

W. AYSHFORD SANFORD, ESQ., F.G.S., read a paper  
On the Course of the Rivers in Western Europe  
during the Pleistocene Period, and the distribution  
of the Mammalia affected thereby. (*Abstract.*)

He stated that the occurrence of the hippopotamus, accompanied as it was with rhinoceros leptorhinus, and rhinoceros megarhinus and elephas antiquus, all animals allied to forms which now inhabit much warmer countries, together with the reindeer, rhinoceros tichorinus, and elephas primigenius, and other animals of a still more decidedly Arctic type, in the caves and in the valley deposits of our rivers during the period in question was a source of difficulty, the explanation of which he endeavoured to aid. He recapitulated the statements of Sir Charles Lyell as to the changes of level of Western Europe since the first or great glacial epoch, and shewed that during the latter part of that period England, or a portion of it at least, had been sunk to a depth of 1,300 or 1,400 feet, so that beaches containing Arctic shells of existing species were formed at that height on our mountains, and from this submergence the land gradually rose until England, Ireland, and the Orkney and Shetland Islands probably became a portion of the European continent; and adduced arguments from the flora of the west of Ireland, and from the dredgings on the west of the Shetland Islands to prove that this elevation was very considerable, and, judging from the soundings on the one hundred and two hundred fathom line, he argued that the elevation was possibly, if not probably, not less than 1,200 feet, which would have carried a steep coast from the neighbourhood of St. Ander, in Spain, nearly in a straight line to a point more than one hundred miles from the north-west coast of

Ireland, and it would have included the Orkneys and Shetlands in its sweep. All this he justified from the statements of Sir C. Lyell, the late Dr. E. Forbes, Professor Jamieson, and others. He then passed to the question of the course of the rivers, and stated that he had examined the soundings over this area, and had come to the conclusion, that, supposing the elevation of Western Europe to have been uniform, the main river of this part of the world was then the Rhine. The watershed of the plain which now forms the North Sea would have been between Flamborough Head and the Texel, and the course of the Rhine would have been through the Straits of Dover, and it would have had its mouth at a considerable distance from the French coast, off Ushant; and the Humber, the Thames, the Seine, the Loire, and all the rivers on the south coast of England, and probably even the Severn, would have been all tributaries of that vast stream, as it then would have been. He next showed that the tender Irish flora, which came from Biscay along the coast of this old land, probably came at this time, for it could not have survived the previous glacial period in the latitude of Ireland; and that, consequently, the mouth of this great stream would have been habitable by these southern animals during the whole year, and the distance of their summer migrations might not have been greater than is now known to be journeyed by many animals of smaller size on the continent of Africa. The hills, such as the Mendip and the Yorkshire Wolds, would then have been considerable mountains, and would have supported (covered, as they would have been, with the remains of an Arctic flora), perhaps through the year, herds of reindeer, and the northern rhinoceros and elephant, which during their winter migrations to the plains probably tra-

versed the very ground occupied by the hippopotamus and the southern rhinoceros in the summer. He said he was not aware that the hippopotamus had been found north of this supposed great watershed of the Rhine ; its furthest northern limit being, he believed, Kirkdale. The drainage of the vale of Pickering, in which the cave is situated, was the Humber. The mouth of the Severn could not then have been far from that of the Rhine, if it did not flow into it, and therefore the argument affecting the one would affect the other. This elevation appears to have been succeeded by a considerable depression, attended by a corresponding lowering of temperature, which was probably the period of the final disappearance of the great Mammalia, and of the predominance of the reindeer in the pre-historic deposits, and this depression by a moderate elevation both of level and temperature. How long ago these changes took place he knew not, but man certainly existed during a portion of them. No diluvial theory will account for the phenomena he attempted to explain, the tendency of deluges being to confuse and roll up evidence into an indistinguishable mass; whereas the more the evidence he relied on was examined the clearer it was shewn to be.

A paper "On the Formation of Caves" was read by Mr. JAMES PARKER, who illustrated his subject by some carefully prepared drawings of the great cave at Wookey Hole, which he had himself explored for a considerable distance.

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