REVIEWS

E. R. Pounder. *The physics of ice.* Oxford, etc., Pergamon Press, 1965. vii, 151 p., illus. (The Commonwealth and International Library. Geophysics Division.) 17*s.* 6*d.*

Glaciology is in dire need of a textbook. To do justice to all the aspects of this composite discipline it will take an author of rare versatility. Until he comes forth, any treatise on ice is welcome. In his preface, the physicist Pounder admits to a professional bias in the title of his book and proceeds to demonstrate that, if there is a bias, it is in the contents.

Ch. v–vii, constituting about half of the book, deal with the physical nature and properties, the molecular structure, crystallography, elasticity, strength, rheology, friction, density, and the thermal and electrical properties of both pure and salty ice. This concise and well-organized summary, written at about the senior undergraduate level, is clearly the most useful section.

The other half, ch. i–iv and viii, treats some geophysical aspects of ice and, if anything can be criticized, it is the seemingly random coverage and topical imbalance of this part. After having heard of the rheological nature of ice (ch. vi.1) the reader is not told of the whereabouts and rheological state of 99 per cent of the ice on this planet, and Greenland and the Antarctic are only mentioned as cold places which produce icebergs. If space was a limitation, then much of it could have been saved by omitting an elementary derivation of the diffusion equation and a lengthy discussion of some basic features of heat conduction which are not peculiar to ice. The whole complex of interactions between natural ice sheets and their meteorological environment is cursorily dealt with on three pages, while seven of them are devoted to ice-breakers and could have been used profitably for at least a passing mention of some of the more significant ramifications of ice, such as the ice phase in the atmosphere, snow and snow metamorphism, the statistics of ice occurrence, glacier flow, or permafrost.

On p. 8 it is proposed that anchor ice forms by radiational cooling of the river bed, a long-lived idea (probably since H. T. Barnes, 1928) which should not have survived a second thought by the author.

The right-hand side of the diffusion equation (56, p. 136) should read $\rho(\theta)\, C(\theta) \frac{\partial \theta}{\partial t}$ and not $\frac{\partial(\rho C \theta)}{\partial t}$. It denotes the change of enthalpy per unit volume which is, by definition, $dh = \rho c_p \, d\theta$, and not $d(\rho c_p \, \theta)$.

Nevertheless, the book is a worth-while addition to glaciological literature, particularly useful to the glaciologist unfamiliar with the basic physics of sea and lake ice. Its lucid and readable style will make it a stimulating introductory text for students. It is simply but neatly produced and contains numerous instructive line drawings and three photographs.

N. Untersteiner

A. Marussi. *Geophysics of the Karakorum.* Leiden, E. J. Brill on behalf of the Italian National Council of Research, 1964. xvii, 242 p., illus. (Italian Expeditions to the Karakorum (K^2) and Hindu Kush. Scientific Reports. 2. Geophysics. Vol. 1.) Guilders 58.

This book records and discusses the geophysical results of expeditions to the Karakoram carried out under the leadership of Professor Ardito Desio since 1953; the data obtained from 1961 onwards are to appear in a subsequent volume, and those included in the volume under review were obtained during nine months of field work in 1954 and 1955.

The only glaciological work undertaken by the expeditions was an estimation of the thickness of three glaciers (Kuthiah, Godwin Austen and Baltoro) by measurement of their

surface slopes and velocities. Independent estimations were also made from gravity profiles across the glaciers, but the data were complete enough to allow a comparison between the methods on only one profile, that across the Baltoro Glacier at Urdukas. Here the gravity anomaly gave a maximum depth of 390 m. from the velocity. If, however, a better approximation than a semi-ellipse was used for the cross-section of the glacier, the depth indicated by the gravity anomaly increased to 465 m. This chapter of the book occupies only 16 of its 242 p.

However, for those concerned more broadly with the planning, execution and interpretation of the geophysical work of expeditions to mountainous regions, this report would repay some study. The methods of observation and reduction used are described in considerable detail (sometimes the detail seems unnecessarily great) and emphasis is placed upon the practical problems encountered in carrying out work of this kind which tend to be glossed over on brief publication in a journal.

The principal aim of the expeditions has been to establish gravity stations in the high Karakoram where observations have hitherto been few. The success of the 1954–55 seasons can be measured by the 198 stations for which both gravity and height were measured, using a Worden gravimeter and aneroid levelling, respectively. Of these stations, 69 were selected for complete topographic and isostatic reductions; enough to fill a considerable gap in the Bouguer and isostatic anomaly maps of the area, which has of course been one of considerable interest for over a century since the geodetic work of Everest led to the development of the theory of isostasy.

A programme of magnetic observations was also carried out, over 50 absolute values of vertical and horizontal geomagnetic field being determined, with measurements of declination at nine of the stations.

In addition to the work of the expedition itself, a short review of the seismicity of the area, by M. A. Choudhury of the Geophysical Institute at Quetta is included. This includes a reference to a determination of crustal thickness in the Hindu Kush by the identification of P and S phases originating from deep-focus earthquakes there and reflected at the base of the crust before their reception. The great crustal thickness of about 75 km. obtained by this method is in good agreement with that obtained by Soviet geophysicists using conventional large-scale refraction seismology.

The concluding chapters of the book review previous geological interpretations of the gravity field of the region (it is unfortunate that this chapter is illustrated only by cross-sections which are not easy to follow in the absence of a geological map) and summarize the conclusions drawn by the author from the augmented information now available. The negative isostatic gravity anomalies are attributed in places to alluvial material but more importantly to low-density granitic rocks emplaced along the axis of the Karakoram and the Hindu Kush. This thickening of the "granitic layer" of the crust is in accordance with the results of the Russian seismic soundings, and the author suggests that the emplacement of the large axial batholith was of fundamental importance in the Himalayan orogenic process.

An extensive bibliography of the geology and geophysics of the area is included, and the book is clearly written and well produced.

R. F. KING

G. WAGNER. *Klimatologische Beobachtungen in Südostspitzbergen 1960.* Wiesbaden, Franz Steiner Verlag GmbH, 1965. [vii], 69 p., illus. (Ergebnisse der Stauferland-Expedition 1959/60 (Deutsche Expedition nach Südostspitzbergen), Ht. 10.) DM. 26.

THIS report is based on data taken at two stations on Barentsøya in south-east Svalbard. "Wurzburger Hütte" is at a height of 16 m. and "Hohenstaufen" at 402 m. above sea-level on the north side of Freemansundet. The data are condensed in the appendix into two