GLACIOLOGICAL LITERATURE

THIS is a selected list of glaciological literature on the scientific study of snow and ice and of their effects on the Earth; for the literature on polar expeditions, and also on the "applied" aspects of glaciology, such as snow ploughs, readers should consult the bibliographies in each issue of the *Polar Record*. For Russian material the system of transliteration used is that agreed by the U.S. Board on Geographic Names and the Permanent Committee on Geographical Names for British Official Use in 1947. Readers can greatly assist by sending reprints of their publications to the Society, or by informing Dr J. W. Glen of publications of glaciological interest. It should be noted that the Society does not necessarily hold copies of the items in this list, and also that the Society does not possess facilities for microfilming or photocopying.

General glaciology

HAMELIN, L.-E. Contribution au vocabulaire géographique des pays froids: périglaciaire et glaces flottantes. *Revue de Géographie de Montréal*, Vol. 24, No. 3, 1970, p. 305–09. [Discussion of French terms for periglacial and floating ice phenomena.]

MILLER, S. L., *and* SMYTHE, W. D. Carbon dioxide clathrate in the Martian ice cap. *Science*, Vol. 170, No. 3957, 1970, p. 531–33. [Measurements of dissociation pressure of carbon dioxide hydrate make it likely that this is present in the Martian ice sheets.]

Glaciological instruments and methods

KOHNEN, H. Zur Frage der Zwischenschicht. *Zeitschrift für Gletscherkunde und Glazialgeologie*, Bd. 6, Ht. 1–2, 1970, p. 201–04. [Critical comment on theory of Förtsch and Vidal on effect of layer between rock and ice on seismic measurements.]

PEYER, I. La progression des glaciers à travers l'objectif. *Les Alpes. Bulletin Mensuel du Club Alpin Suisse*, 1971, No. 3, p. 41–42. [Describes photogrammetric method used by A. Flotron for measuring advances of glaciers.]

SISSON, R. F. Snowflakes to keep. *National Geographic Magazine*, Vol. 137, No. 1, 1970, p. 104–11. [Well-illustrated description of method of making casts of snow crystals.]

Physics of ice

ACKLEY, S. F., *and* ITAGAKI, K. Ice adhesion studies: properties of defects in the interfacial region. (*In* Snow removal and ice control research. Proceedings of an international symposium held April 8–10, 1970. [*U.S.*] *Highway Research Board. Special Report* 115, 1970, p. 87–96.) [Discussion of adhesion from point of view of defects in the ice that may affect it.]

BERRY, W. B. Low energy electron transmission through ice films at 77°K. *Journal of Chemical Physics*, Vol. 54, No. 4, 1971, p. 1837–38. [Letter. Experimental study of energy loss of electrons in ice and interpretation.]

CASLAVSKY, J. L., *and* VEDAM, K. Epitaxial growth of ice crystals on the muscovite cleavage plane and their relation to partial dislocations. *Journal of Applied Physics*, Vol. 42, No. 2, 1971, p. 516–20. [Use of epitaxy of ice on muscovite mica, which can have two possible connections, to study partial dislocations in muscovite.]

CHEN, J., *and* KEVORKIAN, V. Heat and mass transfer in making artificial snow. *Industrial and Engineering Chemistry. Process Design and Development*, Vol. 10, No. 1, 1971, p. 75–78. [Analytical and experimental study of snow manufacture by spraying water and compressed air into the freezing atmosphere.]

DELSEMME, A., *and* WENGER, A. Density of low temperature ice. *Science*, Vol. 170, No. 3958, 1970, p. 654. [Observations of Seiber and others, ibid., p. 652–54, discussed. Conditions were different from those in which high density amorphous ice was formed.]

DELVES, R. T. Theory of the stability of a solid–liquid interface during growth from stirred melts. II. *Journal of Crystal Growth*, Vol. 8, No. 1, 1971, p. 13–25. [Ice case considered; fast stirring can produce appreciable stabilization.]

GHORMLEY, J. A., *and* HOCHANADEL, C. J. Amorphous ice: density and reflectivity. *Science*, Vol. 171, No. 3966, 1971, p. 62–64. [Experimental study. Density same as that of ice Ih. Reflectivity increases on crystallization.]

GHORMLEY, J. A., *and* HOCHANADEL, C. J. Production of H, OH, and H_2O_2 in the flash photolysis of ice. *Journal of Physical Chemistry*, Vol. 75, No. 1, 1971, p. 40–44. [No absorption by trapped electrons was observed. Ultra-violet absorption is attributed to H and OH radicals.]

HASE, H., *and* KEVAN, L. Optical absorption characteristics and photobleaching behavior of trapped electrons in γ-irradiated alkaline ice. *Journal of Chemical Physics*, Vol. 54, No. 3, 1971, p. 908–14. [Shifts in the absorption band maximum and changes in quantum efficiency interpreted in terms of retrapping and trap interconversion.]

JELLINEK, H. H. G. Ice adhesion and abhesion: a survey. (*In* Snow removal and ice control research. Proceedings of an international symposium held April 8–10, 1970. [*U.S.*] *Highway Research Board. Special Report* 115, 1970, p. 46–77.) [Reviews fundamental studies on ice adhesion. Discussion, p. 76–77.]

JELLINEK, H. H. G., *and* JUZNIC, K. Diffusion of radioactive cesium in polycrystalline ice. *Physica Status Solidi A*, Vol. 2, No. 4, 1970, p. 837–46. [Radioactive tracer studies of grain-boundary diffusion in pure ice and CsCl doped ice.]

KNIGHT, C. A. Experiments on the contact angle of water on ice. *Philosophical Magazine*, Eighth Ser., Vol. 23, No. 181, 1971, p. 153–65. [Two methods give contradictory results, possibly due to anisotropy or disequilibrium.]

KRASTANOV, L., *and others*. Erzeugung von Eiskernen mit Hilfe von Zeolithpulver, [von] L. Krastanov, N. Genadiev, L. Levkov. *Doklady Bolgarskoy Akademii Nauk*, Tom 23, No. 9, 1970, p. 1071–74. [Use of Zeolith powder as ice nucleating agent.]

KVAJIĆ, G., *and* BRAJOVIĆ, V. Segregation of $(^{134}Cs)^+$ impurity during growth of polycrystalline ice. *Canadian Journal of Physics*, Vol. 48, No. 23, 1970, p. 2877–87. [Study of concentration of radioactive ions in liquid and solid phases during vertical freezing of water, both upwards and downwards.]

LEBEDEV, D. P., *and others*. Izucheniye mekhanizma sublimatsii l'da–vody pri koduktivnom podvode tepla i nepreryvnom vvode massy na modeli kapillyarnoporistogo tela [Study of the mechanism of ice–water sublimation with conductive heating and continuous mass input on a capillary porous model]. [By] D. P. Lebedev, T. L. Perel'man, V. I. Derkachev, V. B. Timofeyev, V. V. Alekseyev. *Inzhenerno-Fizicheskiy Zhurnal*, Tom 19, No. 2, 1970, p. 218–23. [Process of sublimation studied by cine-film of evaporation from brass/gauze net between glass plates. Process has pulsation as liquid breaks through ice wall. English summary, p. 223.]

LEBEDEV, D. P., *and others*. Mekhanizm sublimatsii l'da–vody v vakuume iz odnochnogo makrokapillyara pri radiatsionnom podvode tepla [Mechanism of ice–water sublimation *in vacuo* from a single macro-capillary during radiative heating]. [By] D. P. Lebedev, T. L. Perel'man, V. I. Derkachev, V. B. Timofeyev. *Inzhenerno-Fizicheskiy Zhurnal*, Tom 19, No. 2, 1970, p. 211–17. [Cine-photo observations of sublimation processes when water is simultaneously freezing and subliming in a capillary. English summary, p. 216.]

LLIBOUTRY, L. A. Le fluage de la glace. *La Houille Blanche*, 25e An., No. 5, 1970, p. 489–92. [Discussion of mechanism of creep of glacier ice and theories concerning it.]

