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XLVI.— *On a true Leuconid Calcisponge from the Middle Lias of Northamptonshire, and on detached Calcisponge Spicules in the Upper Chalk of Surrey.* By GEORGE JENNINGS HINDE, Ph.D.

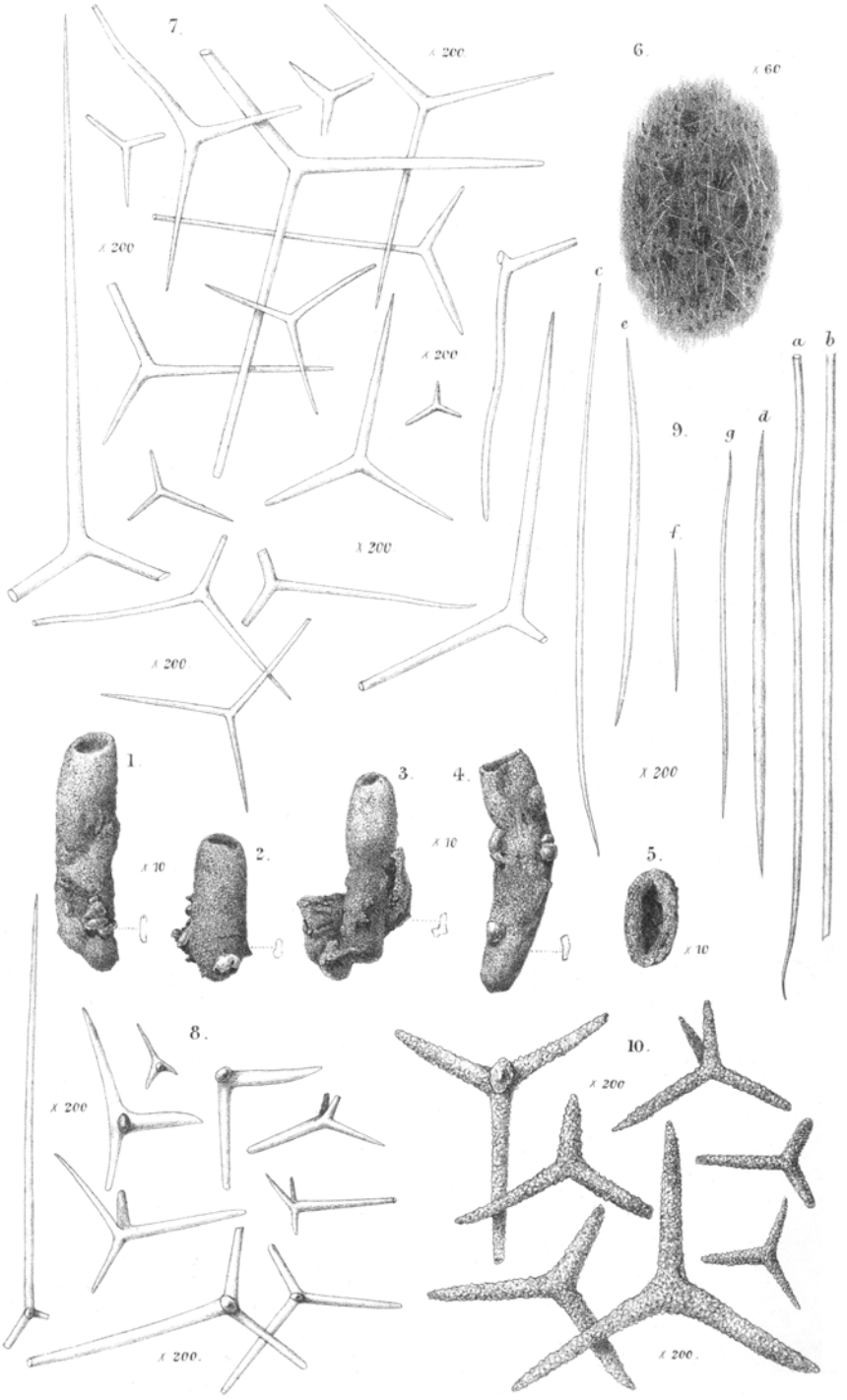
[Plate XVII.]

I. *On a true Leuconid Calcisponge from the Middle Lias of Northamptonshire.*

MR. E. A. WALFORD, F.G.S., of Banbury, kindly sent to me some time since for study and description several specimens of a small sponge which he had discovered in the Marlstone beds of the Middle Lias at King's Sutton, near Banbury. The specimens, though small or almost microscopic in size, appear to be perfect and full-grown, and their state of preservation is so remarkable as to permit of ready determination of their minute skeletal structures. This is the more surprising since the specimens prove to be Calcisponges, as delicate and fragile as any existing representatives of this group. Though occurring in strata of such a comparatively remote geological period, the structure of these specimens so fully agrees with that of existing sponges of the genus *Leucandra*, Hæckel, that I propose to include them therein. Only a single species has as yet been determined, which is described below under the name of *Leucandra Walfordi*.

