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[71]

III. *Report on the Sponges.* By M. BURTON (*British Museum*).

[Received June 14, 1926: Read November 16, 1926.]

(TEXT-FIGURES 4-7.)

THE collections made by the Cambridge Expedition to the Suez Canal during Oct.-Dec. 1924 show that the migration of sponges into the Canal has been almost entirely from the Red Sea. Some of the species found, however, are cosmopolitan, or nearly so, and have been recorded, for the most part, from both the Red Sea and the Mediterranean by previous writers. In one case only, *Mycale rotalis*, has a species hitherto positively exclusive to the Mediterranean appeared in the Canal.

LIST OF SPECIES FOUND.

Where in this list the name of a species appears without comment, it is because the present specimens differ in no essential degrees from the typical form or because the species is so well known as to need no further introduction. The localities are designated by the following letters: P, Port Said; T, Lake Timsah; K, Bitter Lakes; PT, Port Taufiq; R, Gulf of Suez; Km, Canal proper. For details of collecting-stations see General Part, pp. 45 *et seq.*

1. LEUCOLENIA CORIACEA (Montagu).

Previously known distribution.—Atlantic coasts of Europe; Red Sea; W. Indies.
Locality and registered No.—K. 5 (R. N. XXXVIII).

2. LEUCOLENIA PRIMORDIALIS (Haeckel).

Previously known distribution.—Cosmopolitan.
Locality and registered No.—K. 5 (R. N. LXXVII).

3. SYCON RAPHANUS O. Schmidt.

Previously known distribution.—Cosmopolitan.
Localities and registered Nos.—K. 9 (R. N. LVIII); K. 0 (R. N. LXX); K. 5 (R. N. LXXI).

4. LEUCANDRA PRIMIGENIA (Haeckel).

Previously known distribution.—Cosmopolitan.
Locality and registered No.—Km. 76 (R. N. LIII, ii).

5. *LEUCANDRA ASPERA* (O. Schmidt).

Previously known distribution.—Mediterranean and Red Seas.

Localities and registered Nos.—P. 1 (R. N. XXII, i); Km. 87 (R. N. LXIII); K. 9 (R. N. XXXIII, ii); K. 0 (R. N. LXX, i).

. *DONATIA ROBUSTA* (Bowerbank).

Previously known distribution.—Red Sea; Indian Ocean; Australia (*vide* Burton, 1924. Further, a small specimen of this species has reached me from Dr. Gilchrist since the completion of my revision of this genus, so that the distribution of the species is now known to include the Natal coast).

Locality and registered No.—K. 13 (R. N. XV, ii and iii).

7. *RENIERA CINEREA* (Grant).

All the specimens of this species were very small, the largest being barely 20 mm. in length and 5 mm. in diameter. They conform very closely in appearance, texture, and characteristics of the oscules and skeleton with the typical British forms, a point worth noting in view of the remarks on the distribution of the species about to be made. Many of the specimens reported by Dendy (1916 C) from the Indian Ocean and Dendy and Frederick (1924) from Australia under *Reniera permollis*, an undoubted synonym of *R. cinerea*, do not. Neither do Dendy's (1921 B) examples of *R. rosea*, which species is also a synonym of *R. cinerea*. Not only do I doubt the identification of these latter forms with the well-known European *R. cinerea*, but I doubt whether they are even congeneric. This is important, for it limits the distribution of the species, so far as our present records are concerned, to the Arctic, North Atlantic and Pacific Oceans, and South Africa. Nevertheless, in the present chaotic state of knowledge of the various species of *Reniera*, a discussion of their distribution is of little value.

Previously known distribution.—Full extent of distribution not certain, but undoubtedly found in the Arctic, N. Atlantic and N. Pacific Oceans, and possibly throughout the S. Atlantic.

Localities and registered Nos.—P. 1 (R. N. XXVIII, ii); K. 76 (R. N. XXXV, iv, R. N. LI, i); T. 9 (R. N. LV); K. 1 (R. N. XVII); colour in living state, violet.

8. *RENIERA IMPLEXA* O. Schmidt.

