

XIV.—*Notice of Plants and Animals found in the Sulphureous Waters of Harrowgate and Askern, Yorkshire.* By E. LANKESTER, M.D., F.L.S., &c.

IN the distribution of organized beings over the surface of the earth, we generally find an adaptation of the former to the various conditions of the latter.

In many marked cases this adaptation is so great, that organized beings cannot exist but in the peculiar circumstances in which they are first engendered. From this law arises the great variety of organized beings which we find adapted to occupy almost every existing condition of matter. There are, however, some conditions of the inorganic kingdom in which organic beings have not been detected, as excessive cold or heat, the absence of oxygen or the presence of injurious gases, &c. The extent, however, of these exceptions is continually on the decrease, and animated beings or their remains are now found in circumstances which but a few years since would have been thought quite impossible. For an increasing knowledge on this point we are in a great measure indebted to the use of the microscope. By its agency both animal and vegetable productions can be detected in almost all conditions of matter, so that it is difficult to say, with the exceptions of the extremes of heat and cold, under what combination of agencies we might not expect to find a plant or an animal. This extensive adaptation of the one kingdom to the other can now be demonstrated to be essential to the welfare of the whole, as in many instances the lower organic beings derive existence from, and convert into their own substance, those elements which would be destructive of the existence of beings higher in the scale of life. Hence the investigation of this department of science becomes interesting to the physiologist.

Among those conditions of matter which, from their powerful influence on man, might be supposed to be destructive of all animal life, are some varieties of those waters which, from the nature of their contents, are called mineral. Some of these have a temperature exceeding greatly that of the human body, yet many of them contain both plants and animals; in fact, wherever the former are found we may anticipate the existence of the latter.

On the present state of our knowledge with regard to the composition of mineral and thermal waters a report has already appeared, drawn up by Dr. Daubeny at the request of the British Association for the Advancement of Science; in this report reference is made to the existence of both animal and vegetable matter in many cold and thermal springs.



Amongst the substances found in sulphureous springs is one called *glairine*, which has for a long time been recognised by continental chemists, and was carefully investigated by Professor Anglada, who thought it resulted from the chemical action of some of the constituents of the water in which it was found. Dr. Daubeny has also investigated this substance, and, in opposition to the opinion of Anglada, believes it to arise entirely from organic matters in the waters in which it occurs. This notice first induced me to ascertain if this substance was present in the sulphureous waters of Askern and subsequently in those of Harrowgate, and the result has been the detection of forms of animal and vegetable life in circumstances in which I had not previously suspected them.

Previously to Dr. Daubeny's investigation, Dr. Willan had announced the presence of a peculiar organic substance in the waters of Croft in Yorkshire, which Dillwyn named *Conferva nivea*; and many French and German chemists had described organic matters in mineral waters, as resin of sulphur, humus, extractive, Baregine, zoogene, &c., &c.

As great medicinal virtues have been attributed to these substances, they have in certain quarters attracted considerable notice; but not having visited any of the mineral waters of the continent with the view of investigating them, I am not able to say how far those which I have found at Harrowgate and Askern may resemble those described on the continent, and shall only endeavour in this place to point out the nature of certain substances in these waters, which appear to resemble those spoken of by continental writers.

Throughout the whole district in which Askern is situated, the soil in many places, and the mud in the ditches and pools, when tested, gives very decided proof of the existence of sulphuretted hydrogen. At certain seasons of the year many of these spots are covered with a whitish-looking *Conferva*, which I have supposed to be the *Conferva nivea* of Dillwyn. The specimens obtained from off the sulphuretted mud of waters which contain no sulphuretted hydrogen, present a greenish fibre, surrounded by verticilli of numerous smaller fibres. This appears to be the plant in a mature stage of growth. If however a small portion of the mineral water be put aside, it will in the course of a little time present on the sides of the vessel in which it is contained a whitish-looking substance, which, on being examined by the microscope, exhibits a mass of very delicate fibres. The same fibres are found to constitute the white substance which collects around the sides of the sulphur wells, as well as at the bottoms of the cisterns and the pipes through which the water is drawn.



