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SYSTEMATICS OF LOWER LIASSIC AMMONITINA

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ABSTRACT

A revised classification of the Ammonitina of the Lower Lias (Hettangian, Sinemurian, and Lower Pliensbachian Stages) is given. This will be used in the revision of the *Treatise on Invertebrate Paleontology*, Volume L (Cephalopoda: Ammonoidea). The number of genera upheld is reduced as compared with the first edition of the *Treatise* (1957), chiefly as a result of the relegation of more genera to synonymy. The interpretation of a number of genera is discussed, and type specimens are designated where necessary for type species of genera.

INTRODUCTION

All the entries for Jurassic ammonites in the first edition of Part L, Ammonoidea, of the *Treatise on Invertebrate Paleontology* (Moore, ed., 1957) were written by the late W. J. Arkell who accepted about 650 valid genera, with numerous synonyms. Arkell's own research had been wholly on Middle and Upper Jurassic ammonites and the classification and synonymy of the Lower Liassic genera in the *Treatise* resulted from an extensive correspondence between Arkell and Donovan. Donovan is revising the genera of this age (except phyllocerataceans and lycocerataceans) for the projected new edition of Volume L. A rigorous check of all genera by Forsey, made possible by a grant from National Science Foundation funds made available to the editors of the *Treatise* (GB-27274), has revealed a number of deficiencies, principally as regards the designation of types. It is one purpose of the present paper to remedy these. The other purpose is to present in outline the classification which will be employed in the *Treatise* revision.

Almost without exception Lower Liassic ammonite genera were founded on old species of nineteenth century authors: the Sowerbys, d'Or-

bigny, and Quenstedt being the chief ones. This gives rise to numerous difficulties of interpretation, further complicated by the fact that authors of genera, knowing that the original species were poorly characterized, often quoted figures of later authors. Frequently the original species and the later author's figure are not conspecific, or even congeneric, by modern standards. In the 1950's when the first edition of *Treatise* Part L was being prepared, the Rules of the *Zoological Code* required that the nominal type species be interpreted in the sense of its original author (Arkell, 1950, p. 357). This sometimes resulted in the meaning of the genus being changed from that of its author, who had "illegally" quoted a later figure as "genotype" or "genoelectotype." Since then the Rules have been revised (ICZN, 1964) and a new rule (Article 70 (b): Deliberate use of misidentification) permits some of these genera to be interpreted as their authors intended. An example is *Epammonites* (p. 5).

In all practical cases lectotypes have been designated for type species which did not hitherto possess either a holotype or a lectotype. In cases where syntype material does not exist, and has not

been well figured, neotypes are proposed, the adequate definition of the type species being regarded as proper grounds for this under Article 75.

A few cases either defy solution or must await discovery of new material. The genus *Ophideroceras* Spath, 1925, was based on a single specimen, briefly described, and illustrated by an indifferent halftone block and a line drawing. The holotype, whose exact locality and horizon were not known, was lost when Hull Museum was bombed during the last war. Failing the discovery of new material *in situ*, the genus can not be adequately defined. For the time being it is regarded as a harmless *nomen dubium* not calling for any action. It is believed, however, that all important genera now rest on proper type material, the few which do not being mostly synonyms or *nomina dubia* which are unlikely to be used.

Although classification has not changed basically, it is desirable to publish the new version in outline as soon as possible. One or two genera have radically changed their position: *Peripleuroceras* Tutecher & Trueman, 1925, placed in Polymorphitidae in the first edition, is now thought to be a lytoceratacean (and hence does not appear in this paper). *Discamphiceras* and *Euphyllites* have been transferred to Juraphyllitidae (Phyllocerataceae) and *Parapsiloceras* to Pleuroacanthitidae (Lytocerataceae). On the other hand, *Villania*, formerly uncomfortably situated in its own subfamily Villaniinae as an Upper Jurassic lytoceratid, is now known to be of Lower Liassic

age and is placed in Coeloceratinae. Most changes are smaller than these and have been made in an attempt to make the classification more consistent and better balanced.

Seventy-six genera are recognized in this revision as against 106 in corresponding groups in the first edition. Apart from the transfers mentioned above, and removal of four genera to "Incertae sedis," this reduction results from further relegation of genera to synonymy. This has been spread fairly evenly throughout the different families. The number of families is increased from eight to nine as a result of elevation of Cymbitidae to full family status. Although possibly derived from Arietitidae, in which they were formerly placed, Cymbitidae are a long-ranging group, morphologically very distinct, and are better separated from Arietitidae.

We acknowledge the cooperation of numerous museum directors and curators in replying to our enquiries. Dr. M. K. Howarth has kindly supplied photographs of specimens in the British Museum (Natural History). T. A. Getty has helped with information on several genera, and has supplied the discussion of the genus *Defossiceras* included herewith (p. 13). Genera of the family Echioceratidae are not discussed in this paper since they are the subject of a separate systematic study by Dr. Getty (Getty, 1973).

Throughout this paper the *International Code of Zoological Nomenclature* is referred to as the *Code*.

## CLASSIFICATION

The following table gives the classification which it is proposed to adopt in the revised edition of Part L. The outline records accepted genera, subgenera being placed in parentheses after the genera to which they are referred. Synonyms follow within brackets; objective synonyms are designated by the abbreviation *obj.*; others are subjective. Other abbreviations used include *nom. van.* for *nomen vanum*, *nom. null.* for *nomen nullum*, *nom. dub.* for *nomen dubium*, *nom. nud.* for *nomen nudum*, ICZN for *International Commission on Zoological Nomenclature*.

### *List of Lower Liassic Ammonitina*

Superfamily Psilocerataceae Hyatt, 1867

Family Psiloceratidae Hyatt, 1867

*Psiloceras* Hyatt, 1867 [= *Paraphylloceras* Salfeld, 1919; *Psilonotoceras* Quenstedt, 1883, *obj.*; *Psilonotoceras* Buckman, 1906, *nom. van.*]

*Caloceras* Hyatt, 1870

*Psilophyllites* Spath, 1914 [= *Hagenowiceras* Lange, 1921, *obj.*; *Neophyllites* Lange, 1941]

*Laqueoceras* Lange, 1925

Family Schlotheimiidae Spath, 1923

*Schlotheimia* Bayle, 1878 [= *Anguliferites* Lange, 1951; *Scannoceras* Lange, 1924, *obj.*]

*Angulaticeras* Quenstedt, 1883 [= *Argoceras* Steinmann, 1925; *Boucaulticeras* Spath, 1924; *Pseudoschlotheimia* Spath, 1924]

