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ON A SPECIES OF SUB-FOSSIL SOLITARY CORAL FROM THE CHILKA LAKE.

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INTRODUCTION.

In the Report on the Mollusca Gastropoda and Lamellibranchiata of the Chilka Lake (*Memoirs of the Indian Museum*, Vol. V, 1916, p. 338) Annandale and Kemp drew attention to the occasional presence, on the rocks near Ganta Sila in the neighbourhood of Rambha Bay, of skeletons of solitary corals, and figured portion of a stone from the south-eastern side of the Bay bearing skeletal remains of a species of coral (pl. xiv, fig. 3). The specimen has been forwarded to me for detailed study, along with an excellent transverse section of one of the corallites.

Madreporarian corals, which are pre-eminently marine organisms, are not now found in the living condition anywhere in the brackish waters of the Chilka Lake, although solitary corals are said to be abundant in the sea off the coast of Orissa.

The specific gravity of the water in the main area of the Chilka Lake reaches a maximum of only 1·0150 (the maximum recorded in the outer channel being 1·02650), while the sea water some miles below the mouth of the lake gave a reading, in March, of 1·0270. It is not improbable, as Annandale and Kemp pointed out, that "the oyster-bed at Ganta Sila and the corals on the rocks evidently date from a time when this part of the lake was in direct communication with the Bay of Bengal; Ganta Sila and the hills near it then forming an island or group of islands in the sea" (p. 339).

The probable factors that have operated against the maintenance of coral-life in the Chilka Lake are the sediment suspended in the water, the comparatively low but varying salinity, the high temperature and exposure to the sun during dry weather.

The mud in the Chilka Lake is described as forming "two quite distinct layers, one of which remains practically undisturbed except in very rough weather while the other is usually held suspended in the water and only deposited in very sheltered places or at times of unusual calm. This floating layer is, of course, very finely divided and habitually stains the water a dirty clay-colour" (*Mem. Ind. Mus.* V, p. 4). The silt-laden water of the Mahanaddi river-system that enters the northern end of the lake would steadily contribute to the floating sediment in the lake. Mayer[1] and Vaughan[2] have brought forward evidence to show that the effect of sediment on living corals is comparable to that of asphyxiation by heat.

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[1] "Ecology of the Murray Island Coral Reef" by A. G. Mayer. *Papers from the Department of Marine Biology, Carnegie Institution of Washington*, 1918, pp. 36-38.

[2] "Corals and the formation of Coral Reefs" by T. Wayland Vaughan. *Smithsonian Report*, Washington, 1919, p. 202.

The south-westerly monsoon currents that often blow violently for long periods would considerably stir up the sediment in the shallow bottom of the Chilka Lake.

With regard to the second factor Annandale and Kemp remark that "of the varied elements that compose the physical environment of the fauna of the lake by far the most noteworthy is the great periodic change in salinity to which its waters are subject. This factor undoubtedly exercises a continual selective influence on the animals of the lake and it is to it, in the main, that the special interest of the fauna is due" (pp. 5, 6). It appears, from the available records, that the composition of the water of the Chilka Lake varies from that of fresh water during the flood season to nearly that of the sea during the period immediately preceding the monsoon when a considerable volume of sea water enters the lake. For the greater part of the year the water of the main area of the lake remains brackish, whilst in a small area at the southern end of the lake where, owing to the absence of rivers, floods have less effect, the water remains brackish throughout the year.

During the hot weather, when the general level of the water is only about 2 ft. the surface temperature will probably be much higher than that of the Bay of Bengal, especially towards the shores of the lake, a maximum reading of 43°C. having been recorded in March 1914. The experimental studies of Mayer and Vaughan have shown that a temperature higher than 38°C. is inimical to coral life.

The danger of exposure to animal life is imminent in a water-area which is exceedingly shallow like that of the Chilka Lake. When the violence of the monsoon winds is at its height the greater part of Rambha Bay is said to be entirely emptied of water, the water being banked up towards the northern end.

