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PART E, REVISED, VOLUME 4, CHAPTER 6: SYSTEMATIC DECRIPTIONS OF THE CLASS AND ORDER UNCERTAIN: FAMILY DISJECTOPORIDAE

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The reef facies of the Permian and Late Triassic in the Tethyan faunal realm contains encrusting and domical carbonate fossils of organisms composed of rods that form a framework. These fossils are now composed of calcite but may originally have been aragonite, as many show recrystallization microfabrics. Their systematic position has been controversial, and they have commonly been placed in the Hydrozoa (KÜHN, 1939; LECOMPTE, 1956; FLÜGEL & SY, 1959) and also referred to as late Paleozoic stromatoporoids. Like the stromatoporoids, their framework skeleton is commonly traversed by tabulated longitudinal and tangential canals or tubes. These have suggested an affinity to the Cnidaria and particularly to the Hydrozoa, but similar tubes are found in several groups of hypercalcified sponges. Now that the Paleozoic stromatoporoids are recognized as having structures closely resembling living hypercalcified sponges, the disjectoporids are here tentatively placed in the Porifera, but their affinity with the major groups of this phylum is obscured by their total lack of preserved spicules.

The spongiomorphs, Middle Triassic to Upper Cretaceous carbonate fossils, are composed of a framework of largely longitudinal rods that resembles that of the disjectoporids. They have been linked to the disjectoporids and also considered to have been hydrozoans (e.g., FLÜGEL & SY, 1959). However, recent work by GAUTRET and associates (GAUTRET, EZZOUBAIR, & CUIF, 1992; GAUTRET, DAUPHIN, & CUIF, 1994) has shown that the spongiomorphs are cnidarians related to the scleractinian superfamily Poriticae GRAY, 1842. They are therefore not considered further in this volume devoted to the hypercalcified sponges.

Class and Order UNCERTAIN (?Demospongiae or ?Calcispongiae)

Order ?INOZOA Rigby & Senowbari-Daryan, 1996

Family DISJECTOPORIDAE Tornquist, 1901

[Disjectoporidae TORNQUIST, 1901, p. 1121; LECOMPTE, 1956, p. 138; KÜHN, 1939, p. 48; FLÜGEL & SY, 1959, p. 14] [=Coenostromidae WAAGEN & WENTZEL, 1887, p. 925, *partim*; =Coenostromatidae WENTZEL, 1889, p. 18; *non* Coenostromatidae WAAGEN & WENTZEL; STEARN & others, 1999]

Laminar, incrusting, and irregular carbonate skeletons composed of a three-dimensional meshwork of longitudinal and tangential rods (trabeculae), thickened and fused where they intersect, enclosing rounded interspaces, forming an irregular grid in longitudinal sections. Skeletal framework traversed by long, tabulated tubes (canals) and irregular, poorly defined, tangential canal systems. *Permian–Triassic*.

Disjectopora WAAGEN & WENTZEL, 1887, p. 947 [**D. milleporaeformis* WAAGEN & WENTZEL, 1887, p. 948; OD]. Laminar, encrusting to domical skeleton composed of longitudinal (or radial) and tangential (or concentric) rods, intersecting and thickening at subspherical nodes to form irregular, three-dimensional grid. Interspace voids rounded, subspherical, irregularly superposed, aligned tangentially in longitudinal section, giving skeleton concentric banding. Tangential rods may appear to unite into tangential sheets, or laminae, perforated by rounded pores approximately the diameter of nodes where rods thicken at intersections. Vaguely defined, locally tabulated, longitudinal, cylindrical voids approximately twice the diameter of interspaces widely scattered in skeleton. In tangential section, rods cut as circles between

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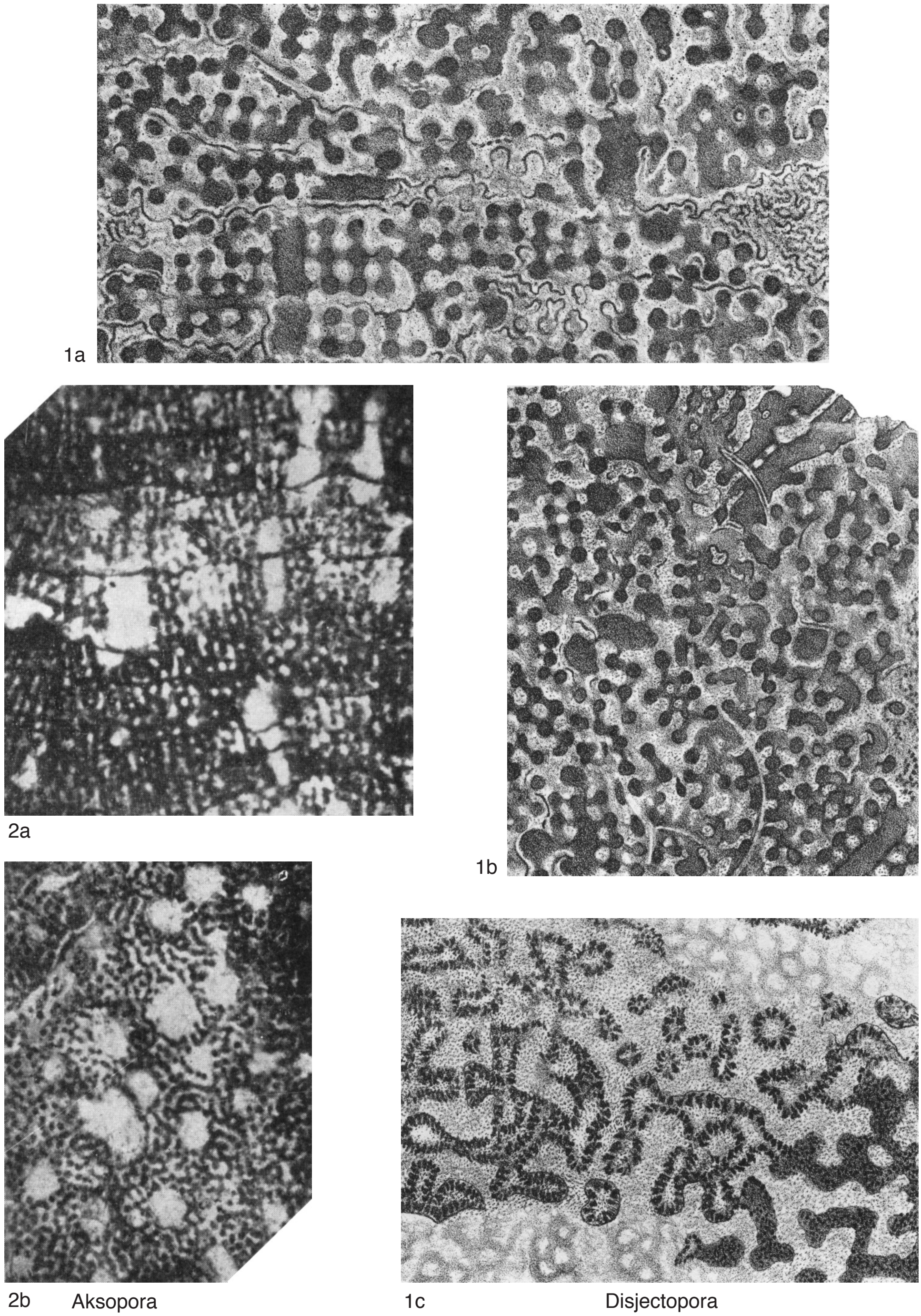

