



Easton, Mississippian cuneate corals

## TRIPLOPHYLLITES (TRIPLOPHYLLITES)

ELLIPTICUS

(White), 1862

Plate 61, figures 1-5, 15; text-figures 6, 7

1865. *Zaphrentis elliptica* WHITE, Boston Soc. Nat. Hist. Proc., vol. 9, p. 31 (1862).
1883. *Zaphrentis elliptica*. WHITE, Twelfth Ann. Rept., U. S. Geol. Geog. Survey Terr. etc., pt. 1, p. 155, pl. 39, figs. 7a, b. (Not figs. 4a, b.) (Advance printing, 1880).
1889. *Zaphrentis carinatus* [sic]. MILLER, North American Geology and Palaeontology, p. 208. (*Nomen nudum* and/or misspelling).
1889. *Zaphrentis elliptica*. MILLER, N. Amer. Geol. and Palaeontology, p. 209.
1889. *Z. [aphrentis] elliptica*. ROWLEY, Amer. Geol., vol. 3, no. 2, p. 115.
1890. *Zaphrentis carinatus* WORTHEN, Geol. Survey Illinois, vol. 8, p. 75, pl. 10, figs. 3, 3a.
1890. *Zaphrentis carinata*. WORTHEN, Geol. Survey Illinois, vol. 8, expl. pl. 10.
1893. *Zaphrentis elliptica*. ROWLEY, Amer. Geol., vol. 12, no. 1, p. 50.
1894. *Zaphrentis elliptica*. KEYES, Missouri Geol. Survey, vol. 4, p. 111, pl. 13, figs. 6a, b.
1897. *Zaphrentis elliptica*. KEYES & ROWLEY, Iowa Acad. Sci., vol. 4, p. 30.
1898. *Zaphrentis carinatus*. WELLER, U. S. Geol. Survey Bull. 153, p. 645.
1898. *Zaphrentis elliptica*. WELLER, U. S. Geol. Survey Bull. 153, p. 647.
1905. *Zaphrentis elliptica*. MERRILL, U. S. Nat. Mus., Bull. 53, pt. 1, p. 703.
1908. *Zaphrentis elliptica*. ROWLEY, Missouri Bur. Mines, ser. 2, vol. 8, p. 38.
1918. *Zaphrentis carinata*. BUTTS, Kentucky Geol. Survey, Mississippian Formations of Western Kentucky, pp. 29, 41 (1917).
1922. *Zaphrentis carinata*. CUMINGS, Handbook of Indiana Geology; Indiana Dept. Cons., Pub. 21, pt. 4, p. 508.
1928. *Zaphrentis elliptica*. WELLER, Missouri Bur. Geol. Mines, ser. 2, vol. 22, pp. 187, 190, 199.

1930. *Triplophyllum carinatum*. CRONEIS, Arkansas Geol. Survey Bull. 3, p. 49.

1943. *Z. [aphrentis] elliptica*. SCHUCHERT, Stratigraphy of the Eastern and Central United States. John Wiley and Sons, Inc., New York, p. 684.

*Description of holotype of Z. elliptica White.*—Coral a curved cone with an elliptical cross-section. Epitheca (slightly eroded) with broad encircling swellings and faint interseptal grooves. Apical portion rather sharply carinate at cardinal and counter positions.

Calyx (diameters 14 by 18 mm.) with a broad smooth floor sloping into the cardinal fossula. Cardinal fossula narrow peripherally and expanded axially with walls of fused axial ends of septa and inner floor consisting of a tabula sloping about 30° into the fossula. Alar pseudofossulae indistinct. Major septa number 38. Cardinal septum becomes very short in upper portion of fossula but traverses lower portion and leans slightly to the right. Right cardinal quadrant with eight septa, right and left counter quadrants with ten septa, and left counter quadrant with eight septa. Counter septum slightly longer and thicker than adjacent majors. Minor septa absent. Tabulae smooth, sloping toward cardinal fossula and down toward epitheca elsewhere.

*Description of paratypes.*—A well preserved paratype (diameters 13.5 by 16 mm) has the calyx inclined 30° toward the cardinal position. Cardinal fossula almost T-shaped axially. Septa number 35. Cardinal septum slopes down into the cardinal fossula and crosses it at its base, leaning to

## EXPLANATION OF PLATE 60

Calyces 2X, lateral and apical views 1X.

