CALCAREOUS ALGÆ

FROM FUNAFUTI

BY

M. FOSLIE

DET KGL. NORSKE VIDENSKABERS SELSKABS SKRIFTER. 1900. NO. 1

AKTIETRYKKERIET I TRONDHJEM
1900

In Notes on two Lithothamnia from Funafuti[1]) I mentioned two specimens from this atoll, where borings have taken place to ascertain the structure of coral-reefs together with other investigations so as to get a general view of the present flora and fauna of the said atoll.

Afterwards Dr. G. Murray was so kind as to send me a collection of calcareous Algæ for determination lately received from Funafuti. This collection contains a rather considerable number of specimens collected in different localities, but comprehends only 4 species[2]), showing this group of Algæ scarcely being represented by any great number of species. On the other hand, each of those species themselves appear in considerable numbers. The same proportion is generally met with in northern seas, where the calcareous Algæ in the sublitoral region frequently grow in banks, little by little increasing both in vertical and horizontal direction and thereby, to a certain degree, correspond with the reef-building in southern seas, where such banks as far as known seldom appear. Here, on the contrary, not only crustlike species but even branched ones most frequently grow in company with Corals, Sponges, etc., and then act as a kind of mortar in holding together the reef-building animals.

From deep water around the atoll of Funafuti is only known a solitary species, *Lithothamnion Philippii* f. *funafutiensis,* which

---

1) Det kgl. norske Videnskabers Selskabs Skrifter. 1899. No. 2.

2) There is a specimen in the collection which perhaps belongs to another species than any of the above. It is however steril and at present not determined, occupying the depressed central parts of a Coral (Porites) and almost buried here. A. No. 25.

appears to be common, but forming only thin crusts on Corals and other hard objects, it does not seem to any high degree to contribute to the formation of new strata, although it sometimes forms almost alternating layers with Corals, Foraminifera, etc. The said form of the species is hitherto only known from a depth of 38—86 fathoms, but it probably also occurs higher up.

In the last quoted considerable depth, calcareous Algæ have not formerly been found alive. The depth in which these Algæ live in southern seas is on the whole but little known. In the northern hemisphere they are frequently to be found from the middle part of the litoral region, here however only crustlike species, and descend to a depth as a rule not exceeding 20 fathoms. They are seldom met with in depths between 20 and 30 fathoms. Two species which in northern waters descend farthest down, viz. *Lithothamnion glaciale* and *Lithothamnion læve,* once have been picked up alive from a depth of 44 fathoms, but the specimens were not well developed.

The other three species from Funafuti appear in the litoral and uppermost part of the sublitoral region. Among these *Lithophyllum craspedium* attains a considerable size and occurs in certain localities in great numbers. According to the list of the collection as well as to be judged from the collection itself, the species contributes, together with divers animals, as an important reef former at Funafuti. So also as regards *Lithophyllum onkodes* which in the litoral region appears in nearly the same manner as *Lithothamnion Philippi* f. *funafutiensis* in deep water, partly forming rather thick layers on rocks or Corals, partly almost alternating layers with the latter. It affords, like *Lithophyllum incrustans* in the northern hemisphere, an example of interesting struggle for existence between calcareous Algæ and Corals, sometimes almost amounting to symbiosis. The third species, *Goniolithon frutescens,* also appears to be abundant and contributes to the same building work, althoug apparently not to the same degree as the other two species.

As remarked l. c. the borings have been brought down to a considerable depth, and samples show that the calcareous Algæ

at least in part occupy a rather prominent part in bulk. It will be of interest to ascertain, whether any of the above species also are represented here.

Lithothamnion Philippii Fosl.

On some Lith. p. 7.

f. *funafutiensis* Fosl.

Notes p. 3.

Syn. Lithothamnion decussatum (Solms) Fosl.[1])

I referred l. c. the present form to *L. Philippii,* being however in doubt whether it was not, perhaps, to be considered specifically distinct. Afterwards I have had the opportunity of examining more specimens, but still I have not been able to draw any true limit.