FIG. 1. Disjectoporidae (p. 1–3).

nets of tangential rods and joined into irregular masses perforated by round pores where section cuts nets. Poorly defined, tangential canal systems may be evident. *upper Permian–Upper Triassic, ?Upper Jurassic:* Pakistan, South China, Japan, Italy, Indonesia, ?Canada (eastern continental shelf).——FIG. 1,*1a–c*. **D. milleporaeformis*, Salt Range, Pakistan; *a,* longitudinal section, ×50; *b,* tangential section, ×50; *c,* part of longitudinal section (*a*) in altered state, ×100 (Waagen & Wentzel, 1887).

Aksopora BOIKO, 1970, p. 50 [497] [**A. tenuitrabeculata*; OD] [=*Aksupora* BOIKO, 1979, p. 55 (type, *A. tenuitrabeculata* BOIKO, 1979, p. 56, *lapsus calami*)]. Skeleton domical, composed of longitudinal rods, regularly joined by tangential rods to form porous, tangential laminae that produce latilamination. Network of rods traversed by long, wide, tabulated, longitudinal canals without walls, passing through several latilaminae. In tangential section, rods joined into network with round interspaces. Astrorhizae inconspicuous. Similar to *Pamiropora* but with longer longitudinal canals. *Upper Triassic:* Pamir Mountains, Tadjikistan.——FIG. 1,*2a–b*. **A. tenuitrabeculata,* holotype, IGD1492, Norian–Rhaetian; *a,* longitudinal section through axis of skeleton showing longitudinal canal system, ×6; *b,* tangential section, ×6 (Boiko, 1970).

Arduorhiza WENTZEL, 1889, p. 1–24 [**Carterina pyramidata* WAAGEN & WENTZEL, 1887, p. 945–947; OD] [=*Carterina* WAAGEN & WENTZEL, 1887, p. 944, obj., *non* BRADY, 1884, a foraminiferan; =*Carta* STECHOW, 1921, p. 253, obj; =*Carterinula* STRAND, 1926, p. ?1–8 (see LECOMPTE, 1956, p. 138; STOCK & others, 1992, p. 10; no type species designated, according to STOCK & others, 1992)]. Skeleton conical with apex down, formed of highly irregular meshwork of rods without prominent or extensive longitudinal or tangential elements, enclosing subspherical interspaces, traversed by wide, prominent, longitudinal canals without walls, and similar tangential, serpentine, and radial canals prominent in tangential section. Tabulae rare. Type shows some canals divided radially by thin, so-called pseudosepta with swollen tips; canals may be an overgrown, parasitic, or commensural organism (Fig. 2*c*). *upper Permian:* Pakistan (Salt Range), Slovenia.——FIG. 2*a–c*. **A. pyramidata*, Salt Range; *a,* tangential section showing canal systems and subspherical interspaces (matrix is dark), ×50; *b,* longitudinal section (matrix is dark), ×50; *c,* fractured surface showing minute canals with so-called pseudosepta (matrix is white), ×30 (Waagen & Wentzel, 1887).

Balatonia VINASSA DE REGNY, 1908, p. 13–14 [**B. koechi* VINASSA DE REGNY, 1908, p. 14–17; OD). Domical to upwardly expanding carbonate skeletons, a few centimeters across, with interior zones of open, irregular structure and peripheral zones dominated by closely set, longitudinal rods. In interior zone, rods, about 50 micrometers wide, irregular in cross section, join to form open network with vermiform interspaces generally radiating outward from axial growth center. In peripheral zones, rods, mostly longitudinal, anastomosing, joined at intervals by swelling that may be aligned locally tangentially but not sufficiently to produce concentric laminae or marked latilamination. In tangential section of peripheral zones, rods of irregular cross section enclose vermiform and labyrinthine interspaces. Large (up to 0.2 mm diameter), round, longitudinal, sparsely tabulated canals present in the peripheral zones of some specimens or species. *?middle Permian, Upper Triassic:* ?South China, Austria, Hungary.——FIG. 3,*1a–c*. **B. koechi*, Lake Balaton, Hungary; *a,* longitudinal section of peripheral zone, ×5; *b,* tangential section of interior zone, ×5; *c,* longitudinal section, ×7 (Vinassa de Regny, 1911).

