PERMIAN CORALS FROM NORTHERN IRAQ

by R. G. S. HUDSON

ABSTRACT. Rugose corals from the Zinnar Limestone Formation (Artinskian) of northern Iraq are allocated to the Waagenophyllidae fam. nov. and grouped as Waagenophyllinae Wang 1950 (redefined) or Wentzelellinae subfam. nov. The lower part of the formation, with abundant *Polydiexodina*, is of *Parafusulina* age and the upper of possible *Neoschwagerina* age. New morphological terms for the rugose corals are explained and *Ipciphyllum ipci* gen et sp. nov. and *Wentzellophyllum* gen. nov. are described. *Michelinia favositoides* Girty is re-established as a valid species.

INTRODUCTION

THE Permian strata of Kurdistan, northern Iraq, are of Tethyan facies and faunal phase, closely comparable to the Permian strata of the neighbouring areas of Anatolia and Iran, and with faunal links with the more distant successions of the Productus Limestones of northern Pakistan and the Maokou and Chihsia Limestones of southern China. They are completely exposed, and reasonably accessible, from their unconformable junction with Lower Tournasian limestones and shales to a possible passage junction with the Trias. They are almost entirely limestones, variously fossiliferous. Their upper part contains a sporadic *Bellerophon* fauna and their lower part a Productid-bryozoan fauna with corals. Fusulines occur in the lower part and calcareous algae occur sporadically throughout.

In the latter parts of 1948 and 1951, R. Wetzel and D. M. Morton, geologists of the Iraq Petroleum Company, during reconnaissance surveys of northernmost Iraq, measured two sections of these Permian limestones and made a small collection of fossils. The author made two visits to the area and took part in these surveys. This account of the corals is one of a series describing the fauna then collected. The loan to the author by J. M. Edmonds, Curator of the Geological Collections of the University Museum, Oxford, of the thin sections of the Permian corals of Iran described by Douglas in 1936 and 1950 has greatly assisted the naming of the Iraq corals. The work has been carried out in the Geological Laboratories of the Iraq Petroleum Company and its publication has been generously authorized by its Directors and Chief Geologist. To all the above the author here records his thanks. All the specimens described in this paper have been presented to the British Museum (Natural History): their individual registrations are here recorded by numbers preceded by the letter R.

LOCATION AND FAUNAL STRATIGRAPHY

About 100 km. north of Mosul and between the Tigris and the Greater Zab rivers, the Iraq–Turkish boundary forms a northern embayment (approx. north of 37° 15′) which brings into Iraq the continuation of a southern foreland range of the Taurus Mountains consisting of an upthrust east–west asymmetrical anticline of Permian limestones flanked north and south by Triassic limestones, dolomites, and shales. In the west the range is crossed by the Khabour River, a tributary of the Tigris, and in the east by the Geli Khana, a tributary of the Greater Zab. Between them the range rises to the peaks of Chia-i-Zinnar (7,390 ft.) in the west and the Zozan-i-Harrur (7,900 ft.) in the east. To

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the east of the Geli Khana there is the peak of Jebel Satina (8,465 ft.). The gorges cut by the Khabour and Geli Khana rivers expose two inliers of pre-Permian rocks, the western inlier with the villages of Chalki (Chalki Islam and Chalki Nasura) and the eastern with the village of Ora, the two villages being about 20 km. apart. The Permian limestones were measured mainly in two sections, the one north from Ora along the Geli Khana gorge and across the northern flank of the anticline, the other north of Harrur (16 km. west of Ora) over the saddle between Chia-i-Zinnar and Zozan-i-Harrur to Darari summer village. It was from these two sections that most of the fossils described in this paper were collected.

The Permian succession is 760 m. thick in the Harrur section where there is possibly a strike fault and 811 m. in the Geli Khana section. It is divided into three formations: an upper one, the Darari Formation, 296 m. thick at Harrur and 318 m. at Geli Khana; a middle one, the Satina Formation (name chosen by Wetzel and Morton), 77 m. at Harrur and 61 m. at Geli Khana; and a lower one, the Zinnar Formation, 387 m. at Harrur and 432 m. at Geli Khana. They are all limestone formations except that the lowest 12·4 m. of the Zinnar Formation is a limestone–mudstone series. The junction of the Zinnar Formation with the underlying Tournaisian (Z–C_1) limestone is a haematitic and pitted but fairly level surface. The Tournaisian limestone is dated by an abundant brachiopod-bryozoan-coral fauna including *Caninia cornucopiae* vars. Mich., *Zaphrentites parallelus* (Carr.), *Z. delanouei* (Ed. and H.), *Fasciculophyllum* cf. *omaliusi* (Ed. and H.), *Michelinia gracilis* Smyth, *M.* aff. *megastoma* Phillips, *Vaughania cleistoporoides* Garw., *Actinoconchus lamellosus* (Léveillé), *Camarotoechia* cf. *letiensis* (Gosselet), *Chonetes* (*Plicochonetes*) *crassistria* (M'Coy), *Dictyoclostus vaughani* (Muir-Wood), *? Plectospirifer strunianus* (Gosselet), *Rhipidomella michelini* (Léveillé), *Spirifer* aff. *tornacensis* de Kon., *Syringothyris cyrtorhyncha* North, *Tylothyris* cf. *laminosa* (M'Coy), *Phillipsia strabonsis* Frech.

The Darari Formation has an occasional *Bellerophon*-Productid-bryozoan fauna but like the Satina Formation is generally unfossiliferous. An exception is a bed of limestone 77 m. from the top of the Permian which contains abundant *Amblysiphonella* and *Steinmannia*. It also has towards its upper part various faunas of thin-shelled lamellibranchs which suggest that its faunal phase is approaching that of the overlying Trias into which it may possibly directly pass. The lower part of the Trias contains a fauna which dates it as of Werfenian age. It includes *Anodontophora fassaensis* Wissman, *Myophoria balatonsis* Frech, *Pseudomonotis* (*Claraia*) *aurita* (Hauer), *P.* (*C.*) *clarai* Emmrich, and *Spirorbis valvata* Goldfuss from lower beds; and *Anodontophora fassaensis* Wissman, *A. fassensis* var. *bittneri* Frech, *Gervillia sp.*, *Myophoria balatonsis* Frech, *M. ? laevigata* Zieten, *M. praeorbicularis* Bittner, and *Pseudomonotis* (*Claraia*) *aurita* Hauer from beds above.

The following calcareous algae have also been recorded from the Zinnar Formation (Elliott, 1955, 1956): *Diplopora sp.*, *Gymnocodium bellerophontis* (Rothpletz), *Macroporella sp.*, *Mizzia velebitana* Schubert, *Permocalculus digitatus* Elliott, *P. forcepinus* (Johnson), *P. fragilis* (Pia), *P. plumosus* Elliott, *P. tenellus* (Pia), and *P. solidus* (Pia). *Mizzia* is very common in the Polydiexodina limestones.

The corals are most abundant about the middle of the Zinnar Formation where limestones, known as the Wentzelella Limestones, contain productids and other brachiopods, bryozoans, and large massive corals all entirely or partly silicified. In the Geli

Khana section, they are 16·5 m. thick and 202 m. below the Satina Formation: in the Harrur section, they are 14·9 m. thick and 236·9 m. below the Satina. Corals also occur in the lowest part, 65 m. or so, of the Zinnar Limestone though they have only been collected from the top 17 mm., the Michelinia beds. In the Geli Khana section these beds are 203·8 m. below the Wentzelella Limestones. They are not exposed in the Harrur section but are well exposed on the slopes of Chia-i-Zinnar above Kaista. In the 203·8 m. between the Wentzelella and Michelinia Limestones corals are rare except in the Geli Khana section where 26·70 m. above the Michelinia beds there is a limestone with corals from which the '*Lonsdaleia*' and *Waagenophyllum*, described later, probably came. The lower part of the Zinnar Limestone, about 65 mm. and including the Michelinia Limestones contains abundant fusulines. These are mainly *Polydiexodina persica* Kahler (Kühn 1933), a species which has already been recorded as abundant in the lower part of the Permian of Persia (Douglas 1936, 1950) and which also occurs in Afghanistan (Dunbar 1933). Other fusulines have also been found in these beds, notably *Parafusulina kattaensis*, the characteristic form of the Lower Productus Limestone (Dunbar 1933) and also found in the Polydiexodina beds of Persia (Douglas 1950). These beds have been allocated to the Parafusulina Zone as should be the lower part of the Zinnar Limestone.

AGE AND CORRELATION

The corals collected from the Wentzelella Limestones include *Wentzelella canalifera* (Mansuy), *W. socialis* (Mansuy), *Wentzellophyllum persicum* (Douglas), *Polythecalis sp.* cf. *P. japonica* Yabe and Minato, *Ipciphyllum ipci* sp. nov., *I. elegans* (Huang), *I.* cf. *subtimoricum* (Huang), *I.* cf. *timoricum* (Gerth). Ten specimens of *Ipciphyllum ipci* were collected, the remainder are represented by one or two specimens. Only *Michelinia favositoides* Girty and *M.* cf. *siyangensis* Reed were collected from the Michelinia beds though other corals do occur there. Two specimens, both from the scree of the considerable thickness of limestone between the above two horizons, are named *Waagenophyllum indicum* (Waagen and Wentzel) var. nov. and '*Lonsdaleia*' *chaoi* (Huang) var.; they probably come from the lower part of this limestone series.