In places where this substance has been allowed to collect for some time, a layer of darker fibres will be found to have formed, which present all the characters of the fibres collected from the sulphuretted mud of the running streams. From this circumstance I have been led to suspect that the two are but different forms of the same plant. If this white substance be kept in a warm room it decomposes and gives out a sulphurous smell, which is stronger and more disagreeable than that of sulphuretted hydrogen. A film also collects upon the surface of the water, and in this state it corresponds very closely to Anglada's description of *glairine*. In one instance I observed this substance to form in a glass-stopped bottle of sulphur water, from which the atmospheric air was excluded, with the exception of a small globule which existed in the neck of the bottle. It forms, however, most rapidly when exposed to the atmosphere; and so quickly does this process go on, that the stone vessels into which the water runs over at the Bath-houses, if cleaned in the morning, will be found covered in many places by night. When exposed to the air the sulphur water is constantly depositing small portions of the salts which it holds in solution, which, in places where it is undisturbed, mix with the vegetable fibres and present themselves in the form of crystals mixed with the fibres. In this state, when collected and dried and submitted to heat, it gives out sulphurous acid gas. Some of the sulphur of this compound may be precipitated from the water; but from the smell of the fibres in decomposing, I am inclined to think that they themselves contain sulphur, and that this is the agent which determines their existence and peculiar form.

Being at Harrowgate during the past summer, I was desirous of confirming the existence of this substance in the sulphur water there. In most of the wells I found on their sides deposits varying in colour and appearance. The different-coloured deposits were arranged in layers, so that on examining a portion it presented several layers one above the other. The principal layers are green, white and red. On examining the green layers I found them to consist of simple fibres of a dark green colour, with transverse bands of a darker shade, resembling some of the species of *Oscillatoria*. The white I found to consist of opake masses of a crystallized character, which were probably salts deposited from the waters by evaporation and the escape of carbonic acid. The red I shall have occasion to mention presently, only observing now that Anglada mentions having observed *glairine* sometimes of a red colour.



In the specimens I brought with me from Harrowgate I could not find the *Conferva nivea*, but in Hooker's 'British Flora' it is stated to have been found at this place.

All the substances which have been enumerated have been referred to very different sources for their origin. Thus Anglada supposed *glairine* to be of chemical origin, whilst others referred it to the vegetable kingdom, and a third class of observers have referred a similar compound to the animal kingdom, calling it zoogene, &c. The different states, in which these substances are presented by nature, would undoubtedly add to these various conclusions. I am not however aware that those who have referred this substance to the animal kingdom have observed living animals in the waters from which it has been taken. Dr. Daubeny remarks in a note, that Turpin had found in the substance called *Baregine* the remains of Infusoria; but no writer that I am aware has recorded the fact of the existence of living animals in waters impregnated with sulphuretted hydrogen.

I have however met with several species of animalcules in these waters, two of which I have more particularly examined, and will now describe. In an analysis of the waters of Askern, published in 1817, the author observes, "Nearly allied to the vegetable kingdom is a singular substance found in a pond at the south corner of the pool. This substance is a powder of a pink or rose colour, which forms a thin covering on the sand and mud at the bottom of the pond."—(*Brewerton.*)

On reading this, I immediately had recourse to the spot, and found the substance lying on the mud of the ditches near Askern, which are strongly impregnated with sulphuretted hydrogen. I at first thought it to be of vegetable origin, and sent some to Mr. Berkeley for the purpose of ascertaining his opinion. From the state in which I sent it he supposed it might be a species of *Protococcus*, at the same time putting to me the query whether it might not be of animal origin. At that time I had seen nothing to lead me to suspect this, unless it might have been the excretion or ova of a beautiful rotiferous animalcule resembling the *Philodina roseola* of Ehrenberg, which is very abundant in the waters of the pool at Askern. After having kept some specimens of the red substance in water exposed to the air, I observed the water one morning of a deep rose colour, and on examining it found it to contain an immense number of very minute animalcules. I now had a clue to the origin of the red substance, and from subsequent examinations found that the red colour of the water and the deposits depended on this animalcule; in



the same manner as water is found of a green colour and having green deposits, from the presence of the *Cercaria viridis*, the green matter of Priestley.