Cancellistroma WU, 1991, p. 98 [**C. ramosa*; OD] [=*Concentristroma* WU, 1991, p. 99 (type, *C. eucalla*, OD); =*Tubulistroma* WU, 1991, p. 100 (type, *T. irregularis*, OD); =*Fungistroma* WU, 1991, p. 101 (type, *F. daemonia*, OD)]. Skeleton ramose, highly irregular or encrusting, composed of longitudinal and tangential rods, swollen at their intersections, forming a grid in which one or the other is more prominent. Skeleton traversed by longitudinal tubes or canals wider than interspaces between rods, in some species of several different sizes. Tangential canal systems present in some species. *middle Permian:* China (Guangxi).——FIG. 4,*1*. **C. ramosa*, holotype, longitudinal section, No. xb36-4-5, Maoku Formation, Xiangbo, ×2 (Wu, 1991).

Irregulatopora WAAGEN & WENTZEL, 1887, p. 951 [**I. undulata* WAAGEN & WENTZEL, 1887, p. 952; OD]. Laminar to encrusting skeleton of highly irregular longitudinal and tangential rods, thickened to nodes at their intersections, enclosing rounded voids in both longitudinal and vertical sections, forming an irregular meshwork penetrated by longitudinal and tangential canals. Longitudinal canals short, without walls, subcircular in cross section, with widely scattered tabulae. Tangential canals irregular, short, vermiform openings in meshwork, without evident pattern. Similar to *Disjectopora* but more irregular. *upper Permian*, *?Upper Triassic:* Pakistan, ?Indonesia.——FIG. 4,*2a–b*. **I. undulata*, Salt Range, Pakistan; *a,* tangential section, ×5; *b,* longitudinal section, dark areas are interspaces or canals, ×38 (Waagen & Wentzel, 1887).

Pamiropora BOIKO, 1970, p. 49 [492] [**P. concentrica*; OD]. Skeleton domical, irregular to columnar, composed of distinct axial and peripheral zones. In axial zone, rods merge into continuous network to enclose longitudinal cylindrical canals. In peripheral zone, rods (about 50 micrometers across) largely separate but joined at intervals to form dense laminae. Tabulated, longitudinal canals (about 0.3 mm in diameter) common in peripheral zone,

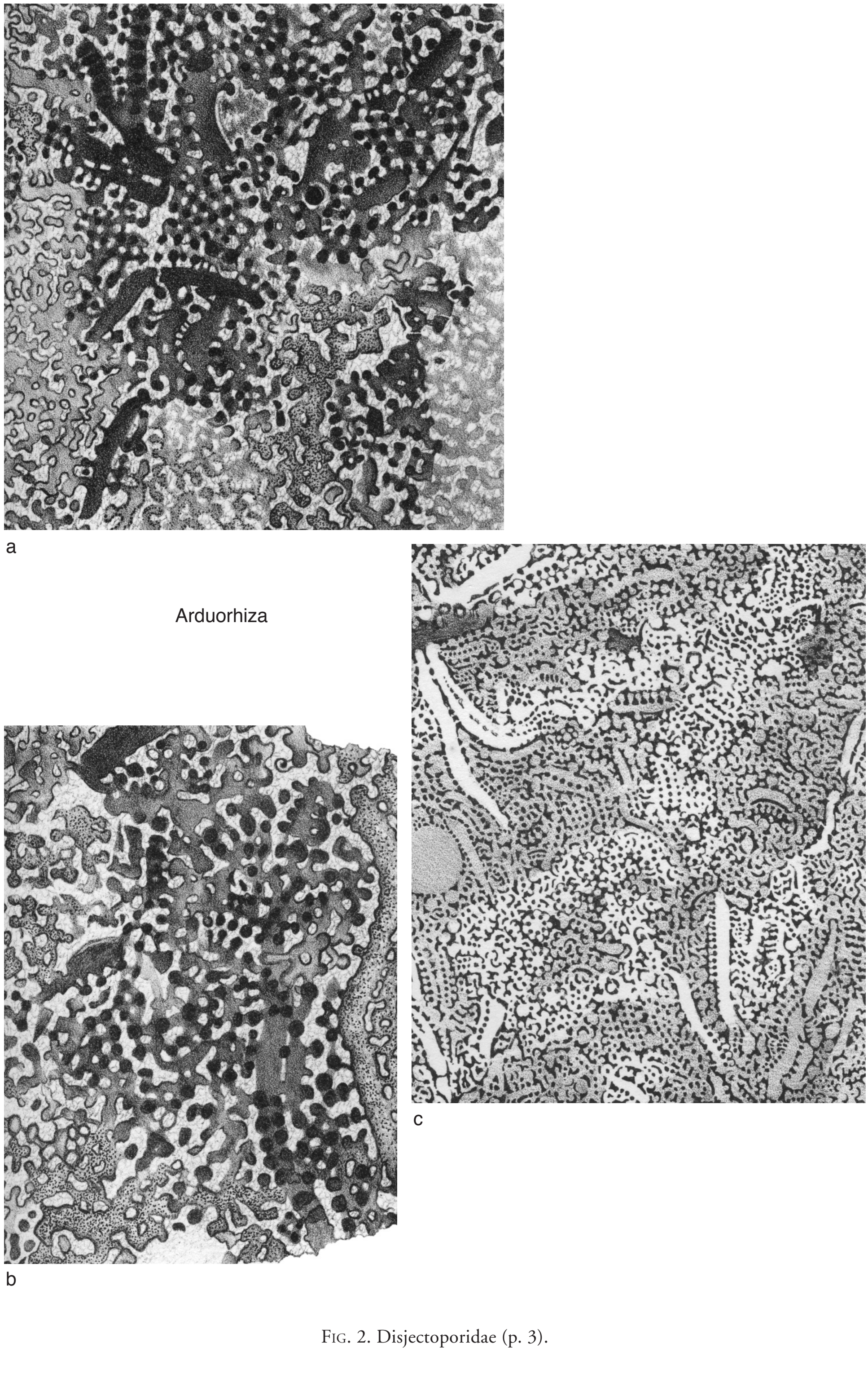

FIG. 2. Disjectoporidae (p. 3).

