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The following paper was read by PROFESSOR T. MCKENNY HUGHES, M.A., F.R.S.,

ON BONE HARPOONS FROM KUNDA IN ESTHONIA:

On the south shore of the Gulf of Finland at Kunda in Esthonia there were, after glacial conditions had passed away, a number of small tarns and swampy estuaries, most of which have been filled by the accumulation of rainwash and alluvium and the growth of peat. Where these lakelets are not in the lines of drainage they have not got filled to the same extent, and remain open sheets of water, as may be seen in Finland, which is known as "the land of a thousand lakes."

Similar conditions once prevailed in the British Isles, though probably each post-glacial episode occurred earlier here than its representative stage in the Baltic Provinces.

When I visited Kunda in 1897 I had great opportunities of seeing the sections, thanks to the Baron Girard de Soucanton and to Dr Bührig, who not only offered us the most generous hospitality, but also showed us all the points of interest and had sections cleared for our inspection. To Dr Bührig I am also indebted for the specimens I now exhibit.

The district is naturally terraced from the higher ground to the sea, and the watercourses consist of small rapids and wider alluvial flats, which were once tarns or swamps, until we reach the ancient lagoons along the shore of the gulf.

There have evidently been many oscillations of level, the uplifts encouraging denudation and the depressions hastening the deposition of sediment.

In one of the hollows in the drift near Kunda the clay which lies at the base has yielded a series of plant remains, which, according to Professor Nathorst, have a distinctly arctic character. He has recognised *Salix polaris*, *S. herbacea*, and *Dryas octopetalā*. This flora followed hard on the receding ice, and dwarf willows and plants of northern type still linger in that district.

Above this is a bed of clay about 18 inches in thickness, in the lower part of which remains of mosses and of the water

milfoil have been detected. This is separated by a bed of sand not more than 3 inches thick, from the marl, of which there is about 3 feet, and on top of this there is a thin layer of peat from 1 to 2 feet thick. As the marl and clay have been largely excavated for the manufacture of cement there have been ample opportunities for studying the succession of beds and the objects entombed in them. At the bottom of the peat, relics of the bronze age are found. I exhibit a bronze and iron ring which was said to have been found here (Plate XIII, fig. 1). Dr Bührig pointed out that there is little or no carbonate of lime in the lowest beds, but that the quantity steadily increases, as we ascend, from 10% to 20% and 60% until it amounts to 85% in the marl. It is not clear whether this is altogether due to the decomposition of the shells of fresh-water molluscs, which are still well preserved here and there, or whether some may not be derived from the denudation of the Silurian limestones as they became exposed on the higher ground around. The bones of animals have been found in considerable quantities in the clayey deposits. Among these Constantin von Graevingk, Professor of Geology and Palaeontology in the University of Dorpat, has determined the Beaver, Reindeer, Wild Boar, and Wild Ox, and on some rising ground, which he thinks was once an island in the lake but is now a hill in the middle of the valley, he found the bones of Bear and Elk, and some birch charcoal which probably indicated the spot on which primaeval hunters had lighted their fire.