MAIDIQUE, M. A., *and others*. Transfer of protons through "pure" ice I_h single crystals. III. Extrinsic versus intrinsic polarization; surface versus volume conduction, by M. A. Maidique, A. [R.] Von Hippel and W. B. Westphal. *Journal of Chemical Physics*, Vol. 54, No. 1, 1971, p. 150–60. [Study of d.c. and transient conductivity of ice interpreted with dielectric measurements.]

MAKAROV, I. YE., *and others*. Kinetika termicheskoy i fotostimulirovannoy gibeli zakhvachennykh elektronov v γ-obluchennom stekloobraznom shchelochnom l'du [Kinetics of the thermal and photostimulated decay of trapped electrons in γ-irradiated glassy alkaline ice]. [By] I. Ye. Makarov, B. G. Yershov, A. K. Pikayev. *Izvestiya Akademii Nauk SSSR. Seriya Khimicheskaya*, 1970, No. 8, p. 1697–702. [Thermal decay of captured electrons and O ion radicals is second order, that of photodecay is first order.]

MONTANO, P. A., *and* SHECHTER, H. Changes of the Mössbauer spectral area at transition points. *Physics Letters*, Vol. 33A, No. 4, 1970, p. 259–60. [Theory of changes in Fe-doped ice. Similarity with changes observed at ferroelectric transition points.]

MOORTI, V. R. G. Permanent multipole contribution to the energy of fully occupied and vacant ice lattices: variation with nonequilibrium orientations of single molecules. *Dissertation Abstracts International*, B, Vol. 30, No. 9, 1970, p. 4085-B–86-B. [Theoretical study of energy of H_2O molecule in ice. Abstract of Ph.D. thesis, New York University, 1968. University Microfilms order no. 70-5328.]

MURRMANN, R. P., *and others*. Ionic diffusion at the ice–solid interface, by R. P. Murrmann, D. M. Anderson and J. W. Peek. (*In* Snow removal and ice control research. Proceedings of an international symposium held April 8–10, 1970. [*U.S.*] *Highway Research Board. Special Report* 115, 1970, p. 78–86.) [Diffusion of $^{22}NaCl$ on ice surface shows properties different from water or bulk ice.]

NAZHAT, N. B., *and* WEISS, J. J. On the nature of bleached color centers in irradiated alkaline ices. *Journal of Physical Chemistry*, Vol. 74, No. 24, 1970, p. 4298–99. [Letter. Discussion of possible nature of colour centres.]

NOVIKOV, P. A., *and* VAGNER, YE. A. Opredeleniye veroyatnykh lokal'nykh skorostey potoka para okolo sublimiruyushchegosya l'da v razrezhennom gaze [Determination of the probable local velocities of vapour outflow around subliming ice in rarefied gases]. *Inzhenerno-Fizicheskiy Zhurnal*, Tom 18, No. 5, 1970, p. 873–77. [Study of discrete evaporation process from ice. Calculation shows area participating decreases with decreasing pressure. English summary, p. 877.]

ODENGRANTZ, F. K., *and* HILDEBRAND, P. H. Ice whiskers and dendrites in a cloud chamber replicated with methyl 2-cyanoacrylate. *Journal of Crystal Growth*, Vol. 8, No. 2, 1971, p. 141–48. [Technique for making replicas of ice crystals in clouds. Habit is intimately connected with whisker formation.]

OREM, M. W. Physical absorption of hydrocarbon vapors on ice. *Dissertation Abstracts International*, B, Vol. 30, No. 12, Pt. 1, 1970, p. 5454–8. [Ethane and propane react irreversibly with ice to form possible clathrates. Pentane and hexane show physical adsorption. Above $-35°$ C behaviour is more like that on liquid water. Abstract of Ph.D. thesis, University of Southern California, 1969. University Microfilms order no. 70-11381.]

SCHENK, J., *and* SCHENKELS, F. A. M. Thermal free convection from an ice sphere in water. *Applied Scientific Research*, Vol. 19, No. 5, 1968, p. 465–76. [Flow patterns and local heat transfer observed and compared with each other and theoretical predictions.]

SEIBER, B. A., *and others*. Density of low temperature ice, by B. A. Seiber, B. E. Wood, A. M. Smith, P. R. Müller. *Science*, Vol. 170, No. 3958, 1970, p. 652–54. [Density and refractive index of amorphous ice measured.]

SHARANIN, YU. I., *and others*. Opredeleniye podvizhnostey i vykhodov zaryazhennykh chastits, voznikayushchikh pri impul'snom radiolize kristallicheskogo l'da [Determination of mobilities and yields of charged particles arising during the pulsed radiolysis of crystalline ice]. *Doklady Akademii Nauk SSSR*, Tom 195, No. 4, 1970, p. 896–97.

SHAWYER, R. E., *and* DEAN, P. Atomic vibrations in hexagonal ice I. *Discussions of the Faraday Society*, No. 48, 1969, p. 102–07. [Calculated frequency spectrum compared with neutron and thermodynamic studies. Effect of deuterium substitution discussed.]

SUTHERLAND, BILL. Two-dimensional hydrogen bonded crystals without the ice rule. *Journal of Mathematical Physics*, Vol. 11, No. 11, 1970, p. 3183–86. [Result of relaxing the Bernal-Fowler rules in the two-dimensional analogue of ice.]

VON HIPPEL, A. R. Do we really understand ferroelectricity? *Journal of the Physical Society of Japan. Supplement*, Vol. 28, 1970, p. 1–6. [Includes discussion of electrical properties of ice.]

VON HIPPEL, A. R. Transfer of protons through "pure" ice I_h single crystals. II. Molecular models of polarization and conduction. *Journal of Chemical Physics*, Vol. 54, No. 1, 1971, p. 145–49. [Theory of electrical processes in ice due to movement of Bjerrum defects and ionic defects.]

VON HIPPEL, A. R., *and others*. Transfer of protons through "pure" ice I_h single crystals. I. Polarization spectra of ice I_h, [by] A. [R.] Von Hippel, D. B. Knoll and W. B. Westphal. *Journal of Chemical Physics*, Vol. 54, No. 1, 1971, p. 134–44. [Detailed study of dielectric relaxation spectra of hexagonal ice.]

WILLIAMS, P. M., *and* MUNNO, F. J. Thermal neutron diffusion at the ice–water phase transition. *Nuclear Science and Engineering*, Vol. 43, No. 1, 1970, p. 120–22. [Review of data available with new experiments indicates that there is no discontinuity in the thermal neutron diffusion coefficient when H_2O freezes.]

YEAN, D. H., *and* RITER, J. R., *jr*. Deformation mechanism for ice VII. *Journal of Chemical Physics*, Vol. 54, No. 1, 1971, p. 294–96. [Theoretical calculation shows protons remain on their original O atoms at all pressures so far achieved without formation of symmetrical H bonds.]

YOMOSA, S., *and* HASEGAWA, M. Valence bond study of the hydrogen bond. III. Formation and migration of ionic defects in water and ice. *Journal of the Physical Society of Japan*, Vol. 29, No. 5, 1970, p. 1329–34. [Theory of formation and migration of ionic defects.]

LAND ICE. GLACIERS. ICE SHELVES

AMBACH, W., *and* EISNER, H. Grundlagen und Ergebnisse von kernphysikalischen Untersuchungen auf Alpengletschern. *Zeitschrift für Gletscherkunde und Glazialgeologie*, Bd. 6, Ht. 1–2, 1970, p. 91–105. [Application of radioactive isotope dating techniques to glaciology, with particular reference to Alpine glaciers.]

ANDERTON, P. W. Deformation of surface ice at a glacier confluence, Kaskawulsh Glacier. (*In* Bushnell, V. C., *and* Ragle, R. H., *ed. Icefield Ranges Research Project. Scientific results. Vol. 2*. New York, American Geographical Society; Montreal, Arctic Institute of North America, 1970, p. 59–76.) [Investigations included study of optic-axis fabrics developed in the ice under changing stress conditions.]

