JOHN C.W. COPE

Dept of Geology, University of Wales College of Cardiff, PO Box 914, Cardiff CF1 3YE, United Kingdom

AMMONITE FAUNAS OF THE AMMONITICO ROSSO OF THE PONTIDE MOUNTAINS, NORTHERN ANATOLIA

A fauna of ammonites from the Ammonitico Rosso of the Pontide Mountains is described. The fauna consists almost entirely of previously described species, though several of them have not been recorded from Turkey hitherto. A possible new genus and some new species are not formally named pending collection of better material. The age of the fauna is predominantly Lower Pliensbachian, and correlations with the Standard North-west European zonal scheme are suggested. Earlier elements are also present in the fauna, however, and include the first record of a Hettangian ammonite from Turkey.

KEY WORDS: *Ammonites, Lower Jurassic, Turkey.*

INTRODUCTION

The ammonites of the Ammonitico Rosso facies of the Tethyan Realm have been known for many years, thanks to the monographic treatment of faunas from various parts of Italy and from Hungary. There have also been earlier descriptions of the Turkish Ammonitico Rosso faunas, the most recent to be published was by Bremer (1985). A full description of a large fauna of ammonites from the Pontide Mountains was made by Alkaya (1979) in an unpublished Ph.D. thesis; regrettably, much of the material in that thesis remains unpublished, but it forms an essential introduction to the faunas of the area, based on large ammonite collections. The present work, based on smaller collections, does however contain genera and species unrecorded by Alkaya, and includes the first record of a Hettangian ammonite from Turkey.

The preservation of the ammonites in the Ammonitico Rosso facies has long been known. A brief summary of the preservation, for those unfamiliar with earlier work follows. The ammonites are virtually invariably preserved as internal moulds, chiefly of phragmocones; body-chambers are preserved but rarely, and peristomal preservation is very rare. The moulds of ammonites are frequently worn and have clearly been reworked, in many cases at least once as they have crinoid hold-fasts preserved on both surfaces. This implies dissolution of the aragonite shell of the ammonite, lithification of the matrix-filled phragmocone and erosion so that the upper surface was available for colonisation by crinoid larvae. Later reworking killed off the adult crinoids thus attached, turned over the lithified ammonite mould and then presented the previous lower surface uppermost for re-colonisation by crinoid larvae. During at least the earlier part of this history, the ammonite mould must have been incompletely lithified (at least in some cases) as the moulds are frequently distorted and "bent" from the original symmetrical shape.

SYSTEMATIC PALAEONTOLOGY

Suborder Phylloceratina Arkell 1950
Superfamily Phylloceratacеae Zittel 1884
Family Phylloceratidae Zittel 1884

Genus **Phylloceras** Suess 1885

Phylloceras (Phylloceras) hebertinum (Reynès)
(Pl. 1, figs 1a, b)

1868 *Ammonites hebertinus* Reynès, p. 94, pl. 2, fig. 3.
1974 *Phylloceras (Phylloceras) hebertinum* (Reynès); Fantini Sestini, p. 221.
(see also for full synonymy).

Material: Ten, NS50-1 - NS50-10.

Localities: Bairkoy Trafo, Günören.

Description: All the specimens are to some degree eroded on both surfaces. The best specimen is figured herein; it is 44 mm in diameter, with a whorl height of c 26 mm (59%), whorl thickness of 22.4 mm (51%) and an umbilical diameter of 3.9 mm (9%).

The whorl section has strongly curved sides and whorl breadth expands rapidly over the last preserved (entirely phragmoconic) whorl, so that at the preserved end of the shell the whorl section approaches the circular.

The suture line is not well-preserved on any specimen, but where visible the saddles appear to be entirely diphyllic.

Remarks: The species shows some similarity to *P. (P.) meneghinii* Gemmellaro, 1874, but this latter species is somewhat more elliptical in whorl section, though the two species seem to be closely related.

Phylloceras (Phylloceras) frondosum (Reynès)
(Pl. 1, figs. 2, 6)

1868 *Ammonites frondosus* Reynès, p. 98, pl. 5, fig. 1.
1974 *Philloceras (Phylloceras) frondosum* (Reynès); Fantini Sestini, p. 222,
(see also for full synonymy).

Material: Three, NS50-11 - NS50-13.

Locality: Günören.

Description: The larger figured specimen, which is the most complete, is eroded to some degree on each side and details of the suture are not clear on this or either of the other specimens. The figured specimen is 105 mm in diamter, has a whorl thickness of 36 mm (34.3%), a whorl height of c. 60 mm (57%) and an umbilical diameter of c. 9 mm (8.6%). The whorl sides are almost planar and are sub-parallel, inclining gently towards the venter which is broad and flat, but with a very slight ridge ventral of the siphuncle. The crowding of the last few suture suggests that the phragmocone may be essentially complete.

Remarks: The species has been widely recorded from the Pliensbachian of southern Europe.

Subgenus **Zetoceras** Kovacs, 1939

Phylloceras (Zetoceras) oenotrium (Fucini)
(Pl. 1, figs 10a, b, 11)

1888 *Phylloceras zetes* Canavari, p. 105, pl. 2, fig. 7 (*non* fig. 6).
1901 *Phylloceras oenotrium* Fucini, p. 34, pl. 5, figs 8, 9; pl. 6, fig. 1.

Material: Ten, NS50-14 - NS50-23.

Localities: Günören, Bairkoy Trafo.

Description: The specimens are entirely of phragmocone and vary in diameter from 76-107 mm. The coiling is quite involute with the small steep-sided umbilicus having a diameter of approximately 9% of the shell diameter. The whorl sides are virtually flat on the compressed earlier whorls, but on the later whorls become gently convex, the convexity increasing to the rounded venter. The sutures are partly eroded on all the specimens, but show tetraphyllic condition of the E lobe and the EL and LU saddles. The L lobe has a trifurcate form which is symmetrically disposed.

Remarks: The tetraphyllic terminations of both saddles and lobes on the outer portion of the whorl at least, serve to place this species in *Zetoceras* Kovacs, 1939. Arkell (1957, p. L 187) treated *Zetoceras* as a genus separate from *Phylloceras*, but the distinctions between the two forms are frequently small, and here a subgeneric distinction is used following Fantini Sestini (1974).

Genus **Calliphylloceras** Spath, 1927

Calliphylloceras bicicolae (Meneghini)
(Pl. 2, figs 1, 4, 8)

1875 *Ammonites (Phylloceras) bicicolae* Meneghini, p. 98, pl. 19, fig. 7.
1974 *Calliphylloceras bicicolae* (Meneghini); Fantini Sestini, p. 233 (see also for full synonymy).

Material: 37 specimens, NS50-24 - NS50-60.

Localities: Günören, Bairkoy Trafo.

Description: The specimens vary in size between 17 and close to 100 mm in diameter. All the material is phragmoconic.

In the earlier whorls the whorl sides are parallel and the venter rounded, but as growth proceeds the whorls become elliptical in cross-section. The umbilicus is small, steep-sided and deep; umbilical diameter varies between 10% and 12% of shell diameter. Constrictions originate on the umbilical wall, from where they swing forward sharply in a prorsiradiate direction, to become straighter and fade towards the venter. On some specimens the constrictions are visible, though less pronounced, over the venter, but on most they fade entirely before reaching the venter, and on some are barely visible on the middle of the whorl side. The number of constrictions varies from specimen to specimen, most have three to five constrictions per whorl, but the number varies between one and six on the material seen.

Remarks: This species is one of the most abundant of the ammonites collected from these Turkish sections.

Family Juraphyllitidae Arkell, 1950

Genus **Juraphyllites** Müller, 1939

Juraphyllites diopsis (Gemmellaro)
(Pl. 2, figs 2, 3, 10, 11)

1884 *Phylloceras diopsis* Gemmellaro, p. 6, pl. 2, figs. 6-8; pl. 6 figs. 1, 2.
1913 *Rhacophyllites diopsis* (Gemmellaro); Meister, p. 532, pl. 20, figs. 9, 9a.
1913 *Rhacophyllites diopsis* (Gemmellaro); Pia, p. 359.

Material: 39 specimens, mostly fragmentary. NS50-61 - NS50-99.

Localities: Günören, Bairkoy Trafo.

Description and Remarks: The material varies greatly from small, phragmoconic specimens, through virtually complete phragmocones, to various pieces of body-chamber — at least one complete with peristome.

The phragmocones, of which two examples are figured herein, are well exemplified by NS50-61 (Pl. 2, fig. 2). This specimen is 55 mm in diameter and has a whorl height of 24.7 mm (45.6%), a whorl thickness of 16.5 mm (30%), and an umbilical diameter of 14.5 mm (26.4%). The sutures are well displayed on the smooth phragmocone. Specimen NS50-62 (Pl. 2, fig. 3) is 65 mm in diameter and is still septate at that diameter. Specimen NS50-80 (not figured) shows the last septum at a diameter of 73 mm. No specimen shows more than a few millimetres of body-chamber attached to the phragmocone, but to judge from the numerous body-chamber fragments, many specimens obtained a diameter of 105-110 mm.

The occurrence of body-chamber material amongst ammonites of the Ammonitico Rosso facies is rare, and amongst the material in these collections is restricted to this species and one or two others. Why this should be so is not known, but it is possible that the strong ribbing which characterises the body-chambers of this species in some way contributed to their preservation. This cannot be the whole answer, however, as strongly ribbed eoderoceratid ammonites are apparently always devoid of body-chamber (q.v.). The smooth phragmocone and ribbed body-chamber of this species are very dis-similar and it is only by finding portions of smooth phragmocone bearing the initial ribbing of the body-chamber that the two can be associated.

Amongst the material ascribable to this species are smaller fragments of body-chamber which would require a phragmocone considerably smaller than the ones described above. Notable amongst this smaller material is a single specimen, representing c. 120° of body-chamber which is complete with a mature peristome bearing a lappet. This specimen (NS50-63, Pl. 2, fig. 10) would have reached maturity at a diameter of c. 50-55 mm — about half of the figure given above for many of the specimens. Such apertural modifications have been long recognised as indicative of microconch forms where the ammonites are sexually dimorphic. Sexual dimorphism has been widely reported from Jurassic and Cretaceous Ammonitina (e.g. Callomon 1963, 1985, Cope 1967, Kennedy & Cobban 1975) but in the Phylloceratina has only, until recently, been recorded in the Juraphyllitidae. Howarth & Donovan (1964) recorded dimorphism in the genus *Tragophylloceras*, but none of their material bore lappets and this record appears to be the first of lappets in the Phylloceratina. Sarti (1990) has reported dimorphism in *Sowerbyceras* (family Phylloceratidae) on the basis of differences of shell breadth (as in Recent *Nautilus*) and claims this could be the normal type of dimorphism in that family.

