THE FOSSIL FLORA OF GREENLAND.

Die fossile flora der polarländer. Von Dr. Oswald Heer. Vol. vii. Zürich, *Wurster*, 1883. 275 p., 62 pl. 4°.

This volume contains, 1°, the flora of the upper cretaceous schists of Patoot; 2°, the tertiary flora of Greenland; 3°, a short memoir on insects' remains found in connection with the plants (cf. Science, i. 1095); 4°, general remarks on the affinities of the plants in relation to their geological age and the climatic circumstances indicated by their characters; 5°, a memoir by Steenstrup on the geology of the localities where remains of plants and coal-deposits have been found; 6°, the marine fauna, with descriptions of the species of invertebrate animals found especially in connection with the plants of Patoot.

This last locality represents the upper member of the cretaceous of Greenland; the lowest being that of Kome, the middle that of Atane. The flora of Patoot has a predominance of conifers and ferns, no Cycadeae, and few monocotyledons, about one-half of the plants being dicotyledons. The table of distribution, which represents the whole cretaceous flora of Greenland, enumerates 335 species, — 88 for Kome, 177 for Atane, and 118 for Patoot. From the characters of the plants, the schists of Kome are referable to the Neocomian. Atane, whose flora is related to that of the Dakota group of Kansas, represents the Cenomanian, while Patoot is apparently Senonian. Most of its species are related to those of Atane, only a few being identified with eocene species from Sezanne and with some miocene types. The plants of the tertiaries of Greenland have been procured from twenty different localities. Their description is also followed by a table of distribution. Of the 282 species enumerated, 33 are known from the tertiary of North America, 10 of them from the Laramie group. The greater number are identified with species found in the lower miocene of Europe, the Aquitanian group, whose flora is widely represented in most of the states, from Hungary to England and France, and from Italy to North Germany. This tertiary flora of Greenland has been predominant, and has preserved its characters for many thousands of years; for the lower strata, where its remains have been found, are separated from the upper, which have the same kinds of plants, by thousands of feet of basaltic masses the deposits of which have been continuous for long periods of time.

In the general remarks considering the climatic conditions which have governed the vegetation as indicated by the characters of the flora, Heer says, that in 1868, from data derived from the determination of 105 species of plants, he had estimated the mean temperature at 9° C.; but now the tertiary flora of Greenland, known by a larger number of plants of various types, — among them a palm, species of Laurus, Magnolia, Diospyros, Sapindus, Zizyphus, etc., whose analogues are now found in Virginia, the Carolinas, etc., — indicates by its constituents a mean temperature of 10° to 11°.

The few mollusks and star-fishes, mostly found at Patoot, have been determined by the French paleontologist, de Loriol. He considers them to be related to some of those described by Meek from the Fox Hill group. Steenstrup's memoir on the geology of the localities where the plants have been found is precise and detailed. It is illustrated by a number of good sections.

The work is accompanied by a map of the western coast of Greenland between 69° 15′ and 72° 30′ north latitude.

THE CHESAPEAKE OYSTER-BEDS.

Report on the oyster-beds of the James River, Virginia (etc.). Coast-survey report for 1881. Appendix, no. 11. By Francis Winslow, U.S.N. Washington, *Government*, 1882. 87 p., 22 pl., 3 maps. 4°.

Among the various investigations of the U.S. coast survey since its organization, the bearing of which is not confined to their geodetic, topographic, or hydrographic relations, the present publication is conspicuous.

By direction of the late superintendent Patterson in 1878, an investigation of the oyster-reefs or natural beds of the Chesapeake and vicinity was entered upon by Lieut. Winslow with the coast-survey schooner Palinurus. The intention was to determine the limits of the beds, their hydrographic features, the nature of the natural and artificial changes which they undergo, and the present distribution of living oysters upon them. It was proposed to thoroughly investigate a limited area, subsequent extension of the work to all the Chesapeake beds to be left for future decision. Under the term 'Chesapeake' we include here not only the beds in the waters of the bay specifically so called, but those in the extensions of salt water from the bay into the various inlets, arms, rivers, etc., adjacent to and continuous with it.

