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MIDDLE JURASSIC TO LOWER CRETACEOUS AMMONITES FROM THE PONTIDE MOUNTAINS, NORTHERN ANATOLIA

Occurrences of ammonites from the Middle Jurassic to Lower Cretaceous successions of the Pontide Mountains, Northern Anatolia, show a range of faunas varying in age from Bajocian to at least Late Barremian. New ammonite records are made for the Middle and Upper Jurassic and Lower Cretaceous rocks of the region. There is no clear evidence that the succession is incomplete, although parts of some stages are not represented by ammonites in the collections. The faunas are closely comparable with the Sub-Mediterranean Province of the European Jurassic and clearly indicate a position on the northern side of the Tethyan suture for the Pontide Jurassic rocks.

KEY WORDS: *Ammonites, Middle-Upper Jurassic, Lower Cretaceous, Turkey.*

INTRODUCTION

Overlying the ammonite faunas of the Ammonitico Rosso is a succession of faunas of ammonites which provide evidence for most of the stages from Bajocian to at least Upper Barremian. The fossils are relatively few in number and many are indifferently preserved; they include a large number of indeterminate perisphinctid ammonites — a group notoriously difficult to identify with less than perfect material. Although the material does not merit monographic treatment, it nevertheless forms an important series of records for the area, for, as Arkell (1956, p. 351) stated, "records of post-Liassic faunas are scarce" (in Anatolia). Since that time, Bremer (1966) has recorded Lower Bajocian and Lower Bathonian in the Ankara region and Enay (1976) has listed new ammonite records for the Upper Jurassic from both the Pontides and the Taurides, but the faunas have not been fully described.

The highest beds of the Ammonitico Rosso of the area studied are of Early Pliensbachian (Ibex Zone) age (Cope 1991) but in eastern Anatolia, in the Erzincan area, the Ammonitico Rosso facies extends upwards through the Domerian and Toarcian, to include most of the Aalenian (Arkell 1956).

MIDDLE JURASSIC

Aalenian

In the Pontide Mountains area, no record of the Aalenian Opalinum Zone faunas known farther to the east, and mentioned above, has been made.

Bajocian

Arkell (1956, p. 350) recorded Bajocian faunas from eastern Anatolia, but the faunas involved (of Opalinum Zone age) are now regarded as belonging to the Aalenian Stage, following the ratification of the Aalenian as a stage by the Jurassic Subcommission. From the Ankara area, Bremer (1966) figured several ammonites to which he assigned a Discites Zone (basal Early Bajocian) age. To Bremer's record may be added some records of Bajocian ammonites from the Pontide Mountains.

The Kozağaç section (KEL series) has yielded a single partial external mould of an ammonite which appears to be a member of the Family Stephanoceratidae. Without supporting evidence of its age, this fragment would most likely be considered indeterminate, but it came from a horizon c. 5 m below an undoubted Lower Bathonian form (see below). The ammonite mould is in a micritic matrix somewhat greyish in colour when compared with the overlying Lower Bathonian. A tentative identification of the form with *Stephanoceras* or *Stemmatoceras* appears most likely, but regrettably the flattened mould shows no detail of whorl shape or inflation and the venter is not preserved. The horizon indicated is certainly Bajocian (*sensu stricto*) and is probably the upper part of the Lower Bajocian.

Other Bajocian ammonites come from the Sakàr region. The section here has yielded two Upper Bajocian ammonites; a *Strenoceras* and a *Polyplectites*. The latter genus ranges into the Bathonian, but the association with *Strenoceras* makes a Late Bajocian age more likely. Both specimens are figured herein on Plate 1. The same locality and horizon also yielded a rhynchonellid brachiopod, identified by Prof. D. V. Ager as *Stolmorhynchia stolidota* Buckman. According to C.D. Prosser (pers. comm.) this species is confined to the Bajocian in Europe. Bremer (1966, pl. 18, figs 1, 2) figured two specimes as *Cadomites* n. sp. aff. *extinctus* and gave the age of these forms as Lower Bathonian, comparing them

with forms in the Zigzag Zone of southern Germany. *Cadomites* is the macroconch of *Polyplectites*, however, and it is possible that Bremer's forms could be of Late Bajocian age.

Bathonian

The presence of Bathonian faunas in Anatolia was reported by Bremer (1966) but, as mentioned above, his *Cadomites* might be of Late Bajocian age. Definite Bathonian faunas have, however, been found in the present study.

The section at Kozağaç (KEL series) has yielded an external mould of *Asphinctites* aff. *patrulii* (Hahn) (figured herein Pl. 1, fig. 3) from c. 5 m above the Bajocian stephanoceratid ammonite mentioned above. *Asphinctites* of the *tenuiplicatus* group (of which *A. patrulii* is part) are confined, throughout Europe, to the topmost part of the Lower Bathonian in the Tenuiplicatus Zone (Torrens 1987, p. 98). A horizon at the top of the Lower Bathonian is thus indicated and suggests that there may be a non-sequence or condensation of the succession between these last two occurrences.

