The high Cretaceous ammonite fauna from Tercis, Landes, France

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Abstract

The very high Cretaceous ammonite fauna from the area close to Tercis-les-Bains, south-west of Dax, Landes, France, has been revised. Even the lower (but not lowest) part of the Grande Carrière is already near the top of the Campanian, belonging to the Zone of *Nostoceras hyatti*. This assemblage-zone has yielded *Hauericeras* *fayoli* (de Grossouvre, 1894), *Pseudokossmaticeras brandti* (Redtenbacher, 1873), *P. tercense* (Seunes, 1892), *Pachydiscus* (*Pachydiscus*) *perfidus* (de Grossouvre, 1894), *P. (P.) subrobustus* (Seunes, 1892), *P. (P.) cf. colligatus* (Binkhorst, 1861), *Nostoceras* (*Nostoceras*) *hyatti* Stephenson, 1941, *N. (N.) helicinum* (Shumard, 1861) and *Baculites* *leopolinitis* Nowak, 1908. This assemblage is comparable to that found in the Zone of *Pseudokossmaticeras* *tercense* in the region of the Bay of Biscay, and to that found in the Zone of *Nostoceras* *pozaryskii* (here re-named the Zone of *Nostoceras* *hyatti*) of the Vistula Valley in Poland.

The lowest occurrence of the overlying Zone of *Pachydiscus* *epiplectus*, and the lowest Maastrichtian recognisable in ammonite terms, is marked by the incoming of *Hoploscaphites* *constrictus* (J. Sowerby, 1817). Other ammonite species from this zone are: *Pachydiscus* (*Pachydiscus*) *epiplectus* (Redtenbacher, 1873) and *Pachydiscus* (Pachydiscus) *neubergicus* (Von Haauer, 1858).

A higher ammonite Zone of *Menuites* (*Anapachydiscus*) *fresvillensis* has been detected only from museum specimens from La Pointe to the north of the Grande Carrière. The ammonites known from this zone are: *Pachydiscus* *jacquoti* *jacquoti* (Seunes, 1890a), *Pachydiscus* (Pachydiscus) *armenicus* *Atebasian* & *Akopian*, 1969, *Desmophyllites* *larteti* (Seunes, 1892), *Diplomoceras* *cylindraceum* (Defrance, 1816), *Glyptoxoceras* *rugatum* (Forbes, 1846).

The highest Maastrichtian ammonite zone in the Biscay region is that of *Menuites* (*Anapachydiscus*) *terminus*. This has not been detected near Tercis.

Key-words: Campanian, Maastrichtian, ammonites, zones, south-west France.

Résumé

La faune d'ammonites de la fin du Crétacé récoltée dans la région de Tercis, au sud-ouest de Dax (Landes, France) est révisée.

La partie inférieure (mais non les couches de base) de la Grande Carrière appartient déjà à la Zone à *Nostoceras hyatti*, ce qui indique un âge proche de la fin du Campanien. Cette zone d’assemblage réunit les espèces *Hauericeras* *fayoli* (de Grossouvre, 1894), *Pseudokossmaticeras* *brandti* (Redtenbacher, 1873), *P. tercense* (Seunes, 1892), *Pachydiscus* (*Pachydiscus*) *perfidus* (de Grossouvre, 1894), *P. (P.) subrobustus* (Seunes, 1892), *P. (P.) cf. colligatus* (Binkhorst, 1861), *Nostoceras* (*Nostoceras*) *hyatti* Stephenson, 1941, *N. (N.) helicinum* (Shumard, 1861) et *Baculites leopolinitis* Nowak, 1908. Cet assemblage est comparable à celui de la Zone à *Pseudokossmaticeras* *tercense* dans la région du Golfe de Gascogne et à celui de la Zone à *Nostoceras pozaryskii* (dénommée ici de la Zone à *Nostoceras hyatti*) dans la vallée de la Vistule, en Pologne.

La base de la Zone à *Pachydiscus* *epiplectus* sus-jacente et celle de l'étage Maastrichtien sont caractérisées par l’apparition d’*Hoploscaphites* *constrictus* (*J., Sowerby, 1817*). D’autres espèces d’ammonites rencontrées dans cette zone sont: *Pachydiscus* (*Pachydiscus*) *epiplectus* (Redtenbacher, 1873) et *Pachydiscus* (Pachydiscus) *neubergicus* (Von Haauer, 1858).

La Zone à *Anapachydiscus* *fresvillensis*, une zone d’ammonites plus élevée, n’a été identifiée que sur base de spécimens de collections provenant de La Pointe, au nord de la Grande Carrière. Les ammonites présentes dans cette zone sont: *Pachydiscus* *jacquoti* *jacquoti* (Seunes, 1890a), *Pachydiscus* (Pachydiscus) *armenicus* *Atebasian* & *Akopian*, 1969, *Desmophyllites* *larteti* (Seunes, 1892), *Diplomoceras* *cylindraceum* (Defrance, 1816), *Glyptoxoceras* *rugatum* (Forbes, 1846).

La zone d’ammonites la plus élevée du Maastrichtien dans la région de la Biscaye est celle à *Anapachydiscus* *terminus*. Elle n’a pas été observée aux environs de Tercis.

Mots-clés: Campanien, Maastrichtian, ammonites, zones, sud-ouest de la France.

Introduction

For ammonite stratigraphy the importance of Tercis is that it provides an expanded section spanning the Campanian-Maastrichtian boundary. This is particularly true if one adopts - as we do - the boreal belemnite standard for the stage boundary, but it possibly also applies if one uses the tethyan planktic foraminiferal standard.

It was only recently that the ammonite succession in the high Upper Campanian to lowest Maastrichtian has been knowingly studied. Many authors have regarded the Zone of *Bostrychoceras* *polyplacum* to be the marker for the top of the Campanian, e.g. Dalbiez, 1960; Rawson et al., 1978. It was the work of Blaszkiewicz (1980) in Poland showed that there were further distinct ammonite zones above this within the Campanian: his Zones of *Didymoceras* *donezianum* and *Nostoceras pozaryskii* corresponded to a belemnite Zone of *Belemnitella langei*. This top part of the Campanian is still ignored by many writers; for example, it is simply missing, leaving a stratigraphical gap, in the EXXON
chart (HAQ et al., 1987, 1988). This top part of the Campanian at Tercis is not only expanded but provides most of the fossils. Thus, though one would always like more specimens, there are sufficient available from known beds to recognise a reliable stratigraphy.

Previous ammonite zonations for the high Campanian to Maastrichtian

Uppermost Campanian and Maastrichtian ammonite zonation for western European successions has been less refined, and less satisfactory, than that based on other groups. DE GROSSEOUVE (1901, p.801, 830) proposed the following sequence (drawing heavily on the work of SCHLÜTER, 1871, 1876), all of which he regarded as Campanian because he did not recognise a Maastrichtian stage:

Upper Campanian

- Pachydiscus neubergicus
- Hoplitites vari

Lower Campanian

- Mortoniceras delawarensense
- Placenticeras bidorsatum

A zone of Bostrychoceras polyplorum was introduced by HAUG (1911, pp. 1170, 1300) and usually regarded by him as Maastrichtian. Subsequent workers have generally adopted a three or four-fold Campanian zonation, with a vari or polyplorum Zone at the summit; the Maastrichtian was then assigned either to a Pachydiscus neubergicus Zone or a Scaphites (Hoploscaphites) constrictus Zone, as with JELETZKY (1951). This author also proposed a more refined scheme for the Maastrichtian, with a lower Zone of Pachydiscus neubergicus + Scaphites (Acanthoschaphites) tridens et var., and an upper Zone of Sphenodiscus binkhorsti.

WRIGHT (1957) gave the following divisions for “classic areas of western Europe” (table 4, p.L128):

Maastrichtian

- Sphenodiscus sp.
- Pachydiscus neubergicus
- Hoplitoplacenticeras vari
- Menabites delawarensis
- Diplacmoceras bidorsatum

Campanian

- Neancyloceras polyplocum
- Belemnella lanceolata

This zonation or variations of it were quoted by ammonite workers until 1980 when BLASZKIEWICZ produced the most significant account of uppermost Campanian and Maastrichtian ammonites from Europe on the basis of the succession in some 460 m of chalks, marls, siliceous limestones (opokas) and siliceous gaiize in the central Vistula Valley. We are most grateful to Dr A. BLASZKIEWICZ for allowing us to study his collections and to Dr R. MARCINOWSKI for guidance in the field. BLASZKIEWICZ both provided a comprehensive review of previous work and recognised the following zonal succession:

Upper

- Belemnella casimirovensis
- Belemnitella junior

Lower

- Belemnitella occidentalis
- Belemnella lanceolata

Note that BLASZKIEWICZ did not offer ammonite indices to correspond with the first three belemnite zones of the Maastrichtian.

The highest Campanian ammonite zone should be renamed the Zone of Nostoceras hyatti, following BURNETT et al. (in press) and KENNEDY & COBBAN (in press), because BLASZKIEWICZ’S material of Nostoceras pozaryskii includes specimens of the widely occurring Nostoceras (N.) hyatti STEPHENSON, and more restricted Nostoceras (N.) helicinum (SHUMARD). Also present in the hyatti Zone of the Vistula Valley are: Hoploscaphites vistulensis BLASZKIEWICZ, H. angulatus (LOPSUKI), H. minimum BLASZKIEWICZ, Jeletzkytes nodosus (OWEN) (the senior synonym of Acanthoschaphites praeglandulosus BLASZKIEWICZ: KENNEDY & COBBAN, in press), Belemnitella lanceolata var., while the first occurrence of the index species is considered as pronouncedly later. In the case of upper boundaries of true ranges of the two taxons, the possibility was assumed of an only insignificantly later. The remaining taxons here occurring and having more closely
determined true ranges include *Pachydiscus perfdus* Grossouvre, *Hoploscaphites minimus* sp.nov. and *Belemniella langei* Jeletzky.

The true range of *Pachydiscus perfdus* Grossouvre is seen as approaching that of *Acanthoscaphe peraequadrispinosus* sp.nov. The position in the roof part or only slightly above the upper boundary of the zone is also assumed in the case of the upper boundary of the true range passing from the former unit of *Belemniella langei* Jeletzky. *Hoploscaphites minimus* sp.nov. is a species decidedly passing to the next unit and whose appearance is related with the upper part of the zone.” (BLASZKIEWICZ, 1980, p.14).

As discussed elsewhere (KENNEDY, COBBAN & SCOTT, 1992) these records of Jeletzkytes nodosus (OWEN) (= *Acanthoscaphe peraequadrispinosus* of BLASZKIEWICZ), *Nostoceras* (N.). *hyatti* and *N. (N.) helicinum* (= *Nostoceras pozaryski*), within the Upper Campanian are crucial to the placement of the Campanian-Maastrichtian boundary in the US Western Interior and Gulf Coast, and elsewhere.

The *Belemnella lanceolata* lanceolata Zone of BLASZKIEWICZ yields *Baculites* spp., *Nostoceras* spp., *Nostoceras schloenbachii* (FAVRE), *Diplomoceras* cylindraceum, *Hoploscaphites minimus* BLASZKIEWICZ, *Acanthoscaphe tridens* (KNER) [= *A. quadriphosphorus* (GEINITZ) and *A. bispinosus* NOWAK of BLASZKIEWICZ], *Pachydiscus neuburgicus* [= subspecies *laricostatus* BLASZKIEWICZ], *Pachydiscus epiplectus* (REDTENBACHER) [= *Pachydiscus colligatus latumtablichatus* BLASZKIEWICZ], *Pseudokossmaticeras galicianum* and *Belemnella lanceolata*. In his discussion of this zone BLASZKIEWICZ (1980, p.14) suggests that, contrary to records in Germany, *Hoploscaphites constrictus* appears some way above the first occurrence of *B. lanceolata* and *A. tridens*, as does *Pachydiscus neuburgicus* *laricostatus* BLASZKIEWICZ (regarded as a synonym of *P. neuburgicus* by KENNEDY & SUMMESBERGER, 1984). In the Michów region, some 30 km north of Kraków, *P. neuburgicus* *laricostatus* and *B. lanceolata* appear at the same level according to BLASZKIEWICZ.

The upper Lower Maastrichtian *Belemnella occidentalis* Zone of BLASZKIEWICZ yielded *Baculites* spp., *Hoploscaphites constrictus* [subspecies anterior of BLASZKIEWICZ], *Acanthoscaphe tridens* [bispinosus NOWAK of BLASZKIEWICZ], *Pachydiscus neuburgicus neuburgicus*, *P. gollevillensis* (d’ORTIGNY) [subspecies nowaki MICHAILOV of BLASZKIEWICZ], *Hauerceras sulcatum* and *Belemnella occidentalis*.

The lower Upper Maastrichtian *Belemnitella junior* Zone of BLASZKIEWICZ yields only *Baculites* species.