The sub-fossil coral from the lake is provisionally determined as *Cylicia smithi* Milne Edwards and Haime.

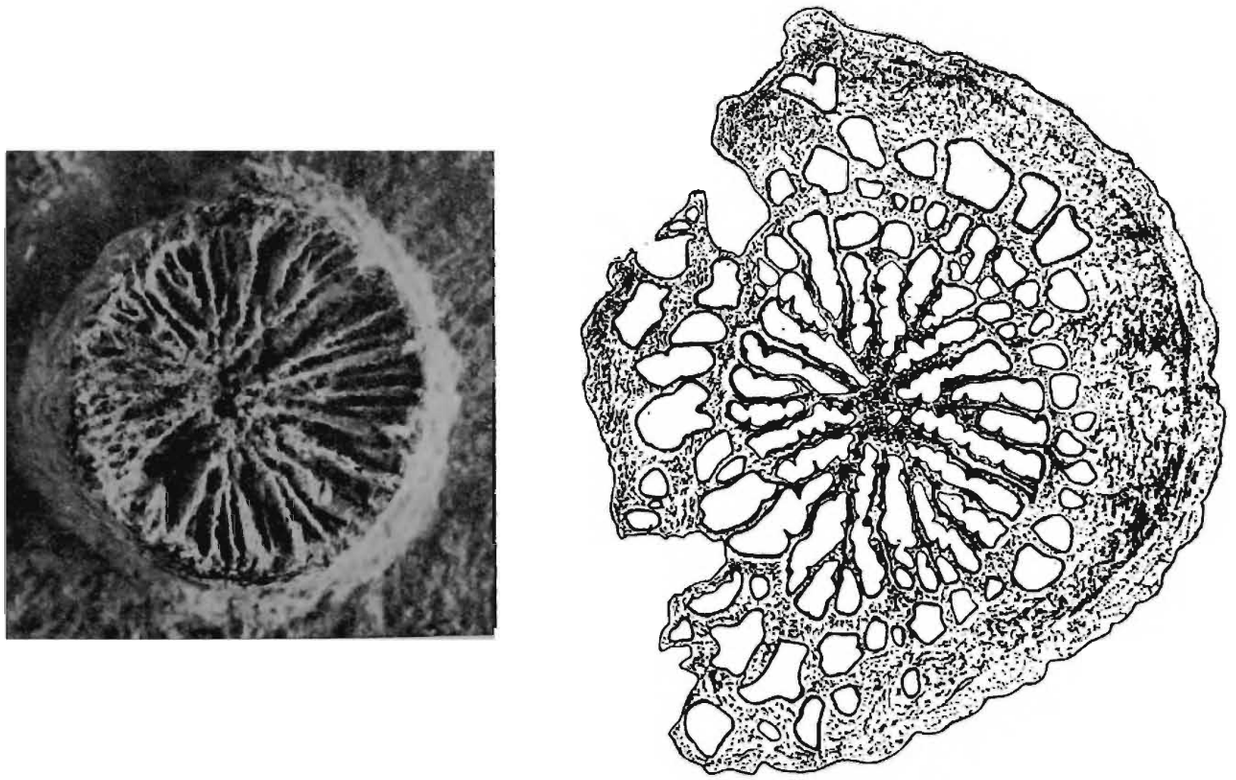
DESCRIPTION OF CORALLITES.

Attached to the pieces of stone are seven single corallites which are entire but varying in size, and four broken ones. The largest corallite measures 7 mm. × 6 mm. (calyx 6 mm. × 5 mm.) in diameter and 2 mm. in height, in which over fifty septa can be counted arranged probably in five cycles, the fifth cycle being incomplete. The smallest corallite is 2 mm. (calyx 1·5 mm.) in diameter and ·5 mm. in height and contains about twenty septa. In a corallite, measuring about 5 mm. (calyx 4·25 mm.) in diameter and 1 mm. in height, which appears to be in a better state of preservation than any of the others, there are about forty septa.