The fusulines and the other fossils have not yet been seriously examined and therefore no foraminiferal age-evidence is available other than the allocation of the Michelinia Limestones to the Parafusulina Zone. Stratigraphical position suggests that the limestones with *Waagenophyllum* and '*Lonsdaleia*' could also be included in this Zone.

The *Waagenophyllum-Wentzelella* faunas are generally considered to be limited to the Sakmarian-Artinskian-Kungurian (Hill 1948, 1957) though their relative positions within that succession are not established with any certainty. Huang (1932) in his description of the corals of the Chihsia and Maokou Limestones of southern China grouped them into five faunas designating them by the following index fossils and listing characteristic fossils.

Maokou Lmst.	*Lophophyllidium kayseri* (Huang)
	Ipciphyllum timoricum (Gerth)
Chihsia Lmst.	*Polythecalis yangtzeensis* Huang
	Hayasakaia elegantula (Y. and H.)
	Wentzellophyllum volzi (Y. and H.)

The '*volzi*' fauna seems to have distinct entity and to be widely distributed in the

Tethyan Permian. The index species occurs in the Carnic Alps (Felser 1937), Anatolia (Bali Maaden, Enderle 1900), southern China (Huang 1932), Japan (Minato 1955) as *Stylidophyllum yokoyamai* (Ozawa). Its associate, *S. kueichowense* Huang, which differs very little from it, occurs in Persia (Douglas 1936, 1950) with *Waagenophyllum* aff. *indicum* (W. and W.), *Polydiexodina*, and *Parafusulina*. It also occurs in the Permian of Ala Dagh, north of Tarsus, Anatolia (Heritsch 1939). '*Lonsdaleia*' *chaoi* occurs in this fauna in the Chihsia Limestone. It seems most probable that the '*Lonsdaleia*' *chaoi* and *Waagenophyllum* cf. *indicum* of northern Iraq are part of the '*volzi*' fauna. The fauna has not been recorded from the Productus Limestones of Pakistan.

The *Hayasakaia* (*Tetrapora* auctt.) and *Polythecalis* faunas are usually grouped together. In this fauna *Wentzelella* and various species of *Ipciphyllum* are abundant. They include *W. canalifera* (Mansuy) from Cambodia, also recorded from the Middle Productus Limestone of the Salt Range, and *Ipciphyllum subtimoricum* (Huang) and allied forms from Timor, Japan, southern China, Salt Range, Afghanistan, Persia, Anatolia, Serbia, Carnic Alps, and Sosio. The fauna is generally that of the Wentzelella Limestones of Iraq. In many of the above localities *Neoschwagerina*, especially *N. cratulifera* (Schwager) occurs associated with this coral fauna, which could quite well be the age of the Wentzelella Limestones of Iraq.

The '*timoricum*' fauna has rarely been identified with certainty west of China and Japan where it is placed in the Yabeina Zone.

MORPHOLOGICAL AND SYSTEMATIC PALAEONTOLOGY

Structural terms

Dissepitheca (scelerotheca *auctt.*). Vertical wall dividing the tabularium from the dissepimentarium. Formed by the thickening of the innermost surface of the dissepiments. Usually forms the bounding wall of the calicular pit. (Pl. 34, figs. 5, 6.)

Crestal septa (Lonsdaleoid septa *auctt.*). Septal ridges, radially continuous, on dissepimental surfaces (usually inclined inwards) replacing normal septa by vertically discontinuous plates. May be extensions of septa of central part of corallite or of septal ridges (denticles) of epitheca. (Pl. 35, figs. 1, 7.)

Crestal septal lamellae. Vertical ridges on surfaces of axial tabellae (usually inclined outwards) replacing normal septal lamellae by vertically discontinuous plates. (Pl. 35, fig. 5.)

Dissepiseptum. Linear arrangement of small lateral dissepiments replacing septum in dissepimentarium. (Douglas 1950, text-figs. 1*a*, *c*.)

Transverse tabulae. Tabulae horizontal or approximately so in tabularium. May be simple or compound, flat, with or without upturned edges, or shallowly curved, proximally or distally, or cystose. (Pl. 35, figs. 2, 3.)

Clinotabulae. Tabulae, vertical or steeply inclined downwards to axis, usually interseptal. May be simple, flat, or shallowly curved (convex surface towards axis) and continuous with transverse tabulae, or compound or elongate-cystose. May simulate dissepiments. (Pl. 33, fig. 4; Pl. 35, fig. 2.)

Clinotabularium. Tabularium with clinotabulae. Usually forms an outer zone of tabularium adjacent to dissepitheca and often sharply distinguished from an inner (periaxial) zone of transverse tabulae. (Pl. 33, fig. 4; Pl. 34, fig. 5.)

WAAGENOPHYLLIDAE fam. nov.

Rugosa, solitary or compound (phaceloid to aphroid). Septa of two or more orders, may be crestal, naotic or dissepisepta. Axial column lonsdaleoid. Tabularium of periaxial

transverse tabulae and outer zone of clinotabulae. Dissepimentarium may be interseptal, crestal-septate, or non-septate.

Remarks. The rugose corals of the Permian which were originally placed in the genus *Lonsdaleia* and later transferred to such genera as *Waagenophyllum* and *Wentzelella* are still usually retained in the Lonsdaleiidae though Wang (1950) has recognized their individuality by placing them in a subfamily, the Waagenophyllinae. Recent work, however, has shown that many Permian forms have developed new structures, many have more than two orders of septa and all of them are characterized by an inner and outer tabularium, distinctions which justify their family separation from the Lonsdaleiidae. Within the new family there is one group with simpler structure and only two orders of septa, and another with more complex structure and three or more orders of septa. Both groups have apparently developed independently along the trend from phaceloid to aphroid corallites and they are therefore in each recognized as a subfamily.

WAAGENOPHYLLINAE Wang 1950

Diagnosis. Waagenophyllidae with simple septa of two orders. Clinotabularium, usually distinct, of very steeply inclined clinotabulae, usually cystose.

WAAGENOPHYLLUM Hayasaka 1924

Type species *Lonsdaleia indica* Waagen and Wentzel 1886

Waagenophyllinae of slender phaceloid corallites. Tabularium, occupying greater part of corallite, formed of wide outer zone of elongate, almost vertical, cystose clinotabulae and very narrow periaxial zone of transverse tabulae. Narrow interseptal dissepimentarium of small, almost vertical, strongly curved, dissepiments.

Waagenophyllum indicum (Waagen and Wentzel) var. nov.

Plate 33, figs. 4, 9

COMPARE

Lonsdaleia indica Waagen and Wentzel 1886, p. 897, pl. 101, figs. 1–3, p. 115, figs. 3, 4; Diener 1897, p. 82, pl. 13, figs. 5, 6; Diener 1911, p. 43, pl. 6, fig. 4 (*non* Mansuy 1912, p. 9, pl. 1, fig. 3.)

Lithostrotion jourdyi Mansuy 1912*b*, p. 69, pl. 13, fig. 5.

Lithostrotion mixtum Mansuy 1912*a*, p. 38, pl. 8, fig. 5.

Waagenella indica, Yabe and Hayasaka 1915, p. 96.

EXPLANATION OF PLATE 32

Specimens R 41997–8 are from Michelinia Limestones in the lower part of the Zinnar Limestone (Permian) of the Geli Khana section, Ora, northern Iraq. R 41996 is from about 27 m. above the Michelinia Limestones.

Figs. 1, 2, 7–9. '*Lonsdaleia*' *chaoi* Huang var. 1, vert. sect. (slightly oblique), R 41996*b*, ×3. Note, on right, new corallite starting within dissepimentarium. 4, Trans. sect., R 41996*c*, ×3. 7, 8, Both from trans. sect. R 41996*a*, ×2·4, through calices and isolated axial columns. 9, Calicular surface of corallum, R 41996, ×0·6. Walls appear thick owing to wearing away of thin edge.

Figs. 3, 4. *Michelinia sp.* cf. *M. siyangensis* Reed. 3, Trans. sect., R 41998*b*, ×2·8, note fine septal spines. 4, Vert. sect., R 41998*a*, ×3, note medial strand within walls and large pores through walls.

Figs. 5, 6. *Michelinia favositoides* Girty. 5, Trans. sect., R 41997*a*, ×3, note large pores through walls. 6, Vert. sect., R 41997*b*, ×3, note spines (as vertical lines of small dots where wall has been only just removed).

Waagenophyllum indicum, Hayasaka 1924, p. 23; Smith 1935, p. 34, pl. 8, figs. 1–6; Heritsch 1937, pl. 2, fig. 5; Soshkina *et al.* 1941, text-figs. 42–44.
Waagenophyllum virgalense var. *mongoliense* Grabau 1931, p. 42, pl. 1, figs. 8, 9.
Waagenophyllum indicum var. *kueichowense* Huang 1932, p. 48, pl. 3, figs. 1, 2.
Waagenophyllum (*Liangshanophyllum*) *wengchenense* Huang 1932, p. 50, pl. 3, fig. 3.
Waagenophyllum aff. *indicum*, Douglas 1950, p. 9, pl. 1, figs. 1, 1*a*.
Waagenophyllum indicum var. *usugenuensis* Minato 1955, p. 103, pl. 19, fig. 3, pl. 31, fig. 1.

