and its collections illustrating physical geology, physiography and geography, mining, metallurgy, and construction, while to the south it is in direct connexion with the mineral and palæontological collections of the Natural History Museum. The plan also shows in the related part of the Natural History Museum the position of a lecture room which the authorities of that Museum contemplate for joint use in connexion with their own Museum and with the Museum of Practical Geology.

There is no need to detail the many advantages of this scheme. They are obvious. It should be noted, however, that the limitations of space in the Jermyn Street building are no less harmful now than they were ten years ago. On the other hand, in the case of the geological section of the new buildings at South Kensington, financial considerations should not now present much difficulty, for the value of the Jermyn Street site would go far to balance the cost of providing the larger new building on the site designated for it.

It is worth while to quote here the concluding section of the 1911 Report of Sir Hugh Bell's committee:

"In other departments of knowledge, the British Museum and the Victoria and Albert Museum have set a high standard for the national provision of Museum facilities. In the domain of Science the requirements of most of the branches of Natural History are already admirably provided for at South Kensington in the Natural History Museum. In no way overlapping or duplicating the functions of these great institutions, but representing aspects of human activity which lie outside their scope, not less ample provision is necessary for those departments of knowledge, invention and discovery, the needs of which have been brought so vividly before us in our inquiry; and we are of opinion that no scheme for a national Science Museum can be regarded as satisfactory unless it provides the buildings necessary for affording to Science and the industries all the assistance a Museum can give. A Science Museum in which all branches of Physical Science, Pure and Applied, and the Scientific and Economic work of the Geological Survey shall be adequately illustrated in close proximity to the other great Museums at South Kensington will, we believe, be of incalculable benefit alike to intellectual progress and to industrial development, and will be recognised as an institution of which the country may well be proud."

Antarctic Geophysics.

THE two reports referred to below[1] are the records of the aurora observations and gravity determinations made during Capt. Scott's last south polar expedition, 1910–1913. They are both dated for 1921, but it was only in February of this year that they reached us.

The original plans for auroral observations on Capt. Scott's *Terra Nova* expedition included photographic determinations of the height of auroræ, using Prof. Störmer's method. This part of the programme unfortunately proved impossible to execute, owing to the lack of the necessary special lenses and photographic plates. The auroral spectrum also was not observed, so that the work accomplished consisted of visual observations, namely, sketches, brief descriptions, and times of occurrence of auroræ. These data are now summarised and discussed by Mr. C. S. Wright, himself a member of the scientific party. The sketches and daily log are not reproduced, but the plan of observation and the resulting data are described in general terms, discussed statistically, and finally considered in their theoretical bearing.

Observations were made at two stations, in what may be termed the Scott-Shackleton strip of the Antarctic coast. One was Cape Evans, 77·6° S., 166° E., and the other was Cape Adare, 71·3° S., 170° E. Both stations are thus within a few degrees of the south magnetic pole, but considerably farther from the pole of the earth's magnetic axis, Cape Adare being at the greater distance. The two stations are about 700 kilometres apart, and a horizontal plane through one station would, in consequence of the earth's curvature, pass over the other at a height of about 40 kilometres. Auroræ occur at heights of about 90 kilometres and upwards above the earth's surface, so that from either station, in clear weather, auroræ above, or even a little beyond, the other, would be visible low down on the horizon. The hills and mountains in the neighbourhood of Cape Evans obscure the free horizon in some directions, though the report does not indicate which these are, nor whether Cape Adare is similarly affected. This information, together with more detailed statistics as to the relative frequency of auroræ at different altitudes, would have added to the value of the report.

In many respects the auroral features at the two stations are strikingly dissimilar. Auroræ are far more frequent at Cape Adare than at Cape Evans, and also more distinguished by brilliance, colour, and motion. Cape Adare is therefore nearer to the region or belt of maximum auroral frequency than Cape Evans is. Moreover, the majority of auroræ visible from Cape Adare lie to the north, so that Cape Adare, and *a fortiori* Cape Evans, is situated within the belt. This has an interesting bearing on the size of the auroral belts; the Arctic auroral zone is generally supposed to have a radius of about 20°, and to be centred at the pole of the earth's magnetic axis. There is no very recent determination of the position of the pole, but it can scarcely have moved more than a degree or two from its position in 1885, the epoch of Adams's investigation. Cape Adare is 27° distant from this point, and as this angle is a lower limit for the radius of the belt, this radius would seem to be greater than was to be expected.

The auroræ visible from Cape Adare, since they lie to the north, must for the most part be less than 3° above the horizon of Cape Evans. Consequently the auroræ seen from the latter station must in the main be different from the former. They represent conditions some degrees within the belt, and they differ in number and brilliance from those near the belt. They appear most frequently in a direction slightly north of east, and least often in the west. Again, whereas the Cape Adare auroræ trend predominantly east and west, or rather from a little north of west to a little south of east, the Cape Evans auroræ show a marked avoidance of the east-west trend. In each case the trend is perpendicular to the direction in which auroræ are least frequently seen. Brightly coloured and quickly moving auroræ are rare at Cape Evans, but fairly common at Cape Adare.

Auroræ were seen at Cape Evans on about one day out of three when seeing conditions were favourable, and about twice as often at Cape Adare. At either station they usually appear first at a low altitude in the direction of maximum frequency, and move

[1] British (*Terra Nova*) Antarctic Expedition, 1910–1913. Observations on the Aurora. By C. S. Wright. (Published for the Committee of the Captain Scott Antarctic Fund.) Pp. viii+48. (London: Harrison and Sons, Ltd., 1921.) 7*s*. 6*d*. net.

