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# FROM THE THESAURUS OF THE MUSEUM COLLECTIONS. I. LIASSIC AMMONITES FROM MUNTEANA (SVINIȚA ZONE, SOUTHERN CARPATHIANS, ROMANIA)

**John H. CALLOMON[1] and Eugen GRĂDINARU[2]**

**Abstract**: The taxonomy of the Liassic ammonites from Munteana (Svinița Zone, South Carpathians, Romania) collected by Răileanu (1953), with some subsequent additions, preserved in the collections of the Department of Geology in the Faculty of Geology and Geophysics, University of Bucharest, is reviewed. The most important elements are represented by the Liparoceratidae. These include forms hitherto unknown, described now as *Liparoceras carpathicum* sp.nov. [M] and *Aegoceras carpathicum* sp.nov. [m]. These liparoceratids reveal the presence of a sharply-constrained biohorizon in the Liassic deposits of Munteana of Pliensbachian, Late Carixian age (Davoei Zone) and provide an important palaeobiogeographic reference-point in the region of the Carpathians.
The Liassic ammonite fauna from Munteana in Răileanu's collection illustrates the value of the fossils that are locked in museum collections, waiting to be described.

**Keywords**: Răileanu's collection, Ammonites, Liassic, Liparoceratidae, Munteana, South Carpathians, Romania.

## INTRODUCTION

The Liassic deposits, which unconformably overlie older formations, have an important development in the South Carpathians on the Romanian territory, both in the Getic Nappe and the Danubian Autochthone (Patrulius 1972, Patrulius & *al*. 1972, Patrulius & Popa 1972). In the Getic Nappe, the Liassic commonly starts with Gresten-type coaly paralic deposits (e.g. in the Braşov and Anina regions). Similar facies occur in the Outer Danubian unit. In the Inner Danubian unit, the Liassic has two distinct isochronous facies: a Gresten-type coaly paralic facies, described as the Cozla facies, and an open-marine, mixed terrigenous-carbonate facies, described as the Munteana facies (Răileanu 1953, 1959). The most important area is in the Svinița (Sirinia) Zone, located in the Banat region. The Munteana facies has rich faunas of brachiopods, pelecypods, ammonites and nautiloids (Tietze 1872, Răileanu 1953, 1959; Răileanu & Iordan 1964; Popa & *al.* 1977). Only the brachiopods have been taxonomically studied, by Răileanu & Iordan (1964). Other groups of fossils have never been systematically studied. Tietze (1872) and more recently Popa & *al.* (1977) figured only ammonites from Munteana facies.

Răileanu (1953, 1959) mentioned several ammonite species in the Munteana facies without describing and illustrating them. These listings were meant only for biostratigraphic dating. Comparing the list with surviving collection, it is evident that only a part of the palaeontological material collected by him is now still preserved in the collections of the Department of Geology in the Faculty of Geology and Geophysics, University of Bucharest. Most of the fossils have no labels either of taxonomic assignment or of precise details of stratigraphic provenance. Conversely, Răileanu's collection from Munteana contain ammonites that were never mentioned in his papers. These ammonites are entirely new, not only to the Banat region but also to the Carpathians as a whole. They are thus highly significant for the local and regional biostratigraphy and palaeobiogeography of the Liassic deposits there. Lastly, comparing Răileanu's collection from Munteana with the ammonite species cited in his papers, it seems that some of his taxonomic assignments are not correct. The aim of the present paper is to describe and figure the ammonites from the Liassic of Munteana that are preserved in Răileanu's collection. Many are of no particular interest, being found widely elsewhere, but one small collection is of hitherto unknown forms. They are in the family Liparoceratidae, which has long been of particular interest because of its prototypic role in studies of ammonite evolution.

Răileanu's collection from Munteana fairly illustrates the state of so many collections of fossils whose fate was regretted already by Teichert & *al.* (1987) and Ziegler (1987), and discussed further by Erwin & Ziegler (1997), Erwin (2001), Allmon (1997, 2005) and NRC (2002). They draw attention to the immense amount of potentially valuable palaeontological information that is unavailable because it is locked up in undescribed collections in university departments and museums the world over. They draw from their own experience numerous examples of palaeontological treasures that have been lying in collections for decades, waiting to be described in print. In consequence, to the two categories defined by Newell (1959), namely the "published record" and the "undiscovered, potentially knowable, record", Teichert & *al.* (1987) added a third, the "discovered, but unpublished fossil record". They

[1] *University College London, 20 Gordon Street, London WC1H OAJ, United Kingdom; E-mail: johncallomon@lineone.net*
[2] *University of Bucharest, Faculty of Geology and Geophysics, Bd. Bălcescu Nicolae 1, Bucharest 010041, Romania; E-mail: egradin@geo.edu.ro*

estimated that the number of species of fossil animals and plants that remain undescribed in the museum collections of the world may be about equal to that of all the fossil species described so far. Teichert & *al.* (1987) pointed out that theoretical studies in palaeobiology are totally dependent on a solid base in taxonomic and morphologic data, to which end much more systematic research resulting in descriptive monographic publications is needed. For this the museum collections represent a major source of undescribed material.

Allmon (1997, 2005) and NRC (2002) emphasized that, properly curated, the value of a collection will increase through time and its useful scientific value will last many decades or even generations. Besides well-curated collections, there are also two other kinds of fossil collections held at universities or other academic institutions: „orphaned" or „endangered collections". Such collections, commonly neither cataloged nor curated, although potentially extremely valuable, are usually unknown and often inaccessible to the public and so face threats to their continued maintenance and even their existence. Emphasizing the importance of fossil collections as the final repositories of the evidence that underlies all stratigraphic and biological palaeontology, past, present and future, Allmon & Poulton (1997), Allmon (1997, 2005), Erwin (2001) and Johnson & *al.* (2005) stress not only the importance of current cataloging and indexing of the specimens but advocate also the publication and maintainance of electronic catalogues, not just of type, figured and cited material, but also of non-typological and stratigraphic collections. Webster & *al.* (2003) discussed the rich taxonomic value found in museum collections as an easy means of increasing the precision of measured sections and the biostratigraphic resolution obtainable by computer-assisted methods.

The region of Banat is well-known for its richly fossiliferous Mesozoic deposits. They were a major source for important fossil collections made around the end of the ninetheenth century, which were deposited in many museums in Austria and Hungary. Only a few of these collections were ever described, most of them remaining unpublished or in the end even lost during the two world wars. Those that were partially described include the Middle Jurassic ammonite fauna of Svinița (Swinitza) in Kudernatsch's original collection, kept in the Naturhistorisches Museum in Vienna, revised with additional material of several hundred specimens in other Hungarian collections by Galácz (1994). Those unpublished but known still to exist in the collections of the Magyar Állami Földtani Intézet in Budapest, include the Middle Triassic ammonoid fauna from Sasca (Szászkabánya), with several new ammonoid species cited under *nomina nuda* by Böckh (1888).

Besides the older collections in museums abroad, many important collections of fossils from Banat, like that of Răileanu, are locked in university departments and museums in Romania awaiting classification and proper description. Nicholson's prediction (1986) that "Museum collections of today, properly maintained, documented, and conserved for long-term use, will be the jewels of scientific research in the 21st century" were long anticipated by the reputed Romanian geologist Gregoriu Ştefănescu when he stated (1872): "We have to collect as much as possible, and if not we, then our successors will have the material on which to build the geological edifice of the country". Răileanu's collection from Munteana shows what remains to be done and the stimulus it can provide for further high-resolution biostratigraphic studies in the region.

## GEOLOGIC SETTING AND STRATIGRAPHY

The locality at Munteana is located on the left bank of the Danube, near the Iron Gates in the Romanian Banat. It is the type-locality for the Munteana facies of the Liassic in the Svinița Zone (Text-fig. 1), named also Sirinia Zone by other Romanian geologists. The Svinița (Sirinia) Zone belongs to the Inner Danubian unit of the Southern Carpathians and has a sedimentary cover that includes Permian, Jurassic and Cretaceous deposits. The Liassic outcrops in the Munteana area were in earlier times studied by Lipold (1864), Tietze (1870, 1872, 1873, 1878) and subsequently by Răileanu (1953, 1959), Răileanu & Iordan (1964), and Popa & *al*. (1977).

