LOWER DEVONIAN *HEXAGONARIA* (RUGOSA) FROM THE ARMORICAN MASSIF OF WESTERN FRANCE

by J. E. SORAUF

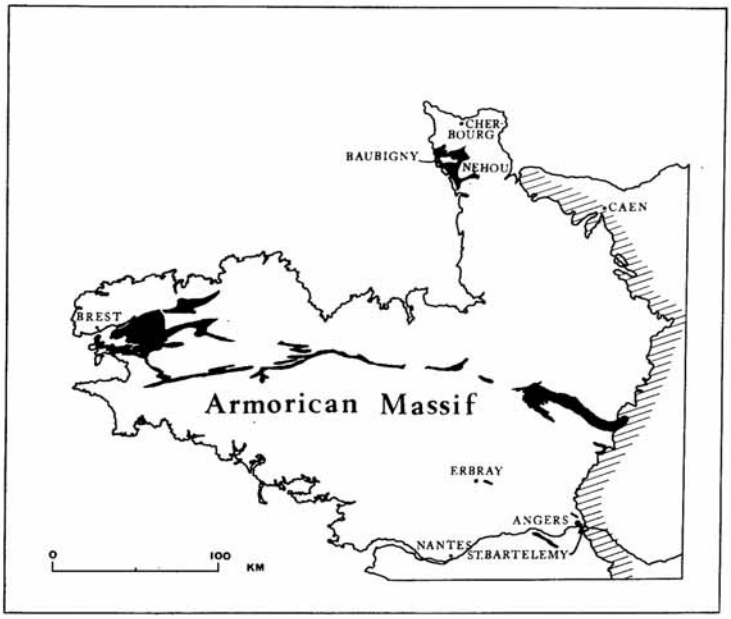
ABSTRACT. Three species of cerioid colonial Rugosa are described from the Siegenian and Emsian rocks of western France. *Hexagonaria namnetensis* and *H. venetensis* appear related to the *H. hexagona* and *H. quadrigemina* lineages respectively. *H.* sp. cf. *longiseptata*, characterized by broad tabularium and few dissepiments is very close to *H. longiseptata* from the Upper Devonian of Russia. Angles formed by septal trabeculae with intercorallite walls and with the margin of the tabularium are demonstrably useful in determining relationships within the genus.

ONLY rarely are massive colonial disphyllid corals found in rocks older than Middle Devonian. The occurrence of such forms in Lower Devonian rocks of the Armorican Massif of western France has long been known (Barrois 1889). They have also been reported from Australia; in the Garra Formation regarded as Emsian by Strusz (1965, p. 522), and in the Lilydale Limestone, the Coopers Creek Limestone, and the Loyola Limestone, which have recently been dated as early Siegenian by Philip and Pedder on the basis of their conodont faunas (1967, p. 797). The massive corals of western France are assignable to the genus *Hexagonaria*, but the taxonomic position of the Australian species has been questioned. Philip and Pedder note that '*Acervularia*' *chalkii* and '*Cyathophyllum*' *approximans* from the Lower Devonian of Australia 'may resemble *Hexagonaria* (or what is generally held to be *Hexagonaria*), but differ in the diffuse nature of the peripheral part of many of their septa' (1967, p. 796). The species under consideration in the present report are *Hexagonaria namnetensis* (Barrois 1889), *H. venetensis* (Barrois 1889), and *H.* sp. cf. *longiseptata* Bulvanker 1958. *H. namnetensis* occurs in the Nehou Limestone (Siegenian) of the Cotentin Peninsula of Normandy, and *H. namnetensis*, *H. venetensis*, and *H.* sp. cf. *longiseptata* are found in the Erbray and Angers limestones (Emsian) near the city of Angers in the Loire Valley (see text-fig. 1).

A. Bigot (1928) has summarized the presence of Lower Devonian limestones in the Baubigny area of the Cotentin Peninsula of Normandy (text-fig. 1). The two most fossiliferous outcrops are seen in the road cut at the village of Roquelles and nearby in the quarry of Baubigny. At Roquelles, beds of highly fossiliferous limestones are seen intercalated with shales. The limestones contain *Hexagonaria namnetensis*, *Favosites punctata*, lamellar and branching *Pachypora* and *Alveolites*, and many stromatoporoids (Bigot 1928, p. 40). In the quarry of Baubigny, the transition is seen between the interbedded limestone and shale of the Nehou Limestone and gray massive limestones, with stromatoporoids and corals, apparently a near-reef facies (p. 40). The Nehou Limestone is considered by Dangeard (1951, p. 61) to be middle Siegenian in age.

In the portion of the Armorican Massif bordering the Loire Valley, the limestones of Angers and Erbray are regarded as Emsian in age (Péneau 1928, p. 86; Lardeux 1965, personal communication). These Emsian limestones are referred to as the Calcaires d'Angers et d'Erbray. The rocks are fossiliferous, with a varied fauna, in the vicinity

[Palaeontology, Vol. 12, Part 2, 1969, pp. 178–88, pls. 35–36.]



