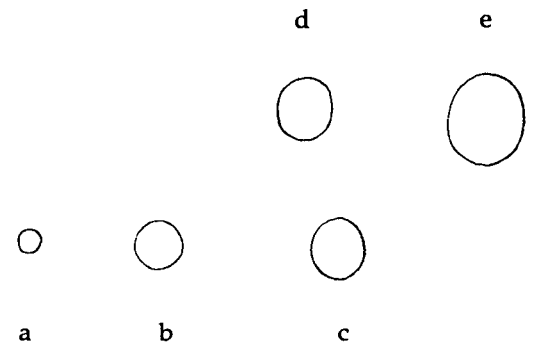

Fig. 9. Whorl section of *Karsteniceras multicostatum* sp. nov. on the crioconic whorl (a, b, c of RGM 352 527) and on the shaft (d, e of RGM 344 990, holotype), × 1.

Description — The embrional whorl is not preserved, but its direct continuation is observable; this is a very open crioconic spiral, which gradually passes into hoplocrioconic coiling. The shaft is thus significally curved and comparatively short and it passes very gradually into the hook. The whorl section (Fig. 9) of the early crioconic stage is subcircular, but later gradually becomes subellipsoidal (higher than wide). The ornamentation of the crioconic spiral consists of simple, very fine, dense, straight, radial ribs, which cross the venter as well as the dorsum straight. On the dorsum the ribs are slightly thinner, whereas on the venter they do not undergo any change. On the last part of the crioconic whorl a few weak constrictions occur; they become frequent on the shaft. As a rule, the first rib after each constriction is more prominent than the following ribs. The suture line is not preserved.

Measurements

no.	D	H	E	O	L	H1	E1	H2
RGM 344 990	29.6	7.8	7.6	18.7	35.0	20.0	?	?
RGM 352 527	29.3	7.5	7.0	19.0	—	—	—	?

Comparison — The described species approaches *K. beyrichii* in the general form of the shell and in the subcircular to ellipsoidal whorl section, but differs from the latter in the much finer and denser ribbing and in the absence of marginal tubercles.

Occurrences — Villa de Leiva, Monastery 'Santo Ecce Homo' (holotype) and 1 km from monastery 'Santa Sofia'; Barremian.

Genus *Monsalveiceras* gen. nov.

Type species — *Monsalveiceras monsalvense* sp. nov.

Derivatio nominis — The genus is named after the type locality of its type species and *ceras* = horn

Diagnosis — Hamiticone shell, with symmetrical coiling in the early stage. The first shaft is slightly curved and passes gradually into the moderately open U-shaped bend, which connects it with the straight second shaft in such a manner that the first and second shafts are subparallel and rather distant from each other. Both shafts only very slowly increase in height. The second shaft passes into a second bend, the morphology of which is not known. The first part of the first shaft is smooth. After that the ornamentation consists of fine, dense, annular, non-tuberculate ribs. On the U-shaped bend the first shallow constriction can be descerned. On the second shaft the ribs are sharp, stronger and variable in hight and distance. There are shallow constrictions bordered on both sides by rather strong annular ribs. Suture line is not known.

Remarks — On account of the hamiticone mode of coiling of the first and second shafts the genus approaches *Hamites* Parkinson, 1811, but differs from it by the absence of asymmetrical coiling in the early ontogenic stage and by the type of sculpture, which consists of annular ribs of variable height and distance. Because of

the constriction-like furrows between two strong annular ribs the described genus approaches *Orbignyceras* Royo y Gomez (= *Veleziceras* Wright, 1957, which appears to be an unnecessary nom. nov.), but the latter differs from *Monsalveiceras* by having fewer, more distant constrictions, which are situated amidst groups of three ribs (instead of two in *Monsalveiceras*). Moreover, until today only two fragments of *Orbignyceras*, viz. of its type species, have been found in the Barremian of Colombia (Royo y Gomez, 1945, p. 460, fig. 1, pl. LXXI, fig. 1 d-e; non fig. c) and both of them are only portions of straight shafts, it is impossible to judge about the whole shell morphology. The one specimen of *Monsalveiceras*, however, shows the entirely preserved first and second shafts. Moreover, it is possible to trace the entire ontogenetic development of the ornamentation beginning from the first smooth shell stage up to the end of the second shaft. Nevertheless, as long as its suture line is unknown, the closest relatives of *Monsalveiceras* cannot be determined.

Distribution — Aptian (?) of Colombia.

Monsalveiceras monsalvense sp. nov.
Pl. 7, fig. 5.

Holotype — RGM 352 528 (116).

Type locality — Southern point of Monsalve.

Type horizon — Aptian (?).

Material — One specimen, the final hook of which is missing.

Derivatio nominis — The species is named after the type locality Monsalve.

Diagnosis — Hamiticone shell with oval whorl section and sharp, annular, slightly prorsiradiate ribs, which on the first shaft are of equal strength and regularly spaced, but on the second shaft of unequal strength and irregularly spaced. On the second shaft the ribs are variable in hight and distance and there are pairs of comparatively strong annular ribs, with constriction-like furrows between them.

Description — The first shaft is slightly curved, the second is straight. The final hook is missing except for the initial small part of its bend, whereas a small part of the first shaft is merely preserved as an imprint. The whorl section is oval and slightly compressed. The initial part (c. 5-6 mm) of the first shaft is smooth. After that the ornamentation consists of sharp, annular, slightly prorsiradiate ribs. On the first shaft they are fine, of equal strength and regularly spaced. On the U-shaped bend between the first and second shafts the ribs are slightly stronger and there is one clearly distinguished constriction as well. On the second shaft the ribs are still stronger and their height and mutual distance is variable. The distance between the ribs varies from 1 mm to 2.5 mm and there are a few weak constrictions bordered on both sides by extra high ribs. The ribs do not bear tubercles and hardly show any difference in strength between venter and dorsum.

Measurements

no.	H	E	H1	E1
RGM 352 528	3	2.7	9.4	8.7

Comparison — See Remarks in the description of the genus *Monsalveiceras*.
Occurrence — Aptian (?) of Monsalve, Colombia.

Genus *Hamiticeras* Anderson, 1938

Type species — *Hamiticeras pilsbryi* Anderson, 1938.

Revised diagnosis — The shell consists of a shaft and a hook attached to each other by a hairpin-shaped bend; the morphology of the early whorls is not known. The early part of the shaft is bent aspinoconically, but the later part is straight and subparallel with the hook. The ornamentation on the early part of the shaft consists of simple, non-tuberculate ribs. Later an ancyloceratitic type of sculpture sets in (alternation of trituberculate main ribs and non-tuberculate thin intercalatory ribs). The umbilical and lateral tubercles are weaker than the ventral ones; they disappear at the end of the shaft, whereas ventral tubercles continue to be present on the hairpin-shaped bend and in some cases may even be present on the beginning of the hook. On the remainder of the hook there are only simple, straight, non-tuberculate ribs. The suture line is of ancyloceratitic type.

Distribution — Aptian of California, Oregon, Colombia, and Caucasus.

Hamiticeras pilsbryi Anderson, 1938
Pl. 13, fig. 1.

1938 *Hamiticeras pilsbryi* — Anderson, p. 216, pl. 79, fig. 1.
1960 *Hamiticeras pilsbryi* — Drushchits, p. 295, pl. XI, fig. 7a-b (non fig. 6a-b).
?1976 *Hamiticeras* sp. — Avram, p. 24, pl. 2, only fig. 1.
1996 *Helicancylus pilsburyi* — Wright et al., p. 224, fig. 174, 2c, non 2a-b.

Holotype — The specimen figured by Anderson (1938, pl. 79, fig. 1), middle Aptian (Gargasian) of North America (near Ono, Shasta County).

Material — Five fragments (nuclei), represented by incomplete shaft-hook combinations: RGM 345 107 (M 819 b/1), RGM 345 108 (957) and by incomplete hooks: RGM 344 983 (111), RGM 344 982 (109), RGM 344 980 (107).

Revised diagnosis — Shaft and hook are subparallel. The ornamentation of the last portion of the shaft consists of simple trituberculate ribs. Umbilical and lateral tubercles are weak and disappear at the end of the shaft, whereas the ventral ones are stronger and are still present on the beginning of the hook. In the late stage of the shaft thin, non-tuberculate intercalatory ribs may very rarely be present. On the hook there are only simple straight ribs, which cross the venter straight without increasing in width. Cross-sections of shaft and hook are compressed, subcircular (wider than high).

Description — The preserved late part of the shaft is straight and passes into the hook with a very sharp bend. The hook is very long, slightly curved and almost straight. The shaft is subcircular in section (slightly higher than wide). The cross-section of the hook is also subcircular, but slightly wider than high (Fig. 10).

The ornamentation of the preserved part of the hook consists of rather strong trituberculate ribs, which are weak between the ventral tubercles. The latter are rather prominent and are also present on the bend that connects the shaft with the hook and even on the beginning of the straight part of the hook. The umbilical and lateral

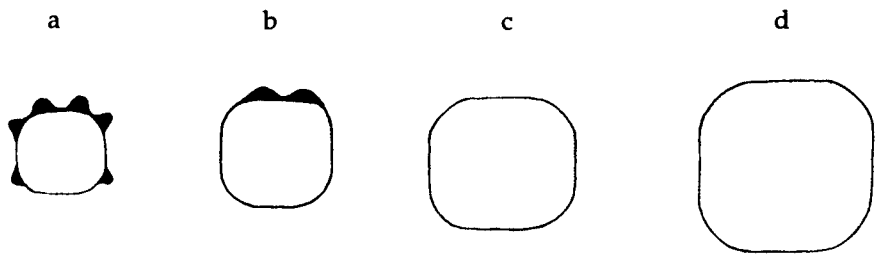

Fig. 10. Cross-section of *Hamiticeras pilsbryi* Anderson, 1938 of the shaft (a), of the hairpin-shaped bend (b), and on the straight part of the hook (c, d); (RGM 345 107), × 1.

tubercles are weak and dissappear at the end of the shaft. On the shaft only one non-tuberculate intercalatory rib was counted, which crosses the venter without interruption. On the venter of the shaft and bend the main ribs become stronger, whereas on the dorsum they are very thin. On the shaft the ribs are inclined forward, but on the straight part of the hook they are slightly inclined backward, simple, rather prominent and widely spaced. On the hook they cross the venter straight and without broadening, whereas on the dorsum they are fine and forwardly convex. Between the main ribs on the dorsum (specimen M 819 b/1) additionally short, thin ribs are intercalated. The suture line is not preserved.

