DESMOCERATACEAN AMMONITES FROM THE TYPE TURONIAN

by W. J. KENNEDY *and* C. W. WRIGHT

ASTRACT. *Lewesiceras peramplum* (Mantell), of which *Ammonites lewesiensis* Mantell is a synonym, is one of the commonest ammonites in the Turonian of Touraine, France, ranging from the early Turonian to the top of the mid-Turonian. Also present are *Puzosia* (*Puzosia*) sp. and *Tragodesmoceras mauryae* sp. nov.; both genera were previously unknown in the area.

IN this contribution we describe the representatives of the Desmocerataceae which occur in the Turonian stage in its type area, Touraine in France (see Hancock, Kennedy and Wright 1977 for the most recent review). The genus *Lewesiceras* is frequent in the area, ranging from the early Turonian to the end of the mid-Turonian. *Puzosia* and *Tragodesmoceras* are present in the mid-Turonian but rare; neither has been previously recorded from the area.

This contribution completes our revision of the mid-Turonian ammonites of the stratotype, and complements papers on *Kamerunoceras* (Kennedy and Wright 1979*a*), the vascoceratines (Kennedy and Wright 1979*b*), *Pseudotissotia* (Kennedy, Cooper and Wright 1979), *Romaniceras* (Kennedy, Wright and Hancock 1980*a*), collignoniceratids (Kennedy, Wright and Hancock 1980*b*), and *Spathites* (Kennedy, Wright and Hancock 1980*c*).

SYSTEMATIC DESCRIPTIONS

Repositories of material. These are indicated as follows: OUM—University Museum, Oxford; BMNH—British Museum (Natural History), London; MNHP—Muséum d'Histoire Naturelle, Paris; SP—Sorbonne Collection, now housed in the Université Paris VI; FSR—Faculté des Sciences, Rennes; FSM—Faculté des Sciences, Le Mans (including the collections of the Musée de Tessé, Le Mans); AM—Muséum d'Histoire Naturelle, Angers; CS—Château de Saumur; LC—Lecointre Collection, Château de Grand Pressigny.

Suture terminology. The suture terminology of Wedekind (1916; see Kullmann and Wiedmann 1970 for a recent review) is followed here: I—Internal lobe; U—Umbilical lobe; L—Lateral lobe; E—External lobe.

Dimensions. All dimensions are given in millimetres, figures in parentheses being the percentage of the total diameter. D—diameter; Wb—whorl breadth; Wh—whorl height; U—umbilicus.

Superfamily DESMOCERATACEAE Zittel, 1895
Family DESMOCERATIDAE Zittel, 1895
Subfamily PUZOSIINAE Spath, 1922
Genus *PUZOSIA* Bayle, 1878, explan. pls. 45 and 46

Type species. Ammonites planulatus J. de C. Sowerby, 1827, p. 136, pl. 570, fig. 5 (*non* Schlotheim, 1820, p. 59) (= *Ammonites subplanulatus* Schlüter, 1871, p. 4, pl. 2, figs. 5–7), by subsequent designation by Douvillé, 1879, p. 91; ICNZ pending.

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Puzosia (*Puzosia*) sp.

Plate 76, figs. 1–2

Material. OUM KZ 759, from the St. Cyr-en-Bourg Fossil Bed, *Collignoniceras woollgari* Zone, Champignonnière Les Rochains, 7 km south of Saumur and north-east of Montreuil-Bellay, Maine-et-Loire.

Description. The specimen is an internal mould with the following dimensions:

D	*Wb*	*Wh*	*Wb: Wh*	*U*
102 (100)	34·5 (34)	41·5 (41)	0·83	27 (26)

Coiling is moderately involute with a small, fairly shallow umbilicus with a low wall and sharply rounded shoulder. The whorl section is compressed, with the greatest breadth just below mid-flank. The inner flanks are flattened; the outer flanks converge to an evenly rounded venter. Ornament, which is poorly preserved, consists of narrow, rounded, evenly spaced ribs which are concave and projected over the ventrolateral shoulders into a broad ventral convexity. There are periodic constrictions on the venter and outer flank, separating groups of ribs. Distant primary ribs which extend to the umbilicus are preserved on one flank, and are visible on the inner whorl in Plate 76, fig. 1.

Occurrence. St. Cyr-en-Bourg Fossil Bed, *Collignoniceras woollgari* Zone, Champignonnière Les Rochains, south-east of Saumur, Maine-et-Loire.

