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Upper Albian, Cenomanian and Upper Turonian ammonite faunas from the Fahdène Formation of Central Tunisia and correlatives in northern Algeria

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ABSTRACT:

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Over 130 species are documented from the Upper Albian, Cenomanian and Upper Turonian Fahdène Formation and correlatives in Central Tunisia and northern Algeria, based on material described by Henri Coquand (1852, 1854, 1862, 1880), Léon Pervinquière (1907, 1910), Georges Dubourdieu (1953), Jacques Sornay (1955), and new collections. The material consists predominantly of limonitic nuclei, together with adults of micromorphs. There is no continuous record, and a series of faunas are recognised that can be correlated with the zonation developed in Western Europe. These are the Upper Albian *Ostlingoceras puzosianum* fauna, Lower Cenomanian *Neostlingoceras carcitanense* and *Mariella* (*Mariella*) *harchaensis* faunas, the upper Lower to lower Middle Cenomanian *Turrilites scheuchzerianus* fauna, Middle Cenomanian *Calycoceras* (*Newboldiceras*) *asiaticum* fauna, Upper Cenomanian *Eucalycoceras pentagonum* fauna, and the Upper Turonian *Subprionocyclus neptuni* fauna. Two new micromorph genera are described, *Coquandiceras* of the Mantelliceratinae and *Cryptoturrilites* of the Turrilitinae. Most of the taxa present have a cosmopolitan distribution, with a minority of Boreal, North American and endemic taxa.

Key words: Ammonites; Cretaceous; Albian; Cenomanian; Turonian; Algeria; Tunisia.

INTRODUCTION

The origins of this contribution go back more than fifty years. It began in the spring of 1959 at the *Colloque sur le Crétacé Supérieur Française*, when the late Jake Hancock (1928–2004) and the late Jost Wiedmann (1931–1993) disputed on the affinities of the nuclei assigned to *Submantelliceras* Spath, 1923: were they the nuclei of *Mantelliceras* Hyatt, 1903, or *Graysonite*s Young, 1958 (Basse de Menorval 1960, p. 807)? In order to investigate the subject, Hancock (at that time my doctoral thesis supervisor) applied for and was awarded a grant from the then Natural Environment Research Council to purchase a long-wheel base Land Rover, and drive to northern Algeria and Central Tunisia (via Marseille and Algiers) to investigate the classic localities of Coquand (1852, 1854, 1862, 1880), Péron (1866, 1883, 1896–1897), Thomas and Péron (1889–1893) and Pervinquière (1903, 1907, 1910), together with those in the Monts du Mellègue (Dubourdieu 1953, 1956; Dubourdieu and Sigal 1949; Sornay 1955) that straddle the Algeria/Tunisia boundary. Our first visit to Algeria and Tunisia took place between March 31st and April 22nd 1965. The trip was not without incident not least of which was my rolling over the Land Rover in northern France. We persisted, however, and arrived in Algiers. A visit to the British Consulate to seek advice on logistics

led to firm advice to return to the United Kingdom forthwith. We persisted, and carried out fieldwork in the area between Berrouaghia and Sour El-Ghozlane (formerly known as Aumale: Péron 1866), made classic by Pervinquière (1910) on the basis of material collected by Phillipe Thomas, Alphonse Péron, and others, with slight results. Continuing to the Monts du Mellège, we left Algeria to discover that the border zone, including some of Dubourdieu's localities, was a sort of no man's land several kilometres wide, bounded by barbed wire and minefields, set up during the Algerian War of Independence (1954–1962). Key outcrops were unvegetated, and strewn with tiny limonitic fossils. In contrast, when revisited in 1984, many of these outcrops were under cultivation, and fossil collecting no longer possible.

It had been Jake Hancock's intention to describe these faunas in his retirement. He handed them over to me shortly before his death in 2004, but only now, more than 50 years after our original collecting, are they described. In what follows, details of localities and outcrops are based on Hancock's field notebooks; his annotated field maps are, sadly, lost; my contribution was to collect the fossils. And the solution to the disagreement between Hancock and Wiedmann? Both were correct to a degree. Some of the limonitic nuclei are *Mantelliceras*; some are *Graysonites*, but the type species of *Submantelliceras* is a paedomorphic dwarf.

PREVIOUS WORK

Limonitic ammonite nuclei of Cretaceous ammonites from north-eastern Algeria were described by Henri Coquand in a series of publications (Coquand 1852, 1854, 1862, 1880). Many species were described, but few were figured. This was partially remedied by Charles Heinz, who, in 1886, produced five photographic plates of fossils described by Coquand. The subsequent history of Coquand's collections is discussed by Szives and Company (2011). They were purchased, on Coquand's death, by Count Andor Semsey in 1882, and presented to the Hungarian Geological Institute. Some of these specimens were described and figured by Pervinquière (1910), who stated them as being in the 'Musée de Budapesth'. I first studied this material in the summer of 1965, when it was housed in the Geological Institute, Nepstadion Korut, Budapest. By the time of a second visit in 1985, the material had been transferred to a field station at Sümeg, where I was able to describe and photograph most of Coquand's specimens that were described and figured by Pervinquière in 1910. Some of this work was published and specimens refigured in Kennedy and Wright (1981, 1984a, b), Wright and Kennedy (1978, 1979, 1996, 2015) and Kennedy *et al*. (2005). The Coquand Collection was subsequently returned to Budapest and is currently housed in the Geological Museum of Hungary according to Szives and Company (2011), but not all of the material I examined in 1985 has been traced.

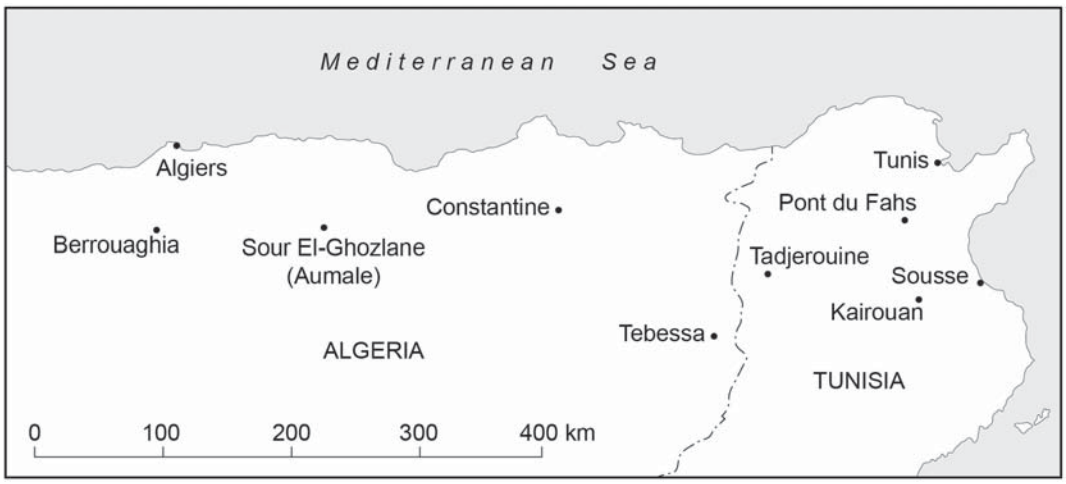
Mid-Cretaceous ammonites from Central Tunisia were described and figured by Pervinquière (1907), and his material deposited in the Sorbonne Collections, thereafter transferred to the basement store below the Université Pierre et Marie Curie (Paris VI), where I first studied it in the 1980's. The specimens are now in the collections of the Laboratoire de Paléontologie of the Muséum national d'Histoire Naturelle, immaculately documented and illustrated in the Muséum's online catalogues. The larger specimens, from limestone sequences, and some of the tiny limonitic specimens were described and figured by Kennedy and Wright (1981, 1984a, b), Wright and Kennedy (1984, 1994, 1995, 1996), Kennedy (2004), and Kennedy and Gale (2015). Material from the Monts du Mellègue was described by Dubourdieu and Sigal (1949), Dubourdieu (1953), and Sornay (1955). Originally deposited in the Collections of the Collège de France, much of the described material is lost (letter from Jacques Sigal, circa 1985). The Lower Albian material, now housed in the collections of the Université Claude Bernard Lyon I, was revised by Kennedy and Klinger (2008a) and Latil (2011); material described by Sornay (1955) is housed in the same institution.

Material from areas in Central Tunisia outside those covered by the present contribution is described in Robaszynski *et al*. (1993, 1994, 2004, 2008).

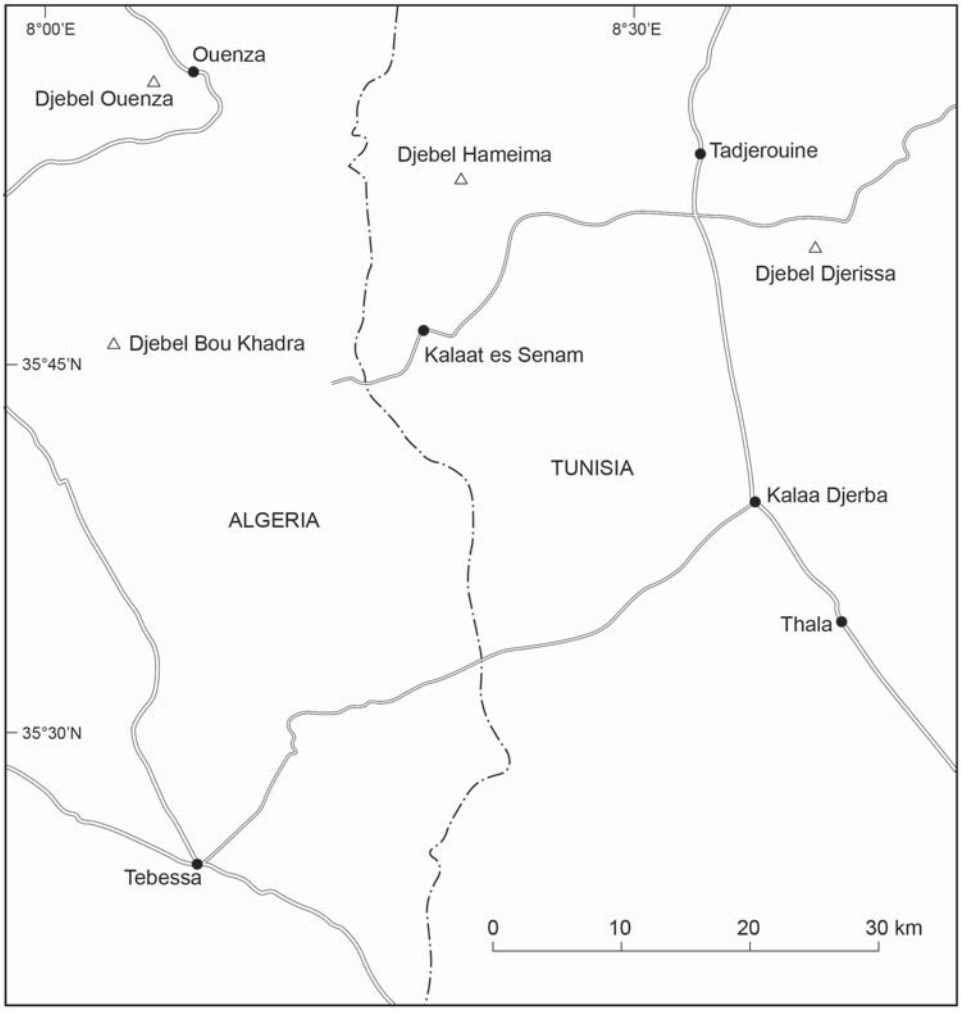
LITHO- AND BIOSTRATIGRAPHY

The present collections mainly come from isolated outcrops of the Fahdène Formation of Burrolet (1956) and correlatives in Central Tunisia and adjacent parts of north-eastern Algeria (Text-figs 1, 2); the reader is referred to the reviews of previous work in Robaszynski *et al*. (1994), Touir *et al*. (2005), contributions in Arnaud-Vanneau and Zghal (2005), and Latil (2011). The key references for localities in the Monts du Mellègue (the source of many of the fossils described below) are the works of Dubourdieu (1953, 1956; in Sornay 1955).

A discontinuous sequence of faunas is assigned to the zonal and subzonal sequence developed in Western Europe (Text-fig. 3; Kennedy and Gale in Wright and Kennedy 2017). The ill-defined *Arrhaphoceras*



Text-fig. 1. Locality map, northern Algeria and Central Tunisia. The classic faunas from Algeria described by Pervinquière (1910), collected by Phillipe Thomas, Alphonse Peron and others came from between Berrouaghia and Aumale in Algeria, the latter now known as Sour El-Ghozlane. The Monts de Mellègue, source of much of the material described herein, lies in western central Tunisia and adjacent parts of Algeria to the west of Tadjerouine (Text-fig. 2)



Text-fig. 2. Locality map, eastern Central Tunisia and adjacent parts of north-eastern Algeria

SUBSTAGE	ZONE, WESTERN EUROPE	FAUNA, PRESENT STUDY
UPPER CENOMANIAN	*Neocardioceras juddii*	
	Metoicoceras geslinianum	
	Calycoceras (*P.*) *guerangeri*	*pentagonum*
MIDDLE CENOMANIAN	*Acanthoceras jukesbrownei*	*asiaticum*
	Acanthoceras rhotomagense	
	Cunningtoniceras inerme	*scheuchzerianus*
LOWER CENOMANIAN	*Mantelliceras dixoni*	
	Mantelliceras mantelli	*carcitanense* and *harchaensis*
UPPER ALBIAN (part)	*Pleurohoplites briacensis*	
	Pervinquiera (*S.*) *perinflata*	*puzosianum*
	Pervinquiera (*S.*) *rostrata*	

Text-fig. 3. Ammonite faunas recognized in the present study correlated with the upper Upper Albian and Cenomanian ammonite zones recognized in Western Europe

briacensis Zone that spans the Albian–Cenomanian boundary in the Global boundary Stratotype Section (Kennedy *et al*. 2004) is equivalent to the *Stoliczkaia* (*Shumarinaia*) *africana* partial Range Zone for the interval between the last occurrence of *Pervinquieria* (*Subschloenbachia*) *perinflata* (Spath, 1922) and *Mantelliceras mantelli* (J. Sowerby, 1814), following Robaszynski *et al*. (1993, 1994, 2008); see discussion in Kennedy and Gale (2017), who review the correlation of this scheme which was developed in the area east of Kalaat Senan and south of Le Kef in Tunisia (Text-fig. 2).

THE SEQUENCE OF FAUNAS

Upper Upper Albian *Ostlingoceras puzosianum* fauna

The fauna is characterised by the occurrence of *Ostlingoceras puzosianum* (d'Orbigny, 1842), with common *Cantabrigites spinosum* (Pervinquière, 1907), *Stoliczkaia* (*Stoliczkaia*) *clavigera* (Neumayr, 1875), *Stoliczkaia* (*Shumarinaia*) *africana* (Pervinquière, 1907), and abundant *Lechites* (*Lechites*) *moreti* Breistroffer, 1936. The fauna is correlated with the *Pervinquieria* (*Subschloenbachia*) *perinflata* Zone on the basis of records from the Montlaux section in Hautes-Alpes, France (Kennedy and Latil 2007), where the index species first appears immediately above the last occurrence of *Pervinquieria* (*Subschloenbachia*) *rostrata* (J. Sowerby, 1817) and just below the first occurrence of *P.* (*S.*) *perinflata* (Spath, 1922).

Lower Lower Cenomanian *Neostlingoceras carcitanense* fauna

The fauna is characterised by the common occurrence of the index species, associated with common *Mantelliceras saxbii* (Sharpe, 1857), *Algerites sayni* (Pervinquière, 1910), *Algerites ellipticus* (Mantell, 1822), and *Sciponoceras roto* Cieśliński, 1959. Correlation with the *carcitanense* subzone of the standard zonation is based on the common occurrence of the index species.

Lower Lower Cenomanian *Mariella* (*Mariella*) *harchaensis* fauna

The fauna is characterised by abundant *Mariella* (*Mariella*) *harchaensis* Dubourdieu, 1953, together with *Neophylicticeras algeriense* sp. nov., *Graysonites elegans* sp. nov., and *Idiohamites alternatus* (Mantell, 1822), and the absence of *Neostlingoceras carcitanense*. The presence of *I. ellipticus* and *Neostlingoceras oberlini* (Dubourdieu, 1953) indicate correlation of the fauna with the *carcitanense* Sub-

zone of the *mantelli* Zone, but its position in relation to the *carcitanense* fauna cannot be established.

Upper Lower to lower Middle Cenomanian *Turrilites scheuchzerianus* fauna

This fauna is problematic. In the well-constrained succession of clays, marls and nodular limestones at Dour el Khiania, 4 km north of Bou Khadra in north-eastern Algeria (Kennedy and Gale 2017), *Turrilites scheuchzerianus* (Bosc, 1801) is lower Middle Cenomanian, first appearing in association with *Cunningtoniceras africanum* (Pervinquière, 1907), and has a last occurrence in association with *Acanthoceras rhotomagense* (Brongniart, 1822). This corresponds to the *inerme* Zone and lower part of the *costatus* Subzone of the *rhotomagense* Zone (Text-fig. 3). In contrast, in well-constrained sections in southern England such as Southerham (Kennedy and Gale 2017, text-fig. 9) it ranges from the upper Lower Cenomanian *dixoni* Zone to the top of the lower Middle Cenomanian *inerme* Zone, with scattered occurrences elsewhere as high as the upper Middle Cenomanian *jukesbrownei* Zone. The *scheuchzerianus* fauna is interpreted as representing the acme of the species, and co-occurrence with *Mantelliceras mantelli* (J. Sowerby, 1814) north of Sour El-Ghosliane and with *Acanthoceras rhotomagense* east of Djebel Sottara (Pl. 26, Figs 12–14) show it to span the Lower/Middle Cenomanian boundary.

Lower Middle Cenomanian *Calycoceras* (*Newboldiceras*) *asiaticum* fauna

The assemblage is characterised by the co-occurrence of the index species in association with *Turrilites acutus* Passy, 1832, in sections north of Djebel Hameima in central Tunisia, indicating a correlation with the upper, *acutus* Subzone of the Middle Cenomanian *rhotomagense* Zone. It also co-occurs with *Calycoceras* (*Newboldiceras*) *planecostatum* (Kossmat, 1897), a marker species for the *Acanthoceras jukesbrownei* Zone with which it is also correlated.

Lower Upper Cenomanian *Eucalycoceras pentagonum* fauna

The fauna is characterised by the presence of the index species, together with *Eucalycoceras rowei* (Spath, 1926), *Euomphaloceras euomphalum* (Sharpe, 1855), and abundant *Scaphites peroni* Pervinquière, 1910. *Calycoceras* (*Newboldiceras*) species are also present.

Lower Upper Turonian *Subprionocyclus neptuni* fauna

The fauna is a low diversity one, characterised by abundant examples of the index species, *Sciponoceras* cf. *bohemicum* (Fritsch, 1872), and *Scalarites* sp.

LOCALITY DETAILS

Sections in north-eastern Algeria

Ravines east of El Faidja, 7.5 km east of Berrouaghia, Algeria, coordinates 3º0’ E, 36º7’ N; road junction at coordinates 5271-3133. Upper Upper Albian *puzosianum* fauna (OUMNH KX.16995–17070, 17206–17215).

Commune of Ziana, 21 km east of Berrouaghia, Algeria, 3º9’ E, 36º7’ N (coordinates 5404-3123). A 1.3 km long outcrop east of road running north from the D20 between Berrouaghia and Sour El-Ghozlane (Aumale) yielded widely separated faunas.

Upper Upper Albian, *puzosianum* fauna inferred, based on the presence of *Cantabrigites spinosum*, although the index species was not found (OUMNH KX.17071–17098).

Lower Cenomanian, possibly *carcitanense* fauna on the basis of the occurrence of *Submantelliceras aumalense* (Coquand, 1862) and *Graysonites cherbensis* (Thomas and Péron, 1889), although the index species was not found (OUMNH KX.17103–17172).

Middle Cenomanian *asiaticum* fauna (OUMNH KX.17099–17102).

A 350 m long outcrop spanned the Upper Cenomanian with *Carthaginites* to Lower or Middle Turonian with *Eubostrychoceras* (OUMNH KX.17117–17190).

The succeeding 35 m long outcrop further south yielded an Upper Turonian *neptuni* fauna (OUMNH KX.17191–17204).

Roadside sections on the D20 to the west of Djebel Sottara, 8.5 km west of Sour El-Ghozlane (Aumale), coordinates 5810–3158. Marls with minor limestone intercalations. The section, at coordinates 5810–3158 yielded an upper Lower to lower Middle Cenomanian *Turrilites scheuchzerianus* fauna, the marker species abundant (OUMNH KX.15975–16031); a section at coordinates 5817-3163 yielded a comparable fauna (OUMNH KX.16068–16095), and a higher, Middle Cenomanian *Calycoceras* (*Newboldiceras*) *asiaticum* association (OUMNH KX.16028–16067).

Sour El-Ghozlane (Aumale), hill slopes 3 km north-west of the town at coordinates 5869-3186 yielded an upper Lower Cenomanian fauna with *Tur-*

rilites scheuchzerianus and *Mantelliceras mantelli* (OUMNH KX.16938–16968). A second outcrop with *Scaphites peroni* Pervinquière, 1907, may belong to the Upper Cenomanian *pentagonum* fauna (OUMNH KX.16977–16994).

Outcrops just west of Oued Besbass, 2 km east-south-east of Djebel el Krorza and 7 km west of the town of Ouenza at coordinates 9819-3085 (see Dubourdieu 1956, pp. 289–290), and corresponding to Niveau K of Dubourdieu (in Sornay 1955, p. 6). Upper Cenomanian *pentagonum* fauna (OUMNH KX.16096–16148.

Henchir el Kerkour, outcrop 5 km approximately west of the peak of Djebel Ouenza, and west of Oued Besbass, coordinates 981,300–306,700. The locality is mentioned by Dubourdieu (1956, p. 261) and the position indicated on his map 69 on p. 446. No stratigraphic relationships were seen; the fauna came from an estimated 20 m sequence of marls, corresponding to to Niveau F of Dubourdieu (in Sornay 1955, p. 5). Upper Upper Albian *puzosianum* fauna (OUMNH KX.15940–15974).

Slopes north and north-west of Gadet Chi, 3 km approximately east of Bou Khadra, around coordinates 9886-2893. Marls yielded an upper Upper Albian fauna (OUMNH KX.16172–16201), with *Cantabrigites spinosum* and abundant *Discohoplites subfalcatus* (Semenov, 1889) in the upper part. A second outcrop, 300 m approximately to the north-east yielded *C. spinosum* and common *Stoliczkaia* (*Stoliczkaia*) *subboulei* (Sornay, 1955) (OUMNH KX.16202–16263). Both collections are assigned to the *puzosianum* fauna on the basis of the presence of a fragment of the index species.

Outcrop 700 m north-east of Koudiat el Assel, 11 km approximately north-north-east of the village of Bou Khadra. 8º05'E 35º51' N, coordinates 9865–2971 (Dubourdieu 1956, p. 308) No stratigraphic relationships were seen, but the collection of around 800 limonitic ammonites, predominantly *Mariella* (*Mariella*) *harchaensis*, came from a 20 m strip of outcrop representing only a few meters of section. Lower Lower Cenomanian *harchaensis* fauna (OUMNH KX.16264–16388).

Sections in Central Tunisia

North of Djebel Hameima, outcrops between Henchir bou Raas (coordinates 1089-2928) and Henchir es Seba, extending from 4 to 7 km north of Djebel Hameima, ~8º21'E 35º57'N (Dubourdieu 1956, pp. 296–299, pl. 18; Chihaoui *et al*. 2010, text-fig. 2). The sequence examined was intermittently exposed in 1965, and comprised thick marls and thin grey-weathering black limestones that prevented intermixing of the tiny limonitic fossils between successive marl units. The limestones yielded, in some cases, fragments of adults (Pl. 1, Figs 1–6) of species represented by nuclei in the marls. When visited in April 1984, the area was under cultivation and the fossil-rich outcrops obliterated. Four faunas were recognized in 1965.

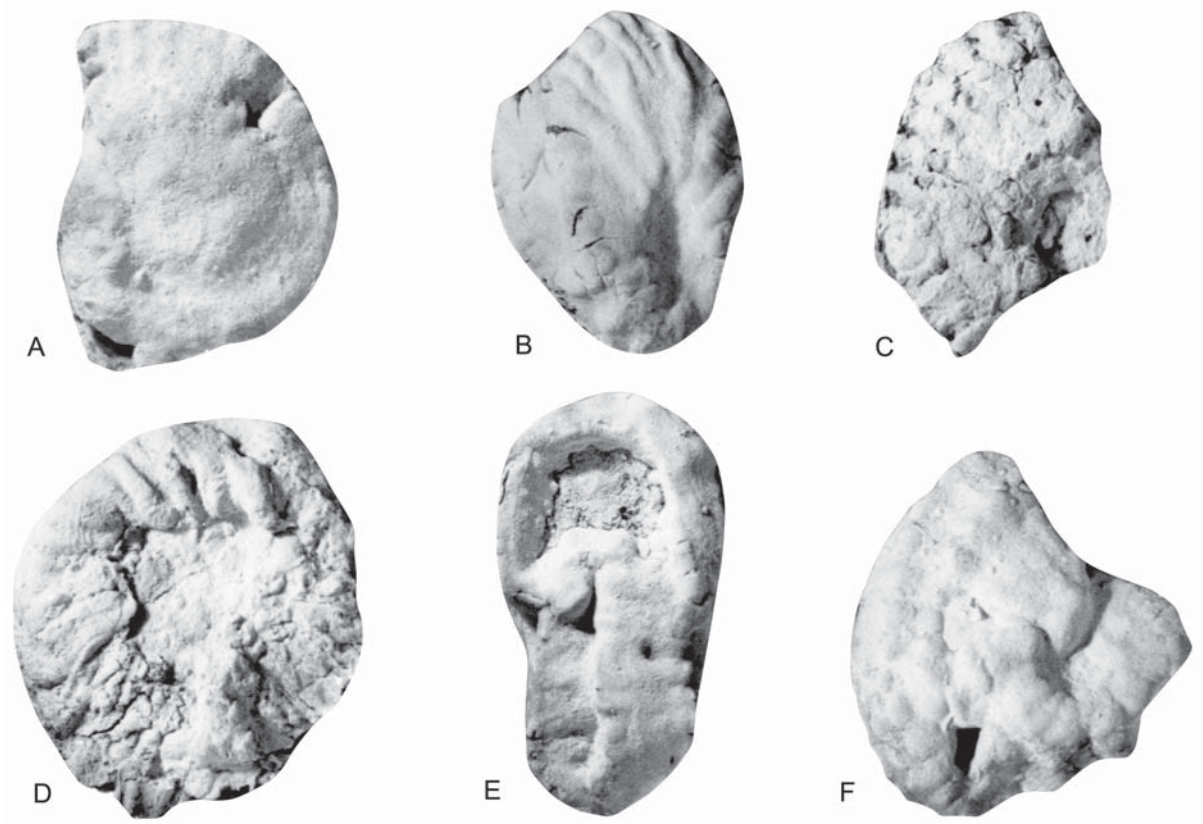
Outcrops just north of Henchir bou Rass yielded an upper Upper Albian *puzosianum* fauna (OUMNH KX.16388–16414) in bed 1 of Dubourdieu.

- 300 m to the north, further outcrops over a distance of over 200 m yielded a rich Lower Cenomanian *carcitanense* fauna (OUMNH KX.9831–9858, 16415–16708) in beds 2–4 of Dubourdieu.
- 320 m to the north again, marls with abundant *Pycnodonte flicki* Pervinquière, 1912, corresponding to the upper part of bed 5 of Dubourdieu, yielded a sparse Middle Cenomanian *asiaticum* fauna with *Turrilites acutus* Passy, 1832 (OUMNH KX.16709–16714).
- A kilometre further north, a 310 m long outcrop divided into 7 marl units by thin limestones yielded a rich Upper Cenomanian *pentagonum* fauna (OUMNH KX.9774–9830, 9859–9863, 16715–16935), with some large, originally over-pyritized ammonites (Text-fig. 4), corresponding to part of unit 8 of Dubourdieu (1956, p. 298).

To the north of this, the black laminated limestones of unit 11 of Dubourdieu correspond to the Bahloul Formation (Burrolet 1956) of subsequent authors. It has only yielded the bivalve *Mytiloides* here; elsewhere it has yielded ammonites of the Upper Cenomanian *geslinianum* and *pseudonodosoides* (= *juddii*) zones and Lower Turonian *Watinoceras* (Amedro *et al*. 2005; Robaszynski *et al*. 2010)

See Chihaoui *et al*. (2010, text-fig. 4) and Latil (2011, text-fig. 5) for details of the lower part of the sequence, not studied here.

Badlands 2.5 km south east of Djebel Djerissa (the Djebel Jerissa and Zrissa of authors), around coordinates 386–280 (see text-fig. 2 in Chihaoui *et al*. 2010). Pervinquière (1903, p. 75) gave a brief account of the Upper Albian (his Vraconnien) in the environs of Djebel Djerissa, and described a number of key species in 1907, including *Stoliczkaia* (*Shumarinaia*) *africana*. The Lower Albian succession in the environs of Djebel Djerissa was described by Chihaoui *et al*. (2010) and Latil (2011, text-fig. 7), and the Albian–Cenomanian boundary sequence by Robaszynski *et al*. (2008; their KZ section, text-figs 1 and 6). The Upper Albian part of the sequence from which the



Text-fig. 4. Over-pyritized ammonites from the Upper Cenomanian *pentagonum* fauna north of Djebel Hameima, Central Tunisia. Although generically indeterminate, all are Acanthoceratinae, and probably either *Calycoceras* or *Eucalycoceras*. A – OUMNH KX.16864; B – OUMNH KX.16875; C – OUMNH KX.16876; D – OUMNH KX.9821; E – OUMNH KX.16863; F – OUMNH KX.16865. Figures are × 1

present fauna was collected comprised around 200 m of marls with veins of fibrous calcite and thin limestones, the most distinctive brick-red and 25 cm thick. A *puzosianum* fauna (OUMNH KX.4146–4154, 14130–14333) was collected, with ammonites abundant in the highest few metres of the section; the Albian/Cenomanian boundary was not seen.

Koudiat el Hamra, 7 km west of El Kef. The locality was mentioned by Pervinquière (1903, p. 74), and is marked on the 1:50,000 Le Kef sheet (Burrolet and Sainfeld 1956). An isolated outcrop yielded an Upper Cenomanian *pentagonum* fauna (OUMNH KX.9696–97100).

Si abd el Kerim. Section 1.5 km south of the Koubba and west of the bends on the El Fahs-Siliana road, coordinates 491.9–333.0 This is not the locality mentioned by Pervinquière (1903, p. 72, "Près de la Koubba de ce nom") which was ploughed out when visited in April 1984. It yielded a slight Lower Cenomanian fauna (OUMNH KX.9750–9773).

Pont du Fahs. Sections near the railway station here were mentioned by Pervinquière (1903, p. 72), and a log provided by Salaj (1980, text-fig. 21). A few Lower Cenomanian ammonites (OUMNH KX.9678–9692) were collected from this heavily faulted area (see Bajanik *et al*. 1970, 1:50,000 sheet 35, Zaghouan).

Kat el Margueb, north of Djebel Fguira Salah, near Pont du Fahs yielded a sparse Lower Cenomanian fauna (OUMNH KX.9634–9677).

REPOSITORIES OF SPECIMENS

BGS. GSM: British Geological Survey, Keyworth, Nottinghamshire.

BMNH: The Natural History Museum, London.

EMP: École des Mines Collections, currently housed in the Faculté des Sciences, Université Claud Bernard, Lyon 1, Villeurbanne.

FSL: Faculté des Sciences, Université Claude Bernard, Lyon 1, Villeurbanne.

GMH: Hungarian Geological Museum, Budapest.

GSI: Geological Survey of India, Kolkata.

MNHN: Laboratoire de Paléontologie of the Muséum nationale d'Histoire Naturelle, Paris.

OUMNH: Oxford University Museum of Natural History.

TMM: Texas Memorial Museum, Austin, Texas.

USNM: United States National Museum of Natural History, Washington D.C.

SYSTEMATIC PALAEONTOLOGY

Conventions

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

The taxonomy of Wright (1996) is followed here. Many of the species described below have received detailed discussion in recent publications, and these are referred to rather than repeating them.

Order Ammonoidea Zittel, 1884
Suborder Phylloceratina Arkell, 1950
Superfamily Phylloceratoidea Zittel, 1884
Family Phylloceratidae Zittel, 1884
Subfamily Phylloceratinae Zittel, 1884
Genus *Phylloceras* Suess, 1865

TYPE SPECIES: *Ammonites heterophyllus* J. Sowerby, 1820, p. 119, pl. 266, by monotypy.

Subgenus *Hypophylloceras* Salfeld, 1924

TYPE SPECIES: *Phylloceras onoense* Stanton, 1895, p. 74, by monotypy.

Phylloceras (*Hypophylloceras*) *seresitense seresitense* (Perviquière, 1907)
(Pl. 2, Figs 14–18; Pl. 3, Figs 21, 22)

1907. *Phylloceras velledae* var. *Seresitensis* Pervinquière, p. 52.
2009. *Hyporbulites seresitensis seresitensis* (Pervinquière, 1907); Klein *et al*., pp. 90, 93 (with full synonymy).
2019. *Phylloceras* (*Hypophylloceras*) *seresitense seresitense* (Perviquière, 1907); Kennedy in Gale *et al*., p. 189, pl. 1, figs 11–18; pl. 2, figs 13, 14, 21, 22; text-fig. 13B.

TYPES: Perviquière 1907, p. 52, introduced *seresitensis* a variety of *velledae* of Michelin, but did not figure any of the 20 specimens he mentioned; I have not located the material in the Sorbonne collections. See Kennedy in Gale *et al*. 2019, p. 190 for further discussion.

MATERIAL: The original of Perviquière 1910, p. 9, pl. 10 (1) fig. 1 is MNHN. F. J13722a; MNHN. F. J13772b is the original of Pervinquière 1910, pl. 10 (1), fig. 2, both from the Cenomanian of Berrouaghia, northern Algeria. OUMNH KX.9765, from the Lower Cenomanian of Kef Si Abd el Kerim, Central Tunisia.

DIMENSIONS:

	D	Wb	Wh	Wb:Wh	U
MNHN. F. J13722a	12.2 (100)	4.3 (35.2)	7.5 (61.50	0.57	– (–)
MNHN. F. J13722b	16.8 (100)	5.7 (33.9)	10.3 (61.3)	0.55	– (–)

DESCRIPTION: MNHN. F. J13722a (Pl. 3, Figs 21, 22) is a worn internal mould of a phragmocone, with traces of delicate lirae visible on the outer flanks and ventrolateral shoulders in places. MNHN. F. J13722b (Pl. 2, Figs 16–18) is an internal mould, crushed at the adapertural end. Coiling is very involute, the umbilicus minute, with a flattened outward-inclined umbilical wall forming a circumbilical pit, with a marked break in slope at the junction with the flattened and subparallel flanks. The ventrolateral shoulders and venter are broadly rounded. The surface is worn, but well-developed crowded feebly rursiradiate lirae are present on the outer flanks and ventrolateral shoulders, and pass straight across the venter. OUMNH KX.9765 (Pl. 2, Figs 14, 15), is comparable, and has a maximum preserved diameter of 31 mm.

DISCUSSION: See remarks in Kennedy in Gale *et al*. 2019, p. 190.

OCCURRENCE: Upper Aptian (Balaerics) to Cenomanian. The geographic distribution extends from southern England to southern France, Switzerland, Hungary, Ukraine, northern Spain, Sardinia, northern Algeria, Central Tunisia, The Balaerics, Angola, KwaZulu-Natal in South Africa, Madagascar, Tamil Nadu in South India, Sakhalin, Hokkaido, Alaska, and California.

Phylloceras (*Hypophylloceras*) *seresitense tanit* (Pervinquière, 1907)
(Pl. 3, Figs 5, 6, 10, 11, 13–16)

1907. *Phylloceras Tanit* Pervinquière, p. 53, pl. 3, figs 3–9; text-fig. 5.
2009. *Hyporbulites seresitense tanit* (Pervinquière, 1907); Klein *et. al*., pp. 90, 96 (with full synonymy).

TYPE: The holotype, by original designation, is MNHN. F. J13795, the original of Pervinquière (1907, pl. 3, fig. 6, 7), from north of Bou Tis, Central Tunisia.

MATERIAL: MNHN. F. J13706a, the original of Pervinquière (1907, pl. 3, fig. 3), from the 'Vraconnien' of Si Abd el Kerim, Central Tunisia, 'faisant le passage à *Ph. Velledae*. MNHN. F. J13796a, the original of Pervinquière (1907, pl. 3, fig. 8) and MNHN. F. J13796, the original of Pervinquière (1907, pl. 3, fig. 9), both from the 'Vraconnien', north of Bou Tis, Central Tunisia.

DIMENSIONS:

	D	Wb	Wh	Wb:Wh	U
MNHN. F. J13706b	8.4 (100)	3.8 (45.2)	5.4 (64.2)	0.7	– (–)
MNHN. F. J13796a	11.5 (100)	4.3 (37.4)	7.2 (62.6)	0.6	– (–)
MNHN. F. J13795	13.3 (100)	4.8 (36.1)	8.4 (63.2)	0.57	– (–)

DESCRIPTION: The holotype, MNHN. F. J13795 (Pl. 3, Figs 15, 16; Pervinquière 1907, pl. 3, figs 6, 7) is 13.3 mm in diameter. Coiling is very involute, the umbilicus tiny, of moderate depth, the umbilical wall feebly convex, the umbilical shoulder rounded, the flanks very feebly convex, the outer flanks converging to broadly rounded ventrolateral shoulders, the venter feebly convex. MNHN. F. J13796 (Pl. 3, Figs 5, 6; Pervinquière 1907, pl. 3, fig. 9) has an approximate maximum diameter of 20 mm, and has limonitic overgrowths on the outer whorl. There are delicate radial lirae that pass straight across the venter that are only detectable under low angle light. MNHN. F. J13796a (Pl. 3, Figs 13, 14; Pervinquière 1907, pl. 3, fig. 8) consists of a nucleus and an outer half whorl of phragmocene with a maximum diameter of 11.5 mm. Coiling is very involute, the tiny umbilicus of moderate depth, the umbilical wall very feebly convex, the umbilical shoulder abruptly rounded. The whorl section is compressed, the whorl breadth to height ratio 0.6, the flanks very feebly convex, the outer flanks converging to broadly rounded ventrolateral shoulders, the venter very feebly convex. The surface of the internal mould is smooth, but for faint traces of radial lirae on the ventrolateral shoulders in places.

Of specimens described by Pervinquière as 'faisant le passage à *Ph. Velledae*', MNHN. F. J13706a (Pl. 3, Figs 10, 11; Pervinquière 1907, pl. 3, fig. 3) is a minute individual, only 5.4 mm in diameter. MNHN. F. J13706b has a maximum preserved diameter of 8.4 mm. Coiling is very involute, the umbilicus tiny, with an outward-inclined umbilcal wall, and, in consequence, a conical circumbilical pit. The umbilical shoulder is broadly rounded, the flanks feebly convex, subparallel, the ventrolateral shoulders broadly rounded, the venter feebly convex. There are faint traces of lirae on the ventrolateral shoulder in places.

DISCUSSION: See Wiedmann 1962 (p. 142).

OCCURRENCE: Upper Albian and Lower Cenomanian. Southern England, northern Spain, The Balaerics, Sardinia, Romania, Central Tunisia, Angola, Madagascar, Tamil Nadu in South India, northern Mexico, Texas, and California.

Phylloceras (*Hypophylloceras*) *velledae velledae* (Michelin, 1834)
(Pl. 2, Figs 1–13)

1834. *Ammonites velledae* Michelin, pl. 35.
2009. *Phylloceras* (*Hypophylloceras*) *velledae velledae* (Michelin, 1834); Klein *et al*., pp. 7, 27 (with full synonymy).
2019. *Phylloceras* (*Hypophylloceras*) *velledae velledae* (Michelin, 1834); Kennedy in Gale *et al*., p. 190, pl. 1, figs 3–5.

TYPE: The neotype, designated by Wiedmann 1964, p. 211, is MNHN. F. R00476, the original of d'Orbigny (1841, pl. 82, figs 1, 2), from the Albian of Epothémont, near Bar-sur-Aube, France. It was refigured by Wiedmann (1964, pl. 11) and Joly (in Gauthier 2006, pl. 39, fig. 1).

MATERIAL: OUMNH KX.9653a–d, from the Lower Cenomanian of Kat el Margueb, north of Djebel Fguira Salah, near Pont du Fahs, Central Tunisia.

DIMENSIONS:

	D	Wb	Wh	Wb:Wh	U
OUMNH KX.9653a	25.8 (100)	10.4 (40.3)	16.0 (62.0)	0.65	1.8 (7.0)
OUMNH KX.9653b	29.8 (100)	12.5 (41.9)	17.4 (0.58)	0.71	2.0 (6.7)

REMARKS: All specimens are limonitic nuclei, the

largest 29.8 mm in diameter. Coiling is very involute, the tiny umbilicus comprising around 7% of the diameter. The umbilical wall is flattened and outward-inclined, the umbilical shoulder rounded. The whorl section is compressed, the whorl breadth to height ratio varying around 0.7, the greatest breadth well below mid-flank. The flanks are feebly convex, convergent, the ventrolateral shoulders broadly rounded, the venter feebly convex. The internal mould is smooth; where areas of limonitised shell are well-preserved, there are crowded lirae, best-developed on the outer flanks, ventrolateral shoulders and venter, which they pass straight across.

DISCUSSION: See Wiedmann 1964 (p.209) and Kennedy and Klinger (1977, p. 359 *et seq*.),

OCCURRENCE: Upper Aptian to Lower Cenomanian. The geographic distribution extends from France to the Balearic Islands, Ukraine (Crimea), northern Algeria, Central Tunisia, Mozambique, KwaZulu-Natal South Africa, Madagascar, and Tamil Nadu in South India.

Phylloceras (*Hypophylloceras*) *ellipticum* Kossmat, 1895
(Pl. 2, Figs 19–22)

1865. *Ammonites Sub-Alpinus* Stoliczka, p. 114, pl. 58, fig. 3.
1895. *Phylloceras ellipticum* Kossmat, p. 107 (11), pl. 15 (1), fig. 2; pl. 20 (6), fig. 1.
1907. *Phylloceras ellipticum*? Kossmat; Pervinquière, p. 51, pl. 3, figs 1, 2; text-fig. 4.
1910. *Phylloceras ellipticum* Kossmat; Pervinquière, p. 10.
2009. *Phylloceras* (*Goretophylloceras*) *subalpinum* morph *ellipticum* Kossmat, 1895; Klein *et al*., pp. 32, 37 (with full synonymy).
2019. *Phylloceras* (*Hypophylloceras*) *ellipticum* Kossmat, 1895; Kennedy in Gale *et al*., p. 190, pl. 2, figs 18–20; text-fig. 13c.

TYPE: The holotype is the original of Kossmat (1895, p. 107 (11), pl. 15 (1), fig. 2; pl. 20 (6), fig. 1), previously figured by Stoliczka (1865, pl. 58, fig. 3), and from Penangoor, Tamil Nadu, South India.

MATERIAL: MNHN. F. J13713, the original of Pervinquière (1907, p. 51, pl. 3, figs 1, 2), from Pont du Fahs, Central Tunisia. Pervinquière mentioned a total of six specimens from Guern er Rhezal and Pont du Fahs, of which two were recognised in addition to the figured individual.

DESCRIPTION: MNHN. F. J13713 (Pl. 2, Figs 21, 22) is 8.5 mm in diameter. Coiling is very involute, the umbilicus tiny, the umbilical wall flattened, the umbilical shoulder broadly rounded, the whorl section slightly compressed, elliptical, the inner flanks broadly rounded, the outer flanks flattened and convergent, the ventrolateral shoulders and venter feebly convex. There is no ornament. A second specimen from Guern Er Rhezal, 12.3 mm in diameter, is figured as Pl. 2, Figs 19, 20.

DISCUSSION: See Kennedy in Gale *et al*. 2019, p. 190.

OCCURRENCE: Lower Albian to Upper Cenomanian, southern England, Hungary, Switzerland, Spain, Sardinia, The Baleaerics, Algeria, Tunisia, KwaZulu-Natal in South Africa, and Tamil Nadu, South India.

Phylloceras (*Hypophylloceras*) *pseudolateumbilicatum* Collignon, 1929
(Pl. 3, Figs 18–20)

1907. *Phylloceras decipiens* Kossmat; Pervinquière, p. 55, pl. 3, figs 10, 11; ?text-fig. 6.
1929. *Phylloceras pseudolateumbilicatum* Collignon, p. 149 (13), pl. 15 (1), fig. 12.
2009. *Phylloceras* (*Hypophylloceras*) *pseudolateumbilicatum* Collignon, 1929; Klein *et al*., pp. 6, 20 (with full synonymy).

TYPE: The holotype, by monotypy, is MNHN. F. R.00406, the original of Collignon (1929, p. 149 (13), pl. 15 (1), fig. 12), from the Lower Cenomanian of Diego-Suarez, Madagascar.

MATERIAL: MNHN. F. J13745, the original of *Phylloceras decipiens* Kossmat of Pervinquière (1907, pl. 3, figs 10, 11), from the 'Vraconnien' of Guern er Rhezal, Central Tunisia, a syntype of *Phylloceras pervinquierei* Collignon, 1928, p. 147 (11), and the holotype by monotypy of *Phylloceras pervinquierei* Shimizu 1935, p. 176, a homonym of *Phylloceras pervinquierei* Collignon 1928, p. 147 (11), pl. 15 (1), fig. 9.

DIMENSIONS:

	D	Wb	Wh	Wb:Wh	U
MNHN. F. J13745	9.8 (100)	3.75 (38.3)	5.8 (59.2)	0.65	2.0 (20.4)

DESCRIPTION: The specimen is part internal mould, in part retains limonitised shell material. Coiling is very involute, the umbilicus small and

shallow, the umbilical wall feebly convex, the umbilical shoulder broadly rounded, the whorl section compressed, the whorl breadth to height ratio 0.65, with feebly convex subparallel flanks, the ventrolateral shoulders and venter broadly rounded. There are low, broad, feebly prorsiradiate undulations that expand across the inner flanks and flex back before effacing on the outermost flanks. The surface of the mould is covered in dense, fine, crowded lirae on the inner flank that flex back and are feebly convex at mid-flank, straight on the outer flank, and pass straight across the venter. The lirae increase by branching and intercalation.

DISCUSSION: See Joly 1993 (p. 31).

OCCURRENCE: Lower Cenomanian of Madagascar, Central Tunisia, and Spain.

Genus *Neophylloceras* Shimizu, 1934

TYPE SPECIES: *Ammonites* (*Scaphites*?) *ramosus* Meek, 1858, p. 45, by the original designation of Shimizu (1934, p. 61).

Neophylloceras algeriense (Wiedmann, 1962)
(Pl. 3, Figs 1–4, 7–9)

1910. *Phylloceras Tanit* Pervinquière, p. 9, pl. 10 (1), figs 4–6.
1962a. *Hypophylloceras algeriense* Wiedmann, p. 144, pl. 8, fig. 3; text-fig. 9.
2009. *Neophylloceras algeriense* (Wiedmann, 1962); Klein *et al*., pp. 99, 100 (with additional synonymy).

TYPE: The holotype, designated by Wiedmann (1962, p. 144), is MNHN. F. J13770, the original of *Phylloceras tanit* of Pervinquière (1910, pl. 10 (1), fig. 6), from the Lower Cenomanian of Berrouaghia, northern Algeria.

MATERIAL: MNHN. F. J13711, the original of *Phylloceras tanit* of Pervinquière (1910, pl. 10 (1), fig. 5), from the Cenomanian of Sour El-Ghozlane (Aumale), Algeria.

DIMENSIONS:

	D	Wb	Wh	Wb:Wh	U
MNHN. F. J13771	17.3 (100)	5.6 (32.4)	10.5 (60.7)	0.53	2.1 (12.1)

DESCRIPTION: MNHN. F. J13771 (Pl. 3, Figs 7–9) is 13.7 mm in diameter, and has undergone some *post-mortem* crushing. Coiling is very involute, the small umbilicus comprising 12.1% of the diameter, the umbilical wall flattened and subvertical, the umbilical shoulder very narrowly rounded. The whorl section is compressed oval, the whorl breadth to height ratio 0.53. There is delicate siphonal ridge that is a result of the crushing. Seven widely but irregularly spaced strongly prorsiradiate ribs arise at the umbilical shoulder of the adapertural half of the outer whorl and sweep forwards across the inner flank, flexing back and convex at mid-flank, where they subdivide into delicate lirae, with additional lirae intercalating between, such that there are an estimated five to six times as many lirae on the outer flank and ventrolateral shoulder as there are ribs on the inner flank. The lirae efface over the venter. The holotype (Pl. 3, Figs 7–9) is a limonitic internal mould of a phragmocone that has decomposed badly since it was figured by Pervinquière; the maximum preserved whorl height of the larger fragment (Pl. 3, Figs 1, 2) is 16.5 mm. A distinctive prorsiradiate flank rib is present on the adapertural part of the smaller fragment, and in the middle of the larger.

DISCUSSION: The strong flank ribs distinguish the present species from the other phylloceratids described here. See Wiedmann (1962, p. 144).

OCCURRENCE: Lower Cenomanian of Berrouaghia and Sour El-Ghozlane (Aumale), northern Algeria; Upper Albian of north-western Spain. Also possibly present in the Lower Cenomanian of Madagascar (Collignon 1928, p. 145 (9), pl. 15 (1), fig. 7).

Genus *Phyllopachyceras* Spath, 1925a

TYPE SPECIES: *Ammonites infundibulum* d'Orbigny, 1841, p. 131, pl. 29, figs 4, 5, by the original designation of Spath (1925a, p. 101).

Phyllopachyceras whiteavesi (Kossmat, 1898)
(Pl. 7, Figs 5, 6; Text-fig. 10B)

1895. *Phylloceras Forbesianum* d'Orb. sp., Kossmat, p. 109 (130), pl. 15 (1), fig. 1.
1898. *Phylloceras Whiteavesi* Kossmat, p. 189 (124).
2009. *Phyllopachyceras whiteavesi* (Kossmat, 1898); Klein *et al*., pp. 53, 70 (with full synonymy).
2019. *Phyllopachyceras whiteavesi* (Kossmat, 1898); Kennedy in Gale *et al*., p. 192, pl. 1, figs 1, 2, 6–10; pl. 2, figs 15–17.

TYPE: The holotype is the original of *Phylloceras Forbesianum* d'Orb. sp. (Kossmat 1895, p. 109 (130), pl. 15 (1), fig. 1), from the Uttatur Group of Odium, South India.

MATERIAL: OUMNH KX.9654 (collective of 16 specimens), from the Lower Cenomanian north of Kat el Margueb, north of Djebel Fguira Sala, near Pont du Fahs, Central Tunisia.

DESCRIPTION: The material consists of wholly septate nuclei that range from 11.3–24.5 mm in diameter. Coiling is very involute, the deep, conical umbilicus minute. The umbilical shoulder is broadly rounded, the whorl section varying from slightly depressed to slightly compressed, the flanks feebly convex and subparallel, the ventrolateral shoulders and venter broadly and evenly rounded. The surface of the internal mould is smooth. Where limonitised shell is preserved, prorsiradiate growth lines project forward and are feebly concave on the ventrolateral shoulders and cross the venter in a broad convexity. The suture (Text-fig. 10B) is deeply incised, with narrow-stemmed E/A and A/U2.

DISCUSSION: See Joly (1993, p. 46).

OCCURRENCE: Upper Albian to lower Upper Cenomanian, south-eastern France, Spain (?), The Canary Islands, Central Tunisia, KwaZulu-Natal in South Africa, Madagascar, and Tamil Nadu in South India.

Suborder Lytoceratina Hyatt, 1889
Superfamily Tetragonitoidea Hyatt, 1900
Family Gaudryceratidae Spath, 1927
Genus *Anagaudryceras* Shimizu, 1934

TYPE SPECIES: *Ammonites sacya* Forbes, 1846, p. 113, pl. 14, fig. 10, by the original designation of Shimizu (1934, p. 67).

Anagaudryceras pauli (Coquand, 1862)
(Pl. 5, Figs 1–3)

1862. *Ammonites Pauli* Coquand, p. 322, pl. 35, figs 1, 2.
1907. *Amm. Pauli* Coquand; Pervinquière, p. 70.
?1910. *Lytoceras* (*Gaudryceras*) *Pauli* Coquand; Pervinquière, p. 13.
2009. *Anagaudryceras*? *pauli* (Coquand, 1862); Klein *et al*., pp. 157, 163 (with additional synonymy).

TYPE: The holotype, by monotypy, is GMH K-8443, the original of Coquand (1862, pl. 35, figs 1, 2), from "les assizes plus infèrieurs de l'étage rhotomangien" in the environs of Sour El-Ghozlane (Aumale), northern Algeria.

DIMENSIONS:

	D	Wb	Wh	Wb:Wh	U
GMH K-8443	22.0 (100)	– (–)	6.0 (27.3)	–	10 (45.5)

DESCRIPTION: The holotype is a partially exfoliated individual retaining small areas of the outer shell layer. Coiling very involute, serpenticone. The umbilicus is broad, comprising 45.5% of the diameter, and of moderate depth. The whorl section is depressed, the umbilical shoulder narrowly rounded, the inner flanks flattened, the ventrolateral shoulders broadly rounded, the venter broad, and feebly convex. The surface of the limonitised shell, where preserved, is covered in very fine, prorsiradiate lirae that are invisible to the naked eye. They are prorsiradiate on the flanks, sweep forwards and are feebly concave on the outer flank, and pass more or less straight across the venter. The internal mould is smooth, or bears low folds that are parallel to the growth striae.

DISCUSSION: Coiling, expansion rate, whorl section and ornament of fine lirae indicate *pauli* to be an *Anagaudryceras*. It is probably a junior synonym of the type species, but the specimen lacks sufficient characters to enable meaningful discussion.

OCCURRENCE: As for type.

Anagaudryceras sp.
(Pl. 4, Figs 14–18)

MATERIAL: OUMNH KX.9669–9670, from the Lower Cenomanian of Kat el Margueb, north of Djebe Fguirah Salah, near Pont du Fahs, Central Tunisia.

DIMENSIONS:

	D	Wb	Wh	Wb:Wh	U
OUMNH KX.9669 at	20.0 (100)	7.4 (37.0)	8.5 (42.5)	0.87	6.9 (34.5)
OUMNH KX.9670 at	27.5 (100)	10.0 (36.4)	11.2 (40.7)	0.89	10.2 (37.0)

DESCRIPTION: The specimens are phragmocones, worn and encrusted by a thin limonitic film in places. Coiling is moderately evolute, the shallow umbilicus comprising around 36% of the diameter, the umbili-

cal wall convex and outward-inclined, the umbilical shoulder broadly rounded. The whorl section is compressed, with a whorl breadth to height ratio of around 0.78, the greatest breadth below mid-flank, the inner flanks feebly convex, the outer flanks converging to broadly rounded ventrolateral shoulders, the venter feebly convex. There are indications of constrictions, straight and feebly prorsiradiate on the flanks, and crossing the venter in a very feeble convexity. There is no other ornament. The corroded sutures are deeply incised, with narrow-stemmed saddles.

DISCUSSION: These specimens are assigned to *Anagaudryceras* on the basis of the whorl proportions, which separates them from *Zelandites* in the present faunas. The closest comparisons are with *Anagaudryceras involvulum* (Stoliczka, 1865, p. 150, pl. 75, fig. 1; see synonymy in Klein *et al*. 2009, p. 159), but the whorl section of that species is stouter, and the constrictions straight to feebly convex.

OCCURRENCE: As material.

Genus and subgenus *Eogaudryceras* Spath, 1927

TYPE SPECIES: *Ammonites Numidus* Coquand, 1880, p. 22, by the original designation of Spath (1927, p. 66).

DISCUSSION: Coquand described but did not figure his *Ammonites Numidus*. It was, however, figured photographically by Heinz (1886, pl. 1; note that the figures on the plate are un-numbered). This specimen, the holotype, is GMH K-8159, and is figured here as Pl. 5, Figs 11–13. It was stated to be from Djebel Ouach by Coquand; the associated late 20th century label gives the locality as Sidi M'Sid. It bears no resemblance to the specimen designated lectotype by Howarth (in Wright 1996, p. 3, fig. 3a, b), that is to say the specimen from Djebel Ouach figured by Sayn (1890, pl. 3, fig. 1). The dimensions of Coquand's specimen are as follows:

	D	Wb	Wh	Wb:Wh	U
GMH K-8159 at	13.0 (100)	5.9 (45.4)	4.1 (31.5)	1.4	6.3 (48.5)

GMH K-8159 is a limonitic internal mould with a maximum preserved diameter of 14.5 mm. Coiling is very evolute, with a broad umbilicus of moderate depth that comprises 48.5% of the diameter. The whorls expand slowly; the whorl section is depressed oval, with a whorl breadth to height ratio of 1.4. The umbilical wall and shoulder are broadly rounded, the flanks strongly convex, the venter flattened, and very feebly convex. The surface of the internal mould is smooth, except for prorsiradiate convex striae and periodic very narrow constrictions with associated collar-ribs, nine per whorl, that are more or less transverse across the venter.

Eogaudryceras (*Eogaudryceras*) *vattoni* (Coquand, 1862)

(Pl. 4, Figs 1–3; Pl. 5, Figs 8–10, 14–17; Pl. 6, Figs 16, 21)

1862. *Ammonites vattoni* Coquand, p. 173, pl. 30 (1), figs 9, 10.
1910. *Lytoceras* (*Gaudryceras*) *Vattonei* Pervinquière, p. 11, pl. 10 (1), figs 9, 10.
2009. *Eogaudryceras vattonei* (Coquand, 1862); Klein *et al*., pp. 151, 155 (with synonymy).

TYPE: There are two specimens under the catalogue number GMH K-8849 in the Coquand Collection, here differentiated as GMH K-8849a (Pl. 5, Figs 14–17), and GMH K-8849b (Pl. 5, Figs 8–10). The former bears the closest resemblance to Coquand's figure (1862, pl. 30 (1), figs 9, 10), and is designated lectotype. Both are from Berrouaghia, northern Algeria.

MATERIAL: MNHN. F. J13767, the original of Pervinquière (1910, pl. 10 (1), fig. 10) (Pl. 6, Figs 16, 21), from Sour El-Ghozlane (Aumale), northern Algeria. MNHN. F. J13768, the original of *Lytoceras* (*Gaudryceras*) *vattonei* Coquand of Pervinquière (1910, pl. 10 (1), fig. 9) (Pl. 4, Figs 1–3), from Berrouaghia, northern Algeria.

DIMENSIONS:

	D	Wb	Wh	Wb:Wh	U
MNHN. F. J13768 at	18.5 (100)	– (–)	7.8 (42.2)	–	6.8 (36.8)
GMH K-8849a	26.0 (100)	10.0 (38.5)	9.1 (35.0)	1.1	9.3 (35.8)
GMH K-8849b	26.6 (100)	9.0 (33.8)	10.2 (38.3)	0.88	9.5 (35.7)
MNHN. F. J13767	33.2 (100)	12.4 (37.3)	13.8 (41.6)	0.9	11.5 (34.6)

DESCRIPTION: GMH K-8849a (Pl. 5, Figs 14–17) is beautifully preserved, with areas of replaced shell material retaining the ornament of the external surface; GMH K-8849b (Pl. 5, Figs 8–10) is an internal mould with a corroded surface. Both are phragmocones. Coiling is evolute: the broad, shallow umbilicus comprises 36% approximately of the diameter. The whorls expand slowly. The whorl section varies

from slightly depressed to slightly compressed. The umbilical wall inclines outwards, and merges with the broadly rounded inner and middle flanks. The outer flanks converge to a rather narrowly rounded venter. Where the surface of the replaced shell is preserved, it is seen to be ornamented by fine, prorsiradiate, distant lirae, 21–22 per whorl on the inner whorls. They are convex across the umbilical wall and shoulder, flex forwards and are concave across the flanks, and cross the venter in a broad convexity. The lirae become more crowded as size increases, and number an estimated 26 per whorl at the largest preserved diameter. The internal mould bears faint radial lirae and striae. There are periodic distant, irregular shallow constrictions.

MNHN. F. J13768 (Pl. 4, Figs 1–3; Pervinquière 1910, pl. 10 (1), fig. 9) is a phragmocone that retains limonitized shell. Coiling is very evolute, the umbilicus of the penultimate whorl and adapical part of the outer whorl of moderate depth, the umbilical wall flattened and inclined outwards, producing a broad conical umbilicus. The whorl section is depressed at the beginning of the outer whorl, with a whorl breadth to height ratio of 1.54, with broadly rounded flanks and venter. On the adapertural part of the outer whorl, the whorl section is, in contrast, rounded, the distinctive conical umbilicus lost. There are six low, broad folds on the umbilical wall of the adapertural half of the penultimate whorl, and these persist onto the adapical part of the outer whorl. There are traces of prorsiradiate lirae on the flanks, although ornament is obscured by limonitic overgrowths. Two narrow collar ribs on the venter indicate the presence of constrictions on the internal mould, although their total number cannot be established.

MNHN. F. J13767 (Pl. 6, Figs 16, 21; Pervinquière 1910, pl. 17 (1), fig. 10) is a phragmocone retaining limonitized shell. Coiling is very evolute, the broad umbilicus comprising 34.6% of the diameter, of moderate depth, the umbilical wall flattened and outward-inclined, the umbilical shoulder broadly rounded, the inner and mid-flanks broadly rounded, the outer flanks converging to broadly rounded ventrolateral shoulders and venter. The inner flanks of the penultimate whorl are ornamented by widely spaced prorsiradiate ribs, an estimated 12 per half whorl. On the outer whorl, ornament is of dense lirae, arising on the umbilical wall, feebly prorsiradiate and feebly sinuous on the flanks, where they increase by branching, sweeping forwards and concave on the ventrolateral shoulders, where they strengthen, and cross the venter in a broad convexity.

DISCUSSION: According to Marcinowski and Wiedmann (1990, p. 26), *vattonei* "can be separated from any other eogaudryceratid on the basis of its oval to subtrianglar whorl section, which is nearly as wide as high, The flanks converge towards the venter, resulting in the maximum width near the steep umbilical border." The species remains poorly known.

OCCURRENCE: Lower Cenomanian of northern Algeria; condensed Albian of southern Poland; Lower Cenomanian of Madagascar.

Genus *Zelandites* Marshall, 1926

TYPE SPECIES: *Zelandites kaiparaensis* Marshall, 1926, p. 147, pl. 19, fig. 9; pl. 31, fig. 12, by monotypy.

Zelandites dozei dozei (Fallot, 1885)

(Pl. 4, Figs 4, 5, 14–24; Pl. 5, Figs 4–7; Pl. 6, Figs 17–20)

1880. *Ammonites solarium* Coquand, p. 34 (*nomen oblitum*).
1885. *Ammonites dozei* Fallot, p. 235, pl. 4, fig. 3.
1907. *Ammonites solarium* Coquand; Pervinquière, p. 67.
1910. *Lytoceras* (*Gaudryceras*) *Dozei* Fallot; Pervinquière, p. 14, pl. 10 (1), figs 11–18.
2009. *Zelandites dozei dozei* (Fallot, 1885); Klein *et al*., pp. 194, 195 (with full synonymy).

TYPES: Fallot (1885, p. 236) based his species on specimens from Les Guinards, near Vesc, Drôme, and the Pic du Chervet near Moriez, Basses-Alpes, France, in the Doze Collection, housed in the Sorbonne, and figured one (1885, pl. 4, fig. 3), without stating the locality from which it came. I have failed to trace these specimens.

MATERIAL: GMH K-8442 (Pl. 5, Figs 4–7), the holotype of *Ammonites solarium* Coquand, 1885, p. 34, from Sour El-Ghozlane (Aumale), northern Algeria, plus the following specimens figured by Pervinquière 1910, pl. 10 (1): fig. 13: MNHN. F. J13765 (Pl. 4, Figs 4, 5), from Berrouaghia, northern Algeria; fig. 14: MNHN. F. J13764 (Pl. 4, Figs 22–24), from Sour El-Ghozlane (Aumale), northern Algeria; fig. 15: MNHN. F. J13757 (Pl. 4, Figs 19–21), from Berrouaghia, northern Algeria; fig. 16: MNHN. F. J13763 (Pl. 6, Figs 17, 18), from Sour El-Ghozlane (Aumale), northern Algeria; fig. 17: MNHN. F. J13762 (Pl. 6, Figs 19, 20), from Sour El-Ghozlane (Aumale), northern Algeria. The original of Pervinquière's pl. 10 (1), figs 11, 12 has not been traced.

DIMENSIONS:

	D	Wb	Wh	Wb:Wh	U
MNHN. F. J13757	14.8 (100)	4.1 (27.7)	6.1 (41.2)	0.67	4.5 (30.4)
MNHN. F. J13764	16.9 (100)	4.6 (27.2)	7.5 (44.4)	0.61	5.3 (31.4)
MNHN. F. J13763	22.0 (100)	5.9 (26.8)	8.7 (39.5)	0.68	7.6 (34.5)
MNHN. F. J13762	28.0 (100)	8.7 (31.1)	12.1 (43.2)	0.72	8.9 (31.8)

DESCRIPTION: The holotype of *Ammonites solarium*, GMH K-8442 (Pl. 5, Figs 4–7; Coquand 1862, p. 34; Pervinquière 1910, pl. 10 (1), fig. 18) is a limonitic internal mould of a 120° whorl sector 23 mm long. Coiling is moderately involute, with approximately 50% of the previous whorl covered. The umbilical wall slopes outwards as a broad, crater-like circumbilical pit. The whorl section is compressed trigonal/oval, with a whorl breadth to height ratio of 0.74, the greatest breadth on the inner flank. The inner flanks are rounded, the mid- to outer flanks strongly convergent, the venter relatively narrowly rounded. The surface of the fragment is ornamented by flexuous prorsiradiate growth lines and striae. These are concave on the umbilical wall, convex on the umbilical shoulder, concave on the mid-to outer flank, and strongly projected forwards to cross the venter in a very broad convexity. The lirae and striae are very fine and closely spaced on the umbilical wall and shoulder, but coarsen and become more widely separated over the outer flank and venter. Here they show regular variations from closely to widely separated. The fragment does not show the suture. There are indications of the former presence of a further whorl, now lost.

MNHN. F. J13763 (Pl. 6, Figs 17, 18; Pervinquière 1910, pl. 10 (1), fig. 16) is an internal mould of a half whorl 22 mm in diameter. Coiling is involute, with over 60% of the previous whorl covered, the umbilicus of moderate depth, comprising 31.8% of the diameter, shallow with a flattened outward-inclined wall, the umbilical shoulder rounded. The whorl section is compressed, rounded-trigonal, with feebly convex flanks that converge to a narrowly rounded venter. The surface of the mould is smooth, but for two broad, shallow constrictions, one 60° from the adapertural end of the fragment, the other close to the adapertural end. The boundaries of the constrictions are ill-defined. They are incised into the umbilical wall and are straight and prorsiradiate on the inner flank, flexing back and feebly convex, then flexing forwards and feebly concave on the outer flank and crossing the venter in a broad convexity. There is some variation in the strength of the constrictions on the smaller phragmocones described by Pervinquière (Pl. 4, Figs 4, 5: MNHN. F. J13765, the original of Pervinquière 1910, pl. 10 (1), fig. 13; Pl. 4, Figs 17–21: MNHN. F. J13757, the original of Pervinquière 1910, pl. 10 (1), fig. 15; Pl. 4, Figs 22–24: MNHN. F. J13764, the original of Pervinquière 1910, pl. 10 (1), fig. 14), while his largest specimen, MNHN. F. J13762 (Pl. 6, Figs 19, 20), a half whorl of phragmocone 28 mm in diameter, retains traces of limonitised shell, and appears to lack constrictions.

DISCUSSION: *Zelandites dozei dozei* differs from *Zelandites dozei schroederi* Wiedmann, 1962 (p. 161, pl. 8, figs 12, 13; pl. 13, figs 3, 4; text-figs 18, 19, 20; Wiedmann and Dieni 1968, p. 36, pl. 3, fig. 7; pl. 4, fig. 13) in having an oval, rather than a triangular whorl section. *Zelandites flicki* (Pervinquière, 1907) (p. 65, pl. 3, fig. 16; text-fig. 10; Pl. 4, Figs 25, 26) has 10 prominent, straight, prorsiradiate constrictions per whorl. See Thomel (1987, pl. 1, figs 7–11; pl. 3, figs 3–8; 1992, pl. 18, figs 1–8, 18–20) for illustrations of specimens from the same area as Fallot's types.

OCCURRENCE: Upper Upper Albian and lower Lower Cenomanian, south-eastern France, northern Spain, Switzerland, Hungary, Sardinia, Ukraine (Crimea), northern Algeria, Central Tunisia, Madagascar, and, possibly, Japan.

Zelandites flicki (Pervinquière, 1907)
(Pl. 4, Figs 25, 26)

1907. *Lytoceras* (*Gaudryceras*) *Flicki* Pervinquière, p. 65, pl. 3, fig. 16; text-fig. 10.
?1931. *Lytoceras* (*Gaudryceras*) *flicki* Pervinquière; Collignon, p. 69 (29), pl. 7 (3), fig. 7.
2009. *Zelandites flicki* (Pervinquière, 1907); Klein *et al*., pp. 194, 196 (with synonymy).

TYPE: the holotype, by original designation, is MNHN. F. J04331 (Pl. 4, Figs 25, 26), the original of *Lytoceras* (*Gaudryceras*) *Flicki* Pervinquière 1907, p. 65, pl. 3, fig. 16; text-fig. 10, from the 'Vraconnien' of Djebel Chirich, Central Tunisia.

DIMENSIONS:

	D	Wb	Wh	Wb:Wh	U
MNHN. F. J04331	35.3 (100)	9.8 (27.8)	14.2 (40.2)	0.69	11.0 (31.0)

DESCRIPTION: The holotype is an internal mould of a phragmocone 35.3 mm in diameter. Coiling is moderately evolute, the shallow umbilicus comprising

31% of the diameter, the low wall feebly convex and outward inclined, merging imperceptibly with the umbilical shoulder. The whorl section is compressed, the whorl breadth to height ratio 0.69, the greatest breadth below mid-flank, the flanks feebly convex, the outer flanks converging to broadly rounded ventrolateral shoulders, the venter feebly convex. There are 10 strong, straight, prorsiradiate constrictions on the flanks of the outer whorl that weaken over the venter. The suture (Pervinquière 1907, text-fig. 10) is deeply incised, with narrow-stemmed E/A and A/U2.

DISCUSSION: Pervinquière based the species on six specimens; I have only seen the holotype. The presence of 10 strong, straight constrictions per whorl distiguish *flicki* from other, contemporaneous *Zelandites*.

OCCURRENCE: Lower Cenomanian of Central Tunisia and, possibly, Madagascar.

Genus *Kossmatella* Jacob, 1907

TYPE SPECIES: *Ammonites Agassizianus* Pictet 1847, p. 303, pl. 4, fig. 3, by the subsequent designation of Roman (1938, p. 43).

Kossmatella sp. juv.
(Pl. 4, Figs 6, 7)

1907. *Lytoceras* (*Kossmatella*) cf. *Marut* Stoliczka; Pervinquière, 1907, p. 72, pl. 3, figs 22, 23; text-fig. 12.
1940. *Kossmatella laeviscula* Breistroffer, p. 112 (42) (*pars*).
1956. *Kossmatella laeviscula* Breistroffer; Collignon, p. 66 (*pars*).
2009. *Kossmatella laeviscula* Breistroffer, 1940; Klein *et al*., pp. 200, 203 (*pars*).

MATERIAL: MNHN. F. J13715, the original of *Lytoceras* (*Kossmatella*) cf. *Marut* Stoliczka of Pervinquière (1907, p. 72, pl. 3, figs 22, 23; text-fig. 12), from the 'Vraconnien' of Kef Si Abd el Kerim, Central Tunisia.

DESCRIPTION: This minute specimen is only 4.7 mm in diameter. Coiling is very evolute, the broad shallow umbilicus comprising 47% of the diameter, the umbilical wall flattened and outward-inclined, the umbilical shoulder and flanks strongly convex, the venter broad and feebly convex, the whorl section depressed oval, the whorl breadth to height ratio 1.46. There are weak to strong low, broad, prorsiradiate ribs that arise at the umbilical seam, and are straight and prorsiradiate across the flanks, strengthening progressively before weakening and effacing over the venter, which is near-smooth. The suture (Pervinquière 1907, text-fig. 12 on p. 72) is quite deeply but only moderately incised, with narrow-stemmed bifid E/A and A/U2, and bifid A.

DISCUSSION: Breistroffer (1940, p. 112 (42)) introduced his *Kossmatella laeviscula* as follows: "*K. laeviscula* Brst. nov. sp. (= *Lytoceras* cf. *marut* in PERVINQ. 1907, Et. Pal. tunis., Céphal. Terr. second. p. 72, pl. III, figs. 22–23 = juv.) est une espèce bien distinct en particulier par la grand finesse de sa costulation, du Vraconien (s. l.) d'Algérie (Oued Cheniour: holotype non figure in coll. Blayac) et de Tunisie (Si Abd el Kerim)." I have been unable to trace the holotype in Blayac's material from the Vallée de Cheniour (Blayac 1912, p. 302) during my studies of the collections of the Sorbonne. The specimen figured and described by Pervinquière (Pl. 4, Figs 6, 7) has irregularly spaced quite strong ribs, to which the term 'finesse' does not apply. In the absence of the holotype, I regard *laeviscula* as a *nomen dubium*, and am uncertain as to its affinities.

OCCURRENCE: As for material.

Family Tetragonitidae Hyatt, 1900
Subfamily Tetragonitinae Hyatt, 1900
Genus *Tetragonites* Kossmat, 1895

TYPE SPECIES: *Ammonites Timotheanus* Pictet, 1847, p. 295, pl. 2, fig. 6; pl. 3, figs 1, 2, by the original designation of Kossmat (1895, p. 131 (35)).

Tetragonites spathi Fabre, 1940
(Pl 3, Figs 23, 24; Pl. 4, Figs 8–13)

1940. *Tetragonites spathi* Breistr. *in litt*; Fabre, p. 214, pl. 6, fig. 1; text-fig. 26.
1973. *Carinites spathi* Fabre, 1940; Wiedmann, p. 609, pl. 8, figs 9, 10; text-fig. 11.
1984. *Tetragonites* (*Carinites*) *spath*i Fabre 1940; Wright and Kennedy, p. 49, pl. 1, fig. 5; text-fig. 2a.
1994. *Tetragonites spathi* Fabre, 1940; Kennedy, p. 217, pl. 4, figs 1–4, 7, 8.
2009. *Tetragonites spathi* Fabre; Klein *et al*. pp. 239, 243 (with additional synonymy).

TYPE: The lectotype, by the subsequent designation of Kennedy (1994, p. 217) is the original of Fabre

(1940, pl. 6, fig. 1), in the collections of the Université Aix-Marseille, from the condensed Lower and Middle Cenomanian fauna of the Banc des Lomabards of Cassis, Bouches du Rhône, France. It was refigured by Wiedmann (1973 pl. 8, fig. 10; text-fig. 11a) and Kennedy (1994, pl. 4, figs 1, 2) amongst others.

MATERIAL: MNHN. F. J13799a, the original of Pervinquière (1907, pl. 3, fig. 25), from the 'Vraconnien' of Kef Si Abd el Kerim, Central Tunisia. OUMNH KX.9664–9666 and 9667 (collective of seven specimens), from the Lower Cenomanian of Kat el Margueb, north of Djebel Fguira Salah, near Pont du Fahs Central Tunisia may also belong here. OUMNH KX.16520, from the Lower Cenomanian *carcitanense* fauna north of Djebel Hameima, Central Tunisia.

DIMENSIONS:

	D	Wb	Wh	Wb:Wh	
MNHN. F. J13799a	7.9 (100)	3.9 (49.4)	4.3 (54.4)	0.91	2.3 (29.1)
OUMNH KX.9666	37.8 (100)	14.3 (37.8)	16.7 (44.2)	0.86	10.6 (28.0)

DESCRIPTION: MNHN. F. J13799a (Pl. 3, Figs 23, 24) is a very well-preserved juvenile 7.9 mm in diameter. Coiling is involute, the umbilicus of moderate depth, comprising 29.1% of the diameter, the umbilical wall feebly convex and outward-inclined. The umbilical shoulder is broadly rounded, the whorl section slightly compressed, with subparallel, feebly convex flanks, broadly rounded ventrolateral shoulders and a broad, very feebly convex venter. The venter is smooth on the adapical half of the outer whorl; there is a faint siphonal ridge on the adapertural half. There are four prominent constrictions on the outer whorl. They are deeply incised into the umbilical wall and shoulder, strong, straight and prorsiradiate across the flanks, weak, effaced, and very feebly convex across the venter.

OUMNH KX.9664–9666 are phragmocones 31–37.5 mm in diameter. The specimens (see, for example, Pl. 4, Figs 8–13) retain limonitised shell, and the sutures are not visible. Coiling is moderately evolute, the umbilicus comprising 28% of the diameter, the relatively low umbilical wall feebly convex and outward-inclined, the umbilical shoulder broadly rounded. The whorls are slightly compressed, with a whorl breadth to height ratio of 0.86 in OUMNH KX.9666 (Pl. 4, Figs 10, 11). The flanks are very feebly convex, the middle and outer flanks feebly convergent, the ventrolateral shoulders broadly rounded, the venter feebly convex. OUMNH KX.9665 and 9666 have a feeble siphonal keel preserved over the adapertural sector of the outer whorl (Pl. 4, Figs 10–13). Constrictions are well-developed, seven on the adapertural half whorl of OUMNH KX.9665. The constrictions are irregularly spaced, prorsirdiate on the umbilical wall, straight and feebly prorsiradiate on the inner flanks, projecting forward and feebly concave on the middle and outer flanks and ventrolateral shoulders, crossing the venter in an obtuse chevron. In places, where the limonitic shell is well-preserved, there are adapertural collar ribs associated with the constrictions, most prominent on the ventrolateral shoulder. OUMNH KX.9644 is heavily overgrown in places, with striking ridges of limonite crystals, some, but not all of which mark the site of constrictions/collar ribs.

DISCUSSSION: The specimens show the diagnostic features of the species: a siphonal ridge and numerous irregularly spaced constrictions that cross the venter in an obtuse chevron. See Wiedmann (1973, p. 609), Wright and Kennedy (1984, p. 49) and Kennedy (1994, p. 217) for further discussion.

OCCURRENCE: Lower and Middle Cenomanian. The geographic distribution extends from south-eastern France to southern England, Dagestan, Ukraine (Crimea), and Central Tunisia.

Tetragonites sp. juv.
(Pl. 3, Figs 12, 17)

DISCUSSION: MNHN. F. J13799b, the original of Pervinquière 1907, pl. 3, fig. 26 (Pl. 3, Fig. 12), from the 'Vraconnien' of Kef Si Abd el Kerim, Central Tunisia, has a maximum preserved diameter of 4.4 mm. The original of Pervinquière 1907, pl. 3, fig. 24 (Pl. 3, Fig. 17; MNHN collections), from the 'Vraconnien' of Guern er Rhezal, Central Tunisia, is 10.8 mm in diameter. They are specifically indeterminate.

OCCURRENCE: As for material.

Tetragonitinae sp. juv.
(Pl. 6, Figs 14, 15)

1907. *Lytoceras* (*Tetragonite*s) cf. *Kingianum* Kossmat; Pervinquière, p. 72, pl. 3, fig. 29.
2009. *Saghalinites kingianus* (Kosmat, 1895); Klein *et al*., pp. 253, 255 (with synonymy).

MATERIAL: MNHN. F. J13790, the original of Pervinquière (1907, pl. 3, fig. 29), from the 'Vraconnien' of Kef Si Abd el Kerim, Central Tunisia.

DIMENSIONS:

	D	Wb	Wh	Wb:Wh	U
MNHN. F. J13790	8.3 (100)	3.4 (41.0)	3.2 (38.6)	1.06	4.0 (48.2)

DESCRIPTION: The specimen is a juvenile 8.3 mm in diameter, retaining a 240° sector of body chamber. Coiling is very evolute, serpenticone, the umbilicus comprising 48.2% of the diameter, the whorl section slightly depressed subcircular, the whorl breadth to height ratio 1.06. The surface of the internal mould is smooth, but for four constrictions on the outer whorl. They are very feebly concave across the umbilical shoulder, prorsiradiate and straight on the inner flank, flexing back and feebly convex on the outer flank, feebly concave on the ventrolateral shoulder and transverse over the venter. Pervinquière described the lobes as trifid, but they are not conspicuously so.

DISCUSSION: Kossmat (1895, p. 137 (41)) introduced his *Lytoceras* (*Tetragonites*) *kingianus* for *Ammonites cala* Forbes of Stoliczka (1865, p. 153, pl. 75, fig. 4). The figures are a composite, for as Stoliczka states (explanation of pl. 75, fig. 4): "A cast; the striation on the inner whorl has been restored from another specimen,with the shell". *Lytoceras* (*Tetragonites*) *kingianus* is thus based on at least two specimens, whilst the text suggests further specimens, and it appears to be an *Anagaudryceras*. I can see no basis for assigning Pervinquière's specimen to *kingianus*; it is only 8.3 mm in diameter; the internal mould figured by Stoliczka is 69–70 mm in diameter according to Stoliczka's text. Pervinquière's specimen is regarded as possibly a juvenile member of the Tetragonitinae.

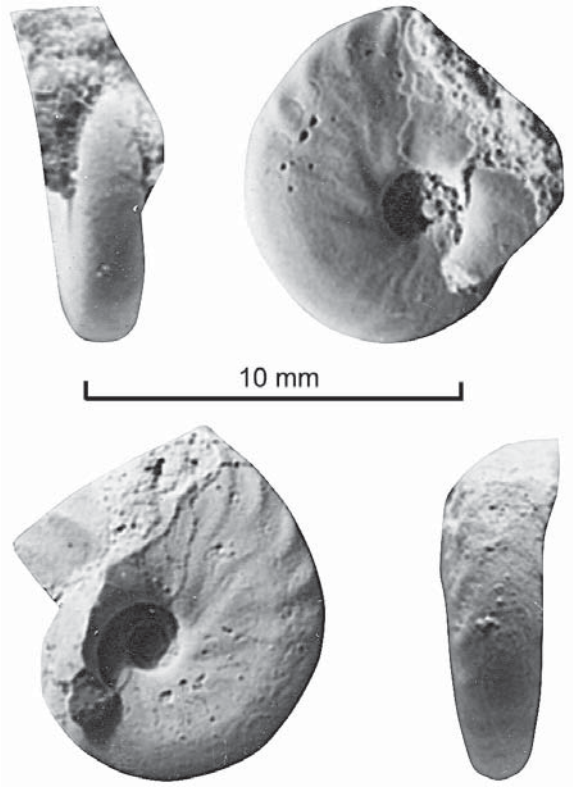
OCCURRENCE: As for material.

Suborder Ammonitina Hyatt, 1889
Superfamily Haploceratoidea Zittel, 1884
Family Binneyitidae Reeside, 1927
Genus *Borissjakoceras* Arkhangelsky, 1916

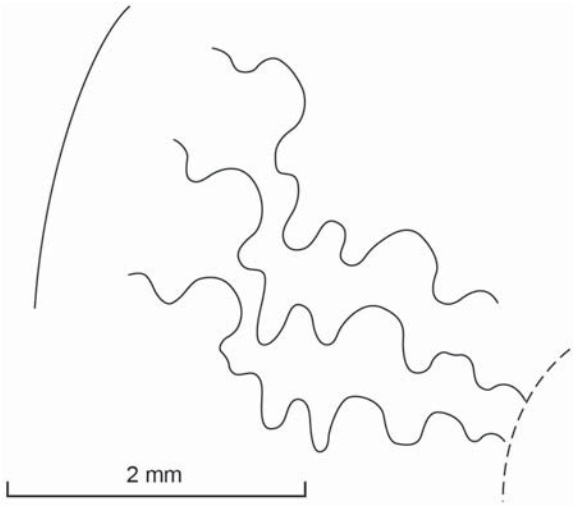
TYPE SPECIES: *Borissjakoceras mirabilis* Arkhangelsky, 1916, p. 55, pl. 8, figs 2, 3, by original designation.

Borissjakoceras falcatum sp. nov.
(Text-figs 5, 6)

TYPE: The holotype is OUMNH KX.16434, paratypes OUMNH KX.16435–16437 from the Lower Cenomanian *carcitanense* fauna north of Djebel Hameima, Central Tunisia.



Text-fig. 5. *Borissjakoceras falcatum* sp. nov. The holotype, OUMNH KX.16434, from the Lower Cenomanian *carcitanense* fauna north of Djebel Hameima, Central Tunisia. The original is 8.5 mm in diameter



Text-fig. 6. *Borissjakoceras falcatum* sp. nov. Partial external sutures of paratype OUMNH KX.16435

DIAGNOSIS: A *Borissjakoceras* with feebly falcoid riblets and lirae on the flanks that strengthen into concave bullae on the ventrolateral shoulders of the adapertural part of the adult phragmocone and the body chamber, linked over the venter by a weaker, convex rib.

DESCRIPTION: The holotype is an adult phragmocone retaining a sector of body chamber, nine mm in diameter, with the crushed remnants of a further sector of body chamber. Coiling is involute, the small, shallow umbilicus comprising 24% of the diameter, with a low, flattened wall and quite narrowly rounded umbilical shoulder. The whorl section is compressed, with flattened subparallel flanks, broadly rounded ventrolateral shoulders, and a feebly convex venter. On the adapical parts of the phragmocone the flanks are ornamented by delicate riblets and striae, straight and prorsiradiate on the inner and middle flanks, then flexing forwards and concave on the outer flanks and ventrolateral shoulders. On the adapertural part of the adult phragmocone and body chamber the ornament strengthens, and the ribs develop into concave bullae on the outer flanks and ventrolateral shoulders, linked over the venter by a weaker convex rib. The suture (Text-fig. 6) is little-incised, with a bifid E/A with a single median incision, and an entire A/U2, U and auxiliary lobes and saddles.

DISCUSSION: *Borissjakoceras falcatum* differs from other species of *Borissjakoceras* with well-developed ventrolateral nodes (Cobban 1961; Kennedy 1988) in the falcoid course of the ribs, and the elongation of the concave ventrolateral bullae.

OCCURRENCE: As for types.

Superfamily Desmoceratoidea Zittel, 1895
Family Desmoceratidae Zittel, 1895
Subfamily Puzosiinae Spath, 1922b
Genus and subgenus *Puzosia* Bayle, 1878

TYPE SPECIES: *Ammonites planulatus* J. de C. Sowerby, 1827 (p. 136, pl. 570, fig. 5), *non* Schlotheim, 1820 (p. 59) = *Ammonites mayorianus* d'Orbigny, 1841, p. 267, pl. 79, figs 1–3, by the subsequent designation of H. Douvillé (1879, p. 91).

Puzosia (*Puzosia*) *mayoriana* (d'Orbigny, 1841)
(Pl. 6, Figs 1–4, 7–10; Pl. 7, Figs 1, 2, 7–9, 15; Text-fig. 9D)

1841. *Ammonites Mayorianus* d'Orbigny, p. 267, pl. 79, figs 1–3.
1984. *Puzosia* (*Puzosia*) *mayoriana* (d'Orbigny, 1841); Wright and Kennedy, p. 55, pl. 3, figs 1, 2, 4, 6, 9–12; pl. 4, figs 1, 2, 5–7; text-figs 1a, b, 2c, h, m, 3n–r, 4a–e) (with synonymy).
1987. *Puzosia* (*Puzosia*) *mayoriana* (d'Orbigny, 1841); Cooper and Kennedy, p. 106, text-figs 1–7, 9, 10 (with synonymy).
2011. *Puzosia* (*Puzosia*) *sharpei* Spath, 1923; Klein and Vašicek, p. 68.
2011. *Puzosia* (*Puzosia*) *communis communis* Spath, 1923; Klein and Vašiček, pp. 65, 70.
2011. *Puzosia* (*Puzosia) communis cantabridgensis* Breistroffer, 1940; Klein and Vašiček, pp. 65, 70.
2011. *Puzosia* (*Puzosia*) *mayoriana* (D'Orbigny, 1841); Klein and Vašiček, pp. 67, 77.
2011. *Puzosia* (*Puzosia*) *octosulcata* (Sharpe, 1857); Klein and Vašiček, pp. 67, 83.

TYPE: The lectotype, by the subsequent designation of Wright and Wright (1951, p. 35), is BMNH 9381, the original of J. de C. Sowerby (1827, pl. 570, fig. 5), from the Cenomanian Lower Chalk of Hamsey, near Lewes, Sussex.

MATERIAL: MNHN. F. J13793, the original of *Puzosia mayoriana* var. *octosulcata* Sharpe of Pervinquière (1907, p. 159, pl. 6, fig. 30), from the 'Vraconnien' of Pont du Fahs, Central Tunisia MNHN. F. J13712 the original of *Puzosia mayoriana* var. *octosulcata* Sharpe of Pervinquière (1907 p. 159, pl. 6, figs 29), from the 'Vraconnien' of Guern er Rhezal, Central Tunisia. MNHN. F. J13710, the original of *Puzosia mayoriana* d'Orbigny of Pervinquière (1907, p. 157, pl. 6, fig. 26), from the 'Vraconnien' of Guern er Rhezal, Central Tunisia. OUMNH KX.9656–9658, from Kat el Margueb, north of Djebel Fguira Salah, near Pont du Fahs, Central Tunisia. OUMNH KX.9804, from the Upper Cenomanian *pentagonum* fauna north of Djebel Hameima, Central Tunisia. OUMNH KX.14231, 14234a, b, from the Upper Albian *puzosianum* fauna 2.5 km south of Djebel Djerissa, Central Tunisia.

DIMENSIONS:

	D	Wb	Wh	Wb:Wh	U
MNHN. F. J13793	10.3 (100)	4.4 (42.7)	5.8 (56.3)	0.76	3.0 (29.2)
MNHN. F. J13712	13.0 (100)	5.8 (44.6)	5.6 (43.0)	1.04	3.8 (29.2)
MNHN. F. J13710	18.4 (100)	7.3 (39.7)	7.4 (40.2)	0.99	6.5 (35.3)
OUMNH KX.9656	21.5 (100)	8.1 (37.7)	9.2 (42.8)	0.57	6.6 (30.7)

DESCRIPTION: *Puzosia* (*P.*) *mayoriana* is interpreted (following Wright and Kennedy 1984, p. 55, pl. 3, figs 1, 2, 4, 6, 9–12; pl. 4, figs 1, 2, 5–7; text-figs 1a, b, 2c, h, m, 3n–r, 4a–e) as a variable species with 4–8 constrictions per whorl. On this basis, MNHN. F. J13712 (Pl. 6, Figs 2–4) and J13793 (Pl. 6, Figs 9, 10) the originals of *Puzosia mayoriana* var. *octosulcata* Sharpe of Pervinquière (1907, p. 159, pl. 6, figs 29, 30) are assigned to the species. MNHN. F. J13793 (Pl. 6, Figs 9, 10) is 10.3 mm in diameter. Coiling is moderately evolute, the umbilicus of moderate depth, comprising 29.2% of the diameter. The umbilical wall is convex and outward-inclined, the umbilical shoulder broadly rounded, the whorl section compressed oval, the whorl breadth to height ratio 0.76, with feebly convex flanks, broadly rounded ventrolateral shoulders and venter. There are ?nine irregularly spaced constrictions on the outer whorl. They are straight and prorsiradiate on the inner flank, concave on the outer flank and ventrolateral shoulder, and cross the venter in a broad, obtuse convexity. MNHN. F. J13712 (Pl. 6, Figs 2–4) is 13 mm in diameter. Coiling is moderately involute, the umbilicus of moderate depth, comprising 29.2% of the diameter. The umbilical wall is flattened, the umbilical shoulder narrowly rounded, the whorl section slightly depressed, the flanks feebly convex and subparallel, the ventrolateral shoulders and venter broadly rounded. There are seven to eight constrictions on the outer whorl. They are deeply incised into the umbilical wall and shoulder, straight and prorsiradiate on the inner flank, very feebly convex at mid-flank, flexing back, strengthening, and feebly concave on the outer flank and ventrolateral shoulder, then sweeping forwards to form an obtuse rounded ventral peak. The adapical and adapertural edges of the constriction are strengthened into feeble collar ribs. MNHN. F. J13710 (Pl. 6, Figs 7, 8) is the original of *Puzosia mayoriana* of Pervinquière (1907, p. 157, pl. 6, figs 26), and is 18.4 mm in diameter. Coiling is moderately evolute, the umbilicus shallow, with a flattened, slightly outward-inclined umbilical wall and very narrowly rounded umbilical shoulder. The whorl section is very slightly compressed, with feebly convex inner flanks, the outer flanks converging to broadly rounded ventrolateral shoulders and venter. The surface of the internal mould is smooth, but for strong constrictions, four on the outer whorl. They are deeply incised into the umbilical wall, feebly sinuous and prorsiradiate on the flanks, sweeping forwards and concave across the ventrolateral shoulders to form an obtuse ventral chevron with a rounded apex. The final constriction has an expanded adapertural edge on the outer flank.

