all subsequently failed in their efforts to surpass Weddell's achievement. Filchner's Deutschland and Bruce's Scotia narrowly escaped disaster and Shackleton's Endurance drifted for ten months before finally succumbing to the almighty pressure of its pack. This was Weddell's second voyage to the Antarctic and it was, by no means, the first to harvest fur seals in the waters south of Cape Horn. Only a few years previously, in 1819, another British sealer, William Smith, had revealed the riches of the South Shetland Islands. But these early sealers were a secretive lot, not given to keeping logs let alone writing books.

Weddell's narrative, first published in 1825, the second edition (1827) of which David and Charles have now reprinted at a tenth of its current auction room value, is of singular interest. It combines one of the very few published accounts of the Antarctic sealing industry at this period with numerous observations on the natural history of the region by an amateur with all the makings of an objective scientist. The text is illustrated with careful charts of the track of the Jane and the Beaufoy (Captain Brisbane), which accompanied her; of Tierra del Fuego, the South Shetland Islands, and of the South Orkney Islands, visited only days after their discovery by George Powell. In addition to the textual descriptions of fauna, flora and the nature of the ice there are appended sections which include "Observations on the Navigation round Cape Horn", a discourse on the use of chronometer sand tables of computed longitude. Illustrated is one of the five truly Antarctic seals discovered by Weddell and named for him *Leptonychotes weddelli*. In this enlarged edition are added "Observations on the Probability of Reaching the South Pole", in which Weddell argues the open polar sea theory, and, in conclusion, "Second Voyage of the Beaufoy to Tierra del Fuego", a very brief account of Brisbane's visit to the Fuegian Indies in 1825. The reprint is prefaced, aptly enough, by Sir Vivian Fuchs, director of the British Antarctic Survey, among whose responsibilities is the maintenance of Britain's Weddell Sea scientific station, Halley Bay, and who himself narrowly escaped Shackleton's fate when the expedition ship Theron was temporarily beset in these waters while attempting to establish an advance party for the Commonwealth Trans-Antarctic Expedition in December 1955.

H. G. R. KING

ANTARCTIC ICE

International Symposium on Antarctic Glaciological Exploration

(ISAGE), Hanover, New Hampshire, USA, September 3–7, 1968. Edited by A. J. Gow, C. Keeler, C. C. Langway and W. F. Weeks. (Publication No. 86 of the International Association of Scientific Hydrology and the Scientific Committee on Antarctic Research.) Pp. xvi + 541. (c/o SCAR, Scott Polar Research Institute: Cambridge, 1970.) 84*s*; $10; B.fr.50.

THIS collection of papers is an excellent representative selection of recent Antarctic glaciological research. It is generally up to date for the year of the symposium, 1968. The articles are grouped under thirteen sections and include presentations of technique, theory, data and general reviews. The emphasis is on the historical and regional aspects of mass ice balance, glacial meteorology, and "deep sounding", which includes deep core drilling, deep probing, and radio echo and seismic exploration. The increasingly important field of glacio-chemistry is represented in two sections devoted to studies of accumulation and particles. Analyses of the dynamics and thermodynamics of ice sheets are presented in two rather short sections. There are also sections devoted to fringe regions of the ice sheet, ice shelves and sea ice. The latter two topics are singled out, along with the ice-rock interface, as promising frontiers of Antarctic glaciology in the frank and witty presidential address by A. P. Crary.

The great impact of the relatively new techniques of deep core drilling and radio echo sounding on Antarctic glaciology is very well shown in the "deep sounding" sections and many new applications of these tools are suggested. Even mishaps can sometimes be put to good use, as in J. Weertman's estimate of minimum water layer thickness from upwelling into a borehole. The eclectic nature of glaciology and the proliferation of sub-disciplines is impressed upon the reader, as suggested by the enumeration of subjects earlier.

Among the highlights of the symposium are the results of the studies of ice structure in the cores from the deep drill hole at Byrd Station by A. J. Gow, the detection of reflecting horizons within the ice by aerial radio echo sounding over a wide sector of Antarctica by G. de Q. Robin, *et al.*, movement studies of the Ross Ice Shelf by C. Swithinbank, and review articles on mass budget of the ice sheet as a whole by P. A. Shumsky and J. Hollin.

While most of the articles are complete, a few are only abstracts. The figures and tables are consistently pointed and readable; bibliographical completeness varies with the author. This volume will be of great value to glaciologists, but there is also much of interest to geophysicists, meteorologists, oceanographers, Pleistocene geologists and students of the polar regions in general.

GILBERT DEWART

PULSATIONS ABOVE THE EARTH

Geomagnetic Micropulsations

By J. A. Jacobs. (Physics and Chemistry in Space, Vol. 1.) Pp. viii + 179. (Springer-Verlag: Berlin and New York, 1970.) 36 DM; $9.90.

ANYBODY who has ever had the need to browse through issues of the old *Journal of Terrestrial Magnetism and Atmospheric Electricity* published during the 1920s and 1930s will know that they were devoted almost exclusively to magnetic and electrical effects above the Earth's surface. Indeed, the few per cent of the Earth's surface field produced externally attracted attention in inverse proportion to its strength. This state of affairs has changed radically over the past twenty years; but, palaeomagnetism notwithstanding, it is still true that more papers are published on the external than the internal field. While investigations into the magnetic field produced inside the Earth have received much of the scientific limelight in recent years, studies of the external field have been going from strength to strength, notably since the advent of the artificial satellite.

Professor Jacobs's new book is concerned with one small aspect of the external magnetic field—geomagnetic micropulsations, those fluctuations of the field whose amplitudes range from a fraction of a gamma to, occasionally, as much as a few tens of gammas, and whose periods lie between 0·1 second and 10 minutes. It is not a review of all the work that has ever been carried out in this field but rather a summary of our present state of knowledge, which means, roughly speaking, a concentration on the progress made during the past decade. A long section on the morphology of geomagnetic micropulsations is followed by a consideration of magnetohydrodynamic waves, the basis of modern theories of micropulsations. This leads naturally into the theories themselves. The final, and most interesting, chapter discusses the insight that studies of micropulsations have given us into the magnetosphere itself. As Jacobs himself points out, one of the most exciting aspects of the subject is the way that micropulsations are being used, and will be increasingly used, for remote sensing of the magnetosphere.

Geomagnetic Micropulsations would be classed as a research monograph (and a good one), which means that