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Lewesiceras Spath (Pachydiscidae, Ammonoidea) from the Turonian of Bohemia

(*8 text-figures, 8 plates, Czech summary*)

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Abstract: Of the family *Pachydiscidae* SPATH, 1922 only a single genus, *Lewesiceras* SPATH, 1939, has been found in the Cretaceous of Bohemia, represented here by four species, i.e. *L. peramplum* (MANTELL, 1822), *L. mantelli* WRIGHT et WRIGHT, 1951, *L. plicatum* sp. n., and *L. lenesicense* sp. n. The ontogenetic development of individual species, particularly of the species *L. peramplum*, has been studied in detail, and the evolutionary trend of morphological changes during the Turonian has been demonstrated. The species hitherto assigned to the genus *Lewesiceras* have been evaluated on the basis of the literature and classified into evolutionary lines. Two new genera, *Menabonites* and *Tongoboryceras* are erected for groups of previously described species.

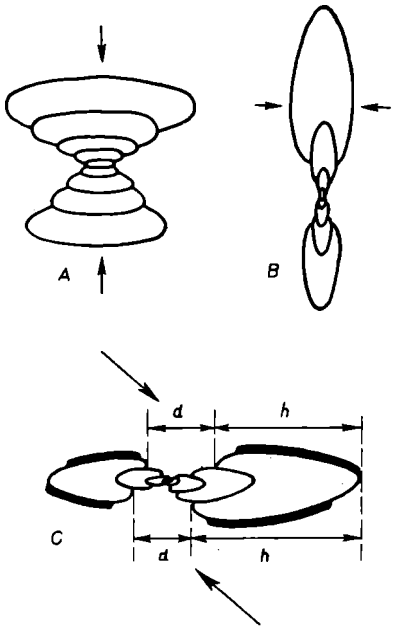
Introduction

Representatives of the genus *Lewesiceras* SPATH, 1939, occur in the Cretaceous of Bohemia only in the Turonian. Four species are present here, which have, however, up to the present been referred to a single species designated as "*Pachydiscus*" *peramplus* (MANTELL, 1822). "*Pachydiscus*" *lewesiensis* (MANTELL, 1822) and "*Pachydiscus*" *juvencus* LAUBE et BRUDER, 1887 have been separated only exceptionally as independent species. I consider, however, both these species to be identical with *L. peramplum* (MANT.) (see below).

Ammonites are not abundant fossils in the Cretaceous of Bohemia (with the exception of several localities with limonitized or pyritized remains). This is true also of the genus *Lewesiceras* SPATH. The material studied comprises roughly 300 specimens mainly from old collections. Most of the material derives from the Bílá hora quarries in Prague (Lower Turonian, Bílá hora Beds – approx. 50 per cent of the material), which are abandoned today and almost completely filled with refuse, and from the quarries around Teplice (Upper Turonian, Teplice Beds – roughly 15 per cent of the material), also mostly disused today. Sporadic finds have been made also in the region of the Jizera Beds (Middle Turonian), in the quarries round Měcholupy near Louny (Lower Turonian), in the Malnice glauco-

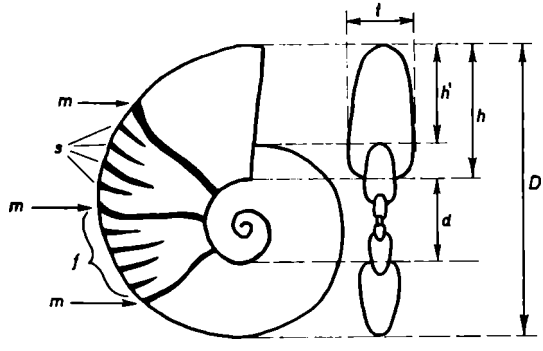
nitic sandstone in the Louny region (uppermost Lower Turonian) and elsewhere.[1]

Most of the material studied is deposited in the collections of the National Museum in Prague – Museum of Natural History (abbreviation NM in text). Access to this material was given to me by the courtesy of Dr. V. Zázvorka, head curator of the Palaeontological Department. I have also used for this study material from the collections of the Palaeontological Department of the Faculty of Natural Sciences, Charles University, Prague (abbr. PFUK) and, to a small extent, the material obtained from my own palaeontological field-work (abbr. GÚ ČSAV – Geological Institute of the Czechoslovak Academy of Sciences). The specimens deposited in the collections of the



1. Diagram of shell deformation

A — depression; *B* — compression; *C* — oblique compression. Deformation of dimensions *D* and *d* at oblique compression does not practically take place, whereas *h* is very distinctly deformed. This deformation creates a false venter and the sculpture elements (ribs in the figure) on one side of the shell seem to reach as far as the "venter", whereas on the opposite side they terminate already far from the "venter" (orig.)



2. Used dimensions of an ammonite shell and morphology of ribbing

D — diameter of shell; *h* — whorl height; *h'* — medial whorl height; *d* — umbilical width; *t* — whorl width; *m* — main rib; *s* — small rib; *f* — field (orig.)

Hradec Králové, Teplice, Litoměřice, Bílina Museums and elsewhere have also been investigated. Details are given in the description of individual species.

Generally, the preservation of ammonites is relatively poor in the Cretaceous of Bohemia (with the exception of several localities with limonitized and pyritized internal moulds of juvenile parts of shells). They occur always as variously deformed internal moulds in sandstones, sandy marlstones or limestones. The terminology of deformations employed and the drawing of some of the measured data are illustrated in fig. 1. The main measured data and their designation are

1 For detailed data on the stratigraphy of the Cretaceous of Bohemia see in V. Klein - J. Soukup 1966.

shown in fig. 2. The suture is more distinctly preserved only in a few specimens, with the exception of *L. lenesicense* sp. n. (known only from limonitized internal moulds of juvenile parts of shells), on which the suture is generally very well preserved.

Acknowledgement. I am very much indebted to Dr. C. W. Wright who kindly read and critized the manuscript and offered helpful suggestions.

Systematic descriptions

Pachydiscidae SPATH, 1922

Only a single genus – *Lewesiceras* SPATH, 1939 (four species) has been ascertained from this family in the Cretaceous of Bohemia. It occurs in the Turonian only.

The main development of the family *Pachydiscidae* starts only in the Coniacian, Santonian, Campanian, and Maestrichtian. The Turonian genus *Lewesiceras* is actually the phylogenetic ancestor of numerous Senonian groups.

Lewesiceras SPATH, 1922

Type species: *Ammonites peramplum* MANTELL, 1822.

Diagnosis: Genus of the family *Pachydiscidae* SPATH, 1922; inner whorls (up to D = 50–100 mm) with main ribs, sometimes slightly sinuate, bent forward on the venter and accompanied on the front edge by a shallow constriction; on the ribs are strong umbilical tubercles, which later in ontogeny become flatter and merge with the ribs; the small ribs are less bent forward and do not reach the umbilical margin; during the development of the shell the umbilical tubercles and small ribs gradually disappear, the main ribs become stronger, barlike and straight, and do not cross over the venter; these prominent barlike ribs remain on the flanks of the whorl right up to the end of development of the shell.

Stratigraphic range: Turonian.

Geographical distribution: England, France, northern Germany, Saxony, Czechoslovakia, North Afrika, Crimea, Caucasus, the southern regions of the Russian Plateau, India; ? U.S.A. (Montana).

Occurrence: practically everywhere in the Turonian of the Cretaceous of Bohemia (for more detailed data see under the individual species).

Species:

L. peramplum (MANTELL, 1822) – Lower and Middle Turonian
L. mantelli WRIGHT et WRIGHT, 1951 – Middle and Upper Turonian
L. plicatum sp. n. – Upper Turonian
L. lenesicense sp. n. – Upper Turonian
L. vaju (STOLICZKA, 1865) – Turonian

Only the first four species occur in the Cretaceous of Bohemia.

Notes on the phylogeny of the genus and its relation to allied genera are given on page 39.

Lewesiceras peramplum (MANTELL, 1822)

Pls. I–III, pl. IV, figs. 1, 2, text-fig. 3

1822 *Ammonites peramplum*; G. A. MANTELL: The fossils of the South Downs etc., p. 200–201.

? 1822 *Ammonites Lewesiensis*; G. A. MANTELL: ibid., p. 199–200, pl. 22, fig. 2.

1823 *Ammonites peramplus*; partim – J. SOWERBY: The mineral conchology etc., IV, p. 79; non pl. 357 [= *Lewesiceras ? mantelli* (WRIGHT et WRIGHT, 1951)].

1840 *Ammonites peramplus*, MANTELL; partim – A. D'ORBIGNY: Paléontologie française, Terrains crétacés, I, Céphalopodes, p. 333–334; non pl. 100, figs. 1, 2 [= *Lewesiceras mantelli* (WRIGHT et WRIGHT, 1951)].

1840 *Ammonites Lewesiensis* MANT.; partim – H. B. GEINITZ: Charakteristik der Schichten u. Petrefacten etc., Heft 2, p. 39–40, pl. 12, figs. 2a, 2b; non pl. 13, fig. 4 [= cf. *Placenticeras memoria-schloenbachi* (LAUBE et BRUDER, 1887)].

1841 *Ammonites peramplus* SOW.; partim – F. A. ROEMER: Versteinerungen etc., p. 87.

1842 *Ammonites peramplus*; partim – H. B. GEINITZ: Charakteristik der Schichten und Petrefacten etc., Heft 3, p. 67, p. iv.

1845 *Ammonites peramplus* MANTELL; partim – J. SOWERBY: Conchologie minéralogique etc. 1, p. 383; non pl. 235 (357) [= *Lewesiceras ? mantelli* (WRIGHT et WRIGHT, 1951)].

1845 *Ammonites peramplus* SOWERBY; partim – A. E. REUSS: Die Versteinerungen etc., p. 21.

1846 *Ammonites peramplus* SOW.; partim – H. B. GEINITZ: Grundriß d. Versteinerungskunde, p. 297.

1849 *Ammonites peramplus*; partim – F. A. QUENSTEDT: Petrefactenkunde Deutschlands, Cephalopoden, p. 216–217.

1850 *Ammonites peramplus*; partim – H. B. GEINITZ: Das Quadersandsteingebirge oder Kreidegebirge in Deutschland, p. 116, pl. 5, figs. 1a, b, 3; non pl. 5, fig. 2 [= *Lewesiceras* cf. *mantelli* (WRIGHT et WRIGHT, 1951)].

? 1850 *Ammonites prosperianus*; F. DIXON: The geology and fossils etc., p. 359, pl. 27, fig. 22.

1852 *Ammonites peramplus*; C. G. GIEBEL: Fauna der Vorwelt, 2, p. 423 (non vidi).

1852 *Ammonites Lewesiensis*; C. G. GIEBEL: ibid., p. 425 (non vidi).

? 1852 *Ammonites prosperianus*; C. G. GIEBEL: ibid., p. 424 (non vidi).

1853 *Ammonites peramplus* MANTELL; partim – D. SHARPE: Description of the fossil remains etc., p. 26, ? pl. 10, figs. 1a, 1b; non pl. 10, figs. 2a, 2b, 3a, 3b [= *Lewesiceras mantelli* (WRIGHT et WRIGHT, 1951)].

1854 *Ammonites peramplus* MANT.; partim – J. MORRIS: Catalogue British fossils, 2. ed., p. 298.

1854 *Ammonites peramplus*; F. RÖMER: Kreidebildungen Westphalens etc., p. 100 (non vidi).

? 1857 *Ammonites Lewesiensis* MANTELL; D. SHARPE: Description of the fossil remains etc., p. 46–47, pl. 21, figs. 1a, 1b, 1c.

1859 *Ammonites peramplus* MANT.; A. v. STROMBECK: Beitrag zur Kenntnis etc., p. 32, 33, 44–47.

1859 *Ammonites Lewesiensis* MANT.; A. v. STROMBECK: ibid., p. 32, 46–47.

1860 *Ammonites peramplus* MANTELL; partim – F. J. PICTET et G. CAMPICHE: Description des fossiles etc. 1, p. 354.

1862 *Ammonites prosperianus*; H. COQUAND: Géologie et Paléontologie etc., p. 287 (non vidi).

1866 *Ammonites Lewesiensis* MANT.; partim – C. SCHLÜTER: Die Schichten etc., p. 64.

1868 *Ammonites peramplus*; C. W. GÜMBEL: Geognostische Beschreibungen etc., 2, 753 (non vidi).

1870 *Ammonites peramplus* SOW.; partim – C. SCHLÜTER: Bericht über eine geogn.-pal. Reise etc., p. 945–948.

1869 *Ammonites peramplus*; J. KREJČÍ: Allgemeine und orographische Verhältnisse etc., p. 60 et al.

1870 *Ammonites peramplus*; J. KREJČÍ: Všeobecné a horopisné poměry etc., p. 43 et al.

1870 *Ammonites peramplus* MANT.; partim – F. ROEMER: Geologie von Oberschlesien, p. 319 to 320, pl. 35, fig. 5.

1871 *Ammonites Lewesiensis* MNT.; partim – C. SCHLÜTER: Cephalopoden etc., 1, p. 23–24, pl. 8, figs. 5, 6, pl. 9, fig. 7; non pl. 8, fig. 7 [= cf. *Placeticeras memoria-schloenbachi* (LAUBE et BRUDER, 1887)].

1872 *Ammonites peramplus* MANTELL. SHARPE; partim – C. SCHLÜTER: ibid., p. 31–36, pl. 10, figs. 7–12; non pl. 10, fig. 13 [= *Lewesiceras mantelli* (WRIGHT et WRIGHT, 1951)].

1872 *Ammonites peramplus* MANT.; partim – A. FRITSCH: Cephalopoden etc., p. 38–39, pl. 8, figs. 2–4; non pl. 8, fig. 1 [= *Lewesiceras mantelli* (WRIGHT et WRIGHT, 1926)].

1877 *Ammonites peramplus* MANT.; partim – A. FRIČ: Weissenberger und Malnitzer Schichten, p. 102.

1879 *Ammonites peramplus* MANT.; partim – A. FRIČ: Bělohorské a malnické vrstvy, p. 97–98.

1881 *Ammonites peramplus*; E. WINDMÖLLER: Die Entwicklung des Pläners etc., p. 36 (non vidi).

1884 *Pachydiscus peramplus* MANT.; partim – K. ZITTEL: Handbuch der Palaeontologie, 2, p. 467.

1886 *Pachydiscus peramplus* MANTELL sp.; partim – G. C. LAUBE: Über böhmische Kreide-Ammoniten, p. 153.

1886 *Pachydiscus Lewesiensis* MANTELL sp.: partim – G. C. LAUBE: ibid., p. 153.

1886 *Pachydiscus juvencus* nov. sp.; G. C. LAUBE: ibid., p. 153.

1887 *Pachydiscus peramplus* MANTELL sp.; partim – C. LAUBE et G. BRUDER: Ammoniten der böhmischen Kreide, p. 225–226, text-figs. 3a, 3b.

1887 *Pachydiscus Lewesiensis* MANTELL sp.; partim – C. LAUBE et G. BRUDER: ibid., p. 226–228, text-figs. 4a–c.

1887 *Pachydiscus juvencus* LAUBE und BRUDER; C. LAUBE et G. BRUDER: ibid., p. 228, pl. 29, fig. 1.

1889 *Pachydiscus peramplus*; A. PERON: Description de mollusques etc., p. 25 (non vidi).

1894 *Sonneratia perampla*; partim – A. DE GROSSOUVRE: Paléontologie des ammonites de la craie etc., p. 49, 109, 144–146, non figs. 42, 63 [= *L. mantelli* (WRIGHT et WRIGHT, 1951)].

? 1894 *Sonneratia* cf. *perampla* – A. DE GROSSOUVRE: ibid., p. 144, fig. 64.

1896 *Pachydiscus peramplus* (MANTELL), 1822; partim – H. WOODS: The Mollusca of the Chalk rock, p. 79–81.

1897 *Pachydiscus peramplus*; R. LEONHARD: Die Fauna der Kreideformation etc., p. 58 (non vidi).

1899 *Pachydiscus peramplus*; partim – A. DE GROSSOUVRE: Sur l'Ammonites peramplus etc., p. 328 et al.

1901 *Neoptychites peramplus* MANTELL sp.; partim – A. DE GROSSOUVRE: Recherches etc.; Première partie, p. 661, text-tab. 26.

1901 *Neoptychites Lewesiensis* MANTELL sp.; A. DE GROSSOUVRE: ibid., p. 661, text-tab. 26.

1901 *Neoptychites juvencus* LAUBE et BRUDER; A. DE GROSSOUVRE: ibid., p. 661, text-tab. 26.

1902 *Pachydiscus peramplus* MANT. spec.; partim – W. PETRASCHECK: Die Ammoniten etc., p. 137–138, pl. 7, fig. 2.

? 1902 *Pachydiscus Lewesiensis* MANT. spec.; W. PETRASCHECK: ibid., p. 139.

1904 *Pachydiscus peramplus*; H. STILLE: Erläuterungen zur geol. Übersichtskarte etc., p. 25 (non vidi).