The various representatives of this species present are encrusting with fistulous vents and very difficult to distinguish from *R. cinerea*. The main point of distinction is, apparently, the smaller size of the spicules in the latter.

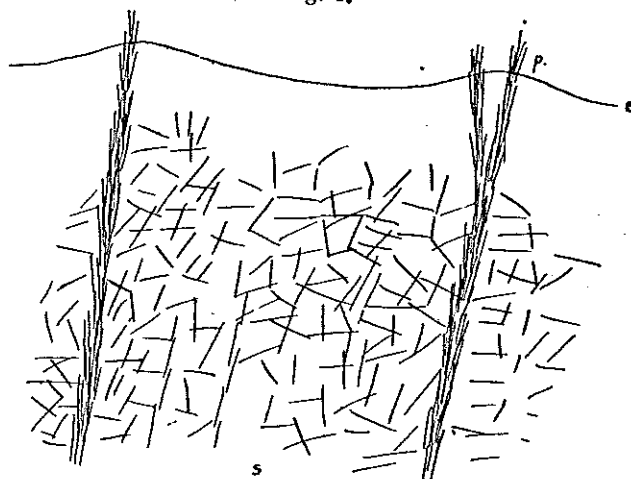
Previously known distribution.—N. Atlantic, Mediterranean, Indian Ocean, Red Sea.

Localities and registered Nos.—P. 4 (R. N. XIII); R. 6 (R. N. XLII, iii and iv).

9. *RENIERA SPINOSELLA* Row, 1911 A (non Thiele).

If a comparison be made of Row's descriptions of the holotypes of his species *Halichondria bubastes* and *Reniera spinosella*, a remarkable similarity will be noticed. When the specimens themselves are compared this is even more noticeable, and I have no hesitation in regarding the two species as synonyms of a single species. Both species agree exactly when examined microscopically. The external form is amorphous, but, despite Row's (*l. c.* p. 320) assertion to the contrary, there are very definite characters by which the species may be recognised. The spicules are arranged in usually multispicular primary fibres running irregularly towards and projecting beyond the surface. There are no regular secondary fibres, but the spaces between the primary fibres are filled with an irregular reticulation of single oxea. Usually this reticulation

Fig. 4.

Section of *Reniera spinosella* Row (from the holotype).

e, ectosome; p, primary bundles of spicules; s, mass of secondary reticulation.

ends just below the surface, leaving the primary fibres free. The spicules of the latter are arranged in a somewhat plumous manner, an unusual feature in the genus *Reniera*. These various characteristics are summed up in fig. 4, and enable us to readily recognise the species. Sometimes the secondary reticulation of oxea filling the spaces between the primary fibres becomes regular and isodictyal, and may be continued right up to the surface, but this is not usual. (See also fig. 5.)

Previously known distribution.—Red Sea.

Localities and registered Nos.—P. 1 (R. N. XXII, ii); Dredger No. 8 (R. N. XXIV, i); Km. 46 (R. N. XXXV, iii); Km. 152 (R. N. LXII, iii); PT. 0 (Wood. D) (R. N. LXXVI); PT 3 (R. N. LXVI).

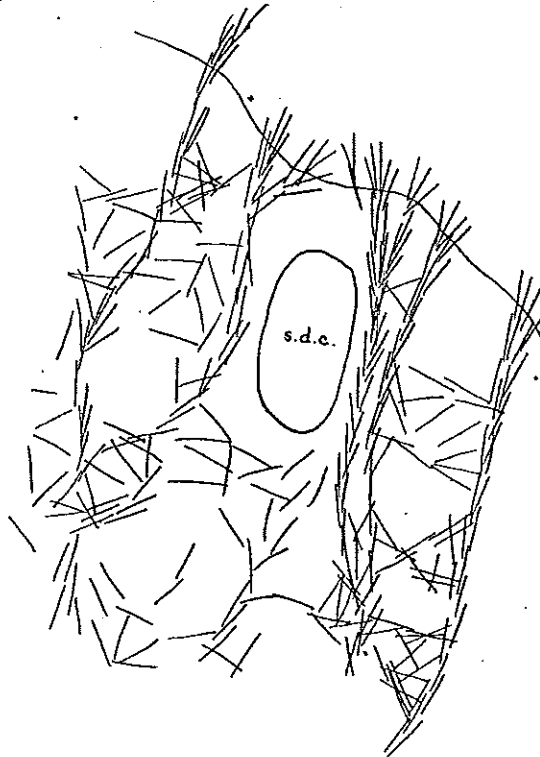
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10. *RENIERA TABERNACULA* Row, 1911 A.