The base of the upper Upper Maastrichtian *Hoploscaphites constrictus* crassus Zone of BLASZKIEWICZ is said to be below the appearance of *Belemnella casimirovensis* (SKOŁOZDROWNA), suggesting that the upper limit of the *junior* Zone is drawn at a lower level in the Vistula Valley than elsewhere in Europe. Apart from the index species, which is no more than a late form of *H. constrictus*, the ammonites are *Baculites* spp., *Diplomoceras cylindraceum*, *Acanthoscaphe varians* (LOPUSKI) and *Sphenodiscus binkhorsti* (BÖHM).

Ammonite zonations of the Maastrichtian have been proposed recently for the coastal succession of the Biscay region. The chief outcrops are at Zumaya and Sopelana in Spain, and at Hendaye and Bidart in France. A review of previous work in the region is provided by WARD & KENNEDY (in press), to which reference should be made. The Maastrichtian succession at Zumaya is more than 200 m in thickness, and five members can be recognized, and traced to the other sections. Planktic foraminiferal zonation of the succession at Zumaya is based on the work of HERM (1965), and a nannofossil zonation is provided by BURNETT et al. (1992). WIEDMANN (1987, 1988a,b) proposed a tentative ammonite zonation for the Zumaya section as follows:

(10 m unzoned)

*Pachydiscus epiplectus* species-level

*Pachydiscus jacquoti* species-level

*Pachydiscus llarenai* species-level

*Pachydiscus gollevillensis* species-level

*Anapachydiscus fresvillensis* species-level

Zone of *Pachydiscus neuburgicus*

Zone of *Pseudokossmaticeras* tercense

*Nostoceras* (N.). *hyatti* occurs in the tercense Zone, for *Cirroceras* (*Cirroceras*) *polyplom* zumayensis WIEDMANN 1962, p.200, pl.9, fig. 5) is based on a body chamber of *N. (N.) hyatti*. The tercense Zone is thus, in part at least, Campanian. The holotype of *Pachydiscus* (P.) *llarenai* WIEDMANN (1960, p.764, pl.4, fig. 6; pl.5, fig. 4) is a crushed *P. (P.) jacquoti*, so it is unlikely that the *jacquoti* and *llarenai* species-levels can really be distinguished. *Pachydiscus epiplectus* (REDTENBACHER), used by WIEDMANN to distinguish his top Upper Maastrichtian species-level, is in fact a Lower Maastrichtian species (KENNEDY & SUMMESBERGER, 1986). WARD et al. (1991) and WARD & KENNEDY (in press) have presented new range-data from all the main sections in the Biscay region, the second paper providing, for the first time, illustrations and taxonomic revisions of the whole ammonite-fauna. They show that some of WIEDMANN’s species-levels overlap, and have proposed the following zonation:

(youngest)

*Anapachydiscus terminus* Zone

*Anapachydiscus fresvillensis* Zone

*Pachydiscus* (P.) *epiplectus* Zone

*Pseudokossmaticeras* tercense Zone

(oldest)

As already noted, the presence of *Nostoceras* (N.). *hyatti* in the tercense Zone at Zumaya shows that it is in part Campanian. In ammonite terms, the tercense Zone at Tercis is contiguous with, but does not overlap with definite Maastrichtian ammonites. However, detailed correlation depends on other groups of fossils and is discussed in the preceding paper. Other key criteria for a correlation between the Biscay region and Tercis are:
The Campanian-Maastrichtian ammonite succession around Tercis

We propose the following ammonite zonation for the uppermost Campanian and Maastrichtian of the Tercis region:

\[
\begin{align*}
\text{Maastrichtian} & \quad \begin{cases} 
\text{Menuites [Anapachydiscus] fresvillensis Zone: not proven} \\
\text{Pachydiscus epiplectus Zone} \quad \text{(gap?)} \\
\text{Menuites [Anapachydiscus] fresvillensis Zone} \\
\text{Nostoceras hyatti Zone} \\
\end{cases} \\
\text{Upper Campanian} & \quad \begin{cases} 
\text{Nostoceras hyatti Zone} \\
\end{cases}
\end{align*}
\]

These are all assemblage-zones. The Zone of *Nostoceras hyatti* is characterised by the occurrence of *Hauericeras fayoli* (DE GROSSOUXRE, 1894), *Pseudokossmaticeras brandti* (REDTENBACHER, 1873), *P. tercense* (SEUNES, 1892), *Pachydiscus (Pachydiscus) perfidus* (DE GROSSOUXRE, 1894), *P. (P.) subrobustus* (SEUNES, 1892), *P. (P.) cf. colligatus* (BINKHORST, 1861), *Nostoceras (Nostocer) hyatti STEPHENSON, 1941, N. (N.) helicinum* (SHUMARD, 1861) and *Baculites leopoliensis* NOWAK, 1908. The zonal fauna is already present in the top 8 m of Unit G of the Tercis Pale Flint Member, and *P. tercense* and *B. leopoliensis* extend to Unit N2, near the top of the Member. *N. (N.) hyatti* itself is known only below Unit M. The *hyatti* Zone is equivalent to most or all of the Zone of *Pseudokossmaticeras tercense* of the Biscay region (WARD & KENNEDY, in press), and part or all of the Zone of *N. hyatti* [pozaryskii] of the Vistula Valley in Poland (BLASZKIEWICZ, 1980).

The Zone of *Pachydiscus epiplectus* is characterised by the co-occurrence of *P. (P.) epiplectus* (REDTENBACHER, 1873), *P. (P.) neubergicus* (VON HAUER, 1858) and *Hoploscaphites constrictus* (J. SOWERBY, 1817). These first occur in Unit N3 of the Tercis Pale Flint Member; *H. constrictus* is present in the basal marl of Unit N3, and is the lowest unequivocally Maastrichtian ammonite found at Tercis to date.

The Zone of *Menuites [Anapachydiscus] fresvillensis* is recognised on the basis of faunas from the higher part of the succession exposed at La Pointe, and includes *Pachydiscus jacquoti jactqui* (SEUNES, 1890a), *Pachydiscus (Pachydiscus) armenicus* ATABEKIAN & AKOPIAN, 1969, *Desmophyllites larteti* (SEUNES, 1892), and *Glyptoxoceras rugatum* (FORBES, 1846).

We have seen no indicators of the *Menuites [Anapachydiscus] terminus* Zone from the Tercis area; whether this is due to collection-failure or its absence from the highest Maastrichtian preserved cannot be determined at this time.

We have also seen but are unable to localise stratigraphically with certainty the following species of the Maastrichtian: *Anagaudryceras lueneburgense* (SCHÜLTER, 1872), *Saghalinites wrighti* BIRKELUND, 1965, and *Pseudokossmaticeras duereri* (REDBENBACHER, 1873). From material in the Bruno Cahuzac collection, the first two species come from the *epiplectus* Zone.

Conventions

The following abbreviations are used to indicate the repositories of specimens mentioned in the text: BMNH: Natural History Museum, London; OUM: University Museum, Oxford; MNHP: Muséum National d'Histoire Naturelle, Paris; SP: Sorbonne Collections, now housed in the Université Pierre et Marie Curie, Paris; these are uncatalogued but include the ARNAUD collection. Type and figured material of the old Sorbonne collections is currently being transferred to the MNHP collections; UPST: Université Paul Sabatier, Toulouse; FSL: Collections of Département des Sciences de la Terre, Université Claude Bernard, Lyon, which also houses the EMP (École des Mines) Collections. USNM: United States National Museum, Washington, D.C., USA. IRSNB: Institut Royal des Sciences Naturelles de Belgique.

All dimensions are given in millimetres; D = diameter, Wb = whorl breadth; Wh - whorl height; U = umbilicus. Figures in parentheses are dimensions as a percentage of diameter. The suture terminology is that of WEDERKIND (1916), as reviewed by KULLMANN & WIEDMANN (1970): E = external lobe; L = lateral lobe; U = umbilical lobe; and I = internal lobe.

Systematic palaeontology

Phylum **Mollusca**

Class **Ammonoidea** ZITTEL, 1884

Suborder **Lytoceratina** HYATT, 1889

Superfamily **TETRAGONITACEAE** HYATT, 1900

Family **GAUDRYCERATIDAE** SPATH, 1927
Genus *Anagaudryceras* SHIMIZU, 1934

**Type species**
*Ammonites sacya* FORBES, 1846, p.113, pl.14, fig.9, by original designation of SHIMIZU, 1934, p.67.

*Anagaudryceras lueneburgense* (SCHLÜTER, 1872) (Pl.1, Figs.8-10; Pl.2, Figs.12,13)

compare:
*1872* Ammonites *Lüneburgensis* SCHLÜTER, p.62, pl.18, figs. 8-9.
1894 *Gaudryceras planorbiforme* J. Böhm - DE GROSSOUVRE, p.231, (pars), pl.27, fig.2 only.
1986 *Anagaudryceras lueneburgense* (Schlüter, 1872) - KENNEDY & SUMMESBERGER, p.185, pl.3, fig.6; pl.15, fig.4.
in press *Anagaudryceras lueneburgense* (Schlüter, 1872) - BIRKELUND, p.00, pl.1, figs.3-5.

**Description and Discussion**
The original of *Gaudryceras planorbiforme* BÖHM of DE GROSSOUVRE (1894, p.231 (pars), pl.27, fig.2 only), represents the juvenile of this species. It is a poorly preserved composite mould (Pl.2, Figs.12,13), just over 53 mm in diameter, with the whorl height comprising 44% of the diameter. The outer whorl is worn, and no ornament survives. There are distant, prorsiradiate, straight to feebly flexed collar-ribs and associated constrictions, three per half whorl.

A second crushed composite mould, MNHP 2001.A.227 (Pl.1, Figs 8-10) is just over 100 mm in diameter, with the whorl height comprising 34% of the diameter and the umbilicus comprising 47% of the diameter. The outer whorl is worn, and no ornament survives. There are distant, prorsiradiate, straight to feebly flexuous collar-ribs and associated constrictions, three per half whorl.

The holotype by original designation is no. 9747 in the collections of the Mineralogical Museum, Copenhagen, the original of BIRKELUND, 1965, pl.2, figs. 5a-c; text-fig. 19, from the reworked Maastrichtian concretions in the basal Danian Oyster-ammonite Conglomerate of Nugssuaq, West Greenland.

**Material**
SP unregistered, ex ARNAUD Collection, one specimen (the smaller: Pl.12, Fig.5) labelled "Angoume, P't Q"; the larger (Pl.1, Figs.5-7) labelled “Tercis, banc à Echinocorys conoidea P3, Determin. De Grossouvre”.

The smaller specimen (Pl.12, Fig.5) is a composite internal mould of a juvenile with a maximum preserved diameter of 31 mm. Coiling is very evolute, the umbilicus comprising 47% of the diameter, shallow, with a flattened wall and narrowly rounded umbilical shoulder. The whorl section has been modified by post-mortem compaction, but appears to have been parallel-sided with a rounded venter. The surface of the mould is smooth, but for distant straight prorsiradiate constrictions.

The larger specimen (Pl.1, Figs.5-7) is a composite mould deformed into an ellipse with a major axis 67 mm in diameter, and two thirds of a whorl of body chamber preserved. Coiling is fairly involute, the umbilicus of moderate depth, with a concave wall and narrowly rounded shoulder. The whorl section is slightly depressed, with flattened inner flanks, convergent outer flanks, narrowly rounded ventrolateral shoulders and a flattened venter. There is no ornament and no constrictions are visible.

**Discussion**
*Saghalinites wrighti* most closely resembles the type species, *S. cala* (FORBES, 1846), recently revised by KENNEDY & HENDERSON (1992a). They differ in that *S. wrighti* has straight constrictions, whereas those of *S. cala* are flexed, and it is on this criterion that the present material is placed in BIRKELUND'S species.

**Occurrence**
Lower Maastrichtian of Neuberg, Steiermark, Austria; in Greenland, north Germany and Denmark it occurs around the Lower/Upper Maastrichtian boundary. In the coastal outcrops in the Biscay region of France and Spain it ranges from the Lower Maastrichtian into the upper Upper Maastrichtian.

Genus *Pseudophyllites* KOSSMAT, 1895

**Type species**
*Ammonites Indra* FORBES, 1846, p.105, pl.11, fig.7, by original designation of KOSSMAT, 1895, p.137 (41).

*Pseudophyllites indra* (FORBES, 1846) (Pl.1, Figs.3-4)
*1846* *Ammonites Indra* Forbes, p.105, pl.11, fig.7.

1992a *Pseudophyllites indra* (Forbes, 1846) - Kennedy & Henderson, p.398, pl.3, figs.7-9, 13-27; pl.4, figs.1-3 (with full synonymy).

in press *Pseudophyllites indra* (Forbes, 1846) - Ward & Kennedy.

**LECTOTYPE**

Designated by Kennedy & Klingler, 1977, p.182, is BMNH C 51068, the original of Forbes, 1846, pl.11, figs. 7a,b, from the Valudur Formation of Pondicherry, south India. There are numerous paralectotypes.

**MATERIAL**

MNHP 7192 (ex d’Orbigny Collection), from Tercis.

**DESCRIPTION**

Although only a juvenile, the form of the umbilicus shows this specimen to be *Pseudophyllites indra*. Differences from other species are fully documented by Kennedy & Henderson (1992a).