As mentioned l. c. it clings more firmly to the substratum than the typical form. The conceptacles of sporangia frequently are slightly smaller than in the said form, and they are on a section shown to be more compressed, or a little lower. However, the greatest difference lies in the structure, but even here I have not been able to draw any true limit. In this respect the typical form is rather varying, and so also as regards f. *funafutiensis.* The perithallic layer shows the same development in both, and in some parts of a crust the cells are much varying in shape and size, in others less, on the whole both forms in this respect corresponding with each other. But on the other hand, the hypothallic layer is as a rule much differing. It is in the typical form frequently to be found distinctly marked and vigorously developed, forming a coaxilate layer composed of cells which are up to 30 μ long and 18 μ broad, frequently however about 18 μ long and 10 μ broad, with thick walls. In f. *funafutiensis* the hypothallus appears as a rule to be much reduced, on a section frequently showing a very

---

[1]) I still keep the name *Lithothamnion Philippii* to avoid confusion with the plant described under the name of *L. decussatum* by Ellis & Solander and Philippi.

thin and not sharply defined layer of rather irregular and more or less bent cell-rows, with the cells up to 24 μ long but frequently shorter, and as a rule thinner walls than in the typical form. However, it shows even in this respect transitions to f. *typica,* in which some irregularity and a rather feebly developed hypothallus occasionally is to be seen.

The sporangia in f. *funafutiensis,* not mentioned l. c., are four-parted, 150—180 by 60—100 μ. The conceptacles of cystocarps are scattered and on the whole rather scarce, conical, acute and of about the same diameter as those of sporangia.

The present form seems to be common in deep water at Funafuti. According to the list compiled by the collector the specimens preserved have been taken under the following conditions.

A. No. 19. Falefatu, 38 fathoms. „Mass of dead Porites encrusted by Nullipore with live Lithodomus boring the Porites". This mass is in the part which has turned upwards coated with *L. Philippii* f. *funafutiensis,* and rather resembles in habit B. No. 13, with well developed conceptacles of sporangia.

A. No. 21. Funamanu, 45 fathoms. „Dead reef Coral coated with Polyzoa, Sponges, etc." A large piece here and there coated with a few small crusts of the present species, in part provided with young conceptacles.

A. No. 22. Depth 80 fathoms off Funamanu, Funafuti. „Crateriform (fungoid?) Coral with Nulllipore, Sponges, Polytrema, etc.)". In some of the pieces from this considerable depth are also to be found a few rather young crusts of the present plant.

A. No. 24. Funamanu, Funafuti, depth 80 fathoms. „Fragments from $1^1/_2$ in. to 4 in. long of Nullipore (encrusting), with Halimeda, large disc-shaped Foraminifera, Alcyonarian, selerobasic Corallum, coated with Nullipore, etc.". Some of the pieces are here and there coated with small and young crusts of the species in question, in part furnished with conceptacles of cystocarps.

B. No. 13. Off Tutanga, Funafuti, 41 fathoms. Aug. 1898. „A loose slab of pinkish to dull pale crimson[1]) Nullipore something

[1]) Including a young *Heyssonelia* not determined.

like a flake of stalagmite . . . . some large and disc-shaped Foraminifera . . . . The slab had no fresh break and therefore must have been lying loose. There is every appearance of the large disc-shaped Foraminifera being insitu here". The slab is about 20 by 12 cm. and 2—3 cm. thick, but very irregular. The said Alga forms a thin coat in the upper as well as lower part of the slab, which appears to be composed of a rather great number of animals, especially Corals and Foraminifera, on a section often forming alternating layers. It bears numerous conceptacles of sporangia as well as some scattered conceptacles of cystocarps. This is the type referred to in my Notes.

B. No. 15. Off Tutanga, Funafuti, 86 fathoms. Aug. 1898. „Fragments of a dead Coral broken off. One lump of concentric Nullipore like an old boss of stalagmite; but very porous and much bored, crusted with thin coat of purple Nullipore, tubes of Serpula, small Lamellibranchs like Chama. Some giant Foraminifera. In formation some bladdery green Algæ". These masses of Corals, etc. are here and there coated with some young crusts of the present species. Some very young leaves of other Florideæ are attached to the same masses, but the supposed green Algæ are not to be seen, and it is impossible that such Algæ should live in such a depth as mentioned above.

