tained from the Secretary of the Charles Lathrop Pack Forest Education Board, 1214 Sixteenth Street, N.W., Washington, D. C.

THE annual congress of the Royal Institute of Public Health opened on May 19 in the Aula of the Frankfurt University. Some 200 members and delegates of the institute were present, and among the English visitors were Lord Leverhulme, treasurer, and Professor Sir Thomas Oliver, chairman of the Council of the Institute, and Sir William Smith, a former president. Lord Reading, the president, was unable to attend, and his address was read by the British Consul-General. In the course of the address Lord Reading said that the congress had its own international significance and was engaged in war against a common enemy to defeat and destroy disease and to make for better conditions of life, physical, mental and moral, throughout mankind. In its respective spheres it was traveling, even though it may be subconsciously, in the direction all fervently desired to attain—that of peace and good will among men. At a reception held on Wednesday the Chief Burgomaster of Frankfurt, Dr. Landmann, handed Sir Thomas Oliver, for delivery to the Royal Institute of Public Health, the city's highest decoration—the golden plaque—in memory of the fact that Frankfurt was the first German city to be visited by the institute since the war. Sir Thomas Oliver in return bestowed upon the Chief Burgomaster the honorary membership of the institute for his conspicuous services to the institute.

THE ninth meeting of the International Institute of African Languages and Cultures was recently held in Paris. The congress dealt with important linguistic and anthropological problems of the Africa of to-day. Professor Antoine Meillet, president of the Institut d'Ethnologie, acted as president of the congress, and Professor Henri Labouret as vice-president. The members of the council were received by Dr. Charcot, the president of the Geophysical Society of France, and M. Grandidier, secretary-general of the society. At the beginning of the meeting, which lasted for three days, the chairman announced that the Rockefeller Foundation of New York had decided to give to the institute a yearly contribution of £5,000 for five years, plus a further contribution calculated at the rate of £1 for every £2 obtained by the institute from other sources to enable it to carry out further study and research in Africa.

Nature writes that the Royal Dublin Society will celebrate its bicentenary during June, as it was founded on June 25, 1731, at a meeting held in the rooms of the Philosophical Society in Trinity College, Dublin. The society at its foundation was known as "The Dublin Society for improving Husbandry, Manufactures, and other useful Arts and Sciences," and during the two centuries of its existence its activities have ranged over all the subjects included in the original title, and have been extended to include pure science, the fine arts and music. They include such diverse functions as the Dublin Horse Show, recitals of classical music and the provision of radon for therapeutic purposes throughout Ireland. The bicentenary celebrations will be held at the society's headquarters at Ball's Bridge, where ample accommodation is available for the large gatherings that a membership roll of nine thousand is likely to entail, during the period June 23–27. The functions will include an opening conversazione, special scientific and general meetings (the latter on the bicentenary date, Thursday, June 25), a garden party and a period ball. In addition to these functions at Ball's Bridge, their Excellencies the Governor-General of the Irish Free State and Mrs. McNeill have kindly promised to invite the special guests of the society to a garden party which will be held in the grounds of the Viceregal Lodge on Wednesday, June 24. An exhibition will be staged in some of the halls and grounds illustrating the advances made in agriculture, industry, science and art in Ireland during the past two centuries. An interesting feature of the bicentenary week will be the presentation to Sir John Purser Griffith of the Society's Boyle Medal, which has recently been conferred on him in recognition of his work in engineering science.

DISCUSSION

NEW OSTRACODERMS FROM OESEL

LAST summer Dartmouth College generously financed my third expedition to the Island of Oesel in the Baltic Sea, where I hoped to find new material for work begun some forty years ago on the "Origin of Vertebrates." This island is famous for the abundance and beautiful preservation of some of the oldest forms of animal life. Among its fossils of the upper Silurian age are many sea scorpions, or eurypterids, which for untold ages had been the highest animals in existence. Mingled with them are several kinds of ostracoderms, a great class of primitive and highly diversified fish-like animals, which at about this geologic period were making their first appearance on the historic screen. We have for many years regarded the ostracoderms as the remote Cambrian, or pre-Cambrian, descendants of the sea scorpions, and the ancestors of the long line of true fishes, reptiles and mammals which hundreds of million years later culminated in man. For in spite of

