

*Presented to the
American Microscopical Society
by Arthur M. Edwards.*

DIRECTIONS

FOR

COLLECTING, PRESERVING, AND TRANSPORTING SPECIMENS OF DIATOMACEÆ, AND OTHER MICROSCOPIC ORGANISMS.

BY

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AMONG the objects to which the attention of naturalists has been recently directed, is a family of plants of peculiar interest; microscopic in dimensions, and of extreme beauty both in outline and exterior sculpture: these are the Diatomaceæ. As far as investigation into the natural history of these minute creations has been carried, it has revealed the fact that, though differing widely in many respects from larger forms of vegetation, they are yet true plants, representing life in its lower stages; where the animal and vegetable kingdoms would seem to shade imperceptibly one into another. Whether such be really the case is, as yet, undecided, but in these simple organisms we are presented with favorable opportunities of investigating that and similar disputed points, together with the phases of cell-life in its independent form. The geometrical purity and grace of form in the Diatomaceæ have attracted to them much deserved attention, while the extreme minuteness of their parts presents the student with ample material for testing the best appliances of modern skill in the manufacture of instruments for investigation. On account, therefore, of the imperfect state of our knowledge concerning them and their life-history, it has become desirable to procure specimens of Diatomaceæ from all parts of the world. To that end the fol-

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lowing directions for collecting, preserving, and transporting them have been drawn up in as simple a manner as possible, and in language as plain as was consistent with the information it was desired to impart.

The directions given should be closely followed, as the methods described have been found, after considerable trial, to be those yielding the most satisfactory results. The Diatomaceæ (popularly called Diatoms) having been, up to a late date, included among the so-called *Infusoria*, any directions that have been published for gathering and forwarding specimens of these organisms apply equally to the objects under consideration.

Diatoms are found in a fossil condition as well as in a recent state; existing forms appearing to differ very little in character from those found in strata below the drift, and presumed to belong to the miocene and cretaceous periods. As fossil deposits are most readily recognized, gathered, and forwarded, they will be first described.

Fossil deposits.—These contain both marine and fresh-water species though never in a mixed state; particular strata appearing to have been deposited at the bottoms of seas, whilst others have formed beneath fresh water in lakes, bays, or rivers. In some cases the particular species contained indicate the character of the piece of water in which they have grown, different groups of forms appearing in ponds, bays, springs, brooks, and rivers, and at various points of elevation above the level of the sea.

The principal fossil deposits of Diatoms hitherto discovered contain marine species, and extend over considerable extent of surface. The most important stratum of this character, belonging to the miocene period, has been discovered on the Atlantic coast of the North American continent, extending from the Patuxent river, in Maryland, as far south as the city of Petersburg, in Virginia. How much beyond these two points it extends has not been ascertained, but it is found underlying the cities of Petersburg, Richmond, and Fredericksburg, in Virginia, and at many other points in that state as well as in Maryland, as at Bermuda Hundred, on the James river, many points on the Rappahannock, and at Nottingham, Piscataway, and Lower Marlboro. It is desirable to obtain specimens from different points in this bed, as it varies in character with every few miles of extent.

These fossil strata, or as they are commonly called "Infusorial

earth," vary greatly in appearance as well as in microscopic character, therefore the following directions will suffice to guide collectors in searching for and detecting them. Gather all earths of a light color, varying from a pure white through different shades of gray, cream, and fawn, to an iron-rust tint. The texture is often friable, at other times of a hard and strong character, though always more or less porous, and when soft of little weight. Infusorial earth is occasionally found as a powder looking like flour or meal. In general these deposits have the appearance of clay, and are often taken for that substance. Collect enough to make up a mass of from three to four pounds weight, or a block of six or eight inches square, and, if possible, from the surface, and at different depths. Keep all specimens separate, not even permitting them to come in contact, by wrapping each in a paper, placing within a label having written upon it *in ink* the exact locality, date of collection, and name of collector. It is also desirable, if possible, to state the depth from the surface, together with any farther information that may be deemed of interest, as supposed extent of the stratum; slope, upwards, towards north, south, east, or west, and thickness.