The second Bathonian ammonite came from Halilar and is a specimen of *Prohecticoceras retrocostatum* (de Grossouvre). This species was introduced as a basal Upper Bathonian zonal index by Torrens (1974) but later abandoned (Torrens *in* Cope 1980) as it had been found to range widely into the succeeding Aspidoides Zone. However, the species clearly dates the horizon as within the lower part of the Upper Bathonian.

Callovian

A large, though predominantly fragmentary and poorly preserved Lower Callovian fauna was yielded at Dümenkiri Mountain, in the Orhaneli area. The fauna includes:

Macrocephalites macrocephalus (Schlotheim)
Homeoplanulites aff. *balinensis* (Neumayr)
Choffatia cf. *cardoti* (Petitclerc)
?Ptychophylloceras sp.

The fossils are preserved, on their unweathered surfaces with a gold limonitic colouring. The example of *Macrocephalites macrocephalus* is c. 210 mm in diameter and agrees in most characters with the neotype (figured by Callomon, 1971, pls. 15, 16). It has a similar rib style and density to the neotype and like it loses the ornament on the outer whorl. Although the umbilicus is occluded by matrix, the Anatolian specimen appears a little more involute than the neotype. The neotype is smaller (140 mm diameter) but is entirely septate, whereas it appears that the Anatolian specimen has at least some body-chamber, but the position of the last septum cannot be determined. In whorl section the Turkish specimen is somewhat more compressed than the neotype.

M. macrocephalus is the zonal and basal subzonal index species for the base of the Callovian Stage and thus precisely dates this fauna.

Associated with the *Macrocephalites* is a single specimen of *Homeoplanulites* aff. *balinensis*, a form characteristic of the Balin Oolite of Poland (Neumayr 1871) which contains both late Bathonian and early Callovian faunas. A Macrocephalus Zone age is therefore consistent with this. Cox (1988) recorded *H.* aff. *balinensis* from the Koenigi Subzone of the Calloviense Zone of England - slightly younger than the Turkish occurrences. A similar horizon in England was also recorded by Cox (1988) for *Choffatia cardoti*; the Anatolian specimen which is compared to this species is a little more finely ribbed than the holotype, but is otherwise very similar. Finally, the fauna includes a single fragment of *?Ptychophylloceras* sp.

Upper Callovian faunas are indicated at several localities including Kozağaç; *Collotia petitclerci* Jeannet (KEL series) and *Peltoceras* sp. (KOZ series). Other Upper Callovian forms include *Choffatia* aff. *poculum* (Leckenby) from Çerkeş (Asağı Bulduk - ÇAB 21).

Unspecified levels within the Callovian Stage included unidentified species of *Choffatia* from the Aktaş Bünüs sections at Gerede; they include both microconch and macroconch forms.

Together with the *Choffatia* from the base of the Bileçik Formation was a perisphinctid close to *Alligaticeras*. The latter genus ranges from Upper Callovian to Lower Oxfordian, but this association of ammonites places the basal Bileçik Formation in the Upper Callovian. The same horizon also yielded an ammonite apparently intermediate between *Calliphylloceras* and *Sowerbyceras*; whilst it possesses sigmoidal constrictions (as in the latter genus) the constrictions of the internal mould are the site of flares on the ventral part of the shell, which extend half way down the whorl-side. Very faint lirae are visible on the ventral region of the initial part of the outer whorl.

Associations of *Alligaticeras* and *Choffatia* were also recorded from section. A (A_2), again requiring an Upper Callovian age.

UPPER JURASSIC

Oxfordian

Definite Oxfordian ammonites are few in number, but the large numbers of indeterminate perisphinctid ammonites undoubtedly include some which are of Oxfordian age, as some of them occur between known Callovian and Kimmeridgian faunas.

The most diagnostic Oxfordian form is a species of *Passendorfia*, a Middle Oxfordian perisphinctid, from 24 m above the base of the Bileçik Formation.

This identification allows poorly preserved perisphinctids from 21 m above the base of that formation (BÇT 21) to be identified as also probably of Middle Oxfordian age; these latter ammonites occur together with *Sowerbyceras tortisulcatum* (d'Orb.).

From Kozağaç (KOZ series) a perisphinctid of Upper Oxfordian affinity is close to *Discosphinctes*.

From the Çerkes region at Asağı Bulduk a loose specimen of a ribbed haploceratid appears close to the genus *Campylites* and would indicate an age within the Oxfordian Stage.

Kimmeridgian

Ammonite faunas of Kimmeridgian age were clearly identified in several localities. Six specimens of *Sutneria platynota* (Reinecke) - a species characteristic of the basal Kimmeridgian (Geyer 1969) came from Aktaş Bünüs; together with these were several specimens of the perisphinctid ammonite *Nebrodites*. These faunas show that this condensed horizon includes forms as high as Lower Kimmeridgian (the oldest faunas from this horizon are of Callovian age - see above).