*Kammerkaroceras* Lange, 1941

*Saxoceras* Lange, 1924

*Sulciferites* Spath, 1922 [= *Charmasseiceras* Spath,

- 1924; *Encycloceras* Blind, 1963; ?*Hesperites* Pompeckj, 1895 (ICZN pend.); *Hongkongites* Grabau, 1928]
- Wahneroceras* Hyatt, 1889 [= *Curviceras* Blind, 1963; ?*Franziceras* Buckman, 1923; *Kammerkarites* Spath, 1924; *Macrogrammites* Buckman, 1928; *Megastomoceras* Lange, 1941; *Storthoceras* Lange, 1941; *Tenoceras* Lange, 1952, obj.; *Tenoceras* Arkell, 1957, obj.]
- Family Arietitidae Hyatt, 1875
- Subfamily Arietitinae Hyatt, 1875
- Coroniceras* Hyatt, 1867
- C.* (*Coroniceras*) Hyatt, 1867 [= *Arnioceratoides* Spath, 1925, obj.; *Epammonites* Spath, 1922; *Pararnioceras* Spath, 1922; *Primarietites* Buckman, 1926]
- C.* (*Arietites*) Waagen, 1869 [= *Arietoceras* Quenstedt, 1883, *nom. van.*; *Arietitites* Spath, 1924, *nom. null.*; *Megarietites* Spath, 1922]
- C.* (*Eucoroniceras*) Spath, 1922 [= ?*Pseudasteroceras* Spath, 1922]
- C.* (*Paracoroniceras*) Spath, 1922
- Arnioceras* Hyatt, 1867 [= *Amioceras* Spath, 1919, *nom. null.*; *Arniotites* Whiteaves, 1889; *Burkhardtoceras* Lopez, 1967; *Eparnioceras* Spath, 1924; ?*Melanhippites* Crickmay, 1928; ?*Melanippites* Crickmay, 1962, *nom. van.*]
- Metarnioceras* Spath, 1925
- Tmaegoceras* Hyatt, 1889
- Vermiceras* Hyatt, 1889
- V.* (*Vermiceras*) Hyatt, 1889 [= *Diplosellites* Buckman, 1925; *Discoceras* Hyatt, 1867, *non* Barrande, 1867; *Gyrophioceras* Spath, 1924; *Keynshamites* Buckman, 1926; *Metophioceras* Spath, 1924; *Protocymbites* Spath, 1923]
- V.* (*Paracaloceras*) Spath, 1923 [= *Alpinoceras* Lange, 1941; ?*Centauroceras* Blind, 1963]
- Subfamily Agassiceratinae Spath, 1924
- Agassiceras* Hyatt, 1875 [= *Aetomoceras* Hyatt, 1900, obj.; *Agassiziceras* Fischer, 1879, *nom. van.*; *Agassizoceras* Buckman, 1904, *nom. null.*]
- Euagassiceras* Spath, 1924 [= *Paracoronites* Buckman, 1927; *Paraconites* Dacqué, 1934]
- Subfamily Alsatitinae Spath, 1924
- Alsatites* Haug, 1894 [= *Gonioptychoceras* Lange, 1941; *Proarietites* Lange, 1922]
- Canavarites* Hyatt, 1900
- Pseudaeomoceras* Spath, 1923 [= *Proarnioceras* Blind, 1963]
- Subfamily Asteroceratinae Spath, 1946
- Asteroceras* Hyatt, 1867
- Aegasteroceras* Spath, 1925 [= *Arctoasteroceras* Frebald, 1960; *Ptycharietites* Spath, 1925]
- Caenisites* Buckman, 1925 [= *Euasteroceras* Donovan, 1953]
- Eparietites* Spath, 1924
- Epophioceras* Spath, 1924
- Hypasteroceras* Spath, 1923
- Pompeckioceras* Spath, 1925
- Subfamily Pseudotropitinae Donovan, n. fam.
- Pseudotropites* Wachner, 1894
- Family Echioceratidae Buckman, 1913
- Echioceras* Bayle, 1878 [= *Echioceratoides* Trueman & Williams, 1925; *Ophioceras* Hyatt, 1867, *non* Barrande, 1865; *Pleurechioceras* Trueman & Williams, 1925]
- Gagaticeras* Buckman, 1913 [= *Parechioceras* Buckman, 1914]
- Leptechioceras* Buckman, 1923 [= *Psilechioceras* Erben, 1956]
- Palaeoechioceras* Spath, 1929 [= *Hypechioceras* Spath, 1956; *Protechioceras* Trueman & Williams, 1927, obj., *non* Spath, 1925, *nom. dub.*]
- Paltechioceras* Buckman, 1924
- P.* (*Paltechioceras*) Buckman, 1924 [= *Epechioceras* Trueman & Williams, 1925; *Euechioceras* Trueman & Williams, 1925; *Kamptechioceras* Trueman & Williams, 1925; *Metechioceras* Trueman & Williams, 1925; *Plesechioceras* Trueman & Williams, 1925; *Stenechioceras* Buckman, 1927; *Vobstericeras* Trueman & Williams, 1925]
- P.* (*Orthechioceras*) Trueman & Williams, 1925 [= *Homechioceras* Trueman & Williams in Buckman, 1925]
- Family Oxynoticeratidae Hyatt, 1875
- Oxynoticeras* Hyatt, 1875 [= *Hypoxynoticeras* Spath, 1925; *Oxynotoceras* Buckman, 1894, *nom. null.*]
- Cheltonia* Buckman, 1904
- Gleviceras* Buckman, 1918 [= *Glevumites* Buckman, 1924; *Glevumites* Spath, 1926, *nom. null.*; *Guibaliceras* Buckman, 1918; *Riparioceras* Schindewolf, 1962; *Tutchericeras* Buckman, 1919; *Victoriceras* Buckman, 1918]
- Paracymbites* Trueman & Williams, 1927
- Paroxynoticeras* von Pia, 1914 [= *Paraoxynoticeras* Arkell, 1957, *nom. null.*]
- Radstockiceras* Buckman, 1918 [= *Carixiceras* Spath, 1925; *Fanninoceras* McLearn, 1930); *Fastigiceras* Buckman, 1919; *Homoxynoticeras* Buckman, 1925; *Kleistoxynoticeras* Buckman, 1925; *Metoxynoticeras* Spath, 1922; *Phylloxynotites* Buckman, 1924; *Reitentoceras* Buckman, 1920]
- Slatterites* Spath, 1923
- Family Cymbitidae Buckman, 1919
- Cymbites* Neumayr, 1878 [= *Metacymbites* Spath, 1923]
- Superfamily Eoderocerataceae Spath, 1929
- Family Eoderoceratidae Spath, 1929
- Subfamily Xipheroceratinae Spath, 1925
- Xipheroceras* Buckman, 1911 [= *Postderoceras* Schindewolf, 1923, *nom. nud.*; *Praederoceras* Dietz, 1923, obj.]

- Bifericeras* Buckman, 1913 [= *Hemimicroceras* Spath, 1925; ? *Ophideroceras* Spath, 1925]  
*Cruciloboceras* Buckman, 1920 [= *Metaderoceras* Spath, 1925]  
*Eoderoceras* Spath, 1925 [= *Derocheras* Hyatt, 1867, non Rafinesque, 1820]  
*Microderoceras* Hyatt, 1871  
*Neomicroceras* Donovan, 1966  
*Promicroceras* Spath, 1925  
Subfamily Coeloceratinae Haug, 1910  
*Coeloceras* Hyatt, 1867  
*Apoderoceras* Buckman, 1921  
*Hyperderoceras* Spath, 1926  
*Pimelites* Fucini, 1896  
*Praesphaeroceras* Levi, 1896 [= *Diaphorites* Fucini, 1896]  
*Tetraspidoceras* Spath, 1926  
*Villania* Till, 1911  
Subfamily Phricodoceratinae Spath, 1938  
*Phricodoceras* Hyatt, 1900 [= *Hemiparinodiceras* Geczy, 1959]  
*Coeloderoceras* Spath, 1923  
*Epideroceras* Spath, 1923 [= *Pseuduptionia* Bremer, 1965]  
Family Polymorphitidae Haug, 1887  
*Polymorphites* Haug, 1887  
*Acanthopleuroceras* Hyatt, 1900 [= *Cycloceras* Hyatt, 1867, non McCoy, 1844]  
*Dayiceras* Spath, 1920  
*Gemmellaroceras* Hyatt, 1900 [= *Leptonotoceras* Spath, 1925; *Tubellites* Buckman, 1924]  
*Platypleuroceras* Hyatt, 1867  
*Tropidoceras* Hyatt, 1867  
*Uptonia* Buckman, 1898 [= *Jamesonites* Buckman, 1923; *Microceras* Hyatt, 1867, non Hall, 1845]  
Family Liparoceratidae Hyatt, 1867  
*Liparoceras*  
*L.* (*Liparoceras*) Hyatt, 1867  
*L.* (*Becheiceras*) Trueman, 1918 [= *Anisoloboceras* Trueman, 1918; *Becheoceras* Dacqué, 1934, nom. null.]  
*L.* (*Parinodiceras*) Trueman, 1918 [= *Platynoticeras* Spath, 1938]  
*L.* (*Vicininodiceras*) Trueman, 1918  
*Aegoceras*  
*A.* (*Aegoceras*) Waagen, 1869 [= *Amblyoceras* Hyatt, 1900]  
*A.* (*Beaniceras*) Buckman, 1913  
*A.* (*Oistoceras*) Buckman, 1911 [= *Defossiceras* Buckman, 1913]  
*Androgynoceras* Hyatt, 1867  
Family Amaltheidae Hyatt, 1867 } Not considered  
Family Dactylioceratidae Hyatt, 1867 } in this paper  
*Incertae sedis*  
*Hyerifalchia* Fucini, 1907  
*Kondiloceras* Fucini, 1901  
*Protechioceras* Spath, 1925, nom. dub. [non Trueman & Williams, 1927]  
*Tmaegophioceras* Spath, 1925

## SYSTEMATIC DESCRIPTIONS AND NOTES ON CERTAIN GENERA

### Superfamily PSILOCERATACEAE Hyatt, 1867

#### Family SCHLOTHEIMIIDAE Spath, 1923

##### Genus ARGOCERAS Steinmann, 1925

[*Argoceras* Steinmann, 1925, p. 358]

The genus *Argoceras* was proposed in a paper on cephalopod evolution. It has been overlooked by later authors, including the authors of the first edition of the *Treatise* and Dr. Howarth who compiled a list of genera omitted from the *Treatise* (Howarth, 1960).

The originally included species are:

1) *Schlotheimia Boucaulti* d'Orbigny [recte *Ammonites boucaultianus* d'Orbigny, 1844, p. 294].

2) *Schlotheimia Laigneletii* d'Orbigny [recte *Ammonites leignelettii* d'Orbigny, 1844, p. 298].

No type species was designated.

TYPE SPECIES. — *Ammonites boucaultianus* d'Orbigny, 1844, p. 294, by subsequent designation herein. This action renders *Argoceras* a junior objective synonym of *Boucaulticeras* Spath, 1924 (see below), which has the same type species by original designation. *Boucaulticeras* has been widely used since its proposal.

In the revised edition of the *Treatise* Part L, it is proposed to regard *Boucaulticeras* as a subjective synonym of *Angulaticeras* Quenstedt, 1883, a name whose status was originally in doubt but which was stabilized by ICZN Opinion 324 (1955). *Argoceras* will therefore appear in the synonymy of *Angulaticeras*.

##### Genus BOUCAULTICERAS Spath, 1924

[*Boucaulticeras* Spath, 1924, p. 194]

TYPE SPECIES. — *Ammonites boucaultianus* d'Orbigny, 1844, p. 294, by original designation.

LECTOTYPE OF TYPE SPECIES.—The specimen represented by d'Orbigny, 1844, pl. 90, fig. 1,2.

This was seemingly designated by Buckman (1906, p. 239) as follows: "*Schlotheimia boucaultiana* (d'Orbigny). 1879, Wright, Mon. Lias Amm., Pl. xviii. Hyatt and Pompeckj accept this; and it seems as if Wright's fig. 2,3 were a redrawing of d'Orbigny's type specimen." D'Orbigny figured only one of his syntypes, but Buckman did not clearly indicate whether he was selecting this as lectotype, or considering that, because of d'Orbigny's selection of it to be figured, it is automatically the holotype by original designation. To avoid any confusion as to the status of the figured specimen it is here designated lectotype if Buckman's statement is not considered sufficient. It is preserved in the Boucault Collection at the Museum of Comparative Zoology, Harvard University.