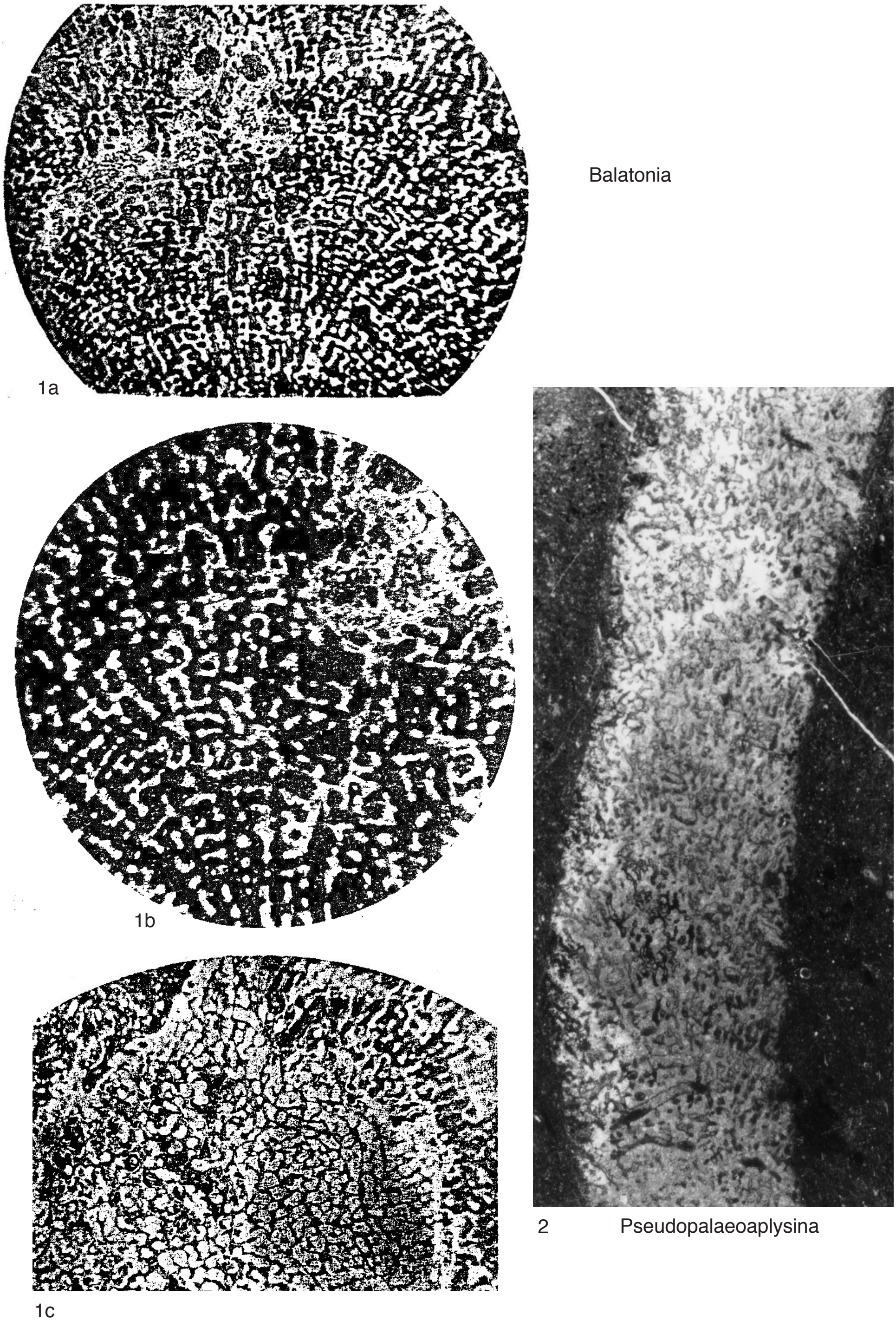

FIG. 3. Disjectoporidae (p. 3–9).