**OCCURRENCE**

(Upper Santonian?) Lower Campanian to Upper Maastrichtian: south India, South Africa (Zululand and Pondoland), Colombia, Brazil (?), Chile, California, the US Gulf Coast, New Jersey (USA), Northern Ireland, Poland, Austria, France (Pyrénées-Atlantiques, Landes, and northern Aquitaine).

Suborder *Ammonitina* Hyatt, 1889

Superfamily *Desmocerataceae* Zittel, 1895

Family *Desmoceratidae* Zittel, 1895

Genus *Desmophyllites* Spath, 1929

**TYPE SPECIES**

*Desmoceras larteti* Seunes, 1892, pl.19, pl.12 (3), fig.2; pl.13, (4), figs.2,3, by subsequent designation of Spath, 1921, p.46, as type species of *Schluteria*, of which *Desmophyllites* is the replacement name.

*Desmophyllites larteti* (Seunes, 1892) (Pl.2, Figs.1-3,10,11,14; Pl.3, Figs.1,4,5)

*1892* *Desmoceras Larteti* Seunes, p.19, pl.12 (3), fig.2; pl.13 (4), figs.2,3.

1984 *Desmophyllites larteti* (Seunes, 1891) - Kennedy & Summersberger, p.156, pl.1, fig.6; pl.2, figs.1-3, 5-6 (with full synonymy).


in press *Desmophyllites larteti* (Seunes, 1891) - Ward & Kennedy, p. ,fig.

**TYPES**

Lectotype, designated by Kennedy & Summersberger (1984, p.156) is the original of Seunes, 1892, pl.13 (4), fig.2; paralectotype is the original of Seunes, 1892, pl.12 (3), fig.2; pl.13 (4), fig.3, and from the "Assise à Pachydiscus Fresvillensis, P. Jacquot et Stegaster, Gan, Route de Gan à Rébénacq", Pyrénées-Atlantiques, France; SP unregistered.

**MATERIAL**

SP unregistered, ex ARNAUD collection, two specimens labelled "Pachydiscus Larteti Seunes Tercis, La Pointe, P3 R. Déterm. de Grossouvre", a further specimen from the same locality, and labelled "Ammonites n.sp". SP unregistered, ex ARNAUD Collection, two specimens labelled "Schluteria Larteti de Gross. Angoumé".

**DIMENSIONS**

<table>
<thead>
<tr>
<th></th>
<th>Lectotype</th>
<th>Pararlectotype</th>
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<tbody>
<tr>
<td>D</td>
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<td>81.4(100)</td>
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<td>24.0(29.5)</td>
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<td>0.58</td>
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<tr>
<td>U</td>
<td>5.3(5.7)</td>
<td>5.1(6.3)</td>
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</tbody>
</table>

**DISCUSSION**

The type specimens are composite moulds showing little, if any, indications of post-mortem crushing. The lectotype has 160° of body chamber preserved; the paralectotype 50°. Both have their early whorls restored in Plaster of Paris, as is clearly shown in Seunes' figures. Coiling is very involute, with a tiny umbilicus comprising around 6% of diameter, shallow, with a flattened umbilical wall and narrowly rounded umbilical shoulder. The whorl section is compressed oval, with a whorl breadth to height ratio of 0.45-0.58, the greatest breadth below mid-flank, the inner flanks broadly rounded, the outer flanks convergent and the venter narrowly arched. Phragmocones appear smooth, but for traces of constrictions visible at the smallest diameter in the paralectotype. These are much more conspicuous towards the end of the phragmocone and on the body chamber, where they come to number 5-6 per half whorl. They are narrow, deep, distant, prorsiradiate and biconcave, being concave on the inner flank, convex at mid-flank and concave on the outer flank, sweeping strongly forwards over the ventrolateral shoulder to cross the venter in a narrow linguoid convexity. The constrictions are preceded by a rounded collar-rib, weak on the inner flanks, but strengthening on the outer flank and best developed over the venter. Interspaces between constrictions bear delicate growth lines and striae; these are most conspicuous on the venter. Suture with narrowly stemmed, symmetrically bifid saddles; L deeply incised; there are numerous auxiliary saddles on the umbilical lobe.

The Tercis specimens are typical wholly septate fragments with whorl heights of up to 40 mm. Those from Angoumé are better preserved, up to an estimated 110 mm diameter, and appear to be adult.

**DISCUSSION**

*Desmophyllites diphylloides* (Forbes, 1846) (p.105, pl.8, fig.8; see Henderson & McNamara 1985, p.54,
pl.4, figs.1-4) is a smaller, stouter species with flattened subparallel flanks (whorl breadth to height ratios of 0.85-0.76 are cited by HENDERSON & MCNAMARA), broadly rounded venter and shallow constrictions that are weaker than those of D. larteti and only feebly flexed in most described examples.

**Occurrence**
Upper Campanian to upper Upper Maastrichtian. There are records from the Gschliefgraben, Austria; Landes, Pyrénées-Atlantiques and the Biscay region of southeastern France and northern Spain and, possibly, Madagascar.

Subfamily **Hauericeratinae** Matsumoto, 1938  
Genus **Hauericeras** DE GROSSOUVRE, 1894  
Type species  
_Ammonites gardeni_ BAILY, 1855, p.450, pi.11, fig.3, by original designation of DE GROSSOUVRE, 1894, p.219.  
_Hauericeras fayoli_ DE GROSSOUVRE, 1894 (Pl.1, Figs. 1,2)  
*1894 Ammonites gardeni_ BAILY, p.220 (pars), pl.27, fig.3.  
1896a _Hauericeras fayoli_ De Grossouvre, 1894 - KENNEDY, p.27, text-fig.9a-j.

**Type Species**  
_Ammonites gardeni_ BAILY, 1855, p.450, pi.11, fig.3, by original designation of DE GROSSOUVRE, 1894, p.219.

**Material**  
OUM KZ 20331, from the Upper Campanian _N._(_N._) _hyatti_ Zone, Unit H at Tercis.

**Description**  
The holotype is a crushed composite mould just over 60 mm in diameter. Coiling is very evolute with a broad, shallow umbilicus comprising 48% of the diameter with a very low wall and narrowly rounded umbilical shoulder. The whorl section is compressed, with subparallel flanks and a narrow, somewhat worn venter. The surface of the mould is smooth, but for distant constrictions, four per whorl. They are narrow, straight and prorsiradiate on the inner flank, convex at mid-flank, concave on the outer flank and strongly projected on the ventrolateral shoulder.

**Discussion**  
KENNEDY & SUMMERSBERGER (1984) and KENNEDY (1986a) describe and discuss _H._ _fayoli_ in detail, and note differences from other species referred to the genus.

**Occurrence**  
Upper Campanian of the Gschliefgraben, Austria. There are imprecisely located specimens from northwestern Aquitaine and Tercis; the latter, by their preservation, are from the Upper Campanian _N._(_N._) _hyatti_ Zone; and doubtful records from the Lower Maastrichtian of Madagascar.

Family **Kossmaticeratidae** Spath, 1922  
Subfamily **Kossmaticeratinae** Spath, 1922  
Genus **Pseudokossmaticeras** Spath, 1922  
Type species  
_Ammonites pacificus_ STOLICZKA, 1865, p.160, pi.77, fig.9, by original designation of SPATH, 1922, p.126.

_Pseudokossmaticeras brandti_ (REDTENBACHER, 1873)  
(Pl.2, Figs.4-6; Pl.4, Figs.1-5; Pl.5, Figs.1-8; Pl.6, Figs. 1-9; Pl.7, Figs.5-11)  
*1873 Ammonites brandti_ REDTENBACHER, p.106, pl.24, fig.1.  
1892 _Pachydiscus aturicus_ SEUNES, p.17, pl.15(6), figs. 2, 3.  
1894 _Pachydiscus brandti_ (Redtenbacher) - DE GROSSOUVRE, p.192, pl.23, figs.2,3 (non pl.30,fig.3, var. _pegoti_ DE GROSSOUVRE = _P._ _tercense_ (SEUNES, 1892)).  
1925 _Kossmaticeras brandti_ (Redtenbacher) - DIENER, p.97.  
1935 _Kossmaticeras brandti_ (Redtenbacher) - TZANKOV, p.11, pl.3, fig.2, (= _P._ _galicia-num_ (FAVRE, 1869)).  
1935 _Kossmaticeras brandti_ (Redtenbacher) - BRINKMANN, p.6.  
1951 _Pseudokossmaticeras brandti_ (Redtenbacher) - MICHAILOV, p.75, pl.11, fig.48.  
1955 _Pseudokossmaticeras brandti_ (Redtenbacher) - MATSUMOTO, p.144.  
1958 _Pseudokossmaticeras brandti_ (Redtenbacher) - REYMENT, p.34, pl.10, fig.1.  
1959 _Pseudokossmaticeras brandti_ (Redtenbacher) - NAIDIN & SHIMANSKY, p.190, pl.13, fig.2.  
1960 _Pseudokossmaticeras brandti_ (Redtenbacher) - WIEDMANN, p.724.  
1964 _Pseudokossmaticeras brandti_ (Redtenbacher) - TZANKOV, p.156, pl.3, fig.1 (= _P._ _galicianum_ (FAVRE, 1869)).  
1976 _Pseudokossmaticeras brandti_ (Redtenbacher) - THIEDIG & WIEDMANN, p.15, pl.1, fig.1.  
1981 _Pseudokossmaticeras brandti_ (Redtenbacher, 1873) - SZASZ, p.102, pl.5, figs.1,2 (= Nowakites sp).  
1982 _Pseudokossmaticeras brandti_ (Redtenbacher, 1873) - TZANKOV, p.30, pl.12, figs.1-3.  
1982 _Pseudokossmaticeras aturicus_ (Seunes, 1890) - TZANKOV, p.32, pl.14, fig.1.
1989  *Pseudokossmaticeras brandti* (Redt.) - *SALAJ & WIEDMANN*, p.303, text-fig.3.

**LECTOTYPE**
No 1873/01/11 in the collections of the Geologische Bundesanstalt, Vienna, the original of *REDTENBACHER* 1873, p.106, pl.24, fig.1, from the Gosau Beds of Grünbach, Austria, designated by *REYMENT*, 1958, p.34.

**MATERIAL**
There are numerous unregistered specimens from Angoumé and Tercis in the SP, EMP, and UPST Collections, including the originals of *SEUNES*, 1892, pl.15(6), figs. 2, 3, the types of *Pachydiscus aturicus* *SEUNES*, 1892, in the EMP and SP collections respectively; a cast of the original of *DE GROSSOUVRE* 1894, pl.23, fig.1 is in the EMP collections, while the original of *DE GROSSOUVRE* 1894, pl.33, figs.2,3, is in the SP collections; OUM KZ 16871, probably from the Pale Flints Member at Tercis.

**DIMENSIONS**

<table>
<thead>
<tr>
<th></th>
<th>D</th>
<th>Wb</th>
<th>Wh</th>
<th>Wb:Wb</th>
<th>U</th>
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<tr>
<td><em>SEUNES</em>, 1892</td>
<td>87.3(100)</td>
<td>(-)</td>
<td>31.2(35.7)</td>
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<td>pl.15(6), fig.2</td>
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</table>

**DESCRIPTION**
An early growth stage is shown by the juvenile 62 mm in diameter, shown as Pl.5, Figs.1,2, and the inner whorls of the original of *SEUNES*, 1892, pl.15(6), fig.3, 58.5 mm in diameter (Pl.7, Figs.5-8, 11). Coiling is very evolute, the umbilicus comprising 38% of the diameter, of moderate depth with a broadly rounded, outward-inclined umbilical wall and broadly rounded umbilical shoulder. The whorl section is depressed reniform, with a whorl breadth to height ratio of 1.17, the greatest breadth below mid-flank, the flanks and venter broadly and evenly rounded. Twenty primary ribs arise at the umbilical seam and strengthen across the umbilical wall, developing into pronounced bullae that extend across the inner half of the flanks at the smallest diameter seen, but as size increases the bullae give rise to single ribs that are coarse, straight and prorsiradiate. They branch both low and high on the flank and additional ribs may intercalate to give a total of twenty six ribs on the venter of the last half whorl, where they are feebly convex. The ribs strengthen progressively as size increases. There are six to seven prominent constrictions per whorl. They are deeply incised into the umbilical shoulder, broad and deep, straight on the inner flank but flexed forwards on the outer flank to become feebly concave; they cross the venter in a broad convexity which is, however, narrower than the convexity of the ribs. These constrictions are flanked by sharp, narrow, adapical and adapertural collar ribs with sharp umbilical bullae. Other specimens of this size show some variability in the coarseness of ribbing with seventeen primaries on the inner whorls of the larger of *SEUNES* specimens (Pl.4, Figs.1-3) and as few as fifteen in others (Pl.7, Fig.9). The later whorls, which extend to diameters of 150 mm, are characterised by the disappearance of clearly differentiated constrictions beyond 90 mm diameter, and a change to predominantly primary ribs, 24-26 per whorl, with well-developed bullae, the ribs coarse, straight and prorsiradiate on the inner and mid-flank, flexing forwards on the ventrolateral shoulder to cross the venter undiminished in strength, in a feebly convex to near-transverse course. There are occasional intercalated ribs that arise both low and high on the flank present to the largest diameters seen, with rib totals of up to 33 per whorl.