BARANOWSKI, S. *Report on the field work of the Polish Spitsbergen expedition, summer 1970*. Wrocław, University of Wrocław, Geographical Institute, 1971. [i, 22] p. [Includes brief account of glaciological programme, carried out chiefly on Werenskioldbreen and Hansbreen, Hornsund region.]

BARKOV, N. I. Ravnovesnaya i minimal'naya tolshchina shel'fovykh lednikov Antarktidy [Equilibrium and minimal thickness of the ice shelves of Antarctica]. *Trudy Arkticheskogo i Antarkticheskogo Nauchno-Issledovatel'skogo Instituta*, Tom 294, 1970, p. 127–41.

BAUER, A., *and* SHUMSKIY, P. A. Travaux glaciologiques à Kerguelen et dans l'Antarctique. *École Pratique des Hautes Études—Sorbonne. Sixième Section: Sciences Économiques et Sociales. Contributions du Centre d'Études Arctiques et Finno-Scandinaves*, No. 8, 1970, [viii], 169 p. [Two parts: A. Bauer, "Premières données sur les glaciers actuels des Îles Kerguelen", p. 1–84; P. A. Shumskiy, "Glaciation de l'Antarctide", p. 85–169. The latter consists of extracts in French from: "Oledeneniye Antarktidy [Ice cover of Antarctica]". (*In* Bugayev, V. A., *and others, ed. Osnovnyye itogi izucheniya Antarktiki za 10 let* [*Main results of studying the Antarctic for ten years*]. [Edited by] V. A. Bugayev, P. A. Shumskiy, A. M. Gusev, S. N. Kartashov, I. Ya. Lapina. Moscow, Izdatel'stvo "Nauka", 1967, p. 27–75.)]

BOGORODSKIY, V. V., *and others*. Nekotoryye rezul'taty radiolokatsionnogo zondirovaniya arkticheskikh lednikov [Some results of radar sounding of Arctic glaciers]. [By] V. V. Bogorodskiy, L. S. Govorukha, B. A. Fedorov. *Trudy Arkticheskogo i Antarkticheskogo Nauchno-Issledovatel'skogo Instituta*, Tom 294, 1970, p. 87–93. [Work in Severnaya Zemlya since 1968.]

BOROVINSKIY, B. A. *Elektro- i seysmometricheskiye issledovaniya mnogoletnemerzlykh gornykh porud i lednikov* [*Electro- and seismometric studies of frozen ground and glaciers*]. Moscow, Izdatel'stvo "Nauka", 1969. 184 p. [Electrical conductivity of ice and permafrost; behaviour of seismic waves in ice and permafrost.]

BORTENSCHLAGER, S. Neue pollenanalytische Untersuchungen von Gletschereis und gletschernahen Mooren in den Ostalpen. *Zeitschrift für Gletscherkunde und Glazialgeologie*, Bd. 6, Ht. 1–2, 1970, p. 107–18. [Results of pollen analytical investigations of glacier ice from Kesselwandferner and of near-by peat bogs are presented and discussed.]

CLASSEN, D. F., *and* CLARKE, G. K. C. Basal hot spot on a surge type glacier. *Nature*, Vol. 229, No. 5285, 1971, p. 481–83. [Deep temperature measurements show temperate basal ice beneath Fox Glacier, Yukon Territory, Canada.]

EPSTEIN, S., *and others*. Climatological implications of stable isotope variations in deep ice cores, Byrd station, Antarctica, by S. Epstein and R. P. Sharp and A. J. Gow. *Antarctic Journal of the United States*, Vol. 6, No. 1, 1971, p. 18–20. [Presents conclusions drawn about Quaternary (Wisconsin) climate from preliminary oxygen- and hydrogen-isotopic analyses of the 1967 Byrd station core.]

FIENNES, R. Parachute drop to Jostedalsbre. *Geographical Magazine*, Vol. 43, No. 5, 1971, p. 319–25. [Well-illustrated popular account of glacier surveying and other activities of the British Jostedalsbre Expedition, Norway, 1970.]

GOVORUKHA, L. S. Balans vneshnego massoobmena lednikov Severnoy Zemli [Balance of external mass exchange of Severnaya Zemlya glaciers]. *Doklady Akademii Nauk SSSR*, Tom 192, No. 3, 1970, p. 603–06. [Data used to make first computations of the mass balance of these glaciers, which agree with evidence from other sources indicating retreat of glaciers at present time. English abstract in *Soviet-Bloc Research in Geophysics, Astronomy, and Space*, No. 237, 1970, p. 24–25.]

GOVORUKHA, L. S. Glyatsiologicheskiye issledovaniya Arkticheskogo i Antarkticheskogo Instituta v Arktike (1960–1969 gg.) [Glaciological studies of the Arctic and Antarctic Institute in the Arctic (1960–69)]. *Trudy*

Arkticheskogo i Antarkticheskogo Nauchno-Issledovatel'skogo Instituta, Tom 294, 1970, p. 5–11. [Summary of work on land ice in Soviet Arctic.]

GOVORUKHA, L. S. Raschet srednego knogoletnego byudzheta l'da v sisteme vneshnego massoobmena lednikovogo pokrova Severnoy Zemli [Calculating the mean long-term ice budget in the external mass balance of the ice cover of Severnaya Zemlya]. *Trudy Arkticheskogo i Antarkticheskogo Nauchno-Issledovatel'skogo Instituta*, Tom 294, 1970, p. 12–27. [Based on 1965 field work.]

GOVORUKHA, L. S., *and* BOGDASHEVSKIY, B. I. Osnovnyye cherty meteorologicheskogo i radiatsionnogo rezhima gornolednikovoy zony Byrranga [Main features of the meteorological and radiation regime of the Byrranga valley glacier zone]. *Izvestiya Vsesoyuznogo Geograficheskogo Obshchestva*, Tom 102, Vyp. 6, 1970, p. 536–42. [Recently discovered glacierized area of Taymyr.]

GOVORUKHA, L. S., *and* YEVSEYEV, M. P. Glyatsiologicheskaya i sinopticheskaya kharakteristika perioda ablyatsii na lednikakh arkhipelaga Severnaya Zemlya [Glaciological and synoptic characteristics of the ablation period on glaciers of the Severnaya Zemlya archipelago]. *Trudy Arkticheskogo i Antarkticheskogo Nauchno-Issledovatel'skogo Instituta*, Tom 294, 1970, p. 51–67. [Work of 1965 Soviet expedition.]

HALLIDAY, W. R., *and* ANDERSON, C. H., *jr.* Glacier caves. *Explorers Journal*, Vol. 48, No. 2, 1970, p. 131–35. [Description of the cave system beneath Paradise Glacier, Mt. Rainier, Washington, U.S.A.]

HANNSS, C. Les glaciers les plus méridionaux des Alpes: observations de morphologie glaciaire dans les Alpes Maritimes, versant italien. *Revue de Géographie Alpine*, Tom. 58, [Fasc.] 4, 1970, p. 620–48. [Recent oscillations of these glaciers described and their moraines examined as indicators of previous behaviour. Snow limits are compared with those of the eastern Alps.]

HOINKES, H. C. Methoden und Möglichkeiten von Massenhaushaltsstudien auf Gletschern. Ergebnisse der Messreihe Hintereisferner (Ötztaler Alpen) 1953–1968. *Zeitschrift für Gletscherkunde und Glazialgeologie*, Bd. 6, Ht. 1–2, 1970, p. 37–90. [Methods for estimating mass balance of glaciers described. Results of measurements on Hintereisferner, 1953–68, presented and implications for mass balance studies in general discussed.]

HOLDSWORTH, G. Mode of flow of Meserve Glacier, Wright Valley, Antarctica. *Dissertation Abstracts International*, B, Vol. 30, No. 10, 1970, p. 4661-B. [Conclusions drawn from observations within and on surface of glacier. Abstract of Ph.D. thesis, Ohio State University, 1969. University Microfilms order no. 70-6797.]

