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Further Notes on the Sponges of Lake Baikal.

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VI. FURTHER NOTES ON THE SPONGES OF LAKE BAIKAL.

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(Plate IX).

In a paper recently published [1] but written some little time ago, I expressed the opinion, tentatively, that the characteristic sponges of Lake Baikal belonged to the subfamily Chalininae and should probably be assigned to the genus *Veluspa*, Miklucho-Maclay. At the time I had had, as I pointed out, no opportunity of comparing specimens from the Siberian lake with marine Haploscleridae. This was still the case at the end of 1912 when I was preparing my report on the sponges of the Lake of Tiberias;[2] but within the last few months I have been able, thanks very largely to the rearrangement of the collection of marine invertebrates in the Indian Museum carried out by Mr. S. W. Kemp, to examine a considerable number of marine Monaxon sponges from different parts of the world. The result has been to confirm my more important contention, that certain of the Baikal sponges were Chalininae; but I find that I was not justified in re-uniting Dybowski's genus *Lubomirskia* with the older genus *Veluspa*, from which he separated it in 1879, or in asserting that all the sponges of the lake (with the exception of those belonging to the Spongillid genera *Spongilla* and *Ephydatia*) were congeneric. It becomes necessary, therefore, to reconsider the generic portion of the species examined, and this will render it possible to discuss their geographical significance.

The precise systematic position of the sponges that constitute one of the most characteristic features of the fauna of Lake Baikal is not only a problem of considerable difficulty, but also one of great geographical interest. Most authorities on the Spongillidae have treated these sponges as a subfamily thereof, or merely as a highly specialized genus allied to the African *Potamolepis* and the South American *Uruguaya*. It is noteworthy that none of those who have hitherto treated in a comprehensive manner of the Spongillidae as a whole have had before them collections from Lake Baikal. Thanks to the authorities of the Zoological Museum of the Imperial Academy of Sciences in St. Petersburg I have been more fortunate in this respect, in that I have been able to examine

[1] *Ann. Mus. Zool. Ac. Sci. St. Pétersb.* XVIII, p. 96 (1913).
[2] *Journ. As Soc. Bengal*, 1913, p. 77.

a very representative set of specimens of the species assigned by Dybowski to his genus *Lubomirskia*. In discussing more fully the result of comparing preparations of these sponges on the one hand with similar preparations of many true Spongillidae, and on the other with those of marine Monaxon sponges, it will be as well to commence by giving a brief abstract of what has already been published on the Baikal species as a result of the examination of collections from the lake.

So long ago as 1772 or 1773 Pallas[1] described the first of these sponges under the name *Spongia baikalensis*.

In 1870 Miklucho-Maclay[2] redescribed this sponge very briefly and assigned it to his new genus *Veluspa*, treating it as a variety of the Arctic marine species *V. polymorpha*.

In 1879 Dybowski[3] again reinstated *Spongia baikalensis* as a distinct species and created a new genus for its reception and for that of all the other sponges from Lake Baikal with which he was acquainted. For this genus he coined the name *Lubomirskia*.

In 1895 several additional species and varieties were described and assigned to *Lubomirskia* by Soukatschoff.[4]

In 1901 Swartschevski[5] pointed out that two distinct genera had been confused under the name *Lubomirskia* and distributed the species described by former authors, together with several new forms described by himself, between the genera *Lubomirskia* and *Veluspa*. He also described some true Spongillinae from Lake Baikal. In the same year Korotneff[6] based some general observations (briefly describing the same Spongillidae) on his own collection, on which Swartschewski also worked. This collection is still being described in a series of monographs.

In my paper of last year[7] I suggested, as a provisional arrangement, that all the genera and species from Lake Baikal placed in *Veluspa* and *Lubomirskia* by other authors, should be reassembled in the latter genus, and that they should be assigned to the subfamily Chalininae of the family Haploscleridae, instead of the Spongillidae.

1. SYSTEMATIC.

It is a disputed point among students of the Porifera whether the classification of the Monaxonida (or Monaxonellida) should be based mainly, if not exclusively, on the form of the microscleres, or whether that of the skeleton-spicules and other macroscleres should not rather be taken first into account. Both parties, how-

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[1] Gauthier de la Peronie's French translation of Pallas's "Travels": *"Voyages de M. P. S. Pallas.....Traduits de l'Allemand* (1778–1793)" is the only version available in Calcutta. The reference to the description of *Spongia baikalensis* in this version is vol. IV, p. 680.