### Genus WAEHNEROCERAS Hyatt, 1889

[*Waehneroceras* Hyatt, 1889, p. 125]

Hyatt proposed the genus *Waehneroceras* for sixteen species without indicating a type species, though he described two in some detail (*Ammonites subangularis* Oppel, 1862, and *Aegoceras tenerum* Neumayr, 1879). Spath (1924), designated *Aegoceras tenerum* Neumayr as the type species and Lange (1925, p. 469) designated *Ammonites subangularis* Oppel, but Spath's designation holds precedence.

TYPE SPECIES.—*Aegoceras tenerum* Neumayr, 1879, p. 31, by subsequent designation by Spath, 1924, p. 195.

There were six syntype specimens from Pfonsjoch and an unspecified number of others from Zlambachgraben (Neumayr, 1879, p. 32). One of the Pfonsjoch examples was figured in side and peripheral views (*op. cit.*, pl. 3, fig. 4a,b) and the suture only of another (pl. 3, fig. 5a,b). Neumayr did not designate a type. Lange (1941, p. 40) listed figure 5 as "Holotype," and in 1952 (p. 98) gave figure 4 as "Holotype," but these statements were without foundation.

LECTOTYPE OF TYPE SPECIES.—The original of Neumayr, 1879, pl. 3, fig. 4a,b, designated herein. It is the only syntype adequately figured. The original was stated by Neumayr to be in the Geological Museum of Innsbruck University. Topotypes were figured photographically by Lange (1952, pl. 12, fig. 1-5).

The interpretation of *Aegoceras tenerum*, and hence of the genus *Waehneroceras*, has been the subject of dispute. Among others, Lange (*loc.*

*cit.*) regarded it as *Caloceras* and Blind (1963, p. 47) as *Psiloceras*. Lange (1941, p. 41) consequently set up a new genus *Storthoceras* for a number of species referred by Hyatt (1889, p. 127) to his genus *Waehneroceras*, and Blind (1963, p. 48) set up a new subgenus *Curviceras* for similar forms, with type species *Ammonites subangularis* Oppel, 1862. Both are regarded here as synonyms of *Waehneroceras*.

The difficulty arises, partly at least, from the small size of the lectotype of *Aegoceras tenerum*, which is only 26 mm in diameter. Neumayr (1879) placed his species in the "Angulati," and both he and Waehner (1886, p. 144) speak of the faint forward curve of the ribs over the venter, shown clearly by Neumayr's illustrations; a feature absent from *Psiloceras* and *Caloceras* as defined in the original (1957) and forthcoming edition of the *Treatise*.

In the last resort, of course, the interpretation of the species is a matter of opinion. The position adopted here is that of the late nineteenth-century continental authors, and preserves the original meaning of the genus *Waehneroceras* as defined by Hyatt.

The genus *Teneroceras* Lange, 1952 [1951, *nom. nud.*], with type species *Aegoceras tenerum* Neumayr is an objective synonym of *Waehneroceras*.

## Family ARIETITIDAE Hyatt, 1875

### Subfamily ARIETITINAE Hyatt, 1875

#### Genus EPAMMONITES Spath, 1922

[*Epammonites* Spath, 1922, p. 173]

The genus *Epammonites* was set up by Spath as follows: "The new genus EPAMMONITES is proposed for *Arietites latisulcatus* (Quenstedt) Schmidt ('Die Arieten des Unt. Lias v. Harzburg,' *Palaeontogr.*, vol. lxi, 1914, p. 22, pl. iv, fig. 1), and includes e.g. *E. parthenope*, *E. isis*, Reynès sp., and *E. compressaries* (Reynès non Quenstedt). It is interpreted as a development parallel with the contemporaneous true large *Arnioceras* of the *ceratitoides* group, belonging to the Upper *Coroniceras* and *gmuendensis* zones. . . . *Epammonites* retains evolute whorls, but does not acquire the stiff costation of *Arnioceras*."

TYPE SPECIES.—*Epammonites latisulcatus* Spath, 1922, p. 173, by original designation.

In the *Treatise* (Arkell, 1957, p. L238) the type species was stated to be *Ammonites latisul-*

*catus* Quenstedt, but in fact the figure of Schmidt, mentioned by Spath, was reproduced in illustration. Now *Ammonites latisulcatus* Quenstedt (1883, p. 85, pl. 12, fig. 1-3; original of fig. 1, preserved at Tübingen, designated lectotype by Blind, 1963, p. 103) is, according to re-examination of photographs of type material by one of us (Donovan), a form from the early *bucklandi* Zone ("Coroniceras zone" of Spath, above) belonging to the genus *Vermiceras* Hyatt, 1889. It is clear from Spath's remarks, however, that he intended the name for late *bucklandi* Zone species of which one is exemplified by Schmidt's cited figure.

Consequent on the above it is proposed to treat *Epammonites* as a genus with a deliberately misidentified type species under Code Article 70(b)(i). According to this rule the type species should be regarded as *Epammonites latisulcatus* Spath, 1922, and the only specimen mentioned by Spath, namely the original of Schmidt (1914, pl. 4, fig. 1), must be regarded as the holotype of this species. When Schmidt studied it, it was preserved in the Geological Museum of Göttingen.

*Epammonites* as thus defined is considered a synonym of *Coroniceras* Hyatt, 1867.

#### Genus EUCORONICERAS Spath, 1922

[*Eucoroniceras* Spath, 1922, p. 176]

TYPE SPECIES.—*Ammonites sinemuriensis* d'Orbigny, 1844, p. 303, by original designation.

The type situation for the type species of *Eucoroniceras* is not satisfactory. D'Orbigny figured (apparently) one specimen (1844, pl. 95, fig. 1-3), regarded as the holotype by Guérin-Franiatte (1966, p. 187), who revised the species. It was said by d'Orbigny to be in the Boucault collection but cannot be traced in that collection at Harvard, or in the d'Orbigny collections at Paris. In fact, as noted by Guérin-Franiatte, no specimens are known which agree precisely with the figures, which could have been composite, compounded (inaccurately) from more than one original. In any case, however, no original type material can now be recognized. The locality was stated by d'Orbigny to be Semur (Côte d'Or), France.

NEOTYPE.—Muséum de Semur-en-Auxois no. 296-4, from St. Euphrône (Côte d'Or), France, figured by Guérin-Franiatte (1966, pl. 74, fig. 2a,b), here designated. The description of the species by Guérin-Franiatte (*loc. cit.*) is regarded

as the diagnosis of the species required under Code Article 75(c)(1) which governs the designations of neotypes.

#### Genus PARACORONICERAS Spath, 1922

[*Paracoroniceras* Spath, 1922, p. 173]

TYPE SPECIES.—*Ammonites gmuendensis* Reynès, 1879, pl. 16, fig. 1,2, *non* Oppel, 1856, p. 80, by subsequent designation by Lange, 1925, p. 470 (= *P. charlesi* Donovan, 1955, p. 12).

The genus *Paracoroniceras* was set up as follows: "PARACORONICERAS, gen. nov., established for the group of *A. gmuendensis*, Oppel (Reynès, Monogr. d. Ammon., 1879, pl. xvi, figs. 1-2), though belonging to a closely allied stock [to *Epammonites*], tends to trigonal whorl-shape and involution."

Spath, by proposing this genus for "the group of . . ." is considered to have intended it to include several species from which a type species has to be designated. He mentions one, that of *Ammonites gmuendensis* Oppel, and gives a reference to another, that of Reynès' figured specimen.

It is clear from Oppel's description (1856, p. 80) that *Ammonites gmuendensis* was an ammonite of the kind for which Spath intended his new genus, here considered to be a subgenus of *Coroniceras* Hyatt, 1867, but Oppel published no figure and enquiries for type material from the Bayerisches Staatssammlung at Munich, where some of the Oppel collection is preserved, have been without result.

Lange (1925) designated Reynès' species as the type species as follows: "Genotyp: *Am. gmuendensis* (Oppel, Reynès 1879. Taf. 16, 1,2)." However, Reynès name is preoccupied by *Ammonites gmuendensis* Oppel. Donovan (1955, p. 12) proposed the new name *Paracoroniceras charlesi* for Reynès' figured specimen (1879, pl. 16, fig. 1,2) which becomes the holotype.

HOLOTYPE.—Reynès' figured specimen (no. R.83) mentioned above, preserved at the Muséum d'Histoire naturelle, Marseille.

#### Genus PARACALOCERAS Spath, 1923

[*Paracaloceras* Spath, 1923, p. 77]

Spath, proposing the genus *Paracaloceras*, merely stated: "genotype: *Arietites coregonensis* (Sowerby) Waehner" and referred to a figure of Waehner, 1888 (pl. 22, fig. 1).

TYPE SPECIES.—*Ammonites coregonensis* J. de

C. Sowerby in de la Beche, 1831, p. 319, fig. 60, by original designation.

The species *Ammonites coregonensis* was named and briefly described by Sowerby on the basis of material from the Lower Lias of the neighborhood of La Spezia, Italy, collected by de la Beche. The description was illustrated by a crude woodcut illustration which is inadequate for recognition of the species. De la Beche's collection has not been mentioned by any author since the original publication, is not known in any museum, and is considered lost. It is therefore desirable to select a neotype from material described by the first worker to revise the species on the basis of topotype material. This was Canavari (1882) who examined "about 100" specimens.