Other Kimmeridgian forms include a fine specimen of *Lithacoceras* cf. *ulmense* (Oppel) found loose at Gerede (Aktaş, Çantur). The same section yielded *Taramelliceras* cf. *trachinotus* (Opp.) together with ataxioceratid ammonites including *Ataxioceras* itself. A similar assemblage was obtained, but not *in situ*, from the Asağı Bulduk section in the Çerkeş region and included, *Ataxioceras* spp., *Taramelliceras* sp., *?Idoceras* sp., *Sowerbyceras* sp. and indeterminate perisphinctids.

A Kimmeridgian age is also indicated for specimens from Kozağaç (KOZ series) including: *Aspidoceras* cf. *acanthicum, Physodoceras* sp. and ataxioceratids.

Tithonian

Lower Tithonian faunas are recorded from several localities. At Kozağaç (KOZ series) *Subplanites* cf. *reisi* (Schneid) occurred. The Aktaş section at Gerede included, towards the upper part of the section (Ag10), a specimen of *Franconites (Parakeratinites)* cf. *tenuicostatus* Zeiss, a species characteristic of the upper part of the Lower Tithonian in Franconia. Also from this horizon are specimens close to *Lemencia* Donze & Enay. From unspecified levels in the same section at Gerede are other Lower Tithonian forms including a large form close to *Dorsoplanitoides*, but with a tendency to tuberculation at the rib furcation point, otherwise this specimen is close to *D. triplicatus* Zeiss. Other forms are identified as *Usseliceras (Subplanitoides)* spp. but cannot be closely matched with Zeiss' Franconian species.

A Tithonian age, but of uncertain horizon within the stage, is indicated by specimens of *Cyrtosiceras* cf. *macrotelus* (Opp.) from sections at Kozağaç (KOZ series) and Gerede (Section Ag). The latter locality also yielded *Haploceras* sp. at the same horizon.

Upper Tithonian is probably indicated by the association of two ammonites from Gerede (Aktaş Çantur section, beds Aç 3-4); these are *Neolissoceras* sp. and a ?berriasellid ammonite showing some similarity to both *Argenticeras* and *Pseudargenticeras*. Although both these ammonites are forms which could be either Upper Tithonian or Berriasian in age, the fact that high Lower Tithonian ammonites occur only a few metres lower in the section suggests that an Upper Tithonian age is more likely.

LOWER CRETACEOUS

A small number of ammonites were collected which are of Lower Cretaceous age.

The earliest Cretaceous age is possibly represented by ammonites from Gerede (Aç 3-4) discussed above; although an Upper Tithonian age is preferred, a Berriasian age cannot be excluded.

The largest number of Cretaceous ammonites came from Dogdu Dag, which yielded a fauna dominated by members of the Subfamily Neocomitinae, and included *Neocomites* spp., *?Kilianella* sp., *Thurmanniceras* sp. and *Karakaschiceras* sp. Together with these is a single specimen of *Neolissoceras*, a haploceratid which ranges from the Upper Tithonian to the Hauterivian. The first three genera range widely through the Berriasian and Valanginian, but *Karakaschiceras* is characteristic of the lower part of the Upper Valanginian. *Thurmanniceras* ranges upwards only as far as the top of the Lower Valanginian; thus the fauna appears likely to encompass the Lower/Upper Valanginian boundary.

Cay 1 section, near Beypazari, yielded a single ammonite fragment which I initially identified as *Distoloceras* sp. Kemper, Rawson and Thieuloy (1981, p. 300) note, however, that the true *Distoloceras* is a north-west European genus. Those authors note that various early Cretaceous neocomitids may have given rise to "*Distoloceras*", locally, such as *Sarasinella* in Madagascar, early Valanginian kilianellids, or late Valanginian *Eleniceras* in France, etc. Thus the Anatolian specimen is likely to be an unnamed homeomorphic genus of the same age, reported as *Distoloceras* from East Africa, the Salt Ranges, Himalayas and Mexico by Arkell (1957, p. 361). The age indicated by the specimen is likely to be within the Valanginian Stage.

A loose specimen from the Aktaş Çantur section at Gerede is of the Upper Valanginian genus *Olcostephanus*.

A somewhat younger Cretaceous age is indicated by a small indifferently preserved fauna from Nalli-

han. This is dominated by fragments of desmoceratid ammonites, including *Plesiospitidiscus* cf. *ligatus* (d'Orb.) and an indeterminate pulchelliid. The *Plesiospitidiscus* indicates an age within the Upper Hauterivian. Younger elements in the fauna may be represented by ?*Eotetragonites* which is ill-preserved, but could indicate a Barremian (or even younger) age. On balance, however, the age of the fauna is likely to be Upper Hauterivian.

The youngest Cretaceous ammonite recorded from the area was found along the road between Mudurnu and Göynuk and is a species of the uncoiled genus *Ancyloceras*. The specimen (pl. 7, fig. 8) is an external mould with two rows of lateral tubercles and strongly prorsiradiate ribbing. It shows the mature hook-shaped end of the shell. The genus is widely recorded from the Tethyan area and ranges from Upper Barremian to Lower Aptian.

