

Review: Antarctic Meteorology

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Source: *The Geographical Journal*, Vol. 56, No. 3 (Sep., 1920), pp. 213-216

Published by: [The Royal Geographical Society \(with the Institute of British Geographers\)](#)

Stable URL: <http://www.jstor.org/stable/1781538>

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("A Journey in the Hauran," *P.E.F. Quarterly Statement*, 1905) in addition to many in List (i.). They probably refer to the ruined villages that now only shelter the Bedawin tribes. Mr. Ewing's spelling is adhered to.

Abrâk	Et'ârah
Ardhîmeh	Hadur
'Asem	Hâmir
*Bî'r Jafir	Kala'
Bûrt	Kaşr Habîbeh
Dajâj	*Kaşr Jenin
Dakîr (Dhakir?)	Kaşûr Barghashah
Deir Damet el Barrâneh	Kaşûr el Hômah
" " Juâneh	Kaşr Zobair
Deir Nîleh	Khîrbet er Raşif
Ed Dawîreh	Kiratah
Eib	Kôm Mâsik
Ekrîm	*Kôm Rômân
El Jisreh	Lâhneh
El Khirseh	Lubweir
El Wabeir	Mrasras
Er Rasîmeh	Umm Sâtisah
Esh'ârah	Waqm
Esmâh	Zubeir
Esmfd	Zubîreh

ANTARCTIC METEOROLOGY

British Antarctic Expedition, 1910-1913. Meteorology. Vol. 1, Discussion. Vol. 2, Charts.— G. C. Simpson, D.Sc., F.R.S. Calcutta: Printed by Thacker, Spink & Co. 1919. Vol. 1, pp. xii. + 326.

DR. SIMPSON obtained leave from the Indian Meteorological Service to accompany Captain Scott on his last expedition, and returning after one year at the Cape Evans base he undertook the discussion of the meteorological results of the expedition, the delay in completing the work being due to the War. The delay would have been still longer but for the decision to print the volumes in India, and it ought to be placed on record that the typography is singularly free from errors. A third volume containing the statistical data on which the discussions and charts are based is promised later. This is a break with tradition; and it soon appears, in turning over the pages of the discussion, that Dr. Simpson is no slave to established ways of doing things. He is original in his method of treating data, and his somewhat daring hypotheses are set forth with attractive directness and clearness. One might be tempted to think that he is satisfied with framing a hypothetical statement which is not contradicted by the available data, instead of deducing a theory which is demonstrated by the observed facts. But we must bear in mind that if demonstration were required it might be necessary to wait a century or two for the collection of adequate data, whereas Dr. Simpson presents us now with a connected explanation of Antarctic meteorology, which though avowedly incomplete, will stimulate future investigations.

We do not propose here to enter into the more technically meteorological aspects of the discussion, nor to weigh the probability that the explanations offered are sufficient and permanent. We wish rather to call attention to the new light thrown on the physical geography of the Antarctic region with reference to earlier views.

* Villages marked thus have good water.

Dr. Simpson proves quite clearly that the anomalies which puzzled the eminent meteorologists who discussed the results of Captain Scott's first expedition in the *Discovery* arise from the very unrepresentative nature of the expedition's base in McMurdo Sound. Ross Island diverts the normal flow of the wind over the surface of the Barrier parallel to the face of the great Victoria Land escarpment, and so gives rise to the extraordinary difference in the direction of the prevailing wind at points on the Barrier at quite short distances from the main base. No less remarkable were the changes in temperature brought about by the proximity of the open sea, the snow-covered Barrier, and the lofty plateau beyond the mountains on the west.

When Maury prepared the last edition of his fascinating 'Physical Geography and Meteorology of the Sea' in 1860 he expressed the opinion of his time that the air temperature in the Antarctic area was much higher than that in the Arctic, while he insisted that a great low-pressure area surrounded the south pole, causing a general indraught of wind from lower latitudes. Nevertheless the tables of wind-frequency which he published from equatorial and polar directions showed that in the highest southern latitudes (up to 60° S.) there was a marked predominance of polar winds. All the old navigators had fought against south-easterly winds when south of 65° S., and it should have been obvious to any one who weighed the facts that such winds proved the existence of a high-pressure area within the Antarctic circle. Neumayer, as long ago as 1872 (and probably at an earlier date) maintained from evidence that the Brave West Winds did not extend south of 61° S., yet so careful a student as Hann resisted the conception of an Antarctic anticyclone up to 1900 except as a very shallow inversion on the surface of a chilled continent of the assumed vast Antarctic cyclone. His views, as he acknowledged in a letter to Dr. R. H. Scott, published in the *Antarctic Manual* of 1901, were somewhat confused. Dr. Simpson gives the credit for the first clear announcement of an Antarctic anticyclone to Fricker in 1893; but Fricker to a large extent went over the same ground as Neumayer and with a like result, strengthened by twenty years of fresh data on drifting ice. Dr. Simpson had the advantage of the data of the earlier Antarctic expeditions of the twentieth century, so that his generalizations have a basis of fact far more substantial than any earlier writer could command.

