MEDLICOTTIOIDEA

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Superfamily MEDLICOTTIOIDEA Karpinskii, 1889

[*nom. transl.* MILLER & FURNISH, 1954, p. 687, *ex* Medlicottinae (*sic*) KARPINSKII, 1889, p. 45] [=Pronoritidae HYATT & SMITH, 1905, p. 108, *partim*]

Advanced Prolecanitida characterized by complex sutures. Ventral lobe narrow, shallowly tridentate. Lateral lobe broadest sutural element, bifid, generally with ventral prong (L_1) transformed during phylembryogenesis into progressively more strongly adventitiously subdivided ventrolateral saddle. [Family-level groupings based primarily on sutural phylogeny, especially phylembryogenesis of lateral lobe and simple or bidentate form of dorsal lobe.] *Mississippian (Visean)–Lower Triassic (Induan).*

Family PRONORITIDAE Frech, 1901

[*nom. transl.* SMITH, 1903, p. 41, *ex* Pronoritinae FRECH, 1901, p. 481] [=Shikhanitidae RUZHENTSEV, 1951, p. 98]

Ancestral medlicottioideans characterized by moderately evolute conch and relatively simple sutures. Shell smooth, flanks flat, venter rounded (convex to slightly concave). Suture comprises 14–32 lobes. Lateral lobe broad, invariably bifid, commonly approaching twice width of corresponding ventral lobe. Up to 10 pairs of external umbilically derived lobes form subequal series decreasing in size to umbilicus. Prongs of lateral and adjacent umbilical lobes may be bidentate or serrate. Two lineages are characterized by simple (Pronoritinae) or bidentate (Neopronoritinae) dorsal lobe. [Pronoritidae form one of the longer lineages of Paleozoic ammonoids, with few changes occurring from the Mississippian to Lopingian. Throughout this interval, differences are so slight that they are of limited value in biostratigraphy; generic categories are gradational and definitions arbitrary.] *Mississippian (Visean)–Lopingian (Wuchiapingian).*

Subfamily PRONORITINAE Frech, 1901

[Pronoritinae FRECH, 1901, p. 481]

Pronoritids with undivided dorsal lobe. *Mississippian (Visean)–Cisuralian (Artinskian).*

Pronorites MOJSISOVICS, 1882, p. 201 [**Goniatites cyclolobus* PHILLIPS, 1836, p. 237; SD FOORD & CRICK, 1897, p. 260] [=*Ibergiceras* KARPINSKII, 1889, p. 42, *nom. nud.*; =*Subpronorites* CHERNOV, 1907, p. 390, *nom. nud.*] Rare, ancestral pronoritins, characterized by small size (generally less than 5 cm diameter), evolute conch (Umin/D, commonly one-third), and simple 14-lobed suture with formula $(V_2V_1V_2)(L_1L_1)UU^1U^2U^3$:ID [Russian], $(E_1E_mE_1)(L_{v2}L_{vd}L_d)U_2U_3U_4$..... [German]. Eight named species. [*Katacanites* KULLMANN, 1963, p. 283 (type, *K. quadratoides,* OD) resembles *Pronorites* and all other pronoritids in possessing a broad, divided lateral lobe. However, the ventral lobe is reported as undivided and narrowly pointed, as in the Prolecanitidae.] *Mississippian (upper Visean):* England, Belgium, Spain, Poland, Germany, Portugal, Bosnia-Herzegovina, Algeria, Russia and Kazakhstan (Southern Urals), ?Middle Asia, USA (Utah, Arkansas, ?Nevada), Thailand (Patalung).——FIG. 122,*4a–c.* **P. cyclolobus* (PHILLIPS), England; *a–b*, ×1; *c*, diameter approximately 30 mm (Foord & Crick, 1897).

Megapronorites RUZHENTSEV, 1949a, p. 60 [**M. sakmarensis;* OD]. Conch large (diameter to 9 cm), relatively evolute (U/D, 0.4 to 0.2 with increasing size), and with flat venter. Suture comprises 18 lobes, including 5 pairs of external umbilically derived lateral lobes and one pair of internal umbilical lobes; similar to *Stenopronorites* but with primary internal lateral lobe linked to fourth external lateral (U^2) instead of third (U^1) in *Stenopronorites.* Sutural formula: $(V_2V_1V_2)(L_1L_1)UU^1U^2U^3U^5$:$U^4$ID [Russian]. Saddle dividing primary external lateral lobe in *Megapronorites,* also lower and more asymmetric than in *Stenopronorites*. Four named species. *Mississippian (Serpukhovian):* Russia and Kazakhstan (Southern Urals), Tajikistan (Pamir), Uzbekistan (Fergana, Tian Shan), Spain, southern China (Guangxi).——FIG. 122,*3a–c.* **M. sakmarensis*; *a–b*, ×0.7; *c*, diameter ranging 60–65 mm (Ruzhentsev, 1949a).

Metapronorites LIBROVICH, 1938, p. 82 [**Pronorites uralensis* var. *timorensis* HANIEL, 1915, p. 25; OD]. Conch discoidal, moderately evolute (U/D, commonly 0.1), with flat flanks and rounded to flat venter. Characterized by suture with 26–32

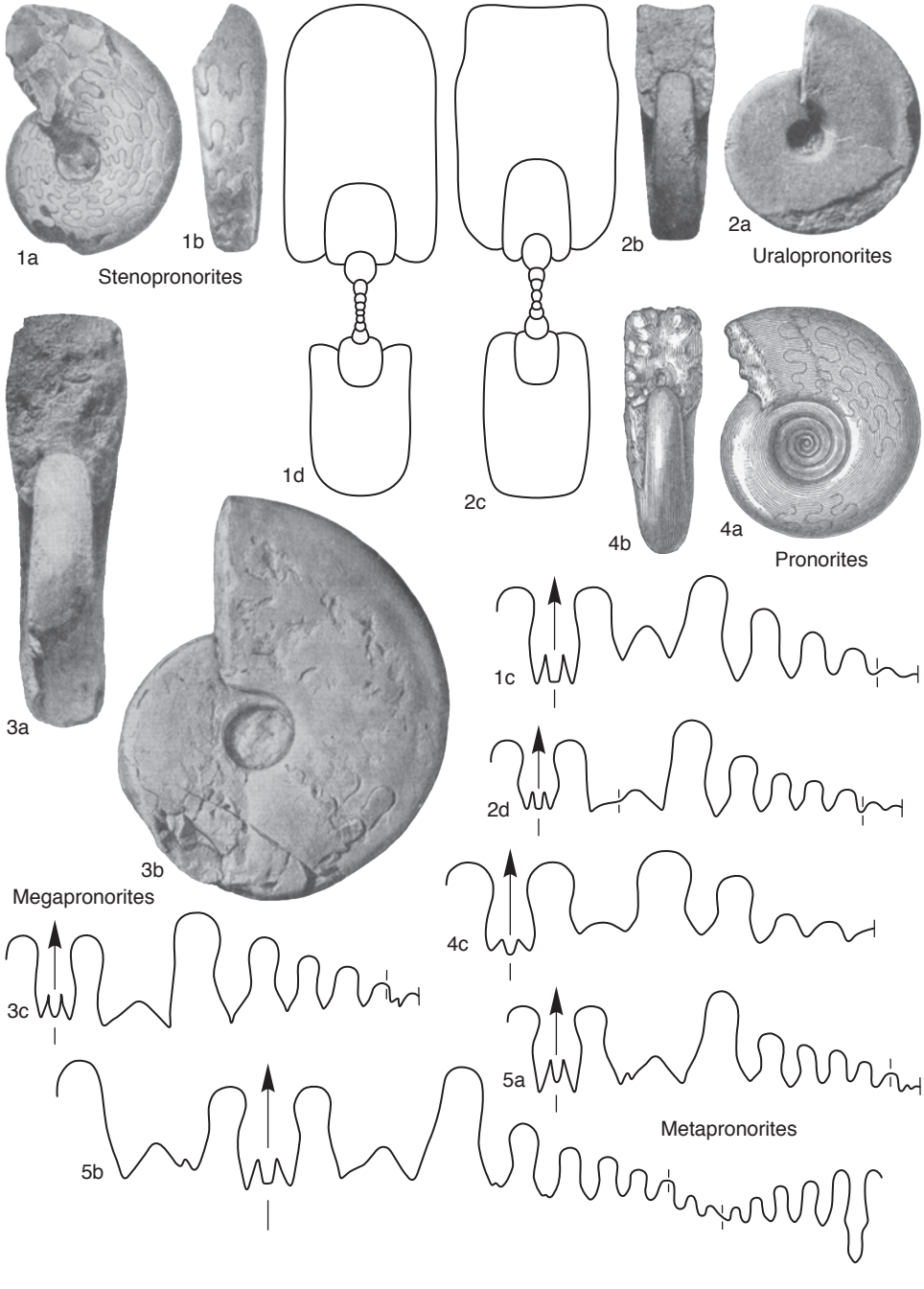

FIG. 122. Pronoritidae (p. 193–196).

lobes, including 7–9 pairs of external umbilically derived lobes and 3–5 pairs of internal umbilicals. Formula: $(V_2V_1V_2)(L_1L_1)UU^1U^2U^4U^6U^8U^{10}.....U^9U^7U^5U^3ID$ [Russian]. Saddle that separates two prongs of external lateral lobe unconstricted, low, with strongly divergent flanks. Either prong of lateral lobe may be denticulate, as may adjacent primary umbilical lobe. Eight named species. [No

suitable illustrations of the type species are available.] *Pennsylvanian (lower Moscovian [Atokan])–Cisuralian (Artinskian):* Indonesia (Timor), USA (western Texas, ?Arkansas), Canada (Yukon, Arctic Archipelago: Ellesmere, Axel Heiberg Island), Kazakhstan (Southern Urals), Russia (Southern Urals, northern Verkhoian), Tajikistan (Pamir), southern China (Guangxi).——Fig. 122,*5a*. *M. pseudotimorensis* (Miller), diameter at 47 mm (Nassichuk, 1975).——Fig. 122,*5b*. *M. cuneilobatus* Ruzhentsev, upper Zhigulian, Southern Urals, diameter approximately 40 mm (Ruzhentsev, 1949a).

Pseudopronorites Nassichuk, 1975, p. 57 [**Pronorites cyclolobus* var. *arkansiensis* Smith, 1896, p. 267; OD)]. Large pronoritins (maximum phragmocone diameter exceeding 9 cm, probably approaching 13 cm and constituting largest representative of family), characterized by primary external lateral lobe subdivided into two more or less equal simple prongs by high (at least two-thirds height of ventrolateral saddle), constricted secondary saddle. Suture comprises 22–26 lobes, 7 or 8 pairs situated externally, and 3 or 4 pairs internally. Juvenile conch smooth, mature shell with broad ventral ribs that become progressively fainter laterally to disappearance dorsad of midflank. Five named species. *Pennsylvanian (Bashkirian–Kasimovian):* Spain, USA (Arkansas, Oklahoma, Kansas, Texas), Canada (Arctic Archipelago: Ellesmere Island), Russia (Novaia Zemlia), China (Guizhou, Guangxi), Japan (southwestern Honshu).——Fig. 123*a–c*. **P. arkansiensis* (Smith); *a–b*, Morrowan, Oklahoma, ×0.75 (Miller, Furnish, & Schindewolf, 1957); *c*, Atokan, Arctic Canada, diameter at 35 mm (Nassichuk, 1975).

Stenopronorites Schindewolf, 1934, p. 169 [**Pronorites cyclolobus* var. *uralensis* Karpinskii, 1889, p. 8; OD; see also *Stenopronorites* Nassichuk, 1975, p. 54] [=*Sinopronorites* Ruan, 1981b, p. 174 (type, *S. nanus,* OD); =*Minepronorites* Nishida, Kyuma, & Egashira, 1998, p. 16 (type, *M. takahasii,* OD)]. Suture similar to *Pseudopronorites,* but saddle dividing prongs of primary external lateral lobe less than one-half height of ventrolateral saddle, and with divergent flanks. Suture comprises 18–24 lobes, including 5 or 6 pairs of external umbilically derived lobes and 1–3 pairs of internal umbilicals. Sutural formula: $(V_2V_1V_2)(L_1L_1)UU^1U^2U^4.....U^3ID$ [Russian]. Fifteen named species. *Upper Mississippian (Serpukhovian)–Middle Pennsylvanian (Moscovian):* Kazakhstan (Southern Urals), Russia (Urals, Novaia Zemlia, Verkhoian, Kolyma, Omolon), Uzbekistan (Fergana, Tian Shan, Kyzylkumy), Kyrgyzstan (southern Fergana, Tian Shan), Morocco, Algeria, Tajikistan (Pamir, Gissar), China (Guizhou, Guangxi, Xinjiang, Ningxia), Japan (southwestern Honshu), USA (Oklahoma, Nevada, California), Canada (Arctic Archipelago: Ellesmere Island), France, Spain, Ukraine (Donets Basin).——Fig. 122,*1a–c*. **S. uralensis* (Karpinskii), Serpukhovian–Bashkirian, Urals; *a–b,* ×1; *c,* diameter approximately 25 mm (Ruzhentsev, 1949a), ×1 (Karpinskii, 1889).——Fig. 122,1*d*. *S. sersoni* Nassichuk, topotype, GSC 103250, Atokan, Ellesmere Island, diameter at 37.5 mm (new, courtesy of D. M. Work & W. B. Saunders).

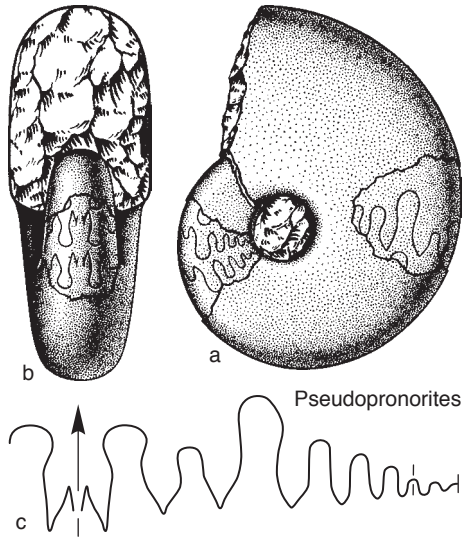

Fig. 123. Pronoritidae (p. 195).

Tridentites Schindewolf, 1934, p. 170 [**Pronorites tridens* Schmidt, 1925, p. 545; OD; =*Goniatites mixolobus* de Koninck, 1880, p. 122, *non* Phillips, 1936, p. 236]. Inadequately known taxon; suture similar to *Pronorites,* but primary external lateral lobe tridentate. One species. *Mississippian (Visean):* Belgium.

Uralopronorites Librovich in Ruzhentsev, 1949a, p. 63 [**U. mirus;* OD; =*Uralopronorites mirus* Librovich in Ruzhentsev, 1947d, p. 45, *nom. nud.*]. Pronoritins with shallowly concave venter, characterized by incipient bifurcation of anomalously broad ventral prong of primary external lateral lobe. Sutural formula: $(V_2V_1V_2)(L_1L_1)UU^1U^2U^4U^6U^7:U^5U^3ID$ [Russian]. Two named species. [Lateral lobe of *U. mirus* is twice width of ventral lobe and more than three times width of adjacent primary umbilical lobe, both relationships representing extremes for Pronoritidae. Additionally, ventral subdivision of the lateral lobe is three-halves as broad as dorsal subdivision and displays an incipient subdivision on its dorsal flank. In all these respects, suture resembles those of ancestral medlicottiid *Prouddenites* (Uddenitinae), a genus characteristic of the Virgilian but represented by more primitive forms in the Desmoinesian (Chatelain, 1984). On these bases, *Uralopronorites* may be interpreted as a medlicottiid precursor. Were it not for its undivided dorsal lobe, *Uralopronorites* could be referred with equal propriety to

the Uddenitinae.] *Mississippian (?Serpukhovian), Pennsylvanian (Bashkirian):* Russia and Kazakhstan (Southern Urals), Tajikistan (Darvas), Serbia.——Fig. 122,*2a–d*. **U. mirus*; *a–b*, ×1; *c*, hypotype, SUI 8490, Urals, diameter at 37 mm (new, courtesy of D. M. Work & W. B. Saunders); *d*, diameter ranging 25–30 mm (Ruzhentsev, 1949a).

Subfamily NEOPRONORITINAE Weyer, 1972

[Neopronoritinae Weyer, 1972a, p. 342]

Pronoritids with bidentate dorsal lobe. *Pennsylvanian (Gzhelian)–Lopingian (Wuchiapingian).*

Neopronorites Ruzhentsev, 1936b, p. 1076 [**Paranopronorites permicus* Chernov, 1907, p. 344; OD] [=*Epipronorites* Maksimova, 1938, p. 25 (type, *E. rotundus,* OD)]. Neopronoritins characterized by irregular serration in prongs of mature external lateral lobe and one to three adjacent umbilical lobes. Dorsal and adjacent internal lobe bidentate. Seven or eight pairs of umbilically derived lobes in external suture, one-half as many internally. Sutural formula: $(V_2V_1V_2)(L_1L_1)UU^1U^2U^4U^6U^8$..... $U^7U^5U^3I(D_1D_1)$ [Russian]. Fourteen named species. [No suitable illustrations of the type species are available.] *Pennsylvanian (Gzhelian)–Cisuralian (Kungurian):* Kazakhstan (Southern Urals), Russia (Urals, Verkhoian), Tajikistan (Pamir), China (Guangxi, Guizhou, Xinjiang, Xizang, Gansu), Indonesia (Timor), Thailand (Loei), USA (Texas), Canada (Ellesmere Island).——Fig. 124,*1a–d. N. carboniferus* Ruzhentsev, Gzhelian, Urals; *a–b*, ×1; *c*, hypotype, SUI 62485, northern Kazakhstan, Aidaralash, diameter at 31 mm (new, courtesy of D. M. Work & W. B. Saunders); *d*, diameter at 42 mm (Ruzhentsev, 1949a).——Fig. 124,*1e. N. tenuis* (Karpinskii), hypotype, SUI 84901, Asselian or Sakmarian, Sholak-Say, Southern Urals, diameter at 34 mm (new, courtesy of D. M. Work & W. B. Saunders).

Paedopronorites Glenister, Furnish, & Zhou, 2004, p. 1014 [**P. leonovae;* OD]. Conch small (maximum phragmocone diameter less than 20 mm), narrowly discoidal (W/D, 0.35–0.40), relatively widely umbilicate (Umin/D, 0.25–0.35, decreasing slightly in ultimate one-half volution), with one-half volution of body chamber. [Dimensions D, H, and W represent conch diameter, corresponding whorl height, and width, and Umin indicates umbilical diameter measured from umbilical seam to seam; all are measured in millimeters, and abbreviations are used in the remainder of the text.] Suture typically comprises 36 lobes, including 8 pairs of umbilically derived external lateral lobes, and 7 pairs of internal umbilicals. Primary lateral lobe broad, constricted adorally, deeply divided into 2 simple round prongs. Ventrad 3 pairs of external umbilical lobes and primary internal lobe asymmetrically bidentate. Both external and internal sutural traces arch forward from venter to umbilical seam. One species. [*Paedopronorites* is interpreted as the terminal paedomorph of the Neopronoritinae. It conforms to the pattern displayed by many late Paleozoic family-level taxa (Glenister & Furnish, 1988a, 1988b), being the geologically youngest representative and characterized by small size, sutural simplification, and low abundance. Eighteen specimens are known from the type Amarassi beds (Amarassi Province, Timor). The consistently small phragmocone diameter (15–17 mm) suggests maturity. Superficial similarity to *Sakmarites* may relate to small size; *Paedopronorites* differs in possession of narrower, more evolute conch and more numerous umbilical subdivisions. The type species is named to honor T. B. Leonova, Paleontological Institute, Moscow.] *Lopingian (Wuchiapingian):* Indonesia (Timor).——Fig. 124,*2a–g*. **P. leonovae; a–c*, holotype, SUI 64445, ×1; *d–e,* paratype, SUI 64446, ×1; *f,* composite holotype, SUI 64445, and paratypes, SUI 64446-64448, diameter at 17 mm (Glenister, Furnish, & Zhou, 2004); *g,* paratype, SUI 12337, diameter at 16 mm (new, courtesy of D. M. Work & W. B. Saunders).

Parapronorites Gemmellaro, 1887, p. 61 [**P. Koninckii;* OD]. Advanced neopronoritins characterized by subequal bidentition of both prongs of external lateral lobe; ventral four to virtually all eight adjacent umbilically derived lobe pairs also bidentate. Internal suture inadequately known (except for *P. rectus* Leonova in Leonova & Dmitriev, 1989), but mature D and I probably bidentate throughout, and umbilical elements simple and number one or two less than in external suture. Five named species (all similar, perhaps conspecific). *Cisuralian (Artinskian)–Guadalupian (Wordian):* Italy (Sicily), Russia (Southern Urals), Ukraine (Crimea), Tajikistan (Pamir), Oman, China (Guizhou, Guangxi, Xizang, Xinjiang), Thailand (Muak Lek), Indonesia (Timor).——Fig. 125,*1a–d*. **P. konincki,* Sosio limestone, Wordian, Sicily; lectotype (herein, *a*), MGUP 101A of Gemmellaro (1887, pl. 5,*16*), and paralectotype (*b–d*), MGUP 101B of Gemmellaro (1887, pl. 5,*17–18*), ×1 (new).——Fig. 125,*1e–f. P. rectus* Leonova in Leonova & Dmitriev, 1989, Bolorian, Pamir; *e*, diameter at 35 mm; *f,* diameter at 40 mm (Leonova & Dmitriev, 1989).