Juraphyllites libertus (Gemmellaro)
(Pl. 2, figs 5, 13)

1884 *Phylloceras libertum* Gemmellaro, p. 4, pl. 2, figs. 1-5.
1913 *Rhacophyllites libertus* (Gemmellaro); Meister, p. 531.
1972 *Juraphyllites libertus* (Gemmellaro); Géczy, p. 53.

Material: Fifteen, NS50-100 - NS50-114.

Locality: Günören.

Description and Remarks: The material consists of phragmoconic specimens and body-chamber fragments, The largest phragmoconic specimen (NS50-100 figured in Pl. 2, fig. 13) is 30 mm in diameter, whorl height is 12.2 mm (40.7%) whorl thickness 8.7 mm (29%) and umbilical diameter 10 mm (33.3%). The whorl sides are smooth but interrupted by constrictions of the internal mould (no specimen has the shell preserved). At 15 mm diameter (e.g. NS50-100, Pl. 2, fig. 13) there are at least six constrictions per whorl. At this diameter they are straight and strongly prorsiradiate, and although they fade perceptibly ventrally, they can be seen to cross the venter — at least on some specimens. The umbilical end of the constrictions is the strongest and the umbilical seam is noticeably affected by their course, giving it a notched appearance. On later whorls the constrictions are not so pronounced on the whorl sides and some do not reach the venter, but the notching of the umbilical margin continues to be conspicuous. At diameters of 20-30 mm there are eight or nine constrictions per whorl.

Four fragments of body-chamber from the same locality are associated with the phragmocones. They are strongly ribbed, particularly on the venter and have deep prorsiradiate constrictions (see Pl. 2, fig. 5) — a feature in which they differ from the body-chamber fragments of *J. diopsis* described above.

The species is widely recorded from the Pliensbachian of southern Europe — both from the lower and upper subdivisions; here the associated fauna is clearly Lower Pliensbachian.

Genus **Tragophylloceras** Spath, 1927

Tragophylloceras numismale (Quenstedt)
(Pl. 1, fig. 4; Pl. 2, fig. 6)

1845 *Ammonites heterophyllus numismalis* Quenstedt, p. 100, pl. 6, figs. 4a, b, 5a, b (only).
1964 *Tragophylloceras numismale* (Quenstedt); Howarth & Donovan, p. 295, pl. 48, fig. 5. (See also for full synonymy).

Material: Four, NS50-115 - NS50-118.

Locality: Günören.

Description and Remarks: The largest of the four internal moulds is 26 mm in diameter, whorl height is 11.2 mm (43%), whorl thickness is c. 5.4 mm (20.8%) and umbilical diameter 6.5 mm (25%). Sutures are visible over the umbilical whorls and parts of the last two sutures are visible on the broken outer whorl. The body-chamber occupies the last half-whorl preserved, but is not complete with peristome.

Howarth & Donovan (1964, pl. 48, fig. 5) figured an English example of this species from the Jamesoni Zone of Robin Hood's Bay, Yorkshire. In their description they remark upon the "complicated ontogeny" of the species, which is smooth to 1.5 mm, constricted to 5-6 mm, and beyond this becomes compressed with 6-8 bands per whorl. The Turkish specimens are of a size to show these bands, but show extremely faint ornament, consisting of straight slightly prorsiradiate ribs which swing forwards sharply towards the venter; they have a similar course to those of the Yorkshire specimen, but are much less distinct. However, as Howarth and Donovan point out (1964, p. 297) the lectotype from Swabia and another form figured subsequently by Quenstedt are figured as entirely smooth.

The species has hitherto been described only from the Jamesoni Zone of Britain and Swabia and the borders of the Massif Central of France. In Anatolia too, its occurrence in the Ammonitico Rosso facies suggests that it may be of the same age, but as the same locality has yielded *Tropidoceras* of the Ibex Zone, a slightly younger date cannot be ruled out.

Suborder Lytoceratina Hyatt, 1899
Superfamily Lytocerataceae Neumayr, 1875
Family Derolytoceratidae Spath, 1927

Genus **Aegolytoceras** Spath, 1924

Aegolytoceras cf. **serorugatum** (Geyer), 1886
(Pl. 1, figs. 5, 7, 8)

Material: Thirteen specimens NS50-119 - NS50-131.

Localities: Günören and Bairkoy Trafo.

Description and Remarks: One specimen, NS50-119, is c. 19 mm in diameter; it shows that from small diameters constrictions appear regularly every quarter of a whorl. This specimen has a body-chamber quarter of a whorl long, which appears to be almost complete. The ventral ribbing, characteristic of the species spears over the last half whorl. Of the remaining specimens, nine fragments are all part of body-chambers. Most of them are quarter of a whorl in length and they represent individuals of estimated diameter of less than 20 mm to about 50 mm. Three specimens begin with the last septum of the phragmocone, but they also show possible mature constriction and flaring of the preserved mouth of the shell; this suggests that they might be complete body-chambers, even though they are a bare quarter of a whorl in length.

All specimens develop ribs on the venter which are interspersed with stronger features around the one or two constrictions diplayed on the body-chamber; the ribs marginal to the constrictions continue from the venter down the whorl sides. The impressed areas of some of the specimens show that the ventral ribbing appeared in excess of a whorl back from the aperture.

This species can be distinguished from the closely-related *A. etruscum* (Fucini) by its smooth whorl sides.

Genus **Audaxlytoceras** Fucini, 1923

Audaxlytoceras audax (Meneghini)
(Pl. 1, fig. 9)

1881 *Ammonites (Lytoceras) audax* Meneghini, p. 38, pl. 5, fig. 6 (nom. nov. pro *Ammonites mendax* Meneghini, 1874 *non* Seebach).
1962 *Audaxlytoceras audax* (Meneghini) Fantini Sestini, p. 508,pl. 38, figs. 9-10 (see also for full synonymy).

Material: Two specimens NS50-131 -NS50-132.

Localities: Bairkoy Trafo and Günören.

Description and Remarks: The more complete specimen, figured herein, has a diameter of 27 mm; whorl height is 9.5 mm (35%), whorl thickness 7.5 mm (28%) and umbilical diameter is 11 mm (41%). The smooth evolute whorls are punctuated by constrictions at quarter whorl intervals. The specimen is entirely phragmoconic.

The general similarity of *Audaxlytoceras* to *Aegolytoceras* (described above) is striking. The two genera have similar shell shape, constrictions and sutures and such differences as do exist appear to me to be worthy of distinction only at a low taxonomic rank. The differences are such that they could even be dimorphs of the same genus. However, Arkell (1957) placed *Audaxlytoceras* (with a query) in the family Nannolytoceratidae Spath, 1927. Herein *Audaxlytoceras* is included in the Derolytoceratidae, but differs from other members of that family in lacking ventral ribs; as we have seen above, such ribs are not present in the earliest whorls of *Aegolytoceras*.

Family Lytoceratidae Neumayr, 1875

Genus **Lytoceras** Suess, 1865

Lytoceras sp.
(Pl. 2, figs 7, 9)

Material: Three incomplete specimens, NS50-133 - NS50-135.

Locality: Bairkoy Trafo.

Description and Remarks: Two of the three specimens are inner septate whorls with a circular cross-section and typical complex lytoceratid suture. Each is around 40 mm in diameter. The largest specimen is a quarter of a whorl of phragmocone which would have been over 110 mm in phragmoconic diameter; like the other specimens it is somewhat abraded, but the characters of the genus - its round whorl and complex suture are readily apparent.

Suborder Ammonitina Hyatt, 1889
Superfamily Psiloceratacea Hyatt, 1897
Family Psiloceratidae Hyatt, 1867
Subfamily Alsatitinae Spath, 1924

Genus **Alsatites** Haug, 1894

Alsatites liasicus (d'Orbigny)
(Pl. 3, fig. 1)

1884 *Ammonites liasicus* d'Orbigny; p. 199, pl. 48.
1879 *Aegoceras liasicum* (d'Orbigny); Wright, pl. 15, fig. 1, pl. 16, figs 1, 2.
1879 *Ammonites liasicus* d'Orbigny; Reynès, pl. 6, figs 9-12.
1881 *Aegoceras laqueolus* Schloenbach; Wright, pp. 315-317.
1952 *Alsatites liasicus* (d'Orbigny); Donovan, p. 644.
1961 *Alsatites liasicus* (d'Orbigny); Dean, Donovan & Howarth, p. 444, pl. 63, fig. 3.

Material: One, NS50-136.

Locality: Sögüt (SC), Ammonitico Rosso.

Description and Remarks: The single specimen is c. 155 mm in diameter and consists almost entirely of phragmocone. The final 30° of the last preserved shell is somewhat crushed and could well be the initial part of the body-chamber. The innermost whorls are not preserved, but even so, there are six whorls visible. At 155 mm diameter the ubilical diameter is 103 mm (66%); this compares closely with the specimens figured by Wright (1879) — c. 68%. The ribs throughout are quite markedly prorsiradiate. Rib densities cannot be accurately determined since no whorl is completely preserved, but at 110 mm diameter there are estimated to have been 48-50 ribs.

The similarity with the lectotype, figured by Reynès (1879) and subsequently designated by Donovan (1952) is considerable.

Horizon: *Alsatites* is confined in North-west Europe to the Liasicus Zone, although the detailed range of *A. liasicus* is not known with certainty (Dean, Donovan & Howarth, 1961, p. 445). It may, however, be used to date the beds from which it came (or was derived) with confidence, as Hettangian. This is apparently the first record of a Hettangian ammonite from Turkey.

Family Schlotheimidae Spath, 1923

Genus **Angulaticeras** Quenstedt, 1883

Angulaticeras sp.
(Pl. 3, figs 3a, b)

Material: One, NS50-137.

Locality: Sögüt (SA). Base of the Ammonitico Rosso.