Measurements

no.	H1	E1	H2	E2
RGM 345 107	12.8	14.5	18.3	20.5

Remarks — The holotype of *H. pilsbryi* is very incomplete (see Anderson, 1938, pl. 79, fig. 1) and therefore the features of the early ontogenic stages and in the transitional area between shaft and hook are not known. As is shown in the synonymy list, only one of the two specimens figured by Drushchits (1960, pl. XI, fig. 7a-b) belongs to this species. This specimen permits to describe the diagnostic features on the transitional segment between shaft and hook. On that segment the ornamentation consists of simple ribs, which become stronger on the venter. On our material the ornamentation on the last part of the shaft consists of simple trituberculate ribs. The umbilical and lateral tubercles gadually disappear at the end of the shaft, only the ventral tubercles remain present up to the first part of the hook.

Occurrences — Loma Monsalve (RGM 344 980, RGM 344 982-983), Sachica (957) and along the road east of Loma La Asomada; ? middle Aptian.

Distribution — Middle Aptian of North America (California and Oregon) and northwest Caucasus; ?Middle Aptian of Colombia.

Hamiticeras chipatai sp. nov.
Pl. 13, fig. 2.

Holotype —RGM 345 101 (M 551).
Type locality — Chipatá (Santander, Colombia).
Type horizon — Aptian (? middle Aptian).
Derivatio nominis — The specimen is named after the type locality Chipatá.
Material — One completely preserved combination of shaft and hook (holotype), found in a concretion. There are two other specimens: RGM 345 181 (M379), a fragment of a shaft, and RGM 345 180 (M 376), a well-preserved fragment consisting of a long shaft and a part of the hook.

Diagnosis — These early part the shaft is aspinoconically bent, but later it becomes straight and subparallel with the hook. The latter is very long. The ornamentation on the early part of the shaft consists of simple, non-tuberculate, straight ribs. Later and up to the end of the shaft the ornamentation consists of alternating trituberculate main ribs and thin, non-tuberculate intercalatory ribs. On the sharp, crank-shaped bend between shaft and hook only the ventral tubercules remain present, whereas the umbilical and lateral ones disappear at the end of the shaft. The straight part of the hook consists of simple, straight, non-tuberculate ribs. The whorl section varies from circular (in the early part of the shaft) to subrectangular (wider than high) in the later part of the shaft.

Description — The early portion of the shaft is aspinoconically bent. Later it becomes almost straight. The bend between the shaft and hook is rather sharp, so that the straight part of the hook is subparallel with the straight part of the shaft. The cross-section (Fig. 11) of the early part of the shaft is circular, but gradually becomes subrectangular; on the hook it is ellipsoidal (wider than high). The ornamentation on the earliest part of the shaft consists of thin, equal, straight, non-tuberculate ribs. Later a sculpture of ancyloceratitic type (alternation of trituberculate and thinner non-tuberculate ribs) gradually sets in. Ventral tubercles appear first and they remain present until the beginning of the straight part of the hook. The lateral and umbilical tubercles appear later and disappear at the end of the shaft. On the straight part of the hook all ribs are equal, straight, non-tuberculate, and moderately distant. They cross the venter straight and without becoming broader. The suture line is not preserved.

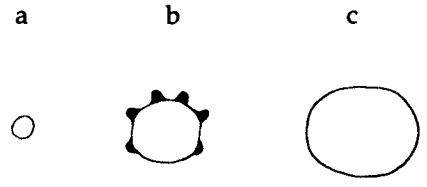

Fig. 11. Cross-section of *Hamiticeras chipatai* sp. nov. (RGM 345 101, holotype), × 1; a, b: on the shaft; c: on the hook.

Measurements

no.	L	H1	E1	H2	E2
RGM 345 101	72.0	7.5	9.8	11.8	13.5

Comparison — *H. chipatai* resembles *H. pilsbryi* in the hairpin shape of the bend between shaft and hook, but clearly differs from it in the features of the sculpture: *H. chipatai* is characterized by regularly alternating trituberculate and non-tuberculate intercalatory ribs on the late part of the shaft, whereas in *H. pilsbryi* non-tuberculate intercalatories are virtually absent. Moreover, in *H. chipatai* the ventral tubercles on the hook are comparatively weak.

Occurrence — Aptian (? middle Aptian), Chipatá (Santander, Colombia).

Genus *Tonohamites* Spath, 1924

Type species — *Tonohamites decurrens* Spath, 1924.

Tonohamites sp. ex gr. *koeneni* Casey, 1961
Pl. 4, fig. 2.

cf. 1961 *Tonohamites koeneni* — Casey, p. 89, text-fig. 31f-h.

Holotype — By original designation: the specimen figured on textfig. 31f-h of Casey, 1961, from the early Aptian of Ahaus, Germany, deposited in the University of Münster.

Material — Two specimens from the early (?) Aptian of the Loma Cabrera directly west of Villa de Leiva, Colombia. One specimen, RGM 345 184 (M710 B), merely consists of a part of the first shaft, the other, RGM 345 183 (M710 A) is more complete, but lacks the hook and the first part of the first shaft.

Description — The shell shows hamiticone coiling and consists of a half, slightly curved first shaft and a straight second shaft connected by an U-shaped bend with the first shaft. The hook is missing except for the first curved part. The whorl section is subcircular with a flattened dorsum. The shell is ornamented with thick, blunt, simple, straight ribs, which cross the venter without interruption. The ribs are thickest on the venter (twice as thick as the interspaces) and thinnest on the dorsum, where they are slightly adorally convex and where the intercalated ribs are of the same thickness as the main ribs. Ribs are slightly forwardly and backwardly inclined just before and after the bend respectively, whereas they are radial on the remainder of the shell. On the preserved beginning of the hook each rib bears minute pin-point ventral tubercles and still smaller lateral tubercles; on two ribs even a very weak umbilical tubercle can be discerned. On the ribs of the shaft and bend there is only a hint of differentiation of the ventral ribs; tubercles are not formed.

Measurements — The adult length may reach 80 mm.

no.	H	E	H1	E1
RGM 345 183	6.0	5.8	10.5	10.2

Comparison — The shell of *Tonohamites*, though normally labeceraticone, may exceptionally have a shape that tends to be hamiticone, for instance in *T. aequicingulatus* (von Koenen). The ribs on the shaft of the latter, however, are thinner and prorsiradiate instead of radial. The ribbing of our specimen is similar to that of *T. koeneni*, but the latter lacks any clear tuberculation and is interpreted to be labeceraticone.

Occurrence — Early(?) Aptian of the Loma Cabrera, directly west of Villa de Leiva.

Distribution — Early Aptian of England; early(?) Aptian of North Germany and Colombia.

Genus *Hamulinites* Paquier, 1900

Type species — *Hamulina munieri* Nicklés, 1894.

Diagnosis — Shell of small size (morphology of complete shell is unknown) with long, slowly expanding straight shaft, which passes into a hook with a very sharp U-shaped bend, so that shaft and hook are very close to (almost in touch with) each other. The ornamentation consists of strong ribs crossing the venter and dorsum without interruption. The suture line is simple with clearly trifid lateral and umbilical lobes (L, U1).

Remarks — The shell morphology of the early ontogenic stages is unknown. Paquier (1900) pointed out that the two small, incomplete specimens (only the shaft and hook are preserved) described by Nicklés (Nicklés, 1894, p. 59, textfig. 42, pl. V, fig. 7-8b) as *Hamulina munieri* do not belong to the genus *Hamulina*, because they have a much stronger ribbing, and the suture line unmistakably has trifid (instead of bifid) lateral lobes. They were considered representatives of the new genus *Hamulinites* Paquier.

In a recently published paper Vašíček & Wiedmann (1994) considerably enlarged the scope of the genus *Hamulinites*: besides the genus *Hamulinites* sensu Paquier they included in it: *Leptoceras* Uhlig, 1883 (partim), *Eoleptoceras* Manolov, 1962 [together with the subgenera *E. (Tzankoviceras)* Manolov, 1962 and *E. (Wrightites)* Manolov, 1962], which all are characterized by an ancyloconic type of shell. Moreover, they considered *Leptoceras parvulum* Uhlig, 1883 a senior synonym of *Hamulinites munieri* (Nicklés, 1894). These ideas are followed by Wright et al. (1996).

We do not agree with this opinion. The type-species of the genus *Hamulinites*, viz. *H. munieri* (Nicklés, 1894), is a fragment, in which merely the almost contiguous shaft and hook are preserved, and which is therefore very similar to the mature stage of a ptychocone type of shell coiling. The specimen described here (RGM 345 100, Pl. 14, figs. 1, 2a-b) also merely consists of a rather long shaft and hook (with a sharp U-

shaped bend), which are almost in touch with each other.

We are of the opinion that there is no reason to assume that ammonites with a ptychoconic type shaft and hook were furnished with a crioconic shell with planispiral whorls in the early ontogenetic stage. The combination of these two types of coiling (i.e. crioconic planispiral stage followed by a ptychoconic type shaft and hook) has never been described in palaeontological literature and we suppose that the combination of these two types of shell morphology does not occur among ammonites. Consequently, we are of the opinion that there is no reason to consider *Leptoceras parvulum* Uhlig to be a synonym of *Hamulinites munieri* and that the scope of the genus *Hamulinites* should be considered the same as that suggested by Paquier (1900).

Distribution - Barremian of Colombia, Spain, and France.

Hamulinites munieri (Nicklés, 1894)
Pl. 14, figs. 1-2.

1894 *Hamulina Munieri* — Nicklés, p. 59, textfig. 42, pl. V, figs. 7, 8, 8b.
1900 *Hamulinites munieri* — Paquier, p. vi-vii, pl. VIII, fig. 3.
1996 *Hamulinites munieri* — Wright et al., p. 225, fig. 177, 2a-b, non 2c-e.

Lectotype — *Hamulina Munieri* Nicklés, 1894, p. 59, pl. V, fig. 8, 8 b (designated here).

Type locality — Querola, near Cocentaina, province of Alicante, Spain.

Type horizon — Barremian.