Discussion. Whorl section, coiling, and ornament suggest that this is a *Puzosia*; the lack of strong bullae precludes reference to *Lewesiceras*, with which it occurs. Too poorly preserved for specific identification, the specimen probably belongs to the group of *Puzosia curvatisulcata* Chatwin and Withers, 1909, and is of interest as the only representative of the genus from Touraine; indeed the genus is virtually unknown at this level in the European Turonian.

Family PACHYDISCIDAE Spath, 1922
Genus *LEWESICERAS* Spath, 1939, p. 296

Type species. *Ammonites peramplus* Mantell, 1822 by original designation.

Occurrence. Rare in the Cenomanian of Texas, Germany, England and Algeria. Common in the Turonian of western Europe and the U.S.S.R. east to the Crimea, North Caucasus, middle Don and Emba Rivers, and the Mangyschlak Peninsula in Transcaspia. There are some doubtful records from North Africa.

Diagnosis. Both large and small species are known. All are characterized by a rounded, commonly depressed whorl section when young, with strong umbilical tubercles giving rise to groups of prorsiradiate ribs, with intercalatories between, and constrictions. In middle growth ornament is normally differentiated into strong bullate ribs separated by numerous weaker intercalatories; at maturity ribs are distant and much reduced or absent over the venter. Adults may be smooth. The suture has wide, open elements and shallower incisions than in later members of the family.

Discussion. In addition to the type species, of which *Lewesiceras lewesiense* (Mantell, 1822), *L. juvencus* (Laube and Bruder, 1887) and *L. sharpei* Spath, 1926 are synonyms (see below), *L. mantelli* Wright and Wright, 1951 (of which *L. romani* Sornay, 1964 and *L. lenesicense* Houša, 1967 are synonyms), *L. plicatum* Houša, 1967 and *L. woodi* Wright, 1979 are referred to the genus.

All these species are from the Turonian; Pervinquière (1910, p. 37, pl. 3, figs. 1, 2*a*–*b*, 3*a*–*b*) described, as *Pachydiscus* sp., a series of very small ammonites from the Lower Cenomanian of Berrouaghia that may be early representatives of the genus. More recently Young (1979) described a fragment referred to the genus from the Lower Cenomanian Buda Limestone of Texas. Wiedmann and Schneider (1979) have described a representative from the Lower Cenomanian of Germany, and we know of a single specimen from England. These rare examples prove a link between the Upper Albian *Eopachydiscus* Wright, 1955, known to occur only in Texas, and the widespread Turonian *Lewesiceras*. The early whorls of *Eopachydiscus* closely resemble those of *Lewesiceras* with ribs and tubercles, and the latter appears to have evolved paedomorphically from the former.

Coniacian species referred to *Lewesiceras* by, for example, Collignon (1952–5) have been separated by Houša into two genera: *Tongoboroceras* Houša, 1967 for coarsely ribbed round-whorled forms and *Menabonites* Houša, 1967 for those with strong ventrolateral tubercles linked across the venter by fine looped ribs. *Ammonites vaju* Stoliczka, 1865, commonly referred to *Lewesiceras*, is probably a *Nowakites* and is of Santonian age.

Lewesiceras peramplum (Mantell, 1822)

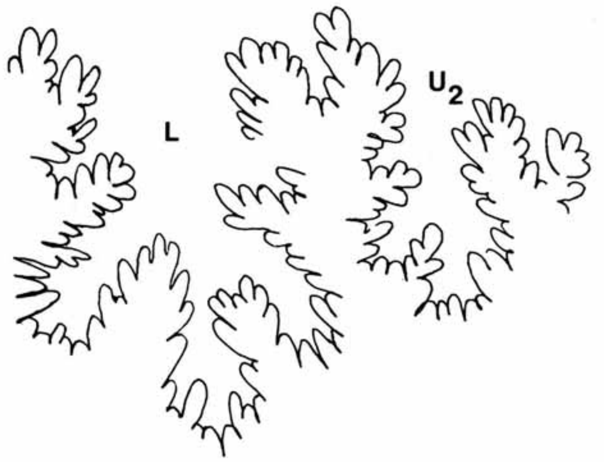
Plate 74; Plate 75, figs. 1–7; text-figs. 1, 2A–B

