oil, and the investment of Japanese capital in lumber and pulp mills in southeastern Alaska.

The hopes and fears of Alaskans, and how they view their future, is summed up in the chapter on "A Matter of Direction".

The Conclusion outlines "The Future of Alaska". Rogers points out the need for fresh and clear thinking about Alaska's prospects; irrational beliefs and attitudes can have no place in building an economically sound Alaska. Boom time thinking must be discarded, and such schemes as legalized gambling offer no real alternative to the proper economic development of the state, based on its natural resources. The new state can grow only if proper planning is used and proper goals set. Otherwise bankruptcy may result.

Rogers write as an Alaskan, with Olympian objectivity. Everything in his economic, social, and political analysis seems to point to bankruptcy as the logical end of this experiment in statehood. To date, the history of Alaska has demonstrated the dominance of mind over matter. But the great claims made for Alaska's future are no substitute for a realistic assessment of the state's resources and prospects. Word magic can only take a state so far. An excess of emotion has often taken the place of logic and common sense. The casual visitor to Alaska is impressed by the friendliness of the people and their optimism. Such a visitor is also impressed by the high standard, and the high cost of living, even in Juneau. As Rogers so ably shows, Alaskans have continually put faith in ideals, dreams, and words, rather than in realities. Some dreams, such as the Taiya Project, ended abruptly. Many ideals have already been wrecked on the harsh rocks of reality; these very rocks may yet tear the whole bottom out of the ship of state. Now that statehood is an accomplished fact, there appears to be little indication that inflated ideas and high standards of living will be dropped.

Whatever happens, all Alaskans have reason to be grateful to Dr. Rogers. In a logical, orderly, and lucid manner, spiced with humour, he has provided a blueprint for Alaska's future development. His study brings to mind Santayana's famous phrase about a people who forget their history. This extremely well written book has a number of clear and relevant illustrations; the statistical tables are well set out, and the index has been carefully compiled.

In the "Whitehorse Star" of January 24th, 1963, a lighthearted letter on the future of Alaska, and its neighbour the Yukon Territory, appeared. It began: "Why don't the Yukon and Alaska get together, declare their independence and form a brand new nation in the far Northwest? If we believe what we hear and read, the Yukon, with a population around 15,000 seems to be headed for provincial status and some people seem to think that it could not happen soon enough. They want to get away from the paternal attitude of the wise men in the East and look after themselves. For Alaskans, the equivalent of Yukon's dreams of provincial status became a reality in Alaska when it became a state. But, to hear some of them now, one would think that they would do most anything to become a territory again." The letter then goes on to extoll the wonders of Alaska and the Yukon — the rich mineral deposits, the vast hydro-electric potential, and the scenery and wonders that linger long in the memory of all who visit the area. Significantly enough, the writer signs himself "A Dreamer".

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VOPROSY FIZIKI I MEKHANIKI L'DA (ON THE PHYSICS AND MECHANICS OF ICE). By V. V. Lavrov. Papers of the Arctic and Antarctic Research Institute, Vol. 247. *Leningrad: Izdatel'stvo "Morskoy Transport". 1962. 118 pages, illustrated, paper. N.P.*

This monograph on the problems of physics and mechanics of ice may be favourably compared with many spe-

cialized reports, papers, and books on the subject that have been published in recent years, since it is the scientific-technological treatment of a number of practical topics by a professional glaciologist.

Chapter I, on the formation of ice, begins with a discussion of structure of liquids and continues with descriptions of the formation of crystals, their growth and various factors affecting growth. In his treatment of the mechanism of the growth of ice crystals in slightly supercooled water (t not lower than −1°C.), the author holds with Fedorov's idea[1] of nucleation around a small piece of ice immersed in supercooled water and experimentally confirms it, establishing at the same time the conditions under which the elementary crystals of ice are formed in the shapes of thin discs, hexagons, and stars. The formation of disc-like crystals of ice in slightly supercooled water is explained as owing to the latent heat being released on the two faces and the edges of hexagonal crystal elements during the phase change, followed by a temperature jump that causes melting of the edges and prevents the regular growth of the ice lattice on the faces of the lamina.

Considerable attention is given to anchor or underwater ice formation. It is suggested that underwater ice slush may form in slightly supercooled water, following an abundant formation of disc-like ice crystals. (The old but interesting idea of anchor ice formation owing to a decrease of infrared radiation intensity with depth in natural freshwater reservoirs[2] has evidently escaped the author's notice.)

Following a descriptive section on the structure of real (not ideal) ice crystals the formation of ice crust and its structure is discussed as conclusion of Chapter I that serves as the theoretical bridgehead for Chapter II on the behaviour of ice under load, treated from the viewpoint of engineering glaciology. As in Chapter I the problems of ice engineering and their solutions are based on the author's own investigations and experiments. Pointing out the high ratio of displacement modulus, E_1, to tensile modulus, E_2, which can be as high as 9 in freshwater ice, the author develops his mathematics of the reduced modulus E_{pr}, which for $E_1 = 81{,}000$ kg./cm.^{2}, and $E_2 = 27{,}000$ kg./cm.^{2} gives a value of 41,000 kg./cm.^{2}, and which can then be used in the regular formula for the flexural moment. The value of E_{pr}, however, is found to vary with the rate of loading and, as pointed out to the author by V. I. Kashtelyan, this modulus changes also with the ratio l/h, where l is the length and h the thickness (height) of the ice sample. The term "scale effect" is coined for this phenomenon and a good deal of discussion is devoted to the explanation and to the effect of this phenomenon on the strength of ice.