OUMNH KX.9656 (Pl. 7, Figs 1, 2) is the best-preserved of the new material, an internal mould 21.5 mm in diameter. The shallow umbilicus comprises 30.7% of the diameter; 50% of the previous whorl is covered. The umbilical wall is flattened, the umbilical shoulder quite broadly rounded. The whorl section is compressed, the whorl breadth to height ratio 0.57, the flanks very feebly convex and subparallel, the ventrolateral shoulders broadly rounded, the venter feebly convex, with a whorl breadth to height ratio of 0.57. The internal mould is smooth, but for constrictions of which there are four on the adapertural 120° sector of the outer whorl. They are feebly concave on the innermost flanks, then straight and prorsiradiate, flexing back and feebly convex at mid-flank before flexing forwards and very feebly convex on the ventrolateral shoulder, crossing the venter in a very feeble convexity. The suture (Text-fig. 9D) is moderately incised, with a bifid E/A, large bifid A/U2, and trifid A.

The largest specimen seen is OUMNH KX.9805 (Pl. 7, Fig. 15), a very crushed phragmocone fragment with a maximum preserved whorl height of 27 mm. The constrictions are conspicuous, straight and very feebly prorsiradiate on the inner half of the flank, sweeping forwards and concave on the outer flank. Crowded delicate ribs that parallel the constrictions are conspicuous on the middle and outer flank region.

DISCUSSION: The species is interpreted as widely variable, following Wright and Kennedy (1984) and Cooper and Kennedy (1987).

OCCURRENCE: Upper Albian to Upper Cenomanian, southern England, France, Spain, Switzerland, Germany, Poland, Romania, Bulgaria, Ukraine (Crimea), Georgia, Kazakhstan, northern Algeria, Central Tunisia, Egypt, Madagascar and, possibly, Japan.

Subgenus *Puzosia* (*Bhimaites*) Matsumoto, 1954

TYPE SPECIES: *Ammonites Bhima* Stoliczka, 1865, p. 137, pl. 69, figs 1–3, by the original designation of Matsumoto (1954, p. 113).

Puzosia (*Bhimaites*) sp.
(Pl. 7, Figs 3, 4)

MATERIAL: OUMNH KX.14310, from the upper Upper Albian *puzosianum* fauna 2.5 km south of Djebel Djerissa, Central Tunisia.

DIMENSIONS:

	D	Wb	Wh	Wb:Wh	U
OUMNH KX.14310	30.6 (100)	9.7 (31.7)	15.0 (49.0)	0.65	7.7 (25.2)

DESCRIPTION: Coiling is moderately involute, the shallow umbilicus comprising 25.2% of the diameter, the low umbilical wall feebly convex, the umbilical shoulder quite narrowly rounded. The whorl section is compressed, with a whorl breadth to height ratio of 0.65, the greatest breadth below mid-flank, the inner flanks feebly convex, the middle and outer flanks converging to broadly rounded ventrolateral shoulders and a feebly convex venter. The surface of the internal mould is smooth, but for a single constriction at the greatest preserved diameter. It is strongly developed on the umbilical wall and shoulder, but weak on the flanks, where it is feebly prorsiradiate, feebly convex on the inner flank, feebly concave on the outer flank, strengthening on the ventrolateral shoulders and venter, where it is flanked by well-developed adapical and adapertural collar ribs. The suture is deeply and intricately incised, with narrow-stemmed bifid saddles and trifid A.

DISCUSSION: Lack of ornament, whorl proportions and form of constrictions indicate *Bhimaites*, the specimen comparing well with juveniles assigned to *P.* (*B.*) *stoliczkai* (Kossmat, 1868) (Stoliczka 1865, pl. 71, fig. 2; Wiedmann and Dieni 1968, pl. 17, fig. 13) and *B. pinguis* (Crick, 1907) (Kennedy and Klinger 2014, p. 10, text-fig. 12a–d); it is regarded as specifically indeterminate.

OCCURRENCE: As for material.

Genus *Parapuzosia* Nowak, 1913

TYPE SPECIES: *Sonneratia daubréei* de Grossouvre, 1894, p. 154, pl. 28, by the original designation of Nowak (1913, p. 350).

Subgenus *Parpuzosia* (*Austiniceras*) Spath, 1922b

TYPE SPECIES: *Ammonites austeni* Sharpe, 1855, p. 28, pl. 12, fig. 1, by the original designation of Spath (1922b, p. 127).

Parapuzosia (*Austiniceras*) sp. juv.
(Pl. 6, Figs 11–13, 22–24)

1910. *Puzosia subplanulata* Schlüter; Pervinquière, p. 34, pl. 11 (2), figs 31, 32.

MATERIAL: MNHN. F. J13769, the original of Pervinquière (1910, p. 34, pl. 2 (17), fig. 31), from Sour El-Ghozlane (Aumale), northern Algeria. MNHN. F. J13760, the original of Pervinquière (1910, p. 34, pl. 11 (2), fig. 32), from Berrouaghia, northern Algeria.

DIMENSIONS:

	D	Wb	Wh	Wb:Wh	U
MNHN. F. J13769	21.7 (100)	6.0 (27.6)	8.6 (39.6)	0.70	7.9 (36.4)
MNHN. F. J13760	35.1 (100)	8.7 (24.8)	12.2 (34.8)	0.7	13.4 (38.2)

DESCRIPTION: MNHN. F. J13769 (Pl. 6, Figs 11–13) is 21.7 mm in diameter, and retains extensive areas of limonitised shell. Coiling is very evolute, with 43% of the previous whorl covered. The broad, shallow umbilicus comprises 36.4% of the diameter, the low umbilical wall flattened, the umbilical shoulder narrowly rounded. The whorl section is very compressed, with a whorl breadth to height ratio of 0.7, the flanks flattened and subparallel, the ventrolateral shoulders broadly rounded, the venter feebly convex. Nine constrictions are visible on the outer whorl. They are deeply incised into the umbilical wall and shoulder, near-straight and prorsiradiate on the inner to middle flank, flexing forwards and concave on the outer flank and ventrolateral shoulder and crossing the venter in a broad convexity. The constrictions are flanked by a strong adapical, and weak adapertural collar rib, the former strengthening into a marked adapertural lip on the venter. The inner to middle flanks appear to have borne occasional primary ribs; in contrast, the outer flanks, ventrolateral shoulders and venter bear numerous shorter ribs, concave on outer flank and ventrolateral shoulder, and feebly convex over the venter. There are six between successive constrictions/collar ribs.

MNHN. F. J13760 (Pl. 6, Figs 22–24) is 35.1 mm in diameter. Coiling is very evolute, with 40% of the previous whorl covered. The broad shallow umbilicus comprises 38.2% of the diameter, the umbilical wall flattened, the umbilical shoulder narrowly rounded. The inner to middle flanks are feebly convex and subparallel, the outer flanks converging to the narrow, arched venter. The specimen retains extensive areas of limonitised shell, the surface of which is smooth, but for broad, shallow constrictions, of which only two are well-expressed on the outer whorl. They have a gently sloping adapical and abrupt adapertural

edge, and are straight and prorsiradiate across the flanks, feebly concave on the ventrolateral shoulders, and cross the venter in a broad, shallow convexity.

DISCUSSION: *Parapuzosia* (*Austiniceras*) are best known from very large individuals. The present specimens are assigned to the subgenus on the basis of the ribbing pattern of MNHN. F. J13769, which corresponds to that of much larger specimens of the type species (Wright and Kennedy 1984, pl. 5, fig. 6), whilst MNHN. F. J13760 corresponds to a nucleus figured by those authors (1984, pl. 5, fig. 3).

OCCURRENCE: As for material.

Genus *Pachydesmoceras* Spath, 1922b

TYPE SPECIES: *Ammonites denisonianus* Stoliczka, 1865, p. 133, pl. 65, fig. 4; pl. 66, figs 1, 2; pl. 66a, by the original designation of Spath (1922b, p. 127).

Pachydesmoceras maroccanum Collignon, 1967
(Pl. 1, Figs 4, 8)

1967. *Pachydesmoceras maroccanum* Collignon, p. 26, pl. 12, fig. 4.

TYPE: The holotype, by monotypy, is the original of Collignon (1967, pl. 12, fig. 4), from the Cenomanian of the Tarfaya Basin, Morocco.

MATERIAL: OUMNH KX.16835–16836, *pentagonum* fauna, from a thin limestone in the Upper Cenomanian north of Djebel Hameima, Central Tunisia.

DESCRIPTION: The fragments are very crushed. OUMNH KX.16836 (Pl. 1, Fig. 8) is the better-preserved, and has an estimated original whorl height of 50 mm. Relatively coarse, sinuous, distant primary ribs strengthen across the flanks and are feebly concave across the inner flank, flex back and are convex at mid-flank, then flexing forwards and feebly concave on the outer flank. Some bifurcate, and there are one or two long or short intercalated ribs. Both fragments bear a single much stronger primary rib, presumably a collar rib associated with a constriction.

DISCUSSION: The style of ribbing of these fragments is identical to that of the holotype of *maroccanum*. A second Moroccan species, *Pachydesmoceras hottingeri* Collignon, 1967 (p. 14, pl. 2, figs 1, 2) is significantly older (lower Upper Albian), with crowded sinuous primaries that bifurcate on the ventrolateral shoulder.

OCCURRENCE: Cenomanian of Morocco, and Upper Cenomanian of Central Tunisia.

Subfamily Desmoceratinae
Genus and subgenus *Desmoceras* Zittel, 1884

TYPE SPECIES: *Ammonites latidorsatus* Michelin, 1838, by the subsequent designation of Böhm 1895, p. 364.

Desmoceras (*Desmoceras*) *latidorsatum* (Michelin, 1838)
(Pl. 7, Figs 16–18; Pl. 8, Figs 14–19)

1838. *Ammonites latidorsatus* Michelin, p. 101, pl. 12, fig. 9.
2011. *Desmoceras* (*Desmoceras*) *latidorsatum* (Michelin, 1838); Klein and Vašíček, pp. 141, 144 (with full synonymy).
2013. *Desmoceras* (*Desmoceras*) *latidorsatum* (Michelin, 1838); Kennedy and Klinger, p. 40, text-figs 1–5.
2019. *Desmoceras* (*Desmoceras*) *latidorsatum* (Michelin, 1838); Kennedy in Gale *et al*., p. 206, pl. 4, figs 19–25; pl. 11, figs 7–14).
2019. *Desmoceras* (*Desmoceras*) *latidorsatum* (Michelin, 1838); Gautam *et al*. p. 20, text-fig. 6f, g (with additional synonymy).

TYPE: The holotype by monotypy, and now lost, is the original of Michelin (1838, p. 101, pl. 12, fig. 9), from the Albian Gault Clay of Aube, France. The neotype (Joly in Gauthier 2006, p. 97, pl. 3, fig. 1) is MNHN. F. B46095, *ex* d'Orbigny Collection 5773-B1. It is from the condensed Albian of Escragnolles, Var, France.

MATERIAL: There are numerous specimens. OUMNH KX.17121, 17160–17163, from the Lower Cenomanian. OUMNH KX.17160–17163, from the Upper Cenomanian, Commune of Ziana, 21 km east of Berrouaghia, northern Algeria. OUMNH KX.17008–17009, from the Upper Albian *puzosianum* fauna east of El Faidja, 7.5 km east of Berrouaghia, northern Algeria. OUMNH KX.16942 (collective of six specimens), from the Lower Cenomanian northwest of Sour El-Ghozlane (Aumale), northern Algeria. OUMNH KX.16219–16221, from north and northwest of Gadet Chi, north-eastern Algeria. OUMNH KX.9700 (collective of six specimens), from the Upper

Cenomanian *pentagonum* fauna of Koudiat el Hamra, south-west of El Kef, Central Tunisia. OUMNH KX.14231, 14234 (collective of three specimens), from the Upper Albian *puzosianum* fauna, 2.5 km south of Djebel Djerissa, Central Tunisia. OUMNH KX.16389, from the Upper Albian *puzosianum* fauna. OUMNH KX.16587, from the lower Lower Cenomanian *carcitanense* fauna. OUMNH KX.16727–16729, from the Upper Cenomanian *pentagonum* fauna, all from north of Djebel Hameima, Central Tunisia.

DIMENSIONS:

	D	Wb	Wh	Wb:Wh	U
OUMNH KX.14234c	25.7 (100)	13.4 (52.1)	13 (50.6)	1.03	5.1 (19.8)

DESCRIPTION: OUMNH KX.14234c (Pl. 8, Figs 14–16) is a typical nucleus, 25.7 mm in diameter, the coiling very involute, the umbilicus of moderate depth, comprising 19.8% of the diameter, with a flattened umbilical wall and broadly rounded umbilical shoulder. The flanks are flattened and subparallel, the ventrolateral shoulders broadly rounded, the venter feebly convex. The specimen retains areas of corroded, limonitised shell; there is no ornament nor are there constrictions visible. OUMNH KX.14231 is the largest phragmocone seen with a maximum preserved diameter of 55.4 mm, the flanks flattened and subparallel, the whorl breadth to height ratio 0.9 approximately.

DISCUSSION: This species and its variants have been described exhaustively by previous authors. See Wiedmann and Dieni (1968, p. 132, p. 12, figs 2, 6–13; text-fig. 81); Kennedy and Klinger (2013a, p. 40, text-figs 1–5); Kennedy and Fatmi (2014, p. 58, text-fig. 11a–h) and Kennedy and Morris (2018, p. 90, figs 5a–f, j–o; 6d).

OCCURRENCE: Middle Albian to Upper Cenomanian, southern England, southern France, Italy, northern Spain, southern Germany, Switzerland, Hungary, Romania, Serbia, Poland, Sardinia, Ukraine, northern Algeria, Central Tunisia, Egypt, Nigeria, Angola, KwaZulu-Natal in South Africa, Mozambique, Madagascar, Tamil Nadu in South India, Pakistan, Japan, New Zealand, Mexico and Venezuela.

Desmoceras (*Desmoceras*) *chirichense*
(Pervinquière, 1910)
(Text-figs 7, 8)

1907. *Desmoceras* (*Desmoceras*) *Chirichensis* Pervinquière, p. 152, pl. 6, figs 17–20; text-fig. 59.
1910. *Puzosia Getulina* mut. *Chirichensis* Pervinquière; Pervinquière, p. 33, pl. 12 (3), figs 6–8.
2009. *Desmoceras* (*Desmoceras*) *chirichense* (Pervinquière, 1907); Klein *et al*., pp. 141, 142 (with additional synonymy).

TYPE: The holotype, by original designation, is the original of Pervinquière (1907, p. 152, pl. 6, figs 19, 20), from 'Vraconnien' of Djebel Chirich, Central Tunisia.

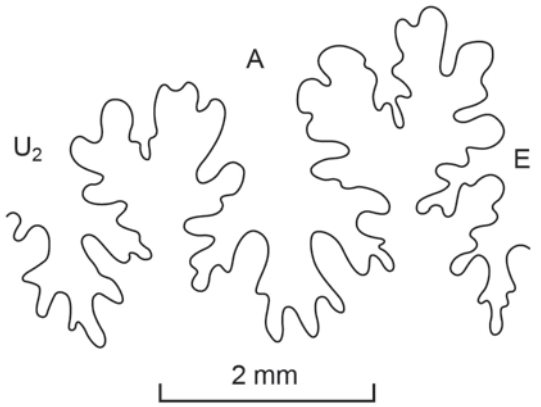
MATERIAL: MNHN. F. J13759, the original of Pervinquière (1910, pl. 17 (3), figs 6, 7), and MNHN. F. J13758, the original of Pervinquière (1910, pl. 17 (3), fig. 8), both from the Cenomanian of Berrouaghia, northern Algeria.

DIMENSIONS:

	D	Wb	Wh	Wb:Wh	U
MNHN. F. J13758	10.9 (100)	7.6 (69.7)	5.6 (51.4)	1.36	– (–)

DESCRIPTION: MNHN. F. J13758 (Text-fig. 7D,

Text-fig. 7. *Desmoceras* (*Desmoceras*) *chirichirense* (Pervinquière, 1910). A-C – MNHN. F. J13759, the original of Pervinquière 1910, pl. 12 (3) figs 6, 7; D, E – MNHN. F. J13758, the original of of Pervinquière 1910, pl. 12 (3) fig. 8. Both are from the Cenomanian of Berrouaghia, northern Algeria



Text-fig 8. External suture of *Desmoceras* (*Desmoceras*) *chirichirense* (Pervinquière, 1910), MNHN. F. J13759, the original of Pervinquière 1910, pl. 12 (3) figs 6, 7

E) has a maximum preserved diameter of 10.9 mm. Coiling is very involute, the umbilicus minute, the umbilical wall flattened and outward-inclined to form a conical circumbilical pit. The umbilical shoulder is broadly rounded. The whorl breadth to height ratio is 1.36. The flanks, ventrolateral shoulders and venter are broadly convex. There are four conspicuous constrictions on the outer whorl. They are straight and prorsiradiate on the umbilical wall, flex back across the umbilical shoulder, deepen, and are initially markedly concave on the flanks, sweeping forwards, weakening, and crossing the venter in an obtuse convex peak. The constrictions are flanked by collar ribs, best developed on the flanks and ventrolateral shoulders, the adapical rib the stronger. At the greatest preserved diameter there are indications of delicate riblets that parallel the course of the constrictions; the surface of the rest of the mould is smooth. At the apertural end of the outer whorl there is what appears to be an umbilical tubercle, interpreted here as an originally pyritic (now limonitic) overgrowth, as noted by Pervinquière (1910, p. 33). MNHN. F. J13759 (Text-fig. 7A–C) is 9.6 mm in diameter prior to the terminal distorted section. The suture of MNHN. F. J13759 (Text-fig. 8) is deeply incised, with bifid E/A, trifid A, and bifid A/U2.

DISCUSSION: The specimens from Berrouaghia described above differ in no significant respects from those assigned to *Desmoceras latidorsatum perinflatum* of Cooper and Kennedy (1979, p. 237, text-figs 37, 38, 39d–f) from the Upper Albian of Angola. Whether *chirichense* is a synonym of a variable *latidorsatum*, a subspecies of *latidorsatum* or a distinct species is unclear from the present limited material. Accordingly, a conservative position is adopted here.

OCCURRENCE: As for types. The material comes from around the Albian Cenomanian boundary, but is not precisely dated.

Desmoceras (*Desmoceras*) sp. juv.
(Pl. 8, Figs 1–13)

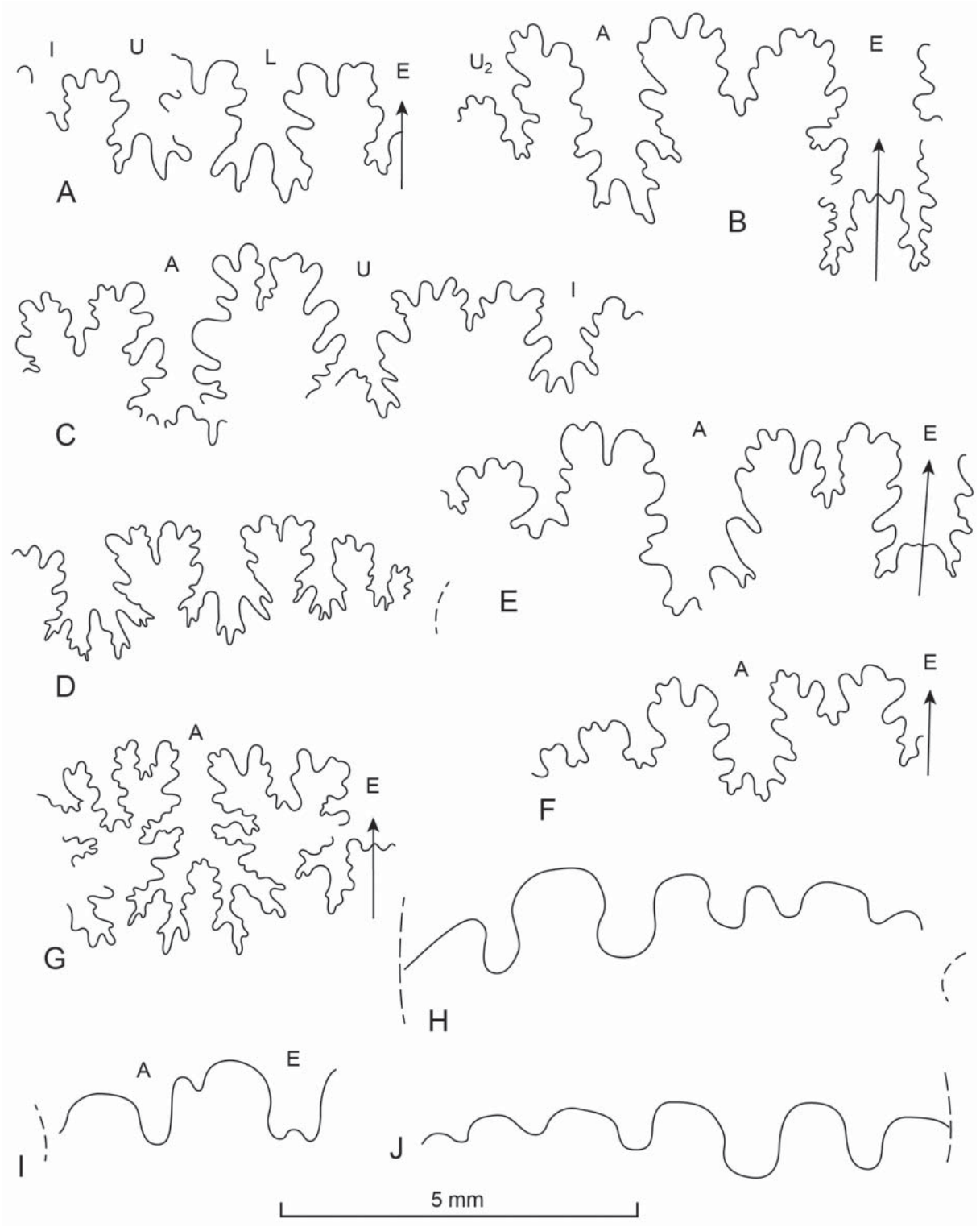
1907. *Puzosia* (*Latidorsella*?) *Paronae* Kilian; Pervinquière, p. 148, pl. 6, figs 10–14; text-figs 56, 57.

MATERIAL: MNHN. F. J13700 (Pl. 8, Figs 1, 2), the original of Pervinquière (1907, pl. 6, fig. 10), from the 'Vraconnien' of Guern er Rhezal, Central Tunisia. MNHN. F. J13716 (Pl. 8, Figs 3–5) the original of Pervinquière (1907, pl. 6, fig. 11), from the 'Vraconnien' north of Bou Tis, Central Tunisia. MNHN. F. J13801 (PL. 8, Figs 9, 10), the original of Pervinquière (1907, pl. 6, fig. 12), from the 'Vraconnien' north of Bou Tis, Central Tunisia. MNHN. F. J13800 (Pl. 8, Figs 11–13), the original of Pervinquière (1907, pl. 6, fig. 13), from the 'Vraconnien' of Si Abd el Kerim, Central Tunisia. MNHN. F. J13704 (Pl. 8, Figs 6–8), the original of Pervinquière (1907, pl. 6, fig. 14), from the 'Vraconnien' north of Bou Tis, Central Tunisia.

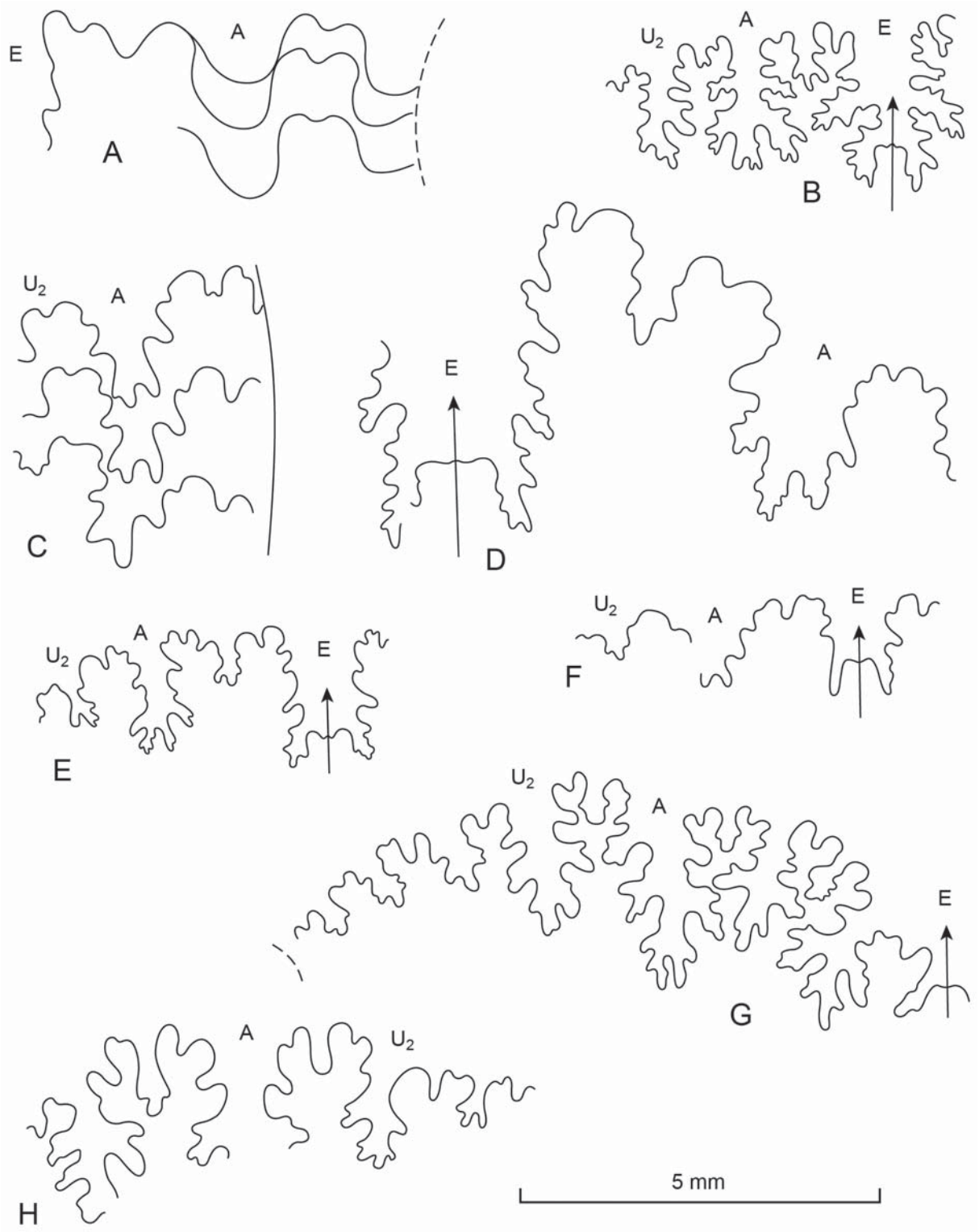
DIMENSIONS:

	D	Wb	Wh	Wb:Wh	U
MNHN. F. J13700	8.0 (100)	3.9 (48.8)	4.8 (60.0)	0.81	– (–)
MNHN. F. J13800	10.6 (100)	5.1 (48.1)	6.1 (57.5)	0.84	2.2 (20.8)
MNHN. F. J13716	20.2 (100)	9.0 (44.6)	9.0 (44.6)	1.0	5.3 (26.2)
MNHN. F. J13704	21.2 (100)	9.8 (46.4)	10.1 (47.9)	0.97	5.5 (26.1)
MNHN. F. J13801	23.3 (100)	10.4 (44.6)	10.3 (44.2)	1.0	6.4 (27.5)

DESCRIPTION: MNHN. F. J13801 (Pl. 8, Figs 9, 10) is a very well-preserved wholly septate limonitic internal mould 23.3 mm in diameter. Coiling is moderately involute, the umbilicus, of moderate depth, comprising 27.5% of the diameter, the umbilical wall flattened and outward-inclined, the umbilical shoulder quite narrowly rounded. The whorl section is as wide as high, and feebly trapezoidal, the flanks flattened, the ventrolateral shoulders broadly rounded, the broad venter feebly convex. The adapical sector of the outer whorl is smooth. There are four barely perceptible constrictions on the succeeding 240° sec-



Text-fig. 9. Suture lines. A – *Scalarites* sp., OUMNH KX.17200. B – *Eucalycoceras rowei* (Spath, 1926), OUMNH KX.16097. C – *Algerites ellipticus* (Mantell, 1822), OUMNH KX.16304. D – *Puzosia* (*Puzosia*) *mayoriana* (d'Orbigny, 1841), OUMNH KX.9656. E, F – *Stoliczkaia* (*Stoliczkaia*) *subboulei*. (Sornay, 1955). E – OUMNH KX.14288c; F – OUMNH KX.16238. G – *Anisoceras auberti* Pervinquière, 1907 OUMNH KX.16308. H – *Neolobites peroni* Pervinquière, 1907, OUMNH KX.16721b. I – *Ficheuria pernoni* Dubourdieu, 1953, OUMNH KX.14302. J – *Neolobites vibrayeanus* (d'Orbigny, 1841), OUMNH KX.16721a



Text-fig. 10. Suture lines. A – *Conlinites evolutum* sp. nov., OUMNH KX.17204. B – *Phyllopachyceras whiteavesi* (Kossmat, 1898), OUMNH KX.9656. C – *Enigmaticeras* cf. *riceae* Kennedy, 2004, OUMNH KX.16498b. D – *Calycocera*s (*Newboldiceras*) *planecostatum* (Kossmat, 1897), OUMNH KX.16647. E – *Stoliczkaia* (*Stoliczkaia*) *clavigera* (Neumayr, 1875), OUMNH KX.14197. F – *Protacanthoceras sottaraense* sp. nov., OUMNH KX.16107. G – *Forbesiceras obtectum* (Sharpe, 1853), OUMNH KX.16107. H – *Forbesiceras largilliertianum* (d'Orbigny, 1841), OUMNH KX.16272

tor; they are straight and prorsiradiate on the flanks, sweeping forwards and effacing on the ventrolateral shoulder. MNHN. F. J13716 (Pl. 8, Figs 3–5), 20.2 mm in diameter, has very poorly developed constrictions. MNHN. F. J13704 (Pl. 8, Figs 6–8), 21.1 mm in diameter, has four narrow constrictions on the outer whorl; they are feebly concave on the inner flank, feebly convex at mid-flank, concave on the outermost flank and ventrolateral shoulder, and cross the venter in a broad convexity. MNHN. F. J13700 (Pl. 8, Figs 1, 2), 8 mm in diameter, is completely smooth. MNHN. F. J13800 (Pl. 8, Figs 11–13), 10.6 mm in diameter, is near-smooth. The sutures (Pervinquière 1907, text-figs 56b and 57 on p. 149) are moderately incised, with bifid lobes and trifid saddles.

DISCUSSION: Pervinquière (1907, p. 148) referred these specimens to *Puzosia paronae* Kilian, 1900. That name was introduced by Kilian (1900, p. 532) for the specimen figured by Parona and Bonarelli (1897, p. 80 (28) (*pars*), pl. 11 (2), fig. 2a) as *Desmoceras* cfr. *emerici* Raspail, from Châteauneuf-de-Contes, Alpes-Maritimes, France. The figure shows a phragmocone approximately 20 mm in diameter with three well-developed constrictions per half whorl, the constrictions sinuous, and deeply impressed on the inner flanks, ventrolateral shoulders and venter. Pervinquière's specimens lack such conspicuous constrictions, and appear to be juvenile *Desmoceras* (*Desmoceras*). It should be noted that he refers to adult specimens, which if correct would suggest his specimens were those of a micromorph. However, all the material he figured is wholly septate, and in the absence of body chambers and indications of adult modifications I am unconvinced.

Specimens from the Cenomanian of Berrouaghia assigned to *Puzosia* (*Latidorsella*) *diphylloides* Forbes by Pervinquière (1910, p. 31, pl. 11 (2), figs 26–30; text-fig. 15) are also juvenile *Desmoceras*, but not *diphylloides*, which is a Santonian to Upper Maastrichtian species (Kennedy and Henderson 1992, p. 405, pl. 6, figs 1–9; pl. 16, figs 1–3, 7–8; pl. 17, figs 4–7; text-fig. 3f). Pervinquière mentioned 20 specimens, collected by Peron and Thomas, one of which is figured here (Pl. 6, Figs 5, 6).

OCCURRENCE: As for material.

Genus *Microdesmoceras* Matsumoto and Muramoto, 1972

TYPE SPECIES: *Microdesmoceras tetragonum* Matsumoto and Muramoto, 1972, p. 378, pl. 47, figs 1–4; text-figs 1–4, by original designation.

Microdesmoceras bucculentum (Pervinquière, 1910) (Pl. 7, Figs 10–14)

1910. *Lytoceras* (*Gaudryceras* (?) *bucculentum* Pervinquière, p. 16, pl. 17 (1), figs 19, 20; text-fig. 4.
1925. *Gaudryceras* (?) *bucculentum* (Pervinquière); Diener, p. 47.
1956. *Gaudryceras*? *bucculentum* (Pervinquière); Collignon, p. 69.
2009. *Gaudryceras*? *bucculentum* (Pervinquière, 1910); Klein *et al.*, pp. 172, 175.

TYPE: The holotype, by monotypy, is MNHN. F. J13701 (Pl. 7, Figs 10–14), the original *Lytoceras* (*Gaudryceras* (?) *bucculentum* Pervinquière, 1910, p. 16, pl. 10 (1), figs 19, 20; text-fig. 4, from the Cenomanian of Berrouaghia, northern Algeria.

DESCRIPTION: The holotype is a limonitic internal mould of an adult 8.1 mm in diameter, with a 240° sector of body chamber preserved. Coiling is very evolute, serpenticone, the broad, shallow umbilicus comprising 36% of the diameter, the umbilical wall low, the umbilical shoulder broadly rounded. The whorl section is compressed, the whorl breadth to height ratio 0.7, the flanks flattened and subparallel, the ventrolateral shoulders broadly rounded, the venter feebly convex. There is a feeble concave constriction on the ventrolateral shoulders at the adapertural end of the body chamber that passes across the venter in a broad convexity, and a further possible constriction at the adapical end of the outer whorl. Delicate lira-like ridges on one flank and the venter may be artefacts of preservation, being of variable shape and present on one flank only. The aperture is marked by a large lappet, the adapical margin strongly convex in the inner to middle flank region, sweeping back and feebly concave on the outer flank. The lappets are preceded by a marked constriction on the outer flank, ventrolateral shoulders and venter. The suture (Pervinquière 1910, text-fig. 4). is relatively simple, with a tall, narrow E/A, broad, trifid A with only minor incisions, and an A/U2 that has only minor indentations, the remaining lobes and saddles of the external suture entire.

DISCUSSION: As will be seen from the synonymy, previous authors have regarded the present species as possibly belonging to the Tetragonitoidea. It is assigned to *Microdesmoceras* on the basis of the

overall size, shape, proportions, and trifid A, as in the type species. The lirae on the body chamber of the type species (Matsumoto and Muramoto 1972, text-fig. 1) follow a sigmoidal course, suggesting that the aperture would probably have borne lateral lappets comparable to those of the present species. *Microdesmoceras bucculentum* differs from *M. tetragonum* in having a compressed whorl section rather than one that is as wide as high (Matsumoto and Muramoto 1972, text-fig. 4). Although clearly a member of the Desmoceratidae, the presence of lappets suggest it might better be assigned to Puzosiinae.

OCCURRENCE: As for type.

Family Pachydiscidae Spath, 1922
Genus *Pseudojacobites* Spath, 1922

TYPE SPECIES: *Pachydiscus farmeryi* Crick, 1910, p. 345, pl. 27, figs 1, 2, by the original designation of Spath (1922b, p. 121).

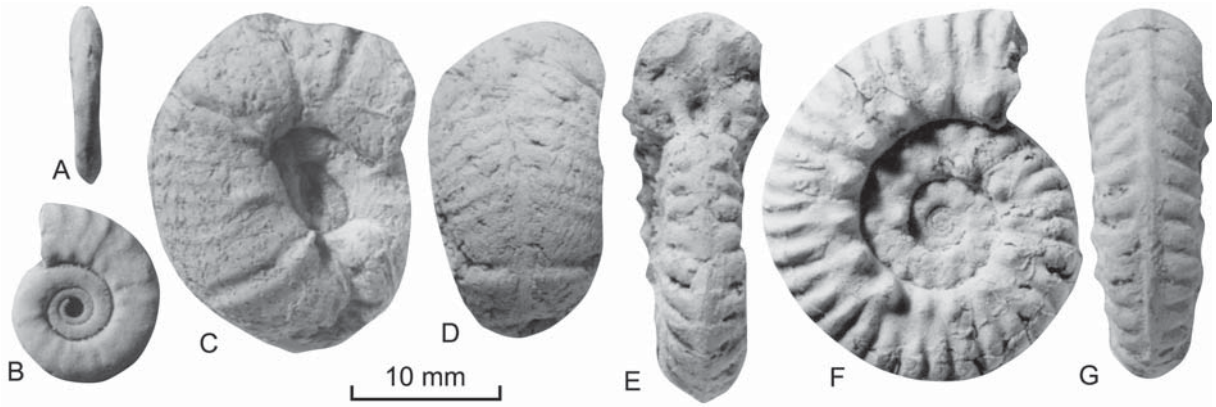
Pseudojacobites sp. juv.
(Text-fig. 11C, D)

1910. *Pachydiscus* sp. Pervinquière, p. 37, pl. 3 (12), figs 1–3.
2019. *Pseudojacobites* sp. juv.; Kennedy, p. 56, text-fig. 27a, b.

MATERIAL: The original of *Pachydiscus* sp. of Pervinquière (1910, p. 37, pl. 3 (12), fig. 3), from the Cénomanien moyen of Berrouaghia in northern Algeria. Originally in the Sorbonne Collections.

DESCRIPTION: The specimen is a wholly septate crushed phragmocone with a maximum preserved diameter of 22.9 mm. Coiling appears to have been moderately evolute, the umbilicus deep, with a convex wall and broadly rounded umbilical shoulder. The whorl section is depressed reniform. There are four strong constrictions on the adapertural half of the outer whorl, deeply incised into the umbilical shoulder, prorsiradiate on the flanks, sweeping forwards across the ventrolateral shoulders, and crossing the venter in a shallow convexity. The constrictions are preceded by a strong collar rib with a well-developed umbilical bulla. There is a much weaker adapertural collar rib, best developed on ventrolateral shoulders and venter. An additional umbilical bulla, not, apparently associated with a collar-rib, gives rise to a pair of primary ribs that strengthen across the flanks, sweeping forwards and concave on the ventrolateral shoulders and feebly convex across the venter. There are additional narrow primary ribs that lack a bulla, but follow the same course as the bullate rib. There are up to eight ribs between successive constrictions.

DISCUSSION: The specimen is assigned to the genus *Pseudojacobites* on the basis of the similarity of coiling, whorl proportions, ornament and constrictions to those of the smallest specimens of the type species from the Upper Turonian of southern England (Wright 1979, pl. 6, fig. 3; Kennedy 2019, pl. 11, figs 5–7). *Pseudojacobites* first appears in the Upper Turonian; I doubt Pervinquière's assignation to the Middle Cenomanian; it is not indicated who collected it but it appears to have been Thomas, as with others from the environs of Berrouaghia (Pervinquière 1910, p. 5).



Text-fig. 11. A, B – *Conlinites*? *ootatoorense* (Stoliczka, 1863), MNHN. F. J13747, the original of Pervinquière 1910, pl. 15 (6), figs 4, 5, his 'varieté à faible ornamentation' from Djebel Guessa, northern Algeria. C, D – *Pseudojacobites* sp. juv., the original of *Pachydiscus* sp. of Pervinquière 1910, p. 37, pl. 3 (12), fig. 3, originally described as from the "Cénomanien moyen" of Berrouaghia in northern Algeria and originally in the Sorbonne Collections. E-G – *Cantabrigites* sp. aff. *valdense* Renz, 1968, the original of *Mortoniceras inflatum* Sowerby of Pervinquière 1910, pl. 15. (6), from Sour El-Ghozlane (Aumale), northern Algeria. Figures are × 2

OCCURRENCE: As for material, an Upper Turonian horizon is proposed.

Superfamily Hoplitoidea H. Douvillé, 1890
Family Hoplitidae H. Douvillé, 1890
Subfamily Hoplitinae H. Douvillé, 1890
Genus *Discohoplites* Spath, 1925a

TYPE SPECIES: *Ammonites coelonotus* Seeley, 1865, p. 237, pl. 10, fig. 2, by the original designation of Spath 1925a, p. 83.

Discohoplites subfalcatus (Semenov, 1889)
(Pl. 9, Figs 1–11)

1899. *Hoplites subfalcatus* Semenov, pp. 130, 170, pl. 5, fig. 5.
2014. *Discohoplites subfalcatus* (Semenov, 1889); Klein, pp. 73, 75 (with full synonymy).

TYPE: The lectotype, by the subsequent designation of Spath (1930, p. 301) is no. L. 39831 in the collections of the Musée Geologique, Lausanne, the original of Pictet and Campiche (1859, p. 210, pl. 27, fig. 2), refigured by Renz (1968, pl. 2, fig. 1), from the upper Upper Albian of Ste Croix, Canton Waadt, Switzerland.

MATERIAL: OUMNH KX.14169, from the Upper Albian *puzosianum* fauna 2.5 km south of Djebel Djerissa, Central Tunisia. OUMNH KX.16183 (collective of 8 specimens), 16184–16190, from the Upper Albian *puzosianum* fauna, slopes north and northwest of Gadet Chi, 3 km approximately east of Bou Khadra, north-eastern Algeria.

DIMENSIONS:

	D	Wb	Wh	Wb:Wh	U
OUMNH KX.16187	15.2 (100)	4.3 (28.3)	8.0 (52.6)	0.54	3.1 (20.4)
OUMNH KX.16188	18.2 (100)	5.4 (29.7)	9.0 (49.5)	0.6	3.7 (20.3)
OUMNH KX.16189	20.4 (100)	6.2 (30.4)	10.5 (51.5)	0.59	4.1 (20.1)
OUMNH KX.16190	21.0 (100)	6.8 (32.3)	11.2 (53.3)	0.61	4.0 (19.0)

DESCRIPTION: Nuclei are up to 21 mm in diameter. Coiling is very involute, the small shallow umbilicus comprising around 20% of the diameter, the umbilical wall flattened and outward-inclined, the umbilical shoulder quite narrowly rounded. The whorl section is very compressed, with a whorl breadth to height ratio that varies around 0.6, the greatest breadth just outside the umbilical shoulder. The inner flanks are feebly convex, the middle and outer flanks flattened and convergent. The ventrolateral shoulders are relatively broadly rounded, the venter flattened, with a strong siphonal groove. Delicate ribs, 22 per whorl in the larger specimens, arise at the umbilical seam, are feebly concave, pass straight up the umbilical wall, and strengthen into long, weak, strongly prorsiradiate bullae that give rise to pairs of narrow prorsiradiate ribs that flex back and are convex around mid-flank before sweeping forwards, strengthening, and becoming markedly concave on the outer flank, where additional ribs intercalate to give up to 80 per whorl at the ventrolateral shoulder, across which the ribs project strongly forwards and extend to the margins of the siphonal groove. The sutures are deeply incised, overlapping and interfering, with a broad bifid E/A and A, and a narrower A/U2.

DISCUSSION: *Discohoplites valbonnensis valbonnensis* (Hébert and Munier-Chalmas, 1875) has much coarser ribbing (see revision in Kennedy *et al*. 2008, p. 41, pl. 4, figs 6–23). *Hyphoplites costosus* Wright and Wright, 1949 (p. 484, pl. 29, fig. 7; Wright and Kennedy 1984, p. 70, pl. 7, fig. 12) has minute ventral clavi.

OCCURRENCE: Upper Upper Albian *perinflata* Zone of the Western European sequence, with records from southern England, south-eastern France, Switzerland, northern Spain, Hungary, Romania, Kazakhstan, north-eastern Algeria and Central Tunisia.

Family Engonoceratidae Hyatt, 1900
Genus *Engonoceras* Neumayr and Uhlig, 1881

TYPE SPECIES: *Ammonites pierdenalis* von Buch, 1848, p. 30a, pl. 6, fig. 8, by the subsequent designation of Pervinquière (1907, p. 200).

Engonoceras sp. juv.
(Pl. 9, Figs 12–17; Text-fig. 24E)

MATERIAL: OUMNH KX.14241–14242, from the upper Upper Albian *puzosianum* fauna 2.5 km south of Djebel Djerissa, Central Tunisia.

DESCRIPTION: There are two nuclei, 11.9 and 12.6 mm in diameter. Coiling is very involute, the umbilicus comprising 12% of the diameter, shallow, with a flattened, outward-inclined umbilical wall

and rounded umbilical shoulder. The whorl section is compressed, with a whorl breadth to height ratio of 0.46, the greatest breadth just outside the umbilical shoulder. The innermost flanks are feebly convex, the middle and outer flanks flattened, converging to sharp ventrolateral shoulders, the narrow venter concave between. OUMNH KX.14242 (Pl. 9, Figs 12–15) has the surface of the internal whorl very well-preserved. A series of low, broad flat straight prorsiradiate ribs-perhaps better described as undulations – on the surface of the mould – extend across the inner third of the flanks, splitting into up to three delicate riblets, initially straight, before flexing forwards and feebly concave on the outermost flank. The external suture of OUMNH KX.14241 (Text-fig. 24E) has a broad E/A with minor incisions and a series of smaller saddles, some of which have entire terminations.

DISCUSSION: These tiny specimens lack species diagnostic features and are left in open nomenclature.

OCCURRENCE: As for material.

Genus *Neolobites* Fischer, 1882

TYPE SPECIES: *Ammonites vibrayeanus* d'Orbigny, 1841, p. 322, pl. 96, figs 1–3, by monotypy.

Neolobites vibrayeanus (d'Orbigny, 1841)
(Pl. 9, Figs 18–20; Text-fig. 9J)

1841. *Ammonites vibrayeanus* d'Orbigny, p. 322, pl. 96, figs 1–3.
2005. *Neolobites vibrayeanus* (d'Orbigny, 1841); Wiese and Schulze, p. 933, text-figs 4a–e; 5a–d; 6a–j; 7a–e; 8a, b, h; 9a, b, d (with synonymy).
2014. *Neolobites vibrayeanus* (d'Orbigny, 1841); Klein, pp. 212, 216 (with additional synonymy).
2014. *Neolobites bassleri* Boit, 1926; Klein, p. 212 (with additional synonymy).
2014. *Neolobites brancai* Eck, 1908; Klein, p. 212 (with additional synonymy).
2014. *Neolobites bussoni* Collignon, 1965; Klein, pp. 212, 213 (with additional synonymy).
2014. *Neolobites choffati* Hyatt, 1903; Klein, pp. 212, 213 (with additional synonymy).
2014. *Neolobites isidis* Greco, 1915; Klein, pp. 212, 214 (with additional synonymy).
2014. *Neolobites maresi* (Coquand, 1862); Klein, pp. 212, 214 (with additional synonymy).
2014. *Neolobites schweinfurthi* Eck, 1908; Klein, pp. 212, 215 (with additional synonymy).
2014. *Neolobites vibrayeanus* (d'Orbigny, 1841); Klein, pp. 212, 216 (with additional synonymy).

TYPE: The holotype, by monotypy, is MNHN, F. R54886, the original of d'Orbigny (1841, p. 322, pl. 96, figs 1–3). It was refigured by Kennedy and Juignet (1981, text-fig. 3a–c) and Kennedy and Juignet in Gauthier (2006, pl. 59, fig. 1).

MATERIAL: OUMNH KX.16721a and 16801, from the Upper Cenomanian *pentagonum* fauna north of Djebel Hameima, Central Tunisia.

DIMENSIONS:

	D	Wb	Wh	Wb:Wh	U
OUMNH KX.16721a	25.8 (100)	6.3 (24.4)	15.6 (60.5)	0.4	– (–)

DESCRIPTION: OUMNH KX.16721a (Pl. 9, Figs 18–20) is a worn phragmocone 25.8 mm in diameter. Coiling is very involute, the shallow umbilicus near-occluded, the umbilical wall flattened, the umbilical shoulder broadly rounded. The whorl section is very compressed, with a whorl breadth to height ratio of 0.4, the greatest breadth just outside the umbilical shoulder. The inner flanks are feebly convex, the middle and outer flanks flattened and convergent, the venter concave between sharp ventrolateral shoulders. The surface of the internal mould is smooth, but for a delicate spiral ridge on the outer flank, possibly the result of *post-mortem* crushing. There are six saddles in the external suture (Text-fig. 9J). OUMNH KX.16801 is 20.7 mm in diameter, and closely comparable.

DISCUSSION: Only three species of *Neolobites* are recognised here, following Wiese and Schulz (2005). The absence of coarse ribs and ventrolateral clavi immediately distinguishes *N. vibrayeanus* from *Neolobites peroni* Hyatt, 1903 (see revision in Kennedy in Kennedy and Gale 2015, p. 254, pl. 3, figs 8, 10, 11; text-fig. 10a) and *N. fourtaui* Pervinquière, 1907 (see revision in Kennedy in Kennedy and Gale 2015, p. 253, pl. 2, figs 1–7, text-figs 9, 10b–d).

OCCURRENCE: Lower Upper Cenomanian, France, Spain, Portugal, Algeria, Central Tunisia, Libya, Egypt, Israel, Jordan, Syria, Saudi Arabia, Oman, Niger, Bolivia, Colombia, Peru and Venezuela.

Neolobites peroni Hyatt, 1903
(Pl. 9, Figs 21, 22; Pl. 13, Figs 28, 29, 31–34; Text-fig. 9H)

1889. *Neolobites vibrayeanus* Thomas and Peron, p. 16, pl. 18, figs 1, 2.
1903. *Neolobites peroni* Hyatt, p. 179.
1907. *Neolobites Peroni* Hyatt; Pervinquière, p. 208, pl. 8, fig. 1.
2014. *Neolobites peroni* Hyatt, 1903; Klein, pp. 212, 215 (with synonymy).
2015. *Neolobites peroni* Hyatt, 1903; Kennedy in Kennedy and Gale, p. 254, pl. 3, figs 8, 10, 11; text-fig. 10a (with additional synonymy).

TYPE: The holotype, by monotypy, is in the MNHP collections, and was said by Thomas and Peron (1889, explanation of pl. 16, figs 1, 2) to be from Djebel Roumana (?), Tunisia. It was refigured by Kennedy and Gale (2015, pl. 3, fig. 11).

MATERIAL: OUMNH KX.9824, 16845–16849, 16721b, from the Upper Cenomanian *pentagonum* fauna north of Djebel Hameima, Central Tunisia.

DIMENSIONS:

	D	Wb	Wh	Wb:Wh	U
OUMNH KX.16721b	26.0 (100)	7.1 (27.3)	15.9 (61.1)	0.45	1.7 (6.5)
OUMNH KX.16846	26.1 (100)	7.9 (30.2)	15.5 (59.4)	0.51	2.7 (10.3)

DESCRIPTION: Most of the specimens are small phragmocones up to 26 mm in diameter. OUMNH KX.16721b (Pl. 9, Figs 21, 22) is a feebly ornamented variant, a phragmocone with a maximum preserved diameter of 26 mm. Coiling is very involute, the minute umbilicus comprising 6.5% of the diameter, the umbilical wall flattened, the umbilical shoulder broadly rounded. The whorl section is very compressed, with the greatest breadth below mid-flank, the inner flanks feebly convex, the middle and outer flanks flattened and convergent, the whorl breadth to height ratio 0.45. The narrow venter is concave between sharp ventrolateral shoulders. The inner flanks are smooth; the outer flanks are ornamented by blunt concave ribs most single, but a few arising in pairs. OUMNH KX.16848 (Pl. 13, Figs 31, 32) is a better preserved individual of this type, 26.1 mm in diameter. OUMNH KX.16847 (Pl. 31 Figs 28, 29) is a 120° sector with a maximum preserved whorl height of 11.2 mm and a whorl breadth to height ratio of 0.62. In contrast to the previous specimens there are two well-developed primary ribs on the adapertural part of the fragment; they arise from feeble umbilicolateral bullae and are markedly prorsiradiate, flexing back and declining at mid-flank, where they are feebly linked to two, perhaps three concave ribs that coarsen markedly on the outer flank, as do intercalated ribs, all ribs terminating in well-developed ventral clavi. OUMNH KX.16849 (Pl. 13, Figs 33, 34) is a much larger phragmocone fragment, with a maximum preserved whorl height of 27 mm approximately. Although encrusted with limonitic overgrowths, it nevertheless shows the ornament of outermost flanks and venter well.

The suture, with entire lobes and saddles (Text-fig. 9H) is typical for the genus.

DISCUSSION: Strong ornament distinguishes the species from *N. vibrayeanus*; the branching ribs separates juveniles from *Neolobites fourtaui* (see revisions in Wiese and Schulz 2005 and Kennedy in Kennedy and Gale 2015, p. 253, pl. 2, figs 1–7; text-figs 9, 10b–d).

OCCURRENCE: Middle and lower Upper Cenomanian, Algeria, Central Tunisia, and northern Spain.

Superfamily Acanthoceratoidea de Grossouvre, 1894
Family Brancoceratidae Spath, 1934
Subfamily Mortoniceratinae H. Douvillé, 1912
Genus *Cantabrigites* Spath, 1933

TYPE SPECIES: *Mortoniceras* (*Cantabrigites*) *cantabrigense* Spath, 1932, p. 380, by original designation by Spath (1933, p. 436).

Cantabrigites wenoensis (Adkins, 1920)
(Pl. 11, Figs 1–13)

1907. *Mortoniceras inflatum* Sowerby var. *orientalis* (?) Stoliczka; Pervinquière, p. 229, pl. 11, fig. 2 only.
1920. *Schloenbachia wenoensis* Adkins, p. 89, pl. 1, fig. 14.
1920. *Mortoniceras worthense* Adkins, p. 91 (*pars*), pl. 1, figs 6, 8, 9 only.
1926. *Prohysteroceras* (?) *tunisiense* Spath, p. 430.
2004. *Cantabrigites wenoensis* (Adkins, 1920); Kennedy, p. 875, text-figs 10l–r, 11a, b, 12a–g (with full synonymy).
2018. *Cantabrigites wenoense* (Adkins, 1920); Klein, pp. 179, 184 (with additional synonymy).

TYPES: The holotype of *Schloenbachia wenoensis* is TMM 21412 (Pl. 11, Figs 1, 2) from the Upper Albian Pawpaw Shale near Fort Worth, Texas, the

original of Adkins (1920, pl. 1, fig. 14), by original designation.

MATERIAL: MNHN. F. J13781, the lectotype of *Spathiceras tunisiense* Spath, 1926, by the subsequent designation of Kennedy (2004, p. 875), is the original of *Mortoniceras inflatum* var. *orientalis* of Pervinquière (1907, p. 229, pl. 9, fig. 2), from the Upper Albian of Djebel Djerissa, Central Tunisia. OUMNH KX.14133–14136, 14190–14191, from the upper Upper Albian *puzosianum* fauna 2.5 km south of Djebel Djerissa, Central Tunisia. OUMNH KX.17085–7086, from the Upper Albian *puzosianum* fauna, commune of Ziana, 21 km east of Berrouaghia, northern Algeria.

DESCRIPTION: The lectotype of *Prohysteroceras* (?) *tunisiense* Spath, 1926 (Pl. 11, Figs 7–9) is a wholly septate juvenile with an estimated original diameter of 18 mm. The initial three whorls are smooth. There are more than 26 strongly prorsiradiate umbilical bullae on the outer whorl. These give rise to one or two sinuous prorsiradiate ribs, with feeble to effaced inner ventrolateral bullae, and well-developed oblique outer ventrolateral clavi. OUMNH KX.14190 (Pl. 11, Figs 3, 4) is 14 mm approximately in diameter, and also records the transition from the smooth to the ribbed and tuberculate stage, with well-differentiated outer ventrolateral clavi only at the greatest preserved diameter. OUMNH KX.17085 (Pl. 11, Figs 5, 6) is a phragmocone with a maximum preserved diameter of 14.6 mm. As with the lectoytpe of *tunisiense*, the early whorls are smooth, ornament only appearing at the adapical end of the outer whorl. The inner flanks are initially smooth, with inner flank ornament present only on the adapertural 90° sector. In contrast ventrolateral ornament is present from the beginning of the outer whorl, outer flank ornament appearing only slightly later. OUMNH KX.17086 (Pl. 11, Figs 12, 13) is interpreted as a coarsely ornamented variant, a 120° sector with well-developed umbilical bullae from a whorl height of 5 mm.

DISCUSSION: A second example from the Pawpaw Shale of Tarrant County, Texas, is figured for comparison (Pl. 11, Figs 10, 11). See Kennedy (2004, p. 877) for discussion.

OCCURRENCE: Upper Upper Albian, north Texas, Cuba, northern Algeria and Central Tunisia.

Cantabrigites spinosum (Pervinquière, 1907)
(Pl. 10, Figs 1–21)

1907. *Mortoniceras inflatum* Sow. var. *spinosa* Pervinquière, p. 229, pl. 9, fig. 3.
1920. *Mortoniceras worthense* Adkins, p. 91, pl. 1, figs 7, 8, 10, 18, 19, 26 only, *non* 6, 8, 9 (= *Cantabrigites wenoensis*); text-fig. 12.
1928. *Neokentroceras worthense* (Adkins); Adkins, p. 235, pl. 20, figs 4–6; pl. 21, fig. 9.
1968. *Mortoniceras* (*Cantabrigites*) *valdense* Renz, p. 60, pl. 10, fig. 14; text-figs 20e, 21e.
1968. *Mortoniceras* (*Cantabrigites*) *helveticum* Renz, p. 61, pl. 10, figs 15, 16; text-figs 20f, 21g.
?1968. *Mortoniceras* (*Cantabrigites*) *curvatum* Renz, p. 61, pl. 11, figs 1, 2; text-figs 20g, 21f.
1968. *Mortoniceras* (*Durnovarites*) *neokentroides* Wiedmann and Dieni, p. 146, pl. 13, fig. 5; text-figs 94, 95.
?1968. *Mortoniceras* (*Mortoniceras*?) *nanoides* Wiedmann and Dieni, p. 141, pl. 13, fig. 11; text-fig. 89.
1979. *Hysteroceras* (*Cantabrigites*) *cantabrigense helveticum* (Renz, 1968); Scholz, p. 115, pl. 30, figs 24–26, 28–30.
2004. *Cantabrigites spinosum* (Pervinquière, 1907); Kennedy, p. 877, text-figs 7a–e, 10a–k, 12h–w, 13 (with full synonymy).
2018. *Mortoniceras* (*Durnovarites*?) *neokentroides* Wiedmann and Dieni, 1968; Klein, pp. 137, 140 (with additional synonymy).
2018. *Cantabrigites helveticum* (Renz, 1968); Klein, pp. 179, 181 (with additional synonymy).
2018. *Cantabrigites spinosum* (Pervinquière, 1907); Klein, pp. 179, 183 (with additional synonymy).

TYPES: The lectotype, by the subsequent designation of Kennedy (2004, p. 877), is MNHN. F. J04235 the original of *Mortoniceras inflatum* Sow. var. *spinosa* Pervinquière, 1907, p. 230, pl. 9, fig. 3, from the upper Upper Albian Fahdène Formation of Djebel Djerissa [Zrissa]. There are several unregistered paralectotypes.

MATERIAL: OUMNH KX.14138 (collective of 10 specimens), 14139 (collective of five specimens), 14140 (collective of 10 specimens), 14141 (collective of seven specimens), 14220 (collective of seven specimens), 14221 (collective of seven specimens), 14222 (collective of nine specimens), 14223 (collective of seven specimens), 14250, 14251 (collective of 12 specimens), 14252 (collective of 15 specimens), 14252 (collective of 15 specimens), 14254 (collective of 18 specimens), 14255 (collective of 21 specimens), all from the upper Upper Albian *puzosianum* fauna 2.5 km south of Djebel Djerissa, Central Tunisia.

DIMENSIONS:

	D	Wb	Wh	Wb:Wh	U
OUMNH KX.14220a	17.0 (100)	6.4 (37.6)	7.9 (46.5)	0.81	6.0 (35.3)
OUMNH KX.14250	18.1 (100)	6.0 (33.1)	6.2 (34.3)	0.97	7.7 (42.5)
OUMNH KX.14191b	22.2 (100)	– (–)	9.4 (42.3)	– (–)	8.5 (38.2)

All dimensions are costal.

DESCRIPTION: The largest specimen seen is OUMNH KX.14251d (Pl. 10, Figs 20, 21), 30 mm in diameter, which retains some body chamber. Coiling is very evolute, the umbilicus comprising up to 45.8% of the diameter, of moderate depth, with a convex wall and broadly rounded umbilical shoulder. The intercostal whorl section is compressed, with feebly convex parallel flanks, broadly rounded ventrolateral shoulders, and a flattened venter with a strong siphonal keel. The costal section is slightly compressed polygonal, with the greatest breadth at the inner ventrolateral tubercle. The flanks of the initial four whorls are near smooth, well-seen in OUMNH KX.14222 (Pl. 10, Fig. 10). Beyond this, primary ribs arise at the umbilical seam. The density and strength of ribs and tubercles is variable, with around 20 primary ribs per whorl at the umbilical shoulder in most individuals. Umbilical bullae vary from weak to strong between individuals, and give rise to strong, straight to very feebly flexuous prorsiradiate primary ribs, either singly or in pairs, with additional ribs intercalating to give a total of up to 30–32 ribs at the ventrolateral shoulder, where they bear conical inner ventrolateral tubercles, from which a broad rib projects forwards, and links to a conical to feebly clavate outer ventrolateral tubercle. These give rise to a progressively weakening rib that projects forwards and is separated from the siphonal keel by a narrow smooth zone. OUMNH KX.14251b (Pl. 10, Figs 15, 16) represents the coarsely ornamented end of the variation spectrum, OUMNH KX.14220a (Pl. 10, Figs 6, 7), the weaker. The suture is moderately incised, with bifid saddles and trifid A.

DISCUSSION: See Kennnedy (2004, p. 879). *Cantabrigites spinosum* is easily separated from *C. wenoensis* on the basis of the only slightly compressed to depressed whorl section, and coarse ornament with strong umbilical, inner and outer ventrolateral tubercles.

OCCURRENCE: Upper Upper Albian, northern Algeria, Central Tunisia, Sardinia, Switzerland, southeast France, Hungary, Cuba, and Texas in the United States.

Cantabrigites sp.
(Text-fig. 11E–G)

MATERIAL: MNHN. F. J13711, the original of Pervinquière (1910, pl. 6 (15), fig. 1), from Sour El-Ghozlane (Aumale), northern Algeria.

DIMENSIONS:

	D	Wb	Wh	Wb:Wh	U
MNHN. F. J13711	25.7 (100)	9.7 (37.7)	8.8 (34.2)	1.1	10.7 (41.6)

DESCRIPTION: The specimen is a phragmocone that retains limonitzed shell. Coiling is evolute, the umbilicus broad and shallow, the umbilical wall low, flattened, the umbilical shoulder rounded. The intercostal whorl section is rounded-rectangular, with feebly convex subparallel flanks, broadly rounded ventrolateral shoulders and a feebly convex venter. The costal whorl section is rounded-trapezoidal, with the greatest breadth at the umbilical bullae. Sixteen primary ribs arise at the umbilical seam, and strengthen across the umbilical wall, linking to coarse bullae, perched on the umbilical shoulder. The bullae give rise to pairs of ribs that are coarse, straight and prorsiradiate on the inner flank, strengthening markedly on the outer flank, where they are feebly concave, sweeping forwards across the ventrolateral shoulder and strengthening into a feeble inner ventrolateral bulla and a poorly differentiated outer ventrolateral tubercle that gives rise to a progressively weakening prorsiradiate rib, the ribs forming an obtuse ventral chevron with a strong siphonal keel at the apex.

DISCUSSION: The specimen differs from *Cantabrigites spinosum* and other material assigned to the genus in the very strong umbilical bullae and very weak ventrolateral tuberculation. Of described material it most closely resembles *Cantabrigites valdense* Renz, 1968 (p. 60, pl. 10, fig. 14; text-figs 20e, 21e) from the Upper Albian of Sainte-Croix, Switzerland, although the strong umbilical tuberculation is equally distinctive.

OCCURRENCE: As for material.

Genus *Euhystrichoceras* Spath, 1923

TYPE SPECIES: *Ammonites nicaisei* Coquand, 1862, p. 323, pl. 35, figs 3, 4, by the original designation of Spath 1923, p. 143.

DISCUSSION: See Kennedy and Wright (1981, p. 418), who place the genus in Mortoniceratinae; Cooper and Owen (2011, p. 301) prefer to place it in the Schloenbachiidae.

Euhystrichoceras nicaisei (Coquand, 1862)
(Pl. 11, Figs 16–24; Pl. 12, Figs 16–30, 34–36)

1862. *Ammonites nicasiei* Coquand, p. 323, pl. 11, figs 3, 4.
non 1968. *Euhystrichoceras nicaisei* (Coquand); Renz, p. 64, pl. 35, fig. 7.
1976. *Euhystrichoceras nicaisei* (Coquand); Juignet and Kennedy, p. 79, pl. 5, figs 5, 6 (with full synonymy).
1981. *Euhystrichoceras nicaisei* (Coquand); Kennedy and Wright, p. 420, pl. 59, figs 1–16, 21–23; text-figs 1a, 2d.
1996. *Euhystrichoceras nicaisei* (Coquand); Wright, p. 147, text-fig. 112.4.
2011. *Euhystrichoceras nicaisei* (Coquand); Cooper and Owen, text-fig. 5e, f.
2018. *Euhystrychoceras nicaisei* (Coquand, 1862); Klein, pp. 188, 189 (with additional synonymy).

TYPES: The lectotype, by the subsequent designation of Juignet and Kennedy (1976, p. 80) is the syntype in the Coquand Collection, housed in the Hungarian Geological Museum, and figured by Pervinquière (1910, pl. 6 (15), fig. 7), from Boghar, Algeria (Pl. 12, Figs 34–36). Pervinquière also figured (1910, pl. 6 (15), figs 6, 8–10) four additional specimens that are paralectotypes, and there are a further two paralectotypes of the species, all catalogued as GMH K-4276 (Pl. 12, Figs 16–30).

MATERIAL: OUMNH KX.15998, 16012, 16084–16085, from west of Djebel Sottara, northern Algeria. OUMNH KX.16572a–b, 16573–16574, from the lower Lower Cenomanian *carcitanense* fauna north of Djebel Hameima, Central Tunisia. OUMNH KX.9638–9641, from the Lower Cenomanian of Kat el Margueb, north of Djebel Fguira Salah, east of Pont du Fahs, Central Tunisia. OUMNH KX.17117 (collective of 5 specimens), from the lower Lower Cenomanian, Commne of Ziana, 21 km east of Berrouaghia, northern Algeria.

DISCUSSION: The species is described and discussed by Kennedy and Wright (1981, p. 420), who outline differences from other species. The material from Ziana includes tiny nuclei down to 4.4 mm in diameter (Pl. 11, Figs 22–25).

OCCURRENCE: Lower Cenomanian, Algeria, Central Tunisia, Haute-Normandie, Sarthe and Bouches-du-Rhône in France, Tanzania, and Madagascar.

Genus and subgenus *Algericeras* Spath, 1925b

TYPE SPECIES: *Ammonites bogharensis* Coquand, 1879, p. 32, by the original designation of Spath 1925b, p. 182.

Algericeras (*Algericeras*) *boghariense boghariense* (Coquand, 1880)
(Pl. 11, Figs 25–27; Pl. 12, Figs 1–7, 10–15; Pl. 13, Figs 6–8)

1862. *Ammonites Favrei* Coquand, p. 172, pl. 2, figs 3, 4 (*non* Ooster)
1880. *Ammonites Boghariensis* Coquand, p. 35.
1907. *Mortoniceras Boghariense* Coq.; Pervinquière, p. 240, pl. 11, fig. 16.
1910. *Mortoniceras* (?) *Boghariense* Coq.; Pervinquière, p. 67, pl. 15 (6), figs 29–33; text-fig. 32.
1981. *Algericeras* (*Algericeras*) *boghariense boghariense* (Coquand); Kennedy and Wright, p. 428, pl. 60, figs 6–8 (with additional synonymy).
1996. *Algericeras* (*Algericeras*) *bogharience* (Coquand); Wright, p. 146, text-fig. 112.3.
2018. *Algericeras* (*Algericeras*) *boghariense boghariense* (Coquand, 1880); Klein, p. 185 (with additional synonymy).

TYPES: The lectotype (Pl. 12, Figs 1–4), by the subsequent designation of Kennedy and Wright (1981, p. 428), is GMH K-8455 in the Coquand Collection, the original of Pervinquière (1910, pl. 15 (6), fig. 30), which is probably the original of *Ammonites favrei* Coquand, 1862 (*non* Ooster), pl. 2, figs 3, 4. There are three further paralectotype specimens, GMH K-8844a–c, figured by Pervinquière, as his pl. 15 (6), figs 29, 31 and 32 (Pl. Figs 8–15). All of the types are from the Lower Cenomanian of Berrouaghia, northern Algeria.

MATERIAL: MNHN. F. J04321, the original of Pervinquière (1907, pl. 11, fig. 7), from Guern er Rhezal, Central Tunisia. OUMNH KX.16429, from the Lower Cenomanian *carcitanense* fauna north Djebel Hameima, where fragmentary specimens compared to the restricted subspecies occur with *Algericeras* (*Algericeras*) *boghariense paucicostatum*.

DIMENSIONS:

	D	Wb	Wh	Wb;Wh	U
GMH K-8455	17.0 (100)	4.3 (25.3)	8.0 (21.3)	0.54	3.9 (22.9)

DESCRIPTION: The lectotype (Pl. 12, Figs 1–4) is a limonitic nucleus 17 mm in diameter Coiling is relatively involute, with a small, shallow umbilicus, the umbilical wall low, the umbilical shoulder narrowly rounded. The whorl section is very compressed, with a whorl breadth to height ratio of 0.54. The flanks are flattened and subparallel, the ventrolateral shoulders rounded, convergent, the venter narrow, with a high, sharp, serrated keel. There are 19–20 umbilical bullae on the outer whorl. They give rise to pairs of primary ribs, while a third rib may be tenuously linked or intercalate between the bullate pairs. The ribs are prorsiradiate, flexuous, convex at mid-flank, concave on the outer flank, sweeping forwards on the ventrolateral shoulder, where they terminate in a small ventrolateral clavus. A near-smooth zone separates these clavi from the siphonal keel. It is crossed by feeble, tapering ribs that connect to the interspaces between the minute siphonal clavi. As a result, ribs and clavi alternate when the specimen is viewed in profile. The paralectotypes (Pl. 12, Figs 5–7, 10–15) are closely comparable but smaller specimens. GMH K-8844a (Pl. 12, Figs 5–7) is the original of Pervinquière (1910, pl. 15 (4), fig. 29), and is 11 mm in diameter GMH K-8844b (Pl. 12, Figs 10–12) is the original of Pervinquière (1910, pl. 15 (4), fig. 31), and is 12.3 mm in diameter. GMH K-8846c (Pl. 12, Figs 13–15) is the original of Pervinquière (1910, pl. 15 (4), fig. 32), and is 13.5 mm in diameter.

OUMNH KX.16429 (Pl. 11, Figs 25–27) is a 180° whorl sector of phragmocone, 27.4 mm in diameter, and far larger than previously described specimens. Coiling is moderately evolute, the umbilicus shallow. The whorl section is compressed, with a whorl breadth to height ratio of 0.6 approximately, the flanks very feebly convex, and convergent. The umbilical wall and shoulder are damaged, but there are indications of small umbilical bullae that give rise to pairs of delicate ribs, while additional ribs intercalate; the ribs are feebly falcoid, straight and prorsiradiate on the inner flank, flexing back and feebly concave on the outer flank, and flexing forwards to well-developed oblique ventral clavi. The mid-ventral region is corroded over most of the specimen, revealing an internal mould of the siphuncle; traces of the siphonal keel and flanking grooves survive at the adapertural end of the fragment.

DISCUSSION: *Algericeras* (*Algericeras*) *boghariense bogharienseboghariense* differs from subspecies *paucicostatum* Kennedy and Wright, 1981 (p. 428, pl. 60, figs 9–19, 27–29; text-figs 1c, 3j–l, 4a). in the lower rib density of the latter: 35–40 per whorl versus 50, the umbilical bullae on alternate ribs tending to strengthen.

OCCURRENCE: Lower Cenomanian of northern Algeria and Central Tunisia.

Algericeras (*Algericeras*) *boghariense paucicostatum* Wright and Kennedy, 1981
(Pl. 11, Figs 14, 15; Pl. 12, Figs 8, 9, 31–33; Pl. 13, Figs 9–19, 25–27)

1907. *Mortoniceras proratum* Coq.; Pervinquière, p. 237 (*pars*), pl. 11, figs 10–12 only.
1910. *Mortoniceras* (?) *proratum* Coquand; Pervinquière, p. 66 (*pars*), pl. 15 (6), figs 27, 28.
1981. *Algericeras* (*Algericeras*) *bogharienseboghariense paucicostatum* Kennedy and Wright, p. 428, pl. 60, figs 9–19, 27–29; text-figs 1c, 3j–l, 4a (with additional synonymy).
2018. *Algericeras* (*Algericeras*) *bogharienseboghariense paucicostatum* Kennedy and Wright, 1981; Klein, pp. 185, 186.

TYPE: The holotype (Pl. 13, Figs 14–16), by the original designation of Kennedy and Wright (1981, p. 429), is MNHN. F. J04334, the original of Pervinquière (1907, pl. 11, fig. 10) (as *Mortoniceras proratum*) from the 'Vraconnien' of Kef Si Abd el Kerim, Central Tunisia.

MATERIAL MNHN. F. J04311, the original of Pervinquière (1907, pl. 11, fig. 12) (Pl. 13, Figs 25–27), from Kef Si Abd el Kerim, Central Tunisia MNHN. F. J04347, the original of Pervinquière (1910, pl. 15 (6), figs 27, 28) (Pl. 13, Figs 11–13), from Berrouaghia northern Algeria; GMH K-9125 (Pl. 12, Figs 31–33), labelled *Euhystrichoceras nicaisei*, and from Djebel Korreo, northern Algeria; GMH K-4276 (Pl. 12, Figs 8, 9), labelled *Mortoniceras* (?) *nicaisei*, and from west of Boghar, northern Algeria. OUMNH KX.16630–16632, from the Lower Cenomanian *carcitanense* fauna north of Djebel Hameima, Central Tunisia.

DESCRIPTION: The subspecies was diagnosed as follows: "A subspecies of *A. boghariense* in which the umbilical tubercles tend to strengthen on alternate primary ribs. The total number of ribs is thirty-five to forty per whorl" (Kennedy and Wright 1981, p. 429). A feature of OUMNH KX.16632 (Pl. 11, Figs 14, 15) is the serration of the siphonal keel noted previously

(Kennedy and Wright 1981, text-fig. 4a), and developed more completely in subgenus *Sakondryella* Collignon, 1964.

DISCUSSION: See above under the nominate subspecies. *Algericeras* (*Algericeras*) *numidicum* (Sornay, 1955) (p. 31, pl. 2, figs 15, 15a; text-fig. 17) has strong flexuous ribs that arise in groups from umbilical bullae.

OCCURRENCE: Lower Cenomanian of northern Algeria, Central Tunisia, and Chihuahua Province, Mexico.

Algericeras (*Algericeras*) *proratum* (Coquand, 1862)
(Pl. 13, Figs 1–5, 20–24)

1879. *Ammonites proratus* Coquand, p. 32.
1907. *Mortoniceras proratum* Coquand; Pervinquière, p. 237 (*pars*), pl. 11, figs 5–9 (*non* figs 10–12 = *Algericeras boghariense paucicostatum* Kennedy and Wright, 1981); text-fig. 97 only.
1910. *Mortoniceras* (?) *proratum* Coquand; Pervinquière, p. 66, pl. 15 (6), figs 20–26 only (*non* figs 27, 28 = *Algericeras boghariense paucicostatum* Kennedy and Wright, 1981).
1981. *Algericeras* (*Algericeras*) *proratum* (Coquand, 1862); Kennedy and Wright, p. 429, pl. 60, figs 1–5, 20–21; text-figs 3h, i, 4b (with additional synonymy).
2018. *Algericeras* (*Algericeras*) *proratum* (Coquand, 1862); Klein, pp. 185, 187 (with additional synonymy).

TYPES: GMH K-8843a, the original of Pervinquière (1910, pl. 15 (16), fig. 22) is here designated lectotype; there are five further specimens with the same catalogue number that rank as paralectotypes; all are from the Cenomanian of Sour El-Ghozlane (Aumale), northern Algeria.

MATERIAL: MNHN. F. J04313 (Pl. 13, Figs 22–24), the original of Pervinquière (1907, pl. 11, fig. 9); MNHN. F. J04321 (Pl. 23, Figs 1–3), the original of Pervinquière (1907, pl. 11, fig. 7); MNHN. F. J04333, the original of Pervinquière (1907, pl. 11, fig. 8), and four additional specimens, from Guern er Rhezal, Central Tunisia. MNHN. F. J04349, the original of Pervinquière (1910, pl. 15 (6), fig. 25); MNHN. F. J04350 (Pl. 13, Fig. 5), the original of Pervinquière (1910, pl. 15 (6), fig. 26), and six additional specimens, from Sour El-Ghozlane (Aumale), northern Algeria.

DESCRIPTION AND DISCUSSSION: See Kennedy and Wright (1981, p. 430).

OCCURRENCE: Lower Cenomanian where well-dated; northern Algeria, Central Tunisia, and possibly Madagascar.

Genus *Conlinites* Kennedy, 2004

TYPE SPECIES: *Conlinites wrighti* Kennedy, 2004, p. 874, text-figs 8a–u, 9a–c, from the upper Upper Albian Pawpaw Shale of Texas.

Conlinites evolutum sp. nov.
(Pl. 16, Figs 14, 15; Text-fig. 10A)

TYPE: The holotype is OUMNH KX.17024, from the Upper Albian *puzosianum* fauna of El Faija, 7.5 km east of Berrouaghia, northern Algeria.

DIAGNOSIS: A very evolute species of *Conlinite*s with an umbilicus that comprises 45% of the diameter.

DESCRIPTION: The holotype is septate to a diameter of 6.8 mm, the approximated sutures indicating it to be adult. A short sector of the adapical part of the body chamber is preserved, and there are indications that it originally extended for an estimated 200°. The broad, very shallow umbilicus comprises 45% of the diameter, the umbilical wall flattened and outward-inclined, the umbilical shoulder broadly rounded. The whorl section is compressed, the flattened flanks subparallel, the ventrolateral shoulders broadly rounded, the venter obtusely fastigiate with a well-developed siphonal keel with a narrowly rounded apex. The early whorls and the adapical 180° sector of the outer whorl lack ornament. On the adapertural 180° sector, blunt umbilical bullae of increasing strength appear, as do more numerous ventral clavi. The sutures are simple (Text-fig. 10A), with a broad, asymmetrically bifid E/A, the dorsal half of which is entire. A is entire, and A/U2 has a median incision only.

DISCUSSION: The small adult size, coiling, relatively coarse ornament and keel indicate the specimen to be a *Conlinites*, differing from the variable type species, where individuals range from coarsely tuberculate to smooth (Kennedy 2004, p. 874, text-figs 8, 9), in the much more evolute coiling, wider umbilicus, and simpler suture. *Ammonites ootatoorensis* Stoliczka, 1863 (p. 56, pl. 32, fig. 2), originally described from the Uttatur Group of Odiyam, Tamil Nadu, South India, is a possible *Conlinites*. It differs from the present species in reaching a much larger

adult size, having finely ribbed inner whorls, and numerous minor incisions in E/A and A. The specimens assigned to *ootatoorense* by Pervinquière (1910) are more problematic. MNHN. F. J13747, the original of his pl. 15 (6), figs 4, 5 (Text-fig. 11A, B), resembles the present specimen, but the suture illustrated by Pervinquière (1910, text-fig. 31 on p. 65) of an otherwise unfigured specimen has numerous minor incisions in E/A and A.

OCCURRENCE: As for type.

Family Lyelliceratidae Spath, 1921
Subfamily Stoliczkaiinae Breistroffer, 1953a
Genus and subgenus *Stoliczkaia* Neumayr, 1875

TYPE SPECIES: *Ammonites dispar* d'Orbigny, 1841, p. 142, pl. 45, figs 1, 2, by the subsequent designation of Diener (1925, p. 179).

DISCUSSION: Cooper (2012, p. 185) regarded *Stoliczkaia* Neumayr, 1875 as a junior primary homonym of *Stoliczkaia* Jerdon, 1870. However, the name introduced by Jerdon on p. 81 of his paper is *Stoliczkia*, which is not a homonym of *Stoliczkaia*, as demonstrated by Klinger (2018).

Stoliczkaia (*Stoliczkaia*) *clavigera* (Neumayr, 1875)
(Pl. 14, Figs 10–15; Pl. 17, Fig. 26; Text-figs 10E, 17C)

1864. *Ammonites dispar* Stoliczka, p. 85, pl. 45, fig. 1 only.
1875. *Stoliczkaia clavigera* Neumayr, p. 933.
2018. *Stoliczkaiella* (*Stoliczkaiella*) *clavigera* Neumayr, 1875); Klein, pp. 222, 223 (with synonymy).
2019. *Stoliczkaia* (*Stoliczkaia*) *clavigera* (Neumayr, 1875); Kennedy in Gale *et al*., p. 217, pl. 17, figs 10–14; text-fig. 14a (with synonymy).

TYPE: The holotype, by monotypy, is the original of Stoliczka (1864, pl. 45, fig. 1) only, GSI. 191 from the Uttatur Group of Moraviatoor, South India. A cast of this specimen was figured by Delanoy and Latil (1988, pl. 5, fig. 1).

MATERIAL: There are numerous specimens from the upper Upper Albian *puzosianum* fauna 2.5 km south of Djebel Djerissa, Central Tunisia: OUMNH KX.14142, 14179–14186, 14276 (collective of 10 specimens), 14277 (collective of 10 specimens), 14278 (collective of five specimens), 14279 (collective of 8 specimens), 14280 (collective of 10 specimens), 14281 (collective of 10 specimens), 14282 (collective of 10 specimens), 14283 (collective of 7 specimens), 14284 (collective of 8 specimens), 14285 (collective of 6 specimens). OUMNH KX.16314 (collective of 6 specimens), from the upper Upper Albian *puzosianum* fauna 700 m north-east of Koudiat el Assel, north-eastern Algeria.

DIMENSIONS:

	D	Wb	Wh	Wb:Wh	U
OUMNH KX.14281a	23.8 (100)	8.9 (37.4)	12.3 (51.7)	0.72	4.2 (17.6)
OUMNH KX. 14281b	25.8 (100)	11.4 (44.2)	14.0 (54.2)	0.81	5.1 (19.8)
OUMNH KX.14278b	38.1 (100)	– (–)	21.5 (56.4)	–	6.2 (16.3)
OUMNH KX.14283a	43.2 (100)	– (100)	23.8 (55.0)	–	6.1 (14.1)

DESCRIPTION: Phragmocones, many of which are crushed to varying degrees, are up to 43.2 mm in diameter; larger phragmocone fragments have whorl heights of up to 28 mm, corresponding to an estimated diameter of around 70 mm. Coiling is involute, the umbilicus comprising as little as 14.1% of the diameter, of moderate depth, with a feebly convex wall and broadly rounded umbilical shoulder. The whorl section is compressed, with whorl breadth to height ratios of between 0.72 and 0.85 in undeformed specimens, the greatest breadth below mid-flank. The inner flanks are feebly convex, the middle and outer flanks flattened and convergent, the ventrolateral shoulders broadly rounded, and the venter feebly convex in intercostal section. Around 14 primary ribs arise at the umbilical seam and strengthen across the umbilical wall and shoulder; some but not all developing a feeble umbilical bulla. The ribs are narrow, straight and prorsiradiate on the inner to middle flanks, with additional long intercalated ribs; the ribs flex slightly forwards on the outer flanks and ventrolateral shoulders to a varying degree and bifurcate, whilst additional short ribs intercalate, to give a total of 24–25 ribs per half whorl at the ventrolateral shoulder. On the early whorls, the tubercles link to small feebly clavate ventrolateral tubercles, linked across the venter by a blunt transverse rib that bears a feeble transversely elongated siphonal tubercle. As size increases, the siphonal tubercle is lost, the ventrolateral clavi weaken and efface, the venter at this stage rounded, the ribs passing straight across. The largest fragments (OUMNH KX.14276a, 14284a) have better developed umbilical bullae, lack ventrolateral tubercles, the primary ribs bifurcating and additional ribs intercalating. The suture (Text-figs 10E, 17C) has a broad, bifid, moderately incised E/A,

narrow and bifid A narrow, U2 small and asymmetrically bifid.

DISCUSSION: See Wright and Kennedy (1994, p. 577) and Kennedy and Klinger (2013b, p. 4).

OCCURRENCE: Upper Upper Albian *rostrata* to lower Lower Cenomanian *mantelli* Zone, with records from Southern England, southeast France, northern Spain, Switzerland, Hungary, Romania, Turkmenistan, northeastern Algeria, Central Tunisia, Japan, Texas, Cuba, Tamil Nadu in South India, and northern KwaZulu-Natal in South Africa.

Stoliczkaia (*Stoliczkaia*) *subboulei* (Sornay, 1955)
(Pl. 13, Figs 30, 35–38; Pl. 14, 16–19;
Pl. 17, Figs 17–22, Text-fig. 9E, F)

1955. *Cottreauites africanus* Sornay, p. 27, pl. 2, fig. 10; text-fig. 13.
1955. *Cottreauites subboulei* Sornay, p. 30, pl. 2, fig. 12.
?1955. *Cottreauites* aff. *subboulei* Sornay, p. 30, pl. 11, fig. 13; text-fig. 16.
2018. *Paracalycoceras africanum* (Sornay, 1955); Klein, p. 242.
2018. *Paracalycoceras subboulei* (Sornay, 1955); Klein, p. 242.

NAME OF THE SPECIES: I regard *africanus* and *subbboulei* of Sornay (1955) as conspecific, and as first revising author, select the latter as the name of the species.

TYPES: Sornay mentioned two specimens in his description of *subboulei*; the original of his pl. 2, fig. 12 is here designated lectotype. The specimens has not been traced; they were described as being from the "Vraconien sup. W du Djebel Ouenza."

MATERIAL: Abundant specimens, OUMNH KX.14286 (collective of 11 specimens), 14287 (collective of 9 specimens), 14288 (collective of 12 specimens), 14289 (collective of 11 specimens), 14290, 14291 (collective of 11 specimens), 14292 (collective of 9 specimens), and 16235–16240, all from the upper Upper Albian *puzosianum* fauna north and northwest of Gadet Chi, 3 km approximately east of Bou Khadra, north-eastern Algeria.

DIMENSIONS:

	D	Wb	Wh	Wb:Wh	U
OUMNH KX.14291b	18.7 (100)	5.5 (29.4)	10.3 (55.1)	0.53	2.8 (14.8)
OUMMH KX.14291a	21.8 (100)	6.5 (29.8)	10.4 (47.8)	0.63	3.5 (16.1)
OUMMH KX.14288c	29.9 (100)	7.4 (24.7)	15.7 (52.5)	0.47	4.3 (14.4)
OUMNH KX.14288a	33.2 (100)	9.7 (29.2)	18.1 (54.5)	0.55	5.2 (15.6)

DESCRIPTION: Phragmocones are up to 36 mm in diameter. Coiling is very involute, the tiny, shallow umbilicus comprising around 15% of the diameter, the low umbilical wall feebly convex, the umbilical shoulder broadly rounded. The whorl section is very compressed, with whorl breadth to height ratios of as little as 0.47, the greatest breadth around mid-flank. The flanks are very feebly convex and subparallel, the ventrolateral shoulders broadly rounded in intercostal section the venter raised, rounded-fastigiate. Ornament varies from weak to strong between individuals. There are five or six feeble bullae per whorl, perched on the umbilical shoulder. They give rise to one or two falcoid ribs, with additional ribs intercalating. The ribs are weak, straight and prorsiradiate on the inner flanks, flexing back, strengthening, and concave on the outer flanks, where they broaden, and link to small ventral clavi. The venter is arched and smooth between the clavi. There is an intermittent mid ventral ridge in some specimens, the result of *post-mortem* crushing. OUMNH KX.14288c (Pl. 14, Figs 18, 19) is a relatively coarser ribbed variant with seventeen ribs per half whorl at the ventral shoulder; OUMNH KX.14288a is a finely ribbed variant, with 21 ribs per half whorl at the ventral shoulder. The suture (Text-fig. 9E, F) is only moderately incised, with broad bifid E/A and narrower A.

DISCUSSION: The lectotype of *subboulei*, 15 mm in diameter according to Sornay, finds a match in individuals of comparable size in the present collections. The lectotype, here designated, of *Cottreauites africanus* Sornay, 1955, (p. 27, pl. 2, fig. 10; text-fig. 13), FSL 596673, was said to be from the base of the Cenomanian east of Djebel Bou Khadra. Sornay gives the diameter as 26 mm; the ornament matches that of comparably sized specimens in the present collections such as OUMNH KX.14288b–c (Pl. 14, Figs 16–19). *Cottreauites* aff. *subboulei* of Sornay (1955, p. 31, pl. 2, fig. 13; text-fig. 16), FSL 596680, came from the same locality as the types of *subboulei*; the only figure is of the venter of a seemingly crushed fragment; it may be a further synonym. *Cottreauites* sp. of Sornay (1955, p. 28, pl. 2, figs 6, 9; text-fig. 14), FSL 596675, has a maximum diameter of 16.3 mm, and whorl breadth to height ratio of 0.72 on

the basis of the dimensions given by Sornay, and has coarser, straight ribs. I am uncertain of its affinities. *Cottreauites melleguensis* Sornay, 1955 (p. 29, pl. 2, figs 8, 14; text-fig. 15) has only 20–21 ribs per whorl according to Sornay; the venter appears to be sharply fastigiate, possibly with siphonal clavi. It has not been traced. The compressed whorls, crowded falcoid ribbing and smooth, arched venter of *subboulei* separate the species from both *S.* (*S.*) *clavigera* and *S.* (*S.*) *djerissaensis*, with which it co-occurs. There are close similarities to *S.* (*S.*) *tenuis* (Renz, 1968) (p. 48, pl. 6, fig. 6; text-fig. 16b, f) from the upper Upper Albian of La Vraconne, Saint Croix, Switzerland. The holotype is similarly compressed, with falcoid ribs, only a little coarser than those of OUMNH KX.14288c (Pl. 14, Figs 18, 19), but the ventral clavi are linked across the venter by a transverse rib, rather than the venter being arched and smooth between clavi. The juveniles from the upper Upper Albian of Angola assigned to this species by Cooper and Kennedy (1979, p. 249, figs 47, 48d–i; 49d–n) are similarly distinguished from the present species.

OCCURRENCE: Upper Upper Albian of north-eastern Algeria and Central Tunisia.

Stoliczkaia (*Stoliczkaia*) *djerissaensis* sp. nov.
(Pl. 14, Figs 1–9; Pl. 17, Figs 23–25)

1907. *Acanthoceras martimpreyi* Coq.; Pervinquière, p. 289, pl. 16, figs 4, 5.
?1955. *Cottreauites* sp.; Sornay, p. 28, pl. 2, figs 6, 9.