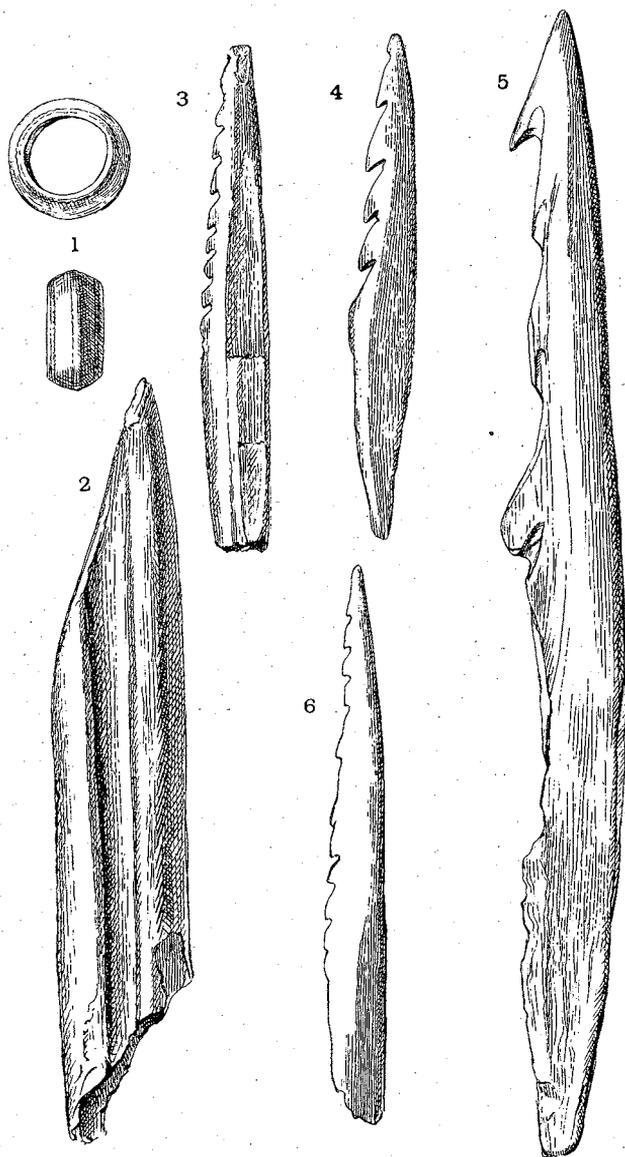
In the clayey deposits with the other remains of animals were various implements, among them bone harpoons and an instrument (Plate XIII, fig. 2) similar to one commonly found in our fens and known among the workmen as a "flayer," from the idea that it was used in stripping off the skins of animals. Compare *Archaeol. Journ.* Vol. LVIII, No. 230, pl. I, figs. 9, 10, and 10 a.

We may learn much as to the conditions of life among the primaeval inhabitants of Britain from an examination of the objects found in the peat of Esthonia. I propose to call attention now to one special group, namely, the fish spears, of which, thanks to my friend Dr Bührig, I am able to exhibit

some interesting examples. These implements are elsewhere associated with the remains of man of every age. For our present purpose it will be sufficient to group them under three heads, the unilateral, in which the spear is barbed on one side only; the bilateral, in which there are barbs on both edges; and the pronged, in which several unilateral spears are fastened together somewhat after the fashion of an eel spear, only that instead of consisting of one flat piece divided up at the end like a fork the prongs are not in one plane.

The bilateral spears are not uncommon in caves of Palaeolithic age, as in Kent's Cavern and the caves of Dordogne. They are found also in deposits of the Neolithic and Bronze ages, as in the Lake Dwellings of Switzerland. The unilateral form, to which all those I have received from Kunda belong, occur in the Palaeolithic caves, the Lake Dwellings, and among the Fuegians of to-day. Of course when we find a unilateral spear it is not always easy to say whether it was intended to be used alone or to be tied with others to form a pronged spear. It is highly probable that some of these Kunda spears were mounted in the same way as the three-pronged fish spear of the Esquimaux. These barbed weapons of Kunda (Plate XIII, figs. 3—6) were spears, not arrows. They are too irregular in form to have been shot any distance with precision, but they may have been used as harpoons and thrust or hurled short distances with or without a string attached. In the lacustrine deposits of Kunda a few feet below the peat the jaw of a large pike was dug up with the point of one of these harpoons sticking in the bone. This specimen is now in the Museum at Dorpat.

In the Mabinogion the great salmon that carried Kai and Gwrhyr to Gloucester had fifty fish spears sticking in his back which he asked the eagle to take out for him. From this we may infer that the people for whom that poem was written must have been familiar with the method of taking fish by striking them with a harpoon, the head of which the fish found it difficult to rub off—of course because it was barbed. In parts of Russia it is still common to take large fish with a spear instead of with a net or line, and the pike is from its habit of



Bone Harpoons from Kunda.

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