1905 *Pachydiscus peramplus*; H. STILLE: Über die Verteilung der Fazies etc., pl. 168 (non vidi).
1907 *Pachydiscus peramplus*; L. PERVINQUIÈRE: Études de paléont. Tunisie, p. 172 (non vidi).
1909 *Pachydiscus peramplus* MANTELL sp.; partim – K. WANDERER: Die wichtigsten Tierversteinerungen etc., p. 62–63, pl. 9, figs. 4, 4a.
1913 *Pachydiscus peramplus*; partim – J. NOWAK: Untersuchungen über die Cephalopoden etc., 3, p. 340, 342–343 et al.
1913 *Pachydiscus juvencus*; J. NOWAK: ibid., p. 343–344 et al.
1916 *Pachydiscus peramplus* MANTELL sp.; partim – Č. ZAHÁLKA: Die Sudetische Kreideformation etc., 1, p. 25.
1922 *Pachydiscus peramplus*; partim – L. F. SPATH: On the Senonian Ammonite fauna of Pondoland, p. 120, 121.
1925 *Pachydiscus peramplus* MANTELL; partim – C. DIENER: Fossilium catalogus, p. 107–108.
1925 *Pachydiscus Lewesiensis* MANTELL; partim – C. DIENER: ibid., p. 106.
1926 *Pachydiscus peramplus*; L. F. SPATH: On new Ammonites etc., p. 82.
? 1926 *Pachydiscus sharpei* nom. nov.; L. F. SPATH: ibid., p. 82.
? 1927 *Pachydiscus sharpei* SPATH; partim – S. A. BILLINGHURST: On some new Ammonoidea etc., p. 514.
1934 *Pachydiscus peramplus* MANT. sp.; partim – H. ANDERT: Die Kreideablagerungen etc., 3, p. 397–398.
1935 *Pachydiscus peramplus* (MANT.); B. ZAHÁLKA: Petrografie a paleontologie křídy etc., p. 4.
1937 *Pachydiscus peramplus* (MANT.); VL. ZÁZVORKA: Geologická vycházka etc., p. 15, picture on the envelope.
1939 *Lewesiceras peramplum* (MANTELL); L. F. SPATH: Problems of Ammonites nomenclature, 6, p. 296.
1951 *Lewesiceras peramplum* (MANTELL); C. W. WRIGHT et E. V. WRIGHT: A survey of the fossil Cephalopoda etc., p. 20.
? 1951 *Lewesiceras sharpei* (SPATH); C. W. WRIGHT et E. V. WRIGHT: ibid., p. 20.
1952 *Lewesiceras peramplum* MANTELL; M. COLLIGNON: Ammonites néocrétacés du Menabe, 2, p. 78.
? 1952 *Lewesiceras sharpei* SPATH; M. COLLIGNON: ibid., p. 78.
non 1823 *Ammonites Lewesiensis*; J. SOWERBY: The mineral Conchology etc., p. 80–81, pl. 358 [= *Parapuzosia leptophylla* (SHARPE, 1853)].
non 1840 *Ammonites Lewesiensis* SOWERBY; A. D'ORBIGNY: Paléontologie Française, Terr. crét., I. Céphalopodes, p. 336–339, pl. 101, figs. 1–3 [= *Pachydiscus gollevillensis* (D'ORB., 1850)], pl. 102, figs. 1, 2 (= ?).
non 1840 *Ammonites prosperianus* D'ORBIGNY; A. D'ORBIGNY: ibid., p. 335–336, pl. 100, figs. 3, 4 [= *Menabonites prosperianus* (D'ORB., 1840)].
non 1845 *Ammonites Lewesiensis* MANTELL; J. SOWERBY: Conchologie Minéralogique etc., p. 383 to 384, pl. 236 (358), figs. 1, 2 [= *Parapuzosia leptophylla* (SHARPE, 1853)].
non 1849 *Ammonites Lewesiensis* MANTELL; F. A. Quenstedt: Petrefactenkunde Deutschlands, Cephalopoden, p. 215–216 (= ?).
non 1865 *Ammonites peramplus* MANTELL; F. STOLICZKA: The fossil cephalopoda etc., p. 130, pl. 65, figs. 1, 2 [= ? *Pseudojacobites anapadensis* (KOSSMAT, 1898)].
non 1873 *Ammonites peramplus* MANT.; F. SCHMIDT: Über die Petrefakten etc., p. 11–13, pl. 1, figs. 8–10 (= ?), pl. 1, figs. 11–15 (= *Menabonites* sp.).
non 1874 *Ammonites peramplus* MANT.; H. B. GEINITZ: Das Elbthalgebirge etc., p. 189–190, pl. 34, figs. 4–7 [= *Lewesiceras mantelli* (WRIGHT et WRIGHT, 1951)].
non 1883 *Ammonites peramplus* MANT.; A. FRIČ: Die Iserschichten, p. 91 [= *Lewesiceras mantelli* (WRIGHT et WRIGHT, 1951)].

non 1885 *Ammonites peramplus* MANT.; A. FRIČ: Jizerské vrstvy, p. 86 [= *Lewesiceras mantelli* (WRIGHT et WRIGHT, 1951)].

non 1889 *Ammonites (Pachydiscus) peramplus* MANT.; A. FRIČ: Teplitzer Schichten, p. 70–71, fig. 41 [= *Lewesiceras mantelli* (WRIGHT et WRIGHT, 1951)].

non 1889 *Ammonites (Pachydiscus) peramplus* MANT.; A. FRIČ: Teplické vrstvy, p. 66, fig. 41 [= *Lewesiceras mantelli* (WRIGHT et WRIGHT, 1951)].

non 1893 *Ammonites (Pachydiscus) peramplus* MANT.; A. FRIČ: Priesener Schichten, p. 76 (= *Lewesiceras lenesicense* sp. n.).

non 1895 *Ammonites (Pachydiscus) peramplus* MANT.; A. FRIČ: Březenské vrstvy, p. 74 (= *Lewesiceras lenesicense* sp. n.).

non 1896 *Pachydiscus peramplus* MANTELL; A. PERON: Les ammonites du Crétacé etc., p. 42–44, pl. 1, fig. 4, pl. 18, fig. 6 [= *Lewesiceras vaju* (STOLICZKA, 1865)].

non 1903 *Pachydiscus (Ammonites) peramplus* MANT.; J. HELLICH: Geologie, p. 60, text-fig. on p. 59 [= ? *Lewesiceras mantelli* (WRIGHT et WRIGHT, 1951)].

non 1913 *Pachydiscus peramplus* MANTELL (SOWERBY); F. ROMAN et P. MAZERAN: Monographie paléontologique, etc. p. 14–16, text-fig. 1, pl. 1, fig. 2 [= *Lewesiceras mantelli* (WRIGHT et WRIGHT, 1951)]; pl. 1, figs. 3, 4 (= ?).

non 1920 *Pachydiscus peramplus* MANTELL; A. DESIO: La creta etc., p. 225, pl. 17, fig. 8, text-fig. 8 (cf. *Eupachydiscus* sp.).

non 1939 *Pachydiscus peramplus* MANT.; E. DACQUÉ: Die Fauna etc., p. 110–111, pl. 5, fig. 1 [= *Lewesiceras mantelli* (WRIGHT et WRIGHT, 1951)].

non 1958 *Lewesiceras peramplus* (MANTELL); V. V. DRUŠČIC, N. P. MICHAJLOV, M. S. ERISTAVI: Nadsemejstvo Desmoceratacеae, pl. 52, figs. 2a, 2b, 2v [= *Lewesiceras ? mantelli* (WRIGHT et WRIGHT, 1951); cf. *L. lenesicense* sp. n.].

non 1959 *Lewesiceras peramplum* (MANTELL); D. P. NAJDIN, V. N. ŠIMANSKIJ: Cephalopoda, p. 185, pl. 12, figs. 4a, 4b, 4v, pl. 13, figs. 4a, 4b [= *Lewesiceras mantelli* (WRIGHT et WRIGHT, 1951)].

Type specimen: as yet not determined. No specimen of this species was figured by G. A. MANTELL (1822). It is also not quite clear from the text whether G. A. Mantell had only one specimen for his study, which would then automatically be the type (the note in his paper on page 201 points rather to the contrary). In case that Mantell's material has been preserved, it will be necessary to designate a type therefrom, preferably perhaps an individual, whose dimensions are given in the original description, and according to which, most probably, the whole description was elaborated.

Remarks: As I unite into a single species the two species described simultaneously [*L. peramplum* (MANTELL, 1822) and *L. lewesiense* (MANTELL, 1822)], it is necessary to choose one valid name for this taxon. Though the original description of *L. lewesiense* was accompanied by a figure, no figure was given and no type determined in the original description of *L. peramplum*. In spite of this fact I suggest for the united species the designation *L. peramplum*, because this name used for a long time has already a constant meaning, while as far as *L. lewesiense* is concerned the opinions of authors differ (as discussed in greater detail on page 22). Moreover, Mantell's original figure of *L. lewesiense* (1822, pl. 22, fig. 2) is at any rate not characteristic (the specimen was probably strongly deformed – note the sharp umbilical edge which occurs in strongly compressed specimens, see page 22). A final decision will be possible after the examination of the original material deposited in London.

Material and preservation: The most abundant material of this species comes from the today already disused quarries at Bílá hora near Prague (Lower Turonian). They are old collections the greater part of which is deposited in the National Museum in Prague (115 specimens). Altogether 186 specimens have been at my disposal from various localities from the Lower and the lower part of the Middle Turonian.

The majority of the individuals examined are by pressure variously deformed specimens. In none of the specimens has the initial part of the shell been preserved. In all instances they are internal moulds. The majority of specimens are compressed, usually obliquely (i.e. obliquely to the axis of coiling and to the plane of coiling). Depressed specimens (i.e. dorsoventrally) are rare. Due to deformation in some specimens the ribs are less projecting, in some cases there is a narrowed umbilicus (only on one side of the shell), and a secondary umbilical edge created by the deformation of the wall of the whorl. I consider this to be one of the reasons for their previous erroneous separation as *L. lewesiense* – see page 23.

Survey of the material studied from the Cretaceous of Bohemia:

National Museum in Prague	115 specimens
Faculty of Natural Sciences, Charles University, collections of the Department of Palaeontology	46 specimens
Collections of the Geological Institute at the Czechoslovak Academy of Sciences	2 specimens
Department of Geology, School of Mines in Ostrava	4 specimens
Regional Museum, Gottwaldov (Lešná)	6 specimens
Bílina Museum	3 specimens
Regional Museum, Hradec Králové	2 specimens
District Museum, Litoměřice	7 specimens
Regional Museum, Teplice	1 specimen
	total 186 specimens

Dimensions:

Specimen No.	D (mm)	d (%)	h (%)
NM-0-1533	26.5	34	40
NM-ČL-2109	34.5	27	43
NM-0-1534	49	31	< 42
NM-0-1531	61	32	39
NM-0-1503	85.5	27	38
NM-0-1519	90.5	31	41
NM-0-1521	124	29	41
NM-0-1523	143	28	38
NM-0-1529	164	29	42
NM-0-1528	225	31	41
NM-ČL-7507	290	29	38
NM-0-1525	323	36	40
Approximate average diameter		29–31	39–41

Due to deformation, the dimensions of the material vary considerably. I have not measured the value t (width of whorl), as this is almost always strongly reduced by compression (whereas in the depressed specimens it increases).

Diagnosis: Species of the genus *Lewesiceras* SPATH; umbilical tubercles begin to project more strongly at D > 20 mm and disappear on merging with the main ribs at D = approx. 70 to 80 mm; small ribs disappear at D = approx. 110 up to 120 mm, in the last section there are commonly 5 to 7 in one field; at D > 130 mm there are only barlike ribs on the whorls; at D = approx. 200 mm there are 10 to 11 ribs per whorl, at D = roughly 300 mm there are 13 up to 14; only rarely is there a weaker one which does not reach the umbilicus. (Orig.)

Description: Shell planulate with rounded venter (in the marlites generally strongly compressed with secondarily sharpened venter). In the umbilical area, walls of whorl turn in a short arc inward (however, without a sharp edge) and fall vertically into the umbilicus. Whorl attains its maximum width (t) approx. at three fourth of its height (h), i.e. approximately in the middle of the area between the umbilical margin and the umbilical seam of a younger whorl.

The tubercles and the ribbing on the surface of the whorls change characteristically during ontogeny. The initial whorls (at D < 20 mm) have developed tiny, slightly projecting umbilical tubercles, rounded or ventrally slightly elongated. These are joined (usually on their posterior margin) by tiny, thin, on the venter curved forward, rounded main ribs. The small ribs are at first only indicated, irregular, generally 2 to 3, sometimes even 4 in one field, the middle one usually more expressively projecting. In the depressed specimens a weakening of small ribs in the middle of the venter is apparent.

At D > 20 mm the umbilical tubercles are more characteristically projecting, at first being regularly round and pointed. Initially, there are 5 to one whorl, later at a larger diameter up to 7. From each umbilical tubercle passes a main rib, curved forward on the venter. At D = approx. 30 mm the main rib is generally still continuously curved forward. On approaching the umbilical tubercle it becomes weaker and joins it from behind. On the front part of the umbilical tubercle, a tiny independent protuberance is sometimes still apparent (indication of the initial stage of another rib), which, however, soon disappears. Between the main ribs, 2 to 3 weaker, shorter small ribs are developed in the ventral part of the whorl, extending on the whorl side far towards the umbilicus. The umbilical tubercles, at first round and considerably projecting, become elliptical and show gradually more distinct indications of elongation in the ventral direction. The sculpture thus passes into the next stage.

At D = approx. 50 up to 60 mm, the elongation of umbilical tubercles is already clearly distinct. Contrary to the preceding stages, they are already somewhat less projecting. The main ribs pass already directly from the umbilical tubercle (from which they are only suggestively separated by a slight weakening) as its continuation. They are slightly sinuous. The small ribs are 3 or 4 in one field, somewhat

weaker, of varying length (the middle one being commonly the strongest, reaching sometimes as far as the umbilicus). Generally, only a short section of 5 or 6 tubercles is developed in this manner, i.e. only a little over a half of a whorl. The number of tubercles (i.e. also of main ribs) attains at D = 80 mm commonly 7 to 8 per whorl.

At D = approx. 80 to 90 mm the slight depression between the umbilical tubercle and the main rib gradually disappears and the tubercle coalesces with the rib. Thus the umbilical tubercles disappear completely. The main ribs then project directly from the umbilical border without any umbilical elevation or strengthening. Each main rib maintains approximately the same height throughout its course and is strong, sinuous, accompanied on the front by a shallow, flat, and wide constriction. These main ribs always cross over the venter. The small ribs are weaker than the main ribs, are of varying length and disappear towards the umbilicus. In the area between the main ribs their number gradually increases (commonly there are 5 or 6, at D = 100 sometimes even 7) but they also become gradually less distinct. At D = approx. 110 mm, there are up to 8 main ribs on the last whorl.

The small ribs disappear completely at D = approx. 110 to 120 mm (seldom already at D = 70 mm [specimen NM-1013/64] or even as late as at D = 130 mim). In the next several fields between the main ribs there are usually only faint ind ca-tions of shallow irregularities, the venter being later completely smooth. After the disappearance of small ribs, the main ribs are still sinuous, accompanied onthe front rim by a wide, shallow, only slightly distinct constriction on the venter. Soon, however, they become gradually stronger on the sides, especially on the dorsal part, but weaken on the venter. At D = 130 to 160 mm (sometimes even sooner, rarely later – which depends also on the preservation of the material) the main ribs on the venter disappear completely, whereas on the flanks of the whor l and particularly at the umbilicus they are more prominent, even barlike. They broaden towards the venter, become flatter until they gradually disappear, i.e. they do not pass over the venter. Thereafter they are straight, without the sinuous bending, slightly rursiradiate and more frequent. The constrictions in front are no longer developed. At D = approx. 200 mm there are 10 to 11 main ribs per whorl, at D = approx. 200 mm, 13 to 14. The barlike ribs begin close to the umbilical border and widen gradually ventrally. After the middle of the whorl side, they become flatter, fade out and finally disappear on the ventral part of whorl side. This style of ribbing remains right up to the end of the development of shell. At D > 250 mm, increasingly more distinct flat swellings appear on the barlike ribs approximately at the middle of the whorl side. The barlike ribs then begin at the umbilicus as slight elevations which gradually broaden and rise ventrally, culminate in the above-mentioned swelling, and fade away on the shoul-der. These barlike ribs never pass over the venter. Only rarely are some of them less developed (generally they do not reach the umbilicus – as discussed in greater detail on page 21). At D > 300 mm, the barlike ribs are constantly getting flatter.

Remarks on the morphology of the described material: The following main trends can be observed in the ontogenetic development of the sculptural elements of shell:

1. The umbilical tubercles at first become accentuated (up to D = approx. 20 mm), then weaken relatively and finally merge with the main ribs (at D = approx. 80 to 90 mm).
2. The small ribs increase in number in the intervals between the main ribs, then weaken simultaneously with the main ribs and finaly disappear (at D = approx. 110 to 120 mm).
3. The main ribs become steadily more accentuated particularly at the whorl flanks, which leads to their disappearing on the venter and transformation into flat barlike ribs on whorl flanks.

These morphological changes are, however, not continuous. Various irregularities in the arrangement of the elements of the sculpture can frequently be observed at certain stages of the ontogenetic development of shell sculpture. At D = 80 to 90 mm, commonly either a main rib is unusually weak or a small rib unusually strong, and projects almost as far as the umbilicus. At this stage the rhythm of the arrangement of sculptural elements, particularly of the distance between them, usually changes. The transformation of the sculpture after the disappearance of small ribs up to the formation of barlike main ribs is pronounced and quick. This transition probably signified the maturing of the individual, as in the further ontogenetic development the character of the sculpture undergoes no further substantial changes, even though several subsequent whorls follow, which – as far as the type of ribbing is concerned – have an already uniform character.

J. NOWAK (1913, p. 342–343) tried to formulate the individual phases of the ontogenetic development of the sculpture in *L. peramplum* (MANT.). According to this author, there is the following sequence of stages:

a) The shell is smooth.
b) From the umbilicus run (main) ribs, which do not cross over the venter.
c) Main ribs pass from the umbilical tubercle, which is sometimes radially elongated, cross over the venter where they are accompanied by a constriction. Here there are intercalated small ribs.
d) Short main ribs (i.e. our barlike ribs) remain only on the flanks of the whorl and do not pass over the venter; the constriction and small ribs are absent.

It is impossible to confirm the existence of the first two phases in the Bohemian material of *L. peramplum*, as the smallest specimens which have been preserved (D = approx. 15 mm) already have main ribs which cross over the venter. Also in other Bohemian species of the genus *Lewesiceras*, in which I have been able to study the earlier phases, only very short main ribs accompanied by a shallow constriction are formed already from the beginning; these pass over the venter, where they are somewhat weakened. J. Nowak states neither the material on which the studied these first two stages, nor the source of his data. Also data regarding the

diameter at which the individual stages occur or pass one into another, are lacking. Between the stages b) and c) of the above-mentioned conception occurs a phase in the ontogenetic development of the shell that cannot be ranged under any of the mentioned stages; already before the appearance of the small ribs it is possible to observe fine umbilical tubercles on the main ribs which pass over the venter. Initially they are rather rounded but later they are increasingly elongated ventrally, becoming gradually flatter until they merge with the main rib. The number of small ribs increases, and not until the main ribs begin to have a barlike character on the flanks of the whorl (in some specimens a short section earlier) do they disappear completely. The umbilical tubercles disappeared already much earlier and cannot be discerned at all. In no case does stage c), as is supposed by J. Nowak, resemble "*Pachydiscus*" *prosperianus* (D'ORB.), in which the sculpture is considerably different (see p. 24). According to my observations, however, the individual stages cannot always be quite precisely discriminated on the shell, the sculpture develops generally in a more or less continuous change with only an occasional acceleration. There is a distinct change only at the onset of the final stage of the sculpture, i.e. of the barlike ribs. Thus, in the development of the shell two basic development periods of the sculpture can be observed, namely the period of the transformation of the sculpture (up to the disappearance of small ribs and the appearance of the first barlike ribs which do not cross over the venter), and the period of stable sculpture (barlike ribs), when the sculpture undergoes no further changes. The boundary line between these basic periods is always most distinct on the shell. I assume that it mirrors the accomplished maturing of the individual (? sexual maturity).