Sakmarites Ruzhentsev, 1936b, p. 1075 [**Pronorites postcarbonarious* var. *vulgaris* Karpinskii, 1889, p. 14; OD]. Diminutive neopronoritins (mature diameter less than 30 mm), with broadly discoidal conch (flanks flat, ventrolateral shoulder narrowly rounded, venter weakly convex, W/D, 0.4–0.6 mm) and relatively large umbilicus (Umin/D, decreases from 0.25–0.15 mm with growth). Body chamber two-thirds volution. Mature peristome outlines shallowly rounded hyponomic sinus, and shallower reentrant across flanks. Suture comprises 18–22 lobes, including 5 or 6 pairs of external umbilically derived lateral lobes and 1 or 2 pairs of internal umbilicals. One or both prongs of primary external lateral lobe, one adjacent umbilical lobe, and primary internal lateral lobe may be

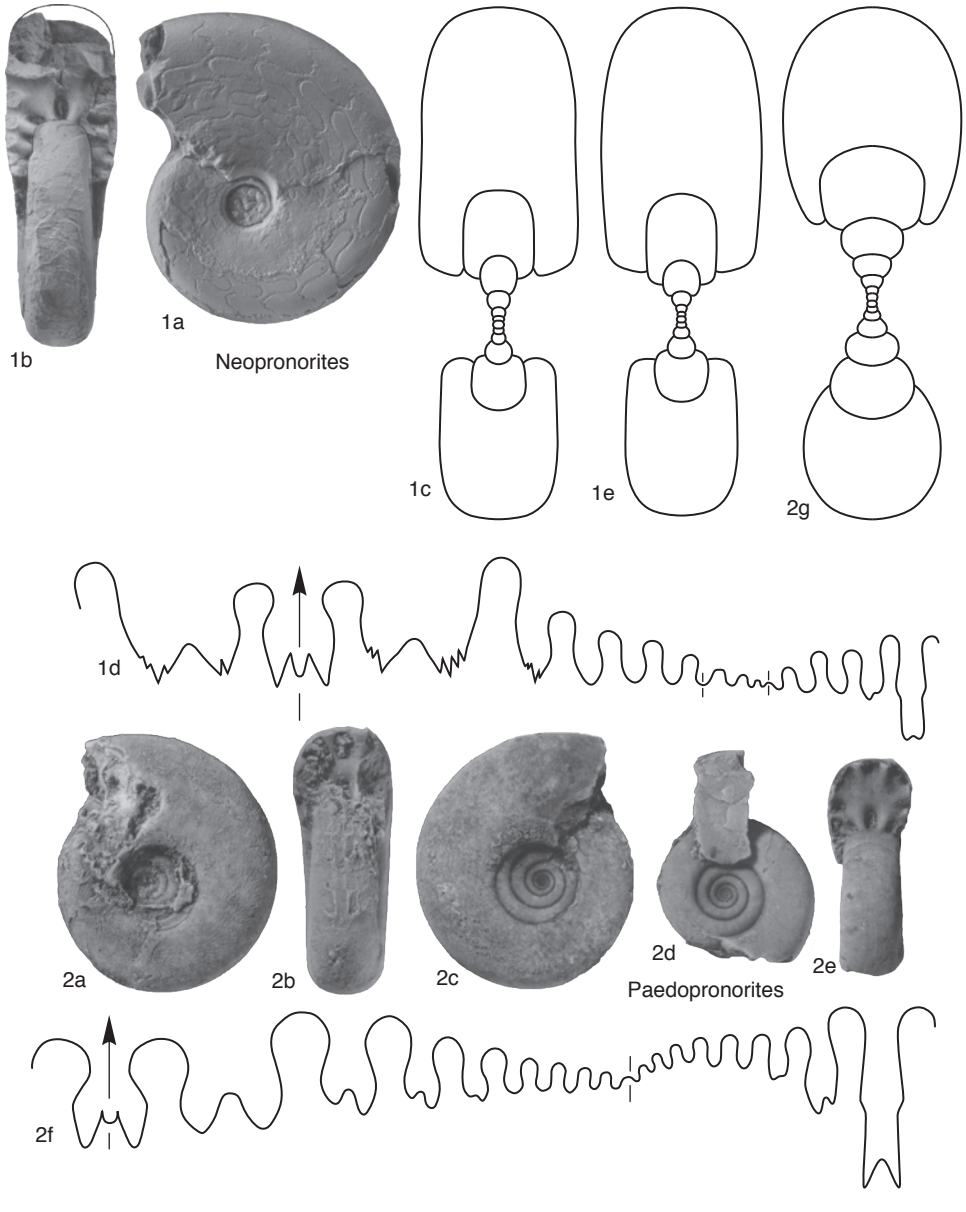

FIG. 124. Pronoritidae (p. 196).

bidentate; dorsal lobe relatively broad. Sutural formula: $(V_2V_1V_2)(L_1L_1)UU^1U^3U^5U^6{:}U^4U^2I(D_1D_1)$ [Russian]. Eight named species. [General sutural similarity suggests a relationship to *Shikhanites.*] *Cisuralian (Asselian–Artinskian [Baigendzhinian])*: Russia (Urals), Kazakhstan (Southern Urals).——FIG. 125,*2a–d*. **S. vulgaris* (KARPINSKII), Artinskian; *a*, hypotype, SUI 84903, diameter at 22 mm (new, courtesy of D. M. Work & W. B. Saunders); *b*, diameter approximately 15 mm (Ruzhentsev, 1950); *c–d,* ×1 (Ruzhentsev, 1956b).——FIG. 125,*2e*. *S. inflatus* RUZHENTSEV, hypotype, Sakmarian, Ultugan-Say, Southern Urals, SUI 97533, diameter at 27 mm (new, courtesy of D. M. Work & W. B. Saunders).

Shikhanites RUZHENTSEV, 1938, p. 245 [**S. singularis;* OD]. Based on single, poorly preserved, septate one-quarter volution, diameter approximately

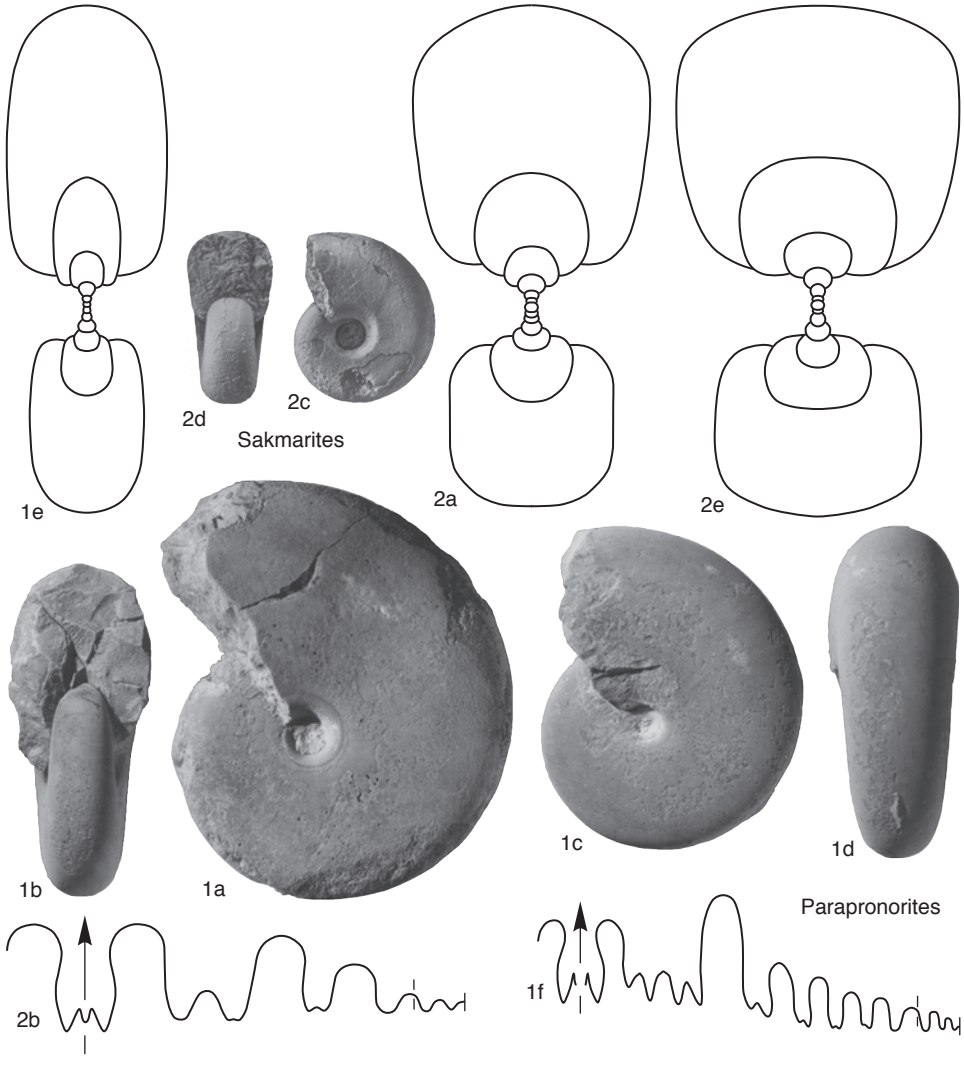

FIG. 125. Pronoritidae (p. 196–197).

25 mm. Conch thinly discoidal, probably involute, with broadly rounded flanks and parabolic ventrolateral shoulders and venter. Ventral lobe interpreted as less than one-half depth of adjacent primary lateral lobe, with middle prong twice depth of shallow flanking pair of prongs. Rounded prongs of lateral lobe may lie significantly below general sutural trace. Succeeding six or more pairs of umbilically derived external lobes simple, with rounded bases. Primary internal lobe (I) linked to third external umbilical (U^2). One species. [Interpreted proportions of ventrolateral sutural elements are atypical for Pronoritidae and may reflect poor preservation of single known representative.] *Cisuralian (Asselian):* Russia (Southern Urals).

Family MEDLICOTTIIDAE Karpinskii, 1889

[*nom. correct.* MILLER & FURNISH, 1954, p. 687, *pro* Medlicottidae HYATT, 1900, p. 563, *nom. transl. ex* Medlicottinae KARPINSKII, 1889, p. 45] [=Darvasiceratidae LEONOVA, 1990, p. 106]

Advanced medlicottioideans characterized by involute conch and complex sutures.

Conch variable in size but commonly large (mature phragmocone diameters as low as 2 cm but may exceed 15 cm, latter representing conch diameter of approximately 25 cm), discoidal to thinly lenticular. Shell lacks conspicuous sculpture except for common presence of row of nodes or ribs near each ventrolateral shoulder. Suture comprises total of 13 to approximately 30 lobes. Ventral prong of broad, primary, external lateral lobe transformed during phylembryogenesis into progressively more highly subdivided ventrolateral saddle, thus: $L_1L_1 > (L_{1.1}L_{1.2}L_1) > v^n s^n l^n L_1$ [Russian]. [In the above formula (Fig. 133*a–b*), v^n (number of subdivisions on ventral flank of ventrolateral saddle) ranges from 0–8, s^n (number of subdivisions on crest of ventrolateral saddle) ranges 0–3, and l^n (number of subdivisions on dorsal flank of ventrolateral saddle) ranges 0–8.] Dorsal lobe bidentate. Umbilically derived external and internal lateral lobes generally form subequal series diminishing uniformly in size to umbilicus. More than one-half of external umbilicals and smaller proportion of internals became bidentate during course of phylembryogenesis. *Pennsylvanian (upper Moscovian)–Lower Triassic (Induan).*

Subfamily UDDENITINAE Miller & Furnish, 1940

[Uddenitinae Miller & Furnish, 1940a, p. 34]

Ancestral medlicottiids characterized by relatively minor modification of primary external lateral lobe. Conch discoidal with flat flanks and shallowly concave to flat venter, lacking conspicuous sculpture, and of moderate size (generally less than 5 cm conch diameter, but reaching 18 cm in extreme case). Ventral prong of primary external lateral lobe transformed during phylembryogenesis into simple broad saddle, thus: $(L_{1.1(v)} L_{1.1(v)}) > s^{1.1}s^{1.1}s^1$ [Russian]. Eight to 13 pairs of umbilically derived external lateral lobes decrease uniformly in size to umbilicus; all normally undivided, although ventral two may be shallowly bidentate. *Pennsylvanian (upper Moscovian [Desmoinesian])–Cisuralian (Kungurian).*

Uddenites Böse, 1919, p. 55 [**U. Schucherti;* OD]. Venter deeply grooved. Ventral prong of primary external lateral lobe bidentate or rarely tridentate, with base aligned at or slightly orad of midheight of adjacent ventral lobe. Sutural formula: $(V_2V_1V_2)$ $(L_{1.1(v)}L_{1.1(v)}L_{1(d)})UU^1U^2$.... [Russian]. Seven named species. *Pennsylvanian (Kasimovian–Gzhelian):* USA (western Texas, northern-southern Midcontinent), Russia and Kazakhstan (Southern Urals), Tajikistan (Pamir), Uzbekistan (Fergana).——Fig. 126,*1a–d.* **U. schucherti,* Virgilian, Gaptank Formation, western Texas; *a–c*, lectotype (herein), BEG 34282 (same as Böse, 1919, pl. 1,*12–14, 18–20*), ×2; *d*, diameter at 20 mm (Miller & Furnish, 1940a) (new).

Daixites Ruzhentsev, 1941, p. 880 [**D. meglitzkyi;* OD]. Similar in conch form to *Uddenites,* but with uniformly rounded venter and ventrolateral shoulders. Ventral prong of primary external lateral lobe bidentate and aligned approximately with base of adjacent ventral lobe. Four named species. *Pennsylvanian (Gzhelian)–Cisuralian (lower Sakmarian [Tastubian]):* Russia (Southern Urals, Yugorskii Peninsula), Kazakhstan (Southern Urals), Tajikistan (Pamir); USA (western Texas), *Virgilian.*——Fig. 126,*2a–d.* **D. meglitzkyi,* Gzhelian, Southern Urals; *a–c,* ×1; *d*, diameter at 28 mm (Ruzhentsev, 1941).——Fig. 126,*2e. D. attenuatus* Ruzhentsev, SUI 62488, Tabantal, Southern Urals, diameter at 21.6 mm (new, courtesy of D. M. Work).

Neouddenites Ruzhentsev, 1961, p. 53 [**N. andrianovi;* OD]. Conch large (to 18 cm conch diameter), with flat venter and conspicuous ventrolateral groove. Ventral prong of primary external lateral lobe tridentate and aligned at or orad of midheight of adjacent ventral lobe; dorsal prong lies significantly below general lineation of flank lobes. Umbilically derived external lateral lobes more numerous (12 or 13) than in other members of subfamily. Two species. Sutural formula: $(V_2V_1V_2)$ $s^{1.1}s^{1.1}s^1L_{1(d)}UU^1U^2$..... [Russian]. [In the above formula, the ventral prong of the primary external lateral lobe ($L_{1(v)}$) is judged to have been modified during phylembryogenesis to the extent that it is better considered to be a tridentate ventrolateral saddle ($s^{1.1}s^{1.1}s^1$).] *Cisuralian (Artinskian–Kungurian):* Russia (Siberia: Tumara Basin, ?Volga-Urals, western Verkhoian, Omolon Massif), Canada (Yukon).——Fig. 126,*3a–c.* **N. andrianovi,* ?Member C of Echii Formation and Member B of Endybal' Formation, Siberia, western Verkhoian; *a–b,* ×0.5; *c*, diameter at 36 mm (Ruzhentsev, 1961).——Fig. 126,*3d–e. N. caurus* Nassichuk, Furnish, & Glenister, northern Yukon Territory, ×1.33 (Nassichuk, Furnish, & Glenister, 1966).

Prouddenites Miller, 1930, p. 395 [**P. primus;* OD]. Ancestral uddenitins; conch similar to *Uddenites,* but venter flat. Suture characterized by tridentate

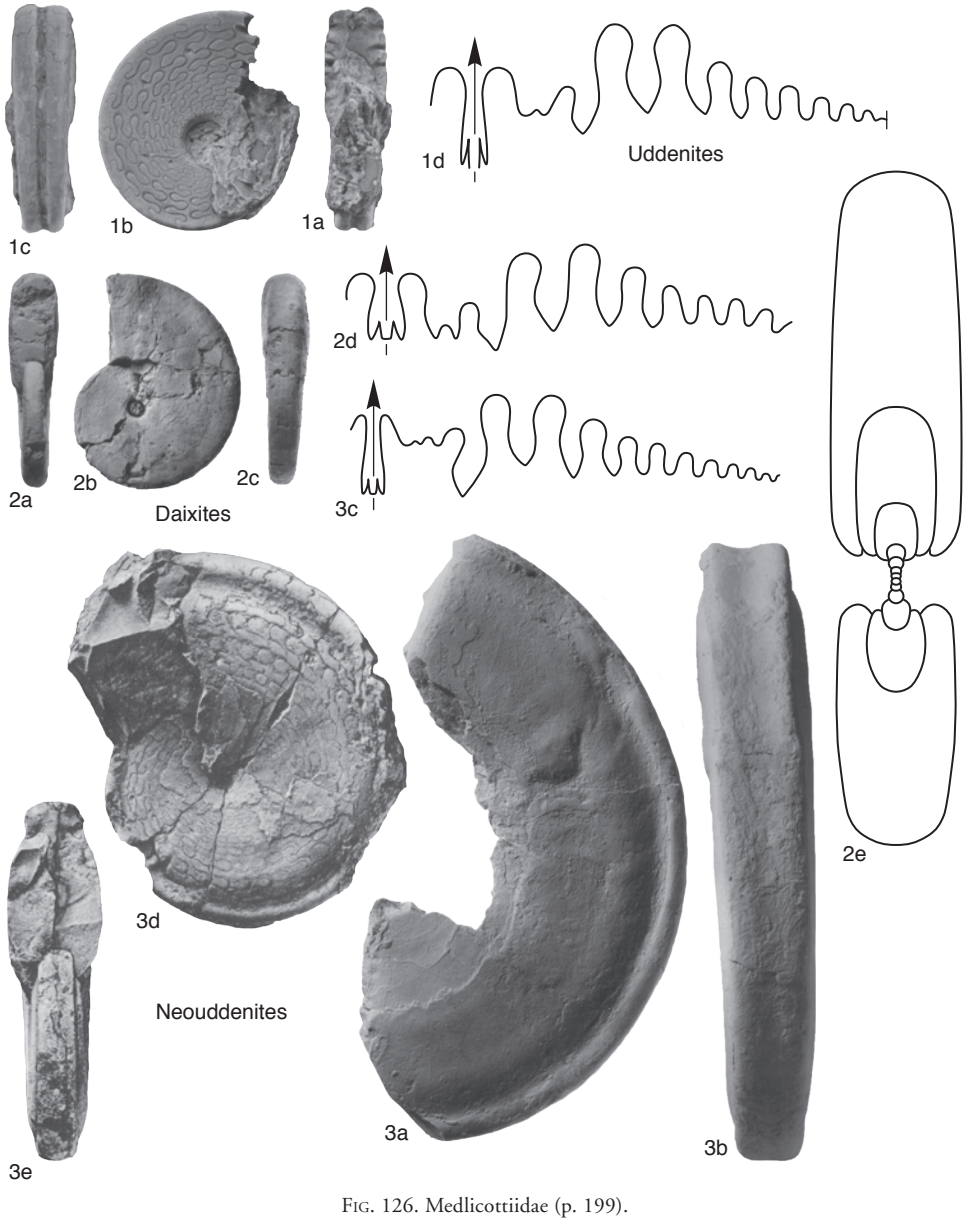

FIG. 126. Medlicottiidae (p. 199).

primary external lateral lobe with all three subdivisions aligned with or slightly orad of base of adjacent ventral lobe. Ventral prong of external lateral lobe ($L_{1.1(v)}L_{1.1(v)}$) broad; both subdivisions and primary umbilical lobe (U) may be bidentate. Three named species. [Overall geometry of the external lateral lobe of *Prouddenites* closely resembles that of presumed ancestor, the Serpukhovian pronoritid *Uralopronorites.* However, the dorsal lobe of *Prouddenites* is bidentate, similar to those of all other medlicottiids, whereas the dorsal lobe of *Uralopronorites* is undivided.] *Pennsylvanian (upper Moscovian [Desmoinesian])–Gzhelian [Virgilian]):* USA (western Texas, north-central Texas, Oklahoma, Kansas, Missouri), Kazakhstan (Southern Urals), China (Xinjiang).——FIG. 127,*1a–f.* **P. primus,* Virgilian; *a–b*, Coffeeville Formation, Oklahoma, ×1 (Miller, Furnish, & Schindewolf, 1957, fig. 119); *c*, Gaptank Formation, western Texas, diameter at 25 mm (Miller & Furnish, 1940a);

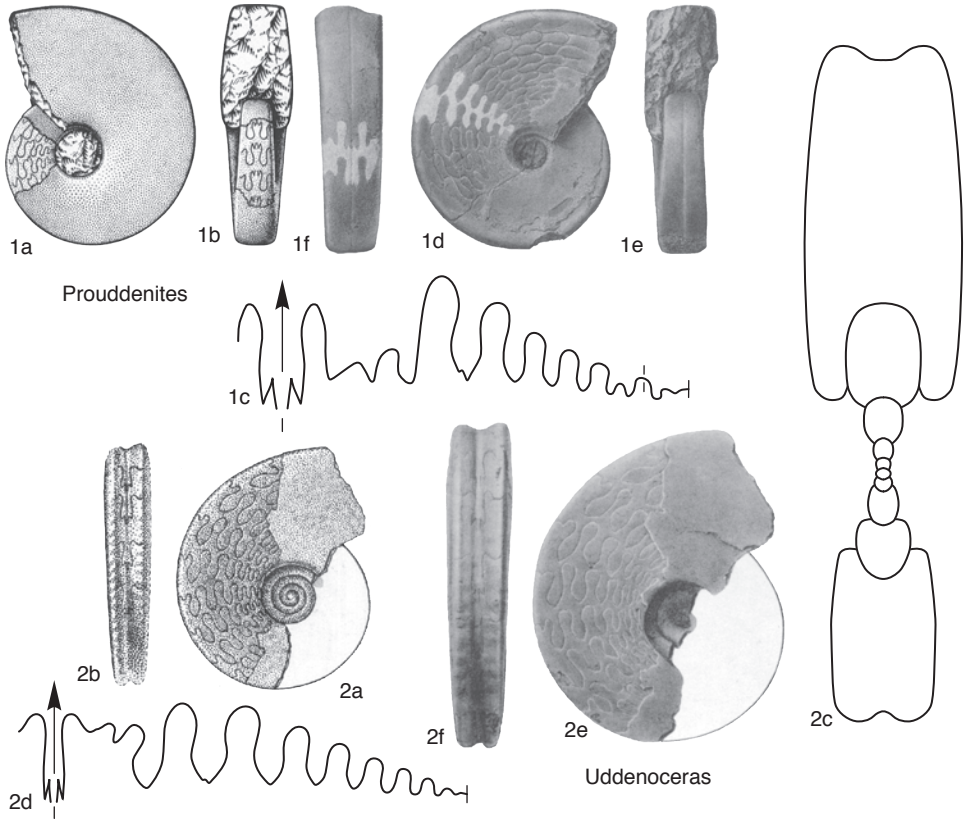

FIG. 127. Medlicottiidae (p. 199–201).

d–f, Winterset Limestone, Missouri, ×1 (Miller & Furnish, 1940c).