[2] *Mém. Acad. Sci. St. Pétersb.* XV, No. 3 (7), p. 4 (1870).

[3] *Mém. Acad. Sci. St. Pétersb.* XXVII, No. 6 (6), p. 11 (1880).

[4] *Trav. Soc. Nat. St. Pétersb.* XXV (2), p. 11 (1895).

[5] *Zapiski Kiev. Obšč. Jest.* XVII (2) (1901).

[6] *Biol. Centralbl.* XXI, p. 306 (1901).

[7] *Ann. Mus. Zool. Ac. Sci. St. Pétersb.* XVIII, p. 96 (1913).

ever, seem to acknowledge that, whatever criterion is adopted in the separation of families, some or all of them will be of polyphyletic origin and include genera that resemble one another because of convergent evolution rather than of direct common descent. The precise classification adopted is, therefore, largely a matter of convenience. If great stress is laid on the microscleres alone there is this difficulty, that in certain genera (*e.g. Homaeodictya*)[1] the microscleres are very liable to be overlooked or lost altogether, and species assigned not only to the wrong genera but even to the wrong family; while in many genera microscleres are invariably absent. In those genera, however, in which they are present there can be little doubt that they form by far the readiest means of identification and separation in the case of properly preserved specimens, and on the whole it is perhaps most convenient to consider them first in separating the larger divisions, although in their absence other characters must be found.

In Prof. Dendy's[2] report on the sponges collected by Prof. Herdman in the Gulf of Manaar (1905) there is, on pp. 133 to 135, a useful discussion of the composition and position of the families of the suborder Sigmatomonaxonellida. This suborder consists of Monaxon sponges in which the typical microscleres are sigmata, or forms derived therefrom, true asters being absent. The first family assigned by Dendy to the suborder is the Haploscleridae, in which, following Topsent[3] he includes the Homorrhaphidae and Heterorrhaphidae as defined by Ridley and himself[4] in 1887 and by other authors He assigns to the Haploscleridae those genera in which chelae and anchorae are absent, the skeleton-spicules being as a rule amphioxi or amphistrongyli and the spicule-fibres typically nonplumose. The marine subfamilies to be considered here belong to this family but have no microscleres.

In dealing with the Baikal sponges it is necessary to consider the relationship between the Haploscleridae and the Spongillidae, in which all other freshwater sponges must at present be placed. In individual specimens, and even in some cases in species and genera, it is often extremely difficult, if not impossible, to find any definite character that would separate a Spongillid from a Haplosclerid. In both families we find sponges totally devoid of microscleres and having a somewhat amorphous skeleton composed of amphioxi held together by a greater or less amount of chitinoid substance.

The typical microsclere of the Haploscleridae is a C-shaped spicule (sigma), which may be modified in different ways but never assumes the complicated form of the chela or of the anchora and rarely becomes straight and rod-like. Microscleres are in

[1] Lundbeck, '*Ingolf*' *Exp.* VI, pt. 1, p. 6, footnote (1902).
[2] Herdman's *Rep. Pearl Oyster Fisheries* (Roy. Soc. London), III (1905).
[3] *Mem. Soc. Zool. France* VII, p. 5 (1894).
[4] '*Challenger*' *Rep. Zool.* XX (Monaxonida) (1887).

some genera completely lost by degeneration. The skeleton consists of a more or less well defined network in the structure of which diactinial or occasionally tylote spicules take an important part, if they do not compose it altogether. In cases in which the spicules form definite fibres they either lie parallel or nearly parallel to one another in the core of these fibres, the chitinoid covering of which varies greatly in strength and thickness (if it exists at all), or else are connected together in a chain-like formation by means of small patches of a similar substance. In some species no spicule-fibres can be detected and the skeletal network is constructed entirely of single spicules either joined together by patches of chitinoid substance and each encased in a thin film of the same substance so as to form a lattice-like reticulation, or else merely massed in the parenchyma without any definite arrangement.

In many genera of Haploscleridae the life-history is unknown, but in those in which it has been investigated a free-swimming larva is produced that is covered externally (except at the broader end) with cilia and has a *solid* body. In many cases the larval ciliated cells exhibit distinct signs of specialization in certain regions, but a pigment-spot is not present.