TYPES: The holotype is OUMNH KX.14230b (Pl. 14, Figs 4–6), paratypes are OUMNH KX.14230a (Pl. 14, Figs 1–3) and OUMNH KX.14229a (Pl. 17, Figs 23–25), all from the upper Upper Albian *puzosianum* fauna 2.5 km south of Djebel Djerrisa, Central Tunisia; paratype MNHN. F. J13776 (Pl. 14, Figs 7–9) is the original of *Acanthoceras martimpreyi* of Pervinquière (1907, pl. 16, figs 4, 5), from the "Vraconniene, Djebel Zrissa".

MATERIAL: There are 10 topotype specimens under the collective numbers OUMNH KX.14229 and 14230, from the upper Upper Albian *puzosianum* fauna 2.5 km south of Djebel Djerissa.

DIAGNOSIS: A coarse-ribbed *Stoliczkaia* (*Stoliczkaia*) with variably developed umbilical bullae on primary ribs, short intercalated ribs, and well-developed ventral tubercles linked across the venter by a strong transverse rib.

DIMENSIONS:

	D	Wb	Wh	Wb:Wh	U
MNHN. F. J13776	17.0 (100)	6.8 (40.0)	8.4 (49.4)	0.81	4.1 (24.1)
OUMNH KX.14230a	22.4 (100)	9.4 (42.0)	10.4 (46.4)	0.9	5.6 (25.0)
OUMNH KX.14230b	22.8 (100)	9.0 (39.5)	11.5 (50.4)	0.78	5.5 (24.1)
OUMNH KX.14229a	26.5 (100)	9.0 (34.0)	13.4 (50.5)	0.67	5.0 (18.9)

All dimensions are costal.

DESCRIPTION: Paratype MNHN. F. J13776 (Pl. 14, Figs 7–9) is a phragmocone 17 mm in diameter. Coiling is moderately involute, with over 60% of the previous whorl covered, the small umbilicus comprising 24.1% of the diameter, and of moderate depth. The feebly convex umbilical wall is outward-inclined, the umbilical shoulder broadly rounded. The whorl section is compressed oval, with feebly convex flanks that converge to broadly rounded ventrolateral shoulders, the venter feebly convex. There are seven primary ribs on the adapical half of the outer whorl. They arise at the umbilical seam and are well-developed across the umbilical wall and shoulder, where they are incipiently bullate, strong, straight and prorsirsdiate across the inner and middle flank and sweeping forwards across the outer flank. One or two ribs intercalate between successive primaries, to give a total of 25–26 ribs at the ventrolateral shoulder of the outer whorl. All ribs bear small ventral clavi, linked across the obtusely fastigiate venter by a broad transverse rib with an incipient to very weakly differentiated siphonal clavus. The holotype, OUMNH KX.14230b (Pl. 14, Figs 4–6), has thirteen primary ribs on the outer whorl, with umbilical bullae of variable strength, and absent in some; there are an estimated 28 ribs at the ventrolateral shoulder. Paratype OUMNH KX.14230a (Pl. 14, Figs 1–3) is similar, paratype OUMNH KX.14229a (Pl. 17, Figs 23–25) is a more compressed individual, with slightly fewer, coarser ribs. The suture (Pervinquière 1907, text-fig. 110) is little-incised, with broad and asymmetrically bifid E/A and narrow, bifid A.

DISCUSSION: The coarse ornament, with well-developed transverse ribs on the venter distinguish *djerissaensis* from other Stoliczkaiinae in the present fauna. The *Cottreauites* sp. of Sornay (1955, p. 28, pl. 2, figs 6, 9), based on a nucleus 16.3 mm in diameter and from east of Djebel Bou Khadra may belong to the present species.

OCCURRENCE: Upper Upper Albian, north-eastern Algeria and central Tunisia.

Subgenus *Stoliczkaia* (*Shumarinaia*) Matsumoto and Inoma, 1975

TYPE SPECIES: *Stoliczkaia* (*Shumarinaia*) *hashimotoi* Matsumoto and Inoma, 1975, p. 277, pl. 39. figs 1–3; text-fig. 1, by original designation.

Stoliczkaia (*Shumarinaia*) *africana* Pervinquière, 1907

(Pl. 15, Figs 3–14, 26–28)

1907. *Stoliczkaia* cf. *dispar* d'Orbigny; Pervinquière, p. 388 (*pars*), pl. 12, fig. 9; text-fig. 151 only.
1907. *Stoliczkaia dispar* var. *Africana* Pervinquière, p. 389, pl. 12, fig. 10; pl. 16, figs 19–23; text-figs 149, 150.
2018. *Stoliczkaiella* (*Shumarinaia*) *africana* Pervinquière, 1907; Klein, p. 233 (with synonymy).

TYPES: The lectotype, by the subsequent designation of Matsumoto and Obata (1975, p. 280), is MNHN. F. J04329 (Pl. 15, Figs 26–28), the original of Pervinquière (1907, p. 389, pl. 12, fig. 10), from the 'Vraconnien' of Djebel Djerissa. There are four paralectotypes, the originals of Pervinquière (1907, pl. 16, figs 19–23). The original of fig. 19 (Pl. 15, Figs 3–5) is in the MNHN collections; the original of fig. 20 is MNHN. F. J13775 (Pl. 15, Figs 9–11); the original of fig. 21 (Pl. 15, Figs 12–14) is in the MNHN collections; the original of figs 22, 23 is MNHN. F. J13777 (Pl. 15, Figs 6–8); all are from the 'Vraconnien' of Djebel Djerissa.

MATERIAL: MNHN. F. J13785 (Pl. 15, Figs 15 16), the original of *Stoliczkaia* cf. *dispar* of Pervinquière (1907, pl. 12, fig. 9; text-fig. 15) (Pl. 15, Figs 15, 16), from the 'Vraconnien' of Guern er Rhezal, Central Tunisia. OUMNH KX.14173 (collective of 10 specimens) and 14174 (collective of 10 specimens), from the upper Upper Albian *puzosianum* fauna 2.5 km south of Djebel Djerissa, Central Tunisia.

DIMENSIONS:

The dimensions of the paralectotypes figured by Pervinquière (1907) are as follows:

	D	Wb	Wh	Wb:Wh	U
MNHN. F. J13777	13.8 (100)	4.8 (34.8)	6.8 (49.2)	0.71	3.0 (21.7)
Pervinquière 1907, pl. 16, fig. 19	15.2 (100)	4.7 (30.9)	7.5 (49.3)	0.63	2.9 (19.1)
Pervinquière 1907, pl. 16, fig. 21	19.0 (100)	6.5 (29.2)	– (–)	–	4.4 (23.2)
MNHN. F. J13755	20.6 (100)	6.6 (32.0)	9.8 (47.5)	0.67	4.7 (22.8)

DESCRIPTION: MNHN. F. J13777 (Pl. 15, Figs 6–8) the original of Pervinquière's pl. 16 figs 22, 23, is a phragmocone 13.8 mm in diameter. Coiling is involute, the small, shallow umbilicus comprising 21.7% of the diameter, the low umbilical wall convex and outward-inclined, with a narrowly rounded umbilical shoulder. The whorl section is compressed, with a whorl breadth to height ratio of 0.71, with feebly convex converging flanks, broadly rounded ventrolateral shoulders and a feebly convex venter. Ornament is very weak to obsolete on the adapical half of the outer whorl, the rounded venter smooth. On the adapertural half, primary ribs arise on the umbilical wall, where they are feeble, strengthen across the umbilical shoulder, where some appear to bifurcate, with additional ribs intercalating low on the flank. The ribs are low, relatively broad, straight and prorsiradiate on the inner to mid-flank, flexing back and strengthening, convex at mid-flank before flexing forwards, concave on the outer flank and projecting forwards on the ventrolateral shoulder, where some strengthen into a weak ventral tubercle, the venter smooth between.

The original of Pervinquière's pl. 16, fig. 21 (Pl. 15, Figs 12–14) is a 180° sector of phragmocone 19 mm in diameter. Coiling is moderately involute, the umbilicus shallow, the umbilical wall very feebly convex and outward-inclined, the umbilical shoulder rounded. The whorl section is compressed. The intercostal whorl section has feebly convex convergent flanks, broadly rounded ventrolateral shoulders and a feebly convex venter. The adapical part of the fragment appears to have been near-smooth, or very feebly ornamented. Parts of five primary ribs are preserved on the fragment. They arise at the umbilical seam, and are coarse, strengthening progressively across the umbilical wall and developing into umbilical bullae of variable strength. The bullae give rise to single coarse primary ribs. There are up to three intercalated ribs between successive primaries; they arise both low and high on the flanks. At one point there are two successive primary ribs without an intercalatory between. The ribs strengthen on the outer flanks, and link to strong ventral clavi, linked across the venter by a coarse transverse rib, the rib profile feebly concave between the clavi.

MNHN. F. J13775 (Pl. 15, Figs 9–11), the original of Pervinquière's pl. 16, fig. 20, is a phragmocone

20.6 mm in diameter. The adapical 120° sector of the outer whorl is smooth. Faint ventral clavi are the first ornament to appear. Ornament strengthens progressively on the adapertural 240° sector of the outer whorl. The ribs are initially delicate primaries that arise either singly or in pairs at the umbilical shoulder, with additional ribs intercalating. The ribs strengthen across the flanks, and are conspicuous on the outer flanks and ventrolateral shoulders only, thereafter strengthening further, and developing umbilical bullae. In this second growth stage, all ribs bear strong ventral clavi, linked across the venter by a strong transverse rib.

The original of Pervinquière's pl. 16, fig. 19 (Pl. 15, Figs 3–5) is a phragmocone 19 mm in diameter, interpreted as a feebly ornamented variant of the species with weak flank ribs that are conspicuous on the outer part of the flanks only at the largest preserved diameter.

The lectotype, MNHN. F. J04329 (Pl. 15, Figs 26–28) is the original of Pervinquière (1907, pl. 12, fig. 10), a 180° wholly septate fragment with a maximum preserved diameter of 29 mm. Primary ribs arise at the umbilical seam and strengthen into umbilical bullae of variable strength that give rise to strong, straight, rectiradiate ribs that link to strong ventral clavi, from which the ribs project forwards and strengthen, producing a distinctly fastigiate costal whorl section; there is an incipient siphonal tubercle at the adapical end of the fragment. One or two intercalated ribs arise both low and high on the flanks to give a total of 11 ribs at the ventrolateral shoulder of the fragment. The suture (Pervinquière 1907, text-fig. 149) is moderately incised, with an asymmetrically bifid E/A and deep, narrow A.

DISCUSSION: The numerous new specimens from Djebel Djerissa differ in no significant respects from the types.

Stoliczkaia (*Shumarinaia*) *hashimotoi* Matsumoto and Inoma, 1975 (p. 277, pl. 39, figs 1–3; text-fig. 10) and *S*. (*S*.) *asiatica* Matsumoto and Inoma, 1975 (p. 279, pl. 39, figs 4–7; text-fig. 11) are both small species that lack ventrolateral tubercles. *S*. (*S*.) *zrissense* Pervinquière, 1907 (p. 225, pl. 11, figs 17, 18; text-fig. 91; see below) has coarse ribs, oblique ventrolateral clavi and a fastigiate venter. *S*. (*S*.) *australe* Kennedy and Klinger, 2103 (p. 9, text-fig. 18c–t) is also a small species, characterised by pairs of flexuous ribs that arise from umbilical bullae and project forwards on the ventrolateral shoulders to form an obtuse ventral chevron, and lack ventrolateral tubercles.

OCCURRENCE: Upper Upper Albian *puzosianum* fauna of Central Tunisia, also recorded from Spain, Nigeria, and Brazil. It extends into the lowest Cenomanian in Central Tunisia (Robaszynski *et al*. 2008, p. 255, text-fig. 6).

Stoliczkaia (*Shumarinaia*) *zrissense*
(Pervinquière, 1907)
(Pl. 15, Figs 1, 2)

1907. *Brancoceras Zrisssense* Pervinquière, p. 225, pl. 11, figs 17, 18; text-fig. 91.
1955. *Prionocycloides* (?) *zrissensis* Pervinquière; Sornay, p 32. pl. 2, fig. 16; text-figs 18, 19.
2018. *Brancoceras* (*Brancoceras*) *zrissense* (Pervinquière, 1907); Klein, pp. 22, 25 (*pars*).

TYPE: The holotype, by monotypy, is MNHN. F. J13791, the original of Pervinquière (1907, p. 225, pl. 11, figs 17, 18); text-fig. 91 from "au nord du Dj. Zrissa, a la limite du Gault et du Cénomanien".

MATERIAl: OUMNH KX.14249, from the upper Upper Albian *puzosianum* fauna 2.5 km south of Djebel Djerissa, Central Tunisia.

DIMENSIONS:

	D	Wb	Wh	Wb:Wh	U
MNHN. F. J313791	11.1 (100)	4.3 (38.7)	5.2 (46.8)	0.83	3.5 (31.5)

DESCRIPTION: The holotype is a limonitic internal mould of a phragmocone 11.1 mm in diameter. Coiling is evolute, the umbilicus comprising 31.5% of the diameter, shallow, with a convex umbilical wall. The whorl section is compressed, rounded-trapezoidal, with flattened convergent flanks, broadly rounded ventrolateral shoulders, and an obtusely fastigiate venter. At the beginning of the outer whorl, ornament is of delicate prorsiradiate ribs that strengthen into feeble oblique ventrolateral clavi. The ornament strengthens 60° from the beginning of the outer whorl, and the succeeding 240° sector bears eight coarse primary ribs that arise on the umbilical wall and strengthen into well-developed umbilical bullae that give rise to a single rib that terminates in a small oblique ventral clavus. Single intercalated ribs arise low on the flank, without developing into a bulla, and strengthen to match the primary ribs. The clavi give rise to a weak prorsirdiate rib that declines before reaching the mid-line of the fastigiate venter. OUMNH KX.14249 consists of a nucleus and a 120° whorl sector of phragmocone with a maximum pre-

served whorl height of just over 5 mm, with coarser ribbing. The suture of the holotype (Pervinquière 1907, text-fig. 91) is little-incised, with broad, bifid E/A and narrow, bifid A.

DISCUSSION: Coarse ornament, oblique ventrolateral clavi and fastigiate venter distinguish the species from *S.* (*S.*) *africana* and other species discussed above. The species is a heterochronous homoeomorph of the Lower and Middle Albian *Brancoceras* Steinmann, 1881.

Genus and subgenus *Neophlycticeras* Spath, 1922a

TYPE SPECIES: *Ammonites brottianus* d'Orbigny, 1841, p. 290, pl. 85, figs 8–10, by the original designation of Spath (1922a, p. 107).

Neophlycticeras algeriense sp. nov.
(Pl. 16, Figs 1–13; Text-fig. 17A)

TYPES: The holotype is OUMNH KX.16312a, paratypes OUMNH KX.16312b–i, all from the Lower Cenomanain *harchaensis* fauna 700 m north-east of Koudiat el Assel, north-eastern Algeria.

DIAGNOSIS: A compressed, involute *Neophlycticeras* with markedly falcoid ribs.

DIMENSIONS:

	D	Wb	Wh	Wb:Wh	U
OUMNH KX.16312e	15.0 (100)	4.7 (31.3)	8.1 (54.0)	0.58	2.2 (14.7)
OUMNH KX.16312b	17.8 (100)	5.1 (28.7)	9.2 (51.7)	0.52	3.1 (17.4)
OUMNH KX.16312a	22.6 (100)	7.8 (34.5)	12.5 (55.3)	0.63	4.0 (17.7)

Dimensions are costal.

DESCRIPTION: Coiling is very involute, the umbilicus comprising around 16% of the diameter, shallow, with a feebly convex wall and quite narrowly rounded umbilical shoulder. The whorl section is compressed, the intercostal section with flattened subparallel flanks, broadly rounded ventrolateral shoulders and a feebly fastigiate venter. The earliest growth stages are shown by the inner whorls of OUMNH KX.16312b (Pl. 16, Figs 1–3). To a diameter of around 5 mm, the whorls are near-smooth, but for feeble crenulations on a siphonal ridge. As size increases, delicate falcoid primary ribs appear, straight and feebly prorsiradiate on the inner flank, strengthening and concave on the outer flanks, and linking to small prorsiradiate ventral clavi, from which a strong prorsiradiate rib projects forwards and links to a tubercle on the siphonal ridge. Additional ribs intercalate, and have a comparable outer flank and ventral development as the primary ribs. The larger specimens, all wholly septate, range from 15–22.3 mm in diameter, and a fragment (OUMNH KX.16312g: Pl. 16, Figs 7, 8) has a whorl height of 13 mm, corresponding to a diameter of an estimated 25 mm. Primary ribs arise on the umbilical wall. Some strengthen into umbilical bullae, others pass across the umbilical shoulder without developing a bulla. There is much variation in this respect; some individual have a few very strong bullae (OUMNH KX.16312a, d, e: Pl. 16, Figs 9–13) in others the bullae are feeble to obsolete (OUMNH KX.16312b: Pl. 16, Figs 1–3), while OUMNH KX.16312c (Pl. 16, Fig. 4) is a passage form between these extremes. Strong umbilical bullae give rise to strong prorsiradiate ribs, weak bullae to weak ribs, and other ribs arise at the umbilical shoulder as delicate lirae. The ribs are straight on the inner flank, flex back around mid-flank, strengthen, and are of uniform strength, linking to small oblique prorsiradiate clavi, from which a rib projects forwards to form an obtuse ventral chevron with a well-developed siphonal clavus at the apex, successive clavi linked by a feeble siphonal ridge. The last few septa of OUMNH KX.16312a and d (Pl. 16, Figs 9–13) crowd, suggesting they may be phragmocones of adults. The suture (Text-fig. 17A) is only moderately incised, with a broad, bifid E/A, narrow, bifid A and small U2.

DISCUSSION: *Neophlycticeras* (*Neophlycticeras*) is typically Upper Albian in the Old World, but there is a good record in the Lower Cenomanian in the New, notably in Texas and northern Mexico, as reviewed by Young (1979) and Kennedy *et al.* (2005). These species reach a large size compared with the diminutive, presumed adult phragmocones of the present species. Thus *N.* (*N.*) *texanum* (Shattuck, 1903) (p. 35, pl. 25, figs 1, 2; see revision in Young 1979, p. 49, pl. 4, figs 4–14; pl. 5, figs 4, 5, 8–10; text-fig. 11t, u, v) reaches a diameter of 123 mm; the ribs of nuclei are not markedly falcoid as in the present species. Nuclei assigned to *N.* (*N.*) *roemeri* (Lasswitz, 1904) by Young (1979) include individuals that are stouter and more coarsely ornamented (Young 1979, pl. 6, figs 1, 2), as are those of *N.* (*N.*) *archera* (Young, 1979) (p. 57, pl. 6, figs 3–9; text-fig. 11d–o).

OCCURRENCE: As for types.

Genus *Metascaphites* Wiedmann, 1962

TYPE SPECIES: *Scaphites*? *Thomasi* Pervinquière, 1907, p. 121, pl. 4, figs 30, 31; text-fig. 39, by the original designation of Wiedmann (1962, p. 212).

Metascaphites thomasi (Pervinquière 1907)
(Pl. 15, Figs 20–25)

1907. *Scaphites* (?) *Thomasi* Pervinquière, p. 121, pl. 4, figs 30, 31; text-fig. 39.
2018. *Metascaphites thomasi* (Pervinquière, 1907); Kennedy and Morris, p. 92, text-figs 4b, 7o–t (with synonymy).
2018. *Metascaphites thomasi* (Pervinquière, 1907); Klein p. 249 (with synonymy).

TYPE: The holotype, by monotypy, is MNHN. F. J04318 (Pl. 15, Figs 20–22), the original of *Scaphites* (?) *Thomasi* Pervinquière 1907, p. 121, pl. 4, figs 30, 31, from the 'Vraconnien' of Djebel Mrhila, below Kef Si Abd el Kader, Central Tunisia.

MATERIAL: OUMNH KX.14154–14157, from the upper Upper Albian *puzosianum* fauna 2.5 km south of Djebel Djerissa, Central Tunisia.

DESCRIPTION: The holotype is wholly septate and 11 mm in diameter. The largest specimen seen, OUMNH KX.14517, has an estimated maximum diameter of 16.5 mm, and may retain a short section of body chamber, although the preservation is defective. Coiling is very involute, the minute umbilicus comprising an estimated 18% of the diameter, the umbilical wall flattened and outward-inclined, the umbilical shoulder broadly rounded. The whorl section is compressed, the whorl breadth to height ratio 0.8 in the holotype, the flanks flattened and subparallel, the ventrolateral shoulders broadly rounded, the venter feebly convex. The flanks of the adapical half of the outer whorl of both the holotype and OUMNH KX.14517 are smooth; there are faint undulations on the venter of the latter. On the adapertural half of the outer whorl of the holotype there are eight prorsiradiate ribs. The adapical three arise on the outer flank, and strengthen into an oblique prorsiradiate ventrolateral bulla, from which a feeble rib crosses the venter in a broad convexity. The succeeding ribs are both primaries that arise on the umbilical wall and strengthen across the flanks, and a single intercalated rib. There are both primary and intercalated ribs in OUMNH KX.14157, the former with a feeble umbilicolateral bulla; in one case, two ribs arise from a bulla. The suture is moderately incised, with a broad, asymmetrically bifid E/A, smaller bifid A, and small A/U2 (Pervinquière 1907, text-fig. 39).

DISCUSSION: As noted by Wright and Kennedy (1984, p. 163), *Metascaphites subthomasi* Wiedmann, 1962 (p. 218, pl. 13, fig. 8; text-figs 57, 58) is a scaphitid. The *Metascaphites thomasi* of Szives (2007, p. 119, pl. 16, fig. 16) has lateral tubercles and does not belong here. ?*Metascaphites kashaii* Szives, 2007 (p. 119, pl. 15, fig. 2) is based on an adult individual 27 mm in diameter with crowded nontuberculate ribs on the adapertural part of what is presumed to be the adult body chamber, and may belong here. ?*Metascaphites scholzi* Szives, 2007 (p. 120, pl. 16, figs 17, 18) has strong ribs on the phragmocone and a broad flat venter to the body chamber with massive outward-directed ventrolateral horns.

OCCURRENCE: Upper Upper Albian, Central Tunisia, Tanzania, and, possibly, Hungary.

Genus *Enigmaticeras* Kennedy, 2004

TYPE SPECIES: *Enigmaticeras riceae* Kennedy, 2004, (p. 888, text-figs 3l–n, s–u, w–z', 23a, b), from the upper Upper Albian Pawpaw Shale of north-central Tarrant County, Texas.

Enigmaticeras cf. *riceae* Kennedy, 1984
(Pl. 16, Figs 16–22; Text-fig. 10C)

Compare:
2004. *Enigmaticeras riceae* Kennedy, p. 888, text-figs 3l–n, s–u, w–z', 23a, b.
2018. *Enigmaticeras riceae* Kennedy, 2004; Klein, p. 241.

TYPES:. The holotype of *Enigmaticeras riceae* is USNM 520295, the original of Kennedy 2004, text-fig. 3y, z, from the upper Upper Albian Pawpaw Shale near Haslet, Tarrant County, Texas. There are 11 paratypes.

MATERIAL: OUMNH KX.16498 (collective of 6 specimens), from the upper Upper Albian *puzosianum* fauna north of Djebel Hameima, Central Tunisia. OUMNH KX.15970, from the upper Upper Albian *puzosianum* fauna of Henchir el Kerkour, north-eastern Algeria.

DIMENSIONS:

	D	Wb	Wh	Wb:Wh	U
OUMNH KX.16498	13.1 (100)	3.7 (28.2)	7.9 (60.3)	0.53	1.7 (13.0)

DESCRIPTION: The material consists of phragmocones between two and 13.1 mm in diameter. Coiling is very involute, the minute, shallow umbilicus comprising around 13% of the diameter, the umbilical wall feebly convex, the umbilical shoulder more narrowly rounded. The whorl section is compressed, with a whorl breadth to height ratio of 0.53 the inner and middle flanks feebly convex, the outer flanks flattened and convergent, the ventrolateral shoulders broadly rounded, the venter feebly convex. Ornament in the best-preserved individuals consists of widely separated delicate riblets and lirae that are near-straight to feebly concave on the inner flank, very feebly convex at mid-flank, very feebly concave on the outer flank and sweep forwards on the outermost flank. The suture is little incised, with a broad, symmetrically bifid E/A, narrow, bifid A, and A/U2 with only minor incisions; the minor saddles adjacent to the umbilical shoulder are entire.

DISCUSSION: The preservation of the present material is not as good as that of the types of *riceae*, but whorl proportions, biconcave riblets and lirae are comparable; the larger specimens have crowded septa and may be adults. The sutures (Text-fig. 10C) of the present material are less incised than those of the type material (Kennedy 2004, text-fig. 32), but there are sufficient similarities in a number of characters to support the generic assignation.

OCCURRENCE: As for material.

Family Flickiidae Adkins, 1928
Subfamily Flickiinae Adkins, 1928
Genus *Flickia* Pervinquière, 1907

TYPE SPECIES: *Flickia simplex* Pervinquière, 1907, p. 214, pl. 9, figs 2–5; text-figs 80, 82, by original designation.

Flickia simplex Pervinquière, 1907
(Pl. 18, Figs 1–15)

1907. *Flickia simplex* Pervinquière, p. 214, pl. 9, figs 2–5; text-figs 80, 82.
1979. *Flickia simplex* Pervinquière, 1907; Wright and Kennedy, p. 693, pl. 88, figs 1–18, 20–24; pl. 89, figs 11, 12; text-figs 2a, d, e, 3j, k, l (with full synonymy).
2004. *Flickia simplex* Pervinquière, 1907; Kennedy, p. 889, text-fig. 3j, k (with additional synonymy).
2018. *Flickia simplex* Pervinquière, 1907; Klein, pp. 252, 253 (with synonymy).

MATERIAL: OUMNH KX.16278 (collective of nine specimens), 16279–16284, 16285 (collective of 15 specimens), from the lower Lower Cenomanian *carcitanense* fauna 700 m north-east of Koudiat el Assel, north-eastern Algeria. OUMNH KX.14245, from the Upper Albian *puzosianum* fauna 2.5 km south of of Djebel Djerissa, Central Tunisia. OUMNH KX.16466 (collective of nine specimens), 16519, 16578, 16636, and 16649–16650, from the lower Lower Cenomanian *carcitanense* fauna north of Djebel Hameima, Central Tunisia.

DISCUSSION: The species was comprehensively reviewed by Wright and Kennedy (1979), who discuss differences from other species.

OCCURRENCE: Upper Upper Albian and Lower Cenomanian, north-eastern Algeria, Central Tunisia, and Johnson County, Texas.

Genus *Ficheuria* Pervinquière, 1910

TYPE SPECIES: *Ficheuria Kiliani* Pervinquière, 1910, p. 36, pl. 12 (3), figs 9–10; text-figs 16–17, by original designation.

Ficheuria kiliani Pervinquière, 1910
(Pl. 18, Figs 16–28)

1910. *Ficheuria Kiliani* Pervinquière, p. 36, pl. 12 (3), figs 9–10; text-figs 16–17.
1979. *Ficheuria kiliani* Pervinquière; Wright and Kennedy, p. 688, pl. 87, figs 16–19, 21–26; text-figs 1a–b, 3e–g.
1996. *Ficheuria kiliani* Pervinquière, 1910; Wright, p. 152, fig. 116.1a, b, c.
non 2007 *Ficheuria kiliani* Pervinquière, 1910; Szives, p. 108, pl. 16, fig. 3; pl. 17, fig. 2.
2018. *Ficheuria kiliani* Pervinquière, 1910; Klein, p. 251 (with synonymy).

TYPES: The holotype, by the original designation of Pervinquière (1910, p. 36), is the original of his pl. 12 (3), fig 9, MNHN. F. J04340, from Sidi Ali (Djebel Guessa), northern Algeria; MNHN. F. J04337, the original of pl. 12 (3), fig. 10, from Sour El-Ghozlane (Aumale), northern Algeria, is a paratype. Both were described as from the Cénomanien (zone à *Amm. inflatus*). Pervinquière mentioned a third specimen, in the Thomas collection, which I have not traced, and probably from Berrouaghia, northern Algeria.

MATERIAL: OUMNH KX.17040, from the upper

Upper Albian east of El Faija, northern Algeria. OUMNH KX.17078–17080, from the upper Upper Albian, Commune of Ziana, 21 km east of Berrouaghia, northern Algeria.

DISCUSSION: Wright and Kennedy (1979, p. 688, pl. 87, figs 16–19, 21–26; text-figs 1a–b, 3e–g) described and figured the type material and discussed differences from other species. The present material includes specimens up to 15.4 mm in diameter.

Ficheuria pernoni Dubourdieu, 1953 (p. 35, pl. 3, figs 51–54, text-fig. 11), described below, has a distinctive depressed whorl section with a narrowly rounded umbilical shoulder.

Szives (2007, p. 108; pl. 16, fig. 3; pl. 17, fig. 2) figured two specimens from Hungary, but referred to only a single specimen in her description and discussion, where it is said to be smooth; this corresponds to her pl. 17, fig. 2. The specimen does not show the sutures, and its assignation to the species is questionable. The second specimen figured as *Ficheuria kiliani* (*loc. cit*., pl. 16, fig. 3) appears to have ribs, and an undulose venter, and belongs to some other species. Szives also referred the originals of *Salaziceras* (*Salaziceras*) *salazacense peyrolense* Scolz, 1979 (p. 93, *pars*), pl. 21, figs 16, 18, 19, 20 only), to *Ficheuria kiliani*. The originals of figs 16, 18, and 20 have ribs, a feature not seen in the type material of *kiliani*, and the original of fig. 19, although smooth, has a depressed rather than compressed cross section. They all belong to some other genus.

OCCURRENCE: Upper Upper Albian of northern Algeria, and, possibly, Hungary.

Ficheuria pernoni Dubourdieu, 1953
(Pl. 18, Figs 29–32; Text-fig. 9I)

1953. *Ficheuria pernoni* Dubourdieu, p. 35, pl. 3, figs 51–54; text-fig. 11.
1975. *Ficheuria pernoni* Dubourdieu; Matsumoto and Inoma, p. 291.
1979. *Ficheuria pernoni* Dubourdieu; Wright and Kennedy, p. 689, text-figs 1c, 3h.
1979. *Ficheuria* aff. *pernoni* Dubourdieu; Wright and Kennedy, p. 690 (*pars*), pl. 87, figs 14, 15 only.
2004. *Ficheuria pernoni* Dubourdieu, 1953; Kennedy, p. 889, text-figs 3g–1, 24a.
2018. *Ficheuria pernoni* Dubourdieu, 1953; Klein, pp. 251, 252.

TYPE: The holotype, by monotypy, is the original of Dubourdieu (1953, p. 35, pl. 3, figs 51–54; text-fig. 11), from the "Sommet du Vraconnien, niveau F" in the environs of Henchir el Kerkour, west of Djebel Ouenza, north-eastern Algeria. It has not been traced.

MATERIAL: OUMNH KX.14194, 14247, 14248, 14301, 14302, from the upper Upper Albian *puzosianum* fauna 2.5 km south of Djebel Djerissa in Central Tunisia.

DESCRIPTION: Specimens range from 8 to 11 mm in diameter. Cadicone, coiling involute, umbilicus deep, conical, umbilical wall flattened, outward-inclined, umbilical shoulder narrowly rounded. The whorl section is depressed, the greatest breadth at the umbilical shoulder, the flanks and venter broadly and evenly convex. The whorl breadth to height ratio is 1.42 in OUMNH KX.14302. The internal mould of the phragmocone is smooth. OUMNH KX.14194 is a crushed individual with a maximum diameter of 13.3 mm. The last two septa are approximated, indicating the specimen to be an adult. It retains a short section of body chamber, ornamented by three narrow riblets, the first and second widely separated, the second and third close together. The suture is very simple, with an entire median element in E, E/A broad, asymmetrically bifid, with a single minor incision, A narrow and entire, A/U2 broader and entire (Text-fig. 9I).

DISCUSSION: The depressed whorl section immediately distinguishes the species from *F. kiliani*.

OCCURRENCE: Upper Upper Albian of north-eastern Algeria, Central Tunisia, and Texas.

Ficheuria? *rudelli* (Dubourdieu, 1949)

1949. *Flickia rudelli* Dubourdieu in Dubourdieu and Sigal, p. 214, pl. 6, figs 1–3; text-figs 1, 2.
1979. *Ficheuria rudelli* (Dubourdieu); Wright and Kennedy, p. 692, text-fig. 1e.
2018. *Ficheuria rudelli* (Dubourdieu, 1949); Klein, pp. 251, 252.

TYPE: The holotype, by monotypy, is FSL596689, the original of Dubourdieu in Dubourdieu and Sigal (1949, p. 214, pl. 6, figs 1–3; text-figs 1, 2), from the Lower Cenomanian west of Djebel Ouenza, north-eastern Algeria, coordinates 981,300–306,700.

DISCUSSION: A description of the holotype, based on Dubourdieu's account, was given by Wright and Kennedy (1979, p. 692), who transferred *rudelli* from *Flickia* to *Ficheuria* on the basis that 'the combi-

nation of shell form, whorl section and suture place it closest to *Ficheuria*.' The shell form and whorl section are certainly closer to species of *Ficheuria* than to the type species of *Flickia*, but the suture has entire lobes and saddles as in *Flickia*. Generic assignation thus depends on whether one regards shell shape or suture as diagnostic, hence the cautious assignation herein.

OCCURRENCE: As for type.

Genus *Litophragmatoceras*
Kennedy and Cobban, 1988

TYPE SPECIES: *Litophragmatoceras incomptum* Kennedy and Cobban, 1998, p. 537, text-figs 3–5, by original designation.

Litophragmotoceras curiosus sp. nov.
(Text-figs 12, 15A)

DERIVATION OF NAME: *Curiosus* (Latin): strange.

TYPE: The holotype is OUMNH KX.16017, from the lower Middle Cenomanian, roadside section on D20 to the west of Djebel Sottara, 8.5 km due west of Sour El-Ghozlane (Aumale), northern Algeria.

DIAGNOSIS: Moderately evolute, compressed, flanks flattened and subparallel, ventrolateral shoulders broadly rounded, venter feebly convex. Ornament of crowded lirae of variable strength that pass straight across the venter. Suture very simple, with entire E, lacking a median saddle, E/A with a minor median incision, A and A/U2 entire.

DESCRIPTION: The holotype is 8.3 mm in diameter; the last two septa are approximated, and the specimen may be adult. It retains a 240° sector of body chamber. Coiling is moderately involute, the shallow umbilicus comprising 37% of the diameter, the umbilical wall feebly convex and inclined outwards, the umbilical shoulder broadly rounded. The whorl section is compressed, the flanks flattened and subparallel, the ventrolateral shoulders broadly rounded, the venter feebly convex. Where limonitised shell is preserved, there are indications of feeble to near-obsolete prorsiradiate lirae on the surface of replaced shell and internal mould. They are prorsiradiate on the flanks, and pass straight across the venter, where they are of variable in strength. The suture (Text-fig. 15A) is very simple, as indicate in the diagnosis.

Text-fig. 12. *Litophragmatoceras curiosus* sp. nov. The holotype, OUMNH KX.16017, from the Lower Cenomanian *scheuchzerianus* fauna, roadside section on D20 to the west of Djebel Sottara, 8.5 km due west of Sour El-Ghozlane, northern Algeria. The original is 8.3 mm in diameter

DISCUSSION: When compared to the type species, *Litophragmatoceras incomptum*, the present species is higher-whorled, the lirae not, so far as can be established, flexuous, while the suture has an entire E and a minor incision in E/A, whereas in *incomptum* there is a large median saddle in E, and E/A is entire (it should be noted that the suture of *incomptum*, as reproduced in Wright (1996, text-fig. 116, 6c) is an inverted version of Kennedy and Cobban (1988, text-fig. 5.4).

OCCURRENCE: As for type.

Subfamily Salaziceratinae Kennedy and Wright, 1984a
Genus *Neosaynoceras* Breistroffer, 1947a

TYPE SPECIES: *Saynoceras Gazellae* Pervinquière, 1907, p. 115, pl. 5, figs 1–6, by the original designation of Breistroffer (1947a, p. 92 (76)).

Neosaynoceras gazellae (Pervinquière, 1907)
(Pl. 17, Figs 1–16)

1907. *Saynoceras Gazellae* Pervinquière, p. 115, pl. 5, fig. 1.
1984. *Neosaynoceras gazellae* (Pervinquière, 1907); Kennedy and Wright, p. 164, pl. 21, figs 1–22; text-fig. 2f–t (with full synonymy).
1996. *Neosaynoceras gazellae* (Pervinquière, 1907); Wright, p. 152, text-fig. 116.1.
2018. *Neosaynoceras gazellae* (Pervinquière, 1907); Klein, pp. 249, 250.

TYPES: The lectotype, by the subsequent designation

of Breistroffer (1947, p. 92 (76)), is MNHN. F. J12576, the original of Pervinquière (1907, pl. 5, figs 2, 3), from the 'Vraconienne' of Guern er Rhezal, Central Tunisia. There are seven paralectotypes, including NMHN. F. J04315, the original of Pervinquière (1907, pl. 5, fig. 1), from the 'Vraconienne' of Pont du Fahs, Central Tunisia; MNHN. F. J04322a, the original of Pervinquière (1907, pl. 5, figs 4, 5), and MNHN. F. J04322b, the original of Pervinquière (1907, pl. 5, fig. 6), both from the 'Vraconnien' of Guern er Rhezal, Central Tunisia.

MATERIAL: OUMNH KX.16266–16268, from the lower Lower Cenomanian *carcitanense* fauna 700 m north-east of Koudiat el Assel, north-eastern Algeria. OUMNH KX.16571, from the lower Lower Cenomanian *carcitanense* fauna north of Djebel Hameima, Central Tunisia.

DISCUSSION: *Neosaynoceras gazellae* is comprehensively revised by Kennedy and Wright (1984a, p. 164, pl. 21, figs 1–22; text-fig. 2f–t). The types are refigured here (Pl. 16, Figs 1–11), as are two well-dated adults (Pl. 17, Figs 12–16).

OCCURRENCE: Lower Lower Cenomanian of north-eastern Algeria and Central Tunisia. Lower Cenomanian of Madagascar.

Superfamily Acanthoceratoidea De Grossouvre, 1894
Family Forbesiceratidae Wright, 1952
Genus *Forbesiceras* Kossmat, 1897

TYPE SPECIES: *Ammonites largilliertianus* D'Orbigny, 1841 p. 320, pl. 95 (*pars*), by the subsequent designation of Diener 1925, p. 180.

Forbesiceras largilliertianum (d'Orbigny, 1841)
(Pl. 19, Figs 1, 2, 4, 5, 9, 12, 13;
Pl. 20, Figs 13, 14, 17, 18; Text-fig. 10H)

1841. *Ammonites largilliertianus* d'Orbigny, p. 320, pl. 95 (*pars*).
1984. *Forbesiceras largilliertianum* (d'Orbigny, 1841); Wright and Kennedy, p. 89, pl. 11, figs 2–6; pl. 12, figs 1–3, 9; pl. 16, fig. 2; text-figs 12a–l; 13 a–z'; 14a–h (with synonymy).
2018. *Forbesiceras largilliertianum* (d'Orbigny, 1841); Klein, pp. 256, 261 (with additional synonymy).
2019. *Forbesiceras largilliertianum* (d'Orbigny, 1841); Kennedy in Gale *et al*., p. 219, pl. 18, figs 1, 2, 6–13; text-fig. 14b.

TYPES: The lectotype, by the subsequent designation of Wright and Kennedy (1984, p. 90) is MNHN. F. B46129 (formerly 6120a); it was figured by Wright and Kennedy (1984, text-fig. 12d, e), and is from the Middle Cenomanian *rhotomagense* Zone phosphatised fauna of the Rouen Fossil Bed, Côte Ste Catherine, Rouen, Seine-Maritime, France; there are several paralectotypes (Wright and Kennedy 1984; Kennedy *et al.* in Gauthier 2006, p. 117).

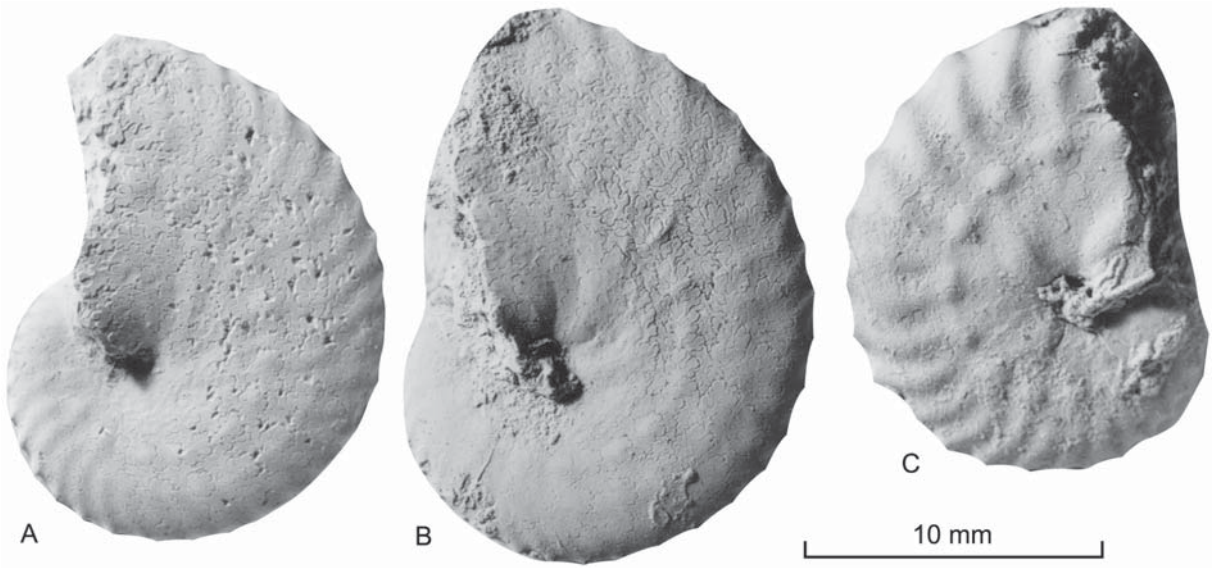
MATERIAL: OUMNH KX.16269–16272, from the Lower Cenomanian *carcitanense* fauna, 700 m north-east of Koudiat el Assel, north-eastern Algeria. OUMNH KX.16584 (collective of six specimens), 16585–16586, from the Lower Cenomanian *carcitanens*e fauna, north of Djebel Hameima, Central Tunisia.

DESCRIPTION: Well-preserved nuclei range from 13.4 to 19 mm in diameter (OUMNH KX.16270–16272 (Pl. 19, Figs 1, 2), and bear very feeble prorsiradiate ribs on the inner to middle flank region that increase by branching and intercalation and strengthen markedly on the outer flank, linking to small ventral clavi, linked across the venter by a low, feeble rib. Fragments have whorl heights of up to 22.6 mm; the best-preserved fragment, OUMNH KX.16584 has a whorl breadth to height ratio of 0.38, and is a relatively coarsely ribbed variant, the ribs feeble on the inner flank, strengthening markedly and progressively across the outer flank, where they are prorsiradiate and feebly concave. They link to well-developed ventral clavi, linked across the venter by a low transverse rib. There is weak mid-ventral ridge. OUMNH KX.16585–16586 (Pl. 20, Figs 13, 14, 17, 18) are feebly ribbed variants with comparable ornament.

DISCUSSION: See Wright and Kennedy (1984) and Kennedy and Klinger (2008b).

OCCURRENCE: *Forbesicera largilliertianum* ranges throughout the Lower and Middle Cenomanian. The geographic distribution extends from Southern England, to France, Switzerland, northern Spain, Germany, Iran, central Asia, north-eastern Algeria, Central Tunisia, Nigeria Angola, KwaZulu-Natal in South Africa, Madagascar, Tamil Nadu in South India, and Japan.

Forbesiceras obtectum (Sharpe, 1853)
(Pl. 19, Figs 3, 4, 6–8, 10, 11; Pl. 20, Figs 1–12,
15, 19, 20; Text-figs 10G, 13)



Text-fig. 13. *Forbesiceras obtectum* (Sharpe, 1853). Intraspecific variation in the ornament of the early whorls, from weak to strong, in A – OUMNH KX.16107; B – OUMNH KX.16100; C – OUMNH KX.16108; all from the Upper Cenomanian *pentagonum* faunas 2 km south-east of Djebel el Krorza, north-eastern Algeria

1853. *Forbesiceras obtectum* Sharpe, 1853, p. 20, pl. 7, fig. 4.
1984. *Forbesiceras obtectum* (Sharpe, 1853); Wright and Kennedy, p. 94, pl. 12, fig. 4; pl. 14, figs 1, 2; pl. 15, fig. 4; text-figs 16g–j, 18 (with synonymy).
2018. *Forbesiceras obtectum* (Sharpe, 1853); Klein, p. 256, 263 (with synonymy).

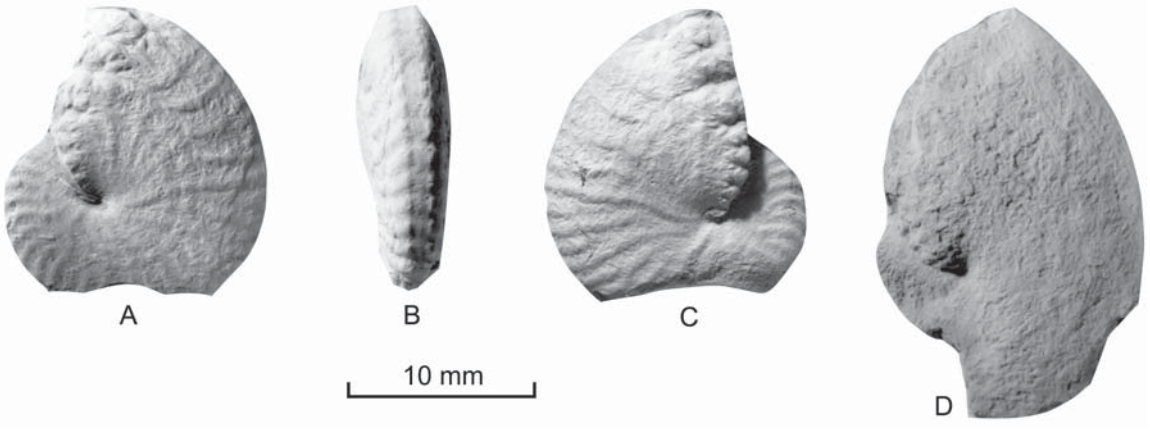
TYPE: The holotype, by monotypy, is the original of Sharpe (1853, pl. 7, fig. 4), from the 'Chalk with siliceous grains' of Chardstock, Devon. It has not been traced.

MATERIAL: MNHN. F. J13788b (Pl. 20, Figs 6, 7), the original of Pervinquière (1907, p. 108, pl. 5, fig. 9), from Guern er Rhezal, and MNHN. F J13702 (Pl. 20, Figs 1–3), the original of pl. 5, fig. 10, from Koudiat el Hamra. MNHN. F. J13788a (Pl. 20, Figs 4, 5), the original of Pervinquière (1907, pl. 5 figs 7, 8), from Guern er Rhezal, all in Central Tunisia. OUMNH KX.16106–16108, from the Upper Cenomanian *pentagonum* fauna 2 km SSE of Djebel el Krorza, northeastern Algeria. OUMNH KX.16713, from the Middle Cenomanian *asiaticum* fauna north of Djebel Hameima, Central Tunisia. OUMNH KX.16726 (collective of eight specimens), 16822–16823, 16824 (collective of five specimens), 16842–16844, from the Upper Cenomanian *pentagonum* fauna north of Djebel Hameima, Central Tunisia. OUMNH KX.16978, from the Upper Cenomanian *pentagonum* fauna 3 km NW of Sour El-Ghozlane (Aumale), north-eastern Algeria.

DIMENSIONS:

	D	Wb	Wh	Wb:Wh	U
MNHN. F. J13788b	17.7 (100)	3.9 (22.0)	10.9 (61.6)	0.36	– (–)
MNHN. F. J13702	27.0 (100)	7.6 (28.1)	17.1 (63.3)	0.44	– (–)

DESCRIPTION: Two extremes of ornament are recognised within the species, with gracile and robust ornament respectively (Text-fig. 13). The early growth stages of gracile forms are well-represented by material from Tunisia described by Pervinquière in 1907. MNHN. F. J13788a (Pl. 20, Figs 4, 5; Pervinquière 1907, pl. 5, figs 7, 8) is a tiny phragmocone only 7.6 mm in diameter. Flank ornament comprises very feeble straight, delicate, irregularly spaced riblets on the adapertural third of the outer whorl that flex forward, strengthen, and are markedly prorsiradiate on the outer flanks, where additional very short ribs intercalate, all linking to well-developed ventral clavi. MNHN. F. J13788b (Pl. 20, Figs 6, 7; Pervinquière (1907, pl. 5, fig. 9) is a phragmocone 17.7 mm in diameter. Coiling is very involute, the umbilicus tiny,



Text-fig. 14. A-C – *Forbesiceras falx* Wright and Kennedy, 1984, OUMNH KX.9809. D – *Forbesiceras bicarinatum* Szász, 1976, OUMNH KX.16803. Both are from the Upper Cenomanian *pentagonum* fauna north of Djebel Hameima, Central Tunisia. Figures are × 1

the flanks flattened and convergent, the ventrolateral shoulders narrowly rounded, the venter very feebly convex. Delicate straight prorsiradiate primary ribs arise low on the flank, and there are both long and short intercalated ribs that strengthen across the flanks, sweeping forwards and very feebly concave on the outermost flanks, where they link to the feeblest outermost flank bullae, obvious only on the adapical half of the outer whorl, and effaced thereafter, and sharp clavi on either side of the very narrow venter.

MNHN. F. J13702 (Pl. 20, Figs 1–3; Pervinquière 1907, pl. 5, fig. 10) continues the ontogeny. Low, broad primary ribs arise on the umbilical shoulder, and additional ribs intercalate on the inner flank. They are straight and prorsiradiate, and link to low, rounded lateral tubercles, of which there are 10 per half whorl. These give rise to pairs of low, broad, feebly concave ribs that strengthen across the outer flanks and link to small clavi, perched on the ventrolateral shoulder. The venter is concave between the clavi, the mid-venter raised into a feebly undulose siphonal ridge, the undulations not differentiated into distinct clavi.

Robustly ornamented individuals include nuclei that range from 13 mm in diameter to fragments with whorl heights of up to 25 mm. OUMNH KX.16108 at a diameter of 16.1 mm has widely spaced blunt umbilical bullae, that give rise to single ribs, and relatively coarse, rounded outer lateral tubercles, seven per half whorl. These give rise to a single rib or pairs of coarse, concave, prorsiradiate ribs that sweep forwards and link to sharp ventral clavi, 12 per half whorl. The flank ornament of the largest fragment seen, OUMNH KX.16722 (Pl. 20, Figs 19, 20) is similar, but here the clavi are linked across the venter by a low transverse rib.

A number of specimens show the sutures (Text-fig. 10G), with deeply incised lobes and saddles, the latter with narrow stems, and E/A with a large incision.

DISCUSSION: See Wright and Kennedy (1984, p. 95).

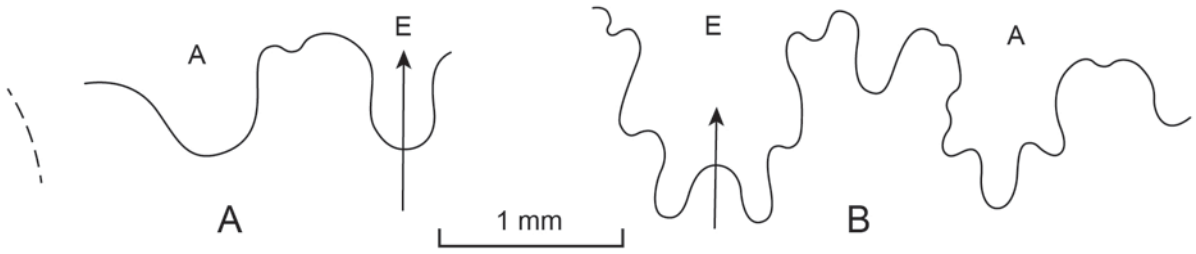
OCCURRENCE: Lower, Middle, and lower Upper Cenomanian, southern England, France, Germany, Turkmenistan, north-eastern Algeria, Central Tunisia, Lebanon, Nigeria, Angola, KwaZulu-Natal in South Africa, and Madagascar.

Forbesiceras bicarinatum Szász, 1976
(Text-fig. 14D)

1976. *Forbesiceras bicarinatum* Szász, p. 170, pl. 1, pl. 2; pl. 3, figs 1, 2; text-figs 1, 2.
1984. *Forbesiceras bicarinatum* Szász, 1976; Wright and Kennedy, p. 96, pl. 14, figs 3–6; pl. 15, fig. 3; pl. 16, figs 1, 3, 4; text-fig. 11f, l–n.
2018. *Forbesiceras bicarinatum* Szász, 1976; Klein, pp. 256, 257 (with synonymy).

TYPE: The holotype (Szász 1976, pls 1, 2; pl. 3, fig. 1) is no. P.12896 in the collections of the Institute of Geology and Geophysics, Bucharest, from the Upper Cenomanian of Dealul Magura, Ponor, in the Hateg region of the Middle Carpathians, Romania.

MATERIAL: OUMNH KX.16803, from the Upper



Text-fig. 15. Suture lines. A – *Litophragmatoceras curiosus* sp. nov., OUMNH KX.16017. B – *Scaphites occlusus* sp. nov., OUMNH KX.164557d

Cenomanian *pentagonum* fauna north of Djebel Hameima, Central Tunisia.

DESCRIPTION: The specimen is a corroded nucleus and the succeeding 180° sector of phragmocone, 52 mm in diameter. Coiling is very involute, the umbilicus minute. The whorl section is very compressed, with a whorl breadth to height ratio of 0.35, the greatest breadth below mid-flank, the inner flanks feebly convex, the middle and outer flanks flattened and convergent, the ventrolateral shoulders sharp and entire, the narrow venter concave between. There are no indications of ornament on the corroded surface of the mould. Such as is visible of the suture is deeply incised, with a large incision in E/A and subphylloid folioles.

DISCUSSION: The details of the suture confirm this specimen as a *Forbesiceras*, and the sharp entire edges to the concave venter characterise *F. bicarinatum*, and distinguish it from all other species referred to the genus.

OCCURRENCE: Lower Upper Cenomanian of Romania, Southern England, and Central Tunisia.

Forbesiceras falx Wright and Kennedy, 1984
(Pl. 20, Fig. 16; Text-fig. 14A–C)

1984. *Forbesiceras falx* Wright and Kennedy, p. 96, pl. 12, fig. 6.
2018. *Forbesiceras falx* Wright and Kennedy, 1984; Klein, pp. 256, 260.

TYPE: The holotype is BMNH C83691, the original of Wright and Kennedy (1984, pl. 12, fig. 6), from the remanié Upper Cenomanian *guerangeri* Zone fauna of the Pinnacles Member (Bed B of authors) of the Beer Head Limestone Formation at Shapwick Grange, Devon.

MATERIAL: OUMNH KX.9823 and, possibly OUMNH KX.9801 (a poorly preserved individual), from the Upper Cenomanian *pentagonum* fauna north of Djebel Hameima, Central Tunisia

DIMENSIONS:

	D	Wb	Wh	Wb:Wh	U
OUMNH KX.9823	38.2 (100)	11.7 (30.6)	25.1 (65.7	0.47	– (–)

DESCRIPTION: Coiling is very involute, the umbilicus minute. The whorl section is compressed, the inner flanks feebly convex, the outer flanks flattened and convergent, the narrow venter sulcate. Quite widely separated narrow prorsiradiate ribs arise on the umbilical shoulder and strengthen across the flanks, while additional ribs intercalate, all linking to a small mid-lateral tubercle. The tubercles give rise to concave ribs, initially strong, but weakening on the outer flank. Further non-tuberculate ribs intercalate, and all ribs link to small clavi, perched on the sharp ventrolateral shoulders. The clavi are linked across the venter by a low, broad rib, and there are faint indications of siphonal clavi in places. The sutures are deeply incised, with a deep incision in E/A.

DISCUSSION: See Wright and Kennedy (1984, p. 96).

OCCURRENCE: Lower Upper Cenomanian, southern England and Central Tunisia.

Family Acanthoceratidae de Grossouvre, 1894
Subfamily Mantelliceratinae Hyatt, 1903

Genus *Mantelliceras* Hyatt, 1903

TYPE SPECIES: *Ammonites mantelli* J. Sowerby, 1814, p. 199, by the original designation of Hyatt (1903, p. 113) (ICZN Specific Name No. 1634).

Mantelliceras mantelli (J. Sowerby, 1814)
(Pl. 21, Figs 14–16; Pl. 23, Figs 29–33)

1814. *Ammonites mantelli* J. Sowerby, p. 119, pl. 55, lower figure only.
1984. *Mantelliceras mantelli* (J. Sowerby, 1814); Wright and Kennedy, p. 99, pl. 16, fig. 5; pl. 17, figs 1, 3; pl. 18, figs 1–3; pl. 19, figs 1–6; pl. 20, figs 1, 2, 4, 5; pl. 21, figs 2, 4; pl. 24, fig. 3; pl. 36, fig. 1 text-figs 20a–d, 26a, c, e, 28a–e (with synonymy).
2019. *Mantelliceras mantelli* (J. Sowerby, 1814); Kennedy in Gale *et al*., p. 221, pl. 20, figs 5, 6; pl. 21, figs 4, 5 (with additional synonymy).

TYPE: The lectotype, by the subsequent designation of Kennedy (1971, p. 54), is BMNH 43940a, from the Lower Cenomanian Chalk Marl of Ringmer, near Lewes, Sussex, the original of J. Sowerby (1814, pl. 55, lower figure only), re-illustrated by Wright and Kennedy (1984, pl. 18, fig. 3a–c).

MATERIAL: The original of Pervinquière (1910, pl. 4 (13), fig. 1), MNHN collections, *ex* Sorbonne collections, and collected by Peron from Sour El-Ghozlane (Aumale), north-eastern Algeria. OUMNH KX.16290, from the Lower Cenomanian *asselensis* fauna 700 m north-east of Koudiat el Assel, north-eastern Algeria. GMH K-8845, labelled *Acanthoceras rhotomagense* Defr., and from Berrouaghia, northern Algeria.

DIMENSIONS:

	D	Wb	Wh	Wb:Wh	U
Pervinquière 1910, pl. 4 (13), fig. 1	22.0 (100)	11.8 (53.6)	10.3 (51.5)	1.15	5.3 (24.1)

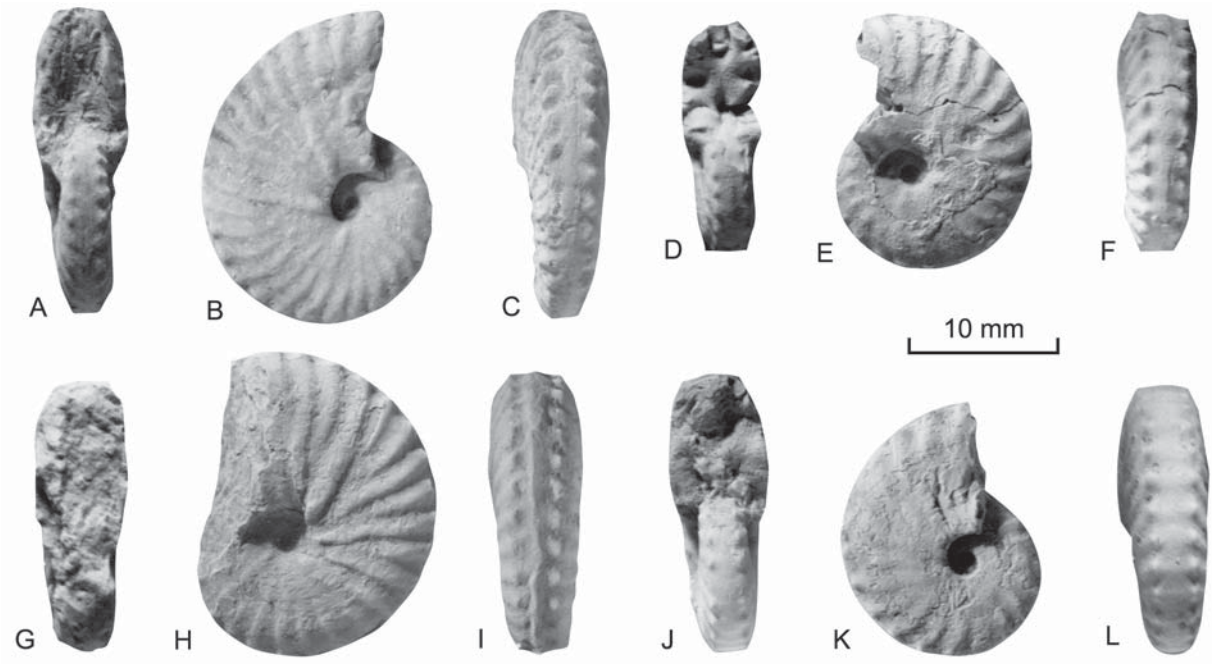
DESCRIPTION: Pervinquière's specimen (Pl. 23, Figs 29–31) is a nucleus with a maximum preserved diameter of 22 mm. Coiling is moderately involute, the umbilicus comprising 24.1% of the diameter, deep, with a feebly convex wall. The whorl section is rectangular in intercostal section, with broadly rounded ventrolateral shoulders and a broad, flattened venter. The costal whorl section is polygonal, with the greatest breadth at the lateral tubercle. Twelve primary ribs arise at the umbilical seam on the outer whorl, strengthen across the umbilical wall and shoulder and link to sharp umbilical bullae of variable strength. These give rise to single strong, straight, prorsiradiate ribs that bear strong rounded/bullate lateral tubercles and weak inner ventrolateral tubercles, linked by a strong rib to strong outer ventrolateral clavi, linked across the venter by a strong transverse rib. Single intercalated ribs that arise at mid-flank separate successive primaries, to give a total of 28 ribs at the ventrolateral shoulder. They lack a lateral tubercle, and have a ventrolateral and ventral development that matches that of the primary ribs. OUMNH KX.16290 (Pl. 23, Figs 32, 33) is a comparable 120º whorl sector of phragmocone with a maximum preserved costal whorl height of 11 mm. GMH K-8845 (Pl. 21, Figs 14–16) differs in no significant respects.

DISCUSSION: The diagnostic features of *Mantelliceras mantelli* are the polygonal costal whorl section, the primary ribs with umbilical, lateral, inner and outer ventrolateral tubercles, the intercalated ribs with inner and outer ventrolateral tubercles. See Wright and Kennedy (1984, p. 101) for a comprehensive discussion.

OCCURRENCE: Commonest in the *Mantelliceras mantelli* Zone of the Lower Cenomanian, but extending into the succeeding *Mantelliceras dixoni* Zone. The species ranges from England to Northern Ireland, France, Germany, Russia, Iran, Kazakhstan, North Africa, KwaZulu-Natal in South Africa, Madagascar, South India, and Japan.

Mantelliceras saxbii (Sharpe, 1857)
(Pl. 21, Figs 1–5, 11–13, 17–19, 27, 28; Pl. 22, Figs 13–22; Pl. 24, Figs 28–31; Text-figs 16A–L, 18A, B)

1857. *Ammonites Saxbii* Sharpe, p. 45, pl. 20, fig. 3.
1862. *Ammonites Martimpreyi* Coquand, p. 172, pl. 1, figs 7, 8.
non 1907. *Acanthoceras Martimpreyi* Coquand; Pervinquière, p. 289, pl. 16, figs 1–5, text-figs 109–111.
non 1907. *Acanthoceras* intermédiaire entre *Ac. Aumalense* Coq. et *Ac. Martimpreyi* Coq.; Pervinquière, pl. 16, figs 6–9.
1910. *Acanthoceras Martimpreyi* Coquand; Pervinquière, p. 41 (*pars*), pl. 13 (4), figs 3–9 only.
1984. *Mantelliceras saxbii* (Sharpe, 1857); Wright and Kennedy, p. 121, pl. 23, fig. 4; pl. 32, figs 1–3; pl. 33, figs 1–4; pl. 34, figs 1–4; pl. 35, figs 1–5; pl. 36, figs 2, 3; pl. 39, fig. 1; text-figs 25b–d, i, 26b, 28l–p (with full synonymy).
2015. *Mantelliceras saxbii* (Sharpe, 1857); Kennedy in Kennedy and Gale, p. 267, pl. 7, fig. 4; pl. 8, fig. 4 (with additional synonymy).



Text-fig. 16. A-L – *Mantelliceras saxbii* (Sharpe, 1857). The originals are part of the Coquand Collection, registered under the collective number GMH K-8846. The late 20th century label identifies them as *Acanthoceras martimpreyi* Coquand, and gives the locality as Berrouaghia-Aumale, northern Algeria. They were not figured by Pervinquière (1910), and their status in relation to what Pervinquière regarded as 'cotypes' of *martimpreyi* is unclear. The original of G-I is of particular interest, as it shows a pseudo-keel, produced *by post-mortem* crushing. J-L – Coquand Collection, GMH K-8814, labelled *Mantelliceras* (*Mantelliceras*) *aumalensis* Coquand, and from Sour El-Ghozlane (Aumale). All figures are × 2

2019. *Mantelliceras saxbii* (Sharpe, 1857); Kennedy in Gale *et al*., p. 224, pl. 20, figs 1, 2, 9–12.

LECTOTYPE: No. 7763 in the collections of the British Geological Survey, the original of Sharpe 1857, pl. 20, fig. 3, by the subsequent designation of Wright and Wright (1951, p. 38). It was refigured by Wright and Kennedy (1984, pl. 35, fig 2), and is from the Lower Cenomanian "Grey Chalk of Ventnor", Isle of Wight.

MATERIAL: OUMNH KX.9853–9855, 16521–16523, 16524 (collective of six specimens), 16531 (collective of 10 specimens), 16533, 16550 (collective of 11 specimens), 16551 (collective of 20 specimens), 16552–16558, 16591 (collective of 20 specimens), 16592 (collective of five specimens), 16593 (collective of 21 specimens), 16594, all from the Lower Cenomanian *carcitanense* fauna north of Djebel Hameima, Central Tunisia.

DIMENSIONS:

	D	Wb	Wh	Wb:Wh	U
OUMNH KX.16592a	20.5 (100)	8.8 (42.9)	10.4 (50.7)	0.85	3.5 (17.0)
OUMNH KX.16532	23.6 (100)	8.6 (36.4)	12.7 (53.8)	0.67	4.0 (16.9)
OUMNH KX.16700	28.5 (100)	– (–)	14.0 (49.1)	–	6.1 (21.4)

DESCRIPTION: The dimensions given above are in some cases approximate due to corrosion, limonitic overgrowths and *post-mortem* crushing, the last of these producing individuals with a very compressed whorl section and an irregular ridge on the venter (Text-fig. 16I). Coiling is moderately involute, the umbilicus comprising as little as 16.9% of the diameter, shallow, with a feebly convex wall and broadly rounded umbilical shoulder. The whorl section is compressed, with whorl breadth to height ratio of up to 0.85 in costal section. The flanks are very feebly convex and subparallel, the ventrolateral shoulders broadly rounded, the venter feebly convex. The costal whorl section is compressed polygonal, with the

greatest breadth below mid flank. Individuals such as OUMNH KX.16592a (Pl. 22, Figs 13–15) have an estimated 26 ribs at the ventrolateral shoulder of the outer whorl. Primary ribs arise at the umbilical seam and strengthen across the umbilical wall and shoulder, where they develop into umbilical bullae of variable strength that give rise to single primary ribs that are straight and recti- to feebly prorsiradiate on the inner flanks, flexing back and in some cases very feebly convex on the outer flank. Up to three ribs intercalate between successive primaries, and arise both high and low on the flanks. All ribs link to a feeble inner ventrolateral bulla, linked by a feebly prorsiradiate rib to a stronger outer ventrolateral clavus, the clavi linked in turn across the venter by a broad transverse rib. OUMNH KX.16700, 28.5 mm in diameter, develops feeble barely detectable lateral bullae on a few ribs, the inner and outer ventrolateral tubercles persisting to the greatest preserved diameter. The largest fragments seen have whorl heights of up to 19 mm; inner ventrolateral tubercles persist in some, but are lost in others. The sutures are poorly preserved in most specimens, with moderately incised bifid lobes and saddles.

DISCUSSION: The most important synonym of *Mantelliceras saxbii* is *Ammonites Martimpreyi* Coquand, 1862 (p. 172 (*pars*), pl. 1, figs 7, 8, reproduced here as Text-fig. 18A, B). What follows updates the discussion in Kennedy and Hancock (1971, p. 441 *et seq*.), which was based on observations I made in Budapest 1965. At that time, the specimens were uncatalogued, and I saw nine in a single tray, labelled:

'*Ammonites martimpreyi* Coquand.'
Roth. [indecipherable symbol]
'Berrouaghia' [indecipherable word] 'Aumale'

Seven of these specimens were figured by Pervinquière in 1910 (pl. 13 (4), figs 2–10) who considered them to be the 'cotypes' of the species, although it is not clear that Coquand had more than a single specimen. Pervinquière considered the original of his pl. 13 (4), fig. 7 (Pl. 21, Figs 1–3 herein) to be 'très probablement le type figuré dans "Geol. Pal. S. Constantine, pl. 1, figs 7–8"'. It differs from Coquand's illustration (Text-fig. 18A, B) in lacking the siphonal keel that Coquand regarded as one of the distinctive features of his species. In spite of this, Kennedy and Hancock accepted Pervinquière's opinion, and designate the specimen neotype. It is a typical *Mantelliceras saxbii* juvenile, with traces of a tiny lateral tubercle, inner and outer ventrolateral tubercles on the adapical half of the outer whorl, the inner ventrolateral thereafter lost.

When I re-examined the material in 1985, the original labels had been replaced, and the specimens assigned numbers (in some case collective); descriptions and interpretations are set out below.

The 'cotype' specimens figured by Pervinquière comprised a tray with seven specimens with the catalogue number GMH K-8846, herein referred to as K8846a–g. The original of Pervinquière (1910, pl. 13 (4), figs 3–10), the original of fig. 2 was not present in the collection. All specimens are limonitic phragmocones. Dimensions are as follows:

	D	Wb	Wh	Wb:Wh	U
GMH K-8846a	14.2 (100)	4.1 (28.9)	6.1 (43.0)	0.67	– (–)
GMH K-8846b	18.6 (100)	6.8 (36.6)	9.2 (49.5)	0.74	2.8 (15.0)
GMH K-8846d	22.8 (100)	13.0 (57.0)	10.5 (46.1)	1.24	3.9 (17.1)
GMH K-8845e	24.8 (100)	8.3 (34.7)	10.9 (44.0)	0.76	4.0 (16.1)
GMH K-8845f	35.5 (100)	11.3 (31.8)	17.7 (49.9)	0.64	7.3 (20.6)

The original of Pervinquière (1910, pl. 13 (4), fig. 2) was not recognised in the collection; it is generically indeterminate from the figure.

GMH K-8845a–f are all assigned to *Mantelliceras saxbii*. GMH K-8846a is the original of Pervinquière (1910, pl. 13 (4), fig. 3), 14.2 mm in diameter. The specimen is rather worn, but shows well-differentiated primary and secondary ribs, 28 per whorl, at the ventrolateral shoulder. These bear persistent inner ventrolateral tubercles that are weak, in part through wear, and stronger outer ventrolateral tubercles.

GMH K-8846b is the original of Pervinquière (1910, pl. 13 (4), fig. 5), and is 18.6 mm in diameter. This specimen has 26–27 ribs per whorl at a diameter of 18.6 mm. It has almost lost its inner ventrolateral tubercles by the beginning of the adapertural half whorl, but has persistent outer ventrolateral clavi.

GMH K-8846c is the original of Pervinquière (1910, pl. 13 (4), fig. 4), 21.7 mm in diameter. There are 31–32 ribs per whorl at the ventrolateral shoulder. The primary ribs arise from feeble umbilical bullae, and all ribs bear progressively effacing inner ventrolateral tubercles and persistent outer ventrolateral clavi.

GMH K-8846d is the original of Pervinquière (1910, pl. 13 (4), fig. 6), 22.8 mm in diameter, and shows the inner ventrolateral tubercles reduced to a mere angulation at the greatest preserved diameter.

GMH K-8846e is the original of Pervinquière

(1910, pl. 13 (4), fig. 6), a comparable individual 24.8 mm in diameter, with 30–32 ribs per whorl.

GMH K-8846f is the original of Pervinquière (1910, pl. 13 (4), fig. 9) (Pl. 24, Figs 28–31), is a crushed individual with 35 ribs per whorl that possesses a tiny mid-lateral tubercle to a diameter of 27 mm.

GMH K-8846g is the original of Pervinquière (1910, pl. 13 (4), fig. 10) (Pl. 24, Figs 32–34) is an individual 33.8 mm in diameter, and damaged on one flank. It is a typical juvenile *Mantelliceras mantelli.*

There are three further specimens, GMH K-8846h–j not figured as 'cotypes' by Pervinquière, and from "Berrouaghia-Aumale", 16.3, 19.0 and 21.6 mm in diameter (Text-fig. 16A–L). All are referred to *Mantelliceras saxbii*. GMH K-8846i is crushed; the crushing has produced a siphonal pseudo-keel. Such pseudo-keels occur in a range of taxa in the present collections (Pl. 3, Fig. 9; Pl. 22, Fig. 19; Pl. 23, Fig. 18), and as suggested previously (Kennedy and Hancock 1971, p. 442), may be the basis for the keel in Coquand's figure (Text-fig. 18A, B) and description.

DISCUSSION: See Wright and Kennedy (1984, p. 123).

OCCURRENCE: *Mantelliceras saxbii* ranges throughout the Lower Cenomanian, with records from southern England, the Boulonnais, Haute Normandie, Maine, Sarthe and Provence in France, northern Spain, Switzerland, Poland, Romania, Bulgaria, Kazakhstan, Iran north of the Zagros, Morocco, Algeria, Tunisia, Angola, KwaZulu-Natal in South Africa, Madagascar, Tamil Nadu in South India, and Japan.

Mantelliceras lymense (Spath, 1926)
(Text-fig. 18C, D)

1907. *Acanthoceras Martimpreyi* Coquand; Pervinquière, p. 289 (*pars*), pl. 16, figs 16, 17 only.
1926. *Eucalycoceras lymense* Spath, pp. 427, 431.
1984. *Mantelliceras lymense* (Spath, 1926b); Wright and Kennedy, p. 102, pl. 10, fig. 9; pl. 22, figs 1–6; pl. 23, figs 1–3; pl. 31, figs 1, 2; pl. 36, fig. 4; text-figs 19; 24a, b, 26d, 28f–j (with synonymy).
2015. *Mantelliceras lymense* (Spath, 1926b); Kennedy in Kennedy and Gale, p. 265, pl. 10, fig. 8 (with additional synonymy).
2019. *Mantelliceras lymense* (Spath, 1926b); Kennedy in Gale *et al*., p. 223, pl. 21, figs 1, 8; pl. 22, figs 3, 4.

TYPE: The lectotype, by the subsequent designation of Wright and Kennedy (1984, p. 102), is the original of Pervinquière (1907, pl. 16, fig. 15), from north of Bargou in Central Tunisia, originally in the collections of the École des Mines, and now housed in the collections of the Université Paul Sabatier, Toulouse.

DESCRIPTION: The holotype is a very well-preserved 180º sector of phragmocone with a maximum preserved diameter of 49 mm. The coiling is moderately evolute, the umbilicus comprising 22% of the diameter, the umbilical wall feebly convex, the umbilical shoulder broadly rounded. The flanks are feebly convex, sub-parallel, the ventrolateral shoulders broadly rounded, the venter feebly convex. Eight to nine primary ribs arise on the umbilical wall and strengthen into bullae, perched on the umbilical shoulder. These are initially very weak, but strengthen progressively. They give rise to single ribs or a pair of ribs, while additional ribs intercalate both low and high on the flanks. They are feebly flexuous on the adapical part of the fragment, thereafter straight and prorsiradiate, all linking to well-developed ventrolateral clavi, linked across the venter by a well-developed transverse rib. The suture is moderately incised, with a broad, bifid E/A, narrow bifid A and narrow bifid A/U2.

DISCUSSION: The presence of umbilical and a single row of ventrolateral tubercles only is distinctive. See Wright and Kennedy (1984, p. 103).

OCCURRENCE: Lower Cenomanian, southern England, Northern Ireland, France, Central Tunisia, Madagascar, Tamil Nadu in South India, and, possibly Germany and Iran.

Genus *Sharpeiceras* Hyatt, 1903

TYPE SPECIES: *Ammonites laticlavius* Sharpe, 1855, p. 31, pl. 14, fig. 1, by the original designation of Hyatt (1903, p. 111).

Sharpeiceras schlueteri Hyatt, 1903
(Pl. 23, Figs 22, 23)

1871. *Ammonites laticlavius* Sharpe; Schlüter, p. 18 (*pars*), pl. 7, figs 4–8.
1903. *Sharpeiceras schlueteri* Hyatt, p. 111.
2015. *Sharpeiceras schlueteri* Hyatt, 1903; Kennedy in Kennedy and Gale, p. 274, pl. 10, figs 2, 5, 10; pl. 11, figs 1, 2; text-fig. 18 (with full synonymy).

TYPES: The lectotype, by the subsequent designation of Wright and Kennedy (1987, p. 130) is the orig-

inal of Schlüter (1871, pl. 7, figs 4, 5), from a mine shaft near Altessen, Germany. It has not been traced. The surviving paralectotype is a *Sharpeiceras laticlavium*, and was refigured by Wright and Kennedy (1987, text-fig. 30) and Kaplan *et al*. (1998, pl. 28).

MATERIAL: OUMNH KX.16622, from the Lower Cenomanian *carcitanense* fauna north of Djebel Hameima, Central Tunisia.

DESCRIPTION: The specimen is a 60° whorl sector of phragmocone with a maximum preserved whorl height of 11.2 mm. The intercostal whorl section is compressed rectangular, with broadly rounded ventrolateral shoulders. The costal whorl section is compressed polygonal. The umbilical shoulder is damaged. The ribs are straight and rectiradiate, and bear a small conical to feebly bullate lateral tubercle, a larger conical inner ventrolateral and a strong outer ventrolateral clavus, the venter smooth between.

DISCUSSION: The fragment resembles closely the larger fragment from Djebel Mrhila described and figured by Kennedy in Kennedy and Gale (2015, pl. 10, fig. 5).

OCCURRENCE: Lower Lower Cenomanian, southern England, France, Switzerland, Central Tunisia, Peru, Venezuela, Angola, Mozambique, and Madagascar.

Genus *Graysonites* Young, 1958

TYPE SPECIES: *Graysonites lozoi* Young, 1958, p. 172, pl. 27, figs 1–11; text-fig. 1b, c, d, f, by original designation = *Mantelliceras wacoense* Böse, 1928, p. 215, pl. 5, figs 9–25; pl. 6, figs 1–4.

Graysonites cherbensis (Thomas and Péron, 1889)
(Pl. 22, Figs 9–12; Pl. 23, Figs 27, 28)

1889. *Hoplites cherbensis* Thomas and Péron, p. 31, pl. 17, figs 4, 5.
1907. *Acanthoceras Suzannae* Pervinquière, p. 298, pl. 16, figs 12, 13; text-fig. 115.
1907. *Sharpeiceras laticlavium* Sharpe var. *byzacenica* Pervinquière, pp. 302, 419, pl. 14, fig. 4.
1907. *Hoplites Cherbensis* Thomas and Péron; Pervinquière, pp. 187, 422.
1910. *Acanthoceras aumalense* Coquand; Pervinquière, p. 42 (*pars*), pl. 13 (4), fig. 18 only.
1985. *Graysonites byzacenica* (Pervinquière, 1907); Howarth, p. 91.
1987. *Acanthoceras laticlavium* var. *byzacenica* Pervinquière; Wright and Kennedy, p. 128, text-fig. 35b, c.
2015. *Graysonites cherbensis* (Thomas and Péron, 1889); Kennedy in Kennedy and Gale, p. 269, pl. 9, figs 1–12; text-figs 15, 16.

TYPE: The holotype, by monotypy, is MNHN. F. R52077, the original of *Hoplites cherbensis* Thomas and Péron, 1889, p. 31, pl. 17, figs 4, 5, refigured by Kennedy and Gale (2015, pl. 9, fig. 7), from Bir Mageur, Djebel Cherb, Central Tunisia.

MATERIAL: MNHN. F. J13784 (Pl. 22, Fig. 9), MNHN collections (Pl. 22, Fig. 10), both from the 'Vraconnien' of Pont du Fahs, Central Tunisia; MNHN. F. J13789 (Pl. 22, Figs 11, 12 herein), the lectotype of *Acanthoceras Suzannae* Pervinquière 1907, pl. 16, figs 12, 13, from the 'Vraconnien' of Koudiat el Hamra, Central Tunisia. MNHN. F. J13752, the original of *Acanthoceras Aumalense* Coquand of Pervinquière (1910, pl. 13 (4), fig. 18), from Djebel Guessa, northern Algeria. OUMNH KX.16595 and 16665–16666, from the Lower Cenomanian *carcitanense* fauna north of Djebel Hameima, Central Tunisia.

DESCRIPTION: The lectotype of *Acanthoceras suzannae* Pervinquière, 1907 (p. 298, pl. 16, figs 12, 13; text-fig. 115: Pl. 22, Figs 11, 12 herein) is a limonitic nucleus 10.3 mm in diameter. Coiling is very involute, the tiny umbilicus comprising 20% of the diameter, shallow, with a vertical wall and very narrowly rounded umbilical shoulder. The whorl section is very compressed, rectangular, with flat, subparallel flanks, broadly rounded ventrolateral shoulders and a narrow, flat venter in intercostal section. The inner to mid-flank region is near-smooth, but for traces of low, broad, prorsiradiate ribs. These arise singly or in pairs, and become conspicuous only on the outer flank, where they link to an elongated inner ventrolateral tubercle, barely differentiated at the adapical end of the outer whorl, but well-differentiated on the adapertural half whorl. A broad rib connects to a sharp outer ventrolateral clavus – or laterally compressed spine – of which there are 22 per whorl, the venter concave between, with a feeble siphonal ridge. The suture (Pervinquière 1907, text-fig. 115 on p. 299) is only moderately incised, with narrow bifd E/A, A and U2.

MNHN. F. J13752 is the original of *Acanthoceras Aumalense* of Pervinquière, 1910, p. 42 (*pars)*, pl. 13, fig. 18 (Pl. 23, Figs 27, 28), from Djebel Guessa in northern Algeria. It is a 90° sector of phragmocone

with a maximum preserved whorl height of 12.9 mm and a whorl breadth of 7 mm. The umbilicus is shallow, with a low, flattened, subvertical wall and narrowly rounded umbilical shoulder. The whorl section is very compressed, with a whorl breadth to height ratio of 0.54, the flanks very feebly convex and subparallel, with broadly rounded ventrolateral shoulders and a feebly convex venter in intercostal section. Six small bullae perch on the umbilical shoulder of the fragment, and give rise to single straight, prorsiradiate ribs, separated by single intercalated ribs, occasionally incipiently linked to a bulla. The ribs broaden and strengthen across the flanks, and link to tiny inner ventrolateral bullae, linked by a strong rib to a strong and markedly oblique outer ventrolateral clavus, the venter smooth between the clavi. The specimen is interpreted as a juvenile *Graysonites cherbensis*.

DISCUSSION: When introducing his *Acanthoceras Suzannae*, Pervinquière (1907, p. 300) mentioned four specimens. I was able to recognise three in the Sorbonne collections in the mid-1980's, the lectotype, and two paralectotypes, the latter minute nuclei, one, 8.7 mm in diameter and from Pont du Fahs (Pl. 22, Fig. 10), and a second, now MNHN. F. J13789, and 10.3 mm in diameter, from Guern er Rhezal (Pl. 22, Fig. 9). Pervinquière (1907, p. 300) also mentioned further specimens from 'Aumale' and Oued Cheniour in the Blayac Collection that are also paralectotypes. I located two large fragments in the Blayac Collection (figured in Kennedy and Gale 2015, pl. 9, figs 11, 12), but is not clear if either of these is the specimen referred to.

That the lectotype of *Acanthoceras Suzannae* is the nucleus of *Graysonites cherbensis* was demonstrated previously (Kennedy in Kennedy and Gale 2015, p. 270). It differs from nuclei of *G. elegans* sp. nov. of comparable size, described below, in the near absence of ornament over most of the flanks, whereas *elegans* has well-developed umbilical bullae and flank ribs (compare Pl. 22, Figs 1–3 and Pl. 22, Figs 11, 12).

OCCURRENCE: Lower Cenomanian of Central Tunisia and, possibly, north-eastern Algeria.

Graysonites elegans sp. nov
(Pl. 22, Figs 1–8; Text-fig. 17B)

TYPES: The holotype is OUMNH KX.16323a (Pl. 22, Figs 4, 5), paratypes (Pl. 22, Figs 1–3, 6–8) are OUMNH KX.16323b–g, and 16321a, b, from the lower Lower Cenomanian *harchaensis* fauna 700 m north-east of Koudiat el Assel, 11 km NNE of Bou Khadra village, north-eastern Algeria.

DIAGNOSIS: A *Graysonites* with nuclei that bear 10–11 umbilical bullae that give rise to delicate feebly falcoid ribs with additional ribs intercalating, all ribs with strong inner and outer ventrolateral tubercles.

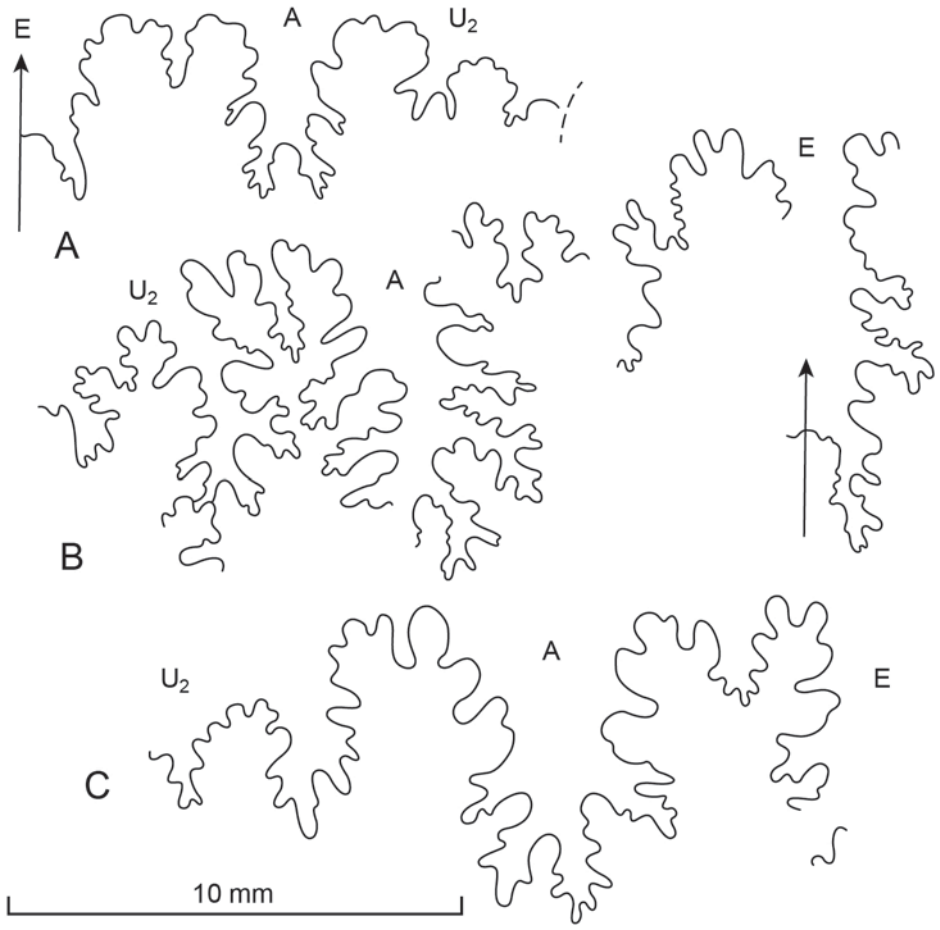
MATERIAL: OUMNH KX.16321, collective of 10 specimens, locality as for types.

DIMENSIONS:

	D	Wb	Wh	Wb:Wh	U
OUMNH KX.16321a	9.7 (100)	3.6 (37.1)	5.9 (60.8)	0.61	1.7 (17.5)
OUMNH KX.16321b	13.7 (100)	5.6 (40.8)	7.1 (51.8)	0.79	2.7 (19.7)
OUMNH KX.16323d	18.1 (100)	6.4 (35.4)	10.2 (56.4)	0.63	3.5 (19.3)
OUMNH KX.16323f	23.9 (100)	8.6 (36.0)	13.6 (56.9)	0.63	4.0 (16.7)
OUMNH KX.16323e	24.2 (100)	9.1 (37.6)	11.7 (48.8)	0.53	4.9 (20.3)

All dimensions are costal.

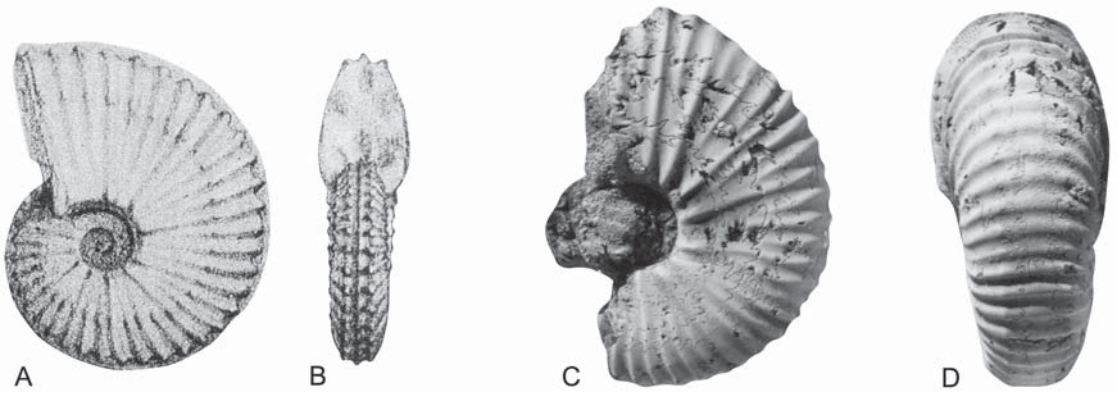
DESCRIPTION: The material consists of whole and fragmentary phragmocones that range from 9.7 to an estimated 35 mm in diameter. Coiling is involute, the shallow umbilicus comprising between 16.7 and 20.3% of the diameter, the low umbilical wall feebly convex, the umbilical shoulder broadly rounded. The intercostal whorl section is compressed, with flattened subparallel flanks, broadly rounded ventrolateral shoulders, and a feebly convex venter. The costal whorl breadth to height ratio varies between 0.61 and 0.79, the greatest breadth at the umbilical bullae, the strength of which has a marked effect on the ratio. The smallest paratype, at a diameter of 9.7 mm, has four strong to weak bullae per half whorl, perched on the umbilical shoulder, that give rise to pairs of strong, straight, prorsiradiate ribs, with additional ribs intercalating, to give a total of 9–10 ribs at the ventral shoulder of the half whorl and a total of 19–20 per whorl. The ribs link to well-developed inner ventrolateral bullae, from which a strong prorsiradiate rib links to a stronger subspinose outer ventrolateral tubercle; the venter between the outer ventrolateral tubercles is arched and undulose, strengthening into incipient siphonal tubercles. Paratype OUMNH KX.16323b (Pl. 22, Figs 1–3), 13.7 mm in diameter, is a strongly ornamented variant, with bullae that strengthen markedly at the greatest preserved diameter, and a total of 16/17 ribs at the ventrolateral shoulder of the outer whorl. The inner ventrolateral



Text-fig. 17. Suture lines. A – *Neophlycticeras algeriense* sp. nov., OUMNH KX.16312g. B – *Graysonites elegans* sp, nov., OUMNH KX.16323a. C – *Stoliczkaia* (*Stoliczkaia*) *clavigera* (Neumayr, 1875), OUMNH KX.16314a

tubercles are small and conical/bullate, the outer ventrolateral clavi much stronger, and subspinose. The mid-venter is feebly undulose. OUMNH KX.16323d, 18.1 mm in diameter, has 10/11 umbilical bullae, and an estimated 22–23 ribs at the ventrolateral shoulder of the outer whorl, the ribs arising from umbilical bullae of variable strength either singly or in pairs, with well-developed inner ventrolateral bullae and sharp outer ventrolateral clavi, linked across the venter by a low, broad rib. Paratype OUMNH KX.16323e has 11 umbilical bullae and 24–25 ribs at the ventrolateral shoulder of the outer whorl, the outer ventrolateral clavi linked across the venter by a broad, transverse rib. The holotype (Pl. 22, Figs 4, 5) consists of just under half a whorl of phragmocone with a greatest preserved whorl height of 16.5 mm. The costal whorl breadth to height ratio is 0.66 at the adapical end of the fragment. Six primary ribs arise at the umbilical seam, strengthen across the umbilical wall, and develop into small bullae, perched on the umbilical shoulder. These give rise to pairs of ribs to give a total of 10 at the ventrolateral shoulder. The ribs are strong, straight, and separated by wider interspaces. All link to well-developed conical inner ventrolateral and sharp, feebly clavate outer ventrolateral tubercles, linked across the venter by a broad prorsiradiate rib. The partially exposed suture of this specimen (Text-fig. 17B) includes a large, deeply incised bifid E/A, deeply incised A and a narrow-stemmed, deeply incisedA/U2 with subphylloid folioles.

