discussion of the thermal economy and structure of the ice and finally the role of the unique blizzards of Adélie Land.

270 radiation measurements were made at Port Martin and a smaller number on the inland ice. Both series were much interrupted by the blizzards of this formidable area: at the Adélie Land coast the average wind speed over the year is of gale force.

The snow surface with its high albedo has a small intake of radiation and, owing to the small vapour content of the air, a relatively strong loss.

With clear sky at Port Martin there is a net loss of radiation from the surface with sun heights up to 27 degrees; on the inland ice, with still higher albedo, with sun heights up to 40 degrees.

There is radiation loss at Port Martin normally from the end of March to mid November, but a gain at times in the summer period. At lat. 80° S. a net radiation loss was found in every month, and Loewe considers this typical of the Antarctic Ice Sheet.

The average radiation loss from the ice cap appears to be 36 kg. calories per cm.^{2} per annum.

The author calculates from a mean meridional (*i.e.* southerly) wind component averaged through the depth of the troposphere of 2·9 knots at the edge of the Antarctic Ice Sheet that eight days would be a normal time spent by the air in crossing Antarctica. It is difficult to judge the representativeness of such a figure. The average cooling of the air layer in eight days over the inland ice would be 14° C.

Temperatures were taken at 1·5 and 20 cm. below the snow/ice surface. At Port Martin, except with very high sun or low overcast, the temperatures at 1 cm. depth were lower than at 5 cm. On the inland ice, the temperatures at 1 cm. depth were in all circumstances lower than those at 5 cm. even at mid summer with the sun high.

The snow surface at Port Martin and at lat. 80° S. is on average colder than the air above it. The winds are predominantly southerly; nevertheless a surface inversion is the normal condition.

The firn temperatures at depths down to 10 m. were measured in narrow bore-holes up to 200 miles (320 km.) inland. At lat. 67° S. and 1,000 m. asl. a yearly mean temperature of −21° C. was indicated and at lat. 69° S. and 2,000 m. asl. −34° C.

The inland ice in Adélie Land is considered by Loewe probably to be frozen right down to bedrock south of lat. 70° S., but faster-moving glacier tongues may thaw the ground underneath by heat generated through friction.

The amount of snow carried in the blizzards was measured in drift traps 50 cm. above the surface. The yearly mean at this height was 50 gm. carried through a vertical plane of one square centimetre each hour. The wind direction in Adélie Land is almost always south or south-east. This suggests a total transport outwards over each metre of the Adélie Land coast of 20,000 tons of snow yearly—probably removing half, possibly more than all, the snow which falls in the coastal belt up to 100 to 150 miles (160–240 km.) inland in this sector. In the reviewer's opinion it is unlikely that the quantities of snow removed by blizzards in other sectors are commensurate with the extreme conditions of Adélie Land. The question of whether the great Ice Sheet in east Antarctica is receiving adequate nourishment for its full maintenance at the present epoch remains open, but Loewe's study is an important contribution to our assessment of this in a specially interesting sector.

H. H. Lamb

INVESTIGATION OF ICE PRESSURE ON DAMS. FIRST REPORT ON MEASUREMENT OF COEFFICIENT OF LINEAR EXPANSION OF ARTIFICAL AND NATURAL ICE. J. G. Willmot. *Hydro-electric Power Commission of Ontario. Research Division Report* No. 56–392, 1956, 41 pages, illus.

This report describes laboratory measurements of the coefficient of thermal expansion of ice in a direction perpendicular to the optic axis. The practical problem which prompted the study is

interesting. If the ice pressure on a dam is calculated on the assumption that the ice surface remains plane, and that the pressure arises because thermal expansion is restrained, the pressures calculated are much too high. It seems that buckling of the ice sheet plays an essential part. The author proposes to use his expansion measurements in a theory, as yet undeveloped, which will include buckling. His figures agree, in general, with those of other workers; but in tests on artificial ice he finds a variation of 30 per cent in the coefficient, which he attributes to the presence of impurities and to the influence on them of the thermal history of the specimen.

J. F. NYE

CRARY, A. P., *and others*, *ed.* Antarctica in the International Geophysical Year, based on a symposium on the Antarctic. *Geophysical Monograph*, No. 1. Washington, American Geophysical Union, 1956. (National Research Council Publication No. 462.) vi, 133 pages, map in folder at back.

THIS geophysical memoir is based on a symposium on Antarctica held in April 1956. It consists of 16 papers by different authors, explaining first, the general International Geophysical Year programme of the United States, and secondly, the work to be done in the Antarctic during the International Geophysical Year. The papers fall broadly into five sections: general, geographical and meteorological, geological and structural, upper atmospheric physics and lastly flora and fauna. The collection has been well edited and despite the width of the field covered the memoir is very readable.

The papers are short, generally 5–10 pages, which means that no one topic can be carried very far. Most papers are, however, followed by good selective bibliographies. The general reader will find that this volume gives a survey of our knowledge of Antarctica at the beginning of the forthcoming Geophysical Year when a third of the continent "still remains to be seen or photographed for the first time". The greater number of the contributions are related to suggestions of research topics connected with the I.G.Y. programme, but one or two, notably the paper by Duncan Stewart on "The petrology of Antarctica," are up-to-date surveys of our present knowledge in certain branches of science.

Only one paper deals directly with Antarctic glaciological research, but since the Antarctic continent is 99 per cent ice-covered, many of the other problems discussed are clearly related to glaciology. The paper on "Objectives of Antarctic glaciological research," by R. P. Sharp, gives a good summary of the main glaciological problems to be tackled by the I.G.Y. parties in the Antarctic and briefly considers such topics as the total volume of the ice, crystal fabrics, glacier movement, climatic fluctuations and the Ross Ice Shelf. There is also a short paper on "The Weddell Sea".

The geological and structural section of the memoir contains a list of all the minerals ever reported from the continent, together with the detailed analyses of 234 rocks and minerals. There is also a stimulating discussion by M. Ewing and B. C. Heezen on "Some problems of Antarctic submarine geology", which includes results of the latest work in this field.

A major section in the memoir is devoted to papers of a more strictly physical nature, and these deal with geomagnetic disturbances, ionospheric conditions, cosmic ray experiments and the aurora australis. This section contains a list of auroral stations with their particulars for the years 1841–1940.

The volume is accompanied by a two-colour map of the Antarctic on a stereographic projection and on a scale of 1 : 6,000,000. The greater part of the map, which is 3 ft. 6 in. (107 cm.) square, is blank and illustrates that our knowledge of the Antarctic is indeed still very rudimentary. The memoir is well-produced and is illustrated by clear line blocks; the most significant omission is an index.

M. M. SWEETING