Material. R 42007 (three pieces) and sections *a* (Pl. 33, figs. 4*a*, 4*b*) and *b* (Pl. 33, fig. 9). Scree, below the Wentzelella Limestones, Geli Khana section, Ora, northern Iraq.

Description (Iraq material). Loosely phaceloid, corallites about 6 mm. across. Generally twenty-two major septa, slightly flexuous, slightly distally thickened but not forming stereozone; reaching to, or close to, axial column to which counter septum is joined. Minor septa up to half length of major. No tertiary septa. Tabularium, about 0·75 of corallite width, consists of outer zone of vertically elongate interseptal clinotabulae and a very narrow periaxial zone of transverse tabulae. Clinotabulae concentric in transverse section, transverse tabulae encircle axial column. Dissepimentarium of two to three rows of almost vertical small rounded dissepiments, transversely concentric. No extra-septal dissepiments. Axial column cuspidate, and irregular, about 1·3 mm. across; irregular medial plate may be absent, and a few irregular septal lamellae and steep, almost vertical, overlapping axial tabellae. Lateral budding with parallel offsets; no horizontal offsets.

Remarks. Most of the forms listed above show slight differences in the width of the axial column, in the number of septal lamellae and axial tabellae, and the length of the minor septa and could justifiably be grouped as one species or as non-significant varieties. The figured type of *L. indica* (type specimen Waagen and Wentzel 1886, pl. 101, fig. 1, 1*a–d*) has a slightly wider and more complex axial column than most; the Iraq form has a narrower and simpler axial column than most and possibly could be considered a definite variant; it is not named since it is a scree specimen.

IPCIPHYLLUM gen. nov.

Type species. *Ipciphyllum ipci* sp. nov.

Diagnosis. Waagenophyllinae with cerioid coralla. Dissepiments mainly interseptal, occasionally slightly non-septate. Clinotabulae may be simple or compound and not cystose.

Remarks. Ipciphyllum is essentially a cerioid *Waagenophyllum*. The species now included in it belong to the '*timoricum*' group and were previously included in *Wentzelella*: they are structurally simpler than species of that genus lacking tertiary septa, dissepisepta, and lateral dissepiments. *Ipciphyllum ipsi* is made the type species since *I. timoricum* (Gerth) is imperfectly known.

Ipciphyllum ipci sp. nov.

Plate 33, figs. 1, 2, 3, 7, 10; Plate 35, fig. 4.

Lonsdaleia indica Mansuy 1908, p. 55, pl. 14, figs. 2, 2*a*; 1912*a*, p. 9, pl. 1, figs. 3*a–e*, pl. 2, fig. 1 (*non Lonsdaleia indica* Waagen and Wentzel 1886, p. 897, pl. 101, figs. 1–3, pl. 115, figs. 3–4; *non Wentzelella indica* Mansuy, Soshkina *et al* 1941, p. 184, pl. 42, figs. 1*a–c*).

Lonsdaleia (*Waagenophyllum*) *timorica* Ozawa 1925, p. 74, pl. 13, figs. 7–9 (*non Lonsdaleia timorica* Gerth 1921, p. 74, pl. 145, figs. 1, 2).

Wentzelella subtimorica Douglas 1936, p. 23, pl. 2, fig. 2, pl. 3, fig. 5; Heritsch 1939, p. 173, pl. 1, figs. 2, 3, pl. 2, figs. 7, 8, 15–17 (*non* Huang 1932, p. 59, pl. 4, fig. 1*a*, *b*; *non* Douglas 1950, p. 14, pl. 2, fig. 4; *non* Minato 1944, p. 105, text-figs. 1, 3; Minato 1955, p. 113, pl. 22, fig. 8 *et al.*).

Holotype. R 42028 (two pieces) and section *a* (Pl. 33, fig. 10). *Paratypes*. R 42002 (two pieces) and section *a*; R 42016 (two pieces) and sections *a*, *b*; R 42017; R 42019 (one piece) and sections *a*, *b* (Pl. 33, fig. 1); R 42021 and sections *a*, *b*; R 42022 (two pieces) and section *a* (Pl. 33, fig. 3); R 42023 and section *a* (Pl. 33, fig. 2); R 42024 (three pieces) and sections *a*, *b* (Pl. 35, fig. 4); R 42026 (five pieces) and sections *a* (Pl. 33, fig. 7) and *b*. All specimens are from Wentzelella Limestones. R 42002 from the Geli Khana section, Ora, northern Iraq. The remainder are from the Harrur section, Chalki, northern Iraq.

Description. Cerioid, with crimped epitheca, corallites polygonal, usually five- or six-sided, and up to 10 mm. across. About thirty-two to forty straight septa which may be thickened in tabularium. Minor septa usually two-thirds length of major but may be as long. No tertiary septa. Axial column arachnoid, circular, up to 1·6 mm. across, with thin medial plate, radial lamellae, and prominent tabellae. Slight dissepitheca. Tabularium narrow, inner zone of simple transverse tabulae and outer zone of overlapping cystose clinotabulae, zones of about equal width. Dissepiments curved concentric or angulo-concentric. Non-septal dissepiments may occur in corallite angles. Budding peripheral.

Remarks. The above species has been previously recorded as *Wentzelella subtimorica* Huang. It differs from that species, which is now allocated to *Ipciphyllum*, in that it has non-septal dissepiments, a wider axial column with more septal lamellae and its dissepiments are more angulo-concentric. *Ipciphyllum flexuosum* (Huang) has an axial column which is more complex and has more tabellae than *I. ipci* which also has a wider tabularium with tabulae better developed.

EXPLANATION OF PLATE 33

The specimens of figs. 1–3, 5, 7, 8, 10 are from the Wentzelella Limestones, Zinnar Limestone (Permian) of the Harrur section, Chalki, northern Iraq; that of figs, 4, 6, 9 was not *in situ* in the Geli Khana section, Ora, northern Iraq, but was from below the Wentzelella Limestones.

Figs. 1–3, 7, 10. *Ipciphyllum ipci* sp. nov. 1, Trans. sect. R 42019*b* from paratype, ×4·5, showing area of young peripheral corallites and irregular breaking up of parent corallite. 2, Trans. sect. R 42023*a* from paratype, ×2·25. 3, Trans. sect. R 42022*a* from paratype, ×4·5 showing young corallites almost entirely consisting of tabularia. 7, Vert. sect. R 42026*a* from paratype, ×4·5. Note narrow periaxial zone of transverse tabulae; clinotabulae partly obscured by septa. Note evenly sized dissepiments. 10, Trans. sect. R 42028*a* from holotype, ×4·5. Note persistence of fine, irregular medial plate.

Figs. 4, 9. *Waagenophyllum indicum* (Waagen and Wentzel) var. nov. 4*a*, *b*. Vert. sects. from R 42007*a*, ×4·5. Note very irregular septal lamellae and very narrow zone of transverse tabulae. 9, Various trans. sects. from R 42007*b*, ×4·5. Note open axial column attached to counter septum.

Figs. 5, 8. *Ipciphyllum* cf. *subtimoricum* (Huang). 5, Trans. sect. R 42020*a*, ×4·5, partly silicified. Note concentric dissepiments and similarity of major and minor septa. 8, Vert. sect. R 42020*b*, ×4·5. Clinotabulae only show in upper and lower part of figure.

Fig. 6. *Ipciphyllum elegans* (Huang). Vert. sect. R 42001*c*, ×9, not medial through axial column. Note wide tabularium.

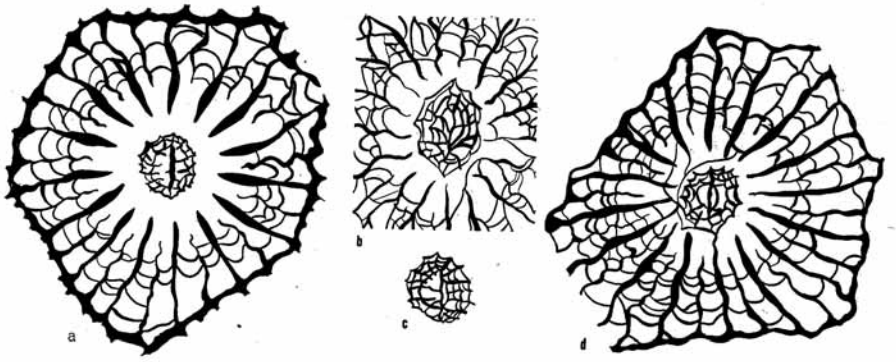
Ipciphyllum elegans (Huang)

Plate 33, fig. 6; text-fig. 1

Wentzelella elegans Huang 1932, p. 61, pl. 4, figs. 3, 4; Douglas 1950, p. 13, pl. 2, fig. 7.

Material. R 42001 (two pieces) and sections *a*, *b* (text-fig. 1), and *c* (Pl. 33, fig. 6). Wentzelella Limestones, Geli Khana section, Ora, northern Iraq.