**DISCUSSION**
The lectotype of *Pseudokossmaticeras brandti* is a near-complete adult (*REYMENT*, 1958, pl.10, fig.1), deformed into an ellipse with a maximum diameter of 153 mm, lacking the internal whorls, and differing in no obvious respects other than preservation from comparable-sized Tercis specimens (Pl.4, Figs.4,5; Pl.5, Figs.7,8).

*P. brandti* differs from co-occurring *Pseudokossmaticeras tercense* (*SEUNES*, 1892) (p.16, pl.15(6), fig.4) (see below) in that the latter is a compressed, slender-whorled species with delicately ribbed inner whorls, the ribs arising in pairs from bullae or intercalating between (Pl.7, Figs.1-4; Pl.8, Figs.1-6). *Pseudokossmaticeras galicianum* (FAVRE, 1869) (p.16, pl.3, figs.5,6; see KENNEDY & SUMMESBERGER, 1987) and its synonyms *P. negri* (MARIANI, 1898, p.34(4), pl.8(1), fig.3) and, possibly, *P. tchihatcheffi* BÖHM, 1927, p.217, pl.13, fig.1) has much finer narrow ribs, arising singly or in pairs from 26 umbilical bullae per whorl at a diameter of 55 mm, and a total of 47-50 ribs in the lectotype. *Pseudokossmaticeras muratovi* MCHIGAILOV, 1951 (p.77, pl.13, fig.32) is more densely ribbed than the present species, lacks prominent umbilical bullae, the ribs bi- and trifurcating at or about mid-flank to give a total of more than 50 ribs per whorl.

*Pseudokossmaticeras cerevicianum* (PETHÖ, 1906) (p.95, pl.8, figs.3) is based upon four specimens from Fruska Gora; the original of PETHO’S pl.6, fig.3 (Pl.6, Figs.7-9) is here designated lectotype of the species; and a paralectotype are shown as Pl.6, Figs.3-9. The original figures show shells with denser, branching ribs in middle growth, and exaggerated coarse bullae and ribs when adult, a quite different morphology from that of *P. brandti*. The specimens show, however, that the coarseness of adult ribbing is less striking than in the figures, and the result of clumsy cleaning of the specimens, and the fine ribs are equally an artefact. The lectotype and paralectotype can be matched in the present material, and *P. cerevicianum* is here regarded as a synonym of *P. brandti*.

**OCCURRENCE**
*Pseudokossmaticeras brandti* has been widely suggested as a Lower Maastrichtian marker. The species is restricted to the Upper Campanian (using the Campanian-
**Pseudokossmaticeras tercense** (Seunes, 1892)

(Pl.7, Figs.1-4; Pl.8, Figs 1-6)

1890b  
*Pachydiscus* aff. *galicianus* Favre - Seunes, p.238, pl.9, fig.5.

*1892*  
*Pachydiscus galicianus* Favre sp. mut. *Tercensis* Seunes, p.16, pl. 15(6), fig.4.

1894  
*Pachydiscus brandti* Redtenbacher sp. var. *Pégotii* de Grossouvre, p.194, pl.30, fig.3.

1925  
*Kossmaticeras galizianum* var. *tercensis* Seunes - Diener, p.98

1955  
**Pseudokossmaticeras tercense** Seunes - Collignon, p.44.

1959  
**Pseudokossmaticeras galicianum** (Favre) - Naidin & Shimansky, p.189, pl.13, fig.1.

1964  
**Pseudokossmaticeras galicianum** tercense (Seunes, 1890) - Tzankov, p.158, pl.6, fig. 1; pl.7, fig.2.

1974  
**Pseudokossmaticeras galicianum** (Favre 1869) - Naidin, p.179, pl.65, fig.4.

1976  
**Pseudokossmaticeras tercense** (Seunes) - Thiedig & Wiedmann, p.18, pl.1, fig.2; pl.2, fig.2.

1986b  
**Pseudokossmaticeras tercense** (Seunes, 1891) - Kennedy, p.1007, pl.1, figs.6,7.

_in press_**Pseudokossmaticeras tercense** (Seunes, 1891) - Ward & Kennedy

**Type**

Lectotype (pl.7, figs. 3,4) by the subsequent designation of Kennedy, 1986b, p.1008, is an unregistered specimen in the SP collections, the original of Seunes, 1892, pl.15(6), fig.4; it is also the original of *Pachydiscus Brandti* Redtenbacher var. *Pégotii* de Grossouvre, 1894, p.192, pl.30, fig.3, here designated lectotype of **Pseudokossmaticeras pégotii** de Grossouvre, which is thus an objective synonym of *P. tercense*.

**Material**

Numerous unregistered specimens from Tercis and Angoumé in the SP, EMP and UPST collections; OUM KZ 20324, from Unit N2, and OUM KZ 16914a-b, from the Pale Grey Flint Member, Tercis.

**Description**

The lectotype is a crushed composite mould, distorted into an ellipse with a major diameter of 80 mm. Coiling is moderately evolute, with 47% of the previous whorl being covered. The umbilicus comprises an estimated 34-35% of the diameter, and is shallow, with a low, flattened, subvertical wall and narrowly rounded umbilical shoulder. The specimen has suffered post-mortem crushing, but the whorl section appears to have been compressed, with feebly convex flanks and a relatively narrowly rounded venter. Much of the inner whorls to an estimated diameter of 45 mm are well-exposed within the umbilicus. An estimated 24 ribs arise at the umbilical seam, and strengthen across the umbilical wall, developing into delicate sharp bullae perched on the umbilical shoulder. These and other non-bullate ribs are narrow, sharp and prorsiradiate, the bullae giving rise to pairs of ribs in many cases, while there are additional intercalated ribs, and periodic broad constrictions flanked by narrow collar ribs. There are 24 umbilical bullae on the outer whorl of the holotype. They are narrow and sharp at the beginning of the outer whorl, thereafter coarsening progressively. They give rise to one, two or three ribs, while there are additional intercalated ribs; all are narrow, straight and prorsiradiate, and pass straight across the venter, totalling an estimated 55-60 ribs per whorl. There are no clearly defined constrictions. The last six or so ribs are much more widely spaced than those preceding them, linking the lectotype to larger specimens in the present collections (Pl.8, Figs.1-6). In adults, there are 23-24 primary ribs per whorl that arise from umbilical bullae for all but the final section of body chamber immediately prior to the aperture. The ribs are much narrower than the interspaces, straight and prorsiradiate on the flanks but flexed forwards and feebly concave over the ventrolateral shoulders and feebly convex to transverse on the venter; they crowd somewhat towards the adult aperture. Long and short intercalated ribs are frequent on the first half of the adult outer whorl, after which nearly all the ribs are long primaries.

**Discussion**

The very fine, delicate ribbing of the inner whors, distant, bar-like ribs on the outer whorl and compressed whorl section serve to distinguish *P. tercense* from co-occurring coarse ribbed *P. brandti*, as well as all other species referred to the genus.

**Occurrence**

Upper Campanian of Landes and Haute Garonne in France; Zumaya, Guipuzcoa in Spain; possibly low Lower Maastrichtian of Carinthia, Austria. “Maastrichtian” (probably Upper Campanian in the sense used here) of Bulgaria and European Russia.

**Pseudokossmaticeras duereri** (Redtenbacher, 1873)

(Pl.2, Figs.7-9)
*1858 Ammonites neubergicus von HAUER, p.12 (pars), pl.2, figs.1-3, non pl.3, figs.1-2.

1985 Pachydiscus (Pachydiscus) cf. neubergicus (Hauer, 1858) - Vasiček, p.76, pl.1, fig.3.

1986 Pachydiscus (Pachydiscus) neubergicus (Hauer, 1858) - Kennedy & Summesberger, p.188, pl.2, figs.1-2; pl.3, figs.1-3; pl.4, figs.1-5; pl.5, figs.1-4, 5; pl.6, figs.1.2, 5; pl.15, figs.7,8; text-fig. 5a, b (with full synonymy).

1986c Pachydiscus (Pachydiscus) neubergicus (Hauer, 1958) - Kennedy, p.34, pl.4, fig.3.

1992a Pachydiscus neubergicus neubergicus (Hauer, 1858) - Kennedy & Henderson, p.420, pl.10, figs.6, 7, 8; pl.11; text-fig. 6a.

in press Pachydiscus neubergicus neubergicus (Hauer, 1858) - Ward & Kennedy

**TYPE**
The holotype is the original of Redtenbacher, 1873, p.118, pl.27, fig.2, no. 1873/01/22 in the collections of the Geologische Bundesanstalt, Vienna, from Gosau, Austria.

**MATERIAL**
SP unregistered, ex Arnaud Collection, labelled "Tercis, Gde Carrière P3".

**DESCRIPTION**
The specimen is a distorted composite mould of half a whorl, with a maximum preserved diameter of 45 mm. Coiling is very evolute, serpenticone, with a reniform whorl section. Numerous narrow primary ribs arise than primary ribs that persist to maturity. The ribs are feebly prorsiradiate, straight on the inner flank and feebly concave on the outer. They are near-transverse on the outer whorl, the latter has many more secondary ribs per whorl: fewer bullae but more secondary than primary ribs that persist to maturity. Pachydiscus gollevillensis (D'Orbigny, 1850) (see revision in Kennedy, 1986c) has 9-11 umbilical bullae and around 80 secondary ribs per whorl: fewer bullae but more secondaries than P. neubergicus, while Pachydiscus armenicus Aatabekian & Akopian, 1969 (p.8, pl.1, fig.2; pl.3, figs 1,2) (see revision in Ward & Kennedy, in press) has more umbilical bullae (16-20 per whorl), and more ventral ribs (62-73 per whorl), than P. neubergicus neubergicus, where the figures are typically 14-18 and 48-60. Pachydiscus jacquoti (Seunès, 1890a) (p.5, pl.3(2), figs.1-3) (see revision in Kennedy, 1986c, p.34,
pl.5, figs.3-11, 15,19; pl.6; text-figs. 2d,e, 3, 4b, 5) has a subcircular whorl section, the coiling evolve and whorls slowly expanding; fewer, distant primary ribs and coarser, distant secondaries.

**Occurrence**

*P. neubergicus neubergicus* has a total range from low in the Lower Maastrichtian to low in the Upper Maastrichtian, where it is succeeded by the subspecies *P. n. disius.* It is known from Tercis and other localities in Landes, Bidart and Hendaye in Pyrénées-Atlantiques, France; Zumaya, northern Spain; north Germany, Denmark, Poland, The Ukraine, Armenia, European Russia, Nigeria, Zululand (South Africa), Madagascar and south India. Subspecies *P. n. disius* is restricted to the Upper Maastrichtian of Western Australia.

**Pachydiscus (Pachydiscus) jacquoti jacquoti**

*SEUNES, 1890a*  
(P.3, Fig.8; Pl.10, Figs.3,6)

*1890a* *Pachydiscus jacquoti* SEUNES, p.5, pl.3(2), figs.1-3.

*1890b* *Pachydiscus jacquoti* Seunes - SEUNES, p.237, pl.9, figs.1-4.

*1892* *Pachydiscus jacquoti* Seunes - SEUNES, p.9, pl.12(3), fig.4.

*1960* *Pachydiscus llarenai* WIEDMANN, p.764, pl.4, fig.6; pl.5, fig.4.

*1962* *Pachydiscus llarenai* Wiedmann - WIEDMANN, p.147, fig.39.

*1986c* *Pachydiscus (Pachydiscus) jacquoti* Seunes, 1890a - KENNEDY, p.34, pl.5, figs.3-11, 15-19; pl.6; text-figs. 2d,e, 3o,s, 4b (with full synonymy).

*1986d* *Pachydiscus (Pachydiscus) jacquoti* (Seunes, 1890) - KENNEDY, figs.9a,b.

*1987* *Pachydiscus (Pachydiscus) jacquoti* (Seunes, 1890a) - KENNEDY, p.171, pl.11, figs.1-4; pl.12, figs.1-3, 8-10; pl.13, figs.1-5; pl.14, figs.4-6, 8-10; pl.15, figs.1-3,12,13; text-fig.7b.

*1992a* *Pachydiscus (Pachydiscus) jacquoti jacquoti* Seunes, 1890 - KENNEDY & HENDERSON, p.426.

in press *Pachydiscus (Pachydiscus) jacquoti jacquoti* Seunes, 1890 - WARD & KENNEDY.

**Types**

SEUNES figured three specimens (1890a pl.3(2), figs.1-3), and mentioned others from the Calcaire à Baculites of the Cotentin Peninsula, Manche, France, Pyrénées-Atlantiques, and north west of Alcoy, Spain. The original of his pl.3(2) fig.1 should be designated lectotype when found (see discussion in KENNEDY 1986c, p.36).