Besides the above mentioned an extremely interesting stratum of a similar character, but in general of a harder texture, has been found on the Pacific coast of North America at Monterey and San Diego in California. Between these two points no record of its occurrence has been made; it becomes, therefore, of importance to trace it from one to the other of these localities and eastward to the mountains.

At Baldjik near Varna, in Bulgaria, on the Black Sea, is a stratum of a stony character, having shells and bones dispersed through it. But very little of this material has found its way into the hands of naturalists.

At Oran in Algeria, Africa, and at Ægina and Caltanissetta in Greece are deposits of marl belonging to the cretaceous period. The marls of the island of Barbadoes are also calcareous in character, and besides Diatoms contain beautiful specimens of Polycystina. A deposit has been lately discovered in the island of Trinidad at South Naparima, and "is considered as connected with the New Red Sandstone; adjoining to which is the sandstone, probably of the same description, in which the Pitch Lake is situated."

All the above mentioned deposits are of marine origin, but many others are found at different parts of the world, containing either marine or fresh-water species; the following are some of these: Bilin, Bohemia; Santa Fiore, Tuscany; Isle de France; polishing slate, Jutland; New Plymouth, New Zealand; Soos, near Eger, Bohemia; several points in Washington Territory and California. Specimens of all of these or any others that may be found are desirable, together with any shells, bones, or other organic remains dispersed through the beds themselves or the strata above or beneath them, whose position should be mentioned on the label.

Sub-peat deposits.—These are mostly of a pulverulent character, when white looking like flour, or when gray, as they commonly are, like clay. They occur beneath existing or extinct bogs, ponds, marshes, rivers, and bays. Sometimes the bottoms of ponds are composed of almost nothing but this material. A mass of about six or eight pounds weight should be secured and the same precautions as to keeping separate and labelling specimens, adhered to as are given above. As these beds are seldom of any great extent they often become obliterated or covered up, so it will be well to secure a large supply of the material. If any shells are dispersed through it they should be secured along with any overlying peat. These sub-peat deposits have been used as polishing powder, under the name of *tripoli*; they have also been called *shell marl*, and are extremely common all over the world, over fifty localities having already been noticed. Specimens from every locality are desirable.

Muds and deposits from the bottoms of rivers, estuaries, and lakes.—As much as can be conveniently transported, say a large handful, of mud from the bottom of rivers, bays, or creeks, taken at any point below high-water-mark, should be dried without squeezing, and marked as before described. The mud and slime attached to anchors, buoys, and submerged woodwork, together with the scrapings from the bottoms of vessels containing shells, plants, zoöphytes, &c. can be dried in the same way without any draining.

Guanos often present us with species of diatoms not otherwise easily obtainable. Quantities of eight or ten pounds weight may be sent in bags made of either stout paper or sacking, the latter material being preferable, with the exact locality and name of

island, with latitude and longitude if possible, and any other information that may be collected and deemed of interest. Thus may be stated the extent of deposit, average quantity removed each year and to what ports sent, also price at such ports, discoverer and date of discovery, and owners' names. The label should consist of stout paper, written upon with ink, and placed *within* the bag. Labels sewed on outside are liable to being rubbed off. Dealers in guano will oblige by forwarding specimens of guanos and any information respecting them.

Shell cleanings.—The sand, mud, algæ, zoöphytes, and ascidians washed or scraped off of shells from all parts of the world yield rich crops of Diatoms, and it is desirable to procure as many of these gatherings as possible. They can be washed, or still better, scraped off of the living or dead shells (the dirtier such shells appear the better), placed in paper and plainly labelled, with the exact locality, and if possible, name of the shell and depth of water in which it was taken. Conchologists will do well to save *all* their shell-cleanings for this purpose. When possible the whole shell, or any fragments in an uncleaned state should be sent.