Row (*l. c.*) mentions the absence of a special dermal skeleton in this species, but I have detected a very delicate tangential surface layer of reticulately-arranged oxea, quite distinct from the underlying main skeleton, recalling very strongly the dermal skeleton in *Halichondria panicea*. Unfortunately Row did not figure the external form of this species. In shape and general appearance it is identical with *Reniera cribriculus* Dendy (1921 B, pl. 3, figs. 1 a, 1 b). This same holds true for the skeleton, and, apart from very minor differences in colour, shape, etc., there is no one point upon which a distinction between the two species might be based.

Fig. 5.



Section at right angles to surface in *Reniera spinosella* Row (from one of the paratypes), showing a variation in the construction of the skeleton. s.d.c., sub-dermal canal.

The genus *Reniera* contains a large number of species which, like the present one, possess a definite dermal skeleton. Others more typical are devoid of such a skeleton. I do not feel satisfied that species with a dermal skeleton and those without such a skeleton can logically be included in the same genus. The present species, and those others possessing a dermal skeleton, should, I think, be removed to the genus *Pellina*, if that genus can be readily separated from the genus *Halichondria*.

Previously known distribution.—Red Sea.

Localities and registered Nos.—T. 5 (R. N. X); T. 3 (R. N. XLI, ii and iii).

11. HALICHONDRIA GLABRATA Keller, 1891 A.

This species is a perfectly typical *Halichondria* with a strong affinity to *H. panicea*. The present specimen agrees very closely with Keller's holotype.

Previously known distribution.—Red Sea.

Locality and registered No.—Km. 157 (R. N. XVIII).

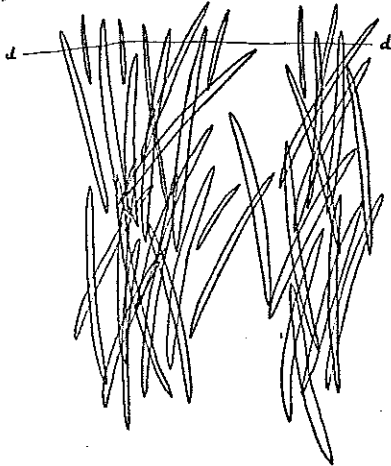
12. TRACHYOPSIS HALICHONDRIOIDES Dendy, 1905 A.

On comparing a preparation from Dendy's holotype of the species with those made by Row (1911 A) from his Red Sea specimens, such a considerable difference was evident between the two that I momentarily doubted the accuracy of Row's identification. On examining the numerous examples of the species in the present collection, however, it became very evident that we have here a species which is subject to considerable variation in practically every one of its features.

Undoubtedly Dendy's specimen with its bundles of oxea running towards the surface, where they end in brushes of spicules, connected at intervals by irregularly-placed more or less transversely-arranged spicules, and Row's specimens, with the irregular reticulation of stout polyspicular bundles, also with dermal brushes, are identical, and the differences they exhibit are merely manifestations of the variability of the species. The oxea themselves are divided into two categories. The larger form the main skeleton, the smaller, almost analogous with the microscleres of other groups of sponges, are found at the surface, for the most part. The number of these small oxea present varies considerably. They may be sparingly or abundantly present, or even, in some cases, apparently absent altogether. I say "apparently absent" advisedly, for I am of the opinion that the apparent absence of the small oxea furnishes an interesting problem in biometrics. The size of the spicules, as is so often the case in sponges, varies considerably, as also does the ratio between the larger and smaller oxea. For example, we may assume that in all the specimens of this species I have examined there are actually two categories of spicules present, large and small. In shape they present no differences at all. In each category the actual length and thickness of the individual spicules varies. In a typical example the average size of the large spicules is so great that the smallest of them will not be so small as the largest of those of the smaller category. Consequently, a sharp distinction will be evident between the two categories. If, however, the ratio between the two categories be smaller, the smaller of the larger spicules will be indistinguishable from the largest of the smaller spicules. There will be no sharp distinction between the two categories, and the smaller oxea will be "apparently absent." Dendy did not sufficiently stress the presence of these smaller spicules, although his figures plainly indicate that he was aware of their presence, for it seems to point to an affinity with