Leucandra Walfordi, sp. n. (Pl. XVII. figs. 1–9.)

Sponges small, club-shaped, subcylindrical or compressed, slightly contracted at the base, which is attached to small grains of sand or fragments of other organisms. Usually growing single, but occasionally two or three individuals are attached together at their bases. The specimens range from 2 to 3·5 millim. in height and from ·6 to 1 millim. in thickness. The outer surface is slightly hispid, with obliquely projecting spicules; the summits are obtusely conical or truncate, without any distinctive neck or spicular collar. The cloacal tube extends nearly to the base of the sponge; it opens by a circular or, in the compressed forms, elliptical aperture, from ·2 to ·5 millim. in width. The inner or cloacal surface of the wall is apparently smooth and without any special layer of spicules. The walls of the sponge are about ·2 millim. in thickness; they are composed of cylindrical or fusiform acerates or rod-shaped spicules and three- or four-



Mintern Bros. lith.

rayed spicules of varying dimensions, which, for the most part, are indiscriminately intermingled together. Most of the acerate spicules are nearly straight, approximately cylindrical rods, with styliform, slightly inflected extremities (figs. 9 *a*, *b*). Of the largest of these I have not met with a complete form; the longest fragments measure ·43 millim. in length and from ·005 to ·01 millim. in thickness. Other acerate spicules are straight or curved and either fusiform, gradually tapering to an acute point at both ends (figs. 9, *d*, *e*), or nearly of an even thickness for the greater portion of their length, and then terminating acutely (figs. 9, *c*, *g*). These latter range from ·09 to ·29 millim. in length and from ·0037 to ·007 millim. in thickness. The rod-shaped spicules apparently form the majority in this species; some of the longer forms are disposed either parallel with the wall or in an oblique direction, so that their distal ends slightly project beyond its general surface.

Of the three-rayed spicules (fig. 7) some are regular in form, that is with the rays of equal length, in others the rays appear to be unequal; but as one or more are usually broken, it is not easy to determine how far they may have been similar originally. The rays are smooth, straight, or rarely with a slight curvature, and very gradually tapering to an acute point. Sagittate forms appear to be absent. There is a great difference in the size of these spicules; in a small specimen the *rays* are not more than ·03 millim. in length by ·004 millim. in thickness, whilst the rays of a large spicule are ·26 millim. in length and ·01 millim. in thickness at the base. In the four-rayed spicules (fig. 8) the facial or plane rays resemble those of the three-rayed forms and the additional apical ray appears to be usually shorter than the facial rays, and in some it is distinctly more robust and somewhat abruptly pointed. The rays in some instances are also decidedly elliptical in section at their bases. The three- and four-rayed spicules are, so far as can be ascertained, irregularly intermingled with one another and with the acerate spicules in the structure of the wall, and no special arrangement either on the dermal or cloacal surfaces is apparent; but it is quite possible that the stout apical ray of the four-rayed spicules may project into the cloacal cavity, though not now recognizable in position.

Of the canal-system in the walls of this species very little can be ascertained; there are here and there minute circular holes on the outer surface, which may be apertures of incurrent canals, and in fractured portions of the wall there are traces of anastomosing canals; also on the inner or cloacal surfaces

there are indications of the larger apertures of excurrent canals. As, however, the intermediate spaces in the spicules of the wall are generally filled with an extremely fine powdery matrix, the courses of the canals, even on the supposition that they were similar to those of existing Leucones of corresponding dimensions, would be to a great extent unrecognizable.

The examples of this species occur detached and free in a decayed rusty rock, mingled with sand and oolitic grains and broken-up fragments of Crinoidea or other Echinoderms. Many retain their outer form as perfectly as any specimen of *Grantia* which might be met with on our coasts at the present day; others have been fractured, and small portions of their wall are found separately. The sand-grains &c. now attached to the bases of some of the specimens are probably the original materials on which the sponge fixed itself during its growth. Not only do these sponges retain their outer form, but the structure of their walls with their loosely arranged interfelted spicules is apparently undisturbed. As already mentioned, the sponges are now infilled with a powdery rusty matrix, much in the same way as recent specimens will get charged with muddy sediment; and this matrix can be partially removed by gentle washing, leaving the loose spicular wall exposed nearly in its pristine condition (fig. 6). By breaking off a fragment of the sponge and still further treating it with water or with a drop or two of spirits of wine, aided by gently touching with a needle or camel's-hair brush, the spicular felt-work becomes disentangled, and its individual constituents separated from each other as readily as those of recent Calcisponges by the action of caustic potash. In reality the structure of these fossil sponges has been preserved almost unaltered and uninjured, in spite of the fact that the spicules of which they consist are exceedingly slender, fragile, and minute, and that they are only loosely and irregularly intermingled together.