TEXT-FIG. 1. Outline map of the northern portion of the Armorican Massif of north-western France. Devonian rocks are shown in black. Corals described in this report are from areas near Nehou in the north, and near Erbray, and near Angers in the south.

of Angers. Farther to the north-west in the Angers Basin, the Erbray Limestone at Erbray was considered by Barrois to be developed in a reefal facies (1889, p. 2).

The following abbreviations are used: MNHNF, Musée National d'Histoire Naturelle de France (Paris); MCVN, Musée Communal de la Ville de Nantes.

Family DISPHYLLIDAE Hill 1939 (*sensu* Strusz, 1965)
Genus HEXAGONARIA Gürich 1896

Hexagonaria namnetensis (Barrois 1889)

Plate 35, figs. 1–6, and Plate 36, fig. 6

1889 *Acervularia namnetensis* Barrois, p. 40, pl. 1, fig. 1a, 1b, 1c.

Diagnosis. Species of *Hexagonaria* with 24–30 attenuate to slightly dilated septa, and diameter of tabularium varying from 3 to 3·5 mm. in mature specimens. Dissepimentarium with on average 4–5 rows of globose dissepiments progressively sloping inward, and tabularium with variable development of complete flat or sloping tabulae or with development of axial flat-topped and periaxial series of tabulae.

Description, type specimen (MCVN). The type specimen of *Hexagonaria namnetensis* (Barrois) shows the essential features of the species.

In transverse section the specimen is characterized by fairly large mature corallites with multi-sided, irregular polygonal shape in cross-section and immature corallites which generally have a sub-triangular cross-section at one stage of their development (Pl. 35, figs. 1, 5). The mature individuals display attenuate to slightly dilated septa, clearly differentiated into first and second orders. First order septa extend into the tabularium, reaching $\frac{1}{2}$ to $\frac{4}{5}$ of the way from the edge of the dissepimentarium to the axis of the corallite. The second order septa extend only a short distance into the tabularium. In 9 mature corallites, the total observed range in diameter of tabularium (D_t) is from 3·2 to 4·1 mm., and the range in total number of septa (n) is 28–32. The mean values are 3·55 mm. for D_t and 28·9 for n.

In longitudinal section the specimen is characterized by largely complete tabulae with varying geometry. Some are more or less flat, some slope across the tabularium, and some are arched. In several corallites, a definite tendency toward development of an axial series of tabulae is apparent (pl. 35, fig. 3).

The dissepimentaria clearly show periodic variations in growth, with bands of smaller, more numerous dissepiments alternating with bands of few and larger ones (Pl. 35, fig. 3). In the zones of small dissepiments, there are generally 4–5 rows of inflated dissepiments, while in the other bands, as few as one or two dissepiments may occupy the entire width of the dissepimentarium (Pl. 35, fig. 3). The dissepiments typically bend progressively inward and slope towards the tabularium at a high angle at the inner border of the dissepimentarium, as is noted on the left side of Plate 35, fig. 3. However, low reflexing of the dissepimentarium is commonly noted (as in the corallite on the right-hand side of the same figure).

The fine structure of the specimen is characterized by truly cerioid walls, with epitheca seen in cross-section as a dark line between two layers of prismatic calcite. The fine structure of the septa is typically seen to have trabeculae in longitudinal section approaching parallel with the intercorallite wall, and making an angle of approximately 40° with the outer margin of the tabularium.