In the Spongillidae, which are closely related to the Haploscleridae and by some authors given only subfamily rank, the typical microsclere is a small amphioxous spicule covered with minute spines, which are evenly disposed on its surface. That this spicule may be convergent towards the sigma is proved by a study of the gemmule-spicules of *Spongilla*, the most primitive genus of the family, and *Pectispongilla*, in both of which certain microscleres have a distinctly C-like outline. The evolution of the microscleres takes, however, a very characteristic course in the family as a whole. In the first place a tendency for the differentiation of the minute spicules that have no part in the formation of the skeleton into two distinct, but not widely divergent types makes its appearance in the most primitive forms. In *Spongilla* it is already well established; we find simple spiny amphioxi, which are never strongly curved, lying free in the dermal membrane and the parenchyma, and also other amphioxi of stouter build and slightly more complicated structure associated only with the gemmules. Although the latter spicules often approach the sigma-type in outline more closely than the "flesh-spicules" do, they are more highly specialized as regards the spines that cover them, in that these spines are often distinctly longer and more recurved at the extremities of the spicule than on the middle part. Unimportant as this specialization usually is in *Spongilla* (it is much more strongly marked in *Pectispongilla*, an offshoot from the direct line of evolution in the family), it has a well-defined significance in other, more highly developed genera. In *Ephydatia*,[1] a genus closely resembling *Spongilla* in general

[1] In the genus *Iotrochota* of the family Desmacidonidae, which as a family is characterized by the presence of the chela or its derivatives, and again in certain

structure, the terminal or subterminal spines of the gemmule-spicule form a regular crown or rotule at both extremities; in *Pectispongilla* they fuse together at both ends of the spicule to form smooth-edged disks; in *Tubella* one of the rotules begins to disappear and a trumpet-shaped spicule is the result, while in *Parmula* this rotule has vanished together with the greater part of the shaft of the spicule, which takes the form of a flat plate (representing the other rotule) with a spine (all that is left of the shaft) projecting upwards from its centre

The evolutionary development of the free microscleres or flesh-spicules of the Spongillidae is much less striking than that of the gemmule-spicules and need not be considered here. In several genera and many species these free microscleres disappear altogether; whereas this is the case with the gemmule-spicules only in a few degenerate forms.

The skeleton of the Spongillidae differs in no essential feature from that of the Haploscleridae; but the chitinoid sheath of the spicule-fibres, if it exists at all, is never so stout as it is in some Haploscleridae, notably in those of the subfamily Chalininae, and the lattice-like network of single spicules characteristic of *Reniera* among the Haploscleridae is never found in its full development.

The free-swimming larva of the Spongillidae has a very characteristic structure, consisting of a *hollow*, bladder-like body, entirely covered externally with homogeneous cilia and invariably without a pigment-spot.

The most characteristic feature of the Spongillidae has, however, as yet been mentioned only incidentally, *viz.* the elaboration of the gemmule.

Gemmules are produced by many Haploscleridae, but consist merely of masses of cells stored with food-material and enclosed in a simple chitinoid case without specialized spicules or a pneumatic covering. In the Spongillidae on the other hand both these structures are commonly associated with the gemmule; in the subfamily Spongillinae the one critical character of most of the genera is the form of the microscleres with which the gemmule is armed, a foraminal tubule or cup (or at any rate a very definite depression in the covering at which the contents of the gemmules may escape on germination) is found in all but a few cases, while in most instances there is a special coat of chitinoid substance containing air-spaces of one kind or another. In the subfamily Potamolepidinae, in which microscleres of all kinds are absent, the gemmule, if it exists at all, is of a much simplified nature and resembles in many respects that of the Haploscleridae: that this is the result of convergence rather than of genetic relationship is proved by the very close structural resemblance between certain Potamolepidinae and certain Spongillinae not of a primitive type.

Hexactinellida, free microscleres very similar superficially to the gemmule-spicules of *Ephydatia* have been produced in totally different lines of evolution.

There is one anatomical feature of the Spongillidae which I have left to the last in considering the distinctive features of the family, because I am not sure of its precise significance; I mean the well-developed subdermal cavities Under this term two quite distinct structures or rather systems have sometimes been confused, *viz.* (*a*) the cavity between the derma and the parenchyma into which water is drawn through the dermal pores on its way into the inhalent or afferent channels of the sponge, and (*b*) the superficial exhalent or efferent channels that extend along the surface of the parenchyma immediately beneath the derma and open into the oscula direct. Both these systems may be traced in all Spongillinae and in *Nudospongilla* among the Potamolepidinae, although the actual dimensions of the channels differ in different species. In *Cortispongilla* and *Pachydictyum* they can also be detected, but not so easily. I have examined only dry specimens of *Potamolepis*, but the structure of the skeleton certainly suggests their presence in this genus also.