From this time I looked out more particularly for this red substance, and soon found that it occurred very extensively in the ditches and pools at and near Askern. Its appearance is however very fluctuating, sometimes covering a large surface of the bottom of the pool with the appearance of red velvet, at other times not a spot is to be seen. At first I did not suspect at all the connection of this animalcule with the sulphur springs, until I observed it most abundant in the water-courses that received the overflowings of the pumps and wells used for drinking and bathing. This induced me to examine the water or mud in which I afterwards found it to occur, and I invariably found, on dipping in a piece of silver coin, that it presented the usual action of sulphuretted hydrogen. So constantly has this been the case, that by this means I have detected sulphuretted hydrogen in spots where I should not have thought it existed. In the red colour before alluded to of the deposits around the sides of the wells at Harrowgate, I recognised the same substance as existed at Askern. Whilst at Knaresborough, I observed this rose-coloured matter in the mud of the water before it passes into the rock which forms the dropping-well; and on plunging a shilling into the mud, it came out presenting the usual discoloration from sulphuretted hydrogen.

The animalcule is very minute, not more than the ten thousandth of an inch in diameter. Its form is oblong, frequently presenting a contraction in the middle of its body, and presenting from two to ten or twelve stomachs. Its line of movement is straight, with a somewhat serpentine movement of the body.

On looking over Ehrenberg's great work on Infusoria, I have not been able to refer it to any of the genera there given, although from its size and the circumstance of its producing a red deposit, it would seem to be his *Astasia hæmatodes*. I cannot, however, distinguish in it a tail, which is a generic character of *Astasia*. The *A. hæmatodes* was discovered by Ehrenberg at the bottom of a lake in the steppe of Platow in Siberia.

I have frequently found another animalcule with this and sometimes alone, forming a deposit of a much lighter colour, having a whitish red or brickdust colour. It is a much longer animal, and has the motions of a *Vibrio*, but not its bead-like form. It possesses from ten to twelve stomachs.

Both these animalcules live in water artificially impregnated



with sulphuretted hydrogen; whilst I have found that other kinds are effectually destroyed by such treatment.

Besides the vegetable and animal forms above mentioned, the sulphur waters during their decomposition afford others, especially under the films that collect on the surface of the water.

XV.—*Remarks upon the Recent and Fossil Cycadeæ.* By  
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THE *Cycadeæ*, originally placed by Linnæus and Jussieu among the Ferns, are an interesting family of plants, from their appearing to form an intermediate place between the Palms, Ferns and Coniferæ; resembling the first in their external habit, the second in the gyrate veneration of their leaves (a character not belonging to the whole family), and related to Coniferæ in the ovula being uncovered, or not furnished with any seed-vessel. The affinities of these families, although previously mentioned by C. Richard\*, were, in this latter respect, finally determined by Mr. R. Brown in his researches into the structure of their reproductive organs, inserted in the Appendix of Capt. King's 'Voyage to Australia.'

The stems or trunks of *Cycadeæ* are generally simple, although some species of *Zamia* appear capable of dividing into two or three terminal buds. In *Cycas* the internal structure consists of a central pith surrounded by two or more circles of laminated vascular and cellular tissue alternating; in *Encephalartos* the central cellular tissue is divided from the external by only one circle of woody fibre†. "The stems are enclosed in no true bark, but have a thick case composed of the persistent scales which have formed the bases of fallen leaves; these, together with other abortive scales, constitute a compact covering that supplies the place of bark."—(*Buckland*‡.)

\* 'Mém. sur les Conifères et Cycadées,' 1826, p. 183. "Il n'est aucune famille de plantes qui ait plus de rapports et de ressemblance avec les Conifères que celle des Cycadées. Ces rapports nous semblent si grands, que nous pensons qu'il est impossible de distinguer ces deux familles, ni par des caractères tirés de leurs fleurs, ni par des caractères puisés dans l'organisation de leurs fruits. Les seuls signes distinctifs qui existent réellement entr'elles consistent uniquement dans leur port et la structure anatomique de leur tige, qui en effet est fort différente dans l'un et l'autre groupe."

M. Richard, however, appears to have been unaware of the internal structure of *Cycas* being stratified; but describes it as similar to that of Palms: "*C. circinalis*, Arbor . . . , ligno albicanti, molli uti in arboribus monocotyledonibus disposito."

† In a specimen of *E. spiralis*, for which I am indebted to the Messrs. Lee of Hammersmith, the external circle of cellular tissue is wanting.

‡ Some interesting observations on the structure of the tissues of *Cycadeæ* have appeared by D. Don, Esq., Libr. L.S. Mr. Don remarks, that "the





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