

or even a hundred times greater than that advanced in recent years by the champions of high isostasy".¹ If this opinion, the result of very careful mathematical studies, be put aside as a pendulum-swing in the opposite direction to that of the isostasy enthusiasts, the adoption of a mean position would still diminish our belief in the possibility of explaining great thicknesses of shallow-water deposits by the sole process of isostatic adjustment.

NOTICES OF MEMOIRS.

I.—A HYÆNA-DEN IN IRELAND.

THE EXPLORATION OF CASTLEPOOK CAVE, COUNTY CORK: BEING THE THIRD REPORT FROM THE COMMITTEE APPOINTED TO EXPLORE IRISH CAVES. By R. F. SCHARFF, H. J. SEYMOUR, and E. T. NEWTON. Proc. Roy. Irish Acad., vol. xxxiv, sect. B, No. 3, pp. 33-72, pls. v-vii, January, 1918.

THE last work of the accomplished and enthusiastic Irish cave-explorer, the late Mr. R. J. Ussher, was the careful examination of the Castlepook cave, co. Cork, which is of much interest as being further south than any cave previously dealt with in Ireland. It is formed as usual by the widening of joints in the Carboniferous Limestone, and the deposits on the floor consist not only of the ordinary cave-earth and stalagmite but also of sand and gravel introduced by water. The cave, in fact, must have been subjected to numerous inundations, and it can never have been suitable for habitation by man. As described by Professor H. J. Seymour, all the pebbles in the introduced gravel are of local origin, whereas many of those in the boulder-clay of the surrounding country are granites from a considerable distance. Some of the deposits containing bones may therefore be of pre-Glacial date. The lowest layer yields especially remains of a brown bear (*Ursus arctos*) as large as the American Grizzly—certainly not the familiar cave-bear. The next layer in some places is crowded with the bones, teeth, and coprolites of the cave-hyæna, with remains of the reindeer and the young mammoth which it dragged into the cave for food. The discovery of a hyæna-den in Ireland is especially interesting; and the proof that the hyæna and reindeer were contemporaneous is important. As might be expected, all the remains of the reindeer are very fragmentary; but Dr. R. F. Scharff, who reports on the mammals, has studied all the known Irish specimens of reindeer, including a fine skull from a bog near Ashbourne, co. Meath, and concludes that they represent a peculiar race which he names *Rangifer tarandus hibernicus*. Among truly Pleistocene mammals there are also the Arctic fox, wolf, hare, Scandinavian lemming, a new form of Arctic lemming, and the Irish deer. Numerous bones of birds, determined by Mr. E. T. Newton, also occur, but do not include any extinct or noteworthy species. A. S. W.

¹ "The Strength of the Earth's Crust": *Journ. Geol.* (Chicago), vol. xxii, p. 313, 1914. The whole investigation is in eleven sections, scattered through vols. xxii-iii, 1914-15.

II.—FOSSIL MAN IN SOUTH AFRICA.

1. PRELIMINARY NOTE ON THE ANCIENT HUMAN SKULL-REMAINS FROM THE TRANSVAAL. By S. H. HAUGHTON. With notes appended on Fragments of Limb-bones, by R. B. THOMSON, and Fragments of Stone, by L. PÉRINGUEY. *Trans. Roy. Soc. S. Africa*, vol. vi, pp. 1-14, pls. i-x, 1917.
2. FOSSIL MAN IN SOUTH AFRICA. By ROBERT BROOM. *American Museum Journal*, vol. xvii, pp. 141-2, 1917.

WELL-FOSSILIZED portions of a human skeleton were discovered in 1913-14 in a cultivated field on the farm of Kolonies Plaats, Boskop, in the Potchefstroom district of the Transvaal. The greater part of a skull-cap, a temporal bone, the horizontal portion of the left mandibular ramus, and some fragments of limb-bones were recovered; but it is uncertain whether the remains represent a burial, and there are no associated fossils or implements to indicate their age. A preliminary description of these interesting specimens is now published and helps to dispel some of the sensational illusions which were derived from newspaper reports at the time of the discovery.

The skull is rather thick, its thickness at the parietal boss being 13 to 14 mm. Its brain-capacity is also remarkably large, probably not less than 1830 c.c. The cephalic index is about 75, so that the specimen is almost dolichocephalic. The forehead is steep, without prominent brow-ridges; but the temporal bone is primitive in the shallowness of the glenoid fossa for the mandibular articulation and the prominence of the supramastoid ridge. The mandible seems to have had a prominent bony chin, and the total length of the molar-series must have been as short as that of the modern European, less than that of the Australian. The second molar, typically modern human, is the only tooth preserved; and the alveoli of the other teeth are too imperfect to determine much of their proportions. On the whole, Mr. Haughton thinks it "possible that the Boskop man was a member of a race which ultimately developed into the Bantu type".

