

**REPORT OF THE PRESIDENT AND
COUNCIL OF THE ROYAL SOCIETY ON
THE INSTRUCTIONS TO BE PREPARED
FOR THE SCIENTIFIC EXPEDITION TO
THE ANTARCTIC REGIONS**

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Report of the President and Council of the Royal Society on the Instructions to be prepared for the scientific expedition to the antarctic regions by Various

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VARIOUS

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OF
THE PRESIDENT AND COUNCIL
OF
THE ROYAL SOCIETY
ON THE INSTRUCTIONS TO BE PREPARED
FOR
THE SCIENTIFIC EXPEDITION
TO
THE ANTARCTIC REGIONS.

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THE PRESIDENT AND COUNCIL OF THE ROYAL SOCIETY having recommended to Her Majesty's Government the equipment of an Antarctic Expedition for scientific objects, were informed by the Lords Commissioners of the Admiralty that it had been determined to send out Captain James Clark Ross on such an expedition, and the Council were at the same time requested to communicate to them, for their information, any suggestions on those subjects, or on other points to which they might wish Captain Ross's attention to be called, in preparing the instructions to that officer*. The Council, having due regard to the magnitude and importance of the question submitted to them, considered that they would best fulfil the wishes of Her Majesty's Government, by a subdivision of the inquiry into different parts, and by referring the separate consideration of each part to distinct Committees, consisting of those members of the Society who were especially conversant with the particular branches of science to which each division of the inquiry had relation. These several Committees, namely, those of Physics, of Meteorology, of Geology and Mineralogy, of Botany and Vegetable Physiology, and of Zoology and Animal Physiology, after bestowing much time and great attention in the investigation of the subjects brought under their notice, have each drawn up very full and

* This request was conveyed in a letter from Sir John Barrow, addressed to the Secretary of the Royal Society, and dated June 13, 1839.

complete Reports of the results of their labours. These reports have been considered and adopted by the Council, and have been incorporated in the following General Report, which the Council present as their opinion on the matters which have been referred to them by Her Majesty's Government. They take this opportunity of declaring their satisfaction at the prospect of the benefits which are likely to accrue to science from the expedition thus liberally undertaken by the Government on the representations made to them by the Royal Society and other scientific bodies in this country, and in conformity with a wise and enlightened policy. They also desire to express their grateful sense of the prompt attention which has been uniformly paid to their suggestions, and of the ample provision which has been made for the accomplishment of the various objects of the expedition.

Royal Society, 8th August, 1839.

SECTION I.—PHYSICS AND METEOROLOGY.

THE Council of the Royal Society are very strongly impressed with the number and importance of the desiderata in physical and meteorological science, which may wholly or in part be supplied by observations made under such highly favourable and encouraging circumstances as those afforded by the liberality of Her Majesty's Government on this occasion. While they wish therefore to omit nothing in their enumeration of those objects which appear to them deserving of attentive inquiry on sound scientific grounds, and from which consequences may be drawn of real importance, either for the settlement of disputed questions, or for the advancement of knowledge in any of its branches,—they deem it equally their duty to omit or pass lightly over several points which, although not without a certain degree of interest, may yet be regarded in the present state of science rather as matters of abstract curiosity than as affording data for strict reasoning; as well as others, which may be equally well or better elucidated by inquiries instituted at home and at leisure.

I. TERRESTRIAL MAGNETISM.

The subject of most importance, beyond all question, to which the attention of Captain James Clark Ross and his officers can be turned,—and that which must be considered as, in an emphatic manner, the great scientific object of the Expedition,—is that of Terrestrial Magnetism; and this will be considered: 1st, as regards those accessions to our knowledge which may be supplied by observations to be made during the progress of the Expedition, independently of any concert with or co-operation of other observers; and 2ndly, as regards those which depend on and require such concert; and are therefore to be considered with reference to the observations about to be carried on simultaneously in the fixed magnetic observatories, ordered to be established by Her Majesty's Government with this especial view, and in the other similar observatories, both public and private, in Europe, India, and elsewhere, with which it is intended to open and maintain a correspondence.

Now it may be observed, that these two classes of observations naturally refer themselves to two chief branches into which the science of terrestrial magnetism in its present state subdivides itself, and which bear a certain analogy to the theories of the elliptic movements of the planets, and of their periodical and secular perturbations. The first comprehends the actual distribution of the magnetic influence over the globe, at the present epoch, in its mean or average state, when the effects of temporary fluctuations are either neglected or eliminated by extending the observations over a sufficient time to neutralize their effects. The other comprises the history of all that is not permanent in the phenomena, whether it appear in the form

of momentary, daily, monthly, or annual change and restoration, or in progressive changes not compensated by counter changes, but going on continually accumulating in one direction, so as in the course of many years to alter the mean amount of the quantities observed. These last-mentioned changes hold the same place, in the analogy above alluded to, with respect to the mean quantities and temporary fluctuations, that the secular variations in the planetary movements must be regarded as holding, with respect to their mean orbits on the one hand, and their perturbations of brief period on the other.