Description. Cerioid, corallites 5 to 6 mm. across, about thirty-two septa, major thickened within tabularium and extend almost to axial column, minor, flexous and about two-thirds length of major, may fail. Axial column arachnoid, about 1·3 mm. across, thick medial plate, radial lamellae, and few tabellae. Wide tabularium about three-quarters width of corallite, mainly of transverse compound tabulae continuing peripherally into



TEXT-FIG. 1. Transverse sections of axial column of *Ipciphyllum elegans* (Huang), R 42001*b*, ×8·4.

steep simple clinotabulae. Dissepimentarium narrow, dissepiments angulo-concentric. No non-septate dissepimentarium. Quite comparable to type of species.

Ipciphyllum cf. *subtimoricum* (Huang)

Plate 33, figs. 5, 8

Cf. *Wentzelella subtimorica* Huang 1932, p. 59, pl. 4.

Material. R 42003 and sections *a*, *b*; R 42005, section *a* only, both from Geli Khana section, Ora; R 42020 (five pieces) and sections *a* (Pl. 33, fig. 5) and *b* (Pl. 33, fig. 8), Harrur section, Chalki. All from Wentzelella Limestones.

Description. Cerioid, corallites about 5 to 6 mm. across, with thirty-six to forty-two septa, major and minor almost equal in length and usually continuous. Axial column up to 1·5 mm. across, of medial plate and tabellae, and rare crestal septal lamellae. Wide tabularium of transverse tabulae and cystose clinotabulae; dissepiments concentric or slightly concave inwards.

Remarks. These specimens, though smaller, are much more similar to the type specimens than most specimens allocated to the species by various authors. The specimen is also

very similar to *Ipciphyllum gnomeiense* (Huang) except that that species has non-septal dissepiments.

Ipciphyllym cf. *timoricum* (Gerth)

Text-fig. 4*a*

COMPARE
Lonsdaleia timorica Gerth 1921, p. 74, pl. 145, figs. 1, 2.
Wentzelella timorica Huang 1932, p. 58, pl. 3, figs. 4–6; *non* Heritsch 1937, p. 2, pl. 1, figs. 6*a–d*, 7.
Wentzelella flexuosa Huang 1932, p. 60, pl. 4, fig. 2.

Material. R 42000 (five pieces) and thin sections *a*, *b*, *c* (text-fig. 4*a*), *d*. Wentzelella Limestones, Geli Khana section, Ora.

Though the specimen is not well preserved it shows many of the characteristic features of *Lonsdaleia timorica* Gerth. Both species have a wide axial column of many tabellae, which almost fills the tabularium leaving little room for transverse tabulae: both have a distinct tabularium emphasized by a dissepitheca. The dissepiments of both are curved concentric, but, nevertheless, the Iraq specimen is on a generally smaller scale and often has a peripheral zone of non-septal dissepiments in which respect it is similar to *I. flexuosum* (Huang); it is unfortunate that its bad preservation prevents more precise naming.

'*Lonsdaleia*' *chaoi* Huang var.

Plate 32, figs. 1, 2, 7–9, text-figs. 2, 3*a–e*

Cf. *Stylidophyllum chaoi* Huang in Yoh and Huang 1932, p. 35, pl. 9, figs. 5*a–b* (*? non Stylidophyllum chaoi* Huang 1932, p. 73, pl. 7, fig. 3).
Cf. *Stylidophyllum orientalis* Douglas 1936, p. 16, pl. 3, fig. 3.

Material. Specimen R 41996 (ten pieces) and sections *a–e*. From scree of uppermost bed of Michelinia Limestones, Geli Khana section, Ora, northern Iraq.

Description. Corallum about 23 cm. by 19 cm. by 7 cm. (incomplete), cerioid, with corallites usually six-sided and *c.* 12 mm. across. Calices with shallow, entirely ridged, slopes and an axial area, *c.* 2·5 mm. to 3 mm. across, mainly occupied by axial boss, *c.* 2 mm. across. Epitheca single, with slight crimping corresponding to major and minor septa. Tabularium about half-width of corallite and clearly delineated by thickening of innermost dissepimental surfaces, forming a dissepitheca. Major septa up to twenty-two, thickened within tabularium but with thin, slightly curved or irregular, extensions

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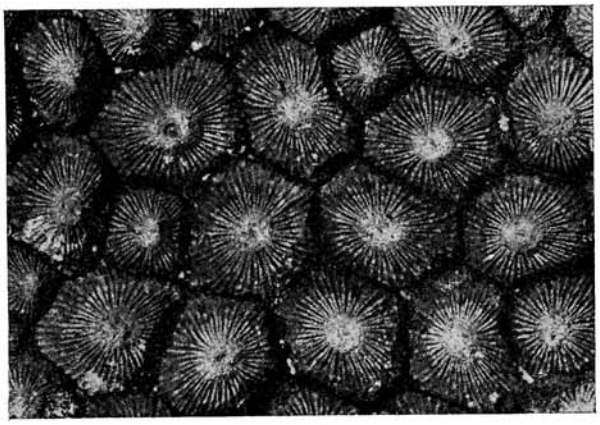
EXPLANATION OF PLATE 34

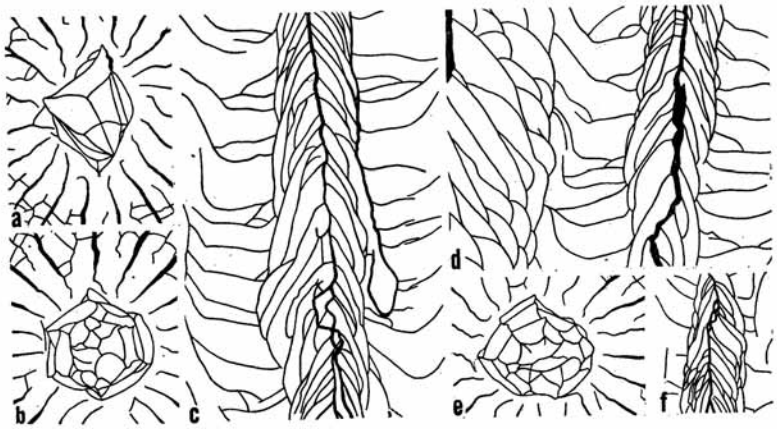
All figured specimens are from the Wentzelella Limestones, Zinnar Limestone (Permian). Those of figs. 1, 3–5, are from the Harrur section, Chalki, northern Iraq, and those of figs. 2, 6 from the Geli Khana section, Ora, northern Iraq.

Figs. 1, 2, 5, 6. *Wentzellophyllum persicum* (Douglas), ×4·5. 1, Trans. sect. R 42027*c*. Note peripheral non-septal dissepiments. 2, Trans. sect. R 42004*a*. Note tendency to elimination of epitheca. 5, Vert. sect. R 42027*a*, through side and end of axial columns. Note lateral dissepiments, tertiary septa, large non-septal dissepiments and small interseptal dissepiments. 6, Vert. sect. R 42004*b*, through medial plate of axial column.

Figs. 3, 4. *Wentzelella socialis* (Mansuy). 3, Vert. sect. R 42012*b*, ×4·5, through medial plate of axial columns. Note lateral dissepiments flanking septa and tendency to replace septa by dissepisepta. If major and minor septa are followed from axial area, the intercalation of tertiary septa can be noted. 4, Trans. sect. R 42012*a*, × 2·25. Note occasional non-septal dissepiments.



TEXT-FIG. 2. Calicular surface of '*Lonsdaleia*' *chaoi* (Huang) var. ×1·6. Photographed with no side lighting to show continuation of septal ridges across peripheral dissepiments.



TEXT-FIG. 3. *a–e*, '*Lonsdaleia*' *chaoi* (Huang) var.; *a*, *b*, *e*, trans. sect., R 41996*e*, ×8, of axial columns; *c*, *d*, vert. sects., R 41996*d*, ×8, of axial columns. *f*, *Wentzelella canalifera* (Mansuy). Vert. sect., R 42013*a*, ×8·3, of axial column.

reaching almost to axial column; extend, not thickened, about half-way across dissepimentarium but may continue to epitheca or be shorter. Crestal septa absent or feebly developed. Minor septa in tabularium thickened and about half length of major but in dissepimentarium usually extend as far as major. Fossulae absent.

Axial column, when fully developed, circular and *c.* 2 mm. across. Medial plate irregular and often medially thickened, crosses column and, proximally, links with counter and cardinal septa. About six septal lamellae, more or less irregular and radial,

may bifurcate. Axial tabellae numerous, about twelve in 5 mm., closely and steeply tented and often entire. Tabulae about nine in 5 mm., horizontal or slightly concave, sharply upturned near dissepimental wall to form clinotabulae, and showing in transverse section a narrow zone of tabular sections entire and curved between septa. Dissepiments shallowly curved and sloping about 45° inwards. Transverse sections of interseptal dissepiments fairly regular though acutely curved, extraseptal dissepiments shallowly curved but irregularly shaped and sized.