Since, in all the corallites, the interstices between the septa are filled in, the different orders of septa cannot be distinguished without examining transverse sections. Nor can the surface characters of theca, septa and columella be determined satisfactorily owing to the worn condition of the corallites.

In the prepared transverse section (Fig. 1, *b*) which measures 6 mm. × 5 mm. (calyx 3·5 mm. × 3 mm.) in diameter, twenty-eight septa can be counted of which twelve septa are principal in as much as they meet the columella. The principal septa are in two alternating series. The first series is distinguished by the fact that a broad subsidiary septum is attached to each side of a principal septum, whilst the principal septa of the second series

are not associated with subsidiary septa. The remaining four septa are much narrower and are arranged in two pairs, each pair meeting a broad subsidiary septum; between these two subsidiary septa is a principal septum of the second series.



a. *b.*

Fig. 1.—*Cylicia smithi* M. Ed. & H.
a. Photograph of one of the corallites, × 5.
b. View of transverse section, × 15.

The comparative fewness of septa, noticeable in the transverse section, is perhaps due to the section having been taken at a comparatively low level to which some of the subsidiary setpa do not extend.

Sides of septa are provided with spinules which show an alternating arrangement. Organic remains are present along the middle of each septum. Calcareous fibres and trabeculae are not visible owing perhaps to secondary rearrangement of skeletal material.

Columella, as seen in transverse section, seems to be well-developed.

From the skeletal characters noted above, it is evident that the species belongs to the Astrangiaceae of Milne Edwards and Haime (*Hist. Nat. Corall.*, Vol. II, p. 606). The diagnostic characters of the genera of the Astrangiaceae, as recognised by Milne Edwards and Haime, are given in the following key :—

I. Epitheca present.
  A. Upper margins of principal septa subentire ... ... *Cylicia.*
  B. Upper margins of principal septa dentate.
    a. Calices somewhat deep; septal teeth long ... ... *Cyptangia.*
    b. Calices quite shallow; septal teeth short ... ... *Rhizangia.*

II. Epitheca absent.

A. Without false cœnenchyme.

a. Upper margins of principal septa dentate ... ... *Astrangia.*

b. Upper margins of principal septa sub-entire.

b1. Columella rudimentary ... ... *Phyllangia.*

b2. Columella well-developed ... ... *Ulangia.*

B. With false cœnenchyme at base of corallites.

a. Calices horizontal and circular ... ... *Cladangia.*

b. Calices oblique, with a projecting semicircular rim ... *Pleurocaenia.*

In all these genera asexual reproduction is by means of extra-tentacular budding. In *Cladangia* and *Pleurocœnia*, which contain only fossil forms, the corallites are connected together by a false cœnenchyme to form colonies, whilst in the remaining genera colony-formation does not take place, buds sooner or later losing organic connection with the parent.

TABLE OF DIAGNOSTIC CHARACTERS OF SPECIES OF ASTRANGIACEÆ.

