Conceivably with a large enough precipitation difference, the trough would never fill and could, in fact, become more marked. Indeed, the unequal precipitation rate is probably why the crest and trough formed in the first place. If we assume the trough precipitation to be half that at the crest during the 20,000 years that the ice has presumably been building up to its present thickness, then the trough would have reached its present average depth of 750 m. below the crest if the annual precipitation at the crest has been 17·5 cm. and if 2·5 cm. of this has been blown from crest to trough (thus giving an annual accumulation of 15 cm. on the crest and 11·25 cm. in the trough). If we approximate to the crest and trough by a flat plateau 500 km. wide beside a flat valley also 500 km. wide (together comprising the 1,000 km. from Executive Committee Mountains to Horlick Mountains), then the transport of snow from crest to trough necessary to effect the gains and losses cited above is $1 \cdot 25 \times 10^{10}$ g. m.$^{-1}$ yr.$^{-1}$, which is smaller than Loewe's figure of 2×10^{10} g. m.$^{-1}$ yr.$^{-1}$ given in his *Études de glaciologie en Terre Adélie, 1951-52*,[10] but more than twice as large as another transport figure of Loewe's, $0 \cdot 47 \times 10^{10}$ g. m.$^{-1}$ yr.$^{-1}$ cited by Vickers.[11] This last figure is based on a wind speed of 35 knots (17·5 m. sec.$^{-1}$) which is probably too large for the average wind speed in Marie Byrd Land. Nevertheless, if we accept the figure of $1 \cdot 25 \times 10^{10}$ g. m.$^{-1}$ yr.$^{-1}$, the crest should be growing relative to the trough at a rate of 3·75 cm. yr.$^{-1}$.

The crest-trough elevation difference would remain constant if the annual precipitation rates were 20 cm. and 10 cm. respectively and if the annual gain and loss by blowing snow was 5 cm. This would require a wind transport by blowing snow of $2 \cdot 5 \times 10^{10}$ g. m.$^{-1}$ yr.$^{-1}$, a greater value than Loewe's large estimate. In view of these considerations based on an estimate that the precipitation at the trough is half that at the crest, Dr. Wexler states that the presence of the trough need not signify that the Byrd ice is younger than 20,000 years. When more complete measurements are available for the accumulation in the trough and on the crest and of the wind transport of snow into the trough, this method might indeed be used to give an independent estimate of the age of the Byrd ice.

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REVIEWS

ARCTIC SEA ICE. Proceedings of the Conference conducted by the Division of Earth Sciences and supported by the Office of Naval Research. National Academy of Sciences—National Research Council, Washington, D.C. Publication 598, December 1958. 271 pages, illus., maps. 28 cm.

THE conference on Arctic sea ice, held at Easton, Maryland, U.S.A., 24-27 February 1958, comprised six daytime sessions, and several evening papers on aspects of sea ice not entirely related to particular topics. The particular topics were classified thus: (1) Distribution and character of sea ice; (2) Sea ice observing and reporting techniques; (3) Physics and mechanics of sea ice; (4) Sea ice formation, growth and disintegration; (5) Drift and deformation of sea ice, and (6) Sea ice prediction techniques. Sea ice operations were discussed at the evening meetings.

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Since Baltic Sea ice differs greatly from that of the Arctic Ocean, the ice problems of this sea are not usually considered with those of the Arctic generally. The scope of this conference was, however, so wide that many Baltic problems could be discussed within its framework.

Papers in (1) included observations on the distribution and character of sea ice in the European Arctic by F. Nusser and a study of modern glacierization in the Soviet Arctic by G. A. Avsyuk. The classification of ice in the Soviet sector of the Arctic, together with a rather elaborate system of symbols for ice maps, was the subject of an appreciation by A. A. Kirillov, and C. Swithinbank outlined the problems of constructing an ice atlas for the use of shipping. This paper records the significant fact that ice damage to U.S. military shipping in 1951 amounted to "many millions of dollars".

The techniques of observing and reporting sea ice were the subjects of five papers in the second group. In Japan it seems that the methods used are a little primitive—with the use of binoculars predominant. The Soviet Union, on the other hand, relies largely on long-range air reconnaissance supported by drift measurements with instruments set up on large ice floes. Observations in the Baltic are mostly made from land, but reconnaissance flights can be arranged by the icebreaker service. Reports are made in code, but lack of a common system of classification rather detracts from its value. In the North American Arctic all ice information is gained from the air, ship-based helicopters give short range cover and shore-based aircraft make frequent flights at medium range along shipping lanes. Long-range reconnaissance provides both tactical support flights and the extended flights needed for forecasting and research purposes. The discussion which followed emphasized the problem of providing a comprehensive ice terminology.

Section 3 was concerned with the physics and mechanics of sea ice. Thermal budget studies on pack ice, made at a station on the pack as part of the I.G.Y. programme, were described by N. Untersteiner and F. Badgley. I. S. Peschanskiy outlined the physical and mechanical properties of arctic ice and described the methods of research used at the Arctic Research Institute of the U.S.S.R. A mathematical approach to the composition of sea ice and its tensile strength was considered in an informative paper by A. Assur, and T. Tabata reported on his studies of the visco-elastic properties of sea ice.

The formation, growth and disintegration of sea ice were the topics of a further group of papers. Among these was an attempt by A. G. Kolesnikov to formulate the problem of ice growth rate, an estimation of sea ice formation and growth by computation, presented by L. S. Simpson and a review of investigations on the same subject, especially in the Okhotsk Sea, by Tabata.

The drift and deformation of sea ice (Session 5) were considered in three papers by I. Browne and A. P. Crary, P. Gordiyenko and T. Fukutomi. The first was based on observations made on the ice island T3 and the Russian contribution summarized the problem of drift, and described conclusions reached from observations at drifting ice stations. Fukutomi considered that his approach to the subject differed from other theories of steady drift by taking into account the ratio of ice area to water area and the resistance of the ice body to wind and water.

Two papers on prediction technique were presented. E. Palosuo gave details of the methods now used by the Baltic Ice Service, which include predictions of the moment of initial freezing in a certain sea area, based on considerations of energy exchange, whereas W. Wittmann discussed Continuity Aids in short range ice forecasting, as used in the North American Arctic.

Of the three miscellaneous papers in the evening sessions perhaps the most interesting was that which described the technique for time-lapse photography of sea ice at Pt. Barrow, in Alaska. Here, 1,130 metres of continuous film were obtained automatically at the spring break-up, between 16 June and 21 August 1957.

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