Material — Two rather well-preserved fragments, RGM 345 100 (M 550) and RGM 352 535 (M 552), which represent combinations of shaft and hook.

Diagnosis — The morphology of the complete shell is unknown. The shaft and hook are very close, almost touching each other. The ornamentation consists of simple, rather distant ribs, especially on the hook. On the dorsum the ribs are thin and reduced in relief. The cross-section of the shaft is subcircular. The dorsum of the hook tends to flatten. The suture line of the shaft is simple, with trifid lateral lobes.

Description — The straight shaft passes by way of a sharp U-shaped bend into the hook. The latter is relatively long and almost touching the shaft. The cross- sections of the shaft and U-shaped bend are subcircular, but on the straight part of the hook the dorsum tends to flatten (Fig. 12). The ornamentation consists of simple, well-elevated ribs, which on the shaft lean forward as they cross the flank and pass straight over the venter without broadening. On the hook the ribs are perpendicular to the direction of the hook and rather distant. The suture line is not preserved.

Measurements

no.	D1	H1	E1	H2	E2
RGM 345 100	12.4	5.4	—	7.8	—
RGM 352 535	12.7	5.3	5.2	6.8	6.7

Remarks — The sharp U-shaped bend and the morphology of the shaft and hook

Fig. 12. Cross-section of the whorls of *Hamulinites munieri* (Nicklès, 1894); a: on the shaft; b: on the straight part of the hook (RGM 352 535), x 1.

of the described specimens are similar to the holotype, but they differ from the holotype in the slightly greater dimensions and in the slightly thicker ribs on the shaft. These differences are here regarded as intraspecific variation.

Occurrence — Chipatá Viejo - Chipatá (Santander, Colombia); ?Barremian.

Distribution — Barremian of Spain; ?Barremian of France and Colombia.

Subfamily Heteroceratinae Spath, 1922

Genus *Colchidites* Djanelidze, 1926 (= *Heteroceras (Santandericeras)* Royo y Gomes, 1945)

Type species — *Colchidites colchicus* Djanelidze, 1926.

Colchidites breistrofferi Kakabadze & Thieuloy, 1991

Pl. 14, figs. 4-6; Pl. 15, figs. 1-2.

1991 *Colchidites breistrofferi*: Kakabadze & Thieuloy, pp. 97-99, text-fig. 13, pl. 5, fig. 7; pl. 6, figs. 1-9.

Holotype — ID 3046 from the 'latest' Barremian of Simiti, Colombia.

Material — Nine rather well-preserved specimens, among which three: RGM 352 552 (M 554), RGM 352 599 (M 646/2), RGM 344 975 (M 646/3) are microconchs. Macroconchs are: RGM 352 598 (M646/1), RGM 344 978 (M598/1), RGM 344 979 (M598/2), RGM 344 976 (886/1), RGM344 977 (886/2), and RGM 352 597 (M240).

Remarks — A very detailed description of this species from one locality (Barbosa) in Colombia was published recently (Kakabadze & Thieuloy, 1991) and therefore we refrain from repeating the description.

Occurrences — Santander, Carratera Puente Nacional - Jesus Maria; Chipatá Viejo - Chipatá (Santander); Loma de la Yuca; northern part of Loma Monsalve; Barremian (? latest Barremian).

Distribution — Upper Barremian of Colombia.

Family Ptychoceratidae Meek, 1876

Genus *Ptychoceras* d'Orbigny, 1842

Type-species — *Ptychoceras emericianum* d'Orbigny, 1842

Ptychoceras aff. *puzosianum* d'Orbigny, 1842

Pl. 14, fig. 3.

Material — One specimen, RGM 352 539 (M 378), represented by fragments of two shafts.

Fig. 13. Cross-section of *Ptychoceras* aff. *puzosianum* d'Orbigny, 1842 of the first (a) and second (b) shaft (RGM 352 539), × 1.

Description — The first shaft is straight and passes into the second one with a very sharp U-shaped bend, so that they are in touch with each other. The cross-section of the beginning of the first shaft is subcircular (slightly wider than high), but later it becomes suboval (wider than high). The second shaft has a suboval section (Fig. 13), which is still wider, and develops a slightly concave dorsum. The preserved part of the first shaft and U-shaped bend are smooth, but in a later stage simple, distant ridges appear, which are rather prominant on the venter. The suture line is not preserved.

Measurements

no.	D1	H1	E1	H2	E2
RGM 352 539	10.7	4.5	5.5	5.8	6.8

Comparison — The described specimen resembles *Pt. puzosianum* in the general form of U-shaped bent and in the type of costae (single distant ridges) at the beginning of the second shaft, but differs from the latter in the wider suboval cross-section of the first and second shafts.

Occurrence — Sachica; Aptian (?middle Aptian).

Superfamily Turrilitaceae Gill, 1871
Family Anisoceratidae Hyatt, 1900
Genus *Protanisoceras* Spath, 1923

Type species — *Hamites raulinianus* d'Orbigny, 1842.

Protanisoceras (Protanisoceras) creutzbergi sp. nov.
Pl. 16, figs. 6.

Holotype —RGM 344 996 (M 452/1).

Type locality — Utica (Cundinamarca). In quebrada Negra, near the village.

Type horizon — Albian.

Derivatio nominis — In honour of Peter Hans Creutzberg (Bogotá, Colombia), who collected the ammonites described here.

Material — One rather well preserved specimen (holotype) without the earliest

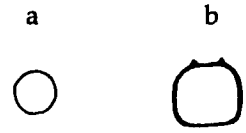

Fig. 14. Cross-section of *Protanisoceras (Protanisoceras) reutzbergi* sp. nov. (RGM 344 996, holotype); a: on the first shaft; b: on the 'hook'; × 1.

whorls. It is found in one concretion together with the 3 other fragments, among which RGM 344 998 (M 452/3) represents the incomplete body-chamber of the hook; the others: RGM 344 999 (M 452/4), RGM 346 036 (M 452/5) represent the shaft and beginning part of the hook.

Diagnosis — Three nearly straight arms are coiled in one plane so as to form a triangle (subtriangular coiling). The cross section of the first and second shaft is subcircular, but the cross section of the hook is suboctagonal (Fig. 14). The first shaft bears straight non-tuberculate ribs, which later, especially in the transitional area between the first and second shafts, become oblique. The hook is ornamented with strong, distant, simple ribs bearing very faint ventral tubercles. On the venter the ribs are thick, whereas the dorsum is smooth and flattened.

Description — The shell consists of three nearly straight arms, which are subtriangularly coiled. The morphology of the earliest stage is not known, but on the dorsum of the living chamber (last part of the hook) there is a concave impression with the imprint of the venter of the non-preserved earlier shaft. Through this it is proven that the shell has a closed triangular form (Pl. 16, fig. 6a-c). The cross-section of the first and second shafts is subcircular, but the last arm (hook) has a suboctagonal cross section (wider than high). The preserved first straight shaft is ornamented with strong, simple, straight ribs; on the knee- shaped bend between the first and second shaft the ribs are asymmetrically curved on the venter; on the second straight shaft the ribbing becomes symmetrical again and consists of straight, strong ribs, which cross the venter straight. On the 'hook' the ribs are slightly inclined backward and bear a pair of ventral tubercles. The dorsum is smooth and markedly flattened.

Comparison — *P. (P.) creutzbergi* resembles *P. (P.) hengesti* Casey, 1961 in the smooth and flattened dorsum of the hook and in the coarse and prominent ribbing, but differs from the latter by the peculiarities of the triangular coiling and in the weak ventral tubercles, which are not elongated in the direction of growth.

Occurrence — Utica (Cundinamarca) in Quebrada Negra, near the village; Albian.

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Manuscript received 10 July 1996.

Plate 1

1a-b. *Crioceratites leivaensis* sp. nov.; RGM 352 533 (holotype), × 1, Barremian, Monastery 'Santo Ecce Homo', Villa de Leiva.
2a-b. *Ancyloceras vandenheckii velezianum* Kakabadze & Thieuloy, 1991; RGM 345 114, × 1, Barremian, Monastery 'Santo Ecce Homo', Villa de Leiva.
3a-b. *Ancyloceras* cf. *vandenheckii vandenheckii* Astier, 1851; RGM 352 540, × 1, Barremian (?late Barremian), Monastery 'Santo Ecce Homo', Villa de Leiva.