NEOTYPE.—The original of Canavari's largest figured specimen, pl. 19(5), fig. 15a-c, designated herein. It is in Pisa Museum.

The ammonites from La Spezia consist chiefly of pyritized nuclei and their outer whorls are unknown. *Ammonites coregonensis* was revised on the basis of excellent east-alpine material by Waehner (1888, p. 311) with numerous figures and reference should be made to this work for a full account of the species.

#### Subgenus CENTAUROCERAS Blind, 1963

[*Centauroceras* Blind, 1963, p. 94]

*Centauroceras* was proposed as a subgenus of *Coroniceras* Hyatt, 1867.

TYPE SPECIES.—*Ammonites centauroides* Savi & Meneghini, 1851, p. 75, by original designation.

Blind stated: "Lectotypus [presumably designated by him] *Aegoceras centauroides* Savi & Meneghini (Canavari) 1882, S. 174, Taf. 17, 16-17." This is not a valid lectotype designation because figures 16 and 17 of Canavari represent two different specimens which, in any case, are not syntypes.

The syntypes comprise: 1) specimens examined by Savi and Meneghini (1851, p. 351—p. 75 of reprint), of which there were at least three, to judge from the table of measurements; 2) a figure of *Ammonites biformis* J. de C. Sowerby in de la Beche, 1833, fig. 58, *non* fig. 60 (figure 57, 59, of the original edition, 1831). De la Beche's figure is a crude woodcut. Neither Savi and Meneghini's nor de la Beche's specimens can now be recognized and therefore no lectotype can be designated.

NEOTYPE.—The original of Canavari, 1882, pl.

19, fig. 16a-c (also Canavari, 1888, pl. 5, same figures), designated herein. The original was preserved in the Geological Museum, Florence University. The specimen came from the La Spezia neighborhood which yielded Savi and Meneghini's original material. Canavari was the first to revise Savi and Meneghini's species and it is reasonable to assume that he could identify them correctly.

The species was described and discussed by Waehner (1888, p. 175, pl. 24, fig. 7-9, pl. 25, fig. 1) and this is regarded as the statement of the characters differentiating the taxon required by *Code* Art. 75(c)(1). It is to be noted that Waehner, studying well-preserved material from the Eastern Alps, showed that Canavari's specimens, of small, depressed ammonites without a keel, were in fact nuclei of larger forms which possessed a strongly keeled, bisulcate venter on the outer whorls. Unfortunately the typical preservation is pyritic nuclei only, the outer whorls being absent. It is considered that a topotype, being available, must be made neotype, but Waehner's material must also be taken into account in order to fully understand the species.

It is proposed in the forthcoming *Treatise* revision to regard *Centauroceras* as a possible synonym of the genus *Paracaloceras* Spath, 1923.

#### Subfamily ALSATITINAE Spath, 1924

The type genus *Alsatites* includes ammonites with a venter which is smooth on the inner whorls but acquires a keel on the outer whorls. There are no grooves flanking the keel and this character distinguishes the genus from many bisulcate genera in the family, here separated as subfamily Arietitinae.

Spath (1924, p. 200) included in the subfamily Alsatitinae (which he proposed as a family) several genera which have a bisulcate stage: *Gyrophioceras*, *Paracaloceras* (see p. 6), *Pseudotropites* (see p. 8), and *Tmaegoceras*. He appears to have done this either because these genera were considered to belong to separate lines of descent, or because they were wholly or largely of Hettangian age in contrast to the bisulcate genera of Sinemurian date.

The present classification is, so far as possible, founded on morphological criteria rather than supposed lines of descent, and the bisulcate genera in the Alsatitidae of Spath have been removed to Arietitinae, the few genera close to

*Alsatites* itself being retained in subfamily Alsatitinae.

### Genus PROARIETITES Lange, 1922

[*Proarietites* Lange, 1922, p. 462]

TYPE SPECIES.—*Arietites proaries* Neumayr, 1879, p. 37, by subsequent designation by Lange, 1924, p. 196.

Neumayr (1879, p. 38) studied four examples of *Proarietites* and no lectotype seems to have been designated.

LECTOTYPE OF TYPE SPECIES.—The only figured specimen of *Arietites proaries*, the original of Neumayr (1879, pl. 7, fig. 1a-c), from Kammerkahr, designated herein. The specimen when figured was in the collection of the Oberbergamt in Munich, but cannot now be traced in any of the Munich collections. The figure, however, is a good one.

In the *Treatise* (Arkell, *et al.*, 1957, p. L235) *Proarietites* was regarded as a junior subjective synonym of *Alsatites* Haug, 1894, following Spath (1924, p. 201). It is proposed to do the same in the revision.

### Genus CANAVARITES Hyatt, 1900

[*Canavarites* Hyatt, 1900, p. 577]

TYPE SPECIES.—*Canavarites discretus* Hyatt, under *Code Art.* 70(b).

*Ammonites discretus* was named by J. de C. Sowerby in de la Beche (1831, p. 320, fig. 63), the illustration being a crude woodcut which is not interpretable. This species was revised by Canavari (1882, p. 60, pl. 21, fig. 9a-c, 10a-d, 11a-c; 1888, p. 187, pl. 7, same figs.) and Hyatt, in setting up the genus *Canavarites*, cited the type species as "*C. (Ariet.) discretum* Canav. sp." Hyatt is therefore considered to have employed deliberate misidentification, as there is no means of knowing whether Canavari's interpretation of the species was the same as that of Sowerby. Canavari examined 14 specimens, some of which have been located at Pisa by Dr. G. Pinna.

LECTOTYPE OF TYPE SPECIES.—Geological Museum, Univ. Pisa No. i 1889, the best preserved of the three figured specimens (original of Canavari, 1882, pl. 21, fig. 10a-d), designated herein. It is refigured in Plate 1, figures 3a,b.

The species has depressed whorls, and an umbilicus a little over one-third of the diameter. A small keel is present from a very early stage in development. Strong radial ribs number between

20 and 25 to the whorl. Canavari's figured specimens comprise only three to four whorls and are probably, like other material from Spezia, pyritized inner whorls only. The lectotype includes half a whorl of body chamber, but is unlikely to have been adult. It remains uncertain whether this species, like others with similar inner whorls such as *Ammonites centauroides* (see p. 7), grew up into a larger ammonite with more compressed outer whorls and sulci as well as a keel on the venter.

### Subfamily ASTEROCERATINAE Spath, 1946

#### Genus HYPASTEROCERAS Spath, 1923

[*Hypasteroceras* Spath, 1923, p. 84]

TYPE SPECIES.—*Asteroceras? ceratiticum* Fucini, 1903, p. 148, by original designation.

LECTOTYPE OF TYPE SPECIES.—Fucini (1903, pl. 23, fig. 1a-c, 2a-c) illustrated two examples of *Asteroceras? ceratiticum* and the one mentioned by Spath, the original of Fucini's figures 1a-c, is here designated lectotype. The original is preserved at the University of Pisa.

### Subfamily PSEUDOTROPITINAE Donovan, n. fam.

TYPE GENUS.—*Pseudotropites* Wachner, 1894, p. 24.

DIAGNOSIS.—The new subfamily Pseudotropitinae contains ammonites of the family Arietitidae with depressed whorls and secondary ribs arising from spines at the ventral ends of primary ribs. It is distinguished from other subfamilies of Arietitidae by the latter character.

The new subfamily Pseudotropitinae contains the nominal genus only.

#### Genus PSEUDOTROPITES Wachner, 1894

[*Pseudotropites* Wachner, 1894, p. 24]

TYPE SPECIES.—*Tropites(?) ultratriasicus* Canavari, 1882, p. 184 (62), pl. 21 (7), fig. 1, 2a,b, 3a-d, 4a-d, 5a,b, by monotypy.

The syntypes comprised nine examples studied by Canavari including the five figured specimens. Three of these (originals of Canavari's fig. 2-4) have been recognized by Dr. G. Pinna at the Geological Museum of the University at Pisa, no. i1891, -2, -4, the original of figure 5 being lost.

LECTOTYPE OF TYPE SPECIES.—Geological Museum, University of Pisa No. i 1894, the original of Canavari (1882, pl. 21, fig. 4a-d), designated herein.



AFFINITIES.—The genus appears to be derived from Alsatitinae of the genus *Canavarites* by the development of lateral tubercles and secondary ribbing; this last character is unique among named genera of Arietitidae. Possibly *Arietites subsalinarius* Waehner (1891, p. 241, pl. 16, fig. 1a-l, 2a-d), which has a venter like that of *Pseudotropites ultratriasicus* although it does not have the cadicone shell-form, should be included in *Pseudotropites*.

## Family OXYNOTICERATIDAE Hyatt, 1875

### Genus GUIBALICERAS Buckman, 1918

[*Guibaliceras* Buckman, 1918, p. 293]

TYPE SPECIES.—*Ammonites guibalianus* d'Orbigny, 1844, p. 259, by original designation.

The species *Ammonites guibalianus* was illustrated (d'Orbigny, 1844, pl. 73, fig. 1-4) by a figure, 95 mm in diameter, of an ammonite stated to be "réduit." This does not exactly represent any surviving specimen in the d'Orbigny collection in the Muséum d'Histoire naturelle, Paris, and is probably an idealized drawing or a composite picture.