Uddenoceras MILLER & FURNISH, 1954, p. 691 [**Uddenites oweni* MILLER & FURNISH, 1940a, p. 36; OD]. Conch similar to *Uddenites,* but commonly narrower and may possess faint ventrolateral nodes. Suture characterized by alignment of all but ventrolateral flank of ventrolateral saddle only slightly apicad of line joining crests of first and second external saddles. Additionally, ventral subdivision of ventrolateral saddle ($s^{1.1}$) is bidentate or faintly crenulate. Three species. *Pennsylvanian (Kasimovian [Missourian]–Gzhelian [Virgilian]):* USA (Texas, northern-southern Midcontinent), Russia (Southern Urals).——FIG. 127,*2a–f.* **U. oweni* (MILLER & FURNISH), Finis Shale, Virgilian, North Texas and Graham Formation, north-central Texas; *a–b,* ×1.5 (Miller, Furnish, & Schindewolf, 1957, fig. 120A,B); *c,* SUI 54555, diameter at 21.5 mm (new, courtesy of D. M. Work); *d,* John Britts Owen Collection 688, diameter at 27 mm; *e–f,* YPM 16800, ×2 (Miller & Furnish, 1940a).

Subfamily MEDLICOTTIINAE Karpinskii, 1889

[*nom. correct.* RUZHENTSEV, 1960d, p. 189, *pro* Medlicottinae KARPINSKII, 1889, p. 45]

Conch intermediate to large, thinly lenticular or discoidal, venter with pair of ventrolateral keels or two rows of nodes. Suture complex, characterized by two or more subdivisions on ventral side of high ventrolateral saddle; more than one-half of umbilically derived external lateral lobes usually bidentate. *Pennsylvanian (Gzhelian)–Lopingian (Wuchiapingian).*

Medlicottia WAAGEN, 1880, p. 83 [**Goniatites orbignyanus* DE VERNEUIL, 1845, p. 378; OD] [?=*Paramedlicottia* LEONOVA, 1992, p. 138 (type, *P. sauksayensis,* OD)]. Conch thinly lenticular, narrow furrowed venter bounded by pair of sharp

ventrolateral keels (generally without nodes). Ventrolateral saddle has 8 to 12 subdivisions, remaining saddles rounded or slightly indented near midheight. External lateral lobe and adjacent umbilical lobes in arched alignment, subequal but decreasing in size to umbilicus. Sutural formula: $(V_2V_1V_2)v^1v^2v^{3\text{-}6}s^1l^1l^{7\text{-}5}l^4l^3l^2l^1L_{1(d)})UU^1U^2$..... [Russian]. Twenty-two named species (most are geographic designations that are too obscurely defined for recognition). *Cisuralian (Sakmarian)–Guadalupian (Wordian):* Russia (Urals, Volga-Urals), Kazakhstan (Southern Urals), Tajikistan (Pamir), Ukraine (Crimea), China (Guizhou, Gansu, ?Xizang, Xinjiang), Japan (southern Kitakami Massif), Indonesia (Timor), Italy (Sicily), Columbia, Mexico (Coahuila), USA (Texas, New Mexico, Nevada), Canada (British Columbia, Yukon, Arctic Archipelago: Devon Island).——Fig. 128*a–q.* **M. orbignyana* (de Verneuil), Artinskian; *a–c*, hypotype, PIUB 9 of Haniel (1915, pl. 2,*8a–c*), Timor, Bitauni, ×1 (new); *d–p,* ontogenetic succession of sutures, showing ventral prong of lateral lobe ($L_{1(v)}$) commonly transformed into complexly subdivided first later saddle, Aktubinsk, Kazakhstan [*d–h,* based on first individual; *i–m,* based on second; *n–o,* third; *p,* fourth]; *d,* whorl height at 0.25 mm; *e,* 0.4 mm; *f,* 0.5 mm; *g,* 0.8 mm; *h,* 1 mm; *i,* 1.2 mm; *j,* 1.8 mm; *k,* 2.5 mm; *l,* 3.6 mm; *m,* 5.3 mm; *n,* 6.7 mm; *o,* 12 mm, and *p,* 33.8 mm (Ruzhentsev, 1949a); *q,* external suture, Aktubinsk, Kazakhstan, SUI 2048, diameter at 35 mm (whorl height estimated about 25 mm or so [probably equal to the stage between *o* and *p* in Ruzhentsev's sequence] (adapted from Miller & Furnish, 1940a).

Artinskia Karpinskii, 1926, p. 8 [**Goniatites Artiensis* Grünewaldt, 1860, p. 138; OD] [=*Promedlicottia* Karpinskii, 1889, p. 23, *nom. nud.; =Prosicanites* Chernov, 1907, p. 359, *nom. nud., non* Tumanskaia in Tumanskaia & Borneman, 1937, p. 113]. Ancestral medlicottiins with subdivision of ventrolateral saddle intermediate in degree between characteristic Medlicottiinae and Propinacoceratinae, and conch resembling Sicanitinae. Conch thinly discoidal, with grooved venter between two rows of prominent ventrolateral nodes bounded by less-conspicuous ribs on ventrolateral flanks. Suture resembles *Medlicottia*, but ventrolateral saddle broader and lower, with 6–8 subdivisions (commonly 2 ventrad, 2 or 3 in crest, 3 dorsad). Sutural formula: $(V_2V_1V_2)v^1v^2s^1s^1l^3l^2l^1L_{1(d)})$ $UU^1U^2U^3U^5$..... [Russian]. Thirteen named species (most indeterminate). [Complex subdivision of the ventrolateral saddle in rare Gzhelian representatives from the Urals initiated lineages that diversified in the early Permian (Asselian), were rare in the succeeding Sakmarian, but then diversified again in the Artinskian to extend through the late Permian and eventual extinction of the order in the Early Triassic (Induan).] *Pennsylvanian (Gzhelian [Virgilian])–Cisuralian (Artinskian*): Kazakhstan (Southern Urals), Tajikistan (Pamir), Russia (Urals, northern Verkhoian), ?southern China (Guangxi), Thailand (Loei), Japan (Kitakami Massif), Indonesia (Timor), USA (Texas, New Mexico), Austria (Carnic Alps).——Fig. 129,*2a–f.* **A. artiensis* (Grünewaldt), Artinskian, Southern Urals; *a–b*, ×1 (Miller, Furnish, & Schindewolf, 1957, as *A. falx*); *c–e*, ×0.67 (Ruzhentsev, 1956b); *f,* diameter at 40 mm (Miller & Furnish, 1940a, as *A. falx*).——Fig. 129,*2g. A. nalivkini* Ruzhentsev, hypotype, SUI 84905, Asselian, Southern Urals, Sholak-Say, diameter at 45 mm (new, courtesy of D. M. Work & W. B. Saunders).

Eumedlicottia Spath, 1934, p. 49 [**Medlicottia bifrons* Gemmellaro, 1887, p. 53; OD]. Conch and suture generally similar to *Medlicottia,* but includes larger specimens (phragmocone may exceed 15 cm diameter), and most saddles in external suture are characterized by distinct paired notches above midheight. Prongs of primary external lateral lobe lie off (above) general lobe alignment. Five named species. *Cisuralian (Artinskian)–Lopingian (Wuchiapingian):* Italy (Sicily), Greece (Chios Island), Oman, Pakistan (Salt Range), southern China (Guizhou), Japan (Kitakami Massif), Russia (Maritime Territory), Indonesia (Timor), Mexico (Coahuila), USA (western and central Texas, Wyoming), Canada (British Columbia), East Greenland.——Fig. 130*a–d.* **E. bifrons* (Gemmellaro), Sosio limestone, Wordian, Sicily; *a,* lectotype (herein), MGUP 93A of Gemmellaro (1887, pl. 9,*18–19*), ×1.33 (new); *b–c,* paralectotype, MGUP 93B of Gemmellaro (1887, pl. 9,*16–17*), ×1.33 (new); *d,* lectotype, diameter approximately 35 mm (Miller & Furnish, 1940a; adapted from Gemmellaro, 1887, pl. 9,*19*).——Fig. 130*e. E. whitneyi* (Böse), Blaine Formation, Roadian, northcentral Texas, diameter at 75 mm (adapted from Miller & Furnish, 1940a).——Fig. 130*f. E. subprimas* Haniel, hypotype, GIUA-T554, Guadalupian, Toenioen Eno, Basleo area, Timor, ×0.67 (new).

Neogeoceras Ruzhentsev, 1947b, p. 641 [**Medlicottia girtyi* Miller & Furnish, 1940a, p. 59; OD]. Sublenticular medlicottiins with relatively broad, shallowly concave venter (width 0.3 to 0.5 maximum conch width). Angular ventrolateral shoulders bordered by shallowly concave ventrolateral flanks, commonly ribbed. Suture characterized by narrow, complexly subdivided ventrolateral saddle ($v^{3\text{-}5}$, $l^{4\text{-}7}$) in which first adventitious element l^1 is only slightly larger than element l^2 and adjacent subdivisions. Additionally, strongly asymmetrical bidentate dorsal subdivision of primary lateral lobe ($L_{1(d)}$) lies beneath general lobe alignment, with ventral prong deeper than dorsal. Ten named species. [Taxonomic position of *Neogeoceras* within the Medlicottiidae is uncertain. Sutures resemble *Medlicottia* in general aspect, but small size of l^1 and extreme depth and asymmetry of $L_{1(d)}$ are unknown in other Medlicottiinae. *Neogeoceras* resembles *Episageceras* in all these respects, and assignment to the Episageceratinae could be justified. However,

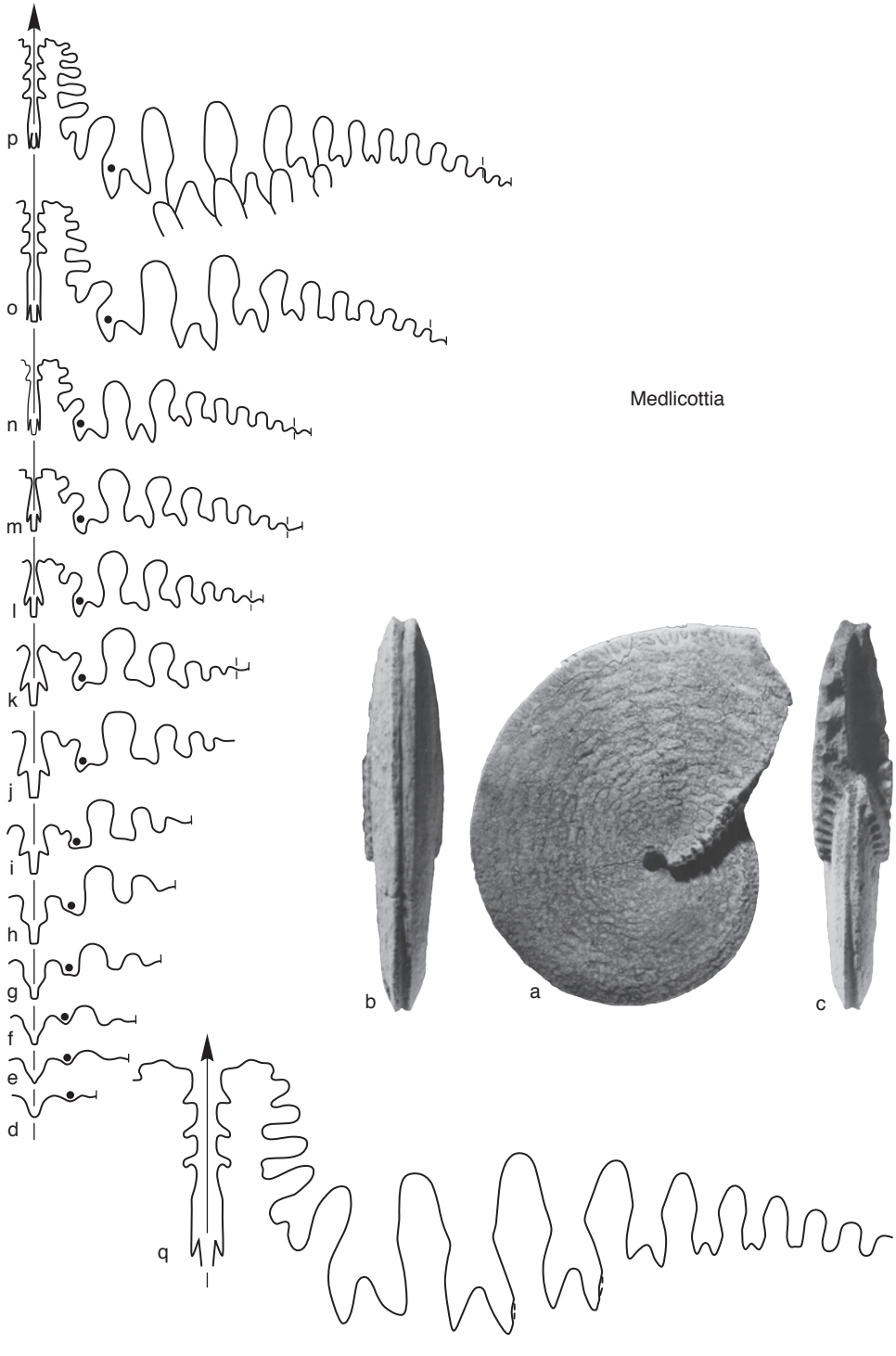

FIG. 128. Medlicottiidae (p. 201–202).

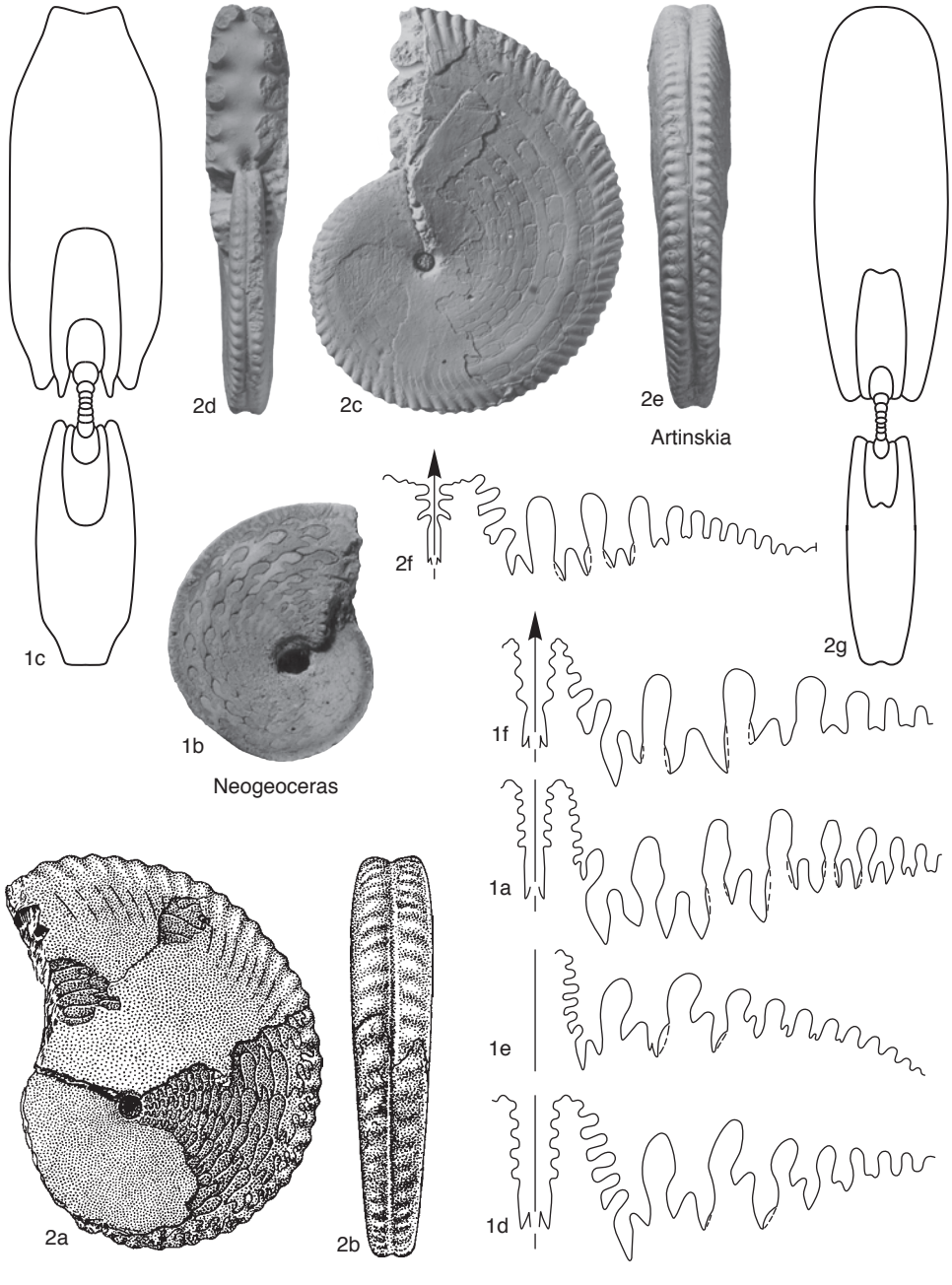

FIG. 129. Medlicottiidae (p. 202–205).

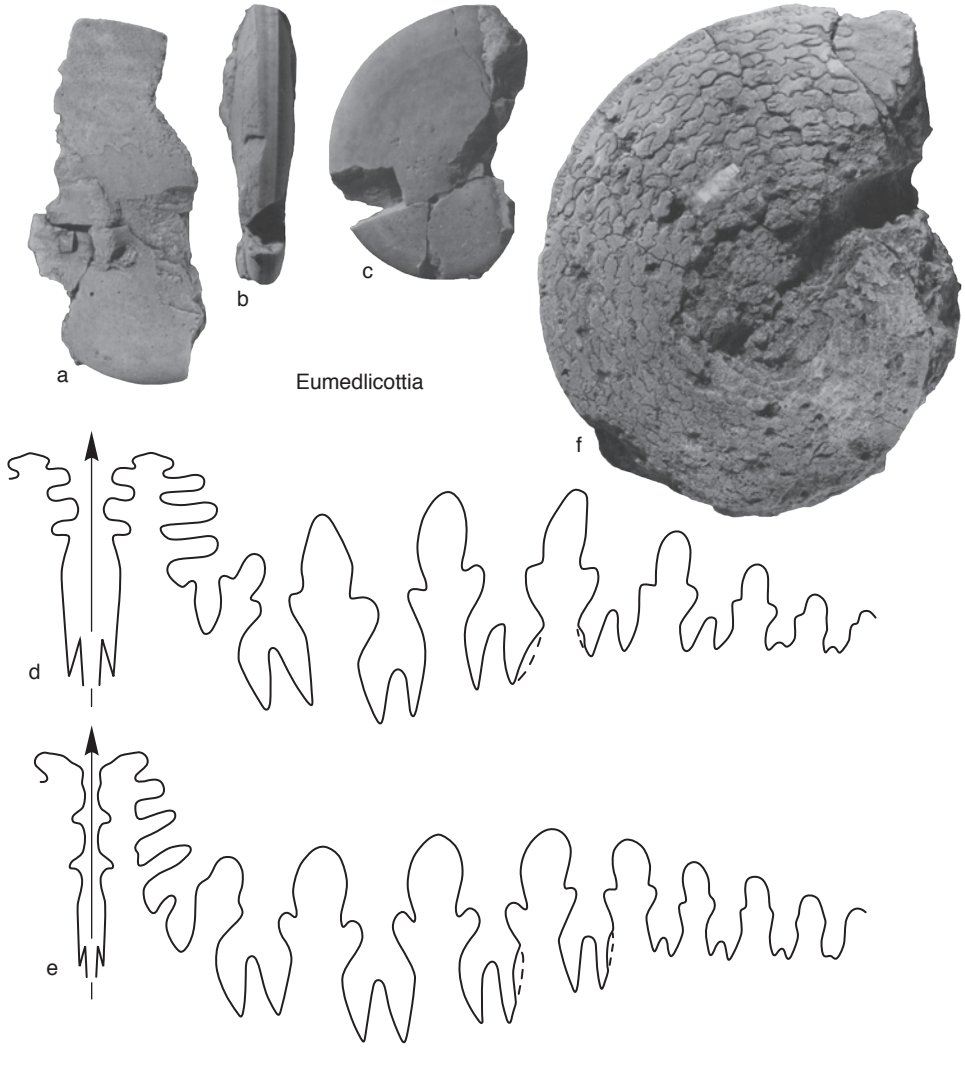

FIG. 130. Medlicottiidae (p. 202).

we prefer to define that subfamily primarily on the basis of the anomalously short primary umbilical lobe (U) and consider *Neogeoceras* as the plausible medlicottiin ancestor of the Episageceratinae.] *Guadalupian (Wordian)–Lopingian (Wuchiapingian):* Mexico (Coahuila), USA (western Texas), Canada (Arctic Archipelago: Cameron Island), Italy (Sicily), Iraq (Kurdistan), Afghanistan, Oman, Russia (Novaia Zemlia, Maritime Territory), China (Xizang), Japan (Honshu), Indonesia (Timor).——FIG. 129,*1a. *N. girtyi* (MILLER & FURNISH), topotype, SUI 61500, Capitanian, Coahuila, diameter at 70 mm (new).——FIG. 129,*1b–d. N. smithi* MILLER & FURNISH; *b*, hypotype, GIUA-B171, Wordian, Basleo, Timor, ×1 (new); *c*, hypotype, SUI 12707, diameter at 29 mm (new, courtesy of D. M. Work & W. B. Saunders); *d*, hypotype, SUI 12657, Amarassi beds, Wuchiapingian, Amarassi, Timor, diameter at 35 mm (new).——FIG. 129,*1e. N. thaumastum* RUZHENTSEV, Wuchiapingian (*fide* ZAKHAROV & PAVLOV, 1986), Maritime Territory, diameter approximately 35 mm (adapted from Ruzhentsev, 1976).——FIG. 129,*1f. N. boreale* (CHERNYSHEV in KARPINSKII, 1926), Wuchiapingian, Novaia Zemlia, diameter approximately 40 mm (Karpinskii, 1926).

