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On Fossil Dermatolithon of Crustose Coralline Algae

By

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From old times Family Corallinaceae has been divided into two subfamilies, Melobesioideae (crustose corallines) and Corallinoideae (articulated corallines). In recent years, however, a new classification system based on detailed morphological studies of living algae has been proposed (JOHANSEN, 1969), which divides Corallinaceae into the following seven subfamilies:

	Subfamily	Genus
1)	Melobesioideae	*Melobesia*, *Clathromorphum*, *Chaetolithon*, *Leptophyton*, *Lithothamnium*, *Mesophyllum*, *Phymatolithon*, *Polyporolithon*, *Sporolithon*
2)	Schmitzielloideae	*Schmitziella*
3)	Lithophylloideae	*Lithophyllum*, *Dermatolithon*, *Pseudolithophyllum*, *Tenarea*, *Aethesolithon*
4)	Mastophoroideae	*Mastophora*, *Choreonema*, *Eosliella*, *Goniolithon*, *Heteroderma*, *Hydrolithon*, *Lithoporella*, *Litholepis*, *Metamastophora*, *Neogoniolithon*, *Porolithon*
5)	Amphiroideae	*Amphiroa*, *Lithothrix*
6)	Metagoniolithoideae	*Metagoniolithon*
7)	Corallinoideae	*Corallina*, *Alatocladia*, *Arthrocardia*, *Bossiella*, *Calliarthron*, *Cheilosporum*, *Chiharaea*, *Jania*, *Marginiosporum*, *Serraticardia*, *Yamadaea*

Criteria of the above new division are; presence or absence of epitheca, the manner of connection of adjacent cells, i.e., whether it is second-pit-connection or cell fusion, the location and roof of tetrasporangial conceptacle, and the presence or absence of genicula. But as these features are either unpreserved in fossil specimens or they disappear in the process of fossilization, this classification cannot be applied offhand to fossils. For example, in fossil specimens having single apertures it is difficult to discriminate between the sexual conceptacle and the tetrasporangial conceptacle. Although there are as many as 24 genera of crustose corallines, the genera so far identified in fossils are less than half of them, because of the difficult conditions as mentioned above. Accordingly, so far as the classification of fossil corallines is concerned, it would be more convenient to exclude the peculiar Schmitzielloideae and place the other six subfamilies in two groups, Melobesioideae (crustose corallines)

and Corallinoideae (articulated corallines). This system is still supported strongly by many researchers. In classifying fossil corallines, paleontologists usually adopt the following four criteria:

1. Type and location of conceptacles
2. Character of hypothallium
3. Character of perithallium
4. Presence or absence of heterocysts and their character

Nevertheless, assignment of fossil *Lithoporella*, *Melobesia* and *Dermatolithon* varies among scholars, since little is known of their external forms and they are identified only by means of sections which are similar to one another and cause confusion of description. In particular, many of the specimens recorded as *Lithoporella melobesioides* are questionable.

Therefore, the present writer in 1967 examined literature on all the species concerned, and by comparing their descriptions he pointed out a few problematical points and proposed some revisions. Because the size of cell and conceptacle differs largely among these species, it made him doubtful if they should be referred all to *Lithoporella melobesioides* when they are ranging in age from Recent to as old as Eocene.

Apart from the writer's report, Marie LEMOINE of France proposed in 1970 to divide *Dermatolithon* into two groups as cited below.

"Il existe deux groupes dans le genre *Dermatolithon*:

1) La plupart sont polystromatiques, constitués: par un hypothalle tel qu'il est décrit plus haut, un périthalle formé d'un nombre de rangées variable suivant les espèces (1 à 40), des cellules corticales.

2) Un petit groupe de trois espèces strictement monostromatiques, formées uniquement par la rangée hypothallienne recouverte de cellules corticales sans formation de périthalle. Dans ce groupe les cellules de l'hypothalle, rectangularies, ne présentent jamais la forme sinueuse.

La transition entre ces deux groupes est établie par des espèces qui présentent simultanement ces deux aspects. De plus j'ai observé, dans un thalle s'élevant en forme de lamelle verticale, le passage à la structure monostromatique, par suite de l'isolement de certaines rangées périthalliennes; ces cellules prennent meme l'aspect caractéristique des cellules hypothalliennes.