[ICELAND: GLACIERS.] The glaciers of Iceland. *Polar Record*, Vol. 14, No. 93, 1969, p. 833. [List and map.]

KASSER, P. Gründung eines "Permanent service on the fluctuations of glaciers". *Zeitschrift für Gletscherkunde und Glazialgeologie*, Bd. 6, Ht. 1–2, 1970, p. 193–200. [Aims of this service founded by the Federation of Astronomical and Geophysical Permanent Services and the International Council of Scientific Unions.]

KASSER, P. Remarques sur les variations des glaciers suisses et le réseau d'observations. *Zeitschrift für Gletscherkunde und Glazialgeologie*, Bd. 6, Ht. 1–2, 1970, p. 141–50. [Presents and discusses annual results of observations on frontal variations of 105 Swiss glaciers, and mass balance of 4 glaciers, between 1962–63 and 1967–68.]

KITANO, Y., *and others*. Migration of chemical elements through phases of the atmosphere, hydrosphere and lithosphere in the Juneau Glacier area. I, by Y. Kitano [and 7 others]. *Geochemical Journal*, Vol. 3, Nos. 2–3, 1969, p. 99–115. [Major chemical elements came mainly from sea-water, except for Ca^{+} and HCO_3^{-} supplied by dissolution of material in muddy sediments formed by glacial erosion. Ratio of borate to chloride is higher in glacial interstitial waters than in saline waters.]

KRUCHININ, YU. A. Geneticheskaya klassifikatsiya form mezorel'yefa shel'fovykh lednikov Antarktidy [Genetic classification of forms of mesorelief of Antarctic ice shelves]. *Trudy Arkticheskogo i Antarkticheskogo Nauchno-Issledovatel'skogo Instituta*, Tom 294, 1970, p. 107–26.

LISS, C.-C. Der Morenogletscher in der patagonischen Kordillere: sein ungewöhnliches Verhalten seit 1899 und der Eisdamm-Durchbruch des Jahres 1966. *Zeitschrift für Gletscherkunde und Glazialgeologie*, Bd. 6, Ht. 1–2, 1970, p. 161–80. [Describes the bursting of the ice dam formed by the Moreno glacier in the southern part of Lago Argentino in 1966. The unusual situation of the glacier may account for its advance, contrary to other glaciers in the region.]

MAAG, H. Ice dammed lakes and marginal glacial drainage on Axel Heiberg Island, Canadian Arctic Archipelago. *Axel Heiberg Island Research Reports, McGill University, Montreal. Jacobsen-McGill Arctic Research Expedition 1959–1962*, 1969, v, 147 p. [Effect of glacial melt water at margins and in tongue area of Arctic valley glaciers was investigated with reference to the role of different types of ice-dammed lakes in the drainage regime of the rivers.]

MARANGUNIC, C. La glaciología en Chile. *Instituto Antártico Chileno Boletín*, No. 5, 1970, p. 26–30. [Brief outline of some glaciological problems in Chile.]

MOSER, R. Der Schmiedstockgletscher—eine um 1850 beachtliche Vergletscherung im Dachsteingebiet. *Zeitschrift für Gletscherkunde und Glazialgeologie*, Bd. 6, Ht. 1–2, 1970, p. 211–14. [Situation and structure of terminal moraine indicate that this Austrian glacier has retreated considerably since 1850.]

PATZELT, G. Die Längenmessungen an den Gletschern der österreichischen Ostalpen 1890–1969. *Zeitschrift für Gletscherkunde und Glazialgeologie*, Bd. 6, Ht. 1–2, 1970, p. 151–59. [Measurements of variations of the fronts of glaciers in the Austrian Alps from 1890 to 1969. Percentages of advancing, retreating, and stationary glaciers are calculated and commented upon.]

PATZELT, G., *and* SLUPETZKY, H. Die Vertikalkomponente der Gletscherbewegung auf der Pasterze 1968–69 und ihr Einfluss auf die Berechnung der Massenbilanz. *Zeitschrift für Gletscherkunde und Glazialgeologie*, Bd. 6, Ht. 1–2, 1970, p. 119–27. [Vertical component of movement of Pasterze glacier was calculated to be 1.27 m/5.3 km² on tongue. Effect on calculation of mass balance discussed.]

ROBIN, G. DE Q., *and others*. Radio-echo sounding of the Antarctic ice sheet, by G. de Q. Robin, S. Evans, D. J. Drewry, C. H. Harrison and D. L. Petrie. *Antarctic Journal of the United States*, Vol. 5, No. 6, 1970, p. 229–32. [Report on S.P.R.I. and N.S.F. programme of long-range flights during 1969–70 season.]

SOONS, J. M. Capricious Franz Josef Glacier. *Geographical Magazine*, Vol. 43, No. 7, 1971, p. 490–94. [Recent fluctuations described.]

STENBORG, T. Studies of the hydrological characteristics of glaciers. *Meddelanden från Uppsala Universitets Geografiska Institutioner*, Ser. A, No. 245, 1970, 11 p. [Summary of author's papers: "Problems concerning winter run-off from glaciers", *Geografiska Annaler*, Vol. 47A, No. 3, 1965, p. 141–84; "Glacier drainage connected with ice structures", ibid., Vol. 50A, No. 1, 1968, p. 25–53; "Studies of the internal drainage of glaciers", ibid., Vol. 51A, Nos. 1–2, 1969, p. 13–41; and "Delay of run-off from a glacier basin", ibid., Vol. 52A, No. 1, 1970, p. 1–30.]

VIVIAN, R. Les variations récentes des glaciers dans les Alpes françaises (1900–1970). Possibilités de prévision. *Revue de Géographie Alpine*, Tom. 59, [Fasc.] 2, 1971, p. 229–42. [Describes studies on fluctuations of glaciers in French Alps since 1900. Discusses problems of forecasting glacier variations, with reference to data from Mer de Glace.]

VIVIAN, R., *and* COLLICARD, J.-P. Fiches des glaciers français. Les glaciers de Bellecôte. *Revue de Géographie Alpine*, Tom. 59, [Fasc.] 2, 1971, p. 271–74. [Summary of knowledge of this glacier.]

VIVIAN, R., *and* PACCALET, Y. Fiches des glaciers français. Le glacier de la Masse. *Revue de Géographie Alpine*, Tom. 59, [Fasc.] 2, 1971, p. 267–70. [Summary of knowledge of this glacier.]

WEERTMAN, J. Theory of water-filled crevasses in glaciers applied to vertical magma transport beneath oceanic ridges. *Journal of Geophysical Research*, Vol. 76, No. 5, 1971, p. 1171–83. [Problem of a liquid-filled crack in a horizontal elastic plate considered, the plate being subjected to a tensile stress and to gravity-induced hydrostatic pressure.]

WELSCH, W., *and* KINZL, H. Der Gletschersturz vom Huascarán (Peru) am 31 Mai 1970, die grösste Gletscherkatastrophe der Geschichte. *Zeitschrift für Gletscherkunde und Glazialgeologie*, Bd. 6, Ht. 1–2, 1970, p. 181–92. [Report of investigations into massive glacier avalanche in Peru, resulting from earthquake, presented and discussed.]

ICEBERGS, SEA, RIVER AND LAKE ICE

BRADFORD, J. D., *and* SMIRLE, S. M., *comp. Bibliography on northern sea ice and related subjects*. Ottawa, Ministry of Transport. Marine Operations and Dept. of Energy, Mines and Resources. Marine Sciences Branch, 1970. xiii, 188 p. [References cited refer mainly to subjects having a bearing on the operation of ships in ice.]

DANIELSON, E. W., *jr*. The surface heat budget of Hudson Bay. *McGill University. Marine Sciences Centre. Manuscript Report* No. 9, 1969, xii, 196 p. [Mean monthly heat fluxes, radiative and turbulent, through bay surface examined. Special emphasis on interrelation of ice cover and heat fluxes.]