As regards brittleness, however, the spicules of the Lias sponges now fracture much more readily than those of existing analogues, and it is exceptional to find perfect forms in microscopic mountings from them. Under the microscope the spicules vary but slightly in appearance from recent forms; their lustre is hardly so brilliant, but their surfaces are equally smooth and even, and show no traces of erosion. In polarized light they behave the same as recent Calcisponge spicules. I have not noticed any traces of axial canals; but even in recent spicules of similar dimensions it is very rarely that the canals can be distinguished.

The figures of the spicules on the accompanying Plate (Pl. XVII. figs. 7, 8, 9), which have all been drawn to a uniform scale of 200 diameters, will convey a better idea of their relation in size and form to those of recent Calcisponges than a verbal description. Judging by the standard proposed by Hæckel (Kalkschw. Bd. i. p. 209) for recent spicules, these fossil forms are included in the four lowest grades of minute, small, medium-small, and medium-large forms; that is to say, the rays of the smallest fossil three-rayed spicule are only ·03 millim. in length, and thus within the sixth or lowest scale, whilst the rays of the largest observed are ·26 millim. in length, and thus of the fourth or medium-small scale. The length of some of the largest acerate spicules would bring them into the scale of the third or medium-large forms. Spicules of the first or second dimensions do not occur in this fossil. When compared with the spicules of recent species of *Leucandra* or of other genera of Leucones, as depicted in Hæckel's Monograph (mostly on the scale of 100 diameters), the fossil forms are seen to be as a rule smaller and more delicate than the recent ones. In some recent species, such as *Leucandra Gossei*, Bowbk., sp., and *L. crambessa*, Hæck., the rays of the three-rayed spicules are of about the same length, but somewhat more robust than the fossil forms; but the acerate spicules in the same sponges are of unmistakably stouter proportions than those in the fossil, and they further differ in not being inflected near the point. In the fossil the simple acerate spicules are more numerous than the three- and four-rayed forms, whilst in most of the recent species of the genus the reverse proportions exist.

Owing to the small size and state of preservation it is not practicable to ascertain the details of the canal-system sufficiently, so as to compare the fossil with its recent analogues; but the evidence, so far as it goes, tends to show that there is the same system of irregular anastomosing canals as in recent Leucones.

The significance of this discovery of fossil Leuconid sponges, structurally similar to the existing genus *Leucandra*, in strata of Liassic age, may be understood from the fact that hitherto no fossil sponge of this family has been met with, though detached spicules, probably belonging to sponges of the same group, have been detected in the Tertiary deposits of St. Erth, Cornwall (Quart. Journ. Geol. Soc. vol. xlii. (1886) p. 214). With the single exception of *Protosycon punctatum*, Goldf., sp., from the Jurassic Limestones of Streitberg, in Franconia, which has been placed by v. Zittel in the Sycones family, no member of either of the three existing families of Calcisponges

established by Hæckel has previously been known. So fragile and apparently unfitted to be preserved as fossils are the structures of recent Calcisponges, that Hæckel did not think entire forms would ever be found in the rocks, though possibly their microscopic detached spicules might be met with (Kalksch. Bd. i. p. 341). And yet, by some most favourable combination of circumstances, this remarkable fossil Calcisponge, as fragile as any of its existing relatives, has been preserved since Liassic times. Since Hæckel's Monograph appeared in 1872 numerous fossil Calcisponges have been determined by v. Zittel and others; but all of them, with the exception mentioned above, belong to the extinct family of the Pharetrones, characterized by having a skeleton of *solid* spicular fibres. This structural type of Calcisponge appears to have been singularly well adapted for fossilization, since sponges of this group are recorded from Devonian strata upwards; but as regards some of the older forms, from the Devonian to the Triassic, further evidence of the nature of their fibrous skeletons is still required. The skeletal fibres in the Jurassic and Cretaceous Pharetrones, however, consist of spicules closely resembling those of existing Leucones and other recent Calcisponges, and on this ground v. Dunikowski placed them as a mere subfamily of the Leucones ('Palæontographica,' Bd. xxix. (1883) p. 34 sep. Abdr.), and believed that the solid fibres were of secondary origin, produced by fossilization. This view is clearly untenable, since the spicules in the solid fibres of the Pharetrones have oftentimes a very definite arrangement, quite impossible to have been produced by mechanical influences from the irregularly intermingled spicules of Leuconid sponges. We now know from this Lias fossil that sponges with true Leuconid structure date as far back in geological time as any Pharetrones with definitely ascertained spicular fibres; and it is not improbable that both groups may have coexisted from the Palæozoic era. It is worthy of note that whilst the Leuconid type still flourishes and is world-wide in its distribution, the Pharetronid type seems to have wholly died out, the latest known * occurring in the Upper Chalk.

