GONIOLITHON AND NEOGONIOLITHON: TWO GENERA OF CRUSTACEOUS CORALLINE ALGAE

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Foslie, in his earlier studies of the crustaceous Corallines, proposed a new genus Goniolithon (see Foslie, "Syst. Surv. Lithoth.," 5 (1898), with scant description. He also described two subgenera, Eugoniolithon, apparently from his designation, the typical subgenus, and Cladolithon, the latter subgenus to include the fruticulose species. The type and only species of Eugoniolithon was the Lithothamnion papillosum Zanardini (as described by Hauck). This certainly is to be considered as the type of the genus Goniolithon of 1898. The only species referred to the subgenus Cladolithon, which in a footnote Foslie describes as a doubtful subgenus, is the Lithophyllum byssoides (Lam'k) Foslie, at that time a heterogeneous mixture in the mind of Foslie, as will be indicated later. Taking G. papillosum (Zan.) Foslie as the type of Goniolithon, the genus is a perfectly distinct entity, being made up of strictly monostromatic layers (without cover cells or perithallus of any kind) and belongs therefore to the subfamily Mastophoreae of the Corallinaceae Crustaceae, all of whose members have monostromatic (at times symmetrically-di-polystromatic?) sterile frond structure, thus differing from all other Corallinaceae. The sterile fronds also have a way of obliquely and lamellately proliferating, and these proliferations produce superposed and distinct layers in Litholepis and Lithoporella, but are agglutinated into a solid frond in the original Goniolithon.

Later, in 1898 ("List of Species of the Lithoth.," p. 8) Foslie changes the name of the subgenus I. Eugoniolithon to subgenus I. Lepidomorphum, listing 4 species of which G. papillosum is first mentioned, while under subgenus II. Cladolithon he mentions G. byssoides first of 18 species and G. moluccense second. In 1900, in his "Revised Systematical Survey of the Melobesieae" (p. 15), Foslie rejects his earlier Goniolithon (of 1898) and proposes an entirely new Goniolithon distinguished by having the tetrasporangia distributed over the floor of the conceptacle and (incidentally
because he makes no mention of their occurrence) with heterocysts scattered through the perithallus. This new Goniolithon may be considered to have been founded on the Lithothamnium moluccense Foslie, since Foslie stated that his G. byssoides of 1898 was intended to refer to his G. moluccense. At any rate, Foslie has proposed two distinct genera under Goniolithon, the original in 1898 with the type G. papillosum (Zan.) Foslie and the other partly visualized under the doubtful subgenus Cladolithon in 1898 but only distinctly segregated about 1904 ("Siboga Exp.," Mon. LXI, 45 (1904)) and finally properly delimited (by the exclusion of Hydrolithon) in 1909 ("Algol. Notis.," VI).

Two facts stand out clearly: (1) that Foslie completely rejected his Goniolithon of early 1898; and (2) that Foslie gradually evolved a new Goniolithon, finally brought to full expression in 1909. The two genera are complete and fairly independent establishments, and no single species of Goniolithon No. 1 survived into Goniolithon No. 2. This condition might have been stabilized by an international botanical congress without change of name, were it not for the fact that the type of Goniolithon No. 1 (Goniolithon papillosum) is a generic type of its own, distinct not only from Goniolithon No. 2 but from all other genera. The proposal which seems most logical is to recognize Goniolithon No. 1, with type species G. papillosum, and to rename Goniolithon No. 2, Neogoniolithon nov. nom., with such a species as is most characteristic and well described, as G. Fosliei (Heydr.) Foslie, for the type. The consequent changes are enumerated in the following paragraphs.

**Goniolithon** Foslie (restr. to subfamily Mastophoreae)

Fronds crustaceous to decidedly thick, composed of separate monostromatic layers arising from those immediately below by obliquely lamelliform proliferation and becoming cemented together; conceptacles simple (without thickening of frond tissue) in all types, opening by a simple pore.

Foslie, "Systematical Survey of the Lithothamnia," 5 (1898), as to subgenus I. Eugoniolithon (non aliorum, p.p. exceptorum). (!) means that the type specimen has been examined by, at least, one of us (Setchell).