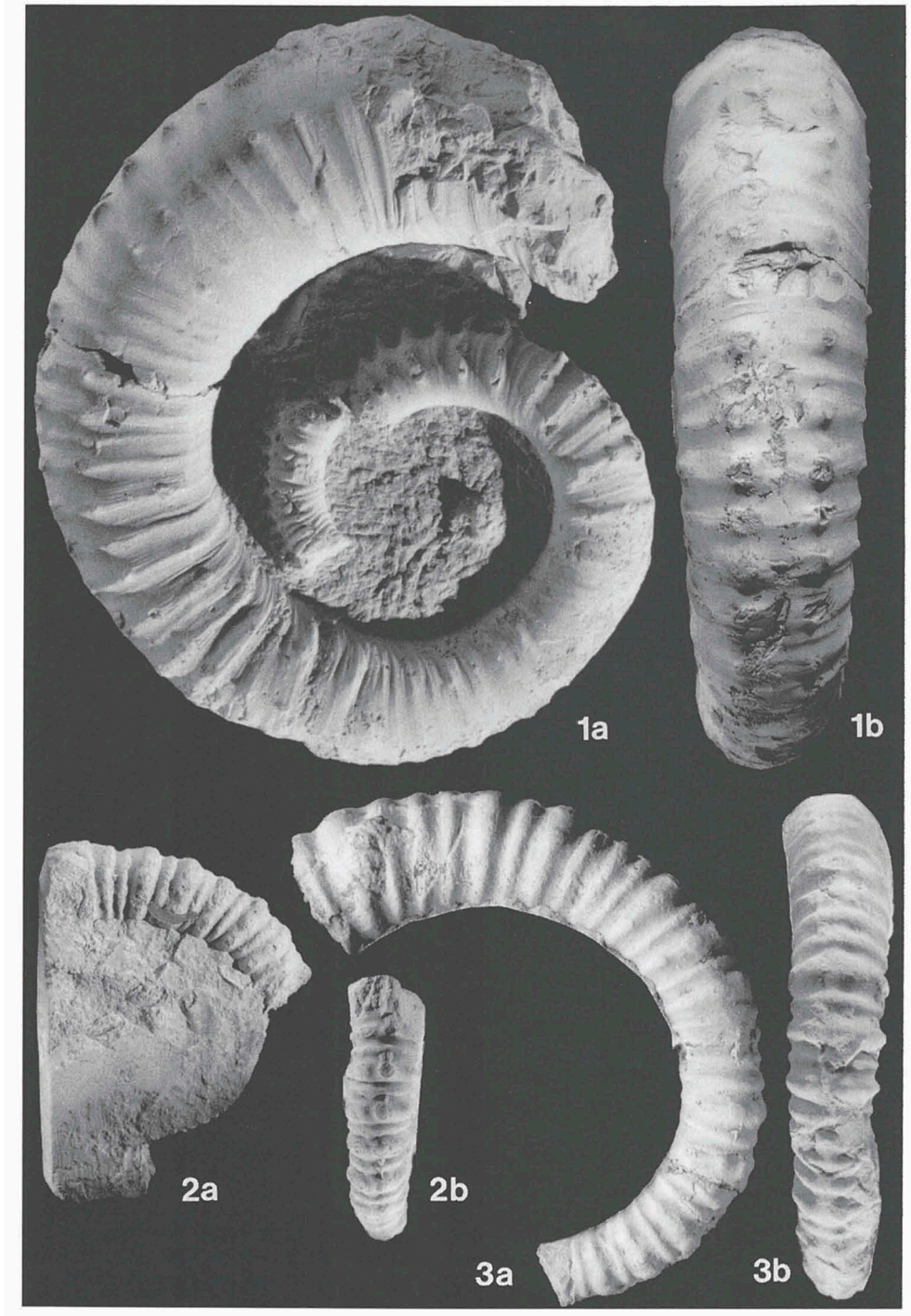

1a
1b
2a
2b
3a
3b

Plate 2

1. *Crioceratites* aff. *emerici* Léveillé, 1835; RGM 345 118, × 1/2, Barremian, Monastery 'Santo Ecce Homo' Villa de Leiva.
2a-b. *Pseudocrioceras anthulai* (Eristavi, 1955); RGM 345 119, × 1/2, Barremian - ?Aptian, Chipatá Viejo - Chipatá (Santander).

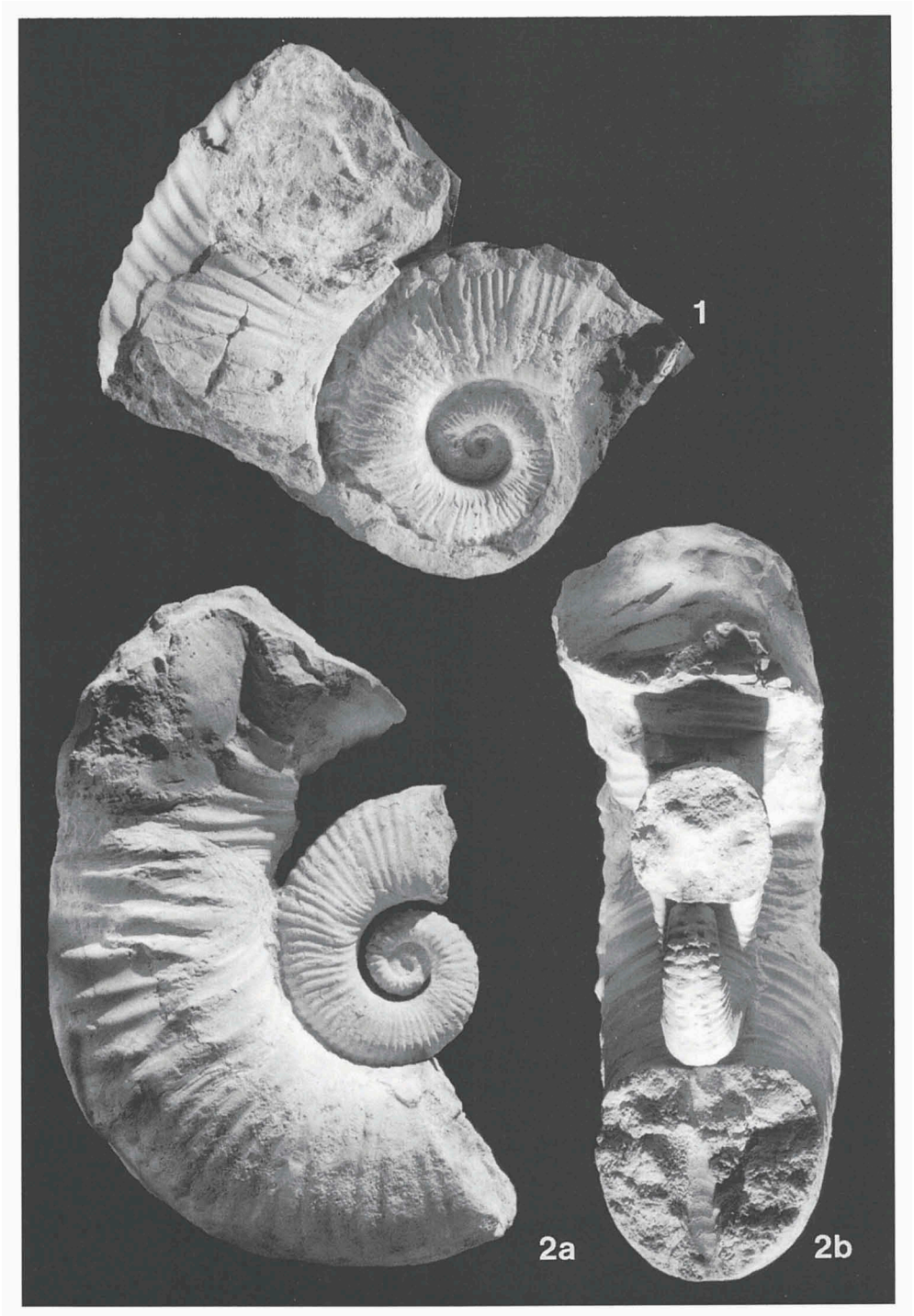

1
2a
2b

Plate 3

1. *Crioceratites* aff. *emerici* Léveillé, 1835; 1: RGM 345 118 (fragment), × 1/2, ventral side of last whorl, Barremian, Monastery 'Santo Ecce Homo', Villa de Leiva.
2a-b: RGM 352 529, × 1, Barremian (?lower Barremian), Loma Cabrera, west of Villa de Leiva.


1
2a
2b

Plate 4

1a-c. *Paracrioceras* sp. ex gr. *barremense* (Kilian, 1895) (form 1); RGM 352 596, × 1, Barremian, Monastery 'Santo Ecce Homo', Villa de Leiva.
2a-b. *Tonohamites* sp. ex gr. *koeneni* Casey, 1961; RGM 345 183, × 1, Aptian (?lower Aptian), Loma Cabrera, west of Villa de Leiva.

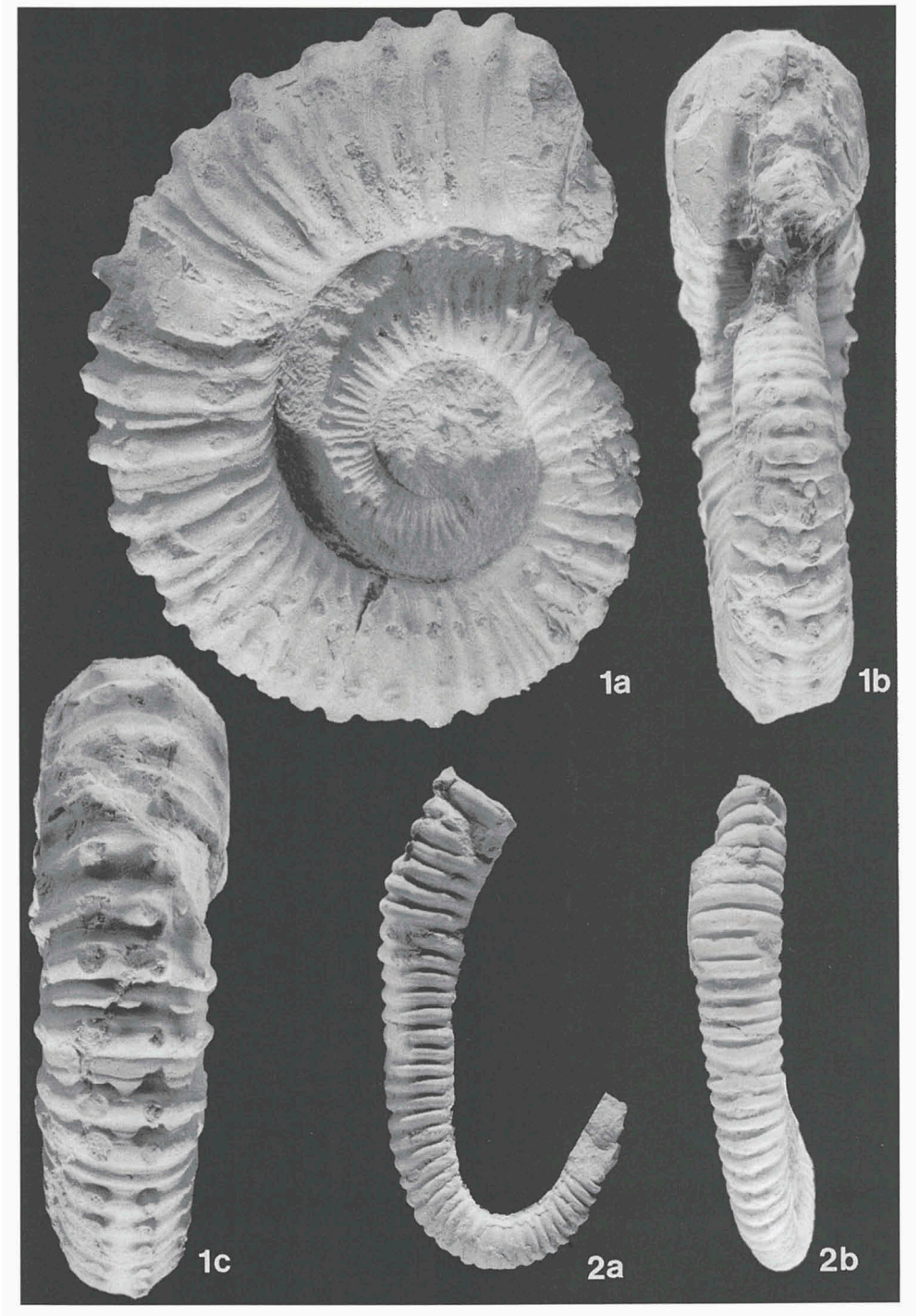

1a
1b
1c
2a
2b

Plate 5

1a-b. *Ancyloceras vandenheckii velezianum* Kakabadze & Thieuloy, 1991; RGM 345 111, × 1, Barremian, Monastery 'Santo Ecce Homo', Villa de Leiva.
2-3. *Pedioceras asymmetricum* sp. nov.; 2a-c: RGM 352 537 (holotype), × 1, Barremian, Monastery 'Santo Ecce Homo', Villa de Leiva; 3a-b: RGM 352 536, × 1, Barremian, Monastery 'Santo Ecce Homo', Villa de Leiva.