AFFINITIES OF THE FAUNAS

The feature which is particularly striking about these ammonite faunas, to anyone used to examining western European faunas, is their similarity to the European forms. The ammonite faunas, from the Bajocian upwards, are closely similar to forms described from Europe and identity at the specific level is clear in many cases.

In the Lias, the faunas are heavily dominated by the phylloceratids and, to a lesser extent, the lytoceratids (Cope 1991) but in the Middle and Upper Jurassic these form only a minor element in the fauna.

It is clear, therefore, that the ammonite faunas from the Pontide Mountains were associated with the northern side of Tethys and show similarities with Europe rather than Africa.

The perisphinctid ammonites, in particular, are forms which are characteristic of the Sub-Mediterranean Province and the zonal scheme used in that province can be applied to the Pontide faunas.

Enay, (1976) in a review of the differences in the ammonite faunas of the northern and southern Anatolian regions concluded that the Northern Anatolian faunas were of European type, whilst the Southern Anatolian faunas were of African type. Although the southern Anatolian Tauride faunas contained sufficient species of European affinity to effect correlation, the faunas were dominated by Ethiopian and Himalayan forms, together with some more typical of the Mexican-Andean area.

On the basis of knowledge of the ammonites, therefore, the position of the Tethyan Suture thus seems clear; it runs through the North Anatolian ophiolite belt as Enay (1976) suggested. However, Ager (1988) found no such difference between the northern and southern Anatolian Jurassic brachiopods, reporting that both were of European affinity.

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RIASSUNTO

Ammoniti provenienti da successioni medio giurassiche fino a cretaciche inferiori delle Pontidi (Turchia settentrionale), rappresentano un insieme di faune di età variabile dal Bajociano fino almeno al Barremiano superiore.

Le segnalazioni di alcune ammoniti sono nuove per le successioni medio e alto giurassiche e basso cretaciche della regione.

Non emergono chiare risultanze che la successione sia incompleta anche se alcuni intervalli di alcuni piani non sono rappresentati dalle ammoniti raccolte.

Le faune sono chiaramente comparabili con quelle della provincia sub-mediterranea del Giurassico europeo e chiaramente indicano per la zona studiata una posizione sul margine settentrionale della Tetide nel Giurassico.

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PLATE 1

Fig. 1 — *Strenoceras* sp., NS50-300, Upper Bajocian, Sakàr.
Figs 2a, b — *Polyplectites* sp., NS50-301, Upper Bajocian, Sakàr.
Fig. 3 — *Asphinctites* aff. *patrulii* (Hahn), NS50-303, Lower Bathonian, Kozağaç. Silicone cast from an external mould.
Fig. 4 — *?Stephanoceras* sp., NS50-302, Lower Bajocian, Kozağaç. Cast in modelling clay from an external mould.
Figs 5a, b — *Prohecticoceras retrocostatum* (de Grossouvre), NS50-304, Upper Bathonian, Halilar.
Fig. 6 — *Homeoplanulites* aff. *balinensis* (Neumayr), NS50-306, Lower Callovian, Dümenkiri.
Fig. 7 — *Choffatia* cf. *cardoti* (Petitclerc), NS50-309, Lower Callovian, Dümenkiri.
Fig. 8 — *?Alligaticeras* sp., NS50-322, Upper Callovian, Aktaş Bünüs, Gerede.
Fig. 9 — *Macrocephalites macrocephalus* (Schlotheim), NS50-305, Lower Callovian, Dümenkiri. × 0.57.