Description: The single poorly preserved whorl fragment is terminated in the matrix by a calcite vein. The specimen represents an individual of c. 20 mm diameter and whorl height of c. 10 mm. The ribs bifurcate close to the umbilical wall and are very gently curved forward. Although the venter is ill-preserved, the ribs appear to terminate immediately on reaching the venter, leaving a smooth mid-ventral band.

Remarks: Although the specimen is fragmentary and poorly preserved, the rib style and venter make the generic assignation unambiguous. The age indicated by the specimen is likely to be the lower part of the Lower Sinemurian, probably the Bucklandi Zone.

Family Arietitidae Hyatt, 1874
Subfamily Arietitinae Hyatt, 1874

Genus **Coroniceras** Hyatt, 1867

Coroniceras cf. **rotiforme** (J. de C. Sowerby, 1824)
(Pl. 3, figs 5a, b)

Material: One, NS50-177.

Locality: Sögüt (SC7).

Description and Remarks: The single specimen consists of about a quarter of a whorl, apparently of phragmocone, as two possible septa are visible on the broken surface, although the suture lines are not apparent. The specimen is part of a phragmocone which would have been c. 150 mm in diameter; allowing for the body-chamber, the total specimen is likely to have been larger than 200 mm in diameter. The curvature of the ribs and development of the

bullae is quite similar to that of the holotype of *C. rotiforme* figured by Guérin-Franiatte (1966, pl. 10) although that specimen is somewhat smaller. However, in her review of the species, Guérin-Franiatte mentions that French specimens of the species are regularly 200-250 mm in diameter.

The whorl section is more compressed than that shown for *C. rotiforme* by Guérin-Franiatte (1966, fig. 26), but the Turkish specimen may possibly be somewhat distorted. The ventral view (Pl. 3, fig. 5b) shows that the central keel is bounded by deep sulci and these in turn are flanked at the outer margins by ridges which form discrete ventral protuberances, so that the venter is best described as tricarinate-bisulcate.

The incomplete nature of this single specimen does not allow a definite identification to be made, but similarities to *C. rotiforme* are considerable.

Horizon: *C. rotiforme* is restricted to the Rotiforme Subzone of the Bucklandi Zone (Lower Sinemurian) in north-west Europe (Dean, Donovan & Howarth *1961*). In both England and France the species is characteristic of the lower part of the Rotiforme Subzone (Dean *et al.* 1961, pp. 449-450).

Subfamily Arnioceratinae Spath, 1924

Genus **Arnioceras** Hyatt, 1867

Arnioceras cf. **semicostatum**
(Young & Bird)
(Pl. 3, fig. 6)

Material: Two, NS50-138 - NS50-139.

Locality: Sögüt (SC), Ammonitico Rosso.

Description and Remarks: Neither of the two specimens is complete, but the more complete of the two, figured herein, would have been at least 48 mm in diameter. The shell is very evolute and the umbilicus would have been 28 mm in diameter (58%). The ribs are straight and rectiradiate on the outer whorls and although the venter is ill-preserved and some degree of lateral compression has occurred, the keel is visible on the less complete specimen. This latter specimen is part of an individual approaching 60 mm in diameter.

The inner whorls, as is typical of the species, are smooth and it appears that the ribbing is initiated at about an umbilical diameter of 18-19 mm (though the shell is poorly preserved at this point). The length of the smooth stage can give an indication of the age of members of this long-ranging genus, and in this case it appears probable that these specimens are of Upper Sinemurian age (D.T. Donovan personal communication).

Upper Sinemurian faunas from Anatolia previously recorded have included the genera *Microderoceras* (Arkell 1956, p. 351) *Crucilobiceras* and *Asteroceras* (Bremer, 1965). The latter author also recorded *Arnioceras*, but is an early Sinemurian genus.

Family Oxynoticeratidae Hyatt, 1875

Genus **Oxynoticeras** Hyatt, 1875

Oxynoticeras pompeckji Gugenberger
(Pl. 4, fig. 2)

1914 *Oxynoticeras numismale* (Oppel); Pia, p. 339, pl. 14, figs. 3a, b.
1929 *Oxynoticeras pompeckji* Gugenberger, p. 390, pl. 11, fig. 13, pl. 12, fig. 14.

Material: Four specimens, NS50-140 - NS50-143.

Localities: Bairkoy Trafo and Günören.

Description and Remarks: All the specimens are phragmoconic. The largest is c. 47 mm in diameter, with a whorl height of 27 mm (57%), a whorl thickness of 10 mm (21%) and an umbilical diameter of 3.5 mm (7%). Measurements of this specimen correspond very closely with Gugenberger's examples. Slightly sigmoidal ribs, which though clearly visible are not prominent, run up the whorl sides, to a point about two thirds of the way up, where they give rise to two or three secondary ribs which swing forwards sharply on the venter. The secondary ribs are only visible under oblique lighting.

These specimens of *Oxynoticeras* clearly do not indicate a horizon in the Oxynotum Zone as the accompanying fauna is predominantly Lower Pliensbachian in age; the species is one of a number of later forms which have been recorded from the uppermost Sinemurian or Lower Pliensbachian of Italy, Hungary and Turkey.

Oxynoticeras soemanni (Dumortier)
(Pl. 4, fig. 4)

1867 *Ammonites soemanni* Dumortier, p. 154, pl. 40, figs. 2-4; pl. 43, figs 1-2.
1879 *Ammonites soemanni* Dumortier; Reynès, pl. 45, figs 44-46.
1901 *Oxynoticeras soemanni* (Dumortier); Fucini, p. 3, pl. 1, fig. 1.

Material: One specimen, NS50-144.

Locality: Gunoren.

Description and Remarks: The single phragmoconic specimen is c. 63 mm in diameter (part of the last preserved whorl is broken, rendering exact measurement difficult). It has a whorl height of 37 mm (59%), a whorl thickness of 15 mm (24%) and an umbilical diameter of 4.5 mm (7%). The last whorl,

which is all that can be seen of this involute form, is essentially smooth, but bears traces of strongly prorsiradiate secondary ribbing on the initial part of the last preserved whorl. The ribs are more subdued than those of *O. pompeckji* described above. The suture too is a little simpler than that of the latter species, with notable simplification of the second lateral saddle when the two species are compared. The similarity of the suture line to that figured by Fucini (1901, text-fig. 1) is considerable, and the Anatolian specimen agrees quite closely with Fucini's figured example, which is, however, yet more involute.

Genus **Hypoxynoticeras** Spath, 1925

Hypoxynoticeras cf. **sphenonotum** (Monke)
(Pl. 4, fig. 9)

Material: One specimen, NS50-145.

Locality: Gunoren.

Description and Remarks: The single specimen is more evolute and more strongly ornamented than the species of *Oxynoticeras* described above. It is 21.5 mm in diameter and has an umbilical diameter of 4.5 mm (21%); this compares with species of *Oxynoticeras* where umbilical diameter seems often similar to that of *O. pompeckji*, described above, at about 7% of diameter.

Within the umbilicus the ribbing of the inner whorls can be seen. On the outer (preserved) whorl there are strong slightly convex primary ribs. Between them, but originating half way up the whorl side, are secondary ribs which swing forwards on the venter is acute, with feebly developed ventral shoulders, but which is not oxycone.

The more evolute coiling and somewhat stouter whorl (26% of diameter) together with the fact that a discrete keel arises from the venter suggest affinities with the genus *Hypoxynoticeras* Spath, 1925. The specimen here described differs from the type species *H. sphenonotum* (Monke) in its less well developed ventral shoulders and its stronger ornament. The lectotype (designated by Arkell, 1957, p. 1243, is believed to be from the Jamesoni Zone of Germany — a similar horizon to that of the present specimen.

Family Echioceratidae Buckman, 1913

Genus **Paltechioceras** Buckman, 1924

Paltechioceras cf. **edmundi** (Dumortier)
(Pl. 3, figs 2a, b)

Material: Two fragmentary specimens, NS50-146 - NS50147.

Locality: Günören.

Description and Remarks: The more complete of the two specimens represents approximately 40% of an individual. The ribs are rectiradiate to slightly rursiradiate as far as the ventral shoulder, where they swing forwards briefly before terminating on the venter itself. Whorl section is quadrate, with a unicarinate bisulcate venter.

Arkell's (1957, p. L244) definition of *Paltechioceras* mentions a tricarinate bisulcate venter, but it is clear from Getty's (1973) revision, that the presence of sulci is the criterion for distinction of this genus from *Echioceras* and that a unicarinate venter is just as frequent as a tricarinate form.

Of the species, now included in *Paltechioceras* figured by Durmortier (1867), *P. edmundi* seems closest to the specimen figured herein, but there are also similarities to *P. oosteri* (Dumortier).

Superfamily Eoderocerataceae Spath, 1929
Family Eoderoceratidae Spath, 1929
Subfamily Eoderoceratinae Spath, 1929

Genus **Ophideroceras** Spath, 1925

Ophideroceras sp.
(Pl. 4, fig. 15)

Material: One septate whorl fragment, NS50-148.

Locality: Bairkoy Trafo.

Description and Remarks: The single fragment represents a quarter of a whorl of phragmocone and is part of an individual with a phragmoconic diameter estimated at 75 mm. At the more mature end of the fragment whorl height is 22 mm and whorl thickness 19 mm.

Although the whorl is eroded, it is clear that each blunt primary rib bears a blunt tubercle on the ventral shoulder; there is also a suggestion of an umbilical swelling on some ribs. Between these main ribs are some finer ribs, apparent only in oblique light.

The whorl section is subquadrate and the impressed area very shallow, suggesting serpenticone coiling. The ribs are visible over the venter, but become subdued there.

There are some similarities with *O. tardecrescens* (Pia), but the incomplete nature of this material makes specific assignment hazardous. The specimen shown a squarer whorl section and more evolute coiling than the species of *Epideroceras* and *Coeloderoceras* described below, but the differences are not that marked. The assignment of these latter genera to a different subfamily from *Ophideroceras* in the Treatise (Arkell 1957) belies their similarity, but may of course indicate the link. Between the Eoderoceratinae and the Coeloceratinae. Arkell's classification of these forms is followed here.