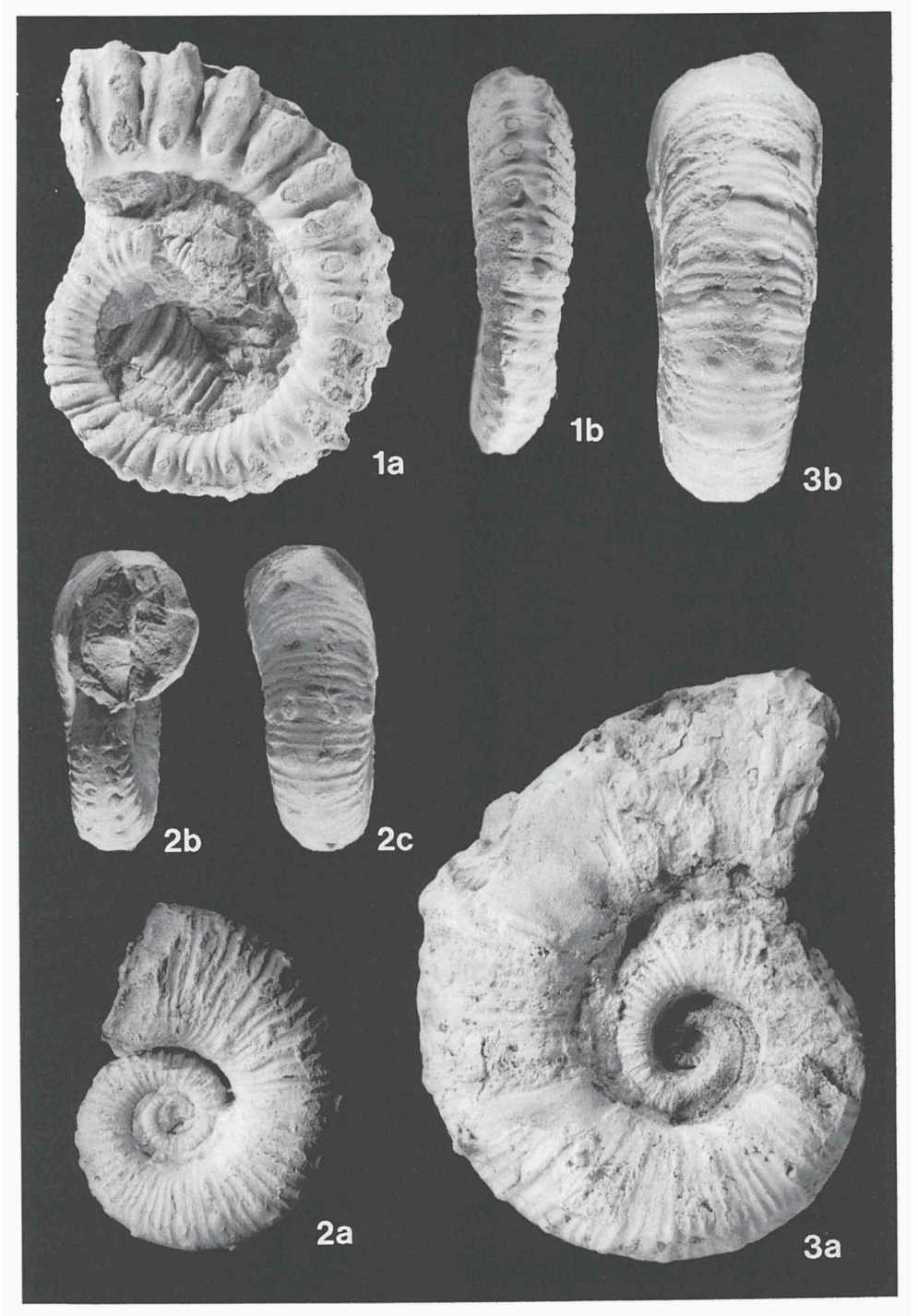

1a
1b
3b
2b
2c
2a
3a

Plate 6

1-4. *Pedioceras caquesense* (Karsten, 1858); 1a-b: RGM 352 546, × 1, Barremian, Monastery 'Santo Ecce Homo', Villa de Leiva; 2a-b: RGM 352 562, × 1, Barremian, Loma la Yesera, S. of Villa de Leiva; 3a-b: RGM 352 563, × 1, Barremian, Loma le Yesera, S. of Villa de Leiva; 4: RGM 352 530, × 1, Barremian, Monastery 'Santo Ecce Homo', Villa de Leiva.

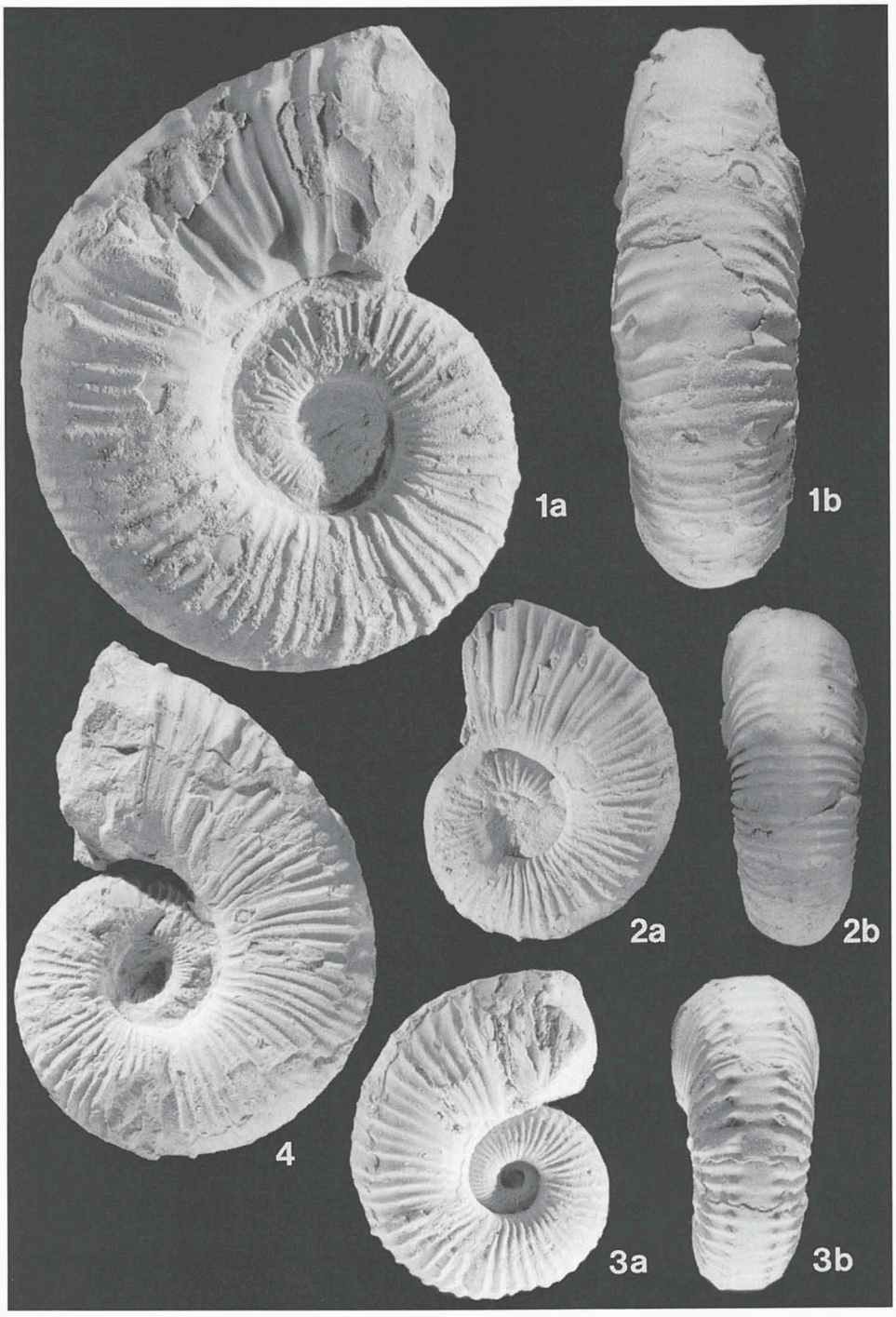

1a
1b
2a
2b
4
3a
3b

Plate 7

1-2. *Pedioceras caquesense* (Karsten, 1858); 1a-c: RGM 352 551, × 1, Barremian, Loma Cabrera, W. of Villa de Leiva; 2a-b: RGM 352 538, × 1, Barremian, Monastery 'Santo Ecce Homo', Villa de Leiva.
3-4: *Karsteniceras beyrichi* (Karsten, 1858); 3a-b: RGM 352 548, × 1, Barremian, Road from Vélez to Chipatá, km 4.5 (Santander); 4a-b. RGM 352 525, × 1, Barremian, Loma la Yesera, S. of Villa de Leiva.
5a-c. *Monsalveiceras monsalvense* sp. nov.; RGM 352 528 (holotype), × 1, ?Aptian, of the southern point of Monsalve.