Syrdenites NASSICHUK, FURNISH, & GLENISTER, 1966, p. 46 [**S. stoyanowi;* OD]. Conch as in *Medlicottia,* large; phragmocone diameter to 15 cm. Suture generally similar to *Eumedlicottia,* but paired notching in lateral saddles continues further orad along dorsal flank of ventrolateral saddle.

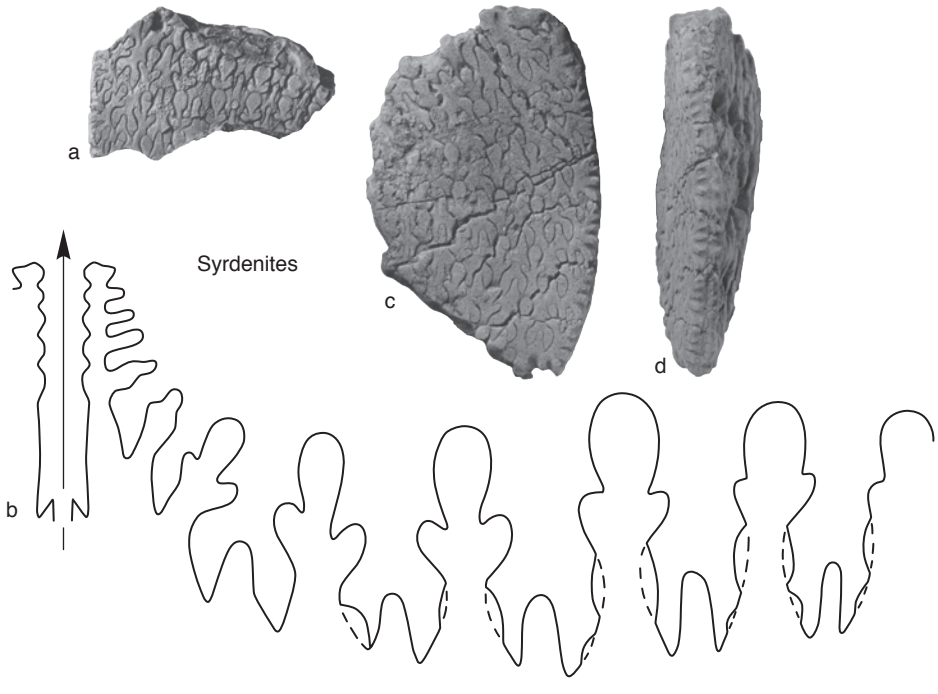

FIG. 131. Medlicottiidae (p. 205–206).

Sutural formula $(V_2V_1V_2)v^1v^2v^3v^4s^1s^{1}[^5]l^{4}[^3]l^{2}[^{1.2}]l^{1.2}[^{1.1}]L_{1(d)}UU^1U^2$..... [Russian]. [Formula indicates that the apical notch on the dorsal flank of the ventrolateral saddle (l^1) subdivided into two discrete elements ($l^{1.2}[^{1.1}]$)]. Sutural elements l^5 through U^2 form a graded sequence, increasing dorsad in size and extent of notching and forming an unbroken arcuate trace. One named species. *Guadalupian (Capitanian)–Lopingian (Wuchiapingian):* Azerbaijan (Caucasus), Russia (Maritime Territory), Japan (Kitakami Massif), Indonesia (Timor), Mexico (Coahuila).——FIG. 131*a–b. *S. stoyanowi,* Wuchiapingian, Azerbaijan; *a*, ×0.5 (Ruzhentsev in Bogoslovskii, Librovich, & Ruzhentsev, 1962, pl. 12,*2*); *b*, diameter approximately 15 cm (Ruzhentsev, 1960d, p. 305, fig. 128b).——FIG. 131*c–d. S.* sp. cf. *S. stoyanowi,* hypotype, SUI 62240, Capitanian, Timor, Toenioen Eno, Basleo area, ×0.67 (new).

Subfamily PROPINACOCERATINAE Plummer & Scott, 1937

[Propinacoceratinae PLUMMER & SCOTT, 1937, p. 89]
[=Miklukhoceratinae LEONOVA in LEONOVA & DMITRIEV, 1989, p. 95; =Darvasiceratidae LEONOVA, 1990, p. 106]

Conch discoidal, with strongly ribbed or nodose venter, ranging in mature diameter from 3.5 cm to 20 cm. Suture characterized by low, broad, ventrolateral saddle with few (2 to 8) subdivisions. More than one-half of umbilically derived external lateral lobes usually bidentate. *Cisuralian (Asselian)–Lopingian (Wuchiapingian).*

Propinacoceras GEMMELLARO, 1887, p. 55 [**P. Beyrichi* GEMMELLARO, 1887, p. 56; SD DIENER, 1921, p. 12]. Conch large (diameter to 20 cm) with strong ventral ribs or nodes separated by median furrow. Suture characterized by undivided ventral flank of ventrolateral saddle and by dorsal subdivision of primary external lateral lobe ($L_{1(d)}$) that is less than one-half size of adjacent primary umbilical lobe. Sutural formula: $(V_2V_1V_2)s^1s^1L_{1(d)}UU^1U^2$..... [Russian]. Type species has mondial distribution; remaining 19 named species poorly characterized and questionably valid. *Cisuralian (Sakmarian)–Guadalupian (Wordian):* Italy (Sicily), Croatia, Iraq (Kurdistan), Oman, Russia and Kazakhstan (Southern Urals), Tajikistan (Pamir), Afghanistan, Ukraine (Crimea), China (Xizang, Xinjiang, Guizhou, Guangxi, Jilin, Gansu), Mexico (Coahuila), Indonesia (Timor), USA (Texas), Japan (Kitakami Massif), Canada (British Columbia). ——FIG. 132,*1a–c. *P. beyrichi,* Sosio limestone Wordian, Sicily; *a–b*, lectotype (herein), MGUP 96A of GEMMELLARO (1887, pl. 5,*12–13*), ×1.2 (Gemmellaro, 1887); *c*, unfigured paralectotype, MGUP 98A of GEMMELLARO (1887), diameter at 26 mm (new).——FIG. 132,*1d. P. ajense* MAKSIMOVA, hypotype, SUI 84906, Artinskian, Baigendzhinian, central Urals, River Kos'va,

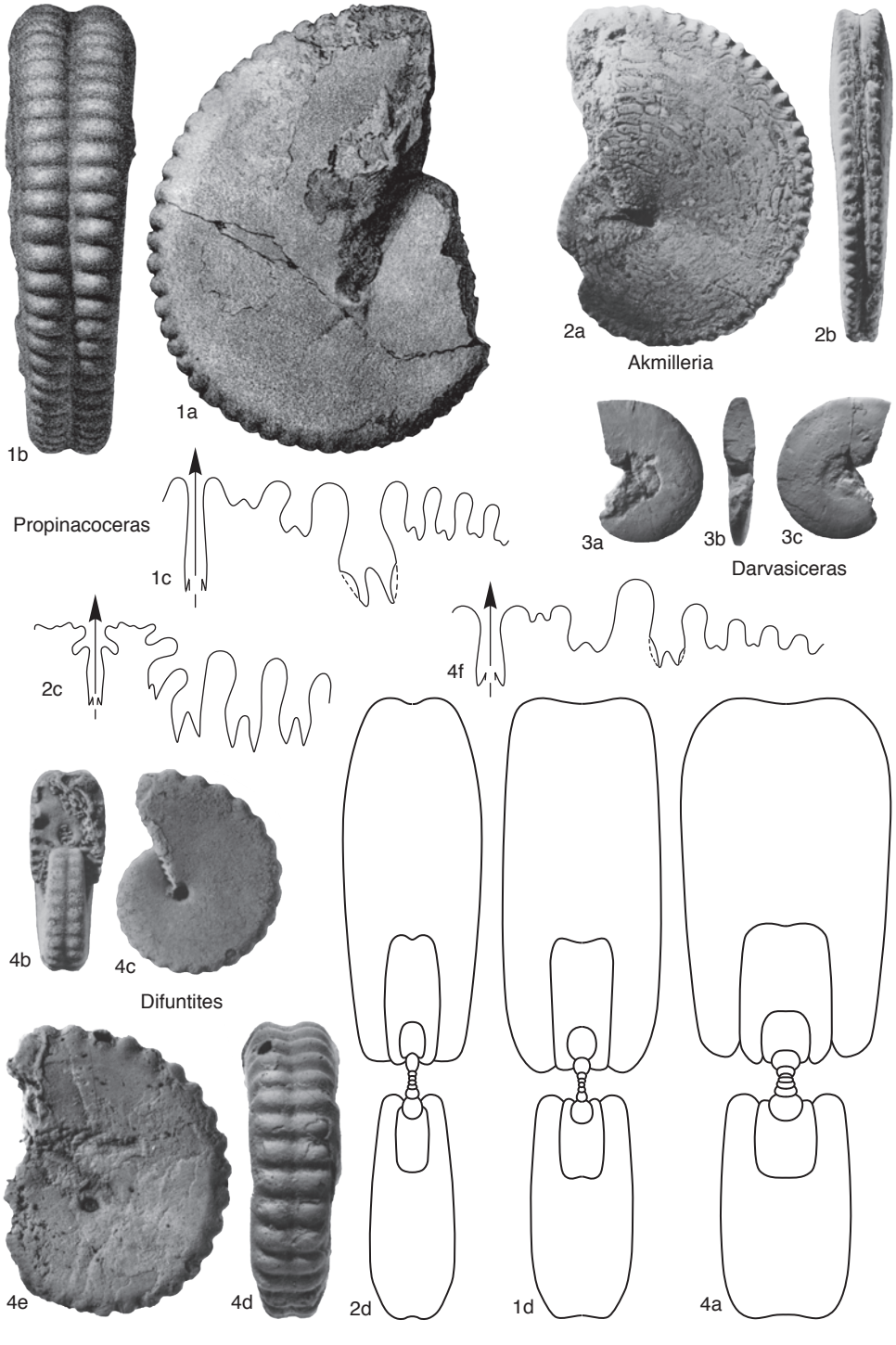

FIG. 132. Medlicottiidae (p. 206–210).

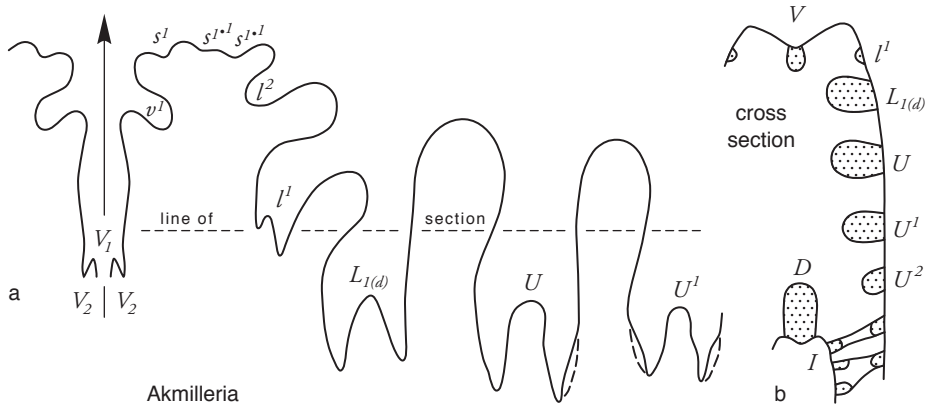

FIG. 133. Medlicottiidae (p. 208).

diameter at 31 mm (new, courtesy of D. M. Work & W. B. Saunders).

Akmilleria RUZHENTSEV, 1940d, p. 474 [**Propinacoceras transitorium* HANIEL, 1915, p. 39; OD]. Conch narrowly discoidal, with two rows of ventral tubercles. Suture characterized by ventrolateral saddle with 5 to 8 subdivisions, 1 on ventral flank, 2 to 5 on crest, 2 dorsad, the first of which is bidentate. Sutural formula: $(V_2V_1V_2)v^1s^1s^1l^2l^1L_{1(d)}UU^1U^2$..... [Russian]. Five named species. *Cisuralian (Asselian–Kungurian):* Kazakhstan (Southern Urals), Indonesia (Timor), USA (commonly Texas, Kansas, Nevada), southern China (Guizhou, Guangxi), Thailand (Loei).——FIG. 132,*2a–c. *A. transitoria* (HANIEL), Bitauni beds, Artinskian, Bitauni, Timor; *a–b*, lectotype (herein), PIUB 7A of HANIEL (1915, pl. 2,*5a–b*), ×0.89 (Haniel, 1915); *c*, previously unfigured paralectotype, PIUB 7B, diameter approximately 70 mm (new).——FIG. 133*a–b. *A. transitoria* (HANIEL); partial suture and septal face to depict sutural symbolism of V. E. RUZHENTSEV utilized herein in modified form (new).——FIG. 132,*2d. A. electraensis* (PLUMMER & SCOTT), hypotype, SUI 51609, Rib Hill-Arcturus Formation, Buck Mountain, Nevada, Artinskian, Aktastinian, diameter at 34 mm (new, courtesy of D. M. Work & W. B. Saunders).

Bamyaniceras TERMIER & TERMIER, 1970, p. 94 [**B. bouyxi;* OD]. Conch similar to *Propinacoceras*, suture with undivided ventral flank and 2 to 4 subdivisions in crest of ventrolateral saddle. Differs in possession of relatively large simple or bifid dorsal subdivision of ventrolateral saddle and retention to maturity of large dorsal subdivision of primary external lateral lobe ($L_{1(d)}$) greater than one-half size of adjacent primary umbilical lobe U, or two elements subequal in extreme cases. Sutural formula $(V_2V_1V_2)s^1s^1l^1L_{1(d)}UU^1$..... [Russian]. Twelve named species. [Ventrolateral sutures of *Bamyaniceras* and *Propinacoceras* may be homeomorphic, the dorsal subdivision of the ventrolateral saddle (l^1) in the former resembling in size and location the dorsal prong of the primary lateral lobe ($L_{1(d)}$) in the latter; however, study of the ontogeny appears to reveal the fundamental difference. *Bamyaniceras* is a dominant medlicottiid of the North American southwest and of Central Asia.] *Cisuralian (Artinskian)–Guadalupian (Wordian):* Tajikistan (Pamir), Afghanistan, Ukraine (Crimea), Italy (Sicily), USA (Texas, Nevada, California), Indonesia (Timor), Thailand (Loei), Western Australia, China (Guizhou, Xinjiang).——FIG. 134,1*a. *B. bouyxi,* Artinskian, Bamyan Mountains, Afghanistan, IGAL, Paris (TERMIER & TERMIER, 1970, pl. 9,*1-2,1-1*), diameter approximately 50 mm (Termier & Termier, 1970).——FIG. 134,1*b–g. B. galilaei* (GEMMELLARO), Sosio limestone, Wordian, Sosio, Sicily; *b,* YPM 15221, diameter approximately 40 mm; *c–d,* lectotype (herein), MGUP 99A of GEMMELLARO (1887, pl. 9,*1–2*), ×1.33; *e–g*, hypotype, USNM 487617, "Pietra Cavorata" (probably Pietra di Salomone), ×1.33 (new).——FIG. 134,1*h–q. B. similis* (HANIEL), Skinner Ranch Formation, Artinskian, near Dugout Mountain, USNM Loc. 700n', Brewster County, western Texas; ontogenetic series of ventrolateral sutures based on one side of single hypotype, USNM 487618, representing alternate sutures for one full whorl, diameter ranging from 5 to 10 mm, and portraying diagnostic developmental features for genus (new).

Darvasiceras LEONOVA, 1990, p. 107 [**D. mirim;* OD] Inadequately known, from rare juveniles; perhaps similar to *Propinacoceras,* but apparently lacking ventrolateral nodes and with anomalously low ventrolateral saddle. Absence of ventrolateral nodes may be a function of small size. One species. *Cisuralian (Artinskian [Yakhtashian]):* Tajikistan (Darvas).——FIG. 132,*3a–c. *D. mirim*, ×1 (Leonova, 1990).

Difuntites GLENISTER & FURNISH, 1988a, p. 57 [**Propinacoceras hidium* RUZHENTSEV, 1976, p. 39;

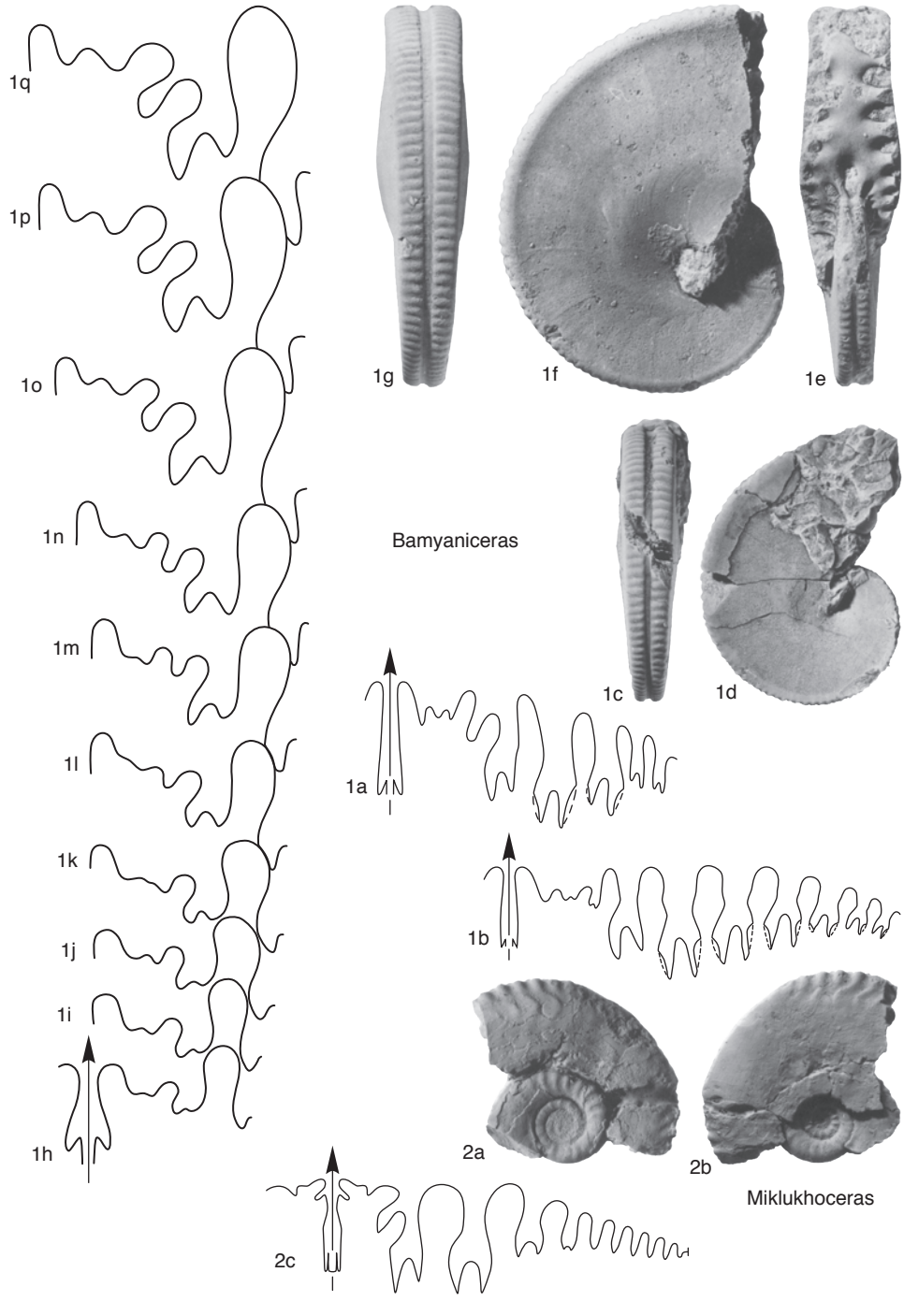

FIG. 134. Medlicottiidae (p. 208–210).