The litho- and biostratigraphy of the Liassic deposits from Munteana, as described by Popa & *al*. (1977), is as follows, from below:

1 - a basal sequence, around 10 meters thick, unconformably overlying Permian pyroclastic rocks, made up of an alternation of whitish quartzose sandstones and grey clays, assigned to the Hettangian (?)-Lower Sinemurian on palynological data.

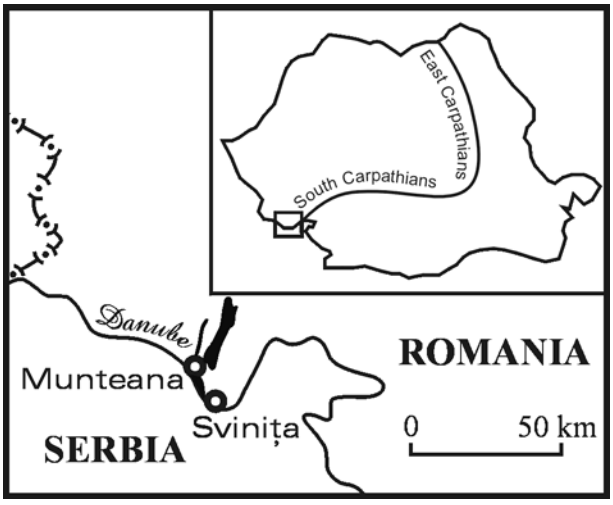


**Fig. 1.** Sketch map showing the occurrences (black areas) of the Liassic deposits in the Svinița Zone in Banat, South Carpathians.

2 - a sequence, over 10 meters thick, of thick-bedded, red and grey, sandy bioclastic oolitic limestones with chamosite and haematite, assigned to the Upper Sinemurian-Carixian, bearing a one-meter thick brachiopod coquina in the middle; Răileanu (1953) reported the occurrence of '*Aegoceras* (*Amblycoceras*) cf. *planicosta* (Sow.)', renamed by Popa & *al.* (1977) as *Promicroceras* cf. *planicosta* (Sowerby), indicating a Late Sinemurian age (Obtusum Zone); from the upper part of the sequence Popa & *al.* (1977) reported and figured *Acanthopleuroceras rursicosta* (Buckman), indicating Early Carixian (Jamesoni Zone).

3 - a sequence of grey quartzose sandstones with lenses of sandy limestones, 3 meters thick, followed by a sequence of around 30 meters of thick-bedded, grey silty bioclastic limestones with chamosite and hematite matrix interlayered by calcareous sandstones and grey siltstones; Răileanu (1953) reported the occurrence of *Liparoceras* (*Becheiceras*) *bechei* (J. Sowerby) and *Aegoceras capricornus* (Schlotheim); Popa & *al.* (1977) reported and figured *Tropidoceras masseanum* (d'Orbigny) and *Aegoceras capricornus* (Schlotheim), indicating Middle Carixian (Ibex Zone) and Upper Carixian (Davoei Zone).

4 - a sequence, around 12 meters thick, mainly of grey-greenish, chamosite-bearing sandy bioclastic limestones and subordinate calcareous sandstones; Tietze (1872) reported and figured '*Amaltheus margaritatus* var. *Muntjanae'* and '*Ammonites Normannianus* d'Orbigny', renamed by Popa & *al.* (1977) as *Amaltheus gloriosus* Hyatt and *Protogrammoceras* sp.; Popa & *al.* (1977) recorded and figured *Amaltheus stockesi* (J. Sowerby), *Amaltheus margaritatus* de Montfort, *Pseudamaltheus* sp., *Pleuroceras* cf. *transiens* (Frentzel), indicating Domerian (Stockesi and Margaritatus Zones).

5 - a sequence, 3 to 4 meters thick, of grey silty crinoidal limestones; Tietze (1872) recorded and figured '*Ammonites spinatus* d'Orbigny', renamed as *Pleuroceras solare* (Phillips) by Popa & *al.* (1977), who also recorded and figured *Pleuroceras solare* (Phillips), indicating Late Domerian (Spinatum Zone).

6 - a sequence starting with blackish clays, 20 cm thick, followed by 2.5 meters of alternating sandy limestones and marly siltstones; Răileanu (in Codarcea & *al.* 1961) reported the occurrence of *Hildoceras bifrons* (Brug.); Popa & *al.* (1977) recorded and figured *Hildaites* sp. aff. *serpentiniformis urkutensis* Géczy, *Harpoceras exaratum* (Young & Bird), *H. mulgravianum* (Young & Bird), *H.* cf. *falciferum* (Sowerby), indicating Early Toarcian (Falcifer Zone), and of *Hildoceras sublevisoni* (Fucini), *H. lusitanicum* (Meister), *H. semicosta* (Buckman), *Lytoceras* sp. ex gr. *L. rhodanicum* (Monestier), *Porpoceras* sp. ex gr. *vortex* (Simpson), *Phymatoceras* sp. ex gr. *lilli* (Hauer), *Catacoeloceras* sp. ex gr. *jordani* (Guex), indicating Early Toarcian (Bifrons Zone);

7 - a sequence, 10 meters thick, of grey quartzose sandstones and sandy limestones; Răileanu (1953) reported '*Lytoceras jurense* (Zieten)'; POPA & *al.* (1977) mentioned and figured *Pseudogrammoceras fallaciosum* (Bayle), indicating Late Toarcian (Variabilis and Thouarsense Zones);

8 - a final sequence, 10 meters thick, of thick-bedded whitish-grey quartzose sandstones, assigned without paleontological data to the Late Toarcian-Aalenian or only Aalenian by Răileanu (1953), Răileanu (in Codarcea & *al.* 1961) and Popa & *al.* (1977).

## SURVEY AND BIOSTRATIGRAPHIC SIGNIFICANCE OF THE LIASSIC AMMONITES FROM MUNTEANA

Among all the ammonite species reported by Tietze (1872), several, such as '*Ammonites capricornus* v. Schlotheim', '*Ammonites* cf. *Actaeon* d'Orbigny', '*Ammonites* cf. *Maugenesti* d'Orbigny' and '*Ammonites Henleyi* Sowerby', were only described and not figured. Also, other ammonite species, such as '*Ammonites* cf. *Actaeon* d'Orbigny' and '*Ammonites* cf. *Maugenesti* d'Orbigny', are not then mentioned by him in the specifically stratigraphic description of the Lias there.

In the case of '*Ammonites Henleyi* Sowerby', this species was listed in a composite fossil assemblage referred by him to the Margaritatus Zone. His text states (1872, p. 65): "Ich nenne nun einige wichtige Fossilien, welche mit dem *Amm. margaritatus* zusammen vorkommen. Es sind dies *Gryphaea cymbium* Lamark, *Amm. Normannianus* d'Orb., *Amm. planicostatus* Sow., *Amm. Henleyi* d'Orb., *Pecten aequivalvis* Sow., *Pecten liasinus* Nyst. Alle diese Arten gelten als vorzugsweise bezeichnend für die Zone des *Amm. margaritatus*."

The specimens referred to the '*capricornus-maculatus'* group (p. 102) are reported from "demselben mergeligen Gestein der Muntjana". The specimen referred to '*Ammonites* cf. *Actaeon* d'Orbigny' was reported (p. 104) to be found together with '*Ammonites Normannianus* d'Orbigny': "Von dieser Art liegen mir einige Exemplare vor, deren eines sich wie eben erwähnt, in einem etwas fremdartigen Gestein zusammen mit *A. actaeon* fand, während ein anderes von mir selbst au der Muntjana zusammen mit dem *Amm. margaritatus* gesammelt wurde."

