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## NEW OCCURRENCES OF THE RUGOSE CORAL *RHIZOPHYLLUM* IN NORTH AMERICA

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*Abstract.*—*Rhizophyllum* is known from Middle or Upper Silurian rocks in Tennessee, Kentucky, Indiana, California, Nevada, Alaska, and Maine; from Lower Devonian rocks in Nevada; and from probable Middle Devonian rocks in Alaska. Four of these occurrences are first noted here, and specimens from Alaska, California, Nevada, and Maine are illustrated. The externally similar *Calceola* is not known to occur in North America.

The genus *Rhizophyllum* has worldwide distribution in rocks of Late Silurian and Early Devonian age; it occurs less commonly in rocks of probable Middle Silurian (Wenlock) and early Middle Devonian (Eifelian) age. In North America, *Rhizophyllum* is now known from coast to coast in rocks representing its full age range.

*Rhizophyllum* is a near relative of the genus *Calceola*, with which it has often been confused because of external similarity. *Calceola* is apparently restricted to the Middle Devonian (Eifelian and Givetian) and is widely distributed on most continents but is not known from North America. Reported occurrences of *Calceola* in North America are numerous, but all so far have been based on the similar-looking *Rhizophyllum*.

The purpose of this contribution is to illustrate and briefly describe specimens of *Rhizophyllum* from Alaska, California, Nevada, and Maine, where no specimens have previously been described or in some cases even noted, and to point out that the "*Calceola*" from Alaska listed by Kindle (1907) and later by Kirk (*in* Buddington and Chapin, 1929) is actually a *Rhizophyllum*.

Helen Duncan and C. W. Merriam read the manuscript and made many helpful suggestions which were accepted in the final version; both provided specimens and information on occurrences. Thin sections were prepared by W. C. Pinckney, Jr.; photographs are by the author.

### PREVIOUSLY NOTED OCCURRENCES

#### Middle or Upper Silurian (Niagaran)—Tennessee, Kentucky, and Indiana

Seven nominal species of *Rhizophyllum* (as *Calceola*) were described from the Brownsport Formation in Tennessee and the Louisville Limestone in Kentucky and southern Indiana by Roemer (1854), Safford (1860), Lyon (1879), Hall (1882), and Davis (1887). Prior to this, Troost (1840) had described some Tennessee specimens as *Calceola sandalina* Lamarek (type species of *Calceola*). Bassler (1915, p. 157–158) grouped all of these in three species which he referred to "*Calceola (Rhizophyllum)*". No review of these has since been attempted, but additional specimens of two of the three species were illustrated or described by Foerste (1931) and by Amsden (1949).

The Brownsport and Louisville Formations are of Niagaran (Wenlock or early Ludlow) age.

#### Middle or Upper Silurian—Great Basin, California, and Nevada

Stauffer (1930, p. 107, pl. 12, figs. 2–3) described and illustrated a single specimen of "*Calceola sandalina* Lamarek" from a section near Kearsarge, Calif. that he considered to be Devonian in age (1930, p. 85–89). Subsequently, Waite (1953, p. 1521) reidentified the coral as *Rhizophyllum* and dated the beds as "late Niagaran or early Cayugan".

Ross (1963) restudied the stratigraphy and named the formations involved. Merriam (*in* Ross, 1963, p. 83) listed *Rhizophyllum* among other corals from the Vaughan Gulch Limestone. Through the courtesy of C. W. Merriam, I have been able to examine the specimen he studied, and a brief description is included under *Rhizophyllum* sp. D. Apparently Merriam's *Rhizophyllum* is from the same stratigraphic unit and locality as Stauffer's.

Merriam (1963, p. 37) listed *Rhizophyllum* from the Silurian at Ikes Canyon, Toquima Range, Nev. This is the first published report of *Rhizophyllum* from Nevada.

#### Middle(?) Devonian—southeastern Alaska

Kindle (1907, p. 325–327) listed fossils from a lower as well as an upper division of the “massive limestone of Long Island, Kasaan Bay”. From the upper division (Kindle collection 819) he listed *Calceola* cf. *sandalina* Lamareck with a few other corals and 52 species of brachiopods, mollusks, and arthropods. He regarded the upper fauna as Middle Devonian in age.

Kirk (*in* Buddington and Chapin, 1929, p. 99–101) reexamined Kindle’s collections and made minor changes of identification, but repeated *Calceola* cf. *sandalina*. Kirk considered Kindle’s upper and lower faunas to be the same and thought that they might be Early Devonian but were more likely Middle Devonian in age.

The identification of *Calceola* cf. *sandalina* in both reports was based on a single individual which was not sectioned. It is described and illustrated here as *Rhizophyllum* sp. B.

Corals in the Kindle collection have been sectioned and restudied, and are listed in the following table. New identifications are in the left column, while the names assigned to the same specimens by Kindle and later by Kirk are in the right column.

<u>This report</u>	<u>Kindle (1907)</u>
<i>Amphiphora</i> sp. (stromatoporoid)	<i>Syringopora</i> sp.
<i>Aulocystis</i> sp.	<i>Cyathophyllum</i> sp.
<i>Favosites</i> sp.	<i>Favosites</i> cf. <i>F. radiceformis</i>
<i>Thamnopora</i> sp.	Not identified
<i>Eddastraea?</i> sp.	<i>Cyathophyllum</i> sp.
<i>Rhizophyllum</i> sp. B	<i>Calceola</i> cf. <i>C. sandalina</i>
<i>Pseudamplexus</i> sp. cf. <i>P. princeps</i> Etheridge	<i>Orthophyllum?</i> sp.
stauriid coral	<i>Cyathophyllum</i> sp.
indeterminate cyathophylloid	<i>Zaphrentis</i> sp.