The dimensions of the shell at which the culmination of the above-mentioned main trends in the development of the sculpture takes place (see description) are, of course, the characteristic feature of the described species. Apart from this, a significant feature is the number of ribs in relation to the diameter of the shell (D), especially in mature whorls, when also the shape of the barlike ribs and the irregularities in their development can be utilized in differentiation from the allied species (see description and fig. 5). All these are characteristics which were subject to phylogenetic changes during the existence of the genus.

Comparison with allied species is presented in the table on p. 38.

There is considerable variability in some features. Differences between individual specimens are apparent especially in the diameter at which a particular degree of ontogenetic development of the tubercles and ribs is reached, especially the culmination points of specific trends in the development of the sculpture. Also the number of main ribs to a whorl at a constant diameter varies, usually by 1 to 2 ribs but rarely by more (see fig. 6). Some features obviously depend considerably on the manner and state of preservation (e.g. the relative strength of sculptural elements, determination of the distance reached in maturity by the barlike main ribs on the flanks of the whorl, as well as determination of the place of disappear-

ance of small ribs, partly also some shell dimensions, etc.). It can, however, be assumed (according to the variability of specimens from the same locality and preserved in the same manner) that also in these features the primary variability was already considerable. In some specimens from the locality Praha-Bílá hora (see, e.g., pl. I, fig. 4), the shell is only moderately compressed, while the sculpture elements are almost obliterated. This is probably an original feature. Some types of deformation, particularly oblique compression (see fig. 1), frequent in marlstones, considerably affect not only the measured dimensions (particularly h, t, d), but must be taken into account also when detecting the place of disappearance of the ventral ends of the barlike main ribs in adult individuals (on one side of the shell they extend, for example, almost on to the „venter", whereas on the other side of the valve to the middle of the "whorl side" only – see fig. 1).

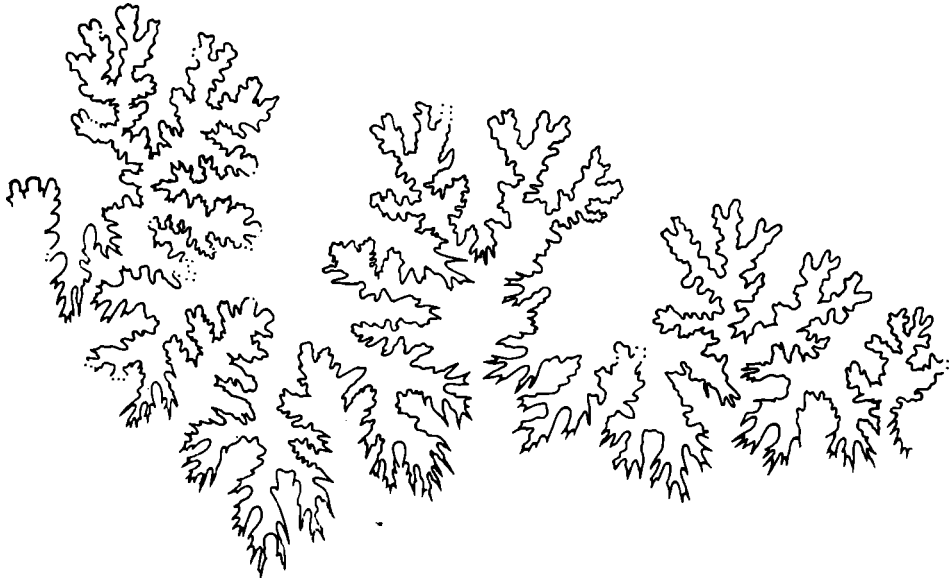
The number of small ribs in individual fields (i.e. in the section delimited by the adjacent main ribs) increases during ontogeny. In case of irregularities in the arrangement of the main ribs, there may be as many as 9 small ribs in one field when a main rib is absent or is only slightly developed as a small rib, and the original two fields merge into one. Not all small ribs do attain the same length. Generally, the middle one extends farthest to the umbilicus. Immediately behind the main rib (i.e. towards the apex) there is sometimes a small rib, perceptible only on the venter, which fills the area created on the venter by the more pronounced convex bending of the main rib. Actually, the main ribs are commonly bent more forward on the venter than the small ribs (see pl. II, fig. 4).

The state of preservation of the material which is at my disposal does not permit the absolutely precise drawing of the suture, because even where it is discernible, it is either corroded or distinctly apparent only in a short, inadequate section. Figure 3 was made according to an individual, on which the suture is exceptionally well preserved but the details, however, are still considerably imperfect. It is a rather complicated suture of a mature individual. The narrow, rectangular ventral saddle is divided into three equally high small saddles. The first lateral saddle is about twice as high as the ventral one. It is relatively narrow, separated by the middle accessory lobe (which extends approximately to the level of the peak of the ventral saddle) into two roughly equal parts, each of which branches into two more or less forward-directed projections (the dorsal projection of the ventral part reaches farthest forward), and one lateral projection. The lateral lobe runs into three accessory lobes sharply tapering at the end. The second lateral saddle is separated into two parts, of which the dorsal part is divided by a deeper accessory lobe than the ventral one.

Of the illustrations of the suture published in the literature, the drawings by G. C. LAUBE et G. BRUDER (1887, figs. 3a, 3b) are, in my opinion, closest to reality, but these also only in the main features. According to my ascertainment, neither the details nor the general arrangement and shape of the main elements correspond exactly to reality and the character of the detailed configuration of the suture

(the sharp accessory lobes and rounded, almost phylloid, subsidiary saddles in the lobes) is only approximately expressed. For my standpoint regarding the suture of the species *L. lewesiense*, figured by the above-mentioned authors, see page 23.

Only very rarely also has the fine sculpture of the external surface of shell been preserved in the internal moulds. Two specimens only, from Bílá hora, show tiny growth lines in the umbilical area of the whorl side.



3. *Lewesiceras peramplum* (MANTELL)
Last suture of individual No. NM-0-1530 at $D \doteq 224$ mm. Lower Turonian, ? Měcholupy, x 1.3 (orig.)

The largest set examined, almost 120 specimens from the Bílá hora quarries in Prague, is, unfortunately not closely stratigraphically delimited but comprises, in my opinion, finds from a considerable part of the Lower Turonian (mainly, however, the lower part). The relatively great variability of this set points to this. The 15 specimens from Měcholupy represent a stratigraphically somewhat narrower section, in the lower part of the Lower Turonian. The variability of this set is also smaller than of the preceding one. Finally, the third set of about 15 specimens from the Malnice glauconitic sandstone around Louny represents the upper part of the Lower Turonian.

No demonstrable morphological differences have been ascertained between the sets from localities of approximately the same age, e.g. Praha-Bílá hora and Měcholupy (lower part of the Lower Turonian), but morphological deviations can be observed, on the other hand, between the set from Praha-Bílá hora (mainly lower part of the Lower Turonian) and the set from the Malnice glauconitic sandstone of the Louny region (upper part of the Lower Turonian). In the set from Bílá hora

(as well as from Měcholupy), at D > 150 mm less developed barlike ribs which do not reach the umbilicus, between the normally developed ribs are rare, they have been formed only in a few individuals, especially in those from Bílá hora However, in specimens from the Malnice glauconitic sandstone these ribs are more frequent and occur in almost all sufficiently large specimens. It seems that this tendency (i.e. the rule that in the younger set the percentage of occurrences of imperfectly developed ribs is higher) persisted also in the Middle and Upper Turonian (in the descendant of the present species, *Lewesiceras mantelli* WRIGHT et WRIGHT, 1951 – see page 30).

Historical survey, relations: Due to the abundant occurrence of the representatives of the genus *Lewesiceras* SPATH in the Turonian of Europe, references to the present species are encountered very often in literature. The opinions of individual authors regarding the extent of this species, however, vary considerably and have, in the course of time, been subject to changes, which are very important for the understanding of the present state of its delimitation. In all the older works (roughly up to 1925), practically all Turonian as well as "Senonian" European finds of the representatives of the present genus *Lewesiceras* were assigned to a single species – *Pachydiscus peramplus* (MANTELL, 1822) [seldom to *Pachydiscus lewesiensis* (MANTELL, 1822) – see below]. The original description by G. A. MANTELL (1822) was very brief and was not accompanied by an illustration. Though J. SOWERBY (1823) published an illustration of a large individual, the specimen does not come from Mantell's material but is an altogether different find. Thus, the type specimen could not hitherto be selected (the fate of Mantell's material is not known to me).

D. SHARPE'S monograph (1853–1857) of the English Upper Cretaceous Ammonites was the basic work used by those authors who monographically described the ammonites from the Cretaceous of Bohemia, as it supplied the most detailed description and the most fitting illustrations. They also classified the Bohemian material according to D. Sharpe's conception. The specimens figured by D. SHARPE as *Ammonites peramplus* MANTELL (1853, pl. 10, fig. 1–3) were separated in 1926 by L. F. SPATH into two new species, *Pachydiscus sharpei* (about this species see p. 31) and *Pachydiscus cricki* (= *mantelli* WRIGHT et WRIGHT, 1951; non *Pachydiscus cricki* KOSSMAT, 1898). L. F. Spath did not retain in the original species *Ammonites peramplus* one single specimen illustrated by D. Sharpe (he does not mention the specimen on pl. 10, fig. 2 – about this see page 31). It thus happened that authors who used Sharpe's monograph as the basis (and this not only in this country) have described as *Ammonites* (later *Pachydiscus*) *peramplus* not only *Lewesiceras peramplum* (MANTELL, 1822), but also other species such as *L. mantelli* WRIGHT et WRIGHT, 1951, *L. plicatum* sp. n., and *L. lenesicense* sp. n. This must be taken into account when judging the individual older papers (I have expressed this fact in the synonymy by the sign "partim"; in those instances where a more accurate decision was impossible, there is a question mark added). More recently, C. W. WRIGHT et

E. V. WRIGHT (1951), revising the above-mentioned monograph by D. Sharpe, have delimited more accurately the stratigraphical range of the mentioned three species in the Cretaceous of England. According to these authors, *L. peramplum* is distributed in the Lower Turonian only (Inoceramus labiatus zone), *L. mantelli* and *L. sharpei* occurring only in the Upper Turonian (Holaster planus zone).

The same lot had befallen D. SHARPE's (1855) conception of the species *A. lewesiensis* (MANTELL, 1822), which was taken again as a starting point by authors engaged in the study of this species. C. W. WRIGHT et E. V. WRIGHT (1951) consider the specimen figured by D. SHARPE (1857, pl. 21, fig. 1) to be a probable member of the species *L. peramplum* (MANTELL). Should this be justified, then all authors describing the species *Ammonites* (later *Pachydiscus*) *lewesiensis* (MANTELL) on the basis of D. Sharpe's description and illustration (and all of them did), were actually describing *Lewesiceras peramplum* (MANTELL)!

I have studied the question of the assignment of the species *L. lewesiense* (MANTELL, 1822) more thoroughly in connection with the revision of the data on its occurrence in the Cretaceous of Bohemia. In my opinion, this species is not present in the Cretaceous of Bohemia. I even assume that its delimitation is not justified, identifications being based either on an incorrect conception or on deformed specimens of the species *L. peramplum* (MANTELL).

The advantage of the nominal species *Lewesiceras lewesiense* (MANTELL, 1822) over *L. peramplum* (MANTELL) was in the fact that G. A. MANTELL's description of the former was accompanied also by an illustration (1822, pl. 22, fig. 2). Mantell stressed as a distinction from *L. peramplum* the strong compression of the whorls ($t \ll h$) in *L. lewesiense*, whereas the whorls in *L. peramplum* "are convex and almost cylindrical" (1822, p. 201). From the description and particularly from the illustration another feature is also apparent – the conspicuously narrow umbilicus (14 per cent of the diameter!). However, D. SHARPE (1857), who had Mantell's specimen at his disposal, writes about it (p. 46) as follows: "The specimen is very imperfect, a part of the back on the younger side of the whorl being worn off, and the whole being so much crushed as to reduce the size of the umbilicus considerably, and to render the whorls flatter, and the back less round, than in perfect specimens: nevertheless it is sufficient to enable us to recognize the species with certainty". In spite of this, however, he differentiated the species *Ammonites lewesiensis* on his material. He considered its characteristic features to be the almost smooth surface of the whorls in the young shell, the narrow umbilicus (without stating the dimensions), the ribs reaching right up to the venter, and in contrast to *L. peramplum*, a more compressed shell. All these features, however, are but a common result of deformations originating during diagenesis (see p. 14). The ribs also always reach the venter only at a certain stage of the ontogenetic development of the whorl sculpture. I, therefore, consider C. W. WRIGHT et E. V. WRIGHT's (1951) opinion that in the case of D. Sharpe's *A. lewesiensis* the species in question is most probably

L. peramplum (MANTELL, 1822), as justified. WRIGHT et WRIGHT (1951) confine the species *L. lewesiense* (MANTELL) only to the specimen described by G. A. MANTELL (1822). On the basis of the upper cited D. SHARPE's find (1857), I consider this standpoint to be untenable and that also in the case of this individual it was probably *L. peramplum*. The final decision can be made only on the basis of the study of the original material.

C. SCHLÜTER (1871) also distinguished *Ammonites lewesiensis* MANTELL in the material from the Cretaceous of northern Germany. He considered, however, its characteristic features to be the edge at the umbilical margin, and contrary to D. Sharpe, the extending of ribs only up to the middle of the whorl side. Both features are common results of the deformation of the shell by compression in the sediment, the second feature being the very contrary to D. Sharpe's conception, and is common at a certain stage of the ontogenetic development of the *L. peramplum* shell. On these grounds I, therefore, consider the *Ammonites lewesiensis* delimited by C. Schlüter to be identical with *Lewesiceras peramplum* (MANTELL).

G. C. LAUBE and G. BRUDER (1887) were the first to distinguish the species *Pachydiscus lewesiensis* (MANTELL) in the Cretaceous of Bohemia and this particularly so on the basis of the shape of the suture (without investigating whether this is also the case on Mantell's original specimen). According to these authors, the suture of this species does not run into fine pointed lobes (as is the case in *L. peramplum*), but its lobes, just as its saddles, are rounded (G. C. LAUBE and G. BRUDER 1887, fig. 4a–c). I had at my disposal the original specimens of these authors and have ascertained that the drawings do not correspond to reality and that the suture, in as far as it can be reliably distinguished, has the usual shape. In my opinion, the mentioned distortion was caused most probably by tracing a suture (as is apparent on the specimens), of which the details were obliterated due to the corrosion of the internal mould surface, the suture being thus simplified. The above-mentioned authors also emphasize that the number of ribs is constant – 11. This feature, however, is subject to considerable changes in ontogeny (see description), as was also observed already by W. PETRASCHEK (1902), and cannot be absolutely considered, only in connection with a certain diameter. I consider, therefore, the species *Pachydiscus lewesiensis* (MANT.) distinguished by G. C. LAUBE and G. BRUDER (1887) as well as by W. PETRASCHEK (1902) to be *L. peramplum* (MANTELL, 1822).

G. C. LAUBE and G. BRUDER (1887) also described from the Lower Turonian of Bílá hora on the basis of a single specimen the new species *Pachydiscus juvencus*. Already from the description and illustration it is quite obvious that the juvenile specimen in question is the species *Lewesiceras peramplum* (MANTELL, 1822). This conclusion has been confirmed also by the examination of the original specimen. Due to a strong compression, the ribs and tubercles on it are somewhat less conspicuous. In this paper it is figured on pl. III, fig. 2.

The majority of the older authors (e.g. D. SHARPE 1853, C. SCHLÜTER 1872,

D. DIENER 1925 and others) assigned *Ammonites prosperianus* (D'ORB., 1840) to the species *Lewesiceras peramplum* (MANTELL) as its juvenile stage. On comparing, however, D'ORBIGNY'S (1840) description and illustration of the species *Amm. prosperianus* with the juvenile stages of *L. peramplum*, several significant differences are apparent at first sight. In d'Orbigny's species, the small ribs extend, particularly in younger stages, right up to the umbilicus, the main ribs are less bent forward and the shape of the ribs indicates the presence of some lateral irregularities ("légèrement ondulées"). None of these features is developed in *L. peramplum* (particularly not in individuals of the same size). I, therefore, do not allocate the species *Ammonites prosperianus* d'ORB., 1840 into the synonymy of the described species. In my opinion it belongs to a different genus (see p. 41).

The present species differs from *Lewesiceras vaju* (STOLICZKA, 1865) (Turonian, Trichinopoly group, India) particularly in that the number of small ribs in individual fields can amount to 5 to 7 or even more, while in *L. vaju* there are only 2 or, at the most 3. As far as I can judge from the photograph of the type cast published by F. ROMAN and P. MAZERAN (1913, fig. 2), in the Indian species the ribs, particularly the small ones, are more projecting and less regularly formed. This characteristic is emphasized also by F. KOSSMAT (1898), who was the only one who compared directly the Bohemian representatives (from the Bílá hora Beds) with the Indian ones. I consider *L. vaju* to be a descendant of *L. peramplum*.

For the reasons for the assignment of *L. sharpei* (SPATH, 1926) to the present species see page 31.

Occurrence, stratigraphical range: *L. peramplum* is not a rare species in the Cretaceous of Bohemia. Up to the present it has been ascertained only in the Lower Turonian and in the lower part of the Middle Turonian.

The majority of the ascertained localities belong to the Lower Turonian. The localities in which it was possible to verify the occurrence on diagnostic specimens deposited mostly in the collections of the National Museum in Prague are the following:

Lower Turonian: Běstvina (= Bestvín, = Bestwin); Černčice near Louny (= Čenčice); Dolní Chabry (= Chabry); Libochovice (= Libochowitz); Libořice; Louny (several localities in the vicinity); Malnice; Měcholupy near Žatec; Praha-Bílá hora; Praha-Prosek (= Prosík); Přílepy near Rakovník; Přemyšlení (= Přemyšlany); Slaný (= Schlan); Slavětín on Ohře; Stradouň (Na Vartě); Vinary near Vysoké Mýto; Všetaty near Mělník; Zeměchy near Louny.

Middle Turonian: Jeřábek brickyard near Roudnice (GÚ ČSAV material); ? Hradiště (hill north of Chotěboř).

The above list does not include the localities quoted in literature from which the diagnostic material was not at my disposal during my investigation. These localities (see list below) yield one or other of the two most abundant species of *Lewesiceras* in the Cretaceous of Bohemia (*L. peramplum* and *L. mantelli*), which were not distinguished by the older authors, all finds of *Lewesiceras* being designated as *Ammonites* (and/or *Pachydiscus*) *peramplus*. As far as the Lower Turonian localities

are concerned, the species in question was actually most probably *L. peramplum*, in the Upper Turonian localities *L. mantelli* (and/or *L. lenesicense* sp. n. or *L. plicatum* sp. n.). The final decision regarding the assignment of individual finds is, however, without the diagnostic material impossible. On these grounds I have set up a collective list of localities cited in literature (with the name of the author by whom the locality is quoted), from which I had no diagnostic material for my study (see below). The localities, where *L. mantelli* is probably concerned, are designated by a cross (+).