There is, however, this difference, that in the planetary theory all these varieties of effect have been satisfactorily traced up to a single cause, whereas in that of terrestrial magnetism this is so far from being demonstrably the case, that the contrary is not destitute of considerable probability. In fact, the great features of the magnetic curves, and their general displacements and changes of form over the whole surface of the earth, would seem to be the result of causes acting in the interior of the earth, and pervading its whole mass; while the annual and diurnal variations of the needle, with their train of subordinate periodical movements, may, and very probably do arise from, and correspond to electric currents produced by periodical variations of temperature at its surface, due to the sun's position above the horizon; or in the ecliptic, modified by local causes; while local or temporary electric discharges, due to thermic, chemical, or mechanical causes, acting in the higher regions of the atmosphere, and relieving themselves irregularly or at intervals, may serve to render account of those unceasing, and as they seem to us casual movements, which recent observations have placed in so conspicuous and interesting a light. The electrodynamic theory, which refers all magnetism to electric currents, is silent as to the causes of those currents, which may be various, and which only the analysis of their effects can teach us to regard as internal, superficial, or atmospheric.

It is not merely for the use of the navigator that charts, giving a general view of the lines of Magnetic Declination, Inclination, and Intensity, are necessary. Such charts, could they really be depended on, and were they in any degree complete, would be of the most eminent use to the theoretical inquirer, not only as general directions in the choice of empirical formulæ, but as powerful instruments for facilitating numerical investigation, by the choice they afford of data favourably arranged; and above all, as affording decidedly the best means of comparing any given theory with observation. In fact, upon the whole, the readiest, and beyond comparison the fairest and most effectual mode of testing the numerical applicability of a theory of terrestrial magnetism, would be, not servilely to calculate its results for given localities, however numerous, and thereby load its apparent errors with the real errors, both of observation and of local magnetism; but to compare the totality of the lines in our charts with the corresponding lines, as they result from the formulæ to be tested, when their general agreement or disagree-

ment will not only show how far the latter truly represent the facts, but will furnish distinct indications of the modifications they require.

Unfortunately for the progress of our theories, however, we are yet very far from possessing charts even of that one element, the Declination, most useful to the navigator, which satisfy these requisites; while as respects the others (the Inclination and Intensity) the most lamentable deficiencies occur, especially in the Antarctic regions. To make good these deficiencies by the continual practice of every mode of observation appropriate to the circumstances in which the observer is placed throughout the voyage, will be one of the great objects to which attention must be directed. And first—

At sea.—We are not to expect from magnetic observations made at sea the precision of which they are susceptible on land. Nevertheless, it has been ascertained that not only the Declination, but the Inclination and Intensity can be observed, in moderate circumstances of weather and sea, with sufficient correctness, to afford most useful and valuable information, if patience be bestowed, and proper precautions adopted. The total intensity, it is ascertained, can be measured with some considerable degree of certainty by the adoption of a statical method of observation recently devised by Mr. Fox, whose instrument will be a part of the apparatus provided. And when it is recollected that but for such observations the whole of that portion of the globe which is covered by the ocean must remain for ever a blank in our charts, it will be needless further to insist on the necessity of making a daily series of magnetic observations, in all the three particulars above-mentioned, whenever weather and sea will permit, an essential feature in the business of the voyage, in both ships. Magnetic observations at sea will, of course, be affected by the ship's magnetism, and this must be eliminated to obtain results of any service. To this end,

First. Every series of observations made on board should be accompanied with a notice of the direction by compass of the ship's head at the time.

Secondly. Previous to sailing, a very careful series of the apparent deviations, as shown by two compasses permanently fixed, (the one as usual, the other in a convenient position, considerably more forward in the ship,) in every position of the ship's head, as compared with the real position of the ship, should be made and recorded, with a view to attempt procuring the constants of the ship's action according to M. Poisson's theory*; and this process should be repeated on one or more convenient occasions during the voyage; and, generally, while at anchor, every opportunity should be taken of swinging round the ship's head to the four cardinal points, and executing in each position a complete series of the usual observations.

Thirdly. Wherever magnetic instruments are landed and observations made on *terra firma*, or on ice, the opportunity should be seized of going through the regular series on ship-board with more than usual diligence and care, so as to establish by actual experiment in the only unexceptionable manner the nature and amount of the corrections due to the ship's action for that particular geo-

* See Appendix A.