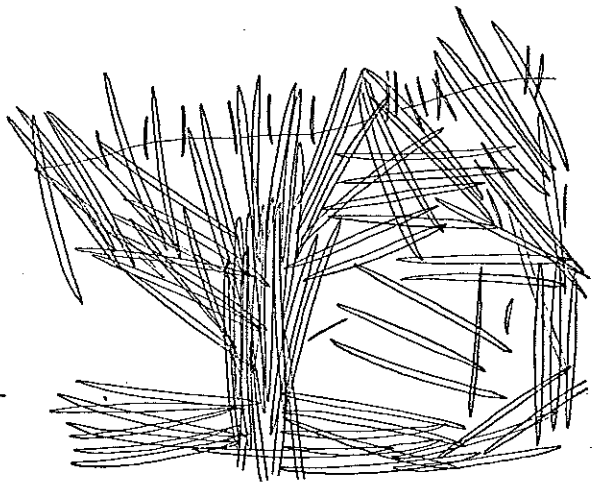
of our common *Hymeniacidon sanguinea* is very instructive in this connection. Returning to Keller's species, we note that the differences between them are of very slight degree. A careful examination of his descriptions leave little doubt that he founded his species in this instance on details of colour, external form, character of the surface, and size of spicules, but that, if these details be compared in the light of our present knowledge of *Trachyopsis halichondrioides*, it will become evident that they, as also the descriptions of the species themselves, are in complete accord with all that has been said above concerning the species described by Dendy from Ceylon. In addition, I have been able to find specimens in the present collection which are exact replicas of those figured by Keller (*l. c.*) under the names *Halichondria granulata* and *H. tuberculata*. Mention must be made of the fact that in the last-named species their author found amphistrongyles in the skeleton. This particular

Fig. 6.



Section at right angles to surface, showing arrangement of skeleton in the holotype of *Trachyopsis halichondrioides* Dendy.

Fig. 7.



Section at right angles to surface, showing arrangement of skeleton in Row's Red Sea specimen of *Trachyopsis halichondrioides* Dendy.

type of spicule is not to be found in the specimens I have examined, but in many of the Suez Canal forms styli, another modification of the oxeote, are present, often in abundance. It is a very curious fact that in those forms in which styli were found, "silica pearls" were also found associated with them. This rather suggests that the modifications of the oxeote spicule and the formation of the "silica pearls" are due to similar causes. What the cause may be it is difficult to say.

Turning to other more distant waters, we see more species hitherto referred to the genus *Halichondria* but agreeing very closely with the present species. Such a one is *H. solida* and its variety *rugosa*, both described by Ridley and Dendy (1887). Both are without a special dermal skeleton, while the main skeleton is the same as

that in the various examples of *Trachyopsis halichondrioides* I have examined. In *H. solida* the surface is minutely granular, in var. *rugosa* tuberculate. It is no extravagance to say that the former compares very favourably with *H. granulata* Keller and the latter with *H. tuberculata* Keller; in fact, like these two species, they are, as I have satisfied myself by actual examination and comparison, synonyms of *T. halichondrioides*.

Halichondria aphysinoides Dendy (1921 B) is very closely allied to the present species, and may possibly prove synonymous with it. Certainly, it belongs to the genus *Trachyopsis* and not to the genus to which its author originally assigned it.

Previously known distribution.—Ceylon, Red Sea, Pacific Ocean.