DYUBKIN, I. A., *and* TOPORKOV, L. G. Temperatura i solenost' vod morya Deyvisa i vnutrivodnyy led [Temperature and salinity of the waters of the Davis Sea and frazil ice]. *Problemy Arktiki i Antarktiki*, Vyp. 35, 1970, p. 26–32.

EVANS, R. J., *and* UNTERSTEINER, N. Thermal cracks in floating ice sheets. *Journal of Geophysical Research*, Vol. 76, No. 3, 1971, p. 694–703. [Quantitative aspects of thermal cracking from a strength of materials viewpoint.]

GOLDBERG, F. Isön T-3. *Polarboken*, 1969–70 [pub. 1970], p. 130–40. [Work undertaken at scientific stations on ice islands, particularly T-3.]

GORBUNOV, YU. A., *and* CHUKANIN, K. I. Pereraspredeleniye l'dov v Vostochno-Sibirskom more po vliyaniyem atmosfernykh protsessov [Distribution of ice in the East Siberian Sea under the influence of atmospheric processes]. *Problemy Arktiki i Antarktiki*, Vyp. 35, 1970, p. 95–100.

GUDMANDSEN, P. Electromagnetic studies of sea ice. *Union Radio-Scientifique Internationale. Bulletin d'Information* No. 177, 1970, p. 7–9. [Mentions further studies required on dielectric properties of sea ice, remote sensing of sea ice, and wave propagation in inhomogeneous anisotropic ice structures.]

HERBERT, W. The first surface crossing of the Arctic Ocean. *Geographical Journal*, Vol. 136, Pt. 4, 1970, p. 511–33. [Appendix by R. M. Koerner, "Ice surface topography in the Arctic Ocean", p. 527–32. Regional and temporal variations in topography described. Measurements of snow accumulation reported.]

IVANOV, V. V., *and* KOMOV, N. I. Osobennosti vskrytiya ledyanogo pokrova na priust'yevom uchastke Yeniseya pri ekstremal'no nizkikh urovnyakh [Features of the break-up of ice in the Yenisey estuary at extremely low water levels]. *Problemy Arktiki i Antarktiki*, Vyp. 35, 1970, p. 19–25.

IZVEKOV, M. V. Nekotoryye rezul'taty nablyudeniy nad dreyfom l'da [Some results of observations of ice drift]. *Problemy Arktiki i Antarktiki*, Vyp. 35, 1970, p. 101–04. [Relations between wind speed and direction and pack ice speed and direction, observed at drifting stations in the Arctic Ocean.]

IZVEKOV, M. V. O koeffitsiyente izvilistosti sutochnogo dreyfa l'da [On the coefficient of wandering in the daily drift of ice]. *Trudy Arkticheskogo i Antarkticheskogo Nauchno-Issledovatel'skogo Instituta*, Tom 293, 1970, p. 151–53. [Difference between distance covered in a straight line and distance actually covered at drifting stations in the Arctic Ocean.]

JOHANNESSEN, O. M., *and others*. Cruise report from the ice drift study in the Gulf of St. Lawrence 1970, by O. M. Johannessen [and 7 others]. *McGill University. Marine Sciences Centre. Manuscript Report* No. 15, 1970, 53 p. [Observations on the different forces acting on an ice field and their effect on ice circulation reported from m.v. *Stephenville* frozen into large floe and allowed to drift for 27 days.]

JOHNSON, J. D., *and* FARMER, L. D. Use of side-looking air-borne radar for sea ice identification. *Journal of Geophysical Research*, Vol. 76, No. 9, 1971, p. 2138–55. [May be used to detect concentrations, floe size and number, and water openings, and to identify age of ice, ice drift, surface topography, fractures and pressure characteristics.]

JONES, G. H. S., *and* DIEHL, C. H. H. Iceberg tracking off Labrador. *Nature*, Vol. 229, No. 5281, 1971, p. 189–90. [Rate and direction of drift of 4 icebergs observed, 14–21 July 1970.]

LEGEN'KOV, A. P., *and* LOSHCHILOV, V. S. K voprosu o nablyudeniyakh za prilivnymi razrezheniyami i splocheniyami l'da [Observations on tidal compaction and diffusion of ice]. *Trudy Arkticheskogo i Antarkticheskogo Nauchno-Issledovatel'skogo Instituta*, Tom 293, 1970, p. 141–50.

LEWIS, E. L., *and* WALKER, E. R. The water structure under a growing sea ice sheet. *Journal of Geophysical Research*, Vol. 75, No. 33, 1970, p. 6836–45. [Data illustrating seasonal changes in temperature and salinity profile beneath an annual sea ice cover are presented and discussed.]

MAYKUT, G. A., *and* UNTERSTEINER, N. Some results from a time-dependent thermodynamic model of sea ice. *Journal of Geophysical Research*, Vol. 76, No. 6, 1971, p. 1550–75. [Conclusions drawn from application of model to central Arctic are discussed.]

MICHEL, B., *and* RAMSEIER, R. O. Classification of river and lake ice. *Canadian Geotechnical Journal*, Vol. 8, No. 1, 1971, p. 36–45. [Describes formation and structure and texture of the primary, secondary and superimposed layers making up an ice cover.]

NIKOLAYEV, S. YE. Vyranivaniye poverkhnosti mnogoletnikh l'dov metodom shpurovogo vzryvaniya [Levelling the surface of old ice by bore hole explosions]. *Problemy Arktiki i Antarktiki*, Vyp. 35, 1970, p. 105–08. [Quicker and easier method of levelling hummocky sea ice.]

NUTTALL, J. B. Observations on break-up of river ice in north central Alberta. *Canadian Geotechnical Journal*, Vol. 7, No. 4, 1970, p. 457–63. [Maximum size of moving ice can be almost as wide as the river and 4 or 5 times as long as this. Effect on bridge piers discussed.]

REEH, N. Natural frequency of the system of a heavy elastic plate covering shallow water. *Bygningsstatiske Meddelelser*, Vol. 41, No. 3, 1970, p. 167–87. [Relation between "kaneling" and long periodic waves produced during calving of icebergs led to studies on natural period of a glacier-fjord system. It was concluded that the finite difference method is suitable for solving complicated eigenvalue problems.]

SHESTERIKOV, N. P. Otsenka koeffitsiyenta teploprovodnosti snega kosvennym metodom [Evaluating the thermal conductivity coefficient of snow by the indirect method]. *Problemy Arktiki i Antarktiki*, Vyp. 35, 1970, p. 92–94. [Measurements in Arctic Ocean to determine effect of snow cover on sea ice.]

STRÜBING, K. Satellitenbild und Meereiserkundung. Ein methodischer Versuch für das Baltische Meer. *Deutsche Hydrographische Zeitschrift*, Jahrg. 23, Ht. 5, 1970, p. 193–213. [Promising results obtained for sea ice reconnaissance in the Baltic Sea by means of satellite pictures.]

SWITHINBANK, C. W. M. The use of satellite photography in studying the distribution of pack ice. *Proceedings of the Challenger Society*, Vol. 4, Pt. 2, 1970, p. 63. [Abstract of lecture describing how information obtained from ESSA-3 and ESSA-7 satellites may be used to select routes for shipping through Antarctic pack ice.]

UNTERSTEINER, N., *and* MAYKUT, G. A. Arktisches Meereis. *Zeitschrift für Gletscherkunde und Glazialgeologie*, Bd. 6, Ht. 1–2, 1970, p. 129–40. [Results presented and discussed of a thermodynamic model which describes growth and decay of sea ice.]

GLACIAL GEOLOGY

ANDREWS, J. T., *and* DUGDALE, R. E. Age prediction of glacio-isostatic strandlines based upon their gradients. *Geological Society of America. Bulletin*, Vol. 81, No. 12, 1970, p. 3769–72. [Strandline gradients decline exponentially towards the present. Relationship can be used to date strandlines in a sequence that already has some dating control.]