Lithophyllum craspedium Fosl.
New or cr. calc. Alg. p. 26.

f. *compressa* Fosl. mscr.
Lithophyllum craspedium Fosl. l. c.

f. *abbreviata* Fosl. mscr.

The form *compressa* attains a considerable size, with coarse and vigorously developed branches. In f. *abbreviata* the branches are as a rule short with rounded thickened ends, and more densely crowded, sometimes rather approaching certain forms of *Lithophyllum racemus* in habit. The specimens of this form that I have seen are but 3—4 cm. in diameter, and the branches 3—5 mm.

thick. It passes into f. *compressa,* which in a young state occasionally shows in part almost plicate branches.

According to the list of the collection the species has been found in the following localities.

A. No. 12, in part. Ocean Platform, opposite drill Camp, Funafuti. Rather young specimens together with *Goniolithon frutescens.*

A. No. 13, in part. Fualopa, Funafuti, about one foot below low water springs. Quite young specimens, a solitary or a couple of branches in company with *Goniolithon frutescens.*

A. No. 14, in part. Fualopa. Rather young specimens of f. *abbreviata,* growing in company with *Lithophyllum onkodes* and *Goniolithon frutescens.*

A. No. 16, in part. „Nullipore, reddish-brown, from Fualopa, Funafuti. Specimens No. 13, 14, 15 and 16 are all more or less important as reef formers at Funafuti". The present species is here in part anastomosed with *Lithophyllum onkodes.*

A. No. 27. „Onoatoa Gilbert Island, a very abundant type and the most important reef former at that Island". „This Nullipore, Finckh says, is actually the reef former at Onoatoa. He saw no live Corals there, but everrywhere on the Lagoon and ocean face immence masses of this particular Nullipore". This is the type mentioned l. c. of *L. craspedium* f. *compressa.*

A. No. 48, in part. „Coral partly overgrown with branching Nullipore from Fualopa, both alive at the time they were collected". The large lumpy Coral is covered with numerous specimens of *G. frutescens,* here and there with young branches of the present species.

Lithophyllum onkodes Heydr.

in Bibl. Bot. H. 41. Pag. 6.

I formerly referred this crustlike species to the genus *Goniolithon.* However, after I got specimens with well developed conceptacles it is shown to be a *Lithophyllum.* It is rather varying both in habit and structure. It partly forms thin crusts on branched Corals partly a thick coat on lumpy Corals or other hard

objects, or stick to the rocks, attaining a thickness of up to 15 mm.

The species seems to be abundant at Funafuti. The following localities are known.

A. No. 11. Reef Platform, Funafuti. Well developed specimens partly attached to rocks partly lumpy Corals or nearly allied animals, occasionally forming almost alternating layers with the latter.

A. No. 12, in part. Ocean Platform opposite drill Camp, Funafuti. Here growing in company with *Lithophyllum craspedium* and *Goniolithon frutescens.*

A. No. 14, in part. Fualopa, Funafuti. Vigorously developed specimens up to nearly 15 mm. in thickness.

A. No. 15. „Crimson and reddish brown Nullipore from Pava Islet, Funafuti; together wit a large Actinozoan". Well developed specimens of the present species.

A. No. 16, in part. Fualopa, Funafuti. Vigorously developed specimens, together with *Lithophyllum craspedium.*

A. No. 28. Funafuti. A branched Coral with a rather thin coat of the present species.

A. No. 50. „Thick growth of Nullipore from the shoals in the Lagoon close to main village, Funafuti, about one foot below low water spring tide". Vigorously developed specimens of *L. onkodes* up to 15 mm. in thickness.

Besides these specimens, that mentioned in my Notes is from „consolidated rock, forming platform Hurricane Beach, Funafuti". The latter grows together with a Coral.

Goniolithon (Cladolithon) frutescens Fosl. mscr.

f. *typica.*

f. *flabelliformis* Fosl. mscr.

