

ANTARCTIC SNOW AND ICE STUDIES II. Edited by A. P. Crary. Washington, D.C.: American Geophysical Union, 1971. 8 x 10½ inches, 412 pages. (Antarctic Research Series, vol. 16.) \$24.50.

This volume of the Antarctic Research Series, like its 1964 predecessor of the same title which was edited by M. Mellor, is a compilation of noteworthy papers by scientists who clearly demonstrate a wealth of expertise in field technique, presentation and discussion.

The volume contains fifteen papers of which the first seven concern geophysics, the next seven relate to snow stratigraphy and accumulation, and the final paper is an account of the glacial geology of the Victoria Valley system.

The first two papers, by Bentley and Chang, and by Beitzel, describe geophysical investigations on traverses in Marie Byrd Land and Queen Maud Land respectively. Seismic, gravimetric, magnetic and altimetric measurements were made by both field parties. In addition, Beitzel augmented his seismic and gravimetric ice-thickness measurements by employing a 30-MHz electromagnetic sounder. Although this reviewer found difficulty in reading a number of the photo-reduced seismic records included in the traverse papers, most are welcome and convincing additions that clearly help to strengthen the authors' presentation and interpretations.

In the third paper Bentley offers evidence for morainal material extending a few hundred meters above bedrock in West Antarctica. He introduces alternatives to moraine and then discusses in detail the behaviour of a low-amplitude seismic echo as it might relate to each alternative. By so doing he supports the evidence and concludes that the most probable explanation of observed reflections is indeed the existence of a layer, or separated successive layers, of morainal debris.

The fourth paper, also by Bentley, deals with seismic anisotropy in the West Antarctic ice sheet. The existence of anisotropy is well documented by a thorough analysis of sixteen seismic profiles. Of particular interest is the significant difference in the mean inclination, relative to the flow plane, of c-axis concentration from near vertical in the interior, where strain rates are small, towards near horizontal where strain rates increase as the continental margin is approached. This report also comes with a bonus in the form of a "Note added in proof" which informs the reader of findings by T. Hughes and of

the support given by the evidence in this paper to Hughes' investigations into convection in the ice sheet.

The next two papers, by Dewart and by Bentley, have to do with gravity observations on, and in the vicinity of, Anvers Island and at South Pole Station respectively: in the first there is a description of the gravimeter survey, and how the data were used to estimate the thickness of the Anvers Island ice cap; while in the second the author states that there was an increase in observed gravity at South Pole Station of 1.0 ± 0.1 mgal in the ten-year period 1957 to 1967, and then concludes through the employment of detailed analysis of data and methods that the increase can be ascribed to a sinking of the station with perhaps a very small contribution from surface motion.

The final paper is geophysics, by Jiracek and Bentley, consists of a discussion of the velocities of electromagnetic waves in ice and the caution the scientist must exercise when employing an EMS system.

The next seven papers are concerned with aspects of glaciology. They serve well to show the progress that has been made in the last decade by field scientists in solving difficulties associated with stratigraphic and mass-balance research in the high, dry-cold interior of the Antarctic ice sheet.

Benson and Cameron in two separate papers describe in considerable detail stratigraphic methods employed at Byrd Station during 1961-1965. By means of access to exposed walls in long trenches and employment of an array of 100 accumulation stakes, added dimensions were given to standard pit techniques generally relied on by traverse parties. Benson also includes interesting comparisons between Byrd Station studies and earlier studies in Greenland.

Taylor, in addition to presenting his accumulation data from the 1962-1963 South Pole traverse, augments the value of Benson's and Cameron's work by discussing the problems encountered on moving field parties when attempting interpretation solely by stratigraphic techniques.