+ Brandýs nad Orlicí – A. FRIČ 1883, 1885
Brněnec – J. KREJČÍ 1869, 1870 (Brünnlitz); A. FRITSCH 1872 (Brünnlitz bei Brüsau); A. FRIČ 1877, 1879
Brnky – A. FRIČ 1877, 1879 (Chabry)
+ Brodce nad Jizerou – A. FRITSCH 1872 (Brodetz)
Břvany – A. E. REUSS 1845 (Weberschan)
+ Česká Třebová – A. MALISCH 1942
Čížovky Hill near Boskovice – B. ZAHÁLKA 1935; J. DVOŘÁK 1950
+ Hodkovice nad Mohelkou – A. FRITSCH 1872 (Liebenau); A. FRIČ 1877, 1879
+ Horky nad Jizerou – A. FRITSCH 1872 (Horka a. d. Iser)
Hošťka – J. KREJČÍ 1879; A. FRITSCH 1872 (Gastorf)
Hrádek near Raná – A. FRIČ 1877, 1879
+ Choceň (Báča quarry) – A. FRIČ 1883, 1885
+ Choroušky – A. FRIČ 1883, 1885
+ Chrudim – A. FRITSCH 1872; J. KREJČÍ 1879
+ Josefův Důl near Ml. Boleslav – A. FRITSCH 1872 (Josephstal)
+ Knížnice near Libuň – A. FRIČ 1883, 1885; Č. ZAHÁLKA 1922 (Horní Knížnice)
+ Kystra – A. FRIČ 1889a, 1889b
+ Kystra – A. FRIČ 1889a, 1889b
Lány (Rakovník district) – A. FRITSCH 1872; A. FRIČ 1877, 1879
Lhotka nad Labem – A. FRITSCH 1872 (Welhotten bei Lobositz)
+ Liběchov near Ml. Boleslav – A. FRIČ 1883, 1885
+ Libichov – J. KREJČÍ 1869, 1870; A. Fritsch 1872 (Libichow bei Dobrawitz)
Libkovice pod Řípem – A. FRITSCH 1872 (Lipkovice); A. FRIČ 1877, 1879
Liblice (near Mělník) – J. KREJČÍ 1869, 1870
+ Litoměřice – J. KREJČÍ 1879; A. FRITSCH 1872 (Gaubenhof oberhalb Leitmeritz)
Lovosice – A. FRITSCH 1872 (Lobositz)
Lysá nad Labem – A. FRITSCH 1872 (Lissa); A. FRIČ 1877, 1879
between Louny and Malnice – C. SCHLÜTER 1872
+ Mělnické Vtelno – A. FRITSCH 1872 (Vtelno); A. FRIČ 1883, 1885 (Vtelno)
Mělník, Labe riverside – A. FRITSCH 1872; A. FRIČ 1877, 1879
+ north of Mělník – A. FRITSCH 1872
+ Nové Benátky – A. FRIČ 1883, 1885
Nymburk – A. FRITSCH 1872
Pátek near Louny – A. FRITSCH 1872; A. FRIČ 1877, 1879; J. KREJČÍ 1879
+ Pátek near Poděbrady – A. FRIČ 1877, 1879; J. HELLICH 1903
Peruc – J. KREJČÍ 1869, 1870; A. FRITSCH 1872; A. FRIČ 1877, 1879
Poplzy – J. KREJČÍ 1879 (Poplz)
Radovesice – J. KREJČÍ 1869, 1870
Roudnice (hillsides behind the brewery) – A. FRIČ 1877, 1879
Roudnice (hillside along the railway to Židovice) – J. KREJČÍ 1869, 1870
+ Rovensko (near the road to Kirchberk) – A. FRIČ 1877, 1879
Skalička near Hradec Králové – W. PETRASCHECK 1913; B. ZAHÁLKA 1949
Slavětín (near Louny) – J. KREJČÍ 1869, 1870; A. FRIČ 1889a, 1889b (Podhrázský mlýn)

Středokluky – A. FRIČ 1877, 1879
Teplice nad Metují – A. FRIČ 1883, 1885 (Weckelsdorf)
Třebívlice (Třiblitz) – J. KREJČÍ 1869, 1870; A. FRITSCH 1872; A. FRIČ 1877, 1879
+ Zámostí near Ml. Boleslav – A. FRITSCH 1872 (Zamošt)
+ Želízy – A. FRITSCH 1872 (Schelesen); A. FRIČ 1883 (Schelesen), 1885 (Železná)
Žernoseky – A. FRITSCH 1872 (Černosek)
+ Životín – A. FRIČ 1883, 1885

Distribution: Outside the territory of Czechoslovakia, *L. peramplum* has been ascertained in the Cretaceous of England, northern Germany, France, Saxony, and in the Cretaceous of North Africa.

Lewesiceras mantelli (WRIGHT et WRIGHT, 1951)

Pl. IV, figs. 3, 4, pl. V, figs. 1–4, pl. VI, figs. 1–4

? 1823 *Ammonites peramplus*; partim – J. SOWERBY: The mineral conchology etc., IV, p. 79, pl. 357.
1840 *Ammonites Lewesiensis* MANT.; partim – H. B. GEINITZ: Charakteristik etc., Heft 2, p. 39 to 40; non pl. 12, figs. 2a, 2b [= *L. peramplum* (MANT.)]; non pl. 13, fig. 4 [= cf. *Placenticeras memoria-schloenbachi* (LAUBE et BRUDER, 1887)].
1840 *Ammonites peramplus* MANTELL; partim – A. D'ORBIGNY: Paléontol. française, Terrains crétacés, 1, Céphalopodes, p. 333–334, pl. 100, figs. 1, 2.
1840 *Ammonites Lewesiensis* MANT.; partim – H. B. GEINITZ: Charakteristik der Schichten u. Petrefacten etc., Heft 2, p. 39–40; non pl. 12, figs. 2a, 2b [= *Lewesiceras peramplum* (MANT.)]; non pl. 13, fig. 4 [= cf. *Placenticeras memoria-schloenbachi* (LAUBE et BRUDER, 1887)].
1841 *Ammonites peramplus* SOW.; partim – F. A. ROEMER: Versteinerungen etc., p. 87.
1842 *Ammonites peramplus* SOW.; partim – H. B. GEINITZ: Charakteristik der Schichten u. Petrefacten etc., Heft 3, p. 67, p. iv.
? 1845 *Ammonites peramplus* MANTELL; partim – J. SOWERBY: Conchologie minéralogique etc., p. 383, pl. 235 (357).
1845 *Ammonites peramplus* SOWERBY; partim – A. E. REUSS: Die Versteinerungen etc., p. 21.
1846 *Ammonites peramplus* SOW.; partim – H. B. GEINITZ: Grundriß d. Versteinerungskunde, p. 297.
1849 *Ammonites peramplus*; partim – F. A. QUENSTEDT: Cephalopoden Deutschlands, p. 216.
1850 *Ammonites peramplus* MANTELL, 1822; partim – H. B. GEINITZ: Das Quadersandsteingebirge oder Kreidegebirge in Deutschland, p. 116, ? pl. 5, fig. 2; non pl. 5, figs. 1a, 1b, 3 [= *Lewesiceras* cf. *peramplum* (MANTELL, 1822)].
1853 *Ammonites peramplus* MANTELL; partim – D. SHARPE: Description of the fossil remains etc., p. 26, pl. 10, figs. 2a, 2b, 3a, 3b; non pl. 10, figs. 1a, 1b [= ? *Lewesiceras peramplum* (MANTELL, 1822)].
? 1866 *Ammonites peramplus*; U. SCHLOENBACH: Über die Parallelen etc., p. 316.
1866 *Ammonites Lewesiensis* MANT.; partim – C. SCHLÜTER: Die Schichten etc., p. 66.
1870 *Ammonites peramplus* SOW.; partim – C. SCHLÜTER: Bericht über eine geogn.-pal. Reise etc. p. 945–948.
1870 *Ammonites Lewesiensis* MANT.; partim – C. SCHLÜTER: ibid., p. 946–947.
1872 *Ammonites peramplus* MANTELL. SHARPE; partim – C. SCHLÜTER: Cephalopoden etc., 1, p. 31–36, pl. 10, fig. 13; non pl. 10, figs. 7–12 [= *Lewesiceras peramplum* (MANTELL, 1822)].
1872 *Ammonites peramplus* MANT.; partim – A. FRITSCH: Cephalopoden etc., p. 38–39, pl. 8, fig. 1; non pl. 8, figs. 2–4 [=*Lewesiceras peramplum* (MANTELL, 1822)].

1874 *Ammonites peramplus* MANT.; H. B. GEINITZ: Das Elbthalgebirge etc., p. 189–190, pl. 34, figs. 4–7.

1883 *Ammonites peramplus* MANT.; A. FRIČ: Die Iserschichten, p. 91.

1885 *Ammonites peramplus* MANT.; A. FRIČ: Jizerské vrstvy, p. 86.

1886 *Pachydiscus peramplus* MANTELL sp.; partim – G. C. LAUBE: Über böhmische Kreide-Ammoniten, p. 153.

1887 *Pachydiscus peramplus* MANTELL sp.; partim – C. LAUBE et G. BRUDER: Ammoniten der böhmischen Kreide, p. 225–226, non. text-fig. 3a, 3b [= *Lewesiceras peramplum* (MANTELL, 1822)].

1889 *Ammonites* (*Pachydiscus*) *peramplus* MANT.; A. FRIČ: Die Teplitzer Schichten, p. 70–71, fig. 41.

1889 *Ammonites* (*Pachydiscus*) *peramplus* MANT.; A. FRIČ: Teplické vrstvy, p. 66, fig 41.

1894 *Sonneratia perampla*; partim – A. DE GROSSOUVRE: Les ammonites de la craie etc., p. 49, 108, 109, 144–146, figs. 42, 63.

1896 *Pachydiscus peramplus* (MANTELL), 1822; partim – H. WOODS: The mollusca of the Chalk rock, p. 79–81.

1901 *Neoptychites peramplus* MANTELL sp.; partim – A. DE GROSSOUVRE: Recherches etc., 1, p. 661, text. tab. 26.

1902 *Pachydiscus peramplus* MANT. spec.; partim – W. PETRASCHEK: Die Ammoniten etc., p. 137 – 138; non pl. 7, fig. 2 [= *L. peramplum* (MANTELL, 1822)].

? 1902 *Pachydiscus* spec.; W. PETRASCHEK: ibid., p. 138–139, text.-fig. 4.

? 1903 *Pachydiscus* (*Ammonites*) *peramplus* MANT.; J. HELLICH: Geologie, p. 60, text.-fig. on page 59.

1909 *Pachydiscus peramplus* MANTELL sp.; partim – K. WANDERER: Die wichtigsten Tierversteinerungen etc., p. 62–63; non pl. 9, figs. 4, 4a [= *L. peramplum* (MANTELL, 1822)].

1913 *Pachydiscus peramplus*; partim – J. NOWAK: Untersuchungen über die Cephalopoden etc., 3, p. 340, 342–343 et al.

1913 *Pachydiscus peramplum* MANTELL (SOWERBY); ? partim – F. ROMAN et P. MAZERAN: Monographie paléontologique etc., p. 14–16, text.-fig. 1, pl. 1, fig. 2; ? pl. 1, figs. 3, 4.

1916 *Pachydiscus peramplus* MANTELL sp.; partim – Č. ZAHÁLKA: Die Sudetische Kreideformation etc., 1, p. 25.

1925 *Pachydiscus peramplus* MANTELL; partim – C. DIENER: Fossilium catalogus, p. 107–108.

1925 *Pachydiscus Lewesiensis* MANTELL; partim – C. DIENER: ibid., p. 106.

1926 *Pachydiscus cricki* nom. nov.; L. F. SPATH: On new Ammonites etc., p. 82.

1927 *Pachydiscus sharpei* SPATH; partim – S. A. BILLINGHURST: On some new Ammonoidea etc., p. 514, text.-fig. 2.

1934 *Pachydiscus peramplus* MANT. sp.; partim – H. ANDERT: Die Kreideablagerungen etc., 3, p. 397–398.

1939 *Pachydiscus peramplus* MANT.; E. DACQUÉ: Die Fauna etc., p. 110–111, pl. 5, fig. 1.

1939 *Pachydiscus* (*Sonneratia*?) *peramplus* MANT.; E. DACQUÉ: ibid., p. 194, pl. 15, figs. 20, 20a, 21.

? 1951 *Lewesiceras mantelli* nom. nov.; C. W. WRIGHT et E. V. WRIGHT: A survey of the fossil Cephalopoda etc., p. 20.

1952 *Lewesiceras Mantelli* WRIGHT; M. COLLIGNON: Ammonites néocrétacées du Menabe, 2, p. 78.

? 1958 *Lewesiceras peramplum* (MANTELL); V. V. DRUŠČIC, N. P. MICHAJLOV, M. S. ERISTAVI: Nadsemejstvo Desmoceratáceae, pl. 52, figs. 2a, 2b, 2v (cf. *Lewesiceras lenesicense* sp. n).

1959 *Lewesiceras peramplum* (MANTELL); D. P. NAJDIN, V. N. ŠIMANSKIJ: Cephalopoda, p. 185, pl. 12, figs. 4a, 4b, 4v, pl. 13, figs. 4a, 4b.

Type specimen: By monotypy (see L. F. SPATH 1926) the specimen figured by D. SHARPE (1853) on pl. 10, figs. 3a, 3b. It is deposited in the British Museum Nat. Hist. London, B. M. No. 88587.

Material and preservation: According to the character of preservation, the studied material of this species can be divided into two groups. The first group is formed primarily of localities in the Teplice Beds (Upper Turonian): Hudcov (formerly Hundorf) and the quarries in the environment (Řetenice, Lahošť, Teplice, etc.), Koštice, Kučlín, etc. The material is preserved here in argillaceous limestones or marlstones and the shells are usually compressed, often to a considerable degree. The second group of localities belongs to the Jizera Beds. Here the material is preserved in sandstones and the deformation is very slight.

All the specimens studied are internal moulds. In the material of this species the compression of the shells is mostly not as great as in the Bohemian species of *L. peramplum*.

In no single specimen has the initial part of the shell been preserved. It is, therefore, impossible to determine accurately the number of whorls.

Survey of the studied material from the Cretaceous of Bohemia:

National Museum in Prague	15 specimens
Faculty of Natural Sciences, Charles University, collections of the Department of Palaeontology	9 specimens
Collections of the Geological Institute at the Czechoslovak Academy of Sciences	3 specimens
Bílina Museum	15 specimens
Hořice Museum	1 specimen
Regional Museum, Hradec Králové	5 specimens
District Museum, Litoměřice	13 specimens
Regional Museum, Teplice	20 specimens
Nymburk Museum	1 specimen
Poděbrady Museum	4 specimens
Department of Geology, School of Mines in Ostrava	4 specimens
	total 90 specimens

Dimensions: Due to deformation, the material exhibits a certain fluctuation in dimensions. In cases of oblique compression (as, e.g., in the individual NM-0-1536) two dimensions of h, measured in a different manner on both sides of the shell (see fig. 1) are sometimes given. In most specimens I have not measured

Specimen No.	D (mm)	d (%)	h (%)
NM-0-1543	30	33.3	45.3
NM-ČL-6422	83	30.1	45.8
NM-0-1526	181	31.5	40.3
NM-0-1536	202	29.1	46.5–39.6
NM-0-1526	245	30.2	38.8
NM-0-1535	283	28.3	41.0
NM-0-1537	610	29.5	44.3
NM-0-1537	840	27.5	41.7
NM-0-1538	850	31.8	40.0
Approximate average diameter		28–31	39–46

the value t for apparent signs of deformation. It is approximately within the range of 35 to 40 per cent.

Diagnosis: Species of the genus *Lewesiceras* SPATH; umbilical tubercles begin to project visibly at D = about 15 mm, and disappear on merging with the main ribs at D = about 50 mm on their transition into barlike ribs; small ribs, at the most 4 in each field, disappear at D = about 65 to 70 mm; at D > 90 mm there are only barlike ribs on the whorl; at D = 200 m there are 12 up to 13 ribs per whorl, at D = approx. 400 mm, 13 to 14; generally, some are weaker and do not reach the umbilicus.

Description: Shell planulate. The rounded venter is apparent only on dorsoventrally flattened specimens; due to compression of the shells lying on their sides in clayey sediments, the venter is generally secondarily subangular or sharp. Whorl sides regularly slightly arched, passing gradually into the umbilicus. The whorl attains its greatest width at about two-thirds of its height, i.e. approximately at the umbilical seam of the subsequent whorl.

The sculpture (tubercles and ribs) on the whorl is subject to characteristic changes during ontogeny. From D = about 15 mm the whorls have on the main ribs prominent umbilical tubercles, rounded at first, but gradually becoming ventrally elongated and relatively weaker; at D = about 30 mm there are 6 to 7 main ribs to a whorl. At D = about 40 mm the elongation of umbilical tubercles is already apparent, and they are somewhat less projecting. From each tubercle passes a main rib bent forward on the venter. Initially there are 2 small ribs, later up to 4, weaker than the main ribs, developed only on the venter. Generally, they are less distinct than in *L. peramplum*. At D = about 50 mm the main ribs acquire already symptoms of a barlike character, i.e. the umbilical tubercle broadens ventrally and the main rib passing from it in ventral direction is stronger, broader and gradually flatter. At D = about 65 mm there are approximately 9 main ribs per whorl. These gradually attain a constantly more distinct barlike character and tend to broaden and disappear towards the venter. Until their disappearance (at D = about 65 to 70 mm) the number of small ribs does not exceed 4 in one field. After their disappearance certain flat irregularities between the main ribs can still be observed in some specimens (this depends chiefly on the state of preservation), generally up to D = about 90 mm. Even after the disappearance of small ribs, the main ribs generally still reach the venter, but gradually less distinctly. They are slightly bent forward on the venter.

At D > 90 mm, the main ribs commonly do not extend any more on to the venter in a distinct form, are more prominent and have already a distinct barlike character; the umbilical tubercle is not apparent any more even as a part of the rib. This is the last development stage of the sculpture, which persists practically right up to the end of the growth of the shell. The main ribs are distinctly prominent particularly at the umbilicus, broaden towards the venter, become flatter and disappear on the ventral part of the whorl side. Towards the umbilicus the distance between

the apexes of adjacent ribs is about double the depth of the space between them. Ventrally the ribs become flatter and the distance between the apexes of adjacent ribs is more than double the depth of the space between them. From D = about 200 mm the shallowing of the space between the ribs is also due to the decrease of their conspicuousness. At this shell diameter, there are about 12 to 13 ribs, at D = about 400 mm approx. 13 to 14 ribs per whorl. At D > 250 mm a strengthening of the ribs in the middle of the whorl side begins to be apparent, which gradually becomes more distinct, forming a lateral swelling. From D = about 400 to 500 mm, the conspicuousness of the ribs begins to decrease. They become very flat, moderate, ventrally broadening elevations on the flanks of the whorl. They are, however, still apparent up to D = 800 mm. A larger specimen was not at my disposal.