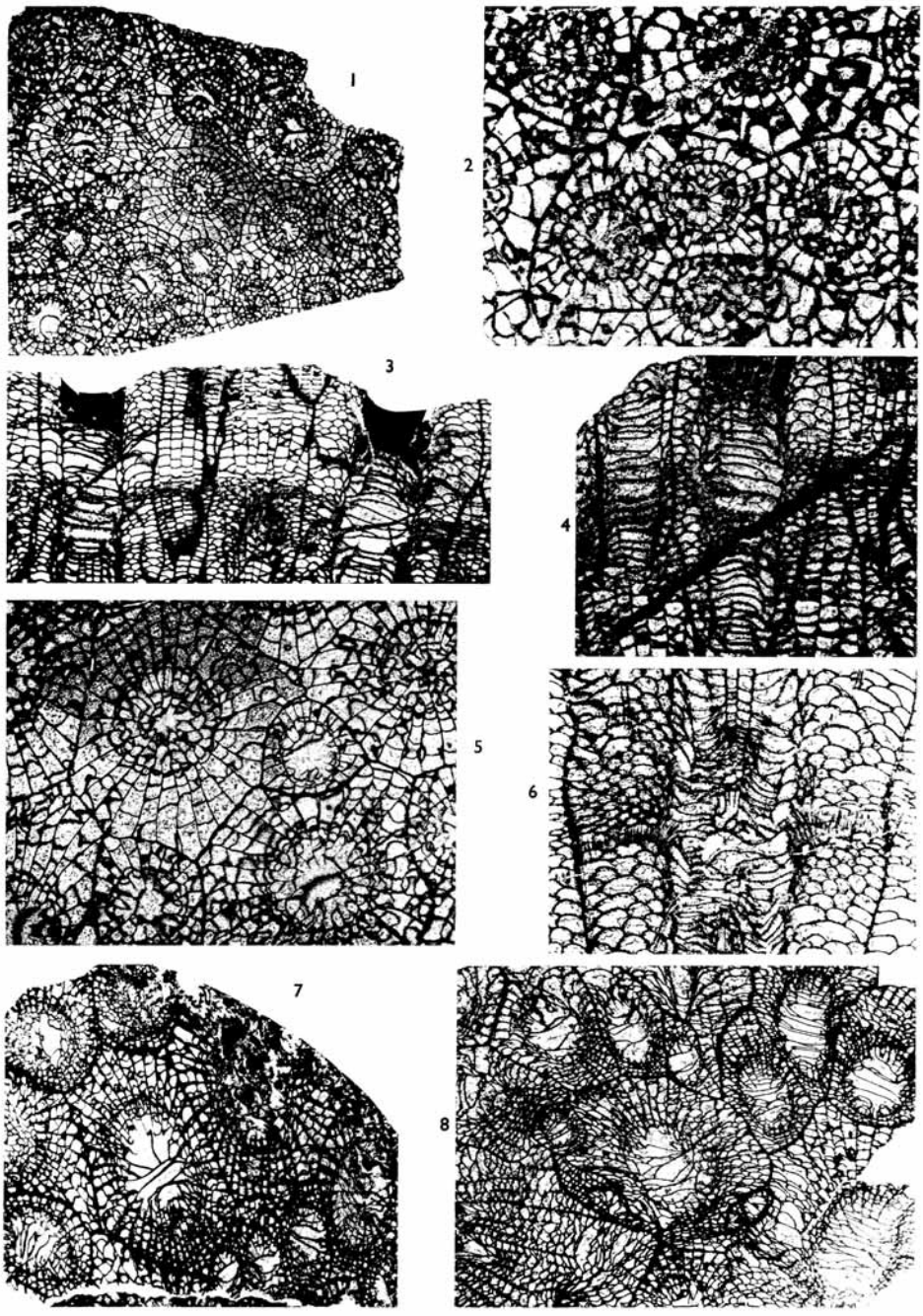
Description. Hexagonaria namnetensis is marked by a relatively small number of septa, with first order septa reaching to, or almost to the axis of the corallite. Little septal dilatation is noted in the majority of corallites, but a few (Pl. 35, fig. 5) do have this characteristic quite well developed. The corallites as seen in transverse section (Pl. 35, figs. 1, 2, 5) depart greatly from equilateral polygons, probably the result of vigorous budding throughout the colony. The buds rapidly develop 18–20 septa, having attained this number by the time epitheca is fully developed between mother and daughter corallites. In adult corallites, the total number of septa, here labeled n, showed a range of 22–35 in 64 individuals of 4 colonies. Means for 4 colonies vary from 24·0 to 29·3 (n).

EXPLANATION OF PLATE 35

Figs. 1, 3, 4, 5. *Hexagonaria namnetensis* (Barrois); Holotype, MCVN. 1, transverse, ×2. 3, longitudinal, ×3. 4, longitudinal, ×4. 5, transverse, ×4. Emsian, Erbray Limestone near Erbray.

Figs. 2, 6. *Hexagonaria namnetensis* (Barrois); MNHNF B44224. 2, transverse, ×5. 6, longitudinal, ×6. Siegenian, Nehou Limestone, from Roquelles, Normandy.

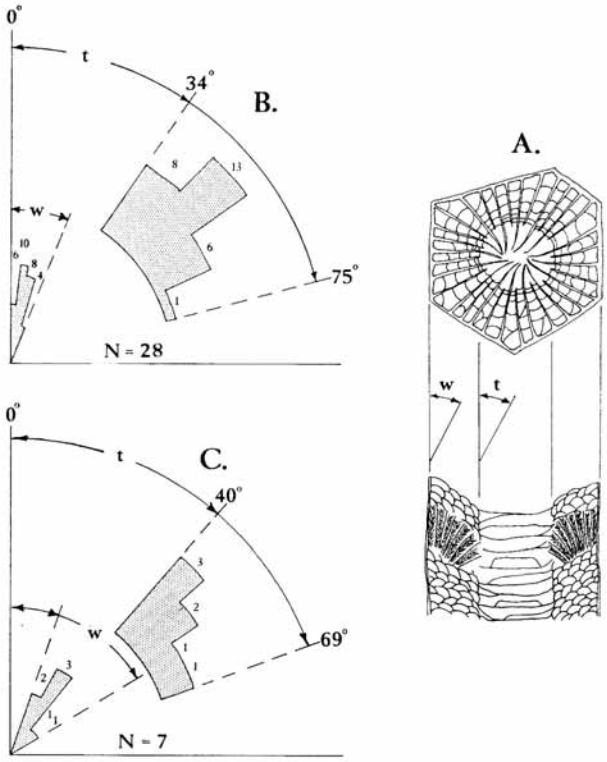
Figs. 7, 8. *Hexagonaria venetensis* (Barrois); Holotype, Collection Lebesconte, MCVN. 7, transverse, ×2. 8, transverse and oblique, ×2. Emsian, Erbray Limestone near Erbray.