DISCUSSION: The present species compares most closely with *Graysonites cherbensis* (Thomas and Péron, 1889) (see above). Nuclei of *cherbensis* lack



Text-fig. 18. A, B – copy of Coquand's original figures of *Ammonites martimpreyi* (1862, pl. 20, fig. 3). C, D – *Mantelliceras lymense* (Spath, 1926). The lectotype, EMP A1185, the original of Pervinquière 1907, pl. 16, fig. 16, from the 'Vraconnien' north of Bargou, Central Tunisia. Figures are × 1

umbilical bullae and distinct ribs on the inner and middle flank at an early growth stage (Pl. 22, Figs 11, 12). The holotype of *elegans* differs from *cherbensis* of comparable size (Kennedy in Kennedy and Gale 2015, pl. 9, figs 4, 8) in its stronger umbilical bullae, and ribs that arise in pairs from bullae. There are also similarities to *Graysonites wacoense* (Böse, 1928) (see revision in Kennedy in Kennedy *et al*. 2005, p. 390, text-figs 24a, b, 26–32, 33d–f, 34–38), but the widely separated ribs, arising in pairs from umbilical bullae are distinctive.

The mid-ventral ridge of some specimens (OUMNH KX.16323f: Pl. 22, Fig. 8) is also seen in some specimens of *Graysonites wacoensis* (Kennedy in Kennedy *et al*. 2005, text-fig. 29a). The incipient siphonal tubercles of some specimens is interpreted as the product of the intersection of the ridge with the transverse ventral ribs linking the outer ventrolateral clavi.

OCCURRENCE: As for types.

Genus *Submantelliceras* Spath, 1923

TYPE SPECIES: *Ammonites Aumalensis* Coquand, 1862, p. 172, pl. 1, figs 27, 28, by the original designation of Spath (1923, p. 143).

DIAGNOSIS: "Dwarf Mantelliceratinae with umbilical bullae that give rise to one or two primary ribs, with additional short intercalated ribs; all ribs bear inner and outer ventrolateral tubercles. Adult body chambers show decline and loss of tubercles, ribs crowding and forming ventral chevron with rounded peak on adapertural part." (Kennedy *et. al*. 2015, p. 10).

DISCUSSION: *Submantelliceras* had been a much misunderstood genus. Spath (1923, p. 148) introduced it as follows: "*Submantelliceras* gen. nov. (type: *Acanthoceras aumalense* [Coquand] Pervinquière: Ammon. Crét. Algér.,' *Mém. Soc. Géol. France, Pal*., (42), 1910, p. 42, pl. iv. fig. 11". The figure referred to is of a specimen that Pervinquière recorded as from Djebel Korreo?, but as noted by Kennedy (in Kennedy *et al*. 2005, p. 388), Coquand stated that his specimens came from the environs of Aumale. Wright (1957, p. 411) regarded *Submantelliceras* as "merely the inner whorls of compressed species of this [*Mantelliceras*] and other genera", and did not mention it in 1996. In contrast, Hancock *et al*. (1993, p. 462) concluded that the holotype of *Graysonites wacoensis* (Böse, 1928) (pl. 5, figs 9, 10, 23, 24; refigured in Kennedy *et al*. 2004, text-fig. 26m, n) and *aumalense* of Coquand (1862, pl. 1, figs 27, 28) were conspecific, the implication being that *Graysonites* Young, 1958 was a junior synonym of *Submantelliceras*. That minute limonitic nuclei like the holotype of *wacoense* might be *Submantelliceras* was suggested already by Adkins (1928, p. 239) and Mancini (1978, 1982); Immel and Seyed-Emami (1985) referred *Graysonites wooldridgei* Young, 1958 to *Submantelliceras*. I discussed the genus further in 2005 (Kennedy in Kennedy *et al*. 2005, p. 388), and was less certain (p. 390). The actual nature of the type species of *Submantelliceras* was, however, already clear from Pervinquière's 1907 account: his text-fig. 114 on p. 298 shows the sutures of an individ-

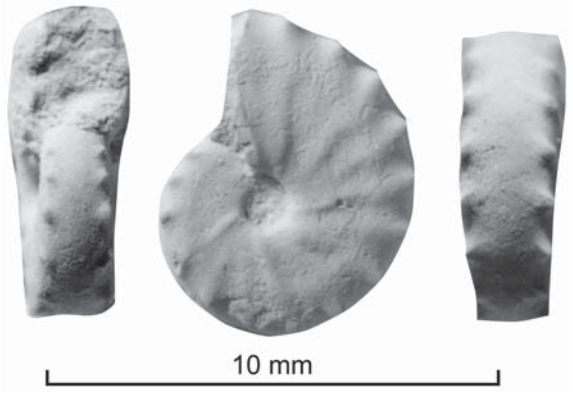
ual, the original of his pl. 16, figs 10, 11 (reproduced here as Text-fig. 20) that are crowded and overlapping at a phragmocone diameter of diameter of only 11.1 mm. As Pervinquière states (1907, p. 298) after a detailed discussion of the sutures of this specimen: "Il me parâit probable que nous avons encore affaire ici à des races naines." The species is, in other words, a dwarf, and presumably a paedomorphic derivative of some larger mantellicerine. Kennedy *et al*. (2015, p. 10, text-fig. 9a–d) were able to confirm this with the illustration of an adult with body chamber 16.4 mm in diameter, from the Lower Cenomanian of Sarthe in France (see also Kennedy in Wright and Kennedy 2015, p. 404, text-fig. 157e–f).

OCCURRENCE: Lowe Cenomanian, Algeria, Tunisia, KwaZulu-Natal in South Africa, Madagascar, south India, Sarthe in France and, possibly, southern England.

S*ubmantelliceras aumalense* (Coquand, 1862)
(Pl. 23, Figs 14–21, 24–26; Pl. 24, Figs 1–9; Text-figs 19, 20)

1862. *Ammonites Aumalensis* Coquand, p. 172, pl. 1, figs 27, 28.
1907. *Acanthoceras Aumalense* Coquand; Pervinquière, p. 296, pl. 16, figs 9–11; text-figs 112–114.
1910. *Acanthoceras Aumalense* Coquand; Pervinquière, p. 42, pl. 13 (4) figs 12, 15, 16, 19 only.
1923. *Acanthoceras aumalense* Coquand; Spath, p. 143.
1925. *Mantelliceras aumalense* Coquand; Diener, p. 168 (*pars*).
non 1993. *Submantelliceras aumalense* (Coquand); Hancock *et al*., p. 462 (= *Graysonites wacoense* (Böse, 1928).
2005. *Submantelliceras aumalense* (Coquand, 1862); Kennedy in Kennedy *et al*., p. 387, text-fig. 25a–i.
2015. *Submantelliceras aumalense* (Coquand, 1862); Kennedy *et al*., p. 10, text-fig. 9a–d.
2015. *Submantelliceras aumalense* (Coquand, 1862); Kennedy in Wright and Kennedy, p. 404, text-fig. 157a–f.

TYPES: the lectotype, by the subsequent designation of Kennedy in Kennedy *et al*. (2005, p. 390), is GMH K-8813d, the original of Pervinquière (1910, pl. 13 (4), fig. 12) (Pl. 24, Figs 6–9), from 'Aumale' (Sour El-Ghozlane) in north-eastern Algeria. Pevinquière figured a number of other specimens that he regarded as 'cotypes' of *Acanthoceras aumalense*; they were refigured by Kennedy in Kennedy *et al*. (2005, text-fig. 25), together with other specimens labelled as being *aumalense* in the Coquand collection. These are interpreted as follows:



Text-fig. 19. *Submantelliceras aumalense* (Coquand, 1862). OUMNH KX.16433, from the Lower Cenomanian *carcitanense* fauna north of Djebel Hamima, Central Tunisia. Figures are × 6

Pl. 13 (4), fig. 11. Not traced; it appears to be a juvenile *Graysonites cherbensis*; Pervinquière gives the locality as Djebel Korreo, and it is thus not a paralectotype.

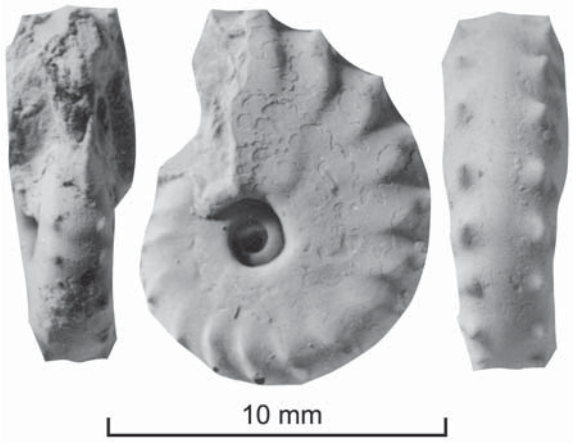
Pl. 13 (4), fig. 12. GMH K-8813c, a paralectotype, from Sour El-Ghozlane (Aumale), refigured here as Pl. 24, Figs 2–4.

Pl. 13 (4), fig. 13. GMH K-8813a, refigured by Kennedy in Kennedy *et al*. (2005, text-fig. 25p–r), a paralectotype, from Sour El-Ghozlane (Aumale), and a juvenile *Forbesiceras* (Pl. 24, Figs 16, 17).

Pl. 13 (4), fig. 14. GMH K-8687 refigured by Kennedy in Kennedy *et al*. (2005, text-fig. 25t, u), from Djebel Korreo, and thus not a paralectotype, and a juvenile *Stoliczkaia* (Pl. 24, Figs 20, 21).

A further possible paralectotype in the Coquand Collection and from Sour El-Ghozlane(Aumale), is GMH K-8814, figured by Kennedy in Kennedy *et al*. (2005, text-fig. 25Y–Z[1]) (Pl. 24, Figs 25–27) is a juvenile *Stoliczkaia*.

MATERIAL: MNHN. F. J13707, the original of Pervinquière (1907, pl. 16, fig. 6), from the 'Vraconnien' north of Djebel Bou Tis, Central Tunisia. MNHN. F. J13709, the original of Pervinquière (1907, pl. 16, figs 10, 11), from the 'Vraconnien' of Guern er Rhezal, Central Tunisia. MNHN. F. J13708, the original of Pervinquière (1907, pl. 16, fig. 8), from the Cenomanian near Ksar Khima, Central Tunisia. MNHN. F. J04342, the original of Pervinquière (1910, pl. 13 (4), fig. 17), from Djebel Guessa, northern Algeria. MNHN collections, the



Text-fig. 20. *Submantelliceras aumalense* (Coquand, 1862). MNHN. F. J13709, the original of Pervinquière 1907, pl. 16, figs 10, 11, from the 'Vraconnien' of Guern er Rhezal, Central Tunisia. The specimen is 11.1 mm in diameter, the final few septa approximated (Pervinquière 1907, text-fig. 114 on p. 298), showing the specimen to be an adult

original of Pervinquière (1910, pl. 13 (4), fig. 19), both from Djebel Guessa, north-eastern Algeria. OUMNH KX.16433 and 16590, from the lower Lower Cenomanian *carcitanense* fauna north of Djebel Hameima, Central Tunisia. OUMNH KX.16965, from the Lower Cenomanian 3 km north-west of Sour El-Ghozlane, northern Algeria.

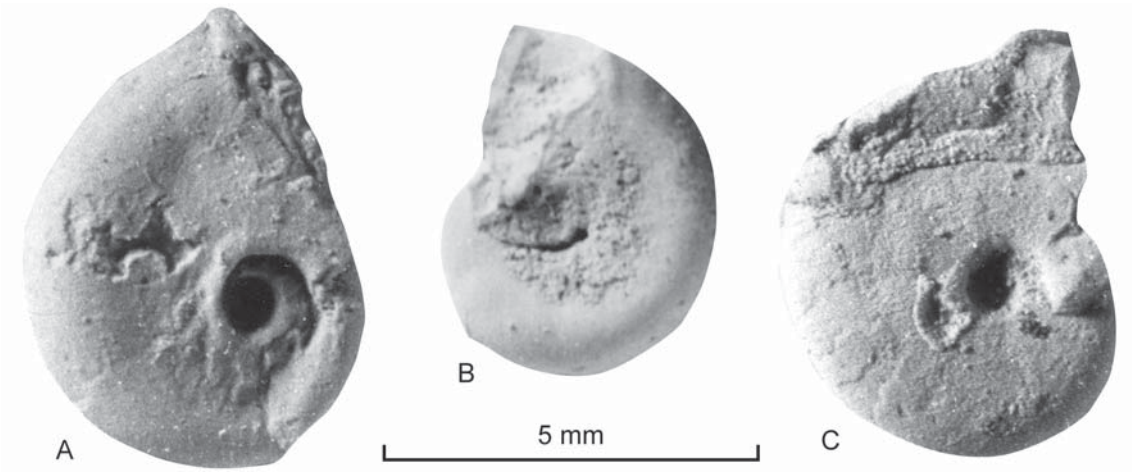
DIMENSIONS:

	D	Wb	Wh	Wb:Wh	U
MNHN. F. J13709	11.1 (100)	3.7 (33.3)	7.1 (64.0)	0.52	1.9 (17.1)
MNHN. F. J04342	11.9 (100)	4.4 (37.0)	6.6 (55.5)	0.67	1.9 (16.0)

DESCRIPTION: The type material consists of tiny limonitic internal moulds. These are initially smooth, thereafter with feeble inner flank ribs that strengthen on the outer flank and ventrolateral shoulder, where they bear well-developed inner and outer ventrolateral tubercles. Paralectotype GMH K-8813c, the original of Pervinquière (1910, pl. 13 (4), fig. 12) (Pl 24, Figs 2–4), is 10.8 mm in diameter. The first part of the outer whorl is smooth. The umbilical shoulder is narrowly rounded, the flanks flattened and subparallel, with broadly rounded ventrolateral shoulders, and a feebly convex venter. The remaining sector of the whorl bears a total of thirteen ribs. Four feeble bullae are present at the umbilical shoulder; these give rise to single ribs, while two non-bullate ribs arise at the umbilical shoulder as mere striae. The ribs are prorsiradiate, feebly concave on the inner flank, convex at mid-flank, and concave and markedly strengthened on the outer flank, where they are accompanied by shorter intercalated ribs. All ribs bear well-differentiated bullate inner ventrolateral tubercles that give rise to a strengthened rib that links to a sharp outer ventrolateral clavus. A feeble convex rib may link clavi across the venter, which is arched, not carinate. The lectotype, GMH K-8813d (Pl. 24, Figs 1, 6–9) has the same general whorl proportions and expansion rate as GMH K-8813c, with a diameter of 11 mm. The adapical sector of the shell is smooth; when ornament appears, it is stronger and coarser than in the previous specimen, with a total of 15 ribs present, with well-developed bullate inner ventrolateral tubercles, and strong, clavate outer ventrolateral tubercles

Of material figured by Pervinquière in 1907, MNHN. F. J13709, the original of his pl. 16, figs 10, 11 (Text-fig. 20) is 11.1 mm in diameter. Coiling is very involute, the small shallow umbilicus comprising 17.1% of the diameter, with a flattened subvertical wall and narrowly rounded umbilical shoulder. The whorl section is compressed rectangular in intercostal section, with broadly rounded ventrolateral shoulders and a very feebly convex to very obtusely fastigiate venter. The whorl breadth to height ratio is 0.52. There are indications of perhaps five umbilical bullae on the outer whorl; only those at the adapertural end are clearly differentiated. Traces of low prorsiradiate flank ribs are conspicuous only at the adapertural end of the phragmocone. In contrast, well-developed coarse ribs, 16 in number, are present on the ventrolateral shoulders from the adapical end of the outer whorl. They bear progressively strengthening inner ventrolateral bullae, linked by a strong prorsiradiate rib to subspinose outer ventrolateral clavi. The mid-venter is raised into a low, rounded ridge. The final three sutures interfere (Pervinquière 1907, text-fig. 114 on p. 298), and show the specimen to be adult. E/A is little-incised, broad and bifid, A narrow and bifid as is U2.

Pervinquière (1907) also illustrated what he regarded as intermediates between *Acanthoceras Aumalense* and *Acanthoceras Martimpreyi*, here regarded as juvenile *aumalense*. Amongst these, MNHN. F. J13707 (Pl. 23, Figs 17, 18), the original of his pl. 16, figs 6, 7, is 10.3 mm in diameter. Six/seven umbilical bullae give rise to one or two ribs, with additional ribs intercalating, to give a total of 16 ribs at the ventrolateral shoulder of the outer whorl, with well-developed ventrolateral tubercles. The striking feature of this specimen is the presence of a ventral 'keel', displaced to one side of the median line of the venter at



Text-fig. 21. Nuclei assigned to *Acanthoceras martimpreyi* Coquand, 1862 by Pervinquière (1907, p. 289). A – MNHN. F. J13705a, the original of Pervinquière 1907, pl. 16, fig. 3; B – MNHN. F. J13714, the original of pl. 16, fig. 2; C – MNHN. F. J13705b. All are described as from the 'Vraconnien' of Guern er Rhezal, northern Algeria

the beginning of the outer whorl, thereafter central, before disappearing. It is interpreted as a preservational artefact, reflecting *post-mortem* crushing.

MNHN. F. J13753, the original of Pervinquière (1910, pl. 13, fig. 17) (Pl. 23, Figs 14–16) is 11.9 mm in diameter. Coiling is very involute, the deep umbilicus comprising 16% of the diameter, the umbilical wall vertical, the umbilical shoulder narrowly rounded, the flanks flattened and subparallel, the intercostal section with broadly rounded ventrolateral shoulders and a very feebly convex venter. The inner flanks of the adapical half of the outer whorl are near-smooth. On the adapertural half, five to six initially very feeble primary ribs appear on the inner flank, with incipient bullae at the greatest preserved diameter. Well-developed ribs are present on the outermost flanks and ventrolateral shoulders from the beginning of the outer whorl, and link to tiny inner ventrolateral bullae, linked by a stronger rib to oblique outer ventrolateral clavi, the venter smooth and feebly convex between the clavi. OUMNH KX.156433 (Text-fig. 19), a well-dated individual, is closely comparable.

DISCUSSION: *Acanthoceras* (*Mammites*) *prenodosoides* Boule, Lemoine and Thévenin, 1907 (p. 13 (33), pl. 2 (9), figs 3–5) is interpreted as a *Submantelliceras* on the basis of abundant material, including adults with body chamber, from northern KwaZulu-Natal in South Africa, described by Kennedy *et al*. (2015, p. 10, text-figs 9e–r, 10a–z[1], 11a–o). Specimens up to 35 mm in diameter are interpreted as macroconchs, with microconchs as little as 25.5 mm in diameter. Coiling is more evolute than in *aumalense*, the umbilicus comprising up to 30% of the diameter. The umbilical bullae and flank ribs are much coarser at diameters corresponding to the present specimens.

OCCURRENCE: Lower Cenomanian of north-eastern Algeria, Central Tunisia, and Sarthe in France.

Submantelliceras sp. juv.
(Text-fig. 21)

1907. *Acanthoceras Martimpreyi* Coq.; Pervinquière, p. 289 (*pars*), pl. 16, figs 2, 3 only.

MATERIAL: MNHN. F. J13714, the original of Pervinquière (1907, pl. 16, fig. 2), MNHN. F. J13705a and b, the former the original of Pervinquière (1907 pl. 16, fig. 3), all from the 'Vraconnien' of Guern er Rhezal in Central Tunisia.

DESCRIPTION: MNHN. F. J13714 (Text-fig. 21B) is 4.6 mm in diameter. Coiling is very involute, with a tiny deep umbilicus, the umbilcal wall flattened, the umbilical shoulder narrowly rounded, the whorl section compressed with flat, subparallel flanks, broadly rounded ventrolateral shoulders and a very feebly convex venter. The only ornament is a single rib on the ventrolateral shoulder at the greatest preserved diameter. MNHN. F. J13705a (Text-fig. 21A) is 6.3 mm in diameter. Compressed and involute, the umbilical

wall is subvertical, the umbilical shoulder narrowly rounded, the flanks flattened and subparallel, the ventrolateral shoulders narrowly rounded, the venter feebly convex. There is no ornament at this stage in my view, although Pervinquière (1907, explanation of pl. 16) suggested that the specimen bore the first marginal tubercle. MNHN. F. J13705b is comparable.

DISCUSSION: These tiny specimens are assigned to *Submantelliceras* on the basis of their similarity to the initial unornamented growth stage of the lectotype of *Submantelliceras aumalense.*

OCCURRENCE: As for material.

Genus *Coquandiceras* nov.

TYPE SPECIES: *Ammonites Jubae* Coquand, 1880, p. 34.

DIAGNOSIS: Small, evolute, serpenticone. Umbilical bullae give rise to primary ribs that may branch, and additional ribs intercalate and link to outer ventrolateral clavi on either side of a sunken venter in the type species. The tubercles efface on the body chamber, the ribs passing straight across the rounded venter on the adapertural part. Other species assigned to the genus have both inner and outer ventrolateral tubercles. Suture simple: E/A with single minor incision, A entire.

DISCUSSION: There is little to add to the diagnosis. The genus is assigned to Mantelliceratinae on the basis of the tuberculation. The extreme simplification of the suture combined with the ornament is unique.

OCCURRENCE: Lower Cenomanian, north-eastern Algeria and Central Tunisia.

Coquandiceras jubae (Coquand, 1880)
(Pl. 21, Figs 23–26)

1880. *Ammonites Jubae* Coquand, p. 34.
1910. *Acanthoceras Blayaci* Pervinquière, p. 43, pl. 13 (4), figs 26–29.

TYPE: The holotype, by monotypy, is GMH K-8451, “elle a été déouverte par M. de Lhotellerie dans les assizes rothomangiennes des environs d’Aumale.”

DESCRIPTION: The holotype (Pl. 21, Figs 23–26) is a limonitised individual 17.7 mm in diameter, distorted by over-mineralisation at the adapertural end. Coiling is relatively evolute, with a broad, shallow umbilicus. The whorl section is compressed, with flattened, subparallel flanks. Tiny umbilical bullae give rise to pairs of primary ribs, which, together with additional intercalated ribs, are prorsiradiate, feebly flexuous, concave on the outer flank, where they terminate in tiny ventrolateral tubercles at the adapical end of the outer whorl. These are closely spaced on either side of the narrow venter. The tubercles decline, and are absent beyond a diameter of 12.5 mm, at which point the ribs are continuous across the flattened, feebly convex venter. The changes in ornament on the outer whorl indicate specimen to be an adult, and the species a micromorph.

DISCUSSION: *Ammonites Jubae* is not a *nomen oblitum* under the terms of Article 29 of the *International Code of Zoological Nomenclature*. *Acanthoceras Blayaci* of Pervinquière is regarded as a junior synonym of *Ammonites Jubae* on the basis of the similar evolute coiling and low expansion rate, common style of ornament, notably the effacement of the ribbing on the flanks, and presence of a single row of ventral tubercles on either side of a narrow depression on the phragmocone. The holotype, by original designation, the original of Pervinquière (1910, p. 43, pl. 13 (4), figs 28, 29), from the Cenomanian of Sour El Ghozlane (Aumale) has not been traced. Pervinquière described it as follows: “Coquille discoïdale, à large ombilic. Tours plus hauts que larges, se recouvrant sur le quart ou le cinquième seulment. Flancs presque plats, portant, autour de l’ombilic, une vingtaine de petites tubercles, de chacun desquels partent deux ou trois côtes flexueuses, d’abord très faibles, puis se renforçant sur le tiers externe et terminant par un léger tubercle à la limite de la région ventrale; sur celle-ci les côtes sont très atténuées, de sort qu’il y a une dépression dans le plan de symétrie; pas de tubercle médian…..Les cloisons.. sont simples…..La première selle est large et vaguement bifide. Le première lobe est arrondie à son extrémité. La deuxième selle, également arrondie, remont fortment. Une deuxième lobe, tout petit, se trouve déjà sur la paroi de l’ombilic.” The second specimen referred to *Acanthoceras blayaci* by Pervinquière (1910, pl. 13 (4), figs 26, 27), MNHN. F. J04342, is illustrated here as Pl. 23, Figs 12, 13, and is regarded as a finely ribbed variant of *Coquandiceras villei*, as discussed below.

Coquandiceras jubae differs from *Coquandiceras villei* (Coquand, 1862) (p. 171, pl. 1, figs 23, 24), described below in that the latter has both inner and outer ventrolateral tubercles.

OCCURRENCE: Lower Cenomanian where well-dated; north-eastern Algeria and Central Tunisia.

Coquandiceras villei (Coquand, 1862)
(Pl. 21, Figs 6, 7; Pl. 23, Figs 1–13)

1862. *Ammonites Villei* Coquand, p. 171, pl. 1, figs 23, 24.
non 1907. *Acanthoceras Villei* Coquand; Pervinquière, p. 300, pl. 16, figs 14, 15 (= *Eucalycoceras pentagonum* (Jukes-Browne, 1896)).
1910. *Acanthoceras Villei* Coquand; Pervinquière, 42, pl. 13 (4), figs 20–25.
1910. *Acanthoceras Blayaci* Pervinquière, p. 43 (*pars*), pl. 13 (4), figs 26, 27 only.

TYPES: There are two specimens in the Coquand Collection, GMH K-8454a (Pl. 21, Figs 6, 7) is the larger, and some 13.9 mm in diameter (refigured by Pervinquière 1910, pl. 4 (13), fig. 21) and GMH K-8454b, 5.6 mm in diameter (refigured by Pervinquière 1910, pl. 4 (13), fig. 21), both from Berrouaghia in northern Algeria. Pervinquière (1910, p. 12) regarded them as 'cotypes' of the species, and identified the larger, GMH K-8454a (Pl. 21, Figs 6, 7), as 'parait être le type figure par Coquand, pl. 1, fig. 23, 24'. It is here designated lectotype of the species.

MATERIAL: MNHN. F. J13751, the original of *Acanthoceras Blayaci* Pervinquière (1910, pl. 13 (4), figs 24, 25), from the Cenomanian of Sour El-Ghozlane (Aumale), northern Algeria. OUMNH KX.16029 and 16087 (collective of 24 specimens), from the uppermost Lower or lower Middle Cenomanian, roadside section on the D20 to the west of Djebel Sottara, northern Algeria.

DIMENSIONS:

	D	Wb	Wh	Wb:Wh	U
MNHN. F. J13787	12.6 (100)	4.3 (34.1)	4.7 (37.3)	0.91	4.9 (38.9)
GMH K-8454a	13.9 (100)	4.3 (30.9)	4.0 (28.8)	1.08	6.3 (45.3)

DESCRIPTION: The lectotype (Pl. 21, Figs 6, 7) is 13.9 mm in diameter. Coiling is evolute, the umbilicus broad and shallow, comprising 45.3% of the diameter. The costal whorl section is slightly depressed, octagonal. The umbilical shoulder is narrowly rounded, the flanks flattened and subparallel, the venter rounded intercostally, with convergent flattened shoulders in costal section, the venter concave between the ventral clavi. There are nine prominent rounded umbilical tubercles on the adapertural half whorl of the lectotype, and 14 on the outer whorl of the paralectotype GMH K-8454b. The tubercles give rise to one or two low, broad ribs. These are near effaced at mid-flank in some cases, and link to conical inner ventrolateral tubercles, 22–24 per whorl, and borne on a strong concave rib. A strong rib links to a well-developed outer ventrolateral clavus. The clavi are closely spaced on the narrow venter, and separated by a ventral depression, across which they are linked by a low, broad rib.

The original of *Acanthoceras Villei* of Pervinquière (1910, pl. 13 (4), figs 24, 25), is MNHN. F. J13751 (Pl. 23, Figs 6–8), a limonitic individual 12.6 mm in diameter. Coiling is very evolute, the umbilicus wide and shallow, comprising 38.9% of the diameter, the umbilical wall low, flattened, and notched to accommodate the inner ventrolateral tubercles of the preceding whorl, the notches separated by the strong umbilical bullae of the succeeding whorl. The whorl section is compressed rectangular in intercostal section, and slightly compressed polygonal in costal section with a whorl breadth to height ratio of 0.91, the greatest breadth at the inner ventrolateral tubercles. Fifteen strong bullae perch on the umbilical shoulder, and give rise to a single broad, straight rib or a pair of ribs, with additional ribs intercalating below mid-flank to give a total of 24–25 ribs at the ventrolateral shoulder of the outer whorl. The ribs are very weak to effaced at mid-flank, strengthen markedly on the outer flank, and link to a strong inner ventrolateral bulla, linked in turn by a strong rib to a stronger outer ventrolateral clavus, the ribs linked across the venter by a strong transverse rib, the costal profile concave between the clavi. The specimen appears to retain some body chamber, but the position of the final suture cannot be established.

The original of *Acanthoceras Blayaci* Pervinquière 1910, pl. 13 (4), figs 26, 27 (Pl. 23, Figs 12, 13), has over 20 umbilical bullae per whorl, and 40 at the ventrolateral shoulder, which differentiate it from the specimens described above, but it shares with these specimens the weakening and effacement of ribbing on the inner flank, and the presence of both inner and outer ventrolateral tubercles, the latter close spaced on the venter, across which they are linked by a low rib, the inner ventrolateral effacing on the body chamber. Pervinquière (1910, p. 44) recognised the similarities of this specimen to *villei*. The new material (OUMNH KX.16029, 16087) is poorly preserved, and over-limonitised. It includes fragments that have the same coarse ribbing as Pervinquière's *villei* (pl. 13 (4), figs 24, 25: Pl. 23, Figs 2–4 herein), and others that ap-

proach his second specimen of *blayaci* (1910, pl. 13 (4), figs 26, 27: Pl. 23, Figs 9–11 herein). The relationship between these fine and coarse-ribbed individual remains unresolved – two species, or intraspecific variants? The latter view is adopted here.

Acanthoceras Villei of Pervinquière 1907 (pl. 16, figs 14, 15: Pl. 29, Figs 9–11 herein) was renamed *Acanthoceras* (*Mantelliceras*) *pervinquierei* by Collignon (1931, p. 82 (42)); it is a juvenile *Eucalycoceras*, and is discussed below.

OCCURRENCE: Lower Cenomanian, northern Algeria and Central Tunisia.

Subfamily Acanthoceratinae de Grossouvre, 1894
Genus *Acanthoceras* Neumayr, 1875

TYPE SPECIES: *Ammonites rhotomagensis* Brongniart, 1822, pp. 83, 391, pl. 6, fig. 2, by the subsequent designation of de Grossouvre (1894, p. 27).

Acanthoceras rhotomagense (Brongniart, 1822)
(Pl. 25, Figs 1–3; Pl. 26, Figs 12–14)

1822. *Ammonites rhotomagensis* Defr.; Brongniart, p. 83, 391, pl. 6, fig. 2.
1987. *Acanthoceras rhotomagense* (Brongniart, 1822); Wright and Kennedy, p. 156, pl. 42, fig. 8; pl. 44, figs 1–11; pl. 45, figs 1–5; pl. 46, figs 1–4, 6; pl. 47, figs 1, 2; pl. 48, figs 1, 2; pl. 49, figs 1, 5, 6; text-figs 47–54, 63f–j, 64a, b, 65a–d, k, 66d, f, g, j, 67a–g, 68; 69 (with full synonymy).
2011. *Acanthoceras rhotomagense* (Brongniart, 1822); Mosavina and Wilmsen, p. 184, text-fig. 5a–c (with additional synonymy).
2015. *Acanthoceras rhotomagense* (Brongniart, 1822) Kennedy in Kennedy and Gale, p. 283, pl. 14, figs 5, 6; pl. 16, figs 8, 9 (with additional synonymy).
2015. *Acanthoceras rhotomagense* (Brongniart, 1822) Kennedy in Morel, p. 140, text-fig. 133a–f.
2018. *Acanthoceras rhotomagense* (Brongniart, 1822); Gale *et al*., p. 114, text-fig. 2.
2019. *Acanthoceras rhotomagense* (Brongniart, 1822); Kennedy in Gale *et al*., p. 232, pl. 28, figs 5–7, 9–10.

TYPE: The lectotype by the subsequent designation of H. Douvillé (1912) is the original of Brongniart (1822, pl. 6, fig. 2), formerly an unregistered specimen in the Sorbonne Collections, and now MNHN. F. J04190, from Rouen, Seine-Maritime. It was refigured by, amongst others, Wright and Kennedy (1987, text-fig. 63f–h).

MATERIAL: MNHN. F. J13794, the original of Pervinquière (1910, pl. 13 (4), fig. 36), from Sour El-Ghozlane (Aumale), northern Algeria. OUMNH KX.16079–16083, from the lower Middle Cenomanian west of Djebel Sottara, northern Algeria.

DIMENSIONS:

	D	Wb	Wh	Wb:Wh	U
MNHN. F. J13749*	20.4 (100)	– (–)	9.9 (48.5)	–	4.1 (20.0)
OUMNH KX.16079*	24.4 (100)	16.1 (66.0)	(49.6)	1.3	6.0 (24.6)

*costal dimensions

DESCRIPTION: MNHN. F. J13749 (Pl. 25, Figs 1–3) is a distorted phragmocone with a maximum preserved diameter of 21 mm approximately. Coiling is moderately involute, the umbilicus deep, with a high, flattened wall and broadly rounded umbilical shoulder. The whorl section is depressed trapezoidal in intercostal section and depressed polygonal in costal section, the greatest breadth at the inner ventrolateral tubercles. On the outer whorl ten primary ribs arise on the umbilical wall, and strengthen across the umbilical shoulder into well-developed bullae. The bullae give rise to single straight, feebly prorsiradiate primary ribs, separated by one or two long or short intercalated ribs. The longer ribs weaken at mid-flank, before strengthening, and all ribs bear strong conical/bullate inner ventrolateral tubercles, linked by a strong feebly prorsiradiate rib to a strong outer ventrolateral clavus, the clavi linked across the venter by a strong transverse rib that bears a strong siphonal tubercle.

The best-preserved specimen is OUMNH KX.16079, 24.4 mm in diameter (Pl. 26, Figs 12–14). Coiling is moderately involute, the deep umbilicus comprising 24.6% of the diameter, the umbilical wall feebly convex, the umbilical shoulder broadly rounded. The intercostal whorl section is compressed, with feebly convex flanks, broadly rounded ventrolateral shoulders, and a feebly convex venter. The costal whorl section is polygonal, with a whorl breadth to height ratio of 1.3, the greatest breadth at the umbilical bullae. Primary ribs arise at the umbilical seam and strengthen into small bullae, 12 on the outer whorl, perched on the umbilical shoulder. The bullae give rise to single coarse straight prorsiradiate ribs, and single ribs intercalate, arising below mid-flank and strengthening to match the primaries at the ventrolateral shoulder to give a total 20 on the outer whorl. All ribs bear a strong conical to feebly bullate inner ventrolateral tubercle, from which a strong

transverse rib links to a strong feebly clavate outer ventrolateral tubercle, the outer ventrolaterals linked across the venter by a feeble transverse rib bearing a well-developed siphonal clavus. Preservation at the adapertural end of the outer whorl is defective, but it appears that the last two ribs are both primaries.

DISCUSSION: See Wright and Kennedy (1984, p. 187). MNHN. F. J13749 (Pl. 25, Figs 1–3) has the same style of ornament as the original of their pl. 46, fig. 4.

OCCURRENCE: Lower Middle Cenomanian. The species occurs in Western Europe from Northern Ireland through England, France from the Boulonnais to Provence, Switzerland, Germany, Bornholm in the Baltic, northern Spain, Romania, Dagestan, Turkmenistan and northern Iran, northern Algeria, Central Tunisia, Tamil Nadu in south India, New Guinea, Japan, and possibly Peru and Bathurst Island, northern Australia.

Acanthoceras amphibolum (Morrow, 1935) *sensu lato*
(Pl. 27)

1935. *Acanthoceras amphibolum* Morrow, p. 470, pl. 49, figs 1–4, 6; pl. 51, figs 3, 4; text-fig. 4.
1987. *Cunningtoniceras amphibolum* (Morrow); Cobban, p. 9, pls 4–8; text-figs 48–63.
1987. *Cunningtoniceras amphibolum amphibolum* (Morrow); Cobban, p. 11, pl. 4; pl. 5, figs 1–25 (with synonymy).
1987. *Cunningtoniceras amphibolum fallense* Cobban, p. 13, pl. 5, figs 26, 27; pls 6–8; pl. 9, figs 48–63 (with synonymy).
1988. *Acanthoceras amphibolum* Morrow, 1935, Kennedy *et al.*, p. 38, text-figs 1w–z, cc–ff, 2a, b (with synonymy).
1990. *Acanthoceras amphibolum* Morrow, 1935; Kennedy and Cobban, p. 98, pl. 3, figs 1–5; pl. 4, figs 1–17; text-figs 5b, 6b, e, 11–14.
1994. *Acanthoceras amphibolum* Morrow, 1935; Amédro in Robaszynski *et al*., p. 426, pl. 14, figs 1, 2.

TYPES: The lectotype, designated by Cobban (1987, explanation of pl. 4), is the original of Morrow 1935, pl. 49, figs 3a, b (refigured by Cobban 1987, pl. 4, figs 4–6); it and three paralectotypes are from the Middle Cenomanian *amphibolum* Zone Graneros Shale near Wilson, Kansas.

MATERIAL: OUMNH KX.16048, from the echinoid-rich bed, Middle Cenomanian *asiaticum* fauna in roadside sections on the D20 to the west of Djebel Sottara, 8.5 km due west of Sour El-Ghozlane (Aumale).

DESCRIPTION: The specimen is a composite mould of a 120º sector of an adult body chamber; the estimated original diameter 170–180 mm. Coiling is evolute, the intercostal whorl section compressed oval, with feebly convex flanks, broadly rounded ventrolateral shoulders and a feebly convex venter. The costal whorl section is rounded-polygonal, with the greatest breadth at the lateral tubercle. There are five coarse, widely separated prorsiradiate ribs on the fragment. They are strong on the umbilical shoulder, and link to strong umbilicolateral bullae, then weaken, and link to a massive ventrolateral tubercle. The damaged venter appears to have been smooth between.

DISCUSSION: The specimen is assigned to *Acanthoceras amphibolum* on the basis of coiling, whorl section and ornament. Cobban (1987) recognized two subspecies of *amphibolum*, the nominate one with more siphonal than outer ventrolateral tubercles on the nucleus, and his *fallense* where they are not developed. Body chambers of the two subspecies are identical, hence the assignation of the present specimen to *amphibolum sensu lato*.

OCCURRENCE: Middle Cenomanian of Kansas, Colorado, Wyoming, South Dakota, Montana, New Mexico, Trans-Pecos and Central Texas in the United States, northern Algeria, Central Tunisia, and Nigeria.

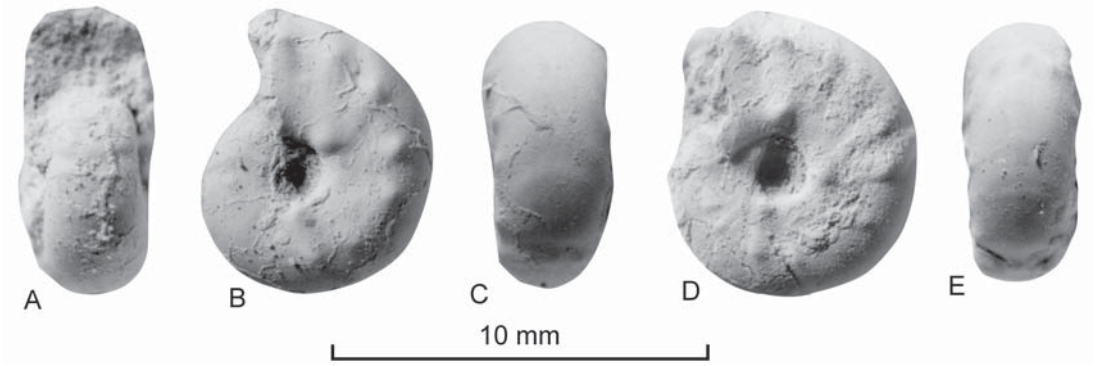
Genus *Protacanthoceras* Spath, 1923

TYPE SPECIES: *Ammonites bunburianus* Sharpe, 1853, p. 25, pl. 9, fig. 3, by the original designation of Spath (1923, p. 144).

Protacanthoceras sottaraense sp. nov.
(Text-figs 10F, 22A–E)

DIAGNOSIS: A small species of *Protacanthoceras* with widely separated shallow constrictions that succeed primary ribs with umbilical, inner and outer ventrolateral and siphonal tubercles, and are succeeded by ribs with inner ventrolateral tubercles only, the venter smooth between.

TYPES: The holotype is OUMNH KX.16057, the paratype OUMNH KX.16058, from the lower Middle



Text-fig. 22. *Protacanthoceras sottaraense* sp, nov. A-C – the holotype, OUMNH KX.16057; D, E – paratype OUMNH KX.16058, from the Middle Cenomanian *asiaticum* fauna west of Djebel Sottara, northern Algeria. Figures are × 5

Cenomanian *asiaticum* fauna in roadside sections on the D20 to the west of Djebel Sottara, 8.5 km due west of Sour El-Ghozlane (Aumale).

DESCRIPTION: The holotype (Text-fig. 22A–C) is a phragmocone 7.4 mm in diameter. Coiling is very involute, the tiny, deep umbilicus comprising 17% of the diameter. The umbilical wall is flattened, the umbilical shoulder quite narrowly rounded. The intercostal whorl section is as wide as high, with flattened parallel flanks, the ventrolateral shoulders broadly rounded, the venter feebly convex. There are barely detectable broad prorsiradiate primary ribs on the adapical half of the outer whorl, and indications of inner and outer ventrolateral tubercles and siphonal tubercles, succeeded by a broad constriction at the beginning of the outer whorl. On the adapertural half of the outer whorl, two strong, conical bullae perch on the umbilical shoulder, with indications of a third at the adapertural end. The adapical bulla gives rise to a single blunt prorsiradiate rib, the succeeding bulla to a pair of ribs, while additional ribs intercalate on the outer flank to give a total of seven at the ventrolateral shoulder, all ribs linking to a conical inner ventrolateral tubercle, from which a rapidly effacing rib projects forwards. That associated with the first prominent rib, at the beginning of the outer whorl, links to a tiny outer ventrolateral tubercle, and a tiny siphonal clavus, and is succeeded by a shallow, broad constriction on ventrolateral shoulders and venter. Beyond this, the venter is smooth between the inner ventrolateral tubercles. The suture of this specimen (Text-fig. 10F) has a broad, bifid E/A with only minor incisions, a narrower A, and an A/U2 with only minor indentations. Paratype OUMNH KX.16058 (Text-fig. 2D, E) has a maximum preserved diameter of 7 mm. It is wholly septate, the last few sutures crowded, suggesting it to be the phragmocone of an adult. It shows the same ontogenetic changes as the holotype, with three constrictions, 90° apart, the third at the greatest preserved diameter. The constrictions succeed a group of inner and outer ventrolateral and siphonal tubercles, and are succeeded by an inner ventrolateral tubercle.

DISCUSSION: The present species is referred to *Protacanthoceras* on the basis of the small adult size combined with the presence of umbilical, inner and outer ventrolateral and siphonal tubercles. Constrictions, as developed in the present species, are also developed by a number of *Protacanthoceras* species, as on the inner whorls of *Protacanthoceras arkelli* Wright and Kennedy, 1980 (p. 82, figs 24–27, 35a–h; Wright and Kennedy 1987, p. 209, pl. 55, figs 1–3, 5; text-figs 82e, g; 83i–p). The present species closely resembles *Protacanthoceras proteus vascoceratoides* Wright and Kennedy 1987, p. 217, pl. 55, fig. 4, but this species does not develop constrictions.

OCCURRENCE: As for types.

Genus and subgenus *Calycoceras* Hyatt, 1900
(ICZN Generic Name No. 1352)

TYPE SPECIES: By designation under the Plenary Powers (ICZN Opinion No. 557) *Ammonites navicularis* Mantell, 1822, p. 198, pl. 22, fig. 5 (ICZN Specific Name No. 1633).

Calycoceras (*Calycoceras*) cf. *naviculare* (Mantell, 1822)
(Pl. 25, Figs 15, 16)

Compare:
1822. *Ammonites navicularis* Mantell, p. 198, pl. 22, fig. 5 (in error in explanation of plate: *Ammonites catinus*).
1981. *Calycoceras* (*Calycoceras*) *naviculare* (Mantell, 1822); Wright and Kennedy, p. 34, pl. 4; pl. 5, figs 1–3; text-figs 13, 14c–e (with full synonymy to 1981).
1990. *Calycoceras (Calycoceras) naviculare* (Mantell, 1822); Wright and Kennedy, p. 236, pl. 61, fig. 1; pl. 62, figs 1–6; pl. 63, figs 1–3; text-figs 88e, i, 89d, 110c (with additional synonymy).
2015. *Calycoceras* (*Calycoceras*) *naviculare* (Mantell, 1822); Kennedy in Kennedy and Gale, p. 292, pl. 22, fig. 6 (with additional synonymy).
2018. *Calycoceras* (*Calycoceras*) *naviculare* (Mantell, 1822); Kostak *et al*., p.156, text-fig. 5a–k.
2019. *Calycoceras* (*Calycoceras*) *naviculare* (Mantell, 1822); Kennedy in Gale *et al*., p. 237, pl. 30, figs 9–13; text-figs 21, 22.

TYPE**:** The holotype, by monotypy, is BMNH 5681, the original of Mantell (1822, pl. 22, fig. 5), from 'Offham', Sussex, England, and inferred to be from the middle Upper Cenomanian Plenus Marl (see Wright and Kennedy 1981, pl. 4).

MATERIAL: OUMNH KX.16782d, from the Upper Cenomanian *pentagonum* fauna north of Djebel Hameima, Central Tunisia.

DESCRIPTION: The specimen is a crushed phragmocone with a maximum preserved diameter of 17.4 mm. Coiling is involute, the deep umbilicus comprising an estimated 20–25% of the diameter, with a convex wall and broadly rounded umbilical shoulder. Twelve ribs arise at the umbilical seam of the outer whorl and link to strong bullae, perched on the umbilical shoulder. These give rise to strong recti- to feebly rursiradiate ribs, and additional long ribs intercalate, to give a total of an estimated 20–22 ribs at the ventrolateral shoulder. The primary ribs bear a strong conical /feebly bullate inner ventrolateral tubercle, from which a strong rib passes straight across the venter and bears a well-developed conical to feebly transversely elongate outer ventrolateral tubercle and a feebly clavate siphonal tubercle. The intercalated ribs, in contrast, lack an inner ventrolateral tubercle, but bear outer ventrolateral and siphonal tubercles that match those on the primary ribs. Only fragments of the sutures are visible, and are moderately incised, with a broad asymmetrically bifid E/A.

DISCUSSION: See Wright and Kennedy (1990, p. 237). The specimen is compared to *naviculare* on the basis of similarities to larger nuclei from Devon (*loc. cit*, pl. 62, figs 1, 4–6).

OCCURRENCE: Lower to middle Upper Cenomanian, southern England, Sarthe, Loire-Atlantique, Eure-et-Loir, Touraine and Provence in France, Germany, Spain, Portugal, Romania, Algeria, Central Tunisia, the Middle East, Angola, Madagascar, Tamil Nadu in South India, Japan, the United States Gulf Coast, Western Interior, and western seaboard.

Calycoceras (*Calycoceras*) cf. *bathyomphalum* (Kossmat, 1895)
(Pl. 25, Figs 9–12; Pl. 26, Figs 15–17)

Compare:
1895. *Acanthoceras bathyomphalum* Kossmat, p. 197 (101), pl. 25 (11), fig. 4.
1990. *Calycoceras* (*Calycoceras*) *bathyomphalum* (Kossmat, 1895); Wright and Kennedy, p. 229, pl. 58, fig. 4; pl. 60, figs 2, 4; text-figs 88g, 94a–c, 95a–h (with full synonymy).
2019. *Calycoceras* (*Calycoceras*) *bathyomphalum* (Kossmat, 1895); Kennedy in Gale *et al*., p. 236, pl. 30, figs 1–6.

TYPE: The lectotype, by the subsequent designation of Wright and Kennedy (1990, p. 229), is GSI 14834, the original of Kossmat 1895, p. 197 (101), pl. 25 (11), fig. 4, from Uttatur, Tamil Nadu. A cast was figured by Kennedy in Gale *et al*. (2019, pl. 30, figs 1–3).

MATERIAL: OUMNH KX.16817, 16851–16852, from the lower Upper Cenomanian *pentagonum* fauna north of Djebel Hameima, Central Tunisia.

DESCRIPTION: OUMNH KX.16851 (Pl. 25, Figs 9, 10) is a 120° whorl sector with a maximum preserved whorl height of 6.8 mm, the whorl section depressed reniform in intercostal section, and depressed polygonal in costal section, with a costal whorl breadth to height ratio of 1.7, the greatest breadth at the inner ventrolateral spines. Three strong conical umbilical bullae perch on the umbilical shoulder, and give rise to single strong, straight, prorsirsdiate ribs; there is a single intercalated rib. All ribs bear a well-developed subspinose, feebly bullate inner ventrolateral tubercle; that at the adapertural end of the fragment

is much larger than those that precede it. The ribs pass straight across the venter, and all bear a small outer ventrolateral and siphonal clavus. OUMNH KX.16817 (Pl. 25, Figs 11, 12) is a slightly larger 120° fragment, with four strong umbilical bullae, seven ribs at the ventrolateral shoulder, three of which develop a large inner ventrolateral spine, the other ribs lacking an inner ventrolateral tubercle. OUMNH KX.16852 (Pl. 26, Figs 15–17), a nucleus 10.2 mm in diameter, may represent an earlier ontogenetic stage.

DISCUSSION: See Wright and Kennedy (1990, p. 229). The present specimens show the same distinctive development of subspinose inner ventrolateral tubercles as the lectotype.

OCCURRENCE: Upper Middle and lower Upper Cenomanian, southern England, France, Central Tunisia, Romania, Madagascar, and Tamil Nadu in south India

Calycoceras (*Calycoceras*) *barruei* (Pervinquière, 1907)
(Pl. 30, Figs 18–20)

1907. *Acanthoceras Barruei* Pervinquière, p. 284, pl. 15, fig. 7.
1990. *Calycoceras* (*Calycoceras*) *barruei* (Pervinquière, 1907); Wright and Kennedy, p. 230, pl. 58, fig. 3; pl. 63, fig. 4 (with synonymy).
2019. *Calycoceras* (*Calycoceras*) cf. *barruei* (Pervinquière, 1907); Kennedy in Gale *et al.*, p. 240, pl. 16, figs 20–25, 29, 30.

TYPE: The holotype, by monotypy, is MNHN. F. J13703, the original of Pervinquière (1907, p. 285, pl. 15, fig. 7), from Koudiat el Hamra, west of El Kef, Central Tunisia.

MATERIAL: OUMNH KX.16782e, from the lower Upper Cenomanian *pentagonum* fauna north of Djebel Hameima, Central Tunisia.

DESCRIPTION: The holotype (Pl. 30, Figs 18–20) is a very crushed phragmocone with a maximum preserved diameter to the ellipse it is deformed into of 26.3 mm. Coiling is very evolute, the deep umbilicus comprising an estimated 30% of the diameter. The whorl section is compressed reniform, with the greatest breadth at the inner ventrolateral tubercles. On the adapical half of the outer whorl the ribs are near-straight and transverse with small, rounded umbilical bullae from which single coarse ribs arise and link to conical inner ventrolateral tubercles, from which a strong rib passes straight across the venter, bearing small outer ventrolateral and siphonal tubercles. On the adapertural half of the outer whorl, strong umbilical bullae give rise to single coarse primary ribs that bear stronger bullate inner ventrolateral tubercles, linked across the venter by a coarse feebly convex rib with outer ventrolateral and siphonal tubercles barely detectable. Single ribs intercalate between successive primaries and either lack tubercles, or have a near-obsolete siphonal row.

OUMNH KX.16782e is also crushed, with well-preserved ventral ornament that compares well with that of the holotype, and dates it precisely.

DISCUSSION: See Wright and Kennedy (1986, p. 236).

OCCURRENCE: Lower Upper Cenomanian of southern England, Central Tunisia and, possibly, Tamil Nadu in South India.

Subgenus *Calycoceras* (*Newboldiceras*) Thomel, 1972

TYPE SPECIES: *Acanthoceras Newboldi* Kossmat, 1897, p. 5 (112), pl. 1 (12), figs 2, 3; pl. 3 (14), fig. 2, by original designation by Thomel 1972, p. 105 = *Acanthoceras rhotomagense* var. *asiatica* Jimbo, 1894, p. 177, pl. 20, fig. 1 (*fide* Wright and Kennedy, 1990, p. 239).

Calycoceras (*Newboldiceras*) *asiaticum asiaticum* (Jimbo, 1894)
(Pl. 26, Figs 4–11, 18–21)

1894. *Acanthoceras rhotomagense* var. *asiatica* Jimbo, p. 177, pl. 20, fig. 1.
1990. *Calycoceras* (*Newboldiceras*) *asiaticum asiaticum* (Jimbo, 1894); Wright and Kennedy, p. 239, pl. 58, fig. 1; pl. 64, figs 1, 2; pl. 65, figs 1–3, 5, 7; pl. 72, fig. 3; text-figs 87d–f, 88f, 97, 98 (with full synonymy).
2010. *Calycoceras* (*Newboldiceras*) *asiaticum asiaticum* (Jimbo, 1894); Kennedy and Klinger, p. 10, text-figs 32, 33a–f, 34j–l, p, q, 36–38, 44d, e, h, 57a–f (with additional synonymy).
2017. *Calycoceras* (*Newboldiceras*) *asiaticum asiaticum* (Jimbo, 1894); Kennedy in Kennedy and Gale, p. 96, pl. 11, figs 5, 6.
2019. *Calycoceras* (*Newboldiceras*) *asiaticum asiaticum* (Jimbo, 1894); Kennedy in Gale *et al*., p. 245, pl. 16, fig. 28; pl. 31; pl. 33, figs 1, 2, 11, 12; text-figs 27–30.

TYPE: The holotype by monotypy is the original of Jimbo (1894, pl. 20, fig. 1), no. 1–105 in the Collections of the Geological Institute, Tokyo University, from the Middle Cenomanian *Trigonia* Sandstone of the Ikushumbets, Hokkaido, Japan. A cast was figured by Wright and Kennedy (1986, text-fig. 97).

MATERIAL: OUMNH KX.16712, 16744a, b, 16746a, b, from the Middle Cenomanian *asiaticum* fauna north of Djebel Hameima, Central Tunisia. OUMNH KX.16036, 16038–16039, from the same fauna west of Djebel Sottara, 8.5 km west of Souar El-Ghozlane (Aumale), northern Algeria.

DESCRIPTION: The material comprises well-preserved small nuclei and larger, generally distorted limonitic individuals that have whorl heights of up to 17 mm. OUMNH KX.16746a (Pl. 26, Figs 18, 19) is typical of the larger limonitic individuals. It is deformed into an ellipse with a major axis of 30 mm. Coiling is moderately involute, the umbilicus of moderate depth, the umbilical wall feebly convex, the umbilical shoulder broadly rounded. The intercostal whorl section is subrectangular with feebly convex subparallel flanks, broadly rounded ventrolateral shoulders and a broad, feebly convex venter. The costal section is polygonal, with the greatest breadth at the inner ventrolateral tubercles. An estimated 15 primary ribs per whorl arise at the umbilical seam, and strengthen across the umbilical wall, developing into small umbilical bullae. These give rise to one or two primary ribs, and there are occasional non-bullate primaries, to give a total of over 30 ribs per whorl at the ventrolateral shoulder. The ribs are feebly prorsiradiate, and straight to feebly flexuous. They link to well-developed feebly bullate inner ventrolateral tubercles, from which a strong feebly prorsiradiate rib links to a stronger feebly clavate outer ventrolateral tubercle, the outer ventrolateral tubercles linked across the venter by a low, transverse rib that bears a weaker transversely elongated tubercle.

DISCUSSION: See Wright and Kennedy (1986, p. 241) and Kennedy in Gale *et al.* (2019, p. 249).

OCCURRENCE: Upper Middle and lower Upper Cenomanian, southern England, France, Germany, northern Spain, Iran, Morocco, north-eastern Algeria, Central Tunisia, KwaZulu-Natal in South Africa, Madagascar, Tamil Nadu in south India, and James Ross Island (Antarctica).

Calycoceras (*Newboldiceras*) *planecostatum* (Kossmat, 1897)

(Pl. 25, Figs 4–8; Pl. 28, Figs 1–6; Text-fig. 10D)

1897. *Acanthoceras Newboldi* var. *planecostata* Kossmat, p. 9 (116), pl. 2 (13), fig. 1.
1990. *Calycoceras* (*Newboldiceras*) *planecostatum* (Kossmat, 1897); Wright and Kennedy, p. 252, pl. 61, figs 2, 3; pl. 67, figs 1–4; text-fig. 101c–e (with full synonymy).
2015. *Calycoceras* (*Newboldiceras*) *planecostatum* (Kossmat, 1897); Kennedy in Kennedy and Gale, p. 297, pl. 20, fig. 7 (with additional synonymy).
2019. *Calycoceras* (*Newboldiceras*) *planecostatum* (Kossmat, 1897); Kennedy in Gale *et al*., p. 253, pl. 32, figs 4–5; pl. 33, figs 3–10; pl. 34; pl. 35 (with additional synonymy).

TYPE: The lectotype, by the subsequent designation of Wright and Kennedy (1990, p. 252), is GSI 14842, the original of Kossmat (1897, p. 9 (116), pl. 2 (13), fig. 1), from the Uttatur Group of Odiyam, South India. A cast was figured by Wright and Kennedy (1986, text-fig. 101c–e) and Gale *et al*. (2019, pl. 32, figs 4, 5).

MATERIAL: OUMNH KX.16046–16047, 16035, 16036, 16038, from the Middle Cenomanian *asiaticum* fauna west of Djebel Sottara, 8.5 km west of Sour El-Ghozlane (Aumale), northern Tunisia.

DIMENSIONS:

	D	Wb	Wh	Wb:Wh	U
OUMNH KX. 16047	21.9 (100)	10.8 (49.3)	10.4 (47.9)	1.04	5.2 (23.7)

DESCRIPTION: OUMNH KX.16047 (Pl. 25, Figs 6–8) is 21.9 mm in diameter; OUMNH KX.16046 (Pl. 25, Figs 4, 5) is a fragment of a slightly larger nucleus. Coiling is moderately evolute, the umbilicus comprising 23.7% of the diameter, the umbilical wall feebly convex, the umbilical shoulder broadly rounded. The intercostal whorl section is as wide as high, with feebly convex subparallel flanks, broadly rounded ventrolateral shoulders and a feebly convex venter. The costal whorl section is polygonal, as wide as high, with the greatest breadth at the inner ventrolateral tubercle. Primary ribs arise at the umbilical seam, strengthen across the umbilical wall and develop into small bullae, 12 per whorl, perched on the umbilical shoulder. The bullae give rise to strong, straight, feebly prorsiradiate ribs, mostly singly, while there is a single non-bullate primary. The ribs strengthen across the flanks, and additional

ribs intercalate, both low and high on the flanks, to give a total of 24 ribs at the ventrolateral shoulder. All ribs bear a feeble inner ventrolateral bulla, from which a feebly prorsiradiate rib links to a stronger conical inner ventrolateral tubercle. The outer ventrolateral tubercles are linked across the venter by a well-developed transverse rib that bears a feebly transversely elongated siphonal tubercle. The suture is moderately incised, with a broad bifid E/A with a deep median incision, a symmetrically to asymmetricaly bifid A and small, symmetrically bifid A/U2.

Much larger individuals are preserved as limestone composite moulds (Pl. 28, Figs 1–6). The best-preserved of these, OUMNH KX.16308 (Pl. 28, Figs 3, 4) is 80 mm in diameter. Eleven primary ribs per half whorl arise at the umbilical seam, sweep back and strengthen across the umbilical wall and develop into small, sharp bullae, perched on the umbilical shoulder. They give rise to single straight prorsiradiate primary ribs that strengthen across the flanks and link to small conical inner ventrolateral tubercles from which a strong rib links to slightly larger outer ventrolateral clavi. The clavi are linked across the venter by a broad transverse rib. The ribs bear a siphonal tubercle at the adapical end of the outer whorl fragment, thereafter lost. The intercalated ribs arise low on the flanks and strengthen to match the primaries, giving a total of 23–24 ribs per half whorl at the ventrolateral shoulder. The suture is moderately incised, with a broad bifid E/A and smaller U. OUMNH KX.16036 (Pl. 28, Figs 5, 6) is a 90º sector of body chamber with a maximum preserved whorl height of 40 mm. Six primary ribs arise at the umbilical seam, sweep back across the umbilical wall and develop into strong umbilical bullae. These give rise to single straight prorsiradiate ribs, with, in some cases a second rib feebly attached. Additional ribs intercalate to give a total of 12 ribs at the ventrolateral shoulder, where they all link to feeble ventrolateral tubercles, linked across the venter by a coarse, transverse rib. The mid-venter region is damaged. OUMNH KX.16035 (Pl. 28, Figs 1, 2) is a 120º whorl sector with a maximum preserved whorl height of 42 mm, with comparable ornament. It is interpreted as the partial body chamber of a microconch.

DISCUSSION: See Wright and Kennedy (1986, p. 253) and Kennedy in Gale *et al*. (2019, p. 254, pl. 32, figs 4–5; pl. 33, figs 3–10; pl. 34; pl. 35). The latter illustrate comparable individuals from Tamil Nadu (see for example their pl. 33, figs 3–10).

OCCURRENCE: Upper Middle and lower Upper Cenomanian, southern England, France, Germany, northern Spain, Iran, Morocco, Central Tunisia, KwaZulu-Natal in South Africa, Tamil Nadu in South India, and James Ross Island, Antarctica.

Calycoceras (*Newboldiceras*) *hippocastanum*
(J. de C. Sowerby, 1826)
(Pl. 26, Figs 1–3, 7–9)

1826. *Ammonites hippocastanus* J. de C.Sowerby, p. 23 (*pars*), pl. 514, fig. 2.
1990. *Calycoceras* (*Newboldiceras*) *hippocastanum* (J. de C. Sowerby, 1826); Wright and Kennedy, p. 253, pl. 71, figs 1–7; pl. 72, figs 1, 2; pl. 73, fig. 3; text-figs 107e, i, l, 108a–d (with full synonymy).

TYPE: The lectotype, designated by Kennedy and Hancock (1970, p. 474), is BGS GSM 37667, the original of J. de C. Sowerby, p. 23 (*pars*), pl. 514, fig. 2, from the Pinnacles Member (Bed C) of the Beer Head Limestone Formation, probably near Humble Point, Devon. It was re-figured by Wright and Kennedy (1986, pl. 71, fig. 7).

MATERIAL: OUMNH KX.9789, 16853, from the Upper Cenomanian *pentagonum* fauna north of Djebel Hameima, Central Tunisia.

DESCRIPTION: The specimens are nuclei 18.4 and 18.9 mm in diameter. Coiling is moderately evolute, the deep umbilicus comprising 24% of the diameter. The umbilical wall is feebly convex, the umbilical shoulder broadly rounded. The intercostal whorl section is depressed rounded-trapezoidal, with feebly convex feebly convergent flanks, broadly rounded ventrolateral shoulders and a very feebly convex venter; the costal whorl section is depressed polygonal, with a whorl breadth to height ratio of 1.3, the greatest breadth at the inner ventrolateral tubercles. Primary ribs arise at the umbilical seam, strengthen across the umbilical wall and shoulder, developing into bullae of variable strength. These give rise to strong, broad, prorsiradiate primary ribs, 14–15 on the outer whorl, that link to strong subspinose conical inner ventrolateral tubercles, from which a single rib or a pair of ribs link to weaker conical/feebly clavate outer ventrolateral tubercles, linked by a blunt transverse rib to feebly clavate siphonal tubercles, to give a total of 24–25 ventral ribs. There are thus almost twice as many outer ventrolateral and siphonal tubercles as inner ventrolateral on the outer whorl of these specimens. The suture is moderately incised, with a broad, asymmetrically bifid E/A and small, bifid A and A/U2.

DISCUSSION: See Wright and Kennedy (1986, p. 262). OUMNH KX.16853 (Pl. 26, Figs 1–3) has the same style of ornament as larger topotypes (*loc. cit*., pl. 71, figs 1, 2).

OCCURRENCE: Lower Upper Cenomanian, *guerangeri* Zone and correlatives in southern England, Sarthe and Alpes-Maritimes in France, Central Tunisia, and possibly Japan.

Genus *Eucalycoceras* Spath, 1923
(ICZN Generic Name no. 1354)

TYPE SPECIES: *Ammonites pentagonus* Jukes-Browne, 1896, p. 156, pl. 5, fig. 1, by the original designation of Spath (1923, p. 144) (ICZN Specific name no. 1635).

Eucalycoceras pentagonum (Jukes-Browne, 1896)
(Pl. 25, Figs 13, 14; Pl. 29, Figs 3, 6–11, 14, 15)

1896. *Ammonites pentagonus* Jukes-Browne, p. 156, pl. 5, fig. 1.
1907. *Acanthoceras pentagonum* Jukes-Browne et Hill; Pervinquière, p. 271.
1907. *Acanthoceras Villei* Coq.; Pervinquière, p. 300 (*pars*), pl. 16, figs 14, 15.
1931. *Acanthoceras* (*Mantelliceras*) *Pervinquierei* Collignon, p. 82 (42).
1990. *Eucalycoceras pentagonum* (Jukes-Browne, 1896); Wright and Kennedy, p. 282, pl. 78, figs 1, 3; pl. 79, figs 1–5; text-figs 89e, 123a, b (with full synonymy).
2019. *Eucalycoceras pentagonum* (Jukes-Browne, 1896) Kennedy in Gale *et al*., p. 257, pl. 39, figs 1–10; pl. 40, figs 11, 12 (with additional synonymy).

TYPE: The holotype, by monotypy, is BGS GSM 53481, the original of Jukes-Browne (1896, p. 156, pl. 5, fig. 1), from the remanié phosphatic fauna of the Pinnacles Member (Bed C) of the Beer Head Formation at Humble Point, west of Lyme Regis, Devon. It was refigured by Wright and Kennedy (1990, pl. 79, fig. 5).

MATERIAL: Collignon introduced his *Acanthoceras* (*Mantelliceras*) *pervinquierei* as a *nomen novum* for "*Ammonites villei* redécrite par Pervinquière en 1910 (3)." His footnote (3) (1929, p. 82 (42)) refers to p. 300, fig. 116, pl. 16, figs 14, 15 in Pervinquière, who refers to a series of specimens under *Acanthoceras villei*, two complete individuals and 'quelques fragments', from Koudiat el Hamra and Bordj Debbich in Tunisia, and also records the species from 'Aumale' and Berrouaghiah in Algeria. The species is thus based on a series of syntypes. MNHN. F. J13787, the original of Pervinquière (1907, pl. 16, figs 14, 15), from Koudiat el Hamra is here designated lectotype; I was also able two recognise two paralectotype fragments from the same locality. OUMNH KX.9790–9792 (collective of five specimens), 16812–16816, 16854, 16896–16898, all from the lower Upper Cenomanian *pentagonum* fauna north of Djebel Hameima, Central Tunisia.

DIMENSIONS:

	D	Wb	Wh	Wb:Wh	U
MNHN. F. J13787	17.2 (100)	6.3 (36.6)	7.7 (44.8)	0.82	5.4 (31.4)
OUMNH KX.16811b	17.8 (100)	6.8 (38.2)	7.5 (42.1)	0.9	5.5 (30.9)
OUMNH KX.16811c	22.2 (100)	8.7 (39.5)	9.8 (44.1)	0.88	7.2 (32.4)

DESCRIPTION: The earliest growth stages are shown by OUMNH KX.16811a, 8.5 mm in diameter (Pl. 25, Fig. 14). The penultimate whorl and the adapical 60° sector of the outer whorl are smooth, the flanks flattened and subparallel, the ventrolateral shoulders broadly rounded, the venter feebly convex. There are twelve prorsiradiate ribs on the succeeding 300° sector, weak on the inner flanks, but strengthening on the outer, and linking to subspinose inner ventrolateral bullae. A broad rib sweeps forwards and links to outer ventrolateral clavi, initially weak, but strengthening rapidly. The venter is feebly fastigiate in costal section, with very feeble siphonal clavi, barely differentiate on the adapical few ribs. The lectotype of *Acanthoceras* (*Mantelliceras*) *pervinquierei* Collignon, 1929, MNHN. F. J13787 (Pl. 29, Figs 9–11), continues the ontogeny to a diameter of 17.2 mm. Coiling is moderately evolute, the shallow umbilicus comprises 31.4% of the diameter, the low umbilical wall very feebly convex, slightly outward-inclined, the umbilical shoulder narrowly rounded. The whorl section is compressed polygonal, with flat parallel flanks, broadly rounded ventrolateral shoulders and an obtusely fastigiate venter in intercostal section. Primary ribs arise at the umbilical seam and develop into small bullae of variable strength, perched on the umbilical shoulder. These give rise to single ribs or a pair of ribs, while additional ribs intercalate to give a total of 28–30 at the ventrolateral shoulder of the outer whorl. The ribs are straight and prorsiradiate to feebly flexed, linking to small inner ventrolateral tubercles, linked by a strong prorsiradiate rib to stronger outer ventrolateral clavi. The clavi are linked across the venter by a broad fee-

ble prorsiradiate rib, with a feeble siphonal clavus at the apex of a very obtuse ventral chevron.

The best-preserved paralectotype of *pervinquierei* comprise a half whorl with the following dimensions:

D	Wb	Wh	Wb:Wh	U
20.5 (100)	6.9 (33.7)	9.8| (47.8)	0.7	4.9 (23.9)

The second paralectotype recognised is a 90° whorl sector with a maximum preserved whorl height of 12.1 mm and a whorl breadth to height ratio of 0.55.

There are numerous other juveniles of comparable size; OUMNH KX.16811b (Pl. 25, Figs 13, 14), a half whorl 17.5 mm in diameter is interpreted as a coarsely ribbed variant, with 11 ribs at the ventrolateral shoulder. It co-occurs with individuals such as OUMNH KX.16811c, 22.2 mm in diameter, with 25–26 ribs at the ventrolateral shoulder of the outer whorl. Larger well-preserved (although often crushed) phragmocones are up to 40 mm in diameter (OUMNH KX.16812: Pl. 29, Fig. 3), and there are fragments from larger individuals with whorl heights of up to 35 mm (OUMNH KX.9819: Pl. 29, Fig. 15).

DISCUSSION: See Wright and Kennedy (1990, p. 283).

OCCURRENCE: The species first appears in the lower Upper Cenomanian *Calycoceras guerangeri* Zone, and extends into the succeeding *Metoicoceras geslinianum* Zone in Western Europe, with records from southern England, Sarthe, Provence and Peche de Foix, Ariège, France, Spain, and Portugal. There are also records from Tadjikistan, Algeria, Central Tunisia, Madagascar, Tamil Nadu in South India, Japan, and Colorado and New Mexico in the United States.

Eucalycoceras cf. *gothicum* (Kossmat, 1895)
(Pl. 29, Figs 19, 20)

Compare:

1965. *Ammonites Rotomagensis* var. *compressus* Stoliczka, p. 69, pl. 34, fig. 5 (= homonym of *Ammonites compressus* of authors; *fide* Sherborn 1925, p. 1430).
1895. *Acanthoceras gothicum* Kossmat, p. 198 (102), pl. 25 (11), fig. 3.
1990. *Eucalycoceras gothicum* (Kossmat, 1895); Wright and Kennedy, p. 279, pl. 76, figs 1, 3, 4, 6; text-fig. 94i–k (with full synonymy).
2019. *Eucalycoceras gothicum* (Kossmat, 1895); Kennedy in Gale *et al*., p. 259, pl. 16, figs 26, 27; pl. 40, figs 8–10).

TYPE: The holotype, by monotypy, is GSI 14833, the original of Kossmat (1895, p. 198 (102), pl. 25 (11), fig. 3), from the Middle Cenomanian *Acanthoceras* beds of Odiyam, South India. A cast of the holotype was figured by Wright and Kennedy (1990, text-fig. 94i–k) and Gale *et al*. (2019, pl. 40, figs 8–10).

MATERIAL: OUMNH KX.16747–16754, from the Upper Cenomanian *pentagonum* fauna north of Djebel Hameima, Central Tunisia.

DESCRIPTION: OUMNH KX.16753 is a nucleus 15.4 mm in diameter. Coiling is moderately evolute, the umbilicus comprising 32% of the diameter, shallow, with a feebly convex wall and broadly rounded umbilical shoulder. The whorl section is compressed, the flanks flattened and subparallel, the ventrolateral shoulders broadly rounded, the venter very feebly convex in intercostal section; the costal whorl breadth to height ratio is 0.8. Twelve primary ribs arise at the umbilical seam, and are well-developed on the umbilical wall, strengthening on the umbilical shoulder into bullae that project slightly into the umbilicus. These give rise to one or two low, broad, rectiradiate ribs that are weak at mid-flank before strengthening on the outer flank; additional ribs intercalate, to give a total of 20 ribs at the ventrolateral shoulder, and all ribs bear strong conical inner, and strong, feebly clavate outer ventrolateral tubercles, linked across the venter by a low, broad, barely differentiated rib bearing a feeble siphonal tubercle. OUMNH KX.16752 is a half whorl 26 mm in diameter, with eight well developed umbilical bullae preserved that project into the umbilicus. There are 12 predominantly primary ribs on the fragment; strong and straight, they bear strong conical inner, stronger, feebly clavate outer, and blunt, feebly clavate siphonal tubercles. The largest fragment seen, OUMNH KX.16747, has a whorl height of 19 mm, and although distorted by post-mortem crushing, has comparable ornament. OUMNH KX.16751 (Pl. 29, Figs 19, 20) is interpreted as a finer-ribbed variant of the species.

DISCUSSION: See Wright and Kennedy (1990, p. 280). The present species is distinguished from *Eucalycoceras pentagonum* on the basis of its coarser ribbing, bullae that project into the umbilicus, and stronger ventrolateral tuberculation.

OCCURRENCE: Upper Middle Cenomanian to lower Upper Cenomanian, southern England, south-eastern France, northern Spain, Romania, Central Tunisia, and Tamil Nadu in South India.

Eucalycoceras rowei (Spath, 1926)
(Pl. 29, Figs 1, 2, 4, 5, 12, 13, 16–18; Text-fig. 9B)

1867. *Ammonites Couloni*? d'Orb.; Guéranger, p. 5, pl. 6, fig. 1.
1926. *Mantelliceras rowei* Spath, p. 431.
1990. *Eucalycoceras rowei* (Spath, 1926b); Wright and Kennedy, p. 280, pl. 76, figs 2, 5; pl. 77, figs 2–10; pl. 78, fig. 2; text-figs 89c, 107f, j, 125a, b (with full synonymy).
1995. *Eucalycoceras rowei* (Spath, 1926); Santamaria Zabala, p. 16, pl. 1, fig. 1.
2009. *Eucalycoceras rowei* (Spath, 1926); Barroso-Barcenilla *et al*., p. 148, pl. 8, fig. 1.

TYPES: The lectotype, designated by Kennedy (1971, p. 83) is BMNH C7285 (Wright and Kennedy 1990, pl. 77, fig. 3), from the phosphatised Upper Cenomanian *guerangeri* Zone fauna of the Pinnacles Member (Bed C) of the Beer Head Limestone Formation, Humble Point, Devon, U.K. The paralectotype, the original of Guéranger (1867, pl. 5, fig. 1), from the Upper Cenomanian Marnes à Ostracées of Sarthe, France, has not been traced.

MATERIAL: OUMNH KX.16097, from 2 km south-east of Djebe el Krorza, north-eastern Algeria, 9701 (collective of 14 specimens), 9702 (collective of five specimens), 9796 (collective of six specimens), 9815 (collective of six specimens), 9816–9818, all from the Upper Cenomanian *pentagonum* fauna north of Djebel Hameima, Central Tunisia;

DIMENSIONS:

	D	Wb	Wh	Wb:Wh	U
OUMNH KX.9796a	22.4 (100)	9.3 (41.5)	9.9 (44.2)	0.94	7.2 (32.1)
OUMNH KX.9796b	24.5 (100)	9.8 (40.0)	11.2 (45.7)	0.89	7.3 (29.8)

DESCRIPTION: The present material comprises nuclei and phragmocone fragments with whorl heights of up to 18 mm. Coiling is moderately evolute, the shallow umbilicus comprising around 30% of the diameter, the umbilical wall flattened, the umbilical shoulder broadly rounded. The whorl section is slightly compressed, the flanks feebly convex and feebly convergent, the ventrolateral shoulders broadly rounded, the venter feebly convex in intercostal section. Around 16 primary ribs arise at the umbilical seam in nuclei such as OUMNH KX.9796a (Pl. 29, Figs 12, 13), and strengthen across the umbilical shoulder, where some but not all develop into small bullae of variable strength. The bullae give rise to feebly prorsiradiate ribs, additional ribs intercalate, and occasional primaries bifurcate. The ribs are straight on the inner flank, and may flex back slightly on the outer flank in some individuals, where they broaden. There is a feeble inner ventrolateral bulla in juveniles, lost beyond whorl heights of around 11 mm, from which a broadening prorsiradiate rib sweeps slightly forwards and links to a stronger outer ventrolateral clavus, the clavi linked over the venter by a broad transverse rib bearing a well-developed siphonal clavus to the greatest size seen (OUMNH KX.9796c). There are around 36 ribs at the ventrolateral shoulder in OUMNH KX.9796b (Pl. 29, Figs 16–18). OUMNH KX.16813 (Pl. 29, Figs 1, 2) is a half whorl 36.2 mm in diameter, the adapertural part uncrushed. The umbilicus, of moderate depth, comprises 28.7% of the diameter, the umbilical wall flattened, the umbilical shoulder quite broadly rounded, the flanks feebly convex and subparallel in intercostal section, the ventrolateral shoulders broadly rounded, the venter very feebly convex. The costal whorl section is slightly compressed, the whorl breath to height ratio 0.94. Primary ribs, 11 per half whorl, arise at the umbilical seam and are strong, straight, and feebly rursiradiate across the umbilical wall, strengthening into crowded bullae, perched on the umbilical shoulder. The bullae give rise to straight, narrow recti- to feebly rursiradiate ribs either singly or in pairs, with additional long intercalated ribs, to give a total of 24 ribs at the ventrolateral shoulder. There are small inner ventrolateral tubercles where the surface of the mould is well-preserved; they are lost as a result of wear over most of the specimen; in contrast, a stronger outer ventrolateral and transversely elongated siphonal tubercle are linked across the venter by a strong transverse rib.

The suture is moderately incised, with broad, bifid E/A and A.

DISCUSSION: See Wright and Kennedy (1990, p. 282).

OCCURRENCE: Lower Upper Cenomanian, southern England, northern France, northern Spain, north-eastern Algeria, Central Tunisia, Israel, Madagascar and, possibly, Romania.

Subfamily Euomphaloceratinae Cooper, 1978
Genus Euomphaloceras Spath, 1923

TYPE SPECIES: *Ammonites euomphalus* Sharpe, 1855, p. 31, pl. 13, fig. 4, by monotypy.

Euomphaloceras euomphalum (Sharpe, 1855)
(Pl. 30, Figs 1, 2, 11–17)

1855. *Ammonites euomphalus* Sharpe, p. 31, pl. 13, fig. 4.
1903. *Acanthoceras* gr. *nodosocostatum* Pervinquière, p. 74.
1907. *Acanthoceras Giltarei* Pervinquière, p. 285, pl. 15, figs 8, 9; text-fig. 108.
1990. *Euomphaloceras euomphalum* (Sharpe, 1855); Wright and Kennedy, p. 294, pl. 85, figs 1, 2, 7, 9; pl. 86, figs 1–10; text-figs 94f–h, 107h (with full synonymy).
2019. *Euomphaloceras euomphalum* (Sharpe, 1855); Kennedy in Gale *et al*., p. 262, text-fig. 34a–k.

TYPE: The holotype, by monotypy, is BMNH 50185, the original of Sharpe (1855, p. 31, pl. 13, fig. 4), said by Sharpe to be from Man O'War Cove, Dorset, but from Humble Point, Devon (Wright and Kennedy 1990, p. 294). It was refigured by Wright and Kennedy (1990, pl. 86, fig. 2).

MATERIAL: The syntypes of *Acanthoceras giltarei* Pervinquière 1907, p. 285, pl. 15, figs 8, 9; text-fig. 108, from the Cenomanian of Koudiat el Hamra west of El Kef, Central Tunisia, MNHN, *ex* Sorbonne Collections, MNHN. F. J13774 (fig. 9) and J13778 (fig. 8). OUMNH KX.9703–9704, from Koudiat el Hamra, south-west of El Kef, Central Tunisia and OUMNH KX.9782, from north of Djebel Hameima, Central Tunisia, both from the lower Upper Cenomanian *pentagonum* fauna.

DESCRIPTION: MNHN. F. J13778 (Pl. 30, Figs 11–13) is a crushed phragmocone with a maximum preserved diameter of 17.4 mm. Coiling is very evolute, the umbilicus deep, the umbilical wall flattened, the umbilical shoulder rounded, the intercostal whorl section compressed oval, the costal whorl section depressed polygonal, the costal whorl breadth to height ratio in excess of 1.33, the greatest breadth at the inner ventrolateral tubercle. Delicate primary ribs arise on the umbilical wall and strengthen into feeble, narrow, widely separated umbilical bullae. These give rise to narrow, delicate, widely separated prorsiradiate primary ribs that efface at mid-flank before strengthening into strong inner ventrolateral tubercles. These give rise to pairs of ribs that link to narrow transverse to feebly prorsiradiate outer ventrolateral/ventral tubercles, the interspaces between the pairs deepened into ventral constrictions. Additional ribs intercalate, bearing outer ventrolateral/ventral tubercles, which they link across the venter. There are an estimated 26–27 ribs on the outer whorl, some of which bear siphonal tubercles.

MNHN. F. J13774 (Pl. 30, Figs 14, 15) is a well-preserved crushed 60° whorl sector of phragmocone with a maximum preserved whorl height of 11 mm approximately, and a whorl breadth to height ratio of 1.51. The intercostal whorl section is depressed oval, the costal whorl section depressed polygonal, with the greatest breadth at the inner ventrolateral tubercles. There are two well-preserved, widely separated primary ribs on the fragment. They arise on the umbilical wall and develop into narrow, pinched umbilical bullae. The weak ribs link to massive conical inner ventrolateral tubercles, from which pairs of ribs link to small transverse to slightly prorsiradiate outer ventrolateral tubercles. A delicate rib intercalates. There are no siphonal tubercles. The interspace between one of the pairs of ventral ribs is deepened into a prominent constriction. The suture (Pervinquière 1907, text-fig. 108) is moderately incised with a tall, relatively narrow E/A and a broad A with a large median element. A/ U2 is smaller than E/A, narrow and bifid.

OUMNH KX.9703 (Pl. 30, Figs 16, 17) is a well-preserved half whorl 23.5 mm in diameter, intermediate in size between Pervinquière's specimens of *giltarei.* There are nine primary ribs on the fragment that arise at the umbilical seam and are narrow and separated by much wider interspaces, sweeping slightly forwards across the umbilical wall, and strengthening into small conical bullae, perched on the umbilical shoulder. These give rise to narrow prorsiradiate ribs that link to strong conical to feebly bullate inner ventrolateral tubercles. A single rib or a pair of ribs link these tubercles across the venter, and bear well-developed transversely elongated outer ventrolateral tubercles, while additional ribs intercalate, with weak or no outer ventrolateral tubercles, to give a total of 22 ribs per half whorl on the venter of the fragment. There are feeble, barely detectable transversely elongated siphonal tubercles on some ribs, and a few ventral constrictions. OUMNH KX.9704 (Pl. 30, Figs 1, 2) is a much larger fragment, wholly septate at an estimated diameter of 39 mm. Ornament is of the same basic style as in the previous specimen, but the ventral ornament is more uniform, with well-developed outer ventrolateral and siphonal tubercles on all ribs, and two constrictions between rib pairs linking the inner ventrolateral tubercles.

DISCUSSION: See Wright and Kennedy 1990, p. 294.

OCCURRENCE: Lower Upper Cenomanian, southern England, Central Tunisia, Madagascar, and Tamil Nadu, South India.

Genus *Lotzeites* Wiedmann, 1960

TYPE SPECIES: *Acanthoceras aberrans* Kossmat, 1895, p. 202 (106), pl. 24 (10), fig. 4, by the original designation of Wiedmann (1960, p. 731).

Lotzeites aberrans (Kossmat, 1895)
(Pl. 30, Figs 3–10)

1895. *Acanthoceras aberrans* Kossmat, p. 202 (106), pl. 24 (10), fig. 4.
1990. *Lotzeites aberrans* (Kossmat, 1895); Wright and Kennedy, p. 292, pl. 85, figs 3–6, 8, 10; text-fig. 94f–h (with full synonymy).
2017. *Lotzeites aberrans* (Kossmat, 1895); Košťák *et al*., p. 159, text-fig. 6d–k (with additional synonymy).
2019. *Lotzeites aberrans* (Kossmat, 1895); Kennedy in Gale *et al*., p. 264, pl. 42, figs 1, 3, 7–12.

TYPE: The holotype, by monotypy, is the original of *Acanthoceras aberrans* Kossmat 1895, p. 202 (106), pl. 24 (10), fig. 4, no. 14828 in the collections of the Geological Survey of India, from the Uttatur Group of Odiyam, Tamil Nadu, South India. A cast was figured by Wright and Kennedy (1990, text-fig. 94f–h) and Gale *et al*. (2019, pl. 42, figs 7–9).

MATERIAL: OUMNH KX.9803, 16796–16800, from the lower Uppper Cenomanian *pentagonum* fauna north of Djebel Hameima, Central Tunisia.

DESCRIPTION: The present material consists of crushed and distorted nuclei, deformed into ellipses with major diameters that range from eight to 30 mm. Coiling is evolute, the umbilicus deep, the umbilical seam notched to accommodate the ventrolateral tubercles of the preceding whorl. Primary ribs arise on the umbilical wall, across which they strengthen, and develop into sharp umbilical bullae, an estimated eight to ten per half whorl. The bullae give rise to strong, straight primary ribs that link to stronger, subspinose ventrolateral tubercles. These give rise to pairs of strong, feebly convex ribs that loop across the venter and link to the corresponding tubercle on the opposite flank. Constrictions are well-developed on ventrolateral shoulders and venter.

DISCUSSION: See Wright and Kennedy (1990, p. 292). *Lotzeites elegans* Kennedy, 2015 (in Kennedy and Gale, p. 307, pl. 16, figs 2, 3; Kennedy in Kennedy and Gale 2017, p. 100, pl. 13, figs 1–3; pl. 14, figs 1–6, 10, 11; text-fig. 11) from the upper Middle Cenomanian of north-eastern Algeria and Central Tunisia differs most obviously in the presence of outer ventrolateral and siphonal tubercles on the inner whorls.

OCCURRENCE: Lower Upper Cenomanian of southern England, Central Tunisia, Madagascar, and Tamil Nadu, south India.

Family Collignoniceratidae Wright and Wright, 1951
Subfamily CollignoniceratinaeWright and Wright, 1951
Genus *Subprionocyclus* Shimizu, 1932, p. 2

TYPE SPECIES: *Prionocyclus hitchinensis* Billinghurst, 1927, p. 516, pl. 16, figs 1, 2, by the original designation of Shimizu, 1932, fig. 2.

Subprionocyclus neptuni (Geinitz, 1849)
(Pl. 31, Figs 1–13; Text-fig. 24A)

1849. *Ammonites Neptuni* Geinitz, p. 114, pl. 3, fig. 3.
2014. *Subprionocyclus neptuni* (Geinitz, 1849); Wilmsen and Nagm, p. 24, text-fig. 13a, c, d.
2019. *Subprionocyclus neptuni* (Geinitz, 1849); Kennedy and Kaplan, p. 70, pl. 1, fig. 6; pl. 38, figs 2–4, 7–9, 11; pl. 39, figs 14, 15; text-fig. 27b–d.
2019. *Subprioncyclus neptuni* (Geinitz, 1849); Kennedy, p. 99, pl. 35, figs 7–11, 28, 29; pl. 36, figs 1–4, 10–13, 20, 21, 24; text-figs 55b, c, d, 57b, d (with full synonymy).

TYPE: The holotype by monotypy, is SaK 10032, the original of Geinitz (1849, pl. 3, fig. 3), housed in the collections of the Staatliches Museum für Mineralogie und Geologie, Dresden, and from the Upper Turonian Plänerkalk of Strehlen, Saxony, Germany, recently refigured by Wilmsen and Nagm (2014, text-fig. 13c), Kennedy and Kaplan (2019, text-fig. 27d) and Kennedy (2019, text-fig. 55d).

MATERIAL: 141 specimens, OUMNH KX.17195 (collective of 33 specimens), 17196 (collective of 23 specimens), 17197 (collective of 32 specimens), 17198 (collective of 33 specimens), 17199 (collective of 20 specimens), all from the Upper Turonian *neptuni* fauna, commune of Ziana, 21 km east of Berrouaghia, north-eastern Algeria.

DESCRIPTION: The present collection of 141 specimens is made up of predominantly tiny nuclei up to 17 mm diameter and fragments with whorl heights of up to 14 mm. Coiling of nuclei is moderately evo-

lute, the shallow umbilicus comprising 30–34% of the diameter, the umbilical wall flattened, the umbilical shoulder broadly rounded. The whorl section is compressed, the whorl breadth to height ratio up to 0.44, the inner to mid-flank region flattened and subparallel, the outer flanks convergent, the ventrolateral shoulders broadly rounded, the venter obtusely fastigiate, with a sharp siphonal keel. The early whorls are smooth, but for a delicate siphonal keel. The succeeding ornamented growth stage is variable. Primary ribs arise at the umbilical seam, and strengthen across the umbilical wall, developing into small bullae, perched on the umbilical shoulder. In robustly ornamented individuals, there are 18 ribs per half whorl at the ventrolateral shoulder. The ribs arise in pairs from well-developed umbilical bullae, while additional ribs arise at the umbilical seam without developing a bulla, or intercalate low on the flanks. The ribs are straight and prorsiradiate on the inner flank, flexing back at mid-flank and are very feebly convex before flexing forwards, strengthening, and linking to small ventrolateral clavi, from which a strong rib project forwards to feeble siphonal clavi. Feebly ornamented variants have up to 26 ribs per half whorl, the ribs arising in pairs from feeble umbilical bullae, singly at the umbilical seam, or intercalating low on the flanks. In some individuals the ribs are more obviously flexuous than the ribs of robustly ornamented individuals. All ribs link to weak ventrolateral clavi, from which they projects forwards and link to small clavi, borne on the siphonal keel. Some nuclei show, in addition the development of an incipient inner ventrolateral bulla. The larger fragments are all robustly ornamented variants, and have a feebly developed conical to feebly bullate inner ventrolateral tubercle.

The sutures (Text-fig. 24A) are only moderately incised, with bifid lobes and saddles.