1822 (May) *Ammonites peramplus* Mantell, p. 200.
1822 (May) *Ammonites lewesiensis* Mantell, p. 199, pl. 22, fig. 2.
1822 (1st July) *Ammonites peramplus* Mantell; J. Sowerby, p. 79, pl. 357.
1853 *Ammonites peramplus* Mantell; Sharpe (*pars*), p. 26, pl. 10, figs. 1*a*, *b* only.
1857 *Ammonites lewesiensis* Mantell; Sharpe, p. 46, pl. 21, figs. 1*a–c*.
1871 *Ammonites lewesiensis* Mnt.; Schlüter, p. 23, pl. 8, figs. 5, 6 (*non* 7); pl. 9, fig. 7.
1872 *Ammonites peramplus*, Mant.; Fritsch, p. 38, pl. 8, figs. 2, 3 (? fig. 1) only.
1887 *Pachydiscus peramplus* Mantell sp.; Laube and Bruder, p. 225, text-figs. 3*a*, *b*.
1887 *Pachydiscus Lewesiensis* Mantell sp.; Laube and Bruder, p. 226, text-figs. 4*a–c*.
1887 *Pachydiscus juvencus* Laube and Bruder, p. 228, pl. 29, fig. 1.
1894 *Sonneratia perampla*; Grossouvre, pp. 49, 109, 144 (*non* figs. 42, 63).
1899 *Ammonites peramplus*; Grossouvre, p. 328.
1902 *Pachydiscus peramplus* Mant. spec.; Petrascheck, p. 137, pl. 7, fig. 2.
1926 *Pachydiscus peramplus* (Mantell); Spath, p. 82.
1926 *Pachydiscus sharpei* Spath, p. 82.
1939 *Lewesiceras peramplum* (Mantell); Spath, p. 296.
1939 *Pachydiscus peramplus* Mant.; Dacqué, p. 110, pl. 5, fig. 1.
1951 *Lewesiceras peramplum* (Mantell); Wright and Wright, p. 20.
1951 *Lewesiceras lewesiense* (Mantell); Wright and Wright, p. 20.
1951 *Lewesiceras sharpei* Spath; Wright and Wright, p. 20.
1967 *Lewesiceras peramplum* (Mantell); Houša, p. 10, pls. 1–3; pl. 4, figs. 1, 2; text-fig. 3.
1978 *Lewesiceras peramplum* (Mantell); Kennedy and Hancock, pl. 24, figs. 1A–C.
1978 *Lewesiceras lewesiense* (Mantell); Kennedy and Hancock, p. V.19.
1980 *Lewesiceras peramplum* (Mantell); Amedro *in* Robaszynski, Amedro, Foucher, Gaspard, Magniez-Jannin, Manivit and Sornay, pp. 214, 231; pl. 7, fig. 6; pl. 8, figs. 1*a*, *b*, 2*a*, *b*.

Types. The lectotype, designated by Amedro (in Robaszynski *et al*. 1980, p. 231) and figured by him as Plate 7, fig. 6; Plate 8, figs. 1*a*, *b*, is BMNH 8108, one of Mantell's (1822) syntypes from 'Lewes, Sussex'. (The tablet on which it stands is labelled holotype in pencil.) The other syntypes, now paratypes, have not been traced. J. Sowerby's (1822, pl. 357) figured specimen is BMNH C44454. Mantell's (1822, pl. 22, fig. 2) figured syntype of *Ammonites lewesiensis* (recently refigured by Amedro *in* Robaszynski *et al*. pl. 8, figs. 2*a*, *b*) is BMNH C3378. Sharpe's (1857, pl. 21, fig. 1) specimen of *A. lewesiensis* is BMNH 36832.

Material. We have seen scores of specimens, in the OUM, BMNH, MNHP, SP, FSR, FSM, AM, CS, and LC collections from many localities in the Saumur region, from Bourré, Poncé, Loches, Lodon and other well-known tuffeau localities.

Dimensions		*D*	*Wb*	*Wh*	*Wb: Wh*	*U*
OUM KZ 764	c	33·9 (100)	15·2 (45)	13·2 (39)	1·15	11·4 (34)
	ic		11·1 (33)	13·2 (39)	0·84	
OUM KZ 763	c	43·9 (100)	19·0 (43)	19·4 (44)	0·98	— (—)
	ic		17·0 (39)	19·4 (44)	0·88	— (—)
EMP. Coll. Bourgeois		124·0 (100)	— (—)	49·5 (40)	—	39·0 (31)
1849	at	106·0 (100)	39·2 (37)	42·5 (40)	0·92	31·0 (29)
MNHP 1893–12		135·0 (200)	52·0 (39)	55·0 (41)	0·95	42·5 (32)
FSM 158		223·0 (100)	105·5 (47)	94·0 (42)	1·12	70·5 (32)
English specimens:						
BMNH 44454		280 (200)	130 (46)	107 (38)	1·21	90 (32)
BMNH 36833		304 (100)	115 (38)	113 (37)	1·01	88·5 (29)
BMNH C 3378		415 (100)	123 (30)	245 (59)	0·50	68 (16)



TEXT-FIG. 1. *Lewesiceras peramplum* (Mantell). Partial external suture of OUM KZ 763, from the St. Cyr-en-Bourg Fossil Bed, Champignonnière Les Rochains, south of Saumur. ×6.