In the Haploscleridae (as also in many other marine Monaxon sponges) many genera and species have both systems well developed. This is the case in many of the Renierinae, the subfamily most nearly related to the Spongillidae. It is not the case, however, in the Chalininae. In this subfamily (or at any rate in all its representatives I have examined) there is practically no subdermal inhalent cavity and the main exhalent channels run up vertical or obliquely to the surface of the sponge, on which they open as a rule in groups.

In all the Baikal sponges I have examined, or of which suitable figures have been published—I have not seen the forms of *Spongilla* and *Ephydatia* described by Swartschevski (1901), whose figures do not illustrate this point—both subdermal systems appear to be absent and the structure of the sponge is in this respect exactly like that of the Chalininae, the distal part of the vertical or radial fibres of the skeleton being buried in the parenchyma to their tips, instead of standing out above the parenchyma and supporting the dermal membrane as a tent-pole supports a tent. Stress has been laid by Dybowski and others on the "grouped" nature of the oscula in the Baikal sponges, and this would seem to be a character usually correlated with the absence of an exhalent subdermal sytem. In the Potamolepidine sponge *Nudospongilla aster* from Palestine, however, it is not so.

Family HAPLOSCLERIDAE.

Subfamily *CHALININAE*.

Genus **Lubomirskia**, Dybowski.

This genus may be defined as follows :—

Sponge massive, consisting of upright cylindrical stems or flabelliform, tough, elastic, not at all friable, with shallow oscula scattered, as a rule in groups, on the surface; main exhalent

channels never running in a horizontal direction immediately below the dermal membrane; inhalent subdermal cavity absent.

Skeleton consisting of a network of well-defined, compact, strongly coherent series of spicules lying parallel or nearly parallel to one another in a thick sheath of chitinoid substance. The vertical fibres branch dichotomously, especially in the outer part of the sponge, and are joined together by transverse fibres containing fewer spicules than themselves. On the surface branching becomes more vigorous and more irregular, so that the external extremities of the vertical fibres form broom like bunches of slender fibres the central part of which is as a rule hollow and forms a nursery for the young embryos. Together these bunches of fine vertical fibres constitute a skeletal cortex (pl. ix, figs. 1, 1*a*).

Spicules.—There are no true microscleres. The skeleton spicules are amphioxous and spiny, the spines being sometimes concentrated at or near the extremities. Smooth slender amphioxi also occur occasionally in the parenchyma.

Type species: *Spongia baicalensis*, Pallas.

No gemmules have been described in this genus and the form of the free-swimming larva is unknown. Embryos in an early stage of development are frequently present in large numbers; they appear to migrate to the cavities in the terminal bunches of the spicule-fibres and probably escape thence on reaching the larval stage.

The only species that can be assigned to the genus are *L. baicalensis* (Pallas) and *L. abietina* (Swartschevski). The latter has been found only in Lake Baikal, but the former occurs also in Arctic seas.[1]

Dybowski has described (1880) several well-defined varieties of *L. baicalensis*, but Soukatschoff's[2] *L. baicalensis* var. *e* cannot belong either to the species or the genus. It is probably a form of *Baikalospongia bacillifera* (Dybowski). A phase to which no name or letter has been assigned was submitted to me by the authorities of the St. Petersburg Academy. In it the upright part of the sponge, instead of consisting as in the typical form of cylindrical systems, is fan-like, the broad, compressed growths usually being curved in horizontal section and sometimes forming incomplete cups. This form evidently reaches a considerable size. Its spicules agree with those of the typical form.

L. baicalensis and *L. abietina* differ mainly in the structure of the skeleton; in the latter the vertical fibres branch much less freely, the skeletal cortex is less well developed and the transverse fibres are fewer and more slender than in the former. *L. abietina* never produces upright growths like those characteristic of the typical form or the phase described above of *L. baicalensis*, but the formation of such growths does not take place in all varieties of the latter species.