Remarks on the morphology: In the ontogenetic development of sculptural elements of the shell, similar main tendencies can be observed as in *L. peramplum* (see p. 17). All of them culminate, however, much earlier. The umbilical tubercles tend to merge with the main ribs already at D = about 40 mm. They do not, however, disappear completely, but form a more distinctly pronounced umbilical part of the main rib. The small ribs disappear much earlier (already at D = 65 to 70 mm), and it is noteworthy that their number never increases above 4. The transition of the main ribs into barlike ribs which do not cross the venter (already at D = about 70 to 90 mm) is also very early. These features are characteristic of *L. mantelli* WRIGHT et WRIGHT.

The variability of the described species concerns particularly the diameter at which the culmination of morphological tendencies takes place. In some specimens, after the disappearance of small ribs the main ribs still pass over the venter for a short section before acquiring a barlike character (at D = about 90 mm); in other specimens of an opposite extreme (e.g. NM-0-1545) the main ribs acquire a barlike character immediately after the disappearance of the small ribs.

On no specimen is the suture sufficiently apparent. Rather commonly some of the barlike ribs are more weakly developed at D > 150 mm; they may almost disappear on the umbilical part of the whorl side (see, e.g. pl. IV, fig. 4). This tendency began already in (the evolutionary ancestor of the described species) *L. peramplum* (MANTELL) (see p. 21) and increases steadily in the younger beds. In *L. mantelli* WRIGHT et WRIGHT such cases can be observed almost in every specimen, in some even several times in one whorl.

Remarks on systematics: As has already been previously discussed in greater detail in the case of *L. peramplum* (see p. 21 and next), the older authors generally comprised under the designation *L. peramplum* several today different forms (among them also *L. mantelli*).

J. HELLICH (1903) figured on p. 59 a specimen designated as *Pachydiscus* (*Ammonites*) *peramplus* MANT., allegedly coming "from the Malnice beds from Blata" (recte Middle Turonian). The figure (and the block) in question is, however,

the same as that used already by A. FRIČ (1889, fig. 41) as *Ammonites peramplus* MANT. from Čížkovice. However, neither in the collections of the National Museum, nor anywhere else has it been possible to trace the figured specimen. It comes, however, presumably from Čížkovice (A. FRIČ 1889a, p. 70; 1889b, p. 66 refers to it). The same applies also to the second ammonite figured by J. HELLICH (1903) on the same page beside the above-mentioned illustration.

In my opinion J. Hellich most probably borrowed both blocks from A. Frič and inscribed them as originating from the Poděbrady region, regardless of the fact that the figured specimens actually came from a different locality.

It is worthy of note that L. F. SPATH (1926) mentions only two of the three specimens figured by D. SHARPE (1853) on plate 10: the individual figured in fig. 1, on which his species *Pachydiscus sharpei* is based, and the individual illustrated in fig. 3, on which he founded his species *Pachydiscus cricki* (= *Lewesiceras mantelli* WRIGHT et WRIGHT, 1951). Nowhere to be found is a reference made to the specimen illustrated in fig. 2. The first student to assign this specimen to *L. sharpei* was S. A. BILLINGHURST (1927). C. W. WRIGHT and E. V. WRIGHT (1951) followed Billinghurst.

C. W. Wright communicated kindly to me in December 1965 this information: "The first point is that my brother and I were wrong in 1951 to follow Billinghurst in assigning Sharpe's fig. 2 to *sharpei*. Fig. 2 certainly represents the same species as fig. 3, but fig. 1 probably does NOT. Sharpe considered all three figures to represent the same species but one that has a long range. From what he says it is clear that he attributed to the same species (*peramplum* for him) specimens from the whole extent of the Turonian, from the base of the Inoceramus labiatus Zone to the top of the Holaster planus Zone. However, he says that large specimens only occur in the lower parts of their range, that is the zones of I. labiatus or Terebratulina lata. Although this is not entirely true, Sharpe must therefore have believed the original of his fig. 1, which is incomplete at D = 300 mm, to have come from the lower part of the Turonian. Since the specimen cannot be traced it is impossible to be certain what its horizon is. It is in my opinion quite possible that it was a laterally compressed specimen of *L. peramplum*. At any rate it is quite impossible to be sure that it is the same species as figs. 2 and 3. Thus the name *sharpei* may well be a synonym of *peramplum* but since this is uncertain it is best regarded as a nomen dubium." I share C. W. Wright's point of view.

Relations: The relations of the described species to *L. peramplum* and *L. plicatum* sp. n. are expressed in the table on p. 38; as far as the number of main ribs in relation to D is concerned see fig. 6. The differences with respect to *L. lenesicense* sp. n. are given on p. 37.

In *L. romani* SORNAY, 1964 (Upper Turonian, d'Uchaux, France) the umbilical tubercles begin to project distinctly already at D = 12 mm and are then more prominent, subglobose. At D = about 25 mm there are 8 to 9 per whorl. On the other hand, in *L. mantelli* the umbilical tubercles do not begin to project distinctly

until D = 15 mm, they are relatively smaller, rather pointed. At D = about 30 mm, there are at the utmost 7 per whorl. The main ribs in *L. romani* acquire a barlike character at D = about 70 mm, according to Sornay's illustrations, in *L. mantelli* at D = about 90 mm. Thus, in the above-mentioned French species the tachygenic tendencies (see p. 39) are even more pronounced than in *L. mantelli*.

Stratigraphical range, occurrence: Up to the present *L. mantelli* has been ascertained in the Cretaceous of Bohemia only in the upper part of the Middle Turonian and in the Upper Turonian. It is more abundant in the Teplice Beds (Upper Turonian) in the Ohře region of the Cretaceous of Bohemia, less abundant in the Jizera facies of the Middle Turonian.

Up to the present specimens from the following localities could be studied:

Middle Turonian (higher part): Bělá pod Bezdězem; Chleby near Nymburk; Choceň; Javornice near Libuň; Mladá Boleslav; Odřepsy; Turnov (Kottler's garden); Vehlovice; Žehuň.

Upper Turonian: Bohosudov (= Mariaschein); Čížkovice; Koštice; Kučlín; Osek near Duchcov (= Osseg); Poplze near Libochovice; Teplice and the neighbouring localities (e.g. Hudcov, Lahošť, Řetenice, etc.); Vrchoslav near Krupka (= Rosenthal).

A. FRITSCH (1872) did not distinguish the described species, though he had in his material specimens belonging to it. In the list of localities of *Ammonites peramplus* reported by him (also 1883, 1889), many obviously belong (in my opinion the majority) to the species *L. mantelli* (for more details see p. 24). Insofar as I could study the diagnostic specimens, they are quoted in the above list. I consider the localities, from which I had no diagnostic specimens, as uncertain. These are quoted in the collective list of uncertain localities in *L. peramplum* on p. 25–26 and are designated by a cross (+).

Distribution: Apart from the Cretaceous of Bohemia, this species has been ascertained in the Cretaceous of Saxony, England, France, northern Germany, in the Crimea, and in North Caucasus, in the Cretaceous of the middle Don region, in the Emba river basin and on the Mangyshlak peninsula.

Lewesiceras plicatum sp. n.

Pl. VII, figs. 1–4

Holotype: Individual No. NM-0-1571 (= ČL-6421), deposited in the collections of the National Museum, Prague. It is figured on pl. VII, fig. 1.

Locus typicus: Hudcov near Teplice (former Hundorf).

Stratum typicum: Teplice Beds, Upper Turonian.

Material: The specimens from the Teplice Beds at my disposal are all strongly compressed. Of this species I have studied altogether 8 individuals from the Cretaceous of Bohemia.

Diagnosis: Species of the genus *Lewesiceras* SPATH: shell relatively considerably compressed; small ribs indistinctly developed, sparse, disappearing at D = 70

Dimensions:

Specimen No.	D (mm)	d (%)	h (%)
NM-0-1571	117.4	28	42
NM-0-1551	126.0	29	41
NM-0-1549	129.4	32	41
NM-0-1550	134.5	30	39

to 80 mm, sometimes even sooner; main ribs with only weakly developed umbilical tubercles remain even after the disappearance of small ribs in their entire course equally projected, sinuous; they acquire a barlike character not until D = about 100 to 120 mm (sometimes, however, even earlier), they are relatively low and narrow, and extend constantly almost up to the middle of the venter where at first they turn forward; at D = about 125 mm there are 15 main ribs per whorl, at a larger D even more.

Description: Shell planulate; venter was probably rounded (all studied specimens are, however, secondarily compressed). Whorl sides are regularly arched and pass smoothly into the umbilicus without being more acutely rounded. Whorl attains its maximum width approximately at the umbilical seam of a subsequent younger whorl (i.e. approximately in two-thirds of its height).

The sculpture (tubercles and ribs) on the whorls changes characteristically during ontogeny. The ribs on the initial whorls (roughly up to D = 35 mm) are shaped as in *L. peramplum*, the small ribs are, however, irregular and are shaped rather as irregular unevennesses between the main ribs. There are approximately 8 distinctly projecting, sometimes unevenly developed umbilical tubercles. At D > 35 mm the umbilical tubercles become flatter and distinctly ventrally elongated, until they disappear and merge with the main ribs. At D = = 60 mm there are about 10 main ribs per whorl. Between them are locally on the venter flat unevennesses which are only occasionally more pronounced than the small rib. The main ribs are distinctly sinnous, and of more or less equal strength from the umbilicus (the umbilical tubercle is already very slightly or not at all discernible) to the venter; they are accompanied by a moderate depression (indications of a constriction) on the front margin. They cross over the venter and are bent forward there. At the umbilicus they are sometimes slightly elevated, fading out on the venter. The unevennesses between them sometimes resemble small flat ribs confined to the venter.

Not until D = about 100 up to 120 mm (sometimes, however, even earlier – see NM-0-1547) do the main ribs gradually acquire a narrow, barlike character, cross over the venter, however, gradually less and less distinctly. They begin as a flat tuberculate elevation at the umbilicus, broaden gradually without a more consider-

able decrease in height right up to the venter, only then becoming slightly flatter, turn slightly forward and disappear only in the centre of the venter (at D = 120 mm and in some individuals even later). In the section of the whorl, where the ribs acquire the barlike character (at D = about 90 to 100 mm), the main ribs commonly become conspicuously dense (generally starting with three closely adjacent ribs). At D = 110 mm there are 11 to 12 ribs per whorl, at D = 125 mm there are 13 to 15 ribs per whorl (in the individual NM-0-1547 there are at D = 130 mm 17 ribs per whorl which still cross over the venter – see pl. VII, fig. 4). This number increases still further, and at D = 220 mm there are 15 to 18 ribs (now already barlike) to a whorl; they are narrow, long and barlike, especially prominent on the ventral half of the whorl side. Not until D > 150 mm do they display indications of a tuberculate elevation at the umbilicus. From the umbilical margin they pass approximately in the same strength, widening moderately, about as far as the middle of the whorl side, disappearing only on the venter.

Remarks and relations: *Lewesiceras plicatum* sp. n. deviates somewhat from the tendency which leads from the Lower Turonian *L. peramplum* to the Upper Turonian *L. mantelli* and lies in the constant decrease of the diameter at which the culmination of individual morphological tendencies takes place, especially the increased frequency of barlike ribs (i.e. the final stage of the ontogenetic development of the sculpture). While in this species the small ribs (and/or their indications) disappear really very early and are practically never distinctly developed on the whorls, the main ribs, especially in some specimens, retain for a long time the sinuous character (even at D = up to 130 mm – specimen NM-0-1549), are roughly equally prominent along their entire course, and cross over the venter. In some specimens this stage does not surpass D = about 100 mm. At D > 100 to 120 mm the ribs attain a moderately barlike character, and are strongest in that part of the venter where they are initially still moderately bent forward. Their number increases, as a result of which the present species has the greatest number of main ribs per whorl of the entire genus. Mature individuals can be distinguished according to this feature.

The divergent characteristics in relation to other species of this genus in the Cretaceous of Bohemia are given in the table on p. 38. *Lewesiceras plicatum* differs from *L. mantelli*, with which it occurs in the same localities, particularly in that the main ribs retain their sinuous character much longer and that at a given diameter there is a greater number of them per whorl (see description), the sculpture is less projecting, and in particular the barlike ribs extend considerably much deeper on the venter. The shell is also more compressed. The absolute data are given in the descriptive part.

I consider the described species to be the descendant of *L. peramplum* (MANT.). In this Lower Turonian species we can observe a certain range of variation just in those features which are characteristic of *L. plicatum* sp. n. The separation of the phylogenetic line leading from *L. peramplum* to *L. plicatum* took place appar-

ently during the Middle Turonian (see fig. 8). In some specimens (particularly in NM-0-1547 – pl. VII, fig. 4) the barlike ribs are especially numerous, narrow, and distinctly pass over the venter even at D = 130 mm. In this feature the mentioned specimen and its like resemble the genus *Nowakites* SPATH, 1922, which might be a descendant of the described species (for more details see p. 44).

Occurrence, stratigraphical range: Rarely only in the Teplice Beds (Upper Turonian). Ascertained in the Hudcov, Koštice, and Čížkovice localities.

Distribution: Hitherto known only from the Cretaceous of Bohemia.

Lewesiceras lenesicense sp. n.

Pl. VIII, figs. 1–7

1872 *Ammonites peramplus*, MANT.; partim – A. FRITSCH: Cephalopoden etc., p. 38–39, pl. 14, figs. 4a, 4b, 5a, 5b; non pl. 8, fig. 1 [= *Lewesiceras mantelli* (WRIGHT et WRIGHT, 1926)]; non pl. 8, figs. 2, 3, 4 [= *Lewesiceras peramplum* (MANTELL, 1822)].

Holotype: Individual No. NM-0-1490 (figured on pl. VIII, figs. 1, 7) deposited in the collections of the National Museum, Prague.

Locus typicus: Lenešice brickyard.

Stratum typicum: Uppermost Turonian.

Material: All the material comes from a single locality – the Lenešice brickyard near Louny. All specimens consist of limonitic internal moulds (with pyrite admixture) of juvenile whorls generally perfectly preserved, undeformed, although a few specimens are compressed or crushed.

The bulk of the material is deposited in the National Museum, Prague (17 specimens, of which 8 are undeformed, generally, however, damaged by the breaking-off of part of the shell). The specimen figured by A. FRITSCH (1872) on pl. 14, fig. 5 (NM-0-1540) has been partly damaged by the decomposition of pyrite, but is now properly conserved. According to the information of Vl. Zázvorka, the specimen figured by A. Fritsch on pl. 14, fig. 4 had not been preserved and was destroyed by the decomposition of pyrite. The large specimen mentioned by A. FRITSCH (1872) in the text on page 39, has been preserved. It is the largest specimen of the studied material (NM-0-1492) figured in this paper on pl. 8, fig. 5. Two specimens have been given to the author by M. Váně (NM-0-1497, NM-0-1498).

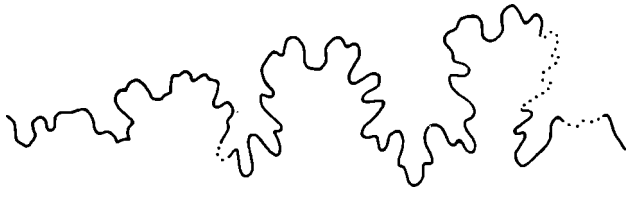
Dimensions:

Specimen No.	D (mm)	d (%)	h (%)	h' (%)	t (%)
NM-0-1497	15.7	35	38	27	53
NM-0-1496	16.0	37	41	28	59
NM-0-1498	17.6	34	40	29	55
NM-0-1540	21.0	38	34	27	52
NM-0-1490 holotype	24.4	36	39	33	57
NM-0-1492	31.5	32	41	29	52

Diagnosis: Species of the genus *Lewesiceras* with moderately depressed whorls (at D up to 30 mm), with sharply projecting umbilical tubercles on the main ribs at D > 10 mm; small ribs from D = about 13 mm; the development of the sculpture and the shape of the whorl at D > 31 mm is not known.

Description: Shell convolute, whorls moderately depressed in cross section, venter regularly arched, umbilical wall rises more or less vertically from spiral plane.

The main ribs are almost undeveloped on the initial internal whorls (at D < 6 mm) and only relatively broad shallow constrictions are distinctly indicated. On their posterior margins there gradually appear at first indications of a rib, later a distinct main rib, at first in the umbilical part, but soon, however, along the entire periphery of the whorl. At D = 9 mm there are 8 main ribs or constrictions per whorl.



4. *Lewesiceras lenesicense* sp. n.
Suture of individual No. NM-0-1496 at *D* = 13.7 mm. Uppermost Turonian, Lenešice brickyard, x10 (orig.)

The constrictions as well as ribs are bent forward and cross the venter in a moderate forward convex arc. At D > 6 mm the ribs project more distinctly. On the anterior margin they are bordered by a shallow constriction. At D = about 10 mm the umbilical parts of these ribs begin to project more distinctly as marked umbilical tubercles, passing in the ventral direction into a forward bent main rib. Initially, these umbilical tubercles are distinctly elongated ventrally, having later (at D = = 14 mm) a rather short ellipsoidal and finally almost rounded shape. Their apexes are bluntly pointed. The main ribs adjoin gradually more and more distinctly the posterior margin of these tubercles, this being distinctly apparent especially at D > 20 mm. The constriction situated closely in front of the main rib on the flank of the whorl is directed right to the tubercle, but disappears just before reaching it. Behind the constriction the umbilical tubercle passes into a main rib; in front of the constriction there is sometimes an indication of a further rib which also passed from the umbilical tubercle forward but disappeared very soon (see, e.g. pl. VIII, fig. 4). In no single instance, however, have I ascertained an obvious case of the joining of two ribs with the umbilical tubercle. On the umbilical side the tubercle fades out more slowly also on its posterior margin. Thus, when covered by the subsequent whorl, the uncovered parts of the umbilical tubercles appear to be distinctly prorsiradiate.

The first indications of small ribs can be seen in the well-preserved specimens already at D = about 10 mm as an irregular surface undulation of the whorl in the ventral part between the main ribs. They are commonly weaker on the venter, being most pronounced in the ventrolateral part of the whorl. At D = about 13 mm

these minute undulations begin to form into distinct small ribs of various length (the middle one being usually the longest). In one field (between two neighbouring main ribs) there is usually one distinct small rib developed, in larger specimens (at D > 15 mm) frequently accompanied by indications of still other, shorter minute ribs. Sometimes a small rib reaches right up to the umbilicus, but no umbilical tubercle is ever developed on it. It bends moderately backward at the umbilicus. The arc formed by the main rib on crossing the venter is always more arched than the arc of the preceding small rib.