Description. This is a very large species, tuffeau specimens reaching almost a metre in diameter. Four distinctive growth stages can be recognized. The smallest specimens before us (Pl. 75, figs. 1–7) are moderately involute, with up to 80%of the previous whorl being covered. The umbilicus is of moderate depth, with a flattened wall; the umbilical shoulder is sharply rounded. The intercostal section varies from slightly to markedly depressed (Wb:Wh ratios vary from 0·88 to 0·84) with convergent, flattened flanks and a broadly rounded venter. The greatest breadth is just outside the umbilical shoulder. There are an estimated seven umbilical bullae per whorl at diameters up to about 60 mm. These vary from strong (in depressed individuals—Pl. 75, figs. 4, 5) to weak (in more compressed ones—Pl. 75, figs. 1–3). They give rise to strong, prorsiradiate gently flexuous or concave ribs singly or in pairs, which sweep forwards over the ventrolateral shoulders to form a narrow ventral convexity (Pl. 75, fig. 5). Up to three shorter, intercalated ribs, arising some way up the flank are present between the main ribs, and are of variable strength and length. There are well-marked constrictions, in front and/or behind the primary ribs. In the second growth stage, which generally extends to at most 130 mm, the whorl section commonly becomes less depressed and the umbilicus shallower. The umbilical bullae decline in strength relative to the primary ribs. These are distant (usually seven to nine per whorl), prorsiradiate, initially gently flexuous, but later straight across the inner and middle flank and projected abruptly forwards across the ventrolateral shoulder. Between these primary ribs are much weaker, shorter, variably developed secondaries, their number increasing progressively until there are up to seven between primaries. This stage is not well represented in the Touraine material.

In the third growth stage the secondary ribs disappear (Pl. 74), and the primary ribs extend from the umbilical bulla to the outer flank, declining as they do so, and virtually effaced on the venter. The whorl section varies from

EXPLANATION OF PLATE 74

Lewesiceras peramplum (Mantell). MNHP, Tuffeau de Touraine, Poncé, Sarthe. A slender variant. Reduced ×0·9.

2

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oval (Pl. 74), when ribs are weak, to circulate-quadrate (text-fig. 2), when ribs are very strong. There are generally from eleven to fifteen bar-like ribs during this third growth stage and, as size increases, the whorls become smooth but for the coarse folds on the flank. Adult body chambers eventually lose all ornament and are commonly crushed, with an apparent very rapid increase in expansion rate.

The suture line has narrow, deeply and finely incised bifid saddles in which the folioles are characteristically parallel-sided, and moderately splayed lobes, of which the first lateral is symmetrically bifid (Houša 1957, fig. 3). The less complex juvenile suture of a Touraine example is shown in text-fig. 1.

Occurrence. In Touraine *Lewesiceras peramplum* first appears in the Lower Turonian Craie Marneuse (e.g. Lecointre 1960). It is common in the St. Cyr-en-Bourg Fossil Bed (54% of the fauna according to Amedro and Badillet 1978) and appears to be one of the commonest ammonites in the higher faunas of Bourré and Poncé.

The Lecointre Collection, housed at the Château de Grand Pressigny, contains a series of poor *Lewesiceras* from the Tuffeau Jaune which appear to belong to this species, indicating that its range in Touraine spans the *Mammites nodosoides* and *Collignoniceras woollgari* Zones. Similarly in England and the Paris Basin it ranges throughout the greater part of the Middle Chalk. Above, in the rich faunas of the Chalk Rock (*Subprionocyclus neptuni* Zone), it is replaced by *L. mantelli* and *L. woodi*. The specimen of *L. mantelli* recently recorded from the *Terebratulina lata* Zone of Surrey (Wright 1979) appears, on preparation, to be a *L. peramplum* nucleus, and this probably applies to all *lata* Zone records of *L. mantelli*. The geographic range of the species extends from England and the Paris Basin south to Touraine and, possibly, south-eastern France. It is also known from Czechoslovakia and Germany. Records from North Africa are doubtful.

TEXT-FIG. 2. *Lewesiceras peramplum* (Mantell). FSM 158, from the Tuffeau de Touraine of Poncé, Sarthe. A robust variant. Reduced ×0·3.