For '*Ammonites* cf. *Maugenesti* d'Orbigny' Tietze (1872, p. 104) wrote: "In dem grünen Gestein der Muntjana, also in der durch *Amm. costatus* bezeichneten Bank, fand ich das Bruchstück eines Ammoniten, der mit der d'Orbigny'schen Zeichung im Höhenverhältnisse der Umgänge und in der Gestalt der geraden, am Externrand dornig zugespitzten Rippen gut übereinstimmt."

For '*Ammonites Henleyi* Sowerby' he wrote (p. 105): "Mit dieser Art identificire ich ein grosses Exemplar aus den glimmerschuppigen, gelbbraunen oder grünlichen festen Mergeln der Muntjana, wo es mit dem *Amm. margaritatus* zusammen vorkam."

In the description of the Lias from Munteana, Tietze (1872) also referred to the ammonites previously reported from this locality by other Austrian geologists, namely Lipold (1864) and Stur (1870, 1871). All the fossils collected from Munteana by Lipold and Stur were identified by the Austrian geologist Karl Peters, who stated (in Lipold (1864, footnote p. 132) that "An derselben Stelle fand Herr Stur Bruchstücke von einem *Ammonites* aus der Gruppe des *A.radians*.".

Unfortunately, Tietze (1872, 1878), instead of giving a proper description of the succession of the Liassic deposits from Munteana with precise informations on the levels of the fauna, chose to enter repeatedly into polemical dispute with the above-mentioned Austrian geologists over the age of the Liassic deposits at this locality. The only ammonites from Munteana figured by Tietze (1872, pl. 2, figs 4, 5 and 6) were '*Ammonites Normannianus* d'Orb.', '*Ammonites margaritatus* var*. Muntjanae'* and '*Ammonites spinatus* d'Orb.', stated then to be deposited in the Museum of the Geologische Bundesanstalt in Vienna. We do not know whether this material still exists in the museum collections in Vienna.

Răileanu (1953), in listing the fossils from different levels in the Lias from Munteana, included also those reported by the earlier authors, such as Tietze's '*Ammonites margaritatus* Montf.*'*, '*Ammonites spinatus* d'Orb.' and '*Ammonites Normannianus* d'Orb.*'*.

As regards Răileanu's collection itself, when comparing the material preserved today in the museum collections of the Department of Geology in the University of Bucharest with that listed by him (1953, 1959), it seems that only parts of his collection have survived. Among the specimens missing are *Promicroceras* cf. *planicosta* (Sow.) [= *Aegoceras* (*Amblycoceras*) cf. *planicosta* (Sow.)] and *Pachylytoceras jurense* (Ziet.) (= *Lytoceras jurense*). One of the elements that also cannot now be identified among them is that referred by Răileanu to *Liparoceras* (*Becheiceras*) *bechei* (J. Sowerby). It could be that the specimen(s) have been lost or that they were misidentified. Other liparoceratids still in fact present in his collection were deeply embedded in matrix and never prepared to an identifiable standard. The collection today contain faunal elements that were not mentioned by Răileanu. Leading among them are other excellently preserved, hitherto unknown ammonites of the family Liparoceratidae, which make a very important addition to the known Liassic ammonite fauna from Munteana. One may suppose that these ammonites represent new discoveries made after the publication of the paper of Răileanu (1953). They are described more fully below in the section on Systematic Palaeontology.

The Liassic ammonite fauna from Munteana now preserved in Răileanu's collection, taxonomically revised or described in the present paper, includes the following taxa:

*Liparoceras carpathicum* sp.nov. [M]
*Aegoceras carpathicum* sp.nov. [m]
*Amaltheus stokesi* (J. Sowerby) [M]
*Uptonia* sp. indet.
*Pleuroceras* cf. *spinatum* (Bruguière) [m]
*Hildoceras bifrons* (Bruguière)

Added to the other taxa cited by Tietze (1872) and Popa & *al.* (1977), the ammonite species in Răileanu's collection listed above support what is known of the biostratigraphy of the Liassic deposits at Munteana (e.g. Popa & *al.* 1977, Popa & Patrulius 1996). As emphasized above, the most important elements among them are the liparoceratids now to be described.

Besides their occurrence in Banat, Liparoceratidae have also been recorded in other regions in Romania, as follows:

*Liparoceras* n. sp. ind. aff. *Lip. striatum* Sow., Braşov region, eastern part of the Getic Nappe, South Carpathians (Jekelius, 1915, p. 100, text-figs 13-14);

*Androgynoceras* sp. aff. *hybrida* (d'Orbigny), Bucovinic Nappe, Hăghimaş Mts, East Carpathians (Patrulius & Popa 1971, p. 134);

*Androgynoceras capricornus* (Schlotheim) and *Aegoceras* sp., Bucovinic Nappe, Hăghimaş Mts, East Carpathians (Grasu 1971, p. 18);

*Liparoceras* (*Becheiceras*) cf. bechei (Sowerby), Bucovinic Nappe, Hăghimaş Mts, East Carpathians (Grasu & Turculeț 1978, p. 70, pl. 1-2);

*Androgynoceras hybridum* (d'Orbigny), Bucovinic Nappe, Hăghimaş Mts, East Carpathians (Preda 1976, p. 36, pl. 6, fig. 5);

*Beaniceras luridum* (Simpson), Bihor Autochthone, Northern Apuseni Mts (Popa 1981, p. 256, pl. 9, figs 1-4; Popa & Patrulius 1996, p. 58, pl. 1, figs. 6-9);

*Aegoceras* sp., Bihor Autochthone, Northern Apuseni Mts (Patrulius & Popa 1971, p. 134; Patrulius & Popa 1996, p. 58, pl. 1, fig. 4);

*Androgynoceras* sp. ex gr. *A. hybridiforme* Spath, Bihor Autochthone, Northern Apuseni Mts (Popa 1981, p. 232; Popa & Patrulius 1996, p. 58).

? *Aegoceras nautiliforme* Buckman, Bihor Autochthone, Northern Apuseni Mts (Popa & *al.* 1983, p. 44);

Their occurrence now reported in the Banat region marks a significant addition to our knowledge of the palaeobiogeography of the Liassic ammonites in the Carpathians.

## SYSTEMATIC PALAEONTOLOGY

Family **LIPAROCERATIDAE** Hyatt, 1867
[including Androgynoceratinae Géczy, 1976, and Aegoceratidae Neumayr, 1875]

This family has attracted special attention since the earliest post-Darwinian attempts to cast the classification of ammonites into phylogenetic form. Its morphologies are so distinctive, its material so abundant and stratigraphically long-ranging, that it seemed to provide one of the best candidates for such endeavours.

As is well known, the first to try was Alpheus Hyatt in the Museum of Comparative Zoology at Harvard in the 1870s, which had acquired large collections and had a library with the classical literature. Two groups could be clearly distinguished: inflated cadicones with dense, laterally bituberculate ribbing - *Liparoceras*; and compressed serpenticones, with regular, coarse, simple, radial ribbing - *Microceras* sensu Hyatt [1867, non Hall, 1845] - a group that came later to be referred to as the 'capricorns' of the genus *Aegoceras* [*sic*]. On the face of it, there seemed little grounds for regarding two such morphologically disparate groups as in any way closely related. The reason was the presence of a third group, whose members changed during ontogeny from early stages that were typical simply-ribbed capricorns to later stages that became typical bituberculate cadicones. They were variously referred to as 'hybrids' (*Amm*. *hybrida* d'Orbigny, 1844) or 'dimorphs' (Spath 1938). For them Hyatt created the genus *Androgynoceras* (a name that would later turn out to have been auspicious). The hybrids were seen to be highly variable, ranging from some individuals in which the carpicorn stage was merely incipient in the nucleus, to others in which it had become dominant and the cadicone stage had been reduced to a final vestigial stage on the bodychamber. It seemed to be overall an evolutionary progression between pure cadicones and pure capricorns. The question was: in which temporal direction? Stratigraphy did not help, for Hyatt's evidence consisted of the Harvard collection, bought from the dealer Krantz in Germany, and the figures in the older literature, with few indications of relative ages. Fortunately, help came from theory: Haeckel's Biogenetic Law, which stated that the ontogeny of the individual recapitulated the phylogeny of its ancestors (palingenesis). It was therefore necessary only to study the ontogeny of an ammonite to discover the nature of its ancestors and therefore its position in the evolutionary succession. The ancestors were therefore the capricorns (*Aegoceras*) that evolved into the cadicones (*Liparoceras*), the 'hybrids' (*Androgynoceras*) seeing the ancestral carpricorn stage progressively pushed back into the juvenile nucleus.