Originally the oyster beds or 'rocks,' as

they are not inappropriately termed by the fishermen, were patches of suitable ground upon which these bivalves had lived for ages, and, dying, left their shells to be overgrown by successive generations. Matted together by this living cement, the successive layers of dead shells and associated *débris* gradually rose toward the surface, covered with distorted, misshapen bivalves in masses like those of the Floridian 'coon oysters.' These beds were separated pretty sharply from the adjacent muddy bottoms, a differentiation which the vertical increase tended to intensify. Horizontal increase doubtless took place, but very slowly. From an economical stand-point the oysters upon these beds were inferior on account of their inconvenient shape and excessive crowding. Among the various conflicting statements drawn out by investigations into the oyster-industry, one fact seems to be generally admitted by fishermen and by experts; namely, that a moderate amount of dredging over the original 'oyster-rocks' was beneficial. This dredging extended the area of the beds, 1°, by dragging the dead shells and 'cultch' over upon adjacent muddy bottoms, and placing it where new spat could settle and grow; and, 2°, by distributing the living oysters more sparsely over the ground, so that they had a chance to grow into regular and even shape and relatively larger size. It is recognized by dealers, — even when the dredging has been carried on, as at present is the case in the Chesapeake, to a disastrous extent, — that the few remaining oysters which are obtained are of larger size and finer flavor than common.

Since the trade in oysters began, the beds have undergone great changes in area and productiveness, until, at present, in two years, on certain beds, the product has diminished in the ratio of six to one, the market-price has nearly doubled, while the demand is constantly increasing. If it were not for supplies received from other sources, the oyster-eaters of cities about the Chesapeake would have to pay nearly European prices for their favorite shell-fish.

It is true that there are numerous laws on the statute-books of Maryland and Virginia; that police steam-launches and men have been enlisted and a sort of war enacted, in time of peace, by state authorities, — all ostensibly in protection of the oyster-beds. Actually the laws are a dead letter; dredging is boldly carried on in close time before the eyes of the 'oyster police,' without the offenders being molested; and the only occasion for active measures arises when a Virginia dredger trespasses in Maryland waters, or *vice versa*. Gore is then apparently in demand, but, in spite of vehement protestations, turns out almost as scarce as oysters.

It was upon this state of things that Lieut. Winslow entered, when he undertook this work without previous experience, or any knowledge of the biological questions involved, except such as might be gleaned from the valuable little work of Moebius on the North Sea fisheries of Europe. Many of the observations which he was directed to take, are, in the present state of our knowledge, productive of no definite result, though eventually they may prove very useful. Thus, observations of the specific gravity and temperature of the water at the bottom and surface, when the total depth was only a few feet, may be said to be almost absolutely fruitless. It is well known that our common oyster flourishes in water which varies at different seasons from the freezing-point to 80° F., and that similar differences of specific gravity must occur between the extremes of its geographical range. Consequently the differences, in summer, of fractions of degrees of temperature in the water over oyster-beds, are of no consequence whatever. What these changes of temperature may signify, when taken in connection with the act of spawning or the development of the embryo, is quite another question, purely biological, and which can be properly treated only by a biological expert of high rank and long experience.

The result of these superfluous observations and detailed description of each individual bed, even condensed as they are, as far as possible, by the author, is to overload the text with details of no interest, and thus to obscure to the reader the value of the investigation, the really interesting facts, and the merits of the investigator, which are neither few nor small. They will amply repay any one who has patience to wade through the mass of details, and pick out those of present value, of which there are many. Space forbids any attempt to summarize them. A large area of the beds was delineated, and the approximate number of marketable oysters upon them determined. Profiles of the beds were obtained in numerous instances, and the character of the subsoil, or bottom under the beds, determined as were the conditions of sedimentation. Nearly all the beds examined are described in detail. Valuable biological data were obtained through the efforts of Dr. W. K. Brooks and Mr. H. J. Rice, most of which have been already made

public in other ways. Much information on the general topic was obtained by questioning the fishermen, whose replies, though biassed by self-interest, may be set off against one another, and a residuum of useful facts obtained.