**Material**

SP unregistered, the original of SEUNES 1890b, pl.9, fig.4, from “Tercis-Bédat”, ex ARNAUD Collection, by the preservation from the Upper Maastrichtian *A. fresvillensis* Zone; MNHP 7188B, ex D’ORBIGNY Collection, from “Tercis”.

**Description**

The larger specimen is a composite internal mould 122 mm long, deformed by post-mortem crushing such that the whorl section is a compressed oval. The umbilicus is broad and of moderate depth, with a rounded undercut wall. The expansion rate is low. Five primary ribs arise at the umbilical seam, sweep back across the umbilical wall, and strengthen into feeble bullae on the umbilical shoulder. These give rise to straight narrow, single, prosiradial ribs that are strong to mid-flank, thereafter effacing, sweeping forwards and feebly convex on the outer flank and disappearing on the venter.

**Discussion**

Evolute coiling, low expansion rate and presence of distant primary ribs only at a relatively small size immediately distinguish this species from all others from Landes before us, and show these specimens to be *Pachydiscus jacquoti jacquoti.* See KENNEDY (1986c) for a full discussion of this species. DE GROSSOUVRE (1894, pl.38, fig.38) illustrated a fine adult of this species from Angoumé under the name *Pachydiscus neubergicus.*

**Occurrence**

The Tercis specimens are imprecisely localised, although preservation suggests the Upper Maastrichtian *A. fresvillensis* Zone. Elsewhere, the species ranges throughout the Upper Maastrichtian, with records from Bidart, Hendaye and the region between Gan and Rébénacq in Pyrénées-Atlantiques; the Calcaire à Baculites of the Cotentin Peninsula, Manche, France; Zumaya in northern Spain; Kunrade, The Netherlands; Armenia and Madagascar.

**Pachydiscus (Pachydiscus) armenicus**

*ATABEKIAN & AKOPIAN, 1969*  
(Pl.13, Figs. 1,2)

*1969* *Pachydiscus gollevillensis armenicus* ATABE­KIAN & AKOPIAN, p.8, pl.1, fig.2; pl.3, figs. 1,2.

*1986c* *Pachydiscus gollevillensis armenicus* Atabekian and Akopian - KENNEDY, p.34.

*1987* *Pachydiscus gollevillensis armenicus* Atabekian and Akopian - KENNEDY, p.171.

in press *Pachydiscus (Pachydiscus) armenicus* Atabekian and Akopian - WARD & KENNEDY.

**Type**

Holotype is the original of ATABEKIAN & AKOPIAN, 1969, pl.3, fig.1, from the Upper Maastrichtian of the Azizbek region of Armenia.
The specimen is a crushed composite mould of a 90° ARNAUD SP unregistered, Collection, labelled MATERIAL the umbilical shoulder and inner flank, where they are arise at the umbilical seam, and strengthen across the umbilical wall; it comprises approximately 23% of the diameter. The whorls are slightly distorted, with a maximum preserved diameter of 145 mm. Coiling is fairly involute, with a broadly rounded whorl breadth to height ratio of 0.94; the flanks are very broadly rounded, the ventrolateral shoulders and venter more narrowly so. The inner flanks are badly corroded, but umbilical bullae can be detected on the beginning of the last half whorl. Better preserved is a ventrolateral and ventral ornament of narrow ribs, concave on the ventrolateral shoulder and convex over the venter, where they number an estimated 50 on the last whorl. The larger Angoumé specimen is crushed and deformed into an ellipse with a major axis of 185 mm (PI.15, Figs.13, 14). Ornament is well-preserved, with well-developed umbilical bullae giving rise to primary ribs that number 8-10 per half whorl. The ribs are narrow and prorsiradiate, and efface across the flanks before strengthening on the outermost flank and venter,

DISCUSSION
We have compared this fragment with the cast of the holotype of Pachydiscus (P.) armenicus, with which it agrees in the combination of numerous primary and secondary ribs. The present species has 16-20 bullae and 62-73 ribs per whorl, whereas in Pachydiscus neubergicus the figures are 14-17 and 48-60. In Pachydiscus gollevillensis (D'ORBIGNY, 1850) [see revision in KENNEDY, 1986c, p.28, pls.1-3; pl.4, figs.4-6; pl.5, figs.12-14, 20-24; pl.11, figs. 1-5; text-figs. 2, 3p.r, 4c (with full synonymy)] there are only 9-11 bullae, but 80 ventral ribs.

OCCURRENCE
Pachydiscus armenicus is an Upper Maastrichtian species, known from Armenia, Landes (the present record), Bidart, Hendaye, and the region between Gan and Rébenaq in Pyrénées - Atlantiques in France, as well as Zumaya in northern Spain.

DESCRIPTION
The specimen is a crushed composite mould of a 90° whorl sector of a phragmocone with a maximum preserved whorl height of 34 mm. Coiling appears to have been moderately involute, with a small, shallow umbilicus, with a low wall and narrowly rounded umbilical shoulder. The whorl section is very compressed due to crushing, but the flanks appear to have been very broadly rounded, and the venter narrowly rounded. There are estimated 7 primary ribs on the fragment. They arise at the umbilical seam, and strengthen across the umbilical shoulder and inner flank, where they are feebly bullate, prorsiradiate and feebly concave. The primary ribs efface across the middle of the flanks, but ornament strengthens on the outermost flank and venter where 16 relatively coarse rounded ribs are preserved on the fragment. They strengthen across the ventrolateral shoulders, and are near-transverse across the venter.

Pachydiscus (Pachydiscus) epiplectus (REDTENBACHER, 1873)
(Pl.11, Figs.1-4; Pl.14, Figs.1,5; Pl.15, Figs.13,14)

*1873 Ammonites epiplectus REDTENBACHER, p.121, pl.28, fig.1
1980 Pachydiscus colligatus latiumblicatius BLASZKIEWICZ, p.46, pl.37, fig.3; pl.38, figs.1-4; pl.50, fig.1.
1986 Pachydiscus (Pachydiscus) epiplectus Redtenbacher, 1873 - KENNEDY & SUMMESBERGER, p.192, pl.6, figs.3,4; pl.7, figs.1,2; pl.9; pl.10, figs.1-3; pl.11, figs.1-4; pl.12; pl.13, figs 1-3 (with full synonymy).

TYPE
Lectotype, by the subsequent designation of KENNEDY & SUMMESBERGER 1986, p.192, is no. 1868.X.15 in the collections of the Geologisches Institut of Vienna University, from Muthmannsdorf in the Neue Welt Basin, Austria.

MATERIAL
SP unregistered, ex ARNAUD Collection from the Carrière Duclerc, Arégave; SP unregistered, ex ARNAUD Collection, 2 specimens from the Grande Carrière, Angoumé; SP unregistered, ex ARNAUD Collection, from the Grande Carrière, Tercis; and OUM KZ 20321 from the Lower Maastrichtian P. (P.) epiplectus Zone Unit N3 at Tercis.

DISCUSSION
The SP specimen is a crushed half a whorl of a composite mould with a maximum preserved diameter of 115 mm and a maximum preserved whorl height of 52 mm. Coiling is very involute with a small umbilicus comprising an estimated 10% of the diameter. The umbilical wall is rounded, the umbilical shoulder more broadly so. Because of crushing it is not possible to reconstruct the original whorl section, although the inner flanks appear to have been somewhat flattened with broadly rounded ventrolateral shoulders and venter. Two distant, narrow, feebly primary ribs are present on the adapical part of the shell; the adapertural parts of the inner to middle flanks are smooth. The outermost flanks, ventrolateral shoulders and venter all bear coarse prorsiradiate ribs, concave on the ventrolateral shoulders, strong and feebly convex on the venter, where they are separated by wide interspaces. Eighteen ribs are preserved on the fragment.

The better preserved of the Angoumé specimens is shown as Pl.14, Figs.1,5. It is slightly distorted, with a maximum preserved diameter of 145 mm. Coiling is fairly involute, the umbilicus deep, with a broadly rounded umbilical wall; it comprises approximately 23% of the diameter. The whorls are slightly compressed, with a whorl breadth to height ratio of 0.94; the flanks are very broadly rounded, the ventrolateral shoulders and venter more narrowly so. The inner flanks are badly corroded, but umbilical bullae can be detected on the beginning of the last half whorl.
where they increase by intercalation. The largest Tercis specimen (ex ARNAUD Collection) is 180 mm in diameter.

**DISCUSSION**

The very feeble inner flank ornament and absence of spine bases show these fragments to be a *Pachydiscus* rather than an *Anapachydiscus* of the *fresvillensis* group. Differences from other species are discussed by KENNEDY & SUMMESBERGER (1986).

**OCCURRENCE**

Lower Maasrichtian of the Neue Welt Basin and Neubei, Steiermark, in Austria. Landes (the present record); Hendaye and Bidart, Pyrénées-Atlantiques in France. The ex-USSR, Bulgaria and, possibly, Madagascar.

**Pachydiscus (Pachydiscus) perfidus**

DE GROSSOUVRE, 1894

(Pl.9, Figs.9,10; Pl.10, Figs.1,2,4,5; Pl.11, Figs.5,6; Pl.12, Figs.1-4,6; Pl.13, Figs.3,4)

1894 *Pachydiscus perfidus* DE GROSSOUVRE, p.213, pl.34, fig.1.

1894 *Pachydiscus subrobustus* Seunes - DE GROSSOUVRE, p.200 (pars), pl.36, fig.2.

1984 *Pachydiscus (Pachydiscus) perfidus* De Grossouvre - KENNEDY & SUMMESBERGER, p.160, pl.3; pl.6, fig.6 (with full synonymy).

**TYPE**

Lectotype, by the subsequent designation of KENNEDY & SUMMESBERGER 1984, p.160, is the original of DE GROSSOUVRE 1894, pl.34, fig.1, SP unregistered, from Angoumé, (Pl.13, Figs.3,4).

**MATERIAL**

Numerous unregistered specimens in the SP and UPST collections, from Tercis and Angoumé. OUM KZ 16844, from the Upper Campanian *N. (N.) hyatti* Zone, Unit J, at Tercis.

**DESCRIPTION**

The lectotype is a crushed internal mould, distorted into an ellipse with a major diameter of 120 mm. Coiling is moderately involute, with the umbilicus comprising 26% of the diameter, shallow, with a low wall and broadly rounded umbilical shoulder. All other specimens are crushed to varying degrees, but the whorl section appears to have been compressed, with broadly rounded inner flanks, convergent outer flanks and a broadly rounded venter. Juveniles to a diameter of 100 mm are densely ribbed, with 18-20 feebly bullate primary ribs per whorl. These are straight, narrow and prosiradiate on the inner and middle flanks, but flex forwards on the outermost flank and cross the venter in a shallow convexity. There are generally two intercalated ribs between the primaries, arising below mid-flank. Beyond 100 mm diameter, ornament changes markedly, to predominantly long ribs which have well-developed umbilical bullae and strengthen markedly across the ventrolateral shoulders such that the venter is near-tabulate in costal section.

The best specimen seen is an incomplete adult 160 mm in diameter (Pl.11, Figs.5,6). Coiling is evolute, the umbilicus comprising 30% of the diameter, of moderate depth, with a flattened wall and broadly rounded umbilical shoulder. The whorl section has been modified by crushing, but appears to have originally been slightly compressed, with broadly rounded inner flanks, convergent outer flanks, and a broadly rounded venter. Thirteen or fourteen primary ribs are visible on the penultimate whorl. They are narrow, strong and distant, rursiradiate on the umbilical wall, and feebly concave and prorsiradiate on the inner flank. The badly crushed initial sector of the outer whorl show ribs branching from these primaries, with some shorter intercalated ribs. On the last half whorl there are 10 primary ribs, narrow, distant and markedly rursiradiate on the umbilical wall, concave on the inner flank, where they are incipiently bullate, straight and prorsiradiate on the inner and mid flank, then strengthening and projecting forwards in a shallow concavity across the ventrolateral shoulder to cross the venter in a broad, shallow convexity. There are one or two coarse, long or short intercalated ribs.

**DISCUSSION**

The juvenile referred to *Pachydiscus subrobustus* SEUNES by DE GROSSOUVRE (1894, pl.36, fig.2) may be better referred to *P. (P) perfidus*. BLASZKIEWICZ (1980) and KENNEDY & SUMMESBERGER (1984) provide recent accounts of *P. (P) perfidus* and discuss differences from others referred to the genus. The rapid change from juvenile to adult ornament, the latter with high compressed whorls and predominantly primary ribs with pronounced ventrolateral thickening is particularly distinctive.

**OCCURRENCE**

Upper Campanian *Nostoceras (N.) hyatti* Zone of Landes, France; the Vistula Valley, Poland; Gschliefgraben, Austria.

**Pachydiscus (Pachydiscus) subrobustus**

SEUNES, 1892

1892 *Pachydiscus subrobustus* SEUNES, p.15, pl.13(4), fig.1

1984 *Pachydiscus* cf. *subrobustus* Seunes, 1891 - KENNEDY & SUMMESBERGER, p.16, pl.8, fig.4 (with full synonymy).