**Goniolithon papillosum** (Zan.) Foslie (type!)

*Lithophyllum papillosum* Zanardini, "Saggio," 43 (1843) (!) (sine descr.) Hauck, "Meeresalgen, 272, pl. 2, fig. 4 (1885) (!). *Lithophyllum papillosum* Foslie in "Siboga Exp.," Mem. 61: 63, fig. 23 (optime!) (1904); Melobesia Cystosirae Hauck., loc. cit., 266, pl. 3, figs. 1, 2, 6 (1885); Adriatic Sea.

**Goniolithon alternans** (Lemoine) comb. nov.

Goniolithon geometricum (Lemoine) comb. nov.

*Lithophyllum (Dermatolithon) geometricum* Lemoine in Boergesen, "Rhodophyc. Canary Islands," 17, fig. 17, pl. 1, fig. 4 (1929); Canary Islands.

Goniolithon preprototypum (Lemoine) comb. nov.

*Lithophyllum preprototypum* Lemoine, "Contrib. Etud. Corallin. fossil.," No. 3: 265, fig. 12 (1917); fossil on Ile de Martinique, W. I.

Goniolithon prototypum (Foslie) comb. nov.

*Lithophyllum prototypum* Foslie, "On Some Lithoth.," 18 (1897); Island of Santa Cruz, W. I. Possibly same as *G. Udoteae* Foslie (according to Lemoine).

Goniolithon tessellatum (Lemoine) comb. nov.

*Lithophyllum (Dermatolithon) tessellatum* Lemoine, *Archiv. Mus. Paris* 4: 68–70, figs. 26, 27, pl. 1, figs. 3, 6, pl. 4, fig. 7 (1929) (!); Galapagos Islands.

Goniolithon Udoteae Foslie

Foslie, "New Melobesieae," 21 (1901); Island of Santa Cruz, W. I., see also *G. prototypum* (Foslie).

Goniolithon lapidea (Foslie) comb. nov.


Species of *Goniolithon (verum!)* are frequent in elevated limestones, probably of the early Eocene period, in the Lau Islands between Fiji and Tonga in the Pacific Ocean. Studies are still in progress.

Neogoniolithon nom. nov.

Fronds from crustaceous to decidedly fruticulose and branched; hypothallus (basal or medullary) coaxial; perithallus of erect filaments, arising from the hypothallus; epithallus more or less distinct of flattened cells; heterocysts frequent or sparse, typically in short vertical rows; conceptacles of all three types, opening by a single pore; tetrasporangia uniformly (always?) distributed over the floor of the tetrasporangial conceptacle. Type species, *Lithothamnium Fosliei* Heydrich, *Ber. deutsch. bot. Gesell.*, 15, 1897, p. 58, for the crustaceous species and *Goniolithon frutescens* Foslie, "Calcareous algae from Funafuti," 9 (1900), for the fruticulose or branched species. A considerable and widely distributed genus.
The following large number of incompletely known series of forms seem properly to be referred here.

Species Crustaceae

**Neogoniolithon accretum** (Foslie et Howe) comb. nov.

*Goniolithon accretum* Foslie et Howe, "New American Corall. Algae," 131, pl. 85, fig. 2, pl. 91 (1906); Bahama Islands, W. I. (!).

**Neogoniolithon Foslei** (Heydrich) comb. nov.


**Neogoniolithon Hariotii** (Foslie) comb. nov.

*Goniolithon Hariotii* Foslie, "Algol. Notis.," III, 13 (1907); Mangareva, in the Marquesas Archipelago (!).

**Neogoniolithon megalocystum** (Foslie) comb. nov.

*Goniolithon megalocystum* Foslie, "Siboga Exp.," Mon. 61: 48, fig. 20, pl. 9, figs. 8, 9 (1904); East Indies.

**Neogoniolithon misakiense** (Foslie) comb. nov.

*Goniolithon misakiense* Foslie, "New Lithoth.," 4 (1905); E. Japan.

**Neogoniolithon myriocarpum** (Foslie) comb. nov.

*Lithothamnium myriocarpum* Foslie, "On Some Lithoth.," 19 (1897); "*Goniolithon myriocarpon*" Foslie, "Siboga Exp.," Mon. 61: 45, pl. 9, figs. 6, 7 (1904); East Indies (!).

**Neogoniolithon orthoblastum** (Heydrich) comb. nov.


**Neogoniolithon pacificum** (Foslie) comb. nov.

*Goniolithon pacificum* Foslie, "Nye Kalkalger," 6 (1908); E. Japan.