DISCUSSION: The present species is comprehensively reviewed by Kennedy and Kaplan (2019) and Kennedy (2019); the present material supports the conclusions reached there.

OCCURRENCE: Upper Turonian, *Subprionocyclus neptuni* Zone, southern England, and correlatives in northern and south-eastern France, ?northern Spain, Germany, Poland, ?Bulgaria, Kazakhstan, north-eastern Algeria, Central Tunisia, Japan, California and Oregon in the United States.

Suborder Ancyloceratina Wiedmann, 1966
Superfamily Turrilitoidea Gill, 1871

Family Anisoceratidae Hyatt, 1900
Genus *Anisoceras* Pictet, 1854

TYPE SPECIES: *Hamites saussureanus* Pictet in Pictet and Roux (1847, p. 374, pl. 13, figs 1–4), by the original designation of Pictet (1854, p. 705).

Anisoceras jacobi Breistroffer, 1947
(Pl. 32, Figs 14–17, 29)

1861. *Anisoceras armatus* Pictet and Campiche, *non* J. Sowerby, p. 62 (*pars*), pl. 48, figs 1, 2, 4, 6.
1926. *Anisoceras picteti* Spath, *non* Matheron, p. 432.
1947b. *Anisoceras jacobi* Breistroffer, p. 310.
1968. *Anisoceras picteti* Spath; Renz, p. 76, pl. 13, figs 8, 9; pl. 14, figs 6–9; pl. 15, fig. 4; text-figs 27c, 28f.
2015. *Anisoceras jacobi* Breistroffer, Klein, pp. 26, 35 (with full synonymy).

TYPE: Breistroffer (1947b, p. 310) introduced *Anisoceras jacobi* as *nomen novum* for *Anisoceras picteti* Spath, 1926 (p. 432), *non* Matheron, 1878. Spath introduced his *picteti* for "*Anisoceras armatum*, Pictet and Campiche, pars, non Sowerby, *loc. cit*., 1857, pl. xxvii, fig. 11", which is thus the holotype of *jacobi* by monotypy. It is no. 39991 in the collections of the Musée Geologique, Lausanne, refigured by Renz (1968, pl. 14, fig. 6), and is from the condensed upper Upper Albian of Saint Croix, Switzerland.

MATERIAL: OUMNH KX.14311, 14319a, b, from the upper Upper Albian *puzosianum* fauna 2.5 km south of Djebel Djerissa, Central Tunisia.

DISCUSSION: Fragments assigned to this species are curved, and have whorl heights of up to 14.5 mm; most are crushed. Ribs loop in pairs between lower lateral and ventral tubercles, and between the ventral tubercles across the venter. There are up to three non-tuberculate ribs between successive tuberculate groups in OUMNH KX.14311 (Pl. 32, Figs 14, 15), which has a maximum preserved whorl height of 6.8 mm, but only one or two in larger fragments. The presence of these intercalated nontuberculate ribs serves to distinguish the species from *Anisoceras perarmatum*.

DISCUSSION: See Spath (1939, p. 554) and Renz (1968, p. 76) under *Anisoceras picteti* Spath, 1939, and Wiedmann and Dieni (1968, p. 67) for further discussion.

OCCURRENCE: Upper Upper Albian, southern England, south-east France, Switzerland, Sardinia,

Angola, and Venezuela. Lower Lower Cenomanian of Haute Normandie, France.

Anisoceras auberti (Pervinquière, 1907)
(Pl. 32, Figs 22, 30; Text-fig. 9G)

1907. *Hamites* (*Anisoceras*?) *Auberti* Pervinquière, 1907, p. 85, pl. 3, fig. 32.
2015. *Anisoceras auberti* (Pervinquière, 1907); Klein, pp. 25, 32 (with full synonymy).

TYPE: Pervinquière (1907, pl. 3, fig. 32) figured a plaster cast (Pl. 32, Fig. 30) of his new species, the original specimen, perhaps an external mould, has not been traced. It was from the Cenomanian of Toukabeur, Central Tunisia, and is the holotype by monotypy.

MATERIAL: OUMNH KX.16308, from the lower Lower Cenomanian *harchaensis* fauna 700 m north-east of Koudiat el Assel, north-eastern Algeria.

DESCRIPTION: The cast of the holotype (Pl. 32, Fig. 30) is of a very crushed individual consisting of a straight shaft and recurved sector. The straight shaft has a maximum whorl height of 18 mm approximately. The rib index is 12 on the shaft, the ribs narrow, feebly concave on the dorsolateral shoulder, straight and rectiradiate to very feebly prorsiradiate on the flanks, across which they strengthen only slightly, and link in pairs at small ventral clavi. This pattern of linking in pairs extends onto the beginning of the curved sector, beyond which the ribs are single, initially feebly sinuous, thereafter feebly concave, with long ventral bullae. OUMNH KX.16308 (Pl. 32, Fig. 22) is a 15.7 mm long curved sector of phragmocone with a maximum preserved whorl height of 8.6 mm, the whorl section compressed oval, with a whorl breadth to height ratio of 0.7. The rib index is 12–13. The ribs are narrow and crowded, well-developed and feebly convex on the dorsum, and vary from feebly rursiradiate to feebly prorsiradiate on the flanks. They link in pairs, with a third rib feebly linked in some cases at well-developed flat-topped conical ventral tubercles, the tubercles linked across the venter by a low, broad rib, feebly differentiated into a pair of narrow riblets. Single non-tuberculate ribs separate tuberculate groups. The sutures is deeply incised, with narrow-stemmed bifid E/A and A/U.

DISCUSSION: See Wright and Kennedy (1995, p. 304).

OCCURRENCE: Lower Lower Cenomanian, southern England, Spain, Poland, Romania, north-eastern Algeria, Central Tunisia, and, possibly New Zealand.

Anisoceras aff. *auberti* (Pervinquière, 1907)

1995. *Anisoceras* aff. *auberti* (Pervinquière, 1907)–*pseudoelegans* Pictet and Campiche, 1861; Wright and Kennedy, p. 304, pl. 91, figs 1, 3.

MATERIAL: OUMNH KX.16628, 16653–16654, from the lower Lower Cenomanian *carcitanense* fauna north of Djebel Hameima, Central Tunisia.

DESCRIPTION: OUMNH KX.16654, the larger of the fragments, is 22 mm long, with a maximum preserved whorl height of 9.4 mm. The whorl section is compressed ovoid, with a whorl breadth to height ratio of 0.7, the venter more narrowly rounded than the dorsum, the flanks feebly convex in intercostal section. The rib index is estimated as 12. The ribs are fine, transverse and well-developed on the dorsum, straight and feebly rursiradiate on the flanks, and straight and transverse on the venter. Ribs link in groups of two or three at low, rounded dorsolateral tubercles, loop to stronger rounded ventral tubercles, and loop between the tubercles across the venter. One or two nontuberculate ribs separate the tuberculate groups.

DISCUSSION: The specimens correspond to *Anisoceras* aff. *auberti* (Pervinquière, 1907)–*pseudoelegans* Pictet and Campiche, 1861 of Wright and Kennedy (1995, p. 304, pl. 91, figs 1, 3). They differ from *auberti* (see revision in Wright and Kennedy 1995, p. 304, pl. 88, fig. 14; pl. 90, fig. 5; pl. 91, figs 2, 4; text-fig. 130j) in the presence of a dorsolateral tubercle, and from *pseudoelegans* in having a conical dorsolateral tubercle rather than a bulla (Renz 1968, pl. 14, figs 10, 12). See Wright and Kennedy (1995, p. 304) for further discussion.

OCCURRENCE: Lower Lower Cenomanian of southern England and Central Tunisia.

Anisoceras leckenbyi Wright and Kennedy, 1995
(Pl. 32, Figs 12, 13)

1907. *Hamites* (*Anisoceras*?) *armatus* Sow.; Pervinquière, p. 84 (*pars*), pl. 4, fig. 2.
1995. *Anisoceras leckenbyi* Wright and Kennedy, p. 305, pl. 90, figs 2, 4, 7, 11.
1998. *Anisoceras leckenbyi* Wright and Kennedy, 1985; Lehmann, p. 30.

2015. *Anisoceras leckenbyi* Wright and Kennedy, 1985; Klein, pp. 26, 36.

TYPE: The holotype, by original designation, is SMC B35769, from the lower Middle Cenomanian of Ventnor, Isle of Wight, in southern England, the original of Wright and Kennedy (1995, pl. 90, fig. 11). There are three paratypes from the same horizon and locality.

MATERIAL: MNHN. F. J13717a, the original of *Hamites* (*Anisoceras*?) *armatus* Pervinquière 1907, pl. 4, fig. 2, from the 'Vraconnien' of Guern er Rhezal, Central Tunisia.

DESCRIPTION: The specimen (Pl. 32, Figs 12, 13) is a slightly curved fragment 11.1 mm long. The whorl section is compressed oval in intercostal section, the whorl breadth to height ratio 0.85; the venter is tabulate in costal section. The rib index is eight, the ribs transverse and effaced on the dorsum, strengthening across the dorsolateral margin, straight and feebly prorsi- to feebly rursiradiate on the flanks, across which they strengthen, and link in pairs at rounded ventrolateral tubercles that are linked across the venter by a pair of ribs. Two or three nontuberculate ribs intercalate between successive tuberculate groups, and are straight and transverse across the venter.

DISCUSSION: See Wright and Kennedy (1995, p. 305). *Anisoceras auberti* (see above) also lacks lateral tubercles, but has a much higher rib density (compare Pl. 32, Figs 12, 13 and Pl. 32, Fig. 22).

OCCURRENCE: Middle Cenomanian of southern England. Cenomanian of Central Tunisia.

Anisoceras cf. *plicatile* (J. Sowerby, 1819)
(Pl. 32, Figs 10, 11)

1819. *Hamites plicatilis* J. Sowerby, p. 281, pl. 234, fig. 1.
1907. *Hamites* (*Anisoceras*?) *armatus* Sow; Pervinquière, p. 84 (*pars*) pl. 4, fig. 3,
2015. *Anisoceras plicatile* (J. Sowerby, 1819); Klein, pp. 26, 39 (with full synonymy).
2019. *Anisoceras plicatile* (J. Sowerby, 1819); Kennedy in Gale *et al*. 277, text-fig. 38b–d.

TYPE: The lectotype, by the subsequent designation of Kennedy (1971, p. 120) is the original of J. Sowerby (1819, p. 281, pl. 224, fig. 1), from the Chalk Marl of Bishopstrow, near Warminster, Wiltshire, in southern England. It is no. 72991 (BC 528) in the collections of the Academy of Natural Sciences of Philadelphia, and was refigured by Wright and Kennedy (1995, text-fig. 130k).

MATERIAL: MNHN. F. J13717b, the original of Pervinquière (1907, pl. 4, fig. 3), from the 'Vraconnien' of Guern er Rhezal, Central Tunisia.

DESCRIPTION: The specimen is approximately 7.3 mm long, with a compressed oval intercostal whorl section, the whorl breadth to height ratio 0.9. The ribs are effaced across the dorsum, strengthen across the dorsolateral margin, and link in pairs at feebly bullate dorsolateral tubercles. Pairs of feebly rursiradiate ribs link in turn to rounded, flat-topped ventral tubercles, linked across the venter by a pair of ribs, with two nontuberculate ribs between successive tuberculate groups.

DISCUSSION: See Wright and Kennedy (1995, p. 307).

OCCURRENCE: Middle Cenomanian, southern England, France, Spain, Germany, Poland, Romania, Central Tunisia, Tamil Nadu in South India, and, possibly, Texas and Japan.

Genus *Idiohamites* Spath, 1925b

TYPE SPECIES: *Hamites tuberculatus* J. Sowerby, 1818, p. 30, pl. 215, fig. 5, by original designation by Spath (1925b, p. 189).

Idiohamites collignoni Spath, 1939
(Pl. 32, Fig. 31)

1931. *Hamites alternatus* Mantell; Collignon, p. 93(53), pl. 9 (5), fig. 27.
1939. *Idiohamites collignoni* Spath, p. 598.
1995. *Idiohamites collignoni* Spath, 1939; Wright and Kennedy, p. 311, pl. 89, fig. 8; text-fig. 131b–d, i (with synonymy).
2015. *Idiohamites collignoni* Spath, 1939; Klein, pp. 48, 51.

TYPE: The lectotype, designated by Kennedy (1971, p. 16) is the original of Collignon (1931, pl. 9 (5), fig. 27), from the Lower Cenomanian of Diego Suarez, Madagascar. It was figured by Wright and Kennedy (1985, text-fig. 131d).

MATERIAL: OUMNH KX.16309, from the lower

Lower Cenomanian *carcitanense* fauna 700 m north-east of Koudiat el Assel, north-eastern Algeria.

DESCRIPTION: The specimen is a 13.5 mm long curved fragment of phragmocone with a maximum preserved whorl height of 10 mm. The whorl section is compressed oval, with a whorl breadth to height ratio of 0.56. The rib index is 8. The ribs are effaced on the dorsum, strengthen across the dorsolateral margin, and are narrow and rectiradiate on the flanks. Every second or third rib bears a well-developed ventral tubercle, the tubercles linked across the venter by a low, transverse rib. The non-tuberculate ribs pass straight across the venter. The suture is deeply incised, with bifid lobes and saddles.

DISCUSSION: See Wright and Kennedy (1985, p. 311).

OCCURRENCE: Lower Lower Cenomanian of southern England, north-eastern Algeria, and Madagascar.

Idiohamites alternatus (Mantell, 1822)
(Pl. 33, Figs 19–24)

1822. *Hamites alternatus* Mantell, p. 122, pl. 23, figs 10, 11.
1955. *Idiohamites alternatus rigidus* Sornay, p. 10, pl. 1, figs 5, 9, 13.
1995. *Idiohamites alternatus* (Mantell, 1822); Wright and Kennedy, p. 308, pl. 92, figs 1–3, 5–10, 12, 13; pl. 93, figs 1, 4–8, 10–12, 14, 15; pl. 94, figs 3, 4, 8, 9; text-fig. 129a, f.
2015. *Idiohamites alternatus alternatus* (Mantell, 1822); Klein, pp. 48, 49 (with additional synonymy).
2015. *Idiohamites alternatus rigidus* Sornay, 1955; Klein, pp. 48, 50.
2015. *Idiohamites alternatus vectensis* Spath, 1939; Klein, p. 49, 51 (with synonymy).

TYPE: The holotype, by monotypy, is the original of Mantell (1882, pl. 23, figs 9, 10), from Middleham, Ringmer, Sussex, in southern England. It has not been traced.

MATERIAL: OUMNH KX.16302–16306, 16307 (collective of 29 specimens), from the Lower Cenomanian *harchaensis* fauna north-east of Koudiat el Assel, north-eastern Algeria.

DESCRIPTION: The material consists of straight and curved fragments with costal whorl heights of up to 14.5 mm. The intercostal whorl section is compressed oval. The costal whorl breadth to height ratio is 0.7. The rib index is four in straight fragments. The ribs are weak and transverse on the dorsum, strengthen across the dorsolateral margin, are coarse, distant and recti- to feebly prorsiradiate on the flanks, and pass straight across the venter. Alternate ribs bear a strong ventral tubercle, the tubercles linked across the venter by a strong straight rib that may be divided into a pair of riblets that loop between the tubercles. The alternate ribs may develop incipient tubercles. The ribs vary from feebly rursiradiate to feebly prorsiradiate around curved sectors. The suture is moderately incised, with broad bifid A, A/U, U, U/I and I.

DISCUSSION: See Wright and Kennedy (1995, p. 310).

OCCURRENCE: Lower Lower Cenomanian, southern England, France, Germany, Poland, Romania, Iran, and north-eastern Algeria.

Genus *Algerites* Pervinquière, 1910

TYPE SPECIES: *Algerites Sayni* Pervinquière, 1910, p. 47, pl. 10 (1), figs 21–25, from the Lower Cenomanian of Sour El Ghozlane (Aumale) and Berrouaghia, north-eastern Algeria.

Algerites sayni Pervinquière, 1910
(Pl. 32, Figs 1–9; Pl. 33, Figs 1–6, 11–14)

1910. *Algerites Sayni* Pervinquière, p. 47, pl. 10 (1), figs 21–25; text-figs 20, 21.
1995. *Algerites sayni* Pervinquière, 1910; Wright and Kennedy, p. 312, pl. 94, fig. 1; text-figs 128d, 130a–i (with synonymy).
1996. *Algerites sayni* Pervinquière; Wright, p. 237, text-fig. 187.1.
2015. *Algerites sayni* Pervinquière, 1910; Klein, pp. 61, 64 (with additional synonymy).
2018. *Algerites sayni* Pervinquière, 1910; Kennedy and Morris, p. 95, text-figs 9d–e, j–m, 10d.

TYPES: The holotype, by original designation is MNHN. F. J04343 (Pl. 32, Figs 1–3), the original of Pervinquière (1910, pl. 10 (1), fig. 25). There are ten further specimens, including MNHN. F. J04348 (Pl. 32, Figs 4–7), the original of Pervinquière (1910, pl. 10 (1), fig. 24); MNHN. F. J04353 (Pl. 32, Figs 8, 9) is the original of Pervinquière (1910, pl. 10 (1), fig. 23). All are from the Lower Cenomanian of Berrouaghia, northern Algeria.

MATERIAL: Numerous fragments, including OUMNH KX.16464 (collective of 10 specimens), 16528, 16599 (collective of 12 specimens), and 16674, from the lower Lower Cenomanian *carcitanense* fauna north of Djebel Hameima, Central Tunisia.

DESCRIPTION: The present material consists of short curved fragments with whorl heights of up to 10 mm. The whorl section is compressed oval, with a whorl breadth to height ratio of 0.5, the flanks very feebly convex. The primary rib index is up to 10, the ribs effaced on the dorsum, strengthening across the dorsolateral margin, where they are very feebly convex. They are feebly rursiradiate across the flanks, and increase by branching and intercalation; most, but not all ribs bear a small ventral tubercle, the tubercles linked across the arched venter by a blunt, transverse rib. There are feeble irregularly distributed and widely separated constrictions on some fragments. The suture is moderately incised, with bifid lobes and saddles (Pervinquière 1910, text-figs 30, 31), a broad E, narrow-stemmed E/A and A/U, and broader U/I; A is relatively broad.

DISCUSSION: Fragments assigned to *Algerites sayni* co-occur with those assigned to *A. ellipticus* (Mantell, 1822), described below. They differ in the broader venter and lower rib density of the latter, the ribs coarser, with fewer bifurcations and tubercles on all ribs. See Wright and Kennedy (1995, p. 313) for further discussion.

OCCURRENCE: Lower Lower Cenomanian of north-eastern Algeria, Central Tunisia, and Devon, England.

Algerites ellipticus (Mantell, 1822)
(Pl. 33, Figs 15–18; Text-figs 9C, 24C)

1822. *Hamites ellipticus* Mantell, p. 122, pl. 23, fig. 9.
1910. *Hamites ellipticus* Mantell var.; Pervinquière, p. 19, pl. 10 (1), fig. 27; text-fig. 5.
1939. *Idiohamites ellipticus* var. *radiatus* Spath, p. 598.
1995. *Algerites ellipticus* (Mantell, 1822); Wright and Kennedy, p. 313, pl. 92, figs 4, 11; pl. 93, figs 2, 3, 9; pl. 94, figs 2, 5–7, 10–12; text-fig. 128a (with full synonymy).
2015. *Algerites ellipticus ellipticus* (Mantell, 1822); Klein, pp. 61, 62 (with additional synonymy).
2015. *Algerites ellipticus radiatus* (Spath, 1939); Klein, pp. 62, 63 (with additional synonymy).

TYPE: The holotype, by monotypy, is BMNH 8611, the original of Mantell (1822, p. 122, pl. 23, fig. 9), from the Lower Cenomanian Chalk Marl of Middleham, Ringmer, Sussex. It was refigured by Wright and Kennedy (1995, pl. 94, fig. 11).

MATERIAL: Numerous fragments, OUMNH KX.16463 (collective of 115 specimens) and 16600 (collective of 19 specimens), from the lower Lower Cenomanan *carcitanense* fauna north of Djebel Hameima, Central Tunisia. OUMNH KX.16315, from the lower Lower Cenomanan *harchaensis* fauna 600 m north-east of Koudiat el Assel, north-eastern Algeria.

DESCRIPTION: Feebly curved fragments have whorl heights of up to 9.5 mm. The whorl section is compressed oval, with a whorl breadth to height ratio of 0.6, the flanks very feebly convex. The rib index varies between four and six. The ribs are weak and transverse on the dorsum, strength across the dorsolateral margin, and vary from recti- to feebly rursiradiate and near-straight to feebly flexuous on the flanks; there are occasional bifurcations on the outer flank. All ribs bear ventral clavi, linked across the venter by a strong transverse rib. The suture (Text-figs 9C, 24C) is moderately incised, with relatively narrow bifid saddles.

DISCUSSION: Differences from *Algerites sayni* are noted above. See Wright and Kennedy (1995, p. 314).

OCCURRENCE: Lower Lower Cenomanian, *Neostligoceras carcitanense* Subzone and correlatives, southern England, France, Poland, Iran, north-eastern Algeria, Central Tunisia, and, possibly, Germany.

Family Hamitidae Gill, 1871
Genus *Hamites* Parkinson, 1811

TYPE SPECIES: *Hamites attenuatus* J. Sowerby, 1814, p. 137, pl. 61, figs 4, 5, by the subsequent designation of Diener (1925, p. 65).

Hamites duplicatus Pictet and Campiche, 1861
*(*Pl. 32, Figs 25–28)

1861. *Hamites duplicatus* Pictet and Campiche, p. 98.
2015. *Hamites* (*Hamites*) *duplicatus* Pictet and Campiche 1861; Klein, pp. 74, 82 (with full synonymy).
2018. *Hamites duplicatus* Pictet and Campiche 1861; Kennedy and Morris, p. 96, text-figs 9f–i, 10a.
2019. *Hamites* (*Hamites*) *duplicatus* Pictet and Campiche 1861; Kennedy in Gale *et al*., p. 279, pl. 52, figs 4–6, 8–10, 15 (*pars*); pl. 53, fig. 1.

TYPE: The lectotype, by the subsequent designation of Spath (1941, p. 641), is the original of Pictet in Pictet and Roux (1847, pl. 14, fig. 7), from the Upper Albian of Mont Saxonnet, Savoie, France.

MATERIAL: OUMNH KX.14318 (collective of 5 specimens), from the upper Upper Albian *puzosianum* fauna 2.5 km south Djebel Djerissa, Central Tunisia. OUMNH KX.16215c and 16262, from the upper Upper Albian *puzosianum* fauna north and north-west of Gadet Chi, north-eastern Algeria. OUMNH KX.16311 (collective of 7 specimens), lower Lower Cenomanian *harchaensis* fauna, 700 m north-east of Koudiat el Assel, north-eastern Algeria. OUMNH KX.16640 (collective of six specimens), 16652 (collective of five specimens), 16691–16693, from the lower Lower Cenomanian *carcitanense* fauna north of Djebel Hameima, Central Tunisia.

DESCRIPTION: Phragmocone fragments have whorl heights of up to 15 mm, and are parts of straight shafts, or shafts with slightly curved sectors, suggesting that when complete, individuals consisted of several shafts linked by curved sectors. The whorl section is slightly compressed oval, with a whorl breadth to height ratio of around 0.9. The rib index is up to nine in OUMNH KX.14318a (Pl. 32, Figs 25, 26), the ribs weakened on the dorsum, strengthening across the dorsolateral margin, and straight on the flanks, where they are recti- to feebly prorsiradiate on straight shafts, but rursiradiate on curved sectors; they pass straight across the enter. The sutures are poorly preserved, with moderately incised bifid lobes and saddles. The most complete specimen, OUMNH KX.12698 (Pl. 1, Fig. 2) is a crushed composite mould of the adapertural part of the penultimate shaft, recurved sector, and the adapical part of the final shaft, with a maximum preserved whorl height of 12 mm and a rib index of up to 11 on the recurved sector.

DISCUSSION: See Wright and Kennedy (1995, p. 298).

OCCURRENCE: Upper Upper Albian to lower Upper Cenomanian. The distribution extends from southern and eastern England to France, Sardinia, Switzerland, Germany, Poland, Hungary, Dagestan, Kazakhstan, Iran, north-eastern Algeria, Central Tunisia, Angola, Tanzania, Madagascar, and Tamil Nadu in South India.

Hamites venetzianus Pictet, 1847
(Pl. 33, Figs 7, 8)

1847. *Hamites Venetzianus* Pictet in Pictet and Roux, p. 390, pl. 14, fig. 6.
1968. *Hamites* (*Stomohamites*) *venetzianus venetzianus* Pictet; Renz, p. 67, pl. 11, figs 15, 16; text-figs 23f, 24b.
1968. *Hamites* (*Stomohamites*) *venetzianus sulcatus* Renz, p. 67, pl. 11, fig. 27; text-fig. 23n.
2004. *Hamites venetzianus* Pictet, 1847; Kennedy, p. 892, text-figs 27b, 29g–j, l, m.
2015. *Hamites* (*Hamites*) *venetzianus venetzianus* Pictet, 1847; Klein, pp. 75, 99 (with synonymy).
2015. *Hamites* (*Hamites*) *venetzianus sulcatus* Renz, 1968; Klein, pp 75, 98 (with synonymy).

TYPE: The holotype is the original of Pictet in Pictet and Roux (1847, pl. 14, fig. 6), from the Upper Albian of Perte-du-Rhône, Ain, France.

MATERIAL: OUMNH KX.16400–16402, from the upper Upper Albian *puzosianum* fauna north of Djebel Hameima, Central Tunisia.

DESCRIPTION: The material consists of straight and slightly curved fragments with whorl heights of up to 10 mm. The whorl section is slightly compressed, subcircular. The rib index varies from three to five. The crowded ribs are very weak on the dorsum, strengthening across the dorsolateral margin, strong, straight, and feebly prorsiradiate on the flanks, and passing straight across the venter.

DISCUSSION: *Hamites venetzianus* is easily recognised, even in fragments, by the coarse, crowded ribs. For discussion see Kennedy (2004, p. 892).

OCCURRENCE: Upper Upper Albian, south-eastern France, southern England, Switzerland, Poland, Central Tunisia, Texas in the United States and, possibly, Angola.

Hamites virgulatus Brongniart, 1822
(Pl. 32, Figs 18–21, 23, 24)

1822. *Hamites virgulatus* Brongniart, p. 395, pl. 7, fig. 6.
2015. *Hamites* (*Hamites*) *virgulatus virgulatus* Brongniart, 1822; Klein, pp. 75, 100 (with synonymy).
2015. *Hamites* (*Hamites*) *virgulatus interruptus* Renz, 1968; Klein, pp. 75, 99 (with synonymy).

TYPE: The neotype, designated by Renz (1968, p. 65), is the original of Pictet and Campiche (1861, pl. 54, fig. 6), from the Upper Albian of Saint Croix, Vaud, Switzerland. It was refigured by Renz (1968, pl. 11, fig. 11; text-fig. 23d), and is no. L39952 in

the collections of the Musée Geologique, Lausanne, Switzerland.

MATERIAL: OUMNH KX.16215a, b, and 16254, from the upper Upper Albian *puzosianum* fauna north and north-west of Gadet Chi, north-eastern Algeria.

DESCRIPTION: Fragments have whorl heights of up to 9.5 mm. The whorl section of uncrushed specimens is compressed oval. The rib index is 5–6, the ribs weakened and effaced on the dorsum, strengthening across the dorsolateral margin, straight and prorsiradiate on the flanks and passing straight across the venter; the rib index is 4–5. Some fragments have the ribbing interrupted over the line of the siphuncle.

DISCUSSION: See Wiedmann and Dieni (1968, p. 53).

OCCURRENCE: Upper Albian, southern England, France, Switzerland, Spain, Sardinia, Hungary, Poland, Romania, Ukraine (Crimea), north-eastern Algeria, northern KwaZulu in South Africa, southern Mozambique, Madagascar, Texas in the United States, Mexico, the Western Territories in Australia, Angola, and possibly Venezuela.

Hamites simplex d'Orbigny, 1842

1842. *Hamites simplex* d'Orbigny, p. 550, pl. 134, figs 3, 12–14.
2015. *Hamites* (*Hamites*) *simplex* d'Orbigny, 1842; Klein, pp. 74, 94 (with full synonymy).
2019. *Hamites simplex* d'Orbigny, 1842; Kennedy in Gale *et al*., p. 280, pl. 52, figs 14, 15 (right) (with additional synonymy).

TYPES: The lectotype, by the subsequent designation of Sornay (1955b) is MNHN. F. R00983; there are seven paralectotypes, refigured by Wright and Kennedy (1995, text-fig. 133d–k). They are from the Middle Cenomanian Rouen Fossil Bed of Rouen, Seine-Maritime, France.

MATERIAL: OUMNH KX.16310 (collective of six specimens), from the lower Lower Cenomanian *harchaensis* fauna, 700 m north-east of Koudiat el Assel, north-eastern Algeria.

DISCUSSION: Whorl section, low rib density, and the strong ribs on the dorsum separate *simplex* from other species in the present faunas. See Wright and Kennedy (1995, p. 297) for further discussion.

OCCURRENCE: The species ranges from Lower to lower Upper Cenomanian. The geographic distribution extends from southern England to France, Germany, Poland, Ukraine, Dagestan, Iran, Madagascar, Tamil Nadu in South India, Bathurst Island (northern Australia), and the United Stated Western Interior.

Genus *Hemiptychoceras* Spath, 1925b

TYPE SPECIES: *Ptychoceras gaultinum* Pictet, 1847, p. 359, pl. 15, figs 5, 6, by the original designation of Spath 1925b, p. 189.

Hemiptychoceras sp.
(Pl. 1, Fig. 1)

MATERIAL: OUMNH KX.12699, from the lower Lower Cenomanian *carcitanense* fauna north of Djebel Hameima, Central Tunisia. OUMNH KX.17084, from the Upper Albian *puzosianum* fauna, commune of Ziana, 21 km east of Berrouaghia, northern Tunisia.

DESCRIPTION: OUMNH KX.12699 is a composite mould that has suffered dorso-ventral crushing. The adapical end of the specimen is interpreted as the beginning of the curved sector, with a marked constriction that is straight and transverse on the venter and concave on the ventrolateral shoulders. It is succeeded by fine even ribs that parallel the constriction. OUMNH KX.17084 is a crushed limonitic fragment 11.5 mm long with a maximum preserved whorl height of 7.4 mm, fine transverse ribbing typical of *Hemiptychoceras*, and a single constriction.

DISCUSSION: The material is too slight and poorly preserved for identification to specific level. The genus has not been previously recorded from North Africa.

OCCURRENCE: As for material.

Family Baculitidae Gill, 1871
Genus and subgenus *Lechites* Nowak, 1908

TYPE SPECIES: *Baculites Gaudini* Pictet and Campiche, 1861, p. 112, pl. 55, figs 5–9, by the original designation of Nowak (1908, p. 350).

Lechites (*Lechites*) *gaudini* (Pictet and Campiche, 1861)
(Pl. 34, Figs 1–5, 19, 20)

1861. *Baculites gaudini* Pictet and Campiche, p. 112, pl. 55, figs 5–9.
1977. *Lechites gaudini* (Pictet and Campiche); Cooper and Kennedy, p. 644, text-figs 1.1–1.38, 2.1–2.30, 3, 4.1–4.18, 5.1–15, 6, 7, 8.16–26 (with synonymy).
2016a. *Lechites* (*Lechites*) *gaudini* (Pictet and Campiche, 1861); Klein, pp. 2, 4 (with synonymy).
2016a. *Lechites* (*Lechites*) *communis* Spath, 1941; Klein, pp. 2, 3 (with synonymy).
2016a. *Lechites* (*Lechites*) *campichei* Renz, 1968; Klein, pp. 2, 3 (with synonymy).
2016a. *Lechites* (*Lechites*) *italicus* Wiedmann and Dieni, 1969; Klein, pp. 2, 6 (with synonymy).
2016a. *Lechites* (*Lechites*) *raricostatus* Breistroffer, 1947; Klein, pp. 2, 3 (with synonymy).
2016a. *Lechites* (*Lechites*) *vraconensis* Renz, 1968; Klein, pp. 2, 8 (with synonymy).
2019. *Lechites* (*Lechites*) *gaudini* (Pictet and Campiche, 1861); Kennedy in Gale *et al*., p. 291, pl. 58, fig. 5.

TYPE: The lectotype, by the subsequent designation of Spath (1941, p. 663) is the original of Pictet and Campiche (1861, p. 112, pl. 55, fig. 5), refigured by Renz (1968, pl. 17, fig. 3). It is no. L40012 in the collections of the Musée Geologique, Lausanne, and from the Upper Albian of Sainte-Croix, Vaud, Switzerland.

MATERIAL: OUMNH KX.14192 (collective of 14 specimens) and 14193 (collective of 14 specimens), from the upper Upper Albian *puzosianum* fauna, 2.5 km south of Djebel Djerissa, Central Tunisia.

DISCUSSION: The species is interpreted broadly here, following Cooper and Kennedy (1997). The ornament of widely (Pl. 34, Figs 1–3) to closely (Pl. 34, Figs 4, 5) spaced even ribs is quite distinct from the smooth to near-smooth shell of *Lechites moreti* (see below), with widely spaced deep, narrow constrictions.

OCCURRENCE: Upper Albian, particularly common and widespread in the upper part of the substage. There are records from southern England, France, Switzerland, Hungary, Romania, Sardinia, Iran, Algeria, Central Tunisia, Madagascar, KwaZulu-Natal in South Africa, Madagascar, Tamil Nadu in South India, Japan, Mexico, Australia and Alexander Island, Antarctica.

Lechites (*Lechites*) *moreti* Breistroffer, 1936
(Pl. 34, Figs 9–12, 16–18, 21–25)

1861. *Baculites Gaudini* var. Pictet and Campiche, p. 112, pl. 55, figs 10, 11.
1936. *Lechites moreti* Breistroffer, p. 66.
2016a. *Lechites* (*Lechites*) *moreti* Breistroffer, 1936; Klein, pp. 2, 6 (with full synonymy).

TYPES: The lectotype, by the subsequent designation of Spath (1941, p. 605), is specimen no. L40016 in the collections of the Musée Geologique, Lausanne, the original of Pictet and Campiche (1861, pl. 55, fig. 10), refigured by Renz (1968, pl. 16, fig. 10; text-fig. 29a), the paralectotype is specimen no. L40015, the original of Pictet and Campiche (1861, pl. 55, fig. 11), refigured by Renz (1968, pl. 16, fig. 12); both are from the upper Upper Albian of La Vraconne, near Saint Croix, Canton Vaud, Switzerland.

MATERIAL: OUMNH KX.14262 (collective of 35 specimens), 14264 (collective of 60 specimens), 14263 (collective of 35 specimens), from the upper Upper Albian *puzosianum* fauna, 2.5 km south of Djebel Djerissa, Central Tunisia.

DESCRIPTION: The material comprises predominantly crushed fragments; phragmocone fragments have whorl heights of up to 12 mm, body chamber fragments having whorl heights of up to 15.2 mm. When uncrushed, the whorl section is slightly compressed subcircular. Narrow constrictions, two in a distance equal to the whorl height, are weakest and feebly concave on the dorsum, strongly prorsiradiate and straight on the inner flank, flexing back, deepening and convex on the outer flank and passing straight across the venter, where they are at their maximum strength. The flanks between are swollen, and smooth in most specimens, although a few referred to the species have additional feeble grooves on flanks and venter (Pl. 34, Figs 9–12). The generally poorly preserved sutures are moderately incised, with bifid lobes and saddles.

DISCUSSION: An ornament of widely separated constrictions separates *moreti* from other, ribbed species; see Cooper and Kennedy (1977) and Scholz (1978).

OCCURRENCE: Upper Upper Albian, southern England, south-east France, Spain, Sardinia, Switzerland, Germany, Hungary, Romania, Ukraine (Crimea), Sardinia, and Tunisia.

Genus *Sciponoceras* Hyatt, 1894

TYPE SPECIES: *Hamites baculoides* Mantell, 1822, p. 123, pl. 23, figs 6–7, by the original designation of Hyatt (1894, p. 578).

Sciponoceras roto Cieśliński, 1959
(Pl. 34, Figs 6–8, 13–15; Text-fig. 23)

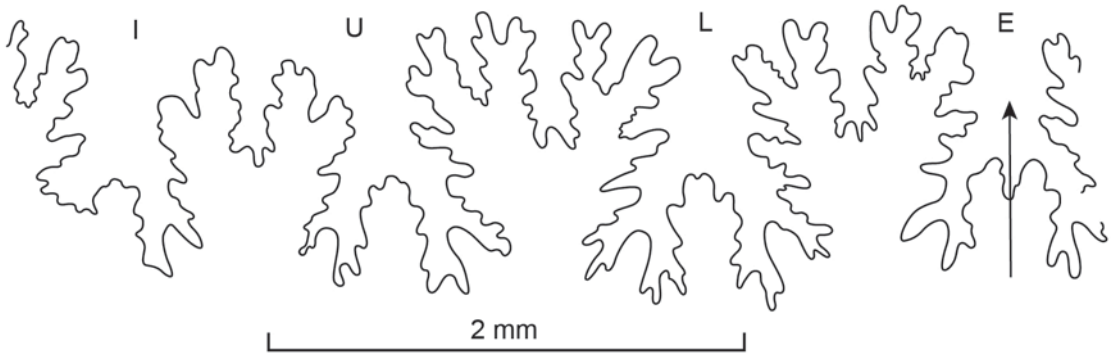
?1907. *Baculites baculoides* Mantell; Pervinquière, p. 92 (*pars*), pl. 4, fig. 8.
?1940. *Cyrtochilus pervinquierei* Breistroffer, pp. 99, 106 (nomen nudum).
1959. *Sciponoceras roto* Cieśliński, pp. 39, 75, 89, pl. 4, fig. 10; text-fig. 14 (2).
1984. *Sciponoceras roto* Cieśliński; Błaszkiewicz and Szymakowska, p. 377, pl. 165, fig. 2.
1989. *Sciponoceras roto* Cieśliński, 1959; Błaszkiewicz and Szymakowska, p. 266, pl. 166, fig. 2.
2016. *Sciponoceras roto* Cieśliński, 1959; Klein, pp. 9, 19 (with full synonymy).

TYPES: Cieśliński (1959, pp. 39, 75, 89) mentioned nine specimens, that are syntypes, and figured three (pl. 4, fig. 10). Błaszkiewicz and Szymakowska (1984, p. 377, pl. 165, fig. 2; English version 1989, p. 266, pl. 166, fig. 2) designated the original of Cieśliński (1959, pl. 4, fig. 10) lectotype and reillustrated it. The specimen is no 955.II. 28 in the collections of the Geological Survey of Poland, Warsaw, and is from the Lower Cenomanian of Chwałowice in the Lublin Trough, Poland. There are two fragments catalogued under this number, while Cieśliński figured what appear to be three different fragments (1959, pl. 4, fig. 10a–c). The largest specimen refigured by Błaszkiewicz and Szymakowska, 10a, is referred to as the lectotype in both text and plate explanation, and I take it to be a valid lectotype designation (the English translation of Cieśliński's plate explanation is problematic: "[10] a – earlier portion, size of specimen 40 mm; b – later portion, size of specimen 35 mm; c – later portion, size of the specimen 22 mm".

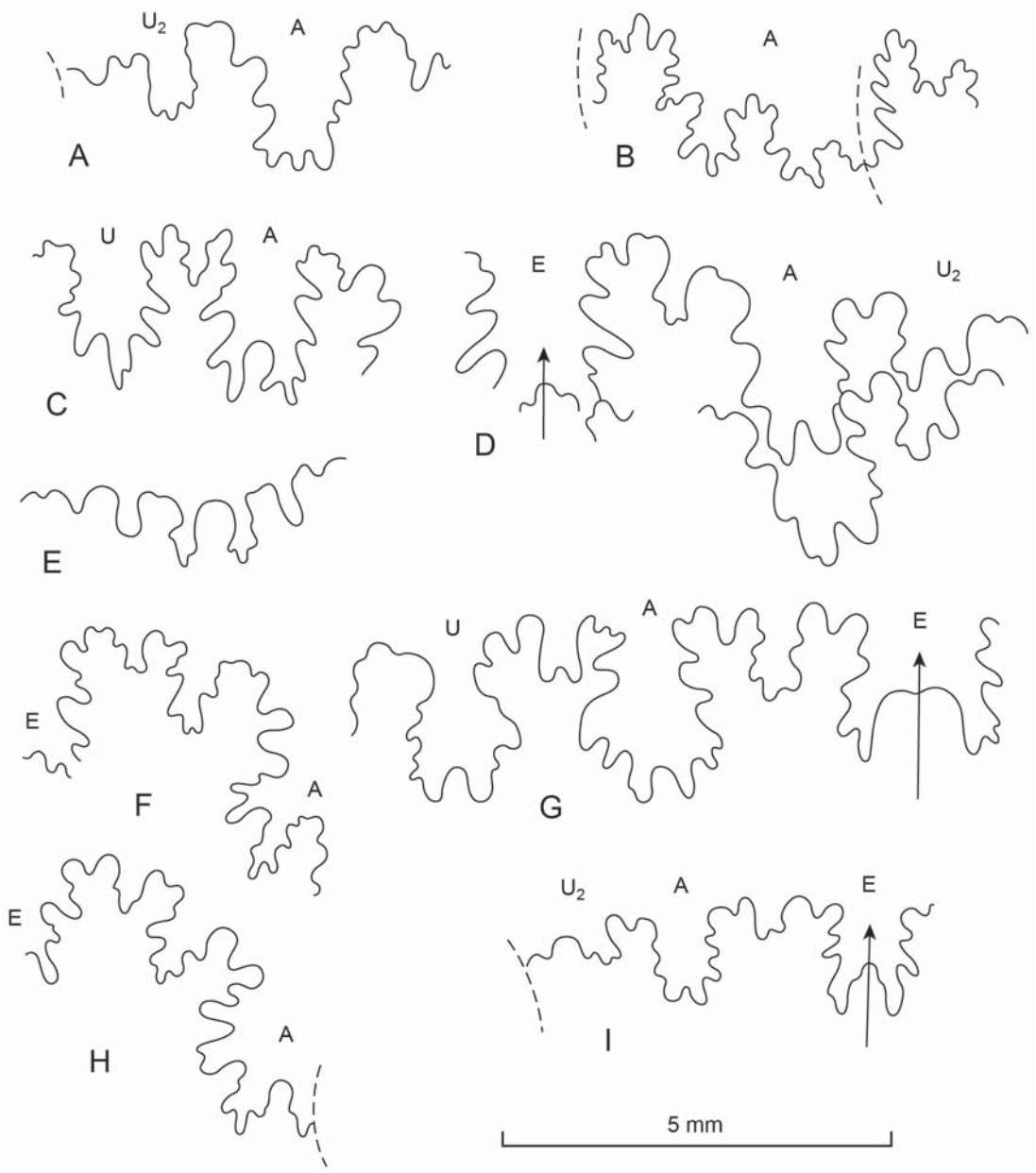
MATERIAL: There are abundant specimens. OUMNH KX.6807–6809, 16611, 16612, 16613 (collective of 19 specimens), 16575 (collective of 17 specimens), and 16576 (collective of 17 specimens), from the lower Lower Cenomanian *carcitanense* fauna north of Djebel Hameima, Central Tunisia. OUMNH KX.16274, 16275, 16276 (collective of 25 specimens), and 16277 (collective of 70 specimens), from the lower Lower Cenomanian *harchaensis* fauna 700 m north-east of Koudiat el Assel, north-eastern Algeria.

DESCRIPTION: The whorl section is circular to very slightly compressed. Fragments of phragmocones have whorl heights of up to 12 mm. Most fragments are smooth, but for constrictions separated by distances equal to around twice the median whorl height (Pl. 34, Figs 6–8). The largest fragment seen, OUMNH KX.16275 (Pl. 34, Figs 13–15) has ribs that are prorsiradiate across the flanks, barely detectable on the inner flanks, but strengthening on the outer flanks and crossing the venter in a very feeble convexity; the rib index is three. The ribs have an asymmetric cross section with a steeper adapertural than adpical face. The suture (Text-fig. 23) is deeply incised, the bifid saddles narrow-stemmed, the bifid lobes with a large median element.

DISCUSSION: Cieśliński described his species as follows: "Cross section of shell circular or very slightly elliptical. Ornament expressed by constrictions most strongly marked on siphonal side. They trend obliquely down, do not fade out on antisiphonal side but become weaker. Except for the constrictions this form displays no other ornamentation, the surface being absolutely smooth. Suture line distinct." In his discussion and re-



Text-fig. 23. Suture of *Sciponoceras roto* Cieśliński, 1959, OUMNH KX.16275



Text-fig. 24. Suture lines. A – *Subprionocyclus neptuni* (Geinitz, 1849), OUMNH KX.17199o. B – *Carthaginites kerimensis* Pervinquière, 1907, OUMNH KX.16121. C – *Algerites ellipticus* (Mantell, 1822), OUMNH KX.16463b. D – *Scaphites peroni* Pervinquière, 1910 (macroconch), OUMNH KX.16127. E – *Engonoceras* sp., OUMNH KX.14242. F – *Mariella* (*Mariella*) *pervinquierei* Diener, 1925, OUMNH KX.16384e. G – *Sciponoceras* cf. *bohemicum bohemicum* (Fritsch, 1872), OUMNH KX.16336. H – *Mariella* (*Mariella*) *harchaensis* Dubourdieu, 1953), OUMNH KX.16380. I – *Scaphites peroni* Pervinquière, 1910 (microconch), OUMNH KX.16134

construction (1959, text-fig. 14, II), the circular whorl section and much wider interspaces between successive constrictions are stressed as features that separate *roto* from *Sciponoceras baculoides* (Mantell, 1822) (see revision in Wright and Kennedy 1995, p. 317, pl. 95, figs 1–3, 5–10; pl. 96, figs 1–7; pl. 97, figs 1–5; pl. 98, figs 29–32; text-figs 129h, 132r, s, 133a–c, m–ff) and *S. subbaculoides* (Geinitz, 1875) (a synonym of *Sciponoceras gracile* (Shumard, 1861) according to Wright and Kennedy 1981, p. 114). The lectotype, designated by these authors is the original of Geinitz (1875, pl. 63, fig. 1). It is figured and described by

Wilmsen and Nagm (2014, p. 232, text-fig. 13j), and is from the upper Upper Cenomanian Plenus-Mergel of the Dölzschen Formation of the railway tunnel north of Niederau-Oberau. Cieśliński's reconstruction of *roto* shows a distance equal to three times the whorl height at the mid-point separating successive constrictions. Unfortunately this feature cannot be established on the lectotype, while in other, presumed paralectotype specimens, the distance between successive ocnstrictions is as little as twice the median whorl height. Furthermore, some presumed paralectotypes have ribs that parallel the constrictions. On this basis, *Sciponoceras roto*, as interpreted here has a circular whorl section, constrictions separated by a distance equal to two or three times the median whorl height between successive constrictions, and may develop flank ribs that parallel the constrictions.

Sciponoceras baculoides of Pervinquière (1907, p. 92 (*pars*), pl. 4, fig. 8), from Mechtat Mergueb in Central Tunisia was renamed *Cyrtochilus pervinquierei* by Breistroffer (1940), but this is a *nomen nudum*. The specimen may well be a *Sciponoceras roto*, but I have not seen the original. Pervinquière's second specimen (1907, pl. 4, fig. 7), MNHN. F. J13792, has an oval whorl section, and is specifically indeterminate.

OCCURRENCE: Lower Cenomanian, southern England, France, Belgium, Germany, Switzerland, northern Spain, Poland, Kazakhstan, north-eastern Algeria, Central Tunisia, KwaZulu-Natal in South Africa, Tanzania, Madagascar, and, possibly Iran.

Sciponoceras cf. *bohemicum bohemicum*
(Fritsch, 1872)
(Pl. 31, Figs 17, 18; Text-fig. 24G)

Compare:

1872. *Baculites Faujassi* Lamarck var. *bohemica* Fritsch, p. 49, pl. 13, figs 23–25, 29, 30.
2016. *Sciponoceras bohemicum bohemicum* Fritsch, 1872; Klein, pp. 9, 14.
2019. *Sciponoceras bohemicum bohemicum* (Fritsch, 1872); Kennedy and Kaplan, p. 93, pl. 49, figs 1–14, 18, 20; text-fig. 25d, e.

TYPE: The lectotype, by the subsequent designation of Wright (1979, p. 285), is the original of *Baculites faujassi* Lamarck var. *bohemica* of Fritsch (1872, p. 49, pl. 13, fig. 25). Fritsch figured four additional specimens which are paralectotypes. All are from the "Priesener Schichten von Lenešic bei Lauen" in the Usti nad Labem region of the Czech Republic, and are housed in the collections of the Národni Museum, Prague.

MATERIAL: OUMNH KX.17191 (collective of 30 specimens) and 17192–17193, from the Upper Turonian *neptuni* fauna, Commune of Ziana, 21 km east of Berrouaghia, north-east Algeria.

DESCRIPTION: Fragments of phragmocone have whorl heights of up to 6.3 mm. The whorl section is compressed oval, with a whorl breadth to height ratio of 0.74. Most fragments lack ornament. The most distinctive specimen, OUMNH KX.19192 (Pl. 31, Fig. 17), has a maximum preserved whorl height of 4.9 mm. There is a single constriction, strongly prorsiradiate, well developed on the outer flanks, and passing across the venter in a feeble convexity. The constriction is preceded by a well-developed collar rib, at its greatest strength on the venter. There are also faint indications of delicate ribs on the outer flank and venter, paralleling the constrictions. The suture is moderately incised, with a broad-stemmed bifid E/A, narrower bifid A, and narrower, narrow-stemmed A/U (Text-fig. 24G).

DISCUSSION: The qualified determination reflects the fragmentary nature of the material, which probably belongs to the late, nominate subpecies. See discussion in Kennedy and Kaplan (2019, p. 95).

OCCURRENCE: As for material. The nominate subspecies occurs in the Upper Turonian of southern and eastern England, northern France, northern Spain, Germany, The Czech Republic, Austria, Poland, and, possibly, Kazakhstan.

Family Turrilitidae Gill, 1871

DISCUSSION: The classification of Wright (1996) and Wright and Kennedy (1996) is followed here. See Cooper (1999) and Klein (2015) for a different approach.

Genus and subgenus *Ostlingoceras* Hyatt, 1900

TYPE SPECIES: *Turrilites puzosianus* d'Orbigny, 1842, p. 587, pl. 143, figs 1, 2, by the original designation of Hyatt (1903, p. 587).

Ostlingoceras (*Ostlingoceras*) *puzosianum*
(d'Orbigny, 1842)
(Pl. 35, Figs 13, 14, 16, 17)

1842. *Turrilites Puzosianus* d'Orbigny, p. 587, pl. 143, figs 1, 2.
2015. *Ostlingoceras* (*Ostlingoceras*) *puzosianum* (d'Orbigny, 1842); Klein, pp. 192, 194 (with full synonymy).

TYPES: As noted elsewhere (Kennedy and Latil 2007, p. 473) d'Orbigny stated (1841, p. 587) that Puzos had sent him two specimens from Reposoir (Haute-Alpes), France, and that his figures were based on one of them. The specimens have not been traced.

MATERIAL: OUMNH KX.14256 (collective of 25 specimens), 10257 (collective of 15 specimens), 14258 (collective of 14 specimens), 14259 (collective of 14 specimens), 14260 (collective of five specimens), all from the upper Upper Albian *puzosianum* fauna 2.5 km south of Djebel Djerissa, Central Tunisia.

DESCRIPTION: There are fragments with up to five whorls; the largest fragment has a maximum preserved whorl height of 17 mm. The apical angle is low (around 20°), the whorls in tight contact, the upper whorl face concave, the inter-whorl suture feebly crenulated, the junction between upper and outer whorl faces narrowly rounded, the upper part of the outer whorl face feebly convex, the junction of outer and lower whorl faces rounded, the lower whorl face feebly convex in intercostal section. There are six to seven weak ribs in a distance equal to the exposed whorl height. The ribs arise at the inter-whorl suture, are feebly prorsiradiate and approximately the same width as the interspaces. They weaken and efface on the lower part of the outer whorl face before strengthening into a small transversely elongated tubercle just above the inter-whorl suture. A narrow groove separates this row from a second row of tubercles, partially concealed in the notches in the inter-whorl suture, linked in turn to a well-developed third row of tubercles on the outermost part of the lower whorl face. These give rise to well-developed radial ribs that extend across the lower whorl face, effacing progressively.

DISCUSSSION: See Kennedy and Latil (2007, p. 474).

OCCURRENCE: Upper Upper Albian, southern England, France, Spain, Sardinia, Switzerland, Hungary, Poland, Romania, North Caucasus, Ukraine (Crimea), Georgia, Iran, Turkmenistan, Central Tunisia and Madgascar.

Ostlingoceras (*Ostlingoceras*) *costulatum* (Pervinquière, 1910)
(Pl. 37, Figs 1, 2)

1910. *Turrilites costatus* var. *costulata* Pervinquière, p. 50, pl. 14 (5), figs 6, 7.
1929. *Turrilites costatus* var. *costulatus* Perv.; Collignon, p. 59 (35), pl. 1 (6), fig. 3.
1964. *Turrilites costatus* var. *costulatus* Pervinquière; Collignon, p. 14, pl. 320, fig. 1393.
1996. *Ostlingoceras* (*Ostlingoceras*) *costulatum* (Pervinquière, 1910; Wright and Kennedy, p. 325, pl. 98, figs 8, 24; text-fig. 138a.
2015. *Turrilites costulatus* Pervinquière, 1910); Klein, pp. 176, 184.

TYPE: The lectotype by the subsequent designation of Wright and Kennedy (1996, p. 325), is MNHN. F. J13727, the original of Pervinquière (1910, pl. 14 (5), figs 6, 7), from Sour El-Ghozlane (Aumale), north-eastern Algeria.

MATERIAL: OUMNH KX.16704–16706, from the lower Lower Cenomanian *carcitanense* fauna north of Djebel Hameima, Central Tunisia.

DESCRIPTION: The lectotype (Pl. 37, Figs 1, 2) comprises three whorls, with a total height of 18 mm. The apical angle is small (22°), with a flattened outer whorl face. Strong equal transverse feebly concave ribs, 26 per whorl, extend across the whole of the outer whorl face and strengthen into a feeble transversely elongated tubercle at the base of the whorl face. A weak prorsiradiate rib links this tubercle to a second elongated tubercle at the outer edge of the lower whorl face. Delicate weakening ribs extend across the lower whorl face from these tubercles. OUMNH KX.16705 is a smaller individual comprising five whorls, the total height 14.5 mm. OUMNH KX.16704 and 16706 are larger fragments, the former with a whorl height of over 15 mm.

DISCUSSION: *Ostligoceras* (*O.*) *costulosum* differs from *O.* (*O.*) *puzosiforme* (see above) and other, Cenomanian species, in having only two, rather than three rows of tubercles.

OCCURRENCE: Lower Lower Cenomanian, southern England, north-eastern Algeria, Central Tunisia, Madagascar and possibly south-eastern France.

Ostlingoceras (*Ostlingoceras*) *collignoni* Wright and Kennedy, 1996
(Pl. 35, Figs 12, 15; Pl. 37, Fig. 5)

1910. *Turrilites* cf. *Colcanapi* Boule, Lemoine and Thévenin; Pervinquière, p. 49, pl. 14 (5), fig. 1.

1931. *Turrilites laevigatus* Collignon, p. 90 (50), pl. 9 (5), figs 18, 19; text-fig. 22 (*non* Coquand, 1862).
1996. *Ostlingoceras* (*Ostlingoceras*) *collignoni* Wright and Kennedy, p. 325, text-fig. 134m, n.
1998. *Ostlingoceras* (*Ostlingoceras*) *collignoni* Wright and Kennedy; Kaplan *et al*., p. 192, pl. 63, fig. 6.
2015. *Ostlingoceras* (*Ostlingoceras*) *collignoni* Wright and Kennedy, 1996; Klein, pp. 192, 193 (with additional synonymy).

TYPE: The holotype, by original designation, is MNHN. F. R01112, the original of *Turrilites laevigatus* Collignon, 1931, p. 90 (50), pl. 9 (5), figs 18, 19; text-fig. 22 (*non* Coquand 1862), from the Lower Cenomanian east of Antsirane, Madagascar. It was refigured by Wright and Kennedy (1996, text-fig. 134m).

MATERIAL: OUMNH KX.9648 (collective of 12 specimens) and 4651, from the Lower Cenomanian of Kat el Margueb, north of Djebel Fguira Salah, near Pont du Fahs, Central Tunisia. MNHN. F. J13725, the original of Pervinquière (1910, p. 49, pl. 14 (5), fig. 1), from Sour El-Ghozlane (Aumale) in north-eastern Algeria.

DESCRIPTION: The material consists of crushed fragments with whorl heights of up to 11 mm. The apical angle is over 40°, the inter-whorl suture little-impressed, the outer whorl face very feebly convex. Delicate crowded, feebly prorsiradiate ribs arise at the inter-whorl suture and extend almost to the base of the outer whorl face; there are six or seven in a distance equal to the exposed whorl height. A smooth zone separates the rib terminations from a delicate spiral ridge, and a second narrow groove from a second spiral ridge. Both ridges appear to have been feebly crenulated. Because of the crushing, the ornament of the lower whorl face is difficult to establish, but it appears to have comprised delicate radial ridges on the outer part at least. MNHN. F. J13725 (Pl. 37, Fig. 5) is equally crushed, with four and a half whorls preserved, the total height 14.6 mm, the maximum preserved whorl height 4.7 mm; it is in part body chamber. The apical angle is 45º. The whorls are in tight contact, the inter-whorl suture barely indented, the outer whorl face very feebly convex. The greater part of the face is occupied by delicate, crowded prorsiradiate ribs. The base of the outer whorl face is marked by a continuous spiral ridge, separated by a narrow groove from a second ridge. The suture is little incised, with a broad, bifid E/A.

DISCUSSION: The very delicate, crowded ribs and the spiral ridges are distinctive. The closest comparison is with *Ostlingoceras* (*Ostlingoceras*) *colcanapi* (Boule, Lemoine and Thévenin, 1907) (p. 39 (59), pl. 6 (13), fig. 3), which is, however, much more coarsely ribbed. See Wright and Kennedy (1995, p. 324) for further discussion.

OCCURRENCE: Lower Cenomanian, north-eastern Algeria, Central Tunisia, and Madagascar.

Genus *Neostlingoceras* Klinger and Kennedy, 1978

TYPE SPECIES: *Turrilites Carcitanensis* Matheron, 1842, p. 267, pl. 41, fig. 4.

Neostlingoceras carcitanense (Matheron, 1842)
(Pl. 35, Figs 6, 8, 9, 18; Pl. 36, Fig. 24)

1842. *Turrilites Carcitanensis* Matheron, p. 267, pl. 41, fig. 4.
1903. *Turrilites Morrisi* Sharpe; Pervinquière,p. 69, 71, 72.
1907. *Turrilites Morrisi* Sharpe; Pervinquière, p. 99, pl. 4, figs 15–17; text-fig. 28.
1996. *Neostlingoceras carcitanense* (Matheron, 1842); Wright and Kennedy, p. 326, pl. 99, figs 1–7, 9–15, 18, 19, 22; pl. 100, fig. 8; text-fig. 140b.
2015. *Neostlingoceras carcitanense* (Matheron, 1842); Kennedy in Kennedy and Gale, p. 310, pl. 24, fig. 10 (with additional synonymy).
2015. *Neostlingoceras carcitanense* (Matheron, 1842); Klein, pp. 197, 199 (with additional synonymy).

TYPE: The holotype, by monotypy, is the original of Matheron (1842, p. 267, pl. 41, fig. 4), from the remanié fauna of the Banc des Lombards at Cassis, Bouches-du-Rhône, France. It was refigured by Fabre (1940, pl. 5, fig. 7).

MATERIAL: OUMNH KX.16515–16517, 16528, (collective of 13 specimens), 16549 (collective of 14 specimens), 16569, 16596 (collective of 20 specimens), 16597 (collective of 22 specimens), 16598, 16624 (collective of 48 specimens), 16625–16627, 16667 (collective of 41 specimens), 1668 (collective of 52 specimens), and 16669 (collective of 7 specimens), all from the *carcitanense* fauna north of Djebel Hameima in Central Tunisia. MNHN. F. J13720, the original of *Turrilites morrisi* of Pervinquière (1907, pl. 4, figs 15, 16), from Si Abd el Kerim, Central Tunisia. MNHN. F. J13748, the original of Pervinquière (1910, pl. 14 (5), fig. 20), from Djebel Guessa, north-eastern Algeria.

DESCRIPTION: Pervinquière's specimens are typical of the present material, which has maximum preserved whorl heights of up to 16 mm. MNHN. F. J13720 (Pl. 35, Fig. 8) has a maximum preserved height of 13.2 mm; the maximum preserved whorl height is 4.7 mm. The outer whorl face is feebly convex above, the lower part flattened. The junction of the outer and lower whorl faces is narrowly rounded, and notched to accommodate the lower rows of tubercles. The lower whorl face is flattened. There are ten widely separated rounded/conical tubercles per whorl in the middle of the outer whorl face, with a second row of smaller tubercles that are twice as numerous at the inter-whorl suture, and a third row, equal in number but displaced adaperturally, housed in the inter-whorl suture. They give rise to rapidly effacing ribs, leaving the greater part of the lower whorl face smooth. MNHN. F. J13748 (Pl. 36, Fig. 24) comprises two whorls and the base of a third, with a maximum preserved whorl height of 7.4 mm, 10 large tubercles in the middle of the outer whorl face and two rows of an estimated 22 smaller tubercles per whorl.

DISCUSSION: There are more than 200 specimens of this species, which has been extensively described and discussed in recent literature (Wright and Kennedy 1996, p. 326). The species differs from *N. oberlini* (Dubourdieu, 1953), in having three, rather than four rows of tubercles.

OCCURRENCE: Lower Lower Cenomanian *N. carcitanense* Subzone of the *M. mantelli* Zone and correlatives. There are records from southern England, France, northern Spain, Switzerland, Germany, Poland, Turkmenistan, Kazakstan, Iran, north-eastern Algeria, Central Tunisia, KwaZulu-Natal in South Africa, Tamil Nadu in South India, Madagascar, and Japan.

Neostlingoceras oberlini (Dubourdieu, 1953)
(Pl. 1, Fig. 6; Pl. 35, Figs 5, 7)

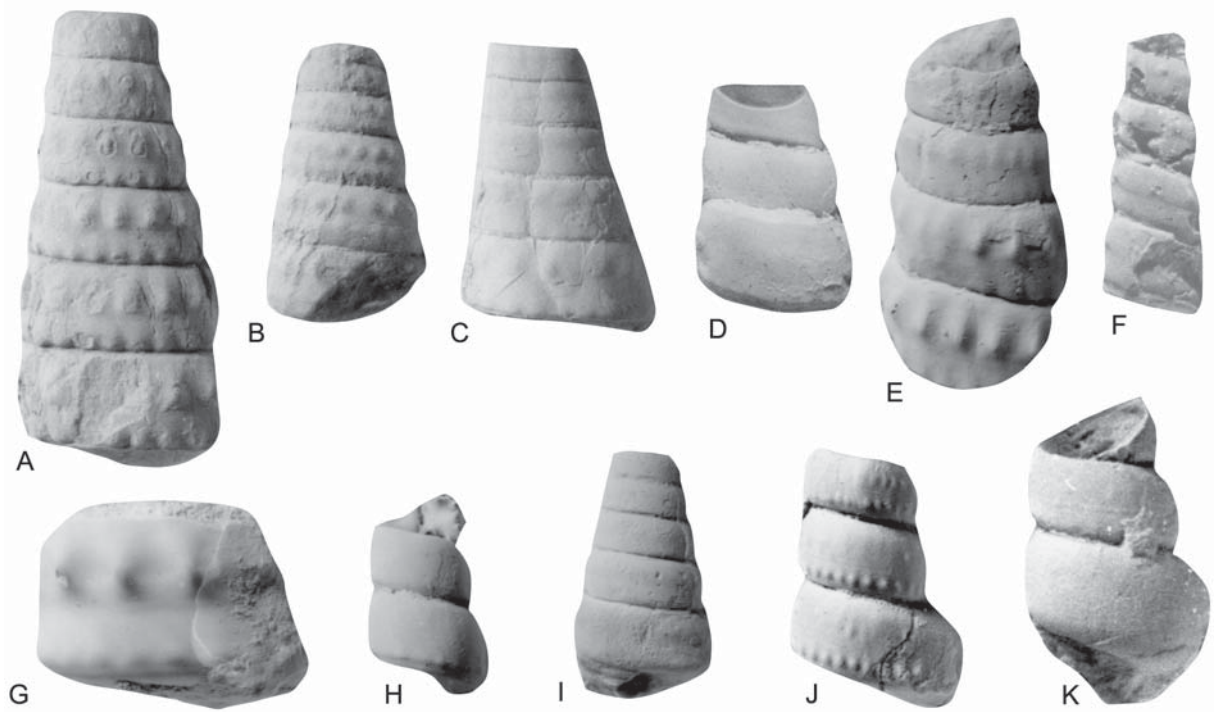
1857. *Turrilites morrisii* Sharpe, p. 65 (*pars*), pl. 26, fig. 5 only.
1953. *Hypoturrilites oberlini* Dubourdieu, p. 59, pl. 4, figs 28–30.
1996. *Neostlingoceras oberlini* (Dubourdieu, 1953); Wright and Kennedy, p. 328, pl. 99, figs 8, 16, 17, 24, 32; pl. 110, fig. 1; pl. 111, fig. 2; text-figs 129d, 137d, h, i, 142b, c (with full synonymy).
1996. *Neostlingoceras oberlini* (Dubourdieu, 1953); Kennedy in Gale *et al*., p. 586, figs 110, 250 p, r.
1998. *Neostlingoceras oberlini* (Dubourdieu, 1953); Kaplan *et al*., p. 198.
2015. *Neostlingoceras oberlini* (Dubourdieu, 1953); Klein, pp. 199, 202 (with additional synonymy).

TYPE: The lectotype, designated by Wright and Kennedy (1996, p. 329), is BGS GSM Geol. Soc. 7782, the original of Sharpe (1857, pl. 26, fig. 5), from the phosphatic Lower Cenomanian *M. mantelli* Zone, *N. carcitanense* Subzone fauna of the Glauconitic Marl of Ventnor, Isle of Wight, U.K.

MATERIAL: OUMNH KX.16334–16337, 16340, from the Lower Cenomanian *harchaensis* fauna 700 m north-east of Koudiat el Assel, north-eastern Algeria. OUMNH KX.16422, from the lower Lower Cenomanian *carcitanense* fauna north of Djebel Hameima, Central Tunisia.

DESCRIPTION: Limonitic juveniles have whorl heights of up to 12 mm, with the flattened outer whorl face typical of *Neostlingoceras*. There are four rows of tubercles, with around 11 conical tubercles per whorl in the upper row of larger tubercles, situated around the middle of the outer whorl face. A second row of smaller conical to transversely elongated tubercles, more than twice as numerous per whorl as those in the upper row are situated on the lower part of the outer whorl face, and lie at the bottom of a blunt rib that extends up to the level of the base of the tubercles in the upper row. A feebly prorsiradiate rib connects to a third row of conical tubercles, displaced slightly adaperturally of those in the second row, and housed in crenulations in the inter-whorl suture. A fourth row of tubercles are situated on the outer part of the lower whorl face, and give rise to radial ribs that extend across the lower whorl face. OUMNH KX.16422 (Pl. 1, Fig. 6) is a composite mould from one of the thin limestones in the Lower Cenomanian sequence north of Djebel Hameima. It is from a large individual, the original whorl height estimated at over 30 mm. There are four rows of tubercles. Only one tubercle is preserved in the upper row, and is large and transversely elongated. The tubercles in the three lower rows are far more numerous and are adaperturally displaced in successive rows.

DISCUSSION: The smaller individuals match well with the lectotype. Although only a fragment, OUMNH KX.16422 exhibits the diagnostic features of the species; an upper row of fewer, larger tubercles, and three rows of more numerous, smaller tubercles below, whereas *N. carcitanense* has only two rows



Text-fig. 25. **A-C, E, I** – *Neostlingoceras virdense* Cobban, Hook and Kennedy, 1989. A – OUMNH KX.16732; B – KX.16734; C – KX.16735; E – KX.16731a; I – KX.16731b, all from the Upper Cenomanian *pentagonum* fauna north of Djebel Hameima, Central Tunisia. **D, H** – *Carthaginites krorzaensis* Dubourdieu, 1953. D – OUMNH KX.9782; H – OUMNH KX.16826, both from the Upper Cenomanian *pentagonum* fauna north of Djebel Hameima, Central Tunisia. **F** – *Carthaginites kerimensis* Pervinquière, 1907, the holotype, MNHN. F. J04323, the original of Pervinquière 1907, pl. 4, figs 18, 1 9, from the ' Vraconnien' of Kef Si Abd el Kerim, Central Tunisia. **G** – *Carthaginites* sp.,OUMNH KX.17151 from the Lower Cenomanian, Commune of Ziana, northern Algeria. **J, K** – *Carthaginites elegans* sp. nov. J – the holotype, OUMNH KX.16052a; K – paratype OUMNH KX.16052b, from the Middle Cenomanian *asiaticum* fauna west of Djebel Sottara, northern Algeria. Figures A-D are × 2; figures F-K are × 3

of smaller tubercles. The species is comprehensively reviewed by Wright and Kennedy (1996, p. 328).

OCCURRENCE: Lower Cenomanian*, M. mantelli* Zone, *N. carcitanense* Subzone, southern England, France, Germany, Poland, Romania, Turkmenistan, Iran, Morocco, Algeria, Central Tunisia, Israel, KwaZulu – Natal in South Africa, Madagascar, and South India.

Neostlingoceras virdense Cobban, Hook, and Kennedy, 1989
(Text-fig. 25A–C, E, I)

1989. *Neostlingoceras virdense* Cobban, Hook, and Kennedy, p. 61, text-figs 63, 95t.
1995. *Neostlingoceras virdense* Cobban, Hook, and Kennedy, 1989; Wright and Kennedy, text-fig. 129g.
1996. *Neostlingoceras virdense* Cobban, Hook and Kennedy, 1989; Wright and Kennedy, p. 329, pl. 98, fig. 19; pl. 99, figs 20–23, 25–27, 29–31.
1999. *Neostlingoceras virdense* Cobban, Hook and Kennedy, 1989; Cooper, p. 7.
2015. *Neostlingoceras virdense* Cobban, Hook and Kennedy, 1989; Klein, pp. 199, 203.

TYPES: The holotype is USNM 425471, the original of Cobban *et al.* (1989, p. 61, text-figs 63, 95t), the paratype is USNM 425472, both from the Upper Cenomanian *Metoicoceras mosbyense* Zone near Virden, New Mexico.

MATERIAL: OUMNH KX.16732–16735, 16731 (collective of eight specimens), 16778–16779, 16850, all from the Upper Cenomanian *pentagonum* fauna north of Djebel Hameima, Central Tunisia.

DESCRIPTION: Specimens have whorl heights

of up to 8.3 mm. The apical angle is low (20°), the inter-whorl suture only slightly impressed. The upper whorl face is feebly concave and smooth, the junction between upper and outer whorl faces narrowly rounded, the upper part of the outer whorl face feebly convex, the remainder flattened, the junction of outer and lower whorl faces narrowly rounded, the lower whorl face very feebly convex, and smooth. The earliest whorls are smooth in some specimens (OUMNH KX.16735: Text-fig. 25C), with a marked depression occupying the middle of the outer whorl face; tubercles begin to differentiate by a whorl height of four mm, whereas in other specimens, tubercles are well-developed at whorl height of two mm (OUMNH KX.16850). There are two rows of tubercles. Those in the upper row number 14–16 per whorl, are transversely elongated, and linked to the inter-whorl suture by a feeble rib. A broad feebly concave zone separates them from the tubercles in the lower row; these are approximately twice as numerous, elongated parallel to the inter-whorl suture and are borne on a feeble ridge.

DISCUSSSION: See Wright and Kennnedy (1996, p. 330). The presence of only two rows of tubercles differentiates the species from *N. carcitanense* and *N. oberlini*.

OCCURRENCE: Lower Upper Cenomanian, New Mexico, southern England, and Central Tunisia.

Genus and subgenus *Mariella* (*Mariella*)
Nowak, 1916

TYPE SPECIES: *Turrilites Bergeri* Brongniart, 1822, p. 395, pl. 7, fig. 3, by the original designation of Nowak (1916, p. 10).

Mariella (*Mariella*) *bergeri* (Brongniart, 1822)
(Pl. 36, Figs 19, 21, 23)

1822. *Turrilites bergeri* Brongniart, p. 395, pl. 7, fig. 3.
2015. *Mariella* (*Mariella*) *bergeri bergeri* (Brongniart, 1822); Klein, pp. 131, 133 (with synonymy).
?2019. *Mariella* (*Mariella*) *bergeri* (Brongniart, 1822); Gautam *et al*., p. 25, text-fig. 25d–f.

TYPE: The holotype, by monotypy, is the original of Brongniart (1822, pl. 7, fig. 3), from the Montagne de Fiz, Savoie, France. It has not been traced.

MATERIAL: OUMNH KX.14293 (collective of 9 specimens), and 14294 (collective of 11 specimens), from the upper Upper Albian *puzosianum* fauna 2.5 km south of Djebel Djerissa, Central Tunisia.

DESCRIPTION: Specimens comprise up to four whorls; the largest fragment has a whorl height of 22 mm. The apical angle is 45°, the whorls in tight contact, the upper whorl face concave, with radial grooves to accommodate the ribs on the base of the preceding whorl. The outer whorl face is strongly convex, the lower whorl face flattened. There are six rows of tubercles in a distance equal to the exposed whorl height. The tubercles in the upper row are transversely elongated, and linked to the inter-whorl suture by a narrow, markedly prorsiradiate rib. A very feeble rib connects to a second row of feebly transversely elongated, adaperturally displaced tubercles, and thence to a third row of conical tubercles just above the inter-whorl suture, in which a fourth row is partially concealed. The tubercles in the lowest row give rise to radial ribs that extend across the lower whorl face.

DISCUSSION: See Atabekian (1985, 1987) for a comprehensive review of the species.

OCCURRENCE: Upper Upper Albian, southern England, France, Switzerland, Germany, Spain, Sardinia, Hungary, Iran, Morocco, Central Tunisia, KwaZulu-Natal in South Africa, Tamil Nadu in South India, Venezuela and California.

Mariella (*Mariella*) *oehlerti oehlerti*
(Pervinquière, 1910)
(Pl. 37, Figs 10, 15, 23)

1910. *Turrilites Oehlerti* Pervinquière, p. 53, pl. 14 (5), figs 14–17; text-fig. 24.
2015. *Cenomariella oehlerti oehlerti* (Pervinquière, 1910); Klein, pp. 152, 154 (with synonymy).

TYPE: The holotype is MNHN. F. J13735, the original of Pervinquière (1910, p. 53, pl. 14 (5), fig. 16), from Sour El-Ghozlane (Aumale) in northern Algeria.

MATERIAL: MNHN. F. J13726, the original of Pervinquière (1910, pl. 14 (5), fig. 17), from Djebel Guessa in northern Algeria. MNHN. F. J13721, the original of Pevinquière (1910, pl. 14 (5), fig. 15), from Sour El-Ghozlane (Aumale) in northern Algeria.

DESCRIPTION: The holotype (Pl. 37, Fig. 10) comprises nine whorls, with a maximum height of 36 mm and a maximum preserved whorl height of 9.9 mm.

The whorls are in tight contact, the inter-whorl suture quite deeply incised, the outer whorl face markedly convex in inter-costal section. There are four rows of tubercles, 18 per whorl. Those in the first row are situated above the middle of the outer whorl face and are rounded and flat-topped. They are linked by a low prorsiradiate rib to a second row of spirally elongated tubercles, displaced adaperturally of the first, and situated below the middle of the outer whorl face. A low, effaced rib links to a third row, close to the second, displaced adaperturally, and housed in notches in the inter-whorl suture. A fourth row of tubercles, again displaced adaperturally, is situated on the outer part of the lower whorl face, and give rise to progressively narrowing ribs that extend across the lower whorl face. MNHN. F. J13726 (Pl. 37, Fig. 23) has comparable ornament, comprising just over three whorls, with a total height of 15.1 mm and as maximum preserved whorl height of 6.8 mm. MNHN. F. J13721 (Pl. 37, Fig. 15) is a slightly smaller individual comprising four whorls.

DIDSCUSSION: *Mariella* (*M.*) *oehlerti* is discussed by Klinger and Kennedy (1978), who recognised two subspecies on the basis of abundant material from the Lower Cenomanian of northern KwaZulu-Natal in South Africa: *oehlerti sensu stricto* (1978, p. 31, pl. 3, fig. e; pl. 4, fig. e; pl. 6, figs h–n; pl. 7, fig. g; pl. 8, figs g–h; text-figs 1a, b 7b, d, 8g) and *oehlerti sulcata* (p. 33, pl. 3, fig. d; pl. 8, fig. d; text-figs 3d–e, 8h), characterised by the presence of a distinctive spiral groove between the second and third rows of tubercles. See also Matsumoto *et al.* (1999, p. 113).

OCCURRENCE: Lower Cenomanian, northern Algeria, KwaZulu-Natal in South Africa, Mozambique, Madagascar, Japan, and Turkmenistan.

Mariella (*Mariella*) *numida* (Pervinquière, 1910)
(Pl. 37, Fig. 12)

1910. *Turrilites bergeri* var. *numida* Pervinquière, p. 53, pl. 14 (5), figs 12, 13.
2015. *Mariella* (*Mariella*) *numida* (Pervinquière, 1910); Klein, pp. 132, 149 (with synonymy).

TYPE: The lectotype, here designated, is MNHN. F. J13724, the original of *Turrilites bergeri* var. *numida* of Pervinquière (1910, p. 53, pl. 14 (5), figs 12, 13), from Djebel Guessa, northern Algeria. (Pervinquière (1910, p. 53) noted: "Pour deux ou trois autres, tel que celui figure planche V, figure 12–13, l'accord [with *Turrilites bergeri*] est moins parfait." This suggests to me that his var. *numida* was based on several specimens, hence the lectotype designation above).

DESCRIPTION: The total height of the lectotype is 15.6 mm, with four whorls preserved; the maximum preserved whorl height 4.8 mm. The apical angle is low (18°), the whorls in tight contact, the upper whorl face markedly concave, the junction of upper and outer whorl faces very narrowly rounded, the upper part of the outer whorl face broadly rounded, the remainder feebly convex. There are four rows of tubercles, three on the outer whorl face, the fourth just above the inter-whorl suture. The tubercles in the first and third rows are subequal, those in the second row slightly larger. The rows are separated by narrow spiral grooves, such that the tubercles appear to be borne on a raised spiral ridge. The tubercles are blunt and transversely elongated, numbering 33 per whorl. The tubercles in the lowest row link to relatively coarse ribs that extend across the lower whorl face.

DISCUSSION: The four rows of crowded tubercles, separated by narrow spiral groooves distinguishes *numida* from all other described species of *Mariella* (*Mariella*).

OCCURRENCE: As for type.

Mariella (*Mariella*) *hillyi* (Dubourdieu, 1953)

1953. *Paraturrilites hillyi* Dubourdieu, p. 46, pl. 6, figs 1–3.
2015. *Mariella hill*yi Dubourdieu, 1953; Klein, pp. 132, 146 (with full synonymy).

TYPE: The holotype, by monotypy, is the orignal of Dubourdieu (1953, pl. 4, figs 1–3), from the upper Upper Albian 9 km south of Djebel Def, Central Tunisia. It has not been traced.

DESCRIPTION AND DISCUSSION: Dubourdieu describes the species as having 26 fine prorsiradiate ribs with four rows of tubercles, the upper row situated on the upper part of the outer whorl face, the second row on the lower part of the outer whorl face, the third row partially concealed in crenulations in the inter-whorl suture. The tubercles in these three rows feebly transversely elongated, and the ribs with a tendency to divide into two, and loop between the tubercles. The fourth row of tubercles is situated on the outer part of the lower whorl face, and the tubercles are smaller than those in the other rows. I have seen no additional specimens.

OCCURRENCE: As for type.

Mariella (*Mariella*) *kerkourensis* (Dubourdieu, 1953)

1953. *Paraturrilites kerkourensis* Dubourdieu, p. 48, pl. 6, figs 4–10; text-fig. 14.
2015. *Mariella kerkourensis* (Dubourdieu, 1953); Klein, pp. 132, 146 (with full synonymy).

TYPES: The species is based on three syntypes from the upper Upper Albian in the environs of Henchir el Kerkour, west of Djebel Ouenza in north-eastern Algeria. They have not been traced.

DESCRIPTION AND DISCUSSION: The species is characterised by a high apical angle of between 40 and 50º, the whorls low and rounded, the upper whorl face only feebly concave, the inter-whorl suture deeply incised. There are four rows of tubercles, only two of which are exposed, the third row concealed in the inter-whorl suture, the fourth on the outer part of the lower whorl face. The upper row of tubercles are situated on the upper third of the outer whorl face, the second row the lower third, the tubercles in the two rows equal, feebly transversely elongated, and linked by a feebly prorsiradiate rib. The tubercles in the third and fourth rows are smaller and conical, those in the fourth row giving rise to a radial rib.

I have seen no further specimens.

OCCURRENCE: As for types.

Mariella (*Mariella*) *harchaensis* (Dubourdieu, 1953)
(Pl. 36, Figs 10, 12, 13, 17, 20; Text-fig. 24H)

1953. *Turrilites harchaensis* Dubourdieu, p. 53, pl. 4, figs 14–21; text-fig. 16.
2015. *Mariella* (*Mariella*) *harchaensis* (Dubourdieu, 1953); Klein, pp. 132, 146 (with full synonymy).

TYPES: The species is based on four syntypes from the Lower Cenomanian north-east of Koudiat el Assel, north-eastern Algeria, of which the original of Dubourdieu (1953, pl. 4, figs 18, 19), was designated lectotype by Wright and Kennedy (1996, p. 345). They have not been traced.

MATERIAL: There are more than 100 specimens from the Lower Cenomanian *harchaensis* fauna 700 m north-east of Koudiat el Assel, including OUMNH KX.16357, 16361, 16370–16383, and 16384c, e, f.

DESCRIPTION: Fragments have whorl heights of up to 11 mm. The apical angle is 19–20°, the whorls high, the upper whorl face deeply concave, the inter-whorl suture feebly impressed. There are four rows of tubercles, 24–27 per whorl, the numbers equal in each row, the tubercles of successive whorls displaced adaperturally from those in the preceding row. Only three rows of tubercles are visible on the outer whorl face. The tubercles in the first row are situated on the upper third of the outer whorl face, the second row at the lower three-fifths, the third row slightly above the inter-whorl suture The distance between second and third rows is smaller than that between the first and second rows, and equal to that between the third and fourth rows. The tubercles in the first three rows are more or less equal, those in the fourth row are smaller, and barely detectable in the smallest individuals. The third and fourth rows of tubercles are linked by feeble ribs that extend across the lower whorl face, and there are traces of ribs between the second and third rows. There are no traces of ribs on the upper part of the outer whorl face, or between the first and second rows of tubercles.

DISCUSSION: Dubourdieu (1953, p. 53) indicated that his new species was very close to *Turrilites pervinquierei* Diener, 1925, introduced as a *nomen novum* for *Turrilites Wiestii*? Sharpe of Pervinquière (1907, p. 98, pl. 4, figs 13, 14; text-fig. 27), based on three specimens from the 'Vraconniene' of Djebel Djerissa. He differentiated the two on the basis that the upper whorl face of *harchaensis* was more markedly excavated than that of *pervinquierei*; the tubercles more numerous in *harchaensis*: 24–27 versus 18–21 per whorl; the tubercles in the third row were equidistant from those in the second and fourth rows in *harchaensis*, whereas in *pervinquierei* the third and fourth rows were closer together, and that the impression on the upper whorl face, housing the fourth row of tubercles of the preceding whorl, were close to the inter-whorl suture in *pervinquierei*, but more widely separated in *harchaensis*.

OCCURRENCE: Lower Lower Cenomanian of north-eastern Algeria.

Mariella (*Mariella*) *pervinquierei* (Diener, 1925)
(Pl. 36, Figs 11, 15, 16, 22; Text-fig. 24F)

1907. *Turrilites* cf. *Wiesti*? Sharpe; Pervinquière 1907, p.84, pl. 4, figs 13, 14; text-fig. 27.
1925. *Turrilites pervinquierei* Diener, p. 84.
1953. *Turrilites pervinquierei* Diener; Dubourdieu, p. 56, pl. 4, figs 23–27; text-fig. 17.

1978. '*Turrilites' pervinquierei* Diener; Klinger and Kennedy, p. 44.
2015. *Turrilites pervinquierei* Diener; Klein, pp. 176, 186.

TYPES: Diener introduce his *Turrilites pervinquierei* as a *nomen novum* for *Turrilites* cf. *Wiesti* Pervinquière 1907, p. 98, pl. 4, figs 13, 14; text-fig. 27, based on three specimens from the 'Vraconnien' of Djebel Djerissa, and *Turrilites* cfr. *Wiestii* Pervinquière (*non* Sharpe) of Böse (1923, p. 153, pl. 10, figs 42–47), based on seven specimens from the 'vraconiano' between Camacho and the Trinidad mine, Zacatecas, Mexico. MNHN. F. J13780, the original of Pervinquière (1907, p. 4, figs 13, 14; text-fig. 27), is here designated lectotype.

MATERIAL: There are numerous specimens from the Lower Cenomanian *harchaensis* fauna 700 m north-east of Koudiat el Assel, including OUMNH KX.16360, 16383 and 16384a, d.

DESCRIPTION: The lectotype comprises four whorls, the maximum preserved height 15.5 mm, the maximum preserved whorl height 5.5 mm. The whorls are in tight contact, the upper whorl face markedly concave, the junction between upper and outer whorl faces narrowly rounded, the outer whorl face convex, the lower whorl face feebly convex. There are four rows of tubercles, with an equal number-21-per whorl in each row. The upper part of the outer whorl face above the first row of tubercles, is smooth. The first row of tubercles lies well above the mid-flank, and are rounded-conical to feebly elongate. The tubercles in the second row are of comparable size and shape, but displaced adaperturally. The third row of tubercles lies just above the inter-whorl suture and are smaller, transversely elongated and oblique. A well- developed prorsiradiate rib links the tubercles in the third and fourth rows, the latter rounded/conical to elongated and situated on the outer part of the lower whorl face.

The suture (Pervinquière 1907, text-fig. 27) is quite deeply incised, with broad, asymmetrically bifid E/A.

The present specimens have whorl heights of up to 22 mm.

DISCUSSION: Differences from co-occuring *Mariella* (*M.*) *harchaensis* are described above under that species.

OCCURRENCE: The types are from the 'Vraconnien' of Central Tunisia. The present material is from north-eastrn Algeria and Central Tunisia. Upper Albian *puzosianum* fauna of north-eastern Algeria and Central Tunisia.

Mariella (*Mariella*) sp.
(Pl. 1, Fig. 7)

MATERIAL: OUMNH KX.9764, from the Lower Cenomanian of Djebel Si Abd el Kerim, Central Tunisia.

DESCRIPTION: The specimen is a crushed composite mould of two whorls of a *Mariella* with a maximum preserved whorl height of 35 mm. The original whorl proportions cannot be established. There are four rows of tubercles, six in a distance to the whorl height. Low, broad, feebly prorsiradiate ribs arise at the inter-whorl suture, and link to a transversely elongated tubercle well above the mid-point of the outer whorl face. A smooth zone separates this row from a second row of slightly smaller adaperturally displaced conical to feebly transversely elongated tubercles below the mid-point of the outer whorl face. A third row of adaperturally displaced tubercles lie just above the inter-whorl suture, and a fourth row of smaller transversely elongated tubercles are concealed in the inter-whorl suture.

DISCUSSION: The large size of this fragment, probably part of an adult body chamber, makes comparisons with the tiny limonitic specimens that dominate the present faunas difficult. The presence of numerous rows of tubercles, 12 on the fragment, and perhaps twice this number per whorl, suggests comparison to *Mariella* (*M.*) *harchaensis*, described above.

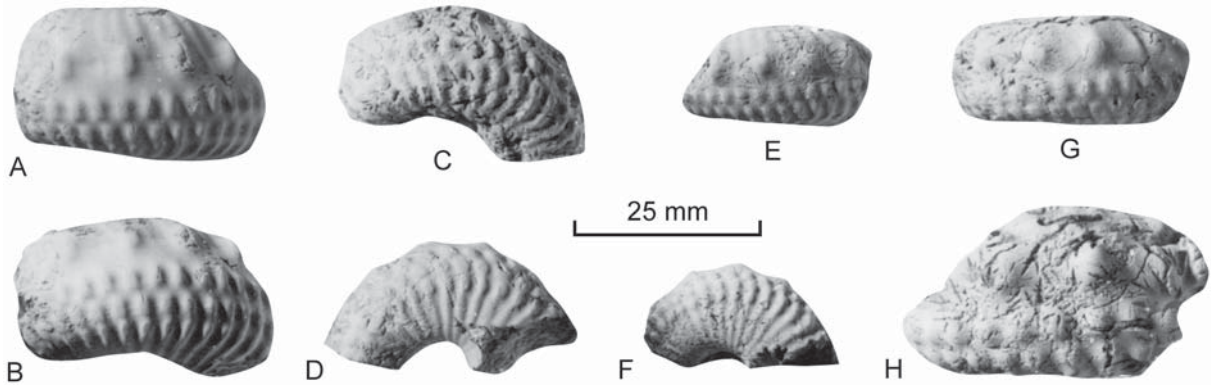
OCCURRENCE: As for material.

Genus *Hypoturrilites* Dubourdieu, 1953

TYPE SPECIES: *Turrilites gravesianus* d'Orbigny, 1842, p. 596, pl. 144, figs 3–5, by the original designation of Dubourdieu (1953, p. 44).

Hypoturrilites schneegansi Dubourdieu, 1953
(Pl. 35, Figs 1–4; Text-fig. 26A–H)

1953. *Hypoturrilites schneegansi* Dubourdieu, p. 63, pl. 4, figs 34–40; text-fig. 19.
1994. *Hypoturrilites schneegansi* Dubourdieu, 1953; Amédro in Robaszynski *et. al*., pl. 16, figs 1–5.
2015. *Hypoturrilites schneegansi* Dubourdieu, 1953; Klein, pp. 157, 165 (with additional synonymy).



Text-fig. 26. *Hypoturrilites schneegansi* Dubourdieu, 1953. A series of fragments from the Lower Cenomanian of the Kef el Azreg section, Central Tunisia (Robaszynski *et al*. 1994, p. 373; text-fig. 12), and figured in that work: A, B – pl. 16, fig. 4; C, D – pl. 16, fig. 2; E, F – pl. 16, fig. 5; G – pl. 16, fig. 3; H – pl. 16, fig. 7. All figures are × 1

TYPES: Dubourdieu (1953, p. 66) mentions 14 specimens in his original account of the species; Amédro in Robaszynski *et. al*. (1994), figured one of Dubourdieu's specimens, the original of the latter's pl. 4, figs 38, 39, as his pl. 16, fig. 1, and designated it lectotype; it is FSL 596085, from Djebel Bou Khadra in north-eastern Algeria.

MATERIAL: OUMNH KX.13938, 16342 (collective of 14 specimens), 16343 (collective of 17 specimens), 16344–16351, and 16352 (collective of 15 specimens), all from the Lower Cenomanian *harchaensis* fauna 700 m north-east of Koudiat el Assel, north-eastern Algeria.

DESCRIPTION: The present fragmentary material has whorl heights of up to 9 mm. The apical angle varies around 35°. The inter-whorl suture is deeply impressed, the upper whorl face feebly concave, with radial grooves that terminate in a conical pit to accommodate the ornament on the base of the preceding whorl. The junction between the upper and outer whorl faces is broadly rounded and crenulated, the crenulations accommodating the third row of tubercles of the previous whorl, the outer whorl face strongly convex in intercostal section, the junction of outer and lower whorl faces broadly rounded, the base of the whorl feebly convex. There are around 11 large conical to transversely elongated tubercles in the upper row (Dubourdieu mentions eight to twelve per whorl in his material), situated a little above the mid-point of the outer whorl face, and connected to the inter-whorl suture by a well-developed feebly prorsiradiate rib. One or two ribs arise at the inter-whorl suture and intercalate between the tubercles. A second row of smaller, transversely elongate tubercles are more than twice as numerous, and located just above the inter-whorl suture. A third row of smaller tubercles are housed in the notches in the inter-whorl suture. A fourth row of tubercles, barely differentiated from those in the third row are situated on the outer most part of the lower whorl face, and give rise to strong feebly flexuous ribs that weaken progressively, but extend across all of the lower whorl face.