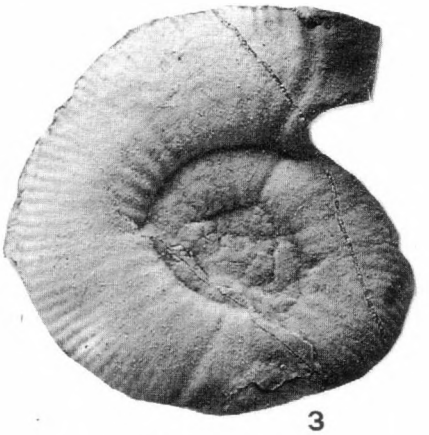
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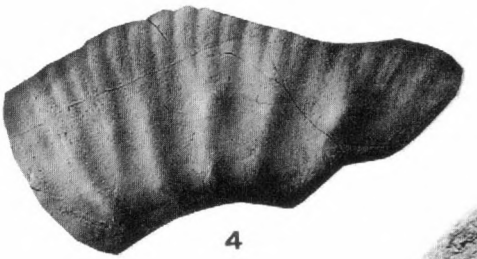
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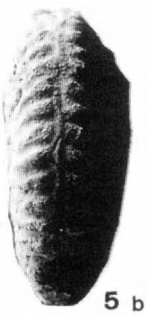
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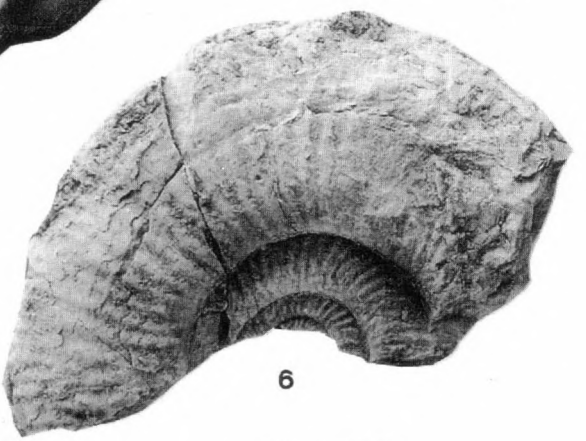
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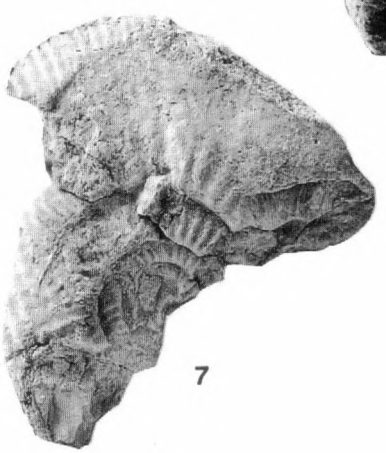
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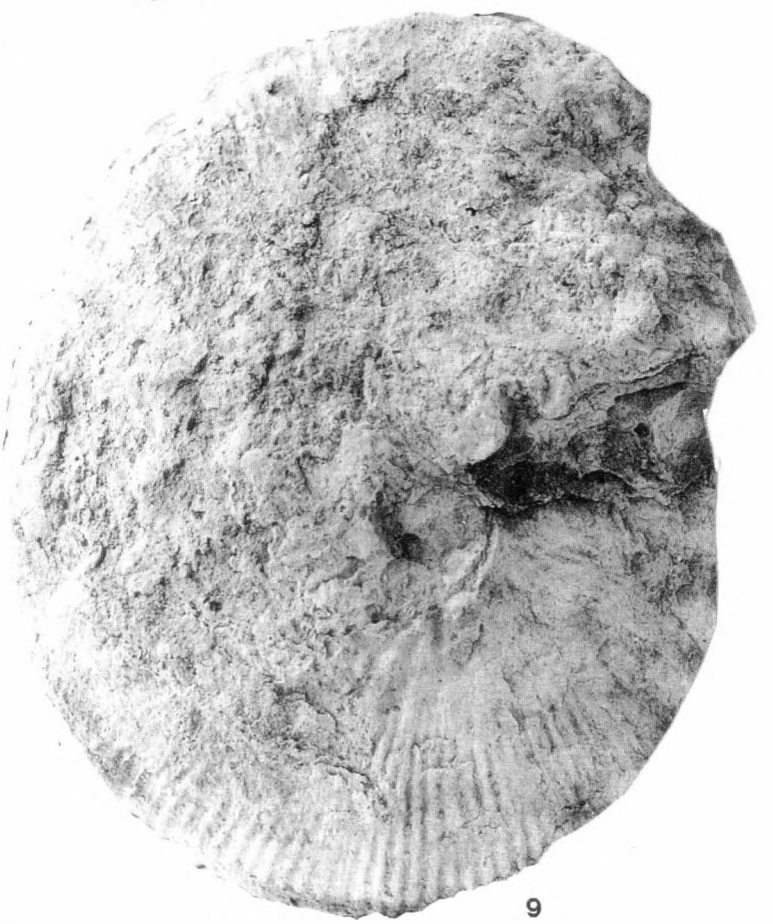
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PLATE 2

Fig. 1 — *Choffatia* sp., NS50-311, Upper Callovian, base of the Bileçik Formation, Çaldagi Tepe, Bayirkoy.
Fig. 2 — *Choffatia* sp., NS50-318, Callovian, Aktaş Bünüs, Çerkes, Microconch.
Fig. 3 — *Neolissoceras* sp., NS50-368, Upper Tithonian (?Berriasian), Aktaş Çantur, Gerede.
Fig. 4 — *Calliphylloceras* sp., NS50-314, Upper Callovian, base of the Bileçik Formation. Form transitional to *Sowerbyceras* (see p. xxx).
Fig. 5 — *Alligaticeras* sp., NS50-312, Upper Callovian, base of the Bileçik Formation, Çaldağı Tepe, Bayirkoy.