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[1] Dybowski, *Sitzb. Nat. Gesellsch. Dorpat*, 1884, p. 44.
[2] *Trav. Soc. Nat. St. Pétersb.* XXV, p. 11 (1895).

The affinities of *Lubomirskia* are, in my opinion, with *Pachychalina*, Schmidt, from which the genus differs in its spiny spicules and in the peculiar structure of the terminal part of the vertical fibres, and, with *Veluspa*, Miklucho-Maclay, which has smooth tylote spicules. The structure of the skeleton-fibre appears to have been misunderstood by Dybowski and by most subsequent writers owing to the facts that the section figured by him (1880 ; pl. II, fig. 5) was too thin to show the real structure, and that the precaution of staining preparations of this genus with some reagent that would display the chitinoid sheath of the fibre has not hitherto been adopted.

The method I have myself used in making the preparations of *L. baicalensis* figured on plate ix is a very simple one. After cutting a thick hand-section of the dried sponge I dissected out a few fibres with their attachments under a binocular microscope and washed them in running water, brushing them at intervals with a camel's-hair brush, until the cellular debris was removed. I then placed them for about ten minutes in a strong aqueous solution of pyrogallic acid. This solution of course stained both the sheath and any remains of cells that still adhered to it, but the former were easily distinguished by their apparently granular nature and removed by further brushing in water. This method is naturally applicable only to skeleton-fibres that have a definite horny sheath.

It will be noted that in fig. 1*a* on plate ix that the horny or chitinoid substance is deposited in the interstices between the smaller twigs of the fibres in concentric layers and that these interstices are often almost completely filled up in this manner.

Subfamily *RENIERINAE.*

Baikalospongia, gen. nov.

Sponge massive or encrusting, resembling *Lubomirskia* in general structure but friable (though hard) and not at all elastic. A stout basal membrane of a horny nature is present.

Skeleton superficially resembling that of *Lubomirskia, except that there is no horny sheath to the fibres and that the vertical fibres do not form definite brush-like tufts at their distal extremity* but are more or less distinctly splayed out to form a horizontal skeletal reticulation

Spicules.—There are no true microscleres. The skeleton-spicules as a rule resemble those of *Lubomirskia*, but the spines at their extremities are usually differentiated more distinctly. In one species (*B. irregularis* (Swart.)) the macroscleres are smooth and blunt at both ends.

Gemmules.—These bodies have been discovered as yet only in one species (*B. bacillifera*), in which they are ovoid or pear-shaped structures with a simple horny covering which is distinctly depressed in a crateriform manner at the narrower end (pl. ix, fig. 3*b*). They lie in the stout basal membrane of the sponge with their long axis parallel to it.

Type-species: *Lubomirskia bacillifera*, Dybowski.

The embryos, which are often abundant in *B. bacillifera*, resemble those of *Lubomirskia*, but the free-swimming larva is unknown.

The following species must be assigned to this genus:—*Lubomirskia bacillifera*, *L. papyracea* and *L. intermedia*, Dybowski, *L. tscherskii*, *L. fusifera* and (probably) *L. baikalensis* var. *e*, Soukatschoff, and *L. irregularis*, Swartschevski. All these sponges are, so far as is known, found only in Lake Baikal.

I have examined numerous specimens of *B. bacillifera* and *B. intermedia*, both of which I assigned in 1913 (or rather in 1911) to the same genus as *Lubomirskia baicalensis*. This was, however, before I had attempted to dissect out individual fibres from the skeleton or to use pyrogallic acid as a stain in their examination. When I attempted to isolate the fibres an essential difference at once became apparent: it was impossible to disassociate them without breaking them into fragments, and they had none of the springiness and elasticity of those of *Lubomirskia*. They were moreover, so fragile that attempts to brush them clean always ended in disaster. Fragments of the skeleton, cleaned as far as possible in running water, were then stained in pyrogallic solution, and the difference in the structure of the skeleton-fibres of the two genera at once became clear. *There is in* Baikalospongia *no horny fibre-sheath*, but the fibres are built up in a ladder-like formation of groups of spicules, which adhere together in bunches and series of bunches by means of thin veil-like films of horny or chitinoid substance secreted at the points at which they are actually in contact. This formation is identical with that found in the skeleton of the harder species of Spongillidae (*cf.* plate ix, figs. 3*a* and 4) and also in many sponges of the subfamily Renierinae.