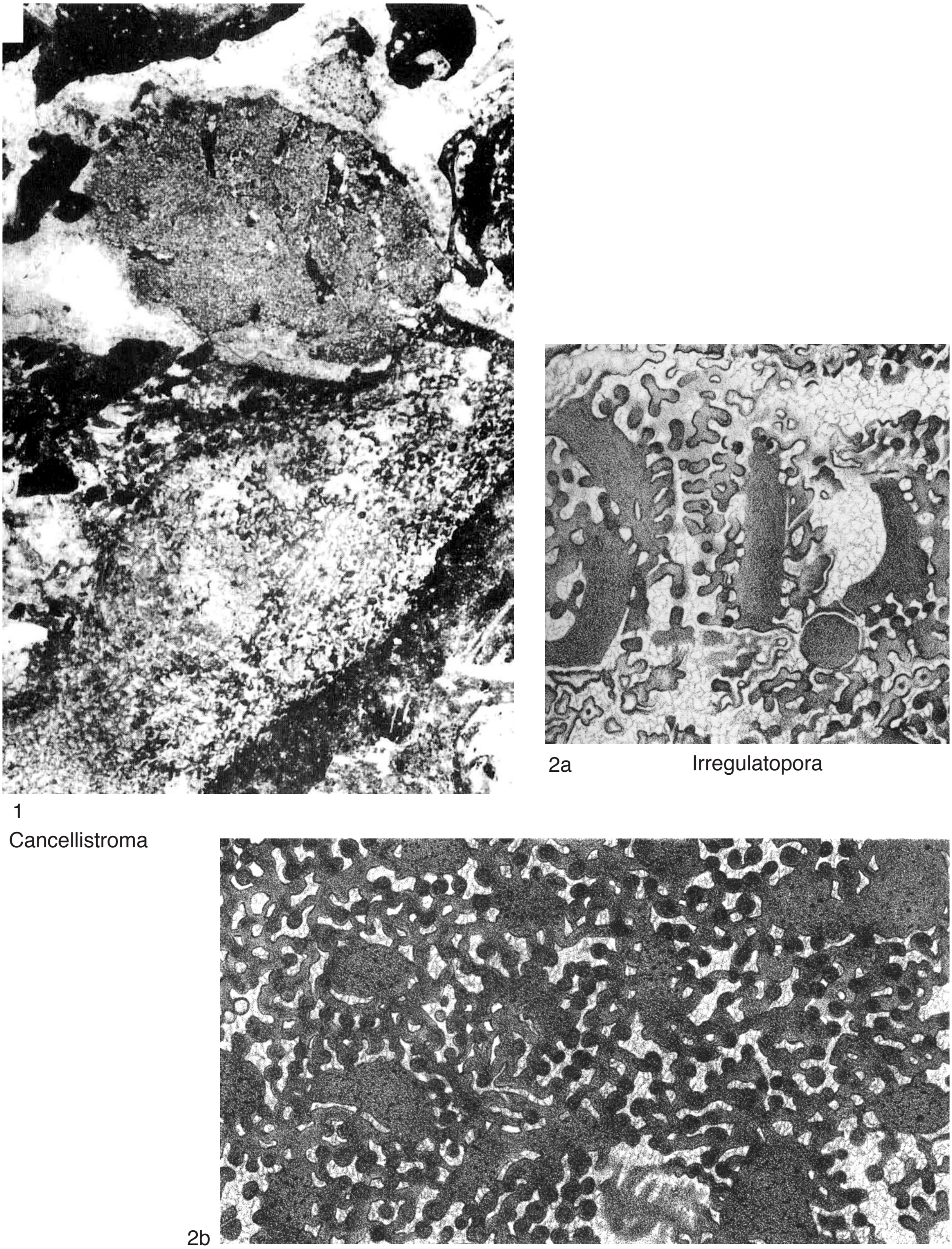

FIG. 4. Disjectoporidae (p. 3).

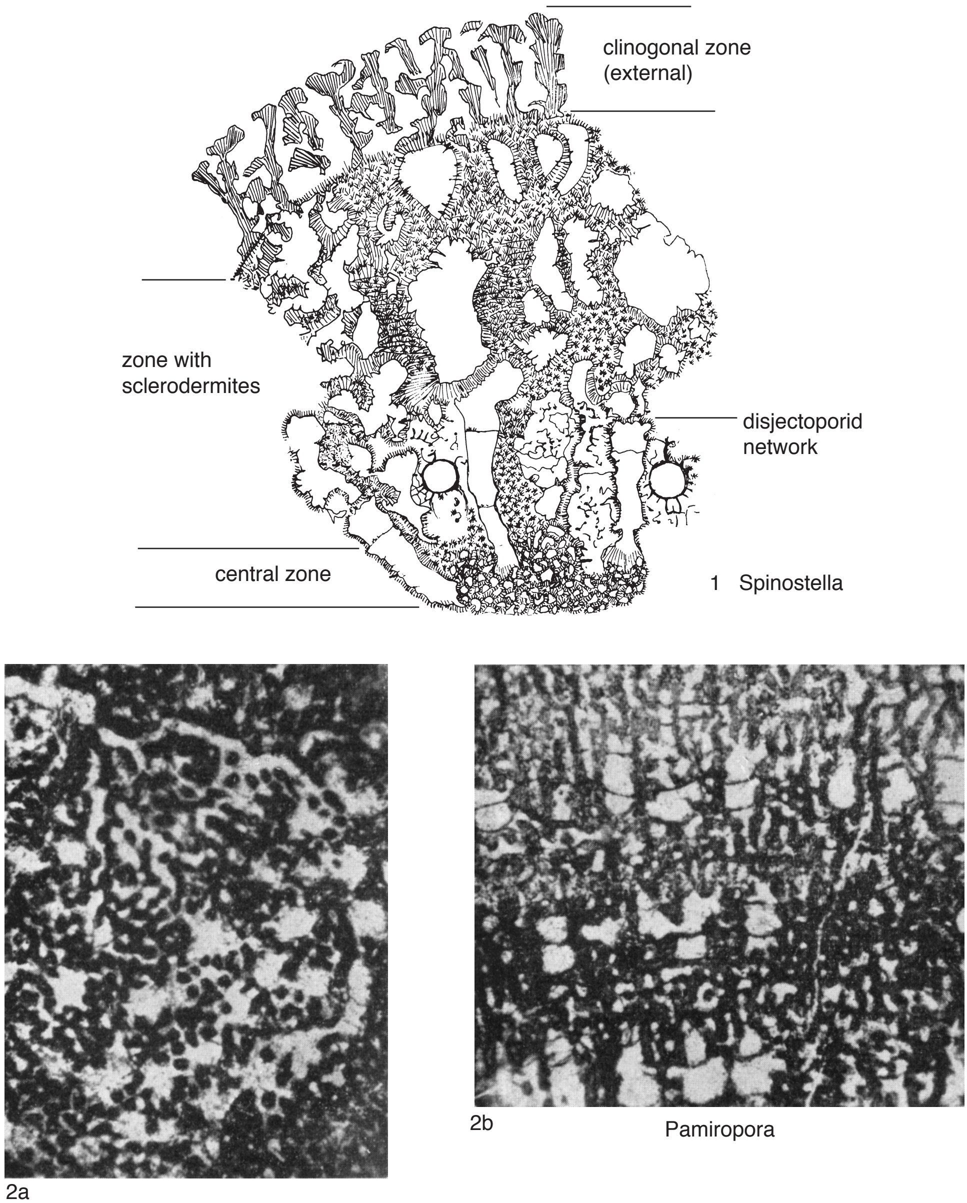

FIG. 5. Disjectoporidae (p. 3–10).