EXPLANATION OF PLATE 75

Figs. 1–7. *Lewesiceras peramplum* (Mantell). 1–3, OUM KZ 763; 4, 5, OUM KZ 764, from the St. Cyr-en-Bourg Fossil Bed, Champignonnière Les Rochains, south of Saumur, Maine-et-Loire. 6, 7, EMP, from Bourré, Loir-et-Cher.

Figs. 8–11. *Lewesiceras mantelli* Wright and Wright. 8, 9, holotype, BMNH 88587 (= Sharpe 1853, pl. 10, figs. 3*a*, *b*), from the Chalk Rock, *Subprionocyclus neptuni* Zone, Oldbury Hill, Wiltshire. 10, 11, BMNH C32289 (= Billinghurst 1927, text-fig. 2*c*), from the same horizon at Hitch Wood, near Stevenage, Herts.

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Discussion. Houša (1957) has given a lengthy synonymy of this species, but we have listed above only those citations which can, in our view, be firmly attributed to the species. *Ammonites lewesiensis* Mantell (1822, p. 199, pl. 22, fig. 2) was distinguished from *Ammonites peramplus* by its much greater involution, 'minute umbilicus', 'very narrow, rounded keel' and 'acutely saggitate aperture'. The figured specimen has recently been figured photographically by Amedro *in* Robaszynski *et al.* 1980, pl. 8, figs. 2*a*, *b*. Apparent differences are due to crushing; some giant Touraine specimens show this same deformation of the body chamber and are commonly identified as *Neoptychites cephalotus* (Courtiller).

All previously figured *L. peramplum* have been crushed and distorted to varying degrees, with the exception of Sowerby's very large specimen (1822, pl. 357). The Touraine material allows, for the first time, comparison of undeformed material with the much better known *L. mantelli* Wright and Wright. The holotype of the latter (Pl. 75, figs. 8, 9), a juvenile, is clearly conspecific with the small paratype of *L. romani* Sornay (Pl. 76, figs. 3, 4) which retains a silicified shell. These specimens show that juveniles of *L. mantelli* and *L. peramplum* are very similar, but in middle growth (e.g. Pl. 75, figs. 10–11, a chalk *L. mantelli*, and Pl. 76, figs. 5–6, the holotype of *L. romani*, which retains silicified shell) *L. mantelli* is usually more inflated, its secondary ribs disappear at a much earlier stage (Pl. 76, fig. 6) and are never more than four between primary ribs and the more numerous primaries are effaced on the venter at a much smaller size. Adult specimens that we have seen never approach the dimensions of *L. peramplum*. *L. lenesicense* Houša (1967, p. 35, pl. 8, figs. 1–7, text-fig. 4) appears to be based on juvenile *L. mantelli*; they all show a very depressed whorl with strong umbilical bullae.

L. plicatum Houša (1957, p. 32, pl. 7, figs. 1–4) is a smaller, compressed Upper Turonian descendant of the *L. peramplum*–*L. mantelli* stock, and shows a further telescoping of ontogenetic features, as is clearly demonstrated by Houša. Secondary ribs are not so clearly differentiated and middle-sized and adult specimens have persistent sinuous ribs with up to seventeen primaries per whorl (Houša 1967, pl. 7, fig. 4). *L. woodi* Wright (1979, p. 312, pl. 3, fig. 21; pl. 6, fig. 6) is an Upper Turonian species known only from small specimens. The ornament is very weak, with eight or nine well-marked constrictions per whorl with associated primary ribs with very feeble bullae; there are two to four feeble secondaries. These features immediately distinguish it from *L. peramplum* of comparable size.

Family MUNIERICERATIDAE Wright, 1952
Genus *TRAGODESMOCERAS* Spath, 1922, p. 127

Type species. By original designation, *Desmoceras clypealoides* Leonhard, 1897, p. 57, pl. 6, figs. 2*a*, *b*.

Diagnosis. Small to medium sized, moderately involute, compressed. Inner whorls usually very compressed, with lanceolate whorl section or fastigiate venter. Flanks ornamented by dense flexuous primary and secondary ribs, strong across the venter, which is markedly crenulate in profile. Constrictions and periodic strengthened ribs are present. In middle and later growth the venter becomes broad and round, and constrictions and periodic ribs strengthen at the expense of the other ribs.

Suture with relatively shallow, denticulate elements.