Ces différents types de structure se retrouvent dans des espèces fossiles."

Then in 1976 LEMOINE published a new important view on *Lithoporella* on the basis of phylogenetic and structural characters. In that paper she arranged and classified the hitherto reported living species of *Dermatolithon* and *Lithoporella* according to her two-group division system. LEMOINE says all the species recorded as *Lithophyllum megacrustum* JOHNSON and *Lithoporella crassa* ISHIJIMA should be assigned to *Dermatolithon*.

The present writer noticed previously (1945) that in the so-called Ryukyu limestone (Pleistocene) are often found coralline specimens which have unusually thick horizontal partitions in their perithallium structure. At that time he considered these specimens

as special types of *Lithoporella* and divided them into several species. But the writer now accepts the view of LEMOINE and transfers those species from *Lithoporella* to *Dermatolithon*. For convenience of future study the known species of *Dermatolithon* are given in Table 1.

Once more on *Dermatolithon megacrustum* (JOHNSON et FERRIS)

This species was reported as *Lithophyllum megacrustum* from the Pleistocene limestone of Fulanga Island (Eastern Fiji) by JOHNSON and FERRIS in 1950. The original description as follows:

"Thallus forms a thick crust or nodular mass several centimeters thick. Hypothallus not shown on our specimens. Perithallum consists of very regular rows of long rectangular cells with thick partition walls separating the rows of cells. The cells are slightly oblique to the row walls. There is a suggestion of alternation, or rows of cells of slightly different lengths.

Many conceptacles present, irregularly spaced throughout the tissue. Around the conceptacles, the cells are smaller and more irregular than in the rest of the tissue. Typical cells measure 0.047 to 0.058 mm. long and 0.015 to 0.018 mm. wide. The conceptacles are 0.297 to 0.396 mm. long and 0.079 to 0.115 mm. high."

The writer previously (1963, 1967) reported and described this species occurring in the Pleistocene limestone of Baltra Island (Galapagos Islands). On that occasion he expressed his doubt that some of the specimens once recorded as *Lithoporella crassa* by the writer himself and those assigned so far to *Lithophyllum megacrustum* may belong to *Lithophyllum megacrustum*. Lately, while examining specimens from the Pleistocene of Hawaii, the writer has newly found this species among them. Therefore, the writer hereby redescribes the species as *Dermatolithon megacrustum* (JOHNSON et FERRIS).

The surface is entirely covered with irregular verruciform process, but the general shape is globular (Plate 1). The specimen is 5 cm in diameter and the thickness to the center (the substratum of basalt) is about 2.5 cm. As is easily observed by the naked eye, the section is very coarse in texture with pores in places. Under a microscope the rows of large rectangular cells are regularly arranged as far as the central part, and they undulate largely here and there making occasional space between rows (Plate 2). Structure of hypothallus, characteristic of *Lithophyllum*, is entirely absent. (There is no trace of differentiation between hypothallus and perithallus.) Perithallus consists of rows of cells with very thick partitions. The thick horizontal partitions are a remarkable character which is not found in other genera of Melobesioideae. Alignment of the cells is sometimes oblique to the thick partitions which separate the rows of cells. The cells are 37 to 62.5 μ long, and 10 to 12 μ wide. Conceptacles are irregularly distributed throughout the tissue from the upper part to the internal part. Conceptacles are one open, long and flat, with the length at least three times the height; they measure 230 to 300 μ by 75 to 100 μ.

Table 1. List of species.