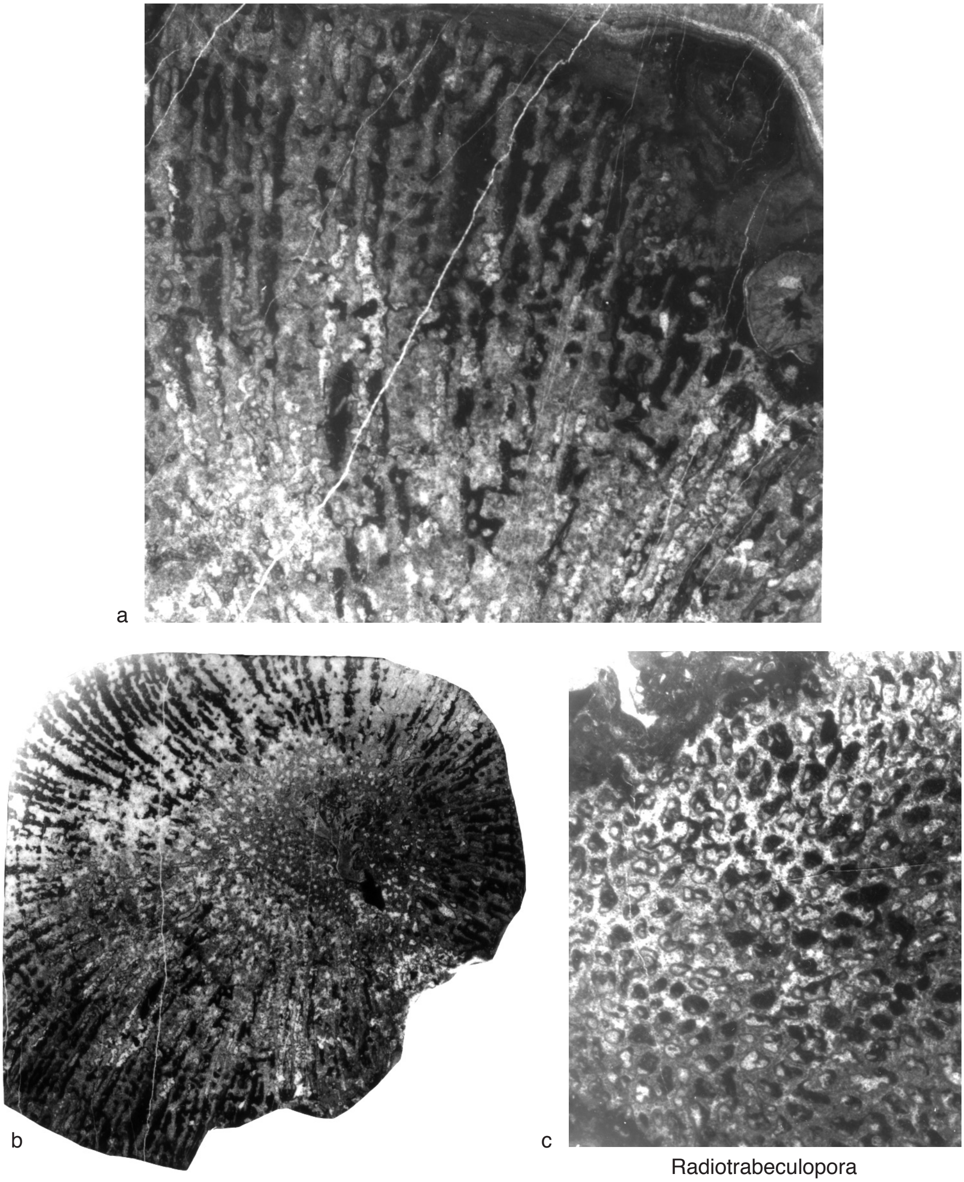

FIG. 6. Disjectoporidae (p. 9–10).

in concentric zones separated by zones without canals, resulting in prominent latilamination. In tangential section, smaller canals in form of astrorhizae common. *Upper Triassic:* Tadjikistan (Pamir Mountains).——FIG. 5,*2a–b*. **P. concentrica; a*, longitudinal section, peripheral zone, ×16; *b,* tangential section showing astrorhiza and cut rods, IGD 1500, Norian–Rhaetian, southeastern Pamirs, ×16 (Boiko, 1970).

Pseudopalaeoaplysina FAN, RIGBY, & ZHANG, 1991, p. 66 [**P. sinensis;* OD]. Skeleton thin plate (about 0.5 mm), apparently attached at one edge, with smooth lateral sides, composed of rods fanning outward and upward from axial plane. Rods dividing outward, discontinuous in longitudinal section, circular in cross section, or more commonly united irregularly laterally to enclose longitudinal interspaces of circular, labyrinthine, and serpentine cross sections.