At D = 15 mm there are 7 main ribs per whorl. In the largest individual (NM-0-1492) there are 8 main ribs per whorl at D = 31.5 mm, sometimes even 9 (individual NM-0-1498 at D = 17.6 mm). The tubercles and ribs never reach into the umbilicus.

Remarks and relations: The described material represents only juvenile whorls of ammonites which otherwise obviously grow to considerably larger dimensions. Thus, the relationship of the described species cannot be adequately evaluated, because, conversely, in the other known species only whorls of later stages are preserved and such well-preserved juvenile whorls as those of the described species are not known in them.

Judging by the individuals which I had at my disposal, the described species appears to be the youngest known member of the genus *Lewesiceras* as the tendencies to shortening of the individual stages in the ontogenetic development attain in this species the highest known maximum. In this species, the umbilical tubercles begin to project sharply already at D = 10 mm, this taking place in *L. peramplum* not sooner than at D = 20 mm (Praha-Bílá hora, Lower Turonian), and in *L. mantelli* roughly at D = 15 to 18 mm (Vehlovice, upper Middle Turonian).

The described species differs from *L. mantelli* particularly by the earlier origin of distinct umbilical tubercles (see above), by a larger number of main ribs per whorl, and fewer small ribs in one field (absolute data are given in the descriptions). So far it is possible to compare only juvenile specimens (the largest specimen of the described species has D = 31 mm). The main difference in relation to *L. mantelli* (as figured by D. SHARPE 1853, pl. 10, figs. 3a, 3b and after the plaster cast of this individual, kindly send to me by M. K. Howarth) is that this specimen has in the individual fields commonly 4 up to 5 distinct small ribs, while in *L. lenesicense* sp.n. there is generally only one distinct small rib in each field, and sometimes additional two minute, indistinct, short ones. In this respect the specimen from the Upper Turonian Mangyshlak figured by V. V. DRUŠČIC, N. P. MICHAJLOV, and M. S. ERISTAVI (1958, pl. 52, fig. 2) comes close to the described new species. However, due to indications of a larger number of small ribs in one field I assign this specimen for the time being to *L. mantelli* WRIGHT et WRIGHT.

At D > 11 to 15 mm in some tubercles indications have been observed of the beginning of another rib that would run in front of the constriction (see e.g. pl. VIII, fig. 4). However, this feature characteristic of the Coniacian genus *Pachy-*

Differences between the species of the genus *Lewesiceras* (excl. *L. lenesicense* sp. n.) ascertained in the Cretaceous of Bohemia

Feature	*peramplum*	*mantelli*	*plicatum* sp. n.
shape of ribs at D = 90–110 mm	main ribs sinuous, equally pronounced, with constrictions in front of them, regular, crossing the venter; small ribs distinctly developed, 5–7 in one field	main ribs beginning at umbilicus strongly tuberculate, ventrally flatten, broaden until disappear, not crossing the venter; small ribs lacking	main ribs sinuous, equally pronounced, crossing the venter, narrow; small ribs indistinct as irregular undulation of the ventral part of the field
number of main ribs at D = 120 mm	8 to 10	11 to 14	12 to 15
cross section through an undeformed whorl	whorl rather laterally compressed, h > t	whorl rather rounded h = t	whorl rather laterally compressed, h > t
shape of barlike ribs at D = about 250 mm	from the umbilicus the rib becomes gradually more prominent attaining its maximum height in the middle of whorl side, fades out ventrally – in longitudinal cross section (along the axis of rib) its surface has elliptical shape	rib attains its maximum height at umbilicus, broadens ventrally and flattens – in longitudinal cross section along the axis of the rib its surface is rather straight	from the umbilicus the rib broadens very slowly and flattens – it is relatively weakly indicated; in longitudinal cross section along the axis of the rib its surface has a straight up to moderately elliptical shape
small ribs disappear at D (number of small ribs in one field)	D = 110 to 120 mm (6 up to 7)	D = about 70 mm (at the utmost 4)	not developed in a distinct form

discoides SPATH, 1922 is never distinctly developed (also the juvenile individuals of *L. mantelli* exhibit similar indications – see D. SHARPE 1853, pl. 10, fig. 3a) and I have traced indications of it also in *L. peramplum* MANT. (see pl. I, fig. 1). In my opinion, this feature, already distinctly developed in some specimens of *L. lenesicense* indicates that the Coniacian *Pachydiscoides* SPATH was the evolutionary successor of the *L. mantelli* → *L. lenesicense* sp. n. line (see also p. 44 and fig. 8).

Occurrence: In the Cretaceous of Bohemia the described species has been ascertained in a single locality only – in the "gastropod horizon" in the Lenešice brickyard near Louny. It is one of the species which point to the Upper Turonian age of this complex, or part of it. The precise horizons of occurrences are not known. Its occurrence is rare.

Apart from the Lenešice brickyard, J. J. JAHN (1891) reports from the pyrope-bearing gravels from the vicinity of Třebívlice (Třiblitzer Pyropensande) the species *Ammonites* cf. *peramplus*. As yet I did not have an opportunity to study the

material (deposited in Vienna), which consists, most probably, of limonitized remains of the described species.

Stratigraphical range: upper part of the Upper Turonian.

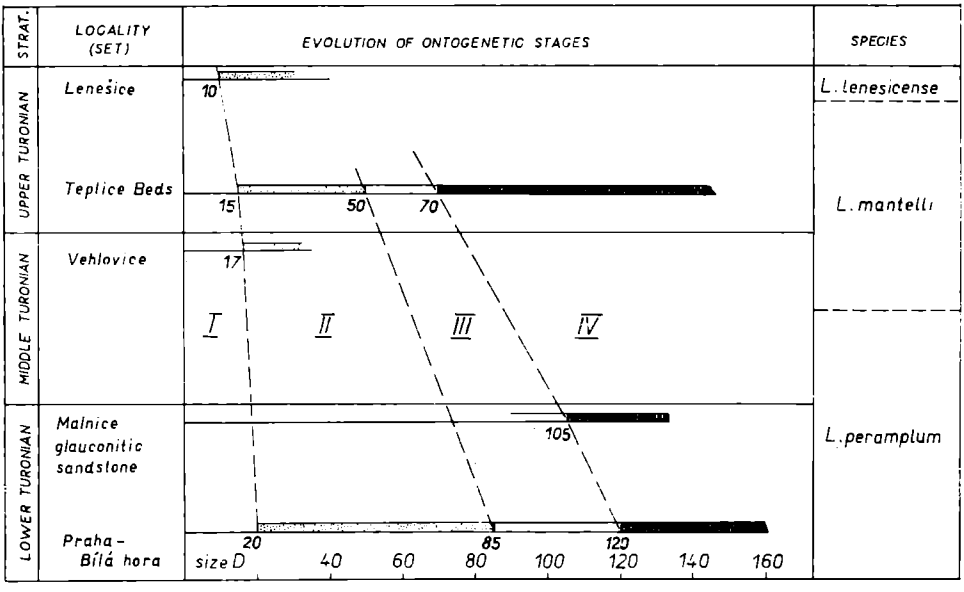
Distribution: Apart from the Cretaceous of Bohemia, for the time being this species is not known.

Remarks on the taxonomy and phylogeny of some Turonian members of the family *Pachydiscidae* particularly the genus *Lewesiceras*

The most significant morphological differences between the species of the genus *Lewesiceras* SPATH, which are represented in the Cretaceous of Bohemia (with the exception of *L. lenesicense* sp. n., of which only juvenile stages are known) are summarily recorded in the table on previous page.

As has been already stated, several regular changes can be observed in the genus *Lewesiceras* SPATH during the Turonian, of which the most important is the shortening of the individual stages of the ontogenetic development of the shell, in other words, the gradual attainment of the final character of the shell sculpture (= ? maturity) at a constantly smaller and smaller diameter of the shell (D) (see fig. 5).

I have divided the ontogenetic development of the shell sculpture into 4 stages:



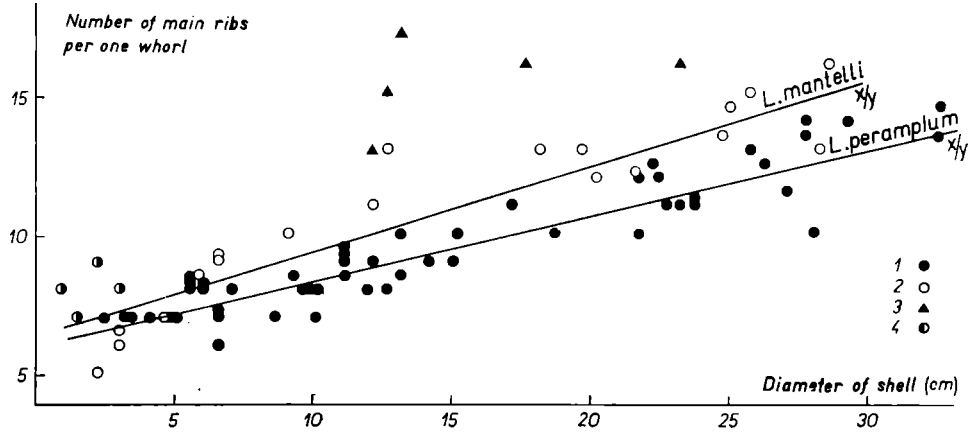
5. Graph showing the evolution of ontogenetic stages during the Turonian in the evolutionary line *Lewesiceras peramplum* → *L. mantelli* → *L. lenesicense* (orig.)

I. Umbilical tubercles are not sharply marked.

II. Umbilical tubercles sharply projecting. Gradually, however, they become rather elliptical and then somewhat ventrally elongated.

III. Umbilical tubercles disappear, i.e. merge with the main ribs which still cross the venter. Small ribs disappear in the course of or, more frequently, at the end of the stage.

IV. Main ribs acquire a barlike character and do not cross the venter.



6. Relation of number of main ribs to shell diameter in the species of the genus *Lewesiceras* in the *Cretaceous of Bohemia* (orig.)
1 — *L. peramplum* (MANT.); *2* — *L. mantelli* (WRIGHT et WRIGHT); *3* — *L. plicatum* sp. n.; *4* — *L. lenesicense* sp. n.

Even though the boundaries between these individual stages are never sharp, a wider or narrower section can still be generally determined on the shell where the successive morphological change has taken place. The values recorded in fig. 5 are the average values obtained for the individual followed sets.

The tendency towards shortening of the individual ontogenetic stages, particularly of stage I and II, is distinctly apparent from the mentioned diagram in fig. 5. Even though the length of period III remains more or less unaltered, the character of the ribbing somewhat changes (the ribs slowly acquire already here a barlike character). This fact will enable the approximate stratigraphic classification of the set of individuals from a stratigraphically unknown horizon according to the ontogenetic development of the shell sculpture. Particular care is required in individual specimens, because similar to any other feature, the degree of the ontogenetic development of the shell sculpture in relation to D is also subject to considerable fluctuating variability.

The relation of the number of main ribs to the diameter of the shell (D) is statistically evaluated in fig. 6. From the regression lines computed for *L. peramplum* (n = 52) and *L. mantelli* (n = 19) it is apparent that during ontogeny the number of

ribs per whorl increases, the increase being at the same time more rapid in *L. mantelli* than in *L. peramplum*. Due to the small number of measurements taken, the regression lines for *L. plicatum* and *L. lenesicense* have not been computed.

So far about 15 species from the Turonian and Coniacian of Europe, Africa, and Asia have been assigned to the genus *Lewesiceras* SPATH, 1939. Many of these species, however, differ very markedly from the type species of the genus [*L. peramplum* (MANTELL, 1822)], particularly owing to the different development of the main and small ribs and to the presence of other (apart from the umbilical tubercles) – one or three – rows of tubercles on the flank of the whorl. On the basis of these features it is posible to divide the species assigned to the genus *Lewesiceras* into three main groups which, in my opinion, represent independent evolutionary branches, each of which comprises several species. Each of these branches begins in the Turonian and passes into the Coniacian (fig. 7). I have not followed their further evolution (there are no conditions for this in Czechoslovakia).

I separate the above-mentioned three evolutionary branches as independent genera. They are as follows:

Lewesiceras SPATH, 1939 – Turonian

Type species: *Ammonites peramplus* MANTELL, 1822.

Diagnosis: See p. 9.

Species:

L. peramplum (MANTELL, 1822) – type species – Lower up to Middle Turonian – distribution see on p. 26

L. mantelli (WRIGHT et WRIGHT, 1951) – Middle up to Upper Turonian – distribution see on p. 32

L. romani SORNAY, 1964 – Upper Turonian – France

L. vaju (STOLICZKA, 1965) – Turonian – India

L. plicatum sp. n. – Upper Turonian – Bohemia

L. lenesicense sp. n. – Upper Turonian – Bohemia

Menabonites gen. n. – Turonian, Coniacian

Type species: *Pachydiscus anapadensis* KOSSMAT, 1898.

Diagnosis: Shell as in *Lewesiceras*, but the whorls are rather broader. Apart from distinct umbilical tubercles on the main ribs which do not disappear in ontogeny, further minute tubercles are formed on the main and on some small ribs in the region of their bending forward on the ventrolateral margin of the whorl, though in some cases not before maturity. India, Madagascar, France.

Species:

M. anapadensis (KOSSMAT, 1898) – Turonian – India

M. prosperianus (D'ORB., 1840) – Turonian – France

M. masiaposensis (COLLIGNON, 1952) – Upper Turonian up to Lower Coniacian – Madagascar

M. beantalyensis (COLLIGNON, 1952) – Upper Turonian up to Lower Coniacian – Madagascar

M. sornayi (COLLIGNON, 1952) – Upper Turonian up to Lower Coniacian – Madagascar

Tongoboryceras gen. n. – Turonian, Coniacian

Type species: *Lewesiceras tongoboryense* COLLIGNON, 1952.

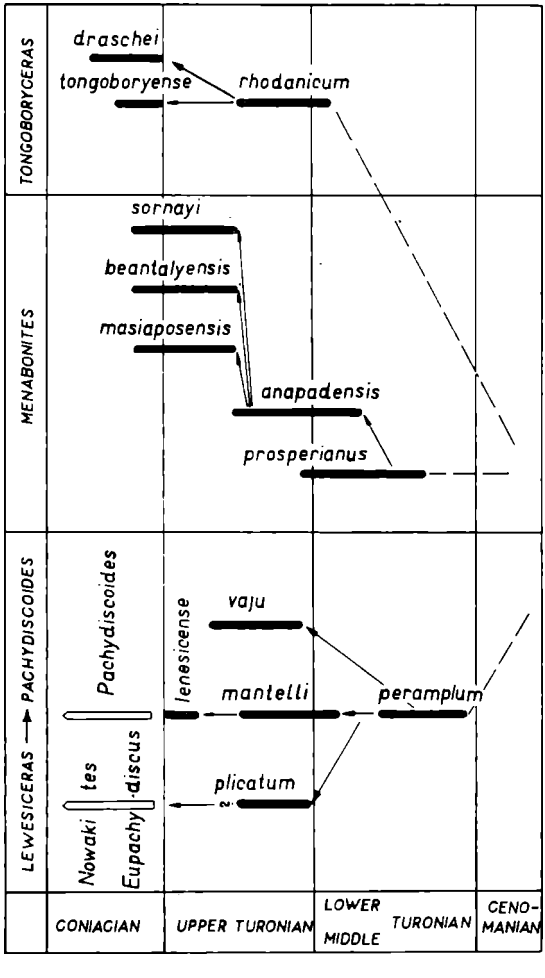
Diagnosis: Whorls depressed (t > h), reniform in section. Main and small ribs approximately equally strong, umbilical tubercles either completely absent or only feebly indicated on main ribs. Ventrolateral tubercles absent.

Species:

T. rhodanicum (ROMAN et MAZERAN, 1913) – Turonian – France

T. tongoboryense (COLLIGNON, 1952) – Lower Coniacian – Madagascar

T. draschei (REDTENBACHER, 1873) – Coniacian – Austria



7. Diagram of evolution of the genera *Lewesiceras* SPATH, *Menabonites* gen. nov., and *Tongobory ceras* gen. nov. (orig.)

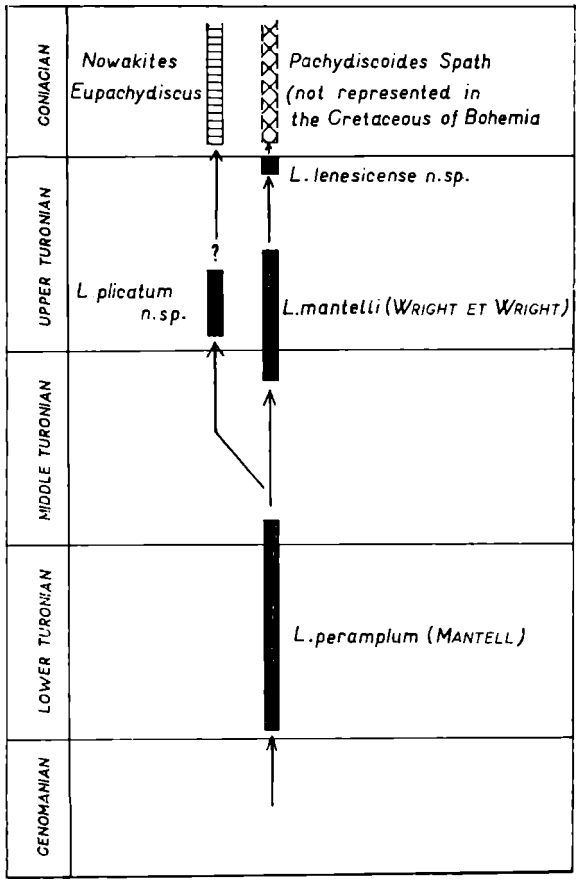
Remarks on the occurrence of the genus *Lewesiceras* in the Cretaceous of Bohemia

In the Lower Turonian of the Cretaceous of Bohemia only *Lewesiceras peramplum* (MANTELL) occurs. This species is present in almost all Lower Turonian localities in the facies of spongilitic calcareous siltstones (marlstones) up to argillaceous limestones (e.g. Bílá hora, Měcholupy). From this point of view its absence at Ždánice is very interesting (at least I have had no

specimen from this locality up to the present, nor did J. SOUKUP [1936] report any from there).

Already during the Lower Turonian certain morphological changes took place in this species (see p. 20). In regions with a markedly changed facies in the Middle Turonian (decrease in the grain-size of sediments, probably deepening of the sea and retreat of the shoreline), this species disappears almost completely (finds in the lower part of the Middle Turonian are rare). I, therefore, consider it to be a species confined to a facies of calcareous siltstone up to argillaceous limestone.