EXPLANATION OF PLATE 76

Figs. 1, 2. *Puzosia* (*Puzosia*) sp., OUM KZ 759, from the St. Cyr-en-Bourg Fossil Bed, Champignonnière L. Rochains, south of Saumur, Maine-et-Loire.

Figs. 3–6. *Lewesiceras mantelli* Wright and Wright. 3, 4, paratype of *L. romani* Sornay in the Dumorti Collection (Muséum de Lyon); 5, 6, the holotype of *L. romani*, MNHP; both from the silicified *S. neptuni* Zo fauna at Uchaux, Vaucluse.

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Discussion. Tragodesmoceras probably evolved from *Tragodesmoceratoides* Matsumoto, 1942 or *Pseudouhligella* Matsumoto, 1942 of Desmoceratinae during the late Cenomanian or early Turonian (Matsumoto, 1954) by compression of whorls, angulation of venter and strengthening of ribs to give the sharp, serrated ventral profile. It probably gave rise to *Muniericeras* de Grossouvre, 1894 of the Coniacian, which is more evolute, has sharper ribs with umbilical and ventrolateral tubercles in some, the ribs branching at both umbilicus and shoulder, never strengthened periodically and strongly projected on the shoulder. The venter may develop a serrated keel, rather than being fastigiate as in *Tragodesmoceras*.

In addition to the type species, *Ammonites clypealis* Schlüter (1872, p. 51, pl. 15, figs. 9–14), *Muniericeras dresdense* Petrascheck (1902, p. 136, pl. 7, fig. 1, text-figs. 2, 3), *T. bassi* Marrow (1935, p. 468, pl. 52, figs. 1*a–c*; pl. 53, figs. 3–5; text-figs. 1–3), *Desmoceras ashlandicum* Anderson (1902, p. 100, pl. 4, figs. 107, 109; pl. 10, fig. 196) and *T. carlilense* Cobban (1971, p. 8, pl. 3, figs. 1, 2; pl. 4, figs. 1–16; pl. 5, figs. 1–5; text-figs. 6–8) all clearly belong to the genus.

Of other species referred to the genus, *Ammonites hernensis* Schlüter (1867, p. 35, pl. 6, fig. 4) has umbilical tubercles and may be a *Nowakites* according to Matsumoto (1954). *Ammonites hernensis* Schlüter, 1872 (p. 40, pl. 11, figs. 12–14) was renamed *Puzosia muelleri* by de Grossouvre (1894, p. 172). *Tragodesmoceras bererense* Collignon (1966, p. 86, pl. 490, fig. 1974) is a Santonian species and its affinities are problematic as it is known only from a body-chamber fragment.

This is a very rare genus in Europe and only a handful of specimens is known from the Turonian. Our understanding of the genus has been clarified, however, by the description of numerous beautifully preserved specimens from the Turonian Carlile Shale of the Black Hills region of the U.S. Western Interior (Cobban 1971).

Occurrence. Where well-dated this is a mid-Turonian genus, with records from Germany, France, Texas, the U.S. Western Interior and California. Ødum (1953, p. 24, pl. 4, fig. 3) records *Tragodesmoceras* cf. *hernense* from the Santonian of Sweden and Schlüter originally recorded *hernense* from the 'Untersenon'.

Tragodesmoceras mauryae sp. nov.

Text-fig. 3A–D.

Holotype. MNHP 6787a (d'Orbigny Collection), from the mid-Turonian *Collignoniceras woollgari* fauna of the Tuffeau de Touraine at Bourré, Loire-et-Cher.

Derivation of name. The species is named after M. Maury of the Angers Museum, who has assisted us in many ways during our researches on the ammonites of Touraine.

Dimensions	*D*	*Wb*	*Wh*	*Wb:Wh*	*U*
MNHP 6787a	110 (100)	37·0 (34)	54·0 (49)	0·69	25·0 (23)
at	97·0 (100)	33·9 (35)	45·6 (47)	0·74	21·2 (22)