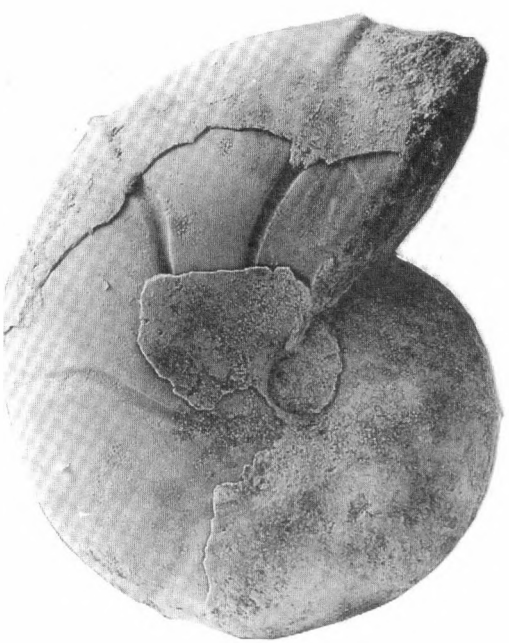
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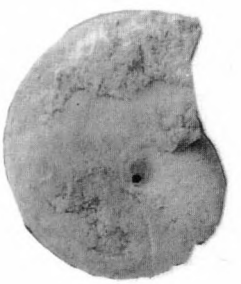
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PLATE 3

Fig. 1 — *Choffatia* aff. *poculum* (Leckenby), NS50-324, Upper Callovian, Asağı Bulduk, Çerkeş. × 0.7.
Fig. 2 — *Haploceras* sp., NS50-366, Tithonian, Aktaş Çantur, Gerede.
Fig. 3 — *Collotia petitclerci* Jeannet, NS50-315, Upper Callovian, Kozağaç.
Fig. 4 — *Ataxioceras* sp., NS50-337, Kimmeridgian, Aktaş Çantur, Gerede.



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PLATE 4

Fig. 1 — *Passendorfia* sp., NS50-329, Middle Oxfordian, 24 m above the base of the Bileçik Formation, Çaldağı Tepe, Bayirkoy.
Fig. 2 — Ataxioceratid gen. indet., NNS50-342, Kimmeridgian, Kozağaç.
Figs 3, 5, 6 — *Sutneria platynota* (Reinecke), NS50-345-7, Lower Kimmeridgian, Aktaş Bünüs, Çerkeş.
Fig. 4 — *Taramelliceras* cf. *trachinotus* (Oppel), NS50-351, Kimmeridgian, Aktaş Çantur, Gerede.
Fig. 7 — *Taramelliceras* sp., NS50-352, Kimmeridgian, Asağı Bulduk, Çerkeş.
Fig. 8 — *Nebrodrites* sp., NS50-344, Lower Kimmeridgian, Aktaş Bünüs, Çerkeş.