**TYPE**

Lectotype, by the subsequent designation of KENNEDY
Pachydiscus (Pachydiscus) cf. colligatus (BINKHORST, 1861)

compare:
1861 Ammonites colligatus BINKHORST, p.25 (pars), pl.8 only.
1986a Pachydiscus (Pachydiscus) colligatus (Binkhorst, 1861) - KENNEDY, p.36, text-figs.13,14.
1987 Pachydiscus (Pachydiscus) colligatus (Binkhorst, 1861) - KENNEDY, p.162, pl.1, figs.1,2; pl.2, figs.1,2; pl.3, pl.4, figs.4,5 (with full synonymy).

TYPE
Lectotype, by the subsequent designation of KENNEDY, 1987, p.162, is an unregistered specimen in the collections of the Museum für Naturkunde, Berlin, the original of BINKHORST 1861, pl.8, from the Upper Campanian of Jaucbe, Brabant, Belgium.

MATERIAL
Several unregistered specimens in the SP and UPST collections, from Tercis and Angoumé, by their preservation from the Upper Campanian Tercis Pale Flint Member. OUM KZ 16833, 16834 and KZ 16836, from the upper part of Unit G at Tercis.

DISCUSSION
These poorly preserved specimens of a large (septate to 180 mm) massive-whorled Pachydiscus, densely ribbed when juvenile, but losing all but the ventral ribbing in middle and later growth, belong to the group of Pachydiscus (P.) colligatus, but are too poorly preserved for firm assignment to the species.

OCCURRENCE
As for material.
Figs.10,11; Pl.18, Figs.4,5,7,8; Pl.19, Figs.8,9). The initial part, joining the spire to the U-shaped body chamber, has irregular bituberculate ribbing that may be annular, looped or zig-zag. On the final sector of body chamber ribs become even, simple, and coarse on the sides, with well-developed tubercles. Ribs may loop or zig-zag between tubercles on the adapical parts of the body chamber, but become simple and annular on the final shaft.

DISCUSSION

_Nostoceras (N.) hyatti_ was revised at length by COBBAN (1974) and KENNEDY & COBBAN (in press). It has a much smaller apical angle to the spire than _N. (N.) helicinum_ (SHUMARD, 1861) (p.191; see COBBAN, 1974, p.8, pl.4, figs.1-21; text-fig 6), although fragments may be difficult to distinguish, while the body chamber has coarser, simpler ribbing, rather than the complex pattern of looped and intercalated ribs shown on _N. (N.) helicinum._

_Nostoceras (N.) pozaryskii_ BLASZKIEWICZ, 1980 (p.26, pl.10, figs.1-5, 8,9,11-15) is in part based on _N. (N.) hyatti_, including the original of his pl.10, figs.8,9,12, (re-illustrated here as Pl.16, Figs.2,3), although the holotype of _N. (N.) pozaryskii_ is a _N. (N.) helicinum_ (BLASZKIEWICZ, 1980, pl.10, figs.1-5; see Pl.16, Figs.7-9). The specimen from the so-called Maurens of Maurens in the Dordogne (KENNEDY, 1986a, pl.20 figs.7-9) is also a _N. (N.) hyatti._

OCCURRENCE

Upper Campanian _N. (N.) hyatti_ Zone of Tercis, Landes; Maurens, Dordogne, France; Zumaya, Spain; the Mons Basin, Belgium; Vistula Valley, Poland; New Jersey, Mississippi, Texas and Colorado (Huerfano County) in the USA; Angola, Madagascar and Israel.

_Nostoceras (Nostoceras) helicinum_ (SHUMARD, 1861)

(Pl.16, Figs.1-4,9; Pl.17, Figs.5-8; Pl.18, Figs.1,6; Pl.19, Figs.5-7)

*1861* _Turrilites helicusin SHUMARD, p.191.
1974 _Nostoceras helicinum_ (Shumard) - COBBAN, p.8, pl.4, figs.1-21; text-fig.6 (with synonymy).
1980 _Nostoceras pozaryskii_ BLASZKIEWICZ, p.26 (pars), pl.10, figs.1-7,11,13,15 only.
in press _Nostoceras (Nostoceras) helicinum_ (Shumard, 1861) - KENNEDY & COBBAN.

TYPES

SHUMARD’s types, from Chatfield Point and Corsicana in Navarro County, Texas, are lost. STEPHENSON (1941, p.411, pl.80, fig.11) designated USNM 21103a, from the Upper Campanian _N. (N.) hyatti_ Zone Nacatooch Sand near Chatfield, Navarro County, Texas, neotype of the species.

**MATERIAL**

OUM KZ 16848, from the Upper Campanian _N. (N.) hyatti_ Zone, Tercis Pale Flint Member, Unit J; OUM KZ 16834 from the Tercis Marly Member, top quarter of Unit G at Tercis; and numerous uncatalogued specimens in the SP and UPST Collections.

**DESCRIPTION**

The helix of OUM KZ 16848 (Pl.18, Fig.6; Pl.19, Figs.5-7) is badly crushed and incomplete, showing only delicate ribbing and no tubercles, although this is probably a result of defective preservation. The loosely coiled section of the spire and adapical part of the body chamber are ornamented by crowded ribs. Some arise from feeble bullae on the flanks, some do not; they are straight and prorsiradiate, commonly bifurcating on the ventrolateral shoulder and zig-zagging and looping irregularly across the venter. There are no tubercles at this stage. Massive ventral tubercles appear on the curved sector of the body chamber and link groups of two flank ribs, with up to three looped ribs connecting the tubercles across the venter.

Ribbing coarsens somewhat on the final shaft, becoming simple and annular, without tubercles.

DISCUSSION

Helices of _Nostoceras (N.) helicinum_ (SHUMARD, 1861, p.191; COBBAN, 1974, p.8, pl.4, figs.1-21; text-fig.6) may be differentiated from those of _N. (N.) approximans_ (CONRAD, 1855) (p.266) and _N. (N.) hyatti_ STEPHENSON, 1941 (p.410, pl.81, figs.9,12-13; COBBAN 1974, p.10, pl.5,figs.1-21; pl.6, figs.1-12; pl.7, figs.1-10; pl.8, figs.1-30; text-fig.8) in their much lower apical angle. The ornament is finer than that of _N. (N.) hyatti_, but coarser than that of _N. (N.) approximans_. Body chambers are easily distinguished. _Nostoceras (N.) helicinum_ is a larger species than _N. (N.) approximans_, has much coarser tubercles on the hook, bullae on the sides and many and complexely looped and intercalated ribs, compared to the small tubercles and simple ribs of _N. approximans_. From _N. (N.) hyatti_ body chambers of _N. (N.) helicinum_ may be distinguished by their much finer ribbing, bullae on the flanks, and complex pattern of looped and intercalated ribs as opposed to the very coarse simple ribbing of _N. (N.) hyatti_. _Nostoceras (N.) helicinum humile_ STEPHENSON, 1941 (p.412, pl.81, figs.4-6) differs from the typical form in its slender whorl and tubercles in the upper row, larger than in the lower. _Nostoceras helicinum crassum_ STEPHENSON, 1941 (p.412, pl.81,figs.7,8) has coarse ribs like _N. (N.) hyatti_, but the low spire typical of _N. (N.) approximans_. The holotype of _N. (N.) pozaryskii_ BLASZKIEWICZ, 1980, and several other figured specimens (pl.10, figs.1-7,11,13,15) are _N. (N.) helicinum_, as can be seen from Pl.16, Figs.4-9.

OCCURRENCE

Upper Campanian _Nostoceras (N.) hyatti_ Zone of Tercis, Landes, France; the Vistula Valley, Poland; New
Jersey, Arkansas, Tennessee, Mississippi and Texas in the USA; Israel. An allied form occurs in Angola. Record from Colombia (BURGL & DUMIT TOBON, 1954, pl.6) belongs to some other species.

Genus **Didymoceras** HYATT, 1894

Type species

*Ancyloceras nebrascense* MEEK & HAYDEN, 1856, p.71 by original designation of HYATT (1894, p.573).

**Didymoceras** sp. nov. (Pl.20, Fig.15)

1963 *Bostrychoceras secoense* YOUNG, p.42 (pars), pl.4, fig.8 only.
1980 *Didymoceras* cf. secosense Young - BLASZKIEWICZ, p.24, pl.5, figs.4,6; pl.7, figs.16,19.

**Material**

An unregistered specimen in the Sorbonne Collections, labelled “Heteroceras polyplocum, Tercis, Grand Carrière, Q”.

**Description**

The specimen is a composite internal mould of the last two whorls of a loosely coiled helix and the initial, uncoiling section of the body chamber. The helical whors are barely in contact, and have a rounded, sub-circular whorl section. Ribs are strong on the upper whorl face, and most are single. They strengthen across the juncture of upper and outer whorl faces (where they may branch) and are feebly concave. They are straight and feebly prorsiradiate on the outer whorl face. One rib, rarely two ribs, link to a strong, transversely elongated tubercle situated approximately at mid-flank, while non-tuberculate ribs intercalate between and extend to the juncture of outer and lower whorl faces. These ribs, and those with tubercles may link to a second row of tubercles at the juncture of outer and lower whorl faces. All ribs are strong, coarse and rectiradiate on the lower whorl face. There are periodic constrictions, and occasional ribs are feebly flared.

**Discussion**

One of YOUNG’S specimens of *Bostrychoceras secoense* (1963, pl.4, fig.8) belongs to this undescribed species of *Didymoceras*; the holotype and other specimens referred to *B. secoense* by YOUNG are *Bostrychoceras polyplocum* (ROEMER, 1841). Fragments referred to as *Didymoceras* cf. secosense by BLASZKIEWICZ (1980, p.24, pl.5, figs.4,6; pl.7, figs.16,19) belong here.

**Occurrence**

Upper Campanian, Tercis, Landes, France; Vistula Valley, Poland; Bergstrom Formation of Travis County, Texas; Wenonah Formation of New Jersey and Pierre Shale of the US Western Interior (KENNEDY & COBBAN, personal observations).

Family **Diplomoceratidae** SPATH, 1926

Subfamily **Diplomoceratinae** SPATH, 1926

Genus **Glyptoxoceras** SPATH, 1925

**Material**

A series of unregistered specimens in the SP Collection, ex ARNAUD Collection, labelled “Tercis, La Pointe, P3”, and presumed to be from the *A. fresvillensis* Zone.

**Description**

These fragments have whorl heights of up to 20 mm, and are up to 50 mm long, with rib indices of 6-9.

Genus **Diplomoceras** HYATT 1900

**Type species**

*Baculites cylindracea* DEFRANCE, 1816, p.160, by original designation of HYATT, 1900, p.571

**Diplomoceras cylindraceum** (DEFRANCE, 1816) (Pl.15, Fig.15; Pl.17, Figs.1-4)

*1816 Baculites cylindracea* DEFRANCE, p.160.
1992 **Diplomoceras cylindraceum** (Defrance, 1816) - HENDERSON, et al., p. 140, figs. 5, 6a-e, h-k, 7. 1992b **Diplomoceras cylindraceum** (Defrance, 1816) - KENNEDY & HENDERSON, p.704, pl.6, figs.1-3; text-figs. 1B,3.

**Type**

Neotype, designated by KENNEDY, 1987, p.183, is IRSNB 10511, from the Upper Maastrichtian Meerssen Chalk of St. Pietersberg, Maastricht, the Netherlands.

**Material**

Two small fragments, SP unregistered, ex ARNAUD Collection, labelled “Heteroceras, Tercis, La Pointe”, and inferred to be from the *A. fresvillensis* Zone. More complete is SP unregistered ex ARNAUD Collection, labelled “*Hamites* - Heteroceras Tercis-Gde Carrière, Danien-Garumnien Sup. W”.

**Description**

The specimens are all crushed. The two smaller frag-
ments have whorl heights of 13.5 and 23.5 mm (Pl.15, Fig.15; Pl.17, Figs.2-4), and rib indices of 8 and 12. The ribs are narrow, sharp, annular, effaced on the dorsum, straight and prorsiradiate on the flanks, strengthening on the outer flank and venter, where they are transverse. The largest specimen (Pl.17, Fig.1) consists of a curved sector with a maximum preserved whorl height of 35 mm and a rib index of 14. Traces of two subparallel shafts survive as composite external moulds.

**DISCUSSION**

High rib index and coiling show these fragments to be *Diplomoceras cylindraceum*. The species is fully discussed by Kennedy (1986c,1987), Kennedy & Henderson (1992b) and Henderson et al. (1992) who provide full synonymies.

**OCCURRENCE**

*Diplomoceras cylindraceum* ranges throughout the whole of the Maastrichtian, and may appear in the Upper Campanian. The geographic range is considerable: northern and south-west France, northern Spain, Italy, the Mons Basin, Belgium, the Netherlands, Denmark, Poland, Austria, The Ukraine, Bulgaria, South Africa, Madagascar, south India, Western Australia, the Antarctic Peninsula, Chile, Argentina, Brazil, California, Alaska (USA), British Columbia (Canada), Japan, and, perhaps, Greenland and New Zealand.