	Hypothallic cells		Perithallic cells		Conceptacles		Locality	Age	Referrence
	Length	Width	Length	Width	Diameter	Height			
	40–50	13–25	19–25	24–25	90	216	Saipan,	Lower	JOHNSON, 1957,
Dermatolithon	50–74	14–20	12–17	19–27	207	247	Mariana Is.	Miocene~	p. 235, pl. 57,
nitida			14–18	25–27	136, 190	208	Ishigaki-shima	Upper	figs. 23
JOHNSON			11–17	28–36	107	273		Eocene	JOHNSON, 1964a
			13–17	23–30	265, 331, 333				p. 11.
			13–22	20–24					
	59–71	21–37	16–22	23–30			Saipan,	Lower	JOHNSON, 1957,
Dermatolithon	35–61	17–24	16–21	21–26			Mariana Is.	Miocene	p. 235, pl. 57,
saipanense			12–17	20–30					figs. 4 & 6.
JOHNSON	40–49	17–23	16–24	19–27					
			17–24	24–29					
			21–22	23–35	252×376				
	35–65	19–23	19–23	23–33	293×588				
			14–27,14–22	20–25,22–28					
Dermatolithon							Guam,	Lower	JOHNSON, 1964b,
guamensis	18–36	11–18	18–21	11–17	330	237	Mariana Is.	Miocene	p. 30, pl. 10,
JOHNSON									figs. 4 & 5.
Dermatolithon							Eniwetok,		JOHNSON, 1961,
marshallensum	40–63	18–27			300	125	Marshal Is.	Miocene	p. 938, pl. 277,
JOHNSON									fig. 13.
Dermatolithon	30–47	12–19			360	240	Trinidad,		JOHNSON, 1955,
eoceneium							British		p. 74, pl. 9,
JOHNSON							West	Eocene	fig. 1
	30–40	12–18					Indies		MASTRORILLI,
									1958, p. 16
Lithophyllum	30–40	9–12	30–40	6–16	290	100	Calabria,	Pliocene	MASTROTILLI,
(*Dermatolithon*)	30–60		25	20			Sicilia	Miocene	1950, p. 64,
papillosum (Zan.)			40	50	250–300	80	Lombardia,		pl. 3 (1), fig. 3
FOSLIE							Piemonte		LEMOINE, 1918,
							(Italy)	Pliocene	p. 101–114,pl. 3

Lithoporella (Dermatolithon) lithoporellaeforme CONTI	40–75–(85)	10–17	15–50	10–25	180–200	90–110	Piemonte Lombardia	Miocene ~ Pliocene	MASTRORILLI, 1950, p. 64–65
Dermatolithon crassa (ISHIJIMA)			50	12–15	350–374	100	Minami-Daito-Jima	Pleistocene	ISHIJIMA, 1942, p. 11–12
Dermatolithon australis (ISHIJIMA)			50	12	200–300	87–110	Kita-Daito-Jima	Pleistocene	ISHIJIMA, 1942, p. 10–11
Dermatolithon hayasakai (ISHIJIMA)			50	25	300–375	110	Kobama-Jima, Okinawa	Pleistocene	ISHIJIMA, 1942, p. 9–10
			41–68	10–14					
	21–25	12–16	21–25	9–12	300–447	81–98			
	40–62	10–14	37–82	9–12	425	92			
Dermatolithon megacrustum (JOHNSON)	39–80	11–18	27–42	9–14	320–403	67–91	Kita-Daito-Jima	Pleistocene probably Recent	Kita-Daito-Jima, (JOHNSON, 1961, p. 929)
			22–36	11–14	278	92			
	29–47	8–9	34–42	9–12	385	109			
	31–76	10–14	30–61	8–12	302–374	90–102			
	45–63	11–13	38–83	9–14	310	140			
			34–54	11–18	302–306	76–93			
	28–34	13–18	40–44	9–17	225–323	73–89			
	15–27	11–15	31–37	9–14	356–383	86–88			
			27–46	8–12	430	130			
	27–47	14–15	31–48	14–15	328	81			
			45–58	10–14	297–396	79–115	Lau, Fiji	Pleistocene	JOHNSON & FERRIS, 1950, p. 16, pl. 7, D, E.
			37–62.5	10–12	230–280	75–100	Baltra, Galapagos		ISHIJIMA, 1963, p. 65, pl. II, fig. 2: pl. V, figs. 1–2
Dermatolithon cinnamomeum (AIROLDI)			21–54	10–32	634	196			AIROLDI, 1937, p. 37–38, pl. 3, fig. 2
					436	130	Somalia	Neogene	
					599	109			
Dermatolithon cremae (RAINERI)							Libye	Neogene	RAINERI, 1923, pl. 15, fig. 12

Table 1. Continued.