He first shows that the low temperatures of the Barrier and of the Plateau are due to the intensity of radiation during the long polar night, and by an ingenious argument he shows how extremely rapid changes of mean temperature must be produced in passing from the open to the frozen sea and from the frozen sea to the surface of the Barrier. A close relation is shown between air temperature and pressure; and Dr. Simpson accepts with approval the theory of the glacial anti-cyclone put forward by Prof. W. H. Hobbs, of Ann Arbor, though, no doubt by an oversight, without attaching sufficient weight to Prof. Hobbs's fundamental contention that an anticyclonic circulation is only set up completely when the cold surface has a dome-shaped contour. Roughly speaking, the theory is that the air chilled by radiation and by contact with the cold surface of the ice or snow-covered land flows down the slopes outwards with accelerating velocity, giving rise to a great area of high atmospheric pressure rapidly falling towards the sea. The outflowing air must of course have its place taken by a cyclonic movement drawing in air from the lower latitudes at a higher level; but in Hobbs's view the whole land surface whatever its altitude is under anticyclonic influence, and he ascribes the precipitation to the ice-needles of the cirrus cloud. Prof. Meinardus, in discussing the

results of the *Gauss* Expedition, shows a general anticyclonic circulation centred at the Pole for sea-level; but from his study of the winds and cloud movement he shows for 4000 metres altitude a single large cyclonic distribution of pressure centred about 75° S., 10° W. Dr. Simpson arrives at a surface isobaric map essentially similar to that of Meinardus, the lowest pressure being placed, as Neumayer put it long ago, about 60° S., and the rise in pressure occurring fairly uniformly towards the Pole. But in preparing his isobaric map for an altitude of 3000 metres Dr. Simpson, following Hobbs, finds that the great Plateau (which he takes as extending from the Victoria Land Mountains through easterly longitudes) produces anticyclonic conditions, while over the other half of Antarctica (from the great Barrier by King Edward Land through westerly longitudes) he deduces a cyclonic distribution. A point which seems to escape him is that at sea-level under this cyclonic distribution Hobbs's theory would not require the existence of anticyclonic conditions, as the Barrier and sea-ice have an approximately level surface without fall enough to start the flow of chilled air by gravity. Into this matter, however, this is not the place to enter.

Dr. Simpson's most interesting discovery is that the bad weather round the margin of the Antarctic region is not due to cyclones centred in the annular trough of minimum pressure, but to a series of surges or pressure waves travelling outwards from the centre of the Antarctic continent. These pressure waves account in a very interesting way for some of the most puzzling phenomena of blizzards, and by setting up forced ascent of the greatly chilled surface air they lead to the condensation of cloud and the formation of snow at levels where without this agency no precipitation would be possible.

A special chapter is devoted to the barometric determinations of the height of the Barrier and the Plateau. Dr. Simpson finds that the mean altitude of the surface of the Barrier from lat. $79\frac{1}{2}^{\circ}$ S. along the meridian of 160° E. to the foot of the Beardmore Glacier is 52 metres or 170 feet above sea-level. He points out that Mohn deduced a mean height of 60 metres (196 feet) from Framheim to the mountains along the meridian of 163° W. Dr. Simpson deals in detail with the barometer readings on the South Pole journeys, working out the differences between consecutive stations on the outward and homeward journeys of the main and supporting expeditions, and he arrives at 9862 feet as the greatest height of the Plateau, in $88\frac{1}{2}^{\circ}$ S., whence there was a fall of level to the pole, the altitude of which above sea-level is 9072 feet. Scott had provisionally calculated the height at $88\frac{1}{2}^{\circ}$ S. as 10,500 feet, and that of the pole as 9500 feet. The late Prof. Mohn, working from the barometric observations on Amundsen's march, gave the height of the Plateau at the pole as only 8051 feet. The discrepancy could not be passed over, and Dr. Simpson goes very fully into the matter. He shows that Mohn had made no allowance for the normal increase of pressure between Framheim and the pole, which would account for nearly 500 feet of difference; but he goes further and works out two completely new determinations by comparing Amundsen's readings at the pole with Meares's on the Barrier on the same date, which gave 9340 feet, and then comparing Scott's readings at the pole with Amundsen's on the Barrier on the same day, which gave 9104 feet. The mean of the three determinations, 9172 feet, or 2796 metres, may safely be taken as the closest approximation to the height of the Plateau at the South Pole.