OD]. Conch small, probably less than 35 mm at maturity, broadly discoidal (W/D, 0.3–0.4), with two rows of relatively large ventral nodes. Suture generally similar to *Propinacoceras,* but characterized by dorsal prong of primary lateral lobe ($L_{1(d)}$), whose breadth exceeds that of adjacent primary umbilical lobe (U) in all growth stages. One species. [*Difuntites* is the smallest, broadest, rarest, and youngest propinacoceratin and is interpreted as the terminal paedomorph of the subfamily.] *Lopingian (Wuchiapingian):* Russia (Maritime Territory), Indonesia (Timor), Madagascar, Mexico (Coahuila), China (Guizhou).——Fig. 132,*4a–f.* **D. hidius* (Ruzhentsev); *a*, hypotype, SUI 12653, diameter at 16 mm (new, courtesy of D. M. Work & W. B. Saunders); *b–c*, single mature specimen, Amarassi beds, Wuchiapingian, Timor, ×2.66 (Glenister & Furnish, 1988a); *d–e*, Upper Liudianzin Suite, Shkotovo district, Russian Maritime Territory, ×1; *f,* diameter at 12 mm (Ruzhentsev, 1976).

Kunlunoceras Wang, 1983, p. 516 [**K. kunlunense;* OD]. Inadequately known, from single specimen, apparently similar to *Darvasiceras* in distinctive low ventrolateral saddle, but differing in possession of two rows of prominent ventrolateral nodes. One species. *Cisuralian (?Artinskian):* northwestern China (Xinjiang).

Miklukhoceras Pavlov, 1967, p. 69 [**M. pamiricum;* OD]. Narrowly discoidal propinacoceratins with two rows of ventral nodes. Juveniles characterized by evolute form and conspicuous ribs that extend across entire flank. At larger size, umbilicus remains open (U/D, 0.2–0.3 at 30 mm diameter), and conspicuous ribs are confined to sigmoidal extensions across ventrolateral flanks from ventral nodes. Suture as in *Akmilleria,* with single subdivision on ventral flank of ventrolateral saddle. Four named species. [The relationship of *Miklukhoceras* to other Medlicottiidae remains unclear. The evolute juvenile form characterizes the entire family but generally there is an absence of conspicuous sculpture.] *Cisuralian (Sakmarian–Kungurian):* Tajikistan (Pamir), northwestern China (Xinjiang), Thailand (Muak Lek).——Fig. 134,*2a–c.* **M. pamiricum,* Bolorian, Pamir; *a–b*, ×1; *c*, diameter approximately 40 mm (Leonova & Dmitriev, 1989).

Subfamily SICANITINAE Noetling, 1904

[Sicanitinae Noetling, 1904, p. 343] [=Artioceratinae Leonova in Leonova & Dmitriev, 1989, p. 108]

Conch intermediate in size, lenticular to discoidal, with strong ventral nodes that may be elongate to simulate pair of ventrolateral keels. Ventrolateral saddle low to intermediate height, with few (3 to 10) subdivisions, l^1 commonly large and bidentate to tridentate. Suture characterized by position of primary external lateral lobe ($L_{1(d)}$) significantly below alignment of subequal, adjacent, umbilically derived lateral lobes; more than one-half of umbilically derived external lobes bidentate. *Cisuralian (Asselian)–Guadalupian (Wordian).*

Sicanites Gemmellaro, 1887, p. 62 [**Medlicottia Schopeni* Gemmellaro, 1887, p. 51; SD Miller & Furnish, 1940a, p. 39, =*Sicanites Mojsisovicsi* Gemmellaro, 1887, p. 64, based on page priority] [=?*Prosicanites* Tumanskaia in Tumanskaia & Borneman, 1937, p. 113 (type, *P. edelsteini,* SD Ruzhentsev, 1949a, p. 41); =*Aktubinskia* Ruzhentsev, 1947b, p. 641 (type, *Artinskia notabilis* Ruzhentsev, 1940d, p. 475, OD); =*Vanartinskia* Ruzhentsev, 1978, p. 41 (type, *V. asiana,* OD)]. Conch lenticular, with ventral nodes varyingly bladelike in most species to simulate paired ventrolateral keels. Ventrolateral saddle intermediate in height, with 7 to 10 subdivisions. Sutural formula: $(V_2V_1V_2)v^1v^{2\text{-}3}s^1s^1l^{5\text{-}3}l^2l^1L_{1(d)}UU^1U^2$..... [Russian]. Nine named species. [Gemmellaro's misinterpretation of the ventrolateral saddle resulted in one of the few instances in which he failed to recognize details important in relationships. Polygonal coiling in *S. schopeni* (Fig. 135*d,g,h*) up to a diameter of 15 mm may serve eventually for separate generic recognition, but there is insufficient current information on other assigned species; diagrammatic cross sections herein (e.g., Fig. 132,*1d, 2d, 4a* herein) indicate that all medlicottiids were evolute as juveniles but then became involute abruptly on reaching adulthood.] *Cisuralian (Asselian)–Guadalupian (Wordian):* Italy (Sicily), Croatia, Iraq (Kurdistan), Oman, Ukraine (Crimea), Kazakhstan (Southern Urals), Tajikistan (Pamir), southern China (Guizhou, Guangxi), Thailand (Loei), Indonesia (Timor), USA (western Texas, Nevada), Mexico (Coahuila).——Fig. 135*a–i.* **S. schopeni* (Gemmellaro), Sosio limestone, Wordian, Sicily; *a–b,* lectotype (herein), MGUP 91A of Gemmellaro (1887, pl. 9,*20–22*), ×1.33; *c–d,* paralectotype, MGUP 91B of Gemmellaro (1887, pl. 9,*23–24*), ×3; *e–g,* topotype, USNM 159902, Pietra di Salomone, Sosio Valley, ×3.33; *h*, paralectotype, MGUP 91C of Gemmellaro (1887, pl. 9,*25*), ×3; *i,* lectotype (herein), MGUP 91A of Gemmellaro (1887, pl. 9,*20–22*), diameter at 30 mm (new).——Fig. 135*j. S asiana* (Ruzhentsev; type species of *Vanartinskia*), Asselian, Pamir, diameter at 40–45 mm (Ruzhentsev, 1978).——Fig. 135*k. S. insulcatus* (Haniel), Bitauni beds, Artinskian: Baigendzhinian, Bitauni, Timor, lectotype (herein), PIUB 6A of Haniel (1915, pl. 2,*3a–b*; fig. 6), diameter at 40 mm (new).——Fig. 135*l–n. S. notabilis* (Ruzhentsev; type species of *Aktubinskia*); *l,* Artinskian, Aktastinian, Aktasty River, Southern Urals, diameter at 17 mm (Ruzhentsev, 1956b), *m,* topotype, Artinskian, Aktastinian, Aktasty River, Southern Urals, SUI 10565A, diameter at 30 mm; *n,* hypotype, SUI 62264, Rib Hill-Arcturus Formation, Artinskian, Aktastinian, Buck Mountain, White Pine County, Nevada, diameter at 70 mm (new).——Fig. 135*o. S. costelliferus* (Miller

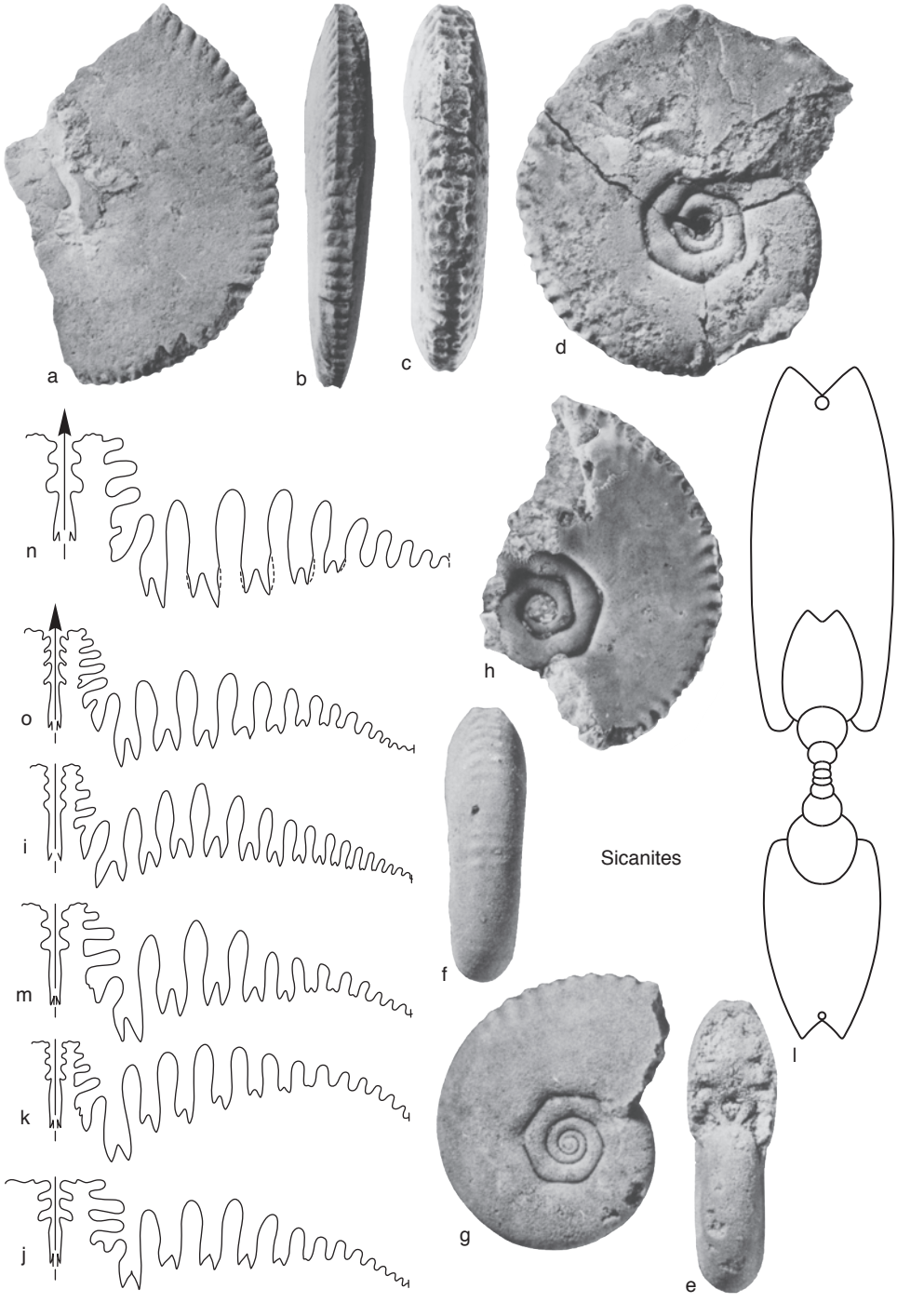

FIG. 135. Medlicottiidae (p. 210–213).

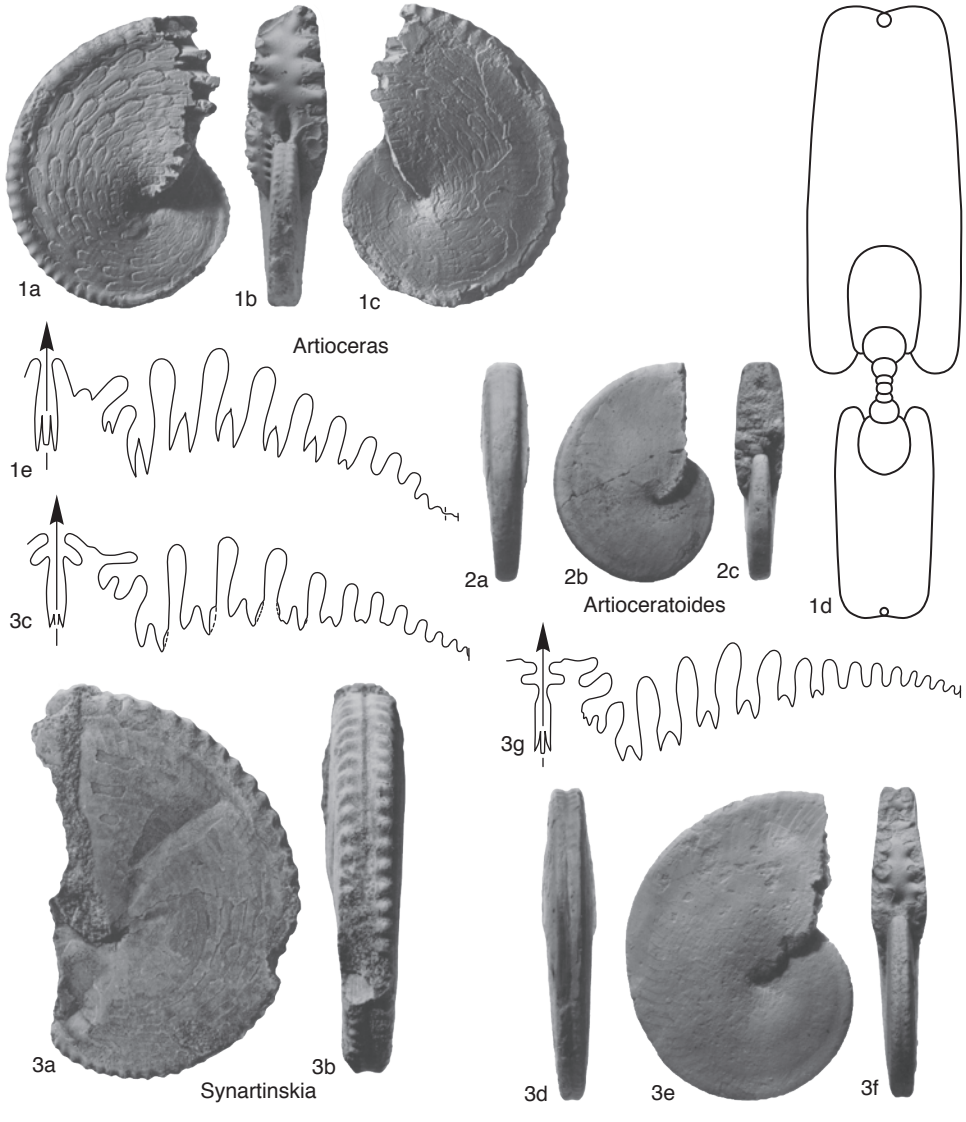

FIG. 136. Medlicottiidae (p. 213).

& Furnish), Leonard Group, Artinskian, western Texas, diameter at 70 mm (Miller & Furnish, 1940a).

Artioceras Ruzhentsev, 1947b, p. 641 [**Propinaceras rhipaeum* Ruzhentsev, 1939c, p. 837; OD]. Conch discoidal with strong equidimensional ventral nodes. Suture characterized by combination of only three subdivisions of ventrolateral saddle with deep dorsal prong of primary external lateral lobe. Sutural formula: $(V_1V_2V_1)s^1s^1l^1L_{1(d)}UU^1U^2$..... [Russian]. One named species. *Cisuralian (Artinskian [Aktastinian])*: Kazakhstan (Southern Urals), southern China (Guizhou, Guangxi), Belgium (Namur).——Fig. 136,*1a–e.* **A. rhipaeum* (Ruzhentsev), Aktasty River area, Southern Urals; *a–c,* ×0.67; *d*, diameter at 14 mm; *e*, diameter at 57 mm (Ruzhentsev, 1956b).

Artioceratoides Leonova, 1985, p. 81 [**A. victori;* OD]. Similar to *Artioceras* in both conch form and suture, but lacking ventral nodes and with only two subdivisions (one bidentate) of ventrolateral saddle. Sutural formula: $(V_1V_2V_1)s^1s^1L_{1(d)}UU^1U^2$..... [Russian]. Two species. [This genus is questionably valid, as differences from *Artioceras* comprise only retention of juvenile characters to slightly larger size.] *Cisuralian (Artinskian–Kungurian):* Tajikistan (Pamir).——Fig. 136,*2a–c.* **A. victori*, ×1 (Leonova, 1985).

Synartinskia Ruzhentsev, 1939d, p. 461 [**S. principalis;* OD] [=*Parasicanites* Leonova, 1985, p. 77 (type, *P. meridionalis,* OD)]. Conch form and ventral sculpture as in *Artioceras.* Suture characterized by deep dorsal prong of primary external lateral lobe in combination with ventrolateral saddle with 4 or 5 subdivisions, one of which is ventrad; first dorsal subdivision (l^1) large and variously dentate. Sutural formula: $(V_2V_1V_2)v^1s^1s^1l^{1-2}L_{1(d)}UU^1U^2$..... [Russian]. Five named species. *Cisuralian (Sakmarian)–Guadalupian (Roadian):* Russia and Kazakhstan (Southern Urals), Tajikistan (Pamir), Canada (Arctic Archipelago: Devon Island).——Fig. 136,*3a–c.* **S. principalis,* topotype, Sakmarian, Aktyubinsk District, Southern Urals, SUI 10561; *a–b*, ×1.33; *c*, diameter at 40 mm (new).——Fig. 135,*3d–g. S. meridionalis* (Leonova; type species of *Parasicanites*), Bolorian-Kungurian, Pamir; *d–f*, ×1; *g*, diameter at 42 mm (Leonova, 1985).

Subfamily EPISAGECERATINAE Ruzhentsev, 1956

[*nom. transl.* Glenister, Furnish, & Zhou, herein, *ex* Episageceratidae Ruzhentsev, 1956a, p. 160]

Medlicottiids with thickly discoidal conch, broad, flat venter (width 0.4 to 0.5 maximum conch width), and angular ventrolateral shoulders. Characterized by complex suture with primary umbilical lobe (U) much shorter than adjacent elements (L_1 and U^1). More than one-half of umbilically derived external lateral lobes usually bidentate. Ventrolateral saddle narrow, high, subdivided by perhaps as few as 8 and by up to 16 subequal subdivisions paired on either side of angular ventrolateral shoulder. [Episageceratins are rare, and details of sutural ontogeny are poorly known.] *Lopingian (Wuchiapingian)–Lower Triassic (Induan).*

Episageceras Noetling, 1904, p. 363 [**Sageceras (Medlicottia) wynnei* Waagen, 1880, p. 81; SD Diener, 1915, p. 165] [=*Protosageceras* Y. Popov, 1961, p. 10 (type, *P. antiquus,* OD)]. Suture characterized by 10 to 16 subdivisions in ventrolateral saddle and by primary umbilical lobe much shorter and appreciably narrower than adjacent lobes. Sutural formula: $(V_2V_1V_2)v^1v^2v^{3-7}s^1s^1l^{7-3}l^2l^1L_{1(d)}UU^1U^2$..... [Russian]. Five named species. *Lopingian (Wuchiapingian)–Lower Triassic (Induan)*: Madagascar, Pakistan (Salt Range), India (Himalaya), Russia (Verkhoian, Okhotskii), Indonesia (Timor), New Zealand (D'Urville Island, South Island), East Greenland, Mexico (Coahuila).——Fig. 137*a.* **E. wynnei* (Waagen); plastoholotype, Chhidru Formation, Wuchiapingian, Salt Range, SUI 12378, diameter at 70 mm (Waagen, 1880).——Fig. 137*b. E.* sp., Greville Formation, Induan, D'Urville Island, New Zealand, SUI 39603, diameter at 90 mm (new).——Fig. 137*c–f. E. dalailamae* (Diener), *Otoceras* beds, Induan, Spiti, Himalaya; *c–e*, ×0.67; *f*, diameter at 80 mm (Noetling, 1904).——Fig. 137*g–j. E. boulei* Treat, holotype, MNHN 1924-2, Wuchiapingian, Ankitohazo, Madagascar; *g–i*, ×0.67; *j*, diameter at 60 mm (new).——Fig. 137*k–n. E. noetlingi* Haniel; *k–l*, holotype, PIUB 10 of Haniel (1915, pl. 2,*10a–b*), Timor, Kuefeu, ×1.33; *m,* topotype, SUI 62308, diameter at 29 mm (courtesy of D. M. Work & W. B. Sauders); *n*, hypotype, SUI 12023, Lopingian, Timor, Basleo, diameter at 25 mm (new).——Fig. 137*o. E.* aff. *E. noetlingi* [based on general similarity of sutures, but whorl section and ventrolateral nodes suggest affinity with *Nodosageceras*], SUI 32869, La Colorada beds, Wuchiapingian, Coahuila, Mexico, diameter at 18 mm (new).