The coral assemblage is either Early or Middle Devonian in age. The genus *Eddastraea* and *Pseudamplexus princeps* are known from both Lower and Middle Devonian rocks of Australia (Hill, 1956, p. 306; Hill, 1950, p. 142). The stromatoporoid genus *Amphiphora* indicates a probable Middle Devonian age for the collection.

#### Miscellaneous records

North American examples of *Rhizophyllum* or “*Calceola*” have been formally described only from the Tennessee-Kentucky-Indiana area. Other listings and citations known to the author have been discussed in the preceding paragraphs but it is likely that some records have been missed since a comprehensive review of all literature dealing with the Silurian and Devonian

of North America is impractical. Bassler (1950) presented extensive lists of corals by formation and geographic area but noted only the Tennessee-Kentucky-Indiana occurrences of “*Calceola*” in North America.

Conrad (1840, 1841) in his preliminary reports on the paleontology of New York, twice mentioned “*Calceola*”. His *Calceola plicata* (Conrad 1840, p. 207) is a *Platyceras* (Hall, 1859, p. 334). His *Calceola indenta* (nomen nudum, Conrad, 1841, p. 37) was listed as a “univalve” along with gastropods, cephalopods, a conulariid, and a tentaculitid. It seems likely that the 1841 specimen was not a coral, but I have not found a later reference to it or attempted to trace the specimen.

#### NEW OCCURRENCES

##### Upper Silurian—southeastern Alaska

USGS 1005–SD. Vermont marble prospect, south shore of Kosciusko Island, between Edna Bay and Holbrook. Collection of Edwin Kirk, 1917.

Brachiopods from this locality were described by Kirk and Amsden (1952) with a brief summary of their occurrence and stratigraphy. On the basis of the brachiopods, Kirk and Amsden (1952, p. 53) suggested an “Upper Silurian” age for the collection.

In addition to the brachiopods, collection 1005 includes tabulate and rugose corals and bryozoans. The following corals have been identified by the present author: *Heliolites* spp., *Thamnopora* sp., *Cystiphyllum* sp., *Rhizophyllum* sp. A, and *Tryplasma* spp. These are suggestive of a Late Silurian age but are not so restricted. The identification of *Rhizophyllum* is based on five specimens that are described in a following section.

##### Silurian(?)—northwestern California

USGS 5922–SD. Dislocated block of limestone, 4 by 5 by 8 feet, on west bank of Trinity River in the center of sec. 2, T. 32 N., R. 10 W., Weaverville quadrangle, Trinity County. Collected by W. P. Irwin, 1961.

A small collection of fossils, principally corals, was submitted by W. P. Irwin for examination and age determination. In a written communication to Irwin, Helen Duncan (October, 1961) listed “cystiphyllid corals (*Rhizophyllum?*)” among other forms and indicated that the age of the collection was Silurian or Devonian, more likely Silurian. With the help of additional sections, the presence of several specimens of *Rhizophyllum* has been confirmed. These are described below as *R.* sp. C. In addition, the associated corals have been restudied by Miss Duncan and myself, and the following list is the result of our joint efforts: heliolitid coral fragments, *Rhizophyllum* sp.

C, *Spongophylloides?* sp., streptelasmatoïd corals, *Tryplasma?* sp., *Zelophyllum?* sp. The corals are badly recrystallized and somewhat distorted in shape due to metamorphism, and most of the identifications are queried. In spite of this, the apparent growth form of *Rhizophyllum* sp. C, the probable presence of *Spongophylloides* and *Zelophyllum*, and the internal morphology of the streptelasmatoïds, are all strongly suggestive of Wenlock or Ludlow (Middle or Late Silurian) age.

The loose block from which the corals were collected was in an area mapped as Bragdon Formation (in central metamorphic belt of Irwin, 1960, p. 18). The Bragdon is considered to be Mississippian in age but contains fragments of older fossiliferous limestones in some conglomerate beds (Irwin, 1960, p. 18).

#### Lower Devonian—Nevada

USGS 6267-SD. Unnamed limestone unit forming a prominent ledge on the east side of Coal Canyon, at an elevation of approximately 6,280 feet; SE¼ sec. 17, T. 25 N., R. 49 E., northern Simpson Park Mountains, Horse Creek Valley 15-minute quadrangle, Eureka County, Nev.; collected by M. R. Murphy, 1957 (J. G. Johnson, written communication, 1963).

The following corals were present in a collection submitted for identification by J. G. Johnson, California Institute of Technology: *Favosites* sp., *Endophyllum* sp., *Mucophyllum* sp., *Papiliophyllum elegantulum* Stumm, *Rhizophyllum* sp. cf. *R. enorme* Etheridge, and cystiphylloid and chonophylloid corals. The identification of the *Rhizophyllum* is based on a single specimen described below.

*Papiliophyllum elegantulum* suggests an Early Devonian age as the species is most common in the *Spirifer kobehana* zone of Merriam (1940, p. 52-53). Merriam considered the zone to be Early Devonian, Oriskany or later, in age, and subsequent workers have agreed with this evaluation. *Endophyllum* is principally a Devonian coral, but species have been described from the Upper Silurian of Europe (Prantl, 1952). *Mucophyllum* is a Middle and Upper Silurian genus that has not been described or illustrated from younger rocks although there are incidental references to Devonian occurrences (for example, Wang, 1950, p. 228). The other listed corals could be either Silurian or Devonian.

As a whole, the corals support an Early Devonian age. The presence of *Mucophyllum* suggests that the fauna may represent an early part of the early Devonian.

According to Johnson (written communication, 1963), who is describing the brachiopods, the unnamed limestone from which the corals were collected is of Gedinnian (early Early Devonian) age and "is overlain by the

Rabbit Hill Formation [Merriam, 1963, p. 42-44] with an upper Gedinnian brachiopod fauna." Further, "the Rabbit Hill is in turn overlain by the Nevada Formation with the zone of *Acrospirifer kobehana* in which *Papiliophyllum elegantulum* is typical. Accordingly, the occurrence of *P. elegantulum* in the unnamed limestone extends the range of the species considerably downward".

#### Upper Silurian—Maine

USGS 6525-SD. On the boundary line between the Spider Lake and Telos Lake quadrangles, on the shore of Third Lake Mattagamon. Collected by Bradford A. Hall, University of Maine, 1961.

A collection of corals which was submitted for identification by B. A. Hall, includes the following: *Cladopora?* sp., *Favosites* sp., *Halysites* sp., *Heliolites* sp., *Syringopora* sp., "*Cystiphyllum*" sp., *Disphyllum* sp., *Entelophyllum* sp., *Rhizophyllum* sp. cf. *R. gotlandicum* (Roemer), and *Triplasma?* sp. The coral assemblage is definitely Silurian, either Wenlock or Ludlow in age. Brachiopods from the same collection have been studied by A. J. Boucot, California Institute of Technology; they indicate a Ludlow (Late Silurian) age (Boucot, written communication, 1962).

The identification of *Rhizophyllum* is based on a single specimen which is described and illustrated below.

#### SYSTEMATIC DESCRIPTIONS

##### Genus *Rhizophyllum* Lindström

*Rhizophyllum* Lindström, 1866a, p. 287; 1866b, p. 411; 1883, p. 22; Sherzer, 1891, p. 296; Hill, 1940, p. 394; Wang, 1948, p. 1, 3; Hill, 1956, p. 314.

*Calceola* of many authors (including all known descriptions or citations of North American specimens).

*Type species.*—By monotypy, *Calceola gotlandica* Roemer, 1856, p. 798; Silurian, Island of Gotland, Sweden.

*Diagnosis.*—*Rhizophyllum* includes calceoloid rugose corals with a semicircular operculum which articulates on the flat, counter side of the corallum. The interior is filled with arched dissepiments and tabellae arranged in an inverted cone pattern. Septa are acanthine or laminar and are limited to the flat side; the counter septum is commonly longer and thicker than the other septa. The wall on the flat side of the corallum is formed by the fusion of the marginal edges of the septa; the curved part of the wall is apparently formed in the same way, although the septa do not project into the lumen even as septal ridges. The axis is straight or curved. The corallum in some species was supported by radiceform processes.

*Discussion.*—Lindström (1866a, b) established the genus *Rhizophyllum* to separate the "*Calceola*" with

cystiphylloid internal structure from typical *Calceola* with stereoplasm-filled interiors. He discussed operculated corals at length (1866a, b, 1883) and placed all of the American "*Calceola*" in two species of *Rhizophyllum*.

Bassler (1915) considered *Rhizophyllum* to be a subgenus of *Calceola* and was followed in this usage by Foerste (1931) and Shimer and Shrock (1944). Sherzer (1891) and Amsden (1949) are the only two American paleontologists who have published taxonomic papers using *Rhizophyllum* as a genus; European and Australian workers have recognized the genus since its first description.

*Rhizophyllum* ranges from the Middle Silurian (Wenlock) to the lower Middle Devonian (Eifelian). Species have been described from rocks of both Silurian and Devonian age in Europe, Asia, Australia, and North America. Middle Devonian occurrences are uncommon but have been reported from the Eifelian of Mongolia (Spassky, 1960, p. 124–125) as well as from Alaska (this article). Hill (1942, p. 13–16) reported *Rhizophyllum* and *Calceola* from the same limestone in Queensland, but she concluded that the age was latest Early Devonian.

*Descriptions.*—The following descriptions are of specimens rather than species, 1 being based on 5 specimens, 1 on 10 specimens, and the other 4 on one specimen each. Two of the "species" are compared with previously named species that are morphologically similar; at least one "species" is new but formal description must await the acquisition of more material.

The dimensions of all specimens described are given in millimeters. Length was measured in a straight line from the counter side of the calice margin to the apex; since most specimens are incomplete at one or both ends, the figures represent minimum length. The diameters were measured at the calice margin or at the uppermost complete growth line.

#### ***Rhizophyllum* sp. A**

Figure 153.1a–e, 153.2a–j, 153.3b

*Description.*—Five specimens of solitary *Rhizophyllum*, lacking radiform processes probably represent a new species. Two cycles of growth lines are prominent on the exteriors; where the outer surface is worn, the traces of the septa can be seen on both flat and convex sides.

In transverse section the counter septum is two or more times the length of the other septa and is thickened to a spindle shape. The septum is formed of calcite fibers radiating upward and from the center of the spindle within an outer sheath of lamellar tissue. This gives an elongate rosette appearance in transverse section and a fan pattern in longitudinal section.

Other septa are numerous and closely spaced; they are enveloped in lamellar tissue but the microstructure of their inner portions has not been observed.

In longitudinal section, the dissepiments are very steep and elongate near the curved, cardinal side but almost horizontal near the counter margin. From the counter side, the dissepiments steepen toward the eccentric axis about which the tabellae are large and horizontal.

Measurements are as follows:

Specimen (USNM No.)	Length (mm)	Diameter (mm)	
		Major	Minor
121200	14	12.7	7.1
121201	19	17.2	9.6
121202	26	27.2	11.8
121203	24	21.8	11.0
121204	--	18.5	10.1

*Discussion.*—*R. sp. A* is characterized by its inflated counter septum. A similar structure is seen in *R. gotlandicum* of Rozkowska (1946, p. 145–146, 154–155, pl. 5, figs. 4a–b) from the Silurian of Podolia. The Podolian material differs in having comparatively few, but large dissepiments and tabellae. *R. gotlandicum* of Soshkina (1937, p. 82, pl. 19, fig. 1–2) from the Upper Silurian of the Urals, lacks the prominent counter septum but is similar in other respects. Typical *R. gotlandicum* (Lindström, 1866a, p. 287, pl. 30, fig. 10–15, pl. 31, fig. 1–8; 1883, p. 23, pl. 3, fig. 1–12, 18, pl. 4, fig. 7) from the Middle and Upper Silurian of Gotland, has a less prominent counter septum and reduced (acanthine?) lateral septa; in addition, typical *R. gotlandicum* has numerous supporting radiform processes.

*Material.*—Five specimens from the Upper Silurian of Alaska (USGS 1005–SD; see stratigraphic discussion). Illustrated specimens, USNM 121200 to 121203. Unillustrated specimen, USNM 121204.

#### ***Rhizophyllum* sp. B**

Figure 153.1f,g

*Description.*—A single specimen of solitary *Rhizophyllum* from the Devonian of Alaska, has a curved, conical shape and lacks radiform processes; dimensions are: length, 15+ mm; and diameter, 11.4 by 20.7 mm. The exterior is marked by growth rugae. In a transverse section, 26 discrete septa are present along 15 mm of the straight margin; the septa are vertically discontinuous and may be acanthine. The presumed counter septum is only slightly longer than the other septa. Dissepiments are small and elongate; large tabellae surround the eccentric axis. A neanic section indicates that the dissepimentarium was relatively narrow in early growth stages, but ephebic and neanic sections are similar in other respects.

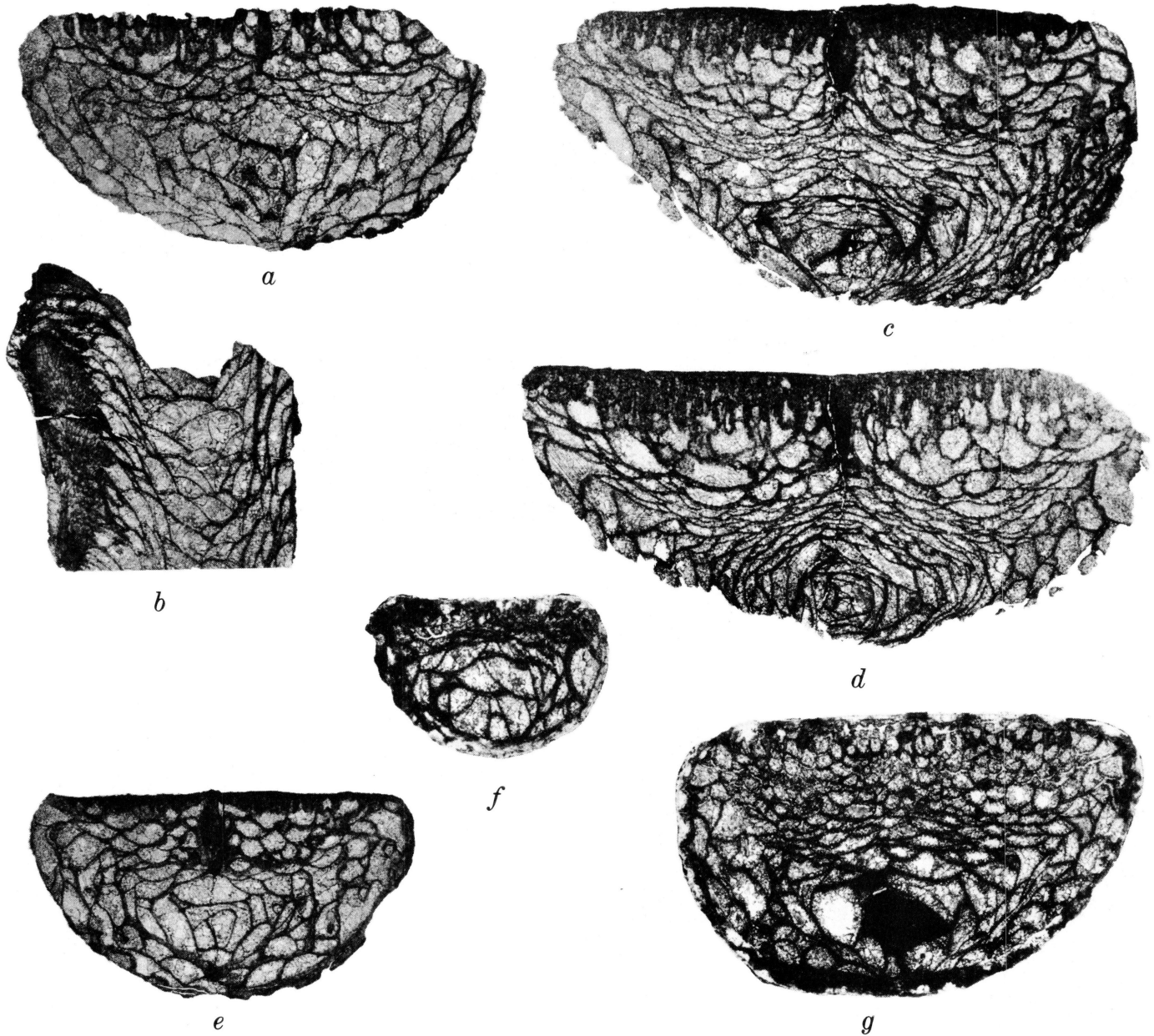


FIGURE 153.1.—*Rhizophyllum* sp. A and sp. B. The counter septum is toward the top of the plate in the transverse thin sections and to the left in the longitudinal thin section. All specimens  $\times 4$ . *a-e*, *Rhizophyllum* sp. A; ephebic sections; *a-b*, USNM 121203; *c-d*, USNM 121202; *e*, USNM 121201; Upper Silurian, Alaska. *f-g*, *R.* sp. B; neanic and ephebic section; USNM 140899; Middle(?) Devonian, Alaska.

*Discussion.*—The one available specimen is morphologically similar to *R. robustum* Shearsby (1906, p. 548, pl. 26, fig. 1-6; Hill, 1940, p. 396, pl. 11, fig. 11a-b) from the Silurian of New South Wales. *R. robustum* differs in being more erect and in having finer tabellae and occasional radiciform processes.

*Material.*—One specimen from the Middle? Devonian of Alaska (Kindle 897; see stratigraphic discussion). Illustrated specimen, USNM 140899; collected by E. M. Kindle, 1905.

#### ***Rhizophyllum* sp. C**

Figure 153.4 *a-e*

*Description.*—Ten or more specimens of a small *Rhizophyllum* are known from transverse sections only. The specimens were found in 2 groups, 1 with 3 or more individuals and the other with 7 or more; the presence of numerous radiciform processes and the spatial relationships of the individuals suggest that they occurred in clumps or small colonies. Individual diameters range from 2.5 by 3.0 mm to approximately 5 by

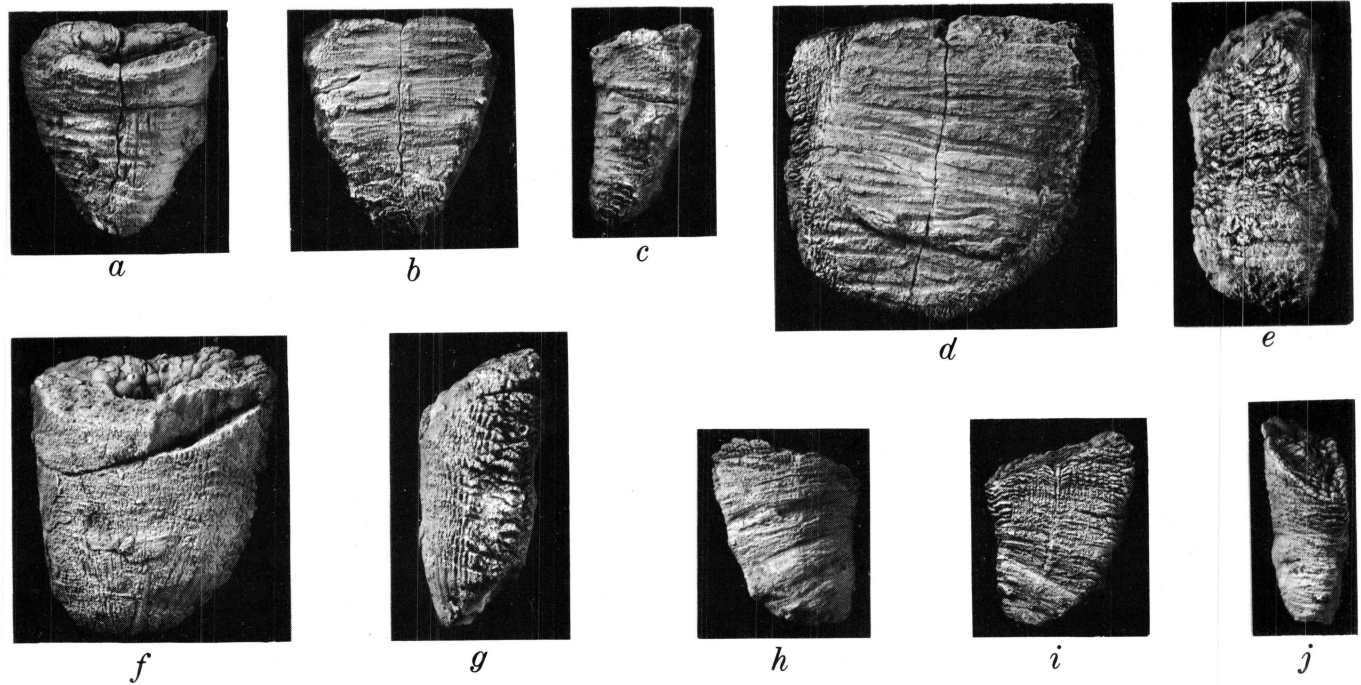


FIGURE 153.2.—*Rhizophyllum* sp. A; exterior views; Upper Silurian, Alaska. *a-c*, cardinal, counter, and side views; USNM 121201. *d-e*, counter and side views; USNM 121202. *f-g*, cardinal and side views; USNM 121203. *h-j*, cardinal, counter, and side views; USNM 121200. All specimens  $\times 1\frac{1}{2}$ .

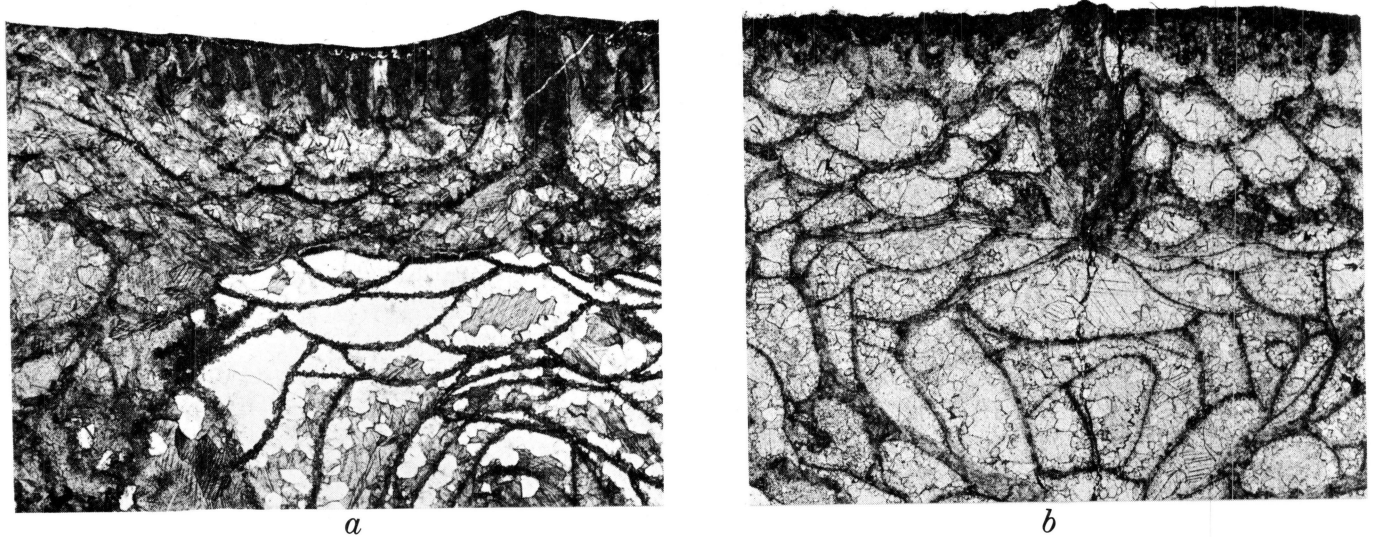


FIGURE 153.3.—*a*, *Rhizophyllum* sp. cf. *R. enorme*; detail of figure 153.5*b*; USNM 121205; Lower Devonian, Nevada. *b*, *R.* sp. A; detail of figure 153.1*e*; USNM 121201; Upper Silurian, Alaska. Transverse thin sections,  $\times 10$ .

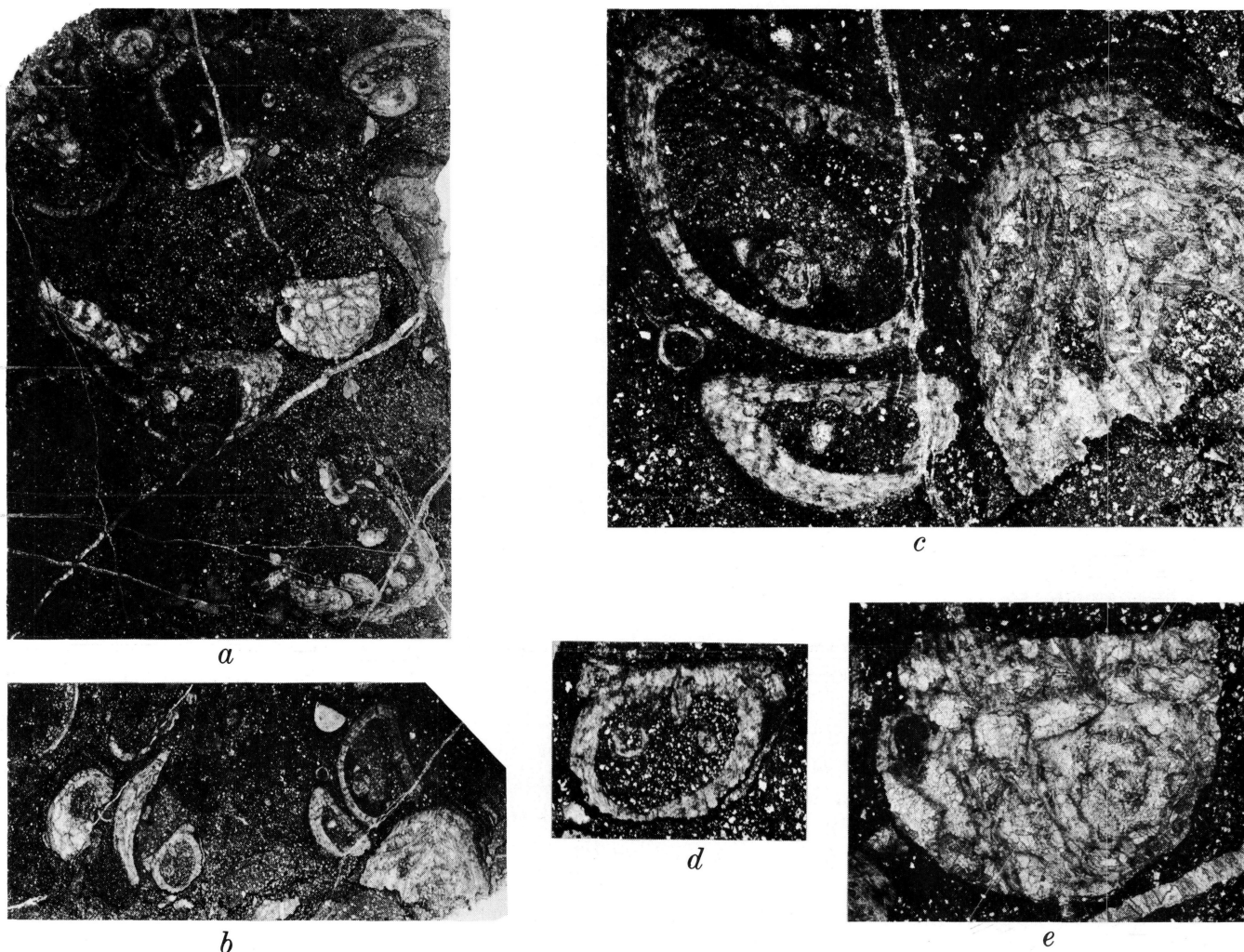


FIGURE 153.4.—*Rhizophyllum* sp. C; USNM 121344; Silurian(?), northwestern California. *a-b*, Sections through group or clump of specimens,  $\times 3$ ; immature and mature transverse sections of individuals and sections of radiciform processes and probable opercula are shown. *c*, Detail of *b*,  $\times 10$ ; transverse sections through neanic portion of two corallites and partial section of ephelic portion of another. *d*, Detail of *b*,  $\times 10$ ; transverse section of neanic portion of a corallite. *e*, Detail of *a*,  $\times 10$ ; transverse section of early ephelic portion of a corallite.

9 mm (3 specimens). All specimens have a relatively thick wall (0.3–0.5 mm) with a prominent counter septum on the straight side. In smaller sections (neanic and brephic?; diameter less than 3.5 by 5.0 mm) other septa form the wall but do not project into the lumen; one or two dissepiments are present in some of the sections. In the larger sections (ephebic) the lumen is filled with dissepimental plates and septa project slightly from the straight margin. The calice is relatively deep and V-shaped. Several crescent-shaped objects in the thin sections may represent the opercula of this species.

*Discussion.*—In apparent growth form and general morphology, *Rhizophyllum* sp. C is similar to *R. elongatum* Lindström (1883, pl. 2) from the Middle or Upper Silurian of Gotland, Sweden, and to *R. attenuatum* (Lyon) (Lindström, 1883, pl. 3, fig. 17) from the Middle or Upper Silurian, Louisville Limestone in

Kentucky. *R. sp. C* is closer to *R. attenuatum* in size and number of radiciform processes, but adequate comparison is not possible because of the nature of the California specimens. *R. sp. C* may be allied to one of the two clump-forming species or may represent a third species but is, in either case, suggestive of Silurian age.

*Material.*—Two groups totaling ten or more specimens from the Middle or Upper Silurian of northwestern California (USGS 5922-SD; see stratigraphic discussion). Illustrated group, USNM 121344; unillustrated group, USNM 121345.

#### *Rhizophyllum* sp. D

[?] *Calceola sandalina* Stauffer, 1930, p. 107, pl. 12, figures 2–3 (not Linnaeus)

*Description.*—A single specimen of solitary *Rhizophyllum* from the Silurian of eastern California, has a



curved conical shape and apparently lacks radiform processes; dimensions are: length, 43+ mm; and diameters, 15+ by 35 mm. The specimen is poorly preserved with beekitized exterior and normally silicified interior. The counter septum projects 2 to 3 mm in large sections; other septa are half as long, discrete, probably acanthine, and limited to the straight side. Dissepiments are steeply inclined on both sides of the eccentrically located axial zone of tabellae; dissepiments and tabellae are of approximately the same size.

*Discussion.*—The specimen is too poorly preserved for comparison with other species of the genus, but it is probably conspecific with Stauffer's specimen (see stratigraphic discussion).

*Material.*—One specimen from the Middle or Upper Silurian of California (USGS 6839-SD). Unillustrated specimen, USNM 121346.

***Rhizophyllum* sp. cf. *R. enorme* Etheridge**

Figures 153.3a, 153.5a,b

*Rhizophyllum enorme* Etheridge, 1903, p. 232-233, pl. 47; Hill and Jones, 1940, p. 182, pl. 2, fig. 3-4.

*Description.*—A single specimen with curved axis is 20+ mm in length, with diameters of 15.8 and 27.5 mm; the exterior is poorly preserved but there is no evidence of radiform processes. In transverse section, 28? septa are present along 14 mm of the straight margin. The counter septum is twice the length of the adjacent septa and is thickened by a sheath of lamellar tissue.

A longitudinal section in the cardinal-counter plane shows rather coarse tabellae at the eccentric axis with smaller, elongate, steeply inclined dissepiments on either side. The structure of the septa cannot be determined from available sections but they seem to be laminar.

*Discussion.*—The described specimen is similar to *R. enorme* as illustrated by Hill and Jones (from the Lower Devonian of New South Wales) in internal structure but is much smaller and has relatively coarser tabellae and dissepiments.

*Material.*—One specimen from the Lower Devonian of Nevada (USGS 6267-SD; see discussion). Illustrated specimen, USNM 121205.

***Rhizophyllum* sp. cf. *R. gotlandicum* (Roemer)**

Figures 153.5 c-e

*Calceola gotlandica* Roemer, 1856, p. 798.

*Rhizophyllum gotlandicum* (Roemer), Lindström, 1866a, p. 287, pl. 30, fig. 10-15, pl. 31, fig. 1-8; 1866b, p. 406-411, pl. 14, fig. 8-18; 1883, p. 23, pl. 3, fig. 1-12, 18, pl. 4, fig. 7.

*Description.*—One specimen of *Rhizophyllum* from the Upper Silurian of Maine is incomplete but represents a solitary, erect form with radiform processes in the apical region; dimensions are: length, 45+ mm; and diameters, 26 by 16 mm. The appearance of the external surface is not known. In transverse section the counter septum is relatively long and inflated; there is a suggestion of a radiating structure and there is a

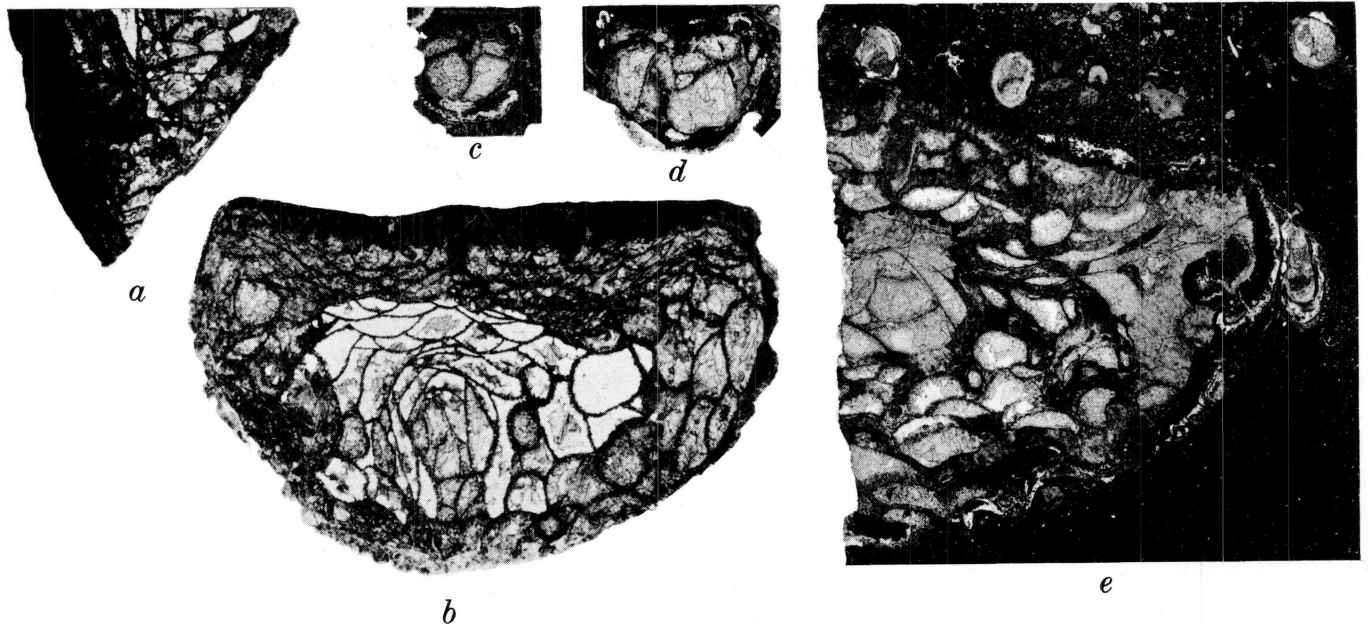


FIGURE 153.5.—*Rhizophyllum* sp. cf. *R. enorme* and *R. sp. cf. R. gotlandicum*. The counter septum is toward the top of the plate in the transverse thin sections and to the left in the longitudinal thin section. All specimens  $\times 4$ . a-b, *Rhizophyllum* sp. cf. *R. enorme*; ephelic longitudinal and transverse sections; USNM 121205; Lower Devonian, Nevada. c-e, *R. sp. cf. R. gotlandicum*; brephic?, neanic, and ephelic transverse sections; circular and oval bodies above and to the right of the specimen in e are sections of radiform processes; USNM 121206; Upper Silurian Maine.

sheath of lamellar tissue. Other septa are short and acanthine.

The dissepiments are elongate and steeply inclined; the axial tabellae are more globose but not much larger than the dissepiments. Both dissepiments and tabellae are thickened with excess stereome deposits.

A neanic section shows a few tabellae with an incomplete marginal row of dissepiments and a short, stumpy counter septum; no other septa are developed. An even earlier section (brephic?) shows only a bulge in the straight side representing the counter septum and a single tabella.

*Discussion.*—The Maine specimen is remarkably similar to specimens illustrated by Lindström (1883). A weathered longitudinal section is like Lindström's figure 6 and the neanic section (my fig. 153.5*d*) is close to his figure 5. Lindström did not publish an illustration of an ephelic transverse section but his calice illustrations (1866*b*, pl. 14, fig. 8–11, 14) suggest that the septal development is similar to that described here for the Maine specimen.

*Material.*—One individual from the Upper Silurian of Maine (USGS 6525–SD; see stratigraphic discussion). Illustrated specimen, USNM 121206. Collected by Bradford A. Hall, 1961.

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