LECTOTYPE OF TYPE SPECIES.—An example 107 mm. in diameter, Muséum d'Histoire naturelle, Paris, no. 1656A in the d'Orbigny catalogue, from Nantua (Ain), France, is designated herein and figured on Plate 2, figures 1a,b.

The lectotype has the widely-spaced primary ribs shown in d'Orbigny's figure and regarded by Buckman (1918) as diagnostic of the genus *Guibaliceras*. In the view of Donovan this feature occurs in individual variants of the group of *Gleviceras subguibalianum* (von Pia) (subjective senior synonym of *G. glevense*, type species of *Gleviceras* Buckman, 1918; Donovan, 1958, p. 13) and *Guibaliceras* and *Gleviceras* are therefore regarded as synonymous. Relative priority of names published simultaneously is determined by the action of the first reviser (Art. 24a) and this appears to have been Donovan (1954, p. 5) who declared *Guibaliceras* and *Victoriceras* (both Buckman, 1918) to be synonyms of *Gleviceras*.

### Genus PAROXYNOTICERAS von Pia, 1914

[*Paroxynoticeras* von Pia, 1914, p. 18]

TYPE SPECIES.—*Ammonites salisburgensis* von Hauer, 1856, p. 47, by subsequent designation by Spath (1924, p. 206).

Spath designated the type species from among the five existing and three new species placed in this genus by von Pia.

LECTOTYPE OF TYPE SPECIES.—Von Hauer examined several specimens of which one (pl. 13, fig. 1-3) was illustrated; this figured specimen is designated lectotype herein. It is probably preserved at Vienna.

Von Pia (1914) mentioned von Hauer's "Original" without indicating whether he considered this as holotype or lectotype. Spath (1924) designated Pia's pl. 1, fig. 2f, as type and this figure was copied by the *Treatise* (Part L, fig. 267,9). However, it is not one of von Hauer's syntypes.

The type species was revised by von Pia (1914, p. 18, 73, pl. 1, fig. 2a-f; pl. 7, fig. 22; pl. 13, fig. 12a-c, e-h). He reexamined von Hauer's "Original" (designated as the lectotype above) and remarked (*op. cit.*, p. 75) that von Hauer's figures are good except for the suture (fig. 3). He copied the whorl section of the lectotype (pl. 7, fig. 22) from von Hauer (pl. 13, fig. 2).

## Superfamily EODEROCERATACEAE Spath, 1929

### Family EODEROCERATIDAE Spath, 1929

#### Subfamily XIPHEROCERATINAE Spath, 1925

#### Genus XIPHEROCERAS Buckman, 1911

[*Xipheroceras* Buckman, 1911, p. iv]

TYPE SPECIES.—*Xipheroceras planicosta* S. S. Buckman=*X. ziphus* (Zieten).

Buckman set up the genus *Xipheroceras* with the following citation: "Type, *Aegoceras planicosta*; Wright, 1880, xxv=*A. ziphus*, Zieten." The ammonite figured by Wright (pl. 25), was identified by him with *Ammonites planicosta* J. Sowerby (now the type species of *Promicroceras*) but this identification was rejected by Buckman and by later authors. Under Article 70(b) this is a "deliberate use of misidentification" and Buckman is held to have set up a new nominal species *Xipheroceras planicosta* Buckman, the holotype being the only specimen assigned to it, the original of Wright (1880, pl. 25), which is in the Geological Survey Museum, London, no. 25033. It is here refigured on Plate 3.

*Ammonites ziphus* Zieten (1830, p. 6, pl. 5, fig. 2a-c) was illustrated by a specimen now in the British Museum (Natural History), no. 62590.

This is a wholly septate nucleus 29 mm in diameter. It corresponds closely to the inner whorls of the holotype of *Xipheroceras planicosta* Buckman and is probably, as Buckman thought (see above), a senior subjective synonym. *X. ziphus* is not the type species as stated in the *Treatise* (Arkell, *et al.*, 1957, p. L245), nor was any application submitted to the ICZN, as stated in the same place.

#### Genus MICRODEROCERAS Hyatt, 1870

[*Microderoceras* Hyatt, 1870, p. 23]

TYPE SPECIES.—*Ammonites birchi* J. Sowerby, 1820, p. 121, by subsequent designation by Spath, 1926, p. 171.

No lectotype has been designated for the type species. Sowerby mentioned that he had three examples of *Ammonites birchi*, one of which he figured (1820, pl. 267). This was an ammonite about 200 mm. in diameter which cannot now be traced. One of the two unfigured syntypes is in the British Museum (no. 43923), mentioned by Sowerby (*op. cit.*, p. 122) as from the collection of James Brodie, and said to be from "Craymouth," which is probably an error for Charmouth on the coast of Dorset, England.

LECTOTYPE OF TYPE SPECIES.—British Museum (Natural History) no. 43923, designated herein, and figured for the first time on Plate 1, figure 1a,b.

#### Subfamily COELOCERATINAE Haug, 1910

##### Genus COELO CERAS Hyatt, 1867

[*Coeloceras* Hyatt, 1867, p. 87]

TYPE SPECIES.—*Ammonites pettos* Quenstedt, 1843, p. 178, by subsequent designation by Buckman, 1898, p. 454.

When he first described *Ammonites pettos* Quenstedt (1843) did not figure it. He evidently had a number of specimens before him, for he remarked on the constancy of form of the species, and he also cited *A. crenatus* Zieten (*non* Reincke), 1830, p. 1, pl. 1, fig. 4a-d. Quenstedt's original material together with the original of Zieten's figures thus constitute the syntypes of the species. Code, Art. 73(c)(i) explicitly permits the inclusion of Zieten's specimen, which is preserved at the Bayerische Staatssammlung für Paläontologie und Historische Geologie at Munich and is refigured herein (Plate 2, fig. 2a,b).

LECTOTYPE OF TYPE SPECIES.—Zieten's figured specimen, in Bayer. Statts. Paläont. u. Hist. Geol.

Munich, referred to above, is designated lectotype herein.

The species *Ammonites pettos* was figured by Quenstedt in 1849 (pl. 14, fig. 8), and this figure was reproduced in the first edition of the *Treatise*, Part L (fig. 274, 3a-c). The original of this figure cannot be recognized in the Quenstedt collection at Tübingen (J. Wendt, written commun.). It appears from the figures to have been similar to the lectotype, but perhaps slightly more compressed.

In his monograph of 1883-85 Quenstedt described the species fully and figured twelve examples definitely referred to the species (Quenstedt, 1885, p. 271, pl. 34, fig. 15-23, 25, 27, 28). These exhibit some variation but include forms (e.g., 15, 20, 21, 23) close to the lectotype.

##### Genus DIAPHORITES Fucini, 1896

[*Diaphorites* Fucini, 1896, p. 124]

TYPE SPECIES.—*Diaphorites vetulonius* Fucini, by monotypy.

The syntypes of the type species include seven examples figured by Fucini (1897, pl. 25, fig. 1a-e; 2; 3a,b; 6; 7a,b; 10a,b; 11a,b), besides sutures (fig. 4,5,8,9), atypical or abnormal forms (fig. 6; 7a,b; 10a,b) and inner whorls (12a,b; 13-15).

LECTOTYPE OF TYPE SPECIES.—The original illustrated on pl. 25, fig. 1a-e, designated herein. It is preserved in the Geological Museum, University of Pisa.

The age of the fauna which included *Diaphorites* was said to be "Lias Medio," a term which corresponded with the whole of the Pliensbachian Stage. The first edition of the *Treatise* Part L (p. L248) stated the age to be late Pliensbachian. There is no foundation for this and the fauna as a whole is consistent with that of early Pliensbachian, especially the ammonites *Tropidoceras* (Fucini, 1897, pl. 25, fig. 22,23,25) and *Gemmellaroceras* (*op. cit.*, pl. 25, fig. 24) and the brachiopod "*Terebratula*" *aspasia* (*op. cit.*, pl. 24, fig. 1). *Diaphorites* is therefore likely to be of this age.

*Diaphorites* is accepted as a member of the subfamily Coeloceratinae, where it was placed uncertainly in the first edition of the *Treatise*. Its inner whorls and suture resemble those of *Pimelites* (see p. 11), which occurs in the same fauna, and which is more obviously a coeloceratine. The genus was set up in Fucini's paper read on 5 July 1896 and published before the end

of the year. The exact publication date is unknown but the British Museum copy was received on 22 December 1896, and is presumed to have been published shortly before this date. *Diaphorites* therefore falls as a subjective synonym of *Praesphaeroceras* (see below).

**Genus PRAESPHAEROCERAS Levi, 1896**

[*Praesphaeroceras* Levi, 1896, p. 275]

TYPE SPECIES.—*Praesphaeroceras campiliense* Levi, by monotypy.

LECTOTYPE OF TYPE SPECIES.—Original of Levi, 1896, pl. 8, fig. 13, designated herein. It was deposited in the Geological Museum, University of Florence, in 1896.

Levi figured five examples of his new species and may have examined more. The largest, illustrated by his fig. 13, is the lectotype designated above.

SYNONYMY.—In the same year that Levi described and partly illustrated a small fauna from the *Terebratula aspasia* beds of Monti Calvi, preserved at Florence, Fucini, by coincidence or otherwise, described material from the same beds and locality, preserved at Pisa. Fucini set up two new genera, *Diaphorites* and *Pimelites*, for small ammonites showing adult features at diameters of between 10 and 20 mm. *Diaphorites* is synonymous with *Praesphaeroceras* as now defined, a view already adopted in the first edition of the *Treatise*, Part L, p. L248. Levi's paper was published on 15th September 1896 and *Praesphaeroceras* therefore takes precedence over *Diaphorites* (see above). This is contrary to the conclusion reached in the first edition of the *Treatise* (p. L248) where *Praesphaeroceras* was placed as a synonym without any reason being given.

