The Surface of the Sea and the Weather

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Mr. MYRES: I refer to the school of maps. They vary in detail, because the prime equator is slightly different in the case of different towns. There are slight deviations, but in the main body the Royal Road is the same, and the course across to Sicily is the same. Probably all used the Phocæan map to the west; I only showed Massalia as shorthand for the point touched. Of course, the point made for, and which is still made for, is beyond Toulon. Hemeroskopion is Cabo de la Nao in Spain, opposite Iviza.

Mr. THORPE: We know they had maps, or, at least, something to steer by.

Mr. MYRES: I think the maps I have been trying to reconstruct show that they had got as far as that. I think it is probable they steered by the stars. In the *Odyssey*, v. 277, Odysseus when trying to get back to Ithaka, is instructed to steer by the Great Bear for fourteen days.

Mr. BEAZLEY: Might I ask one question? Do I understand that Mr. Myres bases his Persian maps on Skylax, or what else?

Mr. MYRES: The map is Skylax's edition of the Persian maps, *plus* the Ionic map for Asia Minor, *plus* the Egyptian maps for Egypt and Libya, *plus* his own explorations east of the great Persian map; but not including any survey of Central Europe, Scythia, or the south shore of the Caspian.

The PRESIDENT: This has been a most interesting paper, and the interest began at the very commencement of the paper, when Mr. Myres explained to us the habit of drawing the roads in a straight line, so that the map of Aristagoras must have been like Paterson's Roads. I am old enough to remember travelling from York to London by coach. We always had Paterson's road-map, and I used to wonder how it was that they were so perfectly straight, because I found it so very different when we got out to walk up the hills. The most striking point, I think, is when he proceeded to point out the route to Susa from Miletus, a straight line. He afterwards explained to us exactly what must have been Aristagoras' conversation with the king of Sparta about the map he had drawn, and he has even drawn the map for us in a way that is, I think, very probably like the bronze plate Aristagoras took with him to try to persuade the king of Sparta to go to Susa, but the king replied that the distance was too great. The interest of the paper was very great at the commencement, and increased. He explained the symmetrical habit of mind of these people, which probably drew them into many errors, but also in various ways got things on a parallel, and so got some verisimilitude in their maps. It had advantages as well as disadvantages. You will all, I am confident, wish me to return a very hearty vote of thanks to Mr. Myres for his very interesting and suggestive paper.

THE SURFACE OF THE SEA AND THE WEATHER.

By H. N. DICKSON.

PROF. OTTO PETTERSSON contributes to the August number of the *Meteorologische Zeitschrift* a further and important instalment of results obtained by the joint labours of Swedish, Norwegian, German, Danish, and British oceanographers in the North Sea and its branches, and in the North Atlantic. Prof. Pettersson deals in this paper chiefly with the meteorological aspect of the question, and discusses more fully than has been possible hitherto the points raised at an early stage of the work, and given in outline by the writer in the *Geographical Journal* for March of the present year. It is clearly shown at the outset how a comparatively small change of temperature in the surface waters of the sea necessarily means a vast quantity of heat imparted to the atmosphere, partly on account of the great specific heat of the water, and partly because cooled particles of water are instantly

removed and made to give place to lighter particles of warmer water. There is thus a double reason why, under normal conditions, the surface of the sea should in winter be maintained at a higher temperature than the land, and so tend to become the home of systems of low barometric pressure, and this altogether apart from its power of supplying these systems with aqueous vapour.

A great deal of evidence is produced to show that in general the regions of relatively warm surface water are indeed regions of relatively low barometric pressure, and the further question then arises as to the relation between the conditions of the surface of the sea and the weather, dependent on the barometric pressure, at different seasons and in different years. From a large number of particular cases where abundant material has been collected by international co-operation, and from long-period averages of observations made at Danish, Norwegian, and Swedish stations, and at the British coastguard stations under the Meteorological Council, it is established almost beyond dispute that where warm oceanic water has from any cause been brought into the North Sea or the Baltic in unusually large quantities in autumn, the weather of the following winter is marked by an unusually large number of cyclones with accompanying mild weather. If, on the other hand, the land streams are stronger than usual, bringing down large quantities of cold fresh water and spreading them widely over the sea-surface, then pressure tends to remain above the average, the cyclones are deflected further to the westward, and the hard cold winter characteristic of steady anticyclonic conditions is the result. The strong contrasts of recent winters, during which the international system of observations was in full swing, afforded exceptionally good opportunities of bringing out this point. The warm winter of 1894 was preceded and accompanied by the presence of vast quantities of warm oceanic water in the North Sea; while in 1895, a winter of intense cold, the southern part of the North Sea was entirely filled with fresh cold waters chiefly derived from the land.

Prof. Pettersson admits that much remains to be done before complete proof of the hypotheses advanced can be obtained. The facts, as at present known to us, will indeed bear no other reasonable interpretation, but in most cases the interaction of cause and effect is so complex that it is often difficult to tell which is which. Every step in the investigation drives one further and further out to sea, where observations become always more and more widely separated; for not until we have a really fairly complete knowledge of the surface currents of the North Atlantic and the Norwegian Sea can we hope to find the cause of the great differences in the distribution of waters nearer home. When the influences controlling these currents are once fully understood, it seems almost certain that a limited number of observations judiciously selected as to time and place, will enable us to forecast with confidence, not the weather for a day or a few days, but the general character of a season, whether the winter is to be mild or severe, and possibly also whether the summer is to be wet or warm.

At the close of the paper published in the March number of the *Geographical Journal*, I was able to state that arrangements had been made for making observations on an extended scale in different parts of the North Atlantic during the years 1896 and 1897. Thanks to the energy and care of the captains and officers of the large number of vessels engaged in the work, more than 1600 samples of surface water have been collected during the first ten months of the period. The greater part of the material thus brought together gratuitously has already been subjected to careful if partial analysis, and if, as seems certain, a similar number of samples can be collected next year, the deficiencies so emphatically pointed out by Prof. Pettersson will have been to some extent made good.