The limb-bones found with the skull are too imperfect for discussion, especially in their present encrusted state, and the three plates of photographs devoted to them are not illuminating. According to Dr. Péringuey, no stone implements have yet been met with at the same spot.

Dr. Broom expresses the opinion that the Boskop man is intermediate between *Eoanthropus* and the early African type of man. In fact, he considers there is "no doubt that the canine was about as large as in the jaw which he still believes belongs to the Piltdown skull". He also thinks the incisors were much larger than in modern man. Mr. Haughton's description and figures, however, lend no support to these views.

A. S. W.

III.—THE BEARING OF THE FACTS REVEALED BY ANTARCTIC RESEARCH UPON THE PROBLEMS OF THE ICE AGE.¹ By MARSDEN MANSON, C. E., Ph. D., Mem. Amer. Soc. C. E., San Francisco, California. From *Science*, n. s., vol. xlv, No. 1200, pp. 639–40.

RECENT Antarctic explorations and researches have yielded significant evidence regarding the problems of the Ice Age, and of the similarity of the succession of geological climates in polar with those in other latitudes.²

These researches have been prosecuted to the ultimate limit of courage, devotion to duty, and endurance—the noble sacrifice of life—as in the cases of Captain Scott, R. N., and his devoted companions and members of the expedition of Sir Ernest Shackleton.

The data secured by these expeditions are alone sufficient to establish the following premises:—

1. That Antarctic ice, although covering areas several times larger than all other ice-covered areas, is slowly decreasing in extent and depth.

2. That the same succession of geological climates have prevailed in Antarctic as in other latitudes.³

So vital are these evidences of the retreat of Antarctic ice that it may be well to briefly quote or refer to the most prominent instances: “All these evidences and many others which space will not allow me to mention lead up to one great fact—namely, that the glaciation of the Antarctic regions is receding.⁴ The ice is everywhere retreating.⁵ The high level moraines decrease in height above the present surface of the ice, the débris being two thousand feet up near the coast and only two hundred feet above near the plateau. (Scott’s lecture on the great ice barrier.⁶)”

This observation applies to an ice-covered area of over 116,000 square miles.

Mr. Griffith Taylor notes the recession of Dry Valley Glacier twenty miles from the sea below Taylor Glacier.⁷

Mr. Taylor also notes and speaks with confidence of the passage of the Ice Age from Antarctica.⁸

In speaking of the evidence of ice retreat over Antarctic areas

¹ This term as used by the writer refers to the Great Ice Age of Pleistocene time. He holds that the occurrences of ice as a geologic agent of magnitude during eras preceding the Pleistocene were not “worldwide” nor as “phenomenal”, nor were they preceded, accompanied, nor followed by conditions as significant as corresponding phenomena of the Ice Age. *Compte Rendu du XIème Congrès Géologique International*, Stockholm, 1910, p. 1105.

² *Scott’s Last Expedition*, vol. ii, p. 206.

³ This part of the evidence is not considered in this paper except inferentially as bearing upon the general subject.

⁴ Scott, *The Voyage of the “Discovery”*, vol. ii, p. 416. See also pp. 423–5, and sketch-map of ice distribution, p. 448.

⁵ Scott, *National Antarctic Expedition, 1900–1904*, vol. i, p. 94.

⁶ *Scott’s Last Expedition*, vol. ii, p. 294.

⁷ *Ibid.*, p. 286.

⁸ *Ibid.*, p. 288. See also photograph following pp. 286, 292.

explored by him, Sir Ernest Shackleton said: "Some time in the future these lands will be of use to humanity."¹

This impressive and conclusive evidence is corroborated by the greater and still more impressive evidences of the comparatively recent uncovering of temperate land areas,² and the progressive retreat of the snow-line to higher elevations in temperate and tropical latitudes and towards the poles at sea-level, being far greater in Arctic than in Antarctic regions. We are therefore confronted with the conclusions—

1. That the disappearance of the Ice Age is an active present process and must be accounted for by activities and energies now at work, and that the use of assumptions and hypotheses is not permissible.

2. That the rates and lines of retreat are and have been determined by exposure to solar energy and the temperatures established thereby; and by the difference in the specific heat of the land and water hemispheres.