**Genus PIMELITES Fucini, 1896**

[*Pimelites* Fucini, 1896, p. 124]

TYPE SPECIES.—*Pimelites populonius* Fucini, by original designation. The formula used by Fucini "n.gen., n.sp." applied to only one of the two species is interpreted as an original designation in accordance with *Code* Article 68(a)(i). Fucini figured the type species in 1897 (pl. 25, fig. 16a-f, 19a,b).

LECTOTYPE OF TYPE SPECIES.—The original of Fucini, pl. 25, fig. 16a-f, the only complete figured specimen which was not referred to a variety, designated herein. It is preserved in the Geological Museum, University of Pisa.

The age of *Pimelites* is believed to be early Pliensbachian. The evidence is discussed under the genus *Diaphorites*.

In shell form, ornament and suture *Pimelites* shows similarities to *Coeloceras* and it is here accepted as a member of the Coeloceratinae, in which it was questionably placed in the first edition of the *Treatise* Part L.

**Subfamily PHRICODOCERATINAE Spath, 1938**

**Subgenus PSEUDUPTONIA Bremer, 1965**

[*Pseuduptionia* Bremer, 1965, p. 162]

Bremer proposed *Pseuduptionia* as a subgenus of *Epideroceras* Spath, 1923, of which *Pseuduptionia* is here considered a junior subjective synonym.

TYPE SPECIES.—*Uptionia micromphala* von Pia, 1913, p. 345, pl. 14, fig. 4a-d, by original designation.

LECTOTYPE OF TYPE SPECIES.—The original of von Pia, 1913, pl. 14, fig. 4d, designated herein and refigured in Plate 2, figures 3a,b. It is preserved in the Naturhistorisches Museum, Vienna, no. 1969/1316(11).

The other figured syntypes are probably conspecific. All are wholly septate and the body chamber of the species is unknown.

**Family POLYMORPHITIDAE Haug, 1887**

**Genus POLYMORPHITES Haug, 1887**

[*Polymorphites* Haug, 1887, p. 107, 120]

The genus *Polymorphites* was validated by ICZN Opinion No. 575 (1959) with type species *Ammonites polymorphus* Quenstedt, 1845, which was designated by Buckman, 1892, p. 267. This action unfortunately left the interpretation of the type species in an unsatisfactory state.

TYPE SPECIES.—*Ammonites polymorphus* was described by Quenstedt (1845, p. 86) and figured in an atlas issued later (1849, pl. 4, fig. 9-13). Difficulty arises because all the specimens figured exemplify trinomials and none illustrates "*Ammonites polymorphus*" as such. Quenstedt was liberal in his use of trinomials (Hölder, 1958). The adjectives used by Quenstedt in the third place are of dubious nomenclatorial status and Hölder (*op. cit.*) has maintained that they are irregular. It is therefore held that the five specimens figured in 1849 are syntypes, eligible to be lectotype, of the species *A. polymorphus*.

Roman (1938, p. 102) indicated a selection when he stated the "genotype" to be *Ammonites polymorphus quadratus* Quenstedt (1849, pl. 4, fig. 9a-d). It is now proposed to make this specimen formally lectotype of the type species.

LECTOTYPE OF TYPE SPECIES.—The original of Quenstedt, 1849, pl. 4, fig. 9a-d ("*Ammonites polymorphus quadratus*") is designated herein lectotype of *Ammonites polymorphus* Quenstedt. It is probably preserved at Tübingen in the Geologisch-Paläontologische Institut und Museum.

Some of Quenstedt's trinomials have been used as specific names by later authors (e.g., *quadratus* by Tutchter & Trueman, 1925, p. 646). The validity of this practice is doubtful. The name *quadratus* was preoccupied before Quenstedt's use of it, according to Hölder (*op. cit.*, p. 21).

### Genus LEPTONOTOCERAS Spath, 1925

[*Leptonotoceras* Spath, 1925, p. 170]

The genus *Leptonotoceras* was set up in the course of referring to some smooth ammonites, associated at Charmouth, Dorset, with *Deroceras armatum* and *Gleviceras*, which ". . . may belong to the group of *Psiloceras abnorme* (Hauer) Geyer<sup>4</sup> (= *Leptonotoceras*, gen. nov.), . . ." Footnote 4 stated: "Cephalopodenfauna des Hierlatz. Abhand. K.K. Geol. Reichsanst., Vol. XII., Pl. 4 [error for Part 4] (1886), p. 240, Pl. II., figs. 24a,b, genotype." It is here maintained that the species represented by Geyer's figure is different from that of von Hauer, and consequently the genus is regarded as having been set up with a deliberately misidentified type species under Code Art. 70(b).

Von Hauer named *Ammonites abnormis* in 1853 (p. 758) and in 1854 he described it in detail and figured it (p. 406, pl. 1, figs. 11-17). The most complete specimen which he figured, the original of plate 1, figures 13,14, is now designated lectotype of *A. abnormis* von Hauer. This is an ammonite with a strongly excentric last whorl, and von Hauer emphasizes this character in his description, noting the rapid increase of umbilical diameter from about 20 percent to about 46 percent. The species appears to be a member of the genus *Cymbites* Neumayr, 1878.

Geyer's figure of 1886 (pl. 2, fig. 24a,b), although also of a small ammonite, does not show excentric coiling. By citing Geyer's figure, Spath, according to his usual practice, clearly intended

the new genus to be interpreted thereby and not by von Hauer's description and figures.

Accordingly, following Code Art. 70(b)(i), Spath is considered to have set up a new nominal species, *Leptonotoceras abnorme* Spath, 1925, which is the type species ("genotype"), by original designation, of *Leptonotoceras* Spath, here considered a synonym of *Gemmellaroceras* Hyatt, 1900.

HOLOTYPE.—The original of Geyer's figures 24a,b, the only specimen cited by Spath, is the holotype of *Leptonotoceras abnorme* Spath by monotypy. Present whereabouts unknown.

### Genus UPTONIA Buckman, 1898

[*Uptonia* Buckman, 1898, p. 453]

TYPE SPECIES.—*Ammonites jamesoni* J. de C. Sowerby, 1827, p. 105, pl. 555, fig. 1, by original designation.

Sowerby's species, *Ammonites jamesoni*, was set up on the basis of a specimen collected on the Island of Mull, Scotland, by R. I. Murchison. The original does not survive in the Sowerby collection at the British Museum and cannot be traced elsewhere. The figure shows small parts only of two successive whorls of a specimen originally about 120 mm in diameter. As the species is type of a genus, and belongs to a group in which considerable change of characters may take place between inner and outer whorls, a neotype is considered necessary.

The figured specimen of *Ammonites jamesoni* came from the Pabba Shales of Carsaig Bay on the south coast of the Isle of Mull (Arkell, 1933, p. 148). No specimen suitable to be a neotype has been located from the type locality, but the Pabba Shales are recognized, with little change, throughout the main Jurassic areas of western Scotland. A specimen from the Isle of Pabay, off eastern Skye, is therefore selected as neotype. This locality is about 105 km. almost due north of the locality of the figured specimen. This is considered to satisfy the condition of Code Art. 75(c)(5) that the neotype should come "as nearly as practicable from the original type locality" and geological horizon.

NEOTYPE.—British Museum (Natural History), no. C40426, designated herein and figured in Plate 4, figures 3a,b.

The specimen is a shell about 170 mm. in diameter, showing the inner as well as the outer whorls. It corresponds well with the type figure

is assumed here that it has), it is a syntype, together with Bean's specimens. Buckman was apparently unaware that the Leckenby Collection (now at Cambridge in the Sedgwick Museum), which incorporates part of the Bean Collection, includes a block with two specimens (SM B11945, B11946) labelled "*Amm. defossus* Simpson," one of which is marked "Bean's type." Leckenby has noted on the block: "Specimen marked X is Bean's type. Mr. B. first named and distinguished this species—the other must be the same." The specimen marked X (B11945) is a typical *Androgynoceras*, whereas the other is an equally typical *Oistoceras*. The belief that both Bean's specimens were conspecific has led to the misidentification of almost all the *Oistoceras* species in the Leckenby Collection as *Defossiceras defossus*.

Since the identification of Whitby Museum specimen no. 103 as the holotype by Buckman (1913) was erroneous, it is now necessary to designate one of the available syntypes as the lectotype. None are of the same size as the specimen cited by Simpson (1843) which was 1.75 in. in diameter (44.4 mm), but examination of these three specimens in the light of Simpson's description, his remarks on the resemblances with other species and the stratigraphical position gives the following results.

The syntypes are:

(a) WM 103. The outer whorls agree with Simpson's description, except that a feeble keel is present, but the inner whorls are coarsely ribbed and the nucleus is smooth. The maximum diameter is 40 mm. This specimen is a typical *Euagassiceras* and must be from the lowest beds exposed in Robin Hood's Bay, if it is not from the Drift (see Spath, 1925, p. 361, 362).