Subfamily Coeloceratinae Houg, 1910

Genus **Coeloderoceras** Spath, 1923

Coeloderoceras ponticum (Pia)
(Pl. 4, fig. 12)

1913 *Coeloceras ponticum* Pia, p. 353, pl. 15, fig. 2.
1923 *Coeloderoceras ponticum* (Pia); Spath, p. 11.
1957 *Coeloderoceras ponticum* (Pia); Arkell, p. L247, fig. 274, 4.

Material: Nine specimens, NS50-149 - NS50-157.

Localities: Bairkoy Trafo and Günören.

Description and Remarks: The largest of the specimens (figured herein) is 34 mm in diameter and is entirely phragmoconic. The whorl height is 10 mm (29%), whorl thickness 12 mm (35%) and umbilical diameter 17.5 mm (51%). These measurements compare very closely with those of Pia (1913) whose figured specimen at 40 mm diameter had dimensions of 28%, 36% and 51% respectively.

The primary ribs are rectiradiate to slightly rursiradiate and terminate on the ventral shoulder in a tubercle, where generally two, but sometimes three, secondary ribs originate and swing forwards over the rounded venter.

The species is quite distinctive, but clearly related to the genus *Epideroceras* (see below) which bears similar ornament, but has different whorl shape.

Genus **Epideroceras** Spath, 1923

Remarks: Arkell (1957, p. L247) placed this genus with a query in the subfamily Phricodoceratinae. Herein it is included in the Coeloceratinae as it appears to me to be more closely related to *Coeloderoceras* (see above) than it is to *Phricodoceras*.

Subgenus **Epideroceras** Spath, 1928

Epideroceras (Epideroceras) latinodosum Bremer
(Pl. 3, fig. 4; Pl. 4, fig. 10)

1965 *Epideroceras (Epideroceras) latinodosum* Bremer, p. 160, pl. 15, fig. 2.

Material: Three specimens, NS50-158 - NS50-160.

Locality: Günören.

Description: The largest of the three phragmoconic specimens (NS50-158, figured herein on Pl. 4, fig. 10) has a diameter of 64 mm, a whorl height of 24 mm (38%), whorl thickness of c. 21 mm (33%) and an umbilical diameter of 25 mm (39%). These dimensions are similar to those given for the holotype by Bremer. His specimen at 62 mm had measurements of 36%, 29% and 43%; thus the holotype is slightly more evolute and has somewhat more slender whorls. Height/breadth ratio of the last whorl is given as 1:1.24 by Bremer; for the specimen here described it is 1:1.15 (although exact measurement of whorl thickness is impeded by matrix).

The strong ribs of the inner whorls are rectiradiate and terminate in a blunt tubercle against the umbilical seam. On the last (preserved) umbilical whorl the ribs are very slightly rursiradiate and sometimes have a swelling on the umbilical shoulder, which in some cases almost becomes a tubercle; in other cases there is not even a swelling at this point. The ventrolateral tubercles are subdued but persist onto the last preserved whorl. From these tubercles, fine faint secondary ribs originate in sheaves of up to five. The primary ribs fade on the last preserved half whorl (which is still phragmocone); the umbilical tubercles persist, but the lateral tubercles fade and secondary ribs, again in sheaves of up to five, arise directly from the umbilical tubercles on the last whorl sector preserved.

Remarks: There is a strong resemblance to the holotype, which is rather more coarsely ribbed than the specimens in this collection. Such differences as do exist, do not appear sufficient to warrant specific distinction.

The smallest specimen (Pl. 3, fig. 4) is 33 mm in diameter and shows the inner whorls well. It is sufficiently similar to the larger specimen to be included in *E. (E.) latinodosum* but also shows some similarity to *E. (E.) mersivanum* (Gugenberger).

Subgenus **Pseuduptonia** Bremer, 1965

Remarks: The subgenus *Pseuduptonia* was proposed by Bremer (1965, p. 162) with *E. (P.) micromphalum* (Pia) as type species. The subgenus is characterised by being more involute than the sugenus *Epideroceras* and has not such prominent tubercles as the latter. Coupled with the greater involution is a heightening of the whorl, so that the whorl section in species of the subgenus *Pseuduptonia* is more slender and less rounded than that of the subgenus *Epideroceras*. Together with the ornamental differences are sutural distinctions.

Epideroceras (Pseuduptonia)
cf. **suessi** (Gugenberger)
(Pl. 4, fig. 8)

Material: One specimen, NS50-161.

Locality: Günören.

Description: The single specimen has a diameter of 39 mm, whorl height 15 mm (38%), whorl thickness 12 mm (31%) and umbilical diameter 13.5 mm

(35%). It is entirely phragmoconic. The ribs are straight rectiradiate and branch at the ventral shoulder to give rise to two to three secondary ribs. As the venter is somewhat eroded little detail is visible there. Because of the high point of furcation only the lower part of the primary ribs is visible within the umbilicus. On the outer whorl there are c. 30 primary ribs (poor preservation precludes exact count) making this specimen more finely ribbed than other species of the subgenus described herein.

Remarks: The specimen appears closest to *E. (P.) suessi* (Gugenberger), from which it differs in being more involute; it also has some affinity with *E. (P.) suspectum* (Pia) which is, however, yet more evolute and has rounder whorl section.

Epideroceras (Pseuduptonia)
cf. **dubium** (Pia)
(Pl. 4, fig. 6)

Material: Two specimens, NS50-162 - NS50-163.

Locality: Günören.

Description and Remarks: The more complete of the two specimens, NS50-162 (figured herein) is 39.5 mm in diameter, has a whorl height of 15 mm (38%), whorl thickness 13 mm (33%) and umbilical diameter 14.5 mm (37%). In its general shell shape it is remarkably similar to *P. (E.)* cf. *suessi* described above. Where it differs from the latter though, is in its ribbing, with some 24 ribs on the last preserved whorl, which is entirely phragmocone. The umbilical shoulder is square and the ribs are rectiradiate. At the ventral shoulder is a furcation point from which two or three secondary ribs arise. The actual point of furcation is marked, near the preserved mouth of the shell, by a small rather indistinct tubercle. Some of the secondary ribs appear to arise by intercalation between the fixed secondaries. Specimen NS50-163 is smaller and less complete, but agrees closely with the specimen described here.

Epideroceras (Pseuduptonia) sp.
(Pl. 4, fig. 5)

Material: One specimen, NS50-164.

Locality: Günören.

Description and Remarks: The single phragmoconic specimen is 58 in diameter, with a whorl height of 21.5 mm (37%), whorl thickness 16 mm (28%) and umbilical diameter 22 mm (38%). Only half of each whorl is preserved, but it is immediately apparent that this specimen is more slender-whorled than other species of the subgenus described above; the ribs are also more subdued. Half a whorl from the preserved end of the entirely phragmoconic specimen, the ribs bear small umbilical bullae, but these fade after three visible ribs. Erosion of the last whorl has reduced the apparent strength of the ribbing and the secondary ribs are not well displayed.

No species of *Pseuduptonia* described hitherto compares at all closely with this specimen, but as the present material is not entirely satisfactorily preserved, a new species is not erected here.

Genus **Coeloceras** Hyatt, 1867

?Coeloceras cf. **heberti** (Oppel)
(Pl. 4, figs 14a, b)

Material: Two specimens, NS50-165 - NS50-166.

Locality: Günören.

Description. Although the larger of the two specimens is still small (diameter c. 24 mm) it appears to have at least some body-chamber, as no sutures are visible. The whorl is a depressed coronate shape with a gently rounded broad venter. There are two rows of tubercles on the whorl-side. The inner tubercles are at the umbilical shoulder and up to five ribs branch from these; at least the inner two (but sometimes more) are looped onto the outer tubercle which is on the ventral shoulder. From this outer tubercle fine ribs branch and swing forwards gently over the venter to connect with the corresponding tubercle on the other ventral shoulder. There are some free secondary ribs intercalated between those originating from the tubercles.

The second specimen, although only 13 mm in diameter agrees in general form with the larger, but at that diameter, only a strong simple rib connects the two rows of tubercles on the whorl side.

Remarks: Generic attribution of this species poses problems. It is clearly a member of the Coeloceratinae, for it shares with them the branching of the ribs from an outer lateral tubercle. In whorl section it is closest to *Coeloceras* itself, but that genus seems to be characterised by only one (the outer) row of tubercles. Assignment to *Epideroceras* seems less satisfactory, since although some species have two rows of tubercles, no species appears to have the coronate whorls which characterize this species. Similarities are shown to some of the species figured by Bremer (1965) as *Microderoceras*, but that generic assignment itself appears to me to be doubtful as the latter genus seems to be entirely early Sinemurian in age; *Epideroceras* could probably better accommodate some of the forms thus assigned by Bremer.

It may be that a new genus is needed for these coronate bituberculate forms, in which case it is

considered advisable to have further material for a full description.

Subfamily Phricodoceratinae Spath, 1929

Genus **Phricodoceras** Hyatt, 1900

Phricodoceras taylori (J. de C. Sowerby)
(Pl. 4, figs 13a, b)

1826 *Ammonites taylori* J. de C. Sowerby, p. 23, pl. 514, fig. 1.
1844 *Ammonites taylori* J. de C. Sowerby; d'Orbigny, p. 136, pl. 9, figs 21a, b
1844 *Ammonites lamellosus* d'Orbigny, p. 283, pl. 84, figs 1, 2.
1849 *Ammonites taylori nodosus* Quenstedt, p. 135, pl. 16, fig. 8.
1880 *Aegoceras taylori* (J. de C. Sowerby); Wright, p. 348, pl. 31, figs 5-7.
1961 *Phricodoceras* aff. *taylori* (J. de C. Sowerby); Donovan, pl. 68, fig. 5.

Material: One specimen, NS50-167.

Locality: Günören.

Description and Remarks: The single phragmoconic specimen has a diameter of 29 mm, whorl height of 13 mm (45%), whorl thickness 17 mm (59%) and umbilical diameter 8 mm (28%). It is well-preserved and terminated at a septum. Strong ribs pass from ventrolateral tubercles to ventral tubercles which are almost perfectly symmetrically disposed across the venter. Between these strong tuberculate ribs are less strong ones which are non-tuberculate. The tubercles are clearly the preserved bases of the spines which characterize the species. The venter tends towards concavity between the ventral tubercles.

P. taylori is the index species of the basal Taylori Subzone of the Jamesoni Zone at the base of the North-west European Lower Pliensbachian. It is believed to be of the same age in Turkey.