The high Cretaceous ammonite fauna from Tercis, Landes, France (the environs of Maurens) in France.

**TYPE SPECIES**

*Baculites vertebralis* Lamarck, 1801, p.103, by the subsequent designation of Meek, 1876, p.391.

*Baculites leopoliensis* Nowak, 1908

(Pl.20, Figs.9-11,14,16-19)

1908 *Baculites aniceps* Lam, sp. em. Nowak 1. varietas *Leopoliensis* Nowak, p.328 (pars), pl.14, fig.1-5,10?,11; text-figs.1-5 on p.329;? text-figs.5-10 on p.331.

1951 *Baculites aniceps* var. *leopoliensis* Nowak - Michaelov, p.46, pl.3, fig.15.

1964 *Baculites aniceps* leopoliensis Nowak, 1908 - Tzankov, p.149, pl.10, fig.2.

1974 *Baculites aniceps* leopoliensis Nowak - Naidin & Shimansky, p.164, pl.53, fig.5.

1976 *Baculites aniceps* leopoliensis Nowak - Atabekian & Khakhimov, p.96, pl.11, figs.11-13.

1986a *Baculites leopoliensis* Nowak, 1908 - Kennedy, p.114, pl.18, figs.1-4,12.

1986b *Baculites leopoliensis* Nowak, 1908 - Kennedy, p.1013, pl.2, figs.1,2,11,12; pl.3, figs.22-24.

**DESCRIPTION**

Specimens are all crushed composite moulds of both phragmocone and body chamber, with maximum preserved whorl heights of up to 35 mm. The whorl section appears to have been compressed, with a broadly rounded to flattened dorsum, feebly convex dorsal flanks, convergent ventral flanks and a narrowly rounded venter. There are up to 3 or 4 ribs in a distance equal to the whorl height. They are weak and feebly convex on the dorsum, but strengthen across the dorsolateral region and are broad, coarse, concave and transverse on the dorsal two thirds of the flank. They project strongly forwards and weaken markedly on the ventral third of the flanks, where additional riblets and striae intercalate, all elements of ornament intersecting the line of the venter at an acute angle, and crossing the venter in a narrow convexity.

**DISCUSSION**

Even transverse crescentic ribs and intercalated riblets and striae on the ventral third of the flanks distinguish *Baculites leopoliensis* from other European Campanian-Maastrichtian species, as discussed by Kennedy (1986a,b), to whom reference should be made. Nowak (1908) regarded this species as Maastrichtian, but we visited a number of Campanian and Maastrichtian localities in Poland in 1990, where we found the species to be common in the upper Campanian *Nostoceras* (N.) *hyatti* [pozaryski] Zone and to be absent in the succeeding Maastrichtian.

**OCCURRENCE**

Upper Campanian of The Ukraine, Vistula Valley, Poland, the Petites-Pyrénées, Landes and Dordogne (the environs of Maurens) in France.
**Hoploscaphites constrictus** (J. Sowerby, 1817)  
*(Pl.20, Figs.1-4)*

*1817* Ammonites constrictus J. Sowerby, p.189, pl.A, fig.1.

1908 Scaphites cf. spiniger Schlütt. - DE GROSSOUVRE, p.38, pl.10, fig.6.

1908 Scaphites cf. monasterensis Schlütt - DE GROSSOUVRE, p.38, pl.11, fig.8.

1986b Hoploscaphites constrictus (J. Sowerby, 1817) - KENNEDY, p.1019, pl.3, figs.1,9-12; pl.4, figs.1-19; pl.5, figs.1-17, 24-26.

1986c Hoploscaphites constrictus (J. Sowerby, 1817) - KENNEDY, p.64, pl.13, figs.1-13, 16-24; pl.14, figs.1-38; pl.15, figs.1-31; text-figs.9,11a-h (with full synonymy).

1986d Hoploscaphites constrictus (J. Sowerby, 1817) - KENNEDY, figs.10,11a-h,11j1.

1987 Hoploscaphites constrictus (J. Sowerby, 1817) - KENNEDY, p.197, pl.31, figs.1,8-26; pl.32, figs.1-12, 18-21 (with full synonymy).

1987 Hoploscaphites constrictus (J. Sowerby) - KENNEDY & SUMMESBERGER, p.34, pl.6, figs.6-24.

1987 Hoploscaphites constrictus (Sowerby, 1817) - VAN DER TUUK, p.64.

1987 Hoploscaphites constrictus constrictus (Sowerby, 1818) - VAN DER TUUK, p.76, figs.5,6,7,11, 20a,21a-c,23a-c.

1987 Hoploscaphites constrictus niedzwiedzkii (Uhlig, 1894) VAN DER TUUK, p.76, figs.9,10,24a-c.

1987 Hoploscaphites constrictus ssp. undet; VAN DER TUUK, p.77, figs.8,25.

1987 Hoploscaphites sp. VAN DER TUUK, p.77, figs.4,17a-c.

1987 Hoploscaphites (J. Sowerby, 1817) - JAGT, p.1, figs.1-6.

1988 Hoploscaphites (J. Sowerby, 1817) - MACHALSKI and WALASZCZUK, p.67, figs.2a,b.

1989 Hoploscaphites (J. Sowerby, 1817) - KENNEDY, figs.9a-9n.

**Types**  
Lectotype, by the subsequent designation of KENNEDY, 1986c, p.68, is no C36733 in the collections of the Natural History Museum, London, the original of J. Sowerby, 1817, pl.A, fig.1; paralecotypes are C70645-C70647, all from the Upper Maastrichtian Calcaire à Baculites of the Cotentin Peninsula, Manche, France.

**Material**  
OUM KZ 16863 and KZ 16867, from the Tercis Dark Flint Member, Unit N3, and OUM KZ 20322 from the basal marl of Unit N3 at Tercis. OUM KZ 16919 is imprecisely localised but, by its preservation, came from a slightly higher horizon. There are a number of unregistered specimens in the SP and UPST Collections.

**Description**  
OUM KZ 1863 is a macroconch phragmocone 27 mm in diameter, and part of the shaft of the body chamber with a maximum preserved whorl height of 21 mm. Coiling of the phragmocone is very involute, with a tiny, deep umbilicus. The inner flanks are ornamented by narrow, straight, primary ribs that increase by branching and intercalation on the middle and outer flank and pass straight across the venter. Delicate ventrolateral tubercles become conspicuous towards the end of the outer whorl. The body chamber is high-whorled, with a straight to feebly convex umbilical wall that conceals part of the umbilicus of the phragmocone. Four progressively coarsening umbilicolateral bullae are preserved. They give rise to low, broad, prorsiradiate ribs, either singly or in pairs, which flex back on the outer flank, where they increase by branching and intercalation, terminating in ventrolateral tubercles. These are small and conical at the beginning of the body chamber, but coarsen and become clavate adaperturally. They are linked across the venter by groups of two or three delicate riblets, with others intercalating between. OUM KZ 16919 is a smaller macroconch with a coarser ribbed phragmocone. OUM KZ 16867 preserves the adapertural end of a macroconch body chamber.

**Discussion**  
The present specimens compare well with macroconchs from the Lower Maastrichtian of Hemmoor, Niederebe, north-west Germany (BIRKELUND, 1982, p.19, pl.3, figs.1-14). There are a number of recent discussions of *H. constrictus*, including reillustration of the type material from the Calcaire à Baculites of Manche, France (KENNEDY, 1986c), Petites-Pyrénées (KENNEDY, 1986b), environs of Maastricht (KENNEDY, 1987; VAN DER TUUK, 1987; JAGT, 1987), Neuberg, Steiermark, Austria (KENNEDY & SUMMESBERGER, 1986) and Nagoryany in The Ukraine (KENNEDY & SUMMESBERGER, 1987).

We see no reason to vary conclusions reached previously (1986c) that the lectotype of *H. constrictus* is a macroconch, and that the form described as *Scaphites niedzwiedzki* UHLIG 1894 (p.220, fig.2) is the microconch of *H. constrictus*, and see no support whatsoever for the views of VAN DER TUUK (1987) that they represent subspecies in which both macro- and microconchs occur. Equally we believe it more rational to treat *H. tenuistriatus* (KNER, 1848) (see revision in KENNEDY, 1987) as a distinct short-lived species rather than a subspecies of *H. constrictus*. The *Hoploscaphites* sp. of VAN DER TUUK (1987, p.77, figs.4,17a,b) with siphonal tubercles from the Upper Maastrichtian of Limburg, the Netherlands, was thought by that author to be possibly transitional between *Hoploscaphites* and *Acanthoscarphites*. It seems to be no more than a malformed *H.*
constrictus and even if this were not the case, could hardly be transitional between these genera, as Acanthoscaphe was first by this bottom of the Maastrichtian.

**OCCURRENCE**

**Hoploscaphites constrictus** ranges through almost the whole of the Maastrichtian. At Kronsmoor in north Germany, the first specimen is 3.5 to 5.0 m above the base of the Belemnella lanceolata Zone, while in Denmark it is common in the topmost hardground of the Maastrichtian White Chalk that is immediately overlain by the Palaeocene Fish Clay. It is known from the Biscay region of France and Spain, Petites Pyrénées (Haute Garonne), Tercis (Landes) and the Calcaire à Baculi of the Cotentin Peninsula (Manche) France; the Nekum and Meerssen Chalks of the Maastrichtian region in Belgium and the Netherlands; Germany, Denmark, southern Sweden, Poland, Austria (Steiermark), Czechoslovakia, Bulgaria, and the ex-USSR region (Donbass, Carpathians, Transcaspia, Kopet Dag).

**Acknowledgements**

The present work was carried out with the financial support of the Natural Environment Research Council (U.K.) and the Central Research Fund of the University of London. We thank R. Parish (London) and R. Marciniowski (Warsaw) for assistance in the field. We are very grateful to Bruno Calhuac of Dax for the use of his extensive collection of ammonites from Tercis Quarry, and to Madame J. Galtier of Dax who has shown us fossils from the former Hontarède Quarry. For permission to study collections in their care we thank M.K. Howarth, H.G. Owen and D. Phillips (London), D. Pajaud, J. Sornay, J.C. Fischer, A. Lauriat-Page, J. Lorentz and H. Gauthier (Paris), M. Bilotte (Toulouse), A. Prieur (Lyons), W.K. Christensen (Copenhagen), A. Blaszkiewicz (Warsaw) and W.A. Cobban (Denver). The technical support of the staff of the Geological Collecions, Oxford University Museum, Department of Earth Sciences, Oxford and the Department of Geology, Royal School of Mines, Imperial College, London is gratefully acknowledged.

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Figs. 1, 2 — *Hauericeras fayoli* DE GROSSOUVRE, 1894, the holotype, SP unregistered, ex ARNAUD Collection, said to be from Assise Q at Montmoreau (Charente), but by its preservation from Tercis.

Figs. 3, 4 — *Pseudophyllites indra* (FORBES, 1846), MNHP 7192 (ex D’ORBIGNY Collection), from Tercis.

Figs. 5-7 — *Saghalinites wrighti* BIRKELUND, 1965, SP unregistered, ex ARNAUD Collection, labelled "*Gaudryceras planorbiforme* Tercis-QR", Tercis, banc à *Echinocorys conoidea* P3. Détermination de Grossouvre".

Figs. 8-10 — *Anagaudryceras lueneburgense* (SCHLÜTER, 1872), MNHP 2001.227 (ex DE GROSSOUVRE Collection), from Tercis. All figures are x 1

Figs. 1-3, 10, 11, 14 — *Desmophyllites larteti* (SEUNES, 1892). 1-3, SP unregistered, ex ARNAUD Collection labelled "*Schluteria larteti* de Gross. Angoumé. 10, 11, SP unregistered, ex ARNAUD Collection labelled "*Ammonites* n. sp., Tercis, La Pointe". 14, SP unregistered, ex ARNAUD Collection, labelled "*Schluteria larteti* de Grossouvre. Angoumé, P3.

Figs. 4-6 — *Pseudokossmaticeras branditi* (REDTENBACHER, 1873). SP unregistered, ex ARNAUD Collection: a juvenile associated with material from Angoumé.

Figs. 7-9 — *Pseudokossmaticeras duereri* (REDTENBACHER, 1873). SP unregistered, ex ARNAUD Collection, labelled "Tercis, Gde. Carrière, P3".

Figs. 12, 13 — *Anagaudryceras lueneburgense* (SCHLÜTER, 1872). SP unregistered, ex ARNAUD Collection, the original of *Gaudryceras planorbiforme* J. BÖHM of DE GROSSOUVRE, 1894, pl.27, fig.2, from the "Grande Carrière de Tercis".

All figures are x 1
PLATE 3

Figs. 1, 4, 5 — Desmophyllites larteti (SEUNES, 1892), SP unregistered, ex ARNAUD Collection, labelled "Pachydiscus larteti Seunes, Angoumé, niveau de la Pointe. Détermination de Grossouvre, PQR".

Figs. 2, 3 — Pachydiscus (Pachydiscus) cf. subrobustus SEUNES, 1892, MNHP unregistered, from Tercis.