In assigning *B. bacillifera* and its allies to this subfamily I rely rather on negative than on positive evidence, placing them there rather because they are neither Spongillidæ (having no subdermal cavities) nor Chalininae (having no horny sheath to their skeleton-fibres) than on account of any definite character they possess. There are two genera *Nudospongilla* (Spongillidae of the subfamily Potamolepidinae) and *Metschnikowia* (probably Renierinae) to which they bear a very close resemblance in many characters, but both of these genera occupy an anomalous and somewhat unsatisfactory position.

Nudospongilla,[1] a genus of my own, is confessedly no more than a convenient generic appellation for those freshwater sponges in which the microscleres have disappeared but the skeleton has not the hardness or compactness of *Potamolepis*, Marshall. The skeleton-spicules may be either smooth or spiny and in the type-species (*N. coggini*, pl ix, fig. 5) have a form not unlike those of some varieties of *B. bacillifera*; they are invariably amphioxous or practically so, whereas those of *Potamolepis* are amphistrongylous.

[1] *Journ. As. Soc. Bengal* 1913, p. 62.

The genus only differs from the subgenus *Stratospongilla* of the genus *Spongilla* in being devoid, apparently in all circumstances, of true microscleres. The skeleton of most species [1] resembles that of *Baikalospongia*, except that the reticulation is never quite so dense and the sponge is therefore even more fragile. *B. intermedia* is, however, a connecting link in this respect. In all the species of *Nudospongilla* I have examined both subdermal cavities can be traced, but in one Syrian form (*N. aster*) the disposition of the oscula somewhat resembles that characteristic of both *Lubomirskia* and *Baikalospongia*.

The genus *Metschnikowia* was described by Grimm from the Caspian Sea. His paper, which is apparently in Russian and was published in 1876 or 1877, is not available to me. Dybowski (1880); pp. 52-59) has redescribed three species, as well as redefining the genus, from the same inland waters. Topsent [2] and Lundbeck [3] refer to *Metschnikowia* Carter's *Isodictya spinispiculum* and also the species originally described by Topsent himself as *Reniera filholi*; both these sponges being found in the Atlantic. But it does not appear that either author had had an opportunity of examining material from the type-locality of *M. tuberculata*, the type-species of the genus, and I would prefer to compare Caspian specimens with true marine ones before expressing an opinion on this point. Dybowski's figures of the skeleton of *M. tuberculata* and *M. flava* (1879; pl. iii, figs. 5 and 6) are detailed and clear, but I have seen no similar figures of that of the marine species placed in the genus by the two authors just named. In any case, Dybowski's figures show that there is a somewhat thin and irregular fibre sheath present in the sponges he illustrated, and that this sheath is strictly comparable to that of some species of *Reniera*. His figure of *M. flava* (*op. cit.* pl. i, fig. 8) proves the existence in that species of well-defined subdermal exhalent channels.

On the whole, keeping in view the close similarity between some species of *Stratospongilla* and some of *Nudospongilla*, and also the biological conditions in which those of the latter genus are found, I am inclined to regard the indubitable resemblance between *Nudospongilla* and *Baikalospongia* as due to convergence, but to accept as probable the view that *Baikalospongia* is closely related to *Metschnikowia*. Until, however, the larval history of the different species assigned to all these genera is more fully known, it is impossible to express with any confidence a dogmatic opinion as to their mutual relationships.

Of the nominal species assigned to *Baikalospongia* on a preceding page I have examined only two, *B. bacillifera* and *B. inter-*

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[1] Evans, *Quart. Journ. Micro. Sci.* XLI, p. 425, pl. 38, figs. 6-8 (1899) has, however, described a well-defined fibre-sheath in one species (*N. moorei*) which I assign provisionally to *Nudospongilla*. The systematic position of this sponge is problematical.

[2] *Mém. Soc. zool. France* XI, p. 226 (1898) and *Res. Camp. Sci. Monaco* XXV (Sponge. Açores), p. 243 (1904).

[3] *'Ingolf' Exp.* VI (1), p. 52 (1902).

media. Of the former Dybowski and others have described varieties; these I have experienced great difficulty, owing to the existence of intermediate forms, in distinguishing. Soukatschoff's *Lubomirskia tscherskii* and *L. fusifera* are possibly no more than varieties of *L. bacillifera*, but *L. papyracea*, Dybowski and *L. irregularis*, Swart., appear to be specifically distinct.