Marine Invertebrata.—Specimens of the entire animal or the contents of the stomach of Echinoidea and Holothuroidea may be sent, as they have been found to yield very fine specimens of microscopic organisms. The entire animal should be preserved in spirit (if alcohol is not procurable brandy or whiskey will answer), but if that be not convenient, they, as well as the contents of the stomachs, may be dried without washing. When preserved in spirits the label may be written in ink on stiff paper or parchment, and when quite dry, tied to the specimen and immersed with it in the spirit. In this way several specimens can be preserved in the same vessel. This method will be found the safest, as labels pasted or gummed on, or otherwise attached to, the vessel are often obliterated, from leakage of the fluid, or removed in transporting. The stomachs of Mollusca also occasionally yield specimens of Diatoms, and it will be well to secure specimens of those creatures in the same way. The stomachs of fish, in the same way, have been found to contain specimens of microscopic organisms.

Soundings, taken in all parts of the world, are desirable. Note the latitude and longitude, depth of water, with name of vessel and collector.

The dust which collects at sea upon the sails or deck of vessels can generally be scraped up with a piece of paper. When the quantity is so small that it cannot be so collected, a piece of damp paper may be laid on it once or twice in several places and then folded up *without drying*. Latitude and longitude, direction of wind at time of falling of dust, name of vessel and collector's name should be noted.

Recent gatherings.—Gather the marine plants adhering to rocks, piers, iron or wood work; the dirtier they look the richer will be the harvest, as the brown coating on aquatic plants obscuring them and submerged iron, stone, or wood work is but a mass of Diatoms. Such gatherings should be dried and placed in layers; each specimen being plainly labelled with the exact locality, date of collection, and collector's name. Fragments of marine plants which would be rejected by the student of Algæ yet yield specimens of microscopic organisms. When convenient the name of the Alga should be stated. If possible it is desirable to transmit specimens of Diatom-encrusted Algæ put up in spirits, as the species are thus preserved in a natural state; but precautions should be taken to tie a label, written on stiff cardboard, in ink, to the neck of the bottle, for the reason above mentioned, under Marine Invertebrata. Fresh-water plants clouded with Diatoms may be gathered in the same way. The finer filamentous species of both marine and fresh-water plants yield the best results, the fucoids secreting a mucus which seems repugnant to the growth of many Diatoms; yet on the stalks of Laminaria and other large olive-colored Algæ are found the finer red tinted species which, in turn, bear upon their fronds a crowd of minute vegetation. Do not clean or wash such Algæ in any way, but merely raise them from the water and, without squeezing, lay them on paper to dry. The moss-like carpeting on submerged rocks is often Diatoms alone, and it will be well to scrape the surface of the stone and remove the gathering to a bottle for preservation in spirits. Fresh-water forms are often found hanging in green colored festoons from the exit pipe of drains, sluices, or fountains.

The green, brown, or fawn-colored scum that floats on the water of bogs, marshes, ponds, or rivers, may be dried on paper in the same way, though it is far preferable to preserve it in spirits. It may be raised from the water by means of a spoon and transferred to a bottle. The surface of the sea may be skimmed by means

of a net made of fine muslin and having an opening left in the bottom in which a four or six ounce phial is tied. If the seawater be permitted to strain through such a net, either by pouring it from a pail or other vessel, or towing it at the stern of a boat, the solid matter will be retained and, after a time, collect in the phial, which can be removed and another substituted. The stain occasionally observed on the surface of the sea in some latitudes as well as the minute organisms causing the luminosity of the ocean, yield rich crops of Diatoms, and should be secured. Such gatherings may have a small quantity of spirit added and then be closely corked. The collection of aquatic plants from the mouths of rivers are extremely desirable, such as have been made in the delta of the Ganges yielding interesting results. The refuse of dredging often yields old shells, mud, or Algæ, and collectors will do well to secure such.

One thing is always to be borne in mind in all cases: *write the label distinctly, in ink, giving the exact locality, date of collection, and name of collector.*

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