A most significant contribution towards positive determination of rates of accumulation by radiometric methods is described by Picciotto, Crozaz, and De Breuck. They detail the methods and results of their research on the three Queen Maud Land traverses during the austral summers 1964 through 1968. By measuring total activity through the firn to identify the 1955 fallout horizon and at the decay of lead-210 they conclude that reliable information is achieved. The value of this

research is immediately borne out in papers by Koerner and by Rundle who compare their results obtained by stratigraphic analysis to those of Picciotto *et al.*

A paper by Hamilton and O'Kelley deals with the increase of microparticle concentrations at six sites on the Antarctic continent. It also discusses changes of soluble salt concentration at South Pole Station for the years 1956 through 1964. The presentation is concise and suggests that studies along this line can contribute to our knowledge of global upper air circulation and perhaps provide a means of tracing flow lines within the ice sheet.

The final paper consists of a lengthy dissertation by Calkin on the glacial geology of the Victoria Valley system. Despite the author's caution that correlations reached are speculative and "presented as a basis of discussion", this paper clearly demonstrates, as do those that precede it, the outstanding professional quality of the research done by the researchers who have contributed to the volume. One cannot but be impressed by the quality of the publication; the painstaking compilation and editing by Cray are very evident throughout. My only constructive criticism might be that I found myself wishing for a general index map as I read. Reading and reviewing the volume, I finally got out a base map of Antarctica and filled in the areas in which research took place — the stations, the traverses, the isolated points reached by aircraft and so forth. When complete, the map emphasized the magnitude of research effort and, perhaps even more important, the degree of integration attained between researchers far apart geographically. This became more and more evident as I read each chapter, and when I had finished "the story" I knew I had read a fine work.

Richard H. Ragle

CHILKOOT PASS: THEN AND NOW. BY ARCHIE SATTERFIELD. *Anchorage: Alaska Northwest Publishing Company, 1973. 5¼ x 8¼ inches, 183 pages, 107 photographs, 2 maps. \$3.95.*

Archie Satterfield is a Seattle newspaperman, photographer, lecturer and tour organizer, as well as the author of articles and other books on Alaska and the Pacific Northwest. According to a note on the back cover, he hiked the Chilkoot twice, and boated from Lake Bennett to Dawson City, in preparation

for this book. He obviously did considerable research as well, for the story of the Chilkoot Pass is reliably told, with significant facts, names and dates.

A combined history and tour guide, the book is a paperback and lacks an index. Its value is however enhanced by about 60 photographs taken in 1897-98 (parts of some of which are adapted as chapter headings) and 46 of the author's own recent Chilkoot photographs. All are fascinating, and the old ones by E. A. Hegg and others are as fresh-looking as the new.

Apparently discounting the California Gold Rush of 1849, Mr. Satterfield declares: "At no time or place in recorded history did so many people voluntarily subject themselves to so much agony and misery and death — and glory — than those twenty to thirty thousand who crossed the Chilkoot Pass on their way to the Klondike goldfields in 1897-98. It can only be compared with an army in retreat or refugees in flight, victims of the madness attending war. Chilkoot was the madness attending gold."

Various other corridors, including the nearby White Pass, were followed on foot and by boat to the interior of Alaska and the Yukon prior to or during the Klondike Gold Rush, but the Chilkoot Trail became the most heavily travelled and most famous, with an ant-like procession of humanity making its way over the pass.

Coincident with the subsiding of the stampede and the completion of a 110-mile narrow-gauge railway from Skagway over the White Pass to Whitehorse in 1900, Chilkoot and the settlements that serviced it were abandoned. But along the trail there still lingers a ghostly aura of drama, given substance by scattered relics of a throng that vanished from the scene at the turn of the century — wagon wheels, sleds, boats, stoves, shoes and fragments of machinery. The trail is an outdoor museum 32 miles long.

Chilkoot has become ever more popular with backpackers, whose numbers have increased sharply through the past few summers. Indeed, as the author urges, an adequately-staffed international park commemorating the Klondike Gold Rush should be created as quickly as possible to control tourist traffic and preserve artifacts that have not already been purloined or vandalized all the way from Skagway and Dyea in Alaska to Dawson City and beyond in the Yukon Territory.

As a devotee as well as a native of the Yukon, going back there again and again, I enjoyed Mr. Satterfield's Chilkoot book.