Latisageceras Ruzhentsev, 1956a, p. 160 [**Episageceras latidorsatum* Noetling, 1904, p. 372; OD]. Conch similar to *Episageceras,* but venter possibly proportionally broader. Suture relatively simple:

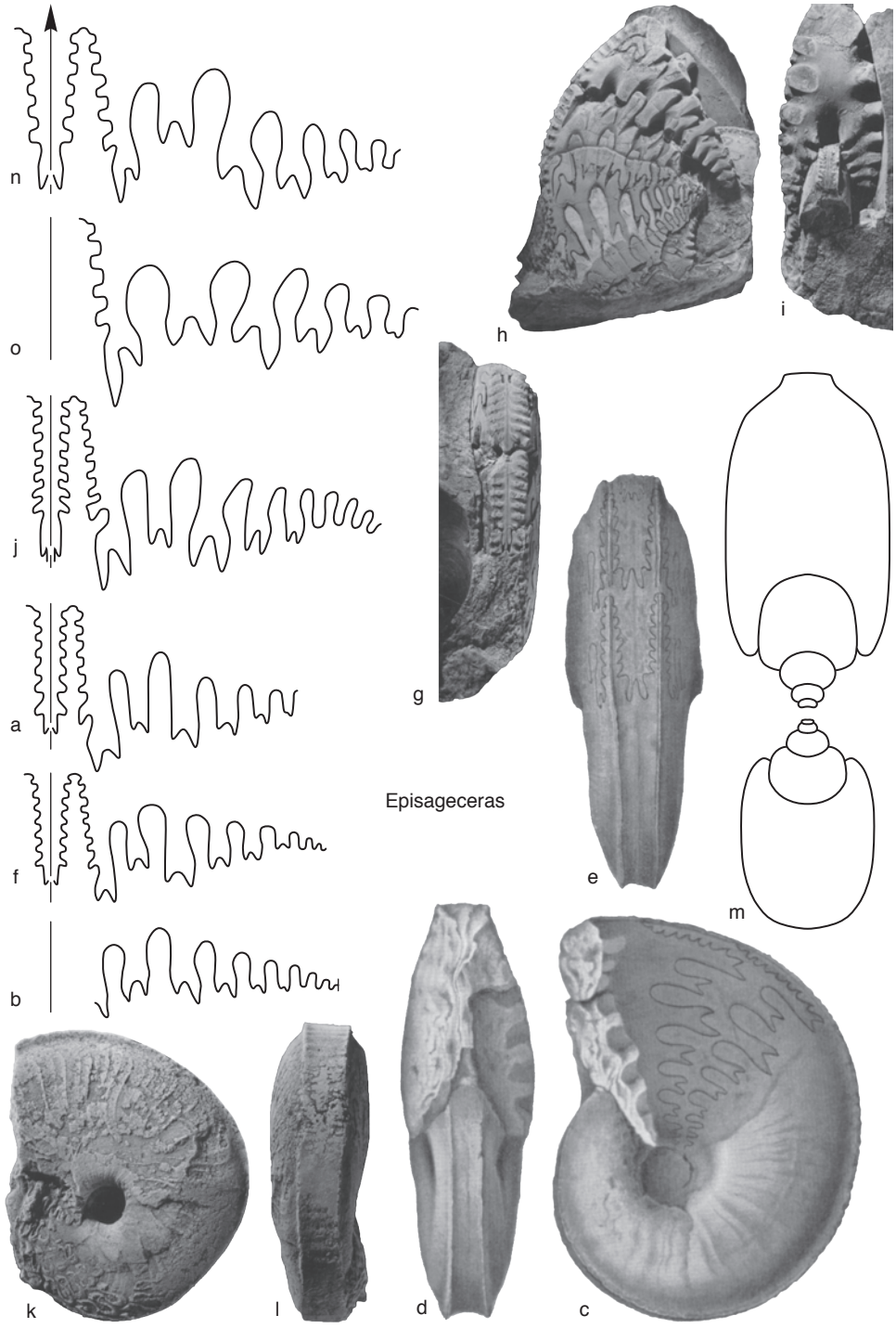

FIG. 137. Medlicottiidae (p. 213).

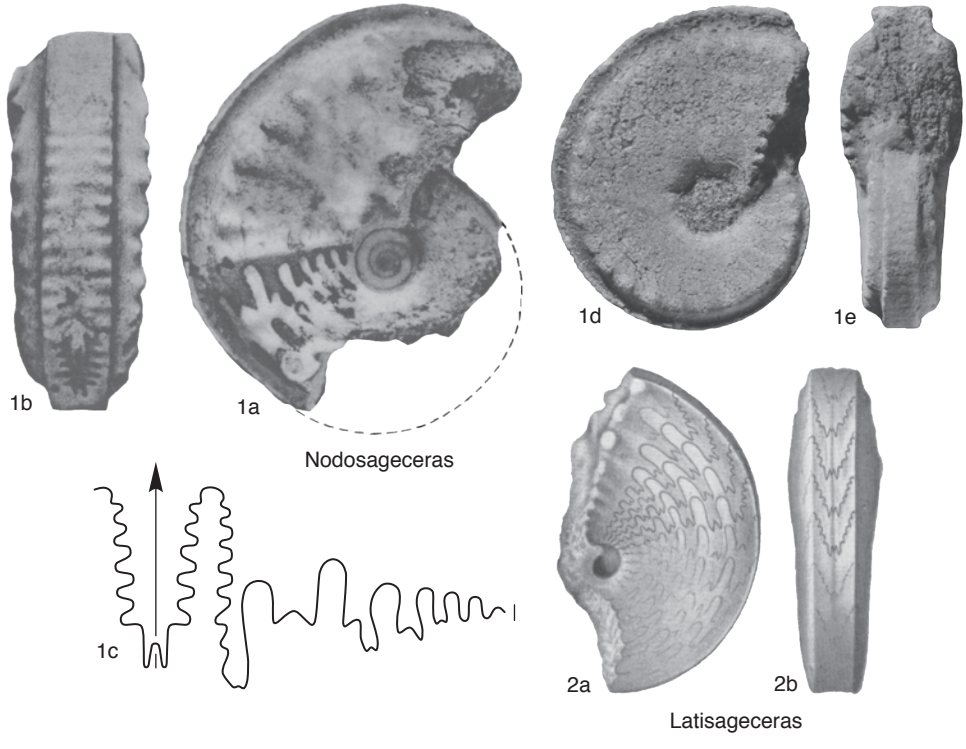

FIG. 138. Medlicottiidae (p. 213–215).

ventrolateral saddle has 8 to 10 subdivisions, and base of primary umbilical lobe may align approximately with adjacent elements. One species. [Genus is rare and inadequately known. The single representative of type species has not been restudied, and published drawings may not accurately portray sutural details.] *Lower Triassic (Induan):* Pakistan (Salt Range), Indonesia (?Timor).——FIG. 138,*2a–b. *L. latidorsatum* (NOETLING), Mianwali Formation, Salt Range, ×0.67 (Noetling, 1904).

Nodosageceras RUZHENTSEV, 1956a, p. 161 [**Episageceras nodosum* WANNER, 1932, p. 257; OD]. Conch similar to *Episageceras,* but groove on ventrolateral flank deeper, and with coarse ribs dorsad of groove to midflank. Primary umbilical lobe much broader than adjacent elements and even shorter than in *Episageceras,* otherwise similar. One species (known from two or three specimens). [See the notation under *Episageceras* (above) for the affinities of *E.* aff *E. noetlingi.*] *Lopingian (Wuchiapingian):* Indonesia (Timor), Mexico (?La Colorada beds, ?Coahuila).——FIG. 138,*1a–c. *N. nodosum* (WANNER); *a–b,* ×2; *c,* diameter approximately 20 mm (Wanner, 1932).——FIG. 138,*1d–e. N.* cf. *N. nodosum,* BMNH C33612, labeled Sosio limestone, Sicily, but preservation and morphology are incongruous: dimensions, shell proportions, sculpture, and preservation strikingly similar to those of Timor types, and common origin is probable, ×2 (new).

UNRECOGNIZED GENERIC NAMES APPLIED TO PALEOZOIC AMMONOIDEA

[Materials for this section prepared by Jürgen Kullmann]

Aganides DE MONTFORT, 1808, p. 30. Type was not named specifically and is of uncertain derivation and affinities. [For discussion, see SCHINDEWOLF, 1923, p. 325.]

Akeshakeceras LIANG & WANG, 1991, p. 80 [**Dzhaprakoceras (A.) longilobatum* LIANG & WANG, 1991, p. 81; OD]. The type species was proposed as a subgenus of *Dzhaprakoceras* but does not belong to

the superfamily Pericycloidea; the holotype shows spiral ornamentation, an acute lateral saddle, and belongs to a goniatitid group (*teste* Riley, 1996, p. 51).

Osmanoceras Kittl, 1904a, p. 674 [**O. undulatum;* M]. Only holotype of type species known, a small, imperfect shell rest that does not display shell form and suture line. *Mississippian (upper Visean):* Bosnia.

Prehoffmannia Plummer & Scott, 1937, p. 360 [*P. milleri; M]. Only holotype of type species known, a small ornamented shell with diameter of 6.3 mm, which does not show shell form and suture. *Pennsylvanian (?Gzhelian):* USA (Texas, Graham Formation, Stephens County).

Family SUNDAITIDAE Ruzhentsev, 1957

[Sundaitidae Ruzhentsev, 1957, p. 56]

[Materials for this section prepared by Brian F. Glenister, William M. Furnish, and Zhou Zuren]

Smooth, thinly discoidal, involute medlicottioideans (Umin/D, 0.15) with parabolic whorl section. Suture characterized by subequal size of external lateral and adjacent primary umbilical lobe, total of approximately 50 lobes, most asymmetrically bidentate, adventitious lobe (s^1) on ventrolateral saddle, and bidentate dorsal lobe. Single genus. *Lopingian (Wuchiapingian).*

Sundaites Haniel, 1915, p. 31 [**S. levis;* OD]. Conch intermediate in size (phragmocone exceeds 4 cm, diameter at mature peristome probably greater than 6 cm), involute (Umin/D, 0.15–0.12 at 3–4 cm diameter), discoidal (W/D, 0.35–0.25), with parabolic whorl section and acutely angular umbilical midwall. Suture comprises 50 lobes, including 12 pairs of umbilically derived external lateral lobes and 10 pairs of internal umbilicals. Virtually all flank lobes (both external and internal) are bidentate. Characterized by shallow adventitious lobe dorsad of crest in ventrolateral saddle and by primary umbilical lobe subequal in size and shape to adjacent primary lateral. One species. *Lopingian (Wuchiapingian):* Indonesia (Timor).——Fig. 139*a–d.* **S. levis*, Amarassi beds; *a–b,* topotype, SUI 64449, ×1; *c,* topotype, SUI 12655, diameter at 41 mm; *d,* composite, topotype, SUI 64449, Haniel, 1915, fig. 5, diameter at 42 mm (new).

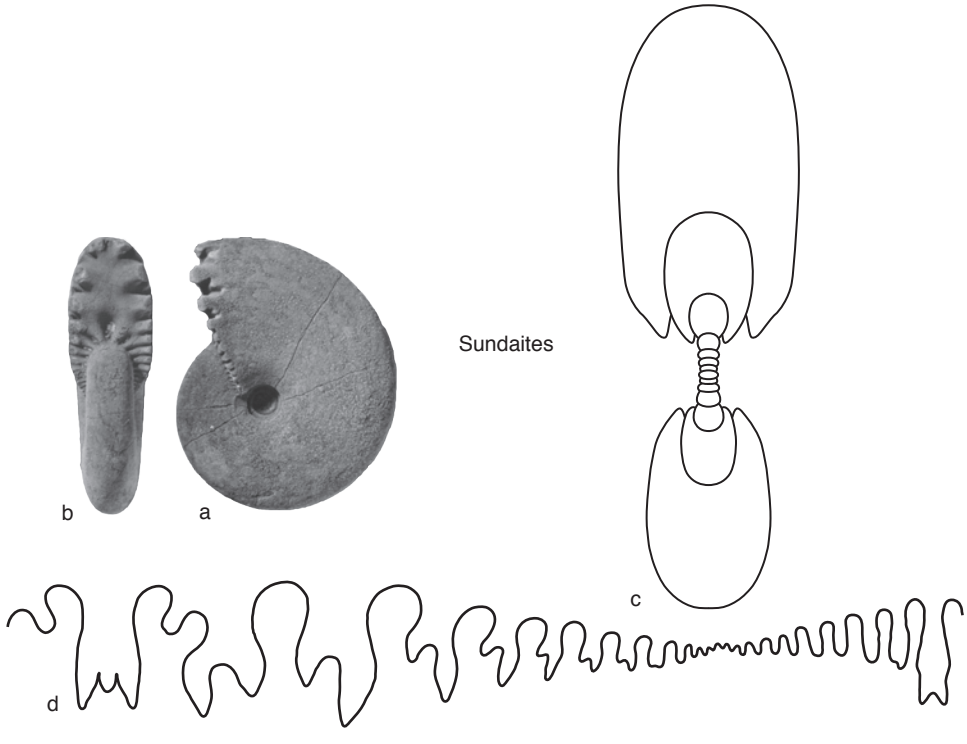

Fig. 139. Sundaitidae (p. 216).

SUPPLEMENTAL GENERA LIST

The following genera have been published or found in the literature since December 2006, the cut-off date for inclusion of full generic descriptions for the present volume. This list represents a late-stage attempt at a complete generic record of the Carboniferous and Permian Ammonoidea.

Suborder TORNOCERATINA
Superfamily PERICYCLOIDEA
Family PERICYCLIDAE
Subfamily PERICYCLINAE

Kornia Ebbighausen & Bockwinkel, 2007, p. 143 [**K. citrus;* OD]. *Mississippian (lower Tournaisian):* Anti-Atlas, Morocco.

Ebbighausen, Volker, & Jürgen Bockwinkel. 2007. Tournaisian (Early Carboniferous/Mississippian) ammonoids from the Ma'der Basin (Anti-Atlas, Morocco). Fossil Record 10(2):125–163, 49 fig.

Superfamily PRIONOCERATOIDEA

Family ACROCANITIDAE
Korn, Bockwinkel, & Ebbighausen, 2007, p. 138

Jdaidites Korn, Bockwinkel, & Ebbighausen, 2007, p. 139 [**J. serpentinus;* OD].

Korn, Dieter, J. Bockwinkel, and V. Ebbighausen. 2007. Tournaisian and Viséan ammonoid stratigraphy in North Africa. Neues Jahrbuch für Geologie und Paläontologie, Abhandlungen 243(2):127–148, 16 fig.

Suborder GONIATITINA
Superfamily GONIATITOIDEA
Family DELEPINOCERATIDAE
Subfamily DOMBARITINAE

Deleshumardites Kullmann in Kullmann, Wagner & Winkler Prins, 2007, p. 139 [**Proshumardites delepinei* Schindewolf, 1939, p. 429; OD]. *Mississippian (upper Visean), Pennsylvanian (Bashkirian):* Cantabrian Mountains, northern Spain.

Kullmann, Jürgen, Robert H. Wagner, & Cornelis F. Winkler Prins. 2007. Significance for international correlation of the Perapertú Formation in northern Palencia, Cantabrian Mountains. Tectonic/stratigraphic context and description of Mississippian and upper Bashkirian goniatites. Revista Española de Paleontología 22(2):127–145, 8 fig.

Delépine, G., & N. Menchikoff. 1937. La faune des schistes carbonifères à *Proshumardites* de Haci-Diab (Confins Algéro-marocains du Sud). Bulletin de la Société géologique de France 5(7):77–89.

Schindewolf, Otto H. 1939. Zur Kenntnis von *Pericleites* Renz und verwandter paläozoischer Ammoineen. Jahrbuch der Preußischen Geologischen Landesanstalt für 1938, 59:423–455.

Superfamily PERICYCLOIDEA
Family PERICYCLIDAE
Subfamily PERICYCLINAE

Nigrocyclus Korn & Feist, 2007, p. 112 [**Pericyclus niger* Delépine, 1935, p. 69; OD]. *Mississippian (middle Tournaisian):* Cabrières (Montagne Noire), phosphoritic nodules, Puech de la Suque Formation.

Delépine,G. 1935. Contribution à l'étude de la faune du Dinantien des Pyrénées. Première partie. Goniatites et Crustacés des nodules phosphatés de l'Ariège. Bulletin de la Société géologique de France 5(5):65–75, pl. 1.

Korn, Dieter, & Raimund Feist. 2007. Early Carboniferous ammonoid faunas and stratigraphy of the Montagne Noire (France). Fossil Record 10(2):99–124, 20 fig.

Superfamily NEOICOCERATOIDEA
Family PARAGASTRIOCERATIDAE
Subfamily AULACOGASTRIOCERATINAE

Nodogastrioceras Ma & Li, 1998, p. 83 [**N. discum;* OD]. Lower Hutang Formation, and Shangrao Formation, Anzhou, Yongping, Qianshan, Jiangxi.

Ma Junwen, & Li Fuyu. 1998. A new family of Gastrioceratoceae. Jiangxi Geology 12(2):82–88. In Chinese.

Zhou Zuren. 2007. Bizarre Permian ammonoid subfamily Aulacogastrioceratinae from South China. Journal of Paleontology 31(4):797–799, 3 fig.

Family METALEGOCERATIDAE
Subfamily SPIROLEGOCERATINAE

Archboldiceras Leonova & Shilovsky, 2007, p. 32 [**Uraloceras lobulatum* Armstrong, Dear, & Runnegar, 1967, p. 91; OD]. *Permian (Kungurian):* Tiverton Formation, Queensland, Australia.

Armstrong, J. D., J. F. Dear, & B. Runnegar. 1967. Permian ammonoids from Eastern Australia. Journal of the Geological Society of Australia 14(10):87–97, 2 fig., pl. 5–6.

Leonova, T. B., & O. P. Shilovsky. 2007. Evolution of the Permian family Spirolegoceratidae (Goniatitida, Ammonoidea). Paleontological Journal 41(1):28–38, 3 fig., 1 pl.

NOMENCLATORIAL NOTE

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REPLACEMENT NAMES FOR TWO PERMIAN AMMONOID JUNIOR HOMONYMS: *HOFFMANNIA* GEMMELLARO, 1887, AND *TAUROCERAS* TUMANSKAIA, 1938

During preparation of the manuscript for *Treatise on Invertebrate Paleontology,* Part L, vol. 2, Carboniferous and Permian Ammonoidea, two junior homonyms were exposed during the editing process.

Hoffmannia GEMMELLARO, 1887, is the senior homonym of *Hoffmannia* FORCART, 1953 (modern gastropod), but also the junior homonym of *Hoffmannia* HEINEMANN & WOCK, 1877 (moth, modern insect) (see p. 135 herein). This case was documented in a review of these modern biological homonyms and the replacement of the gastropod genus by FORCART (1954, p. 21). Therefore, a replacement for ammonoid genus *Hoffmannia* GEMMELLARO, 1887, must be nominated (Article 52 of the International Code of Zoological Nomenclature [ICZN, 1999]).

We here propose the name *Palermoceras*, based upon the province where the Wordian ammonoid was found in Sicily. The type species for *Palermoceras* is *Adrianites (Hoffmannia) hoffmanni* GEMMELLARO, 1887, p. 49 (ICZN *Code* Article 67.8.1).

The related subfamily Hoffmanniinae MOJSISOVICS, 1888, containing the type genus *Hoffmannia,* is consequently replaced by Palermoceratinae ZHOU & GLENISTER herein (see p. 135 herein; ICZN *Code* Article 39).

Tauroceras TUMANSKAIA, 1938 (type species, *Popanoceras scrobiculatum* GEMMELLARO, 1887, OD) is newly recognized to be the junior homonym of a modern Coleoptera insect (HOPE, 1840), and must be replaced by a new name (see p. 181 herein; ICZN *Code* Article 52.2). According to the *Code*, the principle of priority requires that if a name in use for a taxon is found to be invalid, it must be replaced by the next oldest available name from among its synonyms (ICZN *Code* Article 23.3.5).

Tauroceras has two synonyms:

1) *Gemmellaroceras* TUMANSKAIA, 1937, p. 470, *nom. nud.,* senior synonym but also the junior homonym of *Gemmellaroceras* HYATT, 1900, p. 574.

2) *Neopopanoceras* SCHINDEWOLF, 1939, p. 447 (type, *Popanoceras multistriatum* GEMMELLARO, 1887, p. 21, OD), the only available name for replacing the junior homonym *Tauroceras* TUMANSKAIA.

Neopopanoceras SCHINDEWOLF, 1939, is named herein as the replacement for *Tauroceras* TUMANSKAIA, 1938, type species, *Popanoceras scrobiculatum* GEMMELLARO (ICZN *Code* Article 67.8–8.1).

Finally, we thank Jill Hardesty, editor of the volume, for her careful review of the manuscript and for alerting us about junior homonyms *Hoffmannia* FORCART, 1953, and *Tauroceras* HOPE, 1840, during the editing process.

REFERENCES

Forcart, Lothar. 1953. The Veronicellidae of Africa (Mollusca, Pulmonata). Annales du Musée du Congo Belge, Sciences Zoologiques 23:1–110.

Forcart, Lothar. 1954. Two species of Veronicellidae from the Kenya Colony and *Afroveronicella* nom. nov. for *Hoffmannia* Forcart. Proceedings of the Malacological Society 31:20–21.

Gemmellaro, Gaetano G. 1887. La Fauna dei Calcari con Fusulina della Valle del Fiume Sosio (nella Pro-

vincia di Palermo). Giornale di scienze naturali ed economiche 19:1–96, pl. 1–10.
Heinemann, H. & M. F. Wocke. 1877. Die Schmetterlinge Deutschlands und der Schweiz. Zweite Abtheilung. Kleinschmetterlinge. Band 2, Die Motten und Federmotten. C. A. Schwetke und Sohn. Braunschweig. Heft 2:389–825, 1–102, V–VI.
Hope, F. W. 1840. The Coleopterist's Manual, Part the Third, Containing Various Families, Genera, and Species, of Beetles, Recorded by Linnaeus and Fabricius, also, Descriptions of Newly Discovered and Unpublished Insects. London. p. 1–191.
Hyatt, Alpheus. 1900. Tetrabranchiate Cephalopoda. *In* K. A. von Zittel, Text-book of Palaeontology, vol. 1, lst ed., translated by C. R. Eastman. MacMillan & Co. London. p. 502–604, fig. 1049–1259.
ICZN (International Commission on Zoological Nomenclature), 1999. International Code of Zoological Nomenclature, 4th ed. The International Trust for Zoological Nomenclature. London. xxix + 306 p.
Mojsisovics, E. von Mojsvár. 1888. Über einige arktische Trias-Ammoniten des nördlichen Sibirien. Mémoires de l'Academie Impériale des Sciences St. Pétersbourg (series 7) 36(5):1–21, 3 pl.
Schindewolf, Otto H. 1939. Zur Kenntnis von *Pericleites* Renz und verwandter paläozoischer Ammoneen. Jahrbuch der Preußischen Geologischen Landesanstalt 59(for 1938):423–455, 17 fig.
Tumanskaia, Ol'ga G. 1937. Gorizonty permi Kryma [Permian deposits of the Crimea]. Problemy Sovetskoi Geologii 1937(5–6):470–472.
Tumanskaia, Ol'ga G. 1938. O novom rode *Tauroceras* iz permskikh otlozhenii Kryma i Sitsilii [On the new genus *Tauroceras* from deposits of Crimea and Sicily]. Sovetskaia Geologiia 1938(12):145–146, 4 fig.