- FIGS. 1-6, 10—*Triplophyllites (Triplophyllites) clinatus* (Greene), 1904. 1a, Calyx; 1b, apical view; USNM 115206a. 2a, Calyx; 2b, left alar side; 2c, cardinal side; paratype; AMNH 24044. 3a, Calyx; 3b, cardinal side; 3c, left alar side; holotype; AMNH 24041. 4, Calyx; paratype; AMNH 24043. 5, Calyx; hypotype; USC 408. 6, Calyx; supposed syntype of *Z. capuliformis*; UI, RX 11B. 10a, Calyx; 10b, cardinal side; 10c, left alar side; one of the syntypes of *Z. lanceolatus*; IGS (Worthen Coll.) 2572. (p. 395)
- 7-9—*Triplophyllites (Triplophyllites) clinatus* var. *capuliformis* (Rowley), 1900. 7a, Calyx; 7b, oblique view along the trace of the counter septum; paratype; UI, RX 11A. 8a, Calyx; 8b, left alar side; 8c, cardinal side; holotype; UI, RX 11. 9, Oblique view into calyx; paratype; UI, RX 11C. (p. 397)
- 11—*Hapsiphyllum ulrichi* (Worthen), 1890. 11a, Left alar side; 11b, calyx; 11c, cardinal side; holotype; IGS (Worthen Coll.) 2573. (p. 390)
- 12-14—*Triplophyllites (Triplophyllites) clinatus* var. *bicarinatus* Easton, n. var. 12, Calyx; paratype; USC 406. 13a, Calyx; 13b, cardinal side; 13c, right alar side; 13d, apical view; holotype; USC 280. 14, Calyx; paratype; USC 279. (p. 396)

the left and lying in contact with the side of the counter septum. Right and left cardinal quadrants with six septa, one of these in each quadrant next to the cardinal septum being accidentally broken away at the calyx. Right counter quadrant with 11 majors, left counter quadrant with ten majors. Counter septum the same width as other septa, but longer, extending down the axial edge of the cardinal fossula as a ridge which overlaps the right side of the cardinal septum. Minor septa short, present only in counter quadrants. Alar pseudofossulae distinct.

Another paratype (diameters 11.5 by 14 mm.) has a narrow furrow at the inner end of the cardinal fossula, part of which furrow is occupied distally by the counter septum. Septa number 33. Right and left cardinal quadrants with five septa. Right counter quadrant with ten septa. Left counter quadrant with 11 septa. Counter septum longer than adjacent septa. All septa a trifle thickened except cardinal septum. Cardinal septum short leaning to left in floor of fossula. Alar pseudofossulae rather distinct. Minor septa absent.

A broken paratype shows the fibrous bundles of calcite in the septa inclined apically and axially at about 35°.

A paratype broken longitudinally in the cardinal-cardinal plane shows tabulae spaced 10 per cm., both complete and incomplete, peripherally recurved apically, and slightly irregular in spacing and strength. Dissepiments absent.

*Dimensions.*—Holotype: length, 25 mm. along alar septum.

*Remarks.*—White did not select a holotype for this species. The writer hereby selects the largest of his syntypes (UM 2084) figured herein (pl. 61, figs. 2 a-c) as the holotype.

This species seems to have been derived from *Neozaphrentis acuta* by completing the fusion of the septa bounding the lateral sides of the cardinal fossula, by increasing the size of the corallite and number of septa, by adding secondary septa, and by perfecting the cuneate tendency. This species is close enough to *Neozaphrentis* to give one an insight into the modifications which gave rise to at least one species group of *Triplophyllites*. The principal difficulty in

the evolutionary picture concerns the general absence of dissepiments in this species. No dissepiments were observed in the syntypes, but a large specimen figured by section herein (pl. 61, fig. 15b) has a few dissepiments in late growth. It appears to the writer therefore, that the original concept of *Triplophyllites* must be changed somewhat so that the dissepiments should not be looked for principally in early stages of growth but should be expected to be developed according to the evolutionary stage represented by any particular species. Although this does not provide a sharp distinction between categories of corals, it seems to be all that can be said in the present state of our knowledge of North American corals of this genus. In recapitulation, it appears that the cuneate strain of *Triplophyllites* s.s. was derived from the non-dissepimented *Neozaphrentis acuta*. Advanced stages of *T. ellipticus* show true characters of *Triplophyllites* (such as are shown on pl. 61, figs. 15a, b, d.). Radiation from the type *ellipticus* could have given rise to *T. clinatus* and its relatives. Some of these possibly have dissepiments and others seemingly do not. One suspects that a polyphyletic group may be under consideration. The difficulty, of course, stems from lack of enough variable features to enable one to recognize supposed genetic strains. In any case, however, the species as considered herein are recognizable entities with stratigraphic usefulness. It is to be hoped that enough specimens may some day be collected to enable a student to make a detailed study of the ontogeny of these early *Triplophyllites* and to show patterns of change by percentages as in the case of *Z. delanouei* of Scotland,

In the interests of outlining philosophical problems raised by these particular species, I must point out that *T. ellipticus* as it exists in its types can logically be considered to be a related ancestor of *Clinophyllum*. The inclination of the calyx, nature of septal plan, and strength of the counter septum are quite in accord with this conjecture. On the contrary, the compression of the two groups is not in the same plane, so one cannot draw upon *T. ellipticus* as a near relative without interspersing intermediate forms which are not known to exist. More-

over, the stratigraphic distribution is wrong. More work needs to be done on the origin of *Clinophyllum*.