the obvious differences between them, the fundamental pattern of bodily structures and functions in all these different forms is essentially the same, and quite unlike that in any other known kind of animals. For that reason, and because of the suggestive sequence of their appearance in geologic time, together with abundant embryological evidence derived from the study of modern representatives, and especially because of the remarkable anatomical evidence provided by the oral arches of the new fossils from Oesel, the ostracoderms and the sea scorpions may now be regarded, beyond any reasonable doubt, as genetically related. In other words they really are the long sought missing links between the highest invertebrates of those very early times and all the vertebrates that arose in subsequent geologic periods. Many fundamental problems of comparative anatomy, embryology, and organic evolution are dependent for their solution on the recognition of the genetic relations of these two great types of animal life.

The paleontological key to the origin of vertebrates is the structure and arrangement of the chief sense organs of the ostracoderms (such as taste, sight, smell and hearing) and that of the several pairs of jaw-like arches on either side of the mouth. For these grasping and searching sentinels, posted around the main entrance to the body, play conspicuous rôles in the subsequent evolution of the head and face in all the higher vertebrates. And these external features, as always, most clearly express the character of the life within.

There is one little ostracoderm, of which there are many kinds in different parts of the world, in which these organs are enclosed in highly polished and exquisitely modelled bony plates. Although they are usually badly crushed, or scattered about in the muddy sediments now turned to rock, they may, and often do, provide us with exact information as to the nature of these organs, some five hundred million years ago. It was this particular kind of ostracoderm, called Trematapis, that we were looking for. The animal is about three inches long. It is found only in the island of Oesel, and even there its remains are very rare and always fragmentary.

Our excavations for these fossils were the first ones, on a large scale, that had ever been made in Oesel. We spent some seven weeks in the field, using for most of that time a crew of from fifteen to twenty-seven native workmen, ten hours a day. Four or five feet of rock and soil were removed from an area of about four hundred square yards. The lower, fossiliferous layers, some two or three feet thick, were split into thin slabs, in order, if possible, to locate, or partly expose the more complete specimens without injuring them. The slabs were then broken up into small hand pieces and carefully searched for certain bony plates some of them not much larger than the head of a pin.

After exhausting the old site, near Kiehelkond, we moved to Atla, where there is a peasant quarry recently explored by Professor Luha, an Esthonian geologist from the University of Dorpat. Here we found six new species of ostracoderms. One represents a new family and belongs to a new genus that I have called Dartmuthia. One is a new cephalaspid, and another is a small fish, uniformly covered with loose scales and belonging to an order that looks very strange in these surroundings.

Four of the new forms are as follows:

Trematapis milleri, n. sp. Branchiocephalic shield, 45 x 36 mm; highly polished; olfactory opening in bottom of deep pit; six to eight dorsal tubercles; occipital crest high, sharp-edged, and overhanging behind. Named after a friend and supporter of the 1928 expedition.

Trematapis mammillata, n. sp. Shield 39 x 28 mm. Olfactory opening level with or above surrounding surface. Twenty or more small dorsal tubercles.

Didymaspis pustulata, n. sp. Shield about 19 x 29 mm; semi-membranous, flexible; outer surface minutely spiculate; inner surface divided into large, well-marked polygonal areas, with corresponding pustular elevations externally, each one capped with a glistening nodule. Two pairs of marginal areas; distinct oral plates. This form is new to Oesel and gives us for the first time a clear picture of a little known genus.

Dartmuthia gemmifera, n. f., n. g., n. sp. Branchiocephalic shield completely united; 53 x 39 mm; no cornua; one pair of marginal areas. Outer surface smooth and continuous, but divided into minute polygonal areas studded with large gem-like tubercles loosely distributed on dorsal surface, but closely packed on under side of margins, and merging into feather-like ornaments near the gill openings. Ventral post-branchial surface covered with flat, closely united polygonal plates. This represents a new family of ostracoderms, in some respects intermediate between the *Cephalaspidae* and *Trematapidae.*

The new species of *Trematapis* and the specimens collected two years ago now give us an almost complete picture of the external structure of these remarkable animals. Two important plates, which I formerly interpreted as parts of oar-like cephalic appendages, have been found in place, united with their associated anatomical parts. One is a convex anal plate, located at the root of the tail and well within the branchiocephalic shield, as in *Bothriolepis.* The other is a fin-like dorsal trunk spine. Nevertheless we have found indications of at least one pair of cephalic appendages on the margins of the circumoral

region. We have also found well-defined membranous flaps protruding from the posterior opening of the branchiocephalic shield in *T. mickwitzi*.