Through the courtesy of Francis Amédro I have been able to examine larger, phosphatised fragments from the Kalaat Senan area (Amédro in Robaszynski *et al*. 1994, pl. 16, figs 2–5: Text-fig. 26A–H herein) with whorl heights of up to 20 mm, with the same ornament as the smaller specimens described here. They show well the highly distinctive crowded, closely spaced tubercles in the lower three rows.

DISCUSSION: The distinctive features of *Hypoturrilites schneegansi* are the presence of four rows of tubercles, those in the lower three rows close spaced, together, with well-developed ribs on the upper part of the outer whorl face linking to, and intercalating between the tubercles in the upper row. This style of ornament is also shown by *Hypoturrilites laevigatus* (Coquand, 1862), of which *Hypoturrilites tuberculatoplicatus* var. *tenouklensis* (Pervinquière, 1910) is a synonym (see discussion in Wright and Kennedy, 1996, p. 374, pl. 102, fig. 2; text-fig. 146k–m, p, q; and Kennedy in Kennedy and Gale, 2015, p. 312, pl. 24, fig. 18; text-fig. 34a–d), but this species has three, rather than four rows of tubercles. *Hypoturrilites tuberculatoplicatus* (Seguenza, 1882), from the Ceno-

manian of San Giorgio, near Brancaleone, Calabria, Italy, is revised by Wright and Kennedy (1996, p. 374, pl. 108, fig. 7, pl. 113, figs 3, 4, 6, 8, 9), and has four rows of tubercles, as in the present species. They differ in that the second and third rows of tubercles are spirally rather than transversely elongated, and borne on spiral ridges.

OCCURRENCE: Lower Cenomanian of Central Tunisia.

Hypoturrilites betieri Dubourdieu, 1953

1953. *Hypoturrilitesw betieri* Dubourdieu, p. 61, pl. 4, figs 31–33; text-fig. 18.
1978. *Hypoturrilites betieri* Dubourdieu,1953; Klinger and Kennedy, p. 41.
2015. *Hypoturrilites betieri* Dubourdieu, 1953; Klein, p. 156.

TYPE: The holotype, by monotypy, is the original of Dubourdieu (1953, p. 61, pl. 4, figs 31–33; text-fig. 18). It was from the Lower Cenomanian, niveau H of Dubourdieu, in the region of Oued Bou Sbaa, north-eastern Algeria. It has not been traced.

DISCUSSION: On the basis of Dubourdieu's account, the species has the following characteristics. Apical angle 35–40°, whorls low, outer whorl face strongly convex, inter-whorl suture deeply impressed. There are four rows of tubercles, of which only the upper two rows are visible except on the final whorl. The upper row, situated at the upper third of the outer whorl face, are large and prominent, numbering 10–11 per whorl. The second row are situated two thirds of the way down the outer whorl face, and are smaller, elliptical, and more numerous than those in the first row, numbering 17–18 per whorl. There are the same number of tubercles in the third and fourth rows. The third row is concealed in the inter-whorl suture, the tubercles elongated normal to the axis of coiling. The tubercles in the fourth row are close to those in the third row, smaller, and give rise to a delicate rib that extends to the umbilicus.

No further specimens have been seen.

OCCURRENCE: As for type.

Genus *Mesoturrilites* Breistroffer, 1953

TYPE SPECIES: *Turrilites Aumalensis* Coquand, 1862, p. 323, pl. 35, fig. 5, by the original designation of Breistroffer (1953b, p. 1351).

Mesoturrilites aumalensis (Coquand, 1862)
(Text-fig. 27A–G)

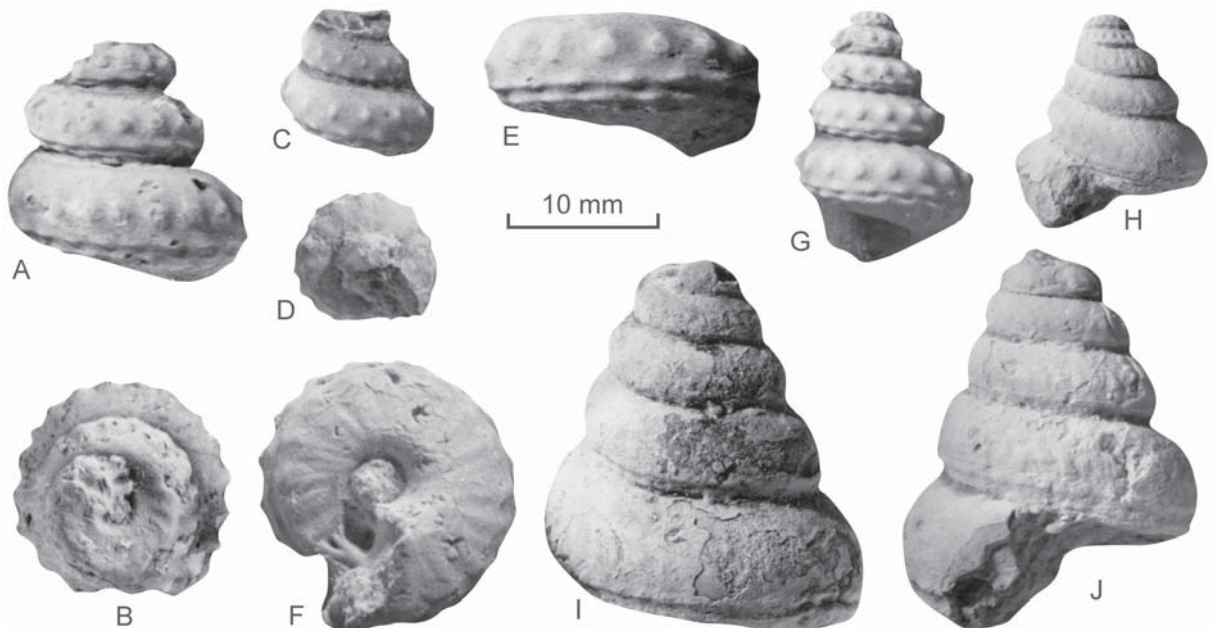
1862. *Turrilites Aumalensis* Coquand, p. 323, pl. 35, fig. 5.
1910. *Turrilites Aumalensis* Coquand; Pervinquière, p. 58, pl. 14 (5), figs 21–26.
1996. *Mesoturrilites aumalensis* (Coquand, 1862); Wright and Kennedy, p. 346, pl. 98, fig. 5; pl. 105, figs 2, 3, 14; text-figs 134j, k, 138s–u, w, 146a–g.
2015. *Mesoturrilites* (*Mesoturrilites*) *aumalensis* (Coquand, 1862); Klein, pp. 170, 171 (with synonymy).

TYPES: Four specimens survive in the Coquand Collection (Text-fig. 27A–G): GMH K-7880a (Text-fig. 27A, B) was designated lectotype by Wright and Kennedy (1996, p. 346). All are from west of Boghar, northern Algeria.

MATERIAL: MNHN. F. J13728, the original of Pervinquière 1910, pl. 14 (5), fig. 21, from Sidi-Ali, northern Algeria. MNHN. F. J13743, the original of Pervinquière (1910, pl. 14 (5), fig. 22), from Sour El-Ghozlane (Aumale), northern Algeria. MNHN. F. J13738 is the original of Pervinquière (1910, pl. 14 (5), fig. 23), from Djebel Guessa, northern Algeria.

DESCRIPTION: The apical angle is 40–45º. The whorls are in tight contact. The upper whorl face is concave, with radial grooves to accommodate the ribs on the base of the preceding whorl. The upper half of the outer, exposed whorl face is convex, and smooth. There is a row of large, conical tubercles situated approximately one third of the way down from the inter-whorl suture. Their number varies from 16 per whorl in GMH K-7880a (Text-fig. 27A, B) to 18 in GMH K-7880b (Text-fig. 27C, D), to 20 in GMH K-7880c (Text-fig. 27E, F). A smooth zone separates this row of tubercles from a second row of much smaller, spirally elongated tubercles, similar in number, but displaced slightly adaperturally, and linked by a low, spiral ridge. A spiral groove separates this row from a third row of tubercles, again similar in number, and the same size as those in the second row, displaced adaperturally, and also borne on a spiral ridge. A fourth row of similar tubercles is concealed in the inter-whorl suture. They give rise to a series of radial ribs on the base of the whorl that decrease in strength towards the umbilicus. The rib and tubercle density on these specimens increases with increasing size, as does the strength and differentiation of the fourth, and lowest row of tubercles.

MNHN. F. J13728 (Pl. 37, Fig. 22) comprises 1.5 whorls. MNHN. F. J13743 (Pl. 37, Figs 19, 20) com-



Text-fig. 27. **A-G** – *Mesoturrilites aumalensis* (Coquand, 1862). A, B – the lectotype, GMH K-7880a, figured by Pervinquière 1910, pl. 14 (5) fig. 25; C, D – paralectotype GMH K-7880b; E, F – paralectotype GMH K-7880c; G – paralectotype GMH K-7800d, the original of Pervinquière 1910, pl. 14 (5) fig. 24, all from west of Boghar, northern Algeria. **H-J** – *Mesoturrilites serpuliforme* (Coquand, 1862). H – the lectotype, GMH K-8456; I, J – paralectotpe, GMH K-8822, both from Sour El-Ghozlane (Aumale), northern Algeria. All figures are × 2

prises two whorls with a maximum preserved whorl height of 7.2 mm, and 19 tubercles per whorl in the upper row. MNHN. F. J13738 (Pl. 37, Fig. 24) comprises 3.5 whorls with a maximum height of 23.3 mm, and a maximum preserved whorl height of 19.3 mm and 16 tubercles per whorl in the upper row.

DISCUSSION: *Mesoturrilites aumalensis* is distinguished from *M. serpuliforme* (Coquand, 1862) (see below) in its much coarser tuberculation and the absence of crowded ribs on the upper part of the outer, exposed whorl face (compare Text-fig. 27A–G and 27H–J). *Mesoturrilites corrugatus* Wright and Kennedy, 1996 (p. 348, pl. 98, figs 4, 17: see below) lacks tubercles on the middle part of the outer, exposed whorl face. *Mesoturrilites boerssumensis* (Schlüter, 1876) (p. 129, p. 28, figs 6, 7; see revision in Wright and Kennedy 1996, p. 347, pl. 105, figs 4, 20; and Kaplan *et al.* 1998, p. 210, pl. 63, figs 7, 8, 10) has a lower apical angle, and relatively coarse ribs on the upper part of the outer whorl face that terminate in incipient tubercles. *Mesoturrilites alternans* (Schlüter, 1876) (p. 130, pl. 38, fig. 9; see Kaplan *et al.* 1998, p. 212, pl. 58, fig. 5) remains poorly known; the type is lost. Schlüter's figure shows a turrilitid with alternately weak and strong ribs covering most of the outer, exposed whorl face, with two spiral ridges below. The specimen figured by Kaplan *et al* has weak ribs alternating with stronger ribs with a well-developed tubercle.

OCCURRENCE: Lower Cenomanian, northern Algeria, southern England, Westphalia in Germany, with possible records from south-eastern France and Japan.

Mesoturrilites corrugatus Wright and Kennedy, 1996
(Pl. 35, Figs 10, 11)

1996. *Mesoturrilites corrugatus* Wright and Kennedy, p. 348, pl. 98, figs 4, 17.
2015. *Mesoturrilites corrugatus* Wright and Kennedy, 1996; Klein, p. 170, 173 (with full synonymy).

TYPES: The holotype is BGS GSM Zb 692, the original of Wright and Kennedy (1996, pl. 98, fig. 4), from the Lower Cenomanian *Neostlingoceras carcitanense* Subzone of Norton Ferris, Wiltshire. U.K. Paratype OUMNH KX.38108 is the original of Wright and Kennedy (1996, pl. 98, fig. 17), from the Lower Cenomanian *Mantelliceras dixoni* Zone Lower Chalk of Southerham near Lewes, Sussex, U.K.

MATERIAL: OUMNH KX.9649–9650, from the Lower Cenomanian of Kat el Margueb, north of Djebel Fguira Salah, Central Tunisia.

DESCRIPTION: OUMNH KX.9649 (Pl. 35, Fig. 10), a crushed individual, consists of two whorls with a maximum preserved whorl height of 5.5 mm approximately. The apical angle is estimated at between 30 and 35°. The inter-whorl suture is only moderately impressed, the upper part of the outer whorl face broadly rounded, the middle and lower parts flattened. The rib index is 3–4, the ribs coarse, very feebly prorsiradiate, strong on the upper part of the outer whorl face, but weakening and effacing on the lower part. There is a marked ridge at the base of the outer whorl face that bears spirally elongated tubercles that correspond to the terminations of the ribs. A narrow groove separates this ridge from a second row of adaperturally displaced spirally elongated tubercles, housed in the inter-whorl suture. These give rise to relatively strong radial ribs on the lower whorl face, although their extent is unclear because of poor preservation. OUMNH KX.9650 (Pl. 35, Fig. 11) is a smaller fragment of three whorls, the total height 10.1 mm, with comparable ornament on the outer whorl face.

DISCUSSION: See Wright and Kennedy (1996, p. 349).

OCCURRENCE: Lower Cenomanian, southern England and Central Tunisia.

Mesoturrilites serpuliforme (Coquand, 1862)
(Pl. 37, Figs 16–18, 21, 25; Text-fig. 27H–J)

1862. *Heteroceras serpuliforme* Coquand p. 178, pl. 2, fig. 7.
1910. *Turrilites Peroni* Pervinquière, p. 60, pl. 14 (5), figs 27–30; text-figs 28, 29.
1996. *Mesoturrilites serpuliforme* (Coquand, 1962); Wright and Kennedy, p. 348, pl. 98, fig. 10; pl. 102, fig. 5; text-figs 138p–r, x, 146h, i, j.
2015. *Mesoturrilites* (*Klingerella*) *serpuliforme* (Coquand, 1962); Klein, pp. 174, 175 (with additional synonymy).

TYPES: The lectotype, by the subsequent designation of Wright and Kennedy (1996, p. 348) is GMH K-8456 (Text-fig. 26H); GMH K-8822 (Text-fig. 27I, J) is a paralectotype. Both are from Sour El-Ghozlane (Aumale), northern Algeria.

MATERIAL: OUMNH KX.16424, from the lower Lower Cenomanian *carcitanense* fauna north of Djebel Hameima, Central Tunisia.

DESCRIPTION: The lectotype (Text-fig. 27H) is a wholly septate limonitic internal mould 12.5 mm high, comprising 4.5 whorls. The apical angle is 55° approximately. The whorls are in tight contact. The upper whorl face is concave, the outer and lower whorl faces feebly convex. The upper part of the outer whorl face is smooth. Numerous small transversely elongated rounded-oval tubercles are present just below the middle of the outer whorl face. These are connected in some cases by feeble prorsiradiate ribs to a row of 30 spirally elongated tubercles per whorl, borne on a low ridge. This is separated by a pronounced groove from a second row of similar, but possibly more numerous tubercles, also borne on a spiral ridge. The lower whorl face is ornamented by delicate radial ribs.

Paralectotype GMH K-8822 (Text-fig. 27I, J) consists of five whorls, with a total height of 23.8 mm. The specimen is wholly septate, and shows well the two rows of tubercles borne on spiral ridges, and a row of tiny tubercles on the lower whorl face.

Turrilites peroni Pervinquière 1910 (pl. 14 (5), fig. 27–30; text-figs 28, 29) is a synonym. The holotype, the original of Pervinquière's fig. 27 (Pl. 37, Fig. 25), MNHN. F. J13742), from Sour El-Ghozlane (Aumale), northern Algeria, has decomposed badly since its original description and illustration. The maximum preserved height is 32.4 mm, with seven whorls present, the maximum whorl height 9.7 mm, the later whorls crushed. The whorls are in tight contact, the inter-whorl suture deeply impressed, the outer whorl face convex, the upper two thirds near-smooth on the adapical whorls, and ornamented by delicate feeble, crowded, concave ribs on the adapertural whorls. They are flat-topped and ribbon-like, with six in a distance equal to the exposed whorl height, and terminate in tiny bullae. A smooth zone separates them from a spiral ridge ornamented by delicate spirally elongated tubercles, displaced adaperturally of the rib terminations. A narrow groove is succeeded by a second spiral ridge that bears very feebly differentiated to obsolete tubercles. MNHN. F. J13732 (Pl. 37, Figs 17, 18), also from Sour El-Ghozlane (Aumale), is the original of Pervinquière's fig. 28. Just under two whorls are preserved, the total height of the fragment 17 mm, the maximum preserved whorl height 7.7 mm. Better preserved than the previous specimen, the ribs on the upper part of the outer whorl face are strongly prorsiradiate, with minute, well-differentiated tubercles on the two spiral ridges, those in the lower row giving

rise to delicate rursiradiate ribs that extend across the lower whorl face. MNHN. F. J13737 (Pl. 37, Fig. 16) is the original of Pervinquière's fig. 29, from Djebel Guessa, northern Algeria. Four whorls are preserved, the total height of the specimen 15.6 mm, the maximum preserved whorl height 7.1 mm. The ornament is distinctly coarser than in the previous specimens. The original of Pervinquière's fig. 30 (Pl. 37, Fig. 21) is from Berrouaghia, northern Algeria, and the largest specimen seen, comprising three whorls with a total height of 38 mm and a maximum preserved whorl height of 15 mm.

OUMNH KX.16424 (Pl. 1, Fig. 3) is a crushed composite mould from one of the thin limestones within the Lower Cenomanian part of the Fahdène Formation north of Djebel Hameima. Three whorls are preserved, the maximum whorl height 10.1 mm. Fine ribs extend across the outer whorl face, with a minute spirally elongated tubercles above mid-flank, below which the ribs weaken, linking to a second row of spirally elongated tubercles at the base of the outer whorl face, and indications of a third row concealed in the inter-whorl suture.

DISCUSSION: The combination of crowded ribs on the upper part of the outer, exposed whorl face, linking to tiny tubercles and numbering 30 or more per whorl, distinguish s*erpuliforme* from other *Mesoturrilites*.

OCCURRENCE: Lower Lower Cenomanian where well-dated, with records from northern Algeria, Central Tunisia, southern England, and Westphalia, Germany.

Mesoturrilites boukhadraensis (Dubourdieu, 1953)

1953. *Turrilites boukhadraensis* Dubourdieu, p. 50, pl. 4, figs 11–13; text-fig. 15.
2015. *Mesoturrilite*s (*Klingerella*) *boukhadraensis* (Dubourdieu, 1953); Klein, p. 174.

TYPE: The holotype, by monotypy, is the original of Dubourdieu (1953, pl. 4, figs 11–13; text-fig. 15), from the Lower Cenomanian in the environs of Djebel Bou Khadra, north-eastern Algeria. It has not been traced.

DESCRIPTION AND DISCUSSION: According to Dubourdieu's account, the whorls are low, the upper surface feebly concave, the inter-whorl suture deeply impressed, the apical angle 30°. There are four rows of tubercles, fifteen per whorl, aligned obliquely; there are no ribs. Only two rows of tubercles are visible on the outer whorl face, the third row concealed in the inter-whorl suture. The tubercles in the upper row are situated a little below the middle of the outer whorl face and are strong and conical. Those in the second row are feebly spirally elongated and are situated a little above the inter-whorl suture. The tubercles in the third row are close to those in the fourth row, which are smaller, conical, and give rise to radial ribs that extend across the lower whorl face.

I have seen no further specimens.

OCCURRENCE: As for type.

Genus T*urrilites* Lamarck, 1801

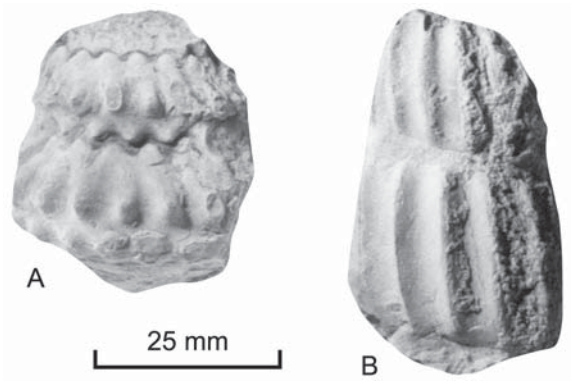
TYPE SPECIES: *Turrilites costatus* Lamarck, 1801, p. 102, by original designation by Lamarck (1801, p. 102).

Turrilites scheuchzerianus Bosc, 1801
(Pl. 36, Figs 1–4, 7–9; Pl. 37, Figs 3, 4, 6–9, 14; Text-fig. 28B)

1708. *Turbinites* Langius, p. 112, fig. 6.
1801. *Turrilites Scheuchzerianus* Bosc in Buffon, p. 190 (copy of Langius).
non 1910. *Turrilites Scheuchzerianus* Bosc; Pervinquière, p. 50, pl. 14 (5), fig. 2 (a gastropod).
1910. *Turrilites costatus* Lamarck; Pervinquière, p. 50 (*pars*), pl. 14 (5), figs 3–5.
1996. *Turrilites scheuchzerianus* Bosc, 1801; Wright and Kennedy, p. 349, pl. 106, figs 7, 8, 11, 12; pl. 107, figs 1–7; text-figs 137g, j, 138c, d, f, g, h, i, n, 139d–i, 140a, d, e, f, g, h, i, 143h; 147a, b (with full synonymy).
2015. *Turrilites scheuchzerianus* Bosc, 1801; Klein, p. 176, 186 (with additional synonymy).
2015. *Turrilites scheuchzerianus* Bosc, 1801; Kennedy in Kennedy and Gale, p. 314, pl. 24, figs 6–8, 11–13, 16, 19.
2019. *Turrilites scheuchzerianus* Bosc, 1801; Kennedy in Gale *et al*., p. 286, pl. 57, figs 16, 21.

TYPE: Bosc's figure is a copy of Langius (1708, pl. 112, fig. 6). The status and whereabouts of the type material of this species has not been established.

MATERIAL: Over 200 specimens: OUMNH KX.16070 (collective of 49 specimens), 16071 (collective of 85 specimens), 16702 (collective of 70 specimens), 16703, all from the upper Lower and lower Middle Cenomanian *scheuchzerianus* fauna, road-



Text-fig. 28. A – *Turrilites acutus* Passy, 1832, The holotype of *Turrilites tevesthensis* Coquand, 1862, the original of his pl. 2, fig. 5, GMH K-8382, from Tenoukla, northern Algeria. B – *Turrilites scheuchzerianus* Bosc, 1801, OUMNH KX.16073, from the Lower Cenomanian *scheuchzerianus* fauna west of Djebel Sottara, 8.5 km west of Sour El-Ghozlane (Aumale), northern Algeria. Figures are × 1

side sections on the D20 to the west of Djebel Sottara, 8.5 km west of Sour El-Ghozlane (Aumale), northern Algeria. Specimens assigned to *Turrilites costatus* by Pervinquière 1910: MNHN. F. J13734, the original of pl. 14 (5), fig. 3; MNHN. F. J13730 the original of pl. 14 (5), fig. 4; MNHN. F. J13741, the original of, pl. 14 (5), fig. 5, all from Sour El-Ghozlane (Aumale) in northern Algeria.

DESCRIPTION: All but one specimen in the present collections are fragments of juveniles with whorl heights of up to 14 mm. The apical angle varies around 25°. The upper whorl face is feebly concave and smooth, the junction between upper and outer whorl faces narrowly rounded and feebly crenulated, the outer whorl face very feebly convex, the junction between outer and lower whorl faces broadly rounded, the lower whorl face very feebly convex and smooth. There are between 20 and 25 ribs per whorl. They arise at the inter-whorl suture and are very feebly concave, varying from straight to feebly prorsiradiate. They are interrupted and near effaced on the lower part of the outer whorl face before strengthening, and extend to the base of the outer whorl face, where they are interrupted by a spiral groove before effacing entirely. OUMNH KX.16073 (Text-fig. 28B) is a crushed fragment of an adult body chamber, and has entire ribs that extend uninterrupted across the whole of the outer whorl face.

Of the specimens figured by Pervinquière (1910) as *Turrilites costatus*, three belong here. MNHN. F. J13741 (Pl. 37, Figs 8, 9), the original of Pervinquière (1910, pl. 14 (5), fig. 5), has a total height 21.5 mm and a maximum preserved whorl height 7.2 mm. The inter-whorl suture is barely impressed, the outer whorl face very feebly convex. The ribs are crowded and feebly prorsiradiate, effaced low on the outer whorl face before strengthening again, sweeping forwards and terminating in a feeble, blunt tubercle. The junction of the outer and lower whorl faces is marked by a groove and sharp spiral ridge. The base of the whorl is smooth. MNHN. F. J13730 (Pl. 37, Figs 6, 7, 14, the original of pl. 14 (5), fig. 4) has a total height of 21.6 mm, the maximum preserved whorl height of 8.2 mm. There are 26 crowded feebly prorsiradiate ribs per whorl that extend across most of the outer whorl face before weakening, to produce a spiral impressed zone then strengthening into a short prorsiradiate rib that extends to the base of the outer whorl face. A narrow groove separates the rib termination from a small tubercle on the outer edge of the lower whorl face. MNHN. F. J13734 (Pl. 37, Figs 3, 4), the original of Pervinquière's pl. 14, fig. 3, has a total height of 21.2 mm, and a maximum whorl height of 6.9 mm.It retains limonitised shell and shows no trace of septa or sutures.

DISCUSSION: See Wright and Kennedy (1996, p. 351).

OCCURRENCE: Upper Lower and Middle Cenomanian. There are records from Bornholm in the Baltic, England, France, Switzerland, Germany, Poland, Spain, southern Italy, Crimea, Iran, Kazakhstan, Turkmenistan, Iran, Morocco, Algeria, central Tunisia, Israel, Nigeria, KwaZulu-Natal in South Africa, Madagascar, Tamil Nadu in South India, Tibet, Japan, the U.S. Gulf Coast and Western Interior.

Turrilites acutus Passy, 1832
(Pl. 36, Figs 5, 6; Pl. 37, Fig. 13; Text-fig. 28A)

1832. *Turrilites acutus* Passy, p. 9, pl. 16, figs 3, 4.
1862. *Turrilites Tevesthensis* Coquand, p. 174, pl. 2, fig. 5.
1996. *Turrilites acutus* Passy, 1832; Wright and Kennedy, p. 358, pl. 103, fig. 3; pl. 104, figs 5, 7, 11; pl. 105, fig. 21, pl. 108, figs 1–4, 8, 11, 12; text-figs 138m, 141a, 146n–o (with full synonymy).
2015. *Turrilites acutus acutus* Passy, 1832; Klein, p. 175, 177 (with synonymy).
2015. *Turrilites acutus* Passy, 1832; Kennedy in Morel, p1. 46.
2017. *Turrilites acutus* Passy, 1832; Kennedy in Kennedy and Gale, p. 104, pl. 7, figs 9, 11, 15, 17.

TYPE: The lectotype by the subsequent designation of Juignet and Kennedy (1976, p. 65), is the original of Passy (1832, pl. 16, fig. 3), MNHN. F. R03993. It is from the Middle Cenomanian of Rouen, Seine-Maritime, France, and was refigured by Kennedy and Juignet (1976, pl. 4, fig. 2) and Wright and Kennedy (1996, pl. 108, fig. 8).

MATERIAL: OUMNH KX.16710–16711, from Middle Cenomanian, *asiaticum* fauna, north of Djebel Hameima, Central Tunisia. MNHN. F. J13731 is the original of Pervinquière (1910, pl. 14 (5), fig. 9), from Batna, northern Algeria. GMH K-8382, the holotype of *Turrilites tevesthensis* Coquand, 1862, p. 174, pl. 2, fig. 3, from Tenoukla, northern Algeria.

DESCRIPTION: OUMNH KX.16710–16711 (Pl. 36, Figs 5, 6) consist of two half whorl fragments with whorl heights of 6 and 7 mm respectively. The upper whorl face is concave and smooth, the junction between upper and outer whorl faces narrowly rounded, the outer whorl face convex in intercostal section, the junction of outer and lower whorl faces more narrowly rounded, the lower whorl face feebly convex and smooth. Twelve ribs per half whorl arise at the junction of upper and outer whorl faces and are strong, straight and feebly prorsiradiate. They terminate in a strong conical tubercle. A smooth zone separates these tubercles from a second row of adaperturally displaced tubercles of comparable size. These are linked by a low, broad rib to a third row of smaller, adaperturally displaced and transversely elongated tubercles. MNHN. F. J13731 (Pl. 37, Fig. 13) consists of a single whorl with a maximum preserved whorl height 7.2 mm and a diameter of 13.9 mm. There are 18–20 strong ribs per whorl on the upper part of the outer whorl face that link to strong sharp tubercles in the middle of the face, with a second row of adaperturally displaced tubercles at the base of the face. A third, adaperturally displaced row of tubercles on the outer part of the lower whorl face give rise to progressively narrowing ribs that extend across the lower whorl face.

GMH K-8382 (Text-fig. 28A), the holotype of *Turrilites tevesthensis*, consists of two whorls. The whorl section is depressed, the outer, exposed whorl face ornamented by 23 strong ribs per whorl. They arise at the junction of the upper and outer whorl faces, and strengthen into strong, sharp tubercles at mid-face. An oblique, low, broad prorsiradiate rib links them to a second row of tubercles, displaced such that the tubercles in the two rows alternate in position. A third row of smaller, spirally elongated tubercles is placed close to the second row, the two rows borne on a double protuberence. This third row is partially concealed in the strongly notched inter whorl suture. The costal profile is deeply concave between the successive rows of tubercles. Upper and lower whorl faces are concealed by matrix.

DISCUSSION: *Turrilites acutus* is curiously rare in northern Algeria and Central Tunisia. See discussion in Wright and Kennedy (1996, p. 359) for a discussion of differences from other species.

OCCURRENCE: The species ranges from Middle Cenomanian to lower Upper Cenomanian. The geographic distribution extends from England to France, Germany, Poland, Spain, northern Russia, Kazakhstan, Turkmenia, Iran, northern Algeria, Central Tunisia, Israel, Nigeria, Angola, KwaZulu-Natal in South Africa, Madagascar, Tamil Nadu in South India, Tibet, Texas, the United States Western Interior, and California.

'*Turrilites*' *asselensis* Dubourdieu, 1953

1953. *Turrrilites asselensis* Dubourdieu, p. 58, pl. 4, figs 46–48.

2015. *Turrrilites asselensis* Dubourdieu, 1953; Klein, pp. 175, 179 (with additional synonymy).

TYPE: The holotype, by monotypy, is the original of Dubourdieu (1953, pl. 4, figs 46–48), from north-east of Koudiat el Assel in north-eastern Algeria. It has not been traced.

DESCRIPTION: The holotype is the only known specimen. The following is based on Dubourdieu's account: apical angle low, 12–15°, whorl section higher than wide. There are three rows of small, sharp, elliptical tubercles of similar size, about 24 per whorl, those in the second and third rows displaced adaperturally of those in the preceding row. The first row are situated one third of the way down from the inter-whorl suture, the second two thirds, and the the third is concealed in the inter-whorl suture. The tubercles of the first row are linked to the inter-whorl suture by a delicate rib. Some of the tubercles in the second and third rows are linked by delicate ribs, or pairs of ribs in some cases. The tubercles in the third row give rise to radial ribs that extend across the lower whorl face.

DISCUSSION: The affinities of this species are problematic in the absence of the holotype and lack of other specimens.

OCCURRENCE: AS for type.

Genus *Carthaginites* Pervinquière, 1907

TYPE SPECIES: *Turrilites* (*Carthaginites*) *kerimensis* Pervinquière, 1907, p. 101, pl. 4, figs 18, 19; text-fig. 29, by original designation.

Carthaginites kerimensis Pervinquière, 1907
(Text-fig. 25F)

1907. *Turrilites* (*Carthaginites*) *kerimensis* Pervinquière, p. 101, pl. 4, figs 18, 19; text-fig. 29.
2015. *Carthaginites kerimensis* Pervinquière; Klein, pp. 204, 205 (with full synonymy).

TYPE: The holotype, by monotypy, is MNHN. F. J04323, the original of Pervinquière (1907, p. 101, pl. 4, figs 18, 19), from the 'Vraconnien' of Si Abd el Kerim, Central Tunisia.

MATERIAL: OUMNH KX.17151, from the Lower Cenomanian, Commune of Ziana, northern Algeria.

DESCRIPTION; The holotype (Text-fig. 25F) is a 12 mm high fragment, with a maximum preserved whorl height of 3 mm, the apical angle 10º. The inter-whorl suture is moderately incised, the upper part of the outer whorl face rounded, the greater part flattened. There is a row of 6–7 relatively large tubercles per whorl on the upper part of the outer whorl face, with a shallow spiral depression below. There is a feeble ridge, succeeded by a spiral groove at the base of the outer whorl face. The suture (Pervinquière 1907, text-fig. 29 on p. 101) has a broad, bifd E/A with only minor incisions.

DISCUSSION: The presence of only a single row of tubercles on the outer whorl face characterises the species.

OCCURRENCE: As for type.

Carthaginites sp.
(Text-fig. 25G)

MATERIAL: OUMNH KX.17151, from the Lower Cenomanian, Commune of Ziana, northern Algeria. OUMNH KX.17151 (Text-fig. 25G) is a 90° sector of body chamber with a maximum preserved whorl height of 9.8 mm. The upper whorl face is obscured by limonitic overgrowths. The junction between upper and outer whorl faces is very narrowly rounded. The upper part of the outer whorl face is very feebly convex, the lower part very feebly concave, the junction between outer and lower whorl faces very narrowly rounded, the lower whorl face very feebly convex and smooth. There are three well-preserved ribs on the upper part of the outer whorl face and traces of a further rib at the adapertural and adapical ends of the fragment. The ribs arise at the inter-whorl suture and are coarse, broad, and feebly prorsiradiate, strengthening into a strong transversely elongated tubercle in the middle of the outer whorl face. The greater part of the lower part of the outer whorl face is feebly concave, and ornamented by feeble, strongly prorsiradiate ribs that link to small bullae, elongated in a direction parallel to the inter-whorl suture, and borne on a feeble blunt ridge at the very base of the outer whorl face. There are at least nine such tubercles on the fragment.

DISCUSSION: This fragment may be part of the adult body chamber of *Carthaginites kerimensis* having a comparable development of the tubercles on the upper part of the outer whorl face, but differs from the much smaller holotype in the develpment of feeble ribs on the lower part of the outer whorl face that link to small tubercles borne on a ridge at the base of the face.

OCCURRENCE: As for material.

Carthaginites krorzaensis Dubourdieu, 1953
(Text-fig. 25D, H)

1953. *Carthaginites krorzaensis* Dubourdieu, p. 66, pl. 4, figs 49–52; text-fig. 20.
1971. *Carthaginites* cf. *inornatus* (Collignon); Kennedy, p. 20, pl. 8, fig. 3 (error for *laevigatus*).
1978. *Carthaginites* cf. *inornatus* (Collignon); Kennedy and Hancock, pl. 11, fig. 5 (error for *laevigatus*).
1996. *Carthaginite* cf. *krorzaensis* Dubourdieu, 1953; Wright and Kennedy, p. 361, pl. 98, fig. 11.
2015. *Carthaginites krorzaensis* Dubourdieu, 1953; Klein, pp. 205, 205.

TYPE: The holotype, by monotypy, is the original of Dubourdieu (1953, pl. 4, figs 49–52, text-fig. 20), from the Upper Cenomanian in the environs of Djebel Ouenza, south-east of Djebel el Krorza. It has not been traced.

MATERIAL: OUMNH KX.9776, 9782, 16826 (collective of six specimens), from the Upper Cenomanian *pentagonum* fauna north of Djebel Hameima, Central

Tunisia. OUMNH KX.16111–16119 and 1612, from the Upper Cenomanian *pentagonum* fauna 2 km south-east Djebel el Krorza, north-eastern Algeria.

DESCRIPTION: OUMNH KX.9782 (Text-fig. 25D) is typical. It consists of 2.5 whorls of body chamber, 15 mm high, with a maximum preserved whorl height of 6.4 mm. The upper whorl face is smooth, the junction of upper and outer whorl faces narrowly rounded; the uppermost part of the outer whorl face is at an angle to the remainder of the outer whorl face, which is flattened. There is a feeble spiral ridge, visible only on the base of the whorl, that bears minute spirally elongated tubercles. This is succeeded by a distinct groove that separates it from the junction of outer and lower whorl faces.

DISCUSSION: The holotype of *Carthaginites krorzaensis* is an approximately 200° whorl fragment, in part septate, with a maximum preserved whorl height of 3 mm. The upper whorl face is smooth and concave, the outer whorl face flattened, and feebly concave at mid-flank, the junction of outer and lower whorl faces a shallow groove with raised edges, the lower whorl face very feebly convex and smooth. The upper, raised edge of the groove separating outer and lower whorl faces is very feebly crenulated, the crenulations the result of the development of very feeble spirally elongated tubercles.

The absence of tubercles on the outer whorl face characterises the species.

OUCCURRENCE: Lower Upper Cenomanian, north-eastern Algeria, Central Tunisia and, possibly, southern England.

Carthaginites elegans sp. nov.
(Text-fig. 25J, K)

TYPES; The holotype is OUMNH KX.16052a, paratype OUMNH KX.16052b, from the Middle Cenomanian *asiaticum* fauna west of Djebel Sottara, northern Algeria.

DIAGNOSIS: Apical angle low, outer whorl face flattened. There are two rows of small tubercles of comparable size; those in the upper row are at mid-flank, and number three/four in a distance equal to the height of the outer exposed whorl face; those in the lower row lie just above the junction of outer and lower whorl faces and number five in the same distance.

DESCRIPTION: The holotype (Text-fig. 25J) consists of 2.5 whorls, the total height 10 mm, the maximum preserved whorl height 4 mm. There is a septal face at the adapical end of the fragment, but it is unclear if the specimen is in whole or part body chamber. The upper whorl face is concave and smooth, the junction of upper and outer whorl faces narrowly rounded, the uppermost part of the outer whorl face feebly convex, the remainder flattened, the junction of outer and lower whorl faces narrowly rounded, the lower whorl face feebly convex, and smooth. The tubercles in the upper row are small, transversely elongated, and situated in the middle of the outer whorl face; there are three/four in a distance equal to the exposed whorl height. The tubercles in the lower row are situated just above the inter-whorl suture, are slightly larger, and slightly more numerous than those in the upper row. The paratype (Text-fig. 25K) has a maximum preserved whorl height of 5 mm approximately, and a slightly lower tubercle density, three in a distance equal to the exposed whorl height in the upper row.

DISCUSSION: *Carthaginites elegans* differs from *Carthaginites kerimensis* in the more numerous and much weaker tubercles in the upper row, and the presence of a second row of tubercles just above the inter-whorl suture. *Carthaginites krorzaensis* is unornamented but for a delicate, minutely crenulated ridge at the junction of the outer and lower whorl surfaces. *Carthaginites yamashitai* Matsumoto, 2002 (p. 359, text-figs 2a–f, 3) is known from the holotype only. The whorl profile is distinctive: the outer whorl face flat, the inter-whorl suture incised such that successive whorls are overhung by the base of the preceding one. The early whorls are smooth but for a spiral groove at mid-flank, and numerous small tubercles at the base of the outer whorl face. The later whorls bear 15 tubercle per whorl above the spiral groove and 30 per whorl at the base of the outer whorl face. *Carthaginites asiaticum* (Matsumoto and Takahashi, 2000) (p. 266, text-figs 5a–i, 6) has a flattened outer whorl face, and much coarser tuberles in the upper row. *Carthaginites multituberculatus* Kennedy, 2019 (in Gale *et al*., p. 284, pl. 57, figs 17, 18, 20, 22; text-fig. 38b) has a single row of large tubercles on the upper part of the outer whorl face and a spiral depression below.

OCCURRENCE: As for types.

Genus *Cryptoturrilites* nov.

TYPE SPECIES: *Cryptoturrilites tenuicostatus* gen. et sp. nov.

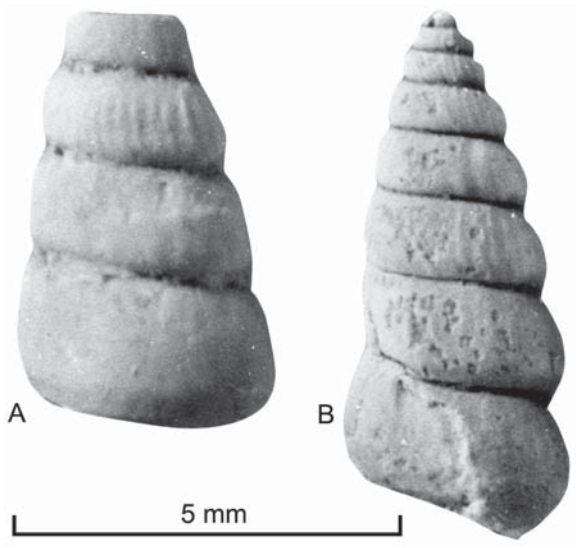
DIAGNOSIS: Apical angle low, inter-whorl suture moderately impressed, outer whorl face feebly convex, and ornamented by close-spaced lirae that extend over most of the outer whorl face, weakening low on the outer whorl face before strengthening into minute obliquely elongated tubercles borne on a spiral ridge, separated by a groove from a second spiral ridge at the junction of outer and lower whorl faces. Suture with minor incisions only.

DISCUSSION; The genus is known from the types only, the holotype with a maximum preserved whorl height of only 1.8 mm. The overall shell shape, the presence of spiral ridges separate by a groove at the base of the outer whorl face, the upper row associated with minute tubercles, together with the very simple sutures suggest affinities with *Carthaginite*s, but the delicate lirae that extend over most of the outer whorl face distinguish the two; in *Cathaginites* the greater part of the whorl face is either smooth, or bears a row of tubercles around mid-flank.

OCCURRENCE: Upper Cenomanian of Central Tunisia

Cryptoturrilites tenuicostatus sp. nov.
(Text-fig. 29A, B)

TYPES: The holotype is OUMNH KX.16917, paratype OUMNH KX.16918, from the Upper Cenomanian *pentagonum* fauna north of Djebel Hameima, Central Tunisia.



Text-fig. 29. *Cryptoturrilites tenuicostatus* gen et sp. nov. A – the holotype, OUMNH KX.16917; B – paratype OUMNH KX.16918, from the Upper Cenomanian *pentagonum* fauna north of Djebel Hameima, Central Tunisia. A is 8.4 mm high; B is 7.8 mm high

DIAGNOSIS: With the characters of the genus.

DESCRIPTION: There is little to add to the diagnosis. The holotype consists of four whorls, the total height just over 7 mm; the paratype consists of eight whorls, with a total height of 6.5 mm; It may retain the protoconch, but preservation is defective.

OCCURRENCE: As for types.

Family Nostoceratidae Hyatt, 1894
Genus and subgenus *Hyphantoceras* Hyatt, 1900

TYPE SPECIES: *Heteroceras roissyanum* Schlüter, error for *Turrilites Reussi* d'Orbigny, 1850, p. 216, by the original designation of Hyatt (1900, p. 587) (see Kaplan and Kennedy 2019, p. 86) for a discussion of the name of the type species).

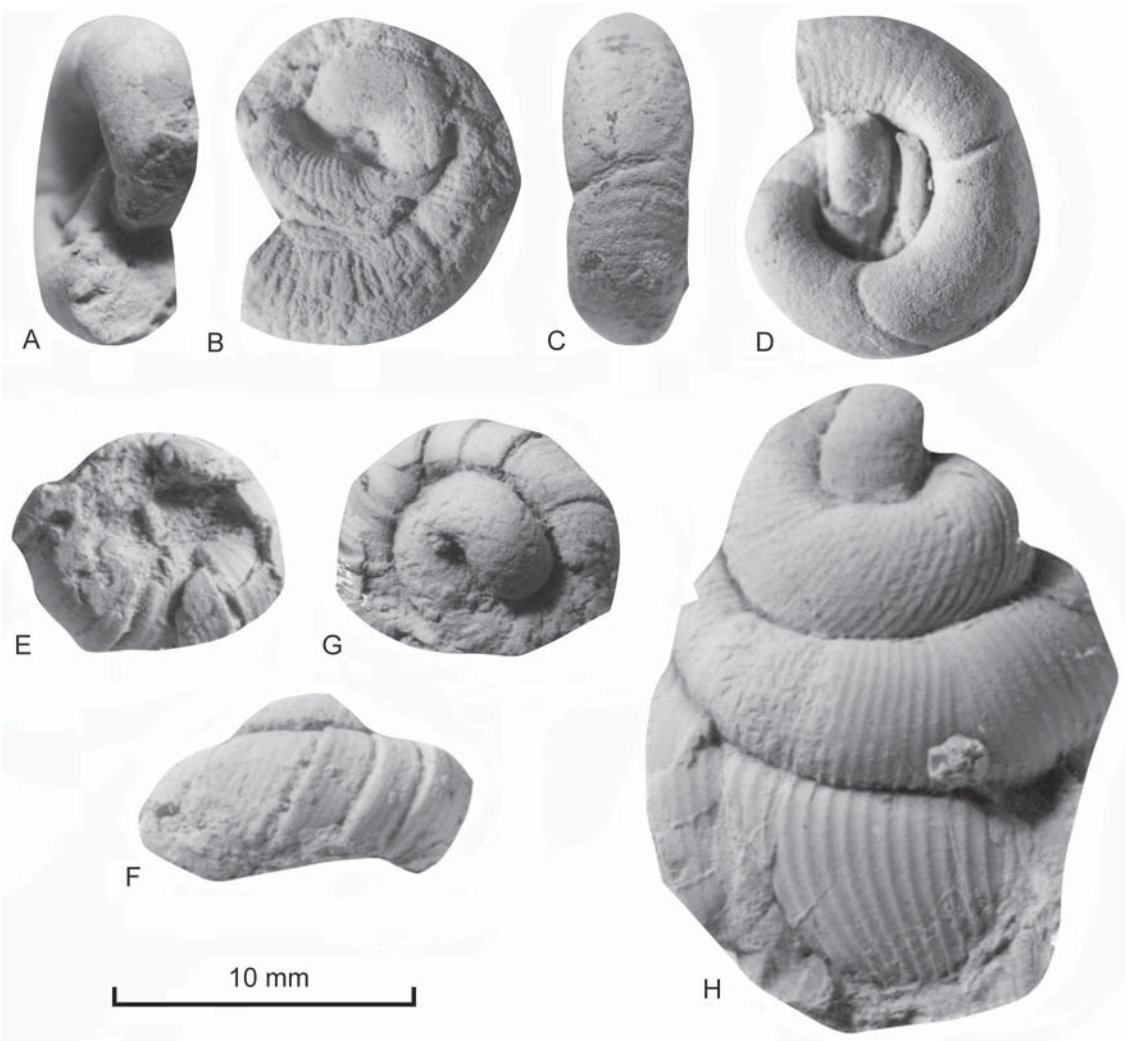
Hyphantoceras reussianum (d'Orbigny, 1850)
(Text-fig. 30E, G)

1850. *Hamites reussianus* d'Orbigny, p. 216.
1910. *Bostrychoceras Thomasi* Pervinquière, p 62 (*pars*), pl. 14 (5), fig. 34 only.
1962. *Hyphantoceras cenomanense* Wiedmann, p. 197, footnote 37.
2019. *Hyphantoceras* (*Hyphantoceras*) *reussianum* (d'Orbigny, 1850); Kennedy and Kaplan, p. 86, pl. 45, fig. 5; pl. 47, figs 1–7 (with full synonymy).

TYPE: The neotype, by the subsequent designation of Kennedy and Kaplan (2019, p. 87, pl. 47, figs 6, 7) is RE 320 A1085 in the collections of the Ruhrland Museum, Essen, from the Upper Turonian *Subprionocyclus neptuni* Zone of the Steinbruch DIMAC, Halle, Westphalia, Germany.

MATERIAL: MNHN. F. J03736, the original of *Bostrychoceras thomasi* Pervinquière 1910 p. 62 (*pars*), pl. 14 (5), fig. 34 only, from Berrouaghia in northern Algeria. It is the holotype, by monotypy, of *Hyphantoceras cenomanense* Wiedmann, 1962 (p. 197, footnote 37).

DESCRIPTION: The specimen consists of a crushed individual with a maximum preserved diameter of 12 mm, comprising part of the initial straight shaft and two whorls of the succeeding helix. The shaft and



Text-fig. 30. A-D – *Eubostrychoceras* (*Eubostrychoceras*) sp., OMNH KX.17177, from the Upper Turonian, Commune of Ziana, northern Algeria. E-G – *Hyphantoceras* (*Hyphantoceras*) *reussianum* (d'Orbigny, 1850). NMHM. F.J. 13736, the original of *Bostrychoceras thomasi* Pervinquière, 1910, pl. 14 (5) fig. 34, originally described as from the "Cénomanien, Berrouaghia", northern Algeria, and the holotype of *Hyphantoceras cenomanense* Wiedmann, 1962. H – *Eubostrychoceras* (*Eubostrychoceras*) *saxonicum* (Schlüter, 1872), MNHN. F. J13739, the holotype of *Bostrychoceras thomasi* Pervinquière, 1910, p. 14 (5), fig. 32, originally described as from the "Cénomanien, Berrouaghia", Algeria'

initial whorl appear to have been smooth. When ornament appears, it consists of groups of between four and six very delicate prorsiradiate lirae separated by much stronger periodic ribs that are succeeded by well-developed constrictions.

DISCUSSION: In spite of its small size, the specimen matches well with more complete *reussianum* at the same ontogenetic stage (Kennedy and Kaplan 2019). The age is presumed to be Late Turonian rather than Cenomanian as stated by Pervinquière (1910, p. 63) and accepted by Wiedmann (1962, p. 197, footnote 37) as with other anomalous records of supposed Cenomanian ammonites from Berrouaghia collected by Thomas and Péron.

OCCURRENCE: Upper Turonian *Subprionocyclus neptuni* Zone and correlatives in southern England, Linconshire and Yorkshire. Also known from northern and south-eastern France, northern Spain,

Germany, Poland, the Czech Republic, Kazakhstan, Sakhalin, northern Tunisia, and the uppermost Turonian or Lower Coniacian of Madagascar.

Genus and subgenus *Eubostrychoceras* Matsumoto, 1967

TYPE SPECIES: *Eubostrychoceras indopacificum* Matsumoto, 1967, p. 333, pl. 18, fig. 1, by the original designation of Matsumoto (1967, p. 332).

Eubostrychoceras (*Eubostrychoceras*) *saxonicum* (Schlüter, 1875) (Text-fig. 33A–D, H)

1875. *Turrilites Saxonicus* Schlüter, p. 30.
1910. *Bostrychoceras Thomasi* Pervinquière, p 62 (*pars*). pl. 14 (5), figs 32, 33 only.
2019. *Eubostrychoceras* (*Eubostrychoceras*) *saxonicum* (Schlüter, 1875); Kennedy and Kaplan, p. 84, pl. 46, figs 1–7 (with full synonymy).

TYPE: Lectotype, by the subsequent designation of Kaplan and Schmid (1988, p. 50), is the original of Geinitz (1840, pl. 13, fig. 1), no. SaK10098 in the collections of the Senckenberg Museum für Mineralogie und Geologie, Dresden, and from the Upper Turonian Plänerkalk of Strehlen, Saxony, Germany. It was refigured by Wilmsen and Nagm (2014, text-fig. 15d).

MATERIAL: MNHN. F. J13739, the holotype, by original designation of *Bostrychoceras thomasi* Pervinquière 1910, p 62 (*pars*). pl. 14 (5), fig. 32, and MNHN. F. J13740, the original of fig. 33, both from Berrouaghia, northern Algeria. OUMNH KX.17177, from the Upper Turonian below the *neptuni* fauna, Commune of Ziana, 21 km east of Berrouaghia, northern Algeria.

DESCRIPTION: The earliest growth stages of OUMNH KX.17177 (Text-fig. 33A–D) consist of parts of two subparallel shafts, visible in the umbilicus of the helical whorls, the greatest preserved diameter of which is 10.3 mm. The larger of the shafts projects through the top of the spire, rotates through 90°, and gives rise to a near-planispire consisting of 1.5 whorls; the maximum preserved whorl height 4.5 mm. The areas that retain limonitised shell are ornamented by fine ribs, very feely concave on the upper whorl face, feebly convex on the outer whorl face, and weakened and very feebly concave on the lower whorl face. The rib index is seven. There are three constrictions, 120° apart, conspicuous on the internal mould, and paralleling the ribs. MNHN. F. J13739 (Text-fig. 30H)), the more complete individual, is crushed, with a maximum preserved height of 21.5 mm. It comprises the adapertural part of a straight shaft, around which three helicoid whorls coil. Ornament is of delicate ribs, more than 10 in a distance equal to the exposed whorl height, and an estimated 70 per whorl. They are straight on the exposed sector of the shaft. On the first whorl they are concave and distinctly rursiradiate, less so on the second whorl, and distinctly prorsiradiate on the third whorl. Over a whorl of body chamber is preserved, but the specimen does not appear to be adult.

DISCUSSION: See Kaplan and Kennedy (2019, p. 84) for a comprehensive revision of the species. The present material was collected by Thomas and Peron, and erroneously referred to the Cenomanian.

OCCURRENCE: Upper Turonian *Subprionocyclus neptuni* Zone, southern England, France, Germany, Poland, the Czech Republic, Kazakhstan, and northeastern Algeria. It is recorded from the Coniacian of Madagascar, and Matsumoto (1967, p. 234) records *E*. aff. *saxonicum* from the Upper Turonian and Coniacian of Japan.

Superfamily Scaphitoidea Gill, 1871
Family Scaphitidae Gill, 1871
Subfamily Otoscaphitinae Wright, 1953
Genus *Worthoceras* Adkins, 1928

TYPE SPECIES: *Macroscaphites platydorsus* Scott, 1924, p. 18, pls 5, 6; pl. 9, fig. 6, by original designation.

Worthoceras cf. *pygmaeum* Butjor, 1991 (Text-fig. 32I, N)

1991. *Worthoceras pygmaeum* Butjor, p. 537, text-fig. 2.
2016. *Worthoceras pygmaeum* Butjor; Klein, pp. 4, 6 (with synonymy).

TYPES: The holotype is GMH K-13731, paratypes GMH K-13730 and 13732 (two specimens) from the upper Upper Albian of the Bóly-1 borehole in southern Hungary, in the collections of the Hungarian Geological Institute, Budapest. The holotype and paratype GMH K-13730 were figured by Butjor as his text-fig. 2 and by Szives (2007, pl. 28, figs 22 and 29).

MATERIAL: OUMNH KX.16390, from the upper Upper Albian *puzosianum* fauna north of Djebel Hameima, Central Tunisia.

DESCRIPTION: The specimen is an internal mould of the straight shaft and recurved sector, with a maximum preserved length of 6.1 mm. The whorl breadth and height of the shaft increase rapidly, such that the adapertural end of the initial shaft and the recurved sector are massive compared to the adapical end of the shaft. There is no ornament.

DISCUSSION: The rapid expansion of whorl height and breadth, producing a very large final sector to the shell are exactly the characters that diagnose the species: "Very small *Worthoceras* with small spiral portion and immense hook in comparison with its dimensions. The surface of the shell is almost smooth." (Butjor 1991, p. 537).

OCCURRENCE: Upper Upper Albian, southern Hungary, south-eastern France, and Central Tunisia.

Genus *Yezoites* Yabe, 1910

TYPE SPECIES: *Scaphites perrini* Anderson, 1902, p. 114, pl. figs 71–73, by the subsequent designation of Diener (1925, p. 213).

Yezoites? *thomasi* (Pervinquière, 1910)
(Text-fig. 33L–O)

1910. *Parahoplites*? *Thomasi* Pervinquière, p. 38, pl. 12 (3), figs 4, 5; text-fig. 18.
1925. *Parahoplites* (?) *thomasi* Pervinquière; Diener, p. 178.
1996. *Parahoplites*? *thomasi* Pervinquière; Wright and Kennedy, p. 385, text-fig. 150j.
2016b. *Yezoites*? *thomasi* Pervinquière; Klein, p. 11.

TYPE: The holotype, by monotypy, is MNHN. F. J13729, the original of Pervinquière (1910, p. 38, pl. 12 (3), figs 4, 5; text-fig. 18), from Berrouaghia, northern Algeria.

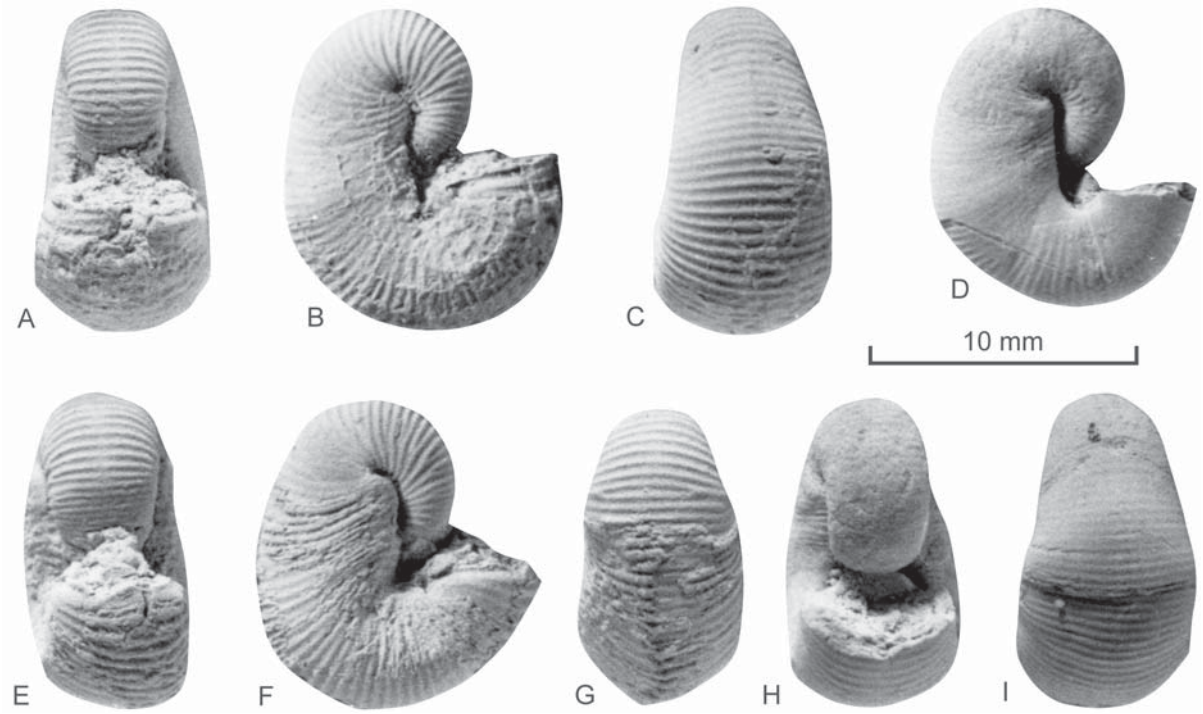
DIMENSIONS:

	D	Wb	Wh	Wb:Wh	U
MNHN. F. J13729	18.7 (100)	7.3 (39.0)	9.1 (48.7)	0.8	5.6 (29.9)

DESCRIPTION: Coiling is evolute, the shallow umbilicus comprising 29.9% of the diameter, the umbilical wall flattened and vertical, the umbilical shoulder narrowly rounded. The whorl section is compressed, the whorl breadth to height ratio 0.8. The flanks are flattened and subparallel, the ventrolateral shoulders and venter broadly rounded. Crowded primary ribs and long intercalated ribs, an estimated 14 per half whorl, are straight and prorsiradiate on the innermost flank, flexing back and feebly convex, then flexing forwards and concave on the outer flank, increasing by branching and intercalation, such that there are three to four times as many ribs at the ventrolateral shoulder as on the inner flank. The ribs strengthen slightly over the venter, which they cross in a shallow convexity. The suture (Pervinquière 1910, text-fig. 18 on p. 38) is moderately incised, with a broad, asymmetrically bifid E/A, narrow, deep A, and narrow A/U2 with only minor incisions.

DISCUSSION: Pervinquière discussed the affinities of this species at length, eventually assigning it to *Parahoplites* with a query. Wright and Kennedy (1996, p. 385) thought it might be the spire of a macroconch of their *Yezoites decipiens* (1996, p. 382, pl. 119, figs 2–8, 10; pl. 120, fig. 3; text-fig. 128b), noting that it differed from that species in having distinct secondary ribs already on the last whorl of the spire. They did not provide arguments for assigning it to *Yezoites*. That it is a scaphitid is clear from a comparison with the phragmocones figured by Jahn (1896, pl. 8, figs 3, 4): the pattern of ribbing and the sutures differ in no significant respects. But whether it is a *Scaphites* or a *Yezoites* is uncertain in the absence of the body chamber, hence the qualified generic assignation here.

OCCURRENCE: This too presents problems. The specimen was collected by Philip Thomas 3.5 km south of la Smaga de Berrouaghia, but as Pervinquière noted (1910, p. 39): "Il est plus difficile de déterminer son niveau exact; l'étiquette porte; quatrième zone, calcaire à Inocerames. Les ammonites que je possède de cette zone (*Phyll. Tanit*, *Ac. Martimpreyi*, *Mort. Nicasiei* etc) indiquent le Cénomanien: c'est vraisemblament à cette étage qu' appartient notre espèce. Il ne faut cependant pas perdre de vue que les Oursins signalés par THOMAS dans cette zone sont sénoniennes, et que d'autre part, il y a une faille au voisinage; peut-être même y en a-t-il plusiers, ce qui laisse quelque incertitude sur le niveau exact de ce fossile." Other ammonites from Berrouaghia collected by Thomas and said to be Cenomanian are actually Upper Turonian, including *Coilopoceras haugi* Pervinquière, 1910 (p. 74, pl. 17 (30), figs 19–23), one specimen of which was from 3 km south of the



Text-fig. 31. *Scaphites bassei* Collignon, 1929. A-C – OUMNH KX.4146; D, H, I – OUMNH KX.16257; E-G – OUMNH KX.4153. All are from the Upper Albian *puzosianum* fauna south of Djebel Djerissa, Central Tunisia

Smaga de Berrouaghia; on balance I suspect this to be the actual age of *thomasi*.

Subfamily Scaphitinae Gill, 1871
Genus *Scaphites* Parkinson, 1811

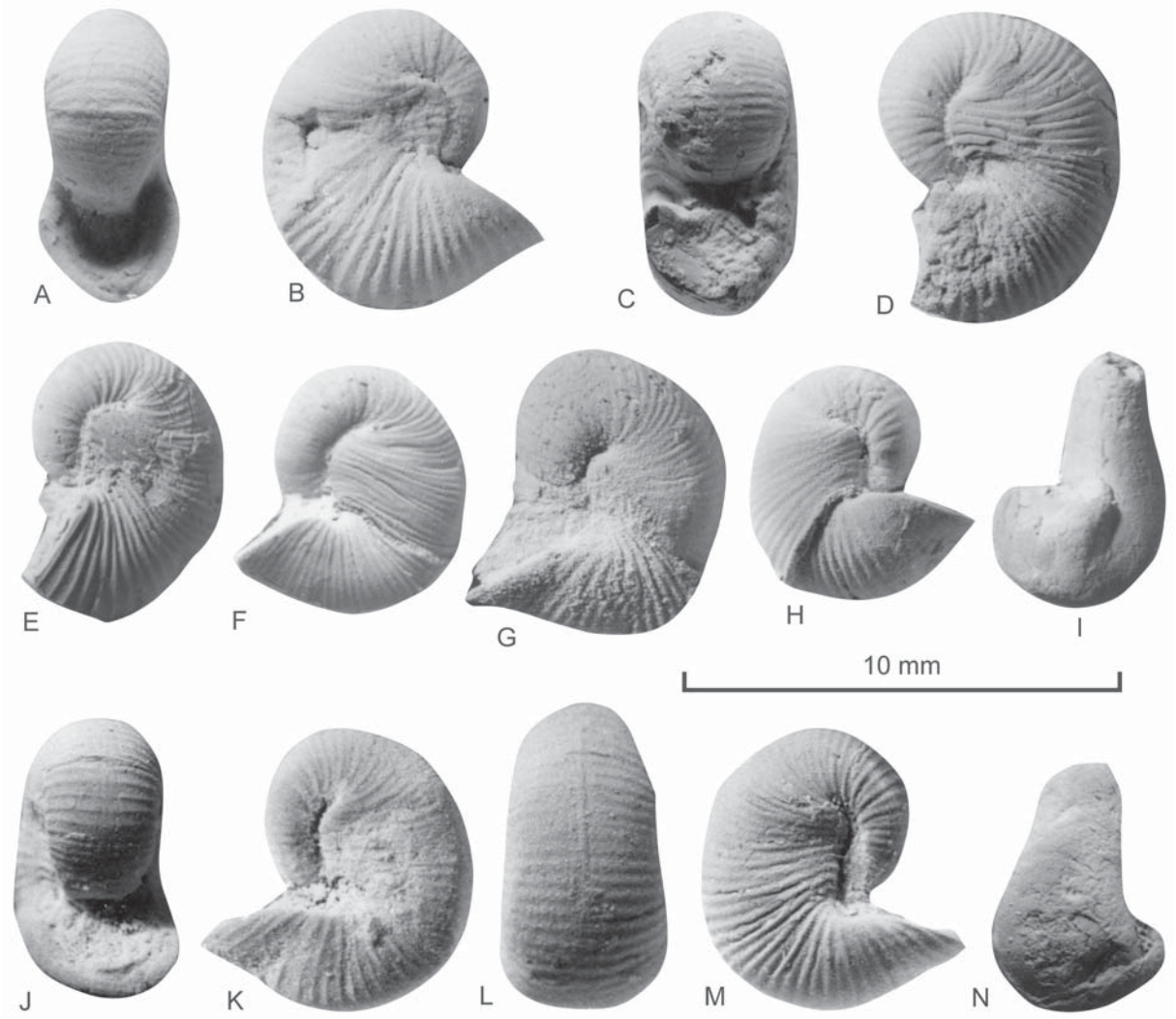
TYPE SPECIES: *Scaphites equalis* J. Sowerby, 1813, p. 53, pl. 18, figs 1–3, by the subsequent designation of Meek (1876, p. 413).

Scaphites bassei Collignon, 1929
(Text-fig. 31A–I)

1907. *Scaphites aequalis* et *Sc. obliquus* Sow.; Pervinquière, p. 118 (*pars*), pl. 4, fig. 27 only.
1929. *Scaphites Bassei* Collignon, p. 51 (27), pl. 19 (5), figs 8, 9.
1955. *Scaphites bassei* Collignon; Sornay, p. 10, pl. 1, figs. 7, 11; text-fig. 3.
2016b. *Scaphites bassei* Collignon, 1929; Klein, pp. 52, 58 (with synonymy).

TYPES: The lectotype, by the subsequent designation of Wright and Kennedy (1996, p. 387) is MNHN. F. R01225, the original of Collignon (1929, pl. 19 (5), fig. 9) (refigured by Wright and Kennedy 1996, text-fig. 151d). There are four paralectotypes, one of which, MNHN. F. A25631, was figured by Collignon (1929, pl. 19 (5), fig. 8; refigured by Wright and Kennedy 1996, text-fig. 151g). All of the types are from the Lower Cenomanian of Diego Suarez, Madagascar.

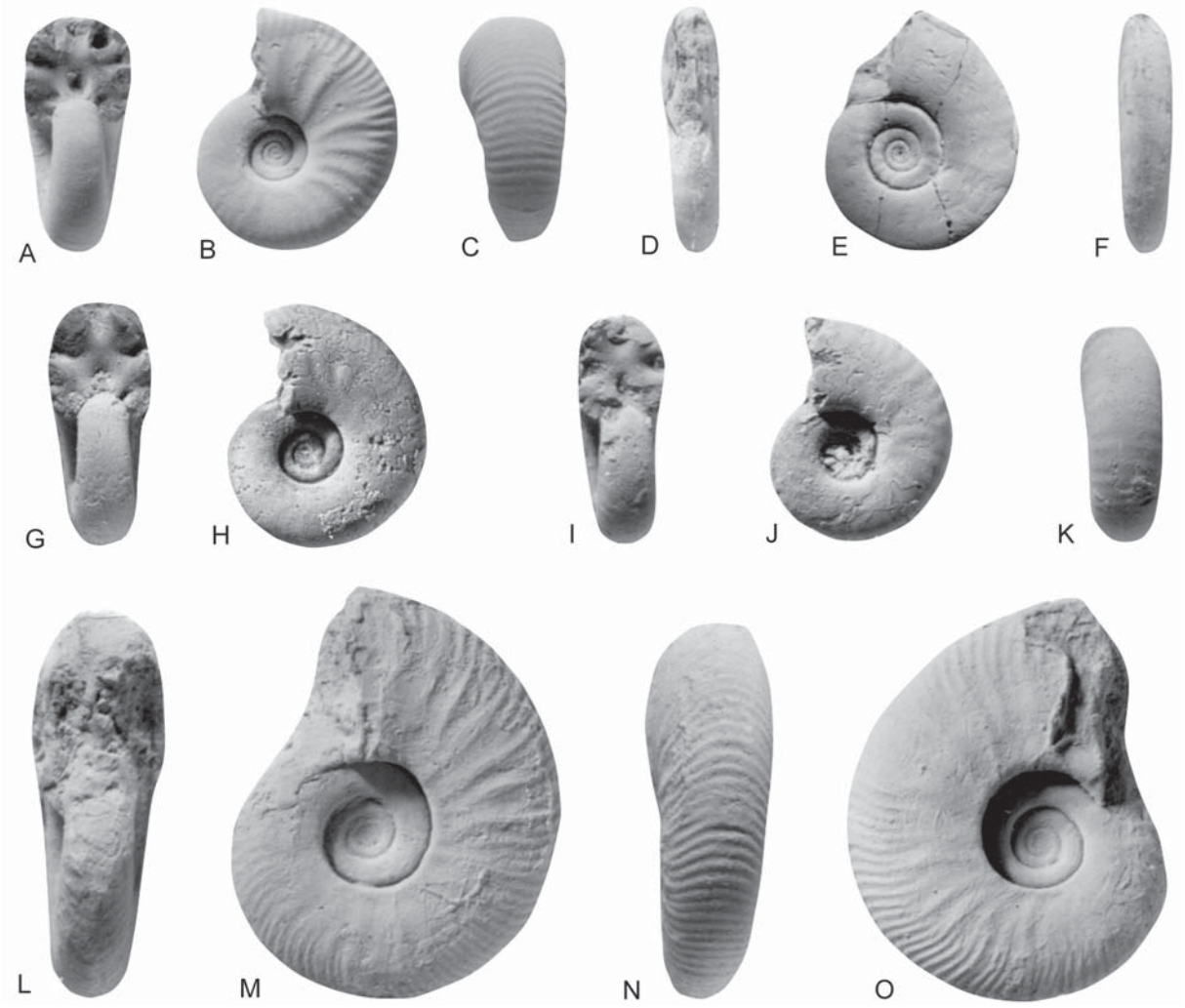
MATERIAL: OUMNH KX.4146–4154, 1416–1418, 14195, from the upper Upper Albian *puzosianum* fauna 2.5 km south of Djebel Djerissa, Central Tunisia. OUMNH KX.15957 (collective of six specimens), from the upper Upper Albian *puzosianum* fauna, Henchir el Kerkour, northern Algeria. OUMNH KX.16222, 16223 (collective of eight specimens), from the upper Upper Albian *puzosianum* fauna, slopes north and north-west of Gadet Chi, north-eastern Algeria. OUMNH KX.16257–16258, 16408–16409, from the upper Upper Albian *puzosianum* fauna north of Djebel Hameima, Central Tunisia. OUMNH KX.17000, 17002, 17003 (collective of 12 specimens), from the upper Upper Albian *puzosianum* fauna, ravines east of El Faïja, northern Algeria. OUMNH KX.17081 (collective of 10 speci-



Text-fig. 32. **A-H**, **J-M** – *Scaphites occlusus* sp. nov. A, B – the holotype, OUMNH KX.16455a; C, D – paralectotype KX.16455b; E – paralectotype KX.16455e; F – paralectotype KX.16455c; G – paralectotype KX.16455d, all from the Lower Cenomanian *carcitanense* fauna north of Djebel Hameima, Central Tunisia. H – OUMNH KX.16287; J-M – OUMNH KX.16289, both from the Lower Cenomanian *harchaensis* fauna north-east of Koudiat el Assel, north-eastern Algeria. **I, N** – *Worthoceras* cf. *pygmaeum* Butjor, 1991, OUMNH KX.16390, from the Upper Albian *puzosianum* fauna north of Djebel Hameima, Central Tunisia

mens), from the upper Upper Albian *puzosianum* fauna, Commune of Ziana, northern Algeria.

DESCRIPTION: Complete adults are up to 13 mm long. The coiling of the spire is involute, the whorl section depressed, with feebly convex flanks, broadly rounded ventrolateral shoulders, and a broad, feebly convex venter. The umbilical seam of the adapical part of the body chamber is convex and conceals the umbilicus of the coiled whorls, and is thereafter straight. The flanks of the shaft are flattened to very feebly convex, the recurved sector with a depressed whorl section and broad, feebly convex venter. In typical examples (Text-fig. 31A–C, E–G) the coiled whorls are ornamented by crowded wiry ribs, straight and prorsiradiate on the inner flanks, flexing back and bifurcating on the outer flank, and passing straight cross the venter. The shaft bears crowded strongly prorsiradiate ribs that vary from straight to feebly convex on the flanks, bifurcating on the outer flanks and ventrolateral shoulders and passing straight across the venter. The rib direction changes from rectiradiate to feebly rursiradiate around the recurved sector; the ribs immediately preceding the



Text-fig. 33. **A-K** – *Scaphites peroni* Pervinquière, 1910. A-C – MNHN. F. J13722, the holotype, the original of Pervinquière 1910, pl. 11 (2), figs 11, 12. D-F – MNHN collections, the original of variety *inornata* Pervinquière 1910, pl. 11 (2), fig. 16. G-H – MNHN. F. J04352b, the original of variety *inornata* of Pervinquière 1910, pl. 11 (2), fig. 15. I-K –MNHN. F. J04352aa, the original of variety *inornata* of Pervinquière 1910, pl. 11 (2), fig. 14. All specimens are from the Cenomanian of Berrouaghia. **L-O** – *Yezoites*? *thomasi* (Pervinquière, 1910), the holotype, MNHN. F. J13729, the original of Pervinquière 1910, p. 38, pl. 12 (3), figs 4, 5, text-fig. 18. All specimens are from Berrouaghia, northern Algeria. All figures are × 3

adult aperture are feebly prorsiradiate, the aperture is preceded by a stronger flared rib, succeeded by a minor constriction. OUMNH KX.16257 (Text-fig. 31D, H, I) although worn, is interpreted as a feebly ornamented variant of the species.

DISCUSSION; See Wright and Kennedy (1996, p. 387). Differences from *Scaphites occlusus* sp. nov. are discussed below.

OCCURRENCE: Upper Upper Albian and lower Lower Cenomanian of northern and north-eastern Algeria and central Tunisia. Lower Lower Cenomanian of southern England, Poland, Madagascar, and Lower to Middle Cenomanian of Ukraine and Kazakhstan.

Scaphites occlusus sp. nov.
(Text-figs 15B, 32A–H, J–M)

DERIVATIN OF NAME: *Occlusus* (Latin): closed, in reference to the occlusion of the umbilicus of the coiled whorls by the umbilical wall of the adapical part of the body chamber.

TYPES: The holotype is OUMNH KX.16455a, paratypes OUMNH KX.16455b–e, from the lower Lower Cenomanian *carcitanense* fauna north of Djebel Hameima, Central Tunisia.

MATERIAL: OUMNH KX.9843 (collective of 7 specimens), 16443, and 16454 (collective of 15 specimens), from the lower Lower Cenomanian *carcitanense* fauna north of Djebel Hameima, Central Tunisia. OUMNH KX.16286 (collective of 12 specimens), 16287–16289, from the lower Lower Cenomanian *harchaensis* fauna 700 m north-east of Koudiat el Assel, north-eastern Algeria.

DIAGNOSIS: Small, complete adults up to 7 mm long. Whorl section of spire depressed reniform, umbilicus of spire concealed by umbilical wall of adapical part of body chamber. Apertural margin expanded outwards, then contracted with smooth concave flange preceding actual aperture. Ornament of wiry ribs that increase by branching and intercalation. Suture simple, with only minor incisions.

DESCRIPTION: Complete adults range from 5.7 to 7 mm long. The umbilicus of the spire is concealed in most specimens; such as is visible suggests it was deep and outwards-inclined, with a feebly convex wall. The whorl section is depressed reniform, with a whorl breadth to height ratio of around 1.7. There are both relatively coarsely and finely ornamented individuals. Crowded wiry ribs arise in pairs at the umbilical shoulder, are prorsiradiate and convex across the flanks, and pass straight across the venter. The body chamber is short. The umbilical wall projects dorsally at the adapical end, producing a bulge with a convex profile that completely conceals the umbilicus of the spire. This part of the body chamber bears crowded wiry ribs that arise singly at the dorsal margin of the bulge, where they are crowded, straight and prorsiradiate, then flexing back and feebly concave, some bifurcating, and additional ribs intercalating, the ribs passing straight across the venter. The ornament changes on that part of the body chamber from the point where the course of the umbilical wall is concave. The ribs are now straight and feebly prorsiradiate, strengthening across the flanks, and increasing by bifurcation and the more-or less regular insertion of intercalated ribs that arise both above and below mid-flank. The whorl section expands immediately preceding the adult aperture, rather like the mouth of a trumpet. The wiry ribs extend across this expanded portion. The expanded section is succeeded by a contraction in the form of a smooth concave flange that immediately precedes the aperture. The suture (Text-fig. 15B) is very simple, with broad E, E/A bifid with only minor incisions, A small, with a deep median incision that produces a trifid lobe outline.

DISCUSSION: *Scaphites occlusus* most closely resembles *Scaphites dailyi* Wright, 1963 (p. 602, pl. 81, fig. 6). Wright does not give the dimensions of the holotype, but from his figure, it is 26 mm long approximately, whereas the largest *occlusus* is only 7 mm long. *S. dailyi* develops primary ribs that branch irregularly into two to four secondaries on the shaft of the body chamber, while the apertural margin of *occlusus* is distinctive. *Scaphites bassei* Collignon, 1929 (p. 27 (51), pl. 19 (5), figs 8, 9), described above, is also larger, with a longer body chamber, the shaft near-straight to feebly convex, with a much smaller expansion of the umbilical margin concealing the umbilicus of the spire, and lacks the distinctive flared apertural margin of the present species.

OCCURRENCE: Lower Cenomanian of north-eastern Algeria and Central Tunisia.

Scaphites peroni Pervinquière, 1910
(Pl. 38, Figs 1–18; Text-figs 24D, I, 33A–K)

1910. *Scaphites Peroni* Pervinquière, p. 26, pl. 11 (2), figs 10–13; text-fig. 10.
1910. *Scaphites Peroni* var. *inornata* Pervinquière, p. 26, pl. 11 (2) figs 14–16; text-fig. 11.
1955. *Scaphites peroni* var. *compressus* Sornay, p. 9, pl. 1, figs 2, 3; text-fig. 1.
1955. *Scaphites peroni* var. *rotundicostata* Sornay, p. 9, pl. 1, figs 4.
1955. *Scaphites peroni* var. *paucicostata* Sornay, p. 9, pl. 1, figs 6, 8, 10; text-fig. 2.
2016b. *Scaphites peroni peroni* Pervinquière, 1910; Klein, pp. 55, 88 (with synonymy).
2016b. *Scaphites peroni compressus* Sornay, 1955; Klein, pp. 55, 88 (with synonymy).
2016b. *Scaphites peroni paucicostatus* Sornay, 1955; Klein, pp. 55, 89 (with synonymy).
2016b. *Scaphites peroni rotundicostatus* Sornay, 1955; Klein, pp. 55, 88 (with synonymy).

TYPE: The holotype, by original designation is MNHN. F. J13722 (Text-fig. 33A–C), from Berrouaghia in northern Tunisia, the original of Pervinquière (1910, pl. 11 (2), figs 11, 12).

MATERIAL: MNHN. F. J04352a, the original of *Scaphites peroni* var. *inornata* Perviquière, 1910,

pl. 11 (2), fig. 14; MNHN. F. J04352b, the original of *Scaphites peroni* var. *inornata* Pervinquière, 1910, pl. 11 (2), fig. 15, both from Berrouaghia in northern Algeria. OUMNH KX.16122 (collective of six specimens), 16123 (collective of 15 specimens), 16124–16134, and 16135–16147 (collectives of 738 specimens), from the Upper Cenomanian *pentagonum* fauna 2 km SE of Djebel el Krorza, north-eastern Algeria. OUMNH KX.16910 (collective of 19 specimens), 16167–16169, 16738–16740, 16763–16765, and 16911–16912, from the Upper Cenomanian *pentagonum* fauna north of Djebel Hameima, Central Tunisia.

DIMENSIONS:

	D	Wb	Wh	Wb:Wh	U
MNHN. F. J13722	11.5 (100)	5,5 (47.8)	6.2 (53.9)	0.89	2.7 (23.5)

DESCRIPTION: The holotype (Text-fig. 33A–C) is a phragmocone spire 11.5 mm in diameter. Coiling is involute, the umbilicus deep, comprising 23.5% of the diameter, the umbilical wall convex, the umbilical shoulder broadly rounded, the whorl section slightly compressed, the whorl breadth to height ratio 0.89. The flanks are feebly convex and subparallel, the ventrolateral shoulders broadly rounded, the venter broad and feely convex. Ribbing is very feeble on the adapical half of the outer whorl, beyond which ornament strengthens progressively. Primary ribs of variable strength arise on the umbilical wall and shoulder. They are narrow, distant and prorsiradiate on the inner and middle flank, bi- or trifurcate on the ventrolateral shoulder, where additional ribs intercalate, the secondary and intercalated ribs delicate, narrow, flexing back and passing near-straight across the venter .

There are abundant specimens assigned here to *Scaphites peroni*. Previous interpretations of the species have been hindered by the fact that no complete body chambers are known. A few of the present specimens retain parts of the shaft (Pl. 38, Figs 1, 2, 10–12, 14–16), and there is a single recurved fragment from the adapertural end (Pl. 38, Fig. 17). Two forms are recognised, interpreted as a microconch/macroconch pair, while each presumed dimorph includes individuals that range from feebly to robustly ornamented. Within a large collection (769 specimens) from south-east of Djebel el Krorza, the microconch is represented by individuals such as OUMNH KX.16124 (Pl. 38, Fig. 1). The final septum lies on the straight shaft, well beyond the end of the planispiral whorls. These are 6.6 mm in diameter, coiling is evolute, the umbilicus comprising 36% of the diameter, with a subcircular whorl section. The early whorls are smooth, ornament appearing on the adapical part of the outer whorl, which bears 15 primary ribs. These are initially weak, but strengthen rapidly, and are at their maximum development just before the adapertural end of the spire, beyond which they weaken markedly. Where strong, they arise on the umbiical wall, where they are weak before strengthening abruptly on the umbilical shoulder. They are coarse, distant and recti- to feebly rursiradiate on the flanks and bifurcate at the ventrolateral shoulder, additional ribs intercalate and strengthen to match the primaries, all ribs well-developed and transverse on the venter. This style of ornament changes abruptly at the beginning of the straight shaft, reducing to very feeble primary ribs and intercalated ribs, at their strongest over the venter. A short section of body chamber is preserved; the venter is smooth. OUMNH KX.16134 has a spire 8 mm in diameter, but here ribbing appears on the adapertural 180° sector of the penultimate whorl and there are 17 primary ribs on the spire, that bifurcate on the ventrolateral shoulder, with additional ribs intercalating. Ornament weakens abruptly on the septate portion of the straight shaft; the adapical part of the body chamber appears to have been smooth. The other end of the variation series is represented by specimens such as OUMNH KX.16130 (Pl. 38, Fig. 3), with a spire 8.3 mm in diameter. Ornament, of comparable density to that of the robustly ornamented individuals is very feebly developed, and weakens markedly on the septate portion of the straight shaft. OUMNH KX.16132 (Pl. 38, Fig. 2) has slightly better developed ornament on the adapertural part of the spire. OUMNH KX.16131 (Pl. 38, Fig. 4) is a passage form between the two extremes of ornament.

Of the macroconchs, OUMNH KX.16122a (Pl. 38, Fig. 5) is a phragmocone of a robustly ornamented variant, some 11 mm in diameter. The whorls are as wide as high, the umbilicus comprising 20% of the diameter with feebly convex convergent flanks, broadly rounded ventrolateral shoulders, and a feebly convex venter. Fifteen to sixteen primary ribs arise on the umbilical wall, strengthen across the umbilical wall and flanks, where they are recti-to feebly rursirdiate, bifurcating on the ventrolateral shoulder, where additional ribs intercalate, the ribs equal, straight and transverse on the venter. OUMNH KX.16125 (Pl. 38, Fig. 6) is a compressed individual, the coiled portion 13.3 mm in diameter, the umbilicus comprising 24% of the diameter. It represents the feebly ornament variant, and retains a scrap of the adapertural end on the body chamber, the ventrolateral

shoulders and venter of which are smooth. OUMNH KX.13122 c, d (Pl. 38, Figs 7, 9) are passage forms between the two extremes of ornament.

The sutures of these individuals (Text-fig. 24D, I) are only moderately incised, with a high, asymmetrically bifid E/A, narrow, bifid A and A/U2.

Body chambers are more completely preserved in material from north of Djebel Hameima in Central Tunisia (Pl. 38, Figs 10–18). There is a comparable range of variation in phragmocones. Body chambers of both microconchs and macroconchs have flank ornament reduced to feeble riblets that are prorsiradiate, convex across the inner flanks, straight on the outer flanks, with low, broad constriction-like folds in some. The umbilical wall partially conceals the umbilicus of the spire in macroconchs (Pl. 38, Figs 14, 16), which have a high, compressed body chamber; in microconchs (Pl. 38, Figs 10, 11, 15) the shaft is slender by comparison

Differences between microconchs and macroconchs are thus size of the coiled portion, that of microconchs smaller than that of macroconchs, and microconchs more evolute than macroconchs, the umbilical wall of the shaft partially occluding the umbilicus of the spire in macroconchs (Pl. 38, Figs 8, 14, 16) that retains a short sector of body chamber.

DISCUSSION: If the above interpretation is accepted, there is continuous variation from the coarsely ornamented var. *paucicostata* of Sornay (1955, p. 9, pl. 1, figs 6, 8, 10; text-fig. 2) via his var. *rotundicostata* (1955, p. 9, pl. 1, fig. 4), individuals corresponding to the holotype (Text-fig. 33A–C), to var *compressa* of Sornay (1955, p. 9, pl. 1, figs 2, 3; text-fig. 1) to var. *inornata* of Pervinquière (1910, p. 26, pl. 11 (2), fig. 14–16; Text-fig. 33D–F). The holotype (by original designation) of *Scaphites peroni* var. *collignoni* Sornay, 1955 (p. 80) is the original of Collignon (1931, p. 87 (47) (*pars*), pl. 9 (5), fig. 11) from northern Madagascar belongs to some different species. The coiling of the phragmocone is serpenticone, with an ornament of delicate wiry ribs, quite different from that of *peroni*.

OCCURRENCE: Upper Cenomanian of north-eastern Algeria and Central Tunisia.

Scaphites sp. group of *geinitzii* d'Orbigny, 1850
(Pl. 31, Figs 14, 15)

MATERIAL: OUMNH KX.17194, from the Upper Turonian *neptuni* fauna, Commune of Ziana, northern Algeria.

DESCRIPTION: The specimen is a complete individual 13.7 mm long, heavily encrusted with limonitic overgrowths. Ornament is well-preserved on the adapertural part of the spire and adapical part of the body chamber shaft. Prorsiradiate primary ribs extend across the flanks, and increase by branching and intercalation, flex back, and pass straight across the venter.

DISCUSSION: Slight as the material is, and given the age, comparison with the *geinitzii* group is indicated, notably specimens from the Uppper Turonian *neptuni* Zone fauna of the Chalk Rock of southern England as figured by Kaplan *et al*. (1987) and Kennedy and Kaplan (2019, pl. 50, figs 14–32; pl. 51, figs 1–17; text-fig. 28a–j).

OCCURRENCE: As for material. *Scaphites geinitzii* is known from the upper Middle and Upper Turonian. The geographic distribution extends from southern and eastern England to northern France, Germany, Poland, the Czech Republic, northern Spain, Bulgaria, Romania, Ukraine (Crimea, Donbass), Kazakhstan, Turkmenistan, and Greenland.

DISCUSSION

The faunas from the Monts du Mellègue and adjacent parts of Central Tunisia provide the most comprehensive record of those described above. The overall composition of the faunas is reviewed. Also discussed is the variation in relative abundance of taxa between marls in sections in the Monts du Mellègue and northern Algeria, and between marl and shallower water marls and nodular limestones in north-eastern Algeria and central Tunisia.

Composition of the faunas

Ostlingoceras puzosianum fauna

There are substantial collections from 2.5 km south of Djebel Djerrisa in Central Tunisia, and the fauna is well-represented in collections from the commune of Ziana, east of Berrouaghia in northern Algeria, north and north-west of Gadet Chi in north-eastern Algeria, and north of Djebel Hameima in central Tunisia. The fauna from south of Djebel Djerissa is dominated by *Lechites* (*Lechites*) *moreti* (130 specimens). This was originally described from Ste Croix in the canton of Vaud in south-western Switzerland associated with a typical Boreal fauna.

Also typically Boreal is *Discohoplites pseudofalcatus*. Its presence on the south side of Tethys has analogues in the presence of *Hyphoplites falcatus aurora* Wright and Wright, 1949, in the Lower Cenomanian of Djebel Mrhila in Central Tunisia (Kennedy and Gale 2015) and *Hyphoplites* in Israel (Avnimelech 1965). The *Cantabrigites* in the fauna have an interesting distribution; both are common in northern Algeria, Central Tunisia, and, in comparable preservation, in the Pawpaw Shale of northeast Texas (Kennedy 2004). There are other similarities between the Texas and North African faunas, both of which include the micromorphs *Conlinites*, *Enigmaticeras*, *Flickia simplex*, and *Ficheuria pernoni*. The full suite of micromorphs in the present fauna is: *Conlinites evolutum*, *Metascaphites thomasi*, *Enigmaticeras* cf. *riceae*, *Flickia simplex*, *Ficheuria kiliani*, *F. pernoni*, *Neosaynoceras gazellae*, and *Worthoceras pygmaeum*. Their presence may be an artefact of preservation or may reflect enviromental preference; corroborative evidence is lacking. Other elements of the fauna have a more cosmopolitan distribution: *Desmoceras* (*Desmoceras*) *latidorsatum*, *Stoliczkaia* (*Stoliczkaia*) *clavigera*, S. (*Shumarinaia*) *africana*, *Hamites* spp., *Ostlingoceras* (*Ostlingoceras*) *puzosianum*, and *Mariella* (*Mariella*) *bergeri*. Apparent endemics (micromorphs apart) are: *Stoliczkaia* (*Stoliczkaia*) *subboulei*, *S.* (*S.*) *djerissaensis*, *S.* (*Shumarinaia*) *zrissense*, *Mariella* (*Mariella*) *harchaensis*, and *M.* (*M.*) *pervinquierei*

Neostlingoceras carcitanense fauna

This is known from outcrops north of Djebel Hameima in Central Tunisia, where the cosmopolitan index species is abundant (219 specimens); its distribution extends from Central Tunisia to southern England, France, northern Spain, Switzerland, Germany, Poland, Turkmenistan, Kazakstan, Iran, north-eastern Algeria, KwaZulu-Natal in South Africa, Tamil Nadu in South India, Madagascar, and Japan. Less widespread is *Neostlingoceras oberlini*, with records from the north side of Tethys from southern England to Turkmenistan and Iran, Israel, KwaZulu-Natal in South Africa, Madagascar and Tamil Nadu in South India. Other widely distributed taxa are *Mantelliceras saxbii*, *Sharpeiceras schlueteri*, *Idiohamites collignoni*, and *Sciponoceras roto*. *Borrisjakoceras falcatum*, *Algericeras* (*Algericeras*) *bogharíense bogharíense*, and *A.* (*A.*) *bogharíense paucicostatum*, and *Scaphites occlusus* are endemic micromorphs. The micromorph *Euhystrichoceras nicaisei* has a disjunct distribution: Central Tunisia, northern Algeria, Haute-Normandie, Sarthe and Bouches-du-Rhône in France, Tanzania and Madagascar.