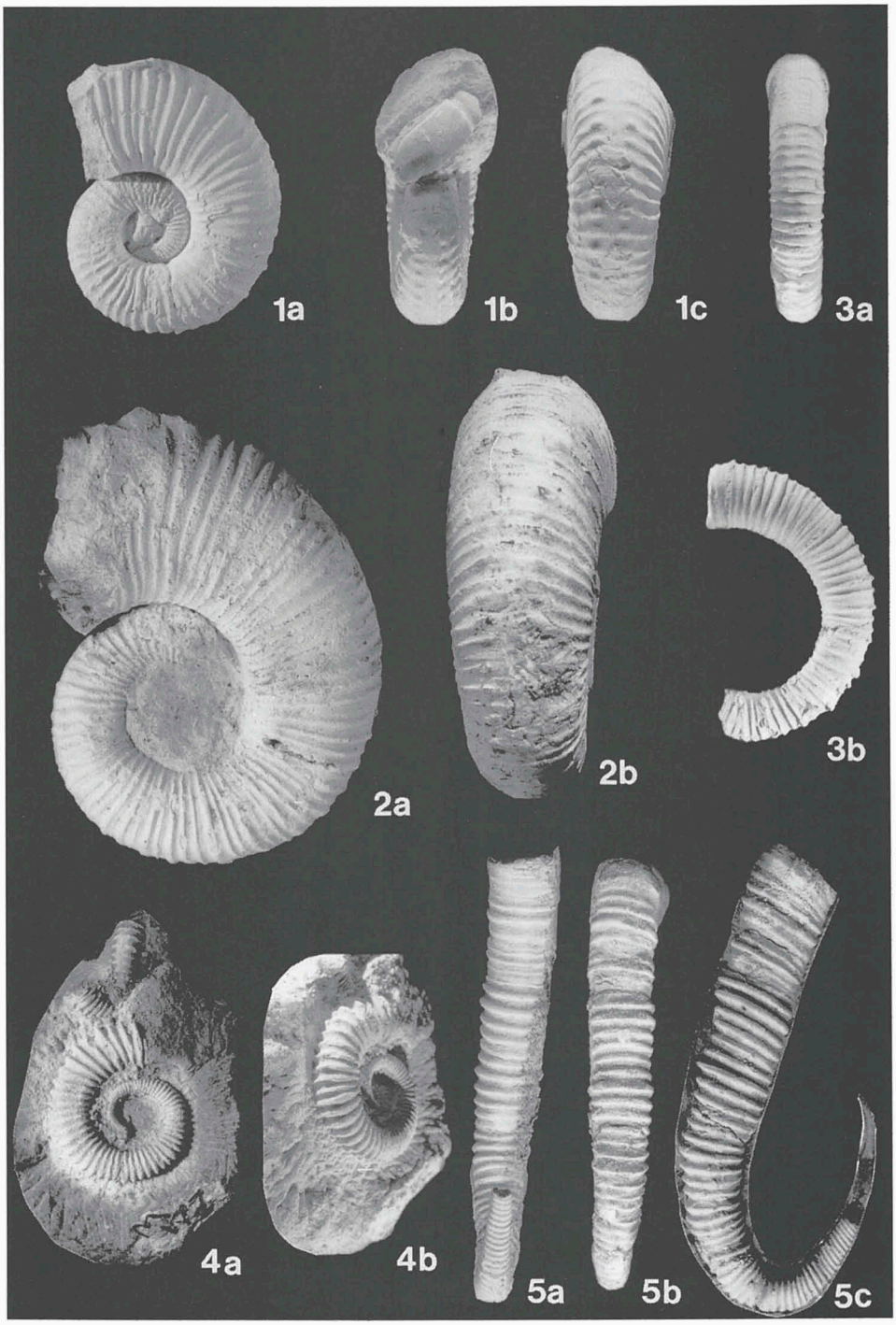

1a
1b
1c
3a
2a
2b
3b
4a
4b
5a
5b
5c

Plate 8

1. *Pseudoaustraliceras columbiae* (Basse, 1928); RGM 345 126, × 1/2, Aptian, Sachica.
2a-b. *Pseudoaustraliceras* sp. ex gr. *ramososeptatum* (Anthula, 1899); RGM 345 127, × 1, middle Aptian, Sachica.


1
2a
2b

Plate 9

1. *Pseudoaustraliceras columbiae* (Basse, 1928); RGM 345 121, × 1, Aptian, Sachica.
2a-c. *Pseudoaustraliceras pavlowi* (Wassiliewskyi, 1908); RGM 345 123, × 1, middle Aptian, Sachica.


1
2a
2b
2c

Plate 10

1. *Pseudoaustraliceras columbiae* (Basse, 1928); RGM 345 121, × 1, middle Aptian, Sachica.
2a-b. *Crioceratites* cf. *tener* Kakabadze & Thieuloy, 1991; RGM 345 117, × 1, Barremian (?lower Barremian), Loma de la Yuca.

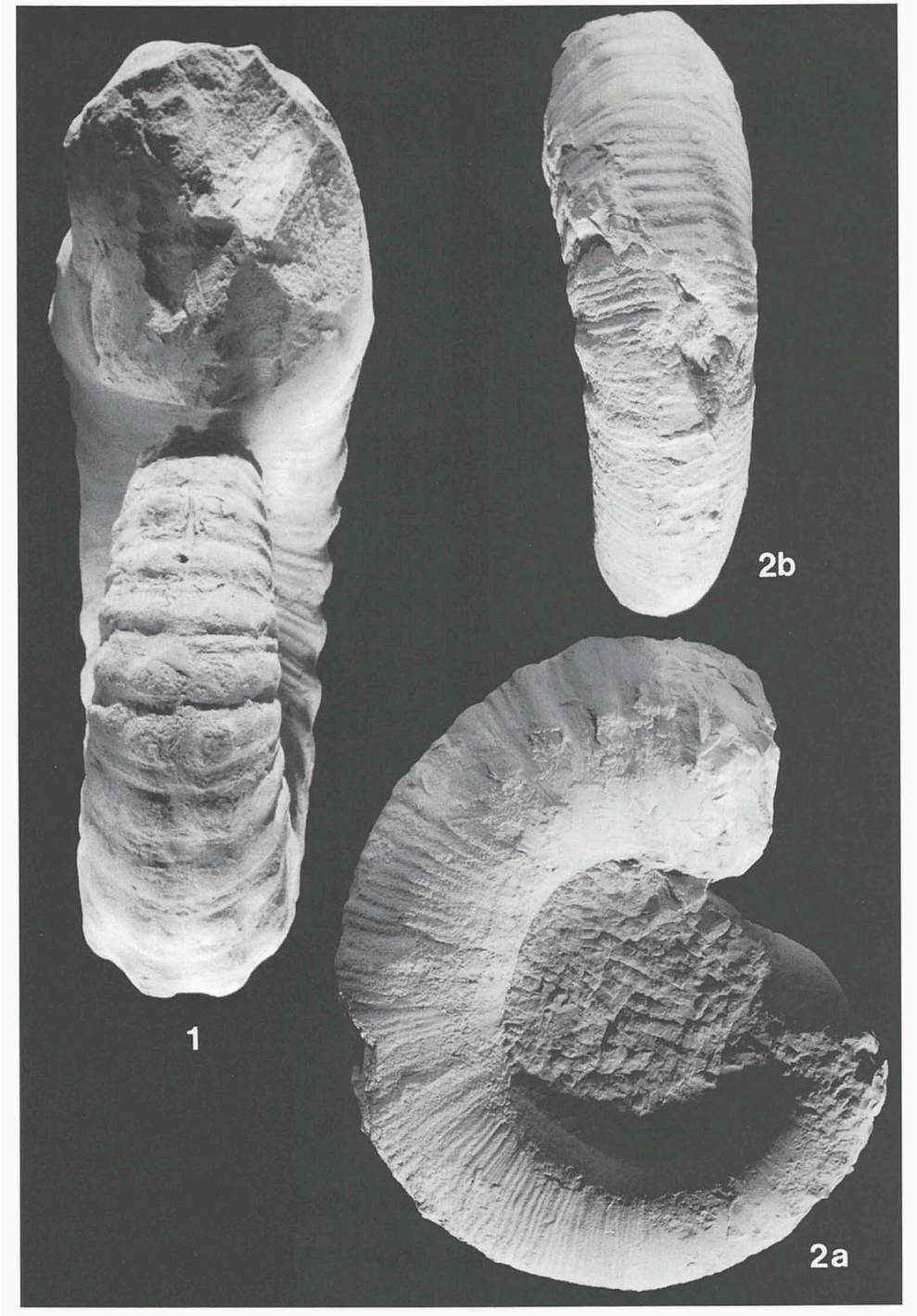

2b
1
2a

Plate 11

1a-b. *Pseudoaustraliceras columbiae* (Basse, 1928); RGM 345 124, × 1, Aptian, Sachica.


1a
1b

Plate 12

1-2. *Pseudoaustraliceras columbiae* (Basse, 1928); 1a-b: RGM 346 037, × 1, Aptian along road E of Loma la Asomada; 2a-c: RGM 345 122, × 1, Aptian, Sachica.