Family SPONGILLIDAE

Subfamily *SPONGILLINAE*.

Swartschevski (1901; pls. iv (figs. 13-15) and v), in a paper written throughout in Russian, has described a *Spongilla* and two forms of *Ephydatia* from Lake Baikal; it should be possible to recognize all of them from his figures, if not from Korotneff's German descriptions (1901; p. 307). He has named them *Spongilla microgemmata*, *Ephydatia olchonensis* and *E. goriaëvii*.

All these sponges are remarkable for the abnormal character of their microscleres and I am inclined to think that they represent merely abortive varieties or phases, respectively of *Spongilla lacustris*, auct., *Ephydatia mulleri*, Liebk. and *E. fluviatilis*, auct. Without examining specimens it is, however, impossible to insist on this opinion.

2.—GEOGRAPHICAL.

In view of the foregoing observations it seems to be possible to consider the sponges of Lake Baikal from a geographical point of view under three headings, (1) sponges of marine origin, (2) sponges of uncertain origin, and (3) undoubted freshwater forms.

(1) In the first of these categories belong the two species assigned here to the genus *Lubomirskia*. The better-known of these (*L. baicalensis*) has actually been found in Behring's Straits, while the other is very closely allied to it. All other Chalininae are marine, but several species occur in semi-detached bodies of water such as the Black Sea.

(2) Although the affinities of *Baikalospongia* are doubtful, it seems probable that its species are derived from a marine stock.

(3) The true Spongillidae that occur in Lake Baikal are all abnormal forms.

The evidence therefore, such as it is, points to a marine origin for the greater part of the sponge-fauna of the lake. There is nothing definite to connect it with any other sponge-fauna but that of the Arctic Sea, but possibly a remote relationship other than convergent may exist between *Lubomirskia* and the species described from Lake Tanganyika by Evans as *Spongilla moorei*. Personally I am of the opinion that the resemblance is merely another instance of convergence, a phenomenon of constant reoccurrence in the Monaxon sponges. But here again, in the absence of embryological evidence, dogmatism is impossible.

The species *Lubomirskia baicalensis*, existing as it does both in the Arctic Sea and in Lake Baikal, and, moreover, being

devoid of reproductive bodies that would be easily transported by external agencies, affords, in any case, strong support for the view that the fauna of the lake includes a real marine element derived from northern waters; while the prolific evolution of species in the apparently endemic genus *Baikalospongia* is exactly parallel to the state of affairs found in the Amphipoda [1] and the Gastropoda [2] of the lake and points to isolation for a considerable period.

[1] Dybowski, "Beitr. der in dem Baikal-See vorkommenden . . . Gammariden," *Horae Soc. Ent. Russ.* X (1874).
[2] Lindholm, *Wiss. Ergebn. Zool. Exp. Baikal-See, Die Mollusken* (1909).

ADDENDUM.

When this paper went to the press I had not seen Topsent's paper on the classification of the Halichondrine sponges on larval characters (*Arch. Zool.* (5) VII, pp. i–xv). He points out (p. xiv) that the larvae of the Haploscleridae (*s.s.*) possess a coloured cap or collar at the posterior, non-ciliated extremity.—*April 24th, 1914.*

EXPLANATION OF PLATE IX

FIG. 1. *Lubomirskia baicalensis* (Pallas).

Fig. 1. Spicule-fibres dissected out of the external part of the sponge; photographed by reflected light and magnified by about 6 diameters. *Fig.* 1*a*. A fragment of the same dissection stained with pyrogallic acid and viewed by transmitted light; × 50. *c.s.* = sheath of spicule-fibre.

FIG. 2. *Baikalospongia intermedia* (Dybowski).