ARMSTRONG, R. L. Glacial erosion and the variable isotopic composition of strontium in sea water. *Nature, Physical Science*, Vol. 230, No. 14, 1971, p. 132–33. [Suggests erosion of Pre-Cambrian shields by continental glaciers would be effective means of adding radiogenic ^{37}Sr to the dissolved load output to the ocean.]

AVSYUK, G. A., *and* GROSVAL'D, M. G. Kaynozoyskaya istoriya oledeneniya i klimata Antarktidy [Cainozoic history of the glaciation and climate of Antarctica]. *Izvestiya Akademii Nauk SSSR. Seriya Geograficheskaya*, 1971, No. 1, p. 133–41. [Report of Oslo symposium, August 1970.]

BARANOWSKI, S. Some remarks on the origin of drumlins. *Geographia Polonica*, No. 17, 1969, p. 197–208. [Distribution of drumlins within a drumlin field and the "fluted moraine problem" discussed in relation to a suggested mechanism of drumlin formation.]

BROCHU, M. Pourcentage du matériel de nature cristalline et cristallophyllienne sur le littoral Gaspésien de l'estuaire maritime du Saint-Laurent, de la Baie de Gaspé et de la Baie des Chaleurs. *Bulletin de l'Association Française pour l'Étude du Quaternaire*, 6e An., No. 20, 1969, p. 207–16. [Study of deposits from the Gaspésian coast of the St. Lawrence estuary, from Gaspé Bay and from Chaleur Bay indicate origin was due to Quaternary glaciation.]

BROOKES, I. A. New evidence for an independent Wisconsin-age ice cap over Newfoundland. *Canadian Journal of Earth Sciences*, Vol. 7, No. 6, 1970, p. 1374–82. [Reinterpretation of the relative ages of glacial striae, and new evidence from erratic till-boulder provenances, support view that the island had its own ice cap at the last glacial maximum.]

CAILLEUX, A., *and* HAMELIN, L.-E. Poste-de-la-Baleine (Nouveau-Québec); exemple de géomorphologie complexe. *Revue de Géomorphologie Dynamique*, 19e An., No. 3, 1969–70 [pub. 1970], p. 128–50. [Deals with factors, such as Quaternary glaciation, affecting geomorphology of the Great Whale River, Quebec.]

CHEBOTAREVA, N. S. Die Flusstäler des Nordwestens der Russischen Ebene—ihr Aufbau und Alter. *Petermanns Geographische Mitteilungen*, Jahrg. 114, Quartalsht. 3, 1970, p. 173–85. [River valleys in north-west Russian plain, which was covered by Valday glaciation, were formed by action of disintegrating ice sheet.]

CLARK, R. A short note on small meltwater channels and "microchannels" at Shaftoe Crags, Northumberland. *Proceedings of the Yorkshire Geological Society*, Vol. 38, Pt. 1, 1970, p. 57–59. [Probable mode of formation beneath waning ice sheet described.]

COLHOUN, E. A. On the nature of the glaciations and final deglaciation of the Sperrin Mountains and adjacent areas in the north of Ireland. *Irish Geography*, Vol. 6, No. 2, 1970, p. 162–85. [Conclusions from field studies suggest there were probably 4 episodes of glaciations, 3 of Irish origin and one of Scottish.]

CONNALLY, G. G., *and* SIRKIN, L. A. Late Glacial history of the upper Wallkill Valley, New York. *Geological Society of America. Bulletin*, Vol. 81, No. 11, 1970, p. 3297–306. [Sequence of events during deglaciation followed and dated, and related to similar events in southern New England.]

CORNWALL, I. *Ice ages: their nature and effects*. London, John Baker Ltd.; New York, Humanities Press Inc., [c1970]. 180 p. [Glacial advance and retreat, and effect on Earth's surface (including flora and fauna) and climate, examined in sequence of lower, middle and upper Pleistocene periods and into post-glacial times.]

DIONNE, J.-C. Structures sédimentaires dans du fluvio-glaciaire, Lac-Saint-Jean, Québec. *Revue de Géographie de Montréal*, Vol. 24, No. 3, 1970, p. 255–63. [Comments on sedimentary structures formed after retreat of ice sheet.]

FLIRI, F., *and others*. Der Bänderton von Baumkirchen (Inntal, Tirol). Eine neue Schlüsselstelle zur Kenntnis der Würm-Vereisung der Alpen, [von] F. Fliri, S. Bortenschlager, H. Felber, W. Heissel, H. Hilscher, W. Resch. *Zeitschrift für Gletscherkunde und Glazialgeologie*, Bd. 6, Ht. 1–2, 1970, p. 5–35. [Radiocarbon and other evidence suggests that last glaciation of Inn valley, Austria, took place between about 20 000 and 11 300 B.P.]

GIDON, P. L'alternance glaciaire-interglaciaire au cours d'une glaciation majeure. *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, Sér. D, Tom. 271, No. 17, 1970, p. 1493–94. [Causes discussed of alternations of glaciations and interglacials during the course of a major glaciation.]

GIDON, P. Glaciations majeures et revolution galactique du système solaire. *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, Sér. D, Tom. 271, No. 4, 1970, p. 385–87. [Relationship suggested between major glaciations and time of revolution of solar system in galaxy.]

GRAF, W. L. The geomorphology of the glacial valley cross section. *Arctic and Alpine Research*, Vol. 2, No. 4, 1970, p. 303–12. [Results of this study show that the glacial valley cross section is a parabola rather than U-shaped, and also imply that the concept of the drainage basin as a geomorphic unit may be applied to a glacial as well as a fluvial situation.]

HARRISON, C. H. Reconstruction of subglacial relief from radio-echo sounding records. *Geophysics*, Vol. 35, No. 6, 1970, p. 1099–115. [Interpretation of results from Antarctica discussed in detail.]

HUGHES, T. Convection in the Antarctic ice sheet leading to a surge of the ice sheet and possibly to a new ice age. *Science*, Vol. 170, No. 3958, 1970, p. 630–33. [Antarctic surge theory of Pleistocene glaciation re-examined in the context of thermal convection theory applied to the Antarctic ice sheet.]

KUPETSKIY, V. N. Ob izmeneniyakh klimata, lednikov i solnechnoy aktivnosti [Changes of climate, glaciers and solar activity]. *Trudy Arkticheskogo i Antarkticheskogo Nauchno-Issledovatel'skogo Instituta*, Tom 294, 1970, p. 68–86. [Links between solar activity and glaciation.]

LAVERDIÈRE, C., *and* LENGELLÉ, J.-G. Trains de broutures glaciaires au Témiscamingue, Québec. *Revue de Géographie de Montréal*, Vol. 24, No. 3, 1970, p. 327–29. [Appearance and possible mode of formation of trains of glacial chattermarks discussed.]

LENGELLÉ, J.-G. Les bourrelets de congère de Luskville, Québec. *Revue de Géographie de Montréal*, Vol. 24, No. 3, 1970, p. 321–26. [Observations on protalus; mechanism of formation due to nivation described.]

LINDSEY, D. A. Glacial marine sediments in the Precambrian Gowganda Formation at Whitefish Falls, Ontario, Canada. *Palaeogeography, Palaeoclimatology, Palaeoecology*, Vol. 9, No. 1, 1971, p. 7–25. [Criteria suggested for recognition of glacial marine sediments based on well-defined characteristics.]

MANIA, D. Zur stratigraphischen Neugliederung des Mittelpleistozäns im Saalegebiet. *Petermanns Geographische Mitteilungen*, Jahrg. 114, Quartalsht. 3, 1970, p. 186–94. [Recent observations suggest new stratigraphical division of middle Pleistocene in the Saale region.]

MARGOLIS, S. V., *and* KENNETT, J. P. Antarctic glaciation during the Tertiary recorded in sub-Antarctic deep-sea cores. *Science*, Vol. 170, No. 3962, 1970, p. 1085–87. [Extent of planktonic foraminifera and glacially derived ice-rafted sands in cores may be associated with cooling and warming of the Southern Ocean during the Tertiary.]