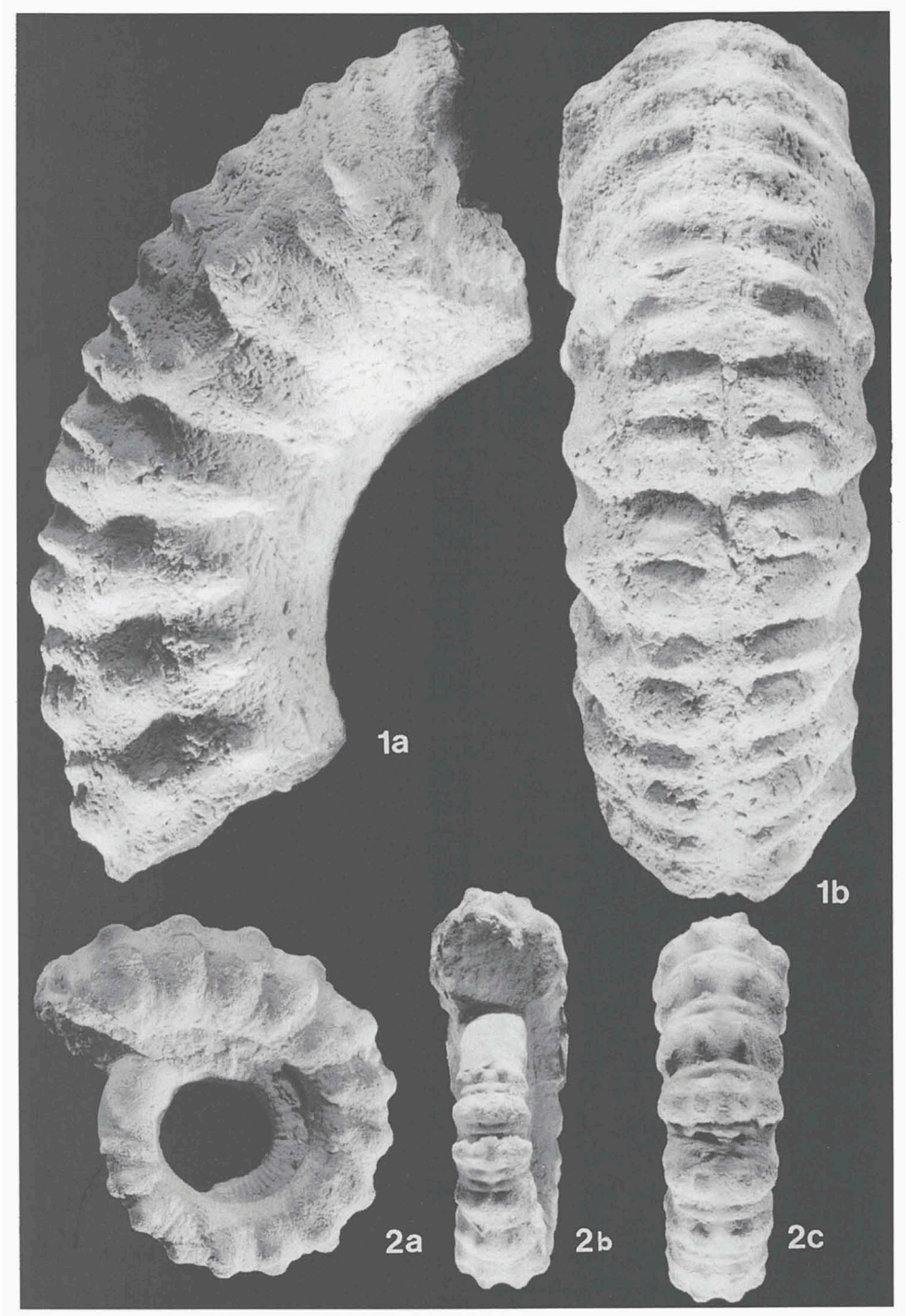

1a
1b
2a
2b
2c

Plate 13

1a-b. *Hamiticeras pilsbryi* Anderson, 1938; RGM 345 107, × 1, Aptian (?middle Aptian), Sachica.
2a-d. *Hamiticeras chipatai* sp. nov.; RGM 345 101 (holotype), × 1, Aptian (?middle Aptian), Chipatá (Santander).

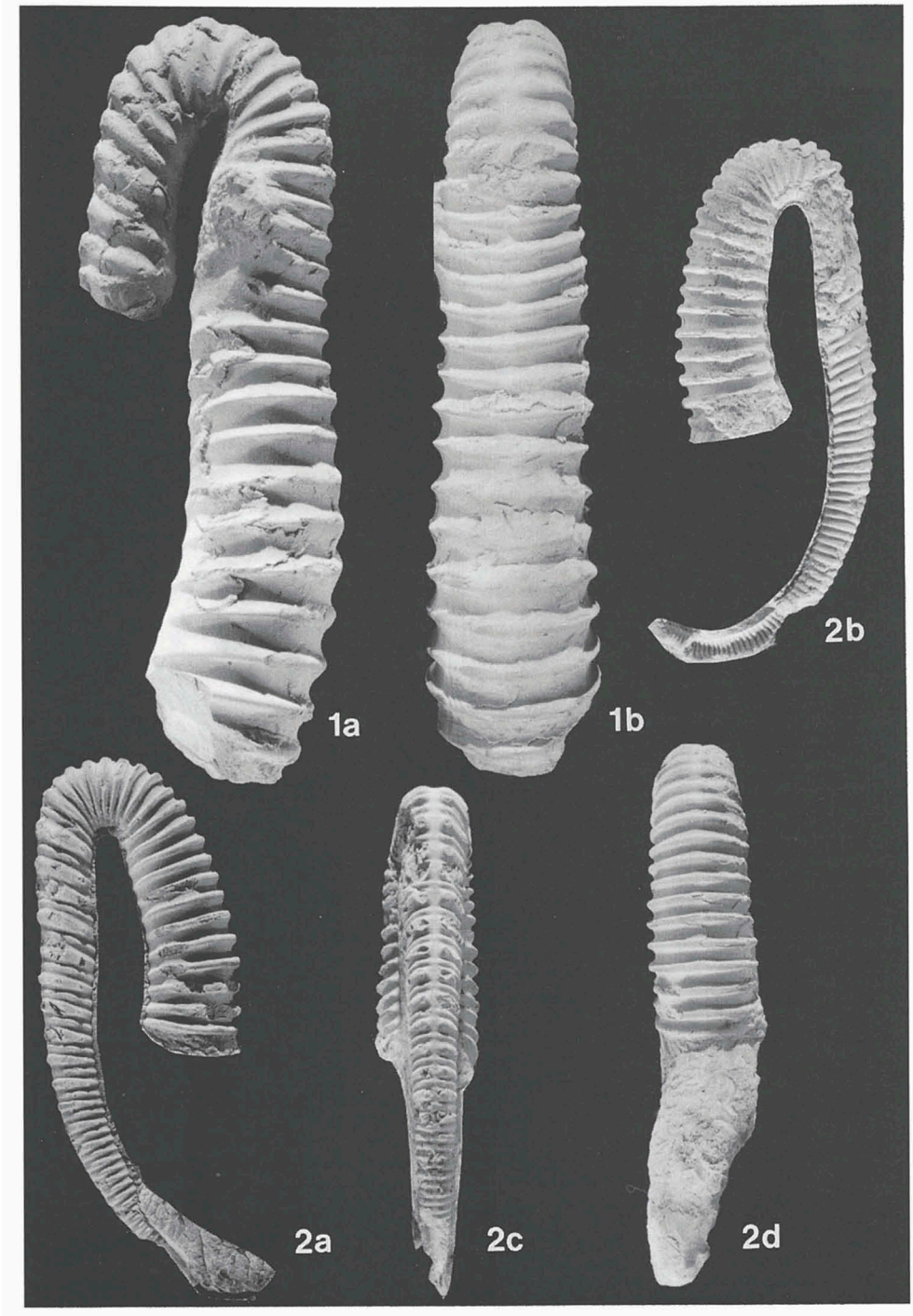

1a
1b
2b
2a
2c
2d

Plate 14

1-2. *Hamulinites munieri* (Nicklés, 1894); 1a: RGM 345 100, × 0.8; 1b: × 1, ?Barremian, along road between Chipatá Viejo - Chipatá (Santander); 2a-b: RGM 352 535, × 1, ?Barremian, along road between Chipatá Viejo - Chipatá (Santander, Colombia).
3a-b. *Ptychoceras* aff. *puzosianum* d'Orbigny, 1842; RGM 352 539, × 1, Aptian (?middle Aptian), Sachica.
4-6. *Colchidites breistrofferi* Kakabadze & Thieuloy, 1991;4a-b: RGM 352 552, × 1, Barremian, along road between Chipatá Viejo - Chipatá (Santander, Colombia). 5a-b: RGM 352 599, × 1, Barremian, road from Puente Nacional to Jesus Maria, Km 8 (Santander); 6a-b: RGM 344 978, × 1, Barremian, road from Vélez to Chipatá, km 4-4.5 (Santander).