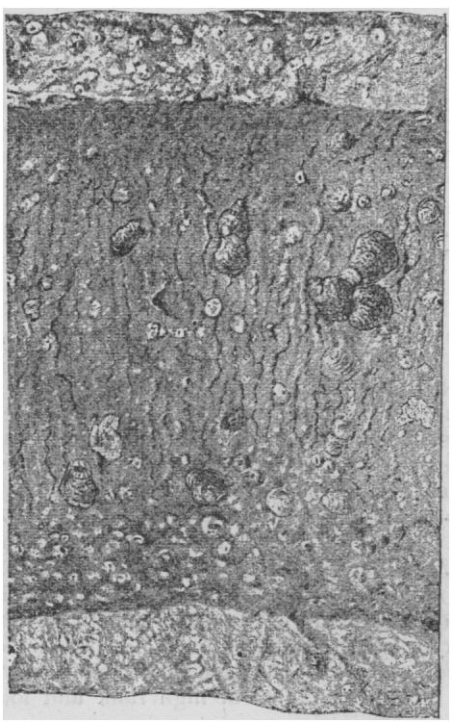

FIG. 1. — LOWER SIDE OF TILE EXPOSED JULY 9–AUG. 2. (TWO-THIRDS NATURAL SIZE.)

To our judgment, apart from the survey and delimitation of many oyster-beds, the most important results of this investigation are, 1°, the determination of the approximate quantity of oysters to the square yard over a great portion of the beds; and, 2°, the data in regard to the rapidity of growth of the young mollusks as indicated by the tile-collectors, and the proportion of mortality among them from causes not yet fully explained. The determination of the small mollusk Astyris, as an enemy of the infant oyster, though not conclusive, is of interest, and, if finally confirmed, important.

The determination of the number of oysters, though as a matter of course approximate only, is important as giving a point of comparison by which future decrease may be measured by repeating the investigation in similar fashion.

There is no doubt that in a comparatively limited time the majority of the Chesapeake beds will be practically destroyed, so far as producing oysters for a market is concerned. Some forty thousand people will have to seek employment in a different field. Probably, under the circumstances, this is the best thing that could happen; for it is doubtful if any less drastic medicine would have the slightest effect on the population residing in the vicinity of the oyster-beds, who, in the face of all the facts, have persisted in setting themselves like flint against any modification or check on their career of destruction. The present observations on the growth and surviving percentage of young oysters on the tile-collectors would have been much fuller and more valuable, had not the oystermen cut the buoys adrift, stolen the thermometers and lines, and destroyed such collectors as they could reach unseen, with the stupid notion that some reservation of beds, or limitation of fishing, was to result from the investigation. Twenty-four bundles of tiles were set and buoyed between July 1 and 14, and by Aug. 1 all but one were

FIG. 2. — LOWER SIDE OF TILE EXPOSED JULY 9–AUG. 23. (TWO-THIRDS NATURAL SIZE.)

removed or destroyed. Fig. 1 represents a portion of one of these tiles, which was placed in position July 9. On July 19, when first

examined, there were a few oysters upon it, but so small that a microscope was necessary to recognize them. On Aug. 2 it was again examined, and the tile of which a portion is figured was removed from the bundle. There were then from 26 to 348 young oysters on a tile; the total number upon the whole bundle was 1,506.