	Hypothallic cells		Perithallic cells		Conceptacles		Locality	Age	Referrence
	Length	Width	Length	Width	Diameter	Height			
Dermatolithon dnblancqui LEM.	30–50	15–20	20–40		300	100	Martinique	Aquitanian	LEMOINE, 1918, 274, fig. 22
Dermatolithon laueneum J. et F.	42–65	11–16	18–21	8–13	165–310	58–115	Fiji, Lau	Neogene	JOHNSON et FERRIS, 1950,13,pl.VII.A,B.
Dermatolithon natatiae (MASLOV)	10–21	15–22 (25)	10–29	7–14	250	140 60	Ukraina	Tortonian	MASLOV, 1956, p. 159–160
Dermatolithon pustulatum (Lmx) FOSLIE							Antiles	Quaternary	PFENDER, 1924, 194.
Dermatolithon raineriae Lem.							Turin	Helvetian	LEMOINE, 1926, 252, fig. 12
Dermatolithon ucrainicurm (Mas)	5–10	10–30	20–60	5–10	150	65	Ukraina	Tortonian	MASLOV, 1956, p. 160–161
Dermatolithon preprototycum Lem.			10–25	5–15	225–300		Martinique	Neogene	LEMOINE, 1971, 560.
Dermatolithon cystoseirae (HAUCK) FOSLIE		12–60						Pleistocene	LEMOINE, 1920, 109.

Remarks: The specimen previously reported had a smooth surface without verruciform process. But it has become known later that the smooth surface is a result of wearing out and the specimen's external form was originally such as that mentioned above. The internal structure was entirely identical with that of the present specimen. Distribution of the species is quite limited both geohistorically and geographically, having been known only from the Pleistocene of the tropics such as Kita-Daito-Jima, Funafuti, Eniwetok, Saipan and Galapagos.

Depository: Illustrated specimen NSM-PP 15637.

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Explanation of Plates

Plate 1

Dermatolithon megacrustum (JOHNSON et FERRIS) ×1.7 NSM pp. 15637, Paratype Oahu 1, Hawaii Is. (Pleistocene)

Fig. 1. Top view.

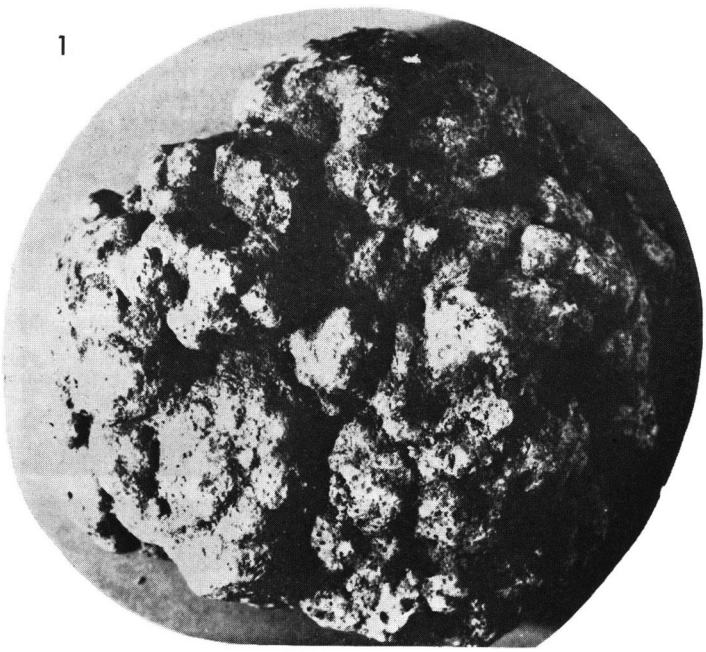
Fig. 2. Transverse section, showing growth layers and structure.