(b) SM B11945 (Bean's type). This specimen, here figured for the first time, on Plate 4, figures 1a,b, is congeneric with *Ammonites maculatus* Young & Bird (= *A. arcigerens* Phillips), but the inner whorls are more closely ribbed. The ribs are not projected on the venter and the whorl section is rounded between the ribs, although somewhat quadrate on them. Since the last part of the body chamber is crushed, its shape is unknown. The specimen is preserved in a ferruginous sandstone characteristic of the highest beds of the Lower Lias in Robin Hood's Bay. The maximum diameter is 41 mm.

(c) SM B11946. This specimen is congeneric with *Ammonites figulinus* Simpson, but is rather

less densely ribbed, a feature which was said to distinguish *A. defossus* from *A. omissus* Simpson (also an *Oistoceras*). The ribs are projected on the venter and the aperture is quadrate. The maximum diameter is 40 mm. The matrix suggests that it is from the sandy top of the Lower Lias of Robin Hood's Bay.

LECTOTYPE OF TYPE SPECIES.—Syntype SM B11946 here designated and figured for the first time on Plate 4, figure 2. It is preserved in the Sedgwick Museum at Cambridge University.

It is clear that the last of the syntypes (above, B11946) agrees most closely with the description and horizon given by Simpson and for these reasons is now selected as the lectotype of *Ammonites defossus* Simpson. Simpson seems to have based his description on Bean's material and subsequently, perhaps, to have misidentified WM 103 as the same species, presumably being unaware of the horizon from which it had been collected. Another case in which Simpson misidentified one of his own species is known (Howarth, 1962, p. 101,102). A specimen identified by Simpson as *Ammonites multanfractus* Simpson is, in fact, the inner whorls of *Gagaticeras gagateum* (Young & Bird).

As a result of the above designation of the lectotype of *Ammonites defossus* Simpson, it is possible to clarify the status of the genus *Defossiceras* Buckman, 1913. This genus, as exemplified by WM 103, was believed by Buckman (1913, p. vii) to be a transition from a liparoceratid, such as *Beaniceras*, to the Amaltheidae and its close resemblance to "*Agassiceras*" (now *Euagassiceras*) was due to "cyclical homeomorphy." Spath (1919, p. 170; 1925, p. 361), on the other hand, considered *Defossiceras* (*sensu* Buckman) to be an "*Agassiceras*," not withstanding Buckman's hypothesis that "*Agassiceras*" was an anagenetic stage of development, whereas *Defossiceras* was catagenetic. If Buckman's interpretation is accepted, the well-established and widely used name *Euagassiceras* Spath, 1924, becomes a junior subjective synonym of *Defossiceras* Buckman, 1913, a name used (except by Buckman) only by Spath (1925), in a discussion of the difficulty of its interpretation. Such a state of affairs does not favor stabilization of the nomenclature. By selecting SM B11946 as the lectotype of *Ammonites defossus*, not only does the type agree more closely with the original description of the species, but

except that at a stage corresponding with the inner of the two whorls shown in the type figure the neotype is more finely ribbed. Sowerby showed the two successive whorls with identical ribbing, which is unusual for forms of this group, and it is thought that this may have been an error of draftsmanship.

## Family LIPROCERATIDAE Hyatt, 1867

### Genus BECHEICERAS Trueman, 1918

[*Becheiceras* Trueman, 1918, p. 66]

TYPE SPECIES.—*Ammonites bechei* J. Sowerby, 1821, p. 143, pl. 280, by original designation.

The genus *Becheiceras* was proposed for "*A. bechei* Wright" (1881, pl. 41, fig. 1-4), but this species is considered to be conspecific with *Ammonites bechei* J. Sowerby by Spath, 1938, Donovan, 1954, and us.

The species *Ammonites bechei* was described on the basis of an ammonite obtained by Sir H. T. de la Beche after whom it was named. Sowerby appears to have had only the one example when he described the species and this, the figured specimen, is therefore regarded (following Spath, 1938, p. 75) as the (lost) holotype. It was stated to come from "Blue Lias" of Lyme [Regis]. Spath (1938) noted that the color definitely identified the holotype as coming from the Red Band, a fossiliferous bed about 1 ft. thick (Lang, 1936, bed 126). The Red Band outcrops on the coast of Dorset between Charmouth and Seatown, between two and three miles east of Lyme Regis, which is, however, a center for dealers and collectors.

The holotype is not preserved in the Sowerby collection at the British Museum and has not been located elsewhere; as already remarked, little of the de la Beche collection is known to survive.

Spath (1938, pl. 11, fig. 1a,b) figured a meta-type, that is, a topotype identified by the original author of the species. It bears a printed label "Sowerby Collection" but no other evidence as to its status. This specimen (British Museum (Natural History) no. C176635) did not, as far as can be judged, form part of an original type-series. As the lost holotype and the figured meta-type are small, and the species grows to a large size, and is the type of a subgenus of *Liparoceras* Hyatt, 1867, it is considered desirable to select a neotype.

NEOTYPE.—British Museum (Natural History)

no. 39731, designated herein. It comes from the same horizon and locality as the holotype, and is figured in Plate 2, figures 4a-c.

A full description of the taxon *Liparoceras* (*Becheiceras*) *bechei* (J. Sowerby) was published by Spath (1938, p. 74).

### Genus DEFOSSICERAS Buckman, 1913

[*Defossiceras* Buckman, 1913, p. vi]

TYPE SPECIES.—*Ammonites defossus* Simpson, 1843, p. 15, by original designation.

*Ammonites defossus* Simpson, 1843 (*ex Bean* MS).

1843. *Ammonites defossus* Simpson, p. 15.

1855. *Ammonites defossus* Simpson, p. 48.

1884. *Ammonites defossus* Simpson, p. 78.

1913. *Defossiceras defossus* (Simpson)—Buckman, p. vi.

*non* 1876, *Aegoceras defossus* (Simpson)—Blake, p. 282; pl. 8, fig. 9 (= *Oistoceras omisum* (Simpson)—Spath, 1938, p. 171).

*non* 1913, *Defossiceras defossus* (Simpson)—Buckman, pl. 76 (= *Euagassiceras* sp.).

The original description of *Ammonites defossus* was based on an evolute form, with a quadrate aperture and straight ribs, projected on the venter, apparently without a keel. This description was repeated without further details in Simpson's later works, but he was at pains to point out that the species is not to be confused with *A. maculatus* Young & Bird (Simpson, 1843, 1855), *A. arcigerens* Phillips (Simpson, 1843, 1855, 1884), *A. figulinus* Simpson (1855, 1884), or with *A. capricornus* Schlotheim (Simpson, 1884). Its stratigraphical position was given as: (a) Marlstone (Simpson, 1843), (b) M[iddle] L[ias] (Simpson, 1855), (c) L[ower] L[ias], d, R[obin] H[ood's] B[ay] (Simpson, 1884). These references are obviously to the ferruginous, sandy beds, which span the Carixian-Domerian boundary in Robin Hood's Bay, Yorkshire, England.

Since Simpson (1843, 1884) stated explicitly that the name of *Ammonites defossus* had been taken from Bean's MSS, it must be assumed that Simpson had seen any specimens of the species which Bean possessed. Any such specimens, therefore, have the status of syntypes and Buckman (1913) was wrong in citing the specimen in the Whitby Museum (no. WM 103, identified as *Amm. defossus* in Simpson's catalogue) as the holotype. If this specimen has type status (and, in the absence of any evidence to the contrary, it

the name *Defossiceras* Buckman becomes a junior subjective synonym of *Oistoceras* Buckman, 1911, so that *Eugassiceras* remains available and valid.

## INCERTAE SEDIS

### Genus KONDILOCERAS Fucini, 1901

[*Kondiloceras* Fucini, 1901, p. 14]

TYPE SPECIES.—*Kondiloceras manciatti* Fucini, 1901, by original designation.

The genus *Kondiloceras* is known from one specimen only, the holotype of the type species, of uncertain horizon (said to be Sinemurian). The earlier part of the last whorl seems to be oxynoticeratid, but the later part, with large midventral tubercles, is unlike any other described Sinemurian ammonite. Attribution to Polymorphitidae in the *Treatise* Part L (1957), on the basis of supposed likeness to the minute ventral tubercles present in, for instance, *Dayiceras*, does not seem likely. On balance, oxynoticeratid affinity seems more probable.

## GENERA OF UNSATISFACTORY STATUS

### Genus CALOCERAS Hyatt, 1870

[*Caloceras* Hyatt, 1870, p. 29]

TYPE SPECIES.—*Ammonites torus* d'Orbigny, 1844, p. 212, by subsequent designation by Buckman, 1912, p. vii.

The holotype of *Ammonites torus* was destroyed at Caen Museum during the last war. There is no specimen suitable for designation as neotype. A cast of the holotype which exists at Marseilles Museum, was figured by Reynès (1879, pl. 2, fig. 20,21).

### Genus EPIDROCERAS Spath, 1923

[*Epidroceras* Spath, 1923, p. 10]

TYPE SPECIES.—*Ammonites roberti* von Hauer, 1853, p. 748, by original designation.

The type species of *Epidroceras* was figured by von Hauer (1854, pl. 3, fig. 1-3), but the figured specimen is lost. Topotype material is poorly preserved and in the circumstances it does not seem useful to designate a neotype.

The interpretation of the genus is not in doubt, good specimens from other localities having been figured, and therefore no practical problem arises. The generic characters have been described by Donovan (1958, p. 36).

### Genus HYPERDEROCERAS Spath, 1926

[*Hyperderoceras* Spath, 1926, p. 47, footnote 1]

TYPE SPECIES.—*Ammonites armatus ruga* Quenstedt, 1884, p. 206, pl. 25, fig. 9,10, pl. 26, fig. 1, by original designation.