Localities and registered Nos.—Km. 5 (R. N. XLVI); Km. 25 (R. N. XLIV, i and ii; XLIX); Km. 46 (R. N. XXIX, XXXV, ii); Km. 54 (R. N. XII); Km. 64 (R. N. XXI, i and ii; LIX); Km. 72 (R. N. LII); Km. 76 (R. N. LIII, i); T. 0 (R. N. XXXIV); T. 2 (R. N. XIV); T. 4 (R. N. XXVII and XLV); Km. 82 (R. N. XXIII); Km. 87 (R. N. LXV, ii); Km. 152 (R. N. LXII, ii); Km. 157 (R. N. XXXIX).

13. CHALINA OCVLATA (Pallas).

Previously known distribution.—Almost cosmopolitan.

Locality and registered No.—R. 6 (R. N. XI).

14. CHALINA GRACILENTA Bowerbank.

I have already expressed the opinion (1926 A) that our ideas concerning the diagnosis of certain genera of the Haploscleridæ based on the relative proportions of spicules and spongin in the skeleton are wrong. The common usage has been hitherto to place all individuals in which the spicules are cemented together, at most, by a little spongin into the genus *Reniera*, those with primary fibres containing only a few serially-arranged oxea entirely surrounded by a thin spongin sheath into *Chalina*, those with multispicular primary fibres surrounded by a coating of spongin into *Pachychalina*, and those in which the skeleton is composed of spongin fibres containing vestigial spicules only into *Ceraochalina*. Although I hope to deal more fully with this point at a later date, I wish to emphasize here that there is abundant evidence that these four types of skeleton-formation, hitherto used as means of generic distinction, represent nothing more than the normal variations met with in some, if not all, the species of the Chalininæ. The present material furnishes another example of this very important fact.

A re-examination of the numerous examples of the species *C. gracilentata* and *C. limbata* in the Bowerbank Collection in the British Museum shows without doubt

that no separation can be made between these two species. Examined microscopically, it is seen that in both species the various individuals collected and identified by Bowerbank could, so far as the structure of the skeleton is concerned, be distributed among the genera *Chalina*, *Pachychalina*, and *Ceraochalina*, on the existing diagnoses of these three genera. This, of course, should not be done. If a number of individuals so obviously conspecific as these should, according to our system of classification, be distributed among several genera, we may be sure that our conception of what constitutes a genus is, in this case, quite wrong.

The present examples resemble the typical European form in external form, appearance, shape of the oscules, and in texture, but some have the skeleton of a *Reniera*, others of a *Pachychalina*, and others of a *Ceraochalina*. Whether the *Reniera* form of skeleton ever occurs in the European forms of this species I do not know. So far as my experience takes me, I should be inclined to suggest that it does not.

Row's *Chalina minor* differs from the other specimens discussed in one feature only—that it is larger. Since this can hardly be regarded as a factor for specific distinction, we have no alternative than to regard it as a synonym of *C. gracilentia*.

Previously known distribution.—Europe, Red Sea.

Localities and registered Nos.—Km. 24 (R. N. XLVII) (apparently a violet colour in life); PT. 12 (R. N. L.).

15. SIPHONOCHALINA COMMUNIS (Carter).

The remarks concerning the variation in the ratio of spicule and spongin made under 14 apply equally here*.

Previously known distribution.—Red Sea, Indian Ocean.

Localities and registered Nos.—K. 0 (R. N. III); PT. 0 (R. N. II, VI, i, iv); R. 5 (R. N. LXXII, i); no locality given (R. N. I, i, ii, iii, iv).

16. SIPHONOCHALINA TUBULOSA (Esper).

Previously known distribution.—S. Africa, Red Sea.

Locality and registered No.—PT. 8 (R. N. IV).

* The colour in life was violet. The intensity of the colour varied in different individuals. The pigment was found to be insoluble in distilled water, dilute alkali, ether, or chloroform. Alcohol caused decolorization. Slightly soluble in dilute acid, giving a violet solution without absorption bands. Addition of alkali to this changes the colour to light yellow. Addition of acid to this does not bring back the violet. On heating the violet acid solution the colour turns to pink.—H. M. Fox.

17. MYCALE DENDYI (Row).

Previously known distribution.—Red Sea.