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upwards, approaching the station, sometimes passing overhead and, after an interval, vanishing while in the region of minimum frequency. The overhead passage was much more common at Cape Adare than at Cape Evans.

The auroræ show a well-marked tendency to occur most often in the early morning, round about 4 A.M. local time. A secondary maximum occurs at Cape Adare at 8 P.M., and a trace of it is apparent also at Cape Evans. In the afternoon the auroræ rarely pass overhead, but they are more often brilliantly coloured and of swift motion than those which occur in the morning. At times of maximum frequency the aurora is also generally of greatest extent.

In the magnetic report of the expedition, by Dr. Chree, the connexion between magnetic activity and the aurora has already been discussed; Mr. Wright here carries the discussion further. It is clear that there is some relation between the two phenomena, though it is not so evident as in latitudes farther from the pole, where auroræ are seen only rarely, and are always accompanied by magnetic storms. Mr. Wright shows, however, that there is a marked correspondence between the magnetic character of a period of several hours about the time of appearance of a brilliant aurora, and the intensity of the aurora; the relationship is much more close than that between the same two characteristics at individual hours. Some of the results of this report had been anticipated by Mawson's report (1908) on the auroral work of the Shackleton expedition, though the latter is not confirmed in all respects. The auroral station in the Shackleton expedition was not far from Cape Evans.

These valuable memoirs will become of still greater significance and importance if and when another south polar expedition conducts similar observations in a part of the Antarctic considerably different in longitude from the Scott-Shackleton region, but at a similar distance from the pole of the earth's magnetic axis.

Mr. C. S. Wright's report [2] on the gravity observations, for which he was responsible, made during the *Terra Nova* expedition, is a record of a most manful struggle against difficulties. It seems very regrettable that the instrumental equipment of the expedition was not of the highest quality, for observations in the Antarctic are sufficiently exacting even under the best conditions. As a matter of fact, some of the equipment for Mr. Wright's gravity work was very bad, particularly the old transit circle on which he had to rely for his clock rates.

Four series of observations were made at Cape Evans, the first two being made in a cave cut in snow-drift consolidated to ice. The cave being small, the temperature varied by 10° C. during the time of observation, due to the observer's presence; all the mirror and lens surfaces were frosted by his breath, and also the prisms, agate planes, and pendulums themselves. A fortnight's break in the series of observations for each determination of g was made in order to allow the mirrors to clear. Notwithstanding all the efforts made to meet these conditions, the first two series gave such discordant results that in the second year a change was decided upon.

Attempts were made to build a small observing hut of (full) petrol cases covered with rubberoid and canvas; the hut was to be heated artificially during the observations. Twice the nearly completed hut was demolished by blizzards, and when at last it was securely built and banked with snow, it had to be abandoned after some days' trial, as it was found impossible to maintain it at a workable temperature, or even to keep it free from drift snow. Finally, the photographic dark-room opening off the living hut was lent as an observing station. Two series of observations were made here, in July and August 1912; the last series was not so good as that made in July, probably owing to the whole hut being shaken by blizzards during the August determination. Rejecting the results obtained in the previous year, the mean value of g from the three pendulums used in 1912 at Cape Evans was 983·003 from the July series and 983·004 from the August series: the probable error of the final mean is given as 0·0023 cm./sec.^{2}. Commdr. Bernacchi, who on Scott's earlier expedition was faced with even greater difficulties in some respects, obtained the values 982·970, 982·979, and 983·025 from his three pendulums, at a spot fifteen miles farther south. These values may be compared with the standard value 981·292 at Potsdam, which was taken as the reference or base station for the gravity work, and where Mr. Wright received training and much help from Prof. Helmert and his staff at the Geodetic Institute.

Observations were also made at Wellington, Melbourne, and Christchurch, in the latter case both on the outward and return journey. The value of g had already been accurately observed at Melbourne by Hecker in 1904 and Alessio in 1905, who obtained accordant values 980·003; the value found by Mr. Wright was 980·009, the difference exceeding the sum of the probable errors in the two cases: no reason for the disagreement can be assigned. The observations at Christchurch, like those made there earlier by Bernacchi, were unfortunately not very successful or accordant. The observation at Wellington was the first that had been attempted there. The check observation at Potsdam at the end of the expedition agreed well with the initial determination made with the same pendulums.

[2] British (*Terra Nova*) Antarctic Expedition, 1910–1913. Determinations of Gravity. By C. S. Wright. (Published for the Committee of the Captain Scott Antarctic Fund.) Pp. 106+4 plates. (London: Harrison and Sons, Ltd., 1921.) 7*s*. 6*d*. net.

Industrial Fatigue Research.

THE third annual report of the Industrial Fatigue Research Board (H.M. Stationery Office, price 2*s*. net) is even more interesting than those which have preceded it. It contains not only an account of the constitution, organisation, investigations, researches, external relations, and publications of the Board, but also nearly fifty pages of original contributions from five of its investigators—Mr. Farmer, Miss May Smith, Mr. Wyatt, Dr. Vernon, and Mr. Weston.

During its three years of activity the Board has published twenty-three reports—seven on general industrial problems, seven on the textile industries, five on the metal industries, two on the boot and shoe industry, one on the pottery industry, and one on the laundry trade. "More recently, however, and pending development of some scheme of actual co-operation with industries . . . the Board have tended to modify their original procedure, and have taken as their objective the study of certain general subjects, not confined to any one industry but of common interest to all, following up each subject along lines which experience shows to be most promising and dealing with it both by field investigation and by laboratory research."

The scientific committees under the Board accordingly comprise those for industrial health statistics, physiology of muscular work, physiology of the

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