Species.	Diameter of calyx.	Height of corallite.	Depth of calyx.	No. of cycles of septa.	Nature of columella.	Fossil or recent.	Locality.
Cylicia rubeola	4 mm.	5 mm.	4 mm.	3 cycles, 3rd cycle incomplete	Well-developed	Recent	New-Zealand.
Cylicia tenella	4 mm.	Unknown	2 mm.	3 complete cycles	Poorly developed	—	New Holland.
Cylicia verreauxi	3 or 4 mm.	3 or 4 mm.	2 mm.	4 cycles, 4th cycle imcomplete	Unknown	—	New Holland.
Cylicia smithi	5 mm.	Unknown	1 mm.	4 complete cycles	Well-developed	—	New-Zealand.
Cryptangia woodi	3 or 4 mm.	Unknown	Unknown	3 cycles, 3rd cycle incomplete	Unknown	Fossil (Miocene).	
Cryptangia parasita	2 to 2·5 mm.	Unknown	Unknown	3 cycles	Unknown	—	
Rhizangia brevissima	6 mm.	3 mm.	Unknown	4 complete cycles	Poorly developed	Fossil (Miocene).	
Rhizangia martini	6 or 7 mm.	15 mm.	Unknown	4 complete cycles	Poorly developed	—	
Rhizangia michelini	4 mm.	Unknown	Unknown	4 complete cycles	Well-developed	Fossil	
Rhizangia brauni	7 mm.	4 mm.	Unknown	5 complete cycles	Considerably reduced	Fossil (Eocene).	
Rhizangia sedgwicki	1 cm.	Unknown	Unknown	5 complete cycles	Well-developed	Fossil	
Astrangia danai	4 or 5 mm.	3 or 4 mm.	2 mm.	3 complete cycles; a few septa of the 4th cycle.	Well-developed	Recent	Unknown locality.
Astrangia michelini	4 mm.	3 or 4 mm.	Unknown	—	Much reduced	Recent	Unknown locality.
Astrangia astræiformis	4 mm.	3 or 4 mm.	Unknown	—	Little developed	Recent	Coast of United States.

TABLE OF DIAGNOSTIC CHARACTERS OF SPECIES OF ASTRANGIACEÆ—*contd.*

Species.	Diameter of calyx.	Height of corallite.	Depth of calyx.	No. of cycles of septa.	Nature of columella.	Fossil or recent.	Locality.
Phyllangia americana	1 cm.	10-15 mm.	Unknown	4 cycles, 4th sometimes incomplete.	Poorly developed	Recent	Martinique.
Phyllangia conferta	3 mm.	Unknown	Unknown	3 cycles	Poorly developed	Fossil (Miocene).	
Ulangia stokesana	15 mm.	6 or 7 mm.	Unknown	5 complete cycles.	Specially well-developed	Recent	Philippines.
Cladangia crassiramosa.	5 mm.	Unknown	Unknown	4 cycles, 4th cycle incomplete.	Poorly developed	Fossil (Miocene).	
Cladangia semisphærica.	7 or 8 mm.	Unknown	Unknown	4 complete cycles	Well-developed	—	
Cladangia perforata	6 or 7 mm.	Unknown	Unknown	4 complete cycles	Unknown	—	
Pleurocœnia provincialis.	2 mm.	Unknown	Unknown	Unknown	Unknown	Fossil	
Pleurocœnia alveolaris.	3 mm.	—	—	—	—	Fossil	

In the recent species of *Phyllangia*, viz., *P. americana*, recorded by Milne Edwards and Haime, the calyx is 10 mm. in diameter, and in the recent species of *Ulangia*, viz., *U. stokesana*, the diameter of the calyx is 15 mm. On the other hand, the diameter of the corallite in *Cylicia*, *Cryptangia*, *Rhizangia* and *Astrangia* is not more than 6 or 7 mm. *Cylicia* and *Astrangia* contain recent species whose calyx is comparatively small, being not more than 4 mm. in diameter and not more than 5 mm. in height.

Milne Edwards and Haime have based the generic distinction between *Cylicia* and *Astrangia* on the presence or absence of epitheca and the nature of the septal margin, *i.e.*, that while in *Cylicia* an epitheca is present and the principal septa have subentire upper border, in *Astrangia* an epitheca is absent and the entire septal margin is dentate. The question whether these skeletal features are associated with differences of generic value in the structure of the soft parts or not has still to be determined.

In the meantime the solitary coral from the Chilka Lake may be assigned to *Cylicia smithi* M. Ed. & H. to which it bears greater resemblance than to any other species of Astrangiaceae recorded by Milne Edwards and Haime.

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