Family Polymorphitidae Haug, 1887

Genus **Uptonia** Buckman, 1898

Uptonia sp.
(Pl. 4, fig. 11)

Material: One specimen, NS50-168.

Locality: Günören.

Description and Remarks: The specimen, which shows lateral compression, which may not be an original feature, is 21 mm in diameter. The ribs are simple rectiradiate and the coiling is evolute. The specimen has suffered abrasion which has removed the ribbing on one section of the shell and abraded the venter, but at one point it can be seen that the ribs swing forwards quite sharply to form chevrons on the venter, Tubercles are absent. No suture lines are visible, so the specimen may include some body-chamber.

Genus **Gemmellaroceras** Hyatt, 1900

Gemmellaroceras cf. **aenigmaticum** (Gemmellaro)
(Pl. 1, fig. 3)

Material: One specimen, NS50-169.

Locality: Bairkoy Trafo.

Description and Remarks: This rather featureless ammonite is 24 mm in diameter. It has a compressed whorl section which as far as can be determined is an original feature. The inner whorls are partly occluded by matrix, but it can be seen that they are essentially smooth. Relatively simple sutures are partially seen and the specimen has almost half a whorl of body-chamber. Faint blunt slightly rursiradiate ribs are visible over the last whorl.

The almost smooth character of this specimen and its compressed whorl section make generic identification clear. The specimen is a little more involute than the type species, *G. aenigmaticum*, but appears otherwise similar.

Genus **Polymorphites** Haug, 1887

?Polymorphites sp.
(Pl. 4, fig. 7)

Material: Two specimens, NS50-170 - NS50-171.

Locality: Günören.

Description and Remarks: The specimens are 27 mm and 28 mm in diameter, respectively. The smaller, NS50-170 (figured herein), shows more of the umbilical whorls, otherwise the two are very similar. The ribs are rectiradiate, albeit with a slight convexity of some of the ribs - each of which terminates at a tubercle at the ventral shoulder. The tubercles do not become noticeable until the last (preserved) quarter of a whorl of each specimen.

Neither specimen shows the venter well, as both have been somewhat abraded (this may also have affected the preservation of the tubercles) and ribbing is not apparent on the venter. The smaller specimen is entirely phragmoconic, but the larger appears to show some body-chamber.

Although ventral detail is not preserved, the subquadrate whorl-section, evolute coiling and rib style strongly suggest the generic assignation to *Polymorphites*: the material is not specifically identifiable. There are similarities to the genus *Platypleuroceras*, but neither specimen shows trace of the inner tubercles characteristic of that genus.

Subfamily Acanthopleuroceratinae Arkell, 1950

Genus **Acanthopleuroceras** Hyatt, 1900

Acanthopleuroceras cf. **valdani** (d'Orbigny)
(Pl. 2, fig. 12)

Material: One body-chamber fragment, NS50-172.

Locality: Günören.

Description and Remarks: The quarter of a whorl of somewhat abraded body-chamber represents an individual of c. 60 mm diameter. The ribs are strong, rectiradiate to the ventral shoulder, where they swing forwards slightly from a tubercle. The venter itself is abraded and the keel not distinctly shown.

In North-west Europe this species is restricted to the Valdani Subzone of the Ibex Zone. If the species is similarly restricted in Anatolia, it implies that the Ammonitico Rosso facies includes this as its youngest fauna in this area. It is perhaps significant that this specimen does not bear the deep reddening characteristic of most ammonites from this facies, But merely a slight pink tinge on one side only.

Genus **Tropidoceras** Hyatt, 1867,

Tropidoceras cf. **masseanum** (d'Orbigny)
(Pl. 4, figs 1, 3)

Material: Four phragmoconic fragments, NS50-173 - NS50-176.

Locality: Günören.

Description and Remarks: The largest of the four specimens represents approximately a quarter of an ammonite of c. 75 mm diameter (excluding the body-chamber). There are faint rectiradiate to slightly rursiradiate ribs on the whorl side, which swing forwards sharply on the venter but are even more subdued there. Although all the specimens are to some degree abraded, the faint ribbing appears to be an original feature. The venter is acute and bears a distinct keel.

In their degree of involution (about 40% of the previous whorl is overlapped) these specimens are close to *T. masseanum* (d'Orbigny); the impressed area corresponds almost exactly to the point where the whorl starts to narrow ventrally. The ribs are not as pronounced as in the allied *T. ellipticum* (Sowerby), though the very low relief of the ribbing on the ventral flanks is similar to that obtaining in *T. ellipticum*.

In North-west Europe *T. masseanum* characterizes the basal Masseanum Subzone of the Ibex Zone of the Lower Pliensbachian.

AGE OF THE FAUNA

The Ammonitico Rosso facies faunas are dominated, as is usual in the Tethyan Lower Jurassic, by Phylloceratids and (to a lesser extent) by Lytoceratids. Correlation with the Standard Zonal scheme of North-west Europe (Dean, Donovan & Howarth, 1961) is made possible by the rarer occurrence of members of the Ammonitina. Listed below is the Standard North-west European Zonal and Subzonal Scheme, with modifications included in the Jurassic Correlation Charts (Cope 1980).

On the list below the zones and subzones which are certainly indicated are indicated by asterisks (*).

The earliest fauna indicated is the Liasicus Zone of the Hettangian, represented by *Alsatites*. This is the first record of an ammonite of Hettangian age from Turkey. The Lower Sinemurian Bucklandi Zone is the next fauna, represented by the *Coroniceras rotiforme* and *Angulaticeras*. The former species is characteristic of the Rotiforme Subzone.

The age of the succeeding fauna of *Arnioceras* is not known with certainty, as the genus is long-ranging. The length of the smooth stage, which would indicate a late Sinemurian age were the specimen from North-west Europe, need not be so indicative in the case of the Anatolian specimen, thus an indeterminate Sinemurian age seems likely. We can safely conclude, however, that in the Sögüt area, the base of the Ammonitico Rosso includes horizons from the Liasicus Zone of the Hettangian up to at least the Bucklandi Zone of the Sinemurian and possibly up as far as the Obtusum Zone. From the Ankara region, Bremer (1965) recorded *Asteroceras*, although the specific name he assigned to it is a species of *Caenisites*. If the specimen is indeed an *Asteroceras* (as his figure suggests to me) it would be indicative of the Obtusum Zone, otherwise a Turneri Zone age appears likely.

The main bulk of the Ammonitico Rosso of the area, belongs to the highest part of the Sinemurian and the Lower Pliensbachian. The oldest of these faunas is indicated by *Paltechioceras* cf. *edmundi*. According to Getty (1973) *Paltechioceras* ranges from the highest part of the Raricostatoides Subzone through to almost the top of the Aplanatum Subzone. An unspecified horizon in the upper part of the Raricostatum Zone thus appears to be indicated.

Succeding this horizon is the Jamesoni Zone, with definite identification of the Taylori Subzone by the occurrence of the subzonal index species. Specimens of *Polymorphites* indicate either the Polymorphus or Brevispina Subzones. Howarth (*in* Cope 1980, p. 48) states that it is rarely possible to distinguish the Brevispina and Polymorphus Subzones because of overlap of the ranges of tbe index species. The succeeding Jamesoni Subzone is probably indicated by the single specimen of *Uptonia* recorded.

Stage/Substage	Zone	Subzone
Lower Pliensbachian	*Prodactylioceras davoei*	*Oistoceras figulinum* *Aegoceras capricornus* *Aegoceras maculatum*
	* *Tragophylloceras ibex*	*Beaniceras luridum* * *Acanthopleuroceras valdani* * *Tropidoceras masseanum*
	* *Uptonia jamesoni*	*Uptonia jamesoni* *Platypleuroceras brevispina* *Polymorphites polymorphus* * *Phricodoceras taylori*
Upper Sinemurian	* *Echioceras raricostatum*	*Paltechioceras aplanatum* *Leptechioceras macdonnelli* *Echioceras raricostatoides* *Crucilobiceras densinodulum*
	Oxynoticeras oxynotum	*Oxynoticeras oxynotum* *Oxynoticeras simpsoni*
	Asteroceras obtusum	*Eparietites denotatus* *Asteroceras stellare* *Asteroceras obtusum*
Lower Sinemurian	*Caenisites turneri*	*Microderoceras birchi* *Caenisites brooki*
	Arnioceras semicostatum	*Euagassiceras sauzeanum* *Agassiceras scipionianum* *Coroniceras reynesi*
	* *Arietites bucklandi*	*Arietites bucklandi* * *Coroniceras rotiforme* *Vermiceras conybeary*
Hettangian	*Schlotheimia angulata*	*Schlotheimia complanata* *Schlotheimia extranodosa*
	* *Alsatites liasicus*	*Alsatites laqueus* *Waehneroceras portlocki*
	Psiloceras planorbis	*Caloceras johnstoni* *Psiloceras planorbis*

Above the Jamesoni Zone, the lower two subzones of the Ibex Zone (the Masseanum and Valdani Subzones) are both identified by their index species. It may thus be, therefore, that the succession in the Anatolian Ammonitico Rosso is essentially complete in the interval between the upper part of the Raricostatum Zone and the Valdani Subzone of the Ibex Zone.

The zonal position of some of the other ammonites is not so clear. For instance, species of *Oxynoticeras* occur at horizons younger than might be expected from our knowledge of North-western European forms. In other cases, genera such as *Epideroceras* are unknown from North-west Europe and thus an approximate Jamesoni - Ibex zonal age may be given to these forms. Similarly, species of Phylloceratids and Lytoceratids are poor indices of precise age and reliance must again be put upon forms occurring farther to the north.

Acknowledgement. I would like to acknowledge the help of Professor D T Donovan who kindly commented on the identify of some of the ammonites and referred me to some of the relevant literature.

RIASSUNTO

Viene descritta una fauna ad ammoniti dell'Ammonitico Rosso delle Pontidi, in Turchia. La fauna consiste quasi interamente di specie già descritte, sebbene alcune di esse non siano mai state segnalate prima d'ora in Turchia.

Un presunto nuovo genere ed alcune nuove specie non sono state formalmente nominate in attesa di trovare del materiale migliore.

La fauna è prevalentemente di età Pliensbachiano inferiore ed è stata tentativamente correlata con lo schema zonale standard dell'Europa nord occidentale.