Remarks. '*Stylidophyllum*' *chaoi* Huang has an axial column in which the medial plate is not distinct from the other septal lamellae, few in number. Otherwise it does not differ significantly from the Iraq specimen. '*Stylidophyllum*' *orientale* Douglas has up to twenty-six major septa and its axial column, in which the medial plate is thickened along its entire length, is slightly larger and slightly more complex than the majority of those in the Iraq specimen, to which it is otherwise similar. The difference between the above two species and the Iraq specimen is so small that they could be justifiably considered minor varieties of the one species.

WENTZELELLINAE subfam. nov.

Diagnosis. Rugosa, solitary or compound, with septa of three or more orders. Axial column compact, variously of medial plate, tented tabellae, and septal lamellae or crestal septal-lamellae. Inner tabularium of transverse tabulae, outer of clinotabulae which may be near vertical and elongate cystose. Septa may be dissepiseptate or naotic. Peripheral dissepiments may be non-septate or closely crestal-septate.

Remarks. The above definition is based on the morphology of *Wentzelella* widened to include various form-genera which might well be considered subgenera. They include forms in which the dissepimentarium is entirely septate and the corallum solitary (*Iranophyllum* Douglas 1936), phaceloid (? *Heritschiella* Moore and Jeffords 1956), cerioid (*Wentzelella* Grabau 1932), partly cerioid and partly meandroid (*Wentzelloides* Yabe and Minato 1944), mainly thamnasterioid (*Lonsdaleiastraea* Gerth 1921); forms in which the peripheral dissepimentarium is non-septate or crestal septate and the corallum solitary, fasciculate or cerioid (*Wentzellophyllum* gen. nov.), partly cerioid and

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EXPLANATION OF PLATE 35

All figured specimens are from the Wentzelella Limestones, Zinnar Limestone (Permian) of the Harrur section, Chalki, northern Iraq.

Figs. 1, 2, 7. *Polythecalis sp.* cf. *P. japonica* Yabe and Minato. 1, Trans. sect. R 42018*a*, ×2·75. Note extension of tertiary septa from denticles of epitheca. 2, Vert. sect. R 42018*c*, ×5·5, upper part not medial. Note clinotabulae in outer zone of tabularium. Upper part of left dissepimentarium shows beginning of new corallite. 7, Trans. sect. R 42018*b*, ×5·5, with cerioid and aphroid corallites. Note formation of new epitheca around corallite in lower right-hand corner.

Figs. 3, 5, 6, 8. *Wentzelella canalifera* (Mansuy). 3, Vert. sect. R 42014*a*, ×5·5. Middle part of axial column through medial plate. Note interseptal clinotabulae. 5, Vert. sect. R 42013*c*, ×5·5. Left axial column is through side of column showing crestal septal lamellae; right axial column is through end of column. Note zigzag septa. 6, Trans. sect. R 42014*c*, ×2·75. 8, Trans. sect. (slightly oblique) R 42013*b*, ×2·75. Note abnormal non-septal dissepiments associated with breaks in epitheca.

Fig. 4. *Ipciphyllum ipci* sp. nov. Trans. sect. R 42024*b* of paratype, ×2·75. Note various stages in corallite growth.

partly aphroid (*Polythecalis* Yabe and Hayasaka 1916), and almost entirely aphroid (*Cystophora* Yabe and Hayasaka 1916).

WENTZELELLA Grabau *in* Huang 1932

Type species *Lonsdaleia salinaria* Waagen and Wentzel 1886

Wentzelellinae with cerioid corallum, thick epitheca; dissepisepta common, tertiary septa variously developed; dissepimentarium almost entirely septate, lateral dissepiments common; tabulae may be sharply divided into clinotabulae and transverse tabulae (*Wentzelella* is essentially a cerioid *Iranophyllum*).

Wentzelella canalifera (Mansuy)

Plate 35, figs. 3, 5, 6, 8; text-fig. 3*f*

Lonsdaleia canalifera Mansuy 1913, p. 109, pl. 11, fig. 12, pl. 12, figs. 1*a*, *b*, *c*; Sen, 1931, p. 35, pl. 6.
Lonsdaleia molengraffi Gerth 1921, p. 76, pl. 145, figs. 3–5.

Material. R 42014 (nine pieces) and sections *a* (Pl. 35, fig. 3), *b*, and *c* (Pl. 35, fig. 6). R 42013 (five pieces) and sections *a* (text-fig. 3*f*), *b* (Pl. 35, fig. 8), and *c* (Pl. 35, fig. 5). From Wentzelella Limestones, Zinnar Limestone, Harrur section, Chalki, northern Iraq.

Description (Iraq material). Cerioid corallum, thick denticulate epitheca and corallites 5 mm. to 8 mm. across. About thirty-two major and minor septa, thickened in tabularium, minor slightly shorter; tertiary septa sporadically developed, usually in angle of corallite. Axial column, 1·5–2 mm. across, mainly of overlapping tabellae tented against a medial plate, slightly thickened, which may deviate from medial line. Septal lamellae, few, mainly crestal. Tabularium, about half corallite width, of outer steep usually elongate-cystose clinotabulae, and inner simple or compound transverse tabulae. Dissepiments well curved; lateral dissepiments common in peripheral dissepimentarium, which is occasionally non-septate.

Remarks. The above description was based on R 42014. The other specimen has slightly wider corallites and axial columns. Peripheral budding is more common and the growth of neotissue makes the general pattern irregular. The dissepimentarium is also more non-septal and aphroid. The coral thus tends towards *Polythecalis*. The dimensions of these specimens, their septal number and their general pattern are close to those of *W. canalifera*; the small canals between the corallites that occur in the type specimens are, in the opinion of the author, parasitic or symbiotic.

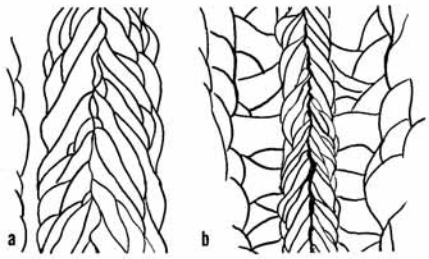
Wentzelella socialis (Mansuy)

Plate 34, figs. 3, 4; text-fig. 4*b*

Lonsdaleia socialis Mansuy 1913, p. 110, pl. 12, fig. 2.

Material. R 42012 (two pieces) and sections *a* (Pl. 34, fig. 4) and *b* (Pl. 34, fig. 3), Harrur Section, Chalki, northern Iraq. R 42015 (seven pieces) and sections *a* (text-fig. 4*b*) and *b–g*, Pirispiki section, 1 km. west of Ora, northern Iraq. Both from Wentzelella Limestones, Zinnar Limestone.

Description (Iraq material). Corallites *c.* 5 mm. across. About thirty-two major and minor septa, minor slightly shorter; tertiary septa sporadically developed. Axial column compact, about 0·08 mm. to 0·1 mm. across, mainly closely tented tabulae, short slightly thickened medial plate and few crested radial lamellae. Dissepiments small, well curved, mainly interseptal; lateral dissepiments very common giving a consistent lace-like-pattern in transverse section. Tabularium clearly distinct from dissepimentarium, half to two-thirds width of corallite; clinotabulae not well developed, numerous subhorizontal transverse tabulae. Peripheral dissepimentarium of R 42015 slightly more non-septal.



TEXT-FIG. 4. *a*, *Ipciphyllum* cf. *timoricum* (Gerth), vert. sect., R 42000*c*, ×12; *b*, *Wentzelella socialis* (Mansuy), vert. sect. R 42015*a*, ×12.

Remarks. Wentzelella canalifera and *W. socialis* were originally described from the Productus Limestones of Cambodia where they occurred with *Neoschwagerina cratulifera* (Schwager) characteristic of the Neoschwagerina Zone. Sen (1931) records *W. canalifera* from the Middle Productus Limestone of the Salt Range.

WENTZELLOPHYLLUM gen. nov.

Type species. Lonsdaleia volzi Yabe and Hayasaka 1915, p. 108; 1920, pl. 8, figs. 6*a*, *b* (see also *Stylidophyllum volzi* (Y. and H.), Huang 1932, p. 65, pl. 6, figs. 1–3, pl. 10, fig. 1; Felser 1937, p. 13, pl. 1, figs. 8*a*, *b*; Heritsch 1939, pl. 2, figs. 6, 18).

Diagnosis. Wentzelellinae, with denticulate epitheca, and dissepimentarium with peripheral zone with, all or in part, no septa or crestal septa.

Remarks. The genus is founded to include those Lonsdaleoid corals with tertiary septa and clinotabulae that have previously been included in the genus *Stylidophyllum* de Fromental 1861 (type species *Lonsdaleia floriformis* Martin, which has neither tertiary septa or clinotabulae). Though most of the species so included are cerioid forms, the genus is so founded that solitary or fasciculate corals are included.

Wentzellophyllum persicum (Douglas)

Plate 34, figs. 1, 2, 5, 6

Wentzelella persica Douglas 1936, p. 24, pl. 2, fig. 3.
Cf. *Stylidophyllum gnomeiense* Huang 1932, p. 75, pl. 7, fig. 2; Heritsch 1939, p. 176, pl. 1, figs. 4, 5; pl. 2, figs. 11, 12.