ONESTI, L. J., *and* HINZE, W. J. Magnetic observations over eskers in Michigan. *Geological Society of America. Bulletin*, Vol. 81, No. 11, 1970, p. 3453–56. [A distinct variation in magnetic intensity exists between ice-laid and fluvio-glacial material; this corresponds to differences in concentration of magnetic materials, which are attributed to mode of transportation of these materials.]

PAGE, N. R. Subglacial limestone deposits in the Canadian Rocky Mountains. *Nature*, Vol. 229, No. 5279, 1971, p. 42–43. [Suggests deposits are the products of pressure melt water.]

PEACOCK, J. D. Marine shell radiocarbon dates and the chronology of deglaciation in western Scotland. *Nature, Physical Science*, Vol. 230, No. 10, 1971, p. 43–45. [Implications of findings discussed.]

REID, J. R., *jr*. Geomorphology and glacial geology of the Martin River Glacier, Alaska. *Arctic*, Vol. 23, No. 4, 1970, p. 254–67. [Detailed description of this drift-covered glacier.]

REID, J. R., *jr*. Glaciers—"living and dead". *Proceedings of the North Dakota Academy of Science*, Vol. 21, 1967, [pub.] 1969, p. 42–55. [Studies of dead-ice phenomena on Martin River Glacier, Alaska, used to explain dead-ice moraine features of the Missouri Couteau, North Dakota.]

REID, J. R., *jr*. Late Wisconsin and Neoglacial history of the Martin River Glacier, Alaska. *Geological Society of America. Bulletin*, Vol. 81, No. 12, 1970, p. 3593–604. [Conclusions summarized about fluctuations of glacier with reference to its history and implications of close proximity of Neoglacial limit and outermost terminal moraine discussed.]

REX, R. W., *and others*. Possible interglacial dune sands from 300 meters water depth in the Weddell Sea, Antarctica, by R. W. Rex, S. V. Margolis, B. Murray. *Geological Society of America. Bulletin*, Vol. 81, No. 11, 1970, p. 3465–72. [Examination of naturally well-sorted sand samples obtained from Berkner Bank suggest bank may have been exposed at surface of sea during an interglacial period.]

RUTSCH, R. F. Eine vergessene Veröffentlichung über erratische Blöcke. *Mitteilungen der Naturforschenden Gesellschaft in Bern*, Neue Folge, Bd. 27, 1970, p. 6–8. [Draws attention to little-known publication on erratic blocks by F. E. Bruckmann in 1742.]

SCHERMERHORN, L. J. G. Upper Ordovician glaciation in northwest Africa? Discussion. *Geological Society of America. Bulletin*, Vol. 82, No. 1, 1971, p. 265–68. [Concludes that this is unlikely. Reply by R. W. Fairbridge, p. 269–74.]

SELBY, M. J., *and* WILSON, A. T. Origin of the Labyrinth, Wright Valley, Antarctica. *Geological Society of America. Bulletin*, Vol. 82, No. 2, 1971, p. 471–76. [Suggests origin of this formation is not glacial, but due to salt weathering along major joints.]

SELBY, M. J., *and* WILSON, A. T. Possible Tertiary age for some Antarctic cirques. *Nature*, Vol. 229, No. 5287, 1971, p. 623–24. [Ice-free cirques in upper Wright Valley described and possible mode of formation and age discussed.]

SEREBRYANNYY, L. R., *and* RAUKAS, A. V. Über die eiszeitliche Geschichte der Russischen Ebene im oberen Pleistozän. *Petermanns Geographische Mitteilungen*, Jahrg. 114, Quartalsht. 3, 1970, p. 161–72. [Discusses multiple continental glaciations taking place in Russian plain during Pleistocene.]

SUGDEN, D. E. Landforms of deglaciation in the Cairngorm mountains, Scotland. *Institute of British Geographers. Transactions*, No. 51, 1970, p. 201–19. [Reinterpretation of characteristic patterns of melt-water channels and fluvio-glacial drift.]

TOMIRDIARO, S. V. Oledeneniye arkticheskogo basseyna v pleystotsene i yego svyaz' s nazemnym i podzemnym oledeneniyem sushi [Glaciation of the Arctic basin in the Pleistocene and its link with surface and underground glaciation of the land]. *Trudy Arkticheskogo i Antarkticheskogo Nauchno-Issledovatel'skogo Instituta*, Tom 294, 1970, p. 172–82. [Speculation about extent and nature of glaciation.]

VEYRET, P. Processus de l'érosion et de l'accumulation glaciaires en action. Observations sur certains glaciers en crue du Massif du Mont Blanc (étés 1968–70). *Revue de Géographie Alpine*, Tom. 59, [Fasc.] 2, 1971, p. 155–70. [Result of 3 years' observations on erosion, and accumulation of material, caused by glacial progression.]

WAGNER, W. P., *and* ESCHMAN, D. F. A probable Late Pinedale terminal moraine in Castle River Valley, Alberta: discussion. *Geological Society of America. Bulletin*, Vol. 81, No. 12, 1970, p. 3773–74. [Alternative to A. M. Stalker's hypothesis is suggested; reply by Stalker, p. 3775–78.]

FROST ACTION ON ROCKS AND SOIL. FROZEN GROUND. PERMAFROST

BAULIN, V. V. Vliyaniye tektoniki na merzlotnyye protsessy [Influence of tectonics on processes in frozen soil]. *Izvestiya Akademii Nauk SSSR. Seriya Geograficheskaya*, 1970, No. 6, p. 75–79. [Based on studies in West Siberian lowland.]

BROWN, R. J. E. Occurrence of permafrost in Canadian peatlands. *Canada. National Research Council. Division of Building Research. Research Paper* No. 432, 1970, [8] p. [General review. Reprinted from *Proceedings, third International Peat Congress held in Quebec, Canada, 18–23 August 1968*, p. 174–81.]

BROWN, R. J. E. Permafrost as an ecological factor in the subarctic. (*In Ecology of the subarctic regions. Proceedings of the Helsinki symposium [held 25 July to 3 August 1966]*. Paris, UNESCO, 1970, p. 129–40. (Ecology and Conservation, 1.)) [Describes occurrence and influence of permafrost. Also published as *Canada. National Research Council. Division of Building Research. Technical Paper* No. 313, 1970.]

BROWN, W. G., *and* JOHNSTON, G. H. Dikes on permafrost: predicting thaw and settlement. *Canadian Geotechnical Journal*, Vol. 7, No. 4, 1970, p. 365–71. [Method developed based on heat conduction theory. Good agreement with observed rates.]

CAILLEUX, A. Dénomination descriptive et génétique des fentes de cryoturbation. *Revue de Géographie de Montréal*, Vol. 24, No. 3, 1970, p. 310–13. [Terminology and description of different products of cryoturbation.]

DIONNE, J.-C. Fentes en coin fossile dans la région de Québec. *Revue de Géographie de Montréal*, Vol. 24, No. 3, 1970, p. 313–18. [Discovery and appearance of fossil ice wedges in this area described.]

FREEZE, R. A., *and* BANNER, J. A. An instrumented experimental site for the investigation of soil moisture, frost, and groundwater discharge. *Canada. Dept. of Energy, Mines and Resources. Inland Waters Branch. Technical Bulletin* No. 21, 1970, vii, 29 p., table [in end-pocket]. [Summarizes first year's results.]

FURRER, G., *and* FITZE, P. Beitrag zum Permafrostproblem in den Alpen. *Naturforschende Gesellschaft in Zürich. Viertelsschrift*, Jahrg. 115, Ht. 3, 1970, p. 353–68. [Review of work on permafrost in the Swiss Alps.]

GANGLOFF, P. Structures de gélisols reliques dans la région de Montréal. *Revue de Géographie de Montréal*, Vol. 24, No. 3, 1970, p. 241–53. [Study of fossil ice wedges and attempt to date them.]