La fauna include anche esemplari più antichi, fra i quali viene segnalato il primo ritrovamento di ammoniti hettangiane della Turchia.

REFERENCES

ALKAYA H.F. (1979) - *Lower Jurassic ammonites from northern Turkey*. Unpublished Ph. D. thesis, University of London.

ARKELL W.J. (1950) - A classification of the Jurassic ammonites. *J. paleont.* **24**: 354-364.

ARKELL W.J. (1956) - *Jurassic Geology of the World*. Oliver & Boyd, Edinburgh & London, xv + 806 pp, 46 pls.

ARKELL W.J. (1957) - *in* ARKELL W.J., KUMMEL B. & WRIGHT C.W. Mesozoic Ammonoidea *in* MOORE R.C. (ed.) *Treatise on invertebrate paleontology. Part. L. Mollusca 4, Cephalopoda, Ammonoidea*. Geological Society of America and Kansas University Press. New York, and Lawrence, L80-L437.

BREMER H. (1965) - Zur Ammonitenfauna und Stratigraphie des unteren Lias (Sinemurium bis Carixium) in der Umbegung von Ankara (Türkei). *N. Jb. Geol. Pal. Abh.*, **122**: 129-221, pls 12-16.

BUCKMAN S.S. (1898) - On the grouping of some divisions of so-called "Jurassic Time". *Q. Jl. geol. Soc. Lond.*, **54**: 442-462.

BUCKMAN S.S. (1913) - *Yorkshire Type Ammonites*, **2**: 68-83, 19 pls London.

CALLOMON J.H. (1963) - Sexual dimorphism in Jurassic ammonites. *Trans Leicester lit. phil. Soc.*, **57**: 21-56, pl. 1.

CALLOMON J.H. (1985) - The evolution of the Cardioceratidae *in* COPE J.C.W. & SKELTON P.W. (eds). Evolutionary case histories from the record. *Spec. Pap. Palaeont.*, 33.

CANAVARI M. (1888) - Contribuzione alla fauna del Lias inferiore di Spezia. *Mem. R. Com. Geol. Italia*, 3, 173 pp, 9 pls.

COPE J.C.W. (1967) - The palaeontology and stratigraphy of the lower part of the Upper Kimmeridge Clay of Dorset. *Bull. Br. Mus. nat. Hist.* (Geol.), **15:** 1-79, pls 1-33.

COPE J.C.W. (Ed.) (1980) - A correlation of Jurassic rocks in the British Isles. Part One: Introduction and Lower Jurassic. *Spec. Rept. geol. Soc. Lond.*, **14**: 73 pp.

DEAN W.T., DONOVAN D.T. & HOWARTH M.K. (1961) - The Liassic ammonite zones and subzones of the North-west European Province. *Bull. Br. Mus nat. Hist.* (Geol.), **4**: 437-505, pls 63-75.

DONOVAN D.T. (1952) - The ammonites of the Blue Lias of the Bristol District. *Ann. Mag. nat. Hist.*, **5**: 629-655, 717-752, pls 12, 13 17-19.

DONOVAN D.T. (1958) - The Lower Liassic ammonite fauna of the Fossil Bed at Langeneckgrat, near Thun (Median Prealps). *Schweiz. palaeont. Abh.*, **74**: 58 pp, 7 pls.

DUMORTIER E. (1867) - Études paléontologiques sur les dépôts jurassiques du Bassin du Rhône. 2. Lias inférieur. 252 pp, 50 pls Paris.

FANTINI SESTINI N. (1962) - Contributo allo studio delle ammoniti del Domeriano di Monte Domaro (Brescia). *Riv. Ital. Paleont. Strat.* **68**: 483-554.

FANTINI SESTINI N. (1974) - Phylloceratina (Ammonoidea) del Pliensbachiano Italiano. *Riv. Ital. Paleont.*, **80**: 193-250.

FUCINI A. (1901-5) - Cefalopodi liassici del Monte di Cetona. *Paleont. ital.*, **7**: 57-227, pls 1-14.

FUCINI A. (1923) - Fossili domeriani dei dentorni di Taormina. *Paleont. ital.*, **26**: (for 1920), 75-116.

GÉCZY B. (1972) - Ammonite fauna from the Lower Jurassic standard profile at Lokut, Bakony Mountains, Hungary. *Ann. Univ. Sci. Rol. Eötvös*, 15.

GÉCZY B. (1976) - Les ammonites du Carixien de la Montagne du Bakony. *Akademiai Kiado éd.*, Budapest, 1-223, 34 pls.

GEMMELLARO G.G. (1884) - Sui fossili degli strati a *Terebratula aspasia* Meneghini della contrada Roche Rosse presso Galati (Provincia di Messina). *Giorn. Sci. nat. econ*, **16**: 48 pp, 7 pls.

GEYER G. (1886) - Über die liasischen Cephalopoden des Hierlatz bei Hallstatt. *Abh. k. k. Geol. Reichsanst.*, **12**: 213-287, pls 1-4.

GUÉRIN-FRANIATTE S. (1966) - *Ammonites du Lias inférieur de France. Psiloceratataceaea: Arietitidae*. Centre national des Recherches Scientifiques, Paris. 2 vols., xviii + 455 pp, 231 pls.

GUGENBERGER O. (1929) - Paläontologisch-stratigraphische Studien über den Anatolischen Lias. *N. Jb. Miner. Geol. Paläont. Beil.-Bd.*, **62**: 235-300, 371-466, 3 pls.

HAUG É (1887) - Über die Polymorphidae, eine neue Ammonitenfamilie aus dem Lias. *N. Jb. Miner. Geol. Paläont.*, **20**: 89-163, pls 4, 5.

HAUG É (1910) - *Traité de Géologie*, **2**: (2), 929-1396. Paris.

HOWARTH M.K. & DONOVAN D.T. (1964) - Ammonites of the Liassic family Juraphyllitidae in Britain. *Palaeontology*, **7**: 286-305.

HYATT A. (1867) - The fossil cephalopods of the Museum of Comparative Zoology. *Bull. Mus. comp. Zoo.*, **1**: 71-102.

HYATT A. (1875) - Remarks on two new genera of ammonites: *Agassiceras* and *Oxynoticeras*. *Proc. Boston Soc. nat. Hist.*, **17**: 225-235.

HYATT A. (1900) - *Cephalopoda* in ZITTEL K.A. *Textbook of Palaeontology*, trans. C.R. Eastman. MacMillan, London, **1**: 502-604.

KENNEDY W.J. & COBBAN W.A. (1976) — Aspects of ammonite biology, biogeography and biostratigraphy. *Spec. Pap. Palaeont.*, **17**: 94 pp, 11 pls.

KOVACS L. (1939) - Bemerkungen zur systematischen Enleitung der Jurassischen Phylloceraten. *Abh. Min. Geol. Inst. St. Tiszia Univ. Debrecen*, **13**: 277-320.

MEISTER E. (1913) - Über den Lias in Nordanatolien nebst Bemerkunden über das gleichzeitig vorkommende Rotliegende und die Gosaukreide. *N. Jb. Miner. Geol. Paläont. Beil.-Bd.*, **35**: 499.548.

MENEGHINI J (1867-1881) - *Monographie des fossiles du calcaire rouge ammonitique (Lias supérieur) de Lombardie et de l'Appennin Central.* In STOPPANI A. *Paléontologie Lombard.* Milan.

ORBIGNY A. D'. (1842-45) - *Paléontologie Française. Terrains Jurassiques.* **1**: Céphalopodes. 642 pp, 234 pls Paris.

OTKUN G. (1942) - Étude paléontologique du quelques gisements du Lias d'Anatolie. *"Meteae", Publ. Inst. Ét. Rech. Min. Turquie*, B. Mém. 8.

PIA J. VON (1913) - Über eine mittelliasische Cephalopodenfauna aus dem nordöstliche Kleinasien. *Ann. k. k. naturhist. Hofmus. Wien*, **27**: 335-388, pls 13-15.

PIA J. VON. (1914) - Untersuchungen über die Gattung *Oxynoticeras* und einige damit zusammenhängende allgemeine Fragen. *Abh. K. k. geol. Reichsanst. Wien,*. **23**: i-iv + 1-179, pls 1-13.

QUENSTEDT F.A. (1845-49) - *Petrefactenkunde Deutschlands. Die Cephalopoden.* Fues. Tübingen, 580 pp, 36 pls.

QUENSTEDT F.A. (1882-85) - *Die Ammoniten des schwäbischen Jura. 1, Der schwarze Jura.* Tübingen, 440 pp, 54 pls.

REYNÈS P. (1879) - *Monographie des ammonites.* Ballière, Paris & Marseilles, Atlas 58 pls.

SARTI C. (1990) - Dimorfismo nella specie *Sowerbyceras loryi* (Mun. Chlm.) del Kimmeridgiano. *Atti II Conv. int. F.E.A. Pergola 1987*, 427-439, 2 pls.

SOWERBY J. DE C. (1823-46) - *The mineral conchology of Great Britain*, London, 4-7, pls 387-648.

SPATH L.F. (1923) - Correlation of the Ibex and Jamesoni zones of the Lower Lias. *Geol. Mag.*, **60**: 6-11.

SPATH L.F. (1924) - The ammonites of the Blue Lias. *Proc. Geol. Assoc. Lond.*, **35**: 186-211, pl. 18.

SPATH L.F. (1925) - Notes on Yorkshire ammonites. *Naturalist, London*, **820**: 137-141; 821, 167-172; 827, 359-364.

WRIGHT T. (1878-86) - Monograph on the Lias ammonites of the British Islands. *Monogr. palaeontogr. Soc. London*, 1-503, pls 1-91.

PLATES

PLATE 1

Figs 1a, b — *Phylloceras (Phylloceras) hebertinum* (Reynès), NS50-1.
Figs 2, 6 — *Phylloceras (Phylloceras) frondosum* (Reynès), NS50-11, 12.
Fig. 3 — *Gemmellaroceras* cf *aenigmaticum* (Gemmellaro), NS50-169.
Fig. 4 — *Tragophylloceras numismale* (Quenstedt), NS50-115.
Figs 5, 7, 8 — *Aegolytoceras* cf. *serorugatum* (Geyer); 5, NS50-119, inner whorls with one quarter of a whorl of body-chamber, × 1.84; 7, NS50-120, body-chamber complete with terminal constriction and peristomal flare, ? microconch; 8, NS50-121 typical larger body-chamber fragment, ? macroconch.
Fig. 9 — *Audaxlytoceras audax* (Meneghini), NS50-131, × 1.55.
Figs 10a, b, 11 — *Phylloceras (Zetoceras) oenotrium* (Fucini), NS50-14, 15.