Localities and registered Nos.—PT. 0 (R. N. VI, iii); PT. 0 (Wood B) (R. N. LXXIV); PT. 0 (Wood D) (R. N. LXXV).

18. MYCALE ROTALIS (Bowerbank).

Previously known distribution.—Europe.

Locality and registered No.—Km. 152 (R. N. XXX).

19. MYCALE EUPLECTELLIROIDES (Row).

Previously known distribution.—Red Sea.

Locality and registered No.—Km. 146 (R. N. XXIV, ii).

20. MYCALE FISTULIFERA (Row).

Previously known distribution.—Red Sea.

Locality and registered No.—T. 8 (R. N. XLIII).

21. MYCALE ERYTHREANA (Row).

Previously known distribution.—Red Sea.

Locality and registered No.—P. 1 (R. N. XXVIII, i).

22. MICROCIONA ATRASANGUINEA (Bowerbank).

Previously known distribution.—British Seas, Gulf of Manaar.

Locality and registered No.—P. 1 (R. N. LVII).

23. MYXILLA INCRUSTANS (Johnston).

This species is probably world-wide in distribution, but at the moment is in need of a thorough revision. The present specimens differ little from Johnston's holotype, with which I have compared them, the only difference being, so far as one can see, that the styli of the main skeleton are for the most part quite smooth. The spining of acanthostyles is subject to considerable variation in many species of this genus, so that I cannot regard the paucity of spines in the present instances as a matter of importance in the identification of these sponges.

Previously known distribution.—Cosmopolitan (probably).

Localities and registered Nos.—P. 0 (R. N. XLVIII, LXI); Km. 14 (R. N. XXVI); Km. 76 (R. N. LX); PT. 0 (Wood D) (R. N. LXXIII).

23 *a.* TEDANIA ASSABENSIS Keller.

The present examples of this species are mainly remarkable for the polytylote character of the megascleres. This appears very early in development when the spicule, still very slender, may be seen to bear a number, 4–6, of small globules of silica at various distances along its length. A similar thing was noted in one specimen of the previous species (23, R. N. LX), and both may ultimately prove to be due to the same factors as those which have produced the styloting of the oxea and the silica pearls in *Trachyopsis halichondrioides*.

Previously known distribution.—Red Sea.

Localities and registered Nos.—T. 12 (R. N. XVI); K. 13 (R. N. VIII, i); P.T. 1 (R. N. XXXII); R. 6 (XLII, v).

24. HYMENIACIDON COCCINEA (Keller).

From the examination of a fragment of the holotype in the British Museum collection it is possible to state definitely what one would suspect from Keller's description, that this species is not a *Reniera*, as its author supposed, but a *Hymeniacidon*. The present example is but doubtfully referred to this species on account of a number of small, apparently siliceous, sigmaspiroid bodies present in the choanosome. Apart from these enigmatic bodies, the Suez Canal specimen is in complete agreement with the holotype. Either the sigmaspiroids are extraneous or they are a new type of microsclere, in which case the species must be removed from the present genus. Should they be true microscleres, I should regard the holotype, in view of the great similarity between it and the present specimen, as a case of an individual which had lost one category of spicules common to the normal individual of the species, a thing by no means uncommon in sponges. Bowerbank's *H. coccinea* is a variety of the common *Halichondria panicea*.

Previously known distribution.—Red Sea.

Locality and registered No.—R. 8 (R. N. VII, i).

25. HYMENIACIDON SANGUINEA (Grant).

Previously known distribution.—Northern Hemisphere.

Locality and registered No.—Km. 5 (R. N. XXXI, XXXVI, LXIV).

26. SUBERITES CARNOSUS (Johnson).

Previously known distribution.—Europe, Red Sea (probably cosmopolitan).

Locality and registered No.—Km. 24 (R. N. IX, ii).

27. PSAMMOPEMMA COMMUNE (Carter).

Previously known distribution.—Australia, Red Sea.*Locality and registered No.*—K. 3 (R. N. XIX).

28. DYSIDEA CINEREA Keller.

Previously known distribution.—Red Sea.*Locality and registered No.*—Km. 157 (R. N. XI) *.