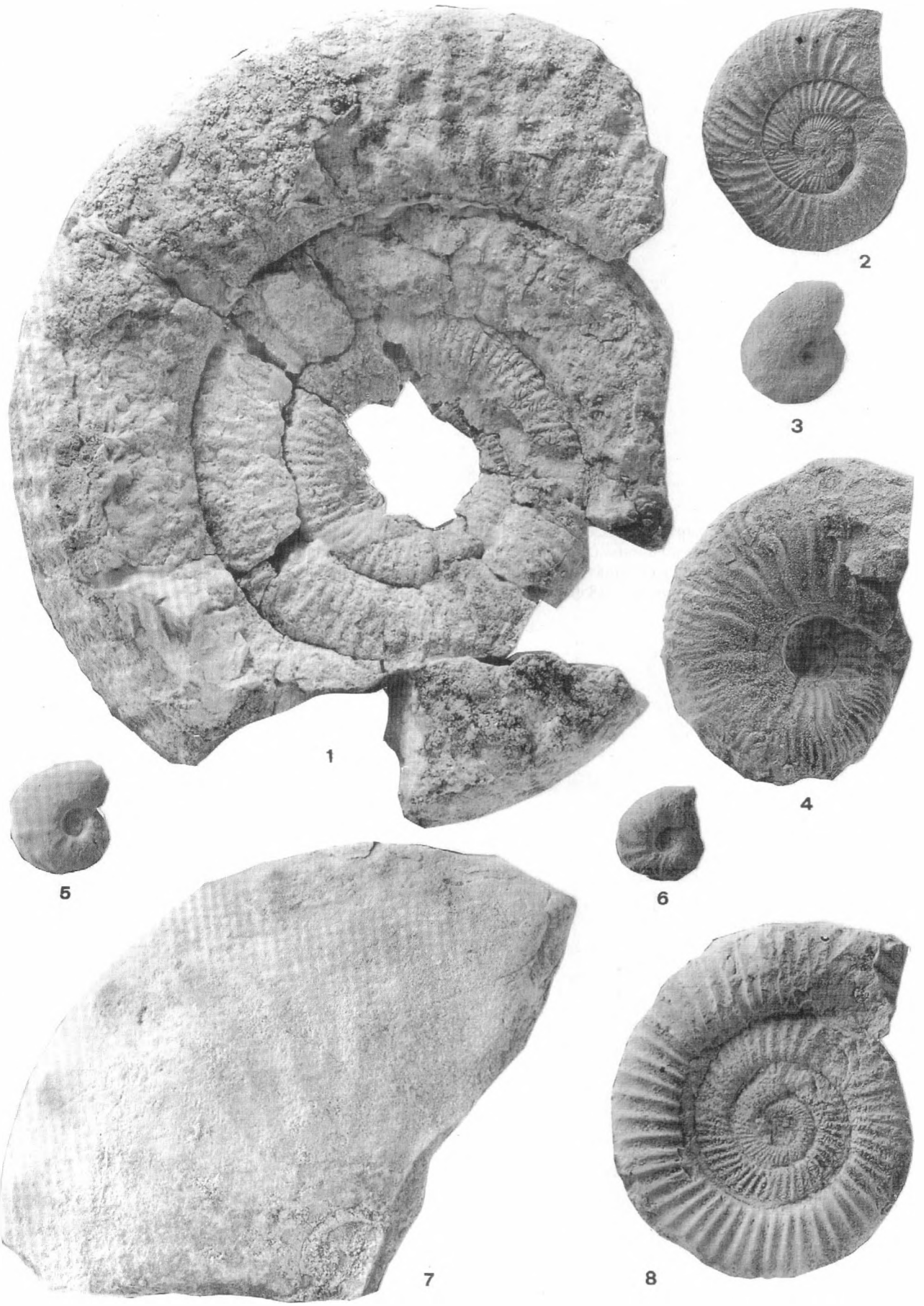

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PLATE 5

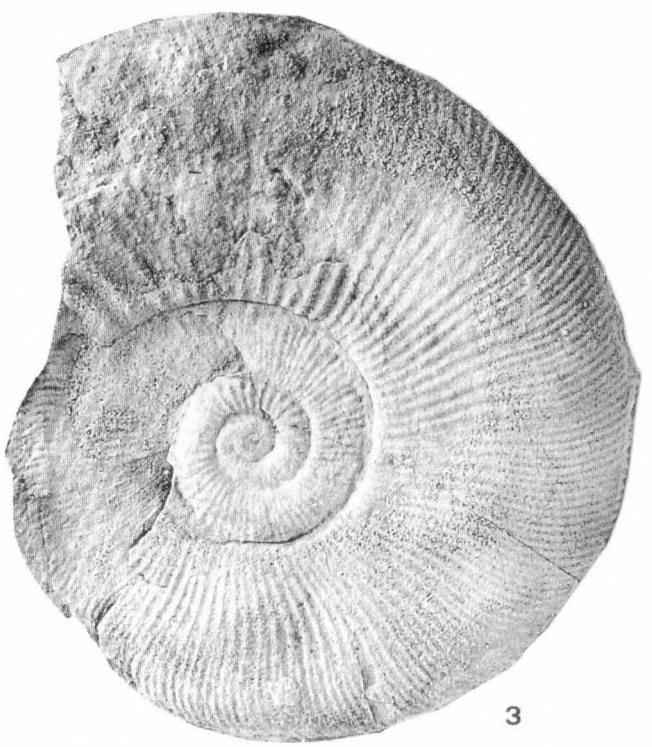
Fig. 1 — *Ataxioceras* sp., NS50-353, Kimmeridgian, Asağı Bulduk, Çerkeş.
Fig. 2 — *Subplanites* cf. *reisi* (Schneid), NS50-361, Lower Tithonian, Kozağaç.
Fig. 3 — *Lithacoceras* cf. *ulmense* (Oppel), NS50-356, Kimmeridgian, Aktaş Çantur, Gerede.
Fig. 4 — *Physodoceras* sp., NS50-357, Kimmeridgian, Kozağac.