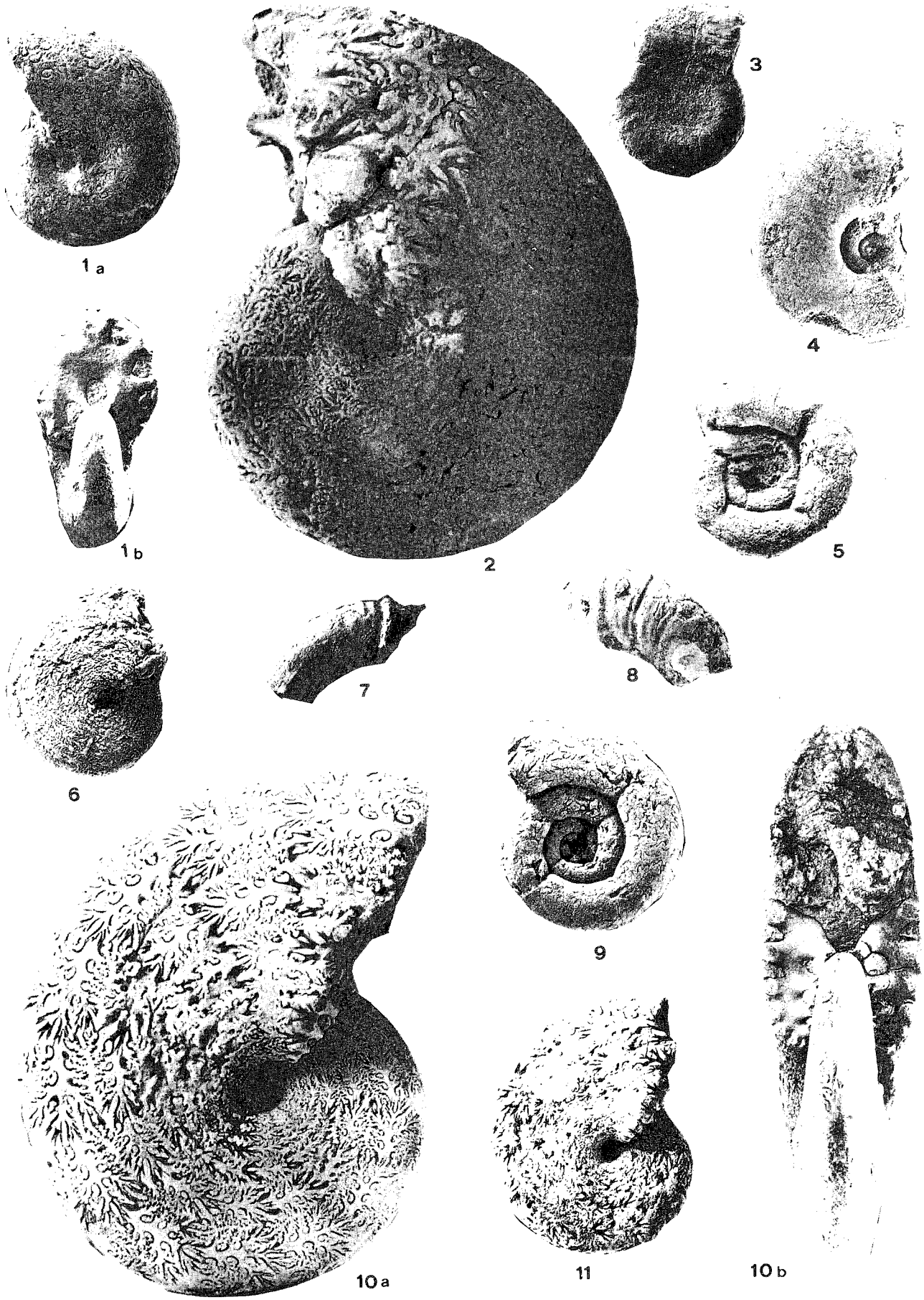

1a
1b
2
3
4
5
6
7
8
9
10a
10b
11

PLATE 2

Figs 1, 4, 8 — *Calliphylloceras bicicolae* (Meneghini), NS50-24, 25, 26.
Figs 2, 3, 10, 11 — *Juraphyllites diopsis* (Gemmellaro); 2, NS50-61; 3, NS50-62; 10, NS5063, mature microconch body-chamber with lappet; 13. NS50-64, Typical large body-chamber fragment, ? macroconch.
Figs 5, 13 — *Juraphyllites libertus* (Gemmellaro); 5, NS50-114, body-chamber fragment; 13, NS50-100, inner whorls, × 1.67.
Fig. 6 — *Tragophylloceras numismale* (Quenstedt), NS50-116, × 1.67.
Figs 7, 9 — *Lytoceras* sp., NS50-113, 4.
Fig. 12 — *Acanthopleuroceras* cf. *valdani* (d'Orbigny), NS50-172.

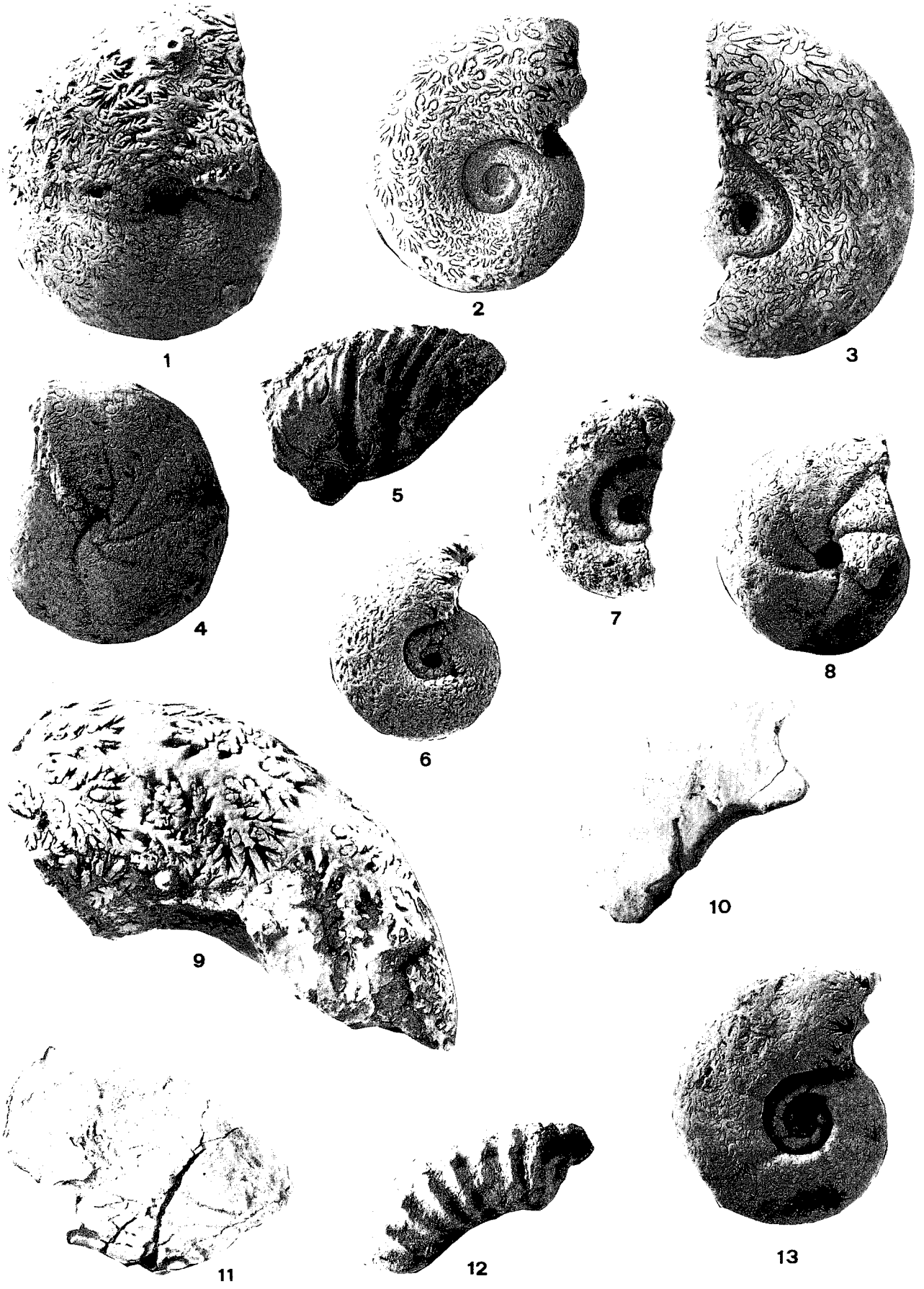
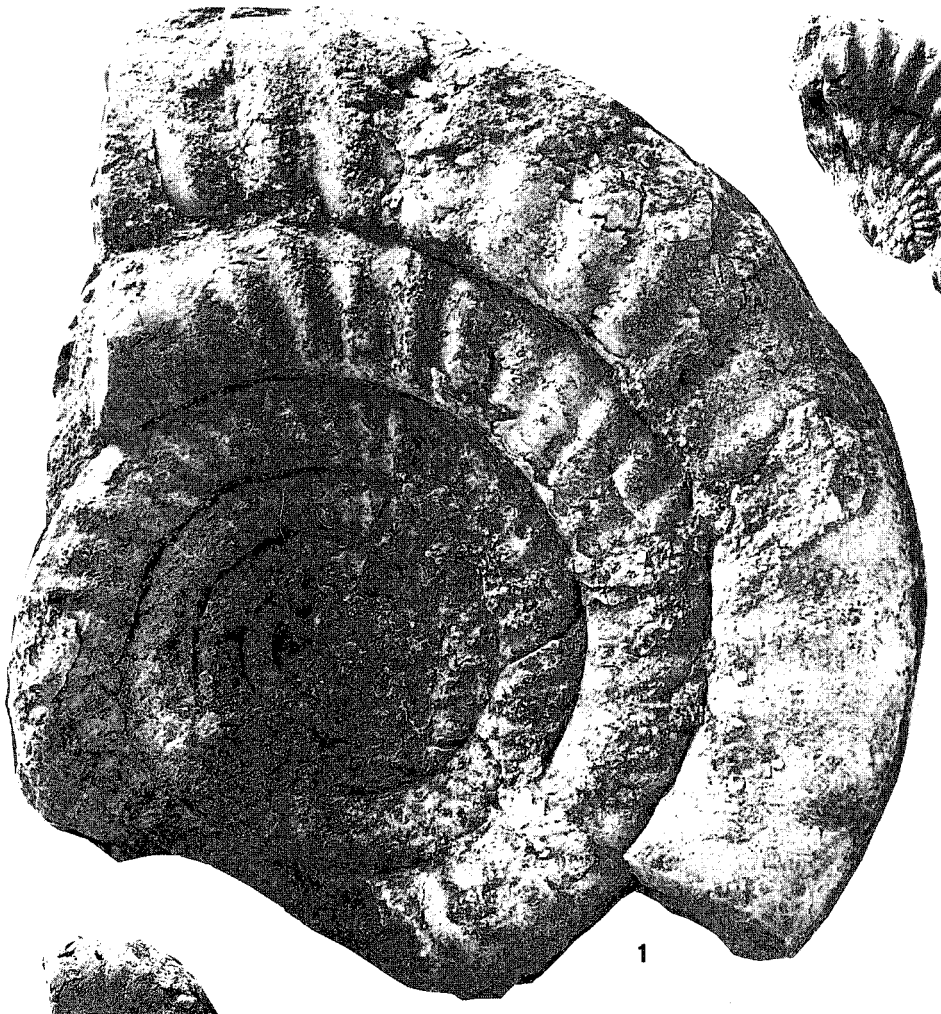