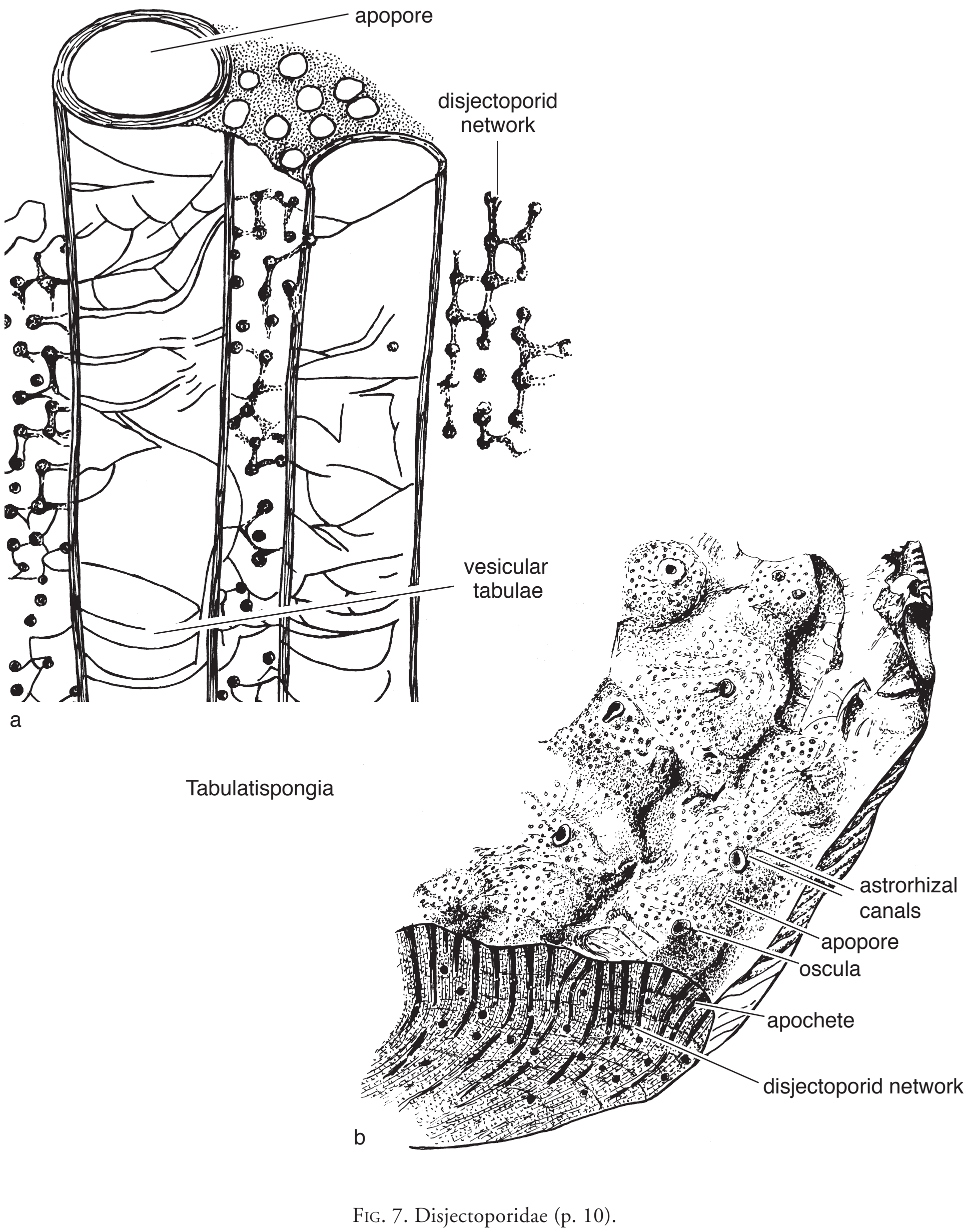

FIG. 7. Disjectoporidae (p. 10).

Interspaces, where circular in section, may resemble longitudinal canals but not crossed by dissepiments or tabulae and completely infiltrated by sedimentary matrix. Tangential structures inconspicuous. *middle Permian:* China (Guangxi).——FIG. 3,*2*. **P. sinensis*, holotype, IG0094, Maoku Formation, Xiangbo, longitudinal section, ×2 (new).

Radiotrabeculopora FAN, RIGBY, & ZHANG, 1991, p. 56 [**R. xiangboensis;* OD] [=*Tubulispongia* WU, 1991, p. 35 (type, *T. concentrica,* OD); =*Flabellisclera* WU, 1991, p. 36 (type, *F. discreta,* OD); =*Gigantosclera* WU, 1991, p. 38 (type, *G. deformis*, OD); =*Gracilitubulus* WU, 1991, p. 39 (type, *G. perforatus*, OD); =*Fungispongia* WU, 1991, p. 39 (type, *F. circularis*, OD) (see FINKS & RIGBY, 2004, p. 624)]. Skeleton irregular, encrusting to columnar, composed of central and peripheral zones. Peripheral zones composed of longitudinal rods, merging and dividing but generally parallel, interrupted by numerous small pores, united by short bridges (nodelike swellings) that are not aligned to form persistent tangential structures, in type species breaking up into nodes (i.e., beaded). Interspaces longitudinally elongated, approximately width of rods (about 0.5 mm). In axial zones, rods merge to enclose subcylindrical interspaces, producing a continuous network structure traversed by astrorhizal canals in some species. *lower Permian–upper Permian:* USA (California), South China (Guangxi, Yunnan), Tunisia.——FIG. 6*a–c.* **R. xiangboensis*, Maoku Formation, Xiangbo, China; *a,* holotype, longitudinal section in peripheral zone showing rods joined by short bridges, IG 5154, ×5; *b,* section of whole holotype showing peripheral and axial zones, IG 5154, ×2; *c,* tangential section of axial zone, paratype, IG 5155, ×4 (new).

Spinostella TERMIER & TERMIER, 1980, p. 4 [**S. praecursor;* OD; no number or repository given]. Skeleton cylindrical; composed of three zones: an axial zone of chaetetid-like, honeycomb structure; an intermediate zone of irregular, spherulitic, structural elements traversed by wide, open canals lined with small spines, and rarer tabulated canals; an outer zone of irregular but dominantly radial structural elements of fasciculate microstructure, and a surface showing canals of astrorhizal form. [This is not a typical disjectoporid and does not have the framework of rods of this group; however, it was placed by TERMIER & TERMIER (1980) in the family Disjectoporidae. The holotype, as they noted, shows many features of the Ceratoporellidae.] *upper Permian:* Tunisia (Djebel Tebaga).——FIG. 5,*1.* **S. praecursor*, drawn from holotype; section of segment of cylindrical skeleton from axial to peripheral zones, ×57.5 (Termier & Termier, 1980).

Tabulatispongia TERMIER & TERMIER, 1977a, p. 30 [**T. stromatoporoides;* OD]. Skeleton tabular, encrusting, composed or an open, rectilinear, three-dimensional grid of finely fibrous, longitudinal and tangential rods that expand into nodes where they fuse. Longitudinal canals with distinct walls and irregular, numerous tabulae, traverse skeleton, leading to pores on surface at crests of mamelons and centers of tangential astrorhizal canal systems. *upper Permian:* Tunisia (Djebel Tebaga).——FIG. 7*a–b.* **T. stromatoporoides*, ?drawn from holotype; *a,* longitudinal section, diagrammatic, approximately ×25; *b,* longitudinal section and surface diagram, approximately ×1 (Termier & Termier, 1977b).

REFERENCES

Boiko, E. V. 1970. Tri novykh roda pozdnetriasovykh stromatoporoidei Yugo-Vostochnogo Pamira [Three genera of Late Triassic stromatoporoids of southeastern Pamirs]. Paleontologischeskiy Zhurnal [Paleontological Journal] 1970(4):46–51. Translation in the Paleontological Journal 4(4):492–498.