Material. R 42004 (six pieces) and sections *a* (Pl. 34, fig. 2) and *b* (Pl. 34, fig. 6) from Geli Khana section, Ora, northern Iraq. R 42025 (five pieces) and sections *a*, *b*, *c*; R 42027 (seven pieces) and sections *a* (Pl. 34, fig. 5), *b*, *c* (Pl. 34, fig. 1), both from Harrur section, Chalki, northern Iraq. All from Wentzelella Limestones, Zinnar Limestone.

Description (Iraq material). Corallites polygonal, from 6 to 7 mm. across, epitheca occasionally absent. Usually thirty septa, thickened in tabularium, minor slightly shorter.

Sporadic development of short tertiary crestal septa. Axial column mainly of medial plate not thickened and numerous axial tabellae, septal lamellae short and crestal; transverse section of column about 0·1 mm. by 0·08 mm. across. Tabularium about one-third of corallite width, with clinotabulae and transverse tabulae. Dissepiments usually small and hemispherical; non-septal dissepiments strongly convex inwards, sides of dissepiment continue line of septa.

Remarks. The specimen figured on Pl. 34, fig. 1 is similar to that figured by Douglas; R 42025 and that on Pl. 34, fig. 2 is slightly more irregular and dissepiments are not so markedly non-septal. The general morphology is similar to that of *Wentzelella socialis* (Mansuy) of which it could be considered the Lonsdaleoid representative. '*Stylidophyllum*' *gnomeiense* Huang and especially that figured by Heritsch from the neighbouring area in Anatolia are comparable to *Wentzellophyllum persicum*; they have perhaps a few additional septa.

POLYTHECALIS Yabe and Hayasaka *emend.* Tseng

Type species *Polythecalis confluens* Yabe and Hayasaka 1916

Wentzelellinae with corallum, partly cerioid and partly aphroid, with thick denticulate epitheca; peripheral dissepimentarium mainly non-septal or crestal-septate. Clinotabulae may be simple, compound, or cystose, and transverse tabulae variously developed.

Polythecalis sp. cf. *P. japonica* Yabe and Minato

Plate 35, figs. 1, 2, 7

Cf. *Polythecalis japonica* Yabe and Minato 1946, p. 466, figs. 1–3; Minato 1955, p. 132, pl. 32, fig. 1 as *Stylidophyllum sikokuense* Minato nom. nov.
Cf. *Stylidophyllum arminae* Felser 1937, p. 14, pl. 1, figs. 9*a–c*.
COMPARE ALSO
Aphroid forms: *Polythecalis rosiformis* Huang *in* Yoh and Huang 1932, p. 42, pl. 10, figs. 1*a–c*; Heritsch 1939, p. 175, pl. 1, figs. 1, 6–8.
Lonsdaleoid forms: *Stylidophyllum variabile* var. *a* and *b*, Gerth 1938, p. 233, pl. 15, figs. 2–6.
Meandroid forms: *Wentzelelloides maiyaensis* Yabe and Minato 1944, p. 141, pl. 12; Minato 1955, p. 114, pl. 24.

Material. R 42018 (three pieces) and sections *a* (Pl. 35, fig. 1), *b* (Pl. 35, fig. 7), and *c* (Pl. 35, fig. 2). From Wentzelella Limestones, Harrur section, Chalki, northern Iraq.

Description. (Iraq material). Fragment of cerioid and aphroid corallum. Cerioid corallites, 5 to 6 mm. across, some almost circular, but usually polygonal with four or five curved sides. Epitheca *c.* 0·3 mm. thick with denticles, up to sixty in a corallite, usually opposite and irregularly corresponding to septa of various orders. When cerioid, corallite consists of a tabularium *c.* 3 mm. across, with an irregular dissepitheca and a narrow though variable dissepimentarium. When aphroid, the tabularium is irregular and not clearly defined and the dissepimentarium is very variable in width. Major septa ten to fourteen (usually ten), extend from dissepitheca almost to axial column (the counter may be slightly longer and the cardinal shorter than the others). Minor septa generally about one-third the major but may be little more than ridges on the dissepitheca. Both major and minor thickened within tabularium; both extend into the dissepimentarium as thick

discontinuous crestal septa which may be closely aligned forming a secondary epitheca. In some aphroid corallites the septa edging the epitheca may be more continuous. Third and occasional fourth-order septa exist as short extensions of the denticles.

Axial column oval, *c.* 0·5 by 0·8 mm. or less, with an irregular medial plate, a few lateral axial tabellae (usually one or two on each side), and a few crestal septal lamellae. Inner tabularium of horizontal or steeply inwardly compound tabulae; outer tabularium of large vertically elongated clinotabulae. Transverse tabular sections very irregular. Dissepiments steeply convex upwards and very variable in size. Lateral dissepiments occur abundantly flanking or even replacing the crestal septa, and thus forming dissepisepta.

Remarks. The various species listed above have a very similar septal pattern. The major septa are few, the minor septa are very irregularly developed and there are various tertiary septa. The axial column is dominated by tabellae and the septal lamellae are usually crestal and few. In each species the budding is peripheral, usually paired and with incomplete fission. Apart from the method of linking one corallite to the other the differences between the species are slight and are mainly differences in corallite width, in number of septa and septal lamellae. These species, however, do show different stages in the elimination of the epitheca and have, therefore, been variously allocated to the form genera *Wentzelella* (cerioid), *Wentzelloides* (meandroid), *Wentzellophyllum* (lonsdaleoid), and *Polythecalis* (part or entirely aphroid), genera most of which show one or more of these trend stages. The Iraq specimen is most like *Polythecalis japonica* from the Polythecalis Zone of Japan. It is, however, also closely similar to '*Stylidophyllum*' *arminae* Felser from the Karnic Alps which has, however, more regular dissepiments. The specimen figured by Felser as pl. 1, fig. 9 suggests that this species is also partly aphroid and it may be a synonym of *P. japonica*. Another possible synonym is '*Stylidophyllum*' *variabile* var. *a* Gerth from the Permian of the eastern Caracorum of the Himalayas. The corallum is cerioid with polygonal corallites, mostly straight-sided, occasionally linked the one with the other by the weakening or suppression of the epitheca, which is normally very thick. The dissepimentarium is either entirely septate or closely laced with crestal septa; the dissepiments are therefore small and vary little in size. Its septal plan and the pattern of its tabularium and dissepimentarium are otherwise very similar to those of *P. japonica* which, however, is slightly more aphroid. '*S.*' *variabile* var. *b* Gerth is like the section of the Iraq specimen figured as Pl. 35, fig. 1. Gerth's varieties *a* and *b* are probably, as he suggests, different growth stages in the one form.

Of the forms described from neighbouring areas, those most like the Iraq specimen are *Polythecalis rosiformis* Huang as figured by Douglas from Iran and by Heritsch from Anatolia. These forms are more aphroid and have a smaller and more regular tabularium which may consist entirely of clinotabulae.

Order TABULATA Milne-Edwards and Haime

Michelinia favositoides Girty

Plate 32, figs. 5, 6

Michelinia favositoides Girty 1908, p. 38; 1913, p. 312, pl. 29, figs. 1–2 (*non Michelinia favosoidea* Billings 1859, p. 114).

Cf. *Michelinia* (*Protomichelinia*) *microstoma* Yabe and Hayasaka 1915, p. 61; Yabe and Hayasaka 1920, pl. 9, figs. 8*a–b*.
Cf. *Michelinia microstoma* Huang 1932, p. 92, figs. 3*a*, 3*b*.
Cf. *Michelinia mansuyi* Reed 1925, p. 12, pl. 1, figs. 16–21.
Cf. *Michelinia* (*Michelinopora*) *multitabulata* Yabe and Hayasaka 1915, p. 59.
Cf. *Michelinia* (*Protomichelinia*) *multitabulata*, Minato 1955, pl. 26, figs. 1, 2, pl. 31, fig. 2.
Cf. *Michelinia siyangensis* Heritsch 1939, pl. 2, fig. 3 (*non Michelinia siyangensis* Reed 1927, p. 108, pl. 7, figs. 4, 5).

Material. R 41997 (three pieces) and sections *a* (Pl. 32, fig. 5) and *b* (Pl. 32, fig. 6) and R 41999 (two pieces) both from Michelinia Limestones, Geli Khana section, Ora, northern Iraq. R 42055 (two pieces) from Michelinia Limestones, Chia-i-Zinnar, Chalki, northern Iraq.

Description (Iraq material). Corallum hemispherical (R 41997 about 5 cm. across and 3·5 cm. high). Holotheca not known. Full-grown corallites usually six-sided and generally 1·5 mm. (max. 2 mm.) across. Corallite walls about 0·2 mm. thick with a medial dark strand and flanked by tissue of spine bases. Numerous approximately circular pores about 0·2 mm. across and fairly evenly distributed (about 0·3 to 0·5 mm. apart). Septal spines, short but distinct, and generally equal, about twenty to twenty-five in a corallite transverse section. They are arranged in vertical rows on the inner surface of the epitheca, each row separated by a very fine groove, thus forming vertical septal ridges well evident in weathered corallites. Tabulae very thin, slightly curved with convex surface upwards, some flat; many short and incomplete, abutting on tabula below; approximately equally spaced, about 10 in 5 mm.