The next step was by Spath (1938), in a classical monograph that still forms one of the basic points of reference for the Liparoceratidae. He now had access to the world's largest collections of all three groups of the Liparoceratidae, in the British Museum (Natural History) in London. These included, moreover, new collections made by Lang from the highly fossiliferous, expanded succession exposed on the Dorset coast that he had recorded with ultimate stratigraphical precision. The wished-for field evidence seemed finally to hand. And it was immediately clear that, overall, the correct succession was the inverse of the one deduced by Hyatt. The earliest forms were the cadicones of *Liparoceras*, the latest the most advanced hybrids and carpicorns. The new characters appeared first in the young and then spread phylogenetically to successively later ontogenetic stages, displacing the ancestral characters (proterogenesis).There was one remaining difficulty. Although the London collection contained representatives of all the intermediate stages of the hybrids, these did not come from Dorset but from many other spot localities in England up to Yorkshire. So once again the intermediate steps in the evolution of the liparoceratids could not be mapped out in detail and had to remain hypothetical. There were moreover what seemed to be already fully-formed but small capricorns occurring side by side with the early cadicone *Liparoceras.* These were therefore brushed aside in a separate genus *Beaniceras* Buckman, 1913, and simply dismissed as a 'dwarf phyletic off-shoot', sometimes even more extremely as 'phylogerontic'. The general trend from cadicones via dimorphs to carpicorns was however encapsulated in a widely-cited diagram of the succession by Spath (1938, p. 5, fig. 1), reproduced redrawn in the *Treatise* (Arkell 1957, p. L115, fig. 153.1-6). Variations on this theme persist, embellished by arguments, largely circular, based on concepts of 'heterochrony' driving 'evolutionary trends' (e.g. Dommergues 1984, 1990, Phelps 1985).

A third step began with the discovery at Blockley, in the English Midlands, of an expanded succession through the beds with the intermediate forms including those with incipient capricorn inner whorls, beds that are now known to be missing in a disconformity in Dorset (Callomon 1963, 1978). The Liparoceratidae are beautifully preserved and consisted almost exclusively of mature adults with modified peristomes. They were moreover abundant - up to 100 specimens from a single faunal horizon - so that their variability could be clearly mapped. Their classification could therefore be attempted along 'horizontal' lines, in terms of a succession of distinct isochronous assemblages approximating to variable palaeobiospecies - successive transients in a 'vertical' evolving lineage. Four such transients were identified, I – IV. The conclusions were clear. (1) The mean diameter of the mature adults was a closely-

defined character, changing only slowly with stratigraphical age. (2) There are only *two* groups of shells, evolving in parallel. (3) They differ in (a) the characteristic fully-grown size, differing by a factor of around 3:1 or more; (b) the form of the final peristome: simple in the large forms, with ventrally projected peak in the small ones. (4) The large forms consist of *Liparoceras* in levels I, II and III, and *Liparoceras* together with the hybrids, with which they intergrade, in level IV. (5) The small forms range smoothly upwards, from *Beaniceras* in I - III into forms transitional to *Aegoceras* in IV. (6) The assemblages are at every level strictly monobiospecific. Taken together, these are all the characteristics typical of monophyletic, sexually dimorphic, monobiospecific successions of ammonites as now so widely recognized in the Middle and Upper Jurassic. Further equally convincing examples have now been demonstrated in new collections, kept in the National Museum of Wales, Cardiff, made by Martin Foster from two sharply-defined horizons in the higher Davoei Zone of Dorset. The final proof of the genetic coupling between the large cadicone/hybrid macroconchs and the smaller serpenticone microconchs can be seen in the youngest forms at the top of the Davoei Zone, conventionally separated generically as *Oistoceras.* In these, the ribbing on the venter of the capricorn whorls has become strongly projected into chevrons in both macro- and microconchs.

It is the purpose of the present account to describe yet another example of such a monobiospecific transient in the evolving lineage of the Liparoceratidae, one from the Lias of Munteana. Its special significance lies in its characterisation of the forms from a level hitherto unknown anywhere else. The formal nominal taxonomy adopted at generic and higher levels will be the conventional one, which readers may change as they wish. The specimens are in the collections of the Geology Department, University of Bucharest, serial numbers prefixed UBLG-RG. [M], [m] refer to macro- and microconch dimorphs respectively.

Genus ***Liparoceras*** Hyatt, 1867
Type species *L. bronni* Spath, 1938 (p.38)
including *Androgynoceras* Hyatt, 1867
Type species *Amm. hybrida* d'Orbigny, 1844

[It is important for the interpretation of *Androgynoceras* to be aware of the correct form of its type species. The lectotype, designated by Spath (1938, p. 111), is the specimen represented by d'Orbigny's pl. 85, figs. 1-3, reproduced in the *Treatise*, p. L252, fig. 278.4a,b. Spath figured a cast (1938, pl. 26, fig. 2) sent to him from Paris of what was taken to be the specimen on which d'Orbigny's lectotype figure was based, although it bore little resemblance to the latter. Subsequent investigation by Tintant & Mouterde (1974, repeated in 1994) showed that the cast was of another specimen that had never been a syntype, hence not eligible to be lectotype. They had concluded that d'Orbigny's lectotype specimen was lost, but that there were other specimens in the collections, not so far figured, that closely resembled the lectotype figure, which could therefore be taken as a reliable guide to the interpretation of the species. They also suggest that the holotype of *Androgynoceras subhybrida* Spath, 1938, pl. 9, fig. 1a, is sufficiently close also to be taken as a guide.]

***Liparoceras carpathicum*** sp. nov. [M]
(Plate 1, Plate 2, figs 1a-c, Plate 3, Plate 4, figs 1a,b, Plate 5, figs 1a-c)

**Material**: 5 specimens;
# 1 holotype: RG 0125, Pl. 1, figs 1a-d, phragmocone with 0.2 whorl bodychamber
2 paratype 1: RG 0126, Pl. 2, figs. 1a-c, wholly septate, nearly complete phragmocone
3 paratype 2: RG 0129, Pl. 5, figs 1a-c, wholly septate,
4 paratype 3: RG 0127, Pl. 3, figs 1a-c, complete phragmocone
5 – RG 0128, Pl. 4, figs 1a-b, fragment to last septum, some bodychamber

| **Dimensions**: | $D_{ph}$/mm | *h* | *w* | *u* | *w/h* | ribs |
|---|---|---|---|---|---|---|
| # 1 | 115 | 0.43 | 0.56 | 0.28 | 1.29 | 16 |
| 2 | 120 (1) | 0.43 | 0.56 | 0.28 | 1.29 | 22 |
| 3 | (80)(2) | 0.43 | 0.52 | 0.33 | 1.20 | 20 |
| 4 | 120 | 0.43 | 0.55 | 0.33 | 1.28 | 30 (3) |
| 5 | ? 150(4) | 0.43 | 0.43 | 0.30 | 1.0 | – |

$D_{ph}$: diameter of phragmocone at last septum; *h = H/D, w = W/D, u = U/D*, coefficients of whorl-height, *H*, whorl-width, *W*, and umbilical width, *U*, at some diameter *D* at or close to $D_{ph}$.

(1) estimated, assuming the end of the preserved umbilical seam lies at the last septum; measurements at diameter 100 mm. (2) wholly septate, incomplete. (3) estimated from the number on the last half-whorl. (4) estimated from superposition on a model spiral obtained from the other specimens with a spiral half-whorl constant $\rho(\pi) = 1.5$. With bodychambers of about 0.7 whorl seen in other species, the final total diameters of these shells would have been in the range of 210-250 mm.