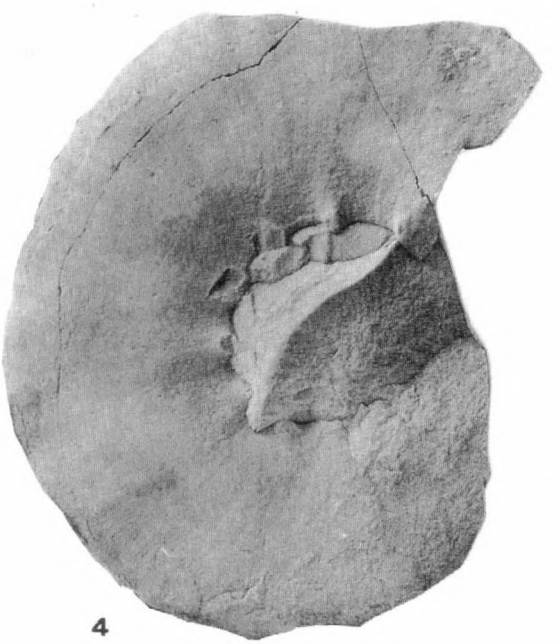
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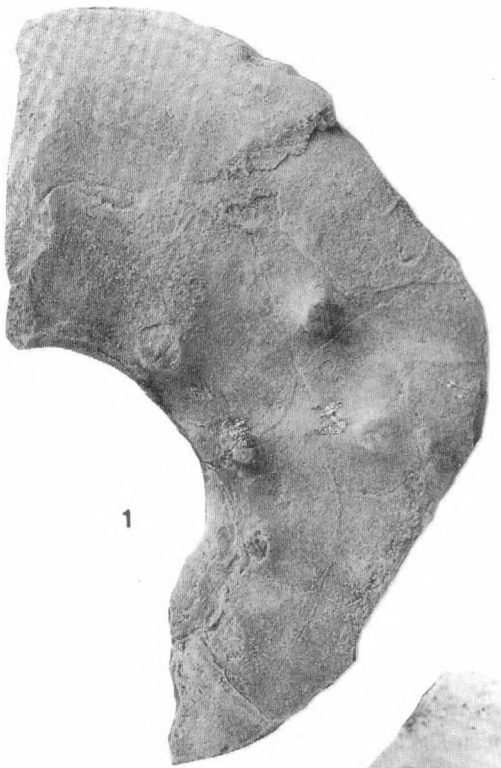
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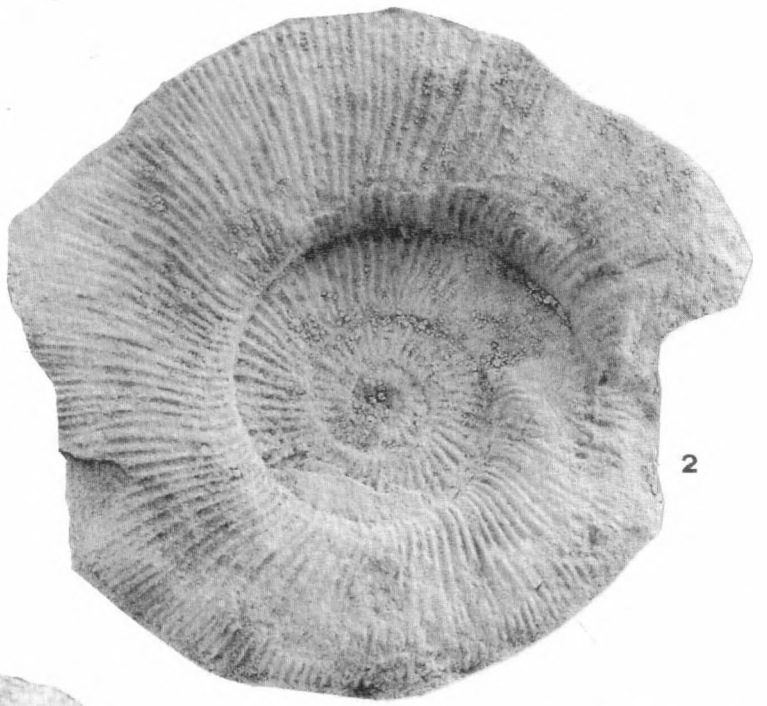
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PLATE 6

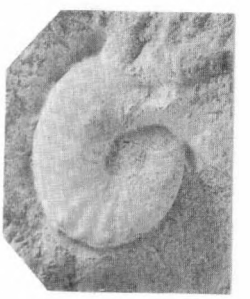
Fig. 1 — *Aspidoceras* cf. *acanthicum*, NS50-358, Kimmeridgian, Kozağac.
Fig. 2 — *Franconites (Parakeratinites)* cf. *tenuistriatum* Zeiss, NS50-373, Lower Tithonian, Aktaş Çantur, Gerede.
Fig. 3 — *Cyrtosiceras* cf. *macrotelus* (Oppel), NS50-377, Tithonian, Aktaş Çantur, Gerede.
Fig. 4 — *?Dorsoplanitoides* sp. aff. *D. triplicatus* Zeiss, NS50-379, Lower Tithonian, Aktaş Çantur, Gerede.
Fig. 5 — *?Lemencia* sp., NS50-383, Lower Tithonian, Aktaş Çantur, Gerede.



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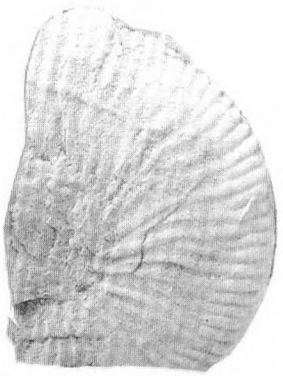
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PLATE 7

Fig. 1 — *Thurmanniceras* sp., NS 50/404, Valanginian, Dogdu Dag.
Figs. 2, 5 — *Neocomites* sp., NS 50/406, 407, Valanginian, Dogdu Dag.
Fig. 3 — *Karakaschiceras* sp., NS 50/402, Valanginian, Dogdu Dag.
Fig. 4 — Gen. nov., homeomorphic with western European *Distoloceras*, NS 50/409, probably Valanginian, Cay 1 section, Beypazari.
Fig. 6 — *Neolissoceras* sp., NS 50/408, Valanginian, Dogdu Dag.
Fig. 7 — *Plesiospitidicus* cf. *ligatus* (d'Orbigny), NS 50/415, Upper Hauterivian, Nallihan.
Fig. 8 — *Ancyloceras* sp., NS 50/420, Upper Barremian-Lower Aptian, Mudurnu-Goynuk, external impression.
Fig. 9 — Berriasellid gen. indet., NS 50/392, Upper Tithonian (?Berriasian), Aktas Çantur.



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