Plate 2

Figs. 1–2. Several superimposed thalli and conceptacles. ×80

Fig. 3. Detailed sketch of a portion of the same specimen shown in Fig. 1. ×50

1



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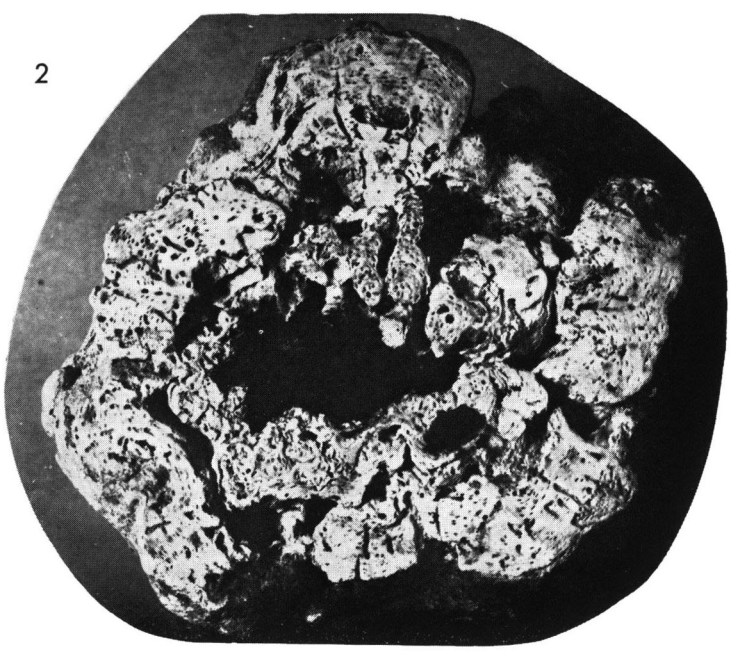

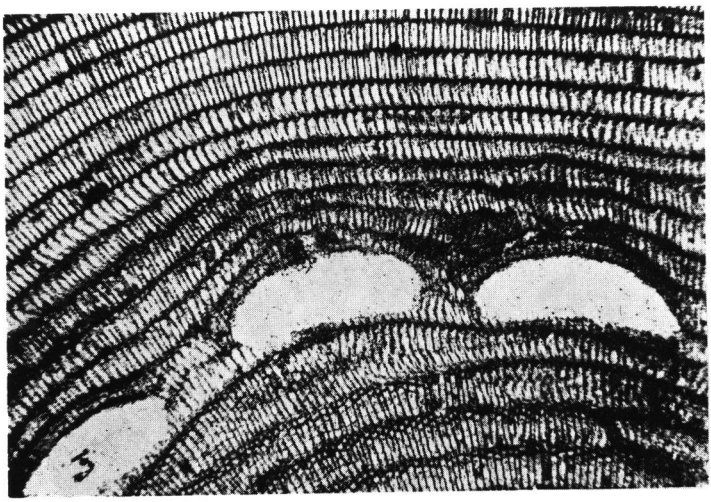

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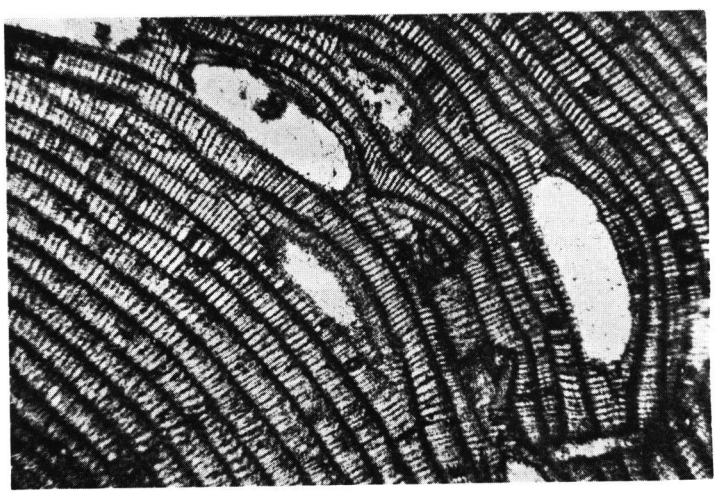

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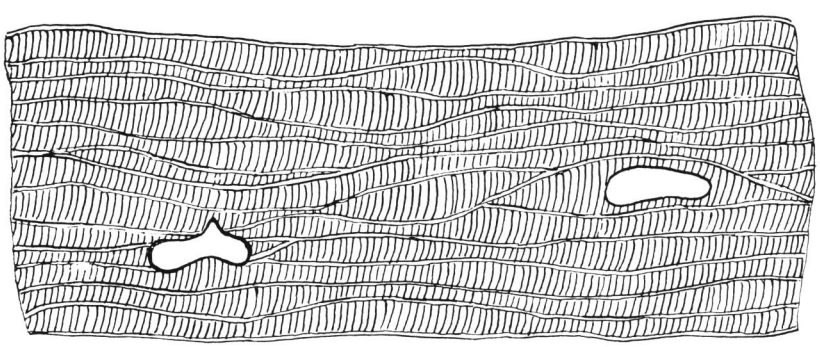

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