**Description**: Overall, a classical example of forms transitional from *Liparoceras* to *Androgynoceras*. A large species; inner whorls evolute, with capricorn ribbing, changing from diameters around 25-30 mm to inflated outer whorls with high, subquadrate, depressed section and a flat or gently rounded venter, the flanks bordered by a double row of nearly paired tubercles and dense secondary ribbing on the venter. The characteristic features of particular note shared by all of the specimens are the shallow slope of the umbilical wall, putting the dominating, inner row of lateral tubercles high on the whorl-side and the less prominent outer row at the latero-ventral edge, and the under-square, depressed, angular whorl-section at the end of the phragmocone. Within these parameters, the ranges of variability of ribbing density and dimensions as shown in the Table are within those seen in other transients.

**Comparisons**: There is a close resemblance to some of the early 'hybrids' described by Spath (1938), from Kilsby and Napton in the English Midlands, 40-50 km NE of Blockley. Those from Kilsby match those from faunas II - IV at Blockley, those at Napton mainly IV. The closest is *L. kilsbiense* var. *aperta* Spath (pl. 4, fig. 1) (*non L. kilbiense* itself, holotype pl. 4, fig. 2, probably fauna II), which has also been found at Blockley, fauna IV. Next closest would be *L. naptonense* Spath (pl. 6, fig. 1a,b), but this is smaller, less depressed and more round-whorled. It may be from somewhat younger beds. Inner whorls showing the transition from capricorn to liparoceratid sculpture may be seen in *L*. aff. *naptonense* (pl. 9, fig. 7) and *L*. aff. *geyeri* (pl. 10, fig. 4). Fully-formed hybrids that are as large as *L. carpathicum* are found higher, in the middle Davoei Zone, exemplified by *L. divaricosta* Trueman (Spath, pl. 5, fig.1) and *L. subcontractum* Spath (pl. 15, fig. 1). But they have acquired a substantially different style of ribbing.

Further abroad, remarkably little material of value for present purposes has been described. Either specimens are isolated finds, or incomplete, or from stratigraphically imprecisely known horizons. Nowhere has an isochronous assemblage of *Liparoceras* been found that suffices to characterize a single biospecific transient. The nearest would be a fauna described by Meister (1986) from Bondons in the French Causses: *L. kilsbiense* (pl. 11, fig. 6) and *L. naptonense* (pl. 13, fig. 5), but they are from a condensed bed spanning the whole of the Davoei Zone.

**Age**: Somewhere in the region of the boundary between the Ibex and Davoei Zones. As in so many cases, this zonal boundary has not so far been formally defined in a type section, although a candidate is now available on the Yorkshire coast, in a classical section at Robin Hood's Bay, recently redescribed by Howarth (2002). The boundary lies between the Luridum Subzone of the Ibex zone below (Dean et al. 1961) and the Maculatum Subzone of the Davoei Zone above. The fauna IV at Blockley has always been included still in the Luridum Subzone on the strength of its small microconch aegoceratid capricorns, *Beaniceras*. cf. or aff. *luridum* (Simpson). The capricorns associated with the present assemblage (see below) suggest a slightly younger age. On balance, therefore, the age seems best assigned to a point in the lower part of the Maculatum Subzone of the Davoei Zone (Tab. 1).

| | | ZONES | SUBZONES | Index species |
|---|---|---|---|---|
| PLIENSBACHIAN | DOMERIAN | **Spinatum** | **Hawskerense**<br>**Apyrenum** | *Pleuroceras hawskerense* (Young & Bird)<br>*Pleuroceras apyrenum* (Buckman) |
| | | **Margaritatus** | **Gibbosus**<br>**Subnodosus**<br>**Stokesi** | *Amaltheus gibbosus* (Schlotheim)<br>*Amaltheus subnodosus* (Young & Bird)<br>*Amaltheus stokesi* (J. Sowerby) |
| | CARIXIAN | **Davoei** | **Figulinum**<br>**Capricornus**<br>**Maculatum** | *Oistoceras figulinum* (Simpson)<br>*Aegoceras capricornus* (Schlotheim)<br>*Aegoceras maculatum* (Young & Bird) |
| | | **Ibex** | **Luridum**<br>**Valdani**<br>**Masseanum** | *Beaniceras luridum* (Simpson)<br>*Acanthopleuroceras valdani* (d'Orbigny)<br>*Tropidoceras masseanum* (d'Orbigny) |
| | | **Jamesoni** | **Jamesoni**<br>**Brevispina**<br>**Polymorphus**<br>**Taylori** | *Uptonia jamesoni* (J. de C. Sowerby)<br>*Platypleuroceras brevispina* (Sowerby)<br>*Polymorphites polymorphus* (Quenstedt)<br>*Phricodoceras taylori* (J. de C. Sowerby) |

Table 1. The Zones and Subzones of the Pliensbachian Stage in the standard NW European chronostratigraphical scale. Index-species for zones: Spinatum: *Pleuroceras spinatum* (Bruguière); Margaritatus: *Amaltheus margaritatus* de Montfort; Davoei: *Prodactylioceras davoei* (J. Sowerby); Ibex: *Tragophylloceras ibex* (Quenstedt); Jamesoni: *Uptonia jamesoni* (J. de C. Sowerby).

Genus ***Aegoceras*** Waagen, 1869
Type species *Amm. capricornus* Schlotheim, 1820
[ = *Amblycoceras* Hyatt, 1900 (obj.)]

Early forms: *Beaniceras* Buckman, 1913: Ibex Zone
type species *Amm. luridus* Simpson, 1855
Late forms: *Oistoceras* Buckman, 1911: Davoei Zone, Figulinum Subzone
type species *Amm. figulinus* Simpson, 1855

***Aegoceras carpathicum*** sp. nov. [m]
(Plate 5, figs 3, 4, 5, 6)

**Material**: 4 specimens;
# 1 holotype: RG 0134, Pl. 5, figs 3a, b, complete adult
2 paratype 1: RG 0136, Pl. 5, figs 5a, b, complete adult
3 paratype 2: RG 0137, Pl. 5, figs 6a, b, adult, nearly complete bodychamber
4 - RG 0135, Pl. 5, figs 4a, b, adult, nearly complete bodychamber

| **Dimensions**: | $D_{max}$/mm | $h^{(1)}$ | $w^{(2)}$ | $u^{(3)}$ | *w/h* | ribs |
|---|---|---|---|---|---|---|
| # 1 | 34 | 0.30 | 0.33-0.45 | 0.38 | 1.1-1.5 | 18 |
| 2 | 42 | 0.32 | 0.35-0.46 | 0.46 | 1.1-1.4 | c.16? |
| 3 | 37 | 0.30 | 0.4 | - | - | c.20? |
| 4 | 35 | - | - | - | - | - |

$D_{max}$: maximum diameter at the aperture. - (1) measured at about half a whorl back from the aperture; (2) the same, between and across the ribs respectively; (3) as (1), estimated.

**Description and comparisons**: Typical capricorns, showing the variability in all characters seen at almost every level in the Ibex and Davoei Zones, including the slight modification of the ribbing and coiling near the aperture, diagnostic of the mature adult stage in ontogeny. The size is relatively small, comparable to the forms of *Beaniceras luridum* found in fauna IV at Blockley placed still in the Luridum Subzone of the Ibex Zone, but the ribbing has changed. In *Beaniceras* it weakens on the venter, which becomes rounded on the adult bodychamber. In the present species, the ribbing on the venter becomes if anything accentuated, consisting of coarse, single, collar-like ribs dividing in some cases into pairs. Such kinds of accentuated ribs are sometimes also found in later transients of the Maculatum and Capricornus Subzones. In the youngest forms, they then develop a pronounced forward swing forming chevrons, characteristic of the conventional morphogenus *Oistoceras*. Of this there is here so far no sign.

A specimen from Munteana of a later form, *Ae.* cf. *capricornus* Schlotheim), was figured by Popa, in Popa & Patrulius (1996), pl.2, figs.2a,b.