GERHOLD, N. Blockgletscher im Ötztal. *Tiroler Heimatblätter*, 45 Jahrg., Ht. 10–12, 1970, p. 107–14. [Describes formation and occurrence of rock glaciers in Ötztaler Alpen.]

HANSEN, K. Geological and geographical investigations in Kong Frederik IX's Land; morphology, sediments, periglacial processes and salt lakes. *Meddelelser om Grønland*, Bd. 188, Nr. 4, 1970, 77 p. [Field work in West Greenland in 1962 and 1965.]

HARRISON, S. S. Note on the importance of frost weathering in the disintegration and erosion of till in east-central Wisconsin. *Geological Society of America. Bulletin*, Vol. 81, No. 11, 1970, p. 3407–10. [Presence of glacial till along creek banks and other locations suggests frost weathering might be major factor contributing to stream bank erosion in this region.]

HIGUCHI, K., *and* FUJII, Y. Permafrost at the summit of Mount Fuji, Japan. *Nature*, Vol. 230, No. 5295, 1971, p. 521. [First report in Japan. Mean depth 64.3 cm, mean altitude 3 732 m, not on south-facing slope.]

HOPPE, G. Från köldens domäner: den ständiga tjälen. *Forskning och Framsteg*, 1970, No. 5, p. 27–31. [General account of permafrost and some of its manifestations.]

JAHN, A. Soil movements under the influence of freezing. (*In Ecology of the subarctic regions. Proceedings of the Helsinki symposium [held 25 July to 3 August 1966]*. Paris, UNESCO, 1970, p. 119–23. (Ecology and Conservation, 1.)) [General discussion of nature of and factors affecting soil movement in Arctic and sub-Arctic regions.]

KAPLAR, C. W. Phenomenon and mechanism of frost heaving. *Highway Research Record*, No. 304, 1970, p. 1–13. [Explanation of frost action on soils, based on the hypothesis that liquid films existing between particles and an ice lens are the focal centres of energy for the heaving process.]

KAPLINA, T. N., *and* ROMANOVSKIY, N. N. O mekhanizme rosta singenetischeskikh povtorno-zhil'nykh l'dov [Growth mechanism of repeated syngenetic ice veins in permafrost]. *Merzlotnyye Issledovaniya*, Vyp. 9, 1969, p. 47–56. [Observations of relation between segregation ice inclusion and ice veins.]

MACKAY, J. R. Disturbances to the tundra and forest tundra environment of the western Arctic. *Canadian Geotechnical Journal*, Vol. 7, No. 4, 1970, p. 420–32. [Topographic consequences of man-induced tundra damage discussed. Thermokarst subsidence, not thermal erosion, is the dominant result of such damage.]

MACPHERSON, J. G., *and others*. Dikes on permafrost foundations in northern Manitoba, by J. G. Macpherson and G. H. Watson and A. Koropatnick. *Canadian Geotechnical Journal*, Vol. 7, No. 4, 1970, p. 356–64. [Describes design and construction of reservoir dikes for a generating station situated in a region of discontinuous permafrost.]

MITCHELL, G. F. Fossil pingos in the south of Ireland. *Nature*, Vol. 230, No. 5288, 1971, p. 43–44. [Several examples described.]

OUTCALT, S. I. A study of time dependence during serial needle ice events. *Archiv für Meteorologie, Geophysik und Bioklimatologie*, Ser. A, Vol. 19, No. 3, 1970, p. 329–37. [Useful data concerning the course of needle ice growth near the soil surface can be gained from a study of the surface temperature-heave record.]

PÉWÉ, T. L. Permafrost and vegetation on flood-plains of subarctic rivers (Alaska): a summary. (*In Ecology of the subarctic regions. Proceedings of the Helsinki symposium [held 25 July to 3 August 1966]*. Paris, UNESCO, 1970, p. 141–42. (Ecology and Conservation, 1.)) [Four phases of flood-plain recognized, based on drainage patterns and distribution of vegetation.]

PIIROLA, J. Frost-sorted block concentrations in western Inari, Finnish Lapland. *Fennia*, 99, No. 2, 1969, 35 p. [Observations of effect of gradient, exposure and elevations of slopes. Also in *Publicationes Instituti Geographici, Universitatis Helsingiensis*, Ser. A, 71, 1969.]

POIRIER, J. Fente de gel fossile aux Îles-de-la-Madeleine, Québec. *Revue de Géographie de Montréal*, Vol. 24, No. 3, 1970, p. 319–20. [Brief description of fossil ice wedge.]

RAPP, A. Some geomorphological processes in cold climates. (*In Ecology of the subarctic regions. Proceedings of the Helsinki symposium [held 25 July to 3 August 1966]*. Paris, UNESCO, 1970, p. 105–14. (Ecology and Conservation, 1.)) [General review of frost-weathering, frost-heaving, creep, boulder depressions, block fields, sorted polygons, solifluction and permafrost.]

SALMI, M. Investigations on palsas in Finnish Lapland. (*In Ecology of the subarctic regions. Proceedings of the Helsinki symposium [held 25 July to 3 August 1966]*. Paris, UNESCO, 1970, p. 143–53. (Ecology and Conservation, 1.)) [External and internal structure, relation to surrounding ground, and development.]

SCHENK, E. Permafrost and frost structures in the subarctic area. (*In Ecology of the subarctic regions. Proceedings of the Helsinki symposium [held 25 July to 3 August 1966]*. Paris, UNESCO, 1970, p. 155–59. (Ecology and Conservation, 1.)) [Discussion of factors affecting formations such as patterned ground and palsas.]

SISKO, R. K. Termoabrazionnyye berega arkticheskikh morey (na primere O. Novaya Sibir') [Thermo-abrasion shores of Arctic seas (on the example of Ostrov Novaya Sibir')]. *Trudy Arkticheskogo i Antarkticheskogo Nauchno-Issledovatel'skogo Instituta*, Tom 294, 1970, p. 183–94. [Erosion of frozen ground by sea-water.]

SVENSSON, H. Frozen-ground morphology of northeasternmost Norway. (*In Ecology of the subarctic regions. Proceedings of the Helsinki symposium [held 25 July to 3 August 1966]*. Paris, UNESCO, 1970, p. 161–68. (Ecology and Conservation, 1.)) [Palsas and fossil ice-wedge polygons described.]

METEOROLOGICAL AND CLIMATOLOGICAL GLACIOLOGY

ALKEZWEENY, A. J. Freezing of supercooled water droplets due to collision. *Journal of Applied Meteorology*, Vol. 8, No. 6, 1969, p. 994–95. [Observations from field work.]

BENJEY, W., *and* LOUGEAY, R. L. Climatological investigations in the Icefield Ranges, summer 1965. Part 1: upper air wind patterns in the St. Elias Mountains, summer, 1965, by W. Benjey. Part 2: microclimatological studies over the Seward Glacier snowpack, by R. L. Lougeay. *Arctic Institute of North America. Research Paper* No. 54, 1969, 102 p. [Results of field studies in Yukon Territory, Canada. Also published in modified form in Bushnell, V. C., *and* Ragle, R. H., *ed. Icefield Ranges Research Project. Scientific results. Vol. 2*. New York, American Geographical Society; Montreal, Arctic Institute of North America, 1970, p. 3–26.]

BIGG, E. K. Comments on "Ice nucleus measurements at three sites in western Washington State". *Journal of the Atmospheric Sciences*, Vol. 27, No. 8, 1970, p. 1218–19. [Comments on paper (title as quoted) by P. V. Hobbs and J. D. Locatelli, ibid., No. 1, 1970, p. 90–100, and reply by Hobbs, p. 1219.]

DOLGIN, I. M. Subarctic meteorology. (*In Ecology of the subarctic regions. Proceedings of the Helsinki symposium [held 25 July to 3 August 1966]*. Paris, UNESCO, 1970, p. 41–61. (Ecology and Conservation, 1.)) [Circulation of atmosphere, radiation, wind, temperature and precipitation in northern U.S.S.R.]

ROEN, S. Tåke- og rