TABLE 5. *Ammonite Zones of the Volgian* (W. J. ARKELL)

| Stages | Zones |
|---|---|
| Volgian (upper) | *Riasanites rjasunensis*<br>*Craspedites nodiger*<br>*Craspedites subditus*<br>*Craspedites fulgens* |
| (lower) | *Lomonossovella blakei,*<br>*Epivirgatites nikitini*<br>*Virgatites virgatus*<br>*Zaraiskites scythicus*<br>*Dorsoplanites dorsoplanus* |

postulating that the ammonites suddenly cast away their shells and that their descendants are to be found at the present day as the Octopoda or other Dibranchiata, has no evidence to support it.

Nor is this the place for a discussion of the nature and scope of ammonoid zones or ages; that is a stratigraphical matter. The principal zones, and the stages in which they are grouped for purposes of the *Treatise,* will be found in Tables 1-5. It should be noted in connection with the tables that the zones of the Paleozoic are not comparable with Mesozoic zones but are more in the nature of the "ages" sometimes distinguished in the Mesozoic, namely, periods dominated by certain genera or families. The distribution of genera in time is shown in Fig. 161.

# SYSTEMATIC DESCRIPTIONS

By W. J. ARKELL, BERNHARD KUMMEL, and C. W. WRIGHT

## INTRODUCTION

### AUTHORSHIP

The systematic descriptions of all Triassic taxa in following pages have been prepared by BERNHARD KUMMEL. In general, W. J. ARKELL is the author of all Jurassic ammonoid taxa and C. W. WRIGHT of all Cretaceous units, but because some families contain both Jurassic and Cretaceous genera, contributions to the text by ARKELL and WRIGHT are intermixed in some places. In the section mainly devoted to description of Jurassic forms, WRIGHT is author of the text on Protetragonitidae (p. L199), Macroscaphitidae (p. L204), Cicatritidae (p. L205), Aconeceratinae (p. L285), as well as diagnoses of Cretaceous genera assigned to otherwise Jurassic families of Phylloceratina and Lytoceratina. Descriptions of the Neocomitinae (p. L356), Oosterellidae (p. L362), and Spiticeratinae (p. L345) are the product of collaboration by ARKELL and WRIGHT.

Because of placement in the predominantly Paleozoic suborder Prolecanitina, the Triassic family Sageceratidae has been described by MILLER & FURNISH in the preceding section of this volume on Paleozoic Ammonoidea, and conversely, Permian genera of the Xenodiscidae and Otoceratidae, included in the predominantly Triassic Ceratitina, have been described by KUMMEL.

### ACKNOWLEDGMENTS

Special appreciation is expressed here for help furnished by L. F. SPATH in connection with KUMMEL's work on Triassic ammonoid taxa, both during studies at the British Museum in 1951-1952 and through subsequent correspondence.

Valuable help with Liassic families and genera was received at all stages of preparation from Dr. D. T. DONOVAN, University of Bristol. Assistance in connection with Cretaceous units by providing important specimens for study, by furnishing advance copies of manuscripts, or by advancing publication of their own work on various ammonoids was given by Vicomtesse ELIANE BASSE DE MÉNORVAL (Paris), G. BOTERO-ARANGO (Colombia), RAYMOND CASEY (London), W. A. COBBAN (Colorado), J. P. CONLIN (Texas), TATSURO MATSUMOTO (Japan), R. A. REYMENT (Nigeria), and Comtesse DE VILLOUTREYS (Monaco). All illustrations that accompany systematic descriptions of Mesozoic ammonoids have been prepared by RAYMOND C. MOORE. Appreciation of the aid furnished by these individuals and various others who are unnamed is expressed here.

## SPECIAL FEATURES OF STYLE

For the most part, systematic descriptions of Mesozoic Ammonoidea conform precisely in style to those given in other sections of the *Treatise,* but some deviations which have been allowed call for explanation.

### ABBREVIATION OF GENERIC NAME AMMONITES

Very many Mesozoic genera of Ammonoidea are based on type species that originally were assigned to the very widely inclusive genus named *Ammonites.* This generic name is indicated by the abbreviation *"Am."*

### DESIGNATION OF SUBGENERA

In parts of the text devoted to Jurassic ammonoids (but not in parts describing Triassic and Cretaceous ammonoids), genus-group taxa (genera, subgenera) are treated as co-ordinate units, except that those considered to be of subgeneric rank are indicated by the abbreviation "Subgen." and those postulated to have such rank by "?Subgen." Genus-group taxa so marked are construed to belong with the next preceding taxon which is not indicated as having subgeneric status; a consequent of this arrangement is omission of all nominate *(sensu stricto)* subgenera. The chief reason for this mode of treatment is the very great difficulty in deciding on the appropriate taxonomic rank of a large number of generic names, especially of many introduced by S. S. BUCKMAN. Hundreds of these names have been reduced to the rank of subjective synonyms, although some are likely to be promoted from this status when the families to which they belong come to be monographed. In the light of present knowledge it is not possible to evaluate all available generic names satisfactorily. Accordingly, the author (ARKELL) of text describing Jurassic ammonoids declines to formalize subgenera, because to do so would, in his opinion, give a spurious appearance of finality in classification and certainly would beg many questions. Much unevenness in the relative size of families is due to nothing more than the publication by BUCKMAN or some other author of numerous available generic names in some family groups and lack of such publication in others.

### DESIGNATION OF SYNONYMS

The names of genus-group taxa which are classed as synonyms are cited in manner conforming to *Treatise* plan as explained in the Editorial Preface, except that the equals sign (=) is reserved for subjective synonyms of a certain kind, namely, junior synonyms based on a type species that is closely allied to or perhaps conspecific with the type species of the senior synonym but not nominally identical (in which case the names would be objective synonyms). The distinction here explained is employed in Jurassic and Cretaceous parts of systematic descriptions but not in the Triassic part of the text.

## Suborder CERATITINA Hyatt, 1884

[*nom. correct.* KUMMEL, 1952 (*pro* suborder Ceratitinae HYATT, 1884; *non* subfamily Ceratitinae MOJSISOVICS, 1879)]

Derivatives of Daraelitidae which underwent extensive evolutionary radiation in development of numerous new adaptive types. Characterized by greater elaboration of suture and acquisition of ornamentation in many groups. Adaptive range of this suborder, which includes most Triassic ammonoids, is very much larger than that shown by Paleozoic groups. *Perm.-Trias.*

## Superfamily OTOCERATACEAE Hyatt, 1900

[*nom. transl.* MILLER & FURNISH, 1954 (*ex* Otoceratidae HYATT, 1900)] [=Xenodisciaceae FRECH, 1902 (*nom. transl.* KUMMEL, 1952, *ex* Xenodiscidae FRECH, 1902)]

Evolute to involute descendants of Daraelitidae with suture increasingly more ceratitic (488). *Perm.-Trias.*

### Family XENODISCIDAE Frech, 1902

[=Paraceltitidae, Paralecanitidae SPATH, 1930; Cibolitidae PLUMMER & SCOTT, 1937]

Conch compressed, discoidal, evolute; venter rounded to acute; lateral ribs commonly present. Suture goniatitic or weakly ceratitic, with 2 lateral lobes. Group derived from Daraelitidae and is itself the ancestral stock of the Lower Triassic Ophiceratidae. *M. Perm.-U.Perm.*

**Xenodiscus** WAAGEN, 1879 [**X. plicatus;* SD WAAGEN, 1895] [=*Proceratites* KITTL, 1903 (obj.) (type *X. plicatus* WAAGEN; SD KUMMEL, herein)]. Venter low, arched, shoulders abruptly rounded, sides flattened and with radial ribs. Suture ceratitic (547). *U.Perm.,* SaltR.-Timor.——FIG. 162,*1*. **X. plicatus,* U.Perm., SaltR.; *1a,b,* ×0.7; *1c,* ×1.5 (547*).

**Xenodiscites** MILLER & FURNISH, 1940 [**X. waageni*]. Like *Xenodiscus* but periphery acute, suture more primitive, lobes only slightly denticulate (291). *U.Perm.*, Mex.-Tex.——FIGS. 162,*4*; 163*D*. **X. waageni*; suture, ×2 (291).

**Xenaspis** WAAGEN, 1895 [**Ceratites carbonarius* WAAGEN, 1873]. Like *Xenodiscus* but no lateral ribs on phragmocone; weak folds or ribs may be present on living chamber (547). *U.Perm.*, SaltR.-Himalaya-Madag.-Timor-Tex.——FIG. 162,*2*. **X. carbonarius* (WAAGEN), SaltR.; *2a,b*, ×0.7; *2c*, ×1.5 (291*, 547).

**Paraceltites** GEMMELLARO [**P. hoeferi*] [=*Paralecanites* DIENER, 1897]. Whorls compressed, venter

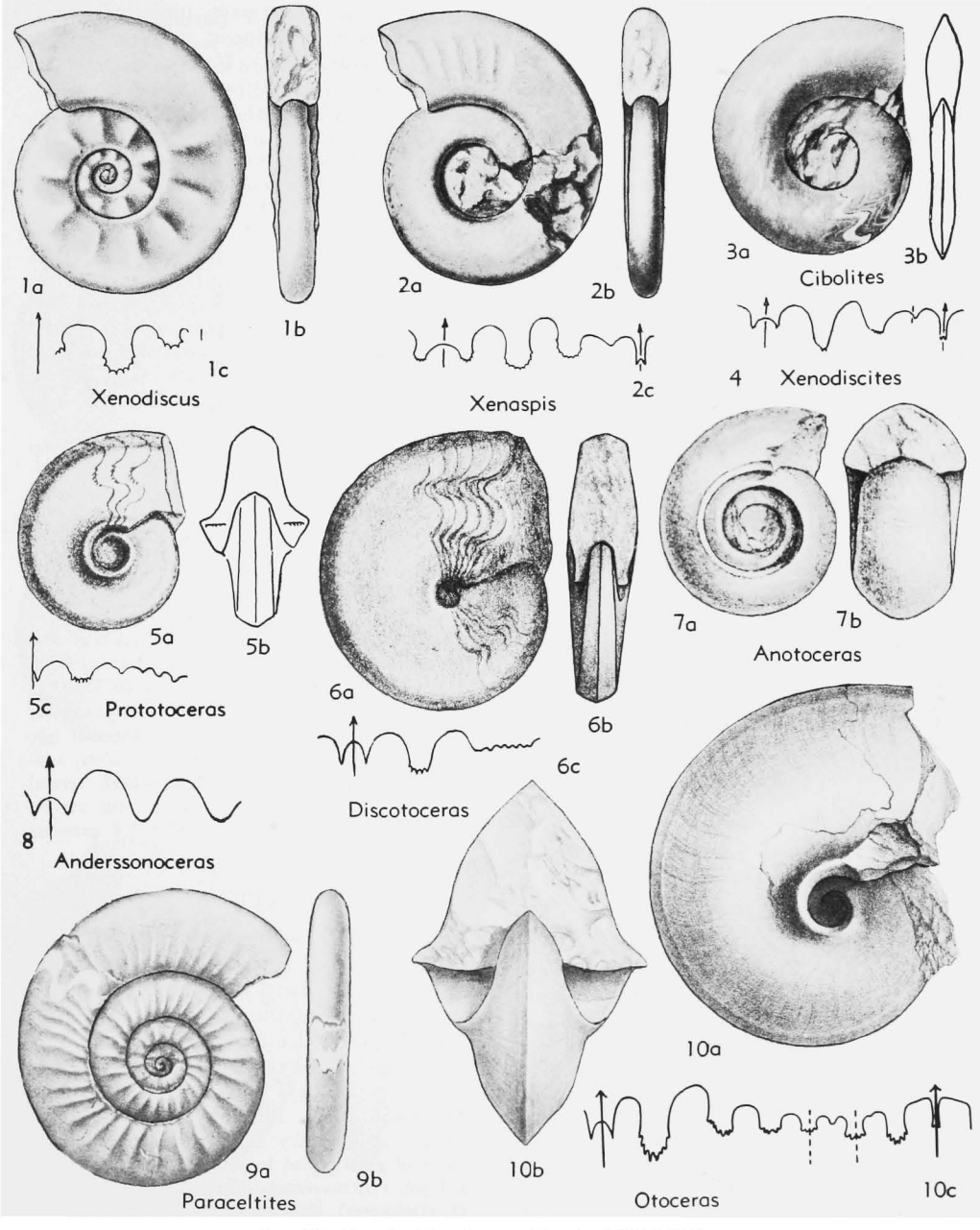



FIG. 162. Xenodiscidae, Otoceratidae (p. L130-L132).

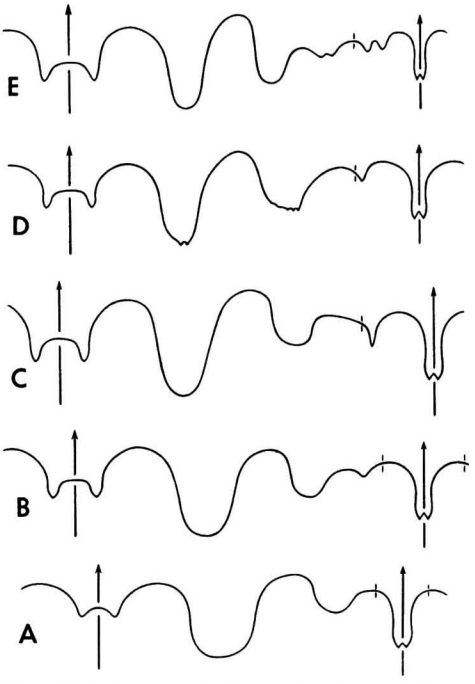



FIG. 163. Sutures of *Paraceltites (A)*, *Cibolites (B,C)*, *Xenodiscites (D)*, and *Kingoceras (E)* (110).

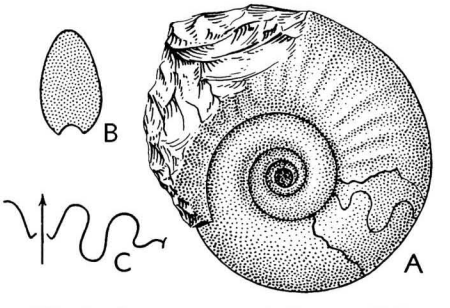



FIG. 164. *Paralecanites sextensis* DIENER, U.Perm., Eu.; ×1 (110).

arched; lateral area with prorsiradiate ribs, venter smooth. Suture goniatitic (291). *M.Perm.-U.Perm.*, Sicily - Alps - Crimea - Tex. - Mex.——FIGS. 162,*9*; 163*A*. *P. elegans* GIRTY, M.Perm., Tex.; 162,*9a,b*, conch, ×0.7 (291*); 163*A*, suture, enlarged.——FIG. 164. *P. sextensis* (DIENER), U.Perm., Eu.; ×1 (291).

**Cibolites** PLUMMER & SCOTT, 1937 [**C. uddeni*]. Like *Xenodiscites* but suture goniatitic, conch smooth (291). *U.Perm.*, Tex.-Mex.——FIGS. 162,*3*; 163*B,C*. **C. uddeni*, Tex.; 162,*3a,b*, conch, ×0.7 (291*); 163*B,C*, suture (291).

**Palaeolecanites** REED, 1944 [**P. chapriensis*]. Whorls higher than in *Paraceltites*, venter narrow, tabulate; umbilical shoulder subrectangular. Suture goniatitic with 3 low lateral lobes. Genus based on single badly weathered specimen, form of suture and whorl section doubtful. *U.Perm.*, SaltR.

## Family OTOCERATIDAE Hyatt, 1900

Involute forms with subtrigonal whorl section; venter tricarinate, umbilical shoulders generally prominent, umbilicus deep. Suture ceratitic (472). *U.Perm.-L.Trias.*

**Otoceras** GRIESBACH, 1880 [**O. woodwardi*] (472). *L.Trias.* (*L. Scyth.*), Himalaya-E.Greenl.-Alaska.

**O. (Otoceras).** Umbilical rim acutely flared (472). *L.Scyth.*, Himalaya - E.Greenl. - Alaska.—— FIG. 162,*10*. **O. (O.) woodwardi*, Himalaya; *10a,b*, ×0.5; *10c*, ×1 (102*).

**O. (Metotoceras)** SPATH, 1930 [**O. (M.) dieneri* (=*Hungarites* sp. DIENER, 1897)]. With no umbilical rim (472). *Scyth.*, Himalaya.

**Anotoceras** HYATT, 1900 [**Prosphingites nala* DIENER, 1897 (holotype, DIENER's pl. 1, fig. 4; SD SPATH, 1930)]. Evolute, reduced otoceratids with rounded or bluntly fastigate venter (472). *L.Trias. (Scyth.)*, Himalaya.——FIG. 162,*7*. **A. nala* (DIENER); *7a,b*, ×1 (102*).

**Prototoceras** SPATH, 1930 [**Ceratites trochoides* ABICH, 1878]. Like *Otoceras* but small, with fastigate venter and flared umbilical rim. Suture ceratitic and simpler (468). *U.Perm.*, Armenia.——FIG. 162,*5*. **P. trochoides* (ABICH); *5a-c*, ×1 (622*).

**Discotoceras** SPATH, 1930 [**Hungarites raddei* ARTHABER, 1900]. Involute smooth; platycones, venter fastigate; umbilical shoulder sharply rounded. Suture ceratitic with broad low saddles and narrow lobes (468). *U.Perm.*, Armenia.——FIG. 162,*6*. **D. raddei* (ARTH.); *6a-c*, ×1 (622*).

**Anderssonoceras** GRABAU, 1924 [**Glyphioceras (Anderssonoceras) anfuense*]. Small smooth like *Prototoceras*, with flared umbilical shoulders; venter low, arched, with low median keel, ventral shoulders angular. Suture goniatitic with narrow lobes. *U.Perm.*, China.——FIG. 162,*8*. **A. anfuense* (629*).

## Family OPHICERATIDAE Arthaber, 1911

Serpenticones with compressed elliptical whorl sections; venter generally rounded; ornamentation usually weakly developed. Suture simple, ceratitic. Descendants of U. Perm. Xenodiscidae (488). *L.Trias.*

**Ophiceras** GRIESBACH, 1880 [*non* SUESS, 1865 (ICZN Opinions 130, 194)] [**O. tibeticum*] [=*Griesbachoceras* MILLER, 1932]. Venter rounded, umbilical wall generally high; conch smooth, with striae of growth and in places a few ribs (472). *L.Scyth. (U.Otoceratan-L.Gyronitan)*, N.Am.-Asia.

**O. (Ophiceras).** Evolute, with high umbilical wall and no tendency toward tuberculation (472).

*L.Scyth.*, N.Am.-Asia.——Fig. 165,*5*. **O. (O.) tibeticum*, Himalaya; *5a,b*, ×0.7; *5c*, ×1 (102*).

**O. (Lytophiceras)** Spath, 1930 [**O. chamunda* Diener, 1897]. Like *O. (Ophiceras)* but more discoidal and involute; without high umbilical rim (472). *L.Scyth.*, N.Am.-Greenl.-Asia.——Fig. 165,*6*. **O. (L.) chamunda*, Himalaya; ×0.7 (102*).

**O. (Acanthophiceras)** Diener, 1916 [**Trachyceras (?) gibbosum* Griesbach, 1880]. Like *O. (Ophiceras)* but with tendency toward blunt, lateral tuberculation (472). *L.Scyth.*, Greenl.-Asia.——Fig. 165,*3*. **O. (A.) gibbosum* (Gries.), Himalaya; *3a,b*, ×0.66 (102*).

**O. (Discophiceras)** Spath, 1935 [**O. (Lytophiceras) subkyoticum* Spath, 1930]. *Ophiceras* with tendency to flat, discoidal conch and narrowing of venter; umbilicus small, often eccentric (473). *L.Scyth.*, N.Am.-Asia.

**O. (Metophiceras)** Spath, 1935 [**O. (M.) subdemissum*]. Evolute with compressed whorl section. First lateral lobe near middle of whorl side and second lateral saddle on umbilical slope (473). *L.Scyth.*, N.Am.-Asia.

**Glyptophiceras** Spath, 1930 [**Xenodiscus aequicostatus* Diener, 1913]. Like *Ophiceras* but with coarse, sigmoidal ribs which tend to degenerate adorally (472). *L.Scyth.*, N.Am.-Asia.——Fig. 165,*1*. **G. aequicostatum* (Diener), Himalaya; *1a,b*, ×0.7 (110*).

**Vishnuites** Diener, 1897 [**V. pralambha*]. Evolute

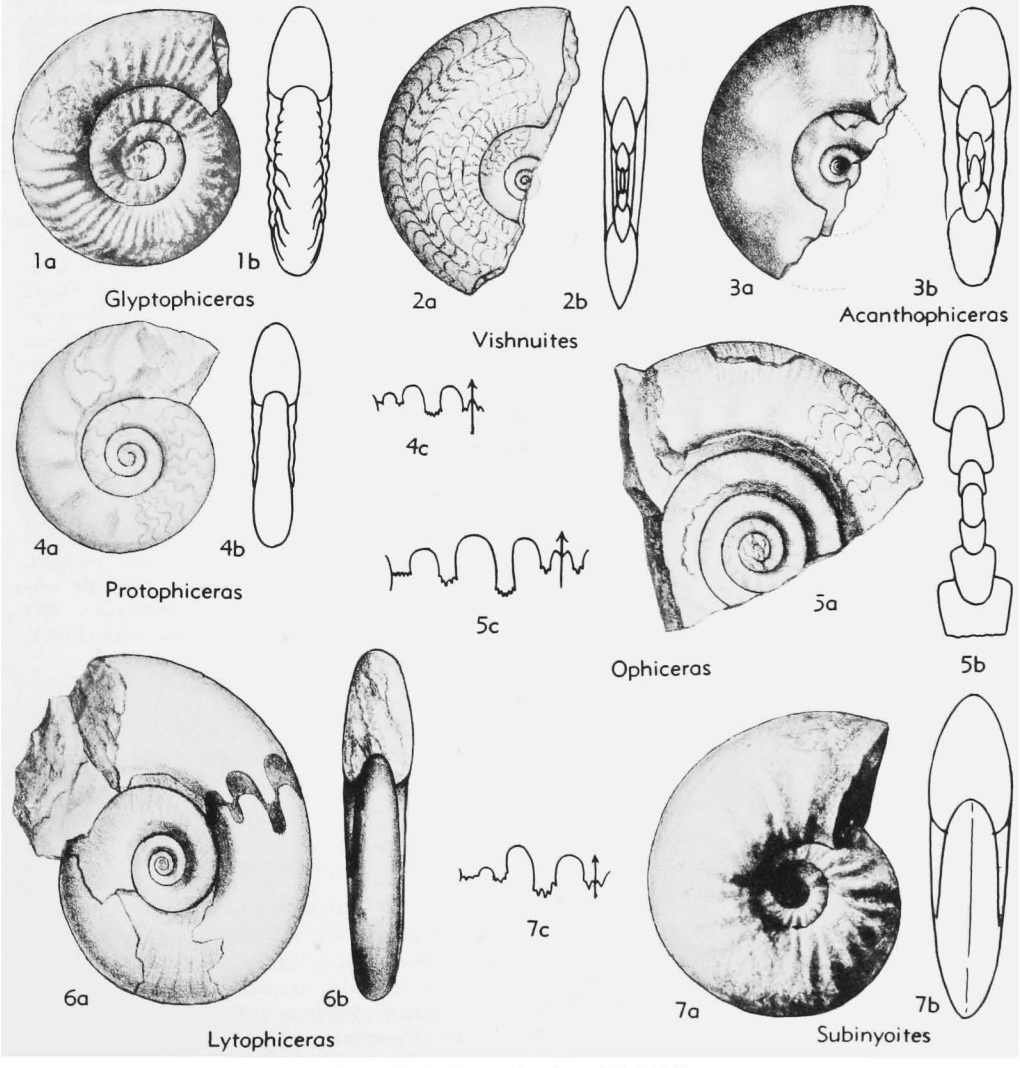



Fig. 165. Ophiceratidae (p. L133-L134).

compressed Ophiceratidae with acute venter (472). *L.Scyth.*, E.Greenl.-Himalaya.

**V. (Vishnuites).** Conch generally smooth (472). *Scyth.*, E.Greenl.-Himalaya.——FIG. 165,2. **V. (V.) pralambha*, Himalaya; *2a,b*, ×0.7 (102*).

**V. (Paravishnuites)** SPATH, 1935 [**V. (P.) oxynotus*]. Like *V. (Vishnuites)* but more involute and with faint, almost radial lineations (473). *Scyth.*, E.Greenl.

**Subinyoites** SPATH, 1930 [**Inyoites kashmiricus* DIENER, 1913]. Compressed, involute Ophiceratidae with blunt radial folds and acute venter. Second lateral saddle high (472). *L.Scyth.*, Kashmir.——FIG. 165,7. **S. kashmiricus* (DIENER); *7a,b*, ×0.7; *7c*, ×1 (110*).

**?Protophiceras** HYATT, 1900 [**Danubites nicolai* DIENER, 1895]. Evolute, whorl section compressed, sides flattened, venter arched; faint ribbing on inner whorls and distant blunt costae on inner lateral area of outer whorls, projecting adorally and weakening peripherally (472). *L.Scyth.*, E.Sib.——FIG. 165,4. **P. nicolai* (DIENER); *4a,b*, ×0.7; *4c*, ×1 (101*).

## Family DIENEROCERATIDAE Kummel, 1952

Evolute, slightly compressed, whorl section rounded, venter arched. Suture ceratitic or goniatitic, generally with only 2 lateral lobes. Considered to be persisting stock from ophiceratids and probably root of some later ornamented stocks (472). *L.Trias.*

**Dieneroceras** SPATH, 1934 [**Ophiceras dieneri* HYATT & SMITH, 1905]. *Scyth.*, Calif.-Nev.-Ida.——FIG. 166,1. **D. dieneri* (HYATT-S.); *1a,b*, ×1; *1c*, ×2 (203*).

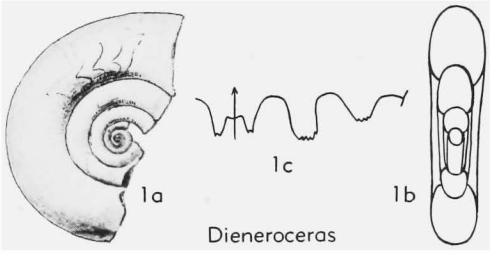



FIG. 166. *Dieneroceras dieneri* (HYATT & SMITH), L.Trias.(Scyth.), Calif.; *1a,b*, ×1; *1c*, ×2 (638).

## Superfamily NORITACEAE Karpinsky, 1889

[*nom. transl.* MILLER & FURNISH, 1954 (*ex* Noritinae KARPINSKY, 1889)] [=Meekoceratáceae WAAGEN, 1895 (*nom. transl.* KUMMEL, 1952, *ex* Meekoceratidae WAAGEN, 1895)]

Typically smooth, more or less discoidal shells with rounded or truncate peripheries and ceratitic sutures, but producing globose, carinate, or ribbed offshoots that may have complicated or simplified sutures. These families are direct or indirect derivatives of the lower Scythian ophiceratids (472). *L. Trias.-M.Trias.*

## Family GYRONITIDAE Waagen, 1895

Evolute to involute, discoidal ammonites with flattened sides and rounded or truncate periphery. Suture ceratitic to subgoniatitic (472). *L.Trias.*

### Subfamily GYRONITINAE Waagen, 1895

Evolute, with ceratitic suture. *L.Trias.*

**Gyronites** WAAGEN, 1895 [**G. frequens*; SD SMITH, 1904]. Venter tabulate, sides flattened, umbilical shoulder rounded, some with strigation near periphery and on it. Suture generally with distinct auxiliary series. *L.Scyth.(Gyronitan)*, SaltR.——FIG. 167,6. **G. frequens*; *6a,b*, ×1 (548*).

**Gyrolecanites** SPATH, 1934 [**Lecanites impressus* WAAGEN, 1895]. Venter tabulate, sides convex, umbilical walls rounded but abrupt. Suture goniatitic with 2nd lateral saddle close to umbilical wall. *L.Scyth.(Gyronitan)*, SaltR.——FIG. 167,1. **G. impressus* (WAAGEN); *1a,b*, ×0.7 (548*).

**Prionolobus** WAAGEN, 1895 [**P. atavus*; SD HYATT & SMITH, 1905]. Discoidal, with rounded or tabulate venter and tendency toward involution. Suture as in *Gyronites*. *Scyth.(U.Gyronitan-L.Flemingitan)*, SaltR. - Himalaya-Timor-Madag.-Mont.-Nev.——FIG. 167,3. *P. impressus* (WAAGEN), Gyronitan, SaltR.; *3a,b*, ×0.7 (548*).

**Ambites** WAAGEN, 1895 [**A. discus*; SD SPATH, 1934]. More involute, compressed discoidal, with moderately small umbilicus; venter tabulate. Suture subgoniatitic. *Scyth.(Flemingitan)*, SaltR.——FIG. 167,2. **A. discus*; *2a,b*, ×0.5 (548*).

**?Gyrophiceras** SPATH, 1934 [**Lecanites gangeticus* (DEKONINCK) WAAGEN, 1895]. Venter rounded, sides convex, umbilical wall rounded. Suture subgoniatitic. *L.Scyth.(Gyronitan-Flemingitan)*, Salt R.-Timor.——FIG. 167,5. **G. gangeticum* (KON.), SaltR.; *5a,b*, ×1; *5c*, ×2 (548*).

**?Catalecanites** SPATH, 1934 [**C. planus* (=*Lecanites* sp. DIENER, 1897)]. Like *Gyronites* but more compressed, with distinct umbilical shoulder; conch smooth. Suture goniatitic. *Scyth.(Flemingitan)*, Himalaya.——FIG. 167,7. **C. planus*; *7a,b*, ×1; *7c*, ×1 (102*).

### Subfamily KYMATITINAE Waagen, 1895

With increasing involution and subgoniatitic suture, being discoidal developments of Gyronitinae (472). *L.Trias.*

**Kymatites** WAAGEN, 1895 [**K. typus*]. Conch compressed, discoidal, smooth; venter tabulate, umbilicus small. Suture as in Gyronitinae but simpler. *Scyth.(Gyronitan)*, SaltR.——FIG. 167,4. **K. typus*; *4a,b*, ×0.7; *4c*, ×1 (548*).

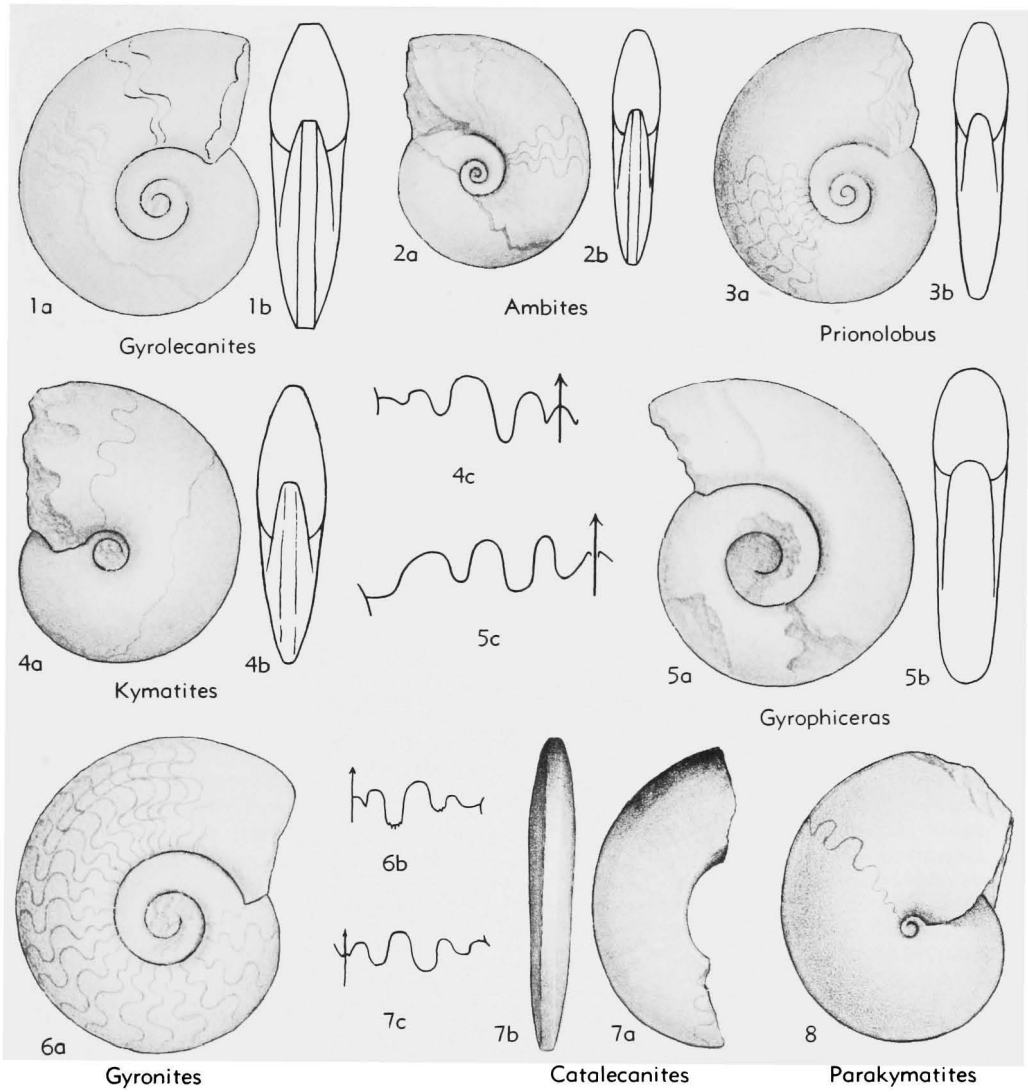



FIG. 167. Gyronitidae (p. L134-L135).

**Parakymatites** WAAGEN, 1895 [**P. discoides*]. Like *Kymatites* but more involute and discoidal. Suture with wide ventral lobe and 3 auxiliary saddles (548). *Scyth.(Flemingitan)*, SaltR.——FIG. 167,*8*. **P. discoides*; ×0.75 (548*).

## Family FLEMINGITIDAE Hyatt, 1900

Evolute, discoidal, generally with robust ornamentation. Suture tending to greater elaboration than in ancestral Ophiceratidae (472). *L.Trias.*

**Flemingites** WAAGEN, 1892 [**Ceratites flemingianus* DEKONINCK, 1863]. Ribbing prominent and generally also strigation; venter rounded to subtruncate. Suture ceratitic but more advanced than in Gyronitidae. *Scyth.(Flemingitan-Owenitan)*, Salt R.-Madag.-Timor.-Ida.-Mont.——FIG. 168,*4*. *F. radiatus* WAAGEN, Flemingitan, SaltR.; *4a,b*, ×0.5 (548*).

**Euflemingites** SPATH, 1934 [**Flemingites guyerdetiformis* WELTER, 1922]. More or less involute serpenticones with slightly compressed whorls, arched venter, and rounded umbilical wall, with distinct strigation but no radial ornamentation. *Scyth.*, Timor-Himalaya-Spitz.-Ida.——FIG. 168,*3*. **E. guyerdetiformis* (WELTER), Timor; *3a,b*, ×0.7; *3c*, ×1 (560*).

**Pseudoflemingites** SPATH, 1930 [**P. timorensis*]. Serpenticones with ribbing as in *Xenodiscoides* or

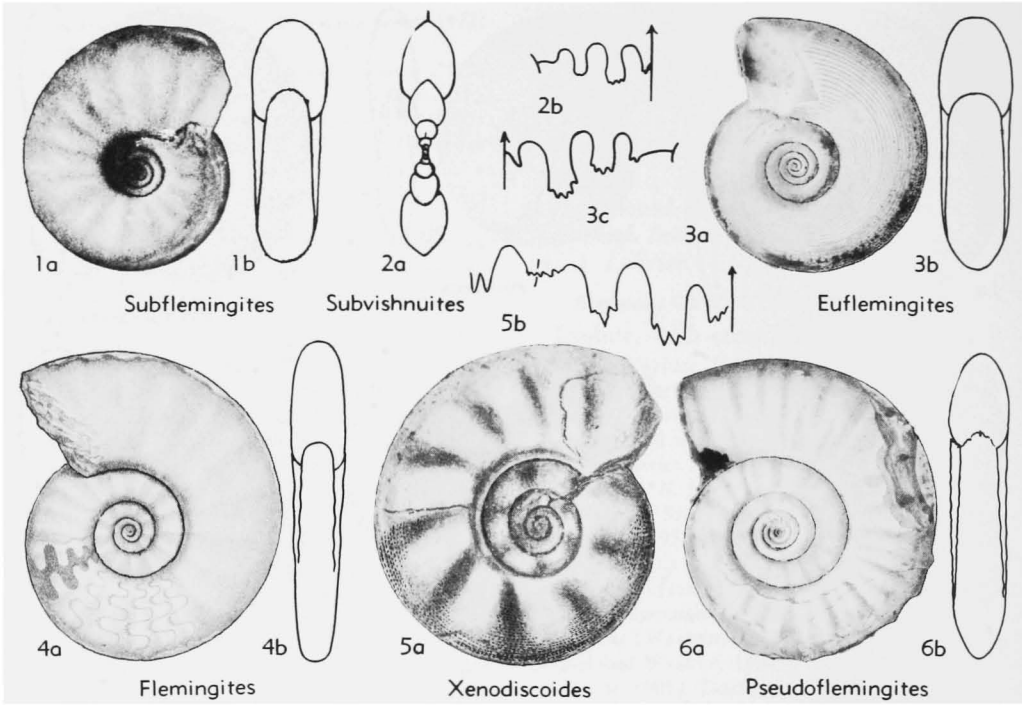



FIG. 168. Flemingitidae (p. L135-L136).

strigation as in *Flemingites*, but with very evolute smooth inner whorls and simpler suture. *Scyth. (Owenitan)*, Timor.——FIG. 168,*6*. **P. timorensis*; *6a,b*, ×0.5 (560*).

**Subvishnuites** SPATH, 1930 [**S. welteri*]. Evolute, smooth, with inner whorls as in *Pseudoflemingites* and similar suture; with tendency for periphery to become fastigate. *Scyth.(Owenitan)*, Timor.——FIG. 168,*2*. **S. welteri*; *2a*, ×0.7; *2b*, ×1 (560*).

**Subflemingites** SPATH, 1934 [**S. involutus* (=*Aspidites meridianus involutus* WELTER, 1922)]. Involute, subdiscoidal, with smooth serpenticone inner whorls; umbilical wall rounded, venter arched. Suture with irregular auxiliaries as in *Clypeoceras*. *Scyth.*, Timor.——FIG. 168,*1*. **S. involutus* (WELTER); *1a,b*, ×1 (560*).

**Xenodiscoides** SPATH, 1930 [**Xenodiscus perplicatus* FRECH, 1905]. Strongly ribbed shells resembling the inner whorls of *Flemingites*, but without strigation; venter rounded or subtabulate. Suture slightly simpler than in *Flemingites* (468). *Scyth.(Flemingitan)*, Salt.R.——FIG. 168,*5*. **X. perplicatus* (FRECH); *5a*, ×0.8; *5b*, ×2 (156*).

## Family XENOCELTITIDAE Spath, 1930

Conch evolute, discoidal, generally ribbed, especially on inner whorls, or constricted, with ribs often projected forwards across a smooth, arched or keeled venter. Suture ceratitic or goniatitic. Derived from primitive "ophiceratid" stock that modified its primitive (*Glyptophiceras*) characters only in ventral area (472). *Up.L.Trias.*

### Subfamily XENOCELTITINAE Spath, 1930

Smooth, venter arched or slightly sharpened; may be crenulate when traversed by faint prolongations of lateral ribs. *L.Trias.*

**Xenoceltites** SPATH, 1930 [**X. subevolutus* (=*Xenodiscus* cf. *comptoni* FREBOLD, 1930; *non* DIENER)]. Compressed serpenticone with faint distant bulges on inner whorls and irregular costation, on outer whorl generally causing constrictions. Suture with 2 weakly toothed lateral lobes (468). *U.Scyth.*, Spitz.-Sib.-SaltR.-Utah.——FIG. 169,*1*. *X. russkiensis* SPATH, Sib.; *1a,b*, ×1; *1c*, ×2 (101*).

**Preflorianites** SPATH, 1930 [**Danubites strongi* HYATT & SMITH, 1905]. Venter tending to become acute, with radial ribbing most prominent on inner whorls, not reaching periphery (468). *U.Scyth.*, Calif.-Ida.-Timor-Albania.—— FIG. 169,*2*. **P. strongi* (HYATT-S.), Owenitan, Calif.; *2a,b*, ×0.7; *2c*, ×2 (203*).

**?Hemilecanites** SPATH, 1934 [**Lecanites discus* ARTHABER, 1908]. Smooth, evolute, with tendency to oxynote venter, mouth border constricted with ventral lappet. Suture reduced. *U.Scyth.*, Calif.-

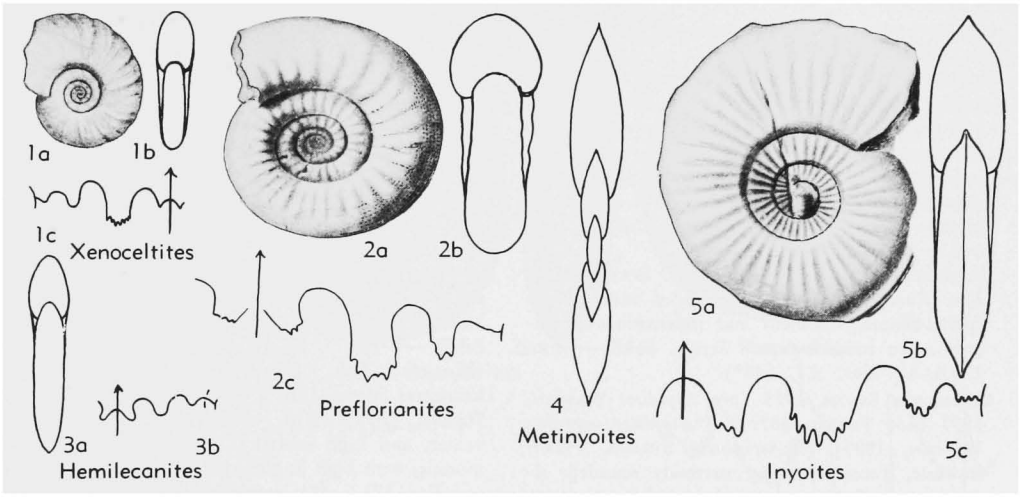



FIG. 169. Xenoceltitidae (p. L136-L137).

Albania.——FIG. 169,*3*. **H. discus* (ARTH.), Albania; *3a,b*, ×2 (472*).

**Subfamily INYOITINAE Spath, 1934**

Compressed, keeled offshoots of same stock that produced *Preflorianites*, with similar costation degenerating into striation and comparable ceratitic suture (472). *L.Trias.*

**Inyoites** HYATT & SMITH, 1905 [**I. oweni*]. Platycones with high hollow keel and distinct umbilical shoulder; radial ribs that diminish toward compressed venter (203). *Scyth.(Owenitan)*, Calif.-?Indochina.——FIG. 169,*5*. **I. oweni*, Calif.; *5a,b*, ×0.7; *5c*, ×2 (203*).

**Metinyoites** SPATH, 1930 [**Vishnuites discoidalis* WELTER, 1922]. More compressed and highly keeled than *Inyoites* and suture more specialized (468). *Scyth.(Owenitan)*, Timor.——FIG. 169,*4*. **M. discoidalis* (WELTER); ×0.7 (560*).

## Family PARANORITIDAE Spath, 1930

Discoidal, more or less involute, with flattened sides and rounded or truncate venter which tends to sharpen. Suture ceratitic, with auxiliaries becoming fairly well individualized (472). *L.Trias.*

**Paranorites** WAAGEN, 1895 [**P. ambiensis*]. Conch more or less involute, periphery narrowly rounded, sides slightly convex, umbilical wall high but rounded. Suture ceratitic, with ventral saddles and lobes more differentiated than in *Ophiceras* or *Prionolobus*. *Scyth.(U.Gyronitan-Flemingitan)*,

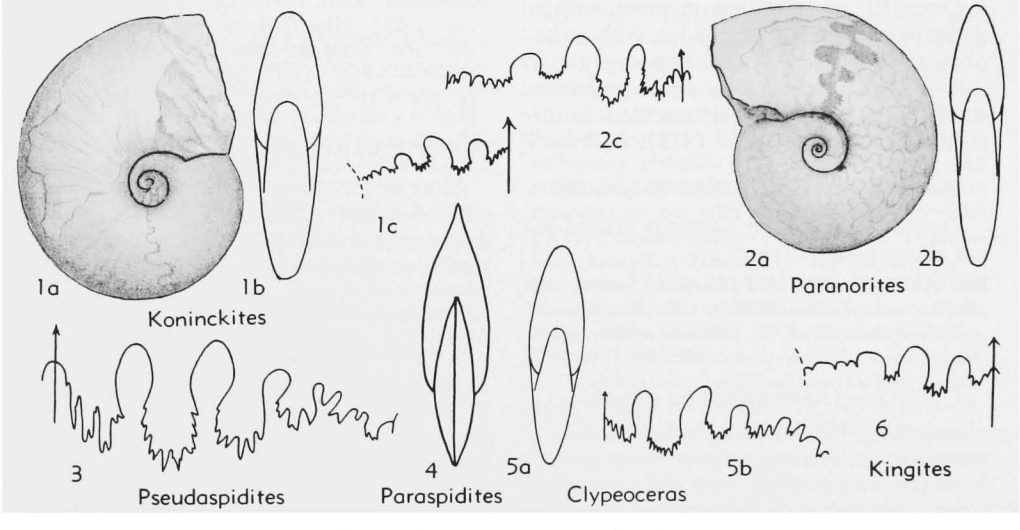



FIG. 170. Paranoritidae (p. L137-L138).

SaltR.——Fig. 170,2. **P. ambiensis; 2a,b,* ×0.3; *2c,* ×0.7 (548*).

**Koninckites** Waagen, 1895 [**K. vetustus;* SD Smith, 1904]. Involute, compressed, with flattened sides and narrowly rounded to subtabulate venter; umbilical wall gently rounded. Suture with greater individualization of elements in auxiliary series. *Scyth.(Gyronitan-Flemingitan),* SaltR.-Himalaya-Mont.——Fig. 170,1. **K. vetustus,* SaltR.; *1a,b,* ×0.7; *1c,* ×1 (548*).

**Kingites** Waagen, 1895 [**K. lens;* SD Spath, 1934]. Like *Koninckites* but with rounded venter, deep funnel-shaped umbilicus and indentations of suture more individualized. *Scyth.,* SaltR.——Fig. 170,6. **K. lens;* ×1 (548*).

**Clypeoceras** Smith, 1913 [*pro Aspidites* Waagen, 1895 (*non* Peters, 1877)] [**Aspidites superbus* Waagen, 1895] [=*Aspiditella* Strand, 1929]. Involute, discoidal; venter narrowly rounded, almost acute. Suture advanced, especially auxiliary series. *Scyth.(Gyronitan-Flemingitan),* SaltR.-Himalaya-Timor.——Fig. 170,5. **C. superbum* (Waagen), SaltR., *5a,* ×0.1; *5b,* ×0.3 (548*).

**Paraspidites** Spath, 1934 [**P. praecursor* (Frech) (=*Aspidites superbus* Waagen, mut. *praecursor* Frech, 1905)]. Involute oxycones with deep umbilicus. Auxiliaries less developed than in *Clypeoceras. Scyth.(Flemingitan),* SaltR.——Fig. 170,4. **P. praecursor;* ×0.7 (156*).

**Pseudaspidites** Spath, 1934 [**Aspidites muthianus* Krafft in Krafft & Diener, 1909]. Involute, with rounded or subtruncate venter. Suture subammonitic with submonophyllic saddles. *Scyth.(Owenitan),* Himalaya-Ida.——Fig. 170,3. **P. muthianus* (Krafft), Himalaya; ×1 (240*).

## Family PROPTYCHITIDAE Waagen, 1895

Discoidal, more or less involute, inflated derivatives of the Ophiceratidae, with arched or sharpened venter; whorl section generally subtrigonal, producing a deep umbilicus; conch smooth or feebly ornamented. Suture ceratitic to subammonitic (472). *L.Trias.*

### Subfamily PROPTYCHITINAE Waagen, 1895

Periphery broadly or narrowly arched but not sharpened. *L.Trias.*

**Proptychites** Waagen, 1892 [**Ceratites lawrencianus* DeKoninck, 1863]. More or less involute, discoidal, with tendency to inflation; venter arched. Suture more advanced than in ancestral Ophiceratidae. *Scyth.(U.Gyronitan-Flemingitan),* Asia-N.Am.——Fig. 171,3. **P. lawrencianus* (Kon.), SaltR. *3a,b,* ×0.3 (548*).

**Pachyproptychites** Diener, 1916 [**Proptychites otoceratoides* Diener, 1895]. With narrowly rounded venter, flattened or slightly concave sides, high umbilical rim and funnel-shaped umbilicus. *Scyth.,* Sib.——Fig. 171,7. **P. otoceratoides* (Diener); *7a,b,* ×0.5 (101*).

**Proptychitoides** Spath, 1930 [**P. decipiens* (=*Proptychites latifimbriatus* Arthaber, 1911 (*non* De-Koninck)]. Like *Proptychites,* with narrowly rounded venter and deep umbilicus but suture subammonitic, with monophyllic saddles. *U.Scyth.,* Albania-Chios.——Fig. 171,6. **P. decipiens,* Albania; ×0.66 (472*).

**Eoptychites** Spath, 1930 [**Proptychites obliqueplicatus* Waagen, 1895]. With rursiradiate, bifurcating, blunt ribs and arched venter. *Scyth.(Flemingitan),* SaltR.——Fig. 171,2. **E. obliqueplicatus* (Waagen); *2a,b,* ×0.7 (548*).

**Ussuriceras** Spath, 1930 [**Proptychites acutisellatus* Diener, 1895]. With weak radial ribs, arched venter, and high umbilical wall. Suture subammonitic, with high linguiform saddles. *Scyth.,* Sib.——Fig. 171,5. **U. acutisellatus* (Diener); ×1 (101*).

**?Procarnites** Arthaber, 1911 [**Parapopanoceras kokeni* Arth., 1908]. Discoidal, involute, ?with increased number of sutural elements. *U.Scyth.,* Albania-Chios.——Fig. 171,4. **P. kokeni* (Arth.); ×2 (22*).

### Subfamily OWENITINAE Spath, 1934

Lenticular to oxynote developments of Proptychitidae, parallel with paranannitids and with similar globose, constricted young, but distinguished by suture (472). *L.Trias.*

**Owenites** Hyatt & Smith, 1905 [**O. koeneni*]. Involute, smooth, lenticular tending to become oxycones. Suture ceratitic with numerous lobes and saddles (203). *Scyth.(Owenitan),* Calif.-Nev.-Ida.-Mont.-Timor.——Fig. 171,8. **O. koeneni,* Calif.; *8a,b,* ×1; *8c,* ×2 (203*).

**Parowenites** Spath, 1934 [**Owenites simplex* Welter, 1922]. Like *Owenites* but with sigmoidal ribs and goniatitic suture. *Scyth.(Owenitan),* Timor.——Fig. 171,1. **P. simplex* (Welter); *1a,* ×0.7; *1b,* ×2 (560*).

## Family PARANANNITIDAE Spath, 1930

More or less globular ammonites with depressed whorl sections, at least in young; commonly constricted. Suture ceratitic or goniatitic, simple (472). *L.Trias.*

### Subfamily PARANANNITINAE Spath, 1930

Venters broadly arched with no tendency towards carination. Suture generally with more than one lateral lobe. *L.Trias.*

**Paranannites** Hyatt & Smith, 1905 [**P. aspenensis*]. Conch involute, subglobose, compressed; early-formed part smooth, later with radial folds or constrictions. Suture ceratitic (203). *Scyth.(Owenitan),*

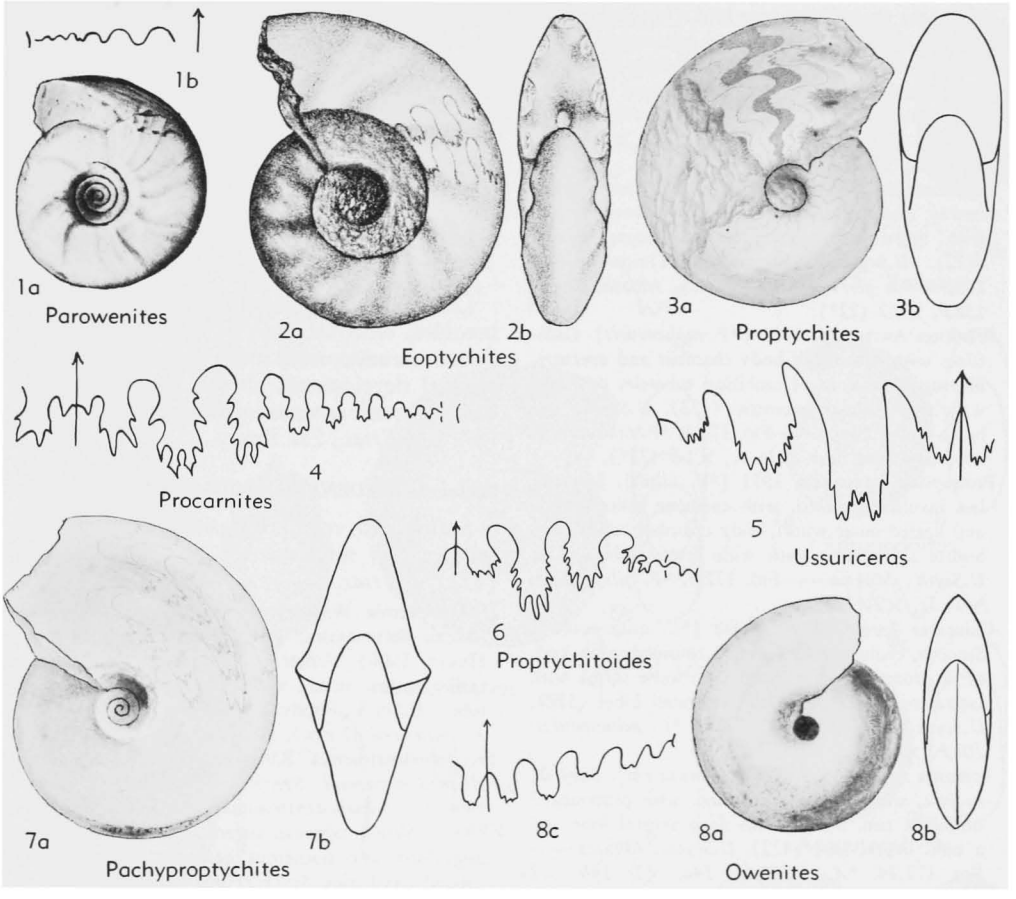



FIG. 171. Proptychitidae (p. L138).

Ida.——FIG. 172,7. **P. aspenensis; 7a,b,* ×1; *7c,* ×3 (203*).

**Arnautoceltites** DIENER, 1916 [**Celtites arnauticus* ARTHABER, 1911] [=*Juvenites, Thermalites* SMITH, 1927]. Like *Paranannites* but with oblique constrictions. Suture goniatitic or ceratitic. *U.Scyth.*, Albania-Chios-Calif.-Nev.-Ida.——FIG. 172,9. **A. arnauticus* (ARTH.), Albania, *9a,b,* ×1; *9c,* ×2 (22*).

**Prosphingites** MOJSISOVICS, 1886 [**P. czekanowski*]. With globose inner whorls and almost keeled, galeate or compressed outer whorls in some; surface smooth or with faint striae, ridges, constrictions. Suture ceratitic. *U.Scyth.*, Calif.-Nev.-Albania-Spitz.-Sib.——FIG. 172,6. **P. czekanowski,* Sib.; *6a,b,* ×0.7; *6c,* ×1 (294*).

**Zenoites** RENZ & RENZ, 1948 [**Prosphingites (Zenoites) helenae*]. Like *Prosphingites,* with arched venter, but with prominent irregular, nearly radial constrictions that encircle whorl section (372). *U.Scyth.,* Chios.——FIG. 172,4. **Z. helenae* (RENZ-R.); *4a,b,* ×1; *4c,* ×2 (372*).

**Isculitoides** SPATH, 1930 [**Isculites originis* ARTHABER, 1911]. Involute, subglobose, smooth, with contracting body chamber and eccentric umbilicus. Suture ceratitic with two lateral lobes. *U.Scyth.,* Albania-Chios-Timor.——FIG. 172,13. **I. originis* (ARTH.), Albania; *13a,b,* ×1; *13c,* ×3 (22*, 372).

**Chiotites** RENZ & RENZ, 1948 [**Prosphingites (Chiotites) globularis*]. Like *Isculitoides* but with longitudinal striae on body chamber. Suture as in *Prosphingites* but with 2 ceratitic auxiliary lobes (372). *U.Scyth.,* Chios.——FIG. 172,11. **C. globularis* (RENZ-R.); *11a,b,* ×1; *11c,* ×3 (372*).

**?Paragoceras** ARTHABER, 1911 [**P. dukagini*]. Like *Arnautoceltites* but with distinctive suture. *U.Scyth.,* Albania-Chios.——FIG. 172,3. **P. dukagini; 3a,b,* ×1; *3c,* ×3 (22*).

### Subfamily COLUMBITINAE Spath, 1930

Venters arched to keeled, conch generally evolute, with early coronate stage. Suture typically with one differentiating lateral lobe. *L.Trias.*

**Columbites** HYATT & SMITH, 1905 [**C. parisianus*]. Evolute, feebly ornamented with ribs, constrictions, and spiral striae; venter arched tending to become acute. Suture ceratitic with large lateral lobe and small 2nd lateral (203). *U.Scyth.*, Ida.-Wyo.-Utah.——FIG. 172,*2*. **C. parisianus; 2a*, ×0.7; *2b*, ×2 (203*).

**Subcolumbites** SPATH, 1930 [**Columbites perrinismithi* ARTHABER, 1908]. Like *Columbites* but with more pronounced tendency to carination (472). *U.Scyth.*, Albania-Chios-?Timor.——FIG. 172,*15*. **S. perrinismithi* (ARTH.), Albania-Chios; *15a,b*, ×0.7 (22*).

**Prenkites** ARTHABER, 1911 [**P. malsorensis*]. Cadicones with constricted body chamber and aperture, bearing indications of umbilical tubercles on inner whorls, umbilicus excentric (472). *U.Scyth.*, Albania-Chios-Timor.——FIG. 172,*8*. **P. malsorensis*, Albania-Chios; *8a,b*, ×1; *8c*, ×1.5 (22*).

**Protropites** ARTHABER, 1911 [**P. hilmi*]. More or less involute, inflated, with cadicone inner whorls and keeled outer whorl, body chamber constricted. Suture subceratitic with wide lateral lobe (472). *U.Scyth.*, Albania.——FIG. 172,*5*. **P. hilmi; 5a,b*, ×1; *5c*, ×2 (22*).

**Chioceras** RENZ & RENZ, 1948 [**C. mitzopouloi*]. Smooth, evolute, whorl section rounded, with keel, as in *Protropites*, developed late; some forms with lateral nodes. Suture with 3 serrated lobes (372). *U.Scyth.*, Chios.——FIG. 172,*10*. **C. mitzopouloi; 10a,b*, ×1; *10c*, ×2 (372*).

**Arianites** ARTHABER, 1911 [**A. musacchi*]. Smooth, evolute, whorl section depressed, with pronounced umbilical rim. Suture with deep ventral lobe and a bifid lateral lobe (472). *U.Scyth.*, Albania.——FIG. 172,*14*. **A. musacchi; 14a*, ×1; *14b*, ×2 (22*).

**Meropella** RENZ & RENZ, 1948 [**Arianites (Meropella) plejanae*]. Like *Arianites* but whorl section not depressed, inner whorls with faint ribs, and suture with 2 bifid lateral lobes (372). *U.Scyth.*, Chios.——FIG. 172,*12*. **M. plejanae* (RENZ-R.); ×4 (372*).

**Epiceltites** ARTHABER, 1911 [**E. genti*]. Evolute, compressed, with fine lineation and periodic flares or constrictions. Suture with single, ceratitic lateral lobe (472). *U.Scyth.*, Albania-Chios.——FIG. 172,*1*. **E. genti; 1a,b*, ×0.7; *1c*, ×2 (22*).

## Family USSURIIDAE Spath, 1930

[*nom. correct.* KUMMEL, herein (*pro* Ussuridae SPATH, 1930)]

Involute, smooth, discoidal ammonites with arched to narrowly rounded venters and flat whorl sides. Suture ammonitic (472). *L.Trias.*

**Ussuria** DIENER, 1895 [**U. schamarae*; SD DIENER, 1895]. Suture submonophyllic with lateral saddles notched on dorsal side. *Scyth.*, Sib.——FIG. 173, *13*. **U. schamarae; 13a,b*, ×0.7 (101*).

**Parussuria** SPATH, 1934 [**Ussuria compressa* HYATT & SMITH, 1905]. All saddles of suture deeply divided. *Scyth.*, Calif.——FIG. 173,*7*. **P. compressa* HYATT-S.; ×0.7 (203*).

**Metussuria** SPATH, 1934 [**Ussuria waageni* HYATT & SMITH, 1905]. Suture with adventitious lobe and saddle. *Scyth.*, Ida.——FIG. 173,*11*. **M. waageni* (HYATT-S.); ×0.5 (203*).

## Family HEDENSTROEMIIDAE Waagen, 1895

Discoidal, compressed, generally smooth, involute, with tabulate to oxynote venters. Suture ceratitic, with more elements than in parallel development shown by Paranoritidae, and with adventitious saddles and lobes (472). *L.Trias., ?M.Trias.*

### Subfamily HEDENSTROEMIINAE Waagen, 1895

Suture with regular ceratitic lobes, smooth saddles and no tendency to simplification (472). *L.Trias.*

**Hedenstroemia** WAAGEN, 1895 [**Ceratites hedenstroemi* KEYSERLING, 1845] [=*Anahedenstroemia* HYATT, 1900]. Venter acute in adult, tabulate in earlier stages. Suture with prominent adventitious lobe. *U.Scyth.*, Spitz.-Sib.——FIG. 173,*5*. **H. hedenstroemi* (KEYS.), Sib.; *5a,b*, ×0.5 (472*).

**Pseudohedenstroemia** KUMMEL, *nom. nov.* [*pro Anahedenstroemia* SPATH, 1934 (*non* HYATT, 1900)] [**Anahedenstroemia himalayica* SPATH, 1934]. Venter tabulate, suture with outer saddles linguiform and numerous generally well-individualized auxiliaries. *Scyth.*, Himalaya-SaltR.-Timor-Calif.——FIG. 173,*6*. **P. himalayica*, Himalaya; *6a,b*, ×0.7 (102*).

**Clypites** WAAGEN, 1895 [**C. typicus*]. Like *Pseudohedenstroemia* but with closed umbilicus and adventitious elements of suture less individualized. *Scyth.*, SaltR.-Himalaya.——FIG. 173,*15*. **C. typicus*, SaltR.; *15a,b*, ×1 (548*).

**Parahedenstroemia** SPATH, 1934 [**Hedenstroemia acuta* KRAFFT in KRAFFT & DIENER, 1909]. Like *Pseudohedenstroemia* but with oxynote periphery. *Scyth.*, Himalaya.——FIG. 173,*3*. **P. acuta* (KRAFFT); *3a,b*, ×1 (240*).

**Epihedenstroemia** SPATH, 1934 [**Hedenstroemia skipetarensis* ARTHABER, 1911]. Venter tabulate, comparatively broad. Suture with primitive lobes and saddles, and high curvature. *U.Scyth.*, Albania.——FIG. 173,*12*. **E. skipetarensis* (ARTH.); ×2 (22*).

**Metahedenstroemia** SPATH, 1934 [**Hedenstroemia kastriotae* ARTHABER, 1911]. Highly compressed conch, with narrowly tabulate venter. Suture with bluntly serrated lobes and well individualized auxiliary saddles. *U.Scyth.*, Albania.——FIG. 173,*10*. **M. kastriotae* (ARTH.); ×1.5 (22*).

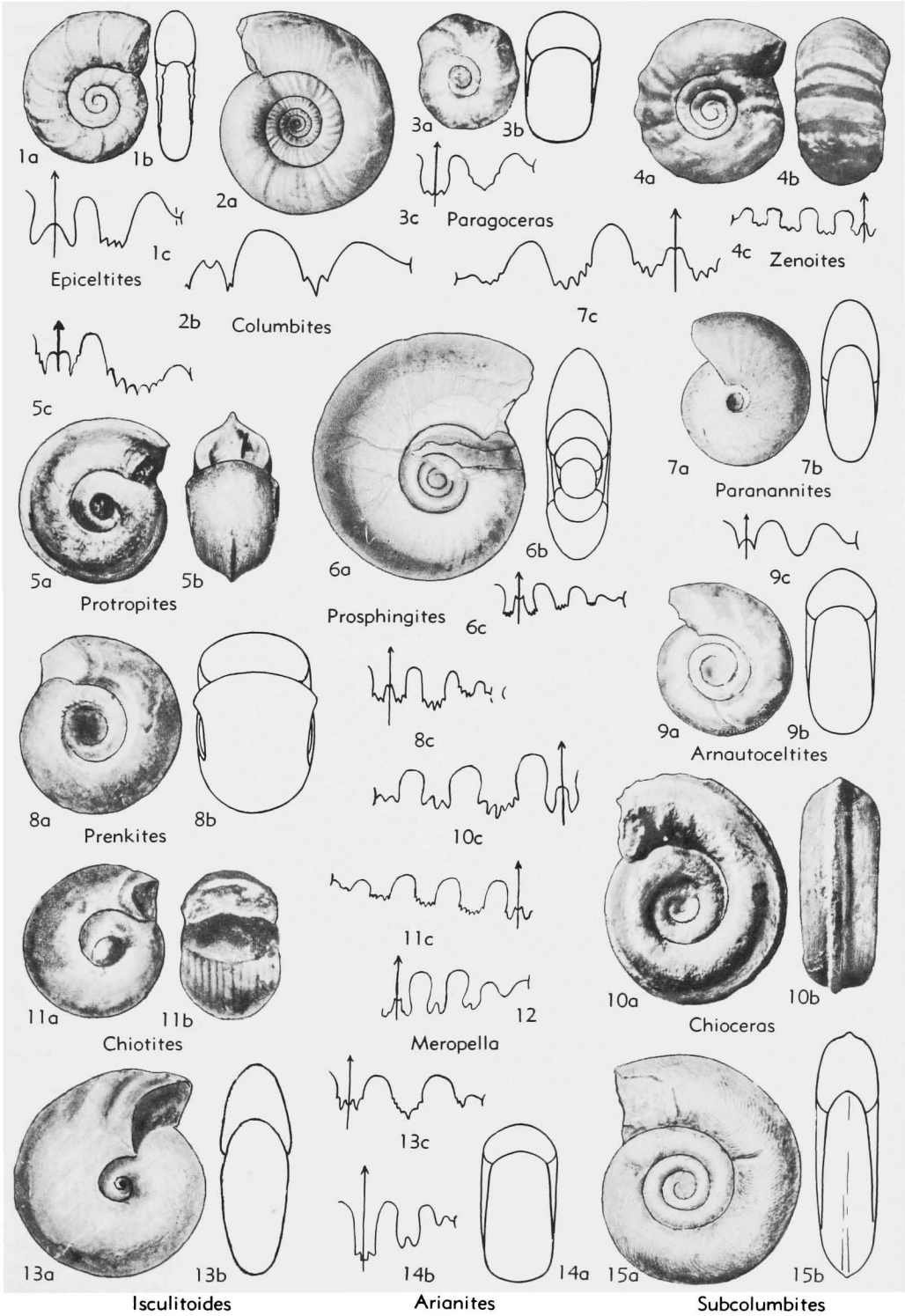



FIG. 172. Paranannitidae (p. L138-L140).

**Tellerites** MOJSISOVICS, 1902 [**Ceratites furcatus* ÖBERG, 1877]. Discoidal, involute, with sulcate venter bordered by 2 keels and faint sigmoidal ribs on sides. Suture with small adventitious saddles. *U.Scyth.*, Spitz.——FIG. 173,*2*. **T. furcatus* (ÖBERG); *2a,b*, ×1; *2c*, ×2 (294*).

### Subfamily LANCEOLITINAE Spath, 1934

Venter tabulate, whorl sides flat. Suture ammonitic with wide, high ventral lobe, indistinct adventitious elements (472). *L. Trias.*

**Lanceolites** HYATT & SMITH, 1905 [**L. compactus*] (203). *Scyth.(Owenitan)*, Ida.-Calif.——FIG. 173, *8*. **L. compactus; 8a*, ×0.5; *8b*, ×1 (203*).

### Subfamily ASPENITINAE Spath, 1934

Venter acute or oxynote, suture almost goniatitic with numerous elements and adventitious lobes (472). *L.Trias.*

**Aspenites** HYATT & SMITH, 1905 [**A. acutus*]. Venter oxynote, conch smooth or with fine, strong radial folds. Suture ceratitic, with small adventitious lobes and goniatitic auxiliaries (203). *Scyth. (Owenitan)*, Ida.-Timor.——FIG. 173,*1*. **A. acutus*, Ida.; *1a,b*, ×0.66; *1c*, ×3 (203*).

**Pseudaspenites** SPATH, 1934 [**Aspenites layeriformis* WELTER, 1922]. Like *Aspenites* but more evolute and with curvature of suture and more numerous auxiliaries. *Scyth.(Owenitan)*, Timor.——FIG. 173, *9*. **P. layeriformis* (WELTER); ×1 (560*).

**?Beatites** ARTHABER, 1911 [**B. berthae*]. Somewhat strongly evolute, with oxynote venter, greatly compressed. Suture goniatitic. *U.Scyth.*, Albania.——FIG. 173,*4*. **B. berthae*; ×1 (22*).

### ?Subfamily BENECKEIINAE Waagen, 1895

[*nom. correct.* KUMMEL, herein (*pro* Beneckeinae WAAGEN, 1895)]

Compressed, smooth oxycones with entire multilobate suture, with small adventitious lobes (472). *L.Trias.-M.Trias.*

**Beneckeia** MOJS., 1882 [*non Beneckeia* UHLIG, 1882 (=*Silesites* UHLIG, 1882)] [**Am. buchi* ALBERTI, 1834] (472). *L.Trias.(U.Scyth.)-M.Trias.(Anis.)*, Ger.-Transjordan.——FIG. 173,*14*. *B. wogauana* (MEYER), Anis., Ger.; *14a,b*, ×1 (702*).

## Family KASHMIRITIDAE Spath, 1930

Costate developments of a stock similar to primitive flemingitids or xenoceltitids tending to peripheral ribbing, as in *Anasibirites*, or to carination (472). *L.Trias.*

**Kashmirites** DIENER, 1913 [**Celtites armatus* WAAGEN; SD DIENER, 1915]. More or less evolute, whorls quadrate, with strong, commonly tuberculate ribbing on inner whorls, degenerating into striation on outer whorls; venter wide; subtabulate, costae commonly continuous across venter. Suture ceratitic, generally with only 2 lateral lobes. *Scyth.*, SaltR.-Himalaya-Timor.——FIG. 174,*4*. **K. armatus* (WAAGEN), Himalaya; *4a,b*, ×1 (110*).

**Anakashmirites** SPATH, 1930 [**Danubites nivalis* DIENER, 1897]. Evolute, serpenticones with ribs tending to thicken toward ventrolateral borders and widely arched peripheries. Suture ceratitic. *Scyth.*, Himalaya-Timor.——FIG. 174,*1*. **A. nivalis* (DIENER), Himalaya; *1a,b*, ×1 (102*).

**Pseudoceltites** HYATT, 1900 [**Celtites multiplicatus* WAAGEN, 1895]. Like *Kashmirites* but venter more arched and smoother; ribs tending to be prominent at ventral shoulders. Suture ceratitic. *U.Scyth.*, SaltR.-Ida.——FIG. 174,*3*. **P. multiplicatus* (WAAGEN), SaltR.; *3a-c*, ×1 (548*).

**?Hanielites** WELTER, 1922 [**H. elegans*]. More or less strongly ornamented and keeled offshoots of kashmiritids, with coronate inner whorls and ceratitic suture. *Scyth.(Owenitan)*, Timor.——FIG. 174,*2*. **H. elegans; 2a,b*, ×1; *2c*, ×2 (560*).

## Family MEEKOCERATIDAE Waagen, 1895

More or less involute, compressed, discoidal forms, smooth or weakly ornamented; venter arched or tabulate. Suture ceratitic with broad saddles (472). *L.Trias.-M.Trias.*

### Subfamily MEEKOCERATINAE Waagen, 1895

Venter tabulate but may be rounded on living chamber of some adults. *L.Trias.*

**Meekoceras** HYATT, in C. A. WHITE, 1879 [**M. gracilitatis* WHITE, 1879]. Involute to evolute, discoidal, generally smooth. Suture with few denticulations in lobes. *Scyth.(Owenitan)*, Calif.-Nev.-Ida.-Utah-Timor.——FIG. 175,*8*. **M. gracilitatis*, Ida.; *8a,b*, ×0.7; *8c*, ×1 (203*).

**Wyomingites** HYATT, 1900 [**Meekoceras aplanatum* WHITE, 1879]. Evolute, compressed, with tabulate venter that tends to widen and become subsulcate; sides smooth or with radial folds. Suture ceratitic, may be goniatitic, with only 2 lateral lobes. *Scyth. (Owenitan)*, Ida.——FIG. 175,*7*. **W. aplanatus* (WHITE); *7a,b*, ×1; *7c*, ×3 (451*).

**Svalbardiceras** FREBOLD, 1930 [**S. spitzbergense*]. Flat, discoidal, venter tabulate, tending to round off in adult; faint distant folds on inner whorls. Suture simple, ?goniatitic. *U.Scyth.*, Spitz.

### Subfamily ARCTOCERATINAE Arthaber, 1911

With arched venters, slightly sigmoidal striae and folds on outer whorl (472). *L. Trias.*

**Submeekoceras** SPATH, 1934 [**Meekoceras mushbachanum* WHITE, 1880]. Robust, more or less evolute, with striae and blunt folds on whorl sides in some. Suture ceratitic with saddles more slender

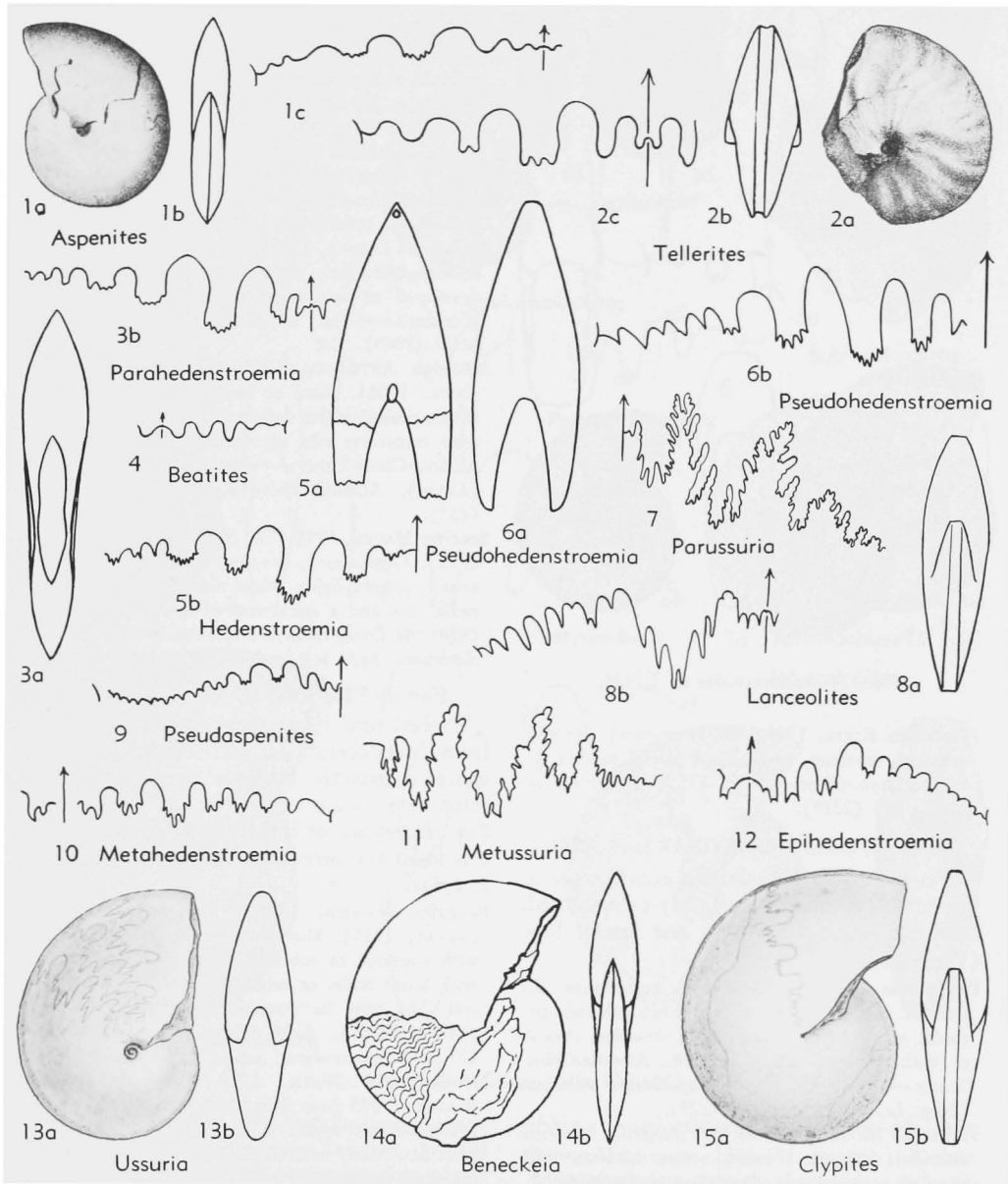



FIG. 173. Ussuriidae (p. L140-L142).

than in *Arctoceras*. *Scyth.(Owenitan)*, N.Am.-Timor.——FIG. 175,*3*. **S. mushbachanum* (WHITE), Ida.; *3a*, ×0.25; *3b*, ×0.7 (203*).

**Arctoceras** HYATT, 1900 [**Ceratites polaris* MOJSISOVICS, 1886] [=*Arctoceroides* STRAND, 1929]. Generally involute, discoidal, venter narrowly arched; smooth or striate; flattened sides. Suture ceratitic with wide, low saddles. *U.Scyth.*, Spitz.——FIG. 175,*4*. **A. polaris* (MOJS.); *4a,b*, ×0.7 (294*).

**Czekanowskites** DIENER, 1915 [**Ceratites decipiens* MOJSISOVICS, 1886]. Like *Arctoceras* but inflated, with globose inner whorls. Suture with higher saddles and more digitations of lobes. *U.Scyth.*, Sib.-?Spitz.——FIG. 175,*2*. **C. decipiens* (MOJS.), Sib.; *2a,b*, ×0.7; *2c*, ×2 (294*).

**?Pseudokymatites** SPATH, 1934 [**Kymatites svilajanus* KITTL, 1903]. Like *Submeekoceras* but smooth and suture with 2 goniatitic lateral lobes. *U.Scyth.*, Yugo.——FIG. 175,*6*. **P. svilajanus* (KITTL); ×1 (232*).

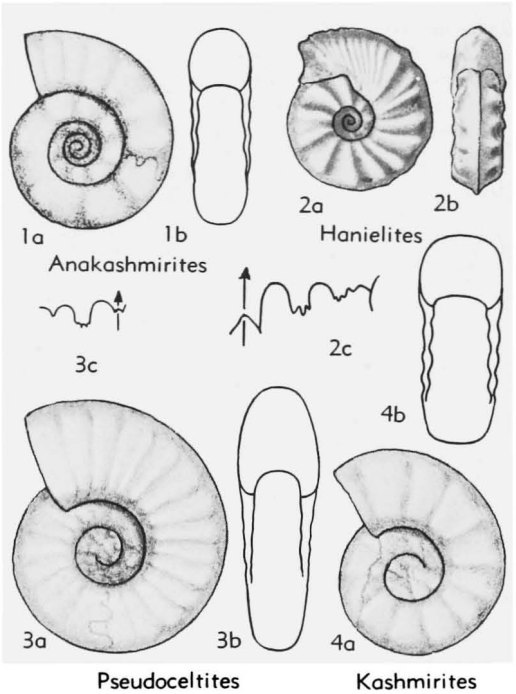



FIG. 174. Kashmiritidae (p. L142).

**?Stacheites** KITTL, 1903 [**S. prionoides*]. Smooth, discoidal, involute, with only 2 lateral saddles. *U. Scyth.*, Yugo.-Chios.——FIG. 175,*5*. **S. prionoides*, Yugo.; ×1 (232*).

**Subfamily DAGNOCERATINAE Spath, 1934**

Venters arched or tabulate, conch more or less involute, smooth or feebly ornamented. Suture ceratitic with only one lateral lobe (472). *L.Trias.-M.Trias.*

**Dagnoceras** ARTHABER, 1911 [**D. nopcsanum;* SD DIENER, 1915]. Venter arched, conch inflated, discoidal, greatest width at umbilical shoulder; smooth or with indistinct folds. *U.Scyth.*, Albania-Chios-Timor.——FIG. 175,*1*. **D. nopcsanum*, Albania-Chios; *1a,b*, ×1; *1c*, ×1.5 (22*).

**?Proavites** ARTHABER, 1896 [**P. hueffeli*]. Involute, discoidal, inflated, smooth, venter tabulate with angular ventrolateral edges. Suture goniatitic. *L. Trias.(U.Scyth.)-M.Trias.(Anis.)*, Yugo.——FIG. 175,*9*. *P. avitus* ARTH., Anis., *9a-c*, ×1 (584*).

## Family NORITIDAE Karpinsky, 1889

Smooth, flat, discoidal; venter tabulate, bordered by pronounced ventral shoulders. Suture ceratitic with club-shaped saddles, 1st lateral lobe divided by median indentation (472). *L.Trias.-M.Trias.*

**Norites** MOJSISOVICS, 1878 [**Am. gondola* MOJS., 1869]. Venter with marginal keels, umbilical shoulder sharp, conch involute. *M.Trias.(Anis.-Ladin.)*, Alps-Balkan-Timor.——FIG. 176,*1*. **N. gondola* (MOJS.), Anis., Alps-Balkan-Greece; *1a,b*, ×0.7; *1c*, ×1 (293*).

**Arthaberites** DIENER, 1900 [**A. alexandrae*]. Involute, discoidal, compressed. Suture resembling that of *Pseudosageceras* or *Cordillerites*. *M.Trias.(Anis.)*, Alps-Balkan.——FIG. 176,*3*. **A. alexandrae; 3a*, ×0.66; *3b*, ×1 (22*).

**Ananorites** DIENER, 1907 [**A. monticola*]. Evolute, smooth, discoidal, with sharp ventral shoulders developed at late stage (104). *M.Trias.(Anis.)*, Himalaya.——FIG. 176,*5*. **A. monticola; 5a,b*, ×0.7 (104*).

**Albanites** ARTHABER, 1909 [**Pronorites triadicus* ARTH., 1908]. More or less involute, smooth or faintly ribbed, sides flattened; venter tabulate and with transverse ribs in some. *L.Trias.(U.Scyth.)*, Albania-Chios-Timor.——FIG. 176,*2*. **A. triadicus* (ARTH.), Albania-Chios; *2a,b*, ×1; *2c*, ×1.5 (22*).

**Bosnites** HAUER, 1896 [**B. clathratus;* SD DIENER, 1915]. Compressed, involute platycone with flat venter, convex sides; whorl sides with low, weak radial ribs and a spiral row of nodes at midpoint (488). *M.Trias.(Anis.)*, Yugo.——FIG. 176,*4*. **B. clathratus; 4a,b*, ×0.5; *4c*, ×0.7 (633*).

## Family PRIONITIDAE Hyatt, 1900

Ribbed and tuberculate forms developed from Meekoceratidae with tendency to acquire a broadly tabulate venter, without transverse costae or notches of Sibiritidae. Suture ceratitic as in *Meekoceras*, with 2 lateral lobes and serrated auxiliary series (472). *L.Trias.*

**Prionites** WAAGEN, 1895 [**P. tuberculatus;* SD DIENER, 1915]. More or less evolute, discoidal, with rounded to subtabulate venters; whorl sides with blunt nodes or tuberculated ribs. Second lateral lobe may be goniatitic, auxiliaries serrated (548). *U.Scyth.*, SaltR.-Himalaya-Timor.——FIG. 177,*2*. **P. tuberculatus*, SaltR.; *2a,b*, ×0.5 (548*).

**Hemiprionites** SPATH, 1929 [*pro Goniodiscus* WAAGEN, 1895 (*non* MÜLLER & TROSCHEL, 1842)] [**Goniodiscus typus* WAAGEN, 1895]. Involute, with flat, nearly smooth sides and tabulate venter; indistinct serration of ventrolateral edge and transverse ribs on periphery, as in *Anasibirites*. *U.Scyth.(Owenitan)*, SaltR.-Timor-Utah-Ida.-Spitz.——FIG. 177,*3*. **H. typus* (WAAGEN), SaltR.; *3a,b*, ×1; *3c*, ×0.7 (548*).

**Gurleyites** MATHEWS, 1929 [**G. smithi*]. Like *Hemiprionites* but with excentric umbilicus, rounded body chamber, tending to inflation; with radial ribs and umbilical nodes. Suture ceratitic as in *Hemiprionites*. *U.Scyth.(Owenitan)*, Utah-Ida.-Spitz.——FIG. 177,*4*. **G. smithi*, Utah; ×0.5 (658*).

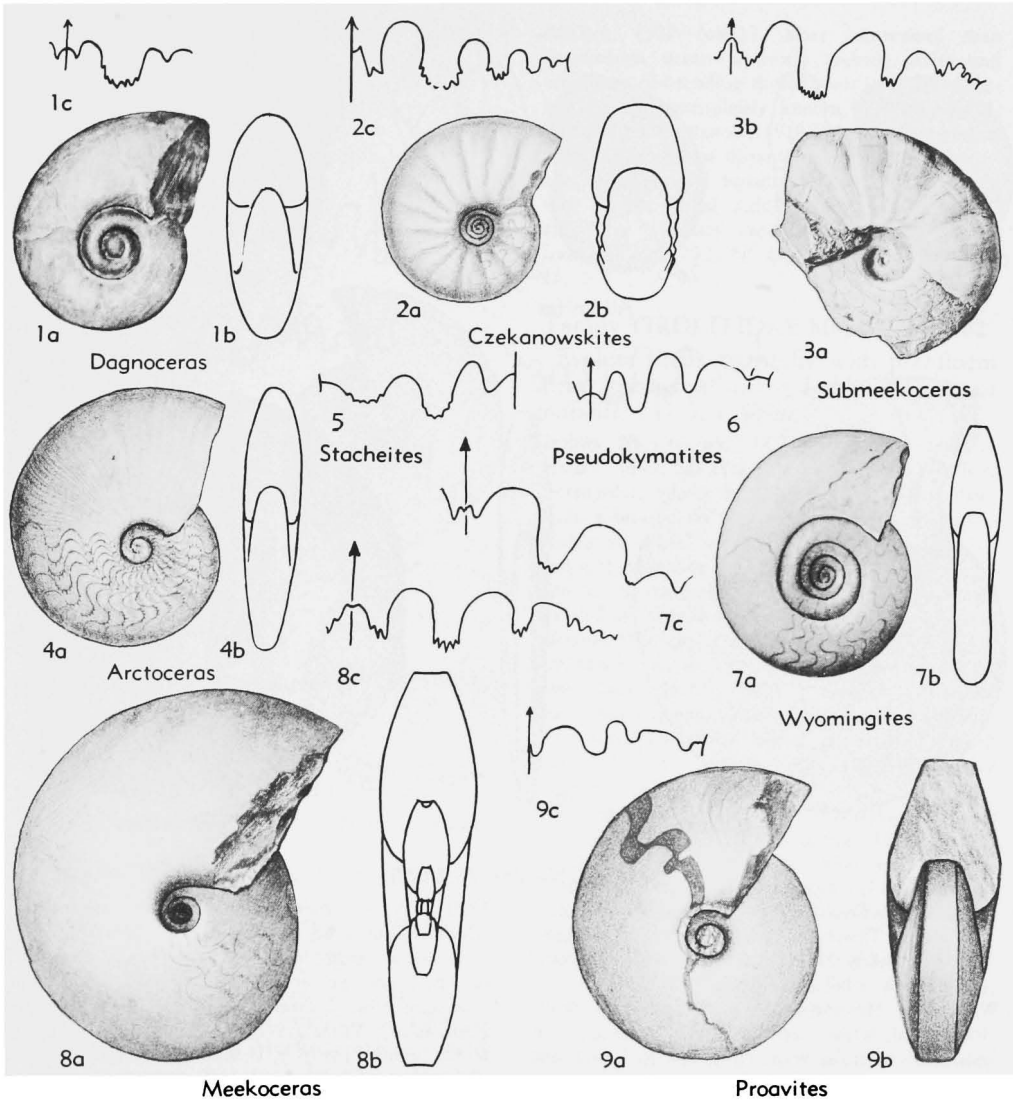



FIG. 175. Meekoceratidae (p. L142-L144).

**Arctoprionites** SPATH, 1930 [**Goniodiscus nodosus* FREBOLD, 1930]. More or less involute, discoidal ammonites with tabulate venters, tending to develop crenulation of the ventral shoulder and ribbing or tuberculation on the whorl sides. Suture as in *Hemiprionites* but with large 1st lateral saddle and simple ventral lobe. *U.Scyth.*, Spitz.—— FIG. 177,*1*. **A. nodosus* (FREBOLD); *1a,b*, ×0.7 (472*).

## Family SIBIRITIDAE Mojsisovics, 1896

Ribbed or tuberculate derivatives of Meekoceratidae with modification of venter ranging from mere widening and transverse ribbing to sulcation (472). *L.Trias-M.Trias.*

**Sibirites** MOJSISOVICS, 1886 [**S. pretiosus*]. Evolute, with subtabulate venter; whorl sides with sigmoidal ribs that thicken at ventral shoulders; ribs form adorally projected chevrons on venter, incompletely fused along mid-line. Suture ceratitic, with 2 lateral lobes. *L.Trias.(U.Scyth.)*, Sib.—— FIG. 178,*3*. **S. pretiosus; 3a,b*, ×1 (294*).

**Anasibirites** MOJSISOVICS, 1896 [*Sibirites kingianus* WAAGEN, 1895; SD DIENER, 1915] [=*Pseudosibirites* ARTHABER, 1911]. More or less involute discoidal, with arched or subtabulate venters; with sigmoidal ribs continuous across and commonly thickened on venter and generally absent on body

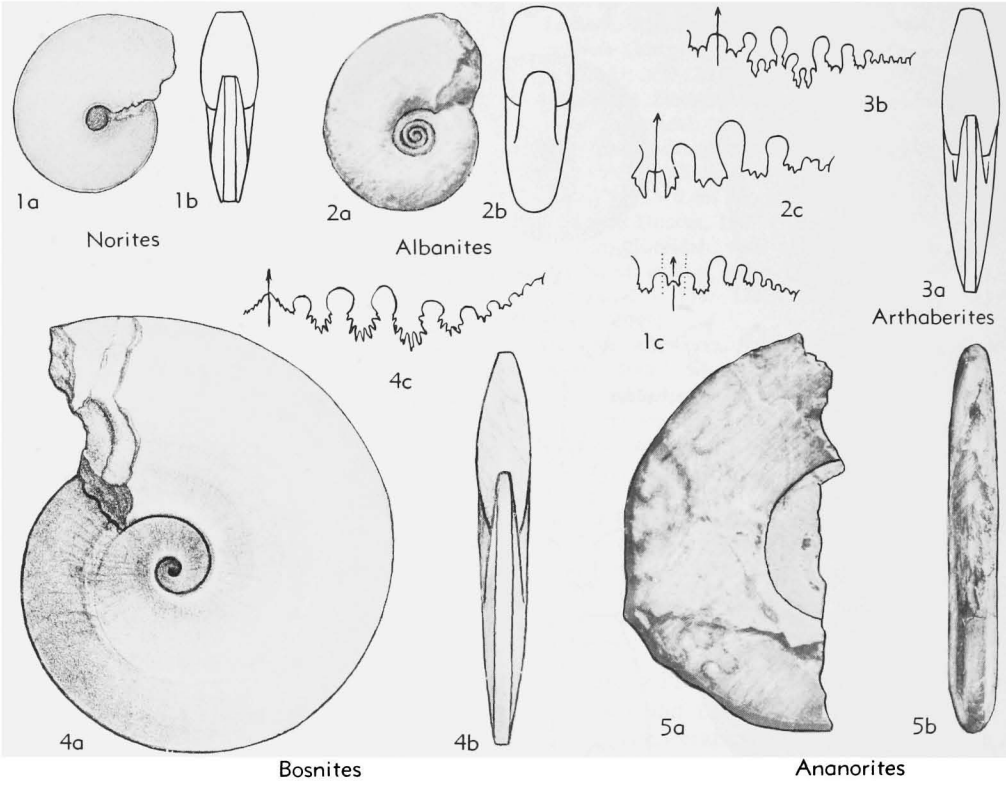



FIG. 176. Noritidae (p. L144).

chamber. *L.Trias.(U.Scyth., Owenitan)*, SaltR.-Himalaya - Timor-Japan-Calif.-Utah-Ida.-?Albania-?Chios.——FIG. 178,*4*. **A. kingianus* (WAAGEN), SaltR.; *4a,b*, ×0.7 (548*).

**Wasatchites** MATHEWS, 1929 [**W. perrini*]. With trapezoidal whorl section, tabulate venter, and umbilical tubercles which give rise to lateral ribs that also cross venter. *L.Trias.(U.Scyth.)*, Utah-Ida.-B.C.-Timor.-Spitz.——FIG. 178,*2*. *W. tridentinus* SPATH, Spitz.; *2a,b*, ×0.7 (472*).

**Anawasatchites** MCLEARN, 1945 [**A. tardus*]. Like *Wasatchites* but with slightly excentric umbilicus, nearly smooth inner whorls. *L.Trias.(U.Scyth.)*, B.C.

**Keyserlingites** HYATT, 1900 [**Ceratites subrobustus* MOJSISOVICS, 1886] [=*Robustites* PHILIPPI, 1901]. Inflated, with subtabulate to arched venter, with umbilical nodes; with lateral ribs that may cross venter or a row of nodes along ventral shoulder. Suture ceratitic with large 1st lateral saddle. *L. Trias.(U.Scyth.)*, Spitz.-Sib.-Ida.——FIG. 178,*7*. **K. subrobustus* (MOJS.), Sib.; *7a,b*, ×0.7 (294*).

**Durgaites** DIENER, 1905 [**Keyserlingites dieneri* MOJSISOVICS, 1902 (=*Ceratites subrobustus* DIENER; *non* MOJS., 1895)] [=*Anastephanites* SPATH, 1930]. Like *Keyserlingites* but with coronate inner whorls and tendency to develop ventrolateral nodes after lateral nodes have shifted to below middle of whorl side; venter arched to subtabulate, with transverse ribs. *L.Trias.(U.Scyth.)-M.Trias.(Anis., Beyrichitan)*, Himalaya-Timor-Calif.——FIG. 178, *6*. **D. dieneri* (MOJS.), U.Scyth., Himalaya; *6a,b*, ×0.2 (102*).

**Pearylandites** KUMMEL, 1953 [**P. troelseni*]. Evolute, with wide deep umbilicus; outer whorls subtrigonal, with prominent umbilical tubercles from which ribs extend ventrally; venter fastigate; inner whorls more depressed, at first rounded, then trapezoidal, with prominent ventrolateral tubercles from which ribs extend dorsally. Suture ceratitic with large 1st lateral lobe. *M.Trias.(Anis.)*, Pearyland.——FIG. 178,*1*. **P. troelseni; 1a,b*, ×0.7; *1c*, ×3 (650*).

**?Olenikites** HYATT, 1900 [**Dinarites spiniplicatus* MOJSISOVICS, 1886]. Involute micromorphs with umbilical nodes on phragmocone that tend to disappear on body chamber or earlier. Suture generally goniatitic with 2 lateral lobes. *L.Trias.(U. Scyth.)*, Sib.——FIG. 178,*5*. **O. spiniplicatus* (MOJS.), *5a,b*, ×1; *5c*, ×2 (294*).

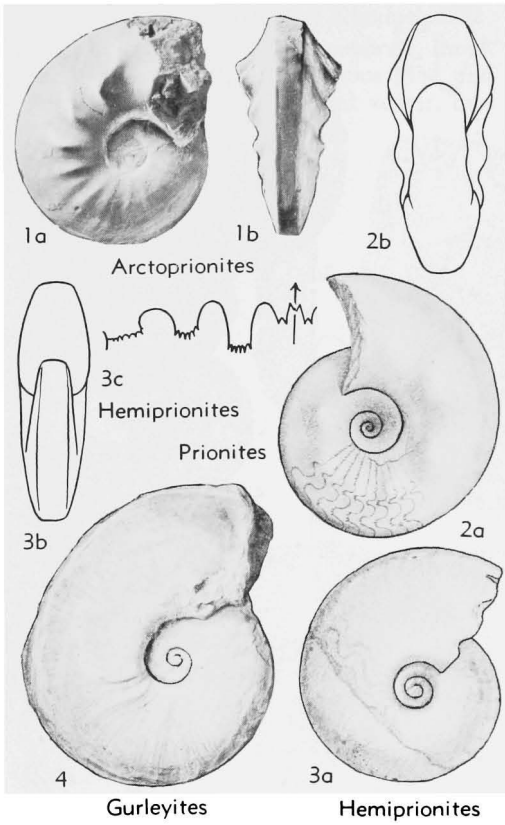



FIG. 177. Prionitidae (p. L144-L145).

## Superfamily CERATITACEAE Mojsisovics, 1879

[*nom. transl.* MOJS., 1896 (*ex* Ceratitidae MOJS., 1879)]

Typically highly ornamented or tuberculate descendants of Meekoceratacеae, with ceratitic suture that may become goniatitic or ammonitic in some offshoots (472). *L. Trias.-U.Trias.*

### Family STEPHANITIDAE Arthaber, 1896

More or less evolute, coronate shells with broadly arched venters, lateral tubercles, and simple ceratitic suture, generally with large 1st lateral saddle (472). *L.Trias.*

**Stephanites** WAAGEN, 1895 [**S. superbus;* SD DIENER, 1915]. Inflated conch with depressed coronate inner whorls and more rounded body chamber. Suture with 2 lateral lobes (548). *U. Scyth.*, SaltR.——FIG. 179,*2*. **S. superbus; 2a,b,* ×0.25; *2c,* ×0.5 (548*).

**Parastephanites** HYATT, 1900 [*Acrochordiceras ataxum* WAAGEN, 1895] [=*Acrochordiceroides* STRAND, 1929 (obj.)]. More compressed than *Stephanites,* venter narrowly arched; nodes and secondary ribs tending to disappear on body chamber. Suture incompletely known. *U.Scyth.*, SaltR.

?**Paratirolites** STOYANOW, 1910 [**P. kittli;* SD SPATH, 1934]. With coarse distant ribs, prominent ventrolateral nodes, and broadly arched venter. Suture with large ventral saddle, small lateral saddle, and large auxiliary saddles. *U.Scyth.*, Armenia-Iran.——FIG. 179,*1*. **P. kittli,* Armenia; *1a,* ×0.7; *1b,* ×1 (719*).

### Family TIROLITIDAE Mojsisovics, 1882

Evolute shells, generally with prominent lateral tubercles; suture feebly ceratitic or goniatitic (472). *L.Trias.*

**Tirolites** MOJSISOVICS, 1879 [**Ceratites idrianus* HAUER, 1865; SD HYATT & SMITH, 1905]. Whorl rectangular, venter broadly rounded or tabulate; with tubercles on ventral shoulders, ribs commonly on whorl sides. Suture with large 1st lateral lobe, goniatitic or ceratitic, and small goniatitic 2nd lateral on umbilical wall. *U.Scyth.*, Alps-Balkan-S.Russ.-Himalaya-Ida.——FIG. 180,*4*. **T. idrianus* (HAUER), Yugo.; *4a,b,* ×0.7 (293*).

**Tirolitoides** SPATH, 1934 [*pro Paraceratites* KITTL, 1903 (*non* HYATT, 1900) [**Ceratites (Paraceratites) prior* KITTL, 1903]. Like *Tirolites* but also with umbilical nodes and 2 denticulated lateral lobes. *U.Scyth.*, Yugo.——FIG. 180,*5*. **T. prior* (KITTL); ×1 (232*).

?**Diaplococeras** HYATT, 1900 [**Dinarites liccanus* HAUER, 1865] [=*Liccaites* KITTL, 1903 (obj.)]. Compressed, with umbilical nodes and clavi on ventral shoulders. Suture ceratitic. *U.Scyth.*, Alps-Yugo.——FIG. 180,*6*. **D. liccanum* (HAUER), Yugo.; *6a,b,* ×0.3 (293*).

**Svilajites** KITTL, 1903 [**Tirolites (Svilajites) cingulatus*]. With transverse ribs across arched venter. *U.Scyth.*, Yugo.——FIG. 180,*1*. **S. cingulatus; 1a,b,* ×1 (232*).

**Bittnerites** KITTL, 1903 [**Tirolites (Bittnerites) bittneri*]. With spinose stage reduced or absent; outer whorl with indistinct, projected ribs that cross venter. *U.Scyth.*, Yugo.——FIG. 180,*3*. *B. malici* KITTL; *3a,b,* ×0.5 (232*).

?**Dorikranites** HYATT, 1889 [**Am. bogdoanus* VON BUCH, 1831] [=*Bogdoites* KITTL, 1903 (obj.)]. Ribs or tuberculation as in tirolitids but with acute venters. Suture simple, lobes entire or slightly toothed at siphonal or umbilical ends. *U.Scyth.*, S.Russ.——FIG. 180,*2*. **D. bogdoanus* (BUCH); *2a,b,* ×0.3; *2c,* ×0.7 (293*).

### Family DINARITIDAE Mojsisovics, 1882

Discoidal, smooth, feebly or strongly ornamented, with simple goniatitic or feebly ceratitic suture and typically only one lateral lobe (472). *L.Trias.*

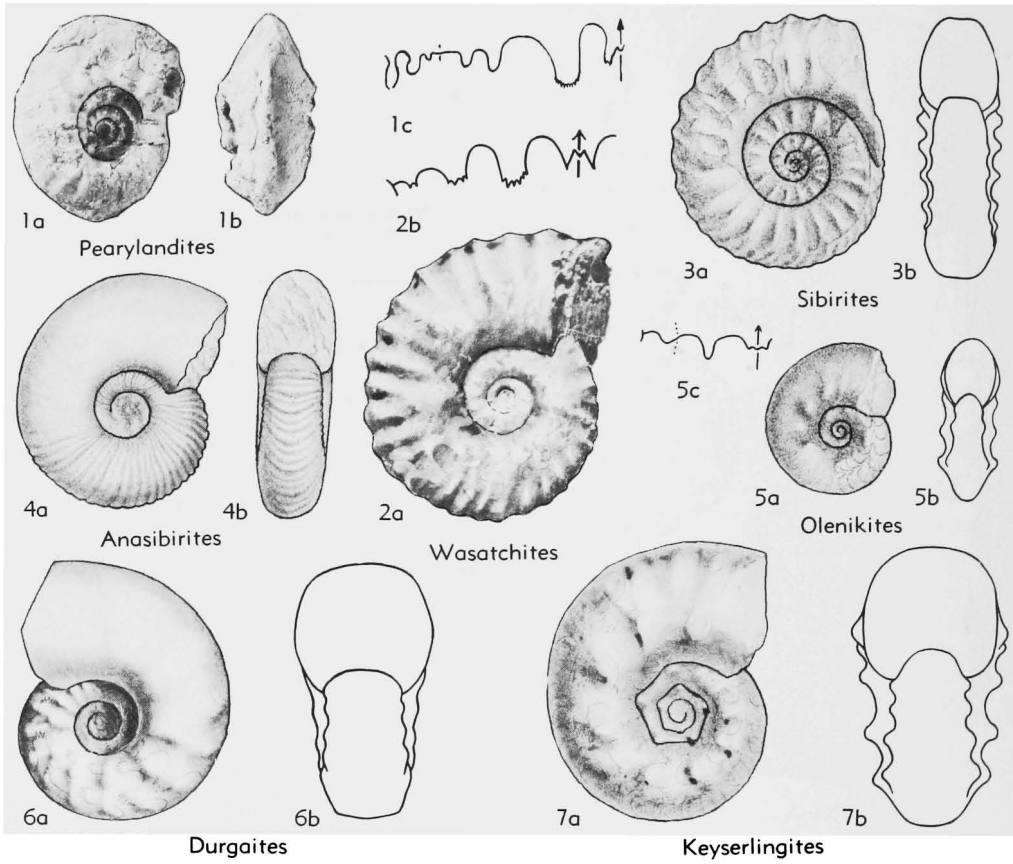



FIG. 178. Sibiritidae (p. L145-L146).

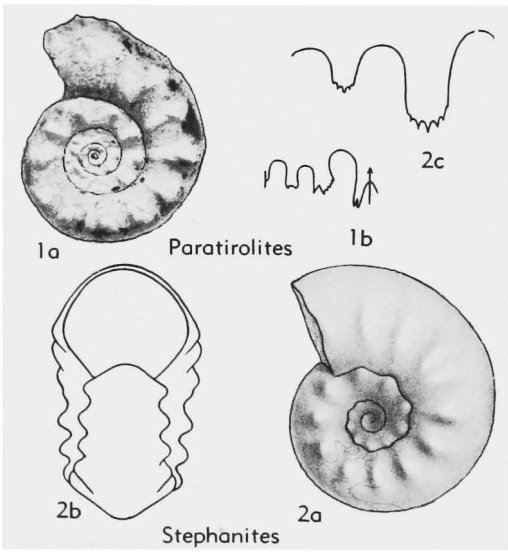



FIG. 179. Stephanitidae (p. L147).

**Dinarites** MOJSISOVICS, 1882 [**Ceratites dalmatinus* HAUER, 1865; SD HYATT & SMITH, 1905] [=*Plococeras* HYATT, 1900 (obj.)]. More or less involute, with rounded or (rarely) flattened venters; conch smooth or with radial folds. Suture goniatitic. *U.Scyth.*, Alps-Balkan.——FIG. 181,*1*. *D. muchianus* (HAUER), Yugo.; ×0.7 (232*).

**Pseudodinarites** HYATT, 1900 [**Dinarites mohamedanus* MOJSISOVICS, 1882] [=*Hercegovites* KITTL, 1903 (obj.)]. Evolute, smooth, with ceratitic lobes. *U.Scyth.*, Balkan.

**Hololobus** KITTL, 1903 [**Tirolites (Hololobus) monoptychus*]. Intermediate between *Dinarites* and *Carniolites*, with entire, undivided ventral lobe. *U.Scyth.*, Yugo.——FIG. 181,*5*. **H. monoptychus*; ×1 (232*).

**Carniolites** ARTHABER, 1911 [**Tirolites carniolicus* MOJSISOVICS, 1882]. Phragmocone as in *Dinarites* but with a few spines on body chamber. *U.Scyth.*, Yugo.——FIG. 181,*3*. **C. carniolicus* (MOJS.); *3a,b*, ×0.5 (232*).

**Family HELLENITIDAE Kummel, 1952**

Serpenticones, whorls subquadrate, shoulders well rounded, conspicuous ribs and well-developed keel on arched venter, bordered by narrow furrows. Suture ceratitic, with large 1st lateral lobe, small smooth 2nd lateral lobe. *L.Trias.*

**Hellenites** Renz & Renz, 1948 [**Tropiceltites prae-*

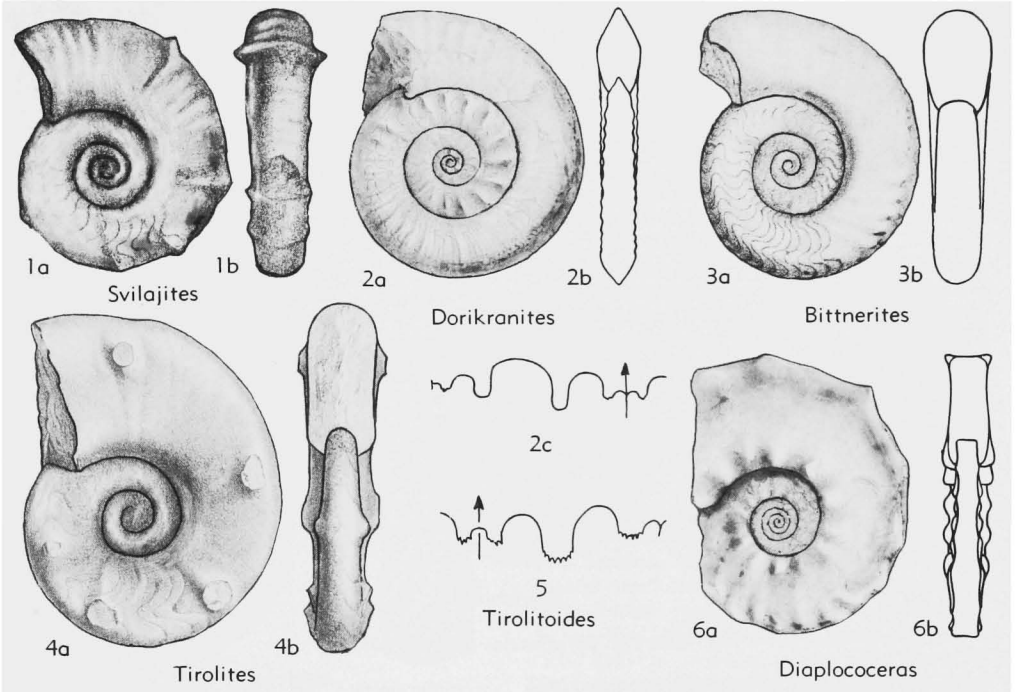



Fig. 180. Tirolitidae (p. L147).

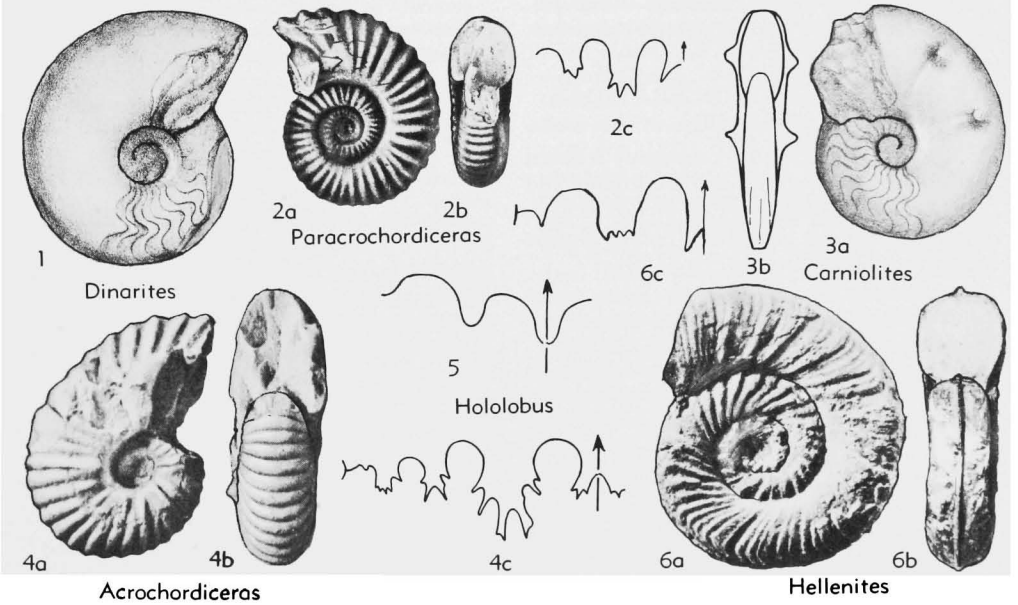



Fig. 181. Dinaritidae, Hellenitidae, Acrochordiceratidae (p. L148-L150).

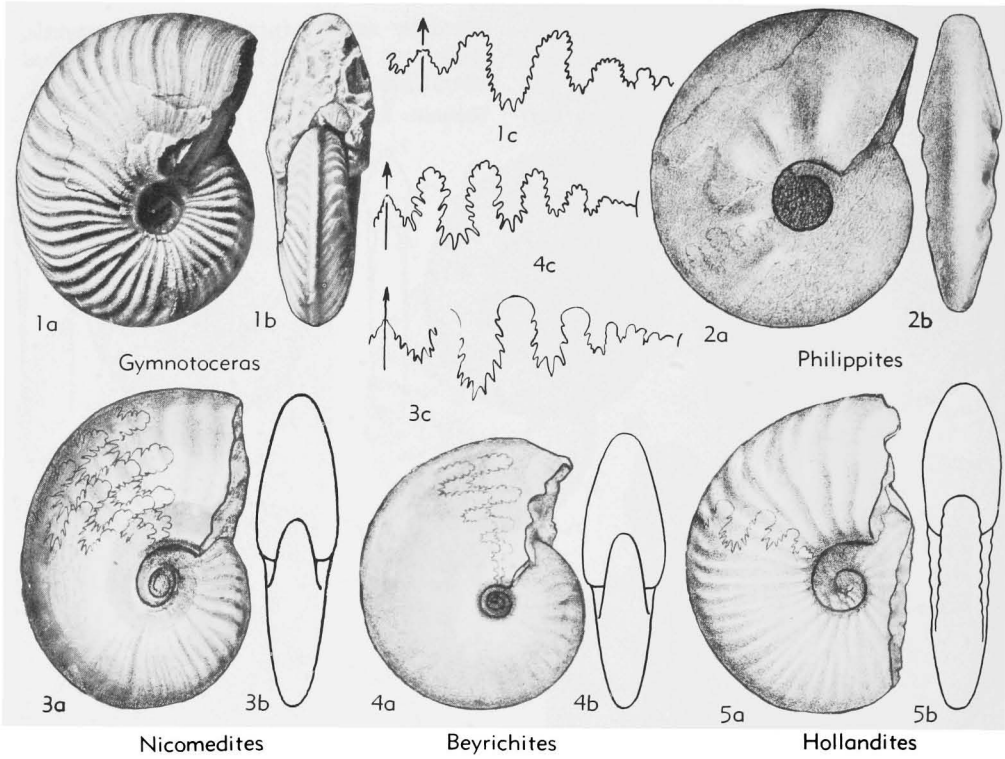



FIG. 182. Beyrichitidae (p. L150-L151).

*maturus* ARTHABER, 1911] [=*Hellenites (Pallasites)* RENZ-R., 1948; *Pseudarniotites* SPATH, 1951]. *U.Scyth.*, Albania-Chios-Ida.——FIG. 181, *6*. **H. praematurus* (ARTH.), Albania-Chios; *6a,b*, ×1; *6c*, ×1.5 (372*).

## Family ACROCHORDICERATIDAE Arthaber, 1911

More or less involute, commonly inflated with strong ribs which are continuous and generally most prominent on arched venter; with or without umbilical nodes. Suture ceratitic or ammonitic (472). *M.Trias.*

**Acrochordiceras** HYATT, 1877 [**A. hyatti* MEEK, 1877]. Suture simpler than in *Silesiacrochordiceras*. *Anis.*, Eurasia-Timor-Calif.-Nev.

**A. (Acrochordiceras).** With umbilical tubercles on earlier whorls (203). *Anis.*, Eurasia-Calif.-Nev.——FIG. 181,*4*. **A. (A.) hyatti*, Nev.; *4a,b*, ×0.7; *4c*, ×1 (203).

**A. (Paracrochordiceras)** SPATH, 1934 [**A. anodosum* WELTER, 1915]. With no tuberculation, suture simple (472). *Anis.*, Timor-B.C.——FIG. 181, *2*, **A. (P.) anodosum* (WELTER), Timor; *2a,b*, ×0.7; *2c*, ×1 (559*).

**A. (Epacrochordiceras)** SPATH, 1934 [**A. portisi* MARTELLI, 1906]. Nontuberculate as in *A. (Paracrochordiceras)* but more compressed and involute, ribbing lost or weakened at some stage, generally on body chamber. *Anis.*, Alps-Balkan-AsiaM.

**Silesiacrochordiceras** DIENER, 1916 [**Acrochordiceras damesi* NOETLING, 1880]. Like *A. (Acrochordiceras)* but with different, more subdivided suture. *Anis.*, Silesia.

## Family BEYRICHITIDAE Spath, 1934

Involute, discoidal, with falcoid, single or bifurcating ribs. Suture ceratitic with tendency to become subammonitic and complex (472). *L.Trias.-M.Trias.*

**Beyrichites** WAAGEN, 1895 [**Am. reuttensis* BEYRICH, 1867; SD SMITH, 1904]. Venter narrowly arched; sigmoidal ribbing tends to disappear or become modified on outer whorl. Suture subammonitic. *L.Trias.(U.Scyth.)-M.Trias.(Anis.)*, Alps-Balkan-Chios-Himalaya-Japan-B.C.-Nev.

**B. (Beyrichites).** Nontuberculate. *L.Trias.(U. Scyth.)-M.Trias.(Anis.)*, Alps-Balkan-Chios-Himalaya-Japan-B.C.-Nev.——FIG. 182,*4*. *B. kesava* (DIENER), Anis., Himalaya; *4a,b*, ×0.7; *4c*, ×1 (100*).

**B. (Gangadharites)** DIENER, 1916 [**Meekoceras gangadhara* DIENER, 1895]. Tubercles at middle

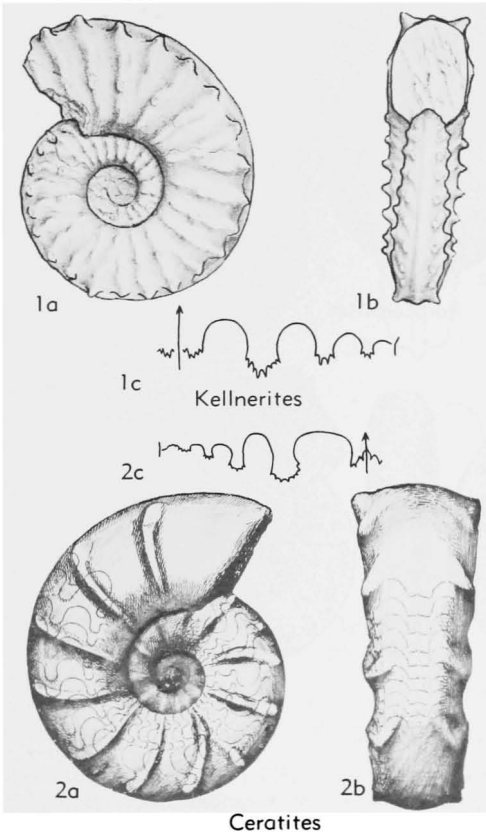



FIG. 183. Ceratitidae (p. L151-L152).

of whorl side and in some also at outer ends of some or all last few ribs on body chamber. *M. Trias.(Anis.)*, Himalaya.

**Nicomedites** TOULA, 1896 [**Ceratites (Nicomedites) osmani*; SD SPATH, 1934] [=*Osmanites, Solimanites, Mohamedites* TOULA, 1896]. Differs from *Beyrichites* in more compressed form, irregular subfalcate ribbing and subceratitic suture. *M.Trias.(L.Anis.)*, AsiaM.——FIG. 182,*3*. **N. osmani*, *3a-c*, ×0.7 (725*).

**Hollandites** DIENER, 1905 [**Am. voiti* OPPEL, 1863]. Evolute, venter arched or subtabulate, ribs subfalcoid, commonly bifurcating, with or without umbilical bullae and only traces of lateral or ventral tubercles; costation tending to be reduced on body chamber to single coarse folds. Suture ceratitic. *M.Trias.(Anis.)*, Alps-Asia-?Sib.-Japan-?B.C.-?Nev.——FIG. 182,*5*. **H. voiti* (OPPEL), Himalaya; *5a,b*, ×0.5 (100*).

**Philippites** DIENER, 1905 [**Ceratites erasmi* MOJSISOVICS, 1882]. Like *Beyrichites* but with blunt ribs, prominent only near umbilical shoulder. *M.Trias.(Anis.)*, Alps-Balkan-Himalaya--?Nev. —— FIG. 182,*2*. **P. erasmi* (MOJS.), Alps; *2a,b*, ×0.7 (293*).

**Gymnotoceras** HYATT, 1877 [**Am. blakei* GABB, 1864]. Venter subtabulate to subcarinate, whorl sides with strong sigmoidal ribs, single or bifurcating. Suture subceratitic (449). *M.Trias.(Anis.)*, Spitz.-Japan- ?Himalaya-B.C.-Nev.——FIG. 182,*1*. **G. blakei*, Nev.; *1a,b*, ×0.7; *1c*, ×1.5 (449*).

## Family CERATITIDAE Mojsisovics, 1879

Involute to evolute, generally highly ornamented with ribs and tubercles; venter tabulate to subcarinate. Suture ceratitic (472). *M.Trias.*

**Ceratites** DE HAAN, 1825 [**Am. nodosa* BRUGUIÈRE, 1792; SD SMITH, 1904] [=*Haaniceras* BAYLE, 1878 (obj.); *Acanthoceratites, Cycloceratites, Dolocerates, Echinoceratites, Gymnoceratites, Hadroceratites, Hoploceratites, Nannoceratites, Opheoceratites, Patagioceratites, Phalacroceratites, Symboloceratites* (obj.) SCHRAMMEN, 1928; *Archioceratites, Balioceratites, Pachyceratites* SCHRAM., 1933]. More or less evolute, robust, with coarse ornamentation usually persisting on body chamber. *Ladin.*, Ger.-Fr.-Sp.-Sard.-Rumania.——FIG. 183,*2*. **C. nodosus* (BRUG.), Ger.-Fr.; *2a-c*, ×0.7 (743*).

**Progonoceratites** SCHRAMMEN, 1928 [**Ceratites atavus* PHILIPPI, 1901; SD SPATH, 1934] [=*Actinoceratites, Caloceratites, Campyloceratites, Leioceratites* SCHRAM., 1928]. Like *Ceratites*, with ornamented inner whorls but more compressed and body chamber more or less smooth. *Ladin.*, Ger.-Fr.——FIG. 184,*6*. **P. atavus* (PHIL.), Ger.; *6a,b*, ×0.7 (681*).

**Discoceratites** SCHRAMMEN, 1928 [**Ceratites intermedius* PHILIPPI, 1901; SD SPATH, 1934] [=*Cosmoceratites* SCHRAM., 1928]. More or less smooth, involute, discoidal, with narrow to almost oxynote venter. *Ladin.*, Ger.-Fr.——FIG. 185,*4*. **D. intermedius* (PHIL.), Ger.; *4a,b*, ×0.3; *4c*, ×0.7 (681*).

**Alloceratites** SPATH, 1934 [**Ceratites schmidi* ZIMMERMANN, 1883]. Like *Discoceratites* in young; later with prominent lateral tubercles and ventrolateral clavi bordering subsulcate venter; indistinct ribbing between tubercles on whorl sides and ribs with strong forward sinus connecting ventrolateral clavi. *Ladin.*, Ger.——FIG. 184,*4*. **A. schmidi* (ZIM.); *4a,b*, ×0.7; *4c*, ×1 (681*).

**Paraceratites** HYATT, 1900 [*non* KITTL, 1903] [**Ceratites elegans* MOJSISOVICS, 1882]. Rather involute, commonly compressed, discoidal, with subcarinate venter; typically trituberculate and with ribs that may become feeble. Saddles of suture less entire than in *Ceratites*. *Anis.*, Eurasia-N.Am.——FIG. 184,*2*. **P. elegans* (MOJS.), Alps-Yugo.; *2a*, ×0.7; *2b*, ×0.3; *2c*, ×1 (293*).

**Frechites** SMITH, 1932 [**Ceratites humboldtensis* HYATT & SMITH, 1905]. Like *Gymnotoceras* but with tuberculation on ventral shoulders and at point of bifurcation of ribs; keel faint or absent (451). *Anis.*, Nev.-B.C.——FIG. 185,*2*. **F. hum-*

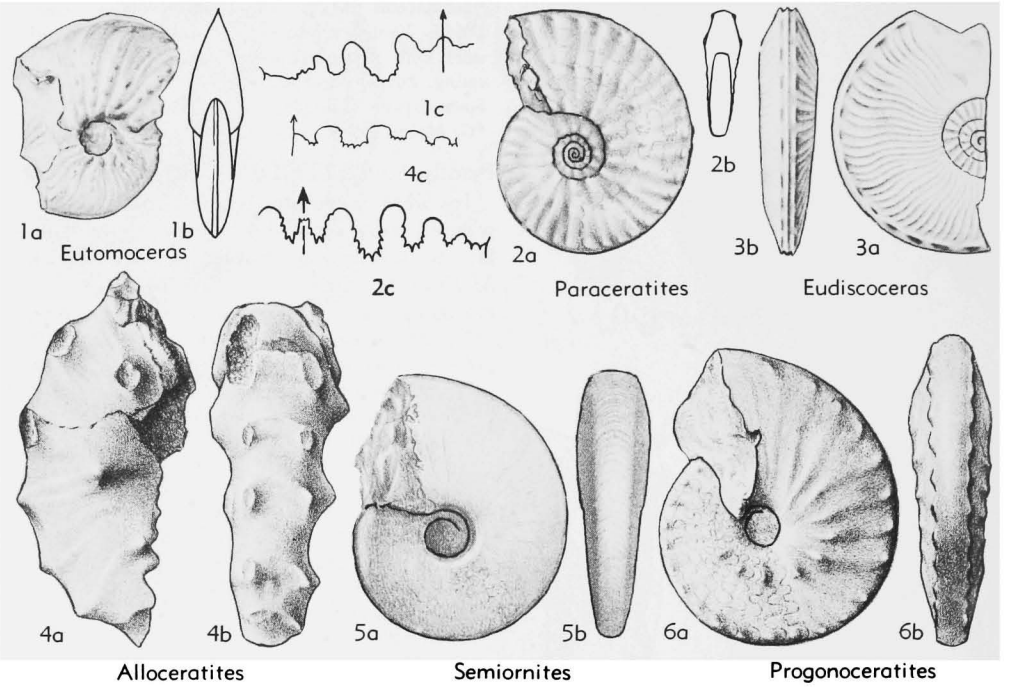



FIG. 184. Ceratitidae (P. L151-L152).

*boldtensis* (HYATT-S.), Nev.; *2a,b,* ×0.66; *2c,* ×1.5 (449*).

**Semiornites** ARTHABER, 1912 [**Ceratites cordevolicus* MOJSISOVICS, 1882; SD DIENER, 1915]. Involute, compressed platycone, with either no distinct ribbing or single row of tubercles, or with ribs bifurcating at umbilical edge. *Anis.*, Alps-Balkan-Himalaya.——FIG. 184,*5*. **S. cordevolicus* (MOJS.), Alps; *5a,b,* ×0.7 (293*).

**Kellnerites** ARTHABER, 1912 [**Ceratites bosnensis* HAUER, 1888] [=*Bosnites* FRECH, 1908 (*non* HAUER, 1896]; *Popinites* SALOPEK, 1915 (obj.)]. Highly sculptured, with radial ribs and several rows of tubercles, outer ones most prominent; venter subcarinate. *Anis.*, Alps-Balkan-Greece.——FIG. 183,*1*. **K. bosnensis* (HAUER), Alps-Balkan; *1a,b,* ×0.5; *1c,* ×1 (633*).

**Bulogites** ARTHABER, 1912 [**Ceratites multinodosus* HAUER, 1892]. Whorl section rectangular; venter broad and flattened; ribbing on whorl sides closely spaced, with 3 or 4 rows of more or less equal-sized tubercles. *Anis.*, Alps-Balkan.——FIG. 185,*5*. **B. multinodosus* (HAUER), Alps-Yugo.; *5a,b,* ×0.5; *5c,* ×1 (633*).

**Halilucites** DIENER, 1905 [**Ceratites rusticus* HAUER, 1896]. Like *Kellnerites* but with distinct keel, tubercles not nearly so prominent; tendency toward decrease of ornamentation (488). *Anis.*, Alps-Balkan-Greece.——FIG. 185,*1*. **H. rusticus* (HAUER), Yugo.; *1a,b,* ×0.7; *1c,* ×1 (633*).

**Eudiscoceras** HYATT, 1877 [**E. gabbi* MEEK, 1877]. Like *Halilucites* but more compressed, discoidal, involute; ribbing closer spaced and finer; venter with keel bordered by clavi (203). *Anis.*, Nev.——FIG. 184,*3*. **E. gabbi; 3a,b,* ×0.7 (203*).

**Eutomoceras** HYATT, 1877 [*non* MOJSISOVICS, 1879 (see MOJS., 1883)] [**E. laubei* MEEK, 1877]. Compressed, discoidal, involute, keeled platycone with ribbed early volutions but tending to degeneration of typically multipapillate ribs to final smoothness (203). *Anis.*, Nev.——FIG. 184,*1*. **E. laubei; 1a,b,* ×0.7; *1c,* ×1 (203*).

**Koptoceras** SPATH, 1951 [**K. falconi*]. Like *Eutomoceras* but with falcate ribs, most marked near umbilicus, declining toward venter; rapid degeneration of ornamentation, adult whorls nearly smooth (488). *Anis.*, Spitz.

**Salterites** DIENER, 1907 [**Ceratites (Salterites) oberhummeri*]. Like *Hollandites* but with strong umbilical tubercles which in later stage move outward, still serving as point of bifurcation of ribs which terminate at ventrolateral edge in small tubercles. Suture ceratitic, as in *Hollandites*. *Anis.*, Himalaya.

**Haydenites** DIENER, 1907 [**Ceratites (Haydenites) hatschekî*]. Evolute, whorl section subrectangular, with broad slightly arched venter; inner whorls with simple radial ribs, outer whorls with nodes at junction of bifurcating ribs, also ribs crossing venter, with small nodes on ventral shoulder. Su-

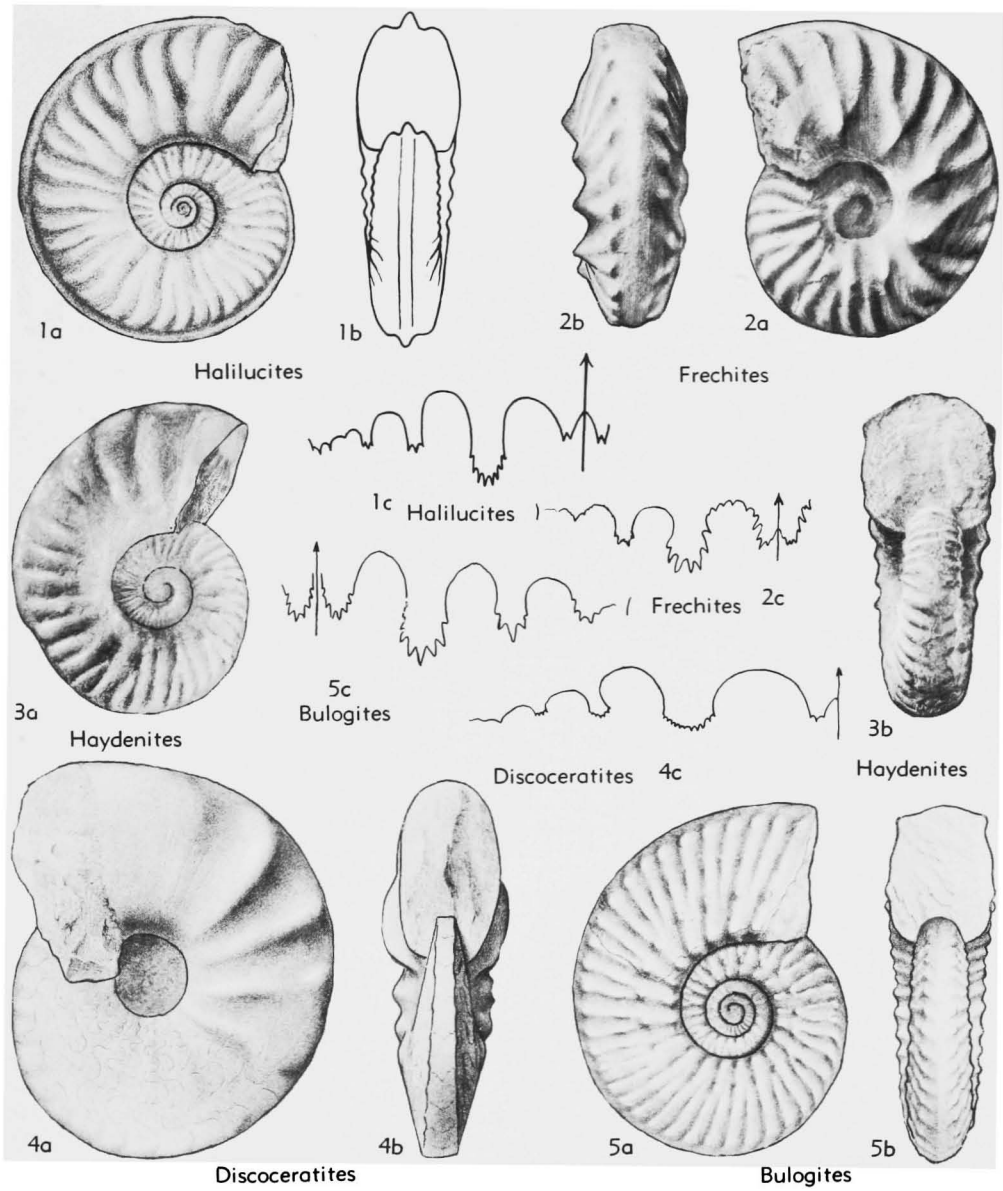



FIG. 185. Ceratitidae (p. L151-L152).

ture ceratitic (104). *Anis.*, Balkan-Himalaya-Nev. ——FIG. 185,*3*. **H. hatscheki* (DIENER), Himalaya; *3a,b*, ×0.25 (104*).

?**Peripleurocyclus** DIENER, 1907 [**Ceratites (Peripleurocyclus) smithianus*]. Compressed, evolute, with rounded venter and strong ribs continuous across venter. Suture ceratitic, with slender saddles (104). *Anis.*, Himalaya.

## Family DANUBITIDAE Spath, 1951

Very evolute, with ribbed whorl sides which may be tuberculate or not; venter rounded to subcarinate. Suture ceratitic (488). *M.Trias.*

**Danubites** MOJSISOVICS, 1893 [**Celtites floriani* MOJS., 1882] [=*Florianites* HYATT, 1900 (obj.)].

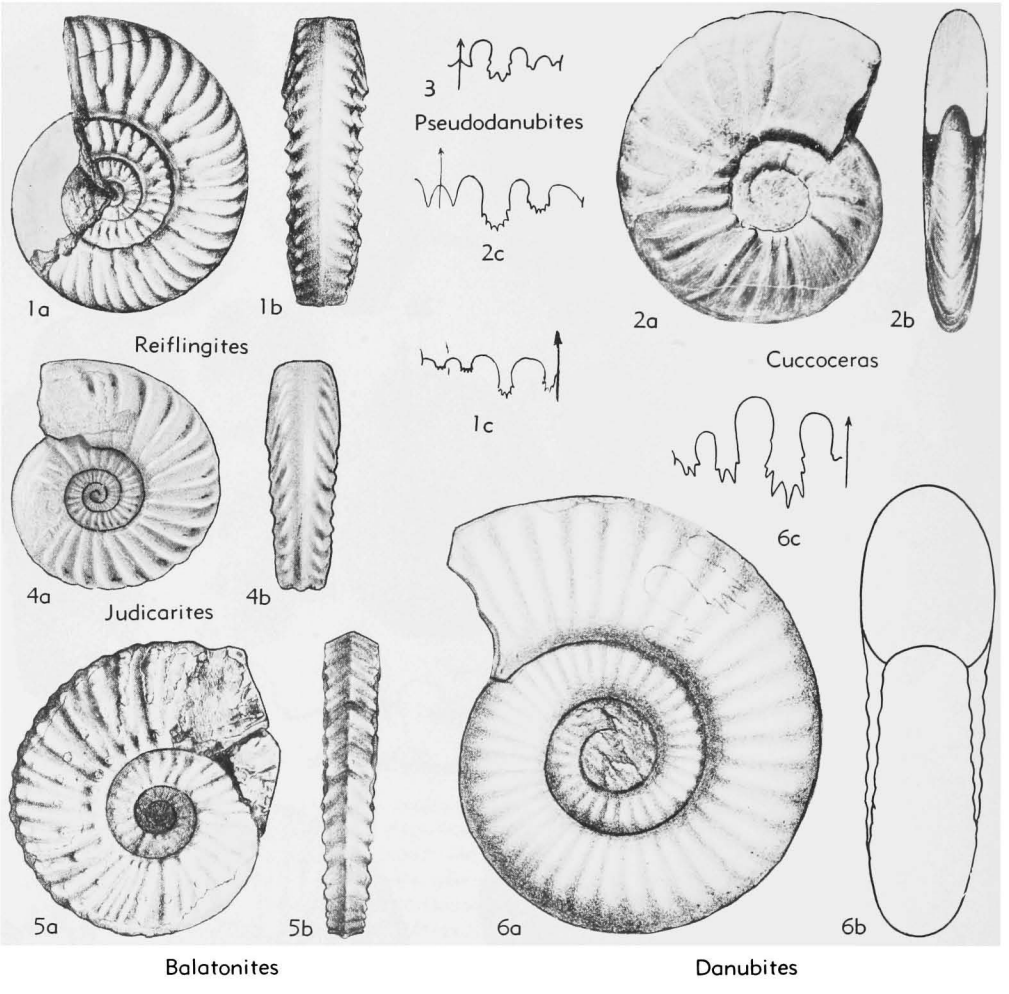



FIG. 186. Danubitidae, Balatonitidae (p. L153-L155).

Whorl section subquadrate, with smooth to feebly carinate venter; whorl sides flattened, with prominent radial ribs that may bend adorally near the ventral shoulder (292). *Anis.*, Alps-Balkan-Himalaya-Timor-Japan.——FIG. 186,*6*. *D. kansa* DIENER, Himalaya; *6a-c*, ×0.7 (100*).

**Pseudodanubites** HYATT, 1900 [**Danubites dritarashtra* DIENER, 1895]. Like *Danubites* but venter obtuse and suture more advanced (100). *Anis.*, Himalaya.——FIG. 186,*3*. **P. dritarashtra* (DIENER); ×1 (100*).

**Reiflingites** ARTHABER, 1896 [**R. eugeniae*]. Like *Danubites* but whorl section trapezoidal, venter tabulate or subcarinate; whorl sides with lateral projected ribs with 1 to 3 generally faint inner ventrolateral nodes (472). *Anis.*, Alps.——FIG. 186,*1*. **R. eugeniae; 1a,b*, ×0.7; *1c*, ×1 (584*).

**?Rikuzenites** YABE, 1949 [**R. nobilis*]. Evolute, whorls slowly expanding; whorl sides with radial ribs; last half volution separated from phragmocone as in *Scaphites*. Suture ceratitic. Type and only specimen may be deformed, genus doubtful. *Anis.*, Japan.

## Family BALATONITIDAE Spath, 1951

Widely umbilicate, more or less serpenticone in form, with strong ornamentation; smooth, rounded, fastigate, or keeled venter; constrictions or more rarely tubercles. Simple ceratitic suture (488). *M.Trias.*

**Balatonites** MOJSISOVICS, 1879 [**Trachyceras balatonicum* MOJS., 1873]. Compressed, highly ornamented, with more or less fastigate venter; radial ribs with variable tuberculation, generally in umbilical, median, and ventrolateral rows, and in

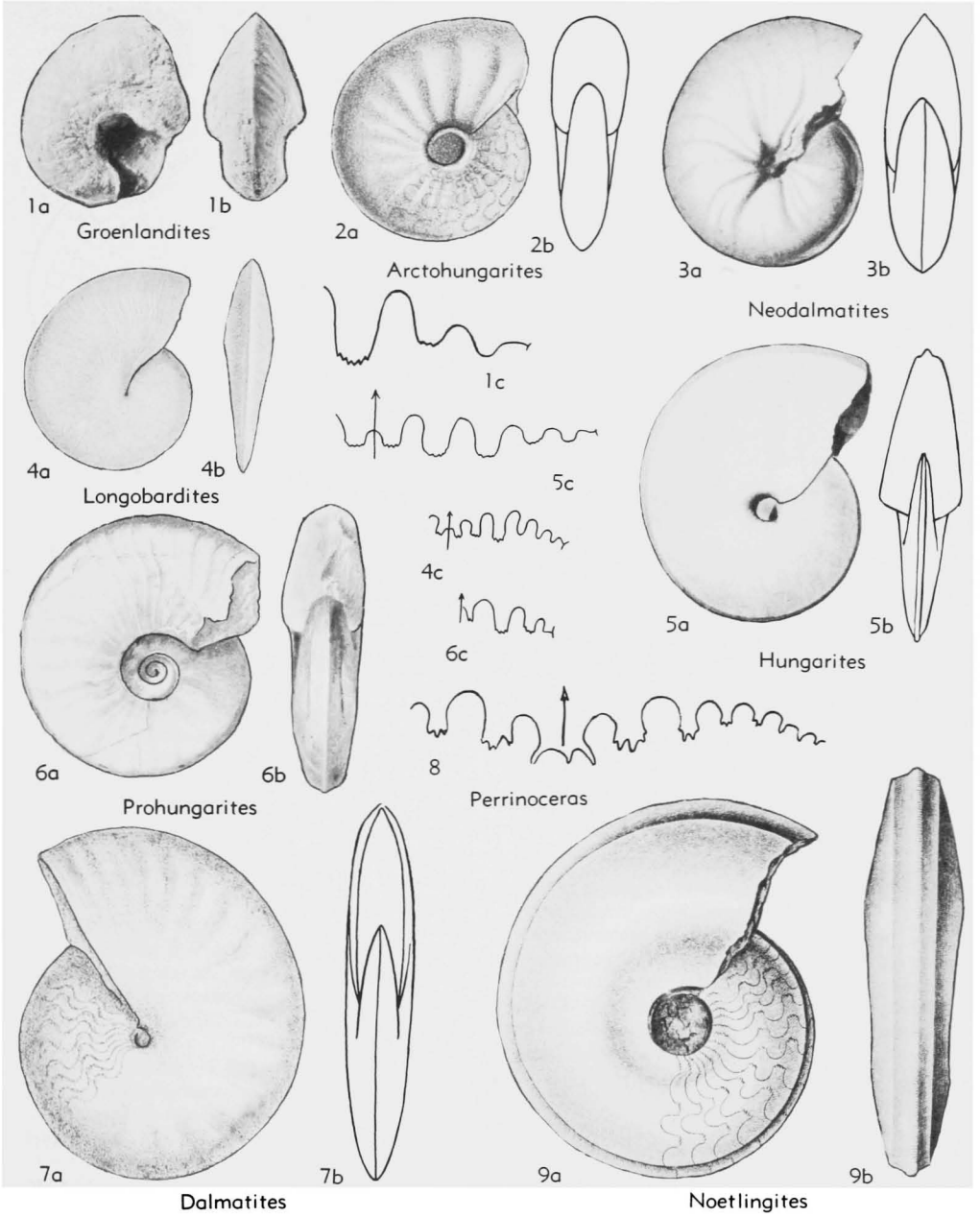



FIG. 187. Hungaritidae (p. L156).

some on center of venter (292). *Anis.*, Alps-Balkan-Ger.-Japan-Nev.——FIG. 186,*5*. **B. balatonicus* (MOJS.), Alps; *5a,b*, ×0.7 (293*).

**Judicarites** MOJSISOVICS, 1896 [**Balatonites arietiformis* MOJS., 1882]. Venter with prominent keel, whorl sides with radial ribs that are inflated and projected adorally on ventral shoulder (295). *Anis.*, Alps-Ger.-Balkan.——FIG. 186,*4*. *J. prezzanus* (MOJS.), Alps-Yugo.; *4a,b*, ×0.7 (293*).

**Cuccoceras** DIENER, 1905 [**Trachyceras cuccense* MOJSISOVICS, 1873]. Compressed, whorl sides flattened, venter narrowly rounded; with ribs and constrictions that are continuous over venter, some forms also with tubercles on whorl sides (488).

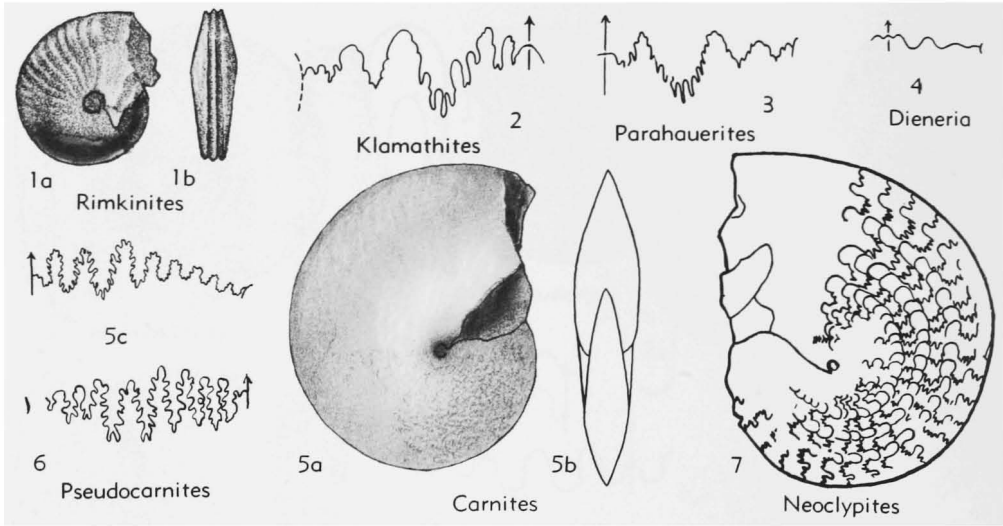



FIG. 188. Carnitidae (p. L157).

*Anis.*, Alps-Yugo.-Himalaya-?Japan-Nev.——FIG. 186,*2*. **C. cuccense* (MOJS.), Alps; *2a-c*, ×1 (584*).

## Family HUNGARITIDAE Waagen, 1895

Involute, compressed, discoidal, with keeled or sharpened venter; smooth or weakly costate. Suture ceratitic, usually with numerous elements, may have adventitious lobes (488). *L.Trias.-U.Trias.*

**Hungarites** MOJSISOVICS, 1879 [**Ceratites mojsisovicsi* ROTH, 1871 (=*Ceratites zalaensis* BOECKH, 1873)] [=*Iberites* HYATT, 1900]. Involute platycone, with high median keel on subtabulate venter; ventral shoulders usually well marked; smooth or with sigmoidal ribs. Suture ceratitic to subammonitic (203). *M.Trias.(Anis.-Ladin.)*, Alps-Sp.-Balkan-Asia M.-Himalaya-N. Sib.-B. C.-Calif.-Nev. ——FIG. 187,*5*. *H. yatesi* HYATT & SMITH, Calif.; *5a,b*, ×1; *5c*, ×2 (203*).

**Noetlingites** HYATT, 1900 [**Ceratites strombecki* GRIEPENKERL, 1860]. Like *Hungarites* but venter fastigate throughout. Suture without median saddle in ventral lobe, 3 lateral lobes, broadly rounded saddles (488). *M.Trias.(Anis.)*, Ger.——FIG. 187,*9*. **N. strombecki* (GRIEP.); *9a,b*, ×0.7 (630*).

**Longobardites** MOJSISOVICS, 1882 [**L. breguzzanus*; SD HYATT & SMITH, 1905]. Involute oxycones without distinct ventral shoulders; with sigmoidal striations. Suture ceratitic, with adventitious lobes (203). *M.Trias.(Anis.-Ladin.)*, Alps-B.C.-Nev.—— FIG. 187,*4*. **L. breguzzanus*, Alps; *4a,b*, ×0.7; *4c*, ×1 (293*).

**Neodalmatites** SPATH, 1951 [**Dalmatites parvus* SMITH, 1914]. Like *Longobardites* but slightly inflated and with weak lateral folds. Suture simpler (449). *M.Trias.(Anis.)*, Nev.——FIG. 187,*3*. **N. parvus* (SMITH); *3a,b*, ×1.5 (449*).

**Groenlandites** KUMMEL, 1953 [**G. nielseni*]. Like *Neodalmatites* but whorl section subtrigonal, umbilical wall nearly vertical. Suture less advanced. *M.Trias.(Anis.)*, Pearyland.——FIG. 187,*1*. **G. nielseni; 1a,b*, ×0.7; *1c*, ×4 (650*).

**Perrinoceras** JOHNSTON, 1941 [**P. novaditus*]. Conch as in *Longobardites*, with sharp venter. Suture ceratitic but simpler, ventral lobe very simple (488). *U.Trias.(Carn.)*, Nev.——FIG. 187,*8*. **P. novaditus*; ×1 (643*).

**Arctohungarites** DIENER, 1916 [**Hungarites triformis* MOJSISOVICS, 1886]. Involute platycones with weak sigmoidal folds on body chamber; distinct keel only on adoral part of phragmocone, tending to again disappear. Suture ceratitic (294). *M.Trias.(Anis.)*, N.Sib.——FIG. 187,*2*. **A. triformis* (MOJS.); *2a,b*, ×1 (294*).

**Dalmatites** KITTL, 1903 [**D. morlaccus*]. Discoidal, involute, nearly smooth oxycones. Suture ceratitic, simple, with 3 feebly toothed lobes (232). *L.Trias.(U.Scyth.)*, Yugo.——FIG. 187,*7*. **D. morlaccus; 7a,b*, ×1 (232*).

**Prohungarites** SPATH, 1934 [**P. similis*]. More or less evolute, discoidal; irregular ribbing continuous across tricarinate or feebly keeled venter. Suture ceratitic, with only 2 lobes (560). *L.Trias.(U.Scyth.)*, Timor-Sib.-Ida.——FIG. 187,*6*. **P. similis*, Timor; *6a,b*, ×0.7; *6c*, ×1 (560*).

## Family CARNITIDAE Arthaber, 1911

Discoidal, compressed, very involute, venter narrow and bicarinate, tricarinate, sharpened or truncated; weak ribs and tubercles

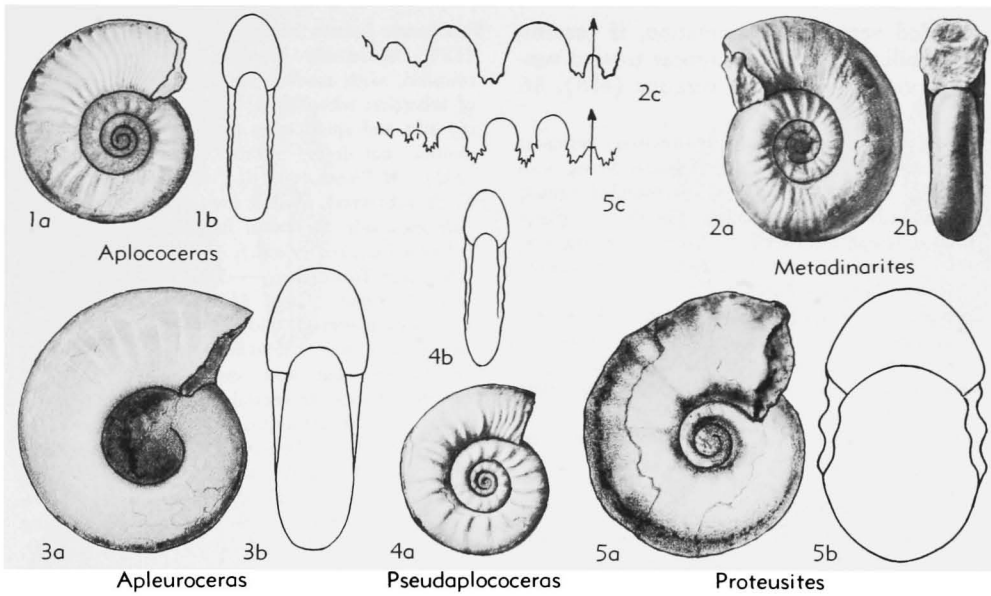



FIG. 189. Proteusitidae, Aplococeratidae (p. L157-L158).

may be present. Suture generally ammonitic, with adventitious and auxiliary elements (488). *M.Trias.-U.Trias.*

**Carnites** MOJSISOVICS, 1879 [**Nautilus floridus* WULFEN, 1793; SD MOJS., 1882]. Venter tricarinate in young, bicarinate to sharpened in later volutions; sides with low flexuous ribs and in places tubercles along mid-line of sides and near venter. Suture ammonitic (293). *U.Trias.(Carn.)*, Alps-Himalaya.——FIG. 188,*5*. **C. floridus* (WULFEN); *5a,b*, ×0.5; *5c*, ×0.7 (293*).

**Rimkinites** MOJSISOVICS, 1902 [**Hungarites nitiensis* MOJS., 1896]. Tricarinate venter persisting; sides with weak sigmoidal ribs, some forms with clavi at ventrolateral edge. Suture subammonitic with no adventitious elements but with auxiliary elements (295). *M.Trias.(Ladin.)-U.Trias.(Carn.)*, Himalaya.——FIG. 188,*1*. **R. nitiensis* (MOJS.), Ladin., Himalaya; *1a,b*, ×1.5 (295*).

**Pseudocarnites** SIMIONESCU, 1913 [**Carnites (Pseudocarnites) arthaberi*]. Venter truncate, conch smooth. Suture with monophyllic saddle endings (488). *U.Trias.(Carn.)*, Rumania.——FIG. 188,*6*. **P. arthaberi*; ×1 (709*).

**Klamathites** SMITH, 1927 [**K. schucherti*]. Venter grooved or slightly rounded; conch nearly smooth or with weak lateral folds. Suture subammonitic (450). *U.Trias.(Carn.)*, Calif.——FIG. 188,*2*. **K. schucherti*; ×1 (450*).

**Parahauerites** DIENER, 1916 [**Hauerites ashleyi* HYATT & SMITH, 1905] [=*Fremontites* SMITH, 1927 (obj.)]. Like *Klamathites* but with simpler suture (450). *U.Trias.(Carn.)*, Calif.——FIG. 188, *3*. **P. ashleyi* (HYATT-S.); ×1 (450*).

**Dieneria** HYATT & SMITH, 1905 [**D. arthaberi*]. Compressed platycone, venter truncate, conch smooth. Suture simple, with only 1st lateral lobe slightly serrated, others entire (203). *U.Trias.(Carn.)*, Calif.——FIG. 188,*4*. **D. arthaberi*; ×2 (450*).

**Neoclypites** SPATH, 1951 [**Metahedenstroemia? desertorum* JOHNSTON, 1941]. Venter truncate or grooved; sides with falciform radial growth lines that may be bundled at intervals. Suture ceratitic, multilobate, with adventitious and auxiliary lobes (488). *U.Trias.(Carn.)*, Nev.——FIG. 188,*7*. **N. desertorum* (JOHNSTON); ×0.7 (643*).

## Family PROTEUSITIDAE Spath, 1951

Generally involute, with arched venter; tendency for outer volution to be excentric; conch extremely variable in degree of involution and relative dimensions; broad fold like ribs, strigation, and umbilical tubercles may all be present or only some of these. Suture ceratitic to slightly ammonitic (488). *M. Trias.*

**Proteusites** HAUER, 1887 [**P. kellneri*] (488). *Anis.*, Balkan-Himalaya-Alaska.——FIG. 189,*5*. **P. kellneri*, Balkan; *5a,b*, ×0.7; *5c*, ×1 (633*).

## Family APLOCOCERATIDAE Spath, 1951

Ceratitids with very simplified suture and tendency to lose their ornamentation; generally evolute, more or less compressed, with

rounded venter; ornamentation, if present, of umbilical ribs that disappear toward venter. Suture goniatitic or ceratitic (488). *M. Trias.*

**Aplococeras** HYATT, 1900 [**Dinarites avisianus* MOJSISOVICS, 1882]. Evolute discoidal forms with convex, converging whorl sides, rounded venter, and slightly flexuous umbilical ribs that disappear toward venter. Suture with 2 lateral lobes (?goniatitic). *Ladin.*, Alps.——FIG. 189,*1*, **A. avisianum* (MOJS.); *1a,b*, ×0.7 (293*).

**Velebites** SALOPEK, 1918 [**Dinarites (Velebites) dinaricus*]. Like *Aplococeras* but ribs more recurved and suture ceratitic. *Ladin.*, Yugo.

**Apleuroceras** HYATT, 1900 [**Ceratites sturi* MOJSISOVICS, 1882]. Evolute, essentially smooth conch, with subquadrate whorl section, broadly rounded venter. Suture ceratitic with 2 lateral lobes (293). *Ladin.*, Alps.——FIG. 189,*3*. **A. sturi* (MOJS.); *3a,b*, ×0.5 (293*).

**Pseudaplococeras** SPATH, 1951 [**Lecanites vogdesi* HYATT & SMITH, 1905]. Compressed, evolute, discoidal conch with flexuous umbilical ribs; venter narrowing adorally. Suture goniatitic. *Anis.*, Nev.-N.Alaska.——FIG. 189,*4*. **P. vogdesi* (HYATT-S.), Nev.; *4a,b*, ×0.7 (449*).

**Metadinarites** SPATH, 1951 [**Dinarites desertorum* SMITH, 1914]. Like *Pseudaplococeras* but whorls more robust. Suture with 2 ceratitic lobes. *Anis.*, Nev.——FIG. 189,*2*. **M. desertorum* (SMITH); *2a,b*, ×0.7; *2c*, ×3 (449*).

**?Dobrogeites** KITTL, 1908 [**D. tirolitiformis*]. Evolute, compressed platycone, with rounded venter, whorl sides divergent; inner whorls with *Tirolites*-like ornamentation, outer whorls smooth, Suture multilobate and smooth. *Anis.*, Rumania.

## Superfamily CLYDONITACEAE Mojsisovics, 1879

[*nom. transl.* MILLER & FURNISH, 1954 (*ex* Clydonitidae MOJS., 1879)] [=Trachyceratataceae HAUG, 1894 (*nom. transl.* KUMMEL, 1952, *ex* Trachyceratidae HAUG, 1894)]

Generally costate, tuberculate ammonoids with smooth, grooved, or keeled venters. Suture ceratitic or ammonitic, goniatitic in a few offshoots. Includes some genera with heteromorph coiling of shell. Whole group descended from Ceratitaceae. *L.Trias.-U. Trias.*

### Family TRACHYCERATIDAE Haug, 1894

More or less involute, highly ornamented derivatives of Ceratitidae; venter generally with median furrow bordered by rows of tubercles or continuous keel; whorl sides with flexuous ribs usually tuberculate, arranged in spiral pattern. Suture ceratitic to ammonitic (488). *M.Trias.-U.Trias.*

**Trachyceras** LAUBE, 1869 [**Ceratites aon* MÜNSTER, 1834]. Moderately involute, compressed; venter rounded, with median furrow bordered by rows of tubercles; whorl sides with single and bifurcating ribs and spiral rows of tubercles. Suture ammonitic, not deeply serrated, with 2 lateral lobes (292). *M.Trias.(Anis.)-U.Trias.(Carn.)*, cosmop.

**T. (Trachyceras)**. With 2 rows of tubercles bordering each side of ventral furrow (292). *M.Trias. (Ladin.)-U.Trias.(Carn.)*, Alps-Balkan-AsiaM.-Himalaya-Timor-Nev.——FIG. 190,*5*. **T. (T.) aon* (MÜNSTER), Carn., Alps; *5a-c*, ×1 (293*).

**T. (Protrachyceras)** MOJS., 1893 [**Trachyceras archelaus* LAUBE, 1869; SD DIENER, 1915]. Like *Trachyceras* but with only a single row of tubercles bordering ventral furrow (292). *M.Trias. (Anis.)-U.Trias.(Carn.)*, Alps-Sp.-Sard.-Balkan-AsiaM.-Himalaya-Timor-Indochina-Calif.-Nev.

**T. (Paratrachyceras)** ARTHABER, 1914 [**T. hofmanni* BOECKH, 1873] [=*Meginoceras* MCLEARN, 1930]. With little or no tuberculation, ribbing dense (23). *M.Trias.(Ladin.)-U.Trias.(Carn.)*, Alps-Sp.-Balkan-Japan-Indochina-B. C. - Nev.——FIG. 190,*8*. **T. (P.) hofmanni* (BOECKH), Carn., Balkan; *8a,b*, ×1 (293*).

**Nevadites** SMITH, 1914 [**N. merriami*]. Evolute, with subrectangular whorl section increasing slowly in height; whorl sides and venter flattened; no ventral furrow; with strong lateral ribs and tubercles, prominent tubercle at end of rib on ventrolateral shoulder. Suture ceratitic (449). *M. Trias.(Anis.)*, Nev.-Balkan-?Japan.——FIG. 190, *10*. **N. merriami*, Nev.; *10a,b*, ×0.7 (449*).

**Anolcites** MOJSISOVICS, 1893 [**Trachyceras doleriticum* MOJS., 1869]. Trachyceratids with no distinct ventral furrow and ribs that cross venter (292). *M.Trias.(Anis.-Ladin.)*, Alps-Balkan-?Himalaya-Nev.——FIG. 190,*7*. **A. doleriticum* (MOJS.), Ladin., Alps; *7a,b*, ×1 (293*).

**Sirenites** MOJSISOVICS, 1893 [**Am. senticosus* DITTMAR, 1866; SD HYATT & SMITH, 1905]. Compressed, with distinct furrow on venter; whorl sides flattened-convex with sigmoidal ribs that bifurcate near ventrolateral edge on a tubercle and project sharply adorally, 2 rows of tubercles on whorl side, one on umbilical shoulder. Tubercles arranged in spiral lines. Suture ammonitic (292). *U.Trias.(Carn. - Nor.)*, Alps-Sicily-Balkan-Himalaya-Timor-Alaska-B.C.-Calif.-?Mex.

**S. (Sirenites)**. With a single row of tubercles bordering ventral furrow (292). *U.Trias.(Carn.-Nor.)*, Alps - Balkan - Himalaya - Timor - Alaska-Calif.-?Mex.——FIG. 190,*9*. **S. (S.) senticosus* (DITTMAR) Carn., Alps; *9a,b*, ×1 (292*).

**S. (Diplosirenites)** MOJSISOVICS, 1893 [**S. (D.) raineri*; SD DIENER, 1915]. Ventral termination of ribs with double tubercles (292). *U.Trias. (Carn.)*, Alps.

**S. (Anasirenites)** MOJSISOVICS, 1893 [**S. (A.) ekkehardi* MOJS.; SD DIENER, 1915]. Ventral fur-

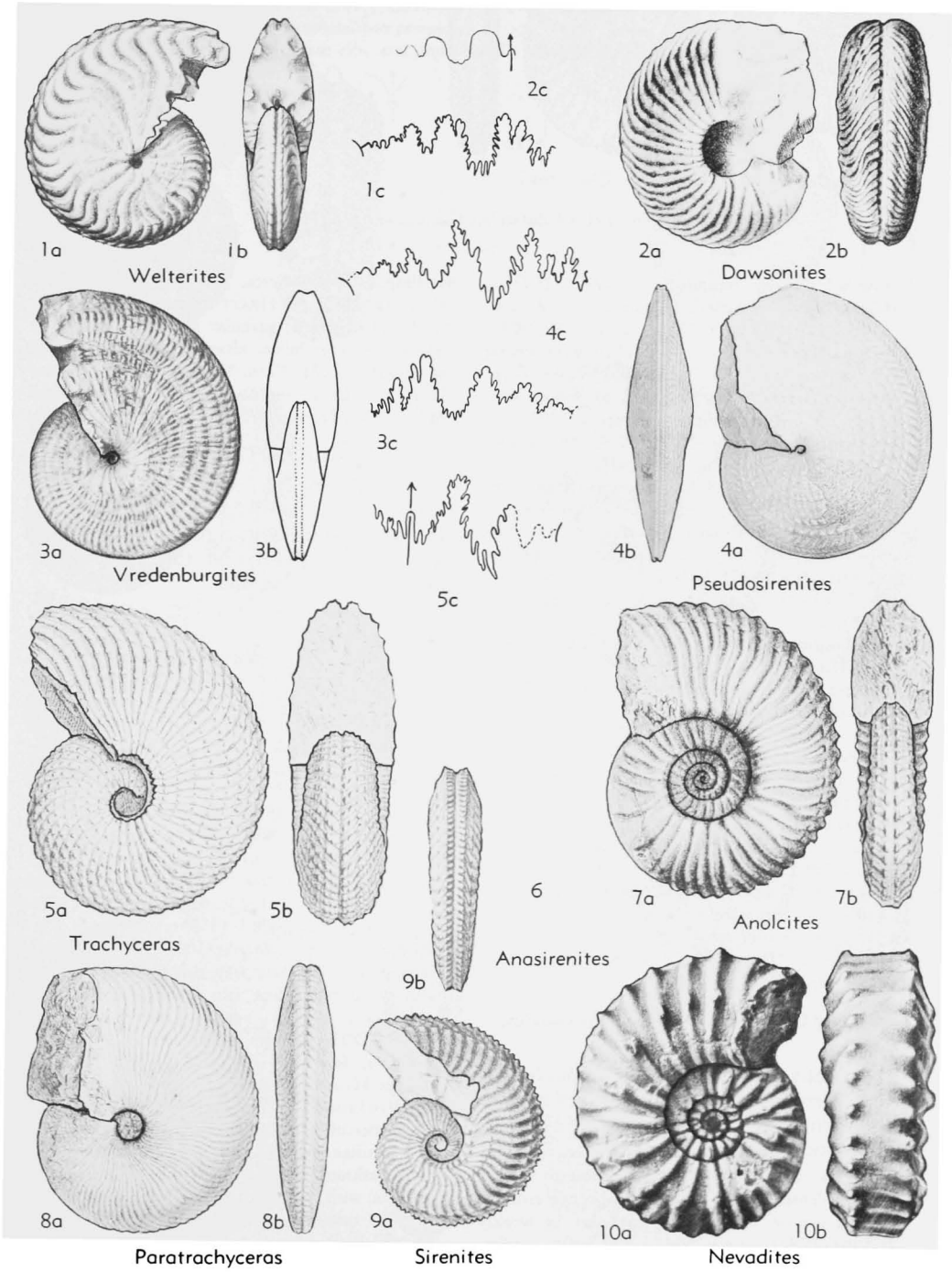



FIG. 190. Trachyceratidae (p. L158-L160).

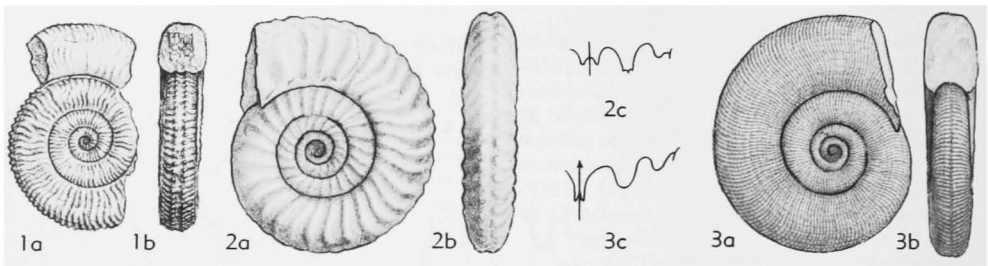



FIG. 191. Clydonitidae, Clionitidae (p. L160).

row bordered by continuous keel (292). *U.Trias. (Carn.-Nor.),* Alps-Sicily-Himalaya.——FIG. 190, 6. **S. (A.) ekkehardi,* Carn., Alps; ×1 (292*).

**Pseudosirenites** ARTHABER, 1911 [**Sirenites stachei* MOJSISOVICS, 1893; SD SPATH, 1951]. Like *Sirenites,* with narrow venter bordered by nodose keel. Suture with 2 adventitious elements (292). *U. Trias.(Nor.),* Alps.——FIG. 190,*4*. **P. stachei* (MOJS.); *4a,b,* ×0.5; *4c,* ×1 (292*).

**Welterites** DIENER, 1923 [**W. egregius*]. Involute, compressed, discoidal; median furrow bordered by nodose keels; whorl sides with flexuous ribs that project sharply forward on ventrolateral area. Suture ammonitic (115). *U.Trias.(Nor.),* Timor.——FIG. 190,*1*. **W. egregius; 1a,b,* ×0.5; *1c,* ×0.7 (115*).

**Vredenburgites** DIENER, 1916 [**Sirenites vredenburgi* DIENER, 1906]. Surface with thin flexuous ribs and numerous spiral rows of bullae. Suture with adventitious elements in 1st lateral saddle (115). *U.Trias.(?Carn.-Nor.),* Himalaya-Timor. ——FIG. 190,*3*. *V. vredenburgiformis* DIENER, Nor., Timor; *3a,b,* ×0.5; *3c,* ×0.7 (115*).

**Dawsonites** BÖHM, 1903 [**Trachyceras canadense* WHITEAVES, 1889]. Moderately evolute, venter broadly rounded, with deep furrow; whorl sides with radial ribs that bifurcate on whorl side and then project sharply adorally; ribs with spiral rows of tubercles. Suture ceratitic, with rounded saddles (450). *U.Trias.(Carn.),* B.C.-Alaska-Bearl.——FIG. 190,*2*. **D. canadense* (WHITEAVES); *2a,b,* ×0.7; *2c,* ×1 (732*).

## Family CLYDONITIDAE Mojsisovics, 1879

Generally evolute, compressed, with fine, dense, irregularly granular ribs; median groove on venter. Suture goniatitic or weakly ceratitic (488). *U.Trias.*

**Clydonites** HAUER, 1860 [**Gon. decoratus* HAUER, 1846]. Venter arched, granular ribs not crossing median groove. Suture goniatitic, may be weakly ceratitic (292). *Carn.-Nor.,* Alps-Sicily.——FIG. 191,*3*. **C. decoratus* (HAUER), Nor., Alps; *3a,b,* ×0.7; *3c,* ×1 (292*).

**Sandlingites** MOJSISOVICS, 1893 [**Am. oribasus* DITTMAR, 1866; SD HYATT & SMITH, 1905]. Venter broad, flattened, granular ribs crossing median groove; with umbilical tubercles. Suture goniatitic or ceratitic (292). *Carn.-Nor.,* Alps-Balkan-Himalaya-Timor-Calif.——FIG. 191,*1*. *S. archibaldi* MOJS., Nor., Himalaya-Timor; *1a,b,* ×0.7 (295*).

## Family CLIONITIDAE Arabu, 1932

Generally evolute, with median ventral furrow usually bordered by rows of tubercles; whorl sides with sigmoidal ribs which may bear spiral rows of tubercles. Suture ceratitic (488). *U.Trias.*

**Clionites** MOJSISOVICS, 1893 [**C. angulosus;* SD HYATT & SMITH, 1905]. Evolute, whorl section subquadrate; with sigmoidal ribs, generally bifurcating, projected on ventrolateral area; little or no tuberculation on ribs. Suture ceratitic with 2 lateral lobes (292). *Carn.-Nor.,* Alps-Balkan-Asia M. - Himalaya - Timor-?Indochina-BearI.-Nev.——FIG. 191,*2*. **C. angulosus,* Carn., Alps; *2a,b,* ×0.7; *2c,* ×1 (292*).

**Alloclionites** SPATH, 1951 [**A. timorensis* (=*Clionites ares timorensis* WELTER, 1914)]. With many tubercles which tend to diminish on body chamber (558). *Carn.-Nor.,* Alps-Balkan-Himalaya-Timor-B.C.——FIG. 192,*9*. **A. timorensis* (WELTER), Timor; *9a,b,* ×0.5 (558*).

**Californites** HYATT & SMITH, 1905 [**C. merriami*]. Evolute, whorl section trapezoidal, sides flattened, with radial tuberculate ribs which end in strong ventrolateral spines; venter low-arched, nearly smooth (203). *Carn.,* Calif.——FIG. 192,*3*. **C. merriami; 3a,b,* ×1; *3c,* ×2 (203*).

**Traskites** HYATT & SMITH, 1905 [**Clionites (Traskites) robustus*]. Evolute, whorl section quadrate, with tuberculate radial ribs which extend on venter to median groove (203). *Carn.,* Calif.

**T. (Traskites).** Ribs coarse, tuberculate. Suture ceratitic with 2 lateral lobes (203).——FIG. 192,*1*. *T. (T.) robustus; 1a,b,* ×0.7; *1c,* ×1 (203*).

**T. (Shastites)** HYATT & SMITH, 1905 [**Clionites (Shastites) compressus*]. More compressed, involute, ribs and tubercles finer, more dense (203).

——Fig. 192,6. *T. (S.) compressus* (Hyatt-S.); *6a,b,* ×0.7 (450*).

**T. (Stantonites)** Hyatt & Smith, 1905 [**Clionites (Stantonites) rugosus*]. More evolute, compressed, with coarse sigmoidal tuberculate ribs and most prominent rows of tubercles on ventrolateral edge, ventral groove aligned by tubercles (203).—— Fig. 192,8. *T. (S.) rugosus* (Hyatt-S.); *8a,b,* ×0.7 (450*).

**T. (Neanites)** Hyatt & Smith, 1905 [**Clionites*

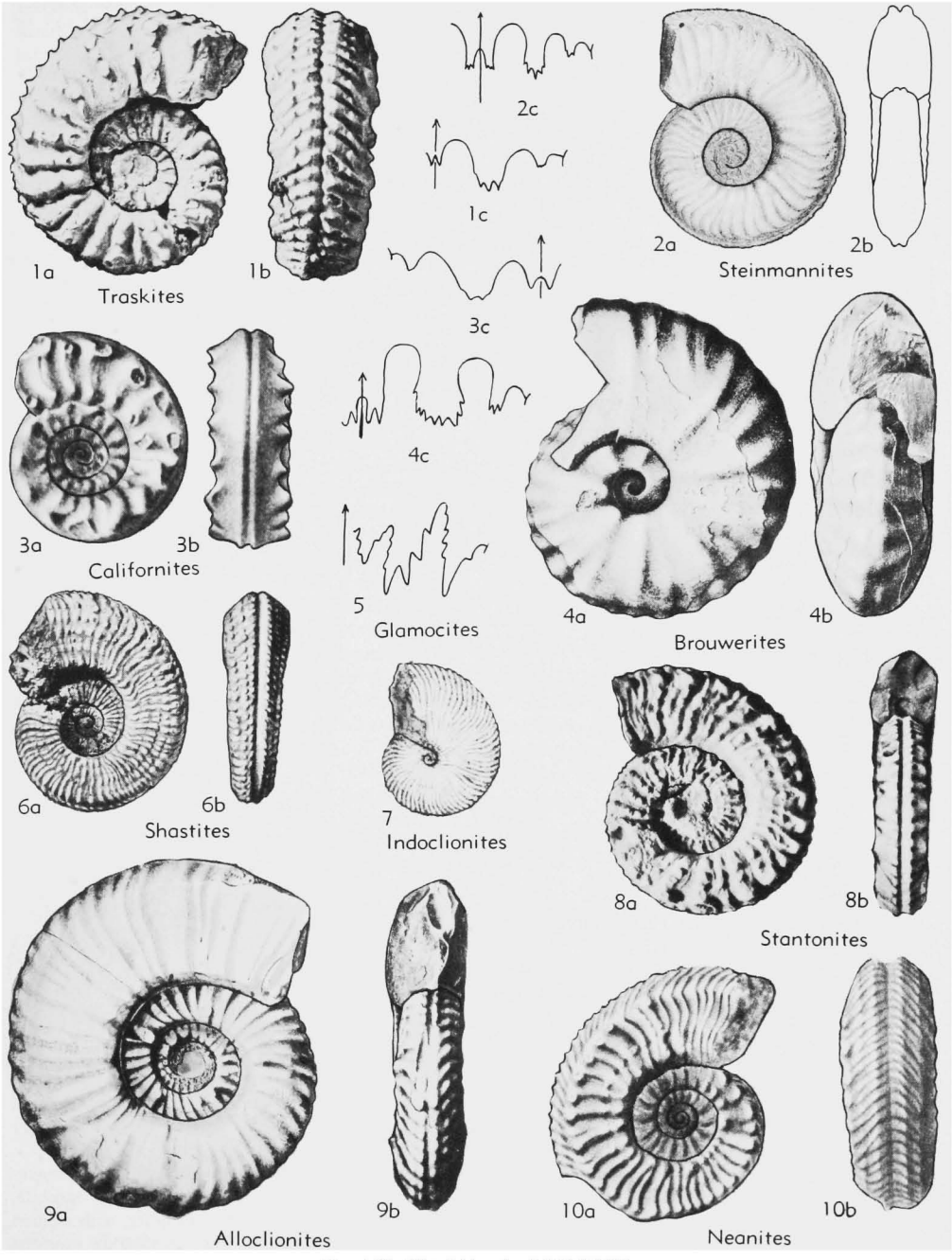



Fig. 192. Clionitidae (p. L160-L162).

*(Neanites) californicus*]. Evolute, whorl sections subquadrate, sigmoidal tuberculate ribs continuous to shallow median groove, ventrolateral tubercles most prominent (203).——FIG. 192,*10*. **T. (N.) californicus* (HYATT-S.); *10a,b*, ×1 (450*).

**Indoclionites** DIENER, 1916 [**Clionites gracilis* DIENER, 1906]. Involute, compressed conch, whorl sides with fine sigmoidal ribs, bundled at umbilical margin, secondary ribs intercalated at middle of whorl side; tubercles on umbilical margin and ventrolateral area (103). *U.Trias.*, Himalaya.——FIG. 192,*7*. **I. gracilis* (DIENER); ×1 (103*).

**Steinmannites** MOJSISOVICS, 1893 [**Am. hoernesi* HAUER, 1849; SD DIENER, 1915]. Evolute, whorl section subrectangular, nodes on flexuous ribs at umbilical margin and distinct swelling of ribs at ventrolateral margin; median groove on venter with raised crenulate edge (292). *Carn.-Nor.*, Alps-Himalaya-Timor.——FIG. 192,*2*. **S. hoernesi* (HAUER), Nor., Alps; *2a,b*, ×0.3; *2c*, ×0.7 (292*).

**Brouwerites** DIENER, 1923 [**Clionites involutus* WELTER, 1914]. Involute, inflated, venter rounded; whorl sides with flexuous ribs ending at prominent node next to median groove; prominent fine strigation (115). *Carn.*, Timor.——FIG. 192,*4*. **B. involutus* (WELTER); *4a,b*, ×0.5; *4c*, ×1 (558*).

**?Glamocites** DIENER, 1917 [**G. katzeri*]. Evolute, whorl section subrectangular, venter arched; radial ribs that pass over venter projecting strongly; tubercles on umbilical and ventrolateral edge. Suture with high 2nd lateral saddle (488). *Carn.*, Yugo.——FIG. 192,*5*. **G. katzeri*; ×1 (606*).

## Family ARPADITIDAE Hyatt, 1900

Generally evolute, compressed, with median furrow bordered by continuous, smooth or crenulated keels, or edges of siphonal groove simulating keel, or by clavi; sigmoidal ribs and tubercles present. Suture ceratitic to ammonitic (488). *M.Trias.U. Trias.*

**Arpadites** MOJSISOVICS, 1879 [**Am. arpadis* MOJS., 1870; SD HYATT & SMITH, 1905]. Compressed, discoidal, evolute; with radial or faintly sigmoidal ribs; ventral keels continuous, smooth; generally umbilical tubercles but lateral and ventrolateral tubercles may occur also. Suture ceratitic with 2 lateral lobes (293). *M.Trias.(Ladin.)-U.Trias.(Carn.)*, Alps - Italy - Balkan - Himalaya-Japan.——FIG. 193,*12*. **A. arpadis* (MOJS.), Ladin., Alps; *12a,b*, ×0.7 (293*).

**Hyparpadites** SPATH, 1951 [**Arpadites liepoldti* MOJSISOVICS, 1882]. Median groove narrow, adjacent area on venter arched to form simulated keels; prominent umbilical and ventrolateral tubercles; weak radial ribs. Suture ceratitic, with 3 lateral lobes (293). *M.Trias.(Ladin.)*, Alps.——FIG. 193,*6*. **H. liepoldti* (MOJS.); *6a,b*, ×0.5 (293*).

**Edmundites** DIENER, 1916 [**Arpadites rimkinensis* MOJSISOVICS, 1896]. With sigmoidal, distant primary ribs, weaker secondaries; keels prominent, smooth. Suture ammonitic (295). *M.Trias.(Ladin.)-U.Trias.(Carn.)*, Himalaya.——FIG. 193,*10*. **E. rimkinensis* (MOJS.); *10a,b*, ×1 (295*).

**Klipsteinia** MOJSISOVICS, 1882 [**Am. achelous* MÜNSTER, 1834; SD DIENER, 1915]. With crenulated keels delayed in appearance; lateral tuberculation present or absent (293). *U.Trias.(Carn.)*, Alps.——FIG. 193,*13*. **K. achelous* (MÜNSTER); *13a,b*, ×0.7 (293*).

**Trachystenoceras** JOHNSTON, 1941 [**Arpadites gabbi* HYATT & SMITH, 1905]. Involute, discoidal; median groove bordered by slightly beaded marginal ridges; sides with low folds made up of sigmoidal striae. Suture ceratitic (203). *U.Trias.(Carn.)*, Calif.-Nev.——FIG. 193,*7*. **T. gabbi* (HYATT-S.); ×1 (203*).

**Silenticeras** MCLEARN, 1930 [**Daphnites (Silenticeras) hatae*]. Involute, discoidal, compressed, venter with prominent median groove but no distinct keels; strong growth lines projected (488). *U.Trias.(Carn.)*, B.C.

**Dittmarites** MOJSISOVICS, 1893 [**Am. rimosus* MÜNSTER, 1841; SD DIENER, 1915]. Median groove bordered by prominent continuous keels; sides with falcate ribs projected on ventrolateral area. Suture ammonitic (292). *U.Trias.(Carn.-Nor.)*, Alps-Greece-Himalaya.——FIG. 193,*2*. *D. rimosus* (MÜNSTER), Carn., Alps; *2a,b*, ×1 (293*).

**Trachypleuraspidites** DIENER, 1906 [**Arpadites (Trachypleuraspidites) griffithi*]. Like *Dittmarites* but falcate bifurcating ribs multituberculate (103). *U.Trias.(Carn.-Nor.)*, Himalaya - Timor.——FIG. 193,*9*. *T. griffithi* (DIENER), Himalaya; *9a,b*, ×0.5 (103*).

**Asklepioceras** RENZ, 1910 [**Arpadites (Dittmarites) segmentatus* MOJSISOVICS, 1893]. Evolute to involute, discoidal to subglobose; median furrow not bordered by keels; prominent, distant projected constrictions that pass over venter. Suture ceratitic, simple (365). *M.Trias.(Ladin.)-U.Trias.(Carn.)*, Alps-Balkan-AsiaM.-B.C.——FIG. 193,*8*. **A. segmentatum* (MOJS.), Carn., Alps; *8a,b*, ×0.7 (292*).

**Muensterites** MOJSISOVICS, 1893 [**Arpadites (Münsterites) ectodus*]. Involute, slightly inflated, venter rounded; median furrow bordered by row of nodes, no continuous keel; also row of nodes on ventrolateral area; nodes decline adorally; ribs broad, low closely spaced, projected (292). *U.Trias.(Carn.)*, Alps.——FIG. 193,*11*. **M. ectodus; 11a,b*, ×1 (292*).

**Drepanites** MOJSISOVICS, 1893 [**Arpadites (Drepanites) hyatti*; SD DIENER, 1915]. Very involute, compressed, discoidal, venter truncate, with median furrow; sides with sigmoidal ribs that are strongest near periphery, ventrolateral angle serrated. Suture

ammonitic (292). *U.Trias.(Nor.)*, Alps-Sicily-Timor.——Fig. 193,*1*. **D. hyatti*; *1a,b*, ×0.7; *1c*, ×1 (292*).

**Daphnites** Mojsisovics, 1893 [**Arpadites (Daphnites) berchtae*; SD Diener, 1915]. Compressed, involute, venter rounded, median furrow with keel-like edge; whorl sides with fine, sinuous, bifurcating, prorsiradiate, projected ribs, usually bundled at umbilical edge. Suture ceratitic (292). *U.Trias.(Nor.)*, Alps-Sicily-Himalaya.——Fig. 193, *3*. *D. ungeri* Mojs., Alps; *3a,b*, ×1; *3c*, ×2 (292*).

**Dionites** Mojsisovics, 1893 [*Arpadites (Dionites) caesar*; SD Diener, 1915]. Compressed, involute, venter arched, distinct median furrow bordered by clavi; sides with dense, sigmoidal, broad ribs, spiral lines, spiral rows of tubercles; sculpture decreases adorally. Suture ammonitic (292). *U.Trias.(Nor.)*, Alps-Himalaya-Timor.——Fig. 193,*5*. **D. caesar*, Alps; *5a,b*, ×0.25; *5c*, ×0.3 (292*).

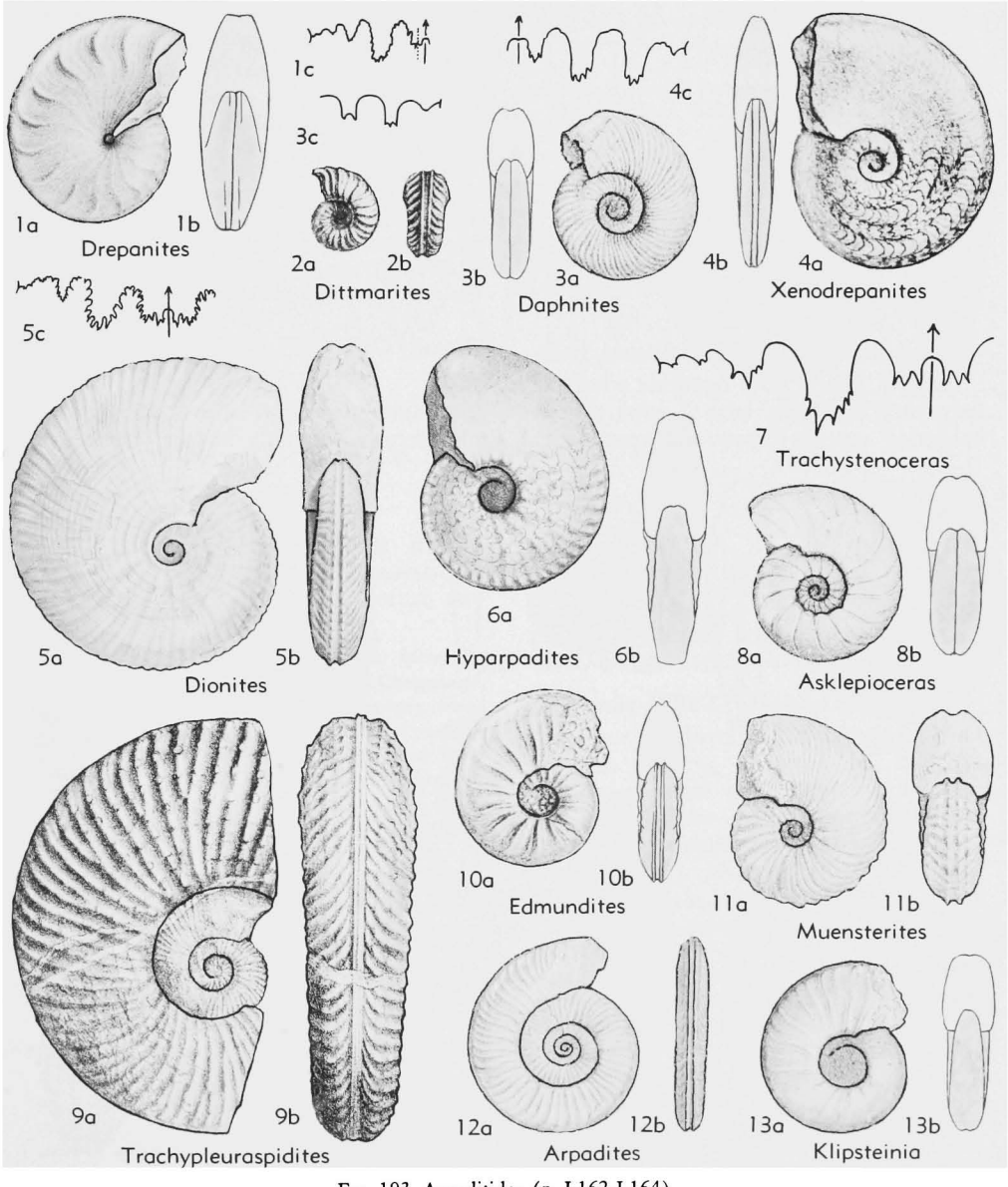



Fig. 193. Arpaditidae (p. L162-L164).

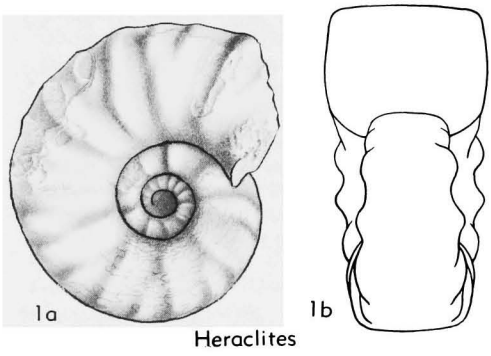



FIG. 194. *Heraclites robustus* (HAUER), U.Trias. (Nor.), Alps; *1a,b,* ×0.25 (p. L164).

**Xenodrepanites** DIENER, 1916 [**Drepanites schucherti* DIENER, 1906]. Very compressed, discoidal, more evolute than *Drepanites;* ventral furrow bordered by crenulated keels; sides with low sigmoidal ribs. Suture subammonitic (103). *U.Trias.*, Himalaya.——FIG. 193,*4*. **X. schucherti* (DIENER); *4a,b,* ×0.7; *4c,* ×1 (103*).

## Family HERACLITIDAE Diener, 1920

Evolute, robust, with quadrate whorl section; early volutions with 2 rows of clavi bordering ventral furrow and ventrolateral row; venter of outer volution smooth, flattened; sides with distant prorsiradiate ribs. Suture subammonitic (488). *U.Trias.*

**Heraclites** MOJSISOVICS, 1879 [**Am. robustus* HAUER, 1855; SD DIENER, 1915] (292). *Nor.*, Alps-Timor. ——FIG. 194,*1*. **H. robustus* (HAUER); *1a,b,* ×0.25 (292*).

## Family LECANITIDAE Hyatt, 1900

Very primitive ammonites, evolute, discoidal, compressed, with goniatitic suture (488). *M.Trias.-U.Trias.*

**Lecanites** MOJSISOVICS, 1882 [**Am. glaucus* MÜNSTER, 1834]. Essentially smooth, some forms with weak sigmoidal ribs (293). *M.Trias.(Ladin.)-U. Trias.(Carn.),* Alps-Nev.——FIG. 195,*2*. **L. glaucus* (MÜNSTER); *2a,b,* Alps; ×1 (293*).

**Badiotites** MOJSISOVICS, 1882 [**Am. eryx* MÜNSTER, 1834]. With sigmoidal ribs and smooth siphonal band; venter acutely rounded (293). *M.Trias. (Ladin.)-U.Trias.(Carn.),* Alps-Greece-Hung.—— FIG. 195,*4*. **B. eryx* (MÜNSTER); ×1 (293*).

## Family CYRTOPLEURITIDAE Diener, 1925

Involute, generally compressed, with narrow furrowed venter which is bordered by

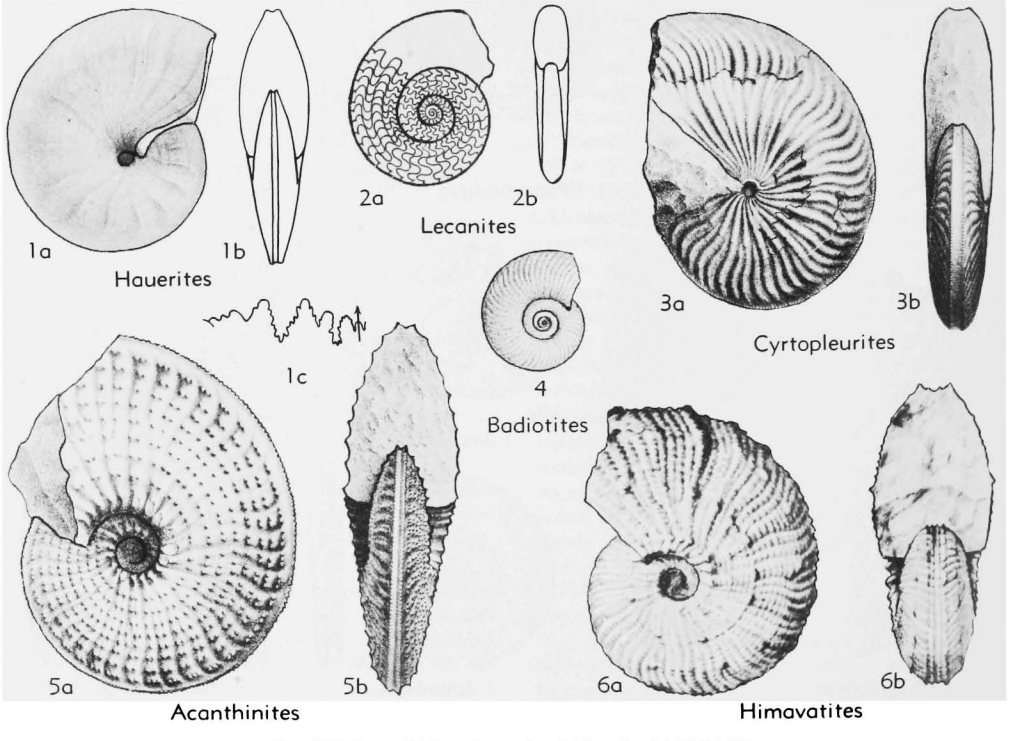



FIG. 195. Lecanitidae, Cyrtopleuritidae (p. L164-L165).

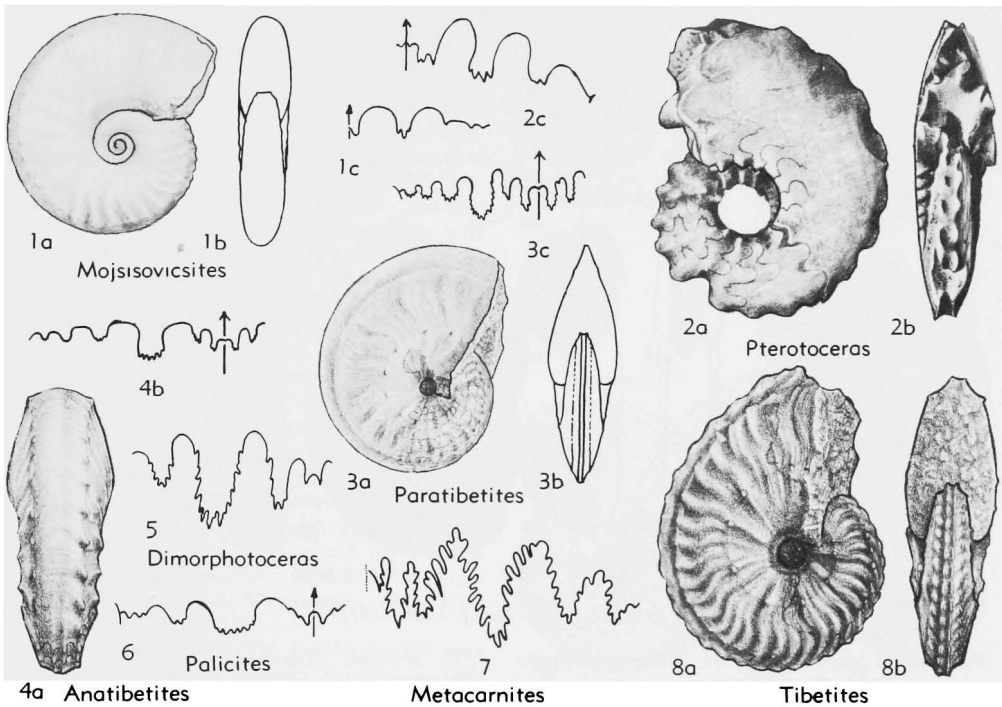



FIG. 196. Tibetitidae (p. L165-L166).

crenulated tubercles or keels or smooth keels; lateral area usually with flexuous ribs and spiral rows of tubercles. Suture ammonitic (488). *U.Trias.*

**Cyrtopleurites** MOJSISOVICS, 1893 [**Am. bicrenatus* HAUER, 1846; SD DIENER, 1915]. Compressed, involute, umbilicus small, venter narrow; whorl sides with sigmoidal ribs that end in crenulated tubercles at edge of and align ventral furrow; inner whorls with few spiral rows of tubercles which decrease adorally (292). *Carn.-Nor.*, Alps-Sicily-Himalaya-Timor-B.C.——FIG. 195,*3*. **C. bicrenatus* (HAUER), Nor., Alps; *3a,b*, ×0.5 (292*).

**Acanthinites** MOJSISOVICS, 1893 [**Cyrtopleurites (Acanthinites) excelsus*; SD DIENER, 1915]. Like *Cyrtopleurites* but with numerous lateral, spiral rows of tubercles and continuous serrated keels aligning ventral furrow (292). *U.Trias.(Nor.)*, Alps-Himalaya-Timor.——FIG. 195,*5*. **A. excelsus* (MOJS.), Alps; *5a,b*, ×0.5 (292*).

**Himavatites** DIENER, 1906 [**Acanthinites (Himavatites) watsoni*]. Whorl sides with flexuous primary and secondary bifurcating ribs, large nodes on primary ribs in spiral pattern, numerous spiral rows of spines on all ribs; ventral furrow shallow, bordered by spirally elongated tubercles (103). *Nor.*, Himalaya-Timor-B.C.——FIG. 195,*6*. **H. watsoni*, Himalaya-Timor; *6a,b*, ×0.5 (115*).

**Hauerites** MOJSISOVICS, 1893 [**Am. rarestriatus* HAUER, 1849; SD HYATT & SMITH, 1905]. With continuous keels bordering ventral furrow; lateral ribs weak, no tubercles (292). *Carn.-Nor.*, Alps-Timor.——FIG. 195,*1*. **H. rarestriatus* (HAUER), Nor., Alps; *1a,b*, ×0.5; *1c*, ×1 (292*).

## Family TIBETITIDAE Hyatt, 1900

More or less involute, compressed, venter generally narrow, bordered by clavi or tubercles at some stage; whorl sides with ribs and tubercles. Suture ceratitic to ammonitic with incipient or actual adventitious elements (488). *M.Trias.-U.Trias.*

**Tibetites** MOJSISOVICS, 1896 [**T. raylli*; SD DIENER, 1915]. Involute, compressed, with narrow venter bordered by 2 rows of clavi; with flexuous lateral ribs and spiral row of nodes at mid-section. Suture ceratitic with incipient adventitious lobule in 1st lateral saddle (295). *U.Trias.(Carn.-Nor.)*, Himalaya-Timor.——FIG. 196,*8*. *T. perrinsmithi* MOJS., Nor., Himalaya; *8a,b*, ×1 (295*).

**Anatibetites** MOJSISOVICS, 1896 [**Tibetites (Anatibetites) kelvini*]. Like *Tibetites* but venter of body chamber flattened and without clavi (295). *U. Trias.(Carn.-Nor.)*, Himalaya-Timor.——FIG. 196, *4*. **A. kelvini*, Nor., Himalaya; *4a*, ×0.7; *4b*, ×1 (295*).

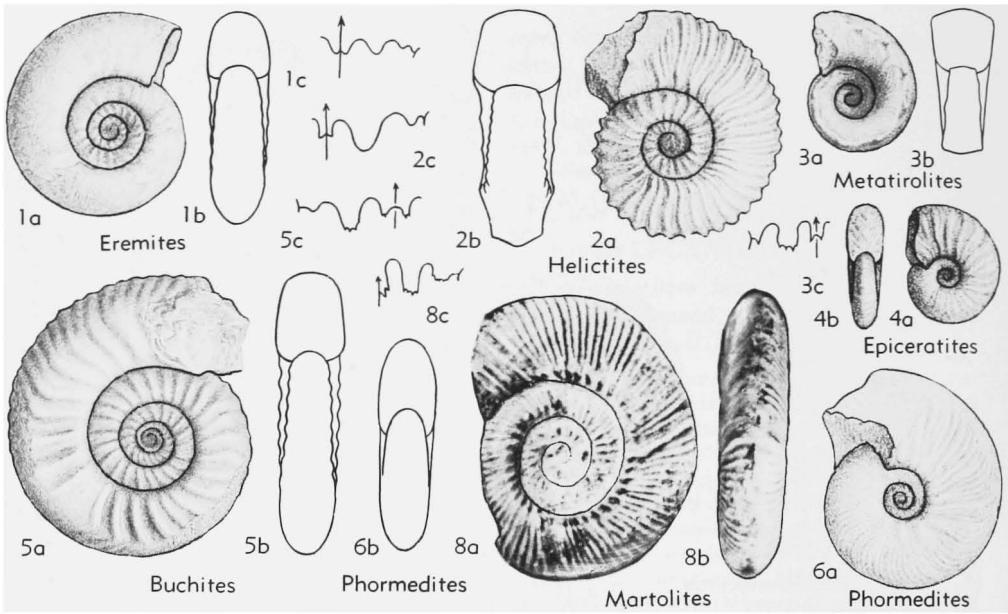



FIG. 197. Buchitidae (p. L166-L167).

**Paratibetites** MOJSISOVICS, 1896 [**Tibetites (Paratibetites) bertrandi*]. Like *Tibetites* in young; then ventral furrow appears bordered by distinct continuous keels, this followed by stage where ventral groove disappears and venter becomes obtusely rounded; ribbing and tuberculation decrease adorally. Suture ceratitic to ammonitic, more complex than in *Tibetites* (295). *U.Trias.(Carn.-Nor.)*, Himalaya-Timor.——FIG. 196,*3*. *P. adolphi* MOJS., Nor., Himalaya; *3a,b*, ×0.5; *3c*, ×1 (295*).

**Neotibetites** KRUMBECK, 1913 [**N. weteringi*]. Like *Tibetites* in young with bicarinate venter, changing to carinate venter and then smooth continuous keel-like venter; ribbing and tuberculation decreases adorally. Suture ceratitic, simple (488). *U.Trias.(Carn.-Nor.)*, E.Indies.

**Metacarnites** DIENER, 1908 [**Carnites (Metacarnites) footei*; SD DIENER, 1915]. Like *Paratibetites* but with a more complex ammonitic suture (105). *U.Trias.(Nor.)*, Himalaya-Timor-B.C.——FIG. 196, *7*. **M. footei*, Himalaya; ×0.5 (606*).

**Pterotoceras** WELTER, 1915 [**P. arthaberi*]. More or less evolute, compressed, discoidal, with ventral furrow bordered by clavi; with umbilical, lateral, and ventrolateral tubercles which decrease adorally. Suture ceratitic (559). *M.Trias.(Ladin.)-U.Trias.(Carn.)*, Timor-B.C.-Alps.——FIG. 196,*2*. **P. arthaberi*, Ladin., Timor; *2a,b*, ×0.7; *2c*, ×1 (559*).

**Dimorphotoceras** SPATH, 1951 [**Pterotoceras abnorme* DIENER, 1923]. Like *Pterotoceras* but tuberculation remaining strong to end. Suture ammonitic, with adventitious saddle in ventral lobe (488). *U.Trias.(Carn.-Nor.)*, Alps-Timor.——FIG. 196,*5*. **D. abnorme* (DIENER), Nor., Timor; ×0.5 (115*)

**Palicites** GEMMELLARO, 1904 [**P. mojsisovicsi*]. Like *Anatibetites*, ventral tubercles disappearing but lateral tubercles persisting to end. Suture ceratitic, simple, with incipient adventitious lobule in 1st lateral saddle (168). *U.Trias.(Carn.)*, Sicily. ——FIG. 196,*6*. **P. mojsisovicsi*; ×0.7 (168*).

**Mojsisovicsites** GEMMELLARO, 1904 [**M. crassecostatus*; SD DIENER, 1915]. Inner whorls with 2 ventral and 2 ventrolateral rows of nodes, disappearing adorally, outer whorl smooth; venter arched, sides with low folds. Suture ceratitic, simple (168). *U.Trias.(Carn.)*, Sicily.——FIG. 196,*1*. *M. orethensis* GEMM.; *1a-c*, ×0.7 (168*).

**Stikinoceras** MCLEARN, 1930 [**S. kerri*]. Compressed, evolute, sides flattened and with flexuous ribs; primary ribs slightly enlarged at umbilical edge; node on ventrolateral area, and on ventral shoulder adjoining a smooth venter bearing a thin, low keel. Suture ceratitic (488). *U.Trias.*, B.C.

## Family BUCHITIDAE Hyatt, 1900

Generally evolute, with subquadrate to suboval whorls; flattened to rounded venter; sides with radial ribs that may cross venter. Suture ceratitic (488). *U.Trias.*

**Buchites** MOJSISOVICS, 1893 [**B. aldrovandii*]. Whorls increasing slowly, venter rounded; sides with flexuous projected ribs that end at smooth siphonal band or cross venter. Suture ceratitic (292). *Carn.-Nor.*, Alps-Sicily-Greece-Himalaya.

——FIG. 197,5. **B. aldrovandii*, Carn., Alps-Greece; *5a,b*, ×0.7; *5c*, ×1 (292*).

**Helictites** MOJSISOVICS, 1879 [**Am. geniculatus* HAUER, 1855; SD DIENER, 1915]. Like *Buchites* but flexuous, with bifurcating ribs that cross straight over venter (292). *Carn.-Nor.*, Alps-Himalaya-Timor-Peru.——FIG. 197,2. **H. geniculatus* (HAUER), Nor., Alps; *2a,b*, ×1; *2c*, ×2 (292*).

**Metatirolites** MOJSISOVICS, 1893 [**Am. foliaceus* DITTMAR, 1866]. Whorl section subquadrate, sides slightly divergent, venter broad, flattened; ventrolateral angle with prominent tubercles. Suture ceratitic (450). *Carn.*, Alps-Calif.——FIG. 197,3. **M. foliaceus* (DITT.); *3a,b*, ×1; *3c*, ×1.5 (292*).

**Epiceratites** DIENER, 1915 [**Am. elevatus* DITTMAR, 1866]. Involute, venter rounded, smooth; sides with weak radial projected ribs. Suture ceratitic (292). *Carn.-Nor.*, Alps-Greece.——FIG. 197,4. **E. elevatus* (DITT.), Carn., Alps; *4a,b*, ×1.5 (292*).

**Phormedites** MOJSISOVICS, 1893 [**P. juvavicus*; SD DIENER, 1915]. Like *Epiceratites* but with dense prorsiradiate ribs, bundled at umbilical edge, strongly projected forming deep adoral curve across venter (292). *Carn.-Nor.*, Alps-Sicily-Himalaya-Timor.——FIG. 197,6. **P. juvavicus*, Nor., Alps-Timor; *6a,b*, ×1 (292*).

**Martolites** DIENER, 1906 [**M. kraffti*]. Evolute, venter rounded, smooth siphonal band; sides with bifurcating ribs; a few oblique constrictions that cross venter; umbilical tubercles on outer volution. Suture ceratitic (488). *Nor.*, Himalaya.——FIG. 197,8. **M. kraffti*; *8a,b*, ×1; *8c*, ×2 (606*).

**Eremites** MOJSISOVICS, 1893 [**Trachyceras orientale* MOJS., 1882]. Evolute, smooth, whorls subquadrate, venter rounded; early volutions with 2 rows of ventral tubercles and rursiradiate ribs. Suture ceratitic (292). *Carn.*, Alps.——FIG. 197,1. *E. crassitesta* MOJS.; *1a,b*, ×1; *1c*, ×1.5 (292*).

## Family THISBITIDAE Spath, 1951

Evolute to involute, compressed, with median continuous keel; whorl sides with falcoid ribs, some constrictions on conch. Suture ceratitic, simple (488). *U.Trias.*

**Thisbites** MOJSISOVICS, 1893 [**T. agricolae*; SD DIENER, 1915]. Evolute to involute, whorl sides with single and bifurcating falcate ribs which terminate at ventrolateral nodes; venter with smooth keel. Suture simple, goniatitic to ceratitic (292). *Carn.-Nor.*, Alps-Sicily-Himalaya-Timor.——FIG. 198,3. **T. agricolae*, Carn., Alps; *3a,b*, ×1 (292*).

**Parathisbites** MOJSISOVICS, 1893 [**Am. scaphitiformis* HAUER, 1855; SD DIENER, 1915]. Like *Thisbites* but generally more involute, keel more prominent, ribs may cross venter. Suture ceratitic (488). *Nor.*, Alps-Himalaya-Timor-B.C.——FIG. 198,4. **P. scaphitiformis* (HAUER), Alps; *4a,b*, ×0.7; *4c*, ×1 (292*).

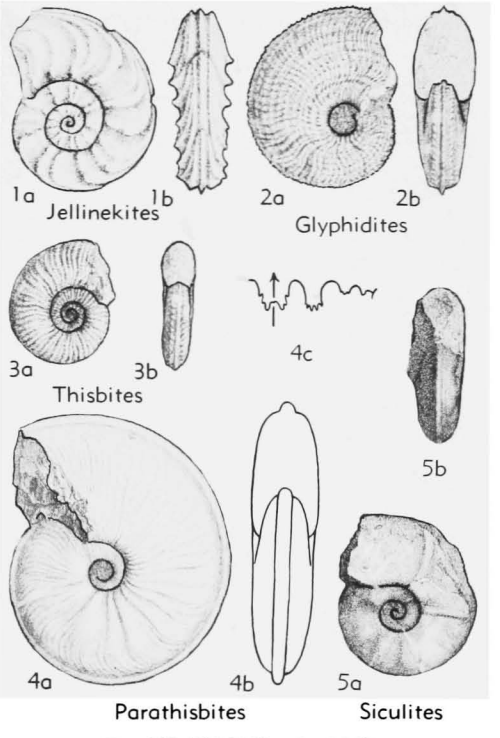



FIG. 198. Thisbitidae (p. L167).

**Glyphidites** MOJSISOVICS, 1893 [**G. docens*]. With serrated keel and granular ribs as in *Clydonites* (292). *Nor.*, Alps-Sicily.——FIG. 198,2. **G. docens*, Alps; *2a,b*, ×1.5 (292*).

**Jellinekites** DIENER, 1906 [**J. barnardi*; SD DIENER, 1915]. Venter tricarinate, marginal keels formed by junction of projected ends of lateral ribs; venter locally interrupted by constrictions; whorl sides with strong single or bifurcating ribs. Suture ceratitic (103). *Carn.-Nor.*, Himalaya-Timor.——FIG. 198,1. **J. barnardi*, Himalaya; *1a,b*, ×0.7 (103*).

?**Siculites** GEMMELLARO, 1904 [**S. dolomiticus*; SD DIENER, 1915]. More or less involute, compressed, venter arched with slight keel; with constrictions and in some species spiral striations. Suture ceratitic (488). *Carn.*, Sicily.——FIG. 198,5. **S. dolomiticus*; *5a,b*, ×1 (168*).

## Family NORIDISCITIDAE Spath, 1951

Evolute, compressed, discoidal, with truncated venter and sharp ventrolateral shoulders. Suture ceratitic (488). *U.Trias.*

**Noridiscites** SPATH, 1951 [**Ceratites viator* MOJSISOVICS, 1893]. *Nor.*, Alps.——FIG. 199,1. **N. viator* (MOJS.); *1a,b*, ×0.7; *1c*, ×1.5 (292*).

## Family DISTICHITIDAE Diener, 1920

Evolute, compressed, generally robust;

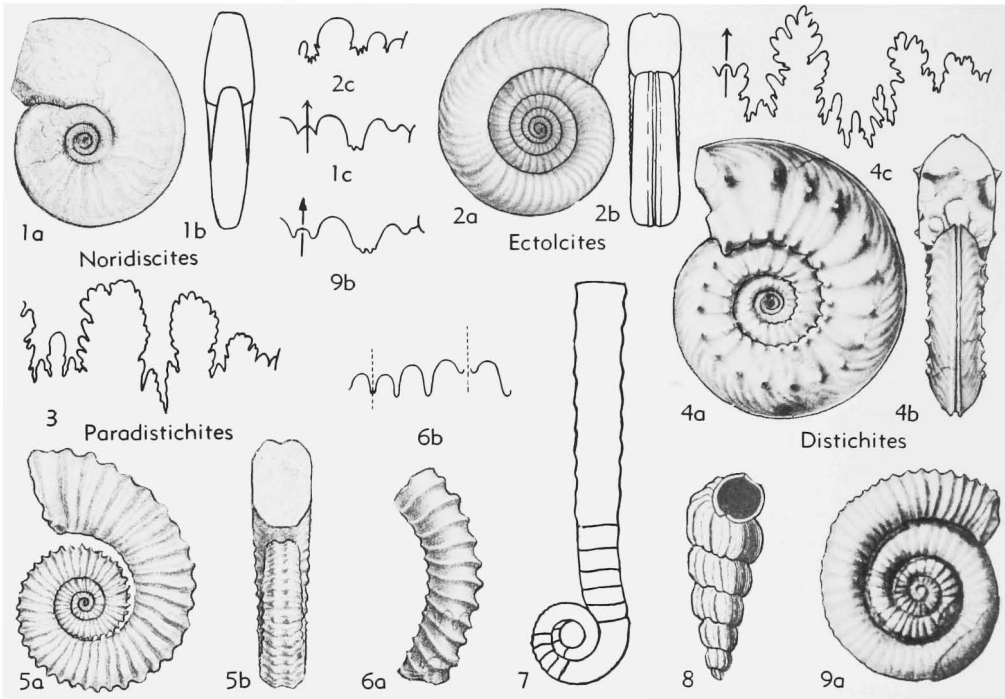



FIG. 199. Noridiscitidae, Distichitidae, Choristoceratidae, Cochloceratidae (p. L167-L169).

venter with median furrow bordered by smooth, low, continuous keel; whorl sides with ribs that bend sharply forward on ventrolateral area, ribs may be tuberculate. Suture ceratitic to ammonitic (488). *U. Trias.*

**Distichites** MOJSISOVICS, 1893 [**D. megacanthus;* SD DIENER, 1915]. Generally with row of nodes on umbilical and ventrolateral areas. Suture ammonitic (292). *Carn.-Nor.,* Alps-Himalaya-Timor-B.C.——FIG. 199,*4*. **D. megacanthus,* Nor., Alps-Timor; *4a,b,* ×0.25; *4c,* ×0.7 (115*).

**Paradistichites** DIENER, 1916 [**Distichites ectolcitiformis* DIENER, 1906]. Like *Distichites* but more involute, sculpture more delicate; saddles of suture less serrated (103). *U.Trias.,* Himalaya-Timor.——FIG. 199,*3*. **P. ectolcitiformis* (DIENER); ×1 (103*).

**Ectolcites** MOJSISOVICS, 1893 [**Am. pseudoaries* HAUER, 1849; SD DIENER, 1915]. Widely umbilicate, with subquadrate whorl section, rounded shoulders. Suture ceratitic to subammonitic (292). *Carn.-Nor.,* Alps-Himalaya-Timor.——FIG. 199,*2*. **E. pseudoaries* (HAUER), Nor., Alps; *2a,b,* ×0.5; *2c,* ×1 (292*).

## Family CHORISTOCERATIDAE Hyatt, 1900

Evolute ammonites that may become uncoiled or straight in outer volutions; whorl sides with radial ribs that pass over venter; ventral furrow present in some forms. Suture simple, ceratitic or goniatitic (488). *U. Trias.*

**Choristoceras** HAUER, 1865 [**C. marshi*]. Very evolute, outer whorl tending to uncoil, whorl section subquadrate, sides with strong radial ribs that may cross shallow ventral furrow; generally tubercles on ribs at ventrolateral area. Suture goniatitic to simple ceratitic (292). *Carn.-Rhaet.,* Alps-Timor-B.C.-Calif.-Nev.——FIG. 199,*5*. **C. marshi,* Rhaet., Alps; *5a,b,* ×1 (292*).

**Hannaoceras** TOMLIN, 1931 [*pro Polycyclus* MOJSISOVICS, 1893 (*non* LAMARCK, 1815; =*Smithoceras* HANNA, 1924, *non* DIENER, 1907)] [**Am. nasturtium,* DITTMAR, 1866] [=*Polysphinctoceras* SPATH, 1934 (obj.)]. Widely umbilicate, compressed, with radial ribs passing over venter, intercostal area narrow. Suture goniatitic or ceratitic. *Carn.-Nor.,* Alps-Sicily-Balkan-Cyprus-Timor-Calif.-Nev.

**H. (Hannaoceras).** Ribs become more widely spaced and thick on outer volution, no ventral furrow (292).

**H. (Sympolycyclus)** SPATH, 1951 [**Polycyclus nodifer* HYATT & SMITH, 1905]. More compressed and with shallow ventral groove at some stage (203). *Carn.*, Calif.——FIG. 199,*9*. **H. (S.) nodifer* (HYATT-S.); *9a*, ×1; *9b*, ×2 (203*).

**Peripleurites** MOJSISOVICS, 1893 [**Choristoceras (Peripleurites) roemeri*; SD DIENER, 1915]. Ventral groove only on inner whorls, ribs continuous across venter; conch not coiled in one plane, strongly uncoiled. Suture goniatitic (292). *Nor.*, Alps-Hung.——FIG. 199,*6*. **P. roemeri*, Alps; *6a*, ×1; *6b*, ×2 (292*).

**Rhabdoceras** HAUER, 1860 [**R. suessi*]. Straight or curved, only larval portion coiled; coarse ribs encircle conch. Suture goniatitic (292). *Nor.*, Alps-Sicily-Hung.-Indon.-Calif.-Peru.——FIG. 199,*7*. **R. suessi*, Alps-Sicily-Indon.-Peru; ×10 (641*).

## Family COCHLOCERATIDAE Hyatt, 1900

Turriliticones with radial ribs. Suture goniatitic (488). *U.Trias.*

**Cochloceras** HAUER, 1860 [**C. fischeri*] (292). *Nor.*, Alps-Timor.——FIG. 199,*8*. **C. fischeri*, Alps; ×1 (743*).

**Paracochloceras** MOJSISOVICS, 1893 [**Cochloceras canaliculatum* HAUER, 1860; SD DIENER, 1915]. Suture of coiling with smooth band, umbilical area generally smooth (292). *Nor.*, Alps.

## Superfamily TROPITACEAE Mojsisovics, 1875

[*nom. transl.* MOJS., 1896 (*ex* Tropitidae MOJS., 1875)]

Involute to evolute generally ornamented ammonoids with ribs and/or nodes. Venter may bear keel, be smooth, or crossed by ribs. Suture generally ammonitic but ceratitic or goniatitic in some offshoots. Body chamber long. *M.Trias.-U.Trias.*

### Family TROPITIDAE Mojsisovics, 1875

Conch involute to evolute, subspherical to discoidal, body chamber long; ventral keel and bordering furrows present, in some forms with keel appearing late; surface with ribs, nodes, spines or smooth. Suture generally ammonitic but may be ceratitic or goniatitic (488). *U.Trias.*

**Tropites** MOJSISOVICS, 1875 [**Am. subbullatus* HAUER, 1849; SD SMITH, 1904]. Whorl shape cadicone, venter broad, arched, with keel and bordering furrows; umbilical shoulder sharply rounded; umbilicus deep and wide; whorl sides with prorsiradiate ribs and umbilical nodes; final whorl contracting; spiral lines on shell. Suture ammonitic (450). *Carn.-Nor.*, Alps-Himalaya-Timor-Alaska-B.C.-Calif.-Nev.——FIG. 200,*6*. **T. subbullatus* (HAUER), Carn., Alps-Himalaya-Timor-Calif., *6a,b*, ×0.7; *6c*, ×1 (292*).

**Discotropites** HYATT & SMITH, 1905 [**Am. sandlingensis* HAUER, 1850] [=*Eutomoceras* MOJSISOVICS, 1879 (*non* HYATT, 1877)]. Involute compressed, discoidal, with acutely rounded venter and high hollow keel without bordering furrows; whorl sides with sigmoidal ribs, small umbilical tubercles and spiral lines. Suture ammonitic (203). *Carn.*, Alps-Sicily-Himalaya-Hung. - ?Indochina - Alaska-Calif.——FIG. 200,*3*. **D. sandlingensis* (HAUER), Alps-Sicily-Calif.; *3a-c*, ×0.5 (292*).

**Anatropites** MOJSISOVICS, 1893 [**Tropites (Anatropites) spinosus*; SD DIENER, 1915]. With spines instead of nodes on umbilical shoulder, at least on early whorls; conch more compressed and less extreme in cross section (292). *Carn.*, Alps-Sicily-Himalaya-Timor-Calif.——FIG. 200,*10*. **A. spinosus*, Alps; *10a,b*, ×1 (292*).

**Paratropites** MOJSISOVICS, 1893 [**Am. saturnus* DITTMAR, 1866; SD DIENER, 1915]. Involute, laterally compressed; mature and early stages similar (203). *Carn.*, Alps-Sicily-Italy-Yugo.-Hung.-Himalaya-Indochina-Timor-Calif.——FIG. 200,*9*. **P. saturnus* (DITTMAR), Alps; *9a,b*, ×1 (292*).

**Gymnotropites** HYATT & SMITH, 1905 [**Paratropites (Gymnotropites) americanus*]. Like *Paratropites* but with smooth shell (203). *Carn.*, Calif.

**Paulotropites** MOJSISOVICS, 1893 [**Am. janus* DITTMAR, 1866; SD DIENER, 1915]. No umbilical tubercles and with paulostome constriction on body chamber (292). *Carn.*, Alps-Sicily-Calif.——FIG. 200,*5*. **P. janus* (DITTMAR), Alps; *5a,b*, ×1 (292*).

**Microtropites** MOJSISOVICS, 1893 [**Am. galeolus* HAUER, 1860; SD DIENER, 1915]. Dwarfed, involute forms; sculpture tending to become obsolete; body chamber leaving regular spiral, becoming contracted (292). *Carn.*, Alps-Sicily-Calif.——FIG. 200,*4*. **M. galeolus* (HAUER), Alps; *4a,b*, ×1 (292*).

**Hoplotropites** SPATH, 1929 [*pro Margarites* MOJSISOVICS, 1889 (*non* GRAY, 1847)] [**Am. jokelyi* HAUER, 1855; SD DIENER, 1915]. Evolute, whorl section subrectangular, venter broad, rounded, with keel; whorl sides with spines on ribs at umbilical or ventral shoulder or both. Suture ammonitic (292). *Carn.*, Alps-Sicily-Himalaya-?Indochina-Timor-Alaska-Calif.——FIG. 200,*8*. **H. jokelyi* (HAUER), Alps-Sicily-Alaska-Calif.; *8a,b*, ×0.7; *8c*, ×0.3 (633*).

**Margaritropites** DIENER, 1916 [**Anatropites margaritiformis* DIENER, 1906]. Like *Hoplotropites* but with large true umbilical tubercles and furrows bordering keel very low (103). *Carn.*, Himalaya.——FIG. 200,*7*. **M. margaritiformis* (DIENER) *7a,b*, ×0.7 (103*).

**Timorotropites** DIENER, 1916 [**Tropites dubiosus* WELTER, 1914]. Involute, globose, venter arched; keel appearing late in ontogeny; whorl sides with

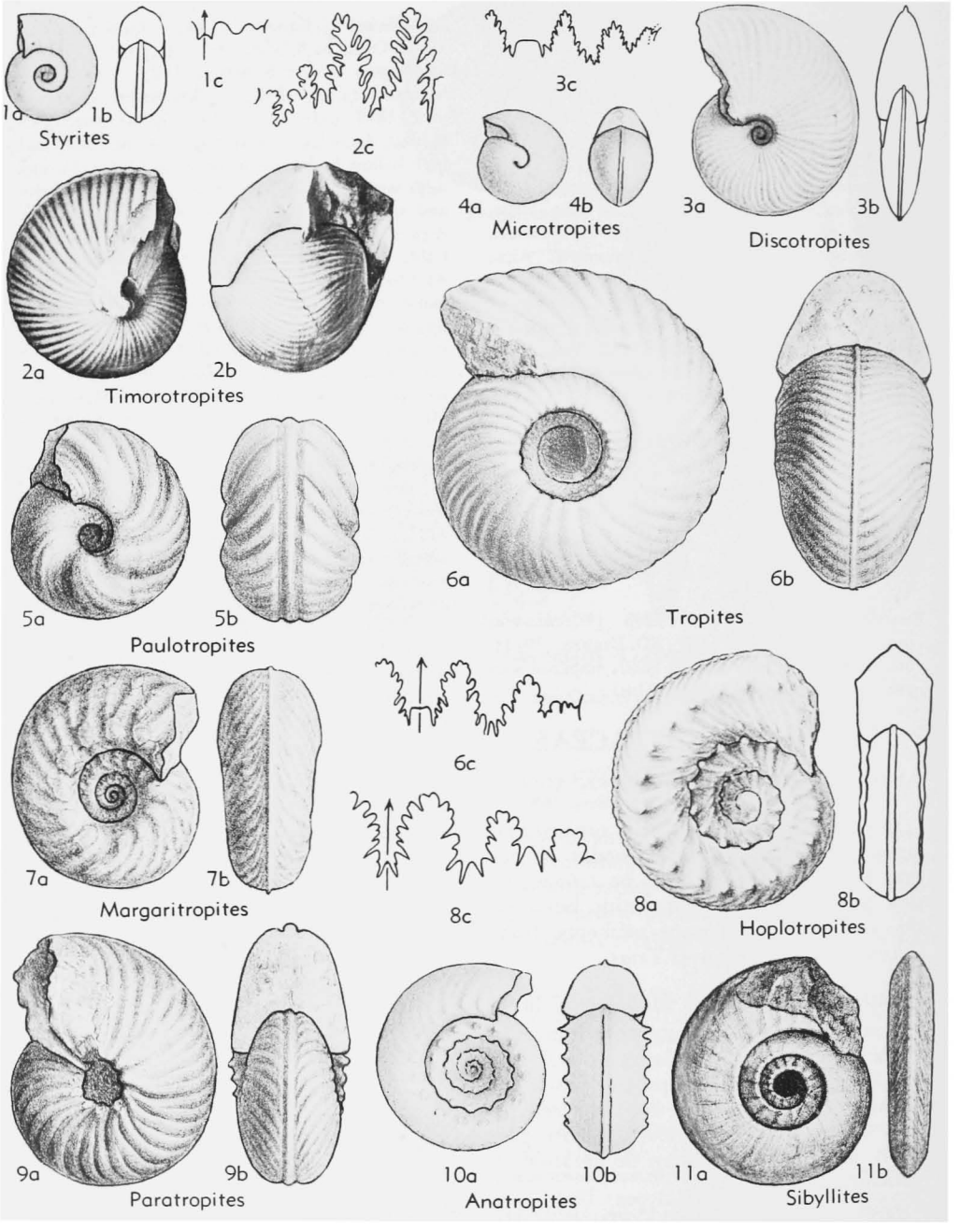



FIG. 200. Tropitidae (p. L169-L171).

radial single and bifurcating ribs and spiral lines. Suture ammonitic but more digitate than in typical tropitids (558). *U.Trias.*, Timor.——FIG. 200,*2*. **T. dubiosus* (WELTER); *2a,b*, ×0.7; *2c*, ×1 (558*).

**Styrites** MOJSISOVICS, 1893 [**S. tropitiformis*; SD DIENER, 1915]. Smooth, small, evolute, compressed, discoidal; venter acute with prominent keel; body chamber contracting. Suture goniatitic (292). *Carn.*, Alps-Hung.-Sicily-Timor.——FIG. 200,*1*. **S. tropitiformis*, Alps; *1a,b*, ×1; *1c*, ×2 (292*).

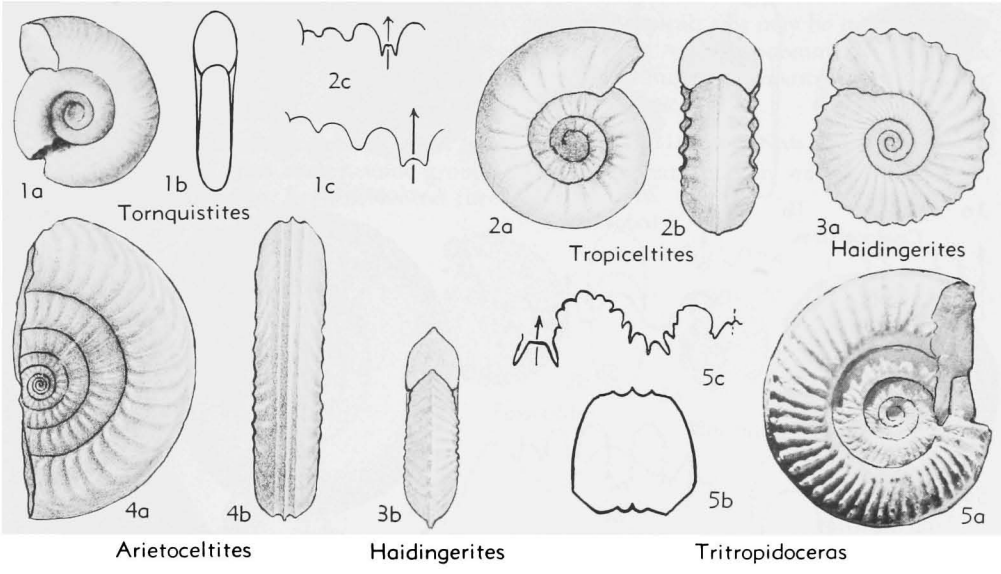



FIG. 201. Tropiceltitidae (p. L171).

**Sibyllites** MOJSISOVICS, 1893 [**S. tenuispinatus;* SD HYATT & SMITH, 1905]. Evolute, compressed, inner whorls with nodes and ribs on whorl sides, venter rounded; venter on outer whorl becoming acute with a blunt keel, commonly combined with decline in ornamentation. Suture ammonitic (292). *Carn.*, Alps.——FIG. 200,*11*. **S. tenuispinatus* (MOJS.); *11a,b*, ×1 (292*).

## Family TROPICELTITIDAE Spath, 1951

Widely umbilicate, allied to Tropitidae, with ventral keel generally on smooth venter; whorl sides with ribs and some nodes; body chamber long. Suture usually simple (488). *U.Trias.*

**Tropiceltites** MOJSISOVICS, 1893 [**T. rotundus;* SD HYATT & SMITH, 1905]. Whorl section subquadrate, venter broadly rounded, smooth, with median keel but no aligning furrows; whorl sides with radial ribs that bend adorally on ventral shoulder. Suture goniatitic (292). *Carn.*, Alps-Calif.——FIG. 201,*2*. **T. rotundus*, Alps; *2a,b*, ×1; *2c*, ×1.5 (292*).

**Arnioceltites** MOJSISOVICS, 1893 [**Am. caducus* DITTMAR, 1866; SD DIENER, 1915]. Like *Tropiceltites* but lateral ornamentation becoming obsolescent on outer whorl (292). *Carn.-Nor.*, Alps-Sicily-?Calif.

**Arietoceltites** DIENER, 1916 [**Tropiceltites arietitoides* DIENER, 1906]. Very evolute forms with lateral sculpture strong and deep furrows bordering ventral keel. Suture simple, ceratitic (103). *Carn.*, Himalaya-Alps.——FIG. 201,*4*. **A. arietitoides* (DIENER), Himalaya; *4a,b*, ×0.5 (103*).

**Tritropidoceras** SCHENK, 1935 [**T. packardi*]. Whorl section subquadrate, with tuberculate prorsiradiate ribs that curve sharply adorally on ventral shoulder; venter with prominent keel bordered by furrows. Suture weakly ammonitic (488). *Carn.*, Ore.——FIG. 201,*5*. **T. packardi; 5a*, ×0.7; *5b*, ×1; *5c*, ×1.5 (699*).

**Haidingerites** MOJSISOVICS, 1893 [**Am. acutinodis* HAUER, 1860]. Evolute, discoidal, with convergent whorl sides; venter acute and with spirally elongated nodes; whorl sides with radial ribs that terminate at ventral nodes (292). *Carn.*, Alps.——FIG. 201,*3*. **H. acutinodis* (HAUER); *3a,b*, ×1 (292*).

**Tornquistites** HYATT & SMITH, 1905 [**T. evolutus*]. Evolute, compressed, whorl sides flattened, venter narrowly rounded; with distinct keel on inner whorls but only faint thin elevation on outer whorl; ornamented with fine sigmoidal ribs that cross venter. Suture goniatitic to weakly ceratitic (203). *Carn.*, Calif.——FIG. 201,*1*. **T. evolutus; 1a,b*, ×1; *1c*, ×3 (203*).

## Family CELTITIDAE Mojsisovics, 1893

Widely umbilicate with radial or prorsiradiate ribs that may or may not pass over the venter; body chamber very long. Suture generally simple (488). *M.Trias.-U.Trias.*

**Celtites** MOJSISOVICS, 1882 [**Trachyceras epolensis* MOJS., 1878; SD HYATT & SMITH, 1905]. Whorl section subquadrate, venter arched, smooth; sides with numerous fine prorsiradiate ribs. *M.Trias. (Ladin.)*, Alps.——FIG. 202,*4*. **C. epolensis* (MOJS.); ×1 (293*).

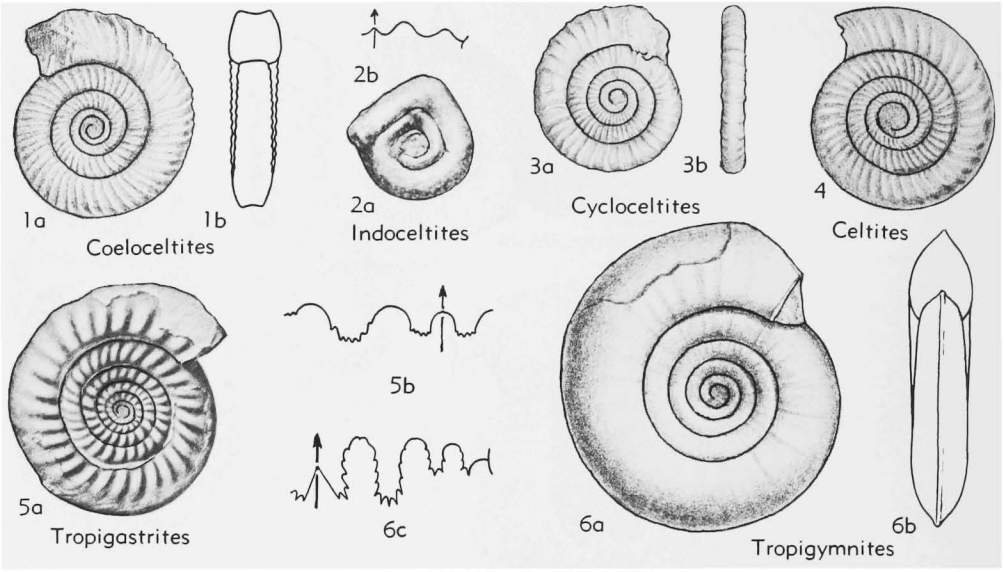



FIG. 202. Celtitidae (p. L171-L172).

**Orthoceltites** SPATH, 1951 [**Goniatites buchii* KLIPSTEIN, 1843 (*non* DE VERNEUIL; =*Aganides klipsteini* D'ORBIGNY, 1850)]. Like *Celtites* but with radial ribs and more rapid coiling of conch (488). *U.Trias.(Carn.)*, Alps.

**Cycloceltites** MOJSISOVICS, 1893 [**Celtites (Cycloceltites) arduini*; SD DIENER, 1915]. With fine and close ribs continuous across venter except in young; also with regular flared ribs. *U.Trias.(Carn.-Nor.)*, Alps.——FIG. 202,*3*. **C. arduini*, Nor., Alps; *3a,b*, ×0.7 (292*).

**Otoceltites** DIENER, 1916 [**Celtites perauritus* DIENER, 1908]. With ribs interrupted along venter by narrow, smooth zone and with distinct flared ribs that pass over venter uninterrupted. Suture goniatitic. *M.Trias.(Ladin.)*, Himalaya.

**Indoceltites** DIENER, 1919 [**Celtites trigonalis* DIENER, 1908]. With trigonal coiling, faint ornamentation confined to apertural end of outer whorl. Suture goniatitic. *M.Trias.(Ladin.)*, Himalaya.——FIG. 202,*2*. **I. trigonalis* (DIENER); *2a*, ×1; *2b*, ×1.5 (105*).

**Coeloceltites** SPATH, 1951 [**Am. rectangularis* HAUER, 1860]. Venter and sides flattened; venter with longitudinal striations, tending to become concave and bordered by distinct subtuberculate ventrolateral edges. *U.Trias.(Carn.)*, Balkan.——FIG. 202,*1*. **C. rectangularis* (HAUER); *1a,b*, ×1 (292*).

**Tropigastrites** SMITH, 1914 [**T. trojanus*]. Widely umbilicate, whorl section depressed to compressed, whorl sides convergent, venter tending to become acute; with umbilical prorsiradiate ribs. Suture ceratitic or weakly ammonitic (449). *M.Trias.(Anis.)*, Nev.-Alps-Balkan.——FIG. 202,*5*. **T. trojanus*, Nev.; *5a*, ×0.7; *5b*, ×2 449*).

**Tropigymnites** SPATH, 1951 [**Sibyllites planorbis* HAUER, 1896]. More compressed than *Tropigastrites*, venter carinate, whorl sides with weak radial ribs. *M.Trias.(Anis.)*, Alps-Balkan-Himalaya-Nev.——FIG. 202,*6*. **T. planorbis* (HAUER), Yugo.; *6a,b*, ×0.7; *6c*, ×1 (633*).

## Family METASIBIRITIDAE Spath, 1951

Small, evolute ammonites derived from Celtitidae, with bifurcating ribs that cross venter, generally tuberculate. Suture simple, ceratitic to goniatitic (488). *U.Trias.*

**Metasibirites** MOJSISOVICS, 1896 [**Am. spinescens* HAUER, 1855]. Whorl section rounded, generally depressed, venter arched; with bifurcating ribs and usually umbilical nodes (292). *Nor.*, Alps-Peru.——FIG. 203,*2*. **M. spinescens* (HAUER), Alps; *2a,b*, ×1; *2c*, ×2 (292*).

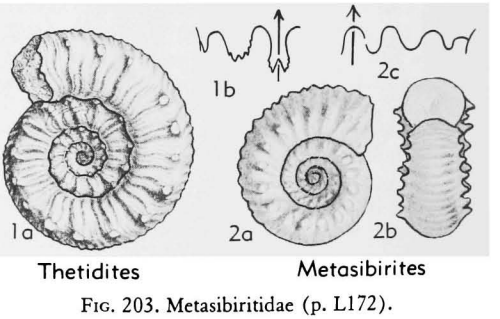



FIG. 203. Metasibiritidae (p. L172).

**Thetidites** MOJSISOVICS, 1896 [**T. huxleyi*; SD DIENER, 1915]. Differs from *Metasibirites* in that ribs bifurcate at ventrolateral nodes rather than

lower on whorl side. Suture simple, ceratitic (295). *Nor.*, Himalaya-Timor.——Fig. 203,*1*. **T. huxleyi*, Himalaya; *1a*, ×0.7; *1b*, ×1 (295*).

## Family HALORITIDAE Mojsisovics, 1893

Subglobose, involute, commonly with lateral ribs that may cross venter, some groups also with nodes on ribs; keels or ventral furrows not typical; ribs may be interrupted on venter; last volution commonly excentric. Suture ammonitic, ceratitic, or goniatitic (488). *U.Trias*.

### Subfamily HALORITINAE Mojsisovics, 1893

Spiral ornamentation weak or absent. *U. Trias*.

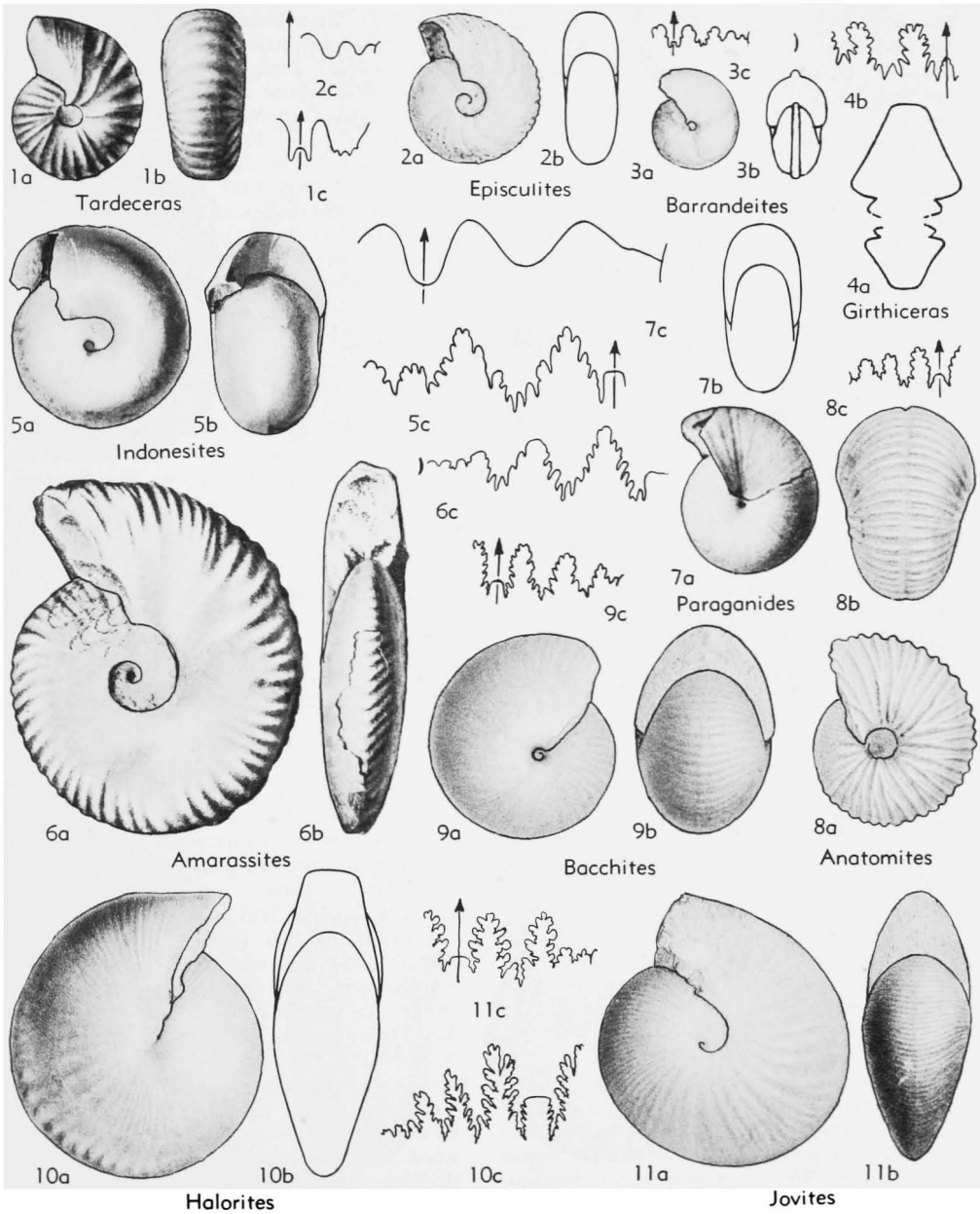



Fig. 204. Haloritidae (p. L174-L176).

**Halorites** MOJSISOVICS, 1879 [**Am. ramsaueri* HAUER, 1846; SD HYATT & SMITH, 1905]. Involute, compressed, subglobose, venter rounded, sides convex; with radial ribs or rows of tubercles diagonal across shell; body chamber long, contracted, excentric. Suture ammonitic (292). *Nor.*, Alps-Sicily-Himalaya-Timor-Calif.——FIG. 204,*10*. **H. ramsaueri* (HAUER), Alps; *10a,b*, ×0.3; *10c*, ×0.7 (292*).

**Homerites** MOJSISOVICS, 1893 [**Am. semiglobosus* HAUER, 1855; SD HYATT & SMITH, 1905]. Small, involute, globose, with excentric outer volution; phragmocone like *Halorites*, body chamber with slight ventral keel and radial dichotomous ribs that usually terminate at spines on ventral shoulder. Suture subammonitic (292). *Carn.*, Alps-Calif.——FIG. 205,*2*. **H. semiglobosus* (HAUER); *2a,b*, ×0.7 (633*).

**Jovites** MOJSISOVICS, 1893 [**Tropites dacus* MOJS., 1875; SD DIENER, 1915]. Like *Halorites* but with faint keel-like ridge on venter and fewer elements in suture (292). *Carn.-Nor.*, Alps-Sicily-Balkan-Himalaya-Timor-Calif.——FIG. 204,*11*. **J. dacus* (MOJS.), Carn., Alps; *11a,b*, ×0.5; *11c*, ×1.5 (292*).

**Bacchites** SMITH, 1927 [**Juvavites bacchus* MOJSISOVICS, 1893]. Subspherical, with closed umbilicus, surface almost smooth but with faint transverse ribs, vestigial constrictions, and faint threadlike keel ridge. Suture ammonitic (450). *Carn.*, Alps-Timor-Calif.——FIG. 204,*9*. **B. bacchus* (MOJS.); *9a,b*, ×0.7; *9c*, ×1 (292*).

**Amarassites** WELTER, 1914 [**A. egrediens;* SD DIENER, 1915]. Like *Halorites* but more compressed, umbilicus more open, excentric; venter fastigate, sigmoidal ribs that cross venter (558). *Nor.*, Timor-Alps.——FIG. 204,*6*. **A. egrediens*, Timor; *6a,b*, ×0.7; *6c*, ×1 (558*).

**Indonesites** WELTER, 1914 [**I. dieneri*]. Very involute, inflated, with broad rounded venter and faint keel; with faint ribs, outer volution excentric. Suture degenerate (558). *U.Trias.*, Timor.——FIG. 204,*5*. **I. dieneri; 5a,b*, ×0.5; *5c*, ×1 (558*).

**Juvavites** MOJSISOVICS, 1879 [**Am. ehrlichi* HAUER, 1855; SD HYATT & SMITH, 1905]. Involute, subglobose, some flattened to subdiscoidal, venter rounded; whorl sides with dichotomous ribs that pass over venter but may be interrupted along venter. Suture ammonitic (292). *Carn.-Nor.*, Alps-Sicily-Himalaya-Timor-Indochina - Alaska - B. C. - Calif.——FIG. 205,*5*. **J. ehrlichi* (HAUER), Nor., Alps; *5a,b*, ×0.7 (633*).

**Anatomites** MOJSISOVICS, 1893 [**Juvavites (Anatomites) rotundus;* SD DIENER, 1915]. Like *Juvavites* but with periodic constrictions that pass over venter; ribs interrupted on venter by slight furrow (292). *Carn.-Nor.*, Alps-Sicily-Balkan-Himalaya-Timor-Kotelny-Alaska-Calif.-Mex.——FIG. 204,*8*. **A. rotundus*, Carn., Alps; *8a-c*, ×1 (292*).

**Griesbachites** MOJSISOVICS, 1896 [**Am. medleyanus* STOLICZKA, 1865]. Like *Juvavites* but with clavi or nodes on ventrolateral area of the phragmocone; no constrictions (295). *Carn.-Nor.*, Alps-Himalaya-Timor-B.C.——FIG. 205,*12*. **G. medleyanus*, Carn., Himalaya; *12a,b*, ×0.5 (295*).

**Molengraaffites** WELTER, 1914 [**Juvavites (Griesbachites) hanni* MOJS., 1896; SD DIENER, 1915]. Like *Griesbachites* but with constrictions (558). *Carn.-Nor.*, Timor-Himalaya.

**Gonionotites** GEMMELLARO, 1905 [**G. italicus;* SD DIENER, 1915]. Inner volutions like *Juvavites*, body chamber inflated, smooth, with only traces of ribs (168). *Carn.-Nor.*, Sicily-Alps-Himalaya-Timor-B.C.-Calif.——FIG. 205,*3*. *G. megasthenis* DIENER, Nor., Timor; *3a,b*, ×0.5 (115*).

**Heinrichites** DIENER, 1920 [**H. paulckei*]. Like *Gonionotites* but developing fine spiral ornamentation (488). *Carn.-Nor.*, Alps.

**Guembelites** MOJSISOVICS, 1896 [**Heraclites (Gümbelites) jandianus*]. With smooth flattened venter; whorl sides with sigmoidal ribs that end at clavi on ventral shoulder; body chamber short. Suture ammonitic (295). *Nor.*, Himalaya-Timor.——FIG. 205,*11*. **G. jandianus*, Himalaya; *11a,b*, ×1 (295*).

**Parajuvavites** MOJSISOVICS, 1896 [**P. blanfordi;* SD DIENER, 1915]. Like *Juvavites* but umbilicus of last volution excentric (295). *Nor.*, Himalaya.——FIG. 205,*4*. **P. blanfordi;* ×0.5 (295*).

**Malayites** WELTER, 1914 [**M. informis;* SD DIENER, 1915]. Like *Juvavites* but with spiral lineation (558). *Carn.-Nor.*, Timor-Alps-Sicily.

**Dimorphites** MOJSISOVICS, 1893 [**Juvavites (Dimorphites) selectus;* SD DIENER, 1915]. Compressed, involute, discoidal, with narrow flattened venter, distinct angular ventral shoulders; whorl sides with sigmoidal ribs that may or may not cross venter; constrictions only on inner whorls (292). *Carn.*, Alps-Sicily-Greece-Timor.——FIG. 205,*7*. **D. selectus*, Alps; *7a,b*, ×0.7 (292*).

**Indojuvavites** DIENER, 1916 [**Juvavites angulatus* DIENER, 1908]. Like *Dimorphites* but venter rounded; sigmoidal ribs on whorl sides that meet on venter in sharp V's pointing adorally (105). *Nor.*, Himalaya-Timor.

**Miltites** MOJSISOVICS, 1893 [**M. rastli;* SD DIENER, 1915]. More or less involute, discoidal, venter rounded, whorl sides with weak flexuous ribs that are interrupted along mid-part of venter; tubercles on umbilical edge in early volutions (292). *Carn.*, Alps-Timor.——FIG. 205,*9*. **M. rastli*, Alps; *9a,b*, ×0.7 (292*).

**Barrandeites** MOJSISOVICS, 1893 [**Am. tubina* DITTMAR, 1866]. Small forms, very involute, venter broadly rounded and with keel on outer whorl; whorl sides smooth except for prominent constrictions. Suture ceratitic (292). *Carn.*, Alps-Sicily.——FIG. 204,*3*. **B. tubina* (DITTMAR), Alps; *3a,b*, ×1; *3c*, ×1.5 (292*).

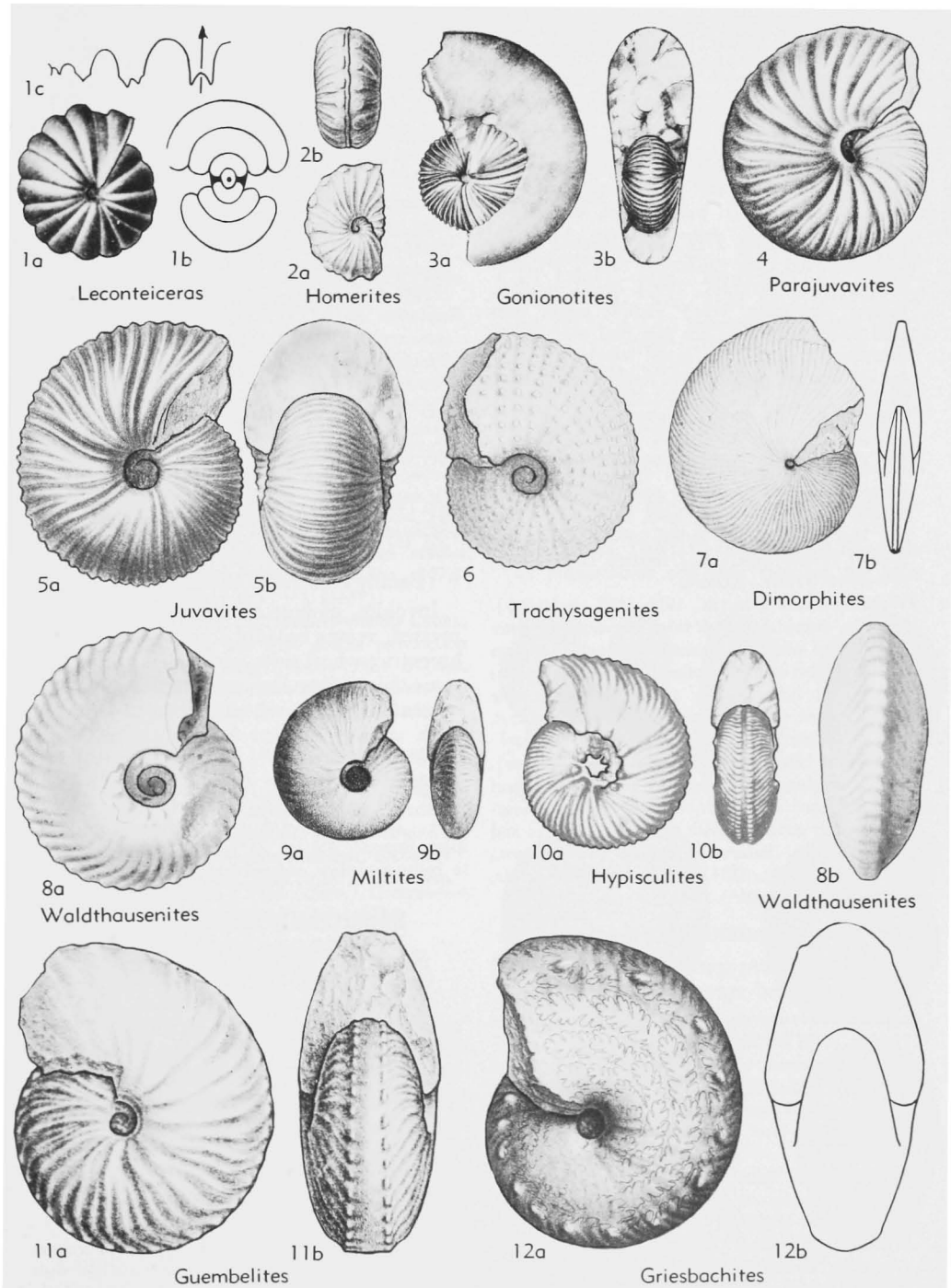



FIG. 205. Haloritidae (p. L174-L176).

**Paraganides** HYATT & SMITH, 1905 [**P. californicus*]. Small involute, compressed, with flattened whorl sides, weak radial ribs that pass straight over rounded venter. Suture goniatitic (203). *Carn.*, Calif.——FIG. 204,*7*. **P. californicus; 7a,b*, ×2; *7c*, ×5 (203*).

**Tardeceras** HYATT & SMITH, 1905 [**T. parvum*]. Like *Paraganides* but venter flatter, whorl sides with umbilical nodes giving rise to ribs that weakly cross venter. Suture ceratitic, simple (203). *Carn.*, Calif.——FIG. 204,*1*. **T. parvum; 1a,b*, ×2; *1c*, ×4 (203*).

?**Leconteiceras** SMITH, 1914 [*pro Leconteia* HYATT & SMITH, 1905 (*non* CHAMPION, 1893)] [**Leconteia californica* HYATT-S., 1905]. Small, involute, globose ammonites, venter arched; whorl sides with broad low radial ribs that pass over venter, intercostal area narrow; inner whorls with low median furrow aligned with small nodes. Suture ceratitic (203). *Carn.*, Calif.——FIG. 205,*1*. **L. californicum* (HYATT-S.); *1a,b*, ×1; *1c*, ×2 (203*).

?**Pseudohalorites** YABE, 1920 [**P. subglobosus*]. Subglobose, involute, lateral areas convex, venter broadly rounded; surface with radial bifurcating ribs that cross venter. Suture ceratitic with undivided ventral lobe and 2 serrated lateral lobes. *?Perm.* or *?Trias.*, S.China.

?**Waldthausenites** WELTER, 1914 [**W. malayicus*]. Involute discoidal, whorl sides convergent, venter narrow and with keel formed by angular junction of lateral ribs; umbilical tubercles on early whorls; with spiral lines. Suture ammonitic but simple (558). *Carn.-Nor.*, Timor-Alps.——FIG. 205,*8*. **W. malayicus*, Nor., Timor; *8a,b*, ×1 (558*).

?**Girthiceras** DIENER, 1909 [**G. pernodosum*]. Small, involute, with flattened convergent whorl sides, flattened venter; umbilical and ventral shoulders sharply rounded; with umbilical tubercles and radiating ribs. Suture ammonitic (488). *Carn.*, Himalaya.——FIG. 204,*4*. **G. pernodosum; 4a*, ×1; *4b*, ×1.5 (606*).

### Subfamily SAGENITINAE Spath, 1951

With prominent spiral ornamentation and more subdivided suture. *U.Trias.*

**Sagenites** MOJSISOVICS, 1879 [**Am. reticulatus* HAUER, 1849; SD SMITH, 1904]. Subglobose, somewhat compressed, involute, venter arched; whorl sides with radial folds or ribs that pass over venter; also spiral ornamentation. Suture ammonitic (203). *Carn.-Nor.*, Alps-Sicily-Timor-Himalaya-Calif.-Peru.

**S. (Sagenites).** Spiral ornamentation consisting of lines or ridges only (203). *Carn.-Nor.*, Alps-Sicily-Timor-Himalaya-Calif.-Peru.

**S. (Trachysagenites)** MOJSISOVICS, 1893 [**Am. erinaceus* DITTMAR, 1866; SD HYATT & SMITH, 1905]. Spiral ornamentation consisting of short spines in regular rows on ribs (203). *Carn.*, Alps-Sicily-Balkan-Himalaya-Timor-Calif.——FIG. 205,*6*. **S. (T.) erinaceus* (DITTMAR), Alps; ×0.7 (292*).

### Subfamily EPISCULITINAE Spath, 1951

With simplified suture and uncoiling of body chamber. *U.Trias.*

**Episculites** SPATH, 1951 [**Am. decrescens* HAUER, 1855] [=*Isculites* DIENER, 1916 (*non* MOJS., 1886)]. Small, involute, compressed, with arched venter; whorl sides with projected ribs that pass over venter and constrictions. Suture goniatitic (488). *Nor.*, Alps-?Timor-B.C.——FIG. 204,*2*. **E. decrescens* (HAUER), Alps; *2a,b*, ×1; *2c*, ×1.5 (292*).

**Euisculites** SPATH, 1951 [**Isculites bittneri* GEMMELLARO, 1904]. Like *Episculites* but with ammonitic suture (488). *Carn.-Nor.*, Sicily-Alps-Himalaya-?Timor.

**Hypisculites** SPATH, 1951 [**Isculites dieneri* PAKUCKAS, 1928]. Like *Episculites* but with umbilical nodes and lateral ribs that end at nodes on ventrolateral area aligning smooth median band on venter. Suture goniatitic (488). *Carn.*, Timor-B.C.——FIG. 205,*10*. **H. dieneri* (PAK.); *10a,b*, ×1 (674*).

## Family DIDYMITIDAE Haug, 1894

Involute, globose conch, somewhat compressed, venter broadly arched, last volution excentric; whorl sides with growth lines and some faint ribs; low median keel may be present on outer whorl. Suture ammonitic with saddles divided by prominent lobule (488). *U.Trias.*

**Didymites** MOJSISOVICS, 1875 [**Am. globus* QUENSTEDT, 1849; SD DIENER, 1915] [=*Paradidymites, Timorodidymites* DIENER, 1916]. *Nor.*, Alps-Sicily-Himalaya-Afghan.-Timor.——FIG. 206,*1*. *D. quenstedti* MOJS., Alps; *1a,b*, ×0.7; *1c*, ×1 (292*).

## Superfamily LOBITACEAE Mojsisovics, 1882

[*nom. transl.* HYATT, 1900 (*ex* Lobitinae MOJS., 1882)]

Involute, generally subglobose, with excentric last volution, contracted body chamber. Suture with 2 bifid lateral lobes in which median division becomes very large. An isolated group, probably descended from Arcestidae (488). *M.Trias.-U.Trias.*

## Family LOBITIDAE Mojsisovics, 1882

Characters of superfamily. *M.Trias.-U. Trias.*

**Lobites** MOJSISOVICS, 1875 [**Clydonites ellipticus* HAUER, 1860; SD MOJS., 1902]. Whorl sides with low radial ribs that cross venter. Suture goniatitic (292). *M.Trias.(Ladin.)-U.Trias.(Carn.)*, Alps-

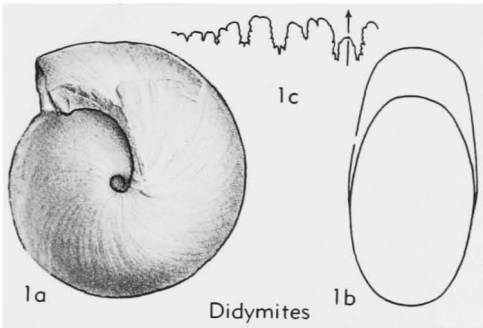



FIG. 206. *Didymites quenstedti* MOJSISOVICS, U.Trias. (Nor.), Alps; *1a,b*, ×0.7; *1c*, ×1 (p. L176).

Balkan-AsiaM.-Himalaya-B.C.-Nev.——FIG. 207, *2*. **L. ellipticus* (HAUER), Carn., Alps; *2a,b*, ×1; *2c*, ×1.5 (292*).

**Paralobites** MOJSISOVICS, 1902 [**Gon. pisum* MÜNSTER, 1841]. Like *Lobites* but conch smooth and inner whorls with constrictions (292). *U.Trias.(Carn.)*, Alps-Himalaya.

**Psilobites** RENZ, 1911 [**Lobites (Psilolobites) argolicus*]. Like *Paralobites* but with no constrictions and simple pointed lobes and rounded saddles (365). *U.Trias.(Carn.)*, Balkan.——FIG. 207,*4*. **P. argolicus*, Greece; *4a,b*, ×1 (365*).

**Coroceras** HYATT, 1877 [**Clydonites monilis* LAUBE, 1869]. Like *Lobites* but with double constriction on body chamber forming 2 hoods (292). *U.Trias.(Carn.)*, Alps-Balkan-Himalaya-Timor-Nev.——FIG. 207,*1*. **C. monilis* (LAUBE), Alps; *1a,b*, ×1 (292*).

**Indolobites** RENZ, 1911 [**Clydonites oldhamianus* STOLICZKA, 1865]. With incipient subdivisions of lobes (365). *?M.Trias.*, Himalaya.——FIG. 207,*3*. **I. oldhamianus* (STOL.); *3a,b*, ×1 (101*).

**Orestites** RENZ, 1911 [**O. frechi*]. Smooth, with suture lobes trifid to irregular, weakly toothed at base and sides (365). *U.Trias.(Carn.)*, Greece.——FIG. 207,*5*. *O. pelopsi* RENZ; ×1.5 (687*).

## Superfamily ARCESTACEAE Mojsisovics, 1875

[*nom. transl.* MOJS., 1896 (*ex* Arcestidae MOJS., 1875)]

Typically involute, smooth, subglobular shells with complex ammonitic sutures, saddles phylloid in some groups; body chamber typically long, commonly with modified apertures. Principal families very abundant, long-ranging; group probably derived from Parannitidae along with the Ptychitidae. *M. Trias.-U.Trias.*

### Family ARCESTIDAE Mojsisovics, 1875

Smooth many-whorled ammonites with long body chambers and modified peristomes; constrictions and flared ribs may be present. Suture ammonitic, lobes and saddles triangular, septa closely spaced (488). *M.Trias.-U.Trias.*

**Arcestes** SUESS, 1865 [**Am. galeiformis* HAUER; 1850 (*pro Am. galeatus* HAUER, 1846; *non* VON BUCH); SD MOJS., 1893]. Characters of family. *M.Trias.(Anis.)-U.Trias.(Rhaet.)*, cosmop.

**A. (Arcestes)** [=*Gonarcestes* DIENER, 1919; *Rhaetites* HYATT, 1900]. Periodic constrictions confined to phragmocone (292). *U.Trias.(Carn.-Rhaet.)*, cosmop.——FIG. 208,*1d,e*. *A. (A.) intuslabiatus* MOJS., Nor., Alps; *1d*, ×0.7; *1e*, ×1 (743*).——FIG. 208,*1c*. *A. (A.) gigantogaleatus* MOJS., Nor., Alps; ×0.25 (584*).——FIG. 208,*1a*. *A. (A.) pinacostomus* DIENER, Carn., Alps; ×0.5 (584*).——FIG. 208,*1b*. *A. (A.) colonus* MOJS., Carn., Alps; ×0.5 (584*).

**A. (Anisarcestes)** KITTL, 1908 [**Anisarcestes subdimidatus*]. Smooth, globose inner whorls, with radial ridges on body chamber, strongest on venter; umbilicus open (488). *U.Trias.(Carn.)*, Alps-Balkan-?Nev.

**A. (Pararcestes)** MOJSISOVICS, 1893 [**Arcestes sublabiatus* MOJS., 1875; SD DIENER, 1915] [=*Galeites* ROLLIER, 1909]. Constrictions and flared ribs on phragmocone and body chamber, the latter

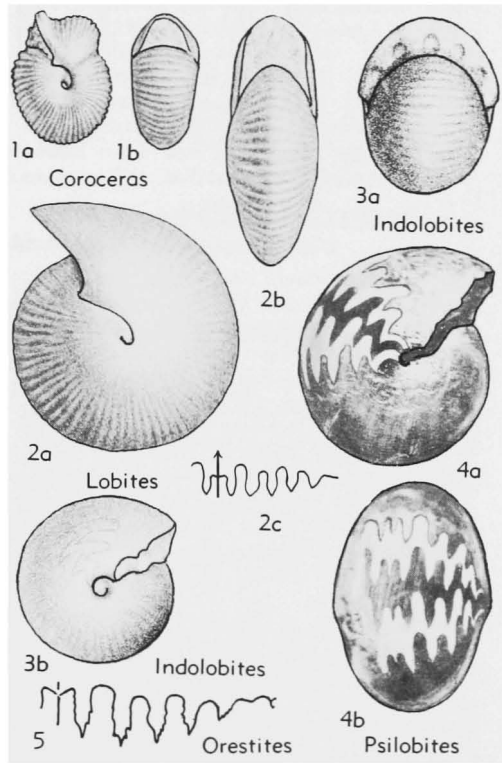



FIG. 207. Lobitidae (p. L176-L177).

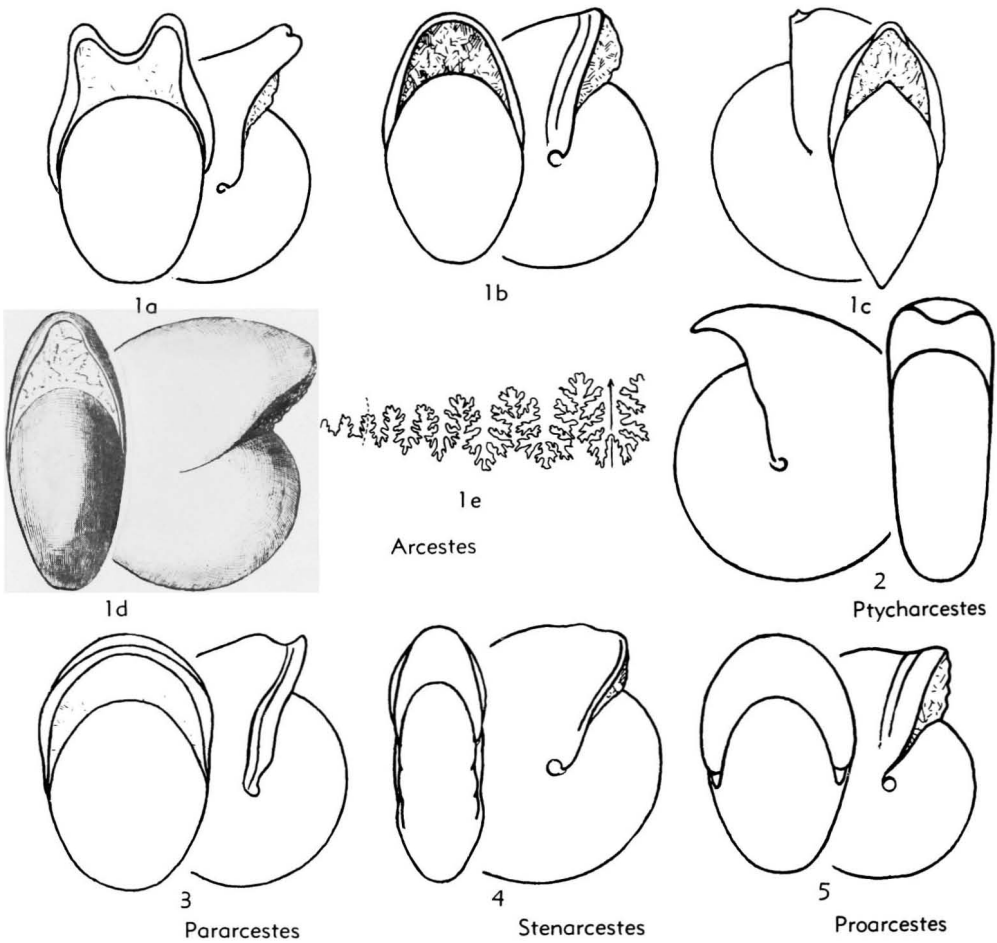



FIG. 208. Arcestidae (p. L177-L178).

also modified; umbilicus closed by callus (292). *M.Trias.(Anis.)-U.Trias.(Carn.)*, Alps - Balkan - Himalaya-Timor.——FIG. 208,*3*. *A. (P.) kerneri* DIENER, Carn., Alps; ×0.5 (584*).

**A. (Proarcestes)** MOJSISOVICS, 1893 [**Arcestes bramantei* MOJS., 1869; SD HYATT & SMITH, 1905]. Constrictions and flared ribs on phragmocone and body chamber similar (292). *M.Trias.(Anis.)-U.Trias.(Carn.)*, Alps - Balkan - Sicily - Himalaya-Timor-Kotelny-Alaska-Calif.-Nev. —— FIG. 208,*5*. *A. (P.) gibbus* HAUER, Anis., Yugo.; ×0.5 (584*).

**A. (Ptycharcestes)** MOJSISOVICS, 1893 [**A. (P.) rugosus*]. With radial ribbing on body chamber (292). *U.Trias.(Carn.-Nor.)*, Alps.——FIG. 208, *2*. *A. (P.) heinrichi* DIENER; ×1 (709).

**A. (Stenarcestes)** MOJSISOVICS, 1895 [**Am. subumbilicatus* HAUER, 1846]. Discoidal, resembling *Joannites* in shape but with deepened umbilicus surrounded by spiral depression or mere dimples (488). *U.Trias.(Carn.-Nor.)*, Alps-Sicily-Himalaya-Timor-N.Caled.——FIG. 208,*4*. *A. (S.) rotulaeformis* GEMMELLARO, Sicily; ×0.5 (584*).

## Family JOANNITIDAE Mojsisovics, 1882

Suture ammonitic, generally curved anteriorly and with bifid saddles. Body chamber long, conch compressed, discoidal, with constrictions or strigations common (488). *M. Trias.-U.Trias.*

**Joannites** MOJSISOVICS, 1879 [**Nautilus cymbiformis* WULFEN, 1793]. Very involute, surface smooth, conch with periodic constrictions. Suture ammonitic, multilobate, curved (293). *M.Trias.(Anis.)-U.Trias.(Carn.)*, Alps - Balkan - Turk. - Himalaya-Timor-Nev.——FIG. 209,*1*. *J. johannisaustriae* (KLIPSTEIN), Carn., Alps-Greece-Rumania; *1a,b*, ×0.25; *1c*, ×0.5 (292*).

**Istreites** SIMIONESCU, 1913 [**Joannites (Istreites)*

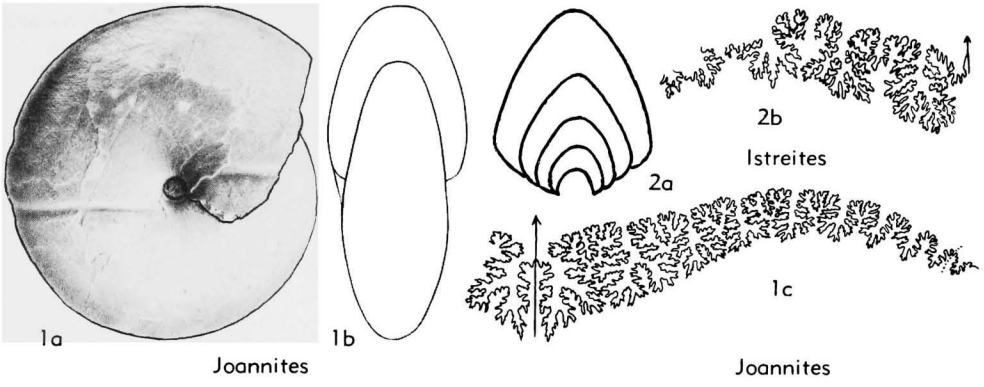



FIG. 209. Joannitidae (p. L178).

*ptychitiformis*]. Like *Ptychites;* differs from *Joannites* in having no constrictions and suture with small but high ventral lobe and no conspicuous curvature (488). *U.Trias.(Carn.),* Balkan-Timor. ——FIG. 209,*2*. **I. ptychitiformis* (SIMION.), Balkan; *2a,b,* ×0.5.

**Romanites** KITTL, 1908 [**R. simionescui*]. Like *Joannites* but strigate and with no constrictions (488). *U.Trias.(Carn.),* Rumania-Greece-Timor.

## Family SPHINGITIDAE Arthaber, 1911

Numerous, generally depressed whorls, umbilicus wide; body chamber long, with oblique constrictions or flared ribs. Suture as in *Arcestes* (488). *U.Trias.*

**Sphingites** MOJSISOVICS, 1879 [**Am. coangustatus* HAUER, 1860; SD DIENER, 1915]. *Carn.-Nor.,* Alps-Sicily-Balkan-?AsiaM.——FIG. 210,*1*. **S. coangustatus* (HAUER), Carn., Alps; *1a,b,* ×0.7; *1c,* ×2 (292*).

## Family CLADISCITIDAE Zittel, 1884

Involute, robust, generally with flattened whorl sides and venter; body chamber long. Suture with retracted suspensive lobe; phylloid saddles in M.Trias. and ammonitic in U.Trias. No constrictions or radial ribs. Family rather homogeneous (488). *M. Trias.-U.Trias.*

**Cladiscites** MOJSISOVICS, 1879 [**Am. tornatus* BRONN, 1832; SD DIENER, 1915]. Strigate, whorl section subrectangular. Suture ammonitic with bifid saddles (292). *U.Trias.(Carn.-Rhaet.),* Alps-Sicily-Balkan-Himalaya-Timor-Alaska-Kotelny. —— FIG. 210,*2*. **C. tornatus* (BRONN), Nor., Alps-Timor; *2a,b,* ×0.7; *2c,* ×1.5 (292*).

**Hypocladiscites** MOJSISOVICS, 1896 [**Arcestes subtornatus* MOJS., 1873; SD DIENER, 1915]. Differs from *Cladiscites* in depth of principal lateral lobe (295). *U.Trias.(Carn.-Nor.),* Alps-Balkan-Sicily-Himalaya-Timor.——FIG. 210,*7*. **H. subtornatus* (MOJS.), Carn., Alps-Balkan-Timor; ×0.5 (293*).

**Paracladiscites** MOJSISOVICS, 1896 [**Am. multilobatus* BRONN, 1832; SD DIENER, 1915]. Differs from *Cladiscites* in having smooth conch and no strigations (295). *U.Trias.(Carn.-Nor.),* Alps-Himalaya-Timor-Spitz.-Nev.

**Procladiscites** MOJSISOVICS, 1882 [**P. brancoi;* SD DIENER, 1915] [=*Phylloceratites* MOJS., 1902]. Like *Cladiscites* but suture with phylloid saddle endings (293). *M.Trias.(Anis.-Ladin.),* Alps-Balkan-Himalaya-Timor-Nev.——FIG. 210,*8*. **P. brancoi,* Alps-Balkan; ×1 (293*).

**Psilocladiscites** MOJSISOVICS, 1896 [**Procladiscites molaris* HAUER, 1887]. Like *Cladiscites* but with smooth conch and suture with phylloid saddle endings (295). *M.Trias.(Anis.),* Balkan.

## Family MEGAPHYLLITIDAE Mojsisovics, 1896

Generally small, very involute, compressed to subglobose; usually smooth. Suture ceratitic with phylloid saddles (488). *M.Trias.-U.Trias.*

**Megaphyllites** MOJSISOVICS, 1879 [**Am. jarbas* MÜNSTER, 1841]. Compressed, involute, low arched venter; smooth but with periodic constrictions, mainly on body chamber. Suture with large number of elements (292). *M.Trias.(Anis.)-U.Trias. (Rhaet.),* Alps - Balkan - Sicily - AsiaM.-Himalaya-Indochina-Timor.——FIG. 210,*4*. **M. jarbas* (MÜNSTER), Ladin.-Carn., Alps-Balkan-Himalaya-Timor; *4a-c,* ×1 (293*).

**Parapopanoceras** HAUG, 1894 [**Popanoceras verneuili* MOJSISOVICS, 1886] [=*Dienerites* MOJS., 1902 (obj.); *Beaumontites* BROWNE, 1952]. Like *Megaphyllites* but more discoidal, body chamber modified (294). *M.Trias.(Anis.),* Spitz.-N.Sib.-N. Greenl.-N.Z.-B.C.——FIG. 210,*3* **P. verneuili* (MOJS.), Spitz.; *3a,b,* ×0.7 (294*).

**Ptychopopanoceras** SPATH, 1951 [**Popanoceras*

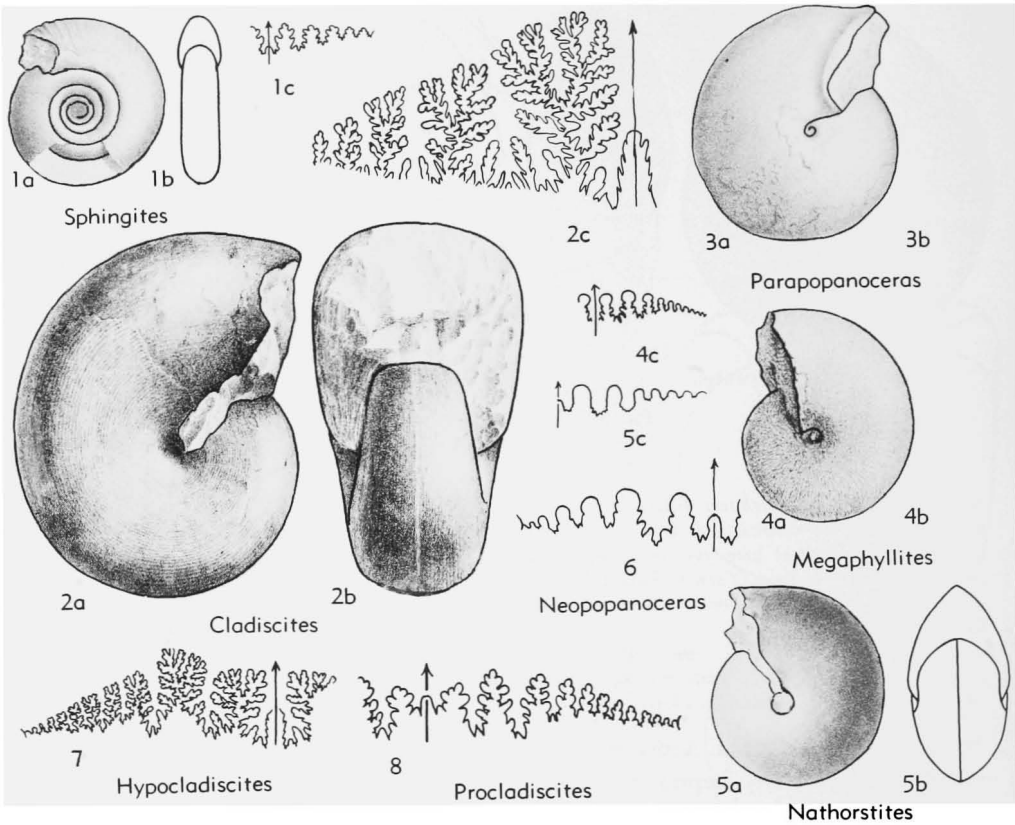



FIG. 210. Sphingitidae, Cladiscitidae, Megaphyllitidae, Nathorstitidae (p. L179-L180).

*hyatti* MOJSISOVICS, 1886]. Like *Parapopanoceras* but with radial folds (294). *M.Trias.(Anis.)*, Spitz.

**Neopopanoceras** SPATH, 1951 [**Popanoceras (Parapopanoceras) haugi* HYATT & SMITH, 1905]. Subglobose, moderately evolute, whorls depressed, venter broadly rounded. Saddles of suture not so phylloid as in *Parapopanoceras* (203). *M.Trias.(Anis.)*, Calif.——FIG. 210,*6*. **N. haugi* (HYATT-S.); ×1.5 (203*).

**?Nitanoceras** MCLEARN, 1937 [**Arcestes? selwyni* MCLEARN, 1930]. Like *Parapopanoceras* but more evolute and with simpler suture (488). *U.Trias.(?Carn.)*, B.C.

## Family NATHORSTITIDAE Spath, 1951

Involute, discoidal, compressed, smooth; venter sharp; inner volutions globular. Suture ceratitic, multisellate, with phylloid saddles (488). *M.Trias.-U.Trias.*

**Nathorstites** BÖHM, 1903 [**Popanoceras mcconnelli* WHITEAVES, 1889]. *M.Trias.(Ladin.)-U.Trias.(Carn.)*, Spitz.-Bearl.-Kotelny-Alaska-B.C.——FIG. 210,*5*. **N. mcconnelli* (WHITEAVES), Carn., B.C.; *5a,b*, ×0.5; *5c*, ×1 (732*).

## Superfamily PTYCHITACEAE Mojsisovics, 1882

[*nom. transl.* SPATH, 1951 (*ex* Ptychitidae Mojs., 1882)]

Typically involute, subglobular to discoidal descendants of L. Triassic paranannitids, with globose inner whorls. Suture ammonitic but including some forms with ceratitic or goniatitic sutures. Conch smooth with lateral folds or strigations (488). *M. Trias.-U.Trias.*

## Family PTYCHITIDAE Mojsisovics, 1882

Involute, subglobular, discoidal to highly compressed; smooth or with lateral ribs or strigations; inner whorls globose. Suture ammonitic (488). *M.Trias.-U.Trias.*

**Ptychites** MOJSISOVICS, 1875 [**Am. rugifer* OPPEL, 1865; SD SPATH, 1951]. Subovoid, compressed, discoidal, umbilicus small, umbilical walls steep; sides with distant radial folds (293). *M.Trias.(Anis.-Ladin.)*, Alps-Ger.-Balkan-Himalaya-Timor-Japan-N.Sib.-Spitz.——FIG. 211,*1*. **P. rugifer* (OPPEL), Anis., Himalaya; *1a,b*, ×0.3; *1c*, ×0.7 (100*).

**Discoptychites** DIENER, 1916 [**Am. megalodiscus* BEYRICH, 1867]. More discoidal than in *Ptychites*, with narrowly rounded to acute venter; raised umbilical edge developed already in early volutions (293). *M.Trias.(Anis.)*, Alps-Balkan-AsiaM.-Himalaya.——FIG. 211,*10*. **D. megalodiscus* (BEYRICH), Alps-Balkan-AsiaM.; *10a*, ×0.5; *10b*, ×1 (293*).

**Flexoptychites** SPATH, 1951 [**Ptychites flexuosus* MOJSISOVICS, 1882]. Like *Ptychites* but more compressed and with flexuous folds or ribs (293). *M. Trias.(Anis.-Ladin.)*, Alps-Balkan-Himalaya.——FIG. 211,*6*. **F. flexuosus* (MOJS.), Anis., Alps-Balkan; *6a,b*, ×0.5; *6c*, ×0.5 (293*).

**Aristoptychites** DIENER, 1916 [**Am. gerardi* BLANFORD, 1863]. With triangular whorl section, venter acutely rounded, umbilical walls steep; radial folds weak. Suture curved (100). *M.Trias.(Anis.)*,

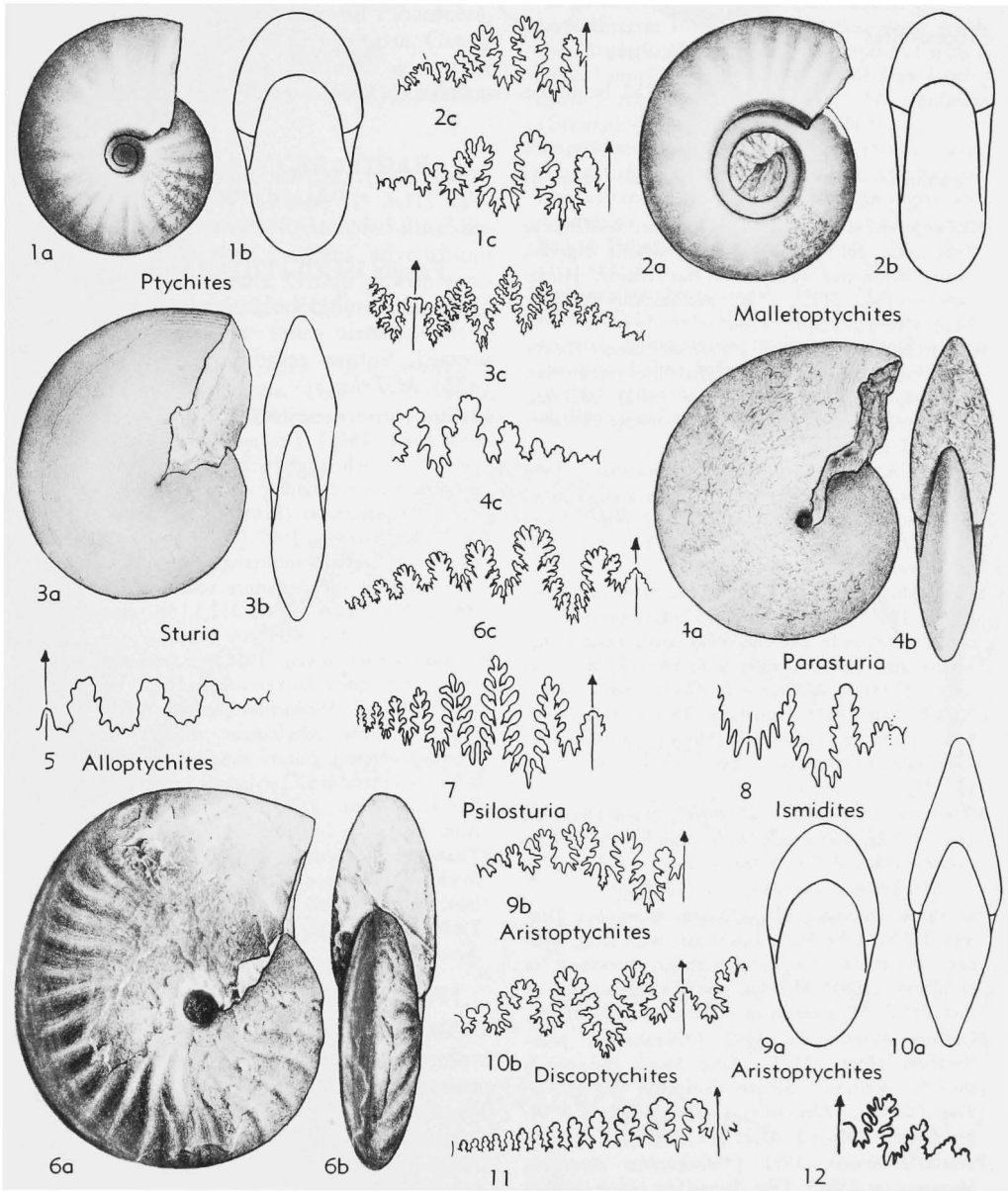



FIG. 211. Ptychitidae (p. L180-L182).

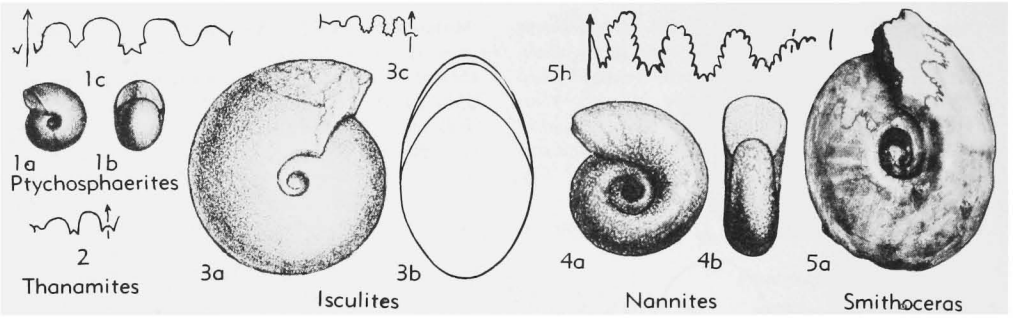



FIG. 212. Isculitidae, Nannitidae (p. L182).

Himalaya.——FIG. 211,9. **A. gerardi* (BLANF.); *9a*, ×0.5; *9b*, ×1 (100*).

**Malletoptychites** DIENER, 1916 [**Am. malletianus* STOLICZKA, 1865]. Very evolute, whorls trigonal, suture distinctive (100). *M.Trias.(Anis.)*, Himalaya.——FIG. 211,2. **M. malletianus* (STOL.); *2a,b*, ×0.3; *2c*, ×0.7 (100*).

**Alloptychites** SPATH, 1951 [**Ptychites meeki* HYATT & SMITH, 1905]. With fine radial lines rather than folds and much simpler suture (203). *M.Trias.(Anis.)*, Nev.——FIG. 211,5. **A. meeki* (HYATT-S.); ×2 (203*).

**Ismidites** ARTHABER, 1914 [**I. marmarensis*]. Like *Ptychites*, with acute umbilical edge and flexuous ribs; short ammonitic suture, only 2 lateral lobes (23). *M.Trias.(?Anis.)*, AsiaM.——FIG. 211,8. **I. marmarensis*; ×1 (23*).

**Sturia** MOJSISOVICS, 1882 [**Amaltheus sansovinii* MOJS., 1869; SD DIENER, 1915]. Compressed discoidal conch as in *Discoptychites*, with spiral striae. Suture ammonitic, saddles with phylloid terminations (293). *M.Trias.(Anis.) - U.Trias.(Carn.)*, Alps-Balkan-AsiaM.-Himalaya - Timor - Japan.——FIG. 211,3. **S. sansovinii* (MOJS.), *Anis.-Ladin.*, Alps-Balkan-Himalaya; *3a,b*, ×0.3; *3c*, ×0.5 (293*).

**Metasturia** SPATH, 1951 [**Sturia? gracilis* HAUER, 1892]. Like *Sturia* but with straight multisellate suture (488). *M.Trias.(Anis.)*, Yugo.——FIG. 211, *11*. **M. gracilis* (HAUER); ×1 (633*).

**Psilosturia** DIENER, 1916 [**Sturia mongolica* DIENER, 1895]. Like *Sturia* but suture with long, slender, pyramidal saddles; strigation confined to periphery (100). *M.Trias.(Anis.)*, Himalaya.——FIG. 211,7. **P. mongolica* (DIENER); ×1 (100*).

**Hyattites** MOJSISOVICS, 1902 [**Pinacoceras praefloridum* MOJS., 1873]. Like *Sturia* but conch smooth, occluded. Suture distinctive (292). *U. Trias.(Carn.)*, Alps-Sicily.——FIG. 211,12. **H. praefloridus* (MOJS.), Alps; ×1 (292*).

**Parasturia** SPATH, 1951 [**Meekoceras emmrichi* MOJSISOVICS, 1882]. Like *Sturia* but conch smooth with weak, distant falcoid ribs, saddles of suture not pyramidal, phylloid saddle endings finely divided (293). *M.Trias.(Anis.-Ladin.)*, Alps.——FIG. 211,4. **P. emmrichi* (MOJS.), Ladin., Alps; *4a,b*, ×0.7; *4c*, ×1 (293*).

## Family ISCULITIDAE Spath, 1951

Involute, subglobular, smooth ammonites with excentric outer volution; whorls depressed. Suture ceratitic to subammonitic (488). *M.Trias.*

**Isculites** MOJSISOVICS, 1886 [**Clydonites hauerinus* STOLICZKA, 1865] [=*Spitisculites* DIENER, 1916 (obj.)]. Conch slightly compressed, whorls depressed. Suture ceratitic. *Anis.*, Himalaya.——FIG. 212,3. **I. hauerinus* (STOL.); *3a-c*, ×1 (100*).

**Smithoceras** DIENER, 1907 [**S. drummondi*]. Evolute, whorl sections subtriangular, umbilical shoulder sharply rounded. Suture subammonitic (104). *Anis.*, Himalaya.——FIG. 212,5. **S. drummondi; 5a*, ×0.5; *5b*, ×1 (104*).

**Ptychosphaerites** SPATH, 1951 [=*Sphaerites* ARTHABER, 1896 (*non* DUFTSCHMID, 1805; *nec* QUENSTEDT, 1852)] [**Sphaerites globulus* ARTH., 1896]. Small, involute, subglobular, smooth, resembling a young arcestid. Suture simple, adventitious lobe between ventral and 1st lateral lobe (488). *Anis.*, Balkan.——FIG. 212,1. **P. globulus* (ARTH.), Alps; *1a,b*, ×2; *1c*, ×6 (584*).

**?Thanamites** DIENER, 1908 [**T. bicuspidatus*]. Like *Isculites* but suture very simple, bifid 1st lateral lobe, rounded small 2nd (105). *Ladin.*, Himalaya-Timor-B.C.——FIG. 212,2. **T. bicuspidatus*, Himalaya; ×1 (105*).

## ?Family NANNITIDAE Diener, 1897

Conch very small, subglobose, generally evolute, smooth; venter rounded, whorls depressed. Suture goniatitic, simple (488). *M. Trias.-U.Trias.*

**Nannites** MOJS., 1881 [**Gon. spurius* MÜNSTER, 1843; SD HYATT & SMITH, 1905]. *M.Trias.(Ladin.)-U.Trias.(Carn.)*, Alps.——FIG. 212,4. **N. spurius* (MÜNSTER), Carn., Alps; *4a,b*, ×3 (293*).

## Superfamily PINACOCERATACEAE Mojsisovics, 1879

[*nom. transl.* Mojs., 1896 (*ex* Pinacoceratidae Mojs., 1879)]

Evolute to involute, generally smooth, compressed ammonoids. Suture ammonitic, with adventitious and auxiliary elements, reaching acme of ammonite sutural specialization in some genera. Gymnitidae seem to stem from Dieneroceratidae and Pinacoceratidae to be derived from Gymnitidae. Group represents one of the common stocks of Middle and Upper Triassic (488). *L.Trias.-U.Trias.*

### Family PINACOCERATIDAE Mojsisovics, 1879

Highly compressed, oxynote, involute. Suture ammonitic with complex adventitious and auxiliary elements. Group probably derived from Gymnitidae (488). *M.Trias.-U. Trias.*

**Pinacoceras** Mojsisovics, 1873 [**Am. metternichi* Hauer, 1846; SD Diener, 1915]. Venter acute, conch smooth. Suture represents acme of ammonite specialization (292). *U.Trias.(Carn.-Nor.),* Alps-Sicily-Balkan-Himalaya-Timor - Kotelny. —— Fig. 213,*1*. **P. metternichi* (Hauer), Nor., Alps-Himalaya-Timor; *1a,* ×0.25; *1b,* ×0.5 (607*).

**Eupinacoceras** Spath, 1951 [*pro Parapinococeras* Arthaber, 1928 (*non* Diener. 1916)] [**Pinacoceras subimperator* Mojsisovics, 1873]. Like *Pinacoceras* but more evolute and with simpler suture (24). *U.Trias.(Nor.),* Alps-Timor.——Fig. 213,*3*. **E. subimperator* (Mojs.); ×0.7 (292*).

**Parapinacoceras** Diener, 1916 [**Pinacoceras aspidoides* Diener, 1900]. Like *Pinacoceras* but with a much simpler suture (488). *M.Trias.(Anis.-Ladin.),* Alps-Yugo.——Fig. 213,*5*. **P. aspidoides* (Diener); *5a,* ×0.5; *5b,* ×0.7 (606*).

**Pompeckjites** Mojsisovics, 1902 [**Am. layeri* Hauer, 1847]. Umbilicus of outer volution excentric; ventral portion of whorl sides with radial or sinuous folds (292). *U.Trias.(Carn.),* Alps-Balkan-Timor-Calif.——Fig. 213,*6*. **P. layeri* (Hauer); *6a,b,* ×0.25; *6c,* ×0.7 (292*).

**Bambanagites** Mojsisovics, 1896 [**B. schlagintweiti;* SD Diener, 1915]. With sculpture, at least on early volutions, as in *Pompeckjites* but body chamber slightly inflated, venter broadly rounded on last volution. Suture simpler and with subphylloid saddle endings (295). *U.Trias.(Nor.),*

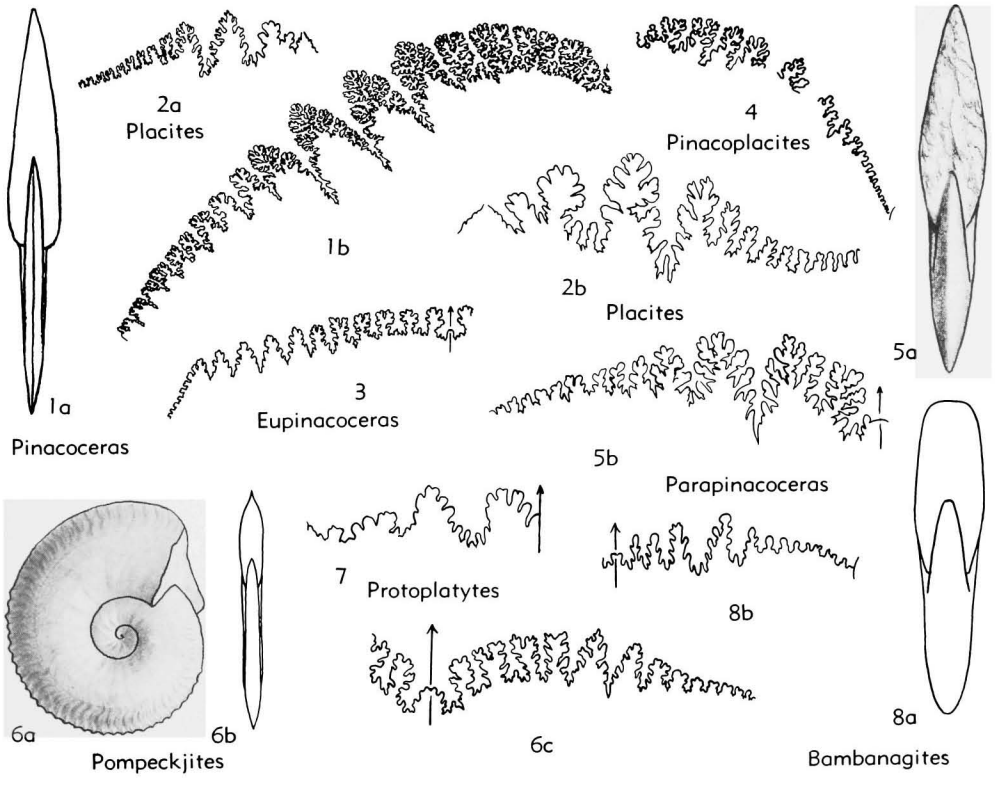



Fig. 213. Pinacoceratidae (p. L183-L184).

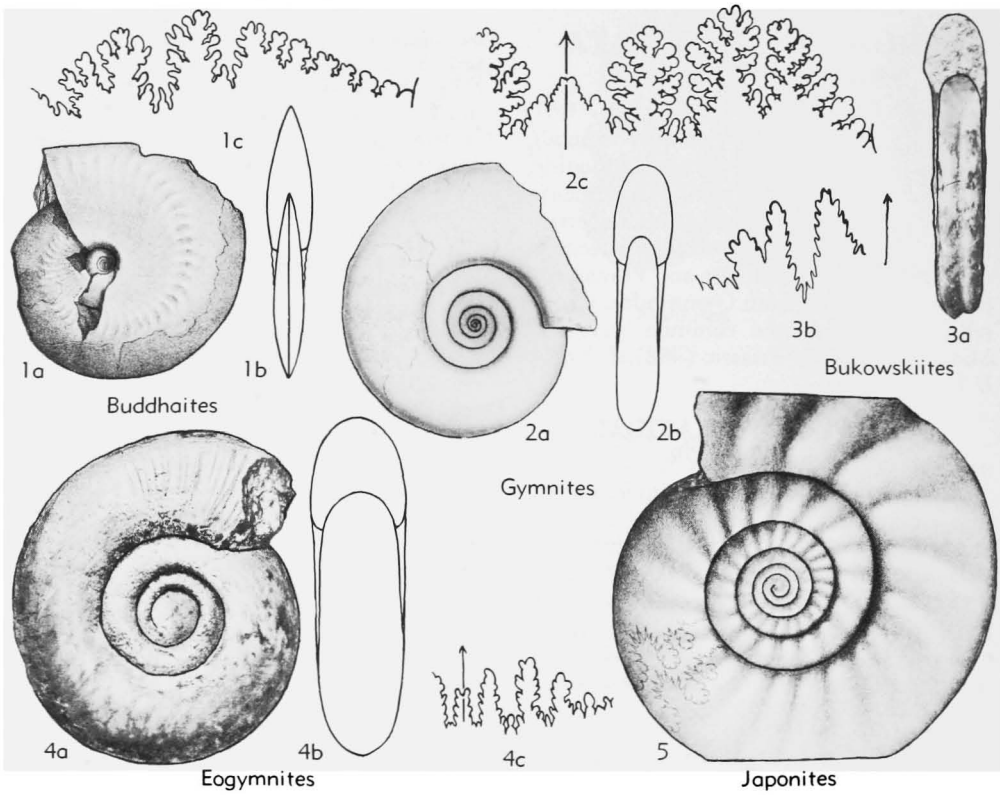



FIG. 214. Gymnitidae (p. L184-L185).

Himalaya.——FIG. 213,*8*. **B. schlagintweiti; 8a*, ×0.5; *8b*, ×1.5 (295*).

**Protoplatytes** COCKERELL, 1905 [*pro Platytes* MOJSISOVICS, 1902 (*non* GUENÉE, 1845)] [**Pinacoceras neglectus* MOJS., 1873]. More or less evolute, smooth pinacoceratid with a simple gymnitid suture (292). *U.Trias.(Nor.)*, Alps.——FIG. 213,*7*. **P. neglectus* (MOJS.); ×1.5 (292*).

**Placites** MOJSISOVICS, 1896 [**Pinacoceras platyphyllum* MOJSISOVICS, 1873] [=*Paragymnites* HYATT, 1900; *Paraplacites* KUTASSY, 1928 *(nom. nud.)*]. Involute, smooth, compressed, with closed umbilicus, flattened whorl sides, rounded venter. Suture not as complex as in *Pinacoceras* (295). *U.Trias.(Carn.-Nor.)*, Alps-Sicily-Balkan-Himalaya-Timor-Sib.-Calif.-Nev.-Peru.——FIG. 213,*2b*. *P. oxyphyllus* (MOJS.), Nor., Alps-Sicily; ×1 (292*).——FIG. 213,*2a*, *P. postsymmetricum* (MOJS.), Nor., Alps, ×0.7 (292*).

**Pinacoplacites** DIENER, 1916 [**Placites meridianus* WELTER, 1914]. Like *Placites* but with an opening umbilicus. Suture with development of adventitious elements similar to those in *Pinacoceras* (558). *U. Trias.*, Timor.——FIG. 213,*4*. **P. meridianus* (WELTER); ×1 (558*).

## Family GYMNITIDAE Waagen, 1895

Evolute to involute, compressed; venters rounded to sharpened, conch generally smooth. Suture ammonitic. Group closely related to Pinacoceratidae (488). *L.Trias.-U. Trias.*

**Gymnites** MOJSISOVICS, 1882 [**Am. incultus* BEYRICH, 1867; SD DIENER, 1915]. Evolute, whorl section oval, venter arched; shell smooth, outer volutions may have costation or rows of nodes or both. Suture ammonitic with 2 lateral lobes and retracted auxiliaries (293). *M.Trias.(Anis.-Ladin.)*, Alps-Balkan-Himalaya-Timor-B.C.-Nev. —— FIG. 214,*2*. **G. incultus* (BEYRICH), Anis., Alps-Balkan-Himalaya; *2a,b*, ×0.25; *2c*, ×1 (293*).

**Anagymnites** HYATT, 1900 [**Am. lamarcki* OPPEL, 1863]. Like *Gymnites* but periphery sharpened or bluntly keeled (100). *M.Trias.(Anis.)*, Alps-Balkan-B.C.-Nev.

**Epigymnites** DIENER, 1916 [**Gymnites ecki* MOJSISOVICS, 1882]. Like *Gymnites* but more involute and commonly with row of lateral tubercles on outer volution (293). *M.Trias.(Ladin.)-U.Trias. (Carn.)*, Alps-Balkan.

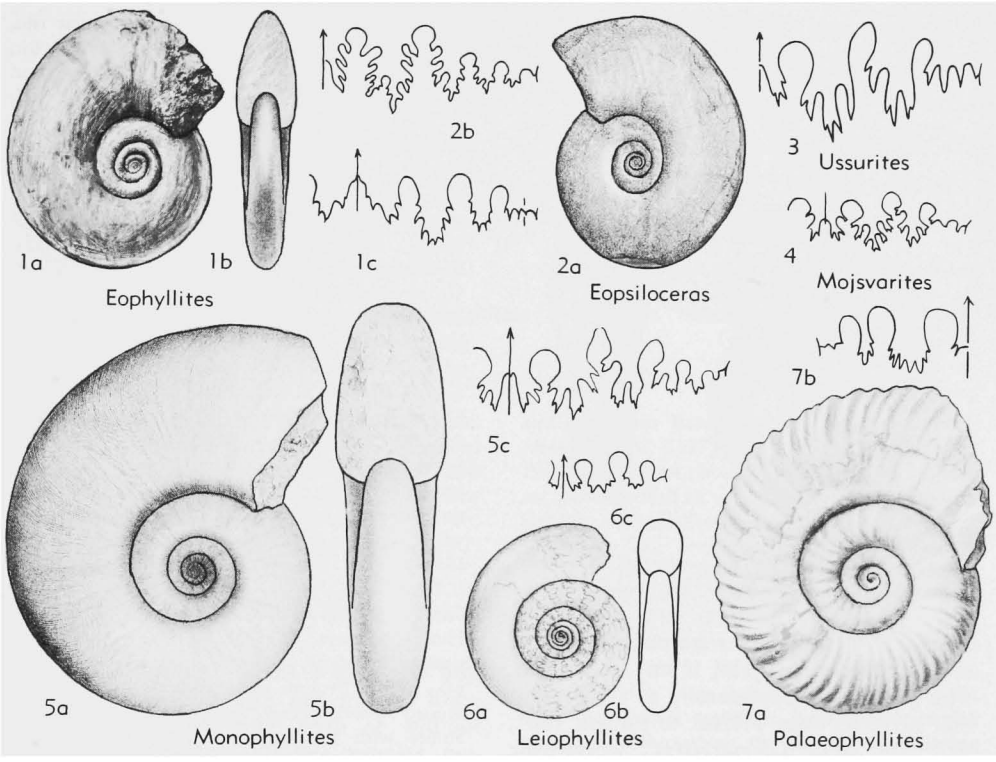



FIG. 215. Ussuritidae (p. L186).

**Xiphogymnites** SPATH, 1951 [**Gymnites spiniger* DIENER, 1917]. Like *Gymnites* but with row of tubercles on venter followed by constrictions (488). *M.Trias.(Anis.)*, Yugo.

**Buddhaites** DIENER, 1895 [**Gymnites (Buddhaites) rama*]. Involute oxycone with flexuous ribs, strongest along mid-portion of whorl side. Suture with long series of auxiliaries (100). *M.Trias.(Anis.)*, Himalaya.——FIG. 214,*1*. **B. rama; 1a,b*, ×0.3; *1c*, ×1 (100*).

**Eogymnites** SPATH, 1951 [**Japonites arthaberi* DIENER, 1915 (=*Japonites sugriva* DIENER var. ARTHABER, 1911; *E. decipiens* SPATH, 1951)]. Like *Gymnites* but whorl section more robust, suture simpler (22). *L.Trias.(U.Scyth.)*, Albania.——FIG. 214,*4*. **E. arthaberi* (DIENER); *4a,b*, ×0.5; *4c*, ×0.7 (22*).

**Japonites** MOJSISOVICS, 1893 [**Ceratites planiplicatus* MOJS., 1888]. Evolute compressed; whorl sides convergent, venter acute or narrowly rounded; with lateral recurved ribs and umbilical bulges. Suture distinctive (488). *M.Trias.(Anis.)*, Japan-Himalayas-Timor-Alps.——FIG. 214,*5*. **J. planiplicatus* (MOJS.), Japan; ×0.3 (664*).

?**Bukowskiites** DIENER, 1907 [**B. colvini*]. Widely umbilicate, with elliptical whorl section, venter rounded and with distinct, narrow siphonal groove. Suture ammonitic, similar to that of *Japonites* (104). *M.Trias.(Anis.)*, Himalaya.——FIG. 214,*3*. **B. colvini; 3a*, ×0.7; *3b*, ×1 (104*).

## Suborder PHYLLOCERATINA Arkell, 1950

Smooth or feebly ornamented derivatives of Meekoceratacae, characteristically with phylloid saddle endings. An exceptionally persistent, conservative stock, which gave rise to all post-Triassic ammonoids as offshoots, but itself remained relatively very little changed (12). *Trias.-Cret.*

## Superfamily PHYLLOCERATACEAE Zittel, 1884

[*nom. transl.* HYATT, 1900 (as Phylloceratida) (*ex* Phylloceratidae ZITTEL, 1884); *nom. correct.* ARKELL, 1952]

The typical, least divergent Phylloceratina. Test thin. Ornament typically confined to fine lineation or liration and some foldlike ribs, with or without constrictions. Suture typically has several auxiliary elements, with

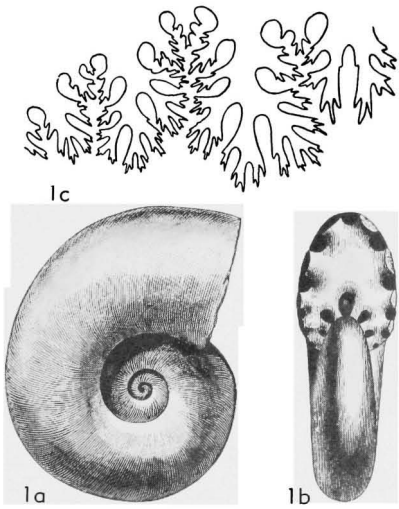



FIG. 216. *Rhacophyllites neojurensis* (QUENSTEDT), U.Trias.(Nor.), Alps (743*) (p. L186).

lobes trifid and saddles normally diphyllic or tetraphyllic. Aptychi, if any, unknown. This is the only superfamily of ammonoids that survived from Triassic to Jurassic (201, 357, 536, 577) *L.Trias.-Cret.*, world-wide but scarce in the Boreal realm.

## Family USSURITIDAE Hyatt, 1900

[=Monophyllitidae J. P. SMITH, 1913]

Discoidal, evolute; venters rounded; little or no ornamentation. Suture with primitive monophyllic saddles, dorsal lobe lituid (472). *L.Trias.-U.Trias.*

**Monophyllites** MOJSISOVICS, 1879 [**Am. sphaerophyllus* HAUER, 1850; SD MOJS., 1902]. Whorl section rounded, venter arched, conch with sigmoidal growth lines. Suture with irregularly trifid 1st lateral lobe, 4 or more monophyllic saddles (472). *M.Trias.(Anis.)-U.Trias.(Carn.)*, cosmop. ——FIG. 215,*5*. **M. sphaerophyllus* (HAUER), Eu.-Asia-Timor; *5a,b*, ×0.4; *5c*, ×0.7 (293*).

**Eophyllites** SPATH, 1930 [**Monophyllites dieneri* ARTHABER, 1908] [=*Monophyllites (Schizophyllites)* RENZ & RENZ, 1948]. Evolute, compressed, discoidal, with subtrigonal whorl section, arched venter, flattened sides; with nearly radial growth lines and indistinct folds. Suture with shallow wide ventral lobe, which tends to be divided by short rounded saddle, long 1st lateral lobe, saddle monophyllic (472). *L.Trias.(U.Scyth.)*, Albania-Chios-Timor.——FIG. 215,*1*. **E. dieneri* (ARTH.), Albania; *1a-c*, ×0.7 (22*).

**Palaeophyllites** WELTER, 1922 [**P. steinmanni*]. Like *Monophyllites* but with smooth inner whorls with some flares, outer whorl with irregular ribs, slightly projected peripherally. Suture monophyllic, simple (472). *L.Trias.(U.Scyth.)*, Chios-Timor. ——FIG. 215,*7*. **P. steinmanni*, Timor; *7a*, ×0.75; *7b*, ×1 (560*).

**Ussurites** HYATT, 1900 [**Monophyllites sichoticus* DIENER, 1895]. Like *Monophyllites* but with simpler suture. First lateral saddle typically indented only on ventral side, 2nd lateral on dorsal side (472). *M.Trias.(Anis.)*, Sib.-Spitz.-Himalaya-Timor-Japan-B.C.-Calif.-?Albania.——FIG. 215,*3*. **U. sichoticus* (DIENER), Sib.; ×0.5 (101*).

**Leiophyllites** DIENER, 1915 [**Monophyllites suessi* MOJSISOVICS, 1882]. Serpenticone, generally smooth with simple monophyllic suture (472). *L.Trias.(U.Scyth.)-M.Trias.(Anis.)*, Eu.-Asia.——FIG. 215,*6*. **L. suessi* (MOJS.), Anis., Eu.-Asia; *6a,b*, ×0.7; *6c*, ×1 (293*).

**Mojsvarites** POMPECKJ, 1895 [**Am. (Ceratites) agenor* MÜNSTER, 1834; SD DIENER, 1915]. Evolute, smooth, with rounded slightly compressed whorl section and arched venter. Suture as in *Monophyllites* but saddles more indented (472). *U.Trias.(Carn.-Nor.)*, Alps-Hung.-Himalaya.——FIG. 215,*4*. **M. agenor* (MÜNSTER), Carn., Alps-Hung.-Himalaya; ×1 (293*).

**Eopsiloceras** SPATH, 1930 [**Am. planorboides* GÜMBEL, 1861]. Evolute, smooth, discoidal, with compressed whorl section, narrowly rounded venter. Suture with terminal monophyllic saddle leaflet and with phylloid lateral leaflets (472). *U.Trias.(Nor.-Rhaet.)*, Alps.——FIG. 215,*2*. **E. planorboides* (GÜMBEL), Rhaet., Alps; *2a*, ×0.7; *2b*, ×1 (348*).

## Family DISCOPHYLLITIDAE Spath, 1927

Like Monophyllitidae but principal saddles have di- or triphyllic terminations (488). *U.Trias.*

**Discophyllites** HYATT, 1900 [**Lytoceras patens* MOJSISOVICS, 1873]. First lateral saddle unsymmetrically monophyllic (472). *Carn.-Nor.*, Alps-Sicily-Himalaya-Timor-Calif.-Alaska.——FIG. 217,*2*. **D. patens* (MOJS.), Nor., Alps-Alaska; ×1 (292*).

**Rhacophyllites** ZITTEL, 1884 [**Am. neojurensis* QUENSTEDT, 1845; SD SMITH, 1927] [=*Diphyllites, Triphyllites* JULLIEN, 1911]. First lateral saddle diphyllic, adjacent lateral saddles diphyllic or triphyllic (472). *Carn.-Nor.*, Alps-Hung.-Sicily-Himalaya-Timor.——FIG. 216,*1*. **R. neojurensis* (QUENST.), Nor., Alps-Timor; *1a,b*, ×0.5; *1c*, ×1 (743*).

**Tragorhacoceras** SPATH, 1927 [**Phylloceras occultum* MOJSISOVICS, 1873]. With peripheral ribs on outer whorl, and suture with large leaflets in diphyllic saddle (472). *Nor.*, Alps-Sicily.——FIG. 217,*3*. **T. occultum* (MOJS.), Alps; *3a,b*, ×0.7 (621*).

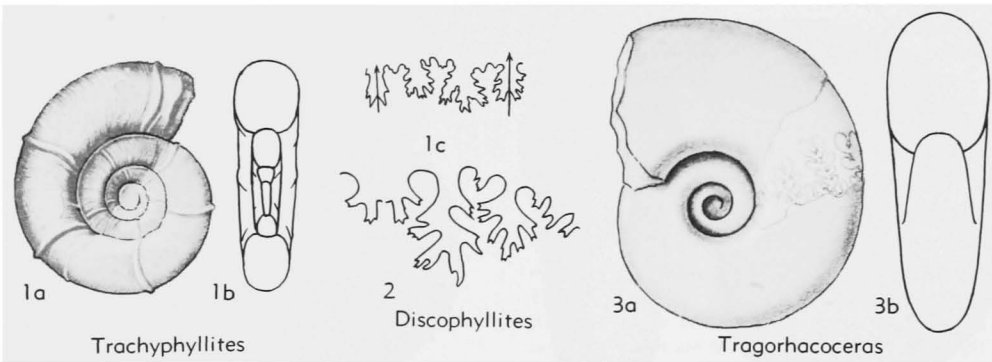



FIG. 217. Discophyllitidae (p. L186).

**Trachyphyllites** ARTHABER, 1927 [**Monophyllites (Trachyphyllites) costatus*]. Evolute, with rounded whorl section; sides with sigmoidal growth lines and about 6 ribs or flares per whorl. Suture less phylloid than other genera of family (472). *Nor.*, Timor.——FIG. 217,*1*. **T. costatus; 1a,b*, ×0.7; *1c*, ×1 (24*).

## Family PHYLLOCERATIDAE Zittel, 1884

Involute, smooth shells with very thin test, many covered with fine growth lines, usually without ribbing, with or without sigmoid constrictions. Sutures complex, major and minor branches of saddles with phylloid or spatulate endings of double (diphyllic), triple (triphyllic), or quadruple (tetraphyllic) type. Probably derived from Triassic Discophyllitidae (239, 466, 577). *U.Jur.-U.Cret.*, world-wide (except Boreal unless stated), especially abundant in Tethyan and Pacific realms.

### Subfamily PHYLLOCERATINAE Zittel, 1884

[Includes Hypophylloceratinae SPATH, 1927, and Phyllopachyceratinae COLLIGNON, 1937]

Without flares and usually without constrictions. *L.Jur.(L.Lias.)-U.Cret.(Maastr.)*, world-wide.

**Phylloceras** SUESS, 1865 [**Am. heterophyllus* J. SOWERBY, 1820] [=*Rhacoceras* HYATT, 1867 (obj.); *Xeinophylloceras* BUCKMAN, 1921; *Heterophylloceras* KOVACS, 1939 (obj.)]. Involute, compressed forms with gentle umbilical slope, dense, fine radial lirae on test but not on internal mold, and some more or less vague radial folds on whorl sides. Sutures with triphyllic saddles. *L.Jur.(Sinem.)-L.Cret.(Valang.)*, world-wide.——FIG. 218,*5*. **P. heterophyllum* (Sow.), L.Jur.(Toarc.), Eng.; *5a,b*, ×0.2 (583n).

**Partschiceras** FUCINI, 1923 [**Am. partschi* STUR, 1851 (*non* KLIPSTEIN, 1843), =*P. monestieri* BREISTROFFER, 1947; SD SPATH, 1927] [=*Partschiphylloceras* ROMAN, 1938 (obj.); *Macrophylloceras* SPATH, 1927]. In addition to lirae as in *Phylloceras*, blunt ribbing gradually sets in on venter and outer half of whorl sides. Sutures with very slender, diphyllic saddles. *L.Jur.(Sinem.)-L.Cret.(Valang.)*, *?L. Cret.(Barrem.)*, world-wide.——FIG. 218,*3a,b*. **P. monestieri* BREISTROFFER, L.Jur.(U.Pliensb.), Italy; ×0.75 (628*).——FIG. 218, *3c,d*. *P.* sp.; ×0.5 (743*).

**Phyllopachyceras** SPATH, 1925 [**Am. infundibulum* D'ORBIGNY, 1841]. Moderately to very involute, inflated, widest point usually at mid-side with flat slope to a minute umbilicus. Smooth to a varying diameter (?throughout in some) with strong rounded ribs on outer part of whorl. Sutures with 1st and 2nd lateral saddles tetraphyllic. *L.Cret.(Barrem.)-U.Cret.(Maastr.)*, Eu.-N.Afr.-S.India-W.Austral.-N.Z.-Japan-Greenl.——FIG. 218,*2a,b*. **P. infundibulum* (ORB.), Barrem, Fr.; ×0.75 (329*).——FIG. 218,*2c*. *P. rouyanum* (ORB.), L. Cret.(Apt.), Fr.; ×1 (329*).

**Procliviceras** FUCINI, 1920 [**Phylloceras proclive* ROSENBERG, 1909] [=*Proclivioceras* ROMAN, 1938 (obj.)]. Very involute; whorl section oval; adult ribbed on venter and outer part of whorl sides; inner whorls feebly constricted in some. Sutures moderately complex, saddles diphyllic. *L.Jur.(Pliensb.)*, Eu.——FIG. 218,*4*. **P. proclive* (ROSENBERG), Aus.; *4a,b*, ×1 (694*).

**Zetoceras** KOVACS, 1939 [**Am. zetes* D'ORBIGNY, 1850]. Compressed, involute. Sutures with saddle endings commonly tetraphyllic. *L.Jur.(Sinem.)-M.Jur.(Baj.)*, probably also *U.Jur.*, Eu.——FIG. 218,*7*. **Z. zetes* (ORB.), L.Jur.((Lias.), Ger.; *7a,b*, type, ×0.3 (358*).

**Hantkeniceras** KOVACS, 1939 [**Phylloceras hantkeni* SCHLOENBACH, 1867 (fig'd. PRINZ, 1904)]. Large, smooth, evolute, whorls somewhat quadrate, flat-sided. Sutures rather simple, with 1st lateral lobe shorter than 2nd lateral. *L.Jur.(U.Pliensb.)*, Hung.-Ger.——FIG. 218,*1*. **H. hantkeni* (SCHLOEN.), Hung.; *1a-c*, ×0.25 (357*).

**Geyeroceras** HYATT, 1900 [**Am. cylindricus* J. DE C. SOWERBY, 1831] [incl. *Lavizzaroceras* KOVACS,

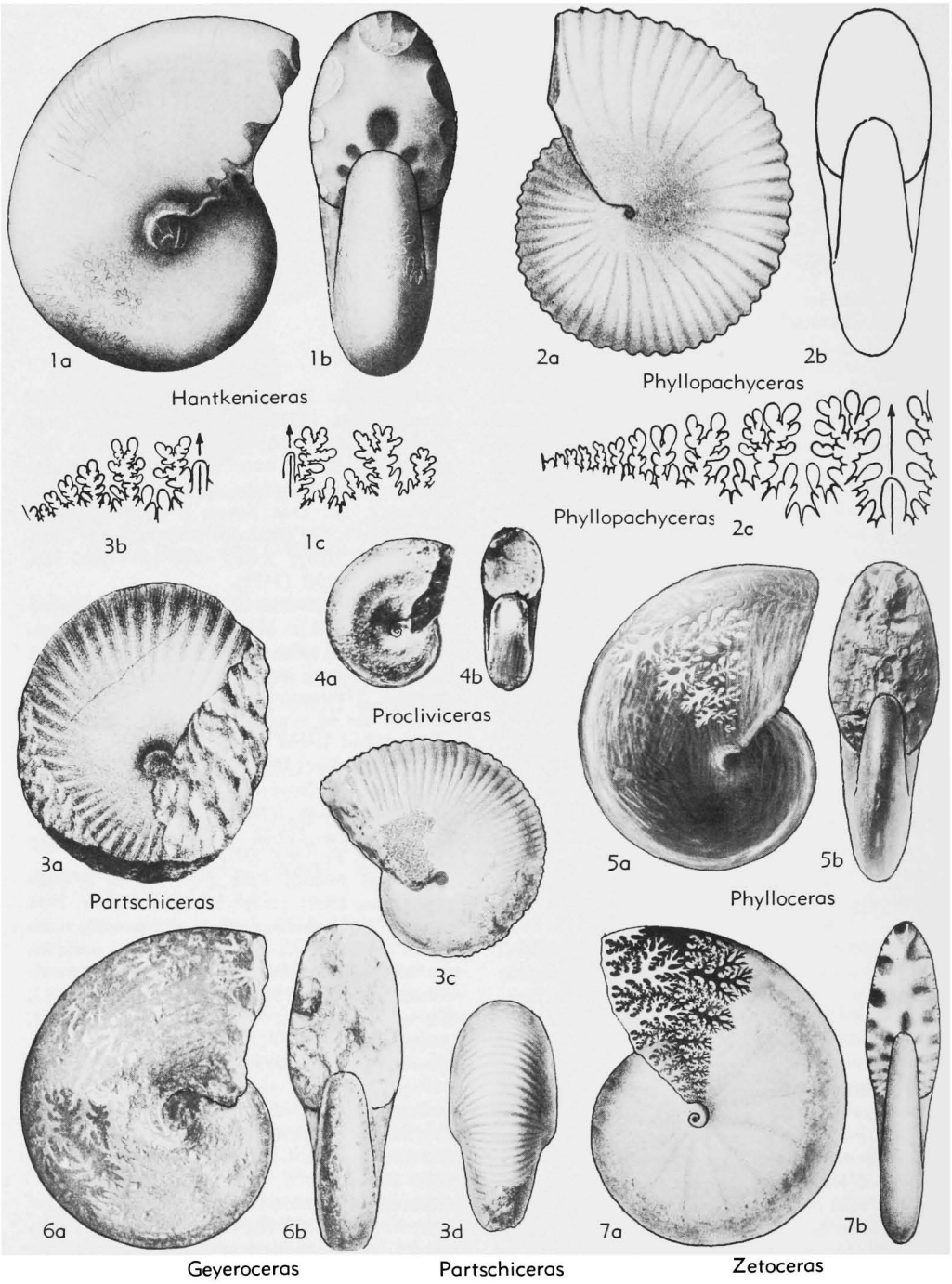
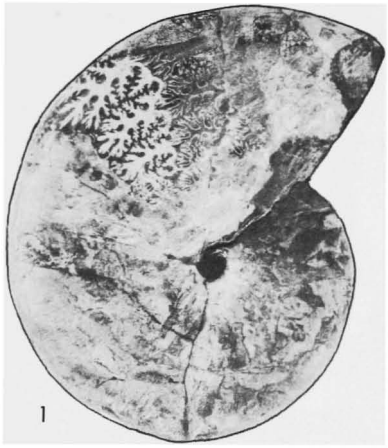



FIG. 218. Phylloceratidae (Phylloceratinae) (p. L187).

1939]. Involute, smooth, compressed, sides and venter flattened. First lateral lobe long; lateral saddles diphyllic to tetraphyllic; internal suture with 3 monophyllic saddles. *L.Jur.(Pliensb.)*, Eu.—FIG. 218,6. **G. cylindricum* (Sow.), Italy; *6a,b*, ×0.7 (307*).



Hypophylloceras

FIG. 219. *Hypophylloceras ononense* (STANTON), L. Cret.(Apt.), Calif.; ×0.5 (2*) (p. L189).

**Hypophylloceras** SALFELD, 1924 [**Phylloceras ononense* STANTON, 1895] [incl. *Neophylloceras* SHIMIZU, 1934; =*Paraphylloceras* SHIMIZU, 1935 *(nom. nud.)* (*non* SALFELD, 1919); *Hyporbulites* BREISTROFFER, 1947; *Goretophylloceras* COLLIGNON, 1949; *Aphroditiceras* MAHMOUD in BREISTR., 1952 *(n.n.)*]. Compressed, finely ribbed, some with periodic stronger ribs or folds. Sutures complex, lobes large and finely divided, asymmetric, 1st lateral much larger than external and 2nd lateral, saddle endings commonly not phylloid. *L.Cret.(Hauteriv.)-U.Cret.(Maastr.)*, world-wide except Boreal.——FIG. 219,*1*. **H. onoense* (STANTON), L.Cret.(Apt.), Calif.; ×0.5 (2*).

### Subfamily CALLIPHYLLOCERATINAE Spath, 1927

Regularly with constrictions or flares or both (466). *L.Jur.(Hett.)-L.Cret.(Alb.)*.

**Calliphylloceras** SPATH, 1927 [**Phylloceras disputabile* ZITTEL, 1869 (?=*Am. demidoffi* ROUSSEAU, 1841)] [*Neocalliphylloceras* BESAIRIE, 1936; *Capitanioceras* KOVACS, 1939; *Euphylloceras* DROUCHTCHITZ, 1953]. Smooth, involute, compressed, with rounded venter and periodic sigmoid constrictions on internal mold, with or without corresponding flares on ventral half of test; surface also with lirae, as in *Phylloceras*. First and 2nd lateral saddles usually triphyllic, others diphyllic. *L.Jur.(Hett.)-L.Cret.(M.Alb.)*, world-wide.——FIG. 220, *3*. **C. disputabile* (ZITTEL), M.Jur.(Bath. or Callov.), Hung.; *3a,b*, holotype, ×0.5 (649*).

**Holcophylloceras** SPATH, 1927 [**Phylloceras mediterraneum* NEUMAYR, 1871 (=*Am. zignodianum* ORB., 1848)] [*Salfeldiella* SPATH, 1927; *Telegdiceras* KOVACS, 1939]. Resembles *Calliphylloceras* but constrictions affect test as well as internal mold and are more acutely sigmoid, linguate, or angular, and outer half of whorl is ribbed. Saddles of sutures diphyllic except 1st lateral saddle, which becomes triphyllic in later forms. *M.Jur.(Baj.)-L.Cret.(Apt.)*, world-wide.——FIG. 220,*5*. **H. mediterraneum* (NEUM.); *5a-c*, ×0.5 (667*).——FIG. 220,*4*. *H. guettardi* (RASPAIL), L.Cret.(Apt.), Fr.; type species of *Salfeldiella*, *4a,b*, ×1; *4c*, enlarged (329*).

**Ptychophylloceras** SPATH, 1927 [**Phylloceras jeddeni* WAAGEN, 1875] [*Tatroceras* KOVACS, 1939; =*Neumayriceras* SORRENTINO, 1942 (*non* ROLLIER, 1909)]. Smooth, involute shells with broadly rounded venter crossed by periodic labial ridges, or flares, which are present even on internal mold; umbilical slope gentle. Suture saddles diphyllic and triphyllic. *M.Jur.(Baj.)-U.Jur.(Tithon.)*, probably world-wide.——FIG. 220,*6*. **P. jeddeni* (WAAGEN), M.Jur.(Callov.), Cutch; *6a-c*, ×0.3 (546*).

**Haplophylloceras** SPATH, 1925 [**Phylloceras strigile* BLANFORD in UHLIG, 1903]. Inner whorls smooth, venter rounded; outer whorl developing flattened venter and large foldlike ribs which strengthen and sharpen in approaching venter, projected as they cross it; umbilical slope gentle. Sutures with saddle endings tending to lose phylloid form and become multifid. *Ju*. or *Cret.*, Spiti sh., India-Indon.-N. Guinea.——FIG. 220,*7*. **H. strigile* (BLANFORD), Spiti sh.; *7a,b*, ×1 (533*).

**Sowerbyceras** PARONA & BONARELLI, 1895 [**Am. tortisulcatus* D'ORBIGNY, 1849] [=*Martelliceras* SORRENTINO, 1942 (obj.) (*non* SCHINDEWOLF, 1925)]. Evolute, compressed, with flattened sides and venter and abrupt or stepped umbilical edge; smooth except for distant, acutely sigmoid constrictions on test and internal mold (but in some unconstricted). Sutures with short lobes. *U.Jur.* (chiefly *Oxf.-Kimm.*), Eu.-N.Afr.-Anatolia-Cauc.-Persia-India.——FIG. 220,*1*. **S. tortisulcatum* (ORB.), U.Jur.(U.Oxf.), Fr.; *1a-c*, ×0.5 (330*).

**Calaiceras** KOVACS, 1939 [**Am. calais* MENEGHINI, 1881]. Evolute, with rounded whorls of medium height, sides somewhat divergent; internal mold with 4 or 5 forwardly curved constrictions per whorl, increasing with growth. Sutures complex, 1st lateral saddle high and diphyllic. *L.Jur.(U. Pliensb.)*, S.Eu.——FIG. 220,*2*. **C. calais* (MEN.), Italy; *2a,b*, ×1 (660*).

**?Holcolissoceras** SPATH, 1928 [**Lissoceras pintacudae* DI STEFANO, 1884]. Evolute, with deep gently falcoid constrictions. Sutures unknown. *U. Jur.(Kimm.)*, Eu.——FIG. 220,*8*. **H. pintacudae* (STEF.), Sicily; *8a,b*, ×0.75 (716*).

## Family JURAPHYLLITIDAE Arkell, 1950

[=Rhacophyllitinae SPATH, 1927 (name based on *Rhacophyllites* AUCTT., *non* ZITTEL, 1884)]

Compressed, evolute, with modified body chamber which usually carries coarse ventral ribbing. A few genera are more involute but all are compressed, and a few lack ribbing. First lateral saddles diphyllic, others

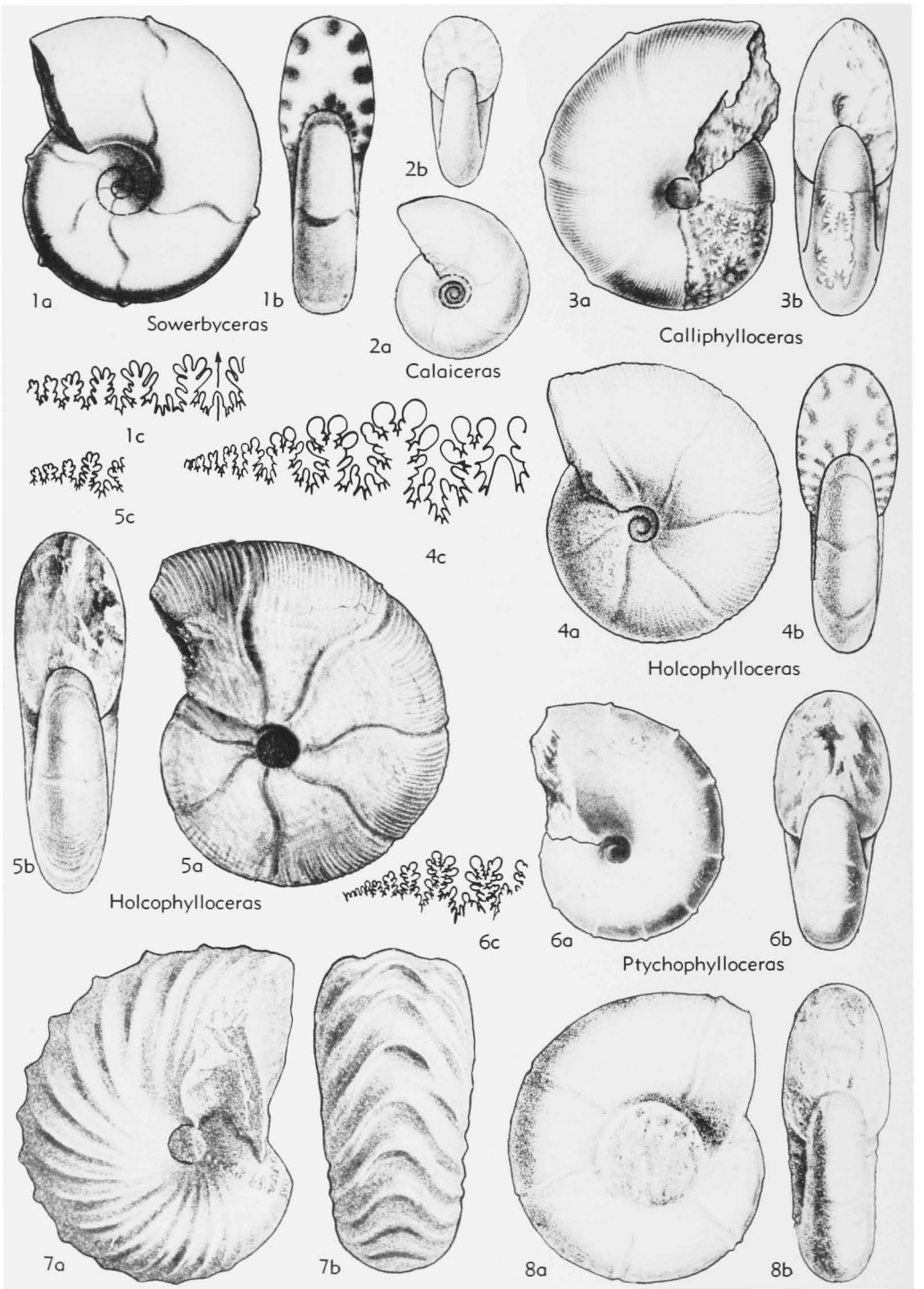



FIG. 220. Phylloceratidae (Calliphylloceratinae) (p. L189).

diphyllic or triphyllic; internal saddles monophyllic. Probably independent descendants of Triassic Discophyllitidae (12, 260, 466, 536). *L.Jur.(L.Lias.-M.Lias.)*, S. Eu.-N.Afr.-Tibet-Indon.-Japan-N.Z.-Arg.

**Juraphyllites** MÜLLER, 1939 [**Phylloceras diopsis* GEMMELLARO, 1884] [=*Rhacophyllites* AUCTT. (*non* ZITTEL, 1884)]. Evolute, with sharp umbilical edge; smooth except for prorsiradiate ribs or folds on body chamber. *Sinem.-Pliensb.*——FIG. 221,*8*. **J. diopsis* (GEMM.), L.Jur.(Pliensb.), Italy; *8a-c*, ×0.5 (627*).

**Tragophylloceras** HYATT, 1900 [**Am. heterophyllus numismalis* QUENSTEDT, 1845; SD BUCKMAN, 1912] [*Phyllolobites* VADASZ, 1907]. Evolute, umbilical

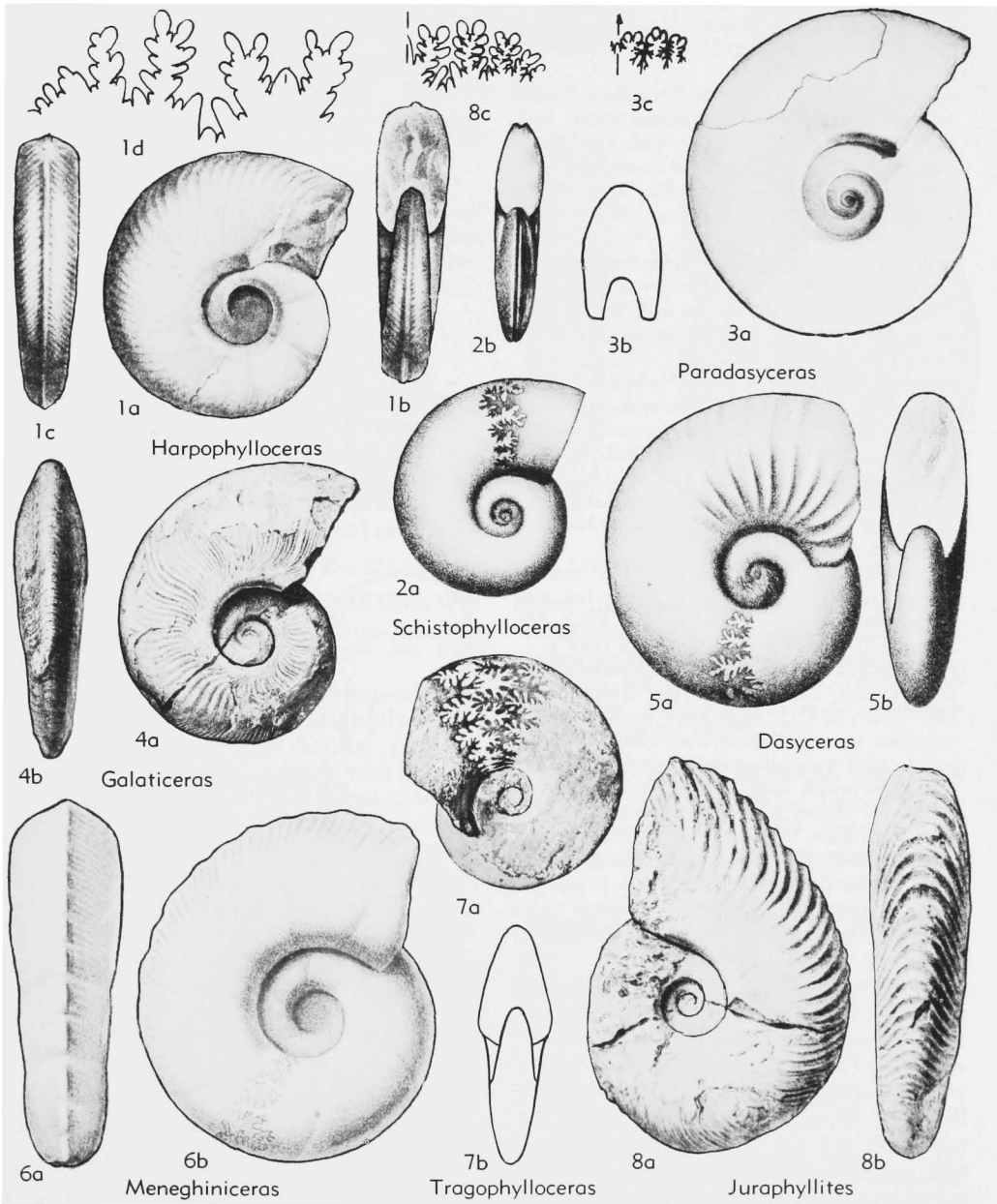



FIG. 221. Juraphyllitidae (p. L191-L192).

angle blunt; ventral half of outer whorl with falcoid foldlike ribs which become plications as they cross venter. *Pliensb.*——FIG. 221,7. **T. numismalis* (QUENST.); *7a,b*, ×0.3 (65*).

**Dasyceras** HYATT, 1900 [**Phylloceras rakosense* HERBICH, 1878] [=*Paradadyceras* COSSMANN, 1901 (obj.)]. Evolute; inner whorls smooth, outer whorl gradually developing coarse falcoid ribs which originate close to umbilical margin and do not pass on to venter. *Sinem.*, Eu.——FIG. 221,5. **D. rakosense* (HERBICH), SE.Eu.; *5a,b*, ×1 (635*).

**Schistophylloceras** HYATT, 1900 [**Phylloceras aulonotum* HERBICH, 1878] [=*Kochites* PRINZ, 1905 (obj.)]. Evolute, smooth shells with keel, which may correspond to ventral sulcus on internal mold; umbilical slope blunt. *Hett.*, Eu.-Tibet.——FIG. 221,2. **S. aulonotum* (HERBICH), SE.Eu.; *2a,b*, ×0.7 (635*).

**Paradasyceras** SPATH, 1923 [**Phylloceras ürmösense* HERBICH, 1878]. Smooth, compressed, evolute, with sharp umbilical angle, no keel. *Hett.* Eu.-N. Caled.——FIG. 221,3. **P. uermoesense* (HERBICH), SE.Eu.; *3a-c*, ×0.25 (550*).

**Meneghiniceras** HYATT, 1900 [**Phylloceras lariense* MENEGHINI, 1867]. Evolute shells with simple, forward-curved or gently sigmoid constrictions (on type species 8 per whorl); and on body chamber ventral ribbing and median row of clavi which form a serrated keel. *Sinem.-Pliensb.*, Eu.——FIG. 221,6. **M. lariense* (MEN.), L.Jur.(U.Pliensb.), Italy; *6a,b*, ×0.75 (660*).

**Harpophylloceras** SPATH, 1927 [**Am. eximius* HAUER, 1854]. Similar to *Juraphyllites* but with continuous keel. *Pliensb.*, Eu.——FIG. 221,1. **H. eximium* (HAUER), Aus.; *1a-d*, ×0.75 (633*).

**Galaticeras** SPATH, 1938 [**Amphiceras harpoceroides* GEMMELLARO, 1884] [*Amphiceras* GEMM., 1884 (*non* GRAY, 1847)]. Shell more evolute than in any other Jurassic Phylloceratina, compressed, discoidal, with rounded-quadrate, slowly enlarging whorls on which feeble juraphyllitid ribbing remains, but sutures have lost their phylloid character as in some Cretaceous forms. *Pliensb.*, Eu.-?Cauc.——FIG. 221,4. **G. harpoceroides* (GEMM.), Italy; *4a,b*, ×0.5 (627*).

## Suborder LYTOCERATINA Hyatt, 1889

[*nom. correct.* ARKELL, 1950 (*pro* suborder Lytoceratinae HYATT, 1889)] [=Lytoceratacea BUCKMAN, 1894 (ranked as suborder)] [Both HYATT and BUCKMAN included Triassic genera in this division of the ammonoids, although no pre-Jurassic forms now are placed here.]

Evolute, loosely coiled, usually round-whorled shells, ornamented with growth lines and commonly flares, rarely ribbed. Sutures with few but very complex elements, with mosslike endings, usually not phylloid; septal lobe present in some. Aptychi single-valved, with shiny surface, striated concentrically (Anaptychus) (found *in situ* in *Lytoceras cornucopia* YOUNG & BIRD L. Toarc. and various Cret. forms). Descended from Triassic Ussuritidae or Discophyllitidae or both, but not known from the Rhaetian (62, 63, 200). *Jur.-Cret.*, world-wide, but especially abundant in Tethyan and Pacific realms, though occurring at certain horizons as far north as Greenl.

## Superfamily LYTOCERATACEAE Neumayr, 1875

[*nom. transl.* ARKELL, 1950 (*ex* Lytoceratidae NEUMAYR, 1875)] [*non* Lytoceratacea BUCKMAN, 1894 (ranked as suborder)]

Coiled Lytoceratina which persisted throughout Jurassic and most of Cretaceous and periodically gave off more or less uncoiled families, especially in Cret. (12). *Jur.-Cret.*

### Family PLEUROACANTHITIDAE Hyatt, 1900

[*nom. correct.* ARKELL, 1950 (*pro* Pleuracanthitidae HYATT, 1900; validation proposed ARKELL, 1955, ICZN pend.)]

Lytoceratacea which combine some characters of Lytoceratina, Phylloceratina, and earliest Ammonitina, and show as well special characters of their own. *L.Jur.(Hett.)*, S.Eu-Tibet-Indon.

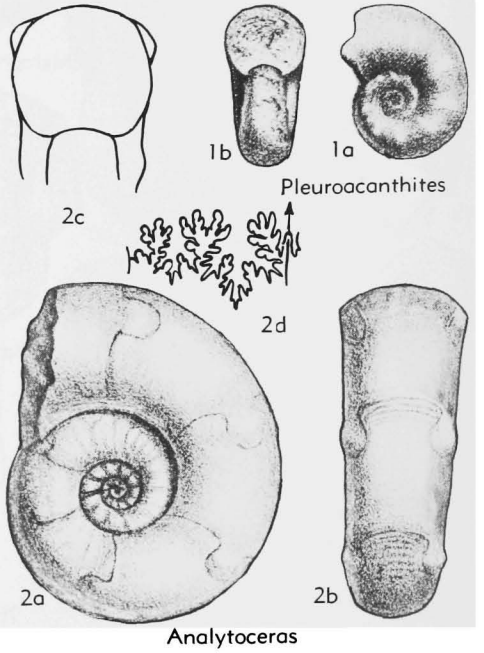



FIG. 222. Pleuroacanthitidae (p. L193).

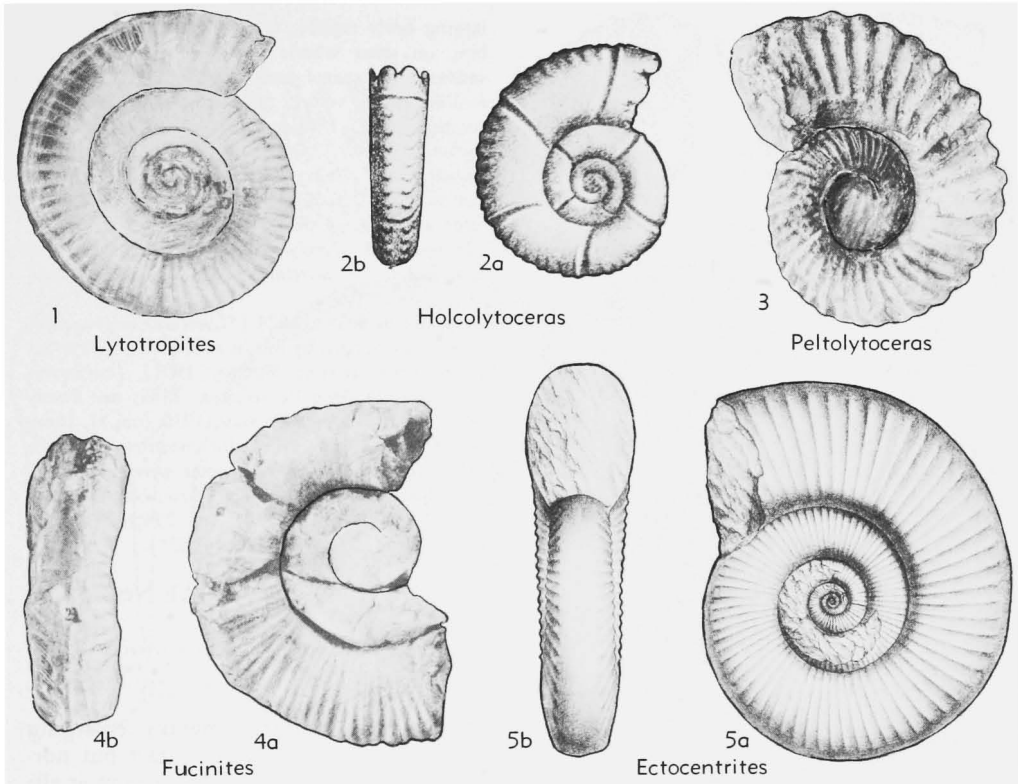



FIG. 223. Ectocentritidae (p. L193-L194).

**Subfamily PLEUROACANTHITINAE Hyatt, 1900**

[*nom. transl. et correct.* ARKELL, 1950 (*ex* Pleuracanthitidae HYATT, 1900), validation proposed ARKELL, 1955 (ICZN pend.)]

Very evolute, whorls numerous, subcircular in section, becoming incipiently keeled in adult; early whorls bearing parabolic nodes, later whorls covered with oblique parabolic lines which are rursiradiate on sides, prorsiradiate on shoulders, and form a long ventral sinus. Sutures with general plan and lobes of Lytoceratina but saddle endings more or less phylloid (12, 201, 550). *L.Jur.(Hett.)*.

**Pleuroacanthites** CANAVARI, 1883 [**Am. biformis* J.DEC.SOWERBY, 1831 (fig'd CANAVARI, 1882); SD HAUG, 1889] [=*Pleuracanthites* ZITTEL, 1884 (obj.)]. Only genus. *Hett.*, Italy.——FIG. 222,*1*. **P. biformis* (Sow.); *1a,b*, ×1 (597*).

**Subfamily ANALYTOCERATINAE Spath, 1927**

[*nom. transl.* ARKELL, 1950 (*ex* Analytoceratidae SPATH, 1927)]

Inner whorls constricted; middle whorls with parabolic lines and conspicuous parabolic nodes; outer whorls with sigmoid flares; adult body chamber with ventrolateral spines (466, 550). *L.Jur.(Hett.)*.

**Analytoceras** HYATT, 1900 [**Am. articulatus* J. DE C. SOWERBY, 1831 (fig'd WAEHNER, 1894)]. Only genus. *Hett.*, Aus.——FIG. 222,*2*. **A. articulatum* (Sow.); *2a-d*, ×1 (550*).

## Family ECTOCENTRITIDAE Spath, 1926

Straight-ribbed planulate Lytoceratacea with smooth or incipiently keeled venter; sutures complex, of lytoceratacean type but having a longer ventral lobe, with lateral lobes more symmetrical and produced and saddle endings tending to be phylloid (466, 550). *L.Jur.(Hett.-Sinem.)*, one genus *L. Pliensb.*, S.Eu.-N.Afr.-Tibet-Indon.-N.Z.

**Ectocentrites** CANAVARI, 1888 [**Am. petersi* HAUER, 1856; SD BONARELLI, 1900] [incl. *Cosmolytoceras* SPATH, 1924]. Ribs fine to medium; venter broad, smooth, flattened; whorls quadrate or rounded; no constrictions. *Hett.* Aus.——FIG. 223,*5*. **E. petersi* (HAUER); *5a,b*, ×0.3 (550*).

**Lytotropites** SPATH, 1924 [**Ectocentrites fucinii* BONARELLI, 1900]. Very evolute, constricted; whorl depressed, rounded, with straight, large but weak radial ribs; venter with incipient keel. (?Sub-

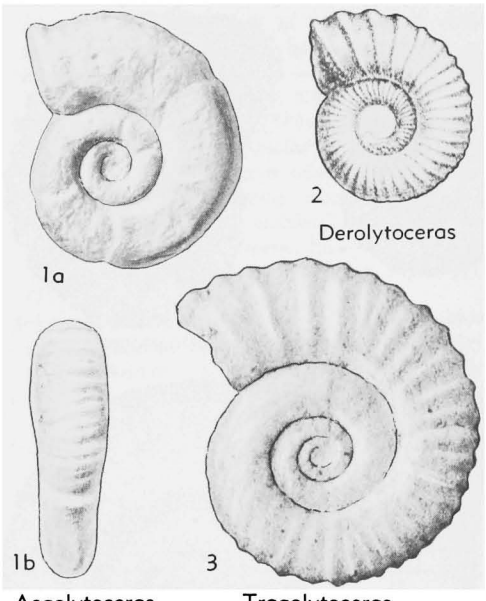



FIG. 224. Derolytoceratidae (p. L194).

gen. of *Ectocentrites*.) *Sinem.*, Italy.——FIG. 223, *1*. **L. fucinii* (BON.); ×0.3 (42*).

**Fucinites** GUGENBERGER, 1936 [**F. sicilianus;* SD ARKELL, herein]. Resembles *Lytotropites* but whorl shape has divergent sides and ribbing is finer. (?Subgen. of *Ectocentrites*.) *Hett.*, Sicily.——FIG. 223,*4*. **F. sicilianus* GUG.; *4a,b*, ×0.5 (181*).

**Holcolytoceras** SPATH, 1924 [**Am. nodostrictus* QUENSTEDT, 1885]. Compressed, planulate, very evolute, whorl shape quadrate-elliptical; inner whorls smooth; internal mold of outer whorls develops comma-shaped ventrolateral bullae which probably represent ribs on test; about 4 to 6 deep constrictions per whorl. Sutures as in *Ectocentrites*. *L.Pliensb.(ibex z.)*, Ger.——FIG. 223,*2*. **H. nodostrictus* (QUENST.); *2a,b*, ×2 (682*).

**Peltolytoceras** SPATH, 1924 [**Ectocentrites giordanii* BONARELLI, 1900]. Massively ribbed *Schlotheimia*- or *Peltoceras*-like forms; whorls enlarging rapidly, subquadrate to somewhat compressed, covered with large, strong, simple ribs, which project beyond ventrolateral angle, but leave middle of venter smooth. *Sinem.*, Italy.——FIG. 223,*3*. **P. giordanii* (BON.); ×0.3 (42*).

## Family DEROLYTOCERATIDAE Spath, 1927

Lytocerataceae developing capricorn ornament. *L.Jur.(Sinem.-Pliensb.)*.

**Derolytoceras** ROSENBERG, 1909 [**Am. lineatus tortus* QUENSTEDT, 1885; SD ROMAN, 1938] [=*Dolytoceras* ROMAN, 1938 (obj.), ?misprint]. Small forms, evolute, whorls only just in contact but enlarging fairly rapidly, subquadrate in section; ribbing on inner whorls fine and dense, changing suddenly to coarse and prorsiradiate, becoming foldlike across venter. Sutures as in young Lytoceratidae (466). *U.Pliensb.*, Eu.——FIG. 224,*2*. **D. tortum* (QUENST.), Ger.; ×2 (682*).

**Tragolytoceras** SPATH, 1924 [**Am. altecinctus* HAUER, 1866]. Similar to *Derolytoceras* but larger and with coarse ribs starting more gradually. (?Subgen. of *Derolytoceras*.) *Sinem.*, S.Eu.——FIG. 224,*3*. **T. altecinctum* (HAUER), Italy; ×1 (42*).

**Aegolytoceras** SPATH, 1924 [**Lytoceras serorugatum* GEYER, 1886, cited by SPATH as *Lytoceras (Geyeria) serorugatum* (STUR) FUCINI, 1901] [=*Geyeria* FUCINI, 1901 (*non* BUCHECKER, 1880; *nec* BUCKMAN, 1899); *Fucinia* TOMLIN, 1930 (obj.)]. Inner whorls round, smooth but for constrictions which are gently convex forward; outer whorl becoming compressed and developing coarse, blunt, curved ventral ribs. *Pliensb.*, Eu.——FIG. 224,*1*. **A. rugatum* (STUR), Italy; *1a,b*, ×1 (162*).

## Family LYTOCERATIDAE Neumayr, 1875

[*sic;* NEUMAYR used correct form of designation for this assemblage but inconsistently used vernacular names only for some other families] [=Thysanoidae HYATT, 1867; incl. Hemilytoceratinae SPATH, 1927]

Shells very evolute, generally enlarging rapidly, having whorls in contact but normally overlapping only slightly or not at all; surface ornamented with various combinations of straight or crinkled growth lines, flares, constrictions and, more rarely, plications. Sutures highly complex, with mosslike detail but few major elements; lateral lobes widely splayed and blunt or obliquely deflected at ends; external lobe short. Aptychus single-valved (Anaptychus) (466). *Jur.-Cret.*, world-wide.

### Subfamily LYTOCERATINAE Neumayr, 1875

Whorls bearing growth lines or lamellar flares or both, corresponding commonly to constrictions on internal mold. External suture with 2 lateral lobes, of which 1st is much the larger, internal suture with cruciform dorsal lobe (466). *L.Jur.(Pliensb.)-U.Cret.(Cenom.)*.

**Lytoceras** SUESS, 1865 [**Am. fimbriatus* J.SOWERBY, 1817; ICZN Opinion 130] [=*Ophiceras* SUESS, 1865 (obj.) (*non* GRIESBACH, 1880, ICZN-validated L.Trias. genus; *Fimbrilytoceras* BUCKMAN, 1918 (obj.); *Thysanoceras* HYATT, 1867; *Thysanolytoceras* BUCK., 1905; *Kallilytoceras* BUCK., 1921; *Crenilytoceras* BUCK., 1926]. Whorls round or quadrate, covered with crinkled growth lines or riblets; some species with lamellar flares, under

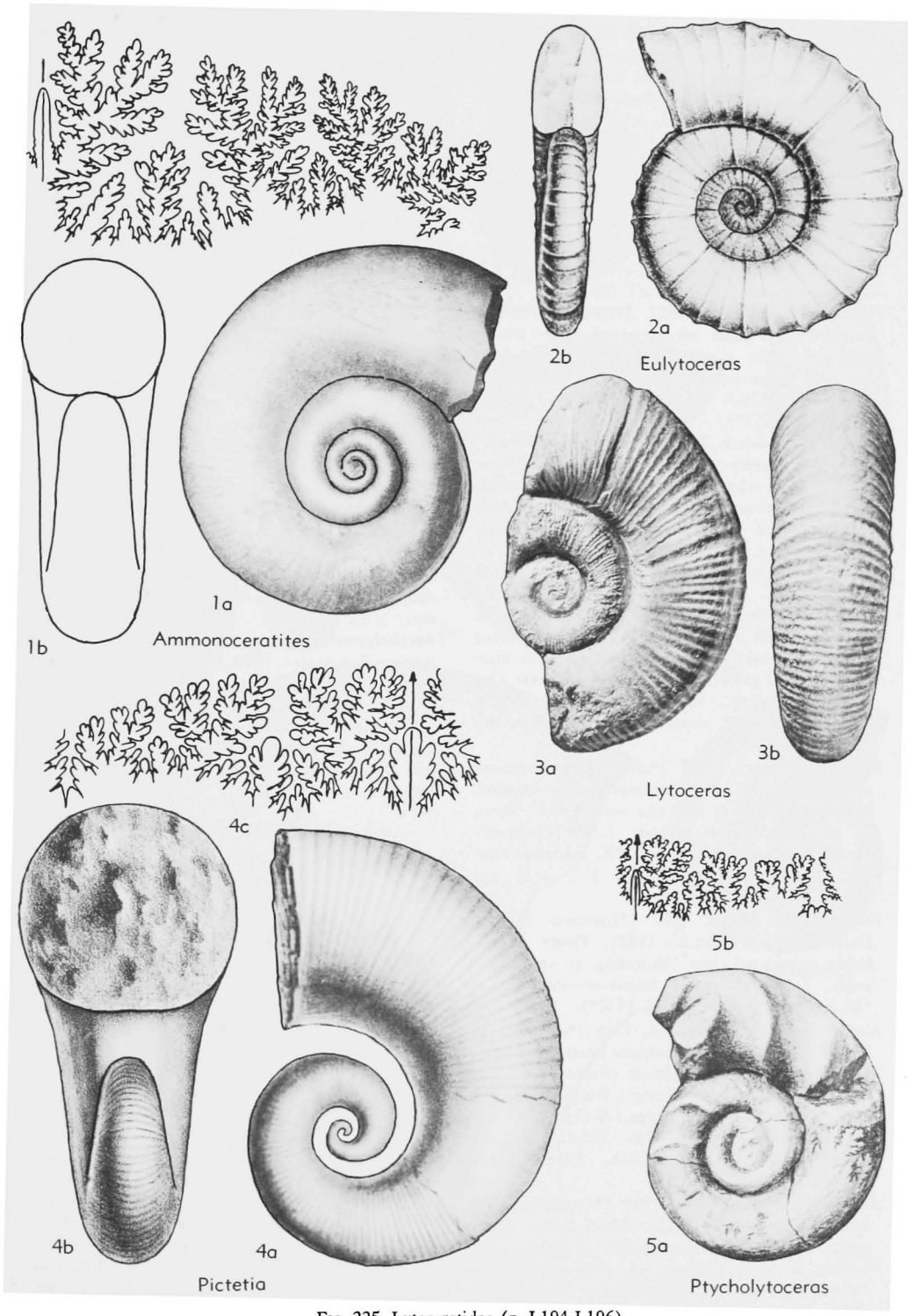



FIG. 225. Lytoceratidae (p. L194-L196).

which slight constriction usually occurs on internal mold; some with fine strigation. *L.Jur.(Sinem.)-U.Cret.*, world-wide, as far N. as Greenl. and N. Alaska.——Fig. 225,*3*. **L. fimbriatum* (Sow.), L. Jur.(L.Pliensb.), Eng.; *3a,b*, ×0.5 (65*).

**Trachylytoceras** Buckman, 1913 [**Am. nitidus* Young & Bird, 1828] [*?Orcholytoceras* Buck., 1926]. Smooth but for rursiradiate plain growth lines which stand out as irregularly spaced rings of variable size. If *Orcholytoceras* is congeneric, the larger species have later growth lines minutely crinkled. *L.Jur.(Toarc.)*, Eng.——Fig. 226,*3*. **T. nitidum* (Young-B.); *3a,b*, ×1 (65*).

**Ptycholytoceras** Spath, 1927 [**Lytoceras humile* Prinz, 1904]. Inner whorls round, outer whorls depressed; sides thrown into prorsiradiate folds which do not pass on to venter. *L.Jur.(Toarc.)*, SE. Eu.——Fig. 225,*5*. **P. humile* (Prinz), Hung.; *5a,b*, ×0.7 (357*).

**Hemilytoceras** Spath, 1927 [**Am. immanis* Oppel, 1865] [*?Saturnoceras* Anderson, 1938 *(nom. nud.)*]. Inner whorls round, smooth, outer whorls becoming depressed and in some developing high lamellae which bend forward over venter. *U.Jur.(Oxf.-Tithon.)*, S.Eu.-C.Eu.-N.Afr.-Cutch.——Fig. 226,*2*. **H. immane* (Oppel), U.Jur.(Tithon.), Eu.; ×0.7 (389*).

**Pterolytoceras** Spath, 1927 [**Am. exoticus* Oppel, 1863]. Whorls subcircular in section, enlarging very slowly, barely in contact; surface with minutely crinkled growth lines and fine irregular ribs. *?Tithon., Valang.*, Himalaya(Spiti sh.)-Punjab. ——Fig. 226,*1*. **P. exoticum* (Oppel), Spiti sh.; *1a-c*, ×0.5 (533*).

**Eulytoceras** Spath, 1927 [**Am. inaequalicostatus* d'Orbigny, 1840]. Whorls compressed or rounded, with regular distant fine ribs and periodic flares, all of which cross venter. *L.Cret.(Hauteriv.-Barrem.)*, Eu.——Fig. 225,*2*. **E. inaequalicostatum* (Orb.), L.Cret.(Barrem.), Fr.; *2a,b*, ×1 (329*).

**?Metalytoceras** Spath, 1927 [**Lytoceras triboleti* Hohenegger in Uhlig, 1883]. Finely ribbed, feebly constricted, ribs bifurcating at very acute angle. *L.Cret.(Valang.)*, Silesia.——Fig. 227,*4*. **M. triboleti* (Hohen.); ×1 (532*).

**Ammonoceratites** Rafinesque, 1815 [**A. lamarcki* Bowditch, 1822] [*Ammonoceras* Lamarck, 1822]. Large, evolute; whorls almost circular, only just in contact; with dense, strongly crinkled fine ribs or growth lines. *L.Cret.(U.Apt.)-U.Cret.(Cenom.)*, Eu.-Sinai-India-Greenl.——Fig. 225,*1*. *A. (A.) mahadeva* (Stoliczka), U.Alb., S.India; *1a,b*, ×0.25; *1c*, ×0.5 (718*).

**Argonauticeras** Anderson, 1938 [**Lytoceras argonautarum* Anderson, 1902]. Whorl section trapezoidal, whorls increasing rapidly in height; ribs weakly crinkled. (Subgen. of *Ammonoceratites.*) *L.Cret.(U.Apt.)*, Fr.-Cauc.-Calif., *?L.Cret.(?M. Alb.)*, Madag.——Fig 226,*7* **A. (A.) argonautarum* (Anderson), L.Cret.(U.Apt.), Calif.; *7a,b*, ×0.5 (580*).

**Pictetia** Uhlig, 1883 [**Crioceras astierianum* d'Orbigny, 1842]. Loosely coiled with whorls not touching, section circular to depressed; body chamber may straighten; surface with feeble, irregular, weakly crinkled ribs. *L.Cret.(L.Alb.-M.Alb.)*, W. Eu.-Madag.-India.——Fig. 225,*4*. **P. astieriana* (Orb.), L.Cret.(M.Alb.), Fr.; *4a-c*, ×0.75 (329*).

### Subfamily MEGALYTOCERATINAE Spath, 1927

Planulate forms which tend to lose lytoceratid characters of whorls and sutures and to resemble perisphinctids (466). *L.Jur.(Toarc.)-M.Jur.(Baj.)*, mainly *Baj.*

**Megalytoceras** Buckman, 1905 [**Lytoceras confusum* Buck., 1881]. Early whorls elliptical in section, bearing periodic flares; later whorls becoming smooth and planulate, with convergent sides, rather wide umbilical area and abrupt umbilical edge. *M.Baj.*, Eng.——Fig. 226,*5*. **M. confusum* (Buck.); *5a,b*, ×0.3 (595*).

**Metrolytoceras** Buckman, 1923 [**M. metretum*]. Early whorls unknown; middle and outer whorls smooth, planulate, with flat sides. Sutures much simplified. *M.Baj.*, Eng.——Fig. 226,*6*. **M. metretum*; ×0.2 (65*).

**?Asapholytoceras** Spath, 1927 [**Lytoceras forojuliense* Taramelli, 1880, cited by Spath as *Lytoceras forojuliense* Meneghini in Prinz, 1904]. Whorls high, compressed, with fine riblets or growth lines which do not show on internal mold; umbilical angle sharp. Exernal suture with 4 lateral lobes; dorsal lobe not cruciform. *Toarc.*, SE. Eu.

### Subfamily VILLANIINAE Arkell, nov.

Planulates retaining typical lytoceratid external sutures but lacking cruciform character of dorsal lobe and with somewhat peltoceratid type of ribbing (505). *M.Jur.(Callov.)*.

**Villania** Till, 1911 [**V. densilobata*]. Inner whorls compressed, ribbed on sides; outer whorls smooth, rounded. [Loczy's (1915, p. 422, pl. 8, 10, 13) identification of several ordinary perisphinctids with *V. densilobata* cannot be accepted.] *M.Jur.(Callov.)*, Hung.-Ger.——Fig. 227,*3*. **V. densilobata*, Hung.; *3a,b*, ×0.7 (505*).

### Subfamily ALOCOLYTOCERATINAE Spath, 1927

Forms with many deep constrictions, which produce some resemblance to capricorns in middle whorls but pass to a smooth and more involute stage. Saddle endings of sutures tend to be phylloid (466). *L.Jur.(Toarc.)-M.Jur.(Baj.)*.

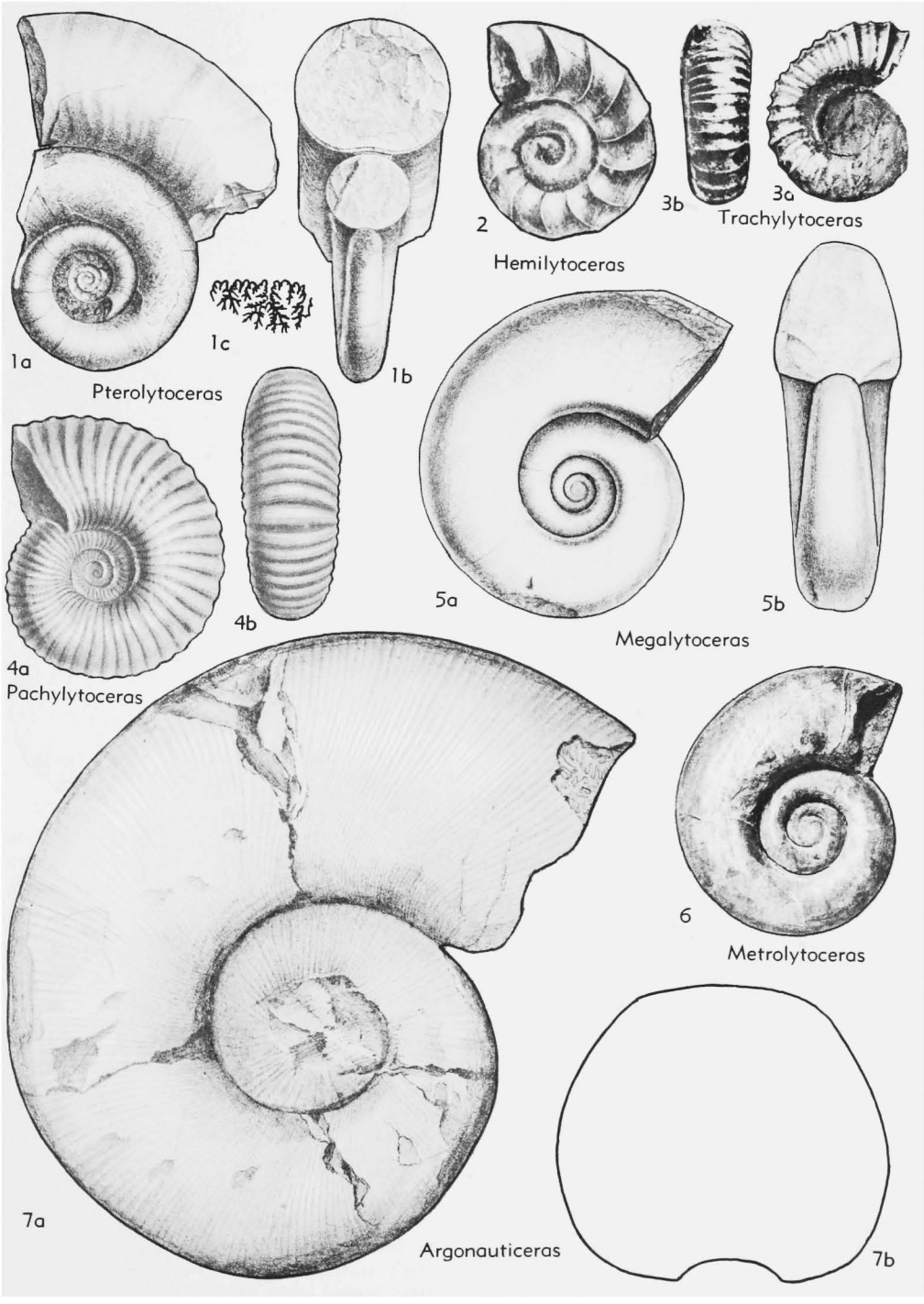



Fig. 226. Lytoceratidae (p. L194-L198).

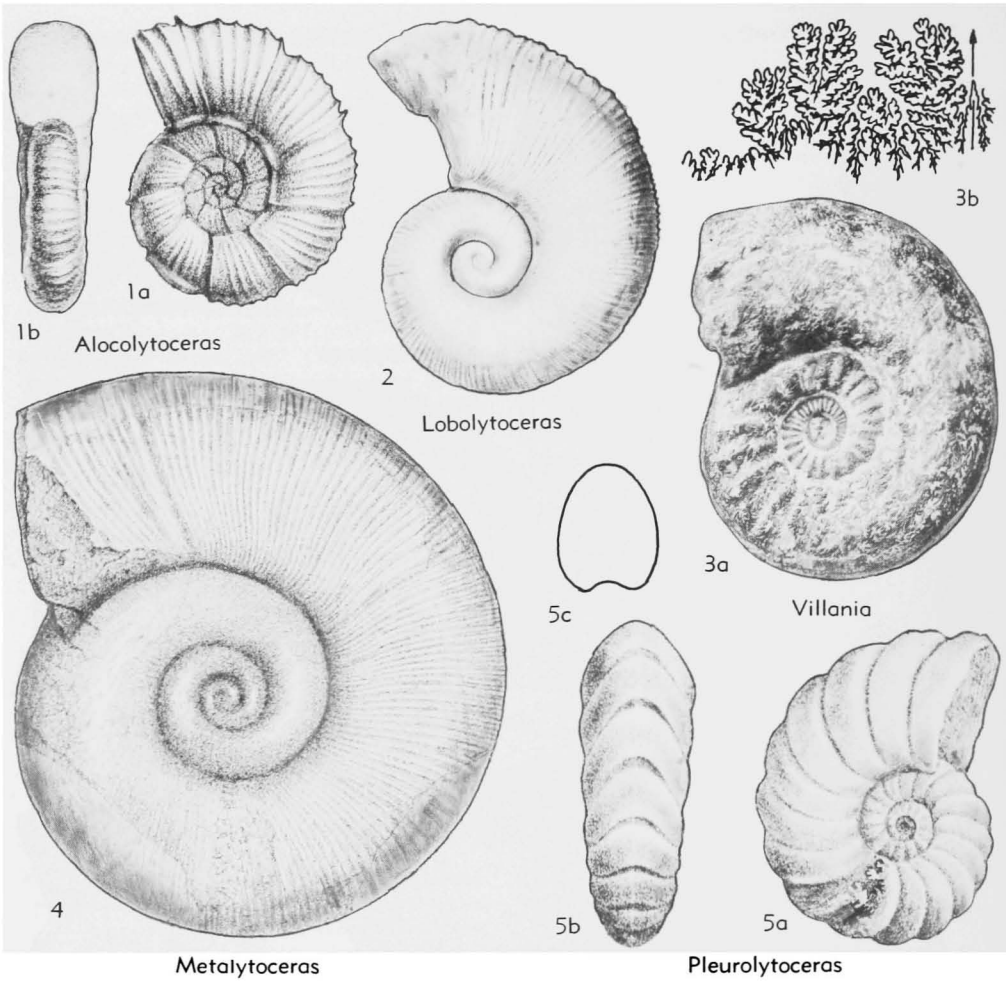



FIG. 227. Lytoceratidae (p. L196-L198).

**Alocolytoceras** HYATT, 1900 [**Am. germaini* D'ORBIGNY, 1845]. Whorls passing from round to oval, rounded-quadrate, or compressed; with about 10 deep constrictions per whorl and 4 to 20 sharp ribs between constrictions. *Toarc.*, Eu.-Himalaya. ——FIG. 227,*1*. **A. germaini* (ORB.), Fr.; *1a,b*, ×1 (330*).

**Pleurolytoceras** HYATT, 1900 [**Am. hircinus* SCHLOTHEIM, 1820 (fig'd QUENST., 1849)]. Whorl section triangular-elliptical, with narrower venter, constrictions more numerous (17 per whorl in type) and interspaces smooth. *Toarc.*, Eu.——FIG. 227,*5*. **P. hircinus* (SCHLOTH.), Ger.; *5a-c*, ×1 (358*).

**Pachylytoceras** BUCKMAN, 1905 [**Am. torulosus* ZIETEN, 1831]. Early whorls round, generally with numerous constrictions, which break up surface into a series of swollen ribs; later whorls becoming elliptical. In the *jurense* group constrictions fail on middle and outer whorls, or in some species entirely, leaving whole shell smooth. *Toarc.-L.Baj.*, Eu.-Crimea-E.Asia-Indon.——FIG. 226,*4*. **P. torulosum* (ZIETEN), Toarc., Ger.; *4a,b*, ×0.5 (742*).

**Lobolytoceras** BUCKMAN, 1923 [**Am. siemensi* DENCKMANN, 1887]. Innermost whorls only have large swollen ribs; later whorls become compressed-elliptical with crinkled growth lines or riblets, which coarsen somewhat near aperture and develop strigation. *Toarc.*, Eu.——FIG. 227,*2*. **L. siemensi* (DENCK.), U.Toarc., Ger.; ×0.25 (605*).

## Family NANNOLYTOCERATIDAE Spath, 1927

Dwarf, evolute, compressed, unribbed forms, with deep constrictions. Sutures relatively simple, with long ventral lobe and 2 main lateral lobes (466). *L.Jur.(U.Pliensb.)-M.Jur.(Bath.)*.

**Nannolytoceras** BUCKMAN, 1905 [**Am. pygmaeus* D'ORBIGNY, 1846] [*Polystomiceras* SPATH, 1924; *Polystomites* SPATH, 1931]. Smooth, many-whorled, with varying number of deep constrictions, which are oblique to acutely sigmoid, running forward on whorl sides, backward on venter; whorl section quadrate. *Baj.-Bath.*, Eu.-N.Afr.——FIG. 228,2. **N. pygmaeum* (ORB.), Baj., Fr.; *2a-c*, ×1 (330*).

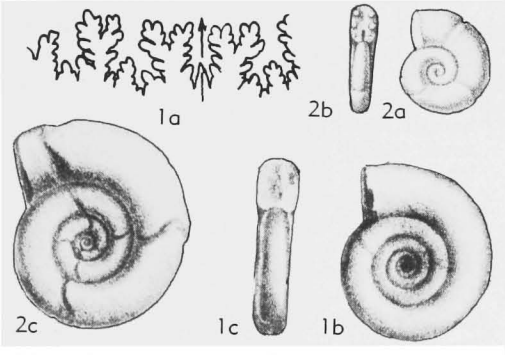



FIG. 228. Nannolytoceratidae (p. L199).

**?Audaxlytoceras** FUCINI, 1923 [**Lytoceras audax* MENEGHINI, 1881; SD ARKELL, herein]. Small, evolute, smooth, compressed, with a few narrow constrictions, which are gently convex forward on whorl sides and straight over venter. *U.Pliensb.*, Italy.——FIG. 228,*1*. **A. audax* (MEN.); *1a-c*, ×1 (660*).

## Family PROTETRAGONITIDAE Spath, 1927

Very evolute, with circular to oval whorl section and regular radial straight or slightly curved constrictions; test smooth or with fine gowth lines only. Suture with a tendency to develop one or more auxiliaries. Probably derived from *Lytoceras (s.s.)*, young whorls of which commonly have a few strong constrictions, as in *Protetragonites* (466). *U.Jur.(U.Tithon.)-L.Cret.(M.Alb.)*.

**Protetragonites** HYATT, 1900 [**Am. quadrisulcatus* D'ORBIGNY, 1840]. Whorl section circular; constrictions few, straight to slightly curved. *U.Jur.(U.Tithon.)-L.Cret.(Valang.)*, Eu.——FIG. 229,*1*. **P. quadrisulcatus* (ORB.), Valang., Fr.; *1a,b*, ×1 (329*).

**Leptotetragonites** SPATH, 1927 [**Am. honnoratianus* D'ORBIGNY, 1840]. Section compressed oval; 10 or more constrictions to whorl, with strong, rounded rib in front. *L.Cret.(Berrias.-Valang.)*, Fr.——FIG. 229,*2*. **L. honnoratianus* (ORB.), Valang., Fr.; ×0.75 (329*).

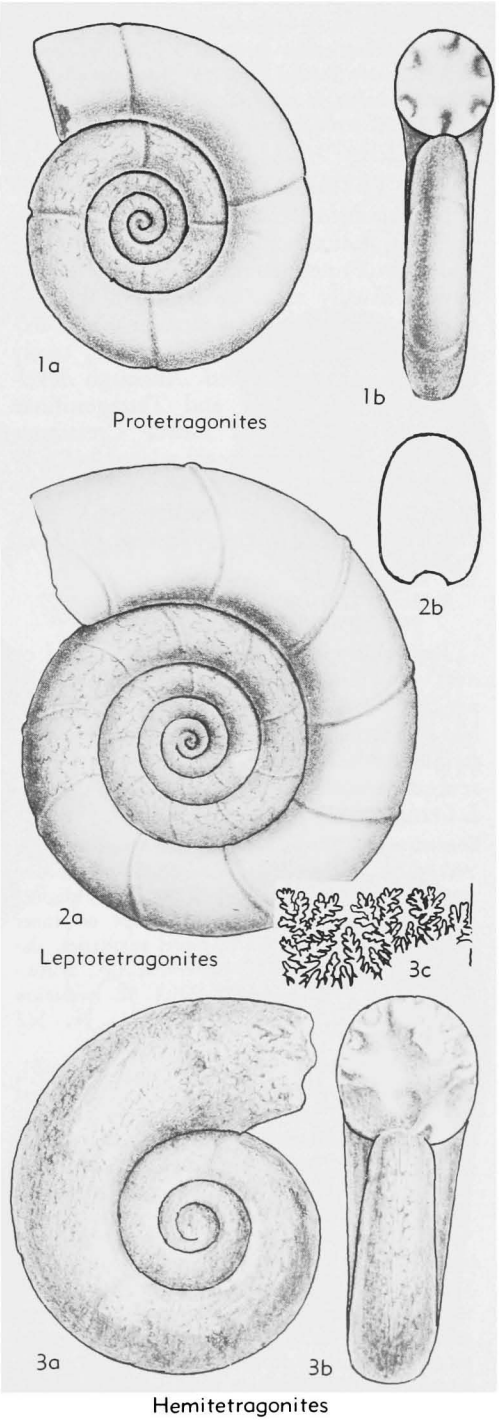



FIG. 229. Protetragonitidae (p. L199-L200).

**Hemitetragonites** SPATH, 1927 [**Am. crebrisulcatus* UHLIG, 1883]. Whorl section more or less round but tending to be slightly flattened on sides and venter; constrictions straight or slightly curved. Suture more incised than in *Protetragonites*. *L. Cret.(Hauteriv.-M.Alb.)*, Fr.-C.Eu.-Madag.——FIG. 229,*3*. **H. crebrisulcatus* (UHLIG), Barrem., Aus.; *3a-c*, ×1 (530*).

## Family TETRAGONITIDAE Hyatt, 1900

Distinguished from Lytoceratidae by having several auxiliary elements in the suture and from Protetragonitidae, its ancestor, in having usually more auxiliaries and being more involute, with less circular whorl section. Shell lirate, striate or smooth, rarely folded or strongly ribbed. Although developed Gaudryceratinae and Tetragonitinae are very distinct, the Lower Cretaceous members are all very closely related and subfamilial separation, as recommended by BREISTROFFER, seems adequate (53, 214, 230, 238, 571). *L.Cret.(Barrem.)-U.Cret. (Maastr.)*.

### Subfamily GAUDRYCERATINAE Spath, 1927

[Includes Hypogaudryceratinae SHIMIZU, 1934]

Typically with rounded and depressed or oval whorl section, becoming higher with age, very fine to coarse lirae. With more or less symmetrically bifid saddles and a single saddle in the internal suture, but there are several exceptions (53, 214, 230, 238, 571). *L.Cret.(Barrem.)-U.Cret.(Maastr.)*.

**Eogaudryceras** SPATH, 1927 [**Am. numidus* COQUAND in SAYN, 1890]. Evolute, whorl section round to rounded-trapezoidal; fine, dense slightly sinuous lirae; no constrictions except on inner whorls. Suture with 2 or more auxiliaries, descending in straight line. *Barrem.-M.Alb.*, W.Eu.-C.Eu.-N.Afr.-Madag.——FIG. 230,*1*. **E. numidum* (COQUAND), U.Apt., Fr.; *1a,b*, ×1; *1c*, ×2 (214*).

**Eotetragonites** BREISTROFFER, 1947 [**E. raspaili*]. Differs from *Eogaudryceras* only in its slightly less regularly bifid saddles of suture, its emphatic oblique dense constrictions and (in some species only) its more angular whorl section. Internal suture still has only one saddle. *?Barrem., U.Apt.-L. Alb.*, S.Eu.-C.Eu.-?Madag.-N.Afr.——FIG. 230,*3*. **E. raspaili*, U.Apt., Fr.; *3a,b*, ×1 (229*).

**Anagaudryceras** SHIMIZU, 1934 [**Am. sacya* FORBES, 1846] [=*Paragaudryceras* SHIMIZU, 1934]. Inner whorls with circular to rather depressed but not angular whorl section, becoming higher than wide on outer whorls; shell with very fine more or less straight but prorsiradiate lirae, rarely smooth; some bearing periodic weak constrictions with strong collar; body chamber usually with more or less strong foldlike ribs. *U.Alb.-Maastr.*, S.Eu.-C.Eu.-N.Afr.-Madag.-S.India-Japan.——FIG. 230,*4*. **A. sacya* (FORBES), Cenom., S.India; ×1 (620*).

**Mesogaudryceras** SPATH, 1927 [**Am. leptonema* SHARPE, 1855]. Early whorls compressed, later whorls less so, sides convex, venter narrowly rounded. Sinuous lirae and absence of constrictions distinguish it from *Anagaudryceras* and *Zelandites* and nature of early whorl section from *Gaudryceras*. Suture with shallow external lobe. *Cenom.*, Eng.-Greenl.——FIG. 232,*1*. **M. leptonema* (SHARPE), Eng.; *1a,b*, ×1 (440*).

**Zelandites** MARSHALL, 1926 [**Z. kaiparaensis*] [=*Varunaites* SHIMIZU, 1926; *Hypogaudryceras* SHIMIZU, 1934; *Anazelandites* MATSUMOTO, 1938]. Small; initially with round whorl section but rapidly becoming more high-whorled and involute; compressed, nearly smooth and with weak to strong, straight or sinuous, radial or prorsiradiate constrictions in some shells marked on outside by a threadlike rib. Suture with very asymmetrical 1st lateral lobe in adult. May include a series of compressed offshoots of other genera but no real distinction is seen between species groups of different dates. *U.Alb.-Maastr.*, N.Afr.-SE.Afr.-S.India-Japan-N.Z.-Chile.——FIG 230,*5a,b*. **Z. kaiparaensis* Camp., N.Z.; *5a*, ×1.5; *5b*, ×7 (274*).——FIG. 230,*5c*. *Z. varuna japonica* MATSUMOTO, Camp., Japan; ×1 (659*).

**Parajaubertella** MATSUMOTO, 1943 [**P. kawakitana*]. Like *Anagaudryceras* at first but whorls rapidly become very depressed, with broad rounded ribs on last whorl. *?Cenom.*, Japan.——FIG. 231,*5*. **P. kawakitana; 5a,b*, ×4 (659*).

**Gaudryceras** GROSSOUVRE, 1894 [**Am. mitis* HAUER, 1866; SD BOULE, LEMOINE & THEVENIN, 1906] [*Epigaudryceras, Pseudogaudryceras* SHIMIZU, 1934; *Neogaudryceras* SHIMIZU, 1935]. Lirae coarser than in *Anagaudryceras*, close or distant, simple or branching, moderately to very sinuous; last whorl may bear variable close or distant strong foldlike ribs. Suture with retracted auxiliaries. May be divisible into subgenera but nominal groups cited in synonymy are not well differentiated. *Turon.-Maastr.*, world-wide except N.Eu.-N.Am. ——FIG. 230,*6*. *G. varagurense* KOSSMAT, Santon., S.India; *6a-c*, ×1 (238*).

**Vertebrites** MARSHALL, 1926 [**V. murdochi*]. With many more whorls, depressed to a later stage than in rest of family; shoulders tending to be nearly angular; lirae very fine, branching regularly at shoulder into still finer ones. Internal suture (at least in type species) with several saddles, decreasing in size to umbilical suture. *Santon.-Maastr.*, N.Afr.-Madag.-S.India-N.Z.-Japan-Calif.-Mex.-Chile.——FIG. 230,*2*. **V. murdochi*, Camp., N.Z.; *2a*, ×1; *2b*, ×2; *2c*, ×4.5; *2d*, ×3 (274*).

### Subfamily KOSSMATELLINAE Breistroffer, 1953

Depressed or oval whorl section with

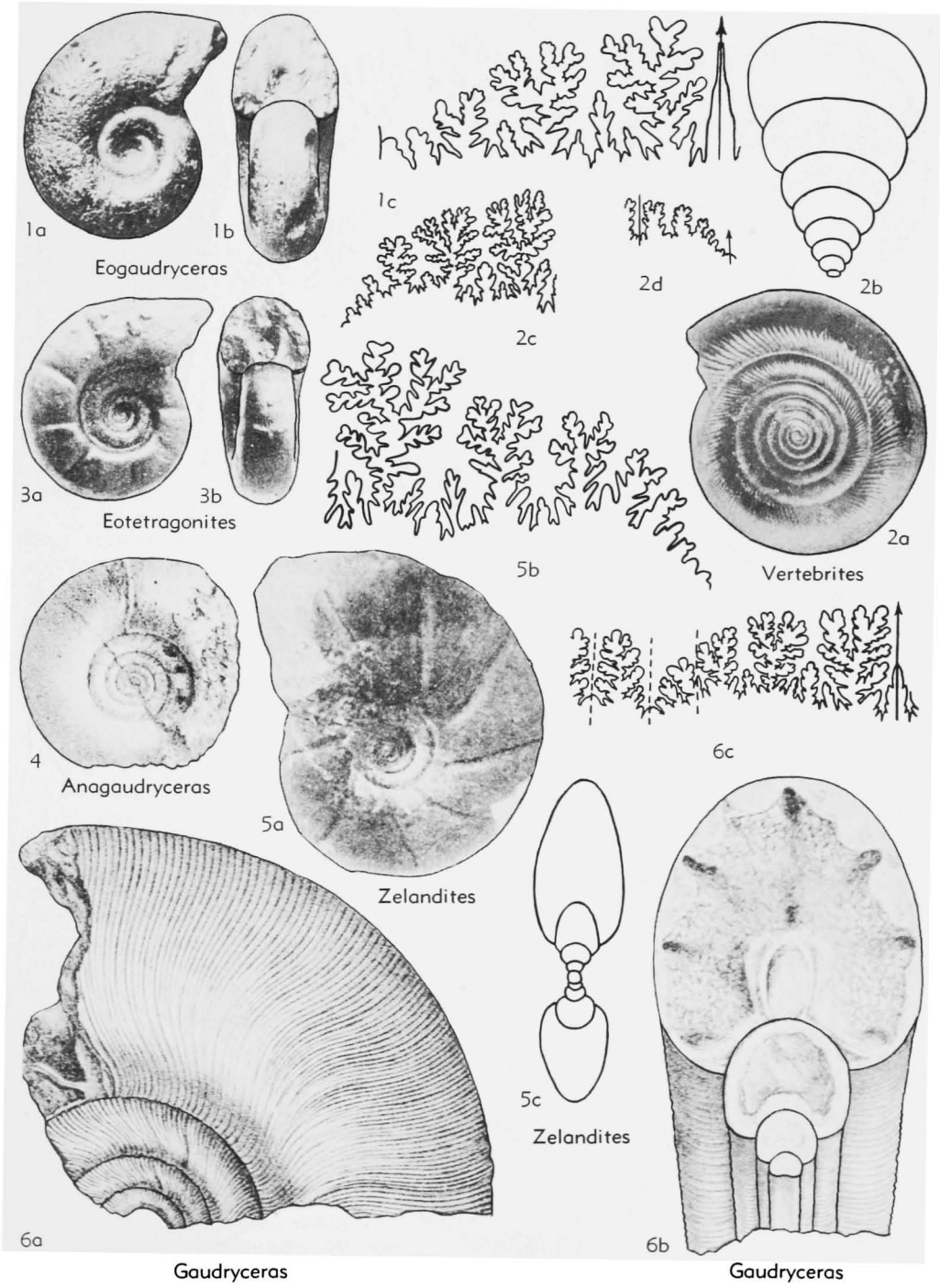



FIG. 230. Tetragonitidae (p. L200).

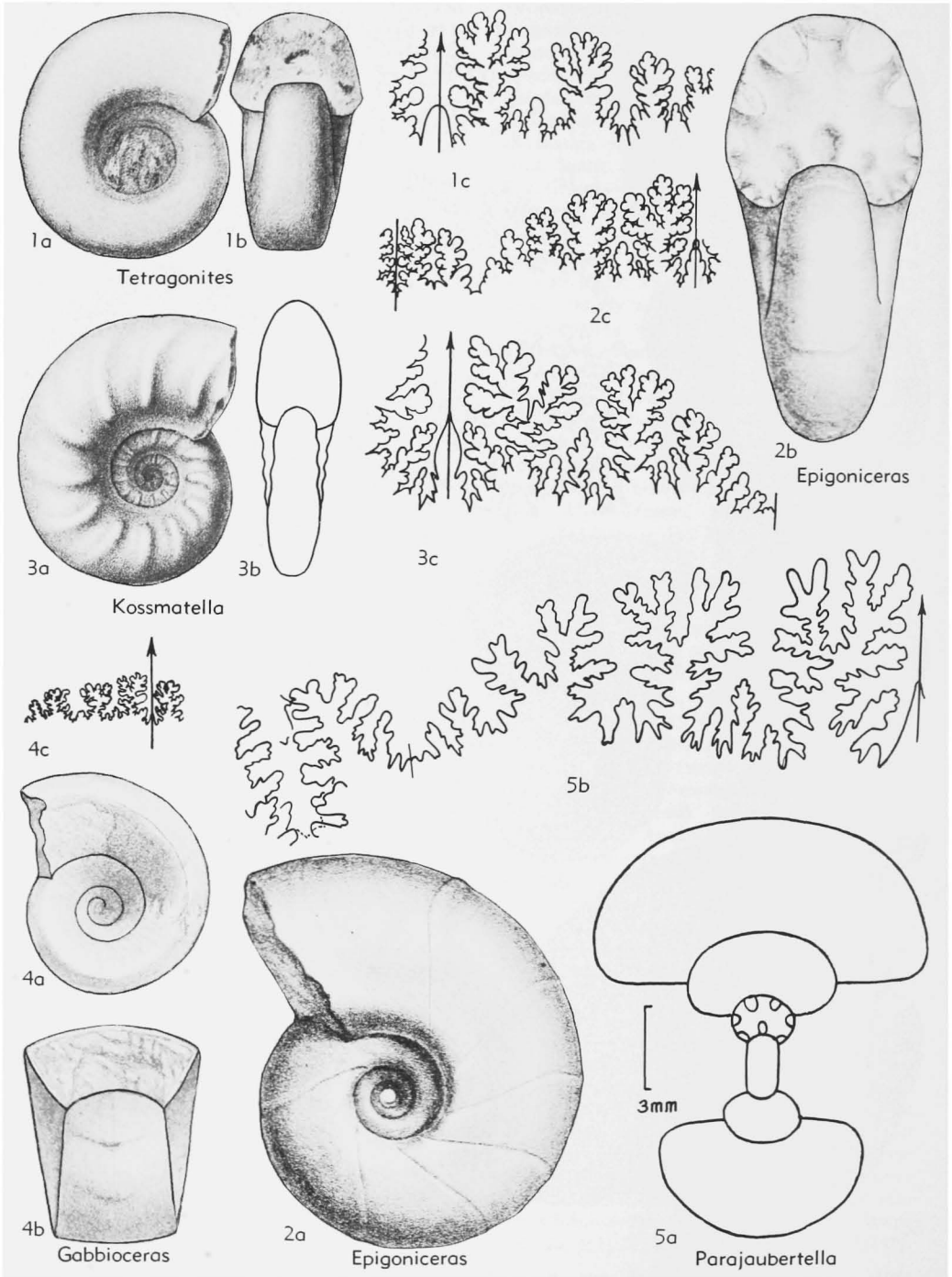



FIG. 231. Tetragonitidae (p. L200-L203).

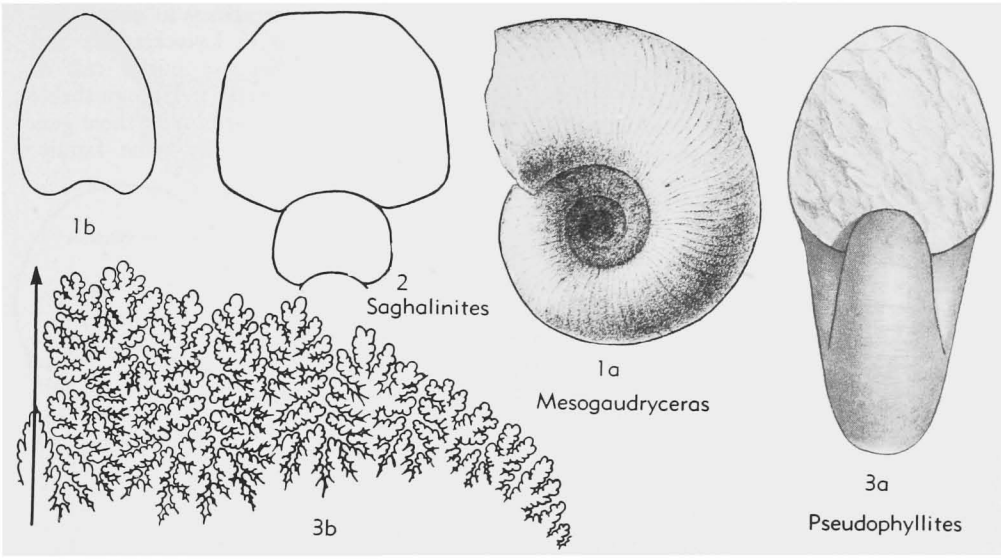



FIG. 232. Tetragonitidae (p. L200-L203).

large regular lateral bulges, derived from approximation of the constrictions of *Eotetragonites;* lirate test and suture as in Gaudryceratinae (53, 214, 230). *L.Cret.(L.Alb.)-U.Cret.(L.Cenom.).*

**Kossmatella** JACOB, 1907 [**Am. agassizianus* PICTET, 1847]. *L.Alb.-L.Cenom.,* Fr.-C.Eu.-Sinai-S.India-Calif.-Tex.-Mex.——FIG. 231,*3.* **K. agassiziana* (PICTET), M.Alb., Fr.; *3a,b,* ×1; *3c,* enlarged (346*).

### Subfamily TETRAGONITINAE Hyatt, 1900

[Incl. Gabbioceratinae BREISTROFFER, 1953]

Typically with square or trapezoidal whorl section, at least during some growth stage; shell usually smooth but some lirate or striate; constrictions usually present, strongly projected on sides and recurved on venter but forming no feature on outside of test. Suture with varying number of auxiliary saddles, internal suture with 2 or more; typically major saddles are irregularly trifid. Derived from *Eotetragonites* (50, 214, 238, 571). *L.Cret.(Apt.)-U.Cret.(Maastr.).*

**Gabbioceras** HYATT, 1900 [**Am. batesi* GABB, 1869 (*non* TRASK, 1855), =**Gabbioceras angulatum* ANDERSON, 1903, ICZN pend.] [=*Jauberticeras* JACOB, 1907; *Jaubertella* JACOB, 1908]. Whorl section round to depressed with a lateral angle distinct at some growth stage, usually very sharp; with or without constrictions, test lirate (?or smooth). *U.Apt.-L.Cenom.,* Fr.-Pol.-Cauc.-Madag.-Calif.——FIG. 231,*4. G. latecarinatum* (ANTHULA), U.Apt., Cauc.; *4a-c,* ×1 (581*).

**Tetragonites** KOSSMAT, 1895 [**Am. timotheanus* PICTET, 1847]. Moderately evolute; whorl section usually squarish but may be round; oblique constrictions usually present. Suture with auxiliaries in straight line and 4 saddles in internal suture. *M.Alb.-U.Cenom.,* Eu. - Sinai - Zululand - S.India-Japan-Tex.-Mex.——FIG. 231,*1.* **T. timotheanus* (PICTET), U.Alb., Fr.; *1a,b,* ×1; *1c,* enlarged (346*).

**Epigoniceras** SPATH, 1925 [**Tetragonites epigonus* KOSSMAT, 1895]. Differs from *Tetragonites* primarily in suture having a retracted suspensive lobe and, usually, more auxiliaries. *L.Turon.-Maastr.,* N. Afr.-W.Afr.-Madag.-S.India-Japan-W.Austral.-N.Z.-Peru.

**E. (Epigoniceras)** [=*Eoepigoniceras, Neoepigoniceras* SHIMIZU, 1935 *(nom. nud.)*]. Moderately involute, whorl section square or trapezoidal. *L. Turon.-Camp.,* distr. as for genus.——FIG. 231, *2.* **E. (E.) epigonum* (KOSSMAT), Camp., S.India; *2a-c,* ×1 (238*).

**E. (Saghalinites)** WRIGHT & MATSUMOTO, 1954 (*ex* SHIMIZU, 1935, *nom. nud.*) [**Am. cala* FORBES, 1845]. Very evolute, whorls increasing very slowly in height; section round to octagonal; regular weak or strong sinuous constrictions. *?U. Santon., Camp.,* Tunis.-Madag.-S.India-Sakhalin. ——FIG. 232,*2.* **E. (S.) cala* (FORBES), Camp., S. India; ×1 (238*).

**Pseudophyllites** KOSSMAT, 1895 [**Am. indra* FORBES, 1845]. Early whorls as in *E. (Epigoniceras)* but later more involute, without constrictions and with much higher and more rounded whorl section; test finely striate. Suture very finely divided. *Camp., ?Maastr.,* S.Afr.-S.India-W.Austral.-N.Z.-Japan-B.

C.——FIG. 232,*3*. **P. indra* (FORBES), ?Maastr., S.India; *3a*, ×0.5; *3b*, ×1 (238*).

## Family MACROSCAPHITIDAE Hyatt, 1900

Distinctly ribbed or spinose derivatives of Lytoceratidae, with tendency to uncoil. Suture more or less as in Lytoceratidae and invariably ornate. Because initial coil of hooked *Macroscaphites* is indistinguishable from normally coiled *Costidiscus*, these genera must be placed in the same family;

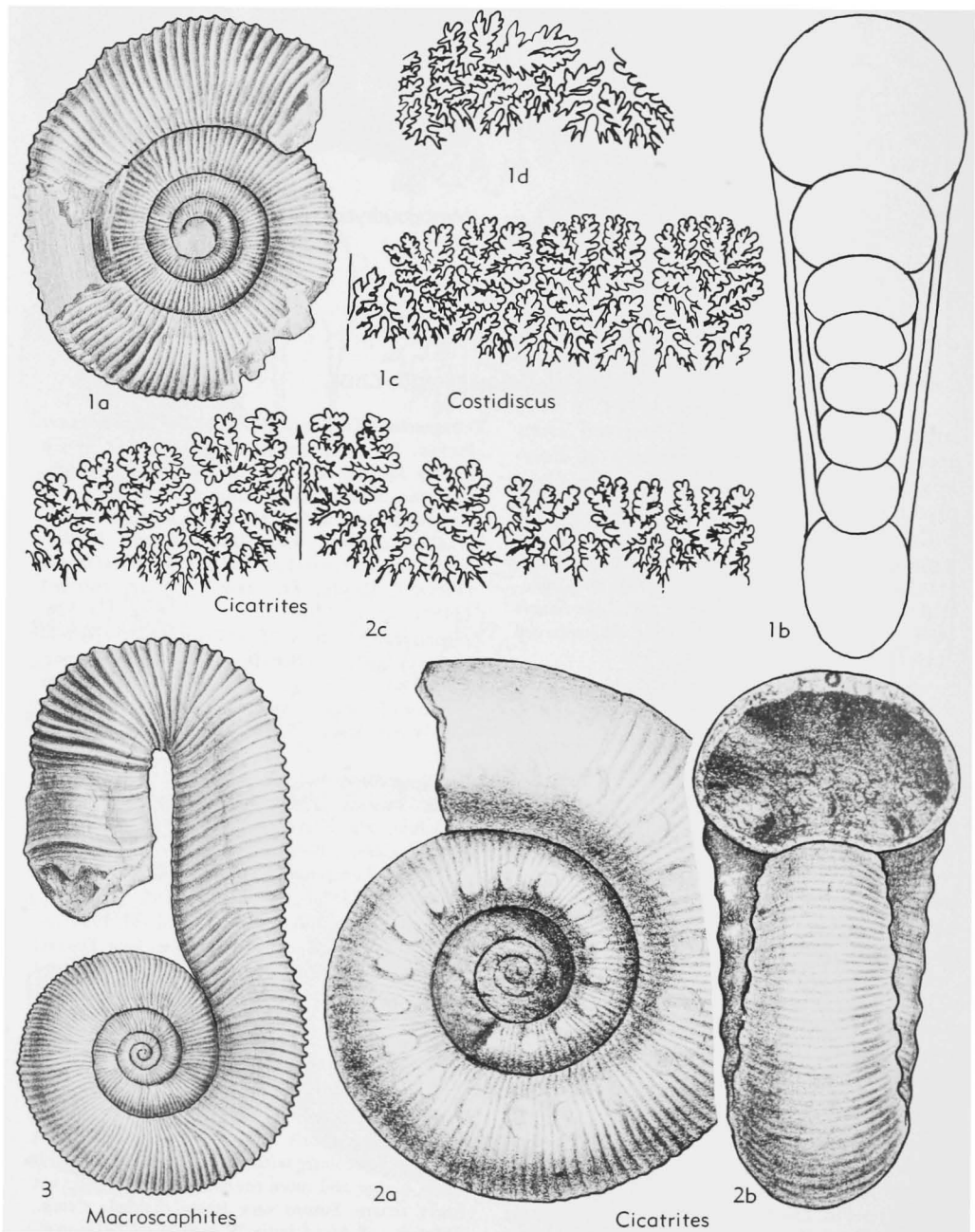



FIG. 233. Macroscaphitidae, Cicatritidae (p. L205).

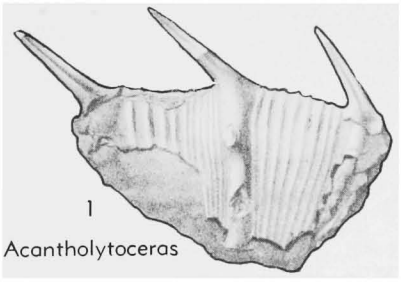



FIG. 234. *Acantholytoceras longispinus* (UHLIG), L. Cret.(Barrem.), Silesia; ×0.5 (530*) (p. L205).

*Macroscaphites* apparently gave rise to various heteromorph offshoots by reduction and disappearance of normally coiled part of shell (229, 530). *L.Cret.(Barrem.-U. Apt.)*.

**Costidiscus** UHLIG, 1882 [**Am. recticostatus* D'ORBIGNY, 1841]. Normally coiled, rather evolute, with dense strong straight radial ribs, which in some species are thickened on umbilical edge or even tuberculate; some forms also with distinct small ventrolateral tubercles; constrictions with enlarged ribs in front and behind usually present. Suture with sharp ends to all lobules; internal lobe with single point. *Barrem.-L.Apt.*, S.Eu.-C.Eu.-Sinai-Mex.——FIG. 233,*1*. **C. recticostatus* (ORB.), Barrem., Silesia; *1a,b*, ×0.75; *1c,d*, ×1 (530*).

**Macroscaphites** MEEK, 1876 [**Scaphites yvani* PUZOS, 1831]. Septate whorls exactly as in untuberculate or tuberculate species of *Costidiscus* (but usually smaller) followed by uncoiled body chamber with straight or even recurved shaft and final hook. *Barrem.-Apt.*, S.Eu.-C.Eu.-N.Afr.——FIG. 233,*3*. **M. yvani* (PUZOS), Barrem., Silesia; ×0.75 (530*).

**Acantholytoceras** SPATH, 1923 [**Hamites (Pictetia) longispinus* UHLIG, 1883]. Whorls not in contact, whorl section oval; periodic enlarged ribs with long hollow umbilical, lower and upper lateral and ventrolateral spines. *Barrem.*, C.Eu.-E.Eu.——FIG. 234,*1*. **A. longispinum* (UHLIG), Barrem., Silesia; ×0.5 (530*).

### Family CICATRITIDAE Spath, 1927

Known only in a few examples of a single species which seems to be derived from *Costidiscus* but differs primarily in its asymmetric suture (3). *L.Cret.(Apt.)*.

**Cicatrites** ANTHULA, 1899 [**C. abichi*]. Very evolute with depressed whorl section; regular flattened umbilical bullae each cover 3 of the dense straight ribs and presumably formed bases of long hollow spines. Suture with bifid elements but irregular and with asymmetric 1st lateral lobe. *L.Apt.-U. Apt.*, Fr.-Cauc.——FIG. 233,*2*. **C. abichi*, U.Apt., Cauc.; *2a-c*, ×1 (581*).

## Superfamily SPIROCERATACEAE Hyatt, 1900

[*nom. transl.* ARKELL, 1950 (*ex* Spiroceratidae HYATT, 1900)]

Uncoiled ammonoids of Jurassic. Possibly offshoots derived from Lytoceratina and hence classifiable with this suborder (12, 201, 355). *L.Jur.(Pliensb.)-U.Jur.(Oxf.)*.

### Family ARCUCERATIDAE Arkell, 1950

Shell in form of open bow, enlarging very slowly; no ventral sulcus; ribs never oblique. Sutures unknown (12, 355). *L.Jur. (Pliensb.)*.

**Arcuceras** POTONIÉ, 1929 [**A. marthae*]. Only genus. *Pliensb.*, Eu.——FIG. 235,*4*. **A. marthae* POTONIÉ, Ger.; × (360*).

### Family SPIROCERATIDAE Hyatt, 1900

[=Parapatoceratidae BUCKMAN, 1926]

Suture lines simple, consisting of 3 lobes

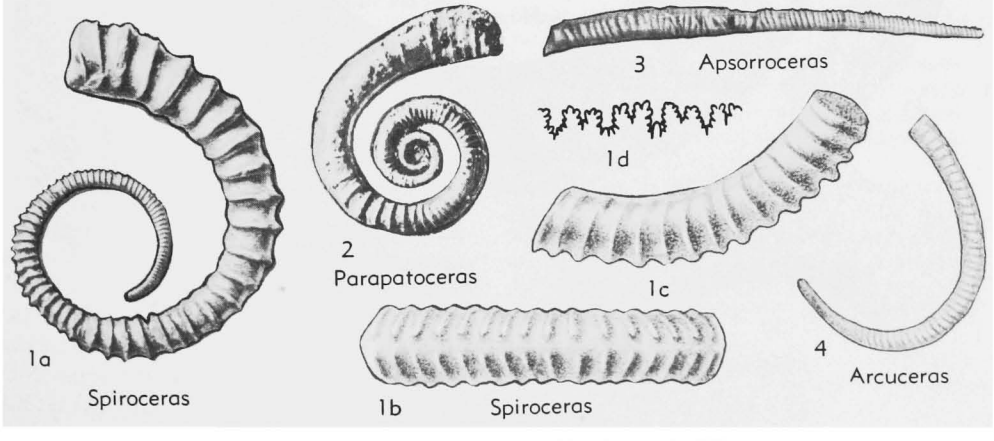



FIG. 235. Arcuceratidae, Spiroceratidae (p. L205-L207).