**Age**: The capricorns by themselves are not closely time-diagnostic. The present assemblage combines the relatively small size of the last forms of *Beaniceras* in the Luridum Subzone with the coarse, strong ribbing found in the early forms of the overlying Maculatum Subzone of the Davoei Zone. These features together suggest a position low in the Maculatum Subzone, which is supported by the evidence of the macroconchs, of *Liparoceras,* described above.

**Some other specimens from the collection**

Family **POLYMORPHITIDAE** Haug, 1887

***Uptonia*** sp.
(Plate 4, fig. 2)

One fragment of bodychamber, RG 0131, not more closely determinable. Early Pliensbachian, Jamesoni Zone.

Family **AMALTHEIDAE** Hyatt, 1867

***Amaltheus stokesi*** (J. Sowerby, 1818) [M]
(Plate 2, fig. 2)

Half of a shell of a macroconch formerly c.110mm in diameter, RG 0130, agreeing in detail with the holotype (refigured by Howarth, 1958, pl. 1, figs. 7a,b. One of the most cosmopolitan species in the northern palaeohemisphere. Late Pliensbachian (Domerian), Margaritatus Zone, Stokesi Subzone.

***Pleuroceras* cf. *spinatum*** (Bruguière, 1789)
(Plate 4, figs 3 a, b)

A small microconch with some bodychamber, RG 0132. Also a much-described common species, the lectotype was figured by Howarth (1959, p. 38, text-fig. 14). Many other variants have been described in the literature under a wide range of different specific names. The macroconch is *P. hawskerense* (Young & Bird, 1828) (lectotype figured by Buckman, 1923, *Type Ammonites*, pl. 408, designated by Howarth, *id*., p. 45). Late Domerian, Spinatum Zone, Hawskerense Subzone.

Family **HILDOCERATIDAE** Hyatt, 1867

***Hildoceras bifrons*** (Bruguière, 1789)
(Plate 5, figs 2a-c)

A phragmocone with the beginning of the bodychamber, RG 0133. One of the commonest and most widespread species of the Early Toarcian, middle Bifrons Zone, Fibulatum Subzone.

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## CAPTIONS OF PLATES

All figures natural size. [M], [m]: macro- and microconch dimorphs respectively. An arrow indicates the last septum of the phragmocone and the onset of the bodychamber, where appropriate.

**PLATE 1**
Figs 1 a-d - ***Liparoceras carpathicum*** sp. nov. [M]. Holotype (RG 0125), adult phragmocone with a part of the bodychamber preserved. Note the beginning of the uncoiling of the umbilical seam as indication of adult maturity. Probably Upper Carixian, lower Davoei Zone, Maculatum Subzone (see text).

**PLATE 2**
Figs 1 a-c - ***Liparoceras carpathicum*** sp. nov. [M]. Paratype 1 (RG 0126), adult phragmocone.
Fig. 2 - **Amaltheus stokesi** (J. Sowerby) [M]. Half a septate shell (RG 0139), matching the holotype almost exactly. Upper Domerian, Spinatum Zone.

**PLATE 3**
Figs 1 a-c - ***Liparoceras carpathicum*** sp. nov. [M]. Paratype 3 (RG 0127), phragmocone complete up to the last septum; a variant with dense tubercles on the middle whorls.

**PLATE 4**
Figs 1 a-b - ***Liparoceras carpathicum*** sp. nov. [M]. Fragment (RG 0128) preserving the last part of the phragmcone and the onset of the bodychamber.
Fig. 2 - ***Uptonia* sp.** indet. Fragment of a bodychamber (RG 0131). Lower Carixian, Jamesoni Zone.
Figs 3 a-b - ***Pleuroceras* cf. *spinatum*** (Bruguière) [m]. A small variant with some bodychamber (RG 0132). Upper Domerian, Spinatum Zone.

**PLATE 5**
Figs 1 a-c - ***Liparoceras carpathicum*** sp. nov. [M]. Paratype 2 (RG 0129), wholly septate, somewhat corroded on one side.
Figs 2 a-c - ***Hildoceras bifrons*** (Bruguière), phragmocone with onset of bodychamber (RG 0133). Lower Toarcian, middle Bifrons Zone.
Figs 3-6 - ***Aegoceras carpathicum*** sp. nov. [m]. Figs 3 a-b: holotype (RG 0134), complete adult; note slight modification of the ribbing at the aperture, indicating maturity. Figs 4 a-b: bodychamber of another complete adult (RG 0135), somewhat distorted. Figs 5 a-b: paratype 1 (RG 0136), complete bodychamber of another mature adult, extremely coarsely ribbed variant. Figs 6 a-b: paratype 2 (RG 0137), another nearly complete adult bodychamber.
For those wishing to accommodate putative dimorphs of a single species in the same taxon, *Aegoceras* [m] would be subsumed into *Liparoceras* [M] and *Ae. carpathicum* would become *Liparoceras carpathicum* [m].