Spath erected the genus *Hyperderoceras* with no diagnosis or description, and included no other species. According to Hölder (1958) it may be possible to accept Quenstedt's trinomen as a species-group name, as it had not been used before Quenstedt and was used only once by him. This is done here, pending action on Quenstedt's trinomials by the ICZN.

Spath cited only Quenstedt's pl. 25, fig. 9, perhaps intending this to be the type, but the original of this figure is now lost. It does not seem advisable to designate a type specimen for *H. rugum* until German material can be re-studied.

The genus *Hyperderoceras* appears to be rare, and apart from the original occurrence, has been reported only from Yorkshire, England (by Howarth, 1962, p. 108: *H. mammilatum* (Simpson) and *H. nativum* (Simpson)).

The following diagnosis has been compiled for the revised edition of the *Treatise*: Evolute, strongly ribbed eoderoceratids, in which certain ribs, at irregular intervals are flared and bear tubercles (about 5-12 per whorl on the septate whorls). The tuberculate ribs bifurcate; the others pass over the venter without interruption, and without loss of strength. Body chamber unknown.

### Genus METADEROCERAS Spath, 1925

[*Metaderoceras* Spath, 1925, p. 363, footnote 1]

TYPE SPECIES.—*Ammonites muticus* d'Orbigny, 1844, p. 274, pl. 80.

O'Orbigny's idealized "type figure" is probably composite, drawn from some of the nine whorl fragments in the d'Orbigny collection preserved in the Muséum d'Histoire naturelle, Paris, and all catalogued under no. 1669. Correspondence is not very good; for example, all the fragments have narrower venters than that shown in the figure. D'Orbigny's figure was reproduced in the first edition of the *Treatise*, Part L (fig. 273,7d-f) at half the original size.

Because of the fragmentary nature of the type material it does not seem that it would be a useful action to designate one of the fragments as lectotype. This is better left until such time as the species may be properly revised.

There is no problem as to the interpretation of the genus *Metaderoceras*. In the current classification, as in the first edition of the *Treatise*, it is placed as a junior subjective synonym of *Crucilobicerias*.

#### Genus METARNIOCERAS Spath, 1925

[*Metarnioceras* Spath, 1925, p. 359]

TYPE SPECIES.—*Metarnioceras sheppardi* Spath, *op. cit.*, p. 359, text-fig. 11b, 12(2), by original designation.

The type species of *Metarnioceras* was not described, and was figured in ventral view and suture line only. The holotype and seven other specimens were destroyed when Hull Museum was bombed during the last war. In the absence of adequate figures or description the type species cannot be satisfactorily interpreted.

A second species originally included by Spath was *Metarnioceras subpellati* Spath, the holotype of which was figured in side view (Spath, 1925, text-fig. 11a, 12(1)) but was also destroyed.

Spath (*op. cit.*, p. 360) mentioned specimens in the British Museum (Natural History), no. 33581 and 37807, as "transitional" from *Metarnioceras* "to *Arnioceratoides*" and noted their resemblance to *Ammonites neera* and *A. leda* Reynès. One of these, identified as *Metarnioceras neera* (Reynès), is figured in a preceding paper by Getty (1973, pl. 1, fig. 10). The holotype of *M. leda* was figured by Donovan (1955, p. 16, pl. 1, fig. 5a,b).

The following is a brief diagnosis of the genus: Small evolute serpenticones. Whorl section subquadrate or compressed, venter fastigate. About three smooth whorls followed by three with sharp, straight ribs. The sharp venter is bordered by smooth or faintly subsulcate bands or may bear

faint chevrons. Suture has lateral saddle long, nearly parallel-sided.

#### Genus OPHIDROCERAS Spath, 1925

[*Ophideroceras* Spath, 1925, p. 137]

TYPE SPECIES.—*Ophideroceras ziphoides* Spath, *op. cit.*, text-fig. 1, 2(a), (b), by original designation.

The holotype of *Ophideroceras ziphoides* and only specimen referred to the type species was destroyed, like that of *Metarnioceras sheppardi*, during the bombing of Hull Museum during the last war. The only photographic figure shows the side view and is of poor quality. The species was not fully described. As far as can be judged from the inadequate figure, no comparable specimen from the type locality (Robin Hood's Bay, Yorkshire, England) appears to exist.

The locality and horizon of the holotype were recorded as ". . . a hard ledge just above the water-level of Mill Beck in Robin Hood's Bay (base of the *varicostatum* zone, according to Tate and Blake's map)." The fossil zones employed by Tate and Blake (1876) differed greatly from those now in use, and Dr. T. A. Getty informs me (pers. commun., 1973) that the horizon referred to probably falls at the base of the *oxynotum* Subzone of the present zonal scheme.

Under the circumstances the type species, and therefore the genus, cannot be interpreted. No other species were referred to the genus by Spath. It is thought, but it cannot be proved, that the lost holotype was an aberrant member of an eoderoceratacean genus such as *Eoderoceras*, *Bifericeras*, or *Xipheroceras*. The genus *Ophideroceras* is regarded as a *nomen dubium* and in the revision of the *Treatise* will be placed as a probable synonym of *Bifericeras*.

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## EXPLANATION OF PLATES

### PLATE 1

All figures  $\times 0.67$ .

#### FIGURE

- 1a,b. *Microderoceras birchi* (J. Sowerby) from Lower Lias, Turneri Zone, Charmouth, Dorset, England. Lectotype (designated herein, p. 10). (British Museum (Natural History) no. 43923).
- 2a-c. *Canavarites discretus* Hyatt from Lower Lias, near La Spezia, Italy. Original of Canavari, 1882, pl. 21, fig. 9a-c. (Geological Museum, Pisa, Italy, no. i 1889).
- 3a,b. *Canavarites discretus* Hyatt from Lower Lias, near La Spezia, Italy. Original of Canavari, 1882, pl. 21, fig. 10a-d. Lectotype (designated herein, p. 8). (Geological Museum, Pisa, Italy, no. i 1889).

### PLATE 2

All figures  $\times 0.67$ .

#### FIGURE

- 1a,b. *Gleviceras subguibalianum* (von Pia) from Nantua (Ain), France. Lectotype (designated herein, p. 9) of *Ammonites guibalianus* d'Orbigny, type species of *Guibaliceras* Buckman, 1918. (D'Orbigny coll. no. 1656A, Muséum d'Histoire naturelle, Paris).
- 2a,b. *Coeloceras pettos* (Quenstedt) from Lower Lias, Pliensbach, Württemberg, Germany. Lectotype (designated herein, p. 10). (Bayerische Staatssammlung für Paläontologie und historisches Geologie, Munich).
- 3a,b. *Epideroceras micromphala* (von Pia) from Ak Dagh, near Amasia, Turkey. Lectotype (designated herein, p. 11) of *Uptonia micromphala* von Pia, type species of *Pseuduptonia* Bremer. (Naturhistorisches Museum, Vienna, no. 1969/1316 (11)).

- 4a-c. *Liparoceras (Becheiceras) bechei* (J. Sowerby) from Lower Lias (Red Band), near Charmouth, Dorset, England. Neotype (designated herein, p. 13). (British Museum (Natural History) no. 39731).

### PLATE 3

All figures  $\times 0.67$ .

#### FIGURE

- 1,2. *Xiphoceras planicosta* S. S. Buckman from Lower Lias, Obtusum Zone, Lyme Regis, Dorset, England. Holotype. (Geological Survey Museum, London, no. 25033 (Earl of Enniskillen Coll.)).

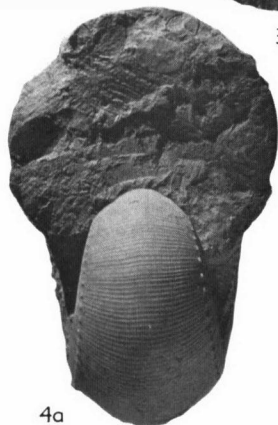
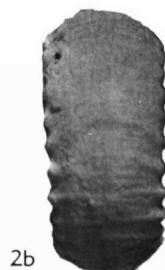
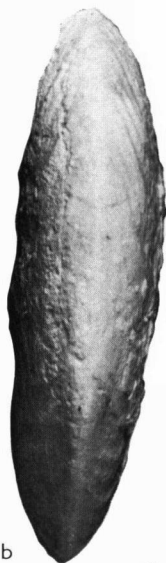
### PLATE 4

All figures  $\times 0.67$  unless otherwise stated.

#### FIGURE

- 1a,b. *Aegoceras maculatum* (Young & Bird) from Lower Lias, Robin Hood's Bay, Yorkshire, England,  $\times 1.3$ . A syntype of *Ammonites defossus* (Bean MS) Simpson, type species of *Defossiceras* Buckman (Sedgwick Museum, Cambridge, England, no. B11945).
2. *Aegoceras (Oistoceras) cf. figulinum* (Simpson) from Lower Lias, Robin Hood's Bay, Yorkshire, England,  $\times 1.3$ . Lectotype (designated herein, p. 14) of *Ammonites defossus* (Bean MS) Simpson. (Sedgwick Museum, Cambridge, England, no. B11946).
- 3a,b. *Uptonia jamesoni* (J. de C. Sowerby) from Pabbay Shales, Isle of Pabbay, western Scotland. Neotype (designated herein, p. 12). (British Museum (Natural History) no. C40426).







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