Subsequent finds of the members of the genus *Lewesiceras* are not known before the upper part of the Middle Turonian. These specimens continue in the evolutionary trend which is evident already in the Lower Turonian sets (see p. 30); however, on account of a greater time interval, the individual features are much more advanced and developed in them. The already referred to gap in the diagnostic material, which represents almost the entire Middle Turonian is, therefore, utilized for the determination of the boundary between the two species of this evolutionary line [i.e. between *L. peramplum* (MANT.) and *L. mantelli* WRIGHT et WRIGHT]. I consider *L. mantelli* WRIGHT et WRIGHT to be the descendant of the Lower Turonian *L. peramplum* (MANT.). This is proved not only by the morphological characteristics, but also by the ecological properties of this species, which, just as its Lower Turonian ancestor, is confined to the sedimentation areas of calcareous siltstones or argillaceous limestones. I consider the occurrence of large shells of this species in the sandy facies of the Jizera Beds to be secondary. In my opinion, they are shells of large specimens drifted by current



8. Diagram of evolution of the genus *Lewesiceras* in the Cretaceous of Bohemia (orig.)

action after death from regions of their original distribution. However, apart from the mentioned species *L. mantelli*, in the Teplice Beds there also exceptionally occur forms of a somewhat different character (particularly a greater number of differently shaped ribs with a diverse course of the ontogeny of shell sculpture). I separate these forms into an independent species *L. plicatum* sp. n., which I derive also from the Lower Turonian *L. peramplum* (see p. 34).

The last member of this genus – *L. lenesicense* sp. n. – is known from the uppermost Turonian of the Ohře region (from a single locality, the Lenešice brickyard). In this species culminate the evolutionary trends which are characteristic of the evolutionary branch of the genus *Lewesiceras* in the Cretaceous of Bohemia for the entire Turonian. In my opinion, this is the descendant of the species *L. mantelli* WRIGHT et WRIGHT (see fig. 8).

No representative of the genus *Lewesiceras* is known from the Coniacian, either from the Cretaceous of Bohemia, or from other regions. The descendants of the described evolutionary line *L. peramplum* → *L. mantelli* → *L. lenesicense* sp. n. are represented in the Coniacian most probably by the genus *Pachydiscoides* SPATH, as indications of some prominent features of this Coniacian genus (e.g. the umbilical branching of main ribs) can be observed already in the Turonian representatives of the genus *Lewesiceras* (see p. 38).

In my opinion, the descendant of the evolutionary line of the species *Lewesiceras plicatum* sp. n. could either be the genus *Nowakites* SPATH, 1922, or the genus *Eupachydiscus* SPATH, 1922. The Coniacian species of the genus *Nowakites* SPATH (Coniacian—Santonian) have dense ribs on the shell [e.g. *N. tallavignesi* (D'ORB.) – in M. COLLIGNON 1952, pl. 9, fig. 3] which cross over the venter. This species might be derived in terms of a simple continuation in the tendencies manifest in *Lewesiceras plicatum* sp. n. The strong main ribs had extended to earlier stages and were denser. On the more pronounced ribs appear umbilical tubercles, the less pronounced ones do not reach the umbilicus. Indications of these tendencies might be observed already in the described material (e.g. in the individual NM-0-1548 – pl. VII, fig. 3). Similarly as some other specimens, this specimen exhibits tendencies to the shortening of some main ribs in places where they are crowded. By this features it resembles the genus *Eupachydiscus* SPATH (Coniacian—Campanian). Unfortunately, early whorls in *Lewesiceras plicatum* sp. n. are not known and thus it cannot be determined, whether the tendency to the adjoining of two ribs with the umbilical tubercles, an important feature of the two mentioned Senonian genera, is manifest also here. Therefore, for the time being, a more definite conclusion is not possible.

K tisku doporučili V. Zázvorka a R. Horný

Přeložila E. Česánková

Geologický ústav ČSAV, Praha

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Explanation of Plates

Pl. I

Lewesiceras peramplum (MANTELL, 1822)

1. NM-0-1524, ×1.3 Lower Turonian, Cretaceous of Bohemia, locality unknown.
2. NM-0-1501, ×1.2 Lower Turonian, ? Praha-Bílá hora.
3. NM-0-1505, ×0.7 Lower Turonian, Praha-Bílá hora.
4. NM-0-1521, ×0.6 Lower Turonian, Praha-Na Šafránce.

Pl. II

Lewesiceras peramplum (MANTELL, 1822)

1. NM-0-1522, ×0.5 Lower Turonian, Praha-Bílá hora.
2. NM-0-1506, ×0.6 Lower Turonian, Praha-Bílá hora.
3. NM-0-1523, ×0.5 Lower Turonian, Praha-Bílá hora.
4. NM-0-1520, ×0.7 Lower Turonian, Praha-Bílá hora.

Pl. III

Lewesiceras peramplum (MANTELL, 1822)

1. NM-0-1542, ×2.4 Middle Turonian, Jeřábek brickyard near Roudnice.
2. NM-0-1499, ×1.4 Holotype of the species *Pachydiscus juvencus* LAUBE et BRUDER, 1887; 1887, pl. 29, fig. 1. Lower Turonian, Praha-Bílá hora.
3. NM-0-1568, ×1.1 Orig. A. FRITSCH 1872, pl. 8, fig. 3. Lower Turonian, Praha-Bílá hora.
4. NM-0-1500, ×1.0 Lower Turonian, Praha-Bílá hora.

Pl. IV

Lewesiceras peramplum (MANTELL, 1822)

1. NM-0-1507, ×0.31 Lower Turonian, Praha-Bílá hora.
2. NM-0-1574, ×0.34 Lower Turonian, Libořice near Měcholupy.

Lewesiceras mantelli WRIGHT et WRIGHT, 1951

3. NM-0-1572, ×0.66 Middle Turonian, Vehlovice.
4. NM-0-1539, ×0.36 Middle Turonian, Javornice u Libuně.

Pl. V

Lewesiceras mantelli WRIGHT et WRIGHT, 1951

1. NM-0-1543, ×2.3 Lower Turonian, Radovesice.
2. NM-0-1544, ×1.2 Upper Turonian, Kučlín.
3. NM-0-1545, ×0.9 Upper Turonian, Hudcov.
4. NM-0-1546, ×0.6 Upper Turonian, Hudcov.

Pl. VI

Lewesiceras mantelli WRIGHT et WRIGHT, 1951

1. NM-0-1526, ×0.29 Orig. A. FRITSCH 1872, pl. 8, fig. 1. Middle Turonian, Mladá Boleslav.
2. NM-0-1567 (ČL-6391), ×0.19 Upper Turonian, Hudcov.
3. NM-0-1566 (ČL-6392), ×0.16 Upper Turonian, Koštice.
4. NM-0-1565 (ČL-6505), ×0.22 Upper Turonian, Bohosudov.

Pl. VII

Lewesiceras plicatum sp. n.

1. NM-0-1571 (ČL-6421), ×0.61 Holotype. Upper Turonian, Hudcov.
2. NM-0-1550, ×0.57 Upper Turonian, Hudcov.
3. NM-0-1548, ×0.46 Upper Turonian, ? Čížkovice.
4. NM-0-1547, ×0.59 Upper Turonian, Čížkovice.

Pl. VIII

Lewesiceras lenesicense sp. n.

1. NM-0-1490, ×1.8 Holotype. Upper Turonian, Lenešice brickyard.
2. NM-0-1491, ×2.7 Upper Turonian, Lenešice brickyard.
3. NM-0-1497, ×2.3 Upper Turonian, Lenešice brickyard.
4. NM-0-1498, ×2.1 Upper Turonian, Lenešice brickyard.
5. NM-0-1492, ×1.8 Upper Turonian, Lenešice brickyard.
6. NM-0-1493, ×3.4 Upper Turonian, Lenešice brickyard.
7. NM-0-1490, ×1.4 Holotype. Upper Turonian, Lenešice brickyard.

All photographs by L. Záporožcová

Lewesiceras Spath (Pachydiscidae, Ammonoidea) z turonu české křídy

(*Résumé anglického textu*)

VÁCLAV HOUŠA

Předloženo 27. května 1965

Z čeledi *Pachydiscidae* byl v české křídě zjištěn pouze jediný rod – *Lewesiceras* SPATH, 1939. Je zde zastoupen čtyřmi druhy (z nich dva nové), které byly až dosud shrnovány pod souborné označení "*Pachydiscus*" *peramplus* (MANTELL). Pouze výjimečně byl oddělován jako samostatný druh "*Pachydiscus*" *lewesiensis* (MANTELL) a "*Pachydiscus*" *juvencus* LAUBE et BRUDER. Oba tyto druhy však pokládám za totožné s *L. peramplum* (MANTELL). Ve spodním turonu a ve spodní části středního turonu se vyskytuje *L. peramplum* (MANTELL, 1822), ve svrchní části středního turonu a ve svrchním turonu (teplické vrstvy) *L. mantelli* WRIGHT et WRIGHT. V teplických vrstvách (svrchní turon) byl vzácně zjištěn *L. plicatum* sp. n. a z nejsvrchnějšího turonu z lenešické cihelny je popsán *L. lenesicense* sp. n.

Studovaný materiál obsahuje asi 300 kusů, z toho přes 180 patří druhu *L. peramplum* (MANT.). To umožnilo podrobně studovat u tohoto druhu ontogenezi skulptury schránky, což bylo v poněkud omezenější míře (nedostatek materiálu) provedeno i u ostatních druhů. Srovnáním bylo zjištěno, že ve fylogenetickém vývoji docházelo během turonu ve vývojové větvi *L. peramplum* → *L. mantelli* → → *L. lenesicense* k tachygenetickým jevům (akcelerace), tj. zkracování jednotlivých etap ontogenetického vývoje schránky. Soubor jedinců ze stratigraficky neznámého horizontu můžeme nyní podle ontogenetického vývoje skulptury schránky přibližně stratigraficky zařadit.

Na základě literárních údajů byly fylogeneticky zhodnoceny všechny druhy až dosud zařazované do rodu *Lewesiceras* SPATH. To umožnilo oddělit od vlastního rodu *Lewesiceras* SPATH (6 druhů) další dva rody nové, a to *Menabonites* gen. n. (5 druhů) a *Tongoboryceras* gen. n. (3 druhy).

Lewesiceras Spath (Pachydiscidae, Ammonoidea) из турона меловых отложений Чехии

Из семейства *Pachydiscidae* SPATH, 1922, в меловых отложениях Чехии установлен лишь единственный род - *Lewesiceras* SPATH, 1939, представленный здесь 4 видами: *L. peramplum* (MANTELL, 1822) (син. *Ammonites lewesiensis* MANTELL, 1822; син. *Pachydiscus juvencus* LAUBE et BRUDER, 1887), *L. mantelli* WRIGHT et WRIGHT, 1951, *L. plicatum* sp. n. и *L. lenesicense* sp. n. Детально изучалось онтогенетическое развитие отдельных видов, особенно вида *L. peramplum*, и установлена последовательность морфологических изменений в туроне. На основе литературных данных оценены установленные до сих пор виды, относимые к роду *Lewesiceras*, и классифицируются по самостоятельным линиям развития (*Menabonites* gen. n. и *Tongoboryceras* gen. n.)