The third chapter treats the mechanical properties of ice and their dependence on the conditions under which the ice crystals and the ice have been formed. In a well-knit presentation the elasticity and ultimate strength of ice under compression, shock load, flexion, and tension are discussed and the methods for the determination of the strength of the ice crust are given. An interesting section on relationship of the deformation modulus, E_{df}, and the ultimate strength, σ, of ice under flexion is also given. The author points out the identity of the physical dimensions of E_{df} and σ, and experimentally confirms a linear relationship between these two parameters.

The fourth and final chapter, on the representation of ice by models, is a monograph in itself, whereas the preceding three form a well-integrated unit on physical and engineering glaciology.

The importance of using models as experimental simulations of natural phenomena under laboratory conditions is well recognized and the art of model building improves from year to year, mainly in the degree of similitude reproduced. In this the "scale effect" discovered by the author comes into play, as well as the effect between the size of the model and its mechanical and elastic parameters. For example, the ratio of the mean cross-section, d, of

an ice crystal and the thickness of the ice sheet, h, is usually 3:70 in natural freshwater bodies, whereas in the laboratory tank ice crystals may grow to 10 to 12 cm. in cross-section, though the thickness of the experimental ice sheet in the tank is only 7 mm. thus giving a ratio of 10:0.7 or 12:0.7. Consequently, the mechanical properties of the natural ice sheet may be quite different from those of the ice sheet grown in the laboratory, since it is lacking the similitude ratio 3:70. To make the model similar to the natural ice sheet, the model ice sheet would have to be grown by a method that would result in the model sheet consisting of ice crystals 0.5 to 0.6 mm. in cross-section. This illustrates the problem of similitude as treated by Lavrov. Conditions for the similitude of the ice of models and methods for achieving it in laboratory-grown ice sheets are discussed in detail.

A few minor flaws appear in this masterly monograph. As the making of laboratory models of ice, so the reinforcement of ice in situ is a quite important physical-glaciological problem that might well have been dealt with in a fifth chapter (see Ref. 3). One misses in the generous list of references (152 titles) the work of K. F. Voytkovskiy[4] on the mechanical properties of ice. Another, and more important flaw is the quality of the paper. This reviewer feels that Lavrov's work deserved to have been printed on better paper.

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[1]Fedorov, E. S. 1915. Protsess kristallizatsii (The process of crystallization). Priroda, December.

[2]Barnes, Howard F. 1899. Notes on frazil and anchor ice. McGill University, Pap. Dept. Phys. No. 10.

[3]Cobble, R. L., and W. D. Kingery. 1962. Ice reinforcement. *In* Kingery, W. D., *Editor*, Ice and snow properties, processes and applications. Cambridge: Mass. Inst. Technol., chapter 12.

[4]Voytkovskiy, K. F. 1960. Mekhanicheskiye svoystva l'da (Mechanical properties of ice). Moscow: Acad. Sci. USSR.

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THE NORTH WEST PASSAGE 1534-1859. A catalogue of an exhibition of books and manuscripts in the Toronto Public Library. Compiled by Edith G. Firth, with an introduction by H. C. Campbell. *Toronto: Baxter Publishing Co. in co-operation with the Toronto Public Library. 1963. 8½ x 11 inches, 27 pages, illustrations, portraits, maps. $1.35.*

Early in 1963 the Toronto Public Library prepared an exhibition of personal narratives and records of the search for the northwest passage. Some 90 books and manuscripts were chosen from the library's collection to be displayed to stimulate interest in the history of the Canadian North. The collection starts with the earliest printed record of Jacques Cartier's first voyage in search of a passage to the wealth of Cathay and ends with M'Clintock's (wrongly spelled McClintock) voyage in the *Fox*. The latter did, in effect, discover the easiest navigable route through the Canadian Arctic Archipelago, a route that was later used successfully by Amundsen. The voyages selected from those undertaken between the two are arranged in chronological order and all the main expeditions are represented.

The catalogue for this exhibition has been issued in booklet form. For each of the exhibits full bibliographical information is given together with an abstract. It is profusely illustrated with pictures from the expeditions and portraits of the chief explorers. Two maps grace the inside covers. An index of explorers' names is provided. The whole effect is that of a carefully planned and handsomely produced concise guide to the search for the northwest passage and the early exploration of the Canadian Arctic.

The booklet can be obtained from either the Toronto Public Library, College and St. George Street, Toronto 2-B, Ontario; or from the Baxter Publishing Company, 228 Bloor Street West, Toronto 5, Ontario.

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