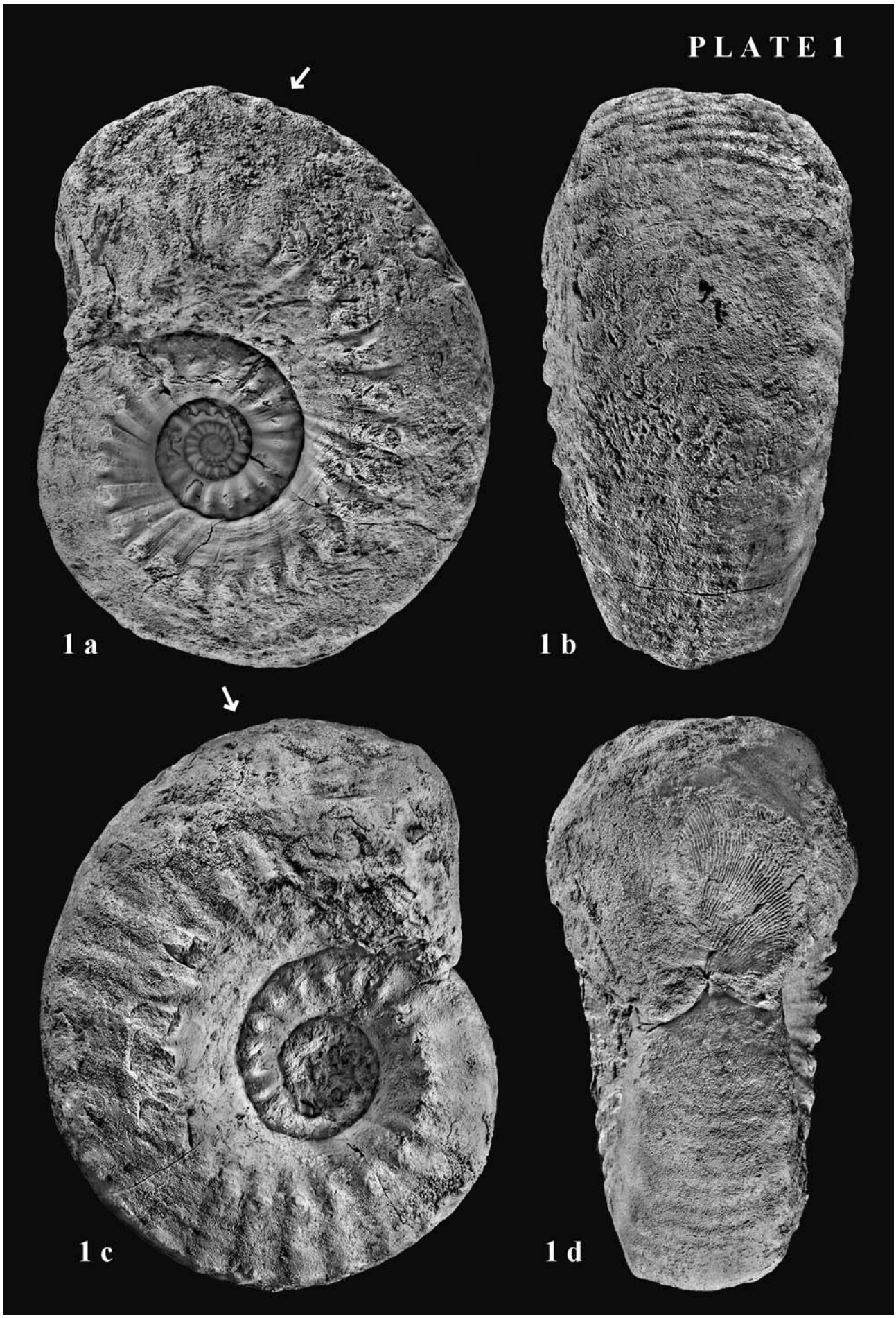
PLATE 1
1 a
1 b
1 c
1 d

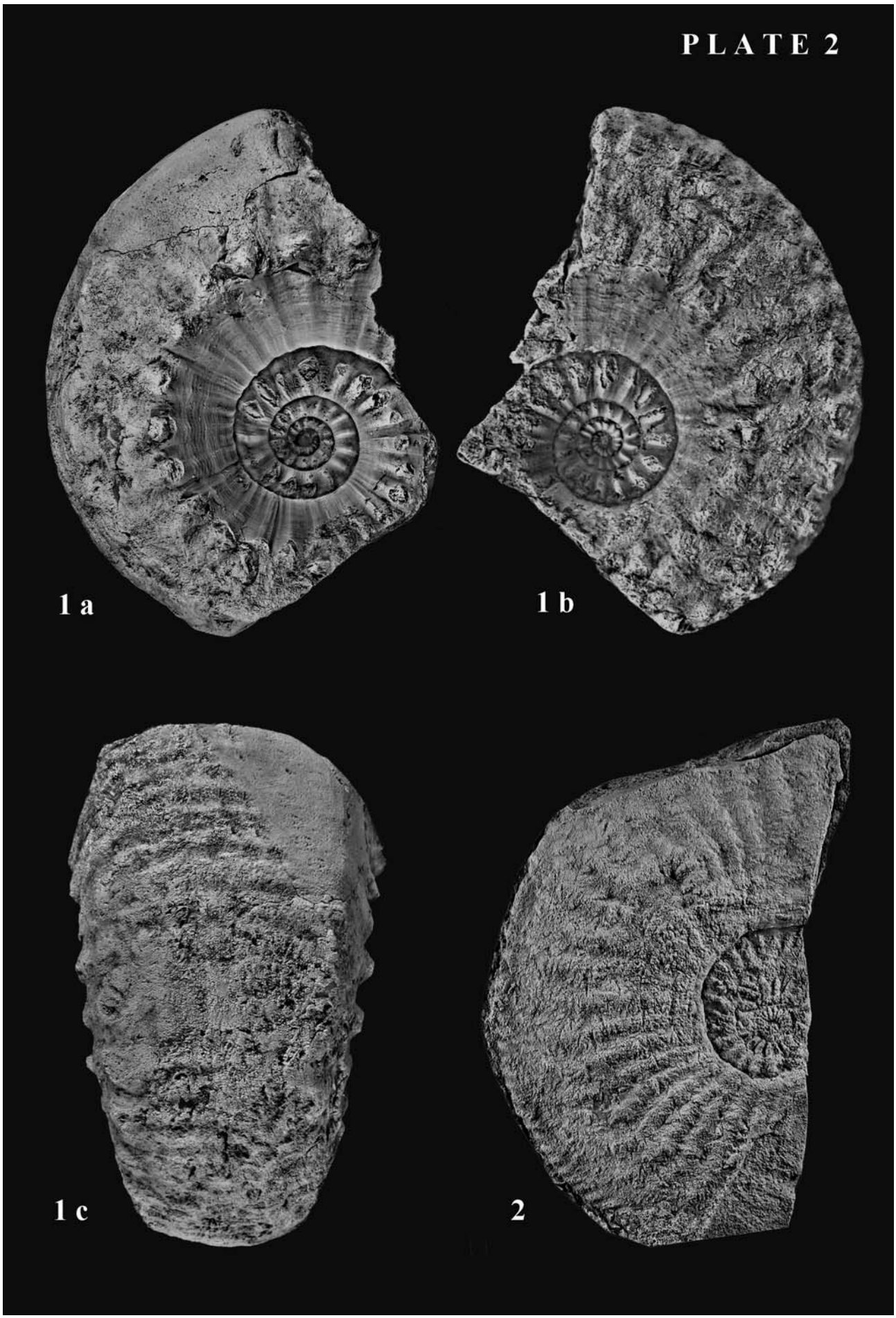
PLATE 2
1 a
1 b
1 c
2

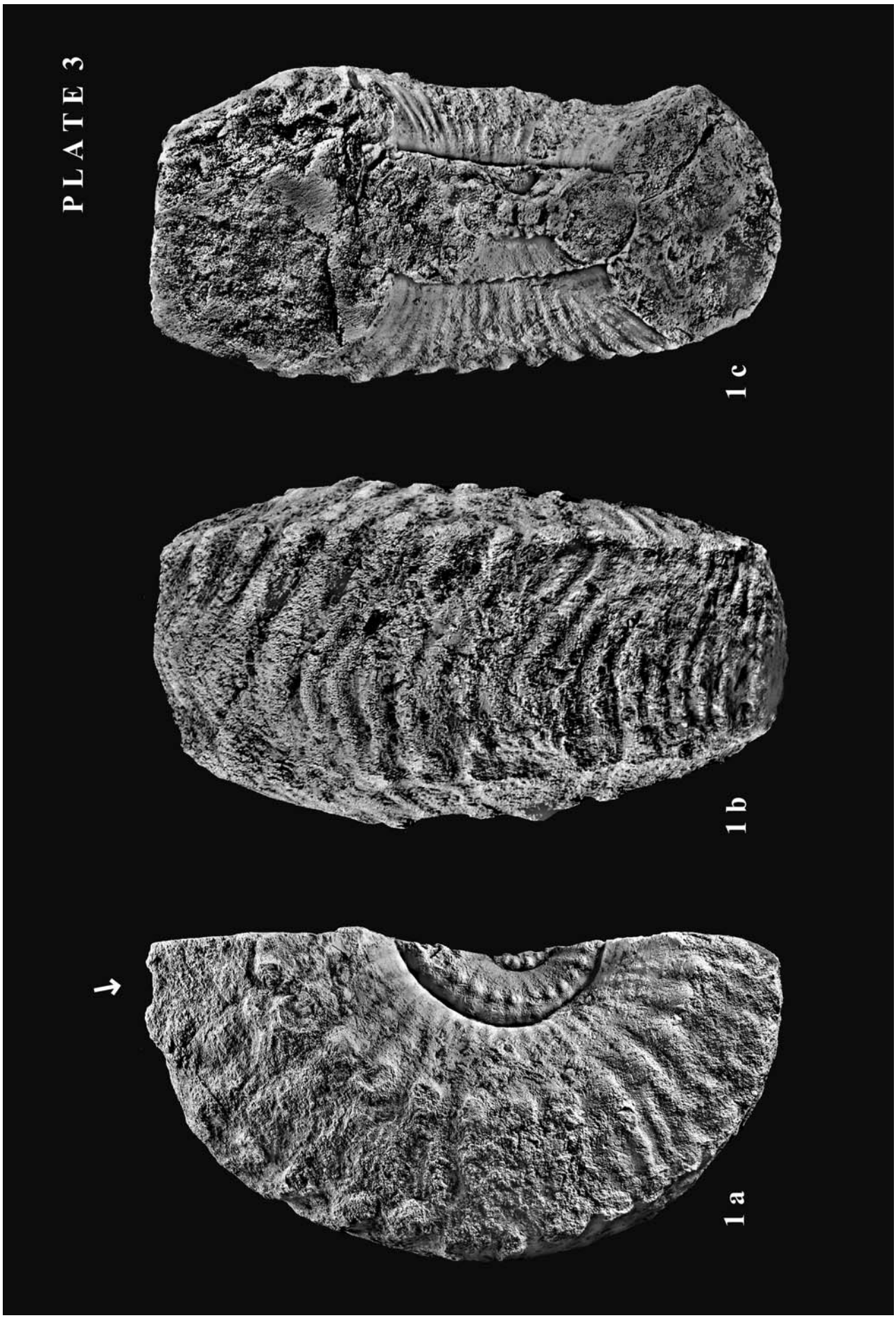
PLATE 3
1 a