29. EURYSPONGIA LACTEA Row.

Previously known distribution.—Red Sea.*Locality and registered No.*—R. 6 (XLII, ii).

30. APLYSINA RETICULATA Lendenfeld.

Previously known distribution.—Red Sea, Indian Ocean.*Localities and registered Nos.*—T. 12 (R. N. LXIX)†; T. 0 (R. N. LIV); Km. 152 (R. N. LXII).

31. HIRCINIA VARIABILIS Schulze.

Previously known distribution.—Almost cosmopolitan.*Localities and registered Nos.*—K. 7 (R. N. LXVIII); K. 13 (R. N. VIII, ii); Km. 146 (R. N. XXV, i); R. 6 (R. N. XLII, i).

EMBRYOLOGY.

Embryos in an advanced stage of development were found in *Chalina oculata* (collected in November) and in *Trachyopsis halichondrioides*, *Reniera tabernacula*, and *Hircinia variabilis* (collected in December).

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* In life of a light blue colour. Smelt of garlic. Pigment soluble in water. No absorption bands. Addition of acid turns colour from blue to pink. Addition of alkali precipitates.—H. M. Fox.

† In life of a dark purple colour. Pigment soluble in water and in alcohol. No absorption bands. Solution in distilled water pink with slight tinge of blue. Acid solution pink without the blue tinge. Addition of alkali gives blue colour and final precipitation. Light causes slow fading of colour in neutral solution.—H. M. Fox.

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Appendix to the Report on the Sponges. By H. MUNRO FOX.

Table 17 shows that 25 species of sponges were found in the Canal, of which 14 have undoubtedly immigrated from the Red Sea, while two only have come from the Mediterranean. Sponges were found to be common at the following stations:— P. 0 (yellow sp.); P. 1; P. 4 (incl. violet sp.); Km. 5 (orange sp.); Km. 14 (yellow and white spp.); Km. 24 and Km. 35 (yellow sp.); Km. 46; Km. 54 and Km. 64 (yellow *Trachyopsis halichondrioides*); T. 0; T. 9, T. 13, T. 15 (violet sp.); Km. 87; K. 0 (*Sycon*); K. 1 (red sp.); K. 2; K. 3 (violet sp.); K. 14 (purple sp.); K. 9; Km. 157; PT. 0; PT, Darse (orange sp.).

TABLE 17.—Distribution of the Sponges in the Canal.

	Mediterranean species.		Red Sea and Indian Ocean species.											Species common to Mediterranean and Red Seas.			Atlantic and Pacific species.									
	<i>Hymenacidon sanguinea.</i>	<i>Mycale rotalis.</i>	<i>Reniera spinosella.</i>	<i>Mycale erythraena.</i>	<i>Microciona atrasangüinea.</i>	<i>Trachyopsis halichondrioides.</i>	<i>Aplysina reticulata.</i>	<i>Reniera tabernaculi.</i>	<i>Tedania assabensis.</i>	<i>Leucosolenia coriacea.</i>	<i>Donatia robusta.</i>	<i>Siphonochalina communis.</i>	<i>Psammodiplosia commune.</i>	<i>Dysidea cinerea.</i>	<i>Halichondria glabrata.</i>	<i>Mycale euplectellionides.</i>	<i>Leucosolenia ymnordialis.</i>	<i>Sycon raphanus.</i>	<i>Leucandra prunigenita.</i>	<i>Leucandra aspera.</i>	<i>Chalina gracilenta.</i>	<i>Mycella incrustans.</i>	<i>Suberites carnosus.</i>	<i>Hircinia variabilis.</i>	<i>Reniera cinerea.</i>	
Port Said.			+	+	+														+						+	
Km. 5.-Km. 76.	+		+			+												+		+	+	+			+	
Lake Timsah.						+	+	+	+																	+
Km. 82-Km. 98.						+												+		+						+
Bitter Lakes.									+	+	+	+	+				+	+							+	+
Km. 133-Km. 157.	+		+			+	+								+	+									+	
Port Taufiq.			+						+			+									+	+				