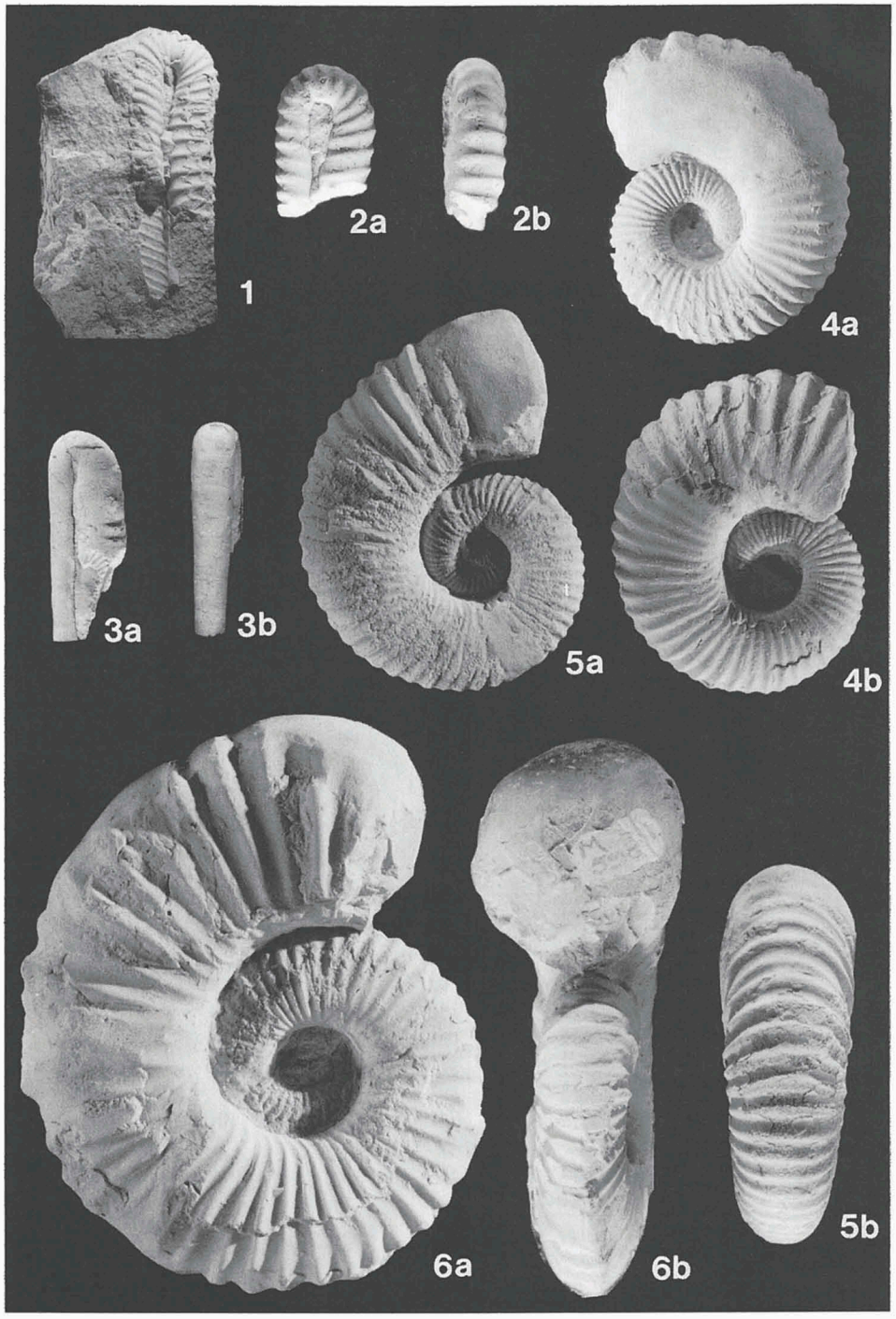

1
2a
2b
4a
3a
3b
5a
4b
6a
6b
5b

Plate 15

1-2. *Colchidites breistrofferi* Kakabadze & Thieuloy, 1991; 1a-b: RGM 344 979, × 1, Barremian, road from Vélez to Chipatá, km 4-4.5 (Santander, Colombia); 2a-b: RGM 352 598, × 1, Barremian, road from Puente Nacional to Jesus Maria, km 8 (Santander, Colombia).

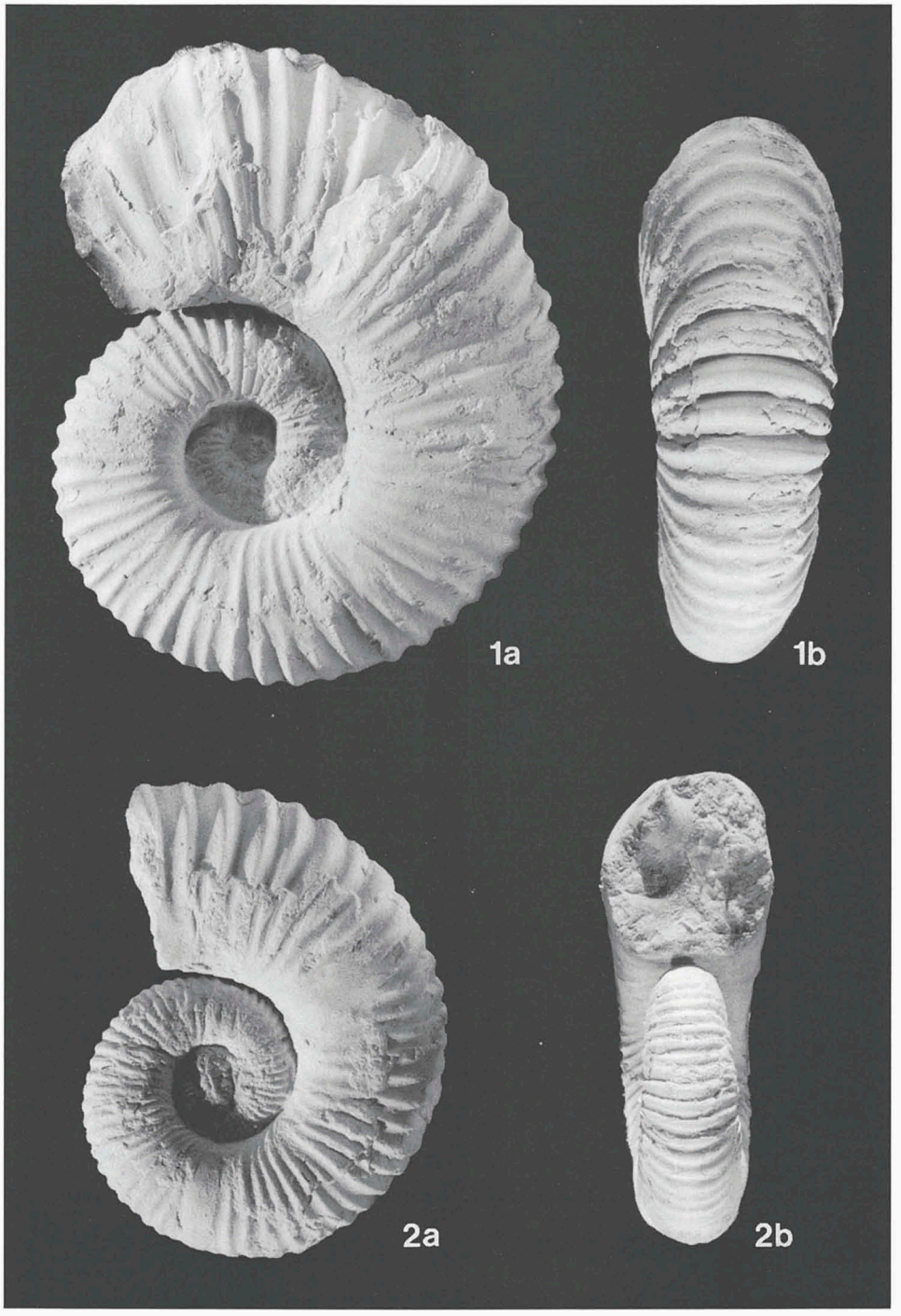
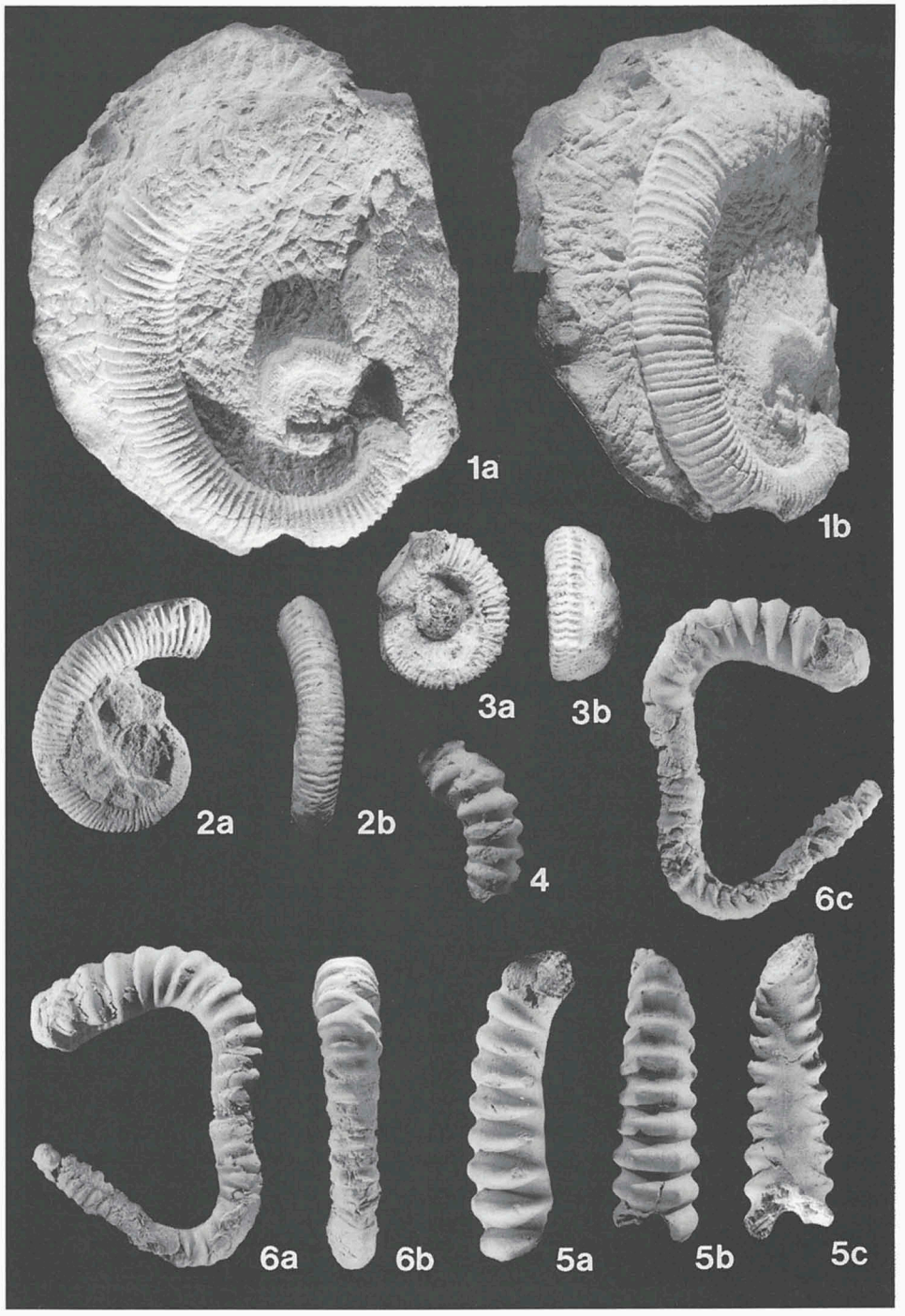

1a
1b
2a
2b

Plate 16

1-2. *Karsteniceras multicostatum* sp. nov.; 1a-b: RGM 344 990 (holotype), × 1, Barremian, monastery 'Santo Ecce Homo', Villa de Leiva; 2a-b: RGM 352 527, × 1, Barremian, 1 km from monastery 'Santa Sofía', Villa de Leiva.

3a-b. *Karsteniceras beyrichi* (Karsten, 1858); RGM 352 526, × 1, Barremian, Loma la Yesera, S. of Villa de Leiva.

4-6. *Protanisoceras (Protanisoceras) creutzbergi* sp. nov.; 4: RGM 346 036, × 1, Albian, Utica (Cundinamarca) in Quebrada Negra; 5a-c: RGM 344 998, × 1, Albian, Utica (Cundinamarca) in Quebrada Negra; 6a-c: RGM 344 996 (holotype), × 1, Albian, Utica (Cundinamarca), in Quebrada Negra.


1a
1b
3a
3b
2a
2b
4
6c
6a
6b
5a
5b
5c