SORAUF, *Hexagonaria*

Diameter of tabularium varied from 2·4 to 4·1 mm., with colony means of from 2·8 to 3·6 mm.

In longitudinal section the species shows width of tabularium in mature specimens approximately $\frac{1}{3}$–$\frac{1}{2}$ of the width of the total corallite, (Pl. 35, fig. 4) although recently budded mother corallites show a resultant lessening in width of the affected side. The

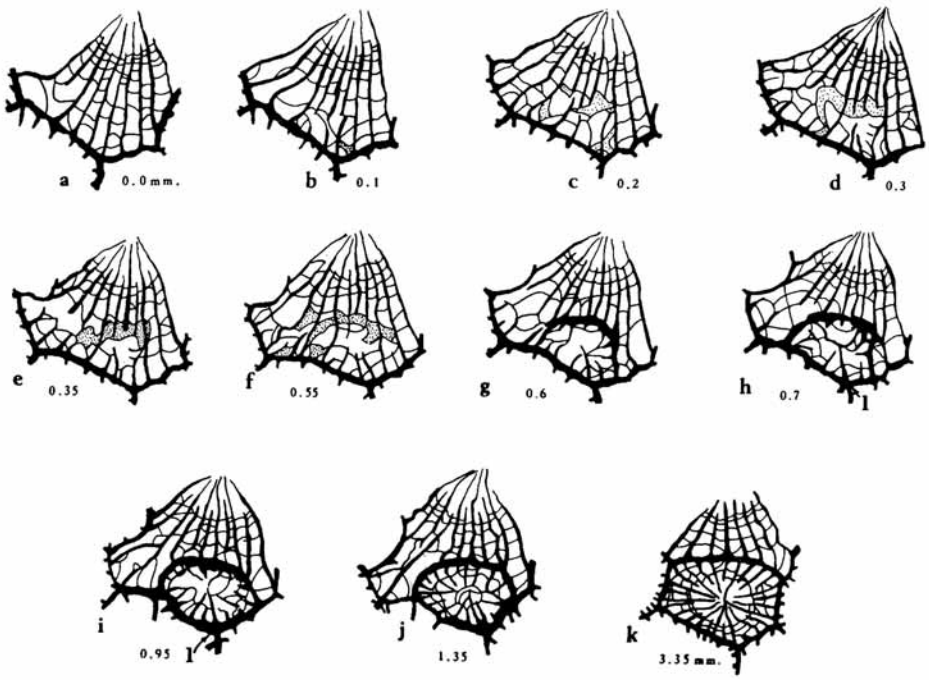


TEXT-FIG. 2. Trabecular angles in *Hexagonaria namnetensis* and *H.* sp. cf. *longiseptata*. A illustrates the method of determining angle W between the intercorallite wall and septal trabeculae, and angle T, the angle between the margin of the tabularium and septal trabeculae. B shows the distribution of readings of W and T for 28 corallites of *H. namnetensis*. C shows distribution of readings for 7 corallites of *H.* sp. cf. *longiseptata*. Pertinent statistics are shown in Table 1.

dissepimentaria are filled with 4–7 rows of dissepiments, and as rate of growth changed there were as many as 7 rows of small dissepiments or as few as 4 rows of larger dissepiments. The horizontal lines of dissepiments are ordinarily oriented nearly perpendicular to the corallite wall, gradually bending downward as the tabularium is approached, but commonly being noticeably reflexed (as in Pl. 35, fig. 6). Such reflexing has been noted in disphyllids (Strusz 1965), and should not be confused with reflexing associated with tight fans of branching septal trabeculae such as those in *Phillipsastraea*.

The tabularium is typically filled with arched tabulae with globose accessory tabellae present periaxially. Where thin-sections strike the exact centre of a corallite it can be noted that long, irregular tabulae are present without, or with few accessory plates. Near septa are seen strongly arched tabulae and tabellae.

The fine structure of the intercorallite walls is 3-layered, showing a central layer of very fine-grained dark calcite (epitheca) between moderately thick prismatic layers of clear fibrous calcite with fibres oriented perpendicular to the epitheca.



TEXT-FIG. 3. Budding sequence in *Hexagonaria namnetensis*. The black-line drawings were prepared directly from photographs of acetate peel prints of serial sections. Fig. 3*a* is the un-budded corallite, and figs. 3*b*–3*k* illustrate the serial development of the daughter corallite. Magnification is ×4.