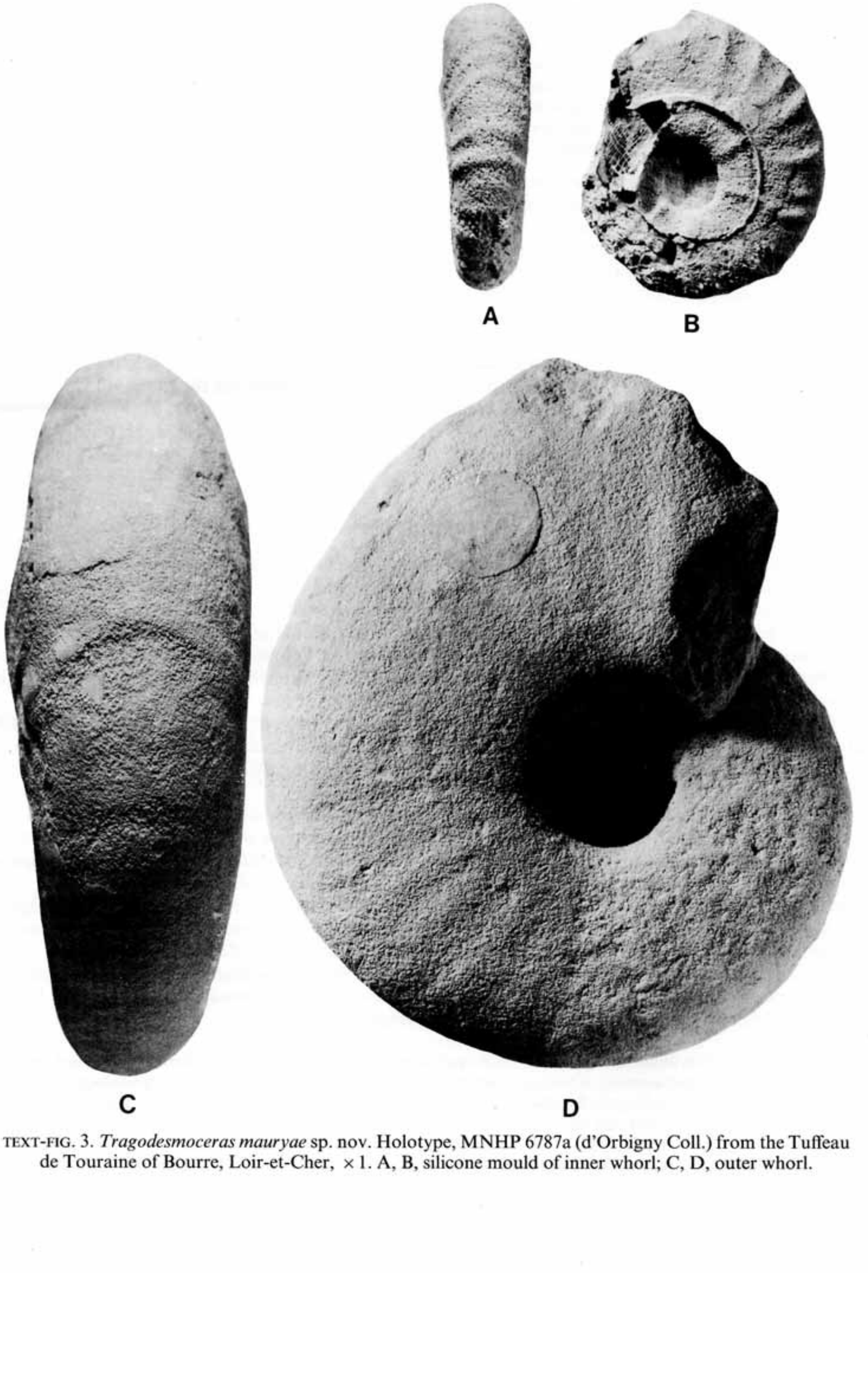
Occurrence. Tuffeau de Touraine, *Collignoniceras woollgari* Zone, Bourré, Loir-et-Cher.

Diagnosis. Inner whorls with sparse periodic ribs (seven per whorl) and two or three coarse intercalatories; venter rounded at first, fastigiate at the end of the phragmocone. Body chamber shows rapid reduction of ribbing, persistence of shallow constrictions and rounding of the venter.

Description. The holotype is a fairly well-preserved internal mould of the outer whorl of a specimen, the first third of which is septate. The inner whorls are lacking, but a mould of the umbilicus and the dorsum of the outer whorl (text-fig. 3A, B) show the features of the early whorls at a diameter of 50–60 mm.

The coiling of the early whorls appears to have been involute, with a compressed whorl section, the greatest breadth low on the flanks, with flattened sides and a narrow, rather rounded fastigiate venter. The umbilical mould shows that there were seven strong periodic ribs to a whorl and that the inner flanks were smooth between. The ribs sweep forwards to mid flank, where two or three shorter ribs are intercalated. All pass across the venter with a broad forwards convexity.