1 b
1 c

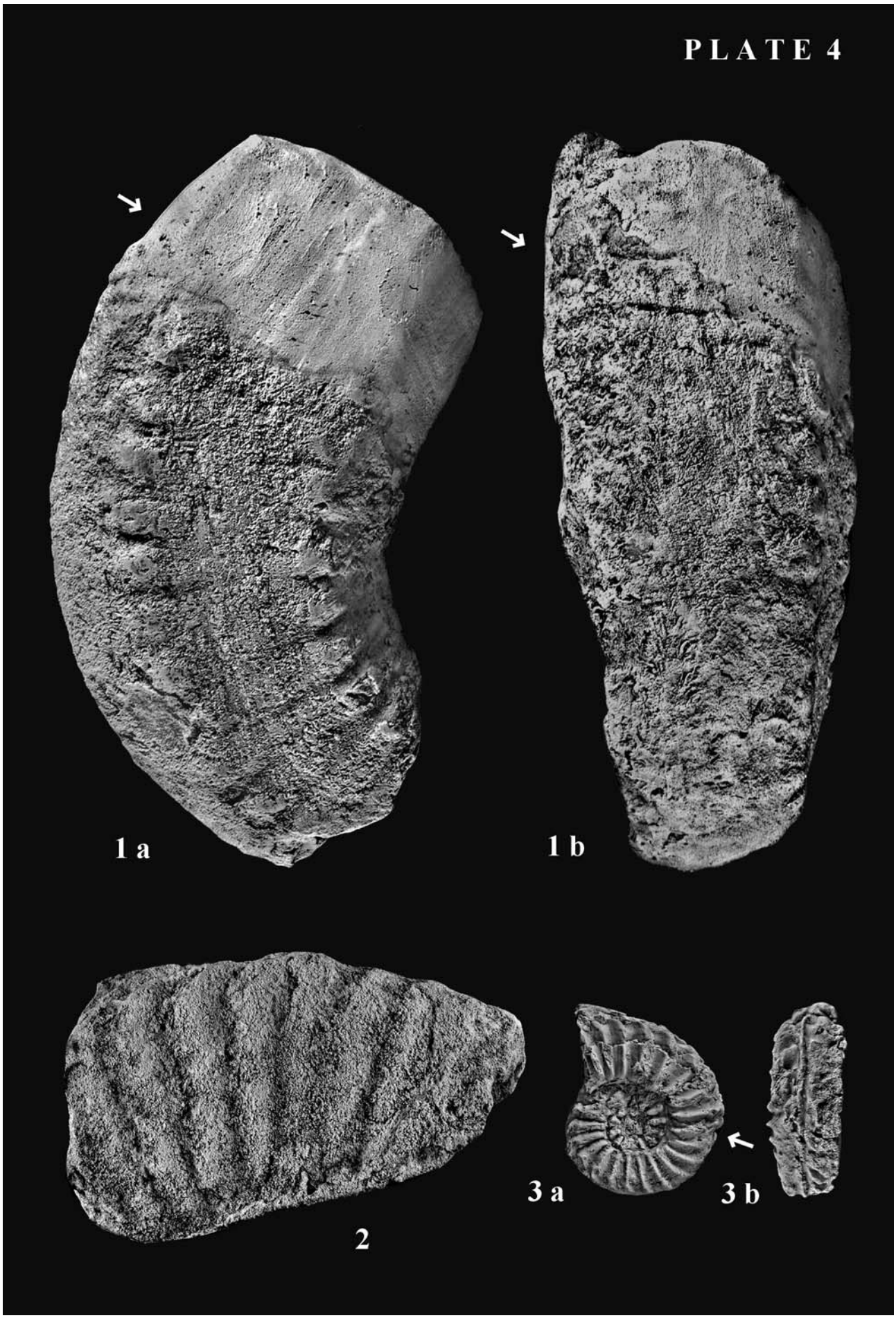
PLATE 4
1 a
1 b
2
3 a
3 b

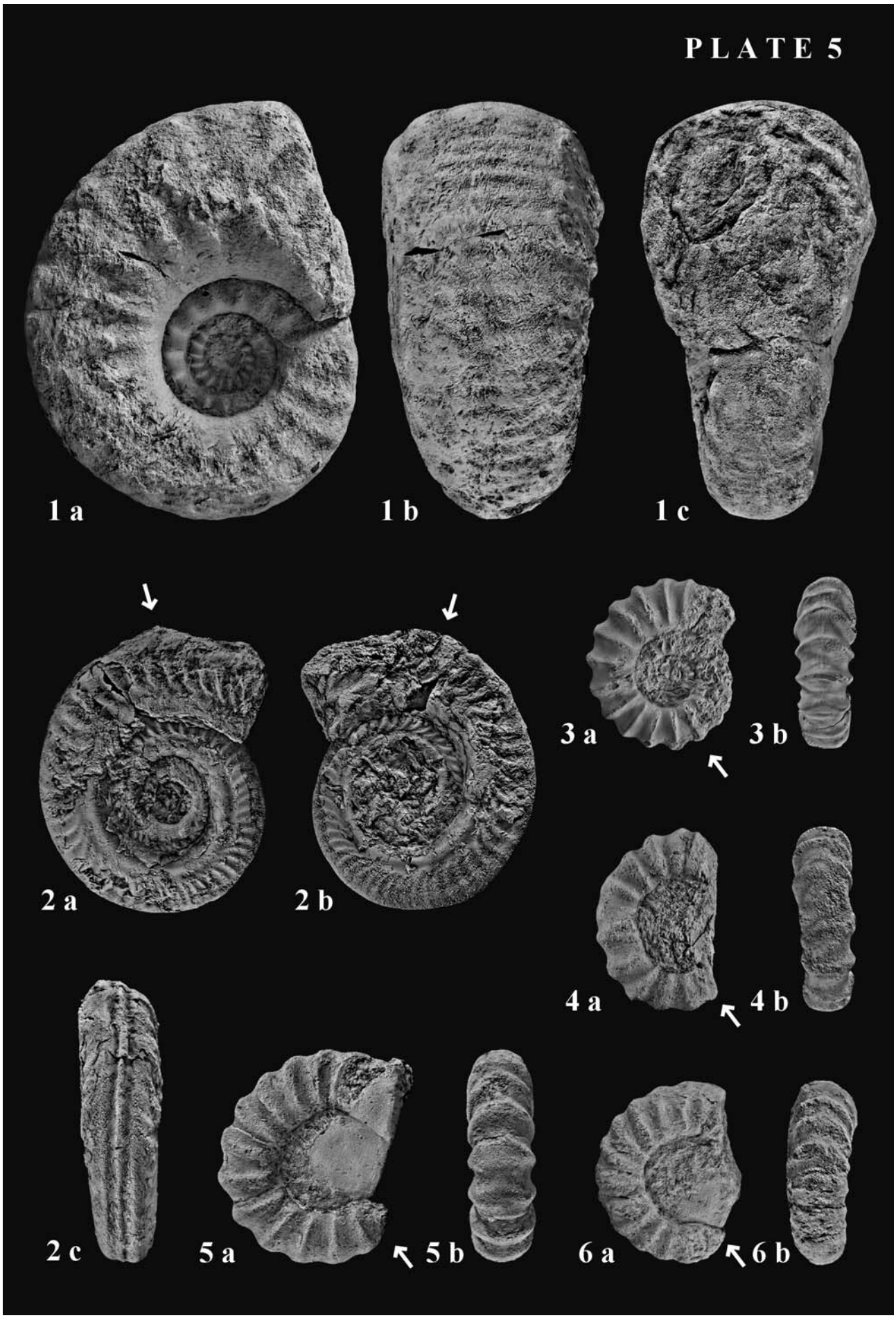
PLATE 5
1 a
1 b
1 c
2 a
2 b
3 a
3 b
4 a
4 b
2 c
5 a
5 b
6 a
6 b