Distribution. The fossils were obtained by Mr. E. A. Walford, F.G.S.†, in a bed belonging to the Marlstone of the

* An Australian Calcisponge, *Leucetta clathrata*, Carter (Ann. & Mag. Nat. Hist. ser. 5, vol. xi. (1883) p. 33), was originally described by Mr. H. J. Carter, F.R.S., as possessing solid spicular fibres; but he has since discovered that the fibres are really tubular (*ib.* vol. xvii. (1886) p. 508).

† I wish to state that the keen observation of Mr. Walford has also brought to light numerous other small Calcisponges in the Inferior Oolite of Dorsetshire, which are now under examination. They are all Pharetrones, and include many new species.

Middle Lias, in the zone of *Ammonites spinatus*, at King's Sutton, Northamptonshire. Associated with the sponges are numerous specimens of well-preserved Foraminifera, Corals, Mollusca, and Polyzoa; these latter have already been described by Mr. Walford (Quart. Journ. Geol. Soc. vol. xliii. 1887, p. 636).

II. *Detached Calcisponge Spicules in the Upper Chalk of Surrey.* (Pl. XVII. fig. 10.)

In some mountings of the finer material of the Upper Chalk (zone of *Micraster*) from Croydon and Sutton, Surrey, there are, in addition to the common Foraminiferal species of *Textularia*, *Globigerina*, &c., some minute three- and four-rayed spicules, very similar in appearance to those of ordinary Calcisponges. The spicules are of calcite, their forms are fairly complete, but their surfaces are rough and uneven, as if covered by the finest particles of the Chalk. The rays are conical, with blunt terminations; they vary from ·04 to ·13 millim. in length and from ·007 to ·02 millim. in thickness. Some are regular forms with rays equal in length; in others the rays are unequal. Beyond some rod-like fragments of the same thickness as the three-rayed forms no other spicules are present in the material. As these spicules correspond in form, size, and mineral structure with those of Calcisponges, it seems reasonable to conclude that they are detached from sponges of this group. The only other inference is that they may be spicules of siliceous Tetractinellid sponges which have been replaced by calcite. But against this supposition is the fact that even the larger forms of true siliceous spicules are very rare in the Chalk of these areas (unless included in the cavities of flints); they have been dissolved, leaving empty moulds in the chalky matrix. Further, in these spicules the three facial rays are approximately in the same plane, the same as those of Calcisponges generally, whereas in the Tetractinellid *Calthrops* spicules the rays are generally disposed in the form of a tripod. It would also be very unusual to find such very small detached forms which had undergone mineral replacement. As Calcisponges of the genus *Elasmostoma* are found in the Chalk of Kent, the occurrence of detached spicules might have been anticipated; but they do not appear to have been noticed previously.

EXPLANATION OF PLATE XVII.

Leucandra Walfordi, figs. 1–9.

Figs. 1–4. Four specimens of the sponge, enlarged to the same scale of ten diameters.

Fig. 5. A transverse section of a specimen, showing the thickness of the wall and the cloacal cavity. Enlarged ten diameters.

Fig. 6. A fragment of the inner surface of the sponge-wall, showing the irregular disposition of the spicules and traces of canals. Enlarged sixty diameters.

Fig. 7. Entire and fragmentary three-rayed spicules of the sponge-wall. Enlarged two hundred diameters.

Fig. 8. Entire and fragmentary four-rayed spicules. Similarly enlarged.

Fig. 9. Entire and fragmentary rod-like and acerate spicules. Enlarged two hundred diameters.

[The above are from the Marlstone of the Middle Lias at King's Sutton, Northamptonshire.]

Fig. 10. Detached three- and four-rayed spicules of Calcisponges from the Upper Chalk of Croydon and Sutton, Surrey. Enlarged two hundred diameters.

XLVII.—*Mr. A. G. Butler's Remarks upon distasteful Insects.* By Edward B. Poulton, M.A., F.R.S.

My attention has only just been directed to Mr. Butler's paper in the August number of this Journal. My only object in replying to the extraordinary statements and inferences therein contained is the enlightenment of readers who may mistake the expression of Mr. Butler's conviction that his notes occupy an altogether unique position for a comprehensive guide to the literature of the subject.

Mr. Butler tells us that the attention which a paper of his published many years ago "has since received has been interesting, as showing how very little has since been done by naturalists either to prove or disprove the truth of the theories based thereon."

From this remark any reader who was not acquainted with the subject might reasonably suppose (1) that the theories alluded to were thought out by Mr. Butler; (2) that Mr. Butler's observations formed the first basis on which the theories rested, and that very little or nothing has been added in the way of proof or disproof since 1869, when Mr. Butler's paper appeared.