*Description of the holotype of Z. carinata Worthen.*—Corallite a curved and compressed cone, the apical region being somewhat flatter than the calical region. Epitheca smooth except for one deep depression near the calyx marking a period of rejuvenescence, and for several other faint encircling depressions. Calyx 8 mm. deep, ovate. Cardinal fossula narrow, deep, and located on the concave side of the corallite. Major septa number 32 or 33, there being about five in each cardinal quadrant and ten in each counter quadrant. The cardinal septum is very short. The counter septum is shorter than neighboring majors and lies in a shallow fossula.

*Dimensions.*—Length (incomplete) of cardinal side, 20 mm.; calical diameters 16 mm. by 13.5 mm.

*Description of hypotypes.*—Three specimens from Quarry, Iowa, have the external features of the species. One of these has been sectioned.

*Section in early maturity* (12 by 15 mm.).—Septa very much thickened by stereoplasm, the axial portion being a dark line. Loculi very narrow, with tabular intersections but no dissepiments observed. Cardinal septum very long, narrow, slightly swollen axially. Counter septum slightly thicker than adjacent majors. Alar pseudofossulae slightly wider than adjacent loculi. On one half of the section there are five septa in the cardinal quadrant and ten in the counter quadrant. Total septa probably 32. Minor septa absent.

*Section in late maturity* (diameters 14 by 17 mm.).—Septa slightly thickened by stereoplasm and with a dark axial line. Cardinal septum long, but discontinuous (probably with a central sag along its upper edge causing it to leave the plane of the section and then reenter it) and bent to the right. Cardinal fossula very much swollen axially. Counter septum half again as thick as adjacent septa. Six septa in each cardinal quadrant and 12 in each counter quadrant, total being 38. Septa are somewhat withdrawn from the axial region. Minor septa not observed. Tabulae in axis and between

septa. Dissepimental intersections sparse. Alar pseudofossulae distinct.

At a slightly later stage minor septa appear and dissepiments are distinctly present. Septal retreat is more pronounced. Cardinal septum is shorter.

*Localities.*—15, 16, 17 (type locality), 18.

*Occurrence.*—This species occurs in the Maynes Creek member of the Hampton formation of Iowa and in the "Keokuk group" of Kentucky.

*Material.*—Specimens studied: 11. Syn-types, UM (White Coll.) No. 2084. Figured hypotype (this paper), USNM No. 115203A. White's figured hypotype, USNM 115203B. Unfigured hypotypes, USNM No. 115204.

#### TRIPLOPHYLLITES (TRIPLOPHYLLITES)

##### CLINATUS (Greene), 1904

Plate 60, figures 1-6, 10; text-figure 9

1890. [*Zaphrentis lanceolatus*]. WORTHEN, Illinois Geol. Survey, vol. 8, pl. 10, fig. 4b.

1904. *Zaphrentis clinatus* GREENE, Contributions to Indiana Palaeontology, pt. 19, p. 187, pl. 56, figs. 6-9.

1906. *Zaphrentis clinatus*. BEEDE, in Cumings and Beede, Indiana Dept. Geol. Nat. Res., 30th Ann. Rept., pp. 1204, 1373, pl. 11, figs. 1-1c.

1922. *Z. [aphrentis] clinatus*. CUMINGS, Handbook of Indiana Geology: Indiana Dept. Cons., Pub. 21, pt. 4, p. 505.

*Description of holotype.*—Corallite a modified elliptical cone curved in the direction of the cardinal fossula. The cross-section is tear drop shaped almost to the calyx, where it becomes ovate; the pointed edge of the tear drop cross-section follows the trace of the counter septum. The corallite is compressed more on the counter than on the cardinal side and has therefore one acute edge and one rounded edge. Theca with faint longitudinal markings.

Calyx shallow, 3 mm. deep at the inner edge of the fossula. Cardinal fossula deep, narrower at the ends than in the middle, flaring at the calyx floor. Alar pseudofossulae longer and slightly wider than other loculi. Counter fossula shallow, resulting only from the depression of the counter septum. Cardinal septum very short in the calyx but reaching the inner edge of the cardinal fossula at its floor and leaning to the right. Right and left cardinal quadrants with six major septa and no minors. Right and left counter quadrants with ten major

septa. Minor septa are best developed in the right counter quadrant; all are very short. Alar septa slightly higher than other septa in cardinal quadrants, and, therefore, extend onto the calyx floor. All 34 major septa meet to form the fossular wall. Tabulae not observed. Theca rather thick.