The septa are unitrabecular (Kato 1963, p. 588). Text-fig. 2 demonstrates that the angle made by septal trabeculae and epitheca is generally less than 22°, while the angle made by septal trabeculae and the outer margin of the tabularium shows a maximum inclination of 34–75° (convex upward arrangement).

Blastogeny. Text-fig. 3 illustrates a typical series of sections through a budding sequence in *H. namnetensis*. The budding encountered within this species was always the type referred to as lateral by Jull (1965, p. 206). Terminology employed here for growth stages is that of Smith (1945, p. 7).

(*a*) *Hystero-brephic stage*. This stage of development begins with the formation of

a concavity in the upper margin of several septa, so that they appear to be broken in the outer dissepimentarium. As Różkowska (1960, p. 15) reported for *Hexagonaria laxa*, budding takes place in the furthest corner from the axis. In the case of *H. namnetensis*, the septa initially 'broken' are one first-order and two adjacent second-order septa. At the same time, there appears to be a thickening of dissepimental calcite in the area later to become the new intercorallite wall. Very early thin septal processes develop from dissepimental folds, as in the right side of text-fig. 3*d* at 0·30 mm.

As seen in text-fig. 3*e* (0·35 mm.), the primary development of corallite shape takes place by the lateral appearance of additional calcite, and interruption of pre-existing septa on both sides of the protocorallite, as illustrated by text-figs. 3*g*, 3*h*, and 3*i*. Epitheca is not noted in the new intercorallite wall until quite late in its development. (Here not until section shown in text-fig. 3*i*, at 0·95 mm.)

(*b*) *Neanic stage*. All text-figures beginning with 3*h*, and extending to include 3*j* are considered as belonging to the neanic stage of *H. namnetensis*, until the tabularium is completely developed. The corallite then has the majority of the characteristics of the species.

Once the wall develops epitheca, septa are quickly inserted, and first and second order septa are established. In the drawings presented in text-fig. 3, it is suggested that the septa labelled *l* is the cardinal or counter-cardinal, and that the septa seen joined to the end of this septum in text-fig. 3*h* are the alar or counter-lateral septa, depending on the identity of the first. Exact identification of these septa is not deemed possible in this sequence, as almost all septa added later are inserted in the quadrant between the alar and the counter-lateral septa, thus furnishing no means of differentiating alar from counter-lateral.

The tabularium, first clearly shown in text-fig. 3*j*, expands, so that it is typically developed in text-fig. 3*k* (3·35 mm.), outlined by several closely spaced dissepiments as seen in the plane of the sections, due to the development of a calicinal pit, with steeply inclined dissepiments present along the walls of this pit.

Remarks. *H. namnetensis* belongs to the group of species that includes *H. hexagona* (Goldfuss); species that are characterized by adorally convex septal trabeculae, progressive axially sloping dissepiments, dilated septa, and the tendency toward development of long first-order septa and axial and periaxial series of tabulae (Sorauf 1967, p. 24). This group has been referred to as the *Hexagonaria hexagona* lineage by Stumm (1948, p. 12). It would appear that the Siegenian and Emsian species, *H. namnetensis*, is closely related to the ancestor of the Frasnian species, *H. hexagona*.

Różkowska proposed the genus *Marisastrum* for those cerioid corals placed by her in the Phillipsastraeacea on the basis of their 'fan-like disposition of trabeculae and presence or absence of horse shoes . . .' (1965, p. 261). It must be assumed that *Marisastrum* is thus characterized by the presence of tight fans of branching septal trabeculae such as those found in *Phillipsastrea* and also in *Marisastrum sedgwicki*, as figured by Różkowska (1965, p. 263, fig. 2). Scrutton (1967, p. 267) placed forms with slightly reflexed calices and broad open fans of the 'disphylloid' type (Strusz 1965, p. 524), with forms more closely allied to *Phillipsastrea* and other genera characterized by tight fans (with branching trabeculae) and a strong tendency toward reflexing of the calicinal platform. In the opinion of this writer, such a grouping is inadmissable. *Hexagonaria hexagona* at

times displays such reflexing (Sorauf 1967, p. 10, fig. 4–1*a*) and even development of a very slight amount of fanning of septal trabeculae of the 'disphylloid' type described by Strusz. Thus, *H. namnetensis* is treated as a species closely related to *H. hexagona.*

Horizon and distribution: H. namnetensis occurs in the Siegenian Nehou Formation of the Cotentin Peninsula of Normandy at Les Roquelles, and in the Emsian Erbray Limestone near Erbray in the Angers Basin in the southern Armorican Massif.

Hexagonaria venetensis (Barrois 1889)

Plate 35, figs. 7 and 8

1889 *Acervularia venetensis* Barrois; p. 41, pl. 1, fig. 2a, 2b, 2c.

Diagnosis. Species of *Hexagonaria* with large corallites, large diameter of tabularia (4–8 mm.), numerous attenuate septa (34–40), and first order septa only somewhat longer than second order, leaving major part of tabularium free of septa. Dissepimentarium typical for genus and tabularium filled with rather complete sloping or flat tabulae.