Přeložila K. Morávková


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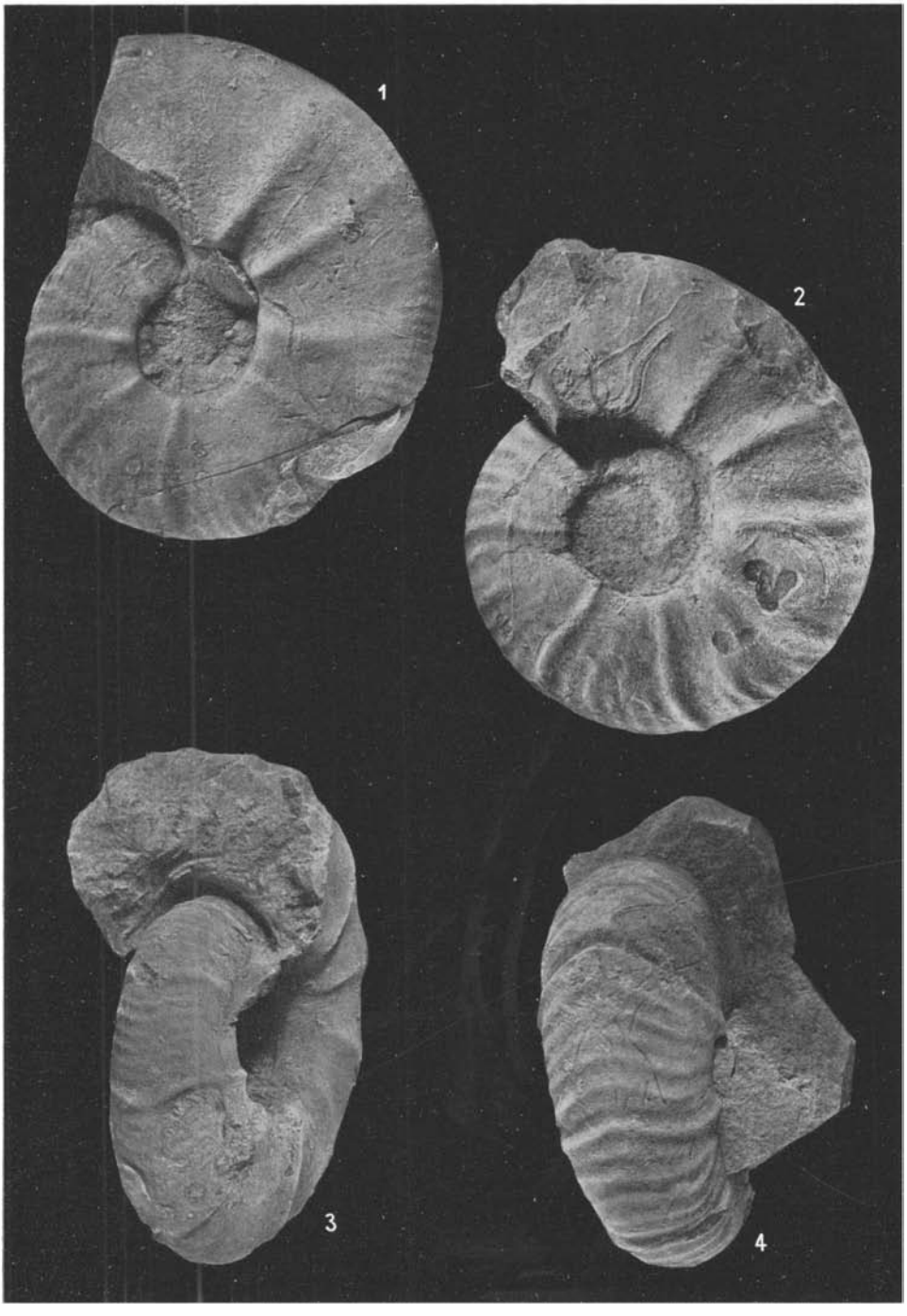
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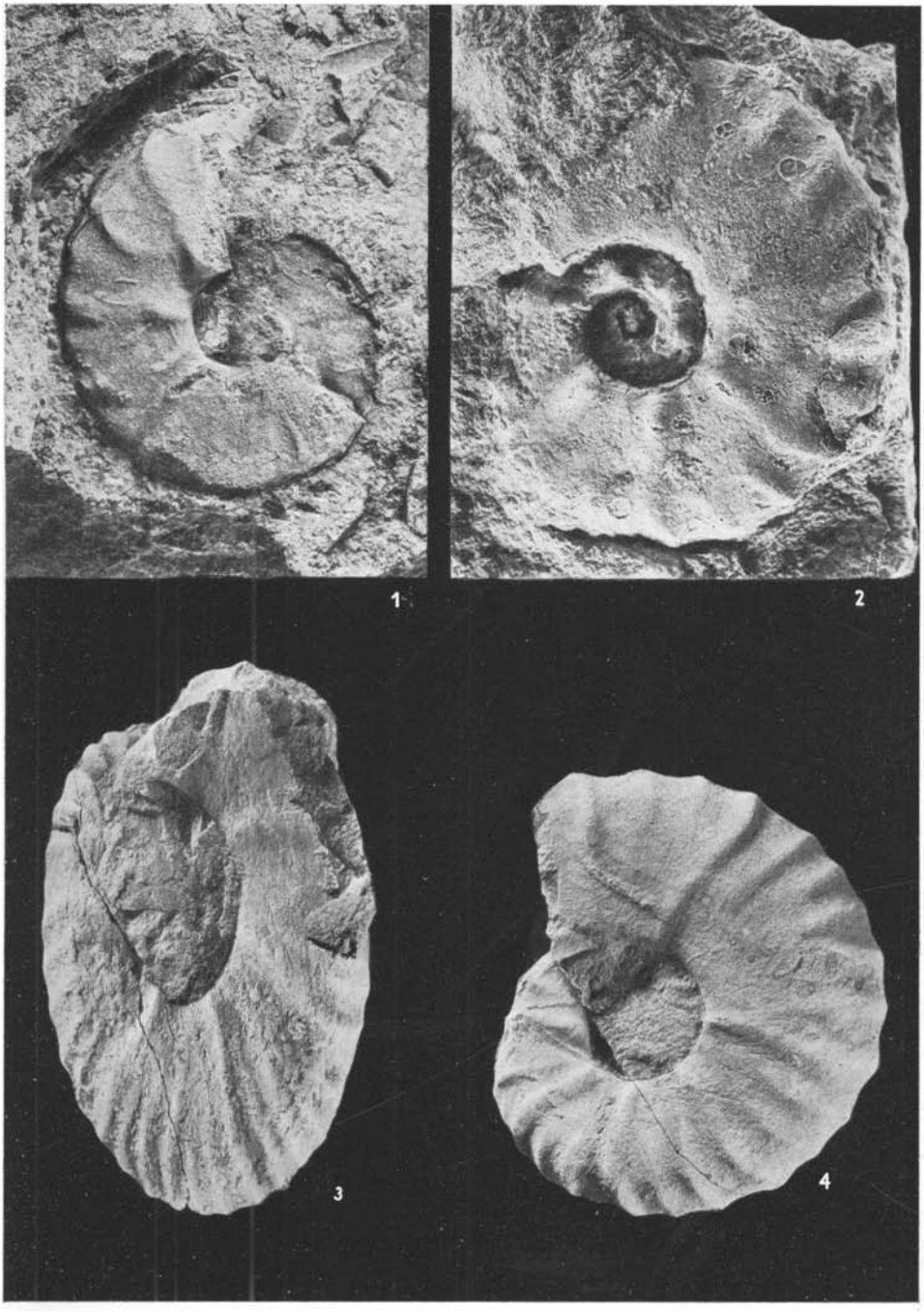
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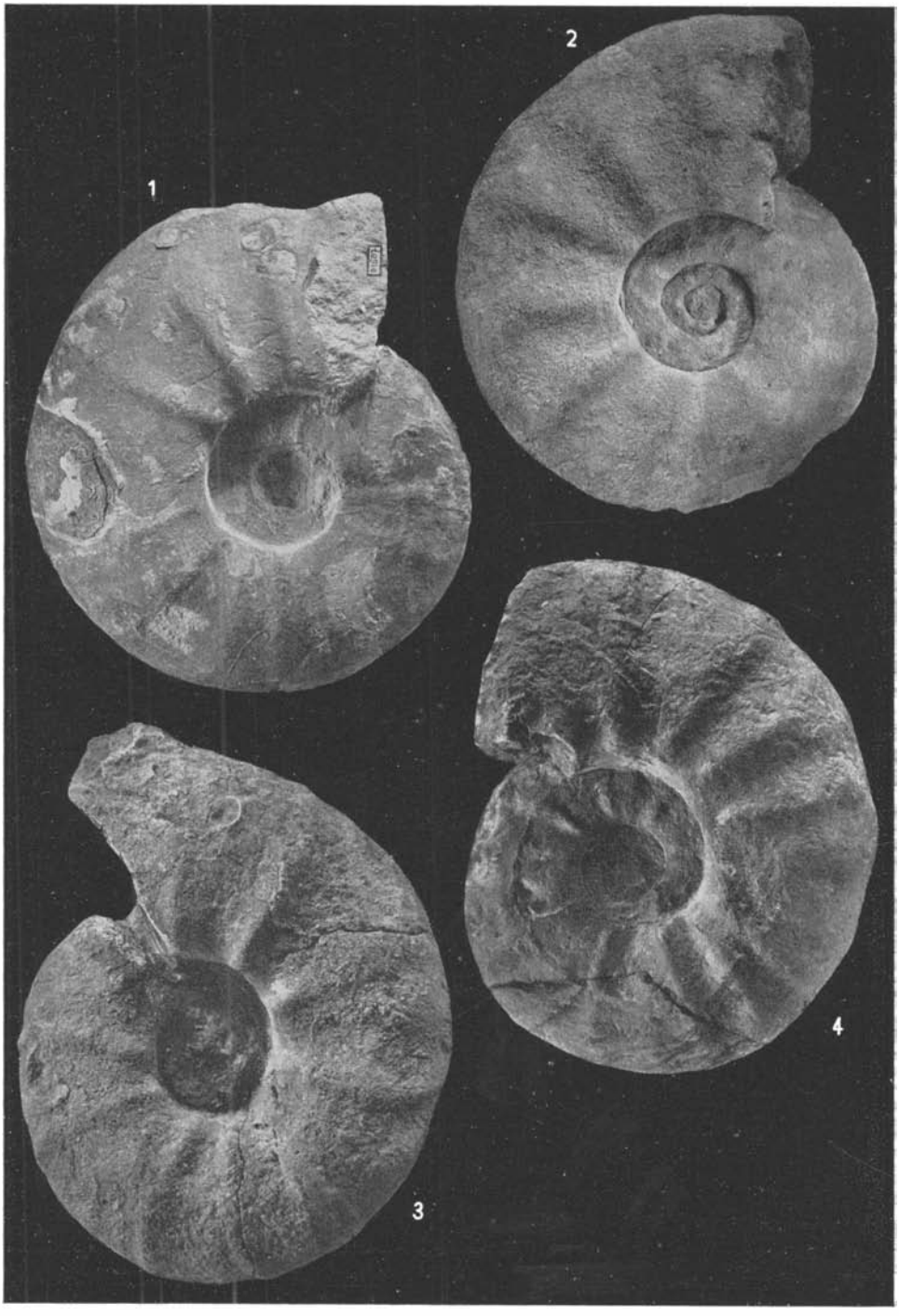
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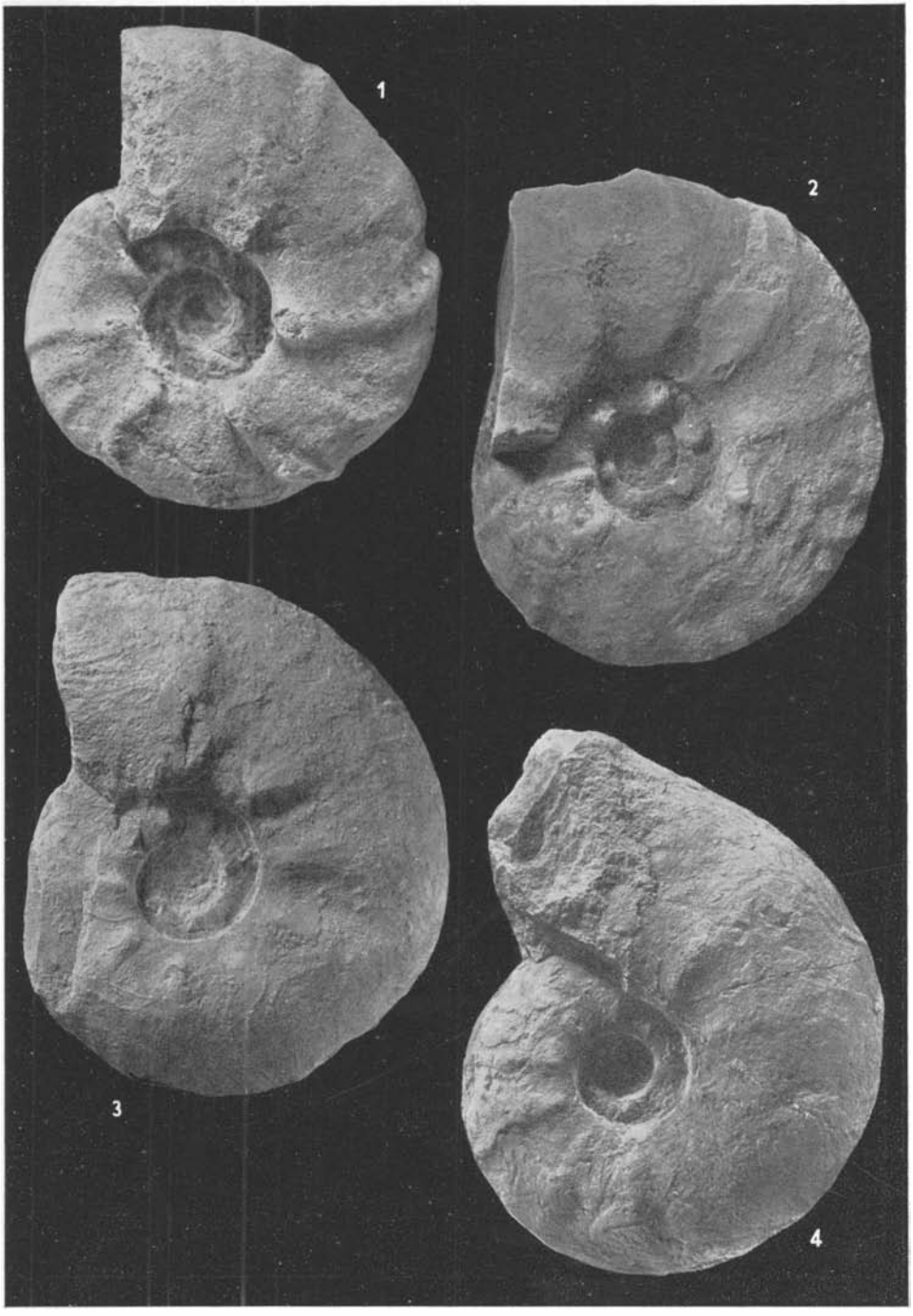
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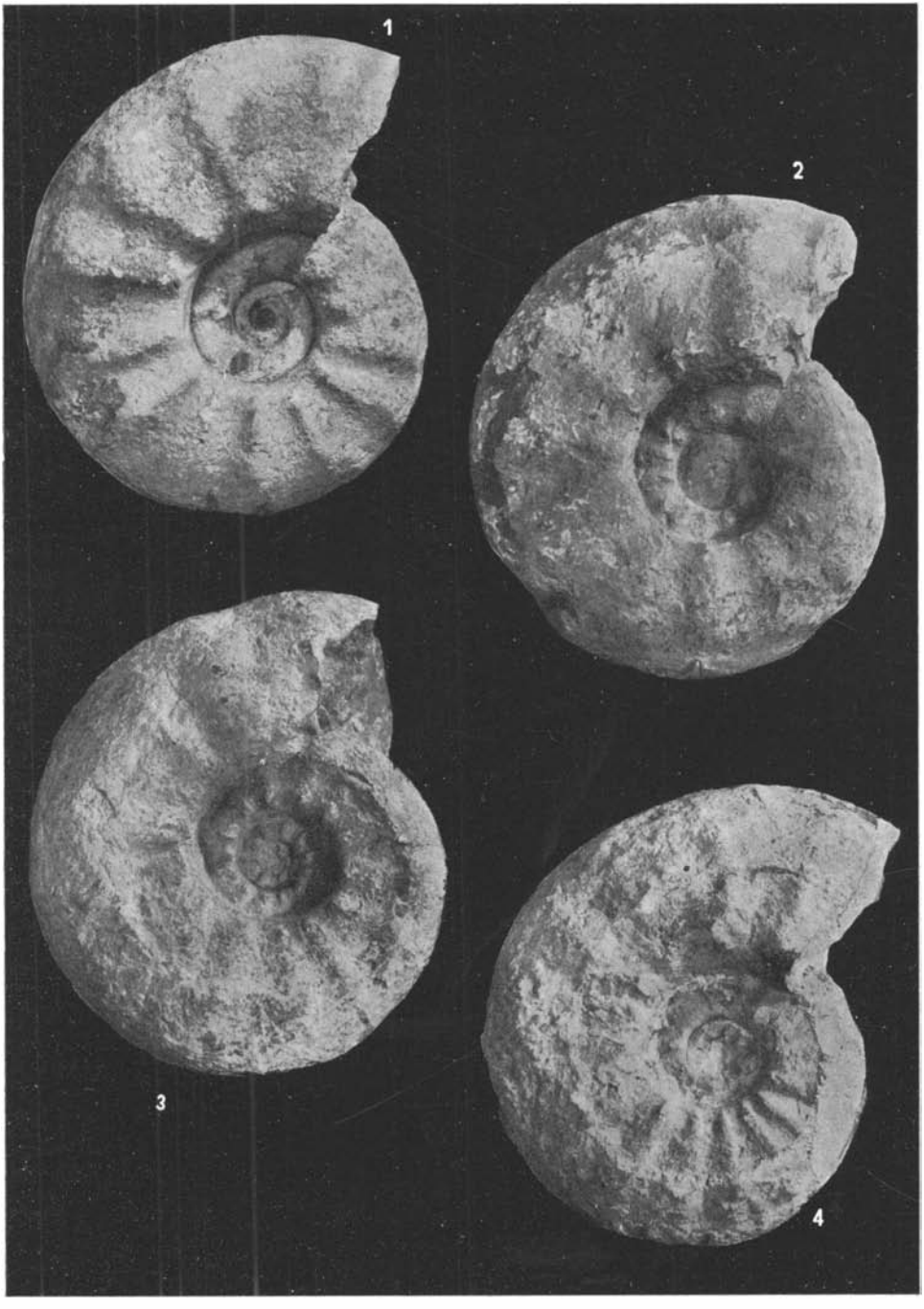
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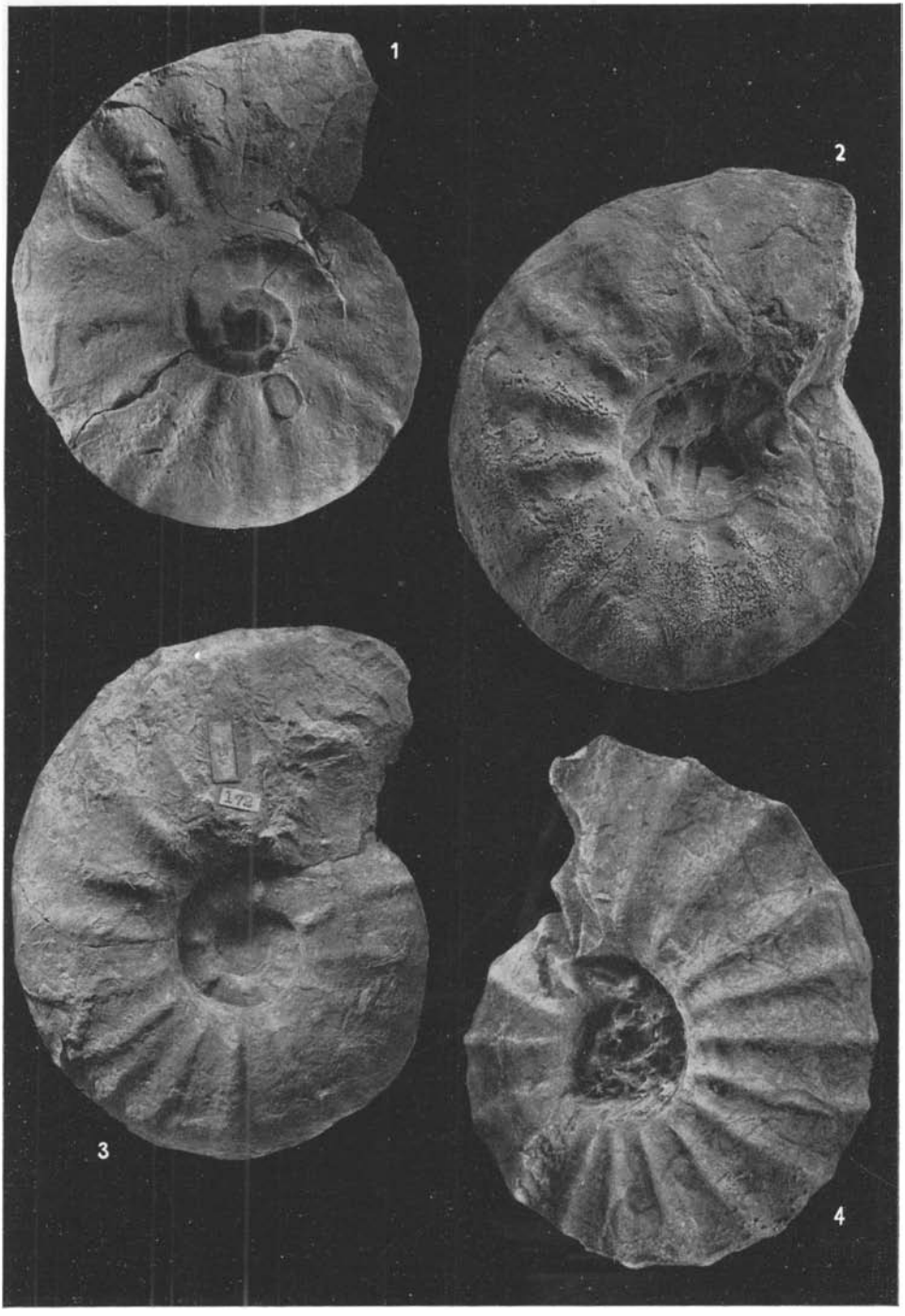
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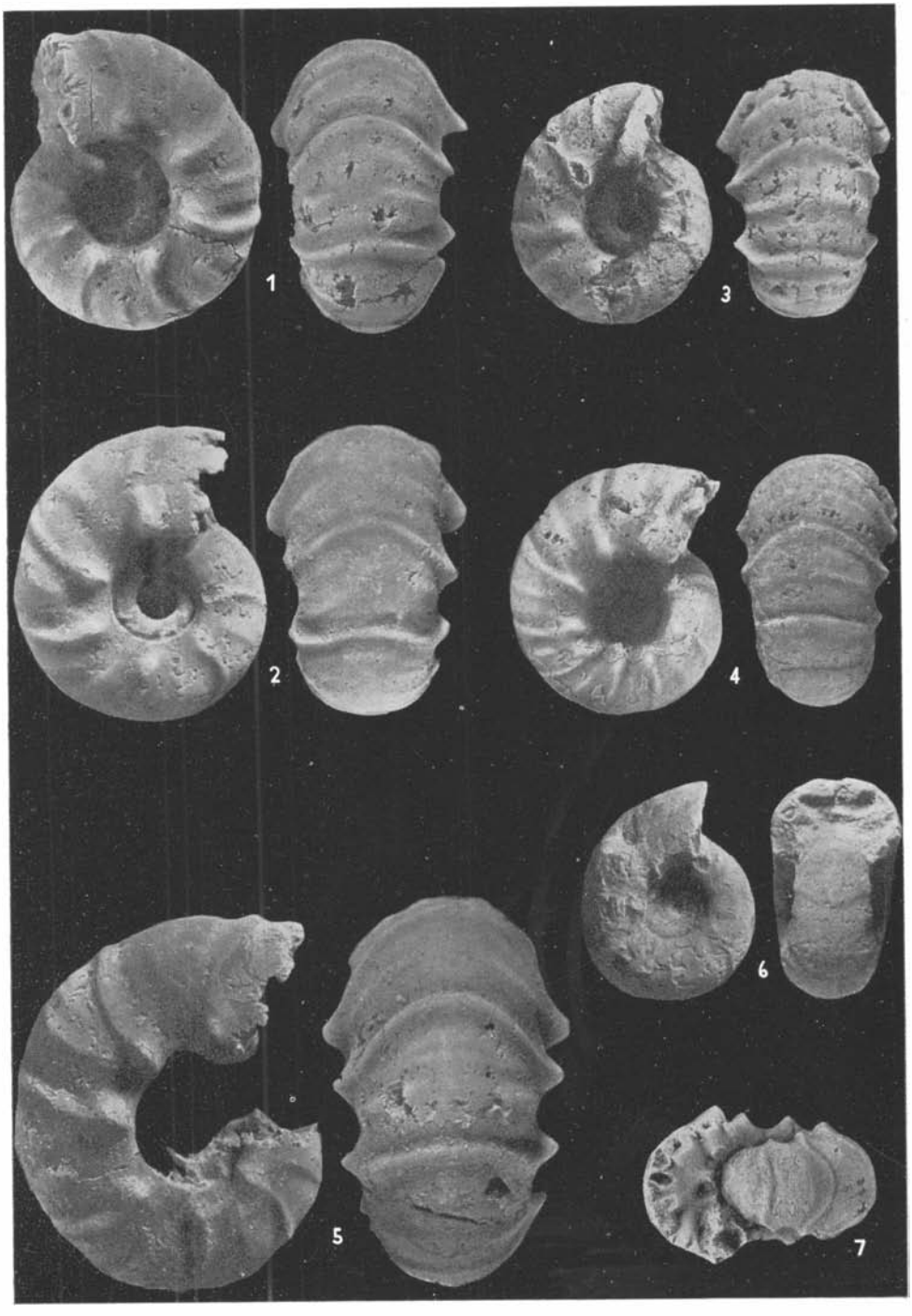
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