Remarks. The specimen, now known to be from the Chihsia Limestone of China, described by Girty (1908, 1913) as *Michelinia favositoides*, is in all ascertainable features identical with the Iraq specimens. Similar forms are *Michelinia microstoma* Y. and H. also from the Chihsia Limestone and *M. mansuyi* Reed from the Pamir Range. Though these differ slightly from *M. favositoides* (*M. microstoma* has slightly wider corallites and indistinct septal spines; *M. mansuyi* also has wider corallites and also much closer tabulae) they were considered by both Yabe and Hayasaka (1915) and by Huang (1932) to be the same as that species (Yabe and Hayasaka 1915, under the mistaken impression that *Michelinia favositoides* Girty was a homonym of *Michelinia favosoidea* Billings 1859, considered it to be an invalid name and, again mistakenly, replaced it by *Michelinia microstoma* (Y. and H.). Another comparable form, from the lower part of the Chihsia Limestone, is *Michelinia multitabulata* Y. and H. As figured by Minato it differs from *M. favositoides* only in that the septal spines are indistinct and the corallites are generally wider (3 to 4 mm. across). Forms figured as *Favosites* from the Permian (as *P. relicta* Gerth 1921, Heritsch 1934, and *Favosites sp.* Hill 1942) have similarities to *M. favositoides* but it has not been possible to make close comparison. The *Michelina* figured by Heritsch in his description of the Anatolia fauna has marked septal spines and tabulae spaced at nine to ten in 5 mm. Though the width of its corallites, generally about 3 mm. across, is greater than that of *M. favositoides* it should be compared with that species rather than with *M. siyangensis*. It is therefore the opinion of the author that the various forms listed above, and probably others from the lower part of the Permian limestone of Tethys, should be allocated to *M. favositoides* Girty or local varieties of that species.

Michelinia sp. cf. *M. siyangensis* Reed

Plate 32, figs. 3, 4

Cf. *Michelinia siyangensis* Reed 1927, p. 108, pl. 7, figs. 4, 5; Huang 1932, p. 94, pl. 12, figs. 1–6; Douglas 1936, p. 26, pl. 3, figs. 10, 10*a*.

Cf. *Michelinia* cf. *placenta* Yoh and Huang 1932, p. 22, pl. 6, figs. 1, 2 (*non Michelinia placenta* Waagen and Wentzel 1886, p. 852, text-figs. 2*a–d*).

Material. R 41998 (two pieces) and sections *a* (Pl. 32, fig. 4) and *b* (Pl. 32, fig. 3). From Michelinia Limestones, Geli Khana section, Ora, northern Iraq.

Description (Iraq material). Corallum hemispherical, about 2·5 cm. across. Corallites polygonal, *c.* 2 to 2·5 mm. across. Epitheca *c.* 0·2 mm. thick. Pores large and irregularly spaced. Septal spines generally indistinct. Tabulae thin, about 1 mm. apart, generally entire.

Remarks. Only a fragment of this form has been collected. It is distinguished from *M. favositoides* by its wider corallites, lack of marked septal spines, and wider spacing of its tabulae. Since the forms figured by Yoh and Huang as *M.* cf. *placenta* and by Reed, Huang, and Douglas as *M. siyangensis* have wider corallites (up to 4 mm. across), the Iraq specimen is not definitely referred to that species.

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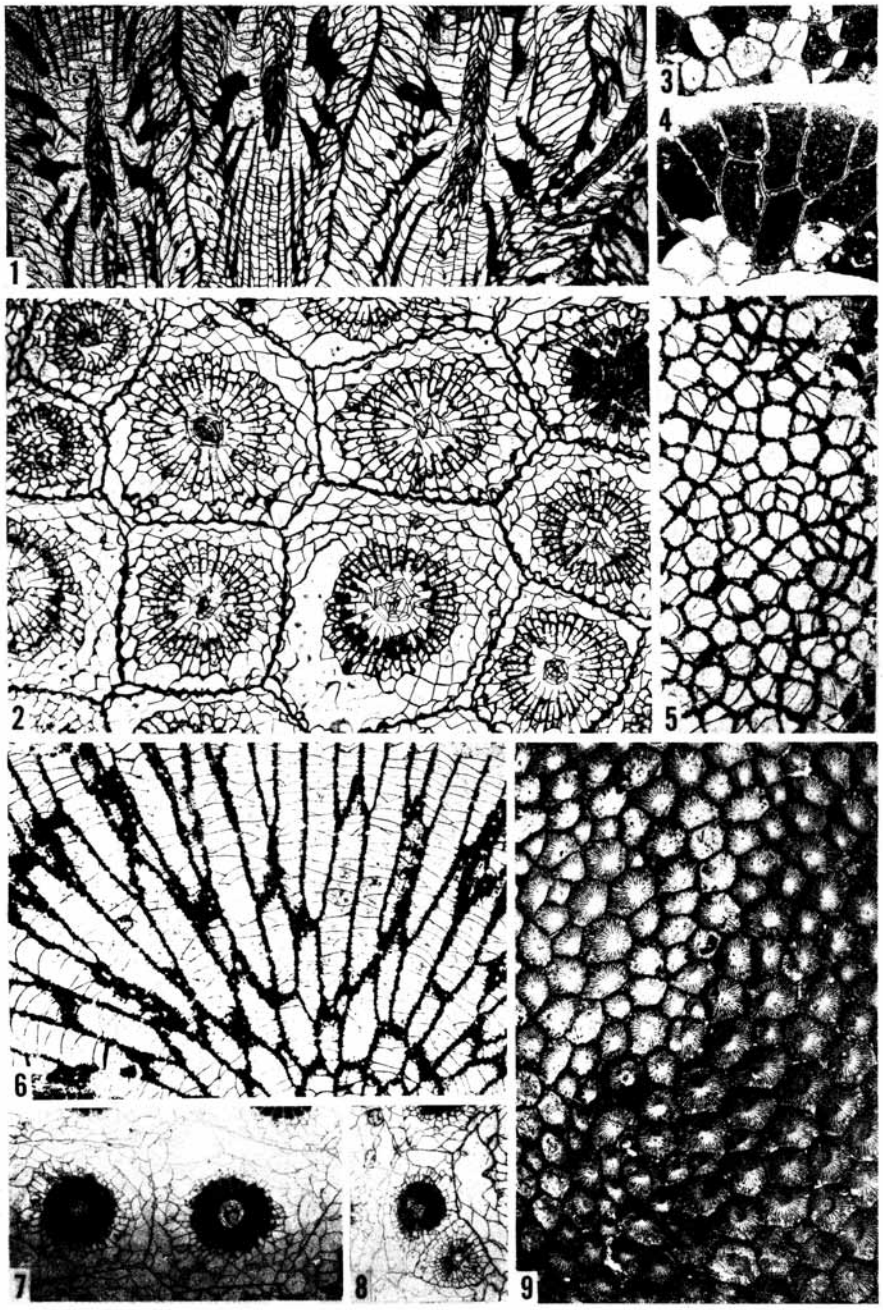

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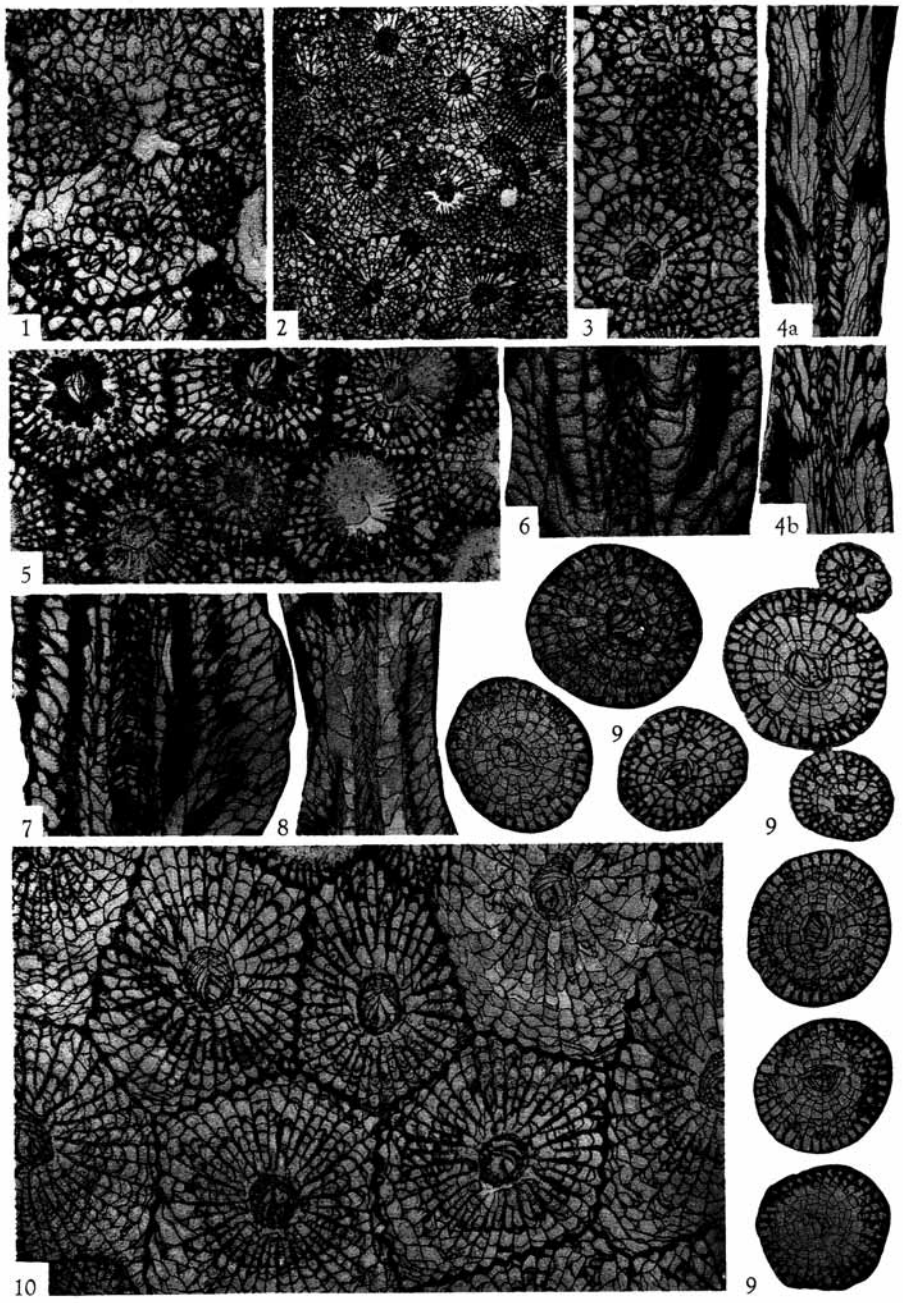