Description, type specimen. (*Collection Lebesconte*, MCVN.) In transverse view, the type specimen is characterized by a broad open tabularium with a large number of attenuate septa (Pl. 35, fig. 7). In 5 mature corallites observed, the diameter of tabularium (D_t) varied between 5·7 and 6·5 mm., with a mean value of 5·9 mm. The number of septa (n) in the same corallites varied between 39 and 45, with the mean value of 42.

Both first and second order septa are attenuate, being thickest at their periphery. Second order septa are quite long, extending a short distance into the tabularium. First order septa extend only slightly further, leaving fully $\frac{4}{5}$ of the tabularium free of septa. Crowding of dissepimental intersection lines at the inner margin of the dissepimentarium is not well developed, and as a result there is no or little development of an 'inner wall' around the tabularium.

In longitudinal view, the dissepimentaria are characterized by irregularity of size and shape of dissepiments (Pl. 35, fig. 8). As shown in this figure, there may be as many as 5 or 6 rows of dissepiments, or a lesser number of very large dissepiments may fill the dissepimentarium. Shapes vary, as some are flattened, some arched, and some more or less irregular. There is no well-marked change in orientation of the dissepiments in the inner dissepimentarium as in many species of *Hexagonaria.* The tabularium is marked by the presence of sloping or down-warped, flat-bottomed tabulae, almost all complete and fairly widely spaced, with few accessory tabellae.

The fine structure of the walls shows clearly a thin dark line of epitheca in the centre of the walls, with layers of prismatic calcite on each side. The attenuate septa do not give the impression of being 'inserted' in the fibrous layer, as is commonly true in other similar species. The septal fine structure is rather typical for species with attenuate septa. The septal trabeculae make a high angle with the intercorallite wall, and do not make an appreciably higher angle with the tabularium margin. In the one place in the type specimen of *H. venetensis* where septal trabeculae could be closely examined, the angle between septal trabeculae and wall is 63° and between septal trabeculae and margin of tabularium is 68°. These numbers are not considered definitive, as only the one reading was possible.

Remarks. In cutting the type specimen of *Hexagonaria venetensis*, it was necessary to avoid altering the external appearance of the specimen as figured by Barrois. Thus, instead of standard transverse and longitudinal thin sections, each turned out to be somewhat oblique, as shown in Plate 35, figs. 7 and 8. Nevertheless, the specimen is described in terms of transverse and longitudinal views.

Hexagonaria venetensis, with its complete tabulae, broad dissepimentarium, large number of septa, and structure of septal trabeculae would seem to be related to such species as *H. quadrigemina* of the Givetian of Belgium and Germany.

Horizon. H. venetensis was described by Barrois from the Erbray Limestone (Emsian) of Erbray (1889). Other specimens have not been available for study.

Hexagonaria sp. cf. *longiseptata Bulvanker*

Plate 36, figs. 1–5

cf. 1958 *Hexagonaria longiseptata* Bulvanker; p. 182, pl. lxxxix, figs. 2a, 2b, pl. xciii, figs. 1a, 1b.

Diagnosis: Species of *Hexagonaria* characterized by small number (generally 26–30) of attenuate septa reaching into broad tabularium. Dissepimentarium poorly developed, occupying minor part of corallite and composed of 2–3 rows of dissepiments. Tabulae variously developed; in some individuals being complete and subhorizontal, in others largely incomplete and steeply inclined, and arched in still others.

Description. In transverse section (Pl. 36, figs. 1, 3) the species is characterized by irregularity in polygonal outline of corallites, a small number of attenuate to slightly dilated septa, and a broad tabularium accentuated by a narrow dissepimentarium with few dissepiments. Four specimens show a grand mean diameter of tabularium (D_t) of 2·85 mm. and a grand mean number of septa (n) of 26·3 for 68 corallites (N). The total observed range for mature corallites is from 2·2 to 3·5 mm. for D_t and from 22 to 32 for n. The figures given above are dependent somewhat on the subjective decision as to which corallites are mature.

The septa are generally attenuate, being thickest near their point of insertion in the corallite wall. They are characterized by second order septa which extend only to the outer border of the tabularium, while the first order septa reach well into the tabularium, extending almost to the axis of the corallite or slightly withdrawn from this position. There is never any joining or swirling of septa in the axial region. In a number of corallites there is slight dilatation of septa in the inner dissepimentarium. Recrystallization of the specimens makes this feature difficult to ascertain precisely. However, dilatation of septa is certainly not characteristic of the species.

The narrow dissepimentarium is seen in transverse section to occupy only the outer $\frac{1}{4}$–$\frac{1}{5}$ of the corallite and to be composed of generally 2–3 dissepiments (Pl. 36, figs. 1, 3). The intersection of dissepiments in the plane of the thin-section outlines the broad tabularium clearly.