RANGES OF TAXA

The stratigraphic distribution of the Carboniferous and Permian Ammonoidea recognized in Part L, Revised, volume 2, is shown graphically in the range chart (Table 1).

For more detailed stratigraphic information, refer to the systematic sections herein, p. 1–219.

The following chart was compiled using software developed for the Paleontological Institute by Kenneth C. Hood and David W. Foster.

It must be emphasized that the order of taxa in this chart is governed entirely by their stratigraphic range and, within that, by alphabetical order, and differs in some cases from the taxonomic order in the systematic parts of the volumes. No taxonomic conclusions should be drawn from the position of taxa in this chart.

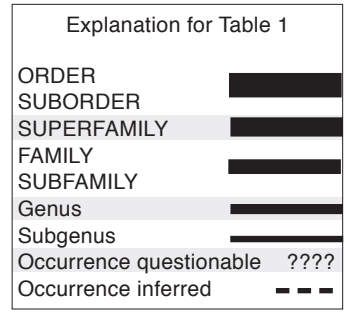


TABLE 1. Stratigraphic distribution of the Carboniferous and Permian Ammonoidea.

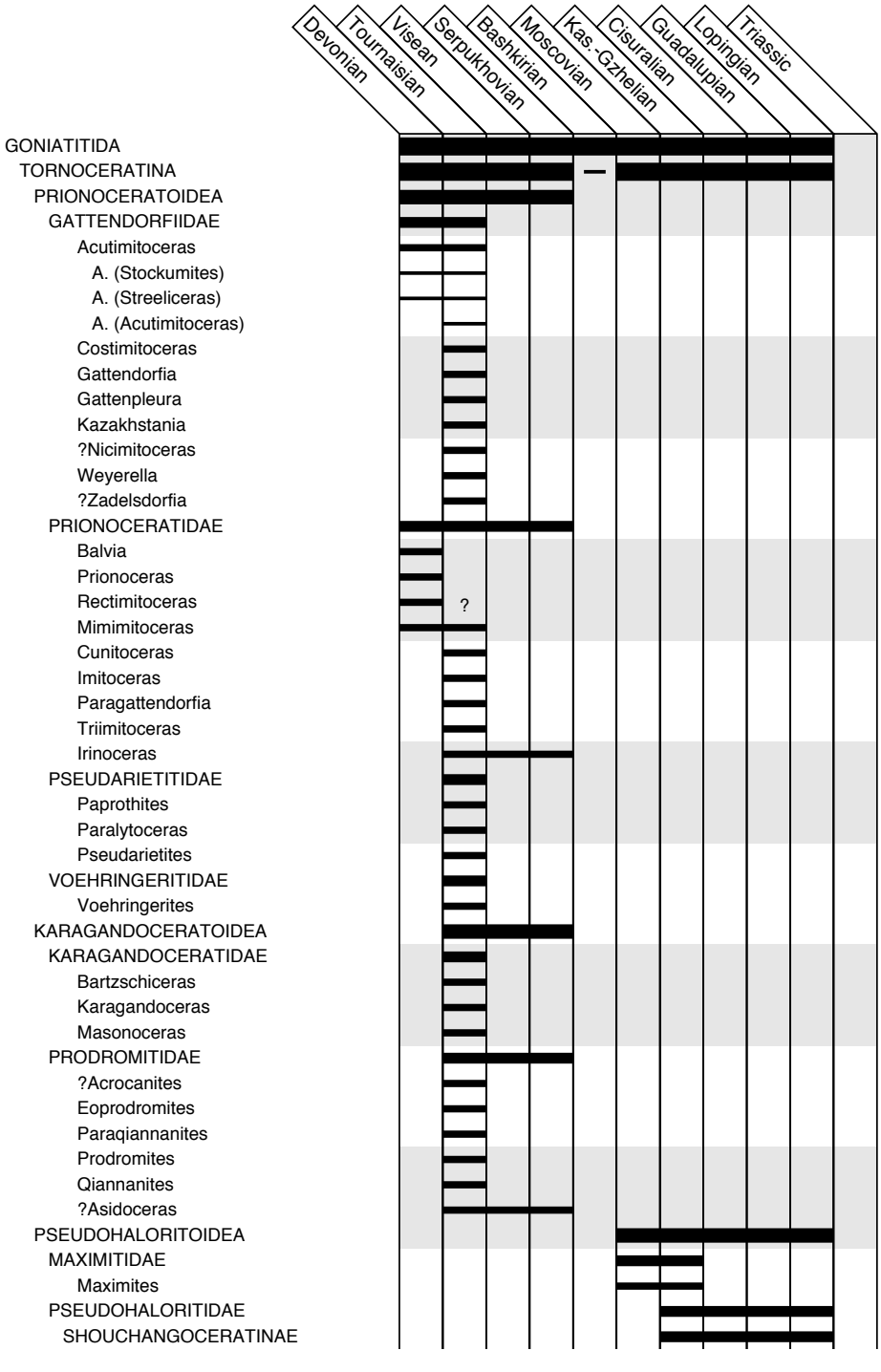
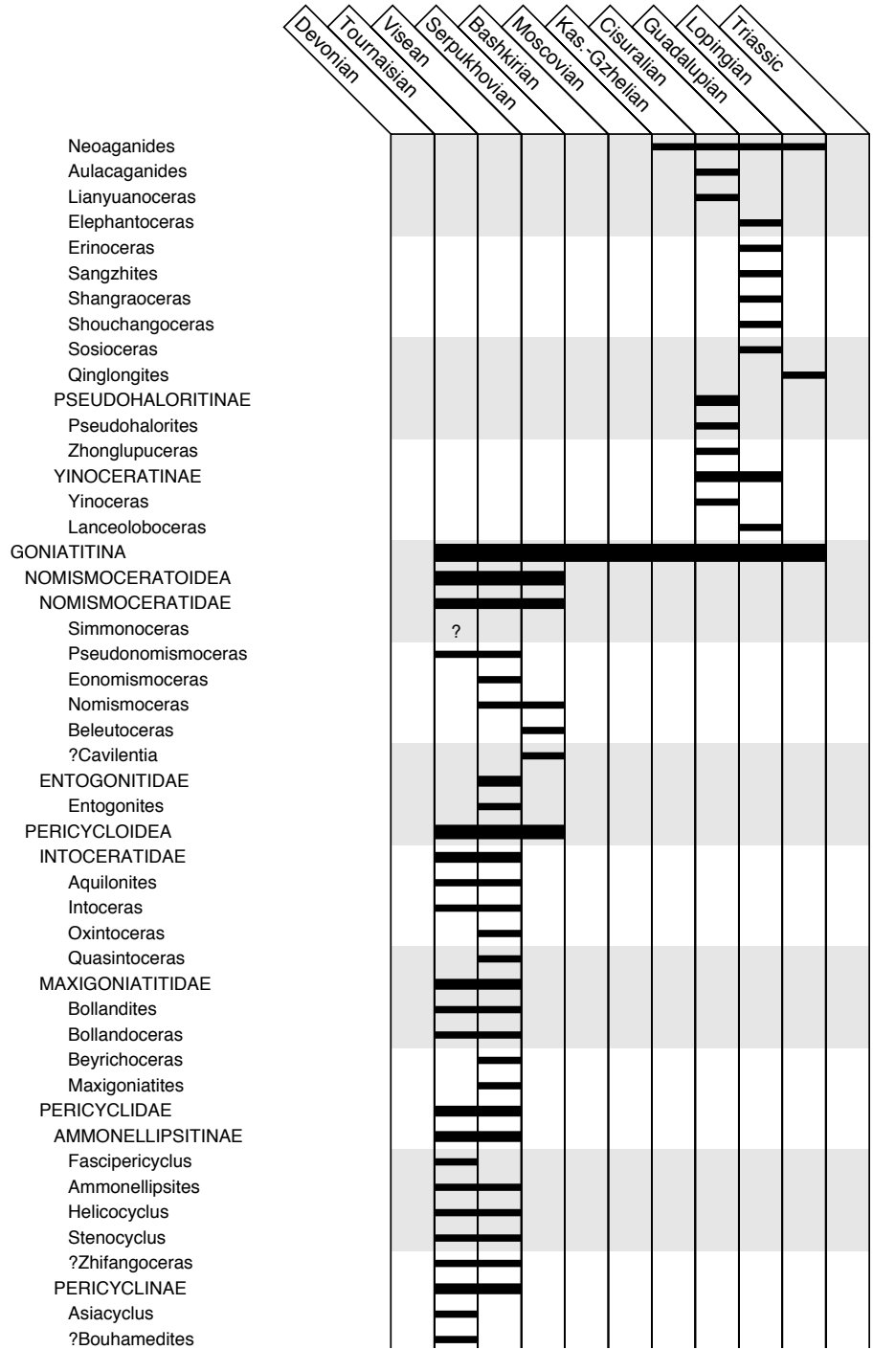


TABLE 1. *(Continued).*



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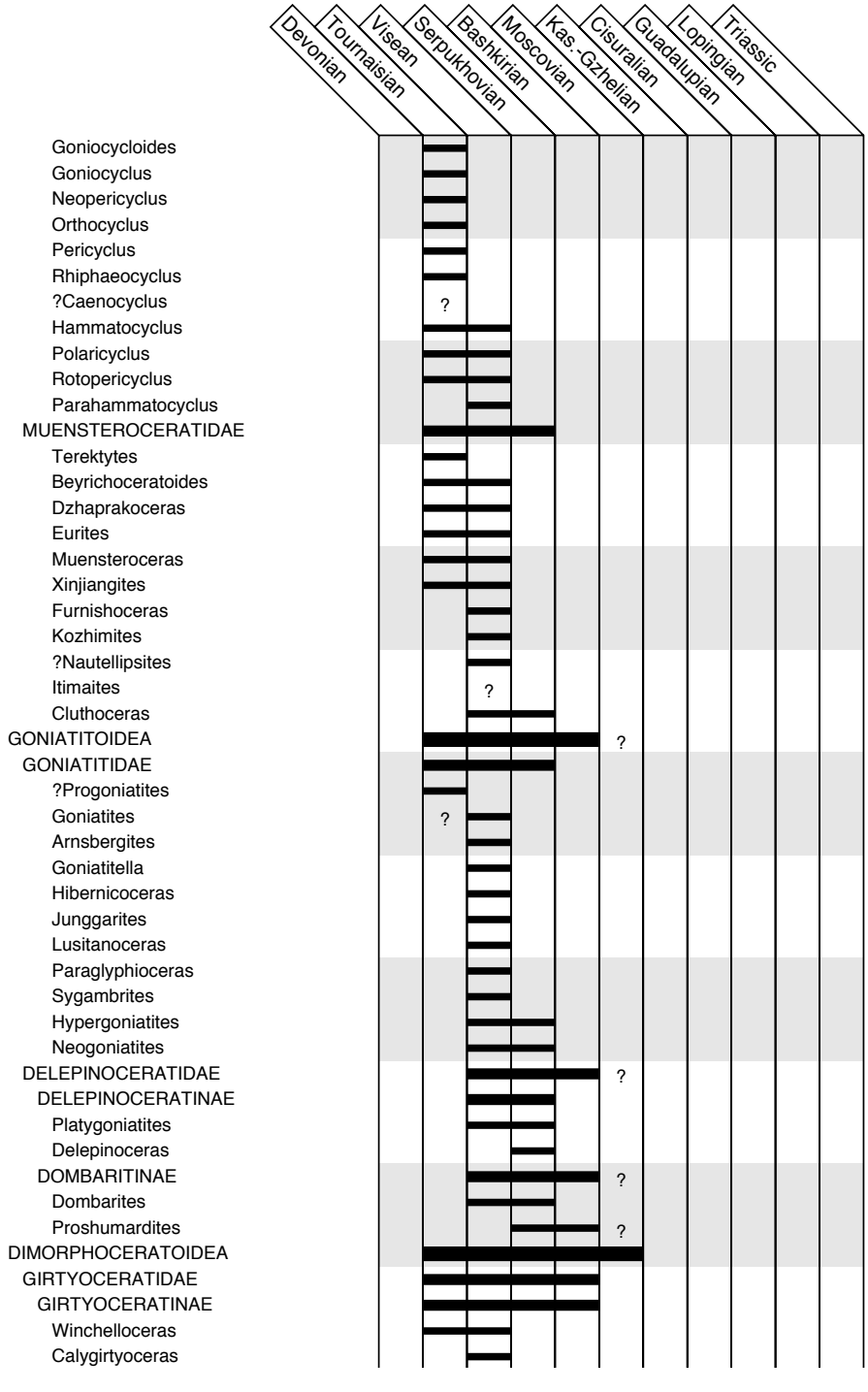

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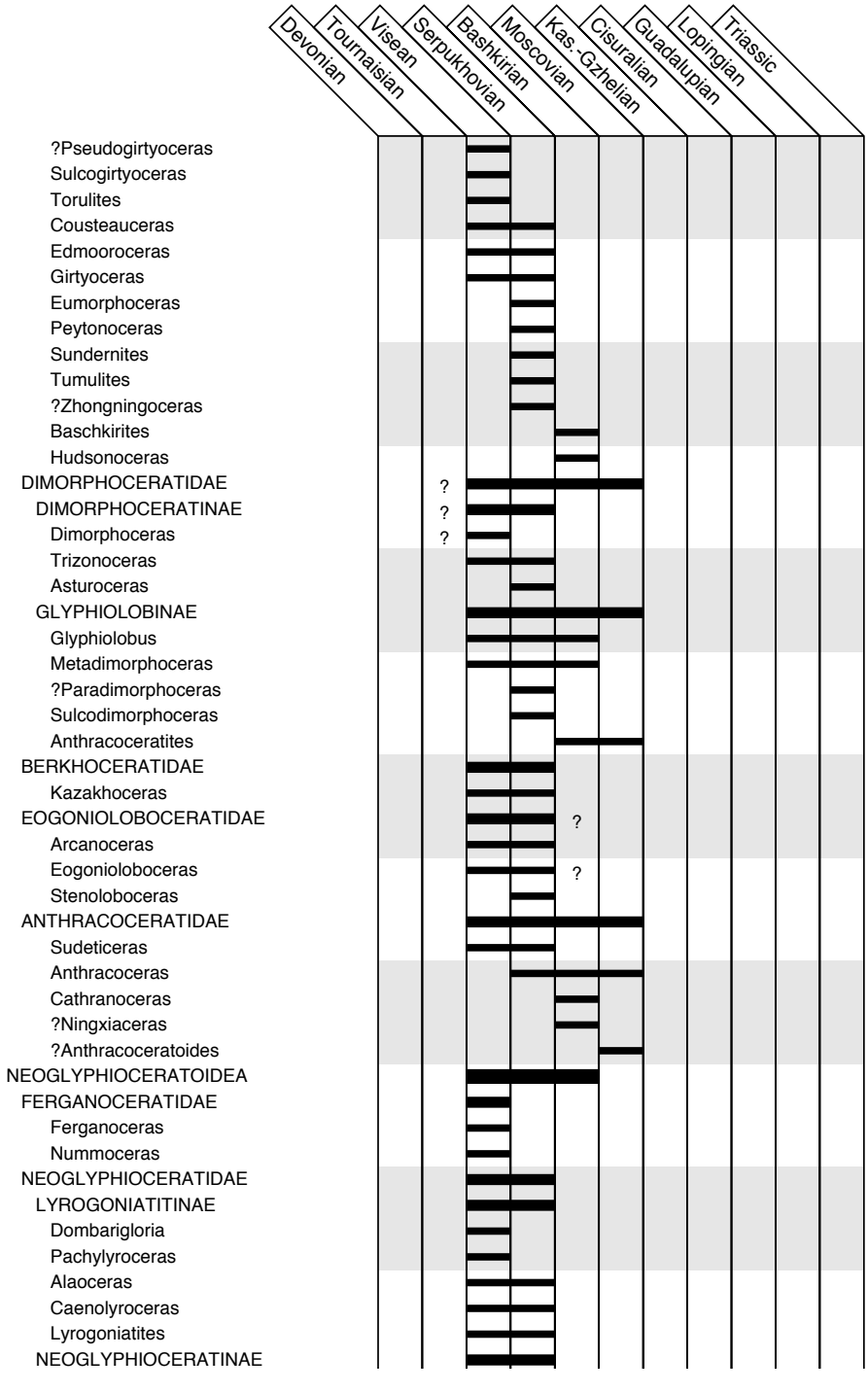


TABLE 1. *(Continued).*

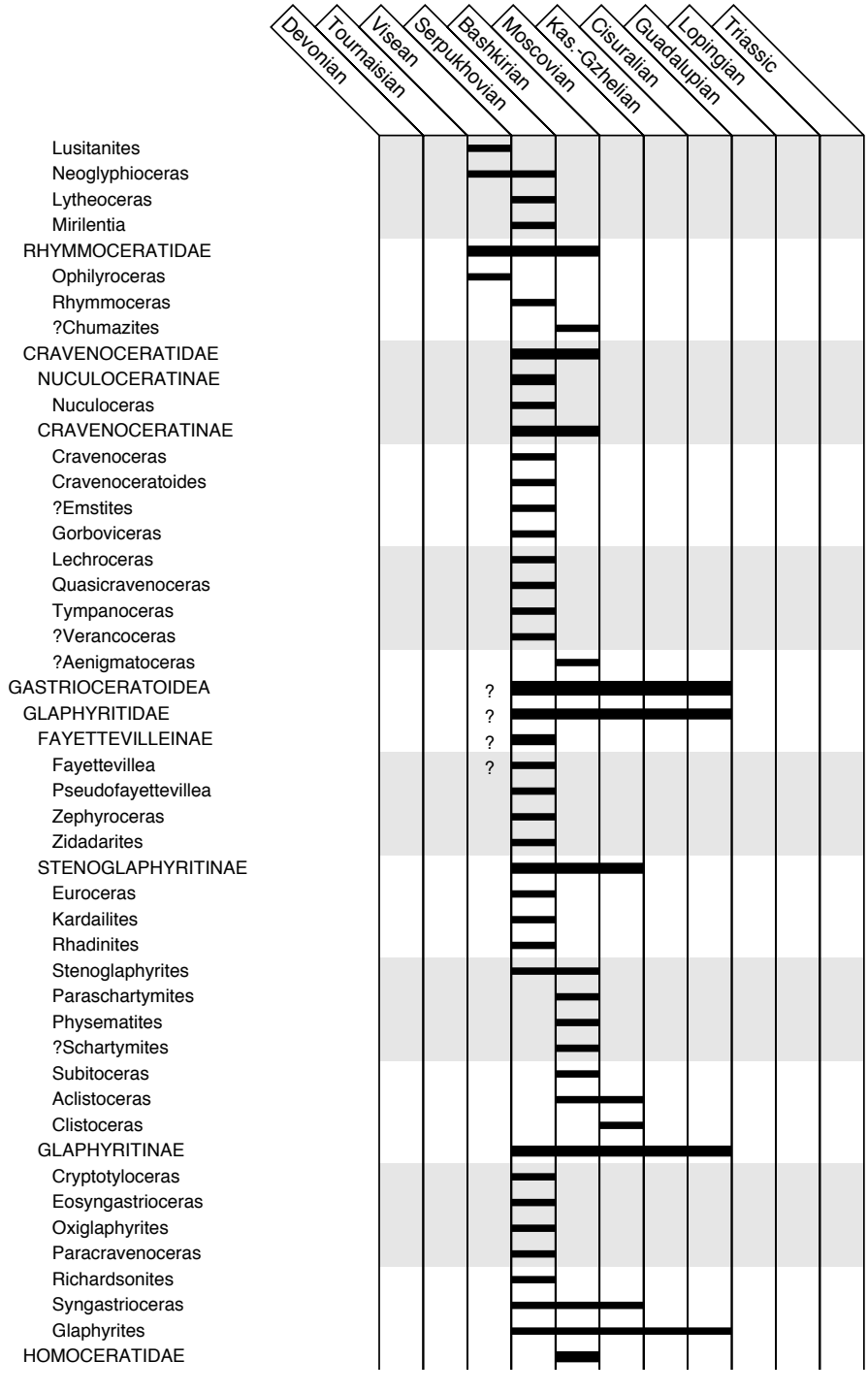
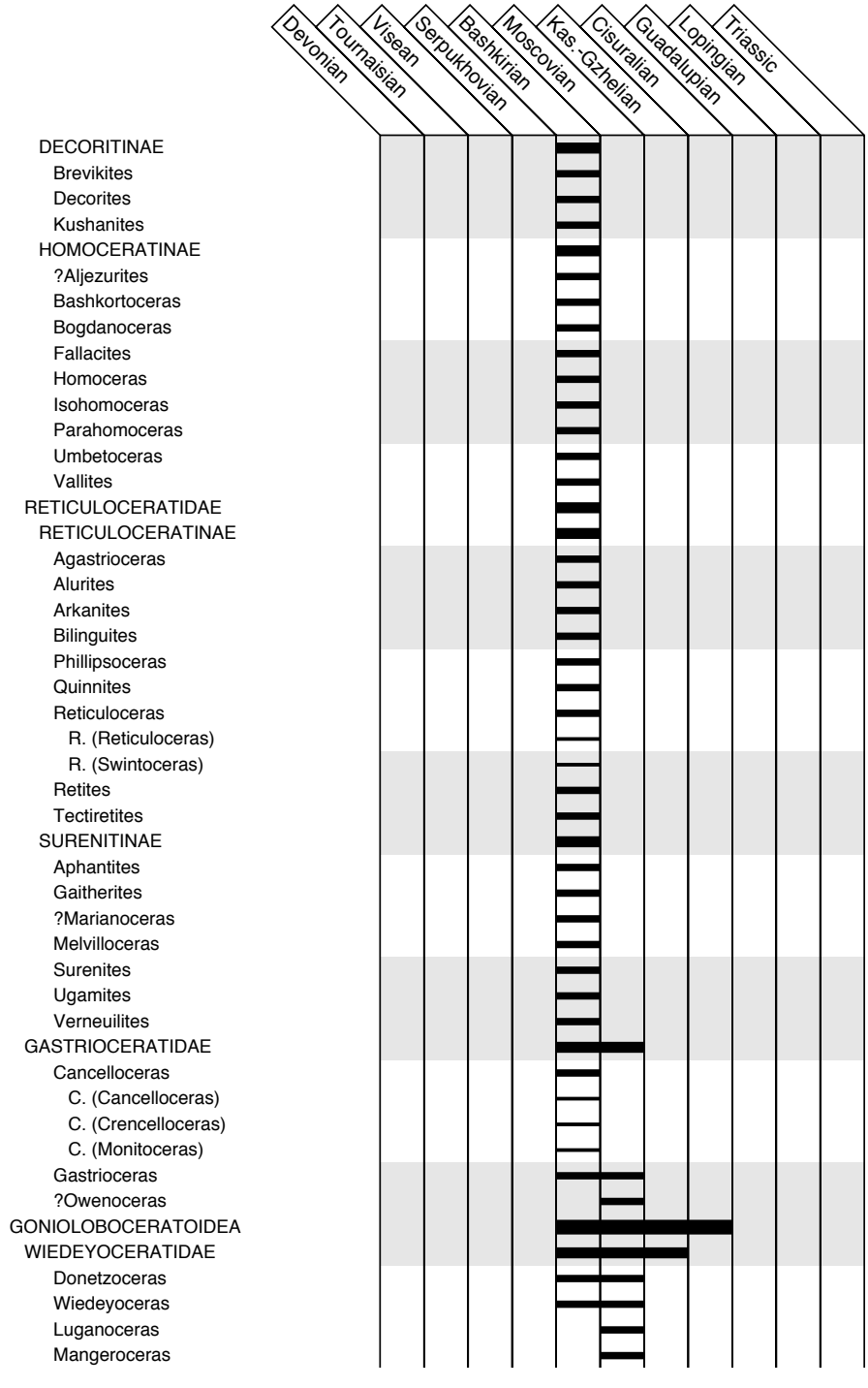