Mariella (*Mariella*) *harchaensis* fauna

The *harchaensis* fauna is known from an outcrop 700 m north-east of Koudiat el Assel, 11 km approximately north-north-east of the village of Bou Khadra in north-eastern Algeria. It is characterised by the flood abundance of the endemic index species, and other endemics: *Hypoturriites schneegansi*, *Neophlycticeras algeriense*, *Graysonites elegans*, and *Scaphites occlusus.* More cosmolitan taxa are: *Anisoceras auberti*, *Idiohamites alternatus*, *Hamites simplex*, *Neostlingoceras oberlini*, and *Sciponoceras roto.*

Turrilites scheuchzerianus fauna

As noted above, this problematic association appears to span the upper Lower to lower Middle Cenomanian interval. It yields an abundant fauna west of Djebel Sottara in northern Algeria, characterised by the flood abundance of *Turrilites scheuchzerianus*. This is a cosmopolitan species, with records on the north side of Tethys from England to Kazakhstan, Turkmenia, and Iran. It also occurs in Israel, Nigeria, Angola, KwaZulu-Natal in South Africa, Madagascar, Tamil Nadu in South India, Tibet, Texas, the United States Western Interior, and California. Of what may be Lower Cenomanian, or Middle Cenomanian survivors, the distribution of *Euhystrichoceras nicaisei* is noted above, whilst *Coquandiceras villei* is endemic. Of undoubted Middle Cenomanian elements, *Acanthoceras rhotomagense* is widely distributed, from the north side of Tethys to New Guinea, Japan, and possibly Peru and Northern Australia.

Calycoceras (*Newboldiceras*) *asiaticum* fauna

The fauna has a cosmopolitan aspect in the form of widely distributed species of *Forbesiceras*, *Calycoceras* (*Newboldiceras*) and *Turrilites*. An exotic element is the specimen *Acanthoceras amphibolum* from a limestone unit west of Sour El-Ghozlane in northern Algeria. The species was originally described from Kansas, and occurs commonly and widely elsewhere in the United States Western Interior and Texas. It was recorded from Central Tunisia by Amédro in Robaszynski *et al*. (1994), and is also known from Nigeria (Zaborski 1985). *Carthaginites elegans* is endemic.

Eucalycoceras pentagonum fauna

This fauna is known from north of Djebel Hameima in Central Tunisia and east-south-east of Djebel el Krorza in north-eastern Algeria. The majority of the fauna: species of *Desmoceras*, *Forbesiceras*, *Calycoceras*, *Eucalycoceras*, and *Euomphaloceras* have cosmopolitan or quasi-cosmoplitan distributions; *Eucalycoceras pentagonum*, for example, is known from Europe, Madagascar, Tamil Nadu in South India, Japan, Colorado and New Mexico in the United States. An exotic element is *Neostlingoceras virdense*, previously recorded from New Mexico in the United States and southern England. *Scaphites peroni*, the numerically dominant element of the fauna (769 specimens from east-south-east of Djebel el Krorza) is endemic, as is the diminutive turrilitid *Cryptoturrilites*. Species of *Neolobites* are typically Tethyan in distribution (Wiese and Schulze 2005), an exception being rare specimens of *Neolobites vibrayeanus* (including the holotype) in Touraine, France, in a Boreal context (Kennedy and Juignet 1991).

Subprionocyclus neptuni fauna

This fauna, from the Commune of Ziana to the east of Berrouaghia in northern Algeria is characterised by the mass occurrence of *Subprionocyclus neptuni* (123 specimens), together with *Sciponoceras* cf. *bohemicum*, *Scalarite*s sp., *Worthoceras* sp., and *Scaphites* group of *geinitzii*. The supposedly Cenomanian *Pseudojacobites* sp. (= *Pachydiscus* sp. juv. of Pervinquière, 1910), *Hyphantoceras* (*Hyphantoceras*) *reussianum* (= *Bostrychoceras thomasi* (*pars*) of Pervinquière, 1910 = *H.* (*H.*) *cenomanense* Wiedmann, 1962), *Eubostrychoceras* (*Eubostrychoceras*) *saxonicum* (= *Eubostrychoceras thomasi* Pervinquière 1910 (*pars*)), *Yezoites*? *thomasi* (= *Parahoplites thomasi* of Pevinquière 1910), collected by Thomas and from Berrouaghia are interpreted as contemporaneous with this fauna. The association is equivalent to that of the *Hyphantoceras reussianum* fauna/event of the Boreal Realm, elements of which extend from Northern Ireland to southern England (the classic fauna of the Chalk Rock: Wright 1979; Kennedy 2019), Germany (Kennedy and Kaplan 2019) and eastwards to the Mangyschlak Mountains of Kazakhstan (Marcinowski *et al*. 1996). The number of *Subprionocyclus* in the present collection exceeds those described from those regions. *Subprinocyclus neptuni* extends more widely, with records from Japan, California and Oregon in the United States. The material from Tunisia adds to previous records of Collignoniceratinae from North Africa: the *Collignoniceras*, *Prionocyclu*s and *Subprionocyclus* (*Reesidites*) from Central Tunisia (Robaszynski *et al*. 1990). Whether the limonitic nuclei of supposedly Cenomanian *Romaniceras* from Berrouaghia and *Coilopoceras* from east of Berrouaghia collected by Thomas and Péron (see discussion in Kennedy *et al*. 1980 and Kennedy and Wright 1984b) are contemporaries of the *neptuni* fauna or older remains to be established.

Geographic and facies variations in faunal composition

One of the most striking features of the limonitic faunas from the marl sequences studied is the difference in composition between those from the Monts de Mellègue, the area between Sour El-Ghoslane (Aumale) and the material from Oued Cheniour in the Bassin de la Sebousse, near Guelma, 70 km east-north-east of Constantine. The Cenomanian faunas from the Monts de Mellègue are dominated by ornamented ammonites: trachyostraca, in both numbers of taxa and individuals. In contrast, the faunas from between Berrouaghia and Sour El-Ghosline are characterised by a high diversity of Phylloceratinae, Gaudryceratidae, Tetragonitidae, and Desmoceratidae: Leiostraca. This difference is even more striking in the fauna from Oued Cheniour collected by Blayac, and listed by him (1912, p. 305). The material was housed in the Sorbonne Collections when I examined it in the 1980's and was apparently seen by Pervinquière, who noted (1907, p. 300) specimens of his *Acanthoceras suzannae* (= *Graysonites cherbensis* herein) from the 'Vraconnien' of Oued Cheniour; they were figured by Kennedy and Gale (2015, pl. 9, figs 11, 12). There were in all, 419 specimens in the collection, the breakdown being as follows:

Phylloceras (*Hypophylloceras*) *seresitense* 305: 73%
Phylloceras (*Hypophylloceras*) *velledae* 54: 13%
Eogaudryceras (*Eogaudryceras*) *vattonei* 18: 4%
Eogaudryceras (*Eogaudryceras*) sp. 9: 2%
Gaudryceras (*Gaudryceras*) sp. 4: 1%
Puzosia (*Puzosia*) *mayoriana* 20: 5%
Forbesiceras largilliertianum 7: 1.7%
Graysonites cherbensis 2: 0.55%

A comparison of Upper Cenomanian shales and coarse terrigenous clastic sequences in Tamil Nadu, South India, revealed a similar variation (Gale *et al*. 2019, p. 28):

- shales: leiostraca 85.1%; trachyostraca 5.8%; heteromorphs 9.1%
- sand- and siltstones: leiostraca 3.6%; trachyostraca 85.7%; heteromorphs 10.8%.

In the Indian example, there were clear environmental differences, the sand- and siltstones accumulated in a shallower near-shore, higher energy, better-illuminated environment; the shales in a deeper off-shore, lower energy, less well-illuminated environment. The present examples all come from comparable facies, and the factors producing these disparate assemblages remains an enigma.

Assemblages from the marls of the Fadène Formation are also markedly different from those of the shallower water marls and nodular limestones of the Douar el Khiana section (Kennedy and Gale 2017) in north-eastern Algeria, 25 km north west of Djebel Hameima. The 470 m section ranges from upper Lower Cenomanian *dixoni* Zone to the top of the Middle Cenomanian *rhotomagense* Zone. Amongst the hundreds of ammonites, classic leiostraca are represented by single specimens of *Phylloceras* (*Hypophylloceras*) *velledae velledae*, *Tetragonites* cf. *subtimotheanus* Wiedmann, 1962, and *Parapuzosia* (*Austiniceras*) cf. *austeni*. A further difference is the presence of the nautiloids *Cymatoceras calabrus* (Seguenza 1881), *Eutrephoceras* (31) and *Angulithes* (28) in the nodular limestones; I found no nautilods in the marls north of Djebel Hameima. There are comparable differences between the marl faunas and those of the shallow water marls and limestones of the sections in Djebel Mrhila (Kennedy and Gale 2015), 100 km south-east of Djebel Hameima which span the Cenomanian stage; there is a single leiostracan: *Desmoceras* (*Desmoceras*) cf. *latidorsatum*, while nautiloids *Cymatoceras*, *Eutrephoceras*, and *Angulithes* are also present.

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PLATES 1–38

PLATE 1

1 – *Hemiptychoceras* sp., OUMNH KX.12699, from the Lower Cenomanian *carcitanense* fauna north of Djebel Hameima, Central Tunisia.

2 – *Hamites duplicatus* Pictet and Campiche, 1861, OUMNH KX.12698; horizon and locality as 1.

3 – *Mesoturrilites serpuliforme* (Coquand, 1862), OUMNH KX.16424; horizon and locality as 1.

4, 8 – *Pachydesmoceras maroccanum* Collignon, 1967. 4 – OUMNH KX.16835; 8 – OUMNH KX.16836; both from the Upper Cenomanian *pentagonum* fauna north of Djebel Hameima, Central Tunisia.

5 – *Mariella* (*Mariella*) sp., OUMNH KX.17206; horizon and locality as 1–3.

6 – *Neostlingoceras oberlini* (Dubourdieu, 1953), OUMNH KX.16422; horizon and locality as 1.

7 – *Mariella* sp., OUMNH KX.9764, from the Lower Cenomanian of Djebel Si Abd el Kerim, Central Tunisia.

Figure 1 is × 2; figures 2-8 are × 1

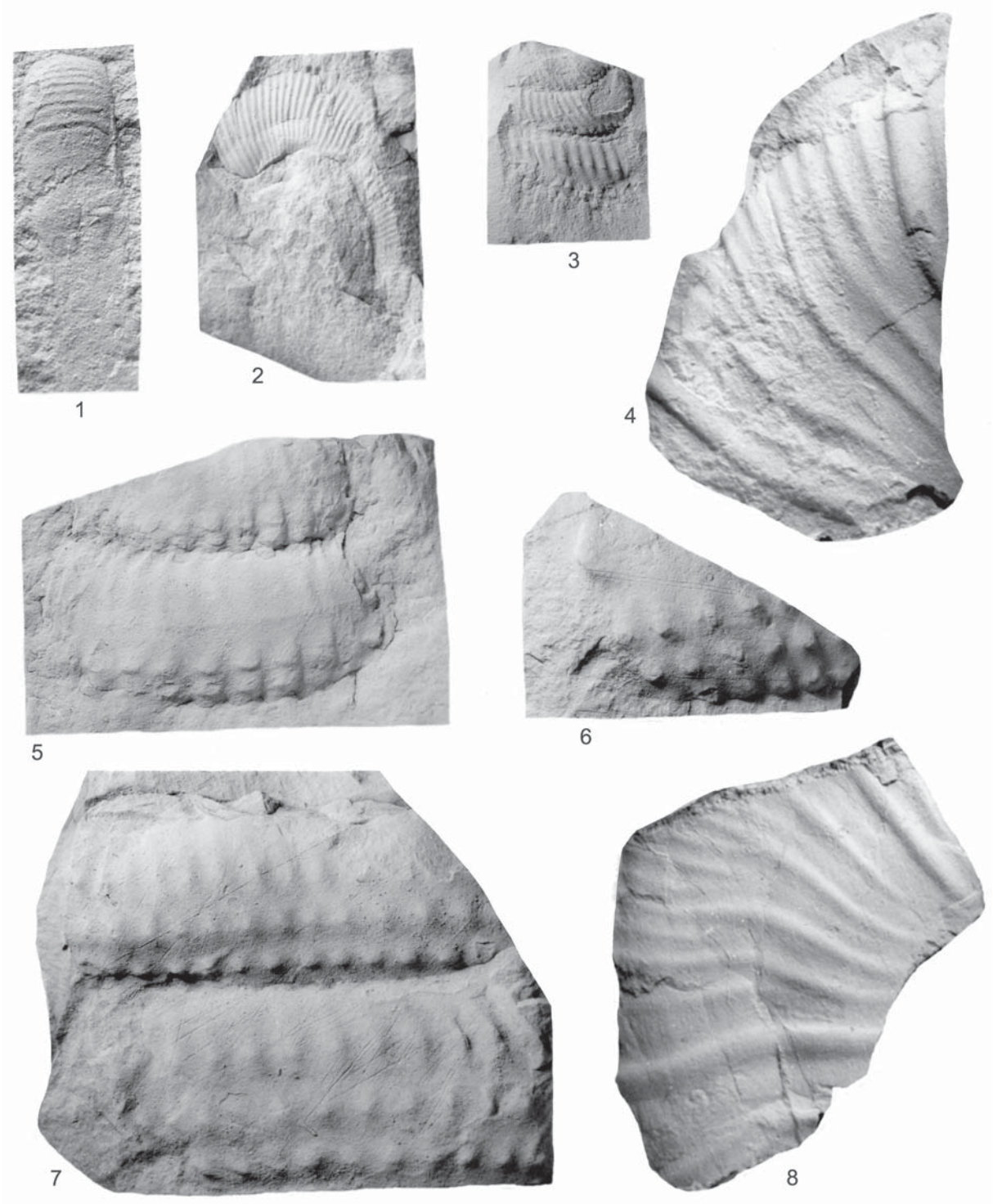
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PLATE 2

1-13 – *Phylloceras* (*Hypophylloceras*) *velledae velledae* (Michelin, 1838). 1-3 – OUMNH KX.9653c; 4-6 – OUMNH KX.9653d; 7, 8, 12, 13 – OUMNH KX.9653b; 9-11 – OUMNH KX.9653a; all from the Lower Cenomanian of Kat el Margueb, north of Djebel Fguira Salah, near Pont du Fahs, Central Tunisia.

14-18 – *Phylloceras seresitense seretisense* Pervinquière, 1907. 14, 15 – OUMNH KX.9765, from the Lower Cenomanian of Kef Si Abd el Kerim, Central Tunisia. 16-18 – MNHN. F. J13772b, the original of Pervinquière 1910, pl. 1 (10), fig. 2, from Berrouaghia, northern Algeria.

19-22 – *Phylloceras* (*Hypophylloceras*) *ellipticum* Kossmat, 1895. 19, 20 – MNHN unregistered, a specimen from Guern er Rhezal, Central Tunisia, one of those mentioned by Pervinquière (1907, p. 52). 21, 22, MNHN. F. J13713, the original of *Phylloceras ellipticum* Kossmat? of Pervinquière 1907, pl. 3, fig. 1, from Pont du Fahs, Central Tunisia. Both specimens were assigned to the 'Vraconnien' by Pervinquière.

Figures 1-18 are × 2; figures 19-22 are × 4

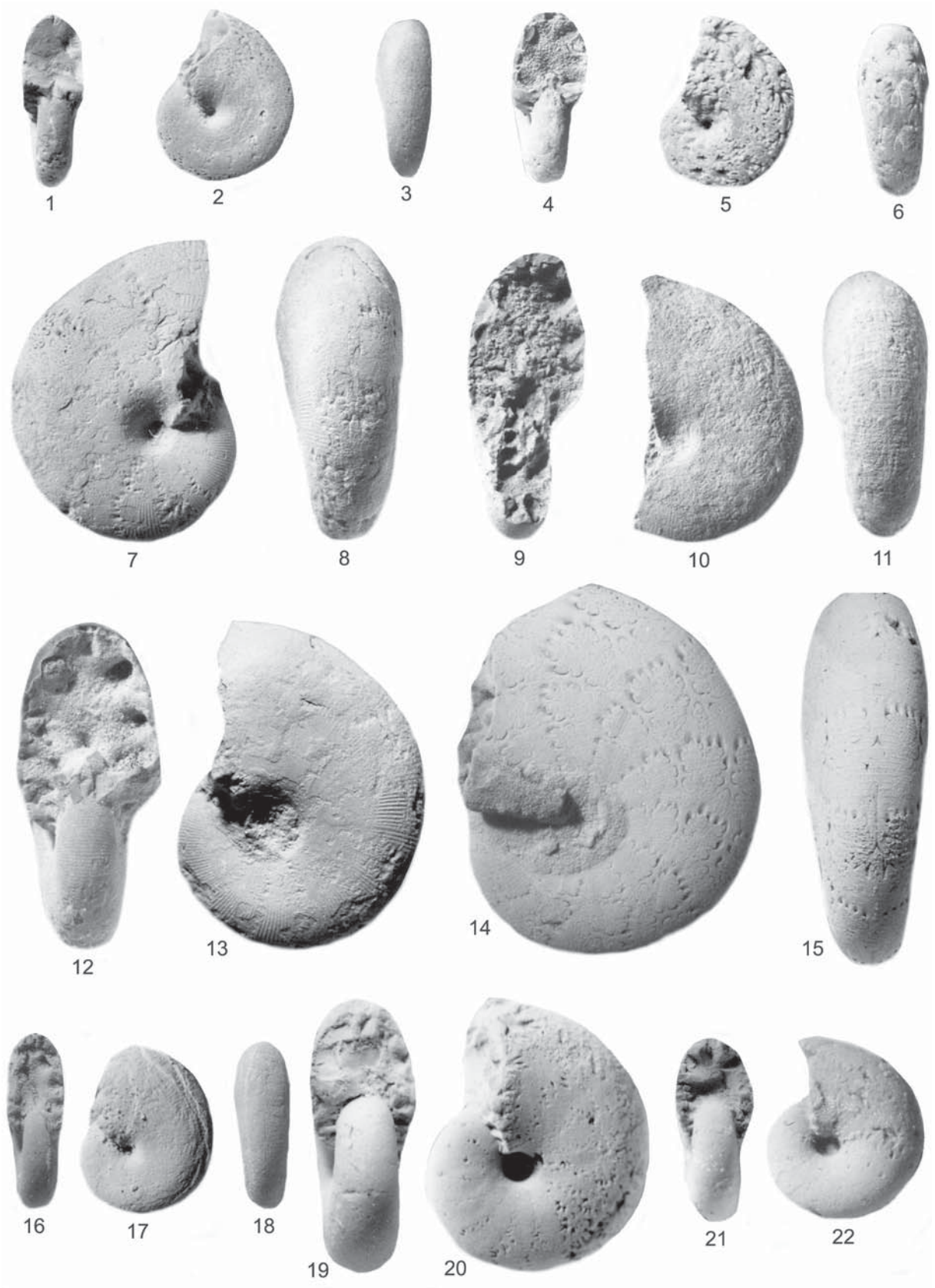
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PLATE 3

1-4, 7-9 – *Neophylloceras algeriense* (Wiedmann, 1962). 1-4 – MNHN. F. J13770, the original of Pervinquière 1910, pl. 10 (1), fig. 6, from Berrouaghia, northern Algeria. 7-9 – the holotype, MNHN. F. J13771, the original of Pervinquière 1910, pl. 1 (10), fig. 5, from Sour El-Ghozlane (Aumale), northern Algeria.

5, 6, 10, 11, 13-16 – *Phylloceras* (*Hypophylloceras*) *seresitense tanit* Pervinquière, 1907. 5, 6 – MNHN. F. J13796, the original of Pervinquière 1907, pl. 3, fig. 9, from Bou Tis, Central Tunisia. 10, 11 – MNHN. F. J13706c, the original of Pervinquiére 1907, pl. 3, figs 3, 4, from Kef Si Abdel Kerim, Central Tunisia. 13, 14 – MNHN collections, the original of Pervinquière 1907, pl. 3, fig. 8, from north of Bou Tis, Central Tunisia. 15, 16 – MNHN. F. J13795, the holotype, the original of Pervinquière 1907, pl. 3, figs 6, 7, from north of Bou Tis, Central Tunisia.

12, 17 – *Tetragonites* sp. juv. 12 – MNHN collections, the original of Pervinquière 1907, pl. 3, fig. 26, from the 'Vraconnien' of Kef Si Abd el Kerim, Central Tunisia. 17 – MNHN collections, the original of Pervinquière 1907, pl. 3, fig. 24, from the 'Vraconnien' of Guern er Rhezal, Central Tunisia.

18-20 – *Phylloceras* (*Hypophylloceras*) *pseudolateumblicatum* Collignon, 1929, MNHN. F. J13745, the original of Pervinquière 1907, pl. 3, fig. 8, from north of Bou Tis, Central Tunisia.

21, 22 – *Phylloceras* (*Hypophylloceras*) *seresitense seretisense* Pervinquière, 1907, MNHN. F. J13772, a the original of Pervinquière 1910, pl. 10 (1), fig. 1, from Berrouaghia, northern Algeria.

23, 24 – *Tetragonites spathi* Fabre, 1940, MNHN. F. J13799, the original of Pervinquière 1907, pl. 3, fig. 25, from Kef Sidi Abd el Kerim, Central Tunisia.

Figures 1-9 are × 2; figures 10-17 are × 5; figures 18-24 are × 4


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PLATE 4

1-3 – *Eogaudryceras* (*Eogaudryceras*) *vattonei* (Coquand, 1862), MNHN. F. J13768, the original of of Pervinquière 1910, pl. 10 (1), fig. 9, from Berrouaghia, northern Algeria.

4, 5, 14-24 – *Zelandites dozei dozei* (Fallot, 1885). 4, 5 – MNHN. F. J13765, the original of Pervinquière 1910, pl. 10 (1), fig. 13, from Berrouaghia, northern Algeria. 19-21 – MNHN. F. J13757, the original of Pervinquière 1910, pl. 10 (1), fig. 15, from Berrouaghia, northern Algeria. 22-24 – MNHN. F. J13764, the original of Pervinquière 1910, pl. 10 (1), fig. 14, from Sour El-Ghozlane (Aumale), northern Algeria.

6, 7 – *Kossmatella* sp. juv., MNHN. F. J13715, the original of *Lytoceras* (*Kossmatella*) cf. *marut* Stoliczka of Pervinquière 1907, pl. 3, figs 22, 23, from Kef si Abd el Kerim, Central Tunisia.

8-13 – *Tetragonites spathi* Fabre, 1940. 8, 9 – OUMNH KX.16520, from the Lower Cenomanian *carcitanense* fauna north of Djebel Hameima, Central Tunisia. 10, 11 – OUMNH KX.9666; 12, 13 – OUMNH KX.9665; both from the Lower Cenomanian of Kat el Margueb, north of Djebel Fguira Salah, near Pont du Fahs, Central Tunisia.

14-18 – *Anagaudryceras* sp. 14-16 – OUMNH KX.9670; 17, 18 – OUMNH KX.9669; both from the Lower Cenomanian of Kat el Margueb, north of Djebel Fguira Salah, near Pont du Fahs, Central Tunisia.

25, 26 – *Zelandites flicki* (Pervinquière, 1907), MNHN. F. J04331, the holotype, the original of Pervinquière 1907, pl. 3, fig. 16, from the 'Vraconnien' of Djebel Chirich, Central Tunisia.

Figures 1-5, 8-26 are × 2; figures 6, 7 are × 4


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PLATE 5

1-3 – *Anagaudryceras pauli* (Coquand, 1862), the holotype, GMH K-8443, from Sour El-Ghozlane (Aumale), northernAlgeria.

4-7 – *Zelandites dozei dozei* (Fallot, 1885), the holotype of *Ammonites solarius* Coquand, 1862, GMH K-8442, from Sour El-Ghozlane (Aumale), northern Algeria.

8-10, 14-17 – *Eogaudryceras vattonei* (Coquand, 1862). 8-10 – GMH K-8849b; 14-17 – GMH K8849a; both from Berrouaghia, northern Algeria.

11-13 – *Eogaudryceras* (*Eogaudryceras*) *numidum* (Coquand, 1862), the holotype, GMH K-8159, from Djebel Ouach, northern Algeria.

All figures are × 2


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PLATE 6

1-4, 7-8, 9, 10 – *Puzosia* (*Puzosia*) *mayoriana* (d'Orbigny, 1841). 1 – MNHN collections, identified as *Puzosia spathi* in Breistroffer's hand, from Boghar, northern Algeria. 2-4 – MNHN. F. J13712, the original of *Puzosia mayoriana* var. *octosulcata* Sharpe of Pervinquière 1907, pl. 6, fig. 29, from Guern er Rhezal, Central Tunisia. 7, 8 – MNHN. F. J13710, the original of *Puzosia mayoriana* var. à 4 sillons of Pervinquière 1907, pl. 6, fig. 26, from Guern er Rhezal, Central Tunisia. 9, 10 – MNHN. F. J13793, the original of *Puzosia mayoriana* var. *octosulcata* Sharpe of Pervinquière 1907, pl. 6, fig. 30, from Pont du Fahs, Central Tunisia.

5, 6 – *Desmoceras* sp. juv. MNHN. F. J13710, the original of *Puzosia diphylloides* Forbes of Pervinquière 1910, pl. 11 (2), fig. 30, from Berrouaghia, northern Algeria.

11-13, 22-24 – *Parapuzosia* (*Austiniceras*) sp. juv. 11-13 – MNHN. F. J13769, the original of *Puzosia subplanulata* Schlüter of Pervinquière 1910, pl. 11 (2) fig. 31, from Sour El-Ghozlane (Aumale) northern Algeria. 22-24 – MNHN. F. J13760, the original of *Puzosia subplanulata* Schlüter of Pervinquière 1910, pl. 11 (2), fig. 32, from Berrouaghia, northern Algeria.

14, 15 – Tetragonitinae sp. juv., MNHN. F. J13790, the original of *Lytoceras* cf. *kingianum* of Pervinquière 1907, pl. 3, fig. 29, from the 'Vraconnien' of Kef Si Abd el Kerim, Central Tunisia.

16, 21 – *Eogaudryceras* (*Eogaudryceras*) *vattonei* (Coquand, 1862), MNHN. F. J13767, the original of Pervinquière 1910, pl. 10 (1), fig. 10, from Berrouaghia, northern Algeria.

17-20 – *Zelandites dozei dozei* (Fallot, 1855). 17, 18 – MNHN. F. J13763, the original of Pervinquière 1910, pl. 10 (1), fig. 10, from Berrouaghia, northern Algeria. 19-20 – MNHN. F. J13762, the original of Pervinquière 1910, pl. 11 (1), fig. 17, from Sour El-Ghozlane (Aumale), Algeria.

Figures 1-13, 16-24 are × 2; figures 14, 15 are × 4

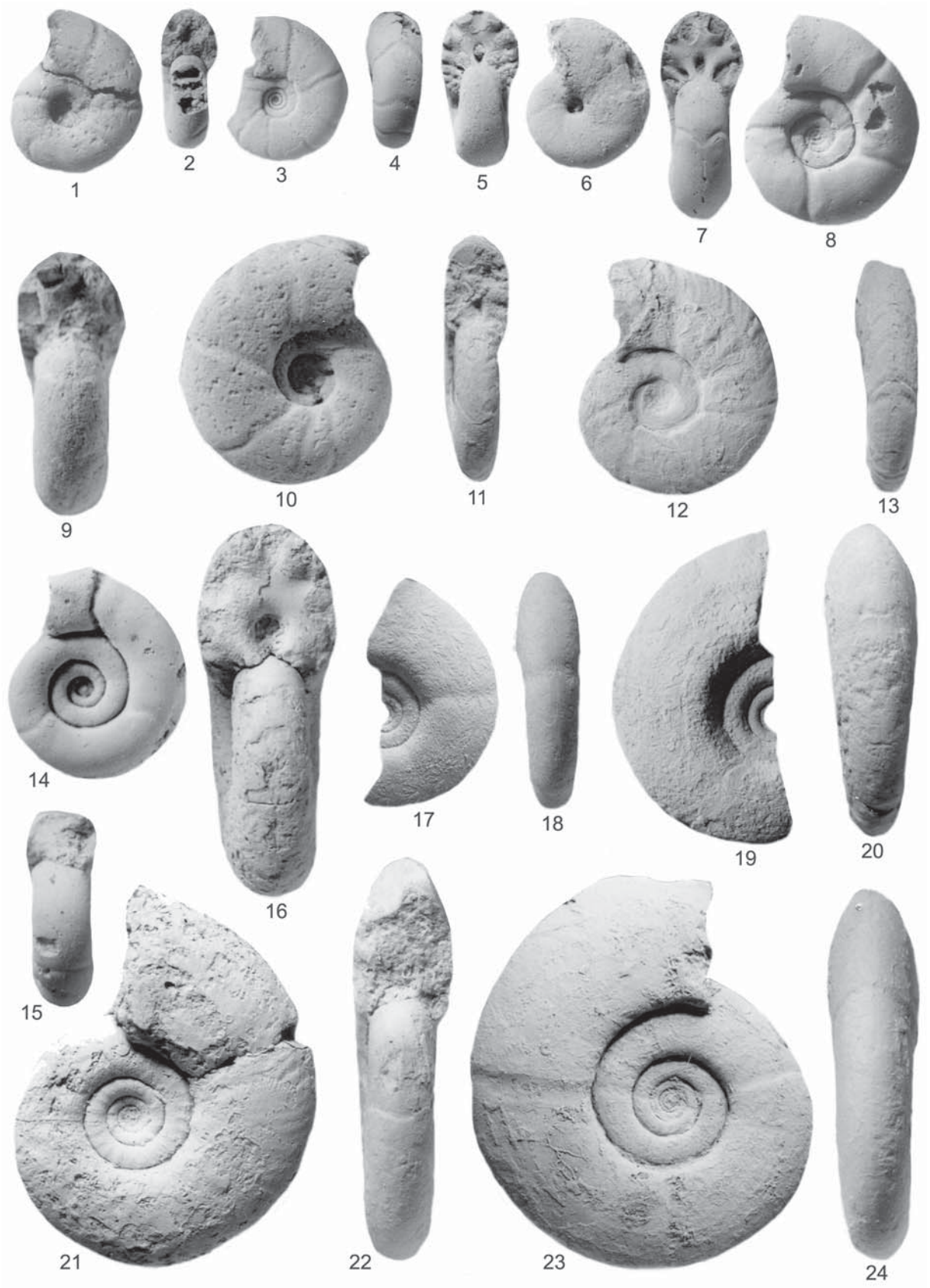
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PLATE 7

1, 2, 7-9, 15 – *Puzosia* (*Puzosia*) *mayoriana* (d'Orbigny, 1841). 1, 2 – OUMNH KX.9656, from the Lower Cenomanian of Kat el Margueb, north of Djebel Fguira Salah, Central Tunisia. 7-9 – OUMNH KX.14234a, from the Upper Albian *puzosianum* fauna, 2.5 km south of Djebel Djerissa, Central Tunisia. 15 – OUMNH KX.9805, from the Upper Cenomanian *pentagonum* fauna north of Djebel Hameima, Central Tunisia.

3, 4 – *Puzosia* (*Bhimaites*) sp., OUMNH KX.14310, from the Upper Albian *puzosianum* fauna, 2.5 km south of Djebel Djerissa, Central Tunisia.

5, 6 – *Phyllopachyceras whiteavesi* (Kossmat, 1898). OUMNH KX.9654a, from the Lower Cenomanian of Kat el Margueb, north of Djebel Fguira Salah, near Pont du Fahs, Central Tunisia.

16-18 – *Desmoceras* (*Desmoceras*) *latidorsatum* (Michelin, 1838), OUMNH KX.9700a, from the Upper Cenomanian *pentagonum* fauna north of Koudiat el Hamra, south-west of El Kef, Central Tunisia.

10-14 – the holotype of *Microdesmoceras bucculentum* (Pervinquière, 1910), MNHN. F. J13701, the original of Pervinquière 1910, pl. 10 (1), figs 19, 20, from Berrouaghia, northern Algeria.

Figures 1-9, 16-18 are × 2; figures 10-14 are × 5; figure 15 is × 1.5

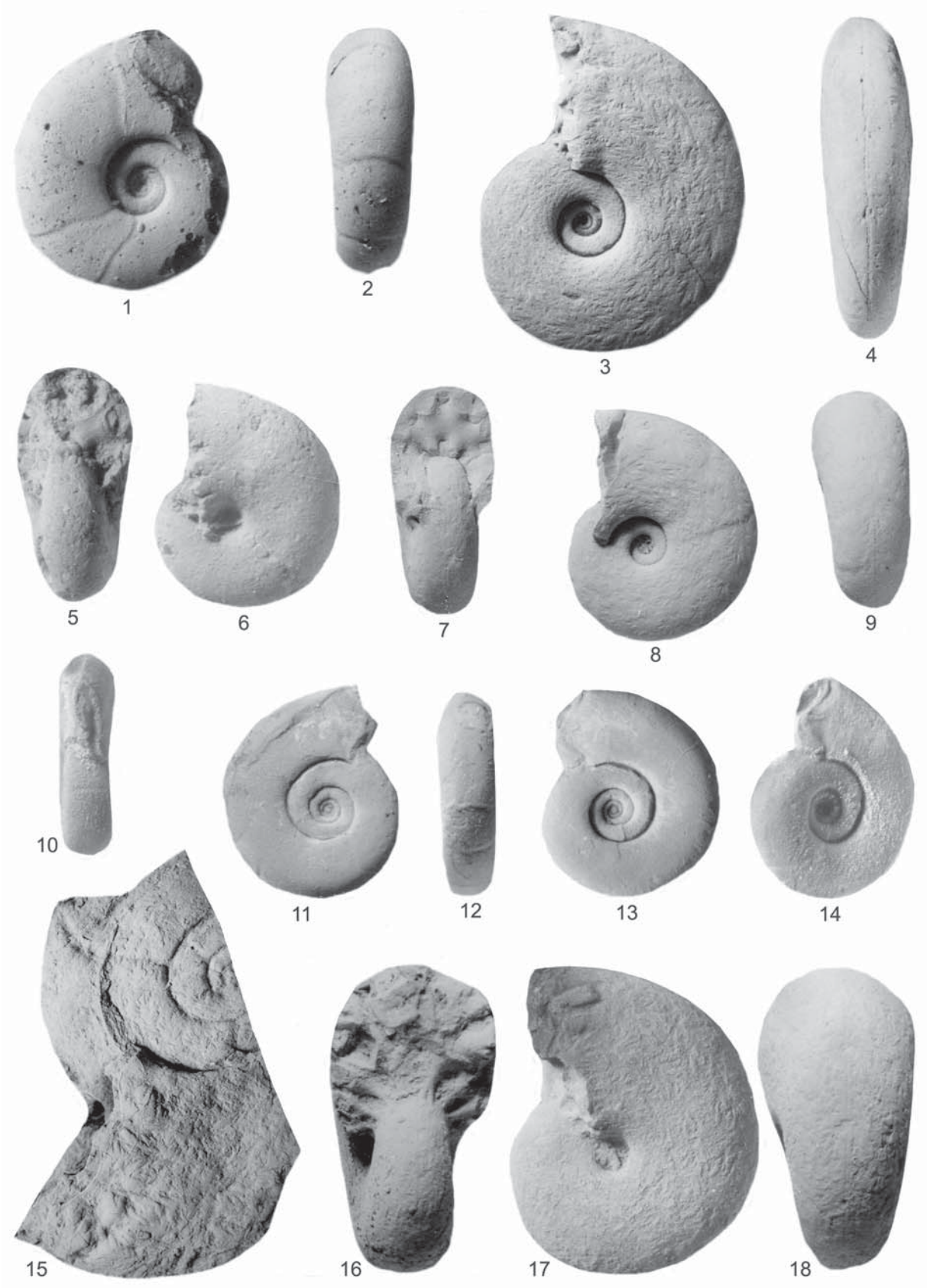
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PLATE 8

1-13 – *Desmoceras* (*Desmoceras)* sp. juv. The originals of *Puzosia* (*Latidorsella*?) *paronae* Kilian of Pervinquière 1907. 1, 2 – MNHN. F. J13700, the original of his pl. 6, fig. 10, from the 'Vraconnien' of Guern er Rhezal, Central Tunisia. 3-5 – MNHN. F. J13716, the original of pl. 6, fig. 11, from the 'Vraconnien' north of Bou Tis, Central Tunisia. 6-8 – MNHN. F. J13704, the original of pl. 6, fig. 12, from the 'Vraconnien' north of Bou Tis, Central Tunisia. 9, 10 – MNHN.F. J13801, the original of pl. 10, fig. 12, from the 'Vraconnien' north of Bou Tis, Central Tunisia. 11-13 – MNHN. F. J13800, the original of pl. 6, fig. 13, from the 'Vraconnien' north of Bou Tis, Central Tunisia.

14-19 – *Desmoceras* (*Desmoceras*) *latidorsatum* (Michelin, 1838). 14-16 – OUMNH KX.14234c; 17-19 – OUMNH KX.14234b; both from the Upper Albian *puzosianum* fauna, 2.5 km south of Djebel Djerissa, Central Tunisia.

Figures 1, 2, 11-13 are × 4; figures 3-10, 14-19 are × 2


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PLATE 9

1-11 – *Discohoplites subfalcatus* (Semenov, 1889). 1 – OUMNH KX.16184; 2, 3 – OUMNH KX.14169; 4 – OUMNH KX.16186; 5 – OUMNH KX.16187; 6, 7 – OUMNH KX.16188; 8, 9 – OUMNH KX.16190; 10, 11 – OUMNH KX.16189; all from the Upper Albian *puzosianum* fauna north and north-west of Gadet Chi, east of Bou Khadra, north-eastern Algeria.

12-17 – *Engonoceras* sp. 12-15 – OUMNH KX.14242; 16, 17 – OUMNH KX.14241; both from the Upper Albian *puzosianum* fauna, 2.5 km south of Djebel Djerissa, Central Tunisia.

18-20 – *Neolobites vibrayeanus* (d'Orbigny, 1841), OUMNH KX.16721a, from the Upper Cenomanian *pentagonum* Zone fauna north of Djebel Hameima, Central Tunisia.

21, 22 – *Neolobites peroni* Pervinquière, 1907, OUMNH KX.16721b, from the Upper Cenomanian *pentagonum* fauna north of Djebel Hameima, Central Tunisia.

Figures 1-11, 18-22 are × 2; figures 12-17 are × 3.5


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PLATE 10

Cantabrigites spinosum (Pervinquière, 1907)

1, 2 – an unregistered paralectotype in the MNHN collections; 3-5 – the lectotype, MNHN. F. J04235, the original of *Mortoniceras inflatum* Sow. var. *spinosa* Pervinquière 1907, pl. 9, fig. 3, from 'Djebel Zrissa' Central Tunisia. 6, 7 – OUMNH KX.14220a; 8, 9 – OUMNH KX.14250; 10, OUMNH KX.14222; 11, 12 – OUMNH KX.14223a; 13, 14 – OUMNH KX.14191b; 15, 16 – OUMNH KX.14251b; 17 – OUMNH KX.14251a; 18,19 – OUMNH KX.14251c; 20, 21 – OUMNH KX.14251d; all from the Upper Albian *puzosianum* fauna, 2.5 km south of Djebel Djerissa, Central Tunisia.

All figures are × 2

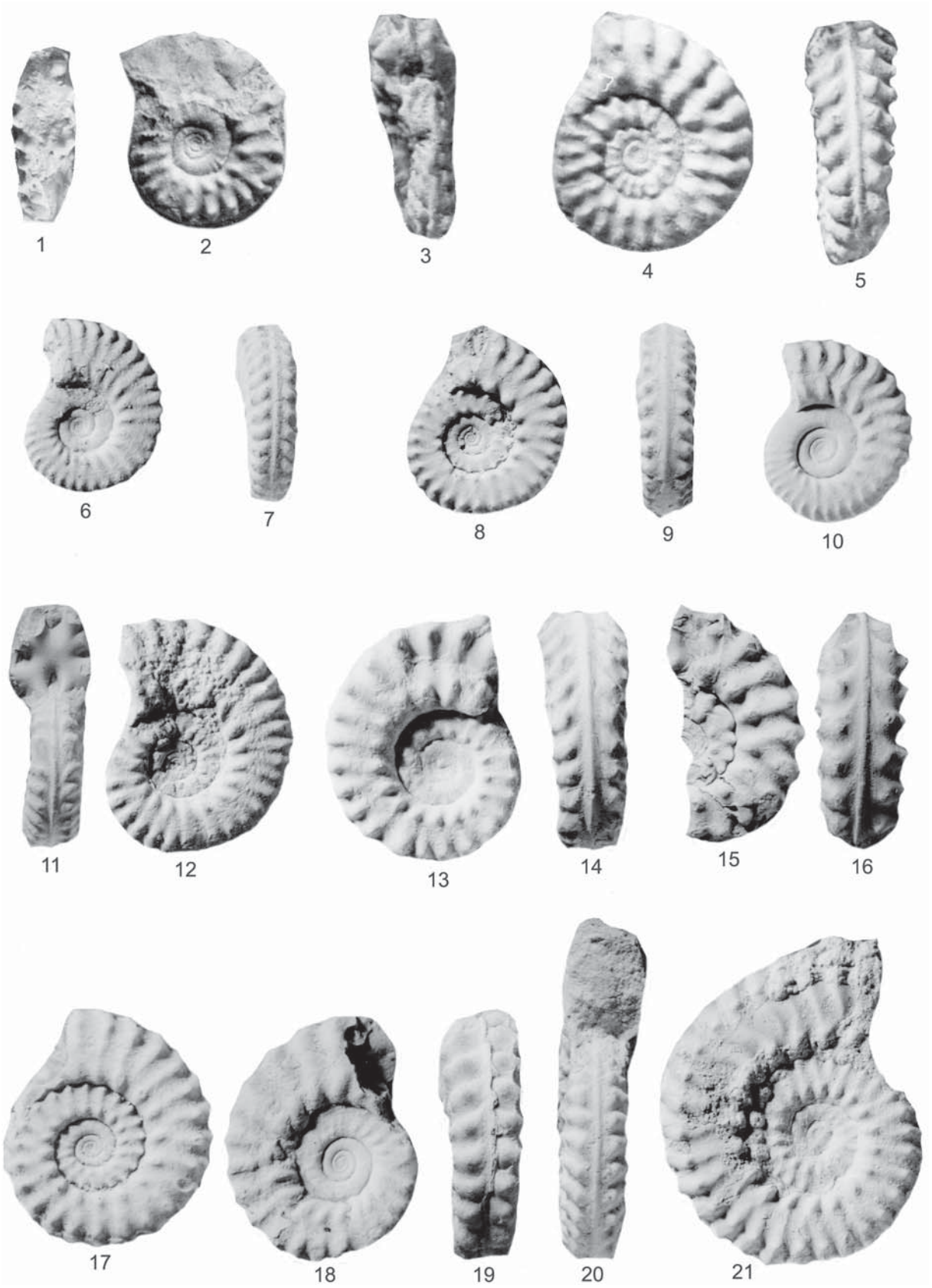
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PLATE 11

1-13 – *Cantabrigites wenoensis* (Adkins, 1920). 1, 2 – the holotype, TMM 21412, the original of Adkins 1920, pl. 1, fig. 14, from the Pawpaw Shale near Fort Worth, Texas. 3, 4, OUMNH KX.14190, from the Upper Albian *puzosianum* fauna, 2.5 km south of Djebel Djerissa, Central Tunisia. 5, 6 – OUMNH KX.17085, from the Upper Albian of Ziana, 21 km east of Berrouaghia, northern Algeria. 7-9 – MNHN. F. J13781, the lectotype of *Prohysteroceras tunisiense* Spath, 1925b, the original of *Mortoniceras inflatum* var. *orientalis* (?) of Pervinquière 1907, pl. 11, fig. 2, from the 'Vraconnien' of Djebel Djerissa, Central Tunisia. 10, 11 – USNM 520226, the original of Kennedy 2005, text-fig. 12d, e, from the Upper Albian Pawpaw Shale north-east of Watatuga, Tarrant County, Texas. 12, 13 – OUMNH KX.17086, from the Upper Albian of Ziana, 21 km east of Berrouaghia, northern Algeria.

14, 15 – *Algericeras* (*Algericeras*) *bogharense paucicostatum* Kennedy and Wright, 1981, OUMNH KX.16632, from the Lower Cenomanian *carcitanense* fauna north of Djebel Hameima, Central Tunisia.

16-25 – *Euhystrichoceras nicaisei* (Coquand, 1862). 16, 17 – OUMNHKX.16572a, from the Lower Cenomanian *carcitanense* fauna north of Djebel Hameima, Central Tunisia. 18, 19 – OUMNH KX.9638, from the Lower Cenomanian of Kat el Margueb north of Djebel Fguira Salah, near Pont du Fahs, Central Tunisia. 20, 21 – OUMNH KX.16086, from the Lower Cenomanian *scheuchzerianus* fauna west of Djebel Sottara, 8.8 km west of Sour El-Ghoslane (Aumale), northern Algeria. 22 – OUMNH KX.I7117a; 23, 24 – OUMNH KX.17117b; both from the Lower Cenomanian, Commune of Ziana, 21 km east of Berrouaghia, northern Algeria.

25-27 – *Algericeras* (*Algericeras*) *bogharíense bogharíense* (Coquand, 1862), OUMNH KX.16429, from the Lower Cenomanian *carcitanense* fauna north of Djebel Hameima, Central Tunisia.

Figures 1-4, 7-13, 16-21, 25-27 are × 2; figures 14 and 15 are × 3; figures 22-24 are × 6

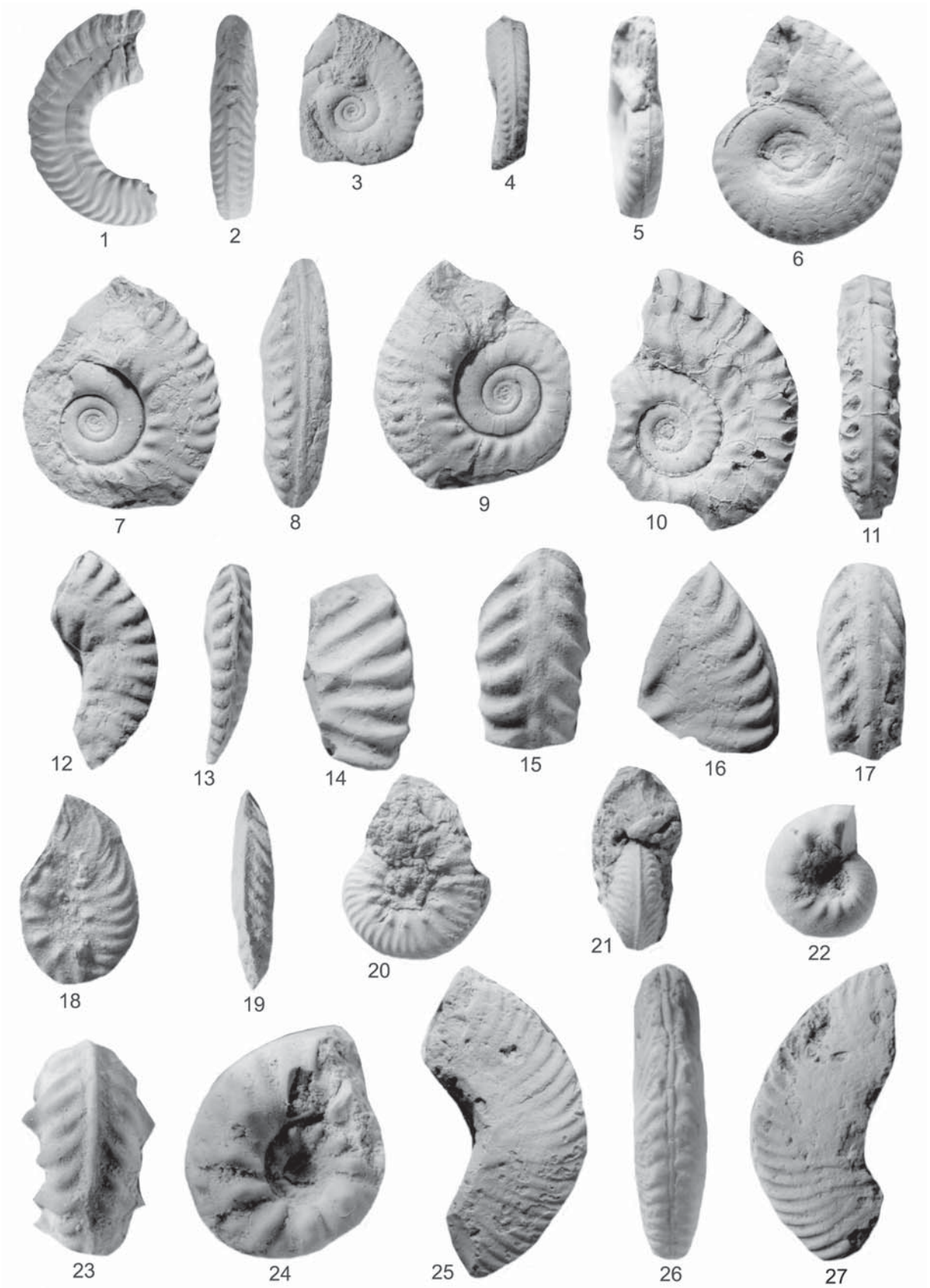
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PLATE 12

1-7, 10-15 – *Algericeras* (*Algericeras*) *boghariense boghariense* (Coquand, 1862). 1-4 – the lectotype, GMH K-8455, the possible original of *Ammonits favrei* Coquand 1862, pl. 2, figs 3, 4, figured by Pervinquière 1910, pl. 15 (6), fig. 30; 5-7 – paralectotype GMH K-8844a, the original of Pervinquière 1910, pl. 15 (6), fig. 29; 10-12 – paralectotype GMH K-8844b, the original of Pervinquière 1910, pl. 15 (6), fig. 31; 13-15 – paralectotype GMH K-8844c, the original of Pervinquière 1910, pl. 15 (6), fig. 32; all from Berrouaghia, northern Algeria.

8, 9, 31-33 – *Algericeras boghariense paucicostatum* Kennedy and Wright, 1981. 8, 9 – GMH K-4276, labelled *Mortoniceras* (?) *nicaisei*, and from Boghar, northern Algeria. 31-33 – GMH K-9125, labelled *Euhystrichoceras nicaisei*, and from Djebel Korreo, northern Algeria.

16-30, 34-36 – *Euhystrichoceras nicaisei* (Coquand, 1862). 16-18 – paralectotype, GMH K-4276, the original of Pervinquière 1910, pl. 15 (6), fig. 6; 19-21 – paralectotype, GMH K-4276; 22-24 – the lectotype, GMH K-4276, the original of Pervinquière 1910, pl. 15 (6), fig. 8; 25-27 – paralectotype, GMH K-4276, the original of Pervinquière 1910, pl. 15 (6), fig. 10; 28-30 – paralectotype, GMH K-4276, the original of Pervinquière 1910, pl. 15 (6), fig. 7; 34-36 – paralectotype, GMH K-4276, the original of Pervinquière 1910, pl. 15 (6), fig. 9; all from west of Boghar, northern Algeria.

All figures are × 2

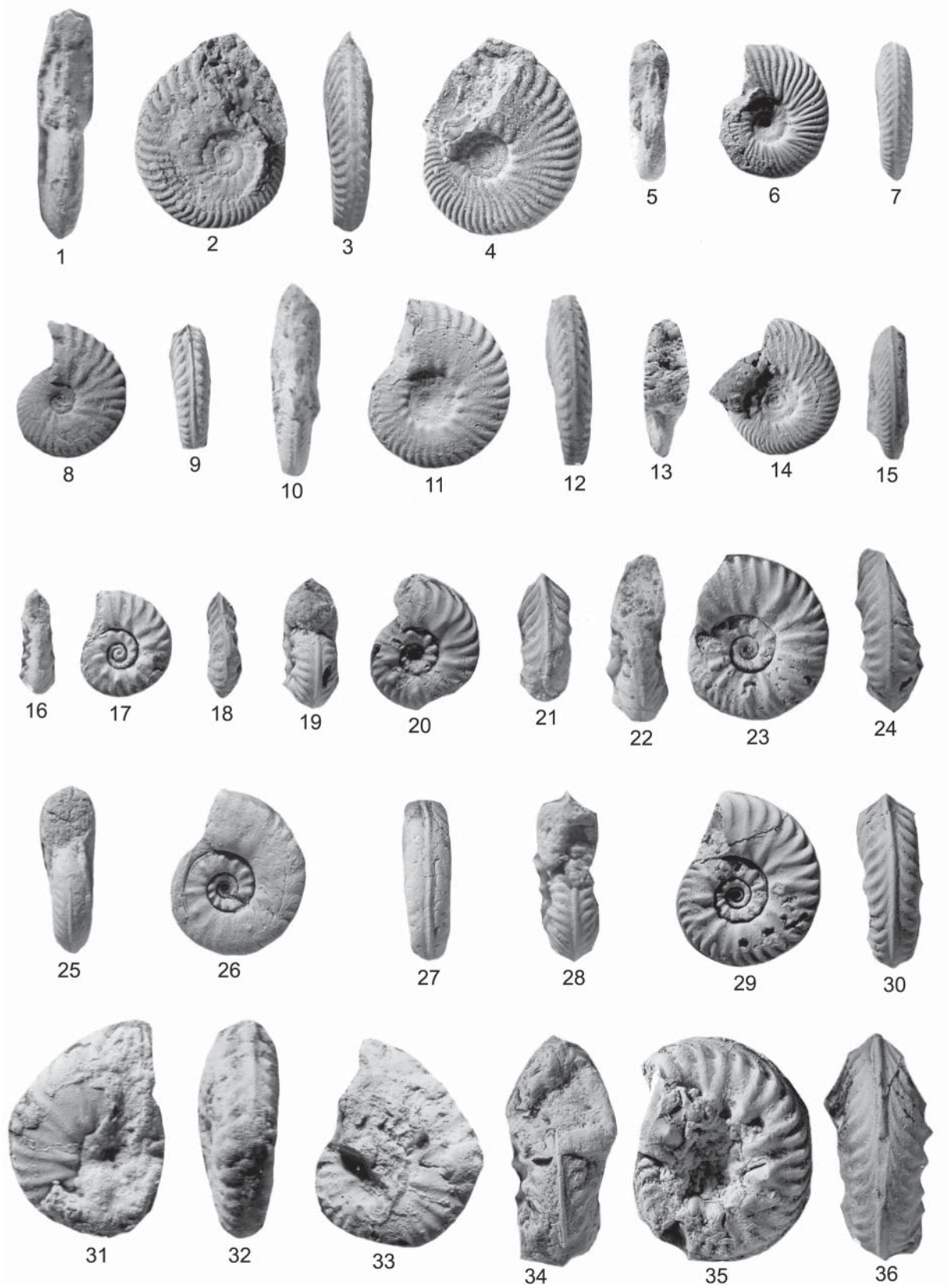
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PLATE 13

1-5, 20-24 – *Algericeras* (*Algericeras*) *proratum* (Coquand, 1879). 1-3 – MNHN. F. J04321, the original of Pervinquière 1907, pl. 11, fig. 7, from Guern er Rhezal, CentralTunisa. 3, 4 – MNHN collections, also from Guern er Rhezal, Central Tunisia. 5 – MNHN. F. J04350, the original of Pervinquière 1910, pl. 15 (6), fig. 26, from Sour El-Ghozlane (Aumale), northern Algeria. 20, 21 – MNHN. F. J04349, the original of Pervinquière 1910, pl. 15 (6), fig. 25, from Sour El-Ghozlane (Aumale), northern Algeria. 22-24 – MNHN. F. J04313, original of Pervinquière 1907, pl. 11, fig. 9, from Guern er Rhezal, Central Tunisia.

6-8 – *Algericeras boghariense boghariense* (Coquand, 1880), MNHN. F. J04430 original of Pervinquière 1907, pl. 11, fig. 16, from Sidi Youssef, Central Tunisia.

9-19, 25-27 – *Algericeras boghariense paucicostatum* Kennedy and Wright, 1981. 9, 10 – MNHN collections, from Kef Si Abd el Kerim, Central Tunisia. 11-13 – MNHN. F. J04347, the original of Pervinquière 1910, pl. 15 (6), figs 27, 28, from Berroaghia, north-eastern Algeria. 14-16 – MNHN. F. J04334, the holotype, the original of Pervinquière 1907, pl. 11, fig. 10, from Guern er Rhezal Central Tunisia. 17-19 – the original of Pervinquière 1907, pl. 11, fig. 11, from Kef Si Abd el Kerim, Central Tunisia. 25-27 – MNHN. F. J04311 the original of Pervinquière 1907, pl. 11, fig. 12, from Kef Si Abd el Kerim, Central Tunisia.

28, 29, 31-34 – *Neolobites peroni* Pervinquière, 1907. 28, 29 – OUMNH KX.16847; 31, 32 – OUMNH KX.16848; 33, 34 – OUMNH KX.16849; all from the Upper Cenomanian *pentagonum* fauna north of Djebel Hameima, Central Tunisia.

30, 35-38 – *Stoliczkai*a (*Stoliczkaia*) *subboulei* (Sornay, 1955). 30 – OUMNH KX.16236; 35, 36 – OUMNH KX.16237; 37, 38 – OUMNH KX.16238; all from the Upper Albian *puzosianum* fauna north and north-east of Gadet Chi, north-eastern Algeria.

Figures 1-32, 35-38 are × 2; figures 33, 34 are × 1

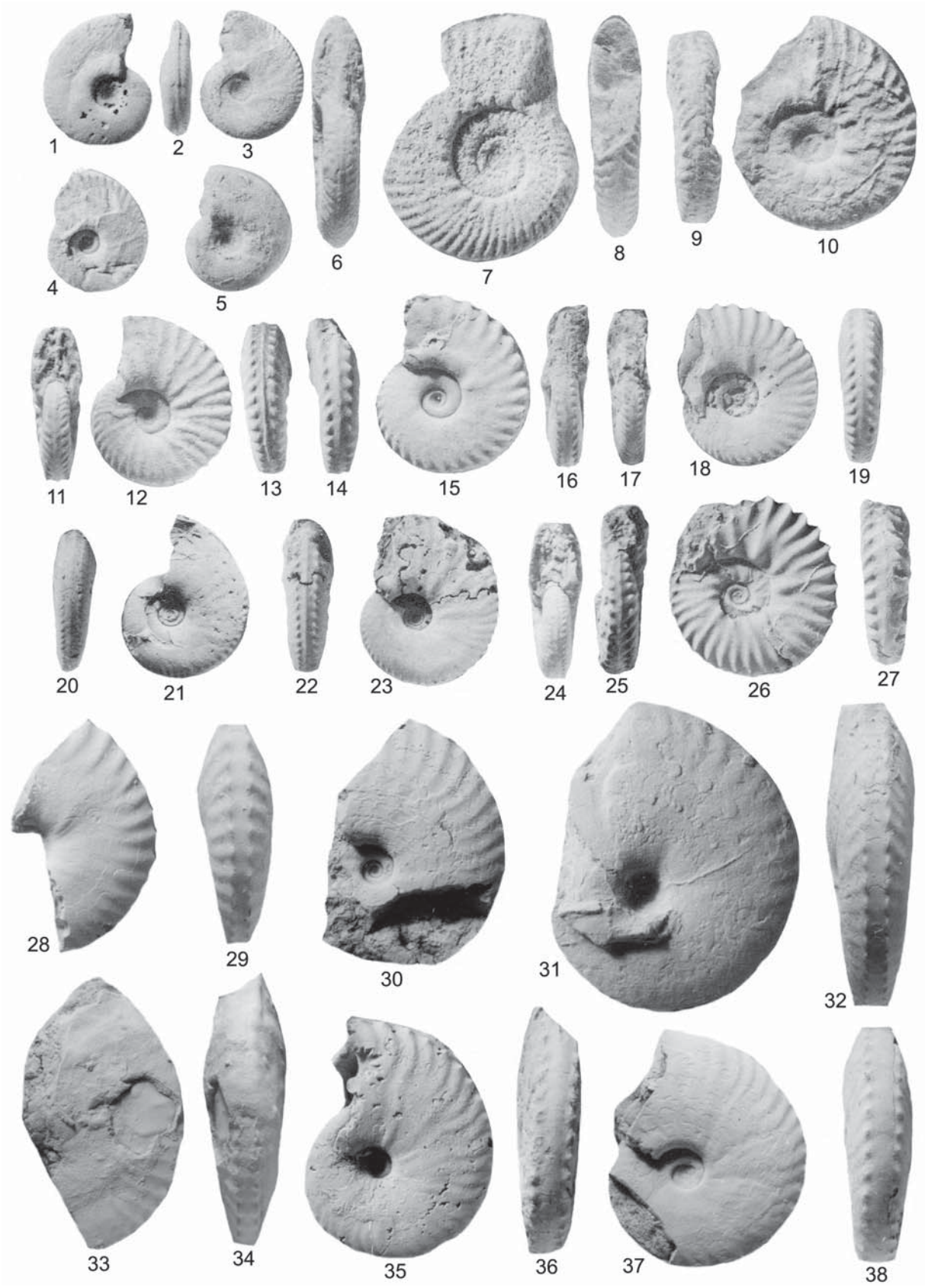
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PLATE 14

1-9 – *Stoliczkaia* (*Stoliczkaia*) *djerissaensis* sp. nov. 1-3 – paratype OUMNH KX.14230a; 4-6 – the holotype, OUMNH KX.14230b; both from the Upper Albian *puzosianum* fauna, 2.5 km south of Djebel Djerissa, Central Tunisia. 7-9 – MNHN. F. J13766, the original of *Acanthoceras martimpreyi*, variété épais à fort côtes et peu nombreuses' of Pervinquière 1907, pl. 16, figs 4, 5, from Guern er Rhezal, Central Tunisia.

10-15 – *Stoliczkaia* (*Stoliczkaia*) *clavigera* (Neumayr, 1875). 10 – OUMNH KX.14278c; 11 – OUMNH KX.14277a; 12, 13 – OUMNH KX.14781a; 14, 15 – OUMNH KX.14277b; all from the Upper Albian *puzosianum* fauna, 2.5 km south of Djebel Djerissa, Central Tunisia.

16-19 – *Stoliczkaia* (*Stoliczkaia*) *subboulei* (Sornay, 1955). 16, 17 – OUMNH KX.14288b; 18, 19 – OUMNH KX.14288c; both from the Upper Albian *puzosianum* fauna, 2.5 km south of Djebel Djerissa, Central Tunisia.

All figures are × 2

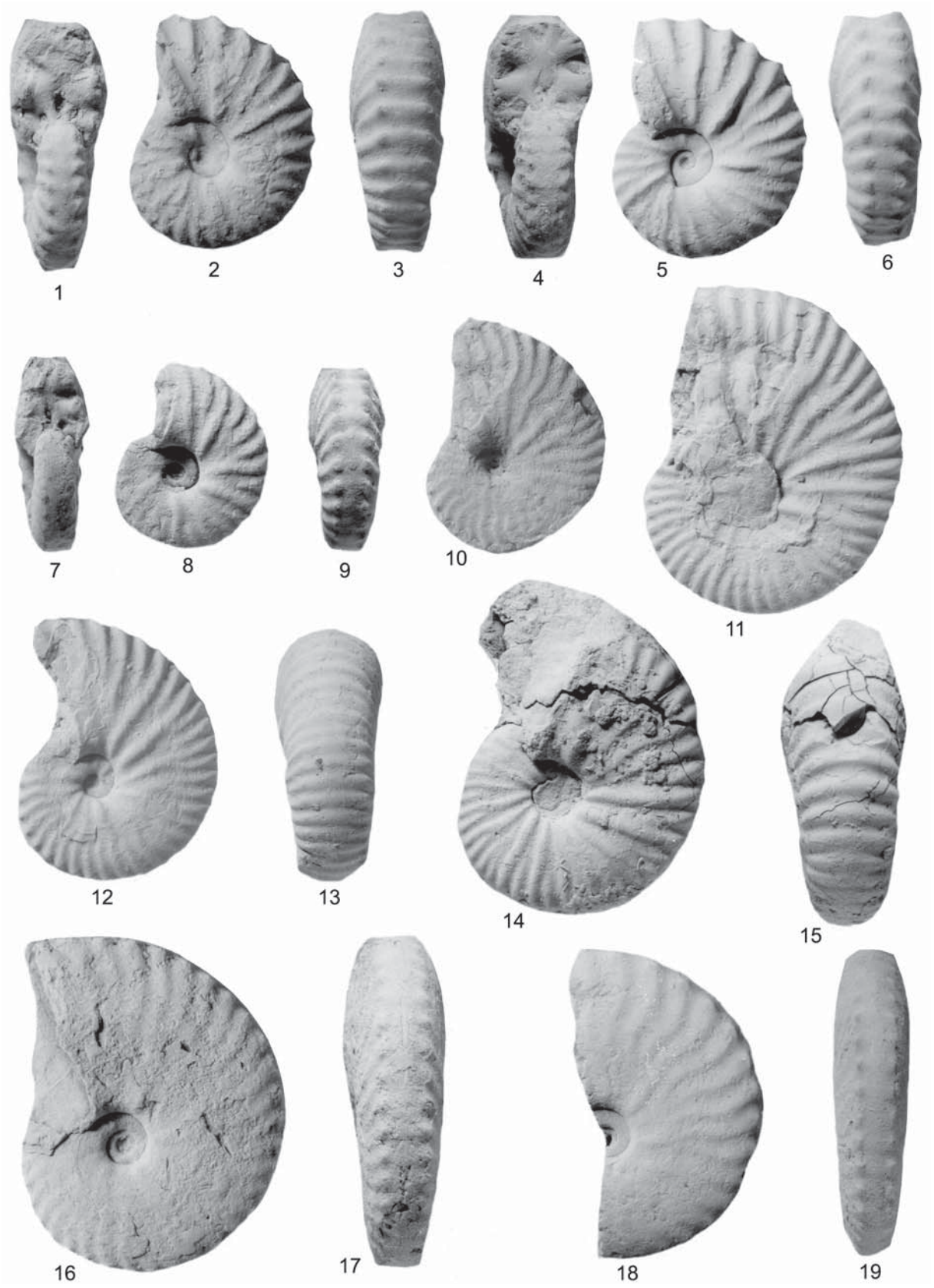
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PLATE 15

1, 2 – *Stoliczkaia* (*Shumarinaia*) *zrissense* (Pervinquière, 1907). The holotype, MNHN. F. J13791, the original of Pervinquière 1907, pl. 11, figs 17, 18, from the 'Vraconnien (?)' of Djebel Djerissa, Central Tunisia.

3-14, 26-28 – *Stoliczkaia* (*Shumarinaia*) *africana* Pervinquière, 1907. 3-5 – MNHN collections, a paralectotype, the original of Pervinquière 1907, pl. 16, fig. 19; 6-8 – MNHN. F. J13777, a paralectotype, the original of Pervinquière 1907, pl. 16, figs 22, 23; 9-11 – MNHN. F. J13775, a paralectotype, the original of Pervinquière 1907, pl. 16, fig. 20; 12-14 – MNHN collections, a paralectotype, the original of Pervinquière 1907, pl. 16, fig. 21; 26-28 – MNHN. F. J04329, the lectotype the original of Pervinquière 1907, pl. 12, fig. 10; all from the 'Vraconnien' of Djebel Djerissa, Central Tunisia.

15, 16 – *Stoliczkaia* (*Shumarinaia*) sp., MNHN. F. J13785, the original of *Stoliczkaia* cf. *dispar* d'Orb. of Pervinquière 1907, p. 12, fig. 9, from Guern er Rhezal, Central Tunisia.

17-19 – *Stoliczkaia* (*Stoliczkaia*) cf. *clavigera* (Neumayr, 1875), MNHN. F. J13794, the original of *Acanthoceras martimpreyi* Coquand of Pervinquière 1907, pl. 16, fig. 1, from Guern er Rhezal, Central Tunisia.

20-25 – *Metascaphites thomasi* (Pervinquière, 1907). 20-22 – the holotype, MNHN. F. J04318, the original of Pervinquière 1907, pl. 4, figs 30, 31, from the 'Vraconnien' of Djebel Mrhila, south of Kef Si Abd el Kader, Central Tunisia. 23-25 – OUMNH KX.14154, from the Upper Albian *puzosianum* fauna, 2.5 km south of Djebel Djerissa, Central Tunisia.

All figures are × 2

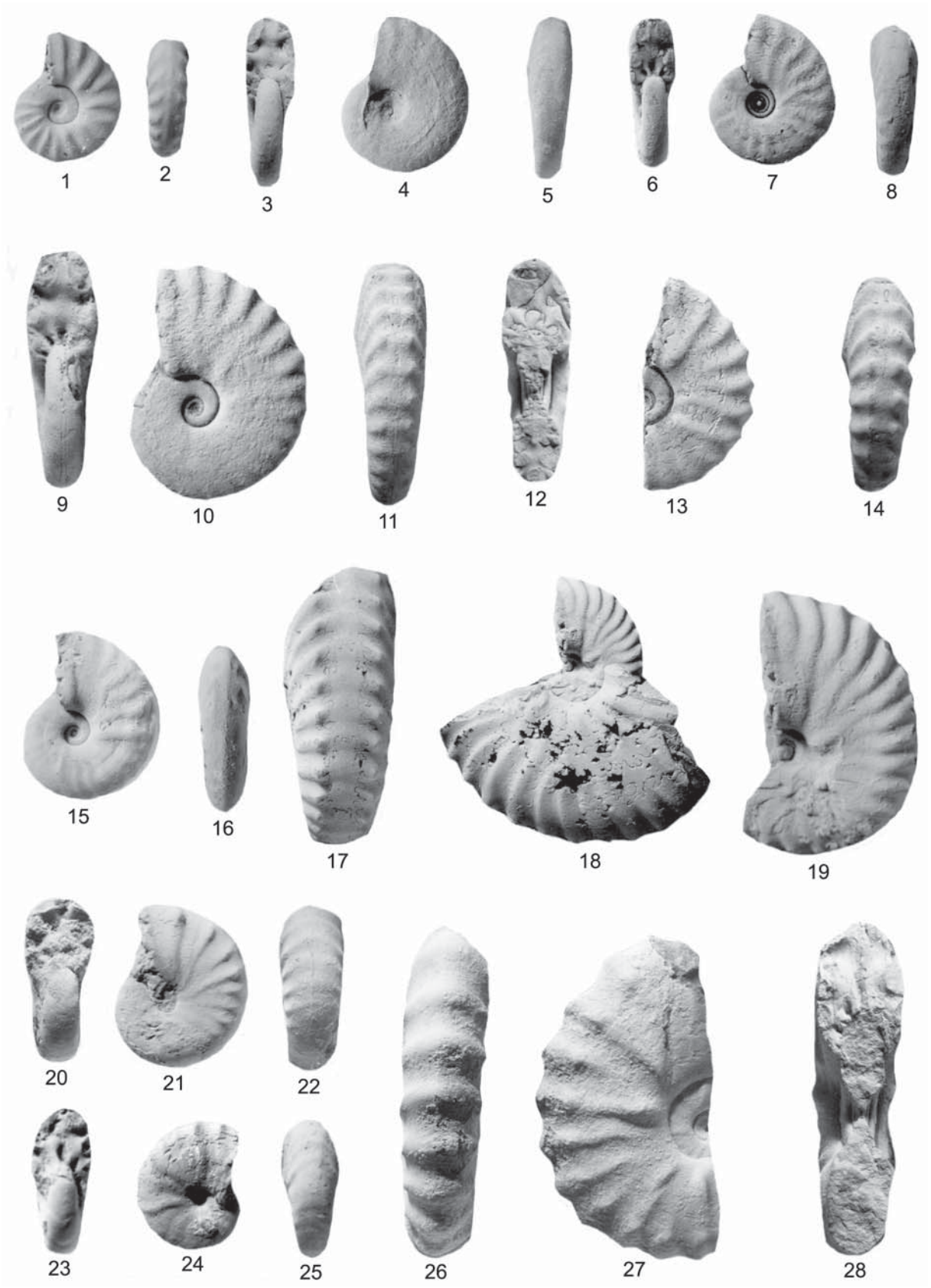
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PLATE 16

1-13 – *Neophlycticeras algeriense* sp. nov. 1-3 – paratype OUMNH KX.16312b; 4 – paratype OUMNH KX.16312c; 5, 6 – paratype OUMNH KX.16312h; 7, 8 – paratype OUMNH KX.16312g; 9-11 – the holotype, OUMNH KX.16312a; 12, 13 – paratype OUMNH KX.16312d; all from the Lower Cenomanian *harchaensis* fauna 700 m north-north-east of Koudiat el Assel, north-eastern Algeria.

14, 15 – *Conlinites evolutum* sp. nov. The holotype, OUMNH KX.17024, from the Upper Albian *puzosianum* fauna, El Faija, northern Algeria.

16-22 – *Enigmaticeras* cf. *riceae* Kennedy, 2004. 16 – OUMNH KX.16498c; 17, 18 – OUMNH KX.16498b; 19-20 – OUMNH KX.16498a; all from the Lower Cenomanian *carcitanense* fauna north of Djebel Hameima, Central Tunisia. 21, 22 – OUMNH KX.15970, from the Upper Albian *puzosianum* fauna of Henchir el Kerkour, north-eastern Algeria.

Figures 1-13 are × 2; figures 14-23 are × 6

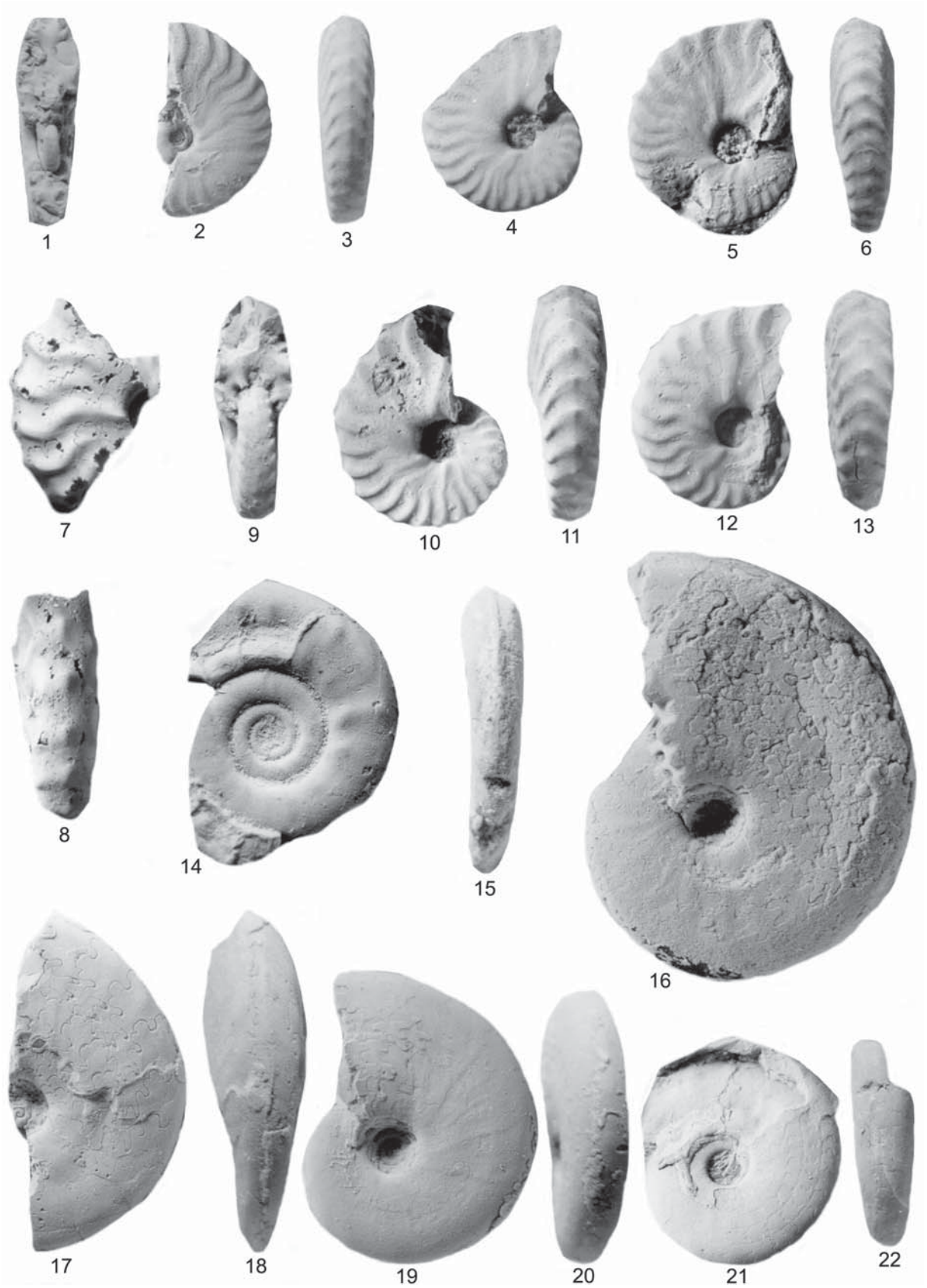
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PLATE 17

1-16 – *Neosaynoceras gazellae* (Pervinquière, 1907). 1-3 – the lectotype, MNHN. F. J12576, the original of Pervinquière 1907, pl. 5, fig. 2; 4, 5 – paralectotype MNHN. F. J04315, the original of Pervinquière 1907, pl. 5, fig. 1; 6-8 – paralectotype MNHN. F. J04322b, the original of Pervinquière 1907, pl. 5, fig. 6; 9-11 – paralectotype MNHN. F. J04322a, the holotype of var. *globosa* Breistroffer, 1947; 1-3, 6-11 are from Guern er Rhezal, 4 and 5 are from Pont du Fahs, Central Tunisia. 12, 13 – OUMNH KX.16266, from the Lower Cenomanian *harchaensis* fauna, Koudiatel Assel, north-eastern Algeria. 14-16 – OUMNH KX.16571, from the Lower Cenomanian *carcitanense* fauna north of Djebel Hameima, Central Tunisia.

17-22 – *Stoliczkaia* (*Stoliczkaia*) *subboulei* (Sornay, 1955). 17-19 – OUMNH KX.14291a; 20-22 – OUMNH KX.14291b; both from the Upper Albian *puzosianum* fauna, 2.5 km south of Djebel Djerissa, Central Tunisia.

23-25 – *Stoliczkaia* (*Stoliczkaia*) *djerissaensis* sp. nov., paratype OUMNH KX.14229a, from the Upper Albian *puzosianum* fauna, 2.5 km south of Djebel Djerissa, Central Tunisia.

26 – *Stoliczkaia* (*Stoliczkaia*) *clavigera* (Neumayr, 1875). OUMNH KX.14278a, from the Upper Albian *puzosianum* fauna, 2.5 km south of Djebel Djerissa, Central Tunisia.

Figures 1-16 are × 3; figures 17-26 are × 2

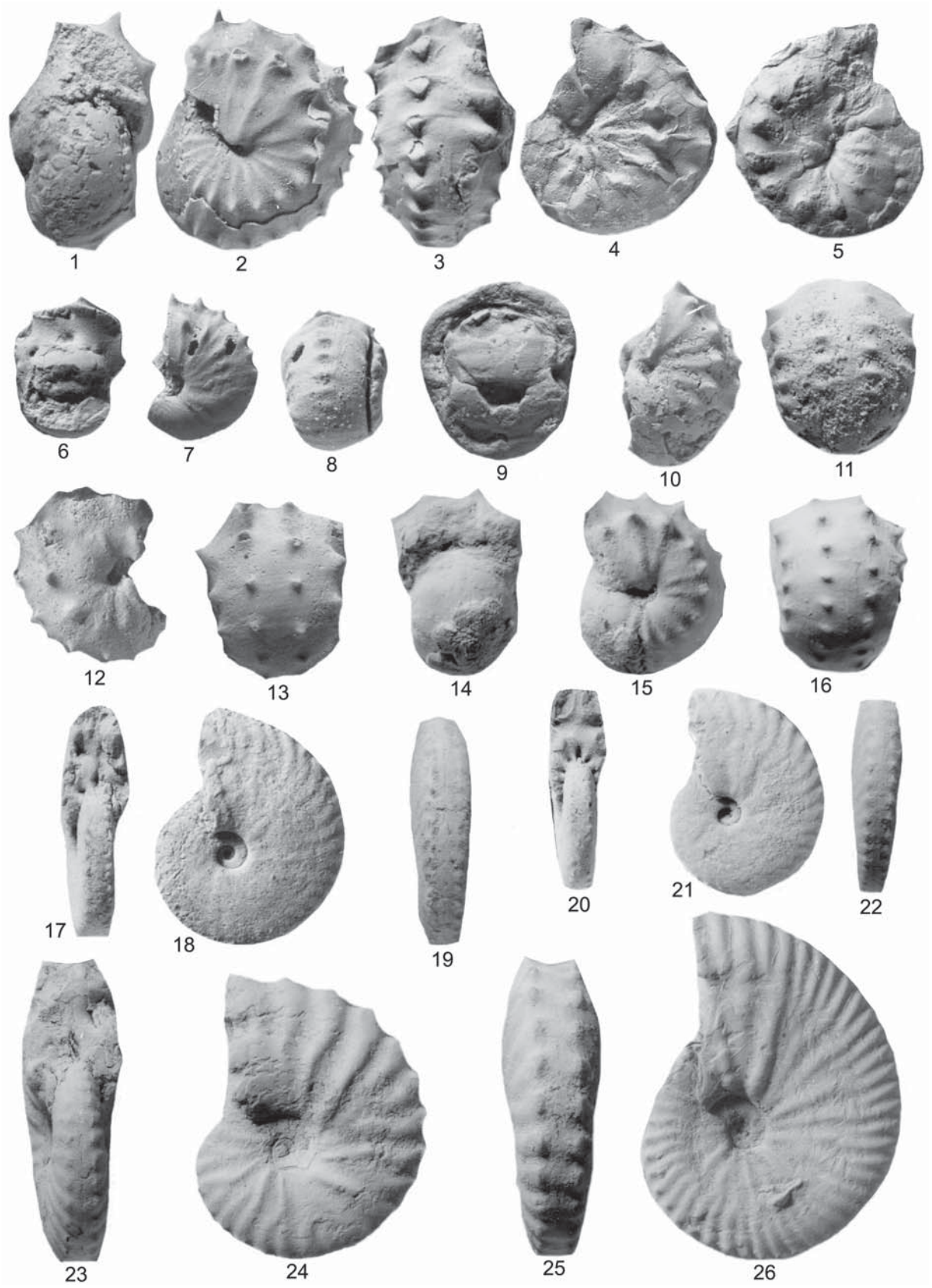
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PLATE 18

1-15 – *Flickia simplex* Pervinquière, 1907. 1-3 – MNHN. F. J04317, the original of Pervinquière 1907, pl. 9, fig. 3; 4, 5 – MNHN. F. J04332a, cited by Pervinquière 1907, p. 215; both from the 'Vraconnien' of Kef Si Abd el Kerim, Central Tunisia. 6-9 – the holotype, MNHN. F. J04312, the original of Pervinquière 1907, pl. 9, figs 4, 5, from the 'Vraconnien entre le Zrissa et le bou el Hanèche', Central Tunisia. 10, 11, 14, 15 – MNHN unregistered; both from Bou Tis, Central Tunisia. 12, 13, MNHN. F. J04335, from the 'Vraconnien entre le Zrissa et le bou el Hanèche'.

16-28 – *Ficheuria kiliani* Pervinquière, 1910. 16-19, 22-25 – the holotype, MNHN. F. J04340, the original of Pervinquière 1910, pl. 12 (3), fig. 9, from Sidi Ali (Djebel Guessa), northern Algeria. 20, 21 – MNHN. F. J04377, the original of Pervinquière 1910, pl. 12 (3), fig. 10, from Sour El-Ghozlane (Aumale), northern Algeria. 26 – OUMNH KX.17079, from the Upper Albian, Commune of Ziana, 21 km east of Berrouaghia, northern Algeria. 27, 28 – OUMNH KX.17040, from east of El Faija, 7.5 km east of Berrouaghia, northern Algeria.

29-32 – *Ficheuria pernoni* Dubourdieu, 1953. 29, 30 – OUMNH KX.14247; 31, 32 – OUMNH KX.14248; both from the Upper Albian *puzosianum* fauna, 2.5 km south of Djebel Djerissa, Central Tunisia.

Figures 1-28 are × 2; figures 29-32 are × 4

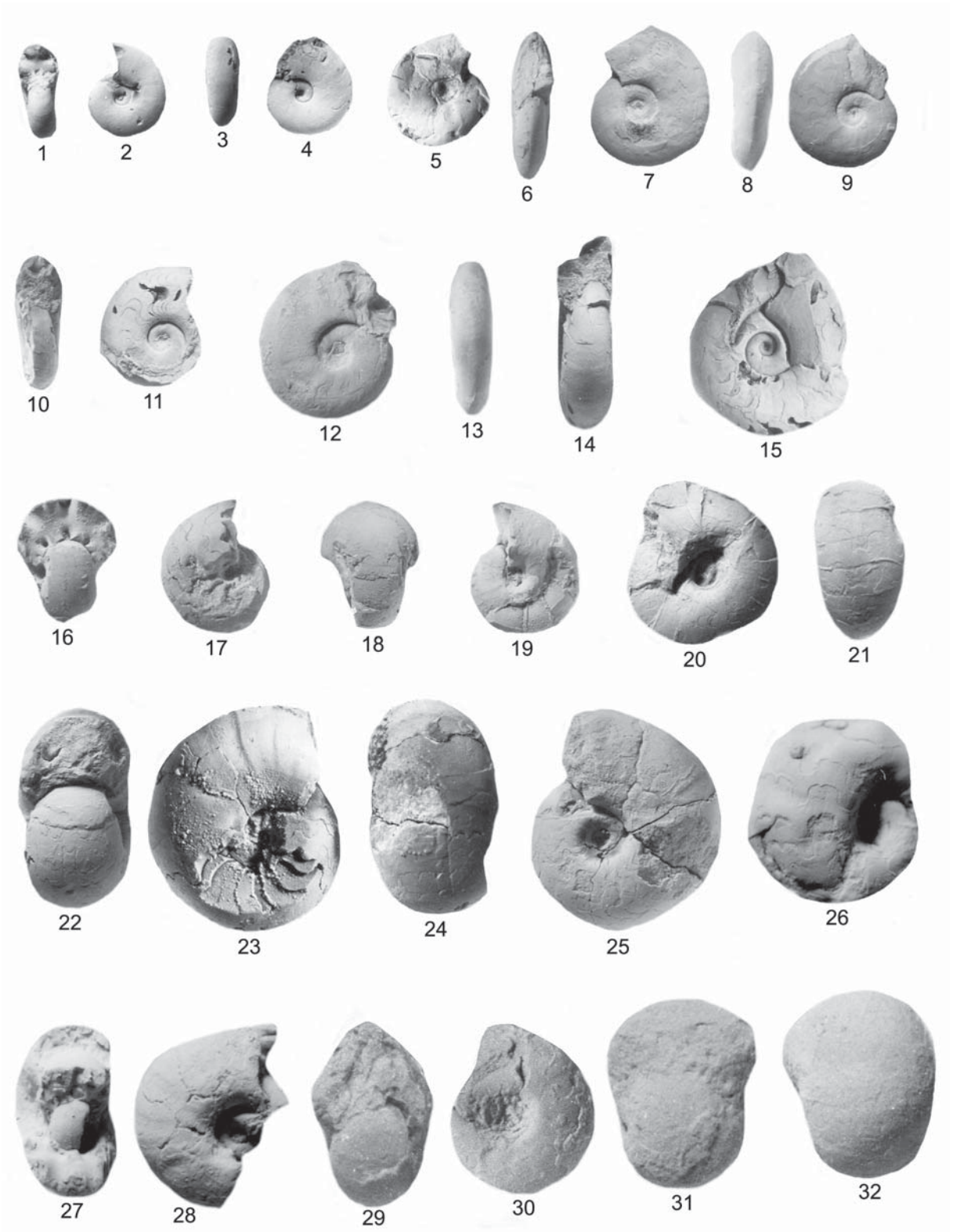
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PLATE 19

1, 2, 4, 5, 9, 12, 13 – *Forbesiceras largilliertanum* (d'Orbigny, 1841). 1, 2 – OUMNH KX.16272; 5 – OUMNH KX.16271; 9 – OUMNH KX.16270; 12, 13 – OUMNH KX.16269; all from the Lower Cenomanian *harchaensis* fauna 700 m north-east of Koudiat el Assel, north-eastern Algeria.

3, 4, 6-8, 10, 11 – *Forbesiceras obtectum* (Sharpe, 1853). 3, 4 – OUMNH KX.16723; 6 – OUMNH KX.16824a; 7 – OUMNH KX.16824b; 8 – OUMNH KX.16824c; 10, 11 – OUMNH KX.16724d; all from the Upper Cenomanian *pentagonum* fauna north of Djebel Hameima, Central Tunisia.

Figures 1, 2, 5-10 are × 3; figures 3, 4, 12, 13 are × 2

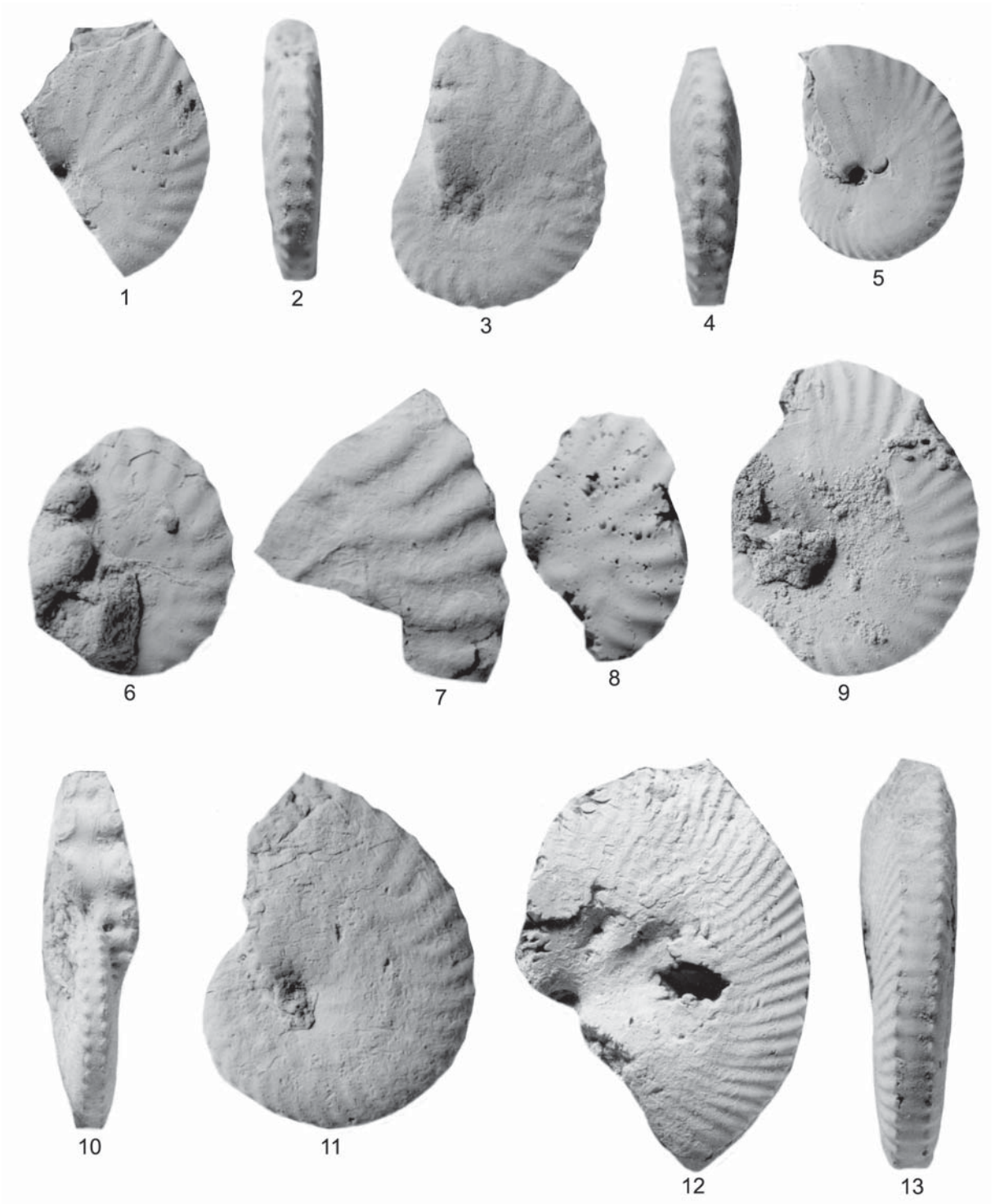
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PLATE 20

1-12, 15, 19, 20 – *Forbesiceras obtectum* (Sharpe, 1855). 1-3 – MNHN. F. J13702, the original of Pervinquière 1907, pl. 5, fig. 10, from Koudiat el Hamra, Central Tunisia. 4, 5 – MNHN. F. J13788a, the original of Pervinquière 1907, pl. 5, figs 7, 8, from Guern er Rhezal, Central Tunisia. 6, 7 – MNHN. F. J13788b, the original of Pervinquière 1907, pl. 5, fig. 9, from Guern er Rhezal, Central Tunisia. 8, 9 – OUMNH KX.16843; 10-12 – OUMNH KX.16726a; 15 – OUMNH KX.16823; 19, 20 – OUMNH KX.16722; all from the Upper Cenomanian *pentagonum* fauna north of Djebel Hameima, Central Tunisa.