In longitudinal section this narrow dissepimentarium is more strikingly displayed (Pl. 36, figs. 2, 4). The dissepimentarium rarely has more than 4 rows of dissepiments, and more commonly has only 2 or 3 rows, and occasionally only one. In a number of corallites the dissepiments are strongly inclined axially and rather flattened in shape

(Pl. 36, fig. 2), while in others, they are more nearly horizontal in attitude and more globose in shape.

The tabularia are variable in the configuration of contained tabulae. In some (Pl. 36, fig. 4), tabulae are rather evenly spaced, complete, and sub-horizontal to gently sloping, while others (Pl. 36, fig. 2) are characterized by incomplete, irregular, steeply sloping tabulae, and still others are filled with evenly spaced, arched tabulae which show a tendency toward development of axial and periaxial series of tabulae.

The fine structure of the intercorallite walls is typical for cerioid disphyllids, three-layered in nature, with dark, thin epitheca sandwiched between two layers of fibrous calcite. The fine structure of septa (Pl. 36, fig. 5) shows septal trabeculae making angles of 20–58° with the intercorallite wall and angles of 40–70° with the inner margin of the dissepimentarium.

Remarks. This species is assigned a taxonomic position very close to *Hexagonaria longiseptata* Bulvanker. Without a larger collection of coralla from the Lower Devonian of France and the opportunity to study the type specimen of Bulvanker, the two species cannot be regarded as identical with certainty. The specimens from the St. Barthélemy quarry are in most characteristics identical to *H. longiseptata* Bulvanker (1958, p. 182, pl. lxxix, fig. 2a, b). The species are closely similar in size, length of septa, presence of attenuate septa, diameter of tabularium, configuration of tabulae, spacing of tabulae, configuration, and number of dissepiments, and in septal fine structure. The main difference between *H. longiseptata* as described by Bulvanker and *H.* sp. cf. *longiseptata* from St. Barthélemy is in number of septa. Bulvanker reports a total of 20 septa (1958, p. 182), while the French species is characterized by 26–34 septa. Bulvanker did not mention limits of variation in septal number for her species. An additional marked difference between the two occurrances is in the age of enclosing strata. *H. longiseptata* occurs in Upper Devonian rocks (D_3) in the Kuznetsk Basin of Russia.

Horizon. Hexagonaria sp. cf. *longiseptata* was collected from the Angers Limestone of Emsian age in the *Fours à Chaux* quarry in St. Barthélemy, a suburb of Angers.

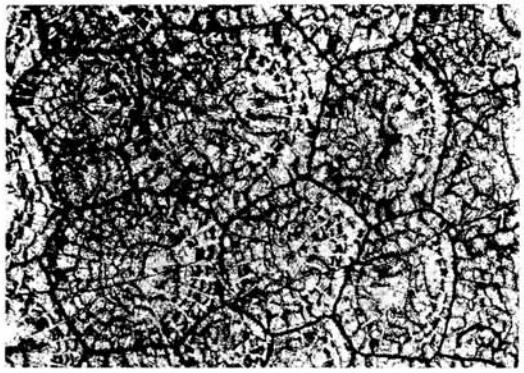
SEPTAL FINE STRUCTURE

The septal fine structure of the three species described herein shows two variations commonly seen in the genus *Hexagonaria*, and allows recognition of relationships of these species with other, well-known species of the genus. The species are characterized by unitrabecular septa, with their configuration seen in longitudinal section as either parallel or convex (Kato, 1963, p. 584).

EXPLANATION OF PLATE 36

Figs. 1–5, *Hexagonaria* sp. cf. *H. longiseptata* Bulvanker. 1, MNHNF B44225, transverse. 2, MNHNF B44226, longitudinal. 3 and 4, MNHNF B44227, transverse and longitudinal, all × 5, and all from Emsian, Angers Limestone, *Fours à Chaux* Quarry, St. Barthélemy. 5, MNHNF B44226, longitudinal view of septum showing septal trabeculae making angle of 20° with intercorallite wall and 63° with margin of tabularium, × 26.

Fig. 6. *Hexagonaria namnetensis* (Barrois); MNHNF B44224, longitudinal, view of septum with adorally convex septal trabeculae paralleling intercorallite wall and making angle of 47° with margin of tabularium, × 18.



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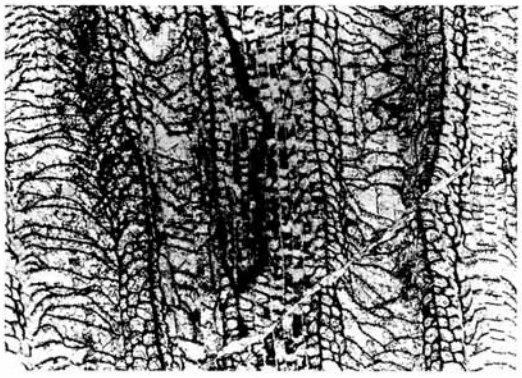