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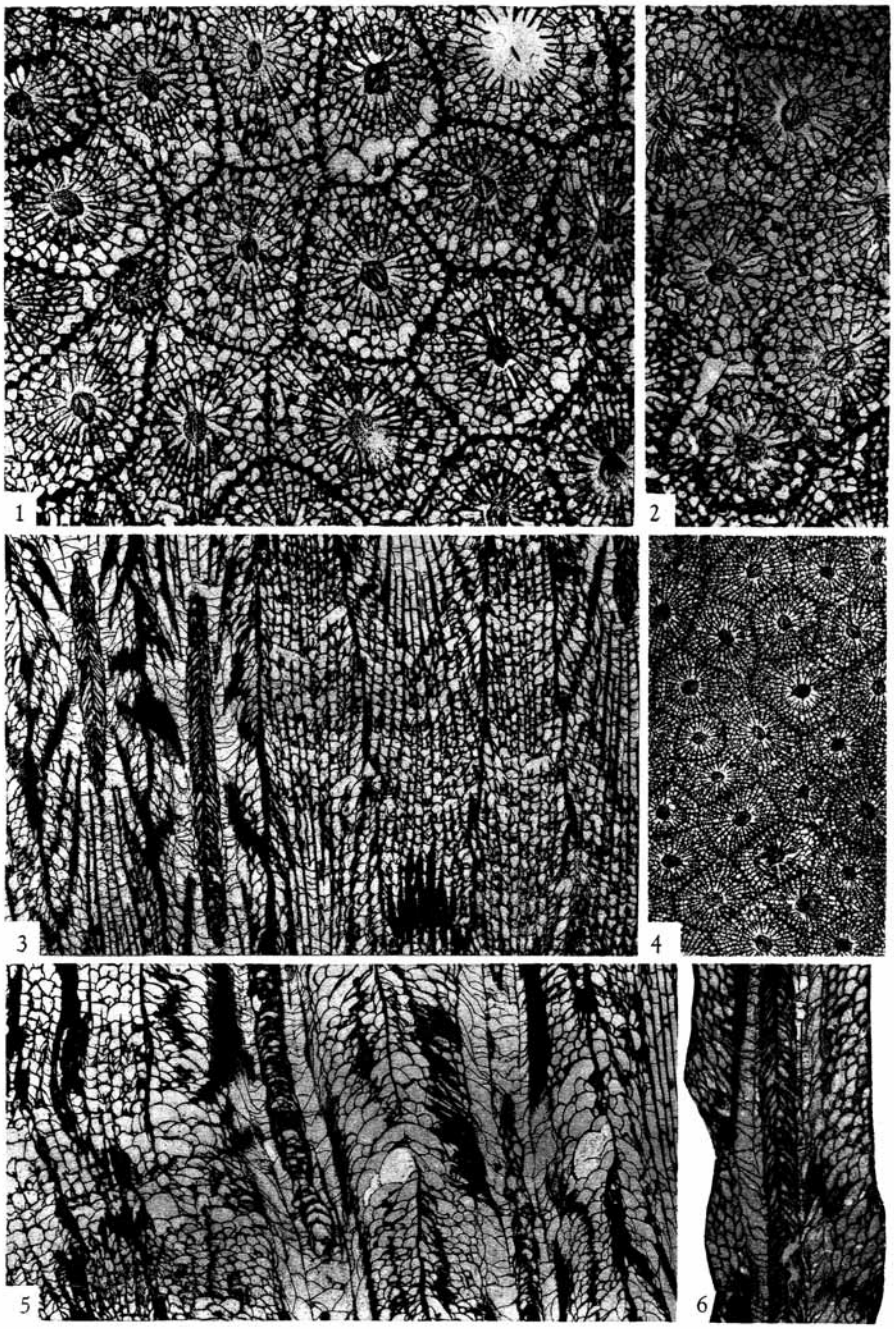

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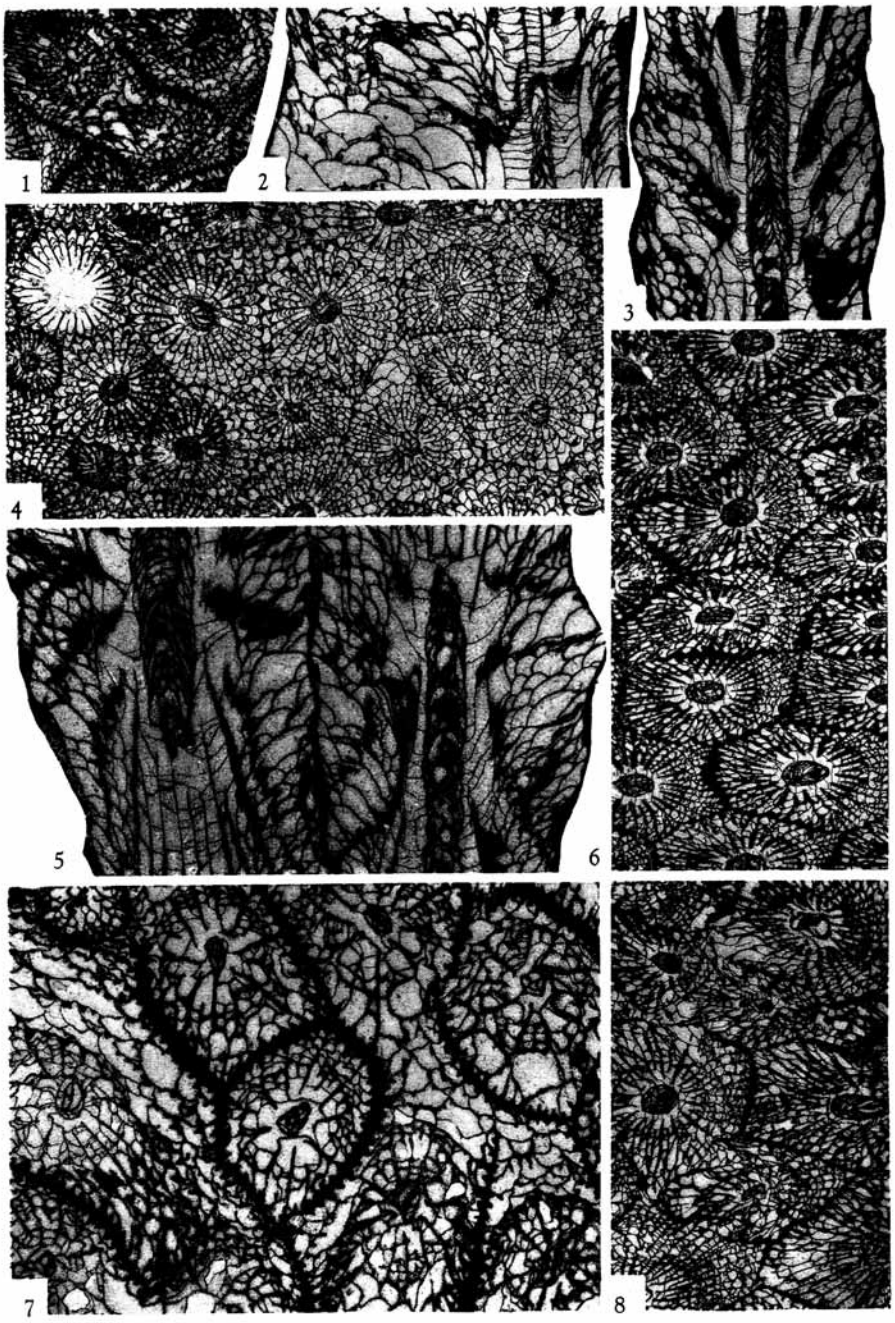

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