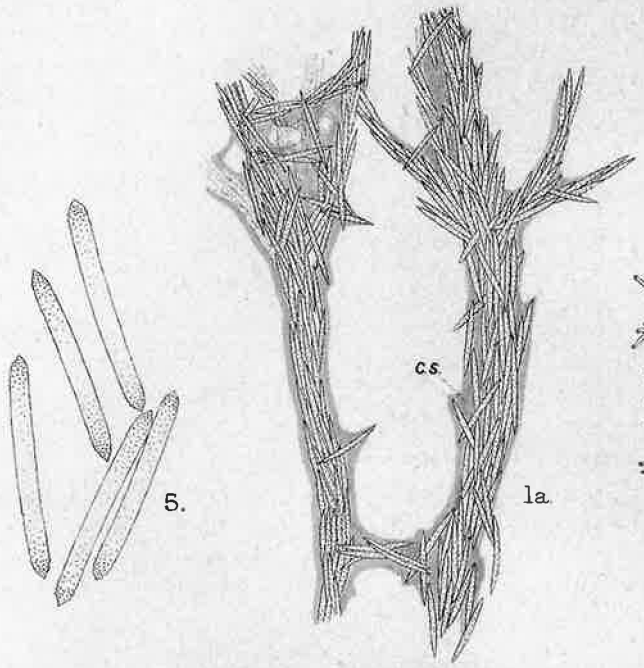
Fig. 2. A hand section (vertical) from the external region of the sponge, showing its compact nature and the absence of a subdermal cavity; photographed by reflected light and magnified by about 6 diameters. *Fig.* 2*a*. Thinner section of the skeleton in the same region; × 50. *e.m.* = dermal membrane; *g.l.* = growth-line.

FIG. 3. *Baikalospongia bacillifera* (Dybowski).

Fig. 3. Fragment of the skeleton (unstained); × 20. *Fig.* 3*a*. Portion of the same stained with pyrogallic acid; × 100. *Fig.* 3*b*. Gemmule, × 20.

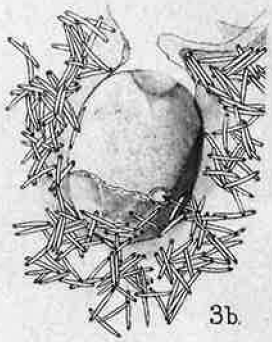
FIG. 4. Fragment of the skeleton of *Corvospongilla ultima* var. *spinosa* similarly treated (for comparison); × 100.

FIG. 5. Spicules of *Nudospongilla coggini* (for comparison with those of *B. bacillifera*); × 100.

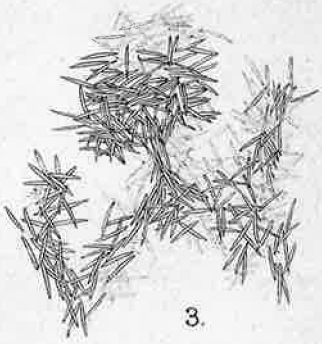


1a.

5.

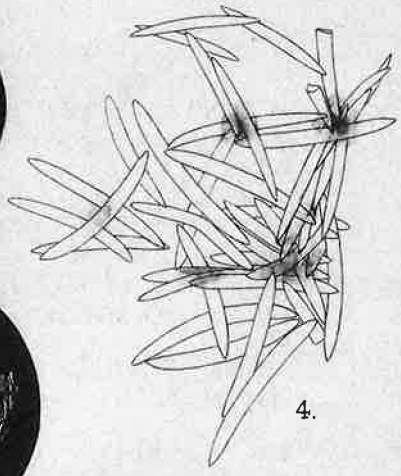


3b.



3.

2.



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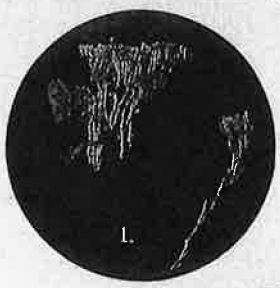
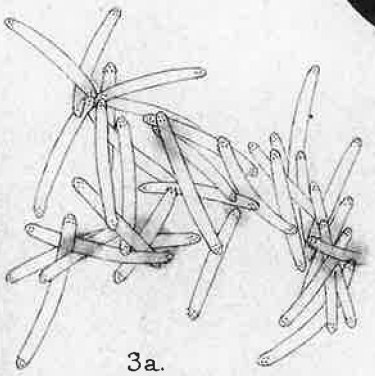
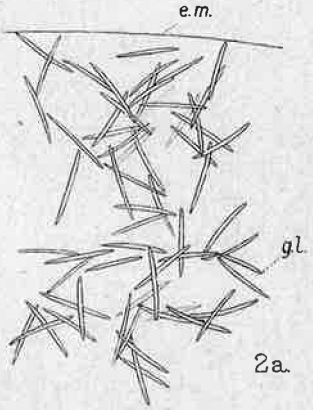


1.



3a.



2a.

A.C. Chowdhury, del.

Bemrose, Colls., Derby.

SPONGES OF LAKE BAIKAL.