13, 14, 17, 18 – *Forbesiceras largilliertianum* (d'Orbigny, 1841). 13, 14 – OUMNH KX.16585; 17, 18 – OUMNH KX.16586; both from the Lower Cenomanian *carcitanense* fauna north of Djebel Hameima, Central Tunisia.

16 – *Forbesiceras falx* Wright and Kennedy, 1984 – OUMNH KX.9801, from Upper Cenomanian *pentagonum* fauna north of Djebel Hameima, Central Tunisia.

Figures 1-3, 6-20 are × 2, figures 4 and 5 are × 5

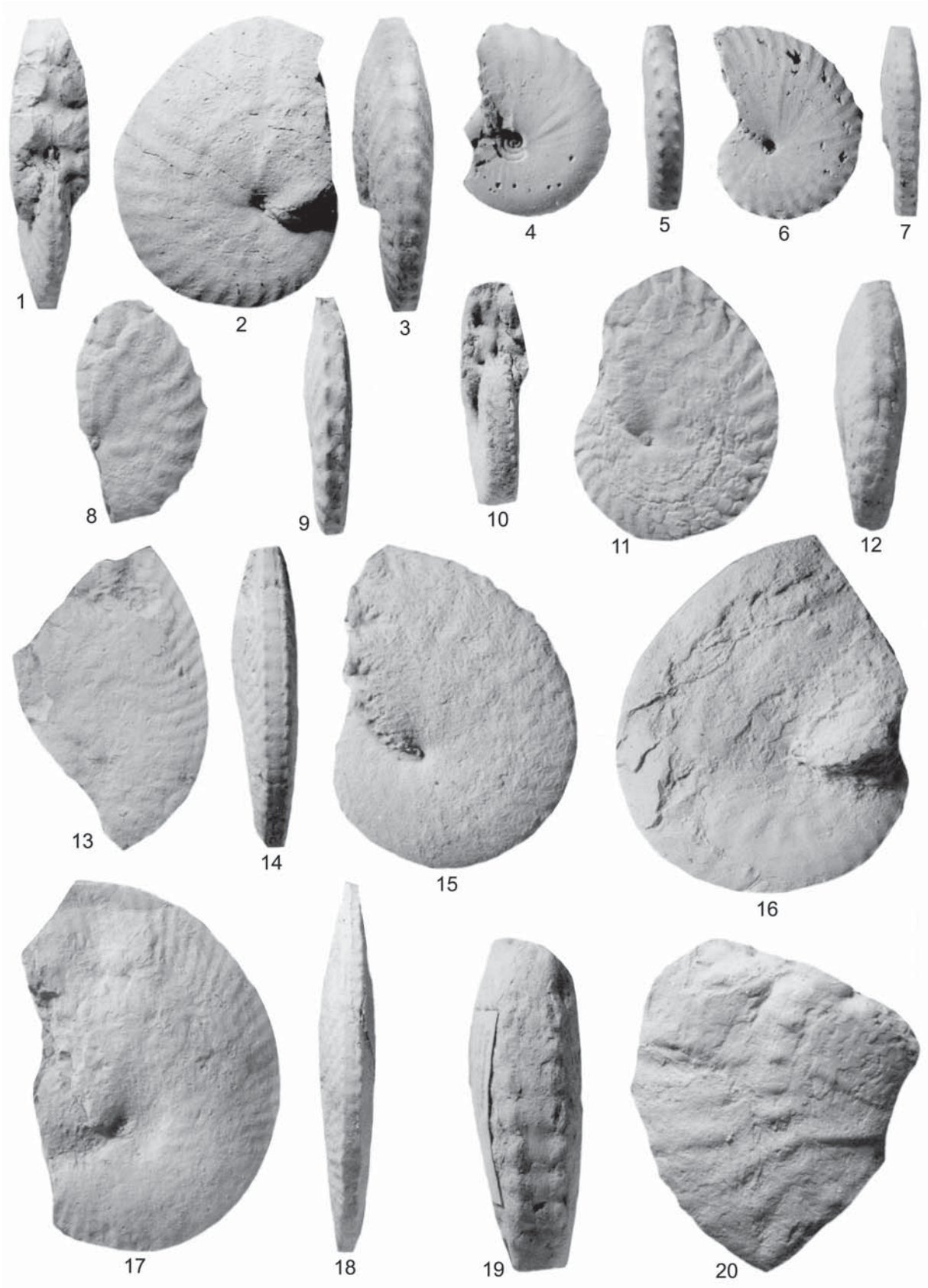
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PLATE 21

1-5, 11-13, 17-19, 27, 28 – *Mantelliceras saxbii* (Sharpe, 1857). 1-3 – GMH K-8846, the neotype of *Ammonites martimpreyi* Coquand, 1862, the original of Pervinquière 1910, pl. 13 (4), fig. 7, described by him as 'probablement le type figuré dans "Géol. Pal. S. Constantine" pl. 1, figs 7–8', from Berrouaghia – Sour El-Ghozlane (Aumale), northern Algeria. 4, 5 – GMH K-8846c, the 'cotype' figured by Pervinquière 1910, pl. 13 (4) fig. 4, from Berrouaghia – Sour El-Ghozlane (Aumale), northern Algeria. 11, 13 – GMH K-8139, labelled.*Mantelliceras aumalensis*, from El Gueit (?), northern Algeria. 17-19 – GMH K-8846e, the 'cotype' figured by Pervinquère 1910, pl. 13 (4) fig. 8, from Berrouaghia – Sour El-Ghozlane (Aumale) northern Algeria. 27-28 – GMH K-8846, presumed to be an unfigured 'cotype' mentioned by Perviquière 1910, p. 41.

6, 7 – *Coquandiceras villei* (Coquand, 1862) GMH K-8454a, the lectotype, figured by Pervinquière 1910, pl. 13 (4), fig. 21, from Berrouaghia, northernAlgeria.

8-10 – *Mantelliceras* sp. juv., GMH K-8845, labelled *Acanthoceras rhotomagensis* Defr., and from Berrouaghia, northern Algeria.

14-16 – *Mantelliceras mantelli* (J. Sowerby, 1814), GMH K-8845, labelled *Acanthoceras rhotomagensis* Defr., and from Berrouaghia, northern Algeria.

20-22 – *Stoliczkaia* (*Stoliczkaia*) sp. juv., GMH K-8814, labelled *Mantelliceras* (*Mantelliceras*) *aumalensis* (Coq.), and from Sour El-Ghozlane (Aumale), northern Algeria.

23-26 – the holotype of *Coquandiceras jubae* (Coquand, 1880), GMH K-8451, from Sour El-Ghozlane (Aumale), northern Algeria.

All figures are × 2

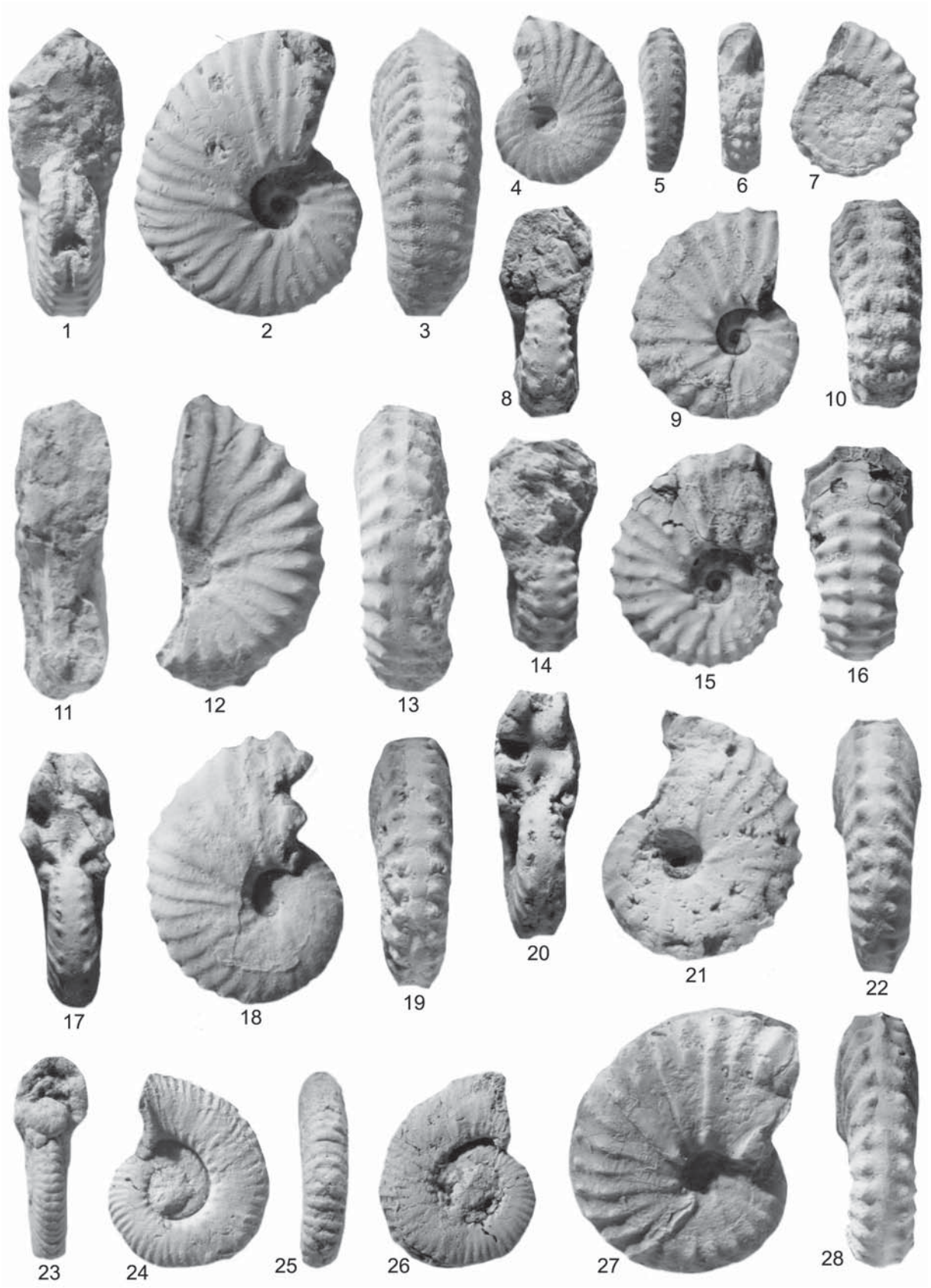
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PLATE 22

1-8 – *Graysonites elegans* sp. nov. 1-3 – paratype OUMNH KX.16323b; 4, 5 – the holotype, OUMNH KX.16323a; 6-8 – paratype OUMNH KX.16323f; all from the Lower Cenomanian *harchaensis* fauna 700 m north-north-east of Koudiat el Asssel, north-eastern Algeria.

9-12 – *Graysonites cherbensis* (Thomas and Peron, 1889). 9 – MNHN. F. J13874; 10 – MNHN unregistered; both referred to *Acanthoceras suzannae* by Pervinquière (1907, p. 300), from Pont du Fahs, Central Tunisia. 11, 12 – MNHN. F. J13789, the lectotype of *Acanthoceras suzannae*, the original of Pervinquière 1907, pl. 16, figs 12, 13, from Koudiat el Hamra, Central Tunisia.

13-22 – *Mantelliceras saxbii* (Sharpe, 1857). 13-15 – OUMNH KX.16592a; 16, 17 – OUMNH KX.16592c; 18, 19 – OUMNH KX.16592b; 20-22 – OUMNH KX.16555; all from the Lower Cenomanian *carcitanense* fauna north of Djebel Hameima, Central Tunisia.

All figures are × 2

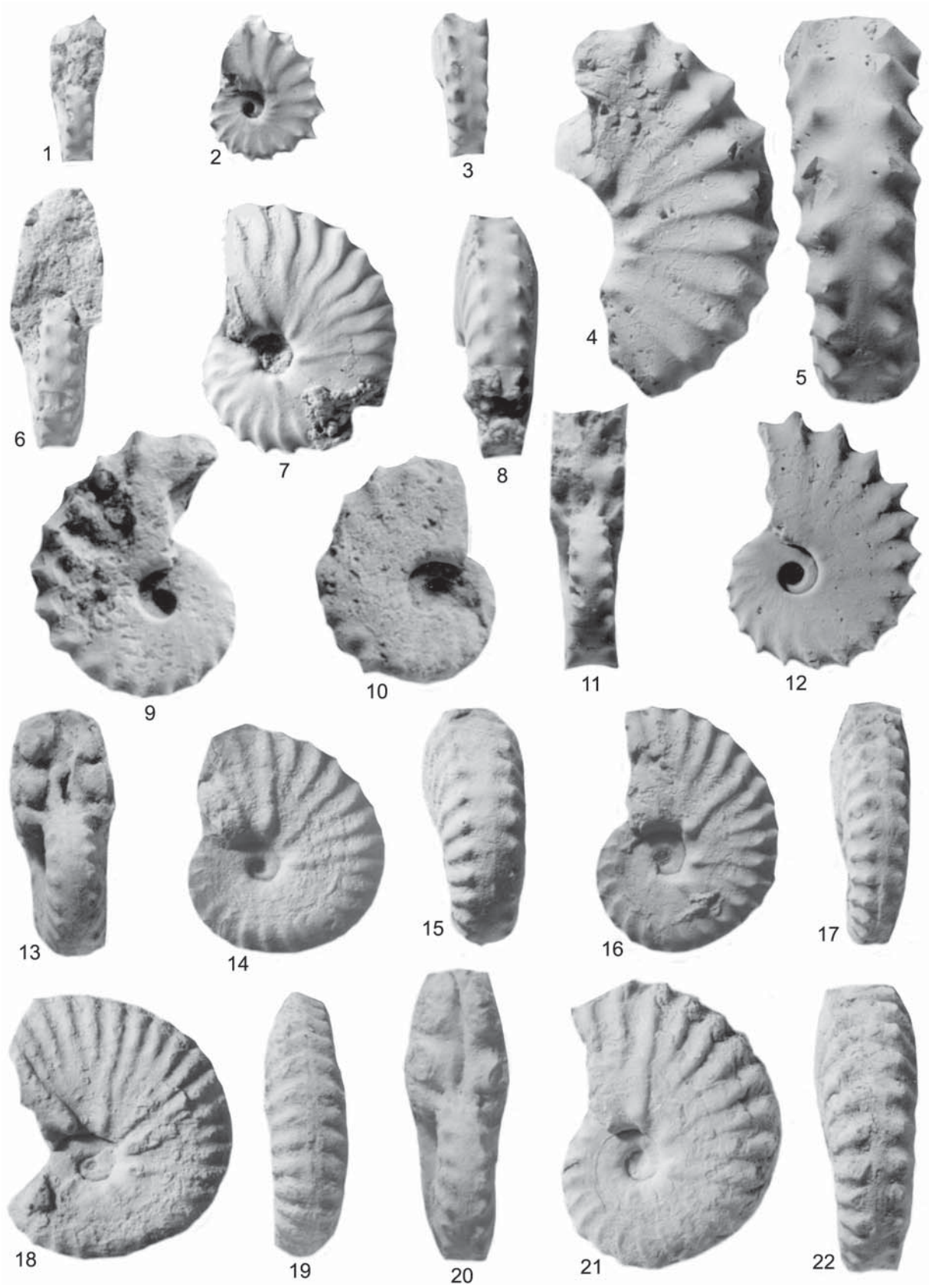
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PLATE 23

1-11 – *Coquandiceras villei* (Coquand, 1862). 1 – OUMNH KX.16087a; 2 – OUMNH KX.16087b; 3 – OUMNH KX.16087c; 4 –OUMNH KX.16087d; 5, OUMNH KX.16087e; 9-11 – OUMNH KX.16029; all from the *scheuchzerianus* fauna, west of Djebel Sottara, 8.5 km west of Sour El-Ghozlane (Aumale), northern Algeria. 6-8 – MNHN. F. J13751, the original of Pervinquière 1910, pl. 13 (4), figs 24, 25, from Sour El-Ghozlane (Aumale), northern Algeria.

12, 13 – *Coquandiceras jubae* (Coquand, 1862) MNHN. F. J04342, the original of *Acanthoceras blayaci* Pervinquière 1910, pl. 4 (13), figs 26, 27, from Sour El-Ghozlane (Aumale), northern Algeria.

14-21, 24-26 – *Submantelliceras aumalense* (Coquand, 1880). 14-16 – MNHN. F. J13753, the original of *Acanthoceras aumalense* Coquand of Pervinquière 1910, pl. 13 (4), fig. 17, from Djebel Guessa, northern Algeria. 17, 18 – MNHN. F. J13707, the original of '*Acanthoceras* intermédiaire entre *Ac. Aumalense* Coq. et *Ac. Marimpreyi* Coq.' of Pervinquière 1907, pl. 16, fig. 6, from the 'Vraconnien' north of Djebel Bou Tis, Central Tunisia. 19-21 – MNHN. F. J13807, the original of 'Autre forme de passage entre *Ac. aumalense* Coq. et *Ac. Martimpreyi* Coq.' of Pervinquière 1907, pl. 16, figs 8, 9, from near Ksar Khima, Central Tunisia. 24-26 – MNHN. F. J13750, the original of '*Acanthoceras Aumalense* Coquand. forme de passage à *Acanthoceras Martimpreyi* Coquand' of Pervinquière 1910, pl. 13 (4), fig. 19, from Djebel Guessa, northern Algeria.

22, 23 – *Sharpeiceras schlueteri*.Hyatt, 1903, OUMNH KX.16622, from the Lower Cenomanian *carcitanense* fauna north of Djebel Hameima, Central Tunisia.

27, 28 – *Graysonites cherbensis* (Thomas and Péron, 1889). MNHN. F. J13752, the original of *Acanthoceras Aumalense* Coquand of Pervinquière 1910, pl. 13 (4), fig. 4, from Djebel Guessa, northern Algeria.

29-33 – *Mantelliceras mantelli* (J. Sowerby, 1814). 29-31 – MNHN collections, the original of Pervinquière 1910, pl. 13 (4), fig. 1, from Sour El-Ghoslane (Aumale), northern Algeria. 32, 33 – OUMNH KX.16290, from the Lower Cenomanian *harchaensis* fauna 700 m north-east of Koudiat el Assel, north-eastern Algeria.

Figures 1-5, 9-11, 14-33 are × 2; figures 6-8 are × 3, figures 12, 13, are × 4


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PLATE 24

1-9 – *Submantelliceras aumalense* (Coquand, 1862). 1, 6-9 – the lectotype, GMH K-8813d, from Sour El-Ghozlane (Aumale), northernAlgeria. 2-4 – paralectotype GMH K-8813c, the original of Pervinquière 1910, pl. 13 (4), fig. 12, from Sour El-Ghozlane (Aumale), northern Algeria.

10-19, 22-24 – *Forbesiceras* sp. juv. 10, 11 – GMH K-8813b, a presumed paralectotype of *Submantelliceras aumalense*, from Sour El-Ghozlane (Aumale), northern Algeria. 12, 13 – GMH K-9123a, labelled *Acanthoceras aumalense* and from Djebel Korreo, northern Algeria. 14, 15 – GMH K-9108a, labelled *Acanthoceras aumalense*, and from Djebel Hallet, northern Algeria. 16, 17 – GMH K-8813a, a presumed paralectotype of *Submantelliceras aumalense*, from Sour El-Ghozlane (Aumale), northern Algeria. 18, 19, GMH K-9123, the original of Pervinquière 1910, pl. 13 (4), fig. 13; 18, 19 – GMH K-9123b, labelled *Acanthoceras aumalense* and from Djebel Korreo, northern Algeria. 22-24 – GMH K-9108b, labelled *Acanthoceras aumalense*, and from Djebel Hallet, northern Algeria.

20, 21, 25-27 – *Stoliczkaia* sp. juv. 20, 21 – GMH K-8687, labelled *Acanthoceras aumalensis*, and from Djebel Korreo, northern Algeria. 25-27 – GMH K-8814, labelled *Mantelliceras* (*Mantellliceras*) *aumalensis* Coq., from Sour El-Ghozlane (Aumale), northernAlgeria.

28-31 – *Mantelliceras saxbii* (Sharpe, 1857), GMH K-8846f, the 'cotype' figured by Pervinquière 1910, pl. 13 (4) fig. 9, from Berrouaghia – Sour El-Ghozlane (Aumale), northernAlgeria.

32-34 – *Mantelliceras mantelli* (J. Sowerby, 1814), GMH K-8846g, the 'cotype' of *Acanthoceras aumalense* figured by Pervinquière 1910, pl. 13 (4), fig. 10, from Berrouaghia – Sour El-Ghozlane (Aumale), northern Algeria.

Figures 2-27 are × 2; figures 1, 28-34 are × 1

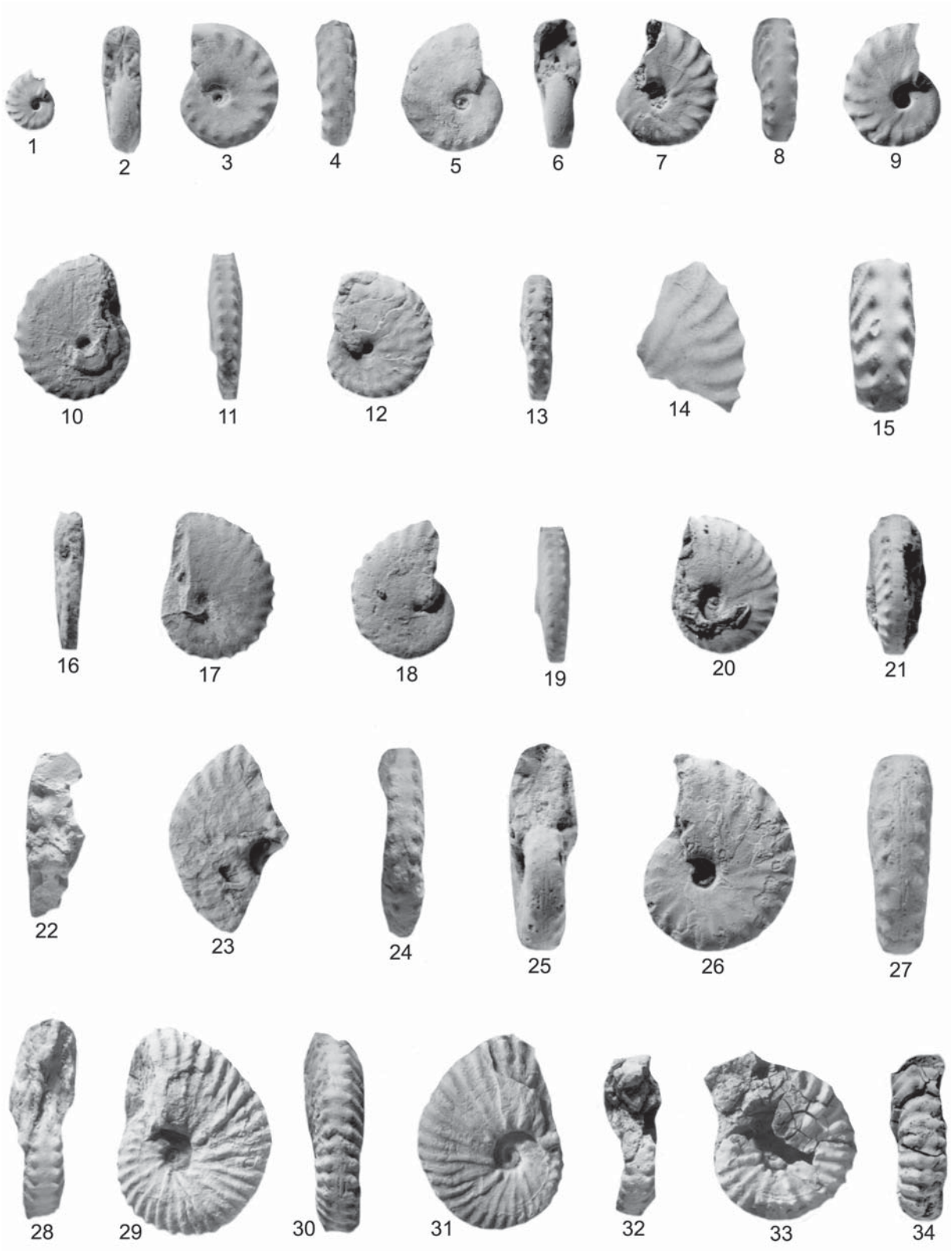
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PLATE 25

1-3 – *Acanthoceras rhotomagense* (Brongniart, 1822), MNHN. F. J13749, the original of Pervinquière 1910, pl. 13 (4), fig. 36, from Sour El-Ghozlane (Aumale), northern Algeria.

4-8 – *Calycoceras* (*Newboldiceras*) *planecostatum* (Kossmat, 1897). 4, 5 – OUMNH KX.16046; 6-8 – OUMNH KX.16047; both from the Middle Cenomanian *asiaticum* fauna of the echinoid-rich bed west of Djebel Sottara, 8.5 km west of Sour El-Ghozlane (Aumale), northern Algeria.

9-12 – *Calycoceras* (*Calycoceras*) cf. *bathyomphalum* (Kossmat, 1895). 9, 10 – OUMNH KX.16851; 11, 12 – OUMNH KX.16817; both from the Upper Cenomanian *pentagonum* fauna north of Djebel Hameima, Central Tunisia.

13, 14 – *Eucalycoceras pentagonum* (Jukes-Browne, 1896), OUMNH KX.16811b, from the Upper Cenomanian *pentagonum* fauna north of Djebel Hameima, Central Tunisia.

15, 16 – *Calycoceras* (*Calycoceras*) cf. *naviculare* (Mantell, 1822), OUMNH KX.16782d, from the Upper Cenomanian *pentagonum* fauna north of Djebel Hameima, Central Tunisia.

17, 18 – *Acanthoceras* or *Cunningtoniceras* sp. juv., OUMNH KX.16782b, from the Upper Cenomanian *pentagonum* fauna north of Djebel Hameima, Central Tunisia.

Figures 1-8, 11, 12 are × 2; figures 9, 10, 13-18 are × 3

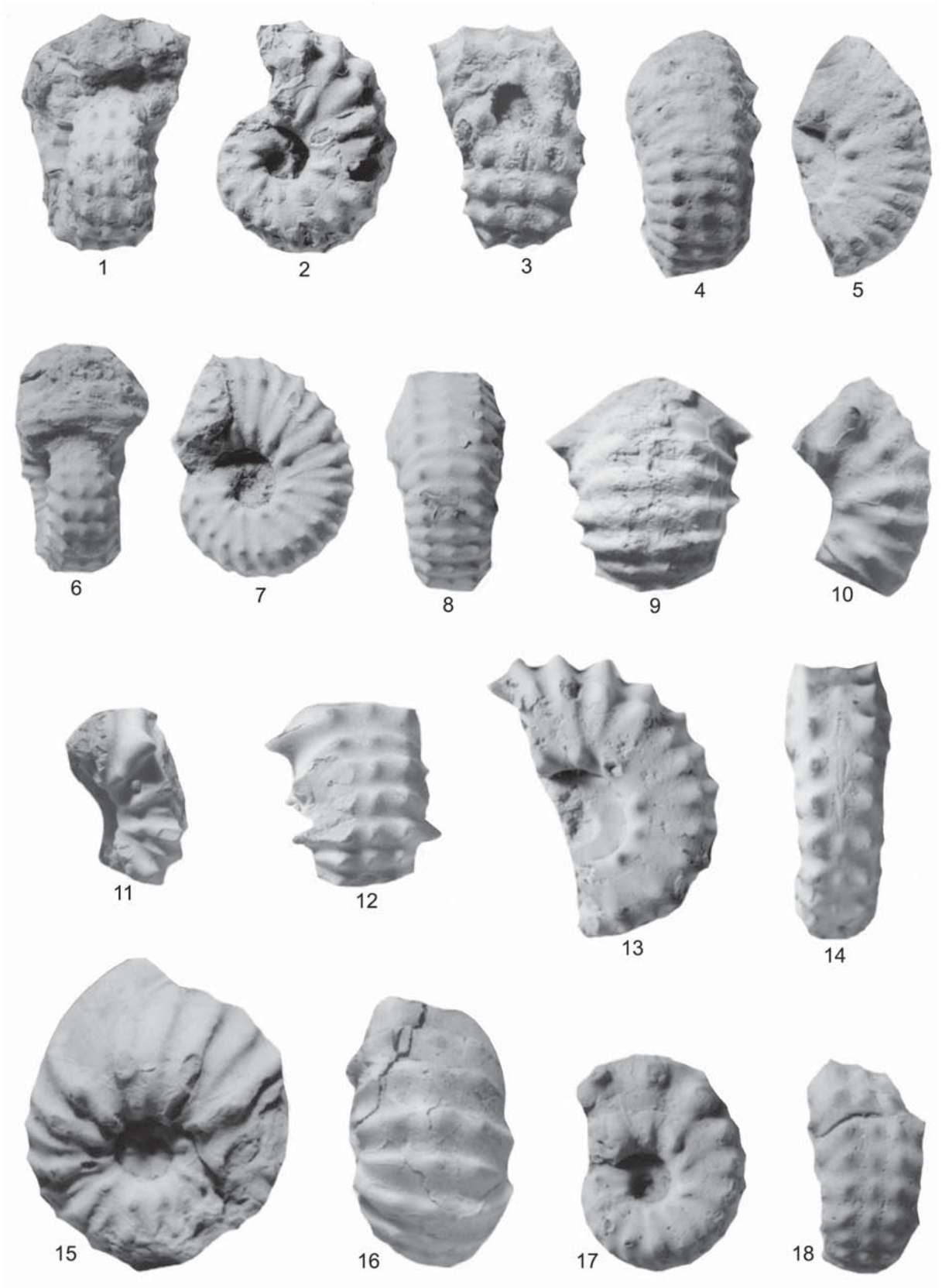
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PLATE 26

1-3, 7-9 – *Calycoceras* (*Newboldiceras*) *hippocastanum* (J. de C.Sowerby, 1826). 1-3 – OUMNH KX.16853; 7-9 – OUMNH KX.9789; both from the Upper Cenomanian *pentagonum* fauna north of Djebel Hameima, Central Tunisia.

4-6, 18-21 – *Calycoceras* (*Newboldiceras*) *asiaticum asiaticum* (Kossmat, 1897). 4-6 – OUMNH KX.16744a; 10, 11 – OUMNH KX.16744b; 18, 19 – OUMNH KX.16746a; 20, 21 – OUMNH KX.16712; all from the Upper Cenomanian *pentagonum* fauna north of Djebel Hameima, Central Tunisia.

12-14 – *Acanthoceras rhotomagense* (Brongniart, 1822), OUMNH KX.16079, from the Middle Cenomanian of Djebel Sottara, 8.5 km west of Sour El-Ghozlane (Aumale), Algeria.

15-17 – *Calycoceras* (*Calycoceras*) cf. *bathyomphalum* (Kossmat, 1895), OUMNH KX.16852, from the Upper Cenomanian *pentagonum* fauna north of Djebel Hameima, Central Tunisia.

Figures 1-3, 7-9, 15-17 are × 3; figures 4-6, 12-14, 18-21 are × 2

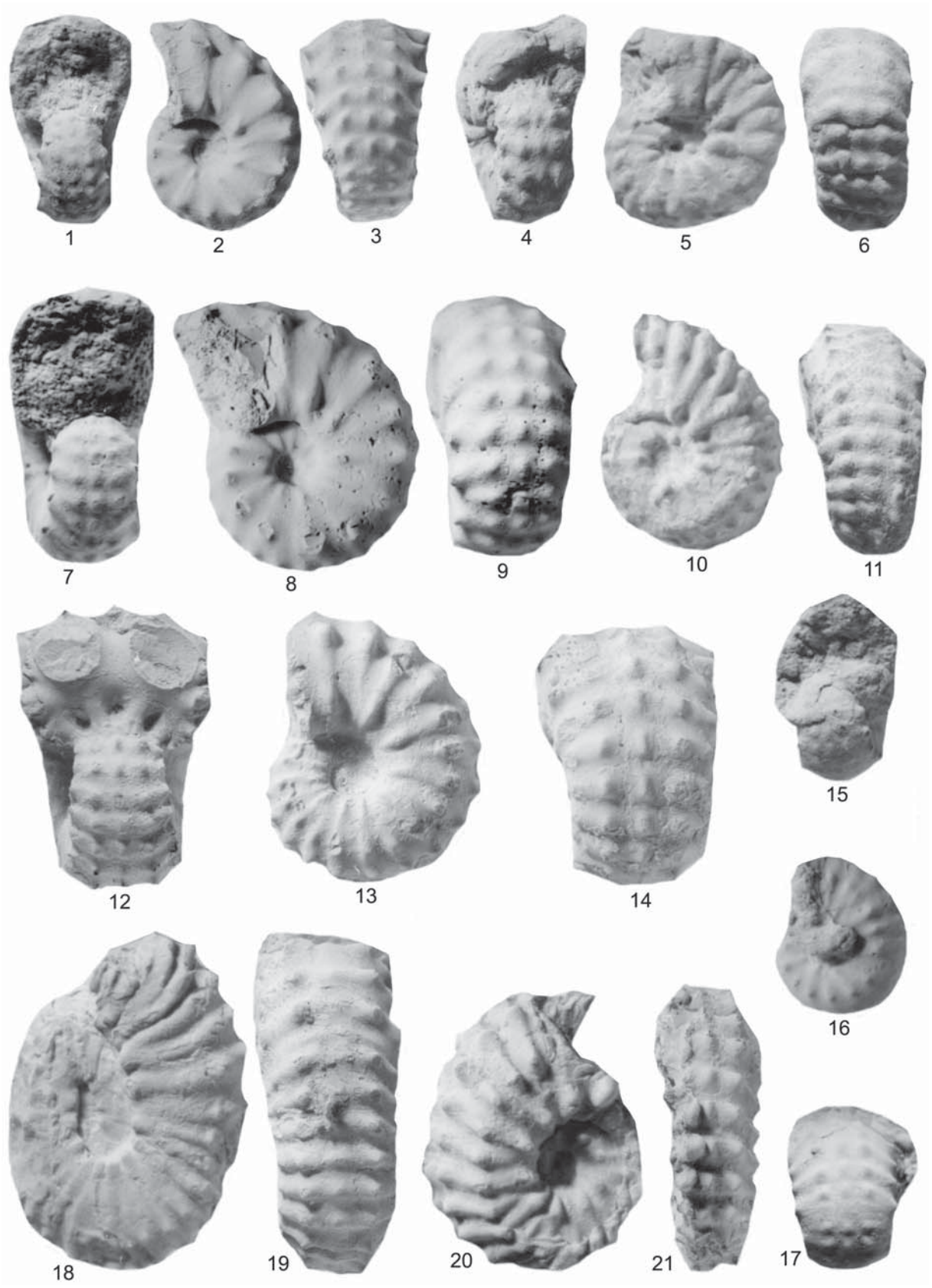
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PLATE 27

Acanthoceras amphibolum Morrow, 1935

OUMNH KX.16048, from the Middle Cenomanian *asiaticum* fauna of the echinoid-rich bed west of Djebel Sottara, 8.5 km west of Sour El-Ghozlane (Aumale), northern Algeria.

Figures are × 1

PLATE 28

Calycoceras (*Newboldiceras*) *planecostatum* (Kossmat, 1897)

1, 2 – OUMNH KX.16035; 3,4 – OUMNH KX.16038; 5, 6 – OUMNH KX.16036; all from the Middle Cenomanian *asiaticum* fauna of the echinoid-rich bed west of Djebel Sottara, 8.5 km west of Sour El-Ghozlane (Aumale), northern Algeria.

All figures are × 1


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PLATE 29

1, 2, 4, 5, 12, 13, 16-18 – *Eucalycoceras rowei* (Spath, 1926b). 1, 2 – OUMNH KX.16813; 4, 5 – OUMNH KX.14097; 12, 13 – OUMNH KX.9796a; 16-18 – OUMNH KX.9796b.

3, 6-11, 15 – *Eucalycoceras pentagonum* (Jukes-Browne, 1896) 3 – OUMNH KX.16812; 6 – OUMNH KX.9791; 7, 8 – OUMNH KX.9790; 9-11 – MNHN. F. J13787, the original of *Acanthoceras villei* (Coquand) of Pervinquière 1907, pl. 16, figs 14, 15, from Koudiat el Hamra, Central Tunisia, and the lectotype of *Acanthoceras* (*Mantelliceras*) *pervinquierei* Collignon, 1931 (footnote 1, p. 82 (42)). 14 – OUMNH KX.16811a; 15 – OUMNH KX.9819.

19, 20 – *Eucalycoceras* cf. *gothicum* (Kossmat, 1895), OUMNH KX.16751.

Unless otherwise indicated, specimens are from the Upper Cenomanian *pentagonum* fauna north of Djebel Hameima, Central Tunisia.

Figures 1-3, 6-8 are × 1; figures 4, 5, 9-13, 17-19 are × 2

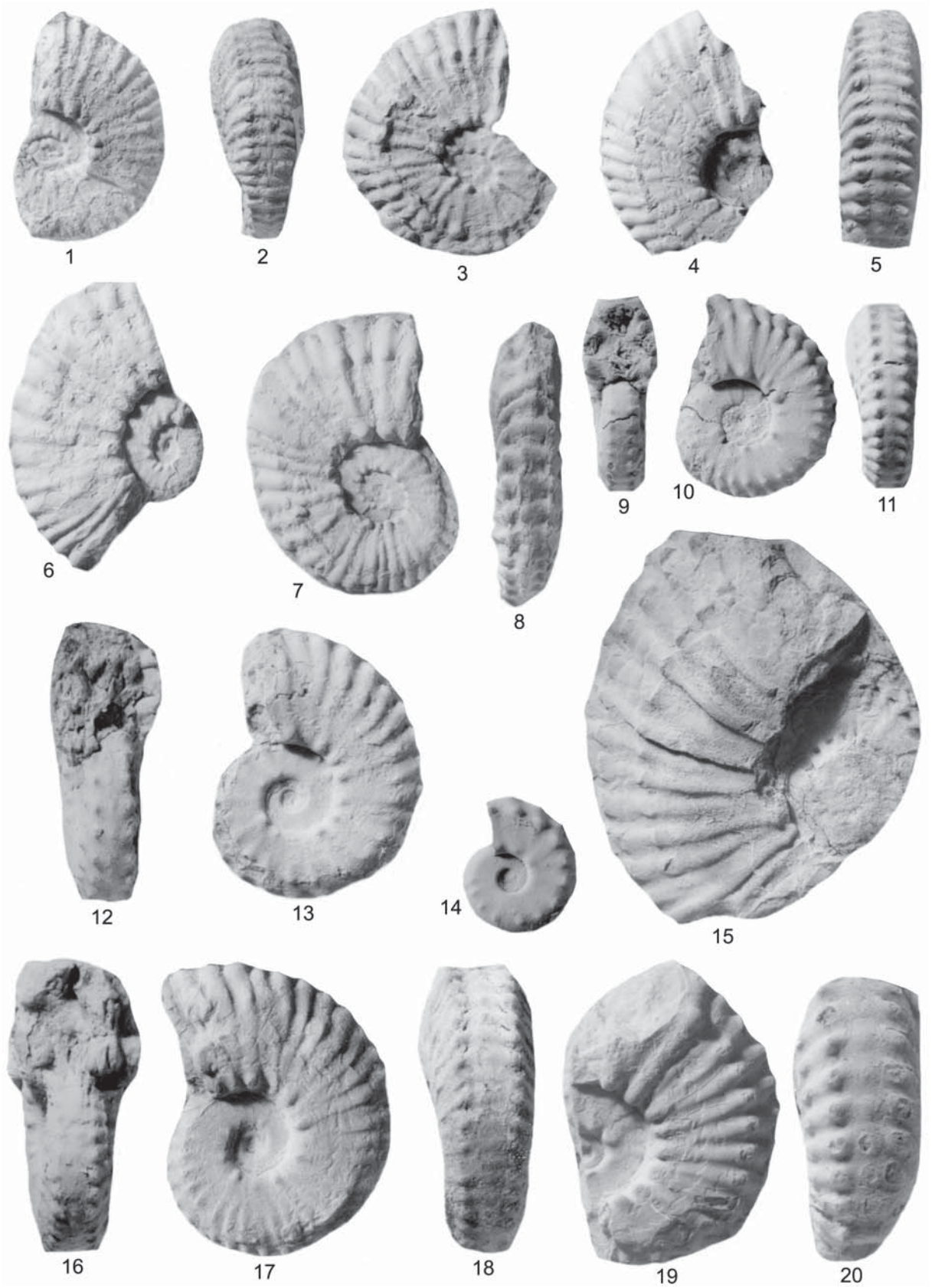
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PLATE 30

1, 2, 11-17 – *Euomphaloceras euomphalum* (Sharpe, 1855). 1, 2 – OUMNH KX.9704; 11 13 – MNHN. F. J13778, the original of *Acanthoceras giltarei* Pervinquière 1907, pl. 15, fig. 8; 14, 15 – MNHN. F. J13744, the original of *Acanthoceras giltarei* Pervinquière 1907, pl. 15, fig. 9; 16, 17 – OUMNH KX.9703.

3-10 – *Lotzeites aberrans* (Kossmat, 1895). 3-5 – OUMNH KX.16800; 6 – OUMNH KX.16798; 7-10 – OUMNH KX.16796; all from the Upper Cenomanian *pentagonum* fauna north of Djebel Hameima, Central Tunisia.

18-20 – the holotype of *Calycoceras* (*Calycoceras*) *barruei* (Pervinquière 1907, pl. 15, fig. 7).

The originals of figures 1, 2, 11-20 are from the Upper Cenomanian *pentagonum* fauna of Koudiat el Hamra, Central Tunisia.

Figures 1-5 are × 1; figures 6-20 are × 2

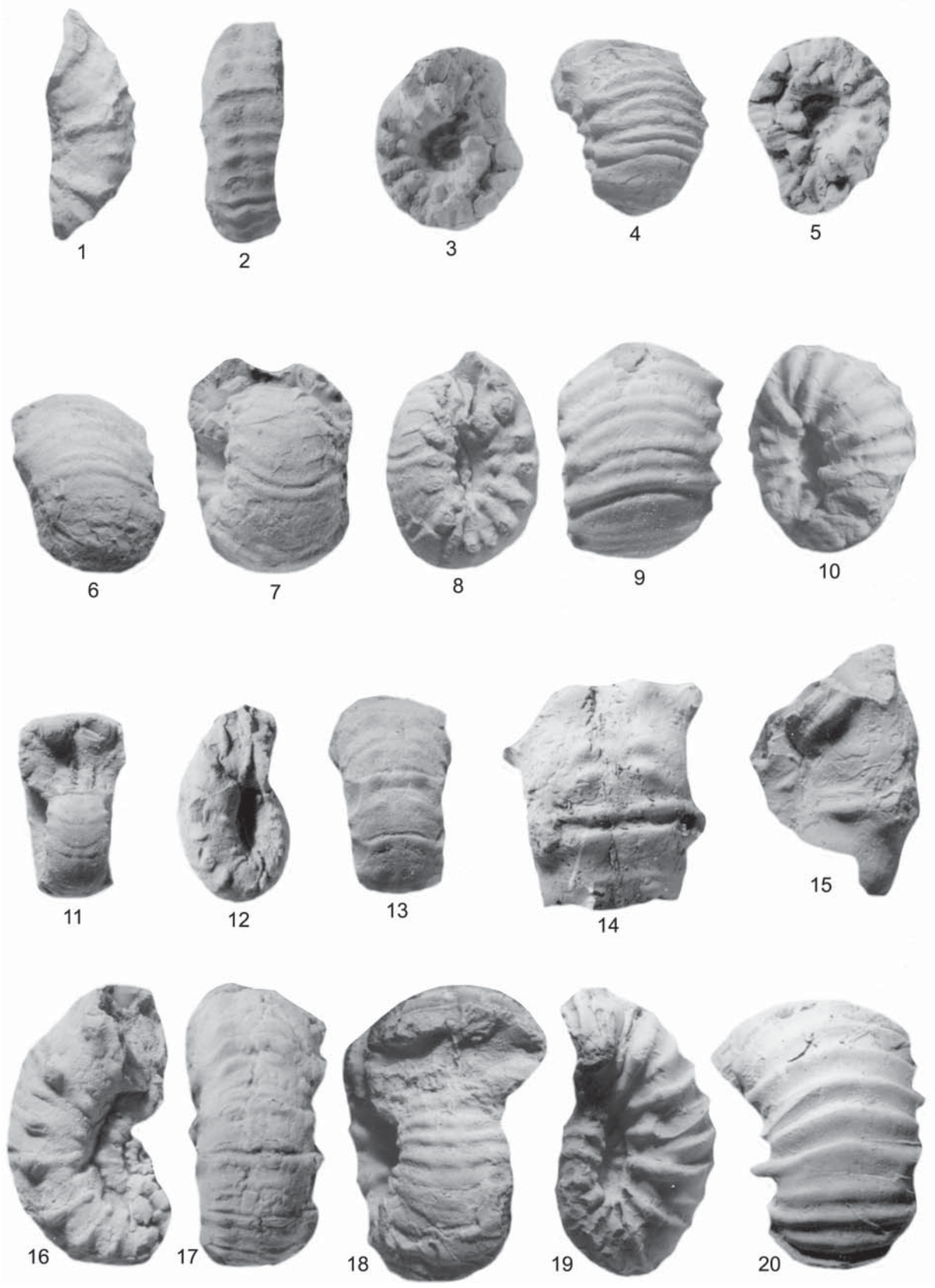
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PLATE 31

1-13 – *Subprionocyclus neptuni* (Geinitz, 1849). 1 – OUMNH KX.17201g; 2 – OUMNH KX.17201d; 3 – OUMNH KX.17201e; 4 – OUMNH KX.17201f; 5 – OUMNH KX.17201i; 6 – OUMNH KX.17201o; 7 – OUMNH KX.17201j; 8 – OUMNH KX.17201h; 9 – OUMNH KX.17201b; 10 – OUMNH KX.17201n; 11 – OUMNH KX.17201m; 12 – OUMNH KX.17201a; 13 – OUMNH KX.17201k.

14, 15 – *Scaphites* sp., group of *geinitzii* d'Orbigny, 1850, OUMNH KX.17194.

16 – *Scalarites* sp., OUMNH KX.17201a.

17, 18 – *Sciponoceras* cf. *bohemicum bohemicum* (Fritsch, 1872). 17 – OUMNH KX.17192; 18 – OUMNH KX.17193.

All specimens are from the Upper Turonian *neptuni* fauna of the Commune of Ziana, 21 km east of Berrouaghia, northern Algeria.

All figures are × 3

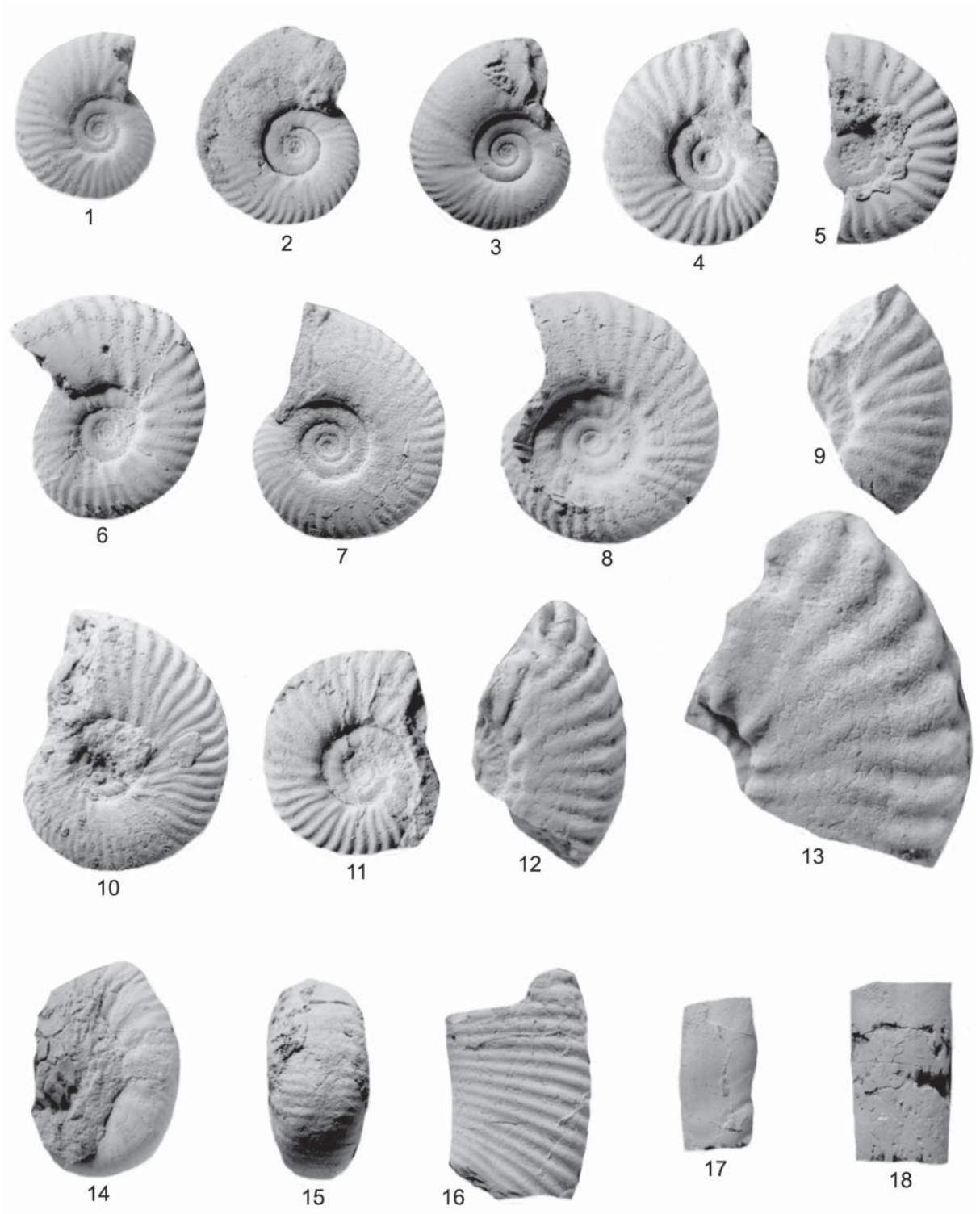
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PLATE 32

1-9 – *Algerites sayni* Pervinquière, 1910. 1-3 – the holotype, MNHN. F. J04343, the original of Pervinquière 1910, pl. 10 (1), fig. 25; 4-7 – MNHN. F. J04348, the original of pl. 10 (1), fig. 24; 8, 9 – MNHN. F. J04353, the original of pl. 10 (1), fig. 32; all from Sour El-Ghozlane (Aumale), northern Algeria.

10, 11 – *Anisoceras* cf. *plicatile* (J. Sowerby, 1819) – MNHN. F. J13717a, the original of *Hamites* (*Anisoceras*?) *armatus* Sow. of Pervinquière 1907, pl. 4, fig. 3, from the 'Vraconnien' of Guern er Rhezal, Central Tunisia.

12, 13 – *Anisoceras leckenbyi* Wright and Kennedy, 1995, MNHN. F. J13717b, the original of *Hamites* (*Anisoceras*?) *armatus* Sow. of Pervinquière 1907, pl. 4 fig. 2, from the 'Vraconnien' of Guern er Rhezal, Central Tunisia.

14-17, 29 –.*Anisoceras jacobi* Breistroffer, 1947. 14, 15 – OUMNH KX.14311; 16, 17 – OUMNH KX.14313; 29 – OUMNH KX.14319; all from the Upper Albian *puzosianum* fauna, 2.5 km south of Djebel Djerissa, Central Tunisia.

18-21, 23, 24 – *Hamites virgulatus* Brongniart, 1822. 18, 19 – OUMNH KX.16215a; 20, 21 – OUMNH KX.16254; 23, 24 – OUMNH KX.16215b; all from the Upper Albian *puzosianum* fauna north and north-west of Gadet Chi, north-eastern Algeria.

22, 30 – *Anisoceras auberti* (Pervinquière, 1907). 22 – OUMNH KX.16308, from the Lower Cenomanian *harchaensis* fauna 700 m north-east of Koudiat el Assel, north-eastern Algeria. 30 – cast of the holotype, the original of Pervinquière 1907, pl. 3, fig. 22, from Toukabeur, Central Tunisia.

25-28 – *Hamites duplicatus* Pictet and Campiche, 1861. 25, 26 – OUMNH KX.14318a, from the Upper Albian *puzosianum* fauna, 2.5 km south of Djebel Djerissa, Central Tunisia. 27, 28 – OUMNH KX.16262, from north and north-west Gadet Chi, north-eastern Algeria.

31 – *Idiohamites collignoni* Spath, 1931, OUMNH KX.16309, from the lower Lower Cenomanian *carcitanense* fauna 700 m north-north-east of Koudiat el Assel, north-eastern Algeria.

Figures 1-9, 16-28 are × 2, figures 10-13 are × 3; figures 29-31 are × 1

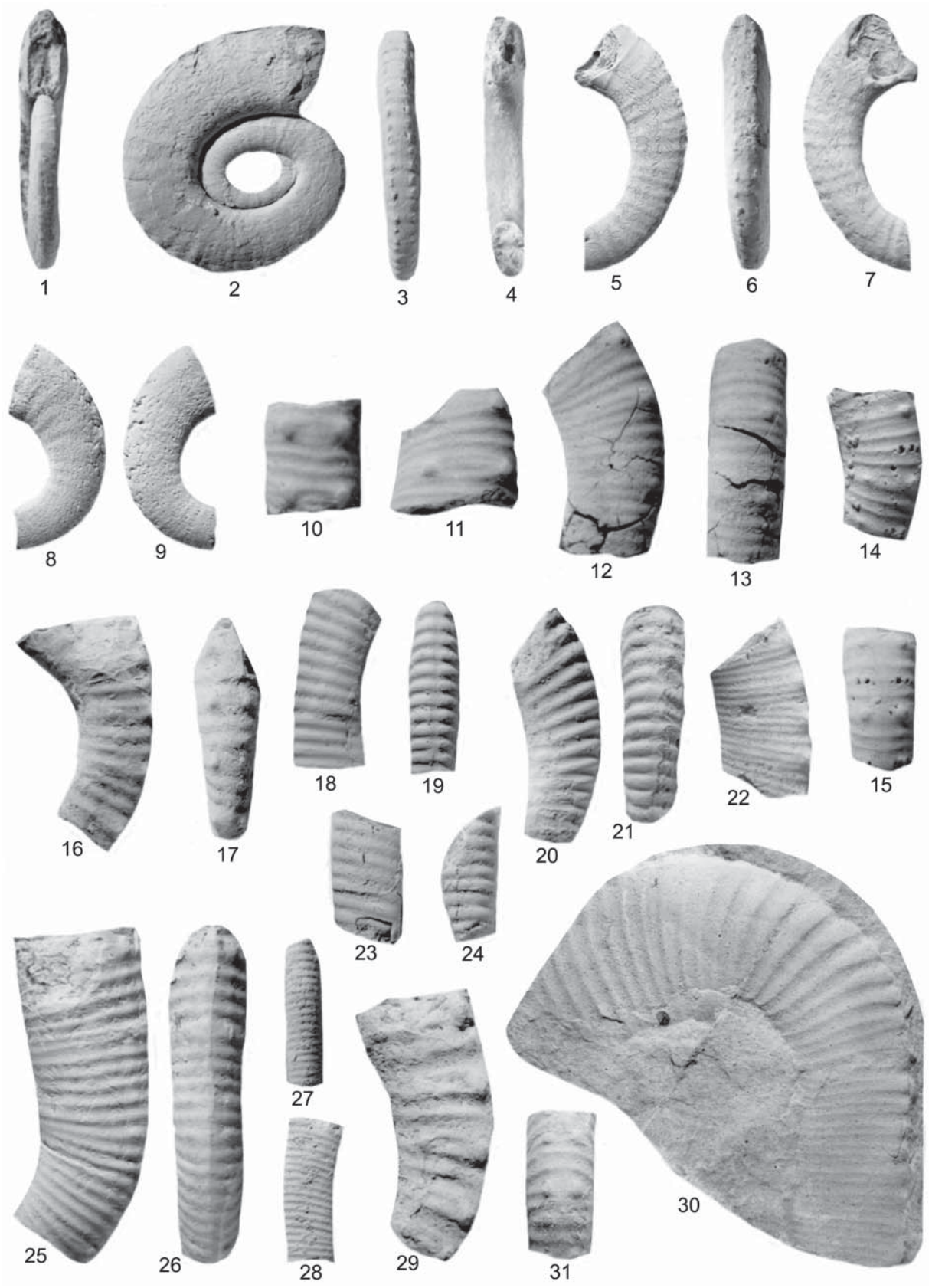
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PLATE 33

1-6, 11-14 – *Algerites sayni* Pervinquière, 1910. 1, 2 – OUMNH KX.16599c; 3, 4 – OUMNH KX.16599d; 5, 6 – OUMNH KX.16599b; 11, 12 – OUMNH KX.16599a; 13, 14 – OUMNH KX.16599c; all from the Lower Cenomanian carcitanense fauna north of Djebel Hameima, Central Tunisia.

7, 8 – *Hamites venetzianus* Pictet, 1847 – OUMNH KX.16400, from the Upper Albian *puzosianum* fauna north of Djebel Hameima, Central Tunisia.

9, 10, 15-18 – *Algerites ellipticus* (Mantell, 1822). 9, 10 – OUMNH KX.16464a; 15, 16 – OUMNH KX.16600b; 17 – OUMNH KX.16600a; 18 – OUMNH KX.16463a; all from the Lower Cenomanian *carcitanense* fauna north of Djebel Hameima, Central Tunisia.

19-24 – *Idiohamites alternatus* (Mantell,1822). 19, 20 – OUMNH KX.16303; 21, 22 – OUMNH KX.16304; 23, 24 – OUMNH KX.16302; all from the Lower Cenomanian *carcitanense* fauna north of Djebel Hameima, Central Tunisia.

Figures 1-18 are × 3; figures 19-24 are × 2

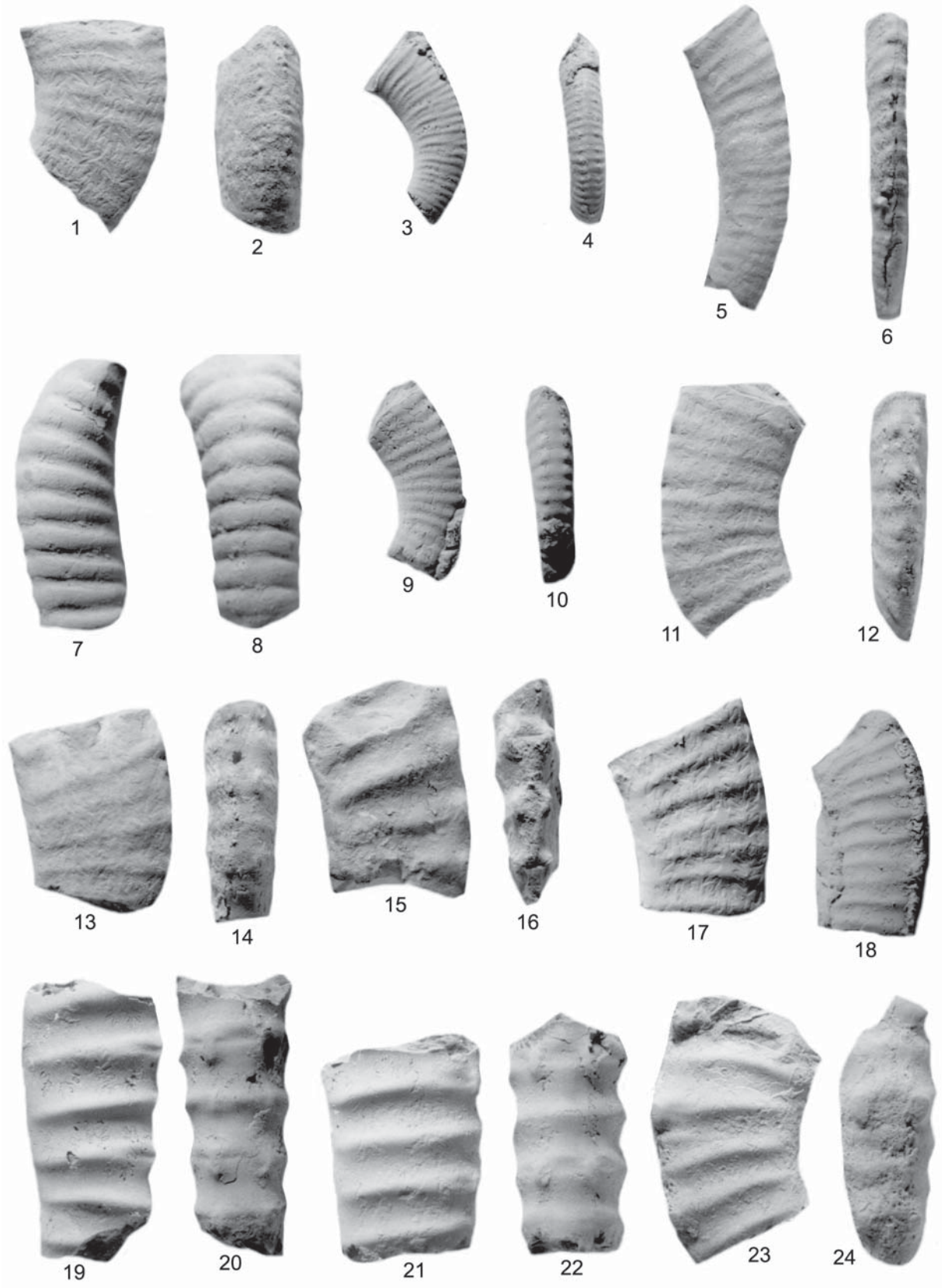
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PLATE 34

1-5, 19, 20 – *Lechites* (*Lechites*) *gaudini* (Pictet and Campiche, 1861). 1-3 – OUMNH KX.14192a; 4, 5 – OUMNH KX.14192b; 19, 20 – OUMNH KX.14193a; all from the Upper Albian *puzosianum* fauna, 2.5 km south of Djebel Djerissa, Central Tunisia.

9-12, 16-18, 21-25 – *Lechites* (*Lechites*) *moreti* Breistroffer, 1936. 9, 10 – OUMNH KX.14264a; 11, 12 – OUMNH KX.14264b; 16, 17 – OUMNH KX.14263d; 18 – OUMNH KX.14264c; 21 – OUMNH KX.14264d; 22, 23 – OUMNH KX.14262a; 24, 25 – OUMNH KX.14263c; all from the Upper Albian *puzosianum* fauna, 2.5 km south of Djebel Djerissa, Central Tunisia.

6-8, 13-15 – *Sciponoceras roto* Cieśliński, 1959. 6-8 – OUMNH KX.16274; 13-15 – OUMNH KX.16275; both from the Lower Cenomanian *harchaensis* fauna 700 m north-east of Koudiat el Assel, north-eastern Algeria.

All figures are × 2

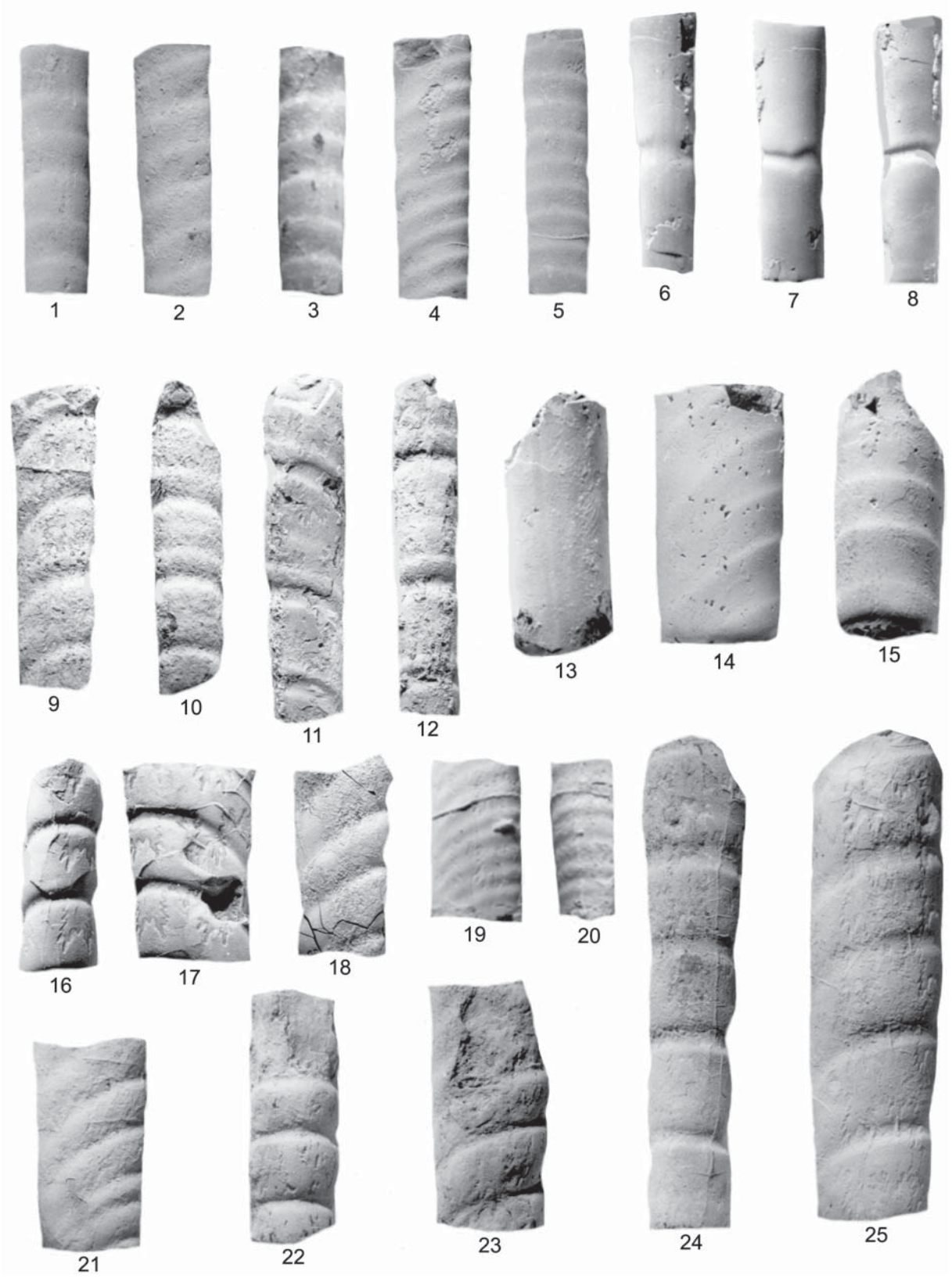
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PLATE 35

1-4 – *Hypoturrilites schneegansi* Dubourdieu, 1953. 1 – OUMNH KX.16346; 2 – OUMNH KX.16345; 3 – OUMNH KX.16348; 4 – OUMNH KX.16338; all from the Lower Cenomanian *harchaensis* fauna 700 m north-east of Koudiat el Assel, north-eastern Algeria.

5, 7 – *Neostlingoceras oberlini* Dubourdieu, 1953. 5 – OUMNH KX.16335; 7 – OUMNH KX.16336; both from the Lower Cenomanian *harchaensis* fauna 700 m north-east of Koudiat el Assel, north-eastern Algeria.

6, 8, 9, 18 – *Neostlingoceras carcitanense* (Matheron, 1842). 6 – OUMNH KX.16598; 9 – OUMNH KX.16627; 18 – OUMNH KX.16625; all from the Lower Cenomanian *carcitanense* fauna north of Djebel Hameima, Central Tunisia. 8 – MNHN. F. J13720, the original of *Turrilites morrisi* Sharpe of Pervinquière 1907, pl. 4, figs 15, 16, from Kef Si Abd el Kerim, Central Tunisia.

10, 11 – *Mesoturrilites corrugatus* Wright and Kennedy, 1996. 10 – OUMNH KX.9649; 11 – OUMNH KX.9650; both from the Lower Cenomanian of Kat el Margueb, north of Djebel Fguira Salah, near Pont du Fahs, Central Tunisia.

12, 15 – *Ostlingoceras* (*Ostlingoceras*) *collignoni* Wright and Kennedy, 1996. 12 – OUMNH KX.9648b; 15 – OUMNH KX.9648c; both from the Lower Cenomanian of Kat el Margueb, north of Djebel Fguira Salah, near Pont du Fahs, Central Tunisia.

13, 14, 16, 17 – *Ostlingoceras* (*Ostlingoceras*) *puzosianum* (d'Orbigny, 1842). 13 – OUMNH KX.15247b; 14 – OUMNH KX.14260b; 16 – OUMNH KX.14260a; 17, OUMNH KX.14259; all from the Upper Albian *puzosianum* fauna, 2.5 km south of Djebel Djerissa, Central Tunisia.

Figures 1-7, 9, 13-18 are × 2; figures 10, 11 are × 3; figure 8 is × 4

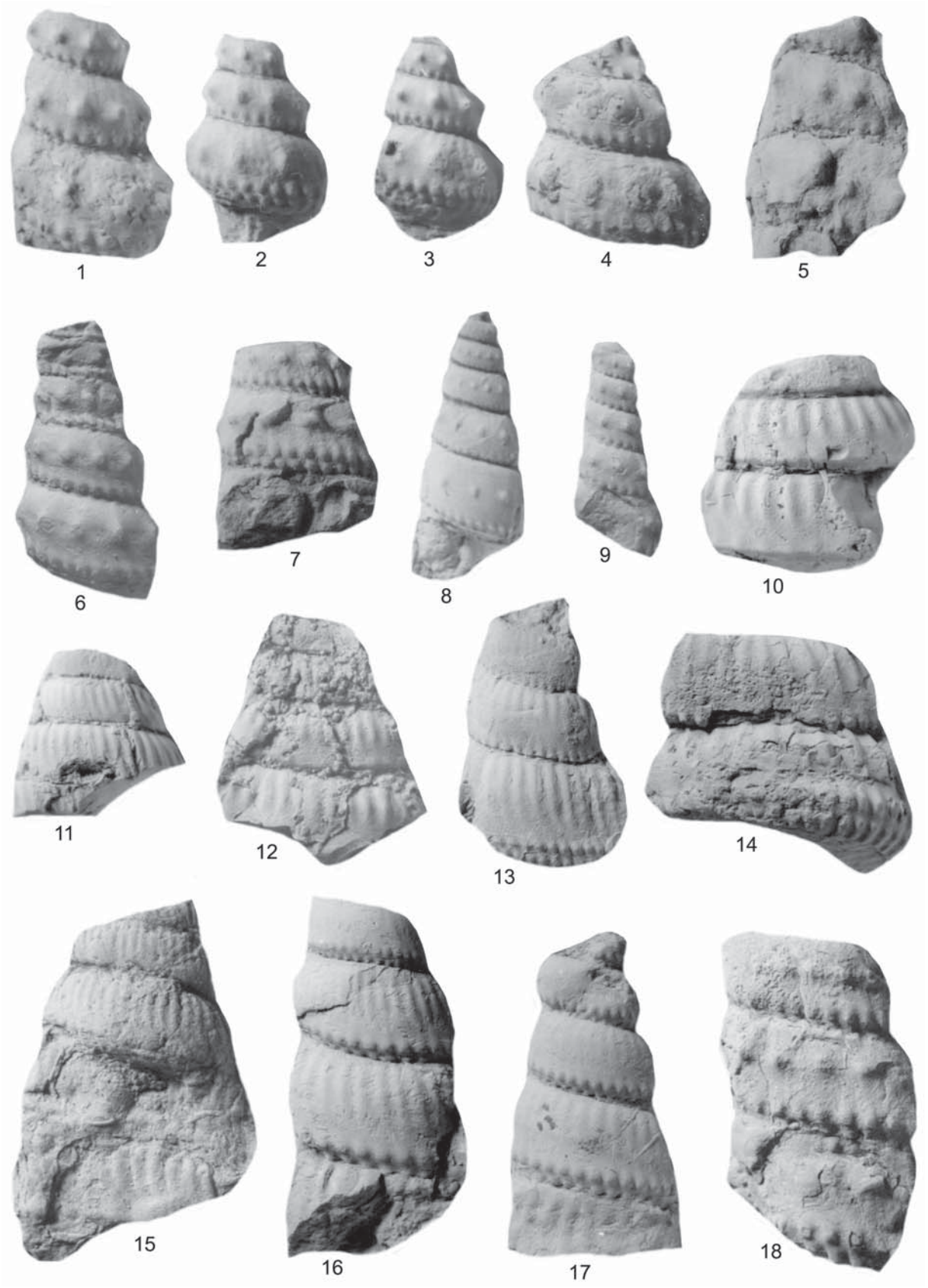
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PLATE 36

1-4, 7-9 – *Turrilites scheuchzerianus* Bosc, 1810. 1 – OUMNH KX.16070d; 2 – OUMNH KX.16070h; 3 – OUMNH KX.16070f; 4 – OUMNH KX.16070a; 7 – OUMNH KX.16070b; 8 – OUMNH KX.16070e; 9 – OUMNH KX.16070c; all from the *scheuchzerianus* fauna west of Djebel Sottara, 8.5 km west of Sour El-Ghozlane (Aumale), northern Algeria.

5, 6 – *Turrilites acutus* Passy, 1832. 5 – OUMNH KX.16711; 6 – OUMNH KX. 16710; both from the Middle Cenomanian *asiaticum* fauna north of Djebel Hameima, Central Tunisia.

11, 15, 16, 18, 22 – *Mariella* (*Mariella*) *pervinquierei* (Diener, 1925). 11 – OUMNH KX.16384d; 15 – OUMNH KX.16384a; 16 – OUMNH KX.16360; 22 – OUMNH KX.16384f; all from the Lower Cenomanian *harchaensis* fauna 700 m north-east of Koudiat el Assel, north-eastern Algeria. 18 – OUMNH KX.9836a, from the Lower Cenomanian north of Djebel Hameima, Central Tunisia.

10, 12, 13, 17, 20 – *Mariella* (*Mariella*) *harchaensis* (Dubourdieu, 1953). 10 – OUMNH KX.16384c; 12 – OUMNH KX.16357; 13 – OUMNH KX.16361; 17 – OUMNH KX.16380, 20 – OUMNH KX.16384f; all from the Lower Cenomanian *harchaensis* fauna 700 m north-east of Koudiat el Assel, north-eastern Algeria.

19, 21, 23 – *Mariella* (*Mariella*) *bergeri* (Brongniart, 1322). 19 – OUMNH KX.14294b; 21 – OUMNH KX.14294a; 23 – OUMNH KX.14293a; all from the Upper Albian *puzosianum* fauna, 2.5 km south of Djebel Djerissa, Central Tunisia.

24 – *Neostlingoceras carcitanense* (Matheron, 1842), MNHN. F. J13748, the original of Pervinquière 1910, pl. 14 (5), fig. 20, from Djebel Guessa, north-eastern Algeria.

Figures 1-7, 10-23 are × 2; figures 5 and 6 are × 3

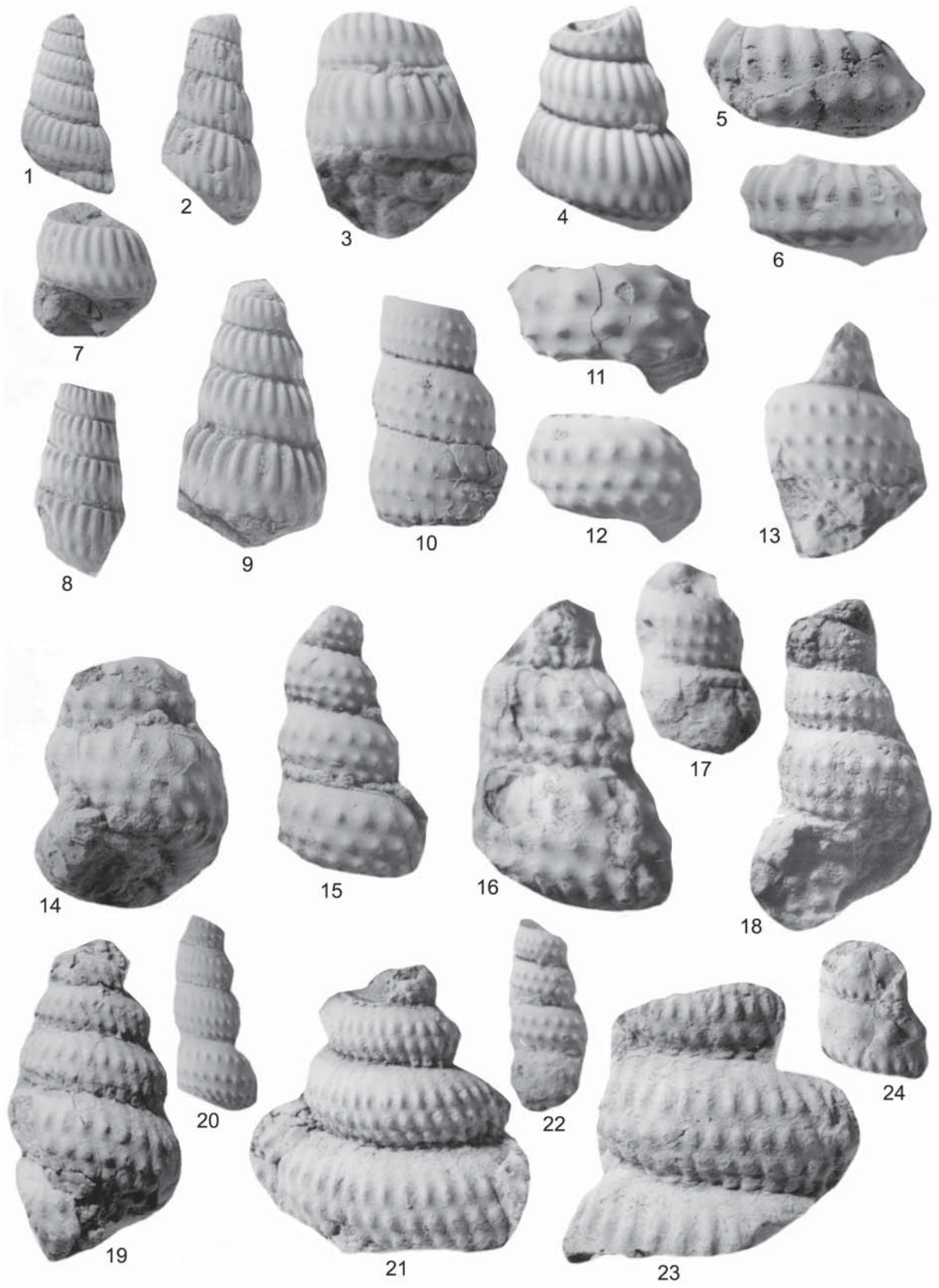
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PLATE 37

1, 2 – *Ostlingoceras* (*Ostlingoceras*) *costulatum* (Pervinquière, 1910), the lectotype, MNHN. F. J13727, the original of *Turrilites costatus* var. *costulata* Pervinquière 1910, pl. 14 (5), figs 6, 7, from Sour El-Ghozlane (Aumale), northern Algeria.

3, 4, 6, 7, 8, 9, **14** – *Turrilites scheuchzerianus* Bosc, 1801. 3, 4 – MNHN. F. J13734, the original of *Turrilites costatus* Lamarck of Pervinquière 1910, pl. 14 (5), fig. 3; 6, 7, 14 – MNHN. F. J13730, the original of pl. 14 (5), fig. 4; 8, 9 – MNHN collections, the original of pl. 14 (5), fig. 5; all from Sour El-Ghozlane (Aumale), northern Algeria.

5 – *Ostlingoceras* (*Ostlingoceras*) *collignoni* Wright and Kennedy, 1996, MNHN. F. J13725, the original of *Turrilites* cf. *colcanapi* Boule, Lemoine et Thévenin of Pervinquière 1910, pl. 14 (5), fig. 1, from Sour El-Ghozlane (Aumale), northern Algeria.

10, 15, 23 –*Mariella* (*Mariella*) *oehlerti oehlerti* (Pervinquière, 1910. 10 – the holotype, MNHN. F. J13735, the original of Pervinquère 1910, pl. 14 (5), fig. 16; 15 – MNHN. F. J13721, the original of pl. 14 (5) fig. 15; 23 – MNHN. F. J13726, the original of pl. 14 (5), fig. 17; all from Sour El-Ghozlane (Aumale), northern Algeria.

11 – indeterminate gastropod, MNHN. F. J13733, the original of *Turrilites scheuchzerianus* Bosc of Pervinquière 1910, pl. 14 (5), fig. 2, from Sour El-Ghozlane (Aumale), northern Algeria.

12 – *Mariella* (*Mariella*) *numida* (Pervinquière, 1910), MNHN. F. J13724, the original of Pervinquière 1910, pl. 14 (5), figs 12, 13, from Djebel Guessa, northern Algeria.

13 – *Turrilites acutus* Passy, 1832, MNHN. F. J13731, the original of Pervinquière 1910, pl. 14 (5), fig. 9, from Batna, northern Algeria.

16, 17, 18, 21, 25 – *Mesoturrilites serpuliforme* (Coquand, 1862). 16 – MNHN. F. J13737, the original of *Turrilites peroni* Pervinquière 1910, pl. 14 (5), fig. 29, from Djebel Guessa, northern Algeria. 17, 18 – MNHN. F. J13732, the original of *Turrilites peroni* Pervinquière 1910, pl. 14 (5), fig. 28, from Sour El-Ghozlane (Aumale), northern Algeria. 21 – MNHN collections, the original of *Turrilites peroni* Pervinquière 1910, pl. 14 (5), fig. 30, from Berrouaghia, northern Algeria. 25 – MNHN. F. J13742, the original of *Turrilites peroni* Perviquière 1910, pl. 14 (5), fig. 27, from Sour El-Ghozlane (Aumale), northern Algeria.

19, 20, 22, 24 – *Mesoturrilites aumalensis* (Coquand, 1862). 19, 20 – MNHN. F. J13743, the original of Pervinquière 1910, pl. 14 (5), fig. 22, from Sour El-Ghozlane (Aumale), northern Algeria. 22 – MNHN. F. J13728, the original of Pervinquière 1910, pl. 14 (5), fig. 21, from Sidi-Ali, northern Algeria. 24 – MNHN. F. J13738, the original of Pervinquière 1910, pl. 14 (5), fig. 23, from Djebel Guessa, northern Algeria.

All figures are × 2

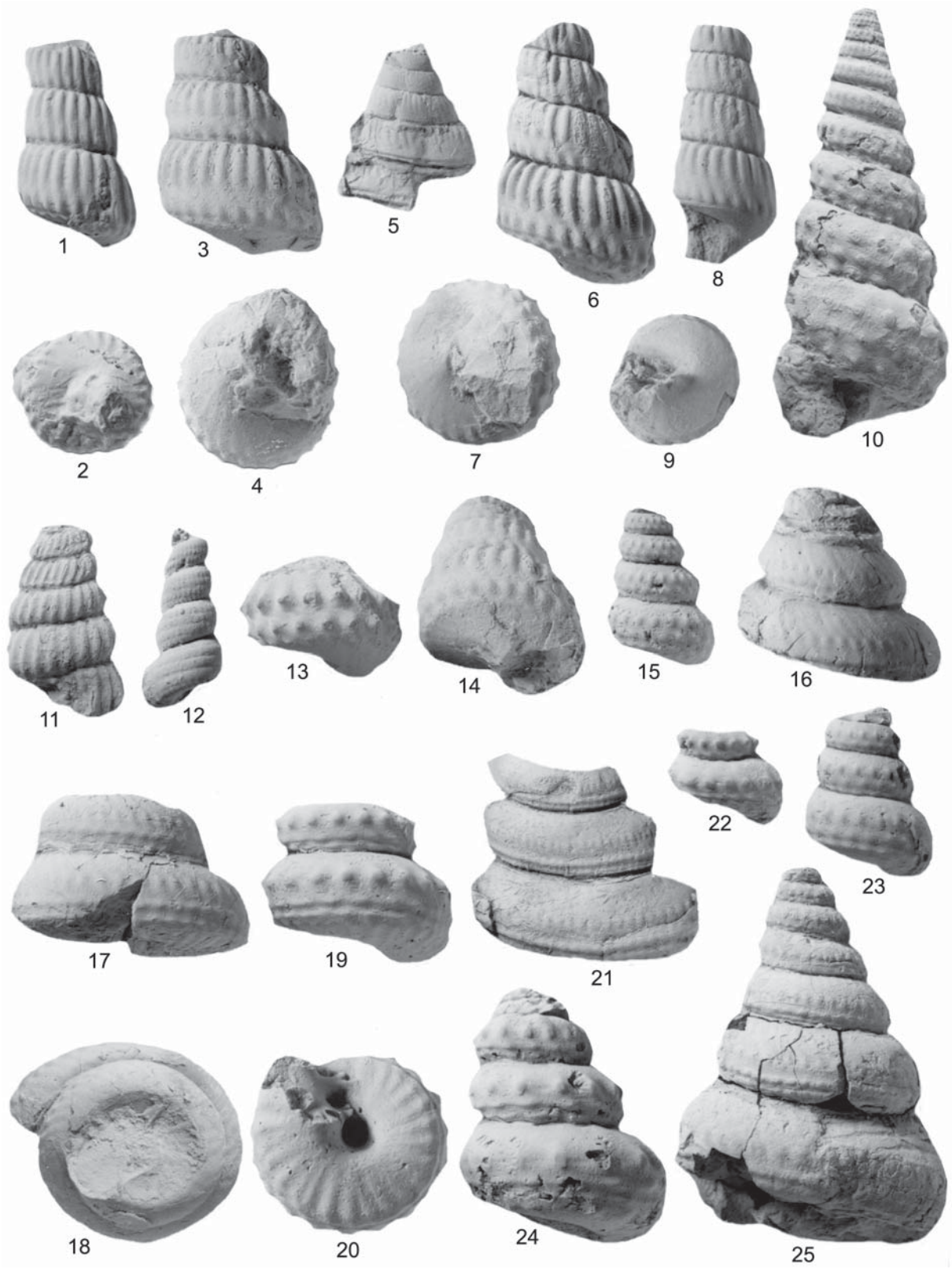
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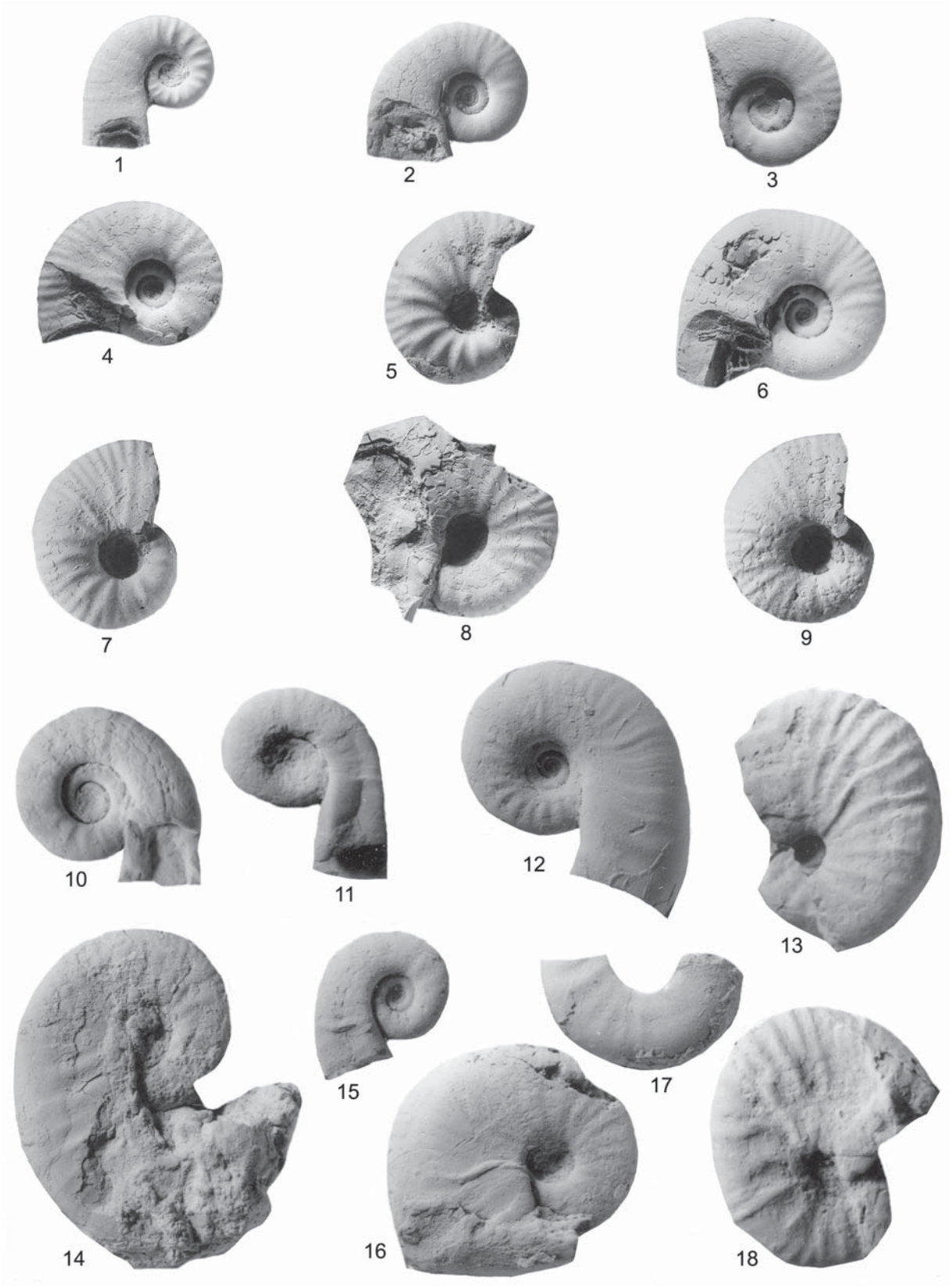
PLATE 38

Scaphites peroni Pervinquière, 1910

1 – OUMNH KX.16124; 2 – OUMNH KX.16132; 3 – OUMNH KX.16130; 4 – OUMNH KX.16131; 5 – OUMNH KX.16122a; 6 – OUMNH KX.16125; 7 – OUMNH KX.16122d; 8 – OUMNH KX.16128; 9 – OUMNH KX.16122c; all from the Upper Cenomanian *pentagonum* Zone, 2 km south-east of Djebel el Krorza, north-eastern Algeria. 10 – OUMNH KX.16911; 11 – OUMNH KX.16912; 12 – OUMNH KX.16767; 13 – OUMNH KX.16910b; 14 – OUMNH KX.16738; 16 – OUMNH KX.16764; 16 – OUMNH KX.16739; 17 – OUMNH KX.167363; 18 – OUMNH KX.16910a; all from the Upper Cenomanian *pentagonum* fauna north of Djebel Hameima, Central Tunisia.

All figures are × 3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