Meinardus, in discussing the meteorology of the *Gauss* expedition, hit upon an ingenious method of deducing the mean height of the Antarctic continent, which he calculated as 1350 metres. Dr. Simpson shows how, by making

assumptions which are at least as reasonable as those of Prof. Meinardus, the mean height would come out as only 852 metres, and as all the data employed are very uncertain it hardly seems safe to rely on the method in the present state of knowledge.

The whole of this volume deserves the careful attention of the student of physical geography, and we congratulate Dr. Simpson on the interest and originality of his work.

HUGH ROBERT MILL.

HANDBOOKS OF THE HISTORICAL SECTION, FOREIGN OFFICE: CENTRAL EUROPE: REVIEW

Handbooks prepared under the Direction of the Historical Section of the Foreign Office.— London: H.M. Stationery Office, 1920. Size $8\frac{1}{2} \times 5\frac{1}{2}$. Nos. 25. Holland, pp. 82, 2s. *net.* 26. Belgium, pp. 220, 5s. *net.* 27. Luxemburg and Limburg, pp. 50, 1s. 6d. *net.* 28. Question of the Scheldt, pp. 22, 6d. *net.* 29. Neutrality of Belgium, pp. 22, 6d. *net.* 30. Alsace-Lorraine, pp. 116, 2s. 6d. *net.* 31. Lorraine and Saar minefields, pp. 30, 1s. *net.* 35. Schleswig-Holstein, pp. 108, 2s. 6d. *net.* 37. Bavarian Palatinate, pp. 36, 1s. *net.* 38. Rhenish Prussia, pp. 84, 2s. *net.* 39. East and West Prussia, pp. 66, 1s. 6d. *net.* 40. Upper Silesia, pp. 42, 1s. *net.* 41. The Kiel Canal and Heligoland, pp. 34, 1s. *net.* 42. German Colonization, pp. 142, 3s. *net.* 43. Poland, pp. 30, 1s. *net.* 44. Russian Poland, pp. 144, 2s. 6d. *net.* 45. Prussian Poland, pp. 58, 1s. 6d. *net.* 46. Austrian Poland, pp. 78, 2s. *net.* 47. Finland, pp. 130, 2s. 6d. *net.* 48. The Åland Islands, pp. 38, 1s. *net.* 50. Courland, Livonia, and Esthonia, pp. 86, 2s. *net.* 52. The Ukraine, pp. 110, 2s. 6d. *net.* 53. The Don and Volga Basins, pp. 108, 2s. *net.*

NOMINALLY historical, these little volumes have great geographical interest and value, the geographical matter in some of them being even more important than the historical, especially with regard to the internal units of Germany and Russia. For instance, Nos. 37, 38, and 39 are almost entirely geographical, the chapter on the economic conditions of the Bavarian Palatinate (37) being particularly good. In 39 (East and West Prussia) special attention is paid to the strategical basis of the frontiers, to the deliberate falsification of the census, and to the distribution of population. The latter bears no relation to race or speech, but only to fertility (p. 17), and this gives significance to the comparative smallness of the Danzig population, though the area is the most fertile in the whole region. Similar falsification of the census for Silesia is noticed in No. 40, again confirming suspicions voiced ten or twelve years ago in this country. [The evidence is summarized in Bernhard's memorandum *Die Fehlerquellen in der Statistik der Nationalitäten*, published by Weber in Berlin early in 1914.] No. 42 (German Colonization) devotes two chapters to (1) early German movements in Europe and migration from Europe, and (2) early Colonial schemes—in opposition to Bismarck. The rest of the volume is mainly concerned, of course, with Africa,—Lord Iddesleigh's subservience to Germany, the Herero massacres, and the crass brutalities of Peters and Schröder being treated with special clarity and restraint.

In the "Russian" volumes there is an admirable summary of the economic geography of Finland (47), and an equally admirable summary of the Åland problem in all its aspects—historic, ethnic, economic, strategic (48). The unity