The third examination was made Aug. 23, when it was found the oysters had increased very much in size and numbers. On the tiles remaining, there were 1,334 oysters. A tile of which a portion is represented in fig. 2 was then removed. On Oct. 10 the bundle was again examined. The oysters had decreased fifty-five per cent in numbers; but two-thirds of them were now over three-quarters of an inch, and two specimens over two inches long, though the shells were still extremely

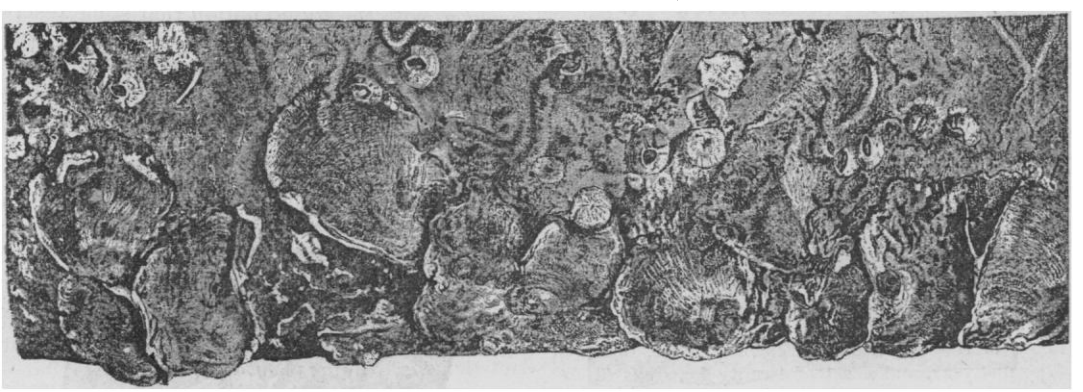

FIG. 3. — UPPER SIDE OF TILE EXPOSED JULY 9–OCT. 10. (TWO-THIRDS NATURAL SIZE.)

delicate. Part of one of these tiles is represented by fig. 3.

It was thus determined, that in 1879 the attachment of the young oysters began about the middle of July, and continued about a month, as after Aug. 20 there were no signs of fresh attachments; that fully fifty per cent died from natural causes within six weeks, no traces of predacious mollusks being noticed on the dead shells, though the evidence on this point is imperfect; that, the attachments being far more profuse on the concave under side of the tiles, the spat just previously must be on or near the bottom, and must rise to attach themselves; lastly, that the rate of growth is much more rapid than had previously been supposed, and may reach two inches in length in three months. Numerous other points of interest may be gleaned from the report, for which we have not space. Enough has been said, however, to show the value of Lieut. Winslow's work, the intelligence and assiduity with which it was carried on, and the wide field which awaits further investigation.

THE PEBBLES OF SCHLESWIG-HOLSTEIN.

Die sedimentär-geschiebe des provinz Schleswig-Holstein. Von Dr. C. GOTTSCHE. Als manuscript gedruckt. Yokohama, *Lévy & Salabelle*, 1883. 6+66 p., 2 maps. 8°.

THIS treatise by Dr. Gottsche, who is at present in Yedo, was an accepted thesis for admission to the position of private teacher at the Kiel university in 1880, printed privately in German at Yokohama in 1883, and seems to be a very painstaking and pretty thorough description of the pebbles, whether of rocks, minerals, or fossils (seventy-six kinds in all), found in four quaternary sedimentary beds at Kiel, with especial reference to the identification of their source, and is accompanied by two maps, — one showing with straight lines thirty directions in which such pebbles of the lowest bed appear to have been transported, and the other giving with similar lines the dissemination of three particular kinds of rock in the same Baltic region. Many of the lines are only a couple of hundred miles long, but some are six hundred or more. The author himself points out that the pebbles have not by any means necessarily been carried along those straight lines; and the place of origin may not necessarily have been exactly at the points where identical rocks are only found at present. Nevertheless the lines show that the transfer has in general been from the north-east, north, or north-west, and never from the westward or southward of Kiel. Of course,