But the most significant discovery was the finding of one and probably two pairs of jaw-like crushing plates in their natural position in two widely different species, *T. mickwitzi* and *T. schmidti*. In both species, they are definitely located on either side of a slit-like longitudinal mouth which is ventral in position, not terminal; and the jaws evidently work sidewise against one another, not forwards and backwards, as they do in typical vertebrates.

Moreover in *Dartmuthia* and *Trematapis* there are four pairs of conspicuous endoskeletal plates and processes arising from the inner lateral surface of the cephalic shield and pointed towards the mouth. They evidently serve, in part, for the attachment of four sets of muscles and clearly indicate that there are really four non-respiratory oral segments in front of and serially homologous with the eight respiratory gill segments. All this agrees with the location of the several pairs of oral arches (premaxillae, maxillae and mandibles) in the embryos of the higher vertebrates. It also agrees with the postulates and predictions of the arachnid theory of the origin of vertebrates.

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THE OCCURRENCE OF OLD MEADOW SOD UNDER THE NEW JERSEY BEACHES

A STUDY of the changes in the position of the shoreline of any coast is very important, but along the New Jersey coast such a study is of particular significance because of the immense amount of money invested in the summer resorts of that state.

There has been some difference of opinion in regard to the question of whether the coast of New Jersey is actually sinking at the present time. Some seventy-five years ago, Dr. George Cook, then New Jersey state geologist, presented evidence which he thought showed that the coast of Cape May County was sinking at the rate of two feet a century or one quarter of an inch a year. Others have expressed the same opinion.

More recently, however, it has been shown that the changes in shore-line may have been brought about by factors other than the subsidence of the land, mainly the erosive action of the waves and currents on the sand beaches. Dr. Douglas Johnson, who has studied the situation thoroughly, says that the evidence favors unusual stability of the land during the past few thousand years.

No matter which interpretation we accept, there still remains undeniable evidence of marked changes in the position of the shore-line along this coast. Cook in the report of the New Jersey state geologist for 1881 pointed out that at numerous places along the coast the wearing away of the beaches had exposed old salt meadow sod on the ocean shore. Since there is no such sod along the shore outside the beaches, this old sod must have grown there when it was a part of the meadow between the beach and the upland, thus indicating a considerable change in the position of the shore-line. At certain places in this sod were to be seen the stumps of old trees, suggesting that the region at one time supported an upland association.

In his volume for 1882 Dr. Cook says that there has been a common report that these meadow sods along the sea border, in some places which were uncovered by violent storms, were plainly marked with the tracks of horses, cattle and sheep. After the severe storm of September 21, 22 and 23, 1882, such tracks were plainly visible a few miles south of Harvey Cedars, Long Beach Island, N. J. They were found in a patch of old meadow sod about three feet below ordinary high-water mark. The sod was thickly marked with the tracks of horses and cattle. The horse tracks were of various but rather small hoofs and without shoes, and the cattle tracks were also of various sizes. The sod and tracks extended back under the hillocks of beach sand.

At that time (1882) that part of the beach had few if any domestic animals on it, but in 1690, when it was settled, horses and cattle were kept on the island which at that time extended considerably farther out to sea.

In the sod near these tracks were seen the stumps of numerous trees and bushes.

Some fifteen years ago, similar tracks of cattle, horses and birds were reported in sod near South Cape May, N. J., exposed after severe storms.

In the last few years patches of this old meadow sod containing the stumps of trees, roots of grass, etc., have been seen in several places along the beach in the vicinity of Cape May. After the heavy seas of early January, 1931, some three feet of sand was eroded from the beach at Cape May Point, exposing the old sod at several places. Stumps of red cedar trees and roots of various plants were seen. Near low-water mark, close to the Cape May Point Coast Guard Station, was seen very clearly the remains of an old corduroy road leading from the present shoreline out toward the sea in the direction of Prissy Wick Shoal, about one mile distant. Tradition says that less than one hundred years ago this shoal was above water and was separated from the present shoreline by low-lying land, and that it was possibly the site of the original Cape May Lighthouse. A study