Thallus attached to rocks or Corals by a thin crust, shrubby or forming much branched balls up to 10 cm. in diameter. Branches repeatedly subdichotomous, or irregularly divided, terete or subcompressed, with rounded or truncate ends, upper branches frequently 1.5—3 mm. thick, or (f. *flabelliformis)* the branches com-

pressed and flabellate. Conceptacles of sporangia conical, with elongated tip, 500—600 μ in diameter.

The species is much varying in shape, sometimes with the appearance of a small bush 2—4 cm. in height, but developing numerous conceptacles, sometimes forming almost roundish balls up to 10 cm. in diameter, and apparently now and then loosening itself from the substratum.

In f. *typica* the branches are terete or subcompressed, subdichotomously or rather irregularly divided, sometimes issuing at right or nearly right angles, short or elongated, with rounded or truncate ends.

In f. *flabelliformis* especially the upper branches are more or less fan-shaped, with segments up to 10 mm. broad.

The conceptacles of sporangia are prominent, numerous though seldom crowded, conical, 500—600 μ in diameter at the base, with an elongated tip, including the latter about 500 μ high. Towards maturity the tip falls away and then the conceptacles are subhemispheric or subhemispheric conical. The sporangia are four-parted, 90—110 by 40—50 μ.

A longitudinal section of a branch does not show any cup-shaped stratification as frequently in other branched species of this group of calcareous Algæ, the inner cells however forming pretty regular radiating rows, frequently $1^1/_2$—2 times longer than broad, or 20—36 by 14—18 μ. The perithallic layer is partly rather feebly partly vigorously developed, with almost square or somewhat rounded cells, or up to $1^1/_2$ times longer than broad. Between the peripheric cells are frequently to be found scattered and rather large cells quite differing from the adjacent ones, which appear to be heterocysts.

The present species much approaches *G. moluccense* in habit, being however coarser, with larger conceptacles and quite different in structure.

In a longitudinal section of a branch of *G. moluccense* the pith layer is composed of alternating long and short cells, forming regular radiating rows. The short cells are frequently twice as long as broad, or 18—28 by 7.5—11 μ, in the longitudinal direc-

tion regularly alternated by a radiating row of cells which are 36—58 μ long and of the quoted breadth. The cells of the perithallic layer are 10—18 μ long, towards the periphery nearly square. The sporangia of this species are four-parted, 55—75 μ long and 25—30 μ broad.

Another species partly much resembling the present species in habit partly approaching *G. moluccense* is described by Heydrich in Bibl. Bot.[1]) under the name of *Lithothamnion Tamiense.* It is unknown to me, and the description l. c. of a longitudinal section is quite different from a similar section of any of the above species, but reminds one rather of a transverse section of one of them, *G. moluccense.*

According to the list of the collection from Funafuti the species in question has been collected in the following localities.

A. No. 12, in part. Ocean Platform, opposite drill Camp, Funafuti.

A. No. 13, in part. Fualopa, Funafuti, about one foot below low water springs.

A. No. 14, in part. Fualopa.

A. No. 46. Fualopa. „This type is very abundant on the leeward (W.) islets of Funafuti atoll".

A. No. 48, in part. „Coral partly overgrown with branching Nullipore from Fualopa, both alive at the time they were collected".

Nullipore from Beach S. of Village, Funafuti Lagoon.

Thus it will be seen that the species probably is common almost everywhere at Funafuti, growing just below low water mark. The specimens A. No. 13 are more delicate, with thinner branches than frequently in specimens from the other localities. A. No. 12—14 grows in company with small specimens of *Lithophyllum craspedium* and with *L. onkodes,* in part anastomosed with the latter species.

A fragment of another and dead specimen probably belongs to the same species. It is labelled A. No. 59, „Nullipore from Lagoon platform at Funafala. This is an important rockformer.

[1]) F. Heydrich. Neue Kalkalgen von Deutsch-Neu-Guinea. Bibliotheca Botanica. Heft. 41. Stuttgart 1897. Pag. 1, t. I, fig. 4—7.

It is also an important reef former". It forms an irregular mass anastomosed with divers small Corals and other animals, and in the main only represents the lower branch-systems of a large specimen. The branches are coarser and more irregular than in any of the above specimens, but as fully agreeing in structure with these, it is most probably to be considered a coarse form of the present species.