Figs. 6, 7 — Pachydiscus (Pachydiscus) neubergicus neubergicus (VON HAUER, 1856), MNHP 7188b (ex D'ORBIGNY Collection), from Tercis.

Fig. 8 — Pachydiscus (Pachydiscus) jacquoti jacquoti (SEUNES, 1890a), MNHP 7188b (ex D'ORBIGNY Collection), from Tercis.

All figures are x 1
Figs. 1-5 — *Pseudokossmaticeras brandti* (Redtenbacher, 1873).
1-3: EMP unregistered, the original of Seunes, 1892, pl.6, fig. 2, from Tercis.
4, 5: an unregistered cast in the EMP Collections of the original of De Grossouvre, 1894, pl.23, fig.1, from the "Grande Carrière de Tercis".

All figures are x 1
PLATE 5

Figs. 1-8 — *Pseudokosmaticeras brandti* (Redtenbacher, 1873).
1,2: SP unregistered, ex Arnaud Collection, labelled "Pachydiscus brandti, Redt. Tercis, Grande Carrière, P3. Détermination De Grossouvre".
3-6: SP unregistered, the original of De Grossouvre, 1894, pl.13, figs. 2, 3, labelled "Tercis, Grande Carrière, P3".
7-8: SP unregistered, ex Arnaud Collection, labelled "Angoumé, Grande Carrière, Q".

All figures are x 1
PLATE 6

Figs. 1-9 — *Pseudokossmaticeras brandti* (Redtenbacher, 1873).
1, 2: OUM KZ 16871 from Tercis Quarry, probably from the Pale Grey Flint Member.
3-6, 7-9: two of the figured type specimens of *Pseudokossmaticeras* [Sonneratia] cerevicianum (Pethő, 1906) (pl. 6, figs. 3, 4) from Fruska Gora, here regarded as a synonym of *P. brandti*; the originals are in the collections of the Geological Survey of Hungary, Budapest.

All figures are x 1
PLATE 7

Figs. 1-4 — *Pseudokossmaticeras tercense* (Seunes, 1892)
1, 2: SP unregistered, ex Arnaud Collection, labelled "Pachydiscus brandti, var. Pégoti. Angoumé, P3, banc a Ech. Arnaudi. Détermination de Grossouvre".
3, 4: SP unregistered, ex Arnaud Collection, the original of *Pachydiscus Galicianus* Favre mut. *Tercensis* Seunes 1892, p.16, pl.15 (6), fig.4, and of *Pachydiscus Brandti* var. Pégoti DE Grossouvre, 1894, p.192, pl. 30, fig. 3, from Tercis.

Figs. 5-11 — *Pseudokossmaticeras brandti* (Redtenbacher, 1873).
5-8, 11: SP unregistered, ex Seunes Collection, the original of *Pachydiscus aturicus* Seunes, 1892, pl. 15 (6), fig. 3, from Tercis.
9, 10: SP unregistered, ex Arnaud Collection, labelled "Pachydiscus brandti, P3, Détermination de Grossouvre. Tercis, Grande Carrière".

All figures x 1
PLATE 8

Figs. 1-6 — *Pseudokossmaticeras tercense* (Seunes, 1892)
1: FSL 13852, from Tercis.
2, 3: EMP Collections, from Angoumé.
4-6: FSL 13852 from Tercis.

All figures x 1
PLATE 9

Figs. 1, 4 — *Nostoceras (Nostoceras) hyatti* Stephenson, 1941. SP unregistered, labelled "Tercis, Grande Carrière, P3".

Figs. 2, 3 — *Pachydiscus (Pachydiscus) jacquoti jacquoti* Seunes, 1890a, labelled "*Pachydiscus Neubergicus* Hauer jacquoti Seunes. Tercis, La Pointe PQR. Détermination De Grossouvre".

Figs. 5-8 — *Pachydiscus (Pachydiscus) neubergicus neubergicus* (Von Hauer, 1858), both SP unregistered, *ex* Arnaud Collection, labelled "*Pachydiscus neubergicus* V.H. Angoumé P3Q".

Figs. 9, 10 — *Pachydiscus (Pachydiscus) perfidus* De Grossouvre, 1894, OUM KZ 16844, from Unit J, Tercis Quarry.

All figures x 1
PLATE 10

Figs. 1, 2, 4, 5 — *Pachydiscus (Pachydiscus) perfidus* DE GROSSOUVRE, 1894.
1, 2: FSL 13890, from Angoumé (ex SAYN Collection).
4, 5: SP unregistered, *ex ARNAUD* Collection, labelled “Angoumé P3Q”.

Figs. 3, 6 — *Pachydiscus (Pachydiscus) jacquoti jacquoti* SEUNES, 1890a. The original of SEUNES, 1890b, pl.9, fig.3, labelled “Danien Inférieur, Tercis”.

All figures are x 1
PLATE 11

Figs. 1-4 — *Pachydiscus (Pachydiscus) epiplectus* (Redtenbacher, 1873).
1, 2: SP unregistered, *ex* Arnaud Collection, labelled "*Pachydiscus Fresvillensis* Seunes, carrière Duclerc, P3Q. *Pachydiscus colligatus* V. Bink = *epiplectus* Redtenbacher = *Fresvillensis* Seunes".
3, 4: OUM KZ 20321, *ex* Hancock Collection, from Unit N2, Tercis Quarry.

Figs. 5, 6 — *Pachydiscus (Pachydiscus) perfidus* De Grossouvre, 1894, SP unregistered, *ex* Arnaud Collection, labelled "Angoumé, Grande Carrière, Q".

All figures are x 1
PLATE 12

Figs. 1-4, 6 — *Pachydiscus (Pachydiscus) perfidus* DE GROSSOUVRE, 1894.
1: SP unregistered, *ex* ARNAUD Collection, labelled "*Pachydiscus brandti* det De Gross. Angoumé, Gde Carrière, P3".
2, 3: SP collections, from Tercis, Grande Carrière.
4, 6: EMP Collections, *ex* DE MORGAN Collection, from Angoumé.

Fig. 5 — *Saghalinites wrighti* BIRKELUND, 1965. SP unregistered, *ex* ARNAUD Collection, labelled "*Gaudryceras, Angoumé, Gde. Carrière, P3*".

Figs. 7-9 — *Pachydiscus (Pachydiscus) neubergicus neubergicus* (VON HAUER, 1858), OUM KZ 16868, from the bottom third of Unit O, Tercis Quarry.

All figures are x 1
Figs. 1, 2 — *Pachydiscus (Pachydiscus) armenicus* ATABEKIAN & AKOPIAN, 1969, SP unregistered, *ex* ARNAUD Collection, labelled "*Pachydiscus Gollevillensis*, La Pointe P3QR, Determin de Grossouvre".

Figs. 3, 4 — *Pachydiscus (Pachydiscus) perfidus* DE GROSSOUVRE, 1894. SP unregistered, *ex* ARNAUD Collection; the lectotype, figured by DE GROSSOUVRE 1894, pl.34, fig.1, from the Grande Carrière, Tercis.

Figs. 5-7 — *Pachydiscus (Pachydiscus) neubergicus neubergicus* (VON HAUER, 1858). SP unregistered, *ex* ARNAUD Collection, labelled "Angoumé, Gde. Carrière".

All figures are x 1
Figs. 1, 5 — *Pachydiscus (Pachydiscus) epiplectus* (REDTENBACHER, 1873). SP unregistered, ex ARNAUD Collection, labelled "*Pachydiscus colligatus* V.B....Angoumé, Gde, Carrière”

Figs. 2-4 — *Nostoceras (Nostoceras) hyatti* (STEPHENSON, 1941). SP unregistered, ex ARNAUD Collection, labelled “Tercis, Gde Carrière, P3”.

All figures are x 1
PLATE 15

Figs. 1-12 — Glyptoxoceras rugatum (FORBES, 1846). 1,2,9; 3-5,6,7,8,11-12, are all SP unregistered, ex ARNAUD Collection, labelled “Heteroceras sp., Tercis, La Pointe”.

Figs. 13 14 — Pachydiscus (Pachydiscus) epiplectus (REDTENBACHER, 1873). SP unregistered, ex SEUNES Collection, labelled “Ammonites epiplectus Redtenbacher” and in a second hand “Mr. Seunes, Angoumé Gde Carrière P3 dertem. de Grossouvre”, and in a third hand “Am colligatus V. Bink”.

Fig. 15 — Diplomoceras cylindraceum (DEFRANCE, 1816). SP unregistered ex ARNAUD Collection labelled “Heteroceras Tercis, La Pointe”.

All figures are x 1
PLATE 16

Figs. 1, 4-9 — *Nostoceras (Nostoceras) helicinum* (SHUMARD, 1861).
1, 4, 5, 6: the original of *Nostoceras pozaryskii* BLASZKIEWICZ 1980, pl.10, fig.14.
7-9: the holotype of *Nostoceras pozaryskii*, the original of BLASZKIEWICZ, 1980, Pl.10, Figs. 1-5; both specimens from the Upper Campanian of Piotrawin in the Middle Vistula Valley, Poland.

Figs. 2-3 — *Nostoceras (Nostoceras) hyatti* STEPHENSON, 1941, the original of *Nostoceras pozaryskii* BLASZKIEWICZ, 1980, pl.10, figs. 8, 9, 12; from the Upper Campanian, east of Melenow in the Middle Vistula Valley, Poland.

All figures are x 1
PLATE 17

Figs. 1-4 — Diplomoceras cylindraceum (DEFRANCE, 1816).
1: SP unregistered, ex ARNAUD Collection, labelled “Hamites - Heteroceras Tercis, Gde Carrière Danien-Garumien sup. W”.
2-4: SP unregistered, associated with material labelled “Tercis, La Pointe”.

Figs. 5-8 — Nostoceras (Nostoceras) helicinum (SHUMARD, 1861), SP unregistered, ex ARNAUD Collection, labelled “Hamites Tercis, Gde Carrière”.

Fig. 9 — Glyptoxoceras rugatum (FORBES, 1846). SP unregistered, ex ARNAUD Collection, labelled “Heteroceras polyplacum Tercis, La Pointe”.

Figs. 10, 11 — Nostoceras (Nostoceras) hyatti STEPHENSON, 1941. SP unregistered, ex ARNAUD Collection, labelled “Heteroceras Sp. Angoumé, Gde Carrière, Q”.

All figures are x 1
Figs. 1, 6 — *Nostoceras (Nostoceras) helicinum* (SHUMARD, 1861).
6: OUM KZ 16848, from Unit J, Tercis Quarry (see also Pl.19, Figs. 5-7).

Figs. 2-5, 7, 8 — *Nostoceras (Nostoceras) hyatti* STEPHENSON 1941.
2, 3: OUM KZ 16835, from the top quarter of Unit G, Tercis Quarry.
4, 7, 8: SP unregistered, *ex* ARNAUD Collection, labelled "*Heteroceras*, Angoumé, Gde Carrière...on voit la columelle du spire".
5: SP unregistered, *ex* ARNAUD Collection, labelled "*Hamites*, Tercis, Grande Carrière, P3" (see also Pl.19, Figs. 8, 9).

All figures are x 1
PLATE 19

Figs. 1-4, 8-10 — *Nostoceras (Nostoceras) hyatti* STEPHEONSON, 1941.
1: EMP unregistered, from Tercis.
2-4, 10: SP unregistered, *ex* ARNAUD Collection, labelled "Hamites, Tercis, Gde Carrière, P3".
8, 9: SP unregistered, *ex* ARNAUD Collection, labelled "Hamites, Tercis, Gde Carrière, P3" (see also Pl. 18, Fig.4).

Figs. 5, 6, 7 — *Nostoceras (Nostoceras) helicinum* (SHUMARD, 1861), OUM KZ 16848, from Unit J, Tercis Quarry (see also Pl.18, Fig.6).

All figures are x 1
PLATE 20

Figs. 1-4 — *Hoploscaphites constrictus* (J. Sowerby, 1817).
1: OUM KZ 16919, from the "upper stage on north face, Grande Carrière, Tercis".
2-4: OUM KZ 16863, from the bottom third of Unit O, Tercis Quarry.

Figs. 5-8, 12, 13 — *Glyptoxoceras* sp. Three fragments, SP unregistered, *ex* ARNAUD Collection, labelled "Tercis, La Pointe".

Figs. 9-11, 14, 16-19 — *Baculites leopoliensis* Nowak, 1908.
9-11: OUM KZ 16856, from the upper part of Unit K, Tercis Quarry.
14: SP unregistered, *ex* ARNAUD Collection, labelled "Tercis, Grande Carrière".
16-18: SP unregistered, *ex* ARNAUD Collection, labelled "Tercis, Gde. Carrière".
19: SP unregistered, *ex* ARNAUD Collection, labelled "Angoumé, P3, niveau à Echinocorys regularis".

Fig. 15 — *Didymoceras* sp. nov.
SP unregistered; labelled "*Heteroceras polyplocum*, Tercis, Grande Carrière, Q".

All figures are x 1