1
2
3
4
5
6
7
8
9
10
11
12
13

PLATE 3

Fig. 1 — *Alsatites liasicus* (d'Orbigny), NS50-136.
Figs 2a, b — *Paltechioceras* cf. *edmundi* (Dumortier), NS50-146, × 2.35.
Figs 3a, b — *Angulaticeras* sp., NS50-137.
Fig. 4 — *Epideroceras (Epideroceras) latinodosum* Bremer, NS50-160, inner whorls of form showing also some affinity with *E. (E.) mersivanum* (Gugenberger).
Figs 5a, b — *Coroniceras* cf. *rotiforme* (J. de C. Sowerby), NS50-177.
Fig. 6 — *Arnioceras* cf. *semicostatum* (Young & Bird), NS50-138.



1

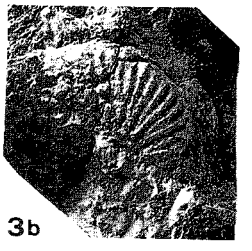
2a



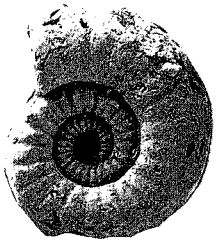
2b



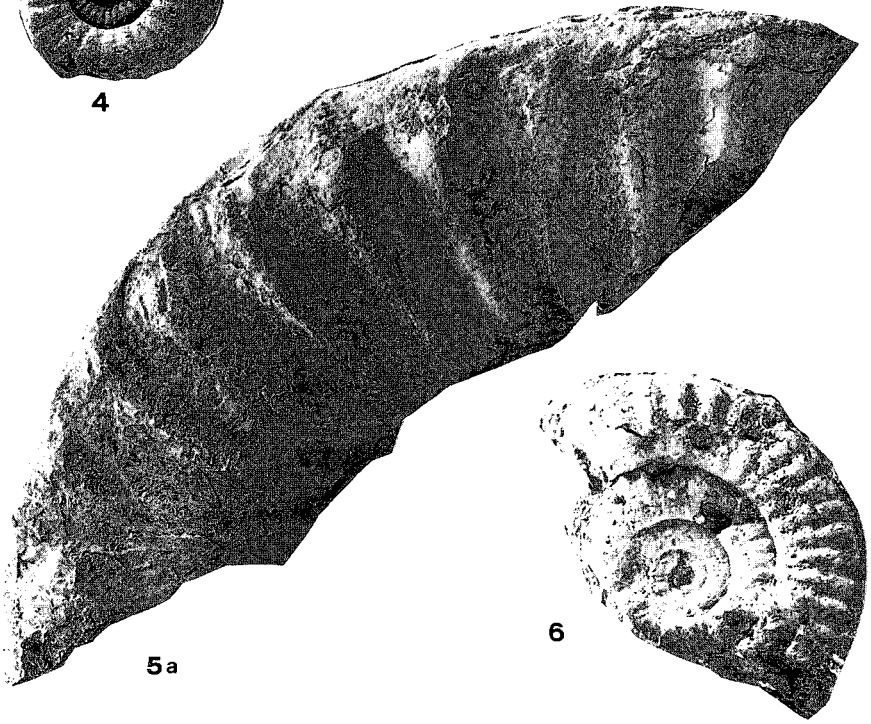
3a



3b



4



5a

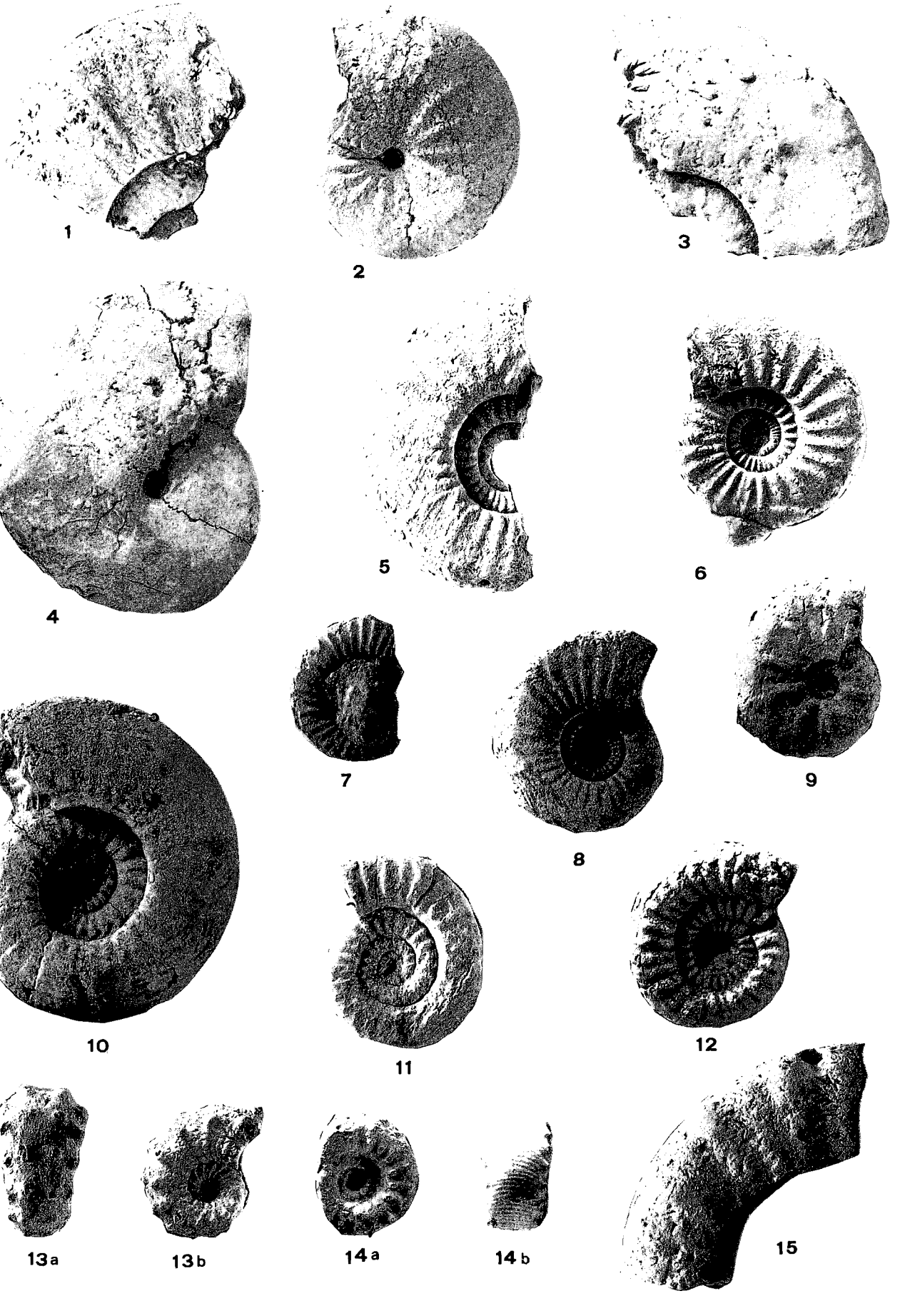


5b

6

PLATE 4

Figs 1, 3 — *Tropidoceras* cf. *masseanum* (d'Orbigny), NS50-173, 4.
Fig. 2 — *Oxynoticeras pompeckji* Gugenberger, NS50-140.
Fig. 4 — *Oxynoticeras scemanni* (Dumortier), NS50-144.
Fig. 5 — *Epideroceras (Pseuduptonia)* sp., NS50-164.
Fig. 6 — *Epideroceras (Pseuduptonia)* cf. *dubium* (Pia), NS50-162, note crinoid hold-fast.
Fig. 7 — *?Polymorphites* sp., NS50-170.
Fig. 8 — *Epideroceras (Pseuduptonia)* cf. *suessi* (Gugenberger), NS50-161.
Fig. 9 — *Hypoxynoticeras* cf. *sphenonotum* (Monke), NS50-145, × 1.6.
Fig. 10 — *Epideroceras (Epideroceras) latinodosum* Bremer, NS50-158.
Fig. 11 — *Uptonia* sp., NS50-168, × 1.8.
Fig. 12 — *Coeloderoceras ponticum* (Pia), NS50-149.
Figs 13a, b — *Phricodoceras taylori (J. de C. Sowerby), NS50-167.*
Figs 14a, b — *?Coeloceras* cf. *heberti* (Oppel), NS50-165.
Fig. 15 — *Ophideroceras* sp., NS50-148.


1
2
3
4
5
6
7
8
9
10
11
12
13a
13b
14a
14b
15