The outer whorl is involute (text-fig. 3C, D), with about 70% of the previous whorl covered. The umbilicus is small (22% of diameter) of moderate depth, with a flattened, outwards-inclined wall and an abruptly rounded



TEXT-FIG. 3. *Tragodesmoceras mauryae* sp. nov. Holotype, MNHP 6787a (d'Orbigny Coll.) from the Tuffeau de Touraine of Bourre, Loir-et-Cher, × 1. A, B, silicone mould of inner whorl; C, D, outer whorl.

shoulder. On the phragmocone the whorl breadth to height ratio is 0·73, with the greatest breadth just outside the umbilical shoulder, the inner flanks flattened and the outer flanks converging to a rounded fastigiate venter.

Ornament consists of coarse, low, rather distant primary and secondary ribs, strengthened across the ventrolateral shoulder and projected to form a chevron of approximately 90° over the venter. These ribs decline rapidly at the beginning of the body chamber; the venter becomes broad and round and the flanks are ornamented by low, broad, dense, flexuous prorsiradiate ribs, which cross the venter with a broad convexity. Periodic shallow constrictions are well developed, each with a parallel strengthened primary rib.

The sutures are only imperfectly preserved, but appear simple, with relatively shallow incisions.

Discussion. The ornament of the inner and outer whorls, whorl section and constrictions clearly show this to be a *Tragodesmoceras*, the features of which are so distinct as to merit separation from previously described species. The relatively broad venter of the inner whorls and coarseness of ribs immediately distinguish it from *Tragodesmoceras clypealoides* and *T. clypeale*; *T. dresdense* has finer ribbing and an acute venter (it is in many respects transitional to *Muniericeras*). The Californian *T. ashlandicum* (see especially Matsumoto 1959, p. 26, pl. 5, figs. 1*a*, *b*; text-figs. 8–10) has a comparably coarse-ribbed early stage, but in middle growth the flexuous ribs, the primaries having well-marked bullae and the body chamber retaining a narrow venter and numerous coarse ribs at greater diameters than the present species are distinctive. *T. bassi* Morrow (see Cobban and Scott 1972, p. 58, pl. 38, figs. 2, 3, 5–13; pl. 39) is much more densely and finely ribbed on the inner whorls, with a fastigiate venter, apparently growing to a greater size (Cobban and Scott 1972, pl. 39—a specimen 310 mm in diameter). In *T. carlilense* Cobban (1971, p. 8, pl. 3, figs. 1, 2; pl. 4, figs. 1–16; pl. 5, figs. 1–5; text-figs. 6–8) the inner whorls are finely ribbed with a sharper venter, the outer whorls being more compressed with finer ribbing.

DISCUSSION

The representatives of Democeratidae, Pachydiscidae and Muniericeratidae described here complete our account of the rich mid-Turonian faunas of the Tuffeau de Touraine. *Puzosia* sp. and *Tragodesmoceras mauryae* sp. nov. represent new records for the area and both are very rare. In contrast, the pachydiscid *Lewesiceras peramplum* makes up half the ammonite assemblage (in terms of numbers of specimens) in the St. Cyr-en-Bourg Fossil bed (low in the broad *Collignoniceras woollgari* Zone, the *Romaniceras kallesi* Zone of Hancock, Kennedy and Wright, 1977) and is common throughout the higher faunas of the *ornatissimum* Zone (= *deverioide* Zone of Hancock *et al.* 1977) and *deverianum* Zone. *Lewesiceras* appears to be a largely northern genus, being rare, if not absent in the rich Mediterranean, African and Middle East Turonian faunas described by, for example, Choffat (1898), Wiedmann (1960, 1964), Pervinquière (1907), Freund and Raab (1969), Collignon (1967) and Reyment (1955).

These desmocerataceans alone are insufficient to allow speculation on the regional affinities of the Touraine mid-Turonian fauna. Taken, however, with the occurrence of mesogean elements such as *Spathites* (*Jeanrogericeras*) Kummel and Decker, 1934, *Neoptychites* Kossmat, 1895, *Fagesia* Pervinquière, 1907 *Vascoceras* Choffat, 1898 and *Kamerunoceras* Reyment, 1954 they lend a distinctive 'southern' aspect to the *kallesi* Zone fauna, which is much more marked than in the higher faunas of the Tuffeau de Touraine and the Tuffeau Jaune. These affinities recall those of the earlier Turonian, where in southern England and Normandy, the genus *Fagesia* Pervinquière, 1907 (= *Plesiovascoceras* Spath, 1925) is frequent, or the uppermost Cenomanian of southern England and France which has yielded rare *Spathites*, *Vascoceras* (= *Provascoceras* Cooper, 1978), *Nigericeras* Schneegans, 1943, and *Thomasites* Pervinquière, 1907.

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