3. That the lines of the disappearance of ice are not conformable with those of its deposition, and mark a distinctly different exposure and climatic control from that which prevailed prior to the culmination of the Ice Age.

4. This retreat also marks a rise in mean surface temperature along these new lines, manifestly due to recently inaugurated exposure to solar radiation and also the inauguration of the trapping of heat derived from such exposure; which process is cumulative and has a maximum not yet reached.

The researches under the direction of Captain Scott and Sir Ernest Shackleton have therefore very rigidly conditioned any inquiry as to the causes of glacial accumulation and retreat. These conditions are CORRECTIVE and DIRECTIVE—*corrective*, in that they have entirely removed any doubts as to the alternate glaciation of the poles under the alternate occurrence of aphelion and perihelion polar winters by the precession of the equinoxes, as advanced by Croll; *directive*, in that they have imposed an appeal to energies now active as causes of retreat, and divested the problem of resorts to the fascinating but dangerous uses of suppositions and hypotheses.

They have, moreover, pointed out with unerring accuracy the vital conclusion that the same energies which have but recently converted the glacial lake beds of Canada into the most productive grain fields of the world will in time convert the tundras of to-day into the grain fields of to-morrow.³

¹ Address to the Commonwealth Club, San Francisco, Calif., November 7, 1916.

² Slight fluctuations in the retreat of the small residual glaciers in temperate latitudes are noted in the reports of the Commission on Glaciers of the International Geological Congress by Professor Harry Fielding Reid. But the great measures of the progressiveness of glacial retreat are in the past disappearance of the Pleistocene ice-fields of temperate latitudes and the present retreat in the Antarctic and Arctic regions.

³ See also *Compte Rendu du XIème Congrès Géologique International*, Stockholm, 1910, p. 1102.

The bearing of this conclusion upon the ultimate development of the human race is so far-reaching in its consequences that the great sacrifice of life attendant upon the prosecution of these researches stands forever as a memorial in the correction of the erroneous and widespread conception that the earth is in a period of refrigeration, desiccation, and decay; and establishes the conclusion that it is in the springtime of a new climatic control during which the areas fitted for man's uses are being extended and that the moss of polar wastes will be replaced by rye and wheat.

IV.—JOHN MICHELL AND MARTIN SIMPSON.

SIR ARCHIBALD GEIKIE read as his Presidential Address to the Yorkshire Union of Naturalists, 1917, a memoir on John Michell (1724–93), one of the pioneer geologists of this country. The memoir, written in Sir Archibald's delightful style, appears in full in the *Yorkshire Naturalist* for January, 1918.

Mr. Thomas Sheppard, remembered recently for his able memoir on William Smith, read to the Yorkshire Geological Society a paper on Martin Simpson (1800–92) (see *GEOL. MAG.*, February, 1918, p. 82).

REVIEWS.

I.—SANDS USED IN MANUFACTURES.

1. A MEMOIR ON BRITISH RESOURCES OF SANDS SUITABLE FOR GLASS-MAKING, WITH NOTES ON CERTAIN CRUSHED ROCKS AND REFRACTORY MATERIALS. By P. G. H. BOSWELL. pp. 92. London: Longmans, Green & Co. 1916.
2. A SUPPLEMENTARY MEMOIR ON BRITISH RESOURCES OF SANDS AND ROCKS USED IN GLASS-MANUFACTURE, WITH NOTES ON CERTAIN REFRACTORY MATERIALS. By P. G. H. BOSWELL. pp. 92. London: Longmans, Green & Co. 1917.
3. BRITISH GLASS-SANDS; THEIR LOCATION AND CHARACTERISTICS. By P. G. H. BOSWELL. From the Transactions of the Society of Glass Technology, vol. i, 1917.
4. NOTES ON AMERICAN HIGH-GRADE GLASS-SANDS. By P. G. H. BOSWELL. From the Transactions of the Society of Glass Technology, vol. i, 1917.
5. SOME GEOLOGICAL CHARACTERS OF MOULDING-SANDS. By P. G. H. BOSWELL. Reprinted from the *Foundry Trade Journal*, August, 1917.
6. SANDS USED IN METALLURGICAL PRACTICE, WITH COMPARATIVE NOTES ON THOSE USED IN GLASS-MANUFACTURE. By P. G. H. BOSWELL. Reprinted from the *Journal of the Society of Chemical Industry*, 1917.

THE petrology of the sedimentary rocks is a subject that has been unduly neglected until recent times. Considerable attention was devoted to the matter by Professor Bonney, mainly in connexion with cemented types which could be studied in their slices. The early investigations of Retgers, Dick, Thoulet, Bréon, and others may