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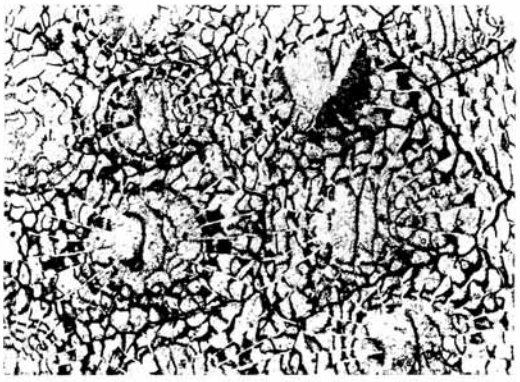

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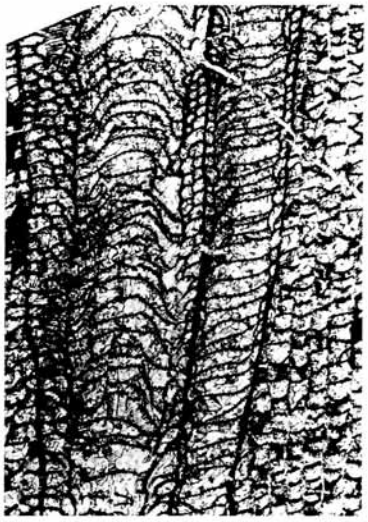

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SORAUF, *Hexagonaria*

Hexagonaria namnetensis is characterized by septa with trabeculae that are convex (Pl. 36, fig. 6). Table 1 shows statistics of angles measured on longitudinal sections of septa, as shown in text-fig. 2. *H. hexagona* from the Frasnian of Belgium has similar configuration of septal trabeculae.

TABLE 1

Statistics and parameters, *Hexagonaria namnetensis* and *Hexagonaria* sp. cf. *longiseptata*, septal fine structure

	Hexagonaria namnetensis		*Hexagonaria* cf. *longiseptata*	
	Angle W	Angle T	Angle W	Angle T
Number of septa examined	28	28	7	7
Mean value	10·4°	50·0°	35·1°	52·5°
Standard deviation (using N-1)	6·1°	8·5°	12°	9·3°
Standard error, mean	1·2°	1·6°	4·5°	3·5°
Standard error, deviation	0·8°	1·1°	3·2°	2·5°
Confidence interval for mean				
99%	7·5–13·3°	46–54°	20·9–49·3°	41·5–63·5°
95%	8·4–12·4°	47·3–52·8°	26·3–43·9°	45·7–59·3°
Confidence interval for deviation				
99%	8·4–12·4°	47·2–52·8°	25·1–45·1°	44·7–60·3°
95%	9·0–11·8°	48·1–51·9°	28·9–41·3°	47·7–57·5°

Implied relationships are discussed under remarks in the species description.

As noted above, only one reliable reading of trabecular angles could be made on the type specimen of *Hexagonaria venetensis*, with an angle of 63° between the intercorallite wall and septal trabeculae immediately adjacent to it, and 68° between the inner margin of the dissepimentarium and septal trabeculae.

Hexagonaria sp. cf. *longiseptata* is characterized by high angles between septal trabeculae and intercorallite walls, as shown in Table 1 and text-fig. 2.

As shown in this figure, septal fine structure, and especially angles formed by septal trabeculae and inter-corallite walls and the inner edge of the dissepimentarium constitute a useful criterion in delineating some groups within the genus *Hexagonaria*. In general, species with the adoral convexity in septal trabeculae are characterized by dissepiments that progressively slope inwards toward the tabularium and by septa that are commonly dilated in the inner dissepimentarium. Although *H. namnetensis* does not show marked dilatation of septa, it would be included with this group. Species with more closely parallel septal trabeculae and high wall angles tend towards having attenuate septa and less change in attitude of dissepiments from one part of the dissipimentarium to another. Both *Hexagonaria venetensis* and *H.* sp. cf. *longiseptata* appear to fall into this group. Although numerical values listed above are not based on statistically valid numbers of readings, the limited variability of these readings suggests that such trabecular angles may well prove to be one more valid characteristic to be employed in defining and differentiating species.

Acknowledgements. This paper grew out of conversations and correspondence between the writer and Dr. H. Lardeux of the Musée National d'Histoire Naturelle in Paris. Dr. Lardeux kindly arranged for the loan of type specimens described in this paper, and aided the writer in numerous ways.

Madame Baudouin-Bodin, curator of the Musée d'Histoire Naturelle in Nantes kindly consented to allow the loan of type specimens in her care. Dr. J. Poncet of the University of Caen loaned specimens for study from the Lower Devonian of Normandy. Mr. V. Jindrich of the Geological Survey of Czechoslovakia helped with photography and prepared serial sections of budding sequences while at the S.U.N.Y. at Binghamton. This manuscript was critically read by Dr. C. T. Scrutton of the British Museum (Natural History), and by Dr. John Jell of the University of Queensland. I wish to thank each for their aid.

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Typescript received 5 July 1968