TABLE 1. *(Continued).*



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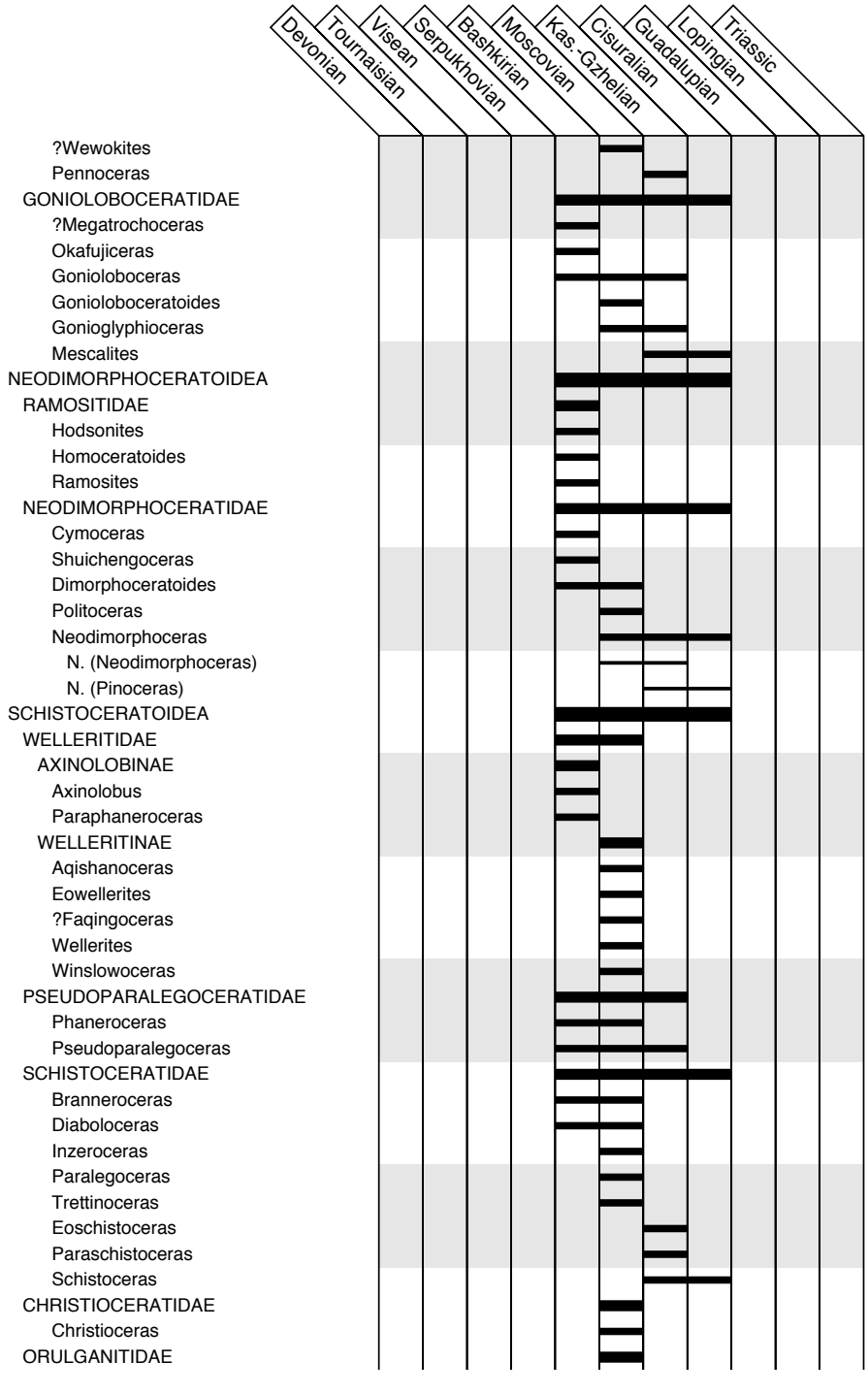

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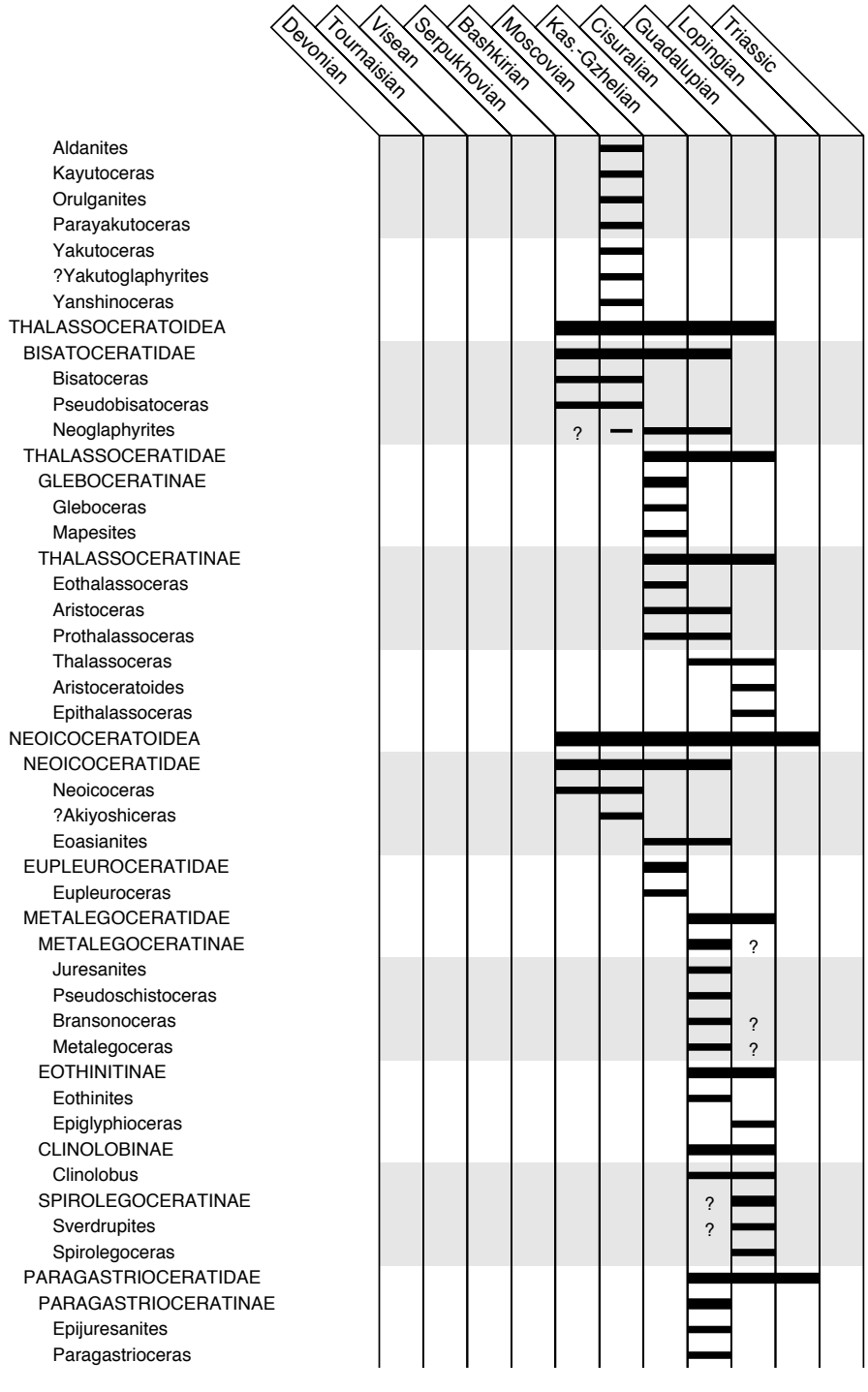

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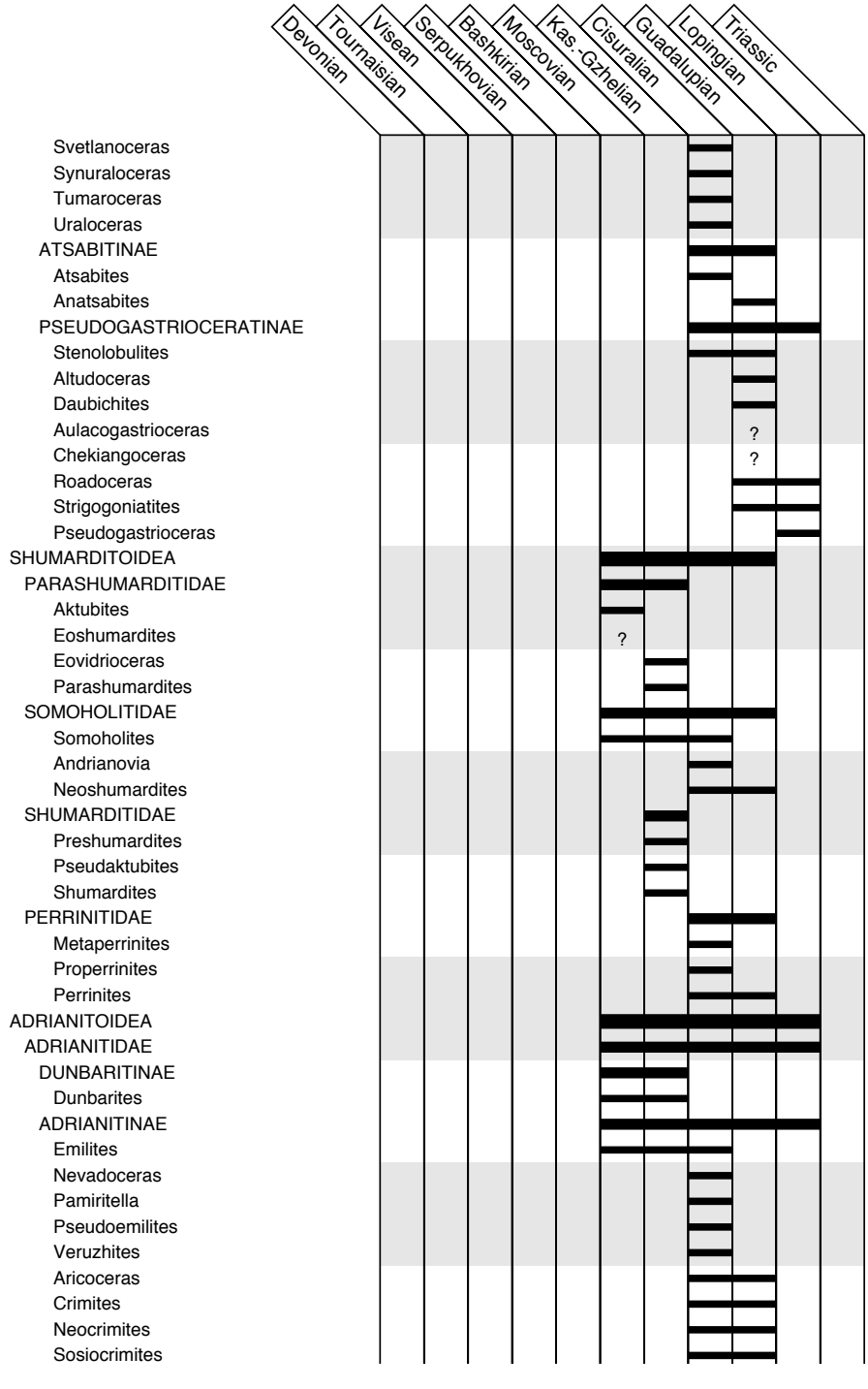

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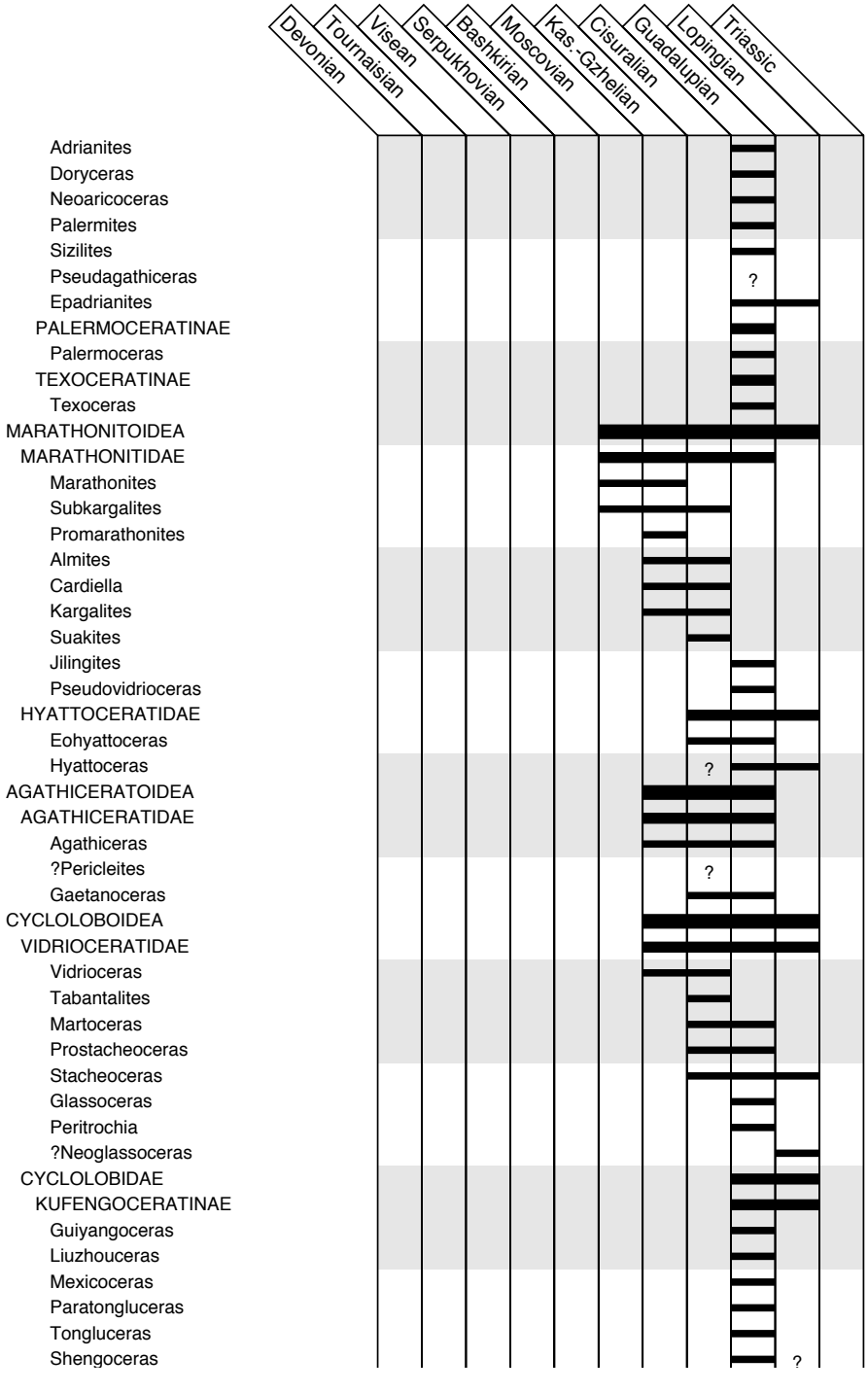

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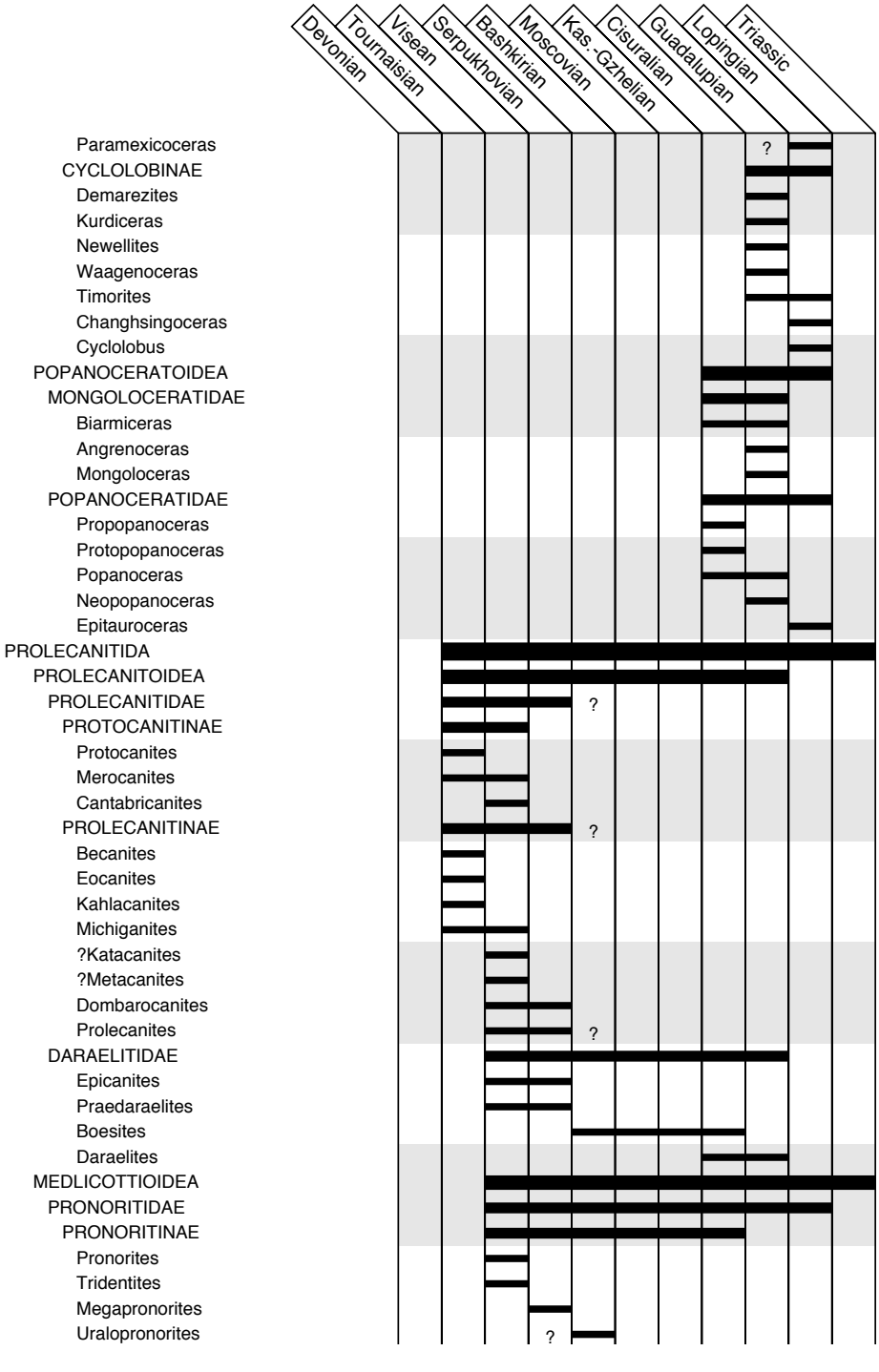

TABLE 1. *(Continued).*