*Dimensions.*—Holotype 18.5 mm. high; calyx 14.5 mm. long and 12 mm. wide. One paratype's calyx is 14 mm.  $\times$  13 mm.; another is 16.5 mm. by 15 mm.

*Paratypes.*—The smallest paratype (calical diameters 8.5 mm.  $\times$  11 mm.) has 31 major septa, no minor septa. Alar pseudofossulae are distinct.

The second paratype (diameters 13 mm.  $\times$  14 mm.) has 33 major septa, a few minor septa in the counter quadrants, indistinct alar pseudofossulae, and a depression on the calical floor on the counter side of the cardinal fossula.

The largest paratype (diameters 15.5 mm.  $\times$  16.5 mm.) has 33 major septa, minors in all but a few loculi, and fairly distinct alar pseudofossulae.

*Material.*—Specimens studied: 14. Holotype: AMNH Nos. 24042–24044. Hypotypes: USC Nos. 281, 408; syntype of *Z. lanceolatus* Worthen, 1890, pl. 10, fig. 4b; IGS (Worthen Coll.) No. 2573; USNM Nos. 115205, 115206, 115206a; UI (Rowley Coll.) No. RX 11B which is a syntype of *Z. capuliformis*.

*Localities.*—1, 3, 4, 5, 23?

*Occurrence.*—The species is known with certainty from the Warsaw (Harrodsburg) and Salem limestones. It is known doubt-

fully from the lower Burlington limestones.

*Remarks.*—The syntypes of *Z. capuliformis* contain one specimen (UI No. RX 11B) which is a typical *T. clinatus*. The mode of preservation closely resembles that of corals from the Salem limestone at Lanesville and some other localities in Indiana. It is not at all like typical Burlington preservation. Although one cannot say definitely that it did not come from the lower Burlington limestone at Louisiana, Missouri, one certainly is prone to doubt it.

The calyx of this coral (diameters 13 by 16 mm.) has a long cardinal fossula extending two-thirds the calical diameter and is broadest about two-thirds of the length, tapering at both ends. Major septa total 32. Cardinal septum is a short ridge which only reaches the deepest part of the fossula. Cardinal quadrants each with six major septa and only rare indistinct minor septa. Counter quadrants each with nine major septa (the first of each being very short) and short minor septa. Counter septum shorter and lower than adjacent majors. The counter edge of the coral has a low sharp keel.

TRIPLOPHYLLITES (TRIPLOPHYLLITES)  
CLINATUS

var. BICARINATUS Easton, n. var.

Plate 60, figures 12–14; text-figure 10

*Diagnosis.*—*Triplophyllites clinatus* with a keel centered at the position of the cardinal septum as well as having one at the position of the counter septum.

EXPLANATION OF PLATE 61

Calyces and sections 2 $\times$  except as noted, lateral and apical views 1 $\times$ .

- FIGS. 1–5, 15—*Triplophyllites (Triplophyllites) ellipticus* (White), 1862. 1, Calyx; paratype. 2a, Cardinal side; 2b, calyx; 2c, right alar side; holotype. 3c Calyx; paratype. 4, Side view from broken right cardinal quadrant into interior, showing nature of septal fibers, 2 $\times$ ; paratype; figures 1–4 UM (White Coll.) 2084. 5a, Cardinal side; 5b, apical view; 5c, left alar side; 5d, calyx somewhat obscured by chert filling; holotype of *Z. carinata* Worthen; IGS (Worthen Coll.) 2564. 15a, Cardinal side; 15b, section in late maturity; 15c, section in early maturity; 15d, right alar side; hypotype; USNM 115203a; this specimen illustrates stages later than that present in the holotype. (p. 393)
- 6, 7—*Neozaphrentis acuta* (White & Whitfield), 1862. 6a, Cardinal side; 6b, calyx; 6c, right alar side; holotype; AMNH 6366/1. 7, Calyx; paratype; AMNH 6366/1. (p. 391)
- 8—*Triplophyllites (Homalophyllites) sp.* UA (Stoyanow Coll.) unnumbered. 8a, Right alar side; 8b, counter side; 8c, calyx. (p. 399)
- 9—*Triplophyllites (Homalophyllites) reversus* (Worthen), 1890. 9a, Calyx, 1 $\times$ ; 9b, right alar side; holotype; IGS (Worthen Coll.) 2567. (p. 398)
- 10–14—*Cyathoxonia venusta* (Greene), 1904. 10, Calyx; hypotype; AMNH 24045. 11, Calyx; hypotype; AMNH 24046. 12, Calyx; hypotype; AMNH 24047. 13a, Left alar side; 13b, cardinal side; hypotype; AMNH 24048. 14a, Calyx, 6 $\times$ ; 14b, right alar side; 14c, cardinal side; holotype; AMNH 23412. (p. 388)