Boiko, E. V. 1979. Pozdnetriasovye Hydrozoa Yugo-Vostochnogo [Late Triassic Hydrozoa of the Southeastern Pamirs]. Akademiya Nauk Tadzhikskoi SSR, Institut Geologii [Tadzhik SSR Academy of Science, Geological Institute]. Donish, Dushanbe. 113 p., 28 pl.

Fan, J. K., J. K. Rigby, & Wei Zhang. 1991. "Hydrozoa" from the Middle and Upper Permian reefs of south China. Journal of Paleontology 65(1):45–68.

Finks, R. M., & J. K. Rigby. 2004. Hypercalcified Sponges. *In* R. L. Kaesler, ed., Treatise on Invertebrate Paleontology, Part E (revised), Porifera, vol. 3. The Geological Society of America, Inc. & The University of Kansas. Boulder & Lawrence, Kansas. p. 585–772.

Flügel E., & E. Sy. 1959. Die Hydrozoen der Trias. Neues Jahrbuch für Geologie und Paläontologie, Abhandlungen 109(1):108 p., 3 pl.

Gautret, P., Y. Dauphin, & J.-P. Cuif. 1994. Une application taxonomique de la microanalyse des éléments mineur dans les tissus aragonitiques fibreux de constructeurs triassique (Démosponges et Scléractiniares). Annales de Paléontologie 80(2):89–106.

Gautret, P., F. Ezzoubair, & J.-P. Cuif. 1992. Recherche sur les affinités des Spongiomorphidae Frech, 1890. 1—Caractéristiques microstructurales et minérologiques de *Spongiomorpha acyclica* Frech, 1890. Geobios 25(3):345–355.

Gray, J. E. 1842. Northern Zoological Gallery, Room II, III, Radiated animals. *In* Synopsis of the Contents of the British Museum, 44th ed. British Museum. London. p. 128–135.

Kühn, O. 1939. Hydrozoa. *In* O. H. Schindewolf, ed., Handbuch der Paläozoologie, 2A. Gebrüder Borntraeger. Berlin. p. 1–68.

Lecompte, M. 1956. Stromatoporoidea. *In* R. C. Moore, ed., Treatise on Invertebrate Paleontology, Part F, Coelenterata. Geological Society of America & University of Kansas Press. New York & Lawrence, Kansas. p. 107–144.

Rigby J. K., & B. Senowbari-Daryan. 1996. Upper Permian inozoid, demospongid and hexactinellid sponges from Djebel Tebaga, Tunisia. The University of Kansas Paleontological Contributions (new series) 7:130 p., 81 pl.

Stearn, C. W., B. D. Webby, H. Nestor, & C. W. Stock. 1999. Revised classification and terminology of Palaeozoic stromatoporoids. Acta Palaeontographica Polonica 44:1–70.

Stechow, E. 1921. Neue Genera und Species von Hydrozoen und anderen Envertebraten. Archiv für Naturgeschichte (Abt. A) 87:248–265.

Stock, C. W., J. St. Jean, R. A. Wood, & L. J. Otte. 1992. Annotated checklist of post-Devonian "stromatoporoid" genera and their type species. Fossil Cnidaria and Porifera Newsletter 21(1.2):22 p.

Strand, E. 1926 [or 1928]. Miscellanea nomenclatoria zoologica et palaeontologica. Achiv für Naturgeschichte (Abt. A) 92:1–8.

Termier G., & H. Termier. 1980. Stromatopores, Trépostomes et Tabulatomorphes du Paléozoique d'Afrique du Nord, rapports avec les Ischyrosponges. Annales de Paléontologie (Invertebrés) 66:1–20.

Termier, H., & G. Termier. 1977a. Spongia. *In* H. Termier, G. Termier, & D. Vachard, eds., Monographie Paléontologique des affleurments Permien du Djebel Tebaga (Sud Tunisien). Palaeontographica (Abt. A) 156:25–46.

Termier, H., & G. Termier. 1977b. Structure et evolution des spongiares hypercalcifies du Paleozoique Superieur. Mémoires de l'Institut Géologique de l'Université de Louvain 29:57–109.

Tornquist, A. 1901. Über mesozoische Stromatoporiden. Sitzungberichte der königlich Preussischen Akademie der Wissenschaften zu Berlin, Jahrgang 1901:1115–1123.

Vinassa de Regny, P. E. 1901. Trias-Spongien aus dem Bakony. Resultate der Wissenschaftlichen Erforschung des Balatonsees. II. Bd. 1. Th. Kommission von Ed. Hölzel. Wien. 22 p., 3 pl.

Vinassa de Regny, P. E. 1908. Neue Schwamme, Tabulaten und Hydrozoen aus dem Bakony. Resultate der Wissenschaftlichen Erforschung des Balatonsees. III. Bd. 1. Th. Pal. Anh. Kommission von Ed. Hölzel. Wien. 17 p., 4 pl.

Vinassa de Regny, P. E. 1911. Trias-Tabulaten, Bryozoen und Hydrozoen aus dem Bakony. Resultate der Wissenschaftlichen Erforschung des Balatonsees. IV. vol. 1. Bd. 1. Th. Kommission von Ed. Hölzel. Wien. 22 p., 2 pl.

Waagen, W., & J. Wentzel. 1887. Class Hydrozoa. *In* W. Waagen, ed., Series 13: Salt Range Fossils, Productus Limestone Fossils: 7. Coelenterata—Amorphozoa—Protozoa. Palaeontologia Indica, Memoirs of the Geological Survey of India. Calcutta. p. 925–962.

Wentzel, J. 1889. Über fossile Hydrokorallinen (*Stromatopora* und ihre Verwandten) nebst eine Anhange. Lotos (new series) 9:1–24.

Wu Ya-Sheng. 1991. Organisms and communities of Permian reef of Xiangbo, China. International Academic Publishers. Beijing. 192 p.