**Neogoniolithon solubile** (Foslie et Howe) comb. nov.

*Goniolithon solubile* Foslie et Howe, *in* Foslie, "Algol. Notis.," IV, 21 (1907); Island of Jamaica, W. I. (!).

**Neogoniolithon versabile** (Foslie) comb. nov.

Species Valde Verrucosae aut ramosae

Neogoniolithon affine (Foslie et Howe) comb. nov.


Neogoniolithon assitum (Foslie) comb. nov.

_Goniolithon assitum_ Foslie, "Algol. Notis.," IV, 23 (1907); Red Sea. (An _Hydrolithon? aut Porolithon?)

Neogoniolithon brassica-florida (Harv.) comb. nov.

_Melobesia brassica-florida_ Harvey, "Nereis Australis," 110 (1849); Algoa Bay, S. E. Africa.

Neogoniolithon finitimum (Foslie) comb. nov.

_Goniolithon finitimum_ Foslie, "Nye Kalkalger," 8 (1908); S. E. Australia.

Neogoniolithon frutescens (Foslie) comb. nov.

_Goniolithon frutescens_ Foslie, "Calc. Algae Funafuti," 9 (1900); "Siboga Exp.," Mon. 61: 53, 54, fig. 22, pl. 10, figs. 7–9 (1904); Indo-Pacific (!).

Neogoniolithon laccadivicum (Foslie) comb. nov.

_Goniolithon laccadivicum_ Foslie, "Siboga Exp.," Mon. 61: 51, pl. 9, figs. 10–13 (1904); Indian Ocean (!).

Neogoniolithon mamillare (Harv.) comb. nov.

_Melobesia mamillaris_ Harvey, "Nereis Australis," 109, pl. 41 (1849); Brazil.

Neogoniolithon mamillosum (Hauck.) comb. nov.

_Lithothamnium mamillosum_ Hauck., "Meeresalgen," 23, pl. 3, fig. 3, pl. 5, fig. 1 (1885); Adriatic Sea.

Neogoniolithon Martellii (Sams.) comb. nov.

_Goniolithon Martellii_ Sams., "Sopra due Alghe Calc. foss.," 241 (1914); Fossil, Albania.

Neogoniolithon Rhizophorae (Foslie et Howe) comb. nov.

_Goniolithon Rhizophorae_ Foslie et Howe, "New Amer. Corall. Alg.," 130 (1906); Bahama Islands, W. I.
Neogoniolithon strictum (Foslie) comb. nov.

Goniolithon strictum Foslie, "New Melobes.," 14, (1901); M. A. Howe, Jour. N. Y. Bot. Garden, 6, n. 64, with figure (1905); Florida and W. I. (!).

Neogoniolithon spectabile (Foslie) comb. nov.

Goniolithon spectabile Foslie, "New Melobes.," 16 (1901); Bermuda Islands. G. strictum Foslie et G. intermedium Foslie valde affine?

Neogoniolithon trichotomum (Heydrich) comb. nov.


The species transferred above seem reasonably to be referred to the second genus Goniolithon of Foslie, as renamed, of necessity, and by us, Neogoniolithon. Of the majority not mentioned here, renewed study of the type material is necessary to determine whether they are true Neogoniolithons or possibly to be referred to Hydrolithon or even to Lithophyllum or Porolithon.

NEW OR LITTLE KNOWN CRUSTACEOUS CORALLINES OF PACIFIC NORTH AMERICA

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Since 1895 and even from somewhat earlier, the senior author has been collecting and studying crustaceous Corallines, especially those from the Indo-Pacific area. Very early many of the specimens, particularly from the coasts of Pacific North America, were sent to M. Foslie at Trondhjem, Norway, the great authority on the groups, and were named and published upon by him. There exists, therefore, in the Herbarium of the University of California many duplicate types and other authentic material for the study of Pacific North American species as well as of adjacent areas.

The junior author prepared, as a Ph.D. thesis, a detailed account of the species of the coasts of Pacific North America, with illustrations, critical notes, as well as a general review of the subfamilies, of the genera, and species, ranging from Bering Straits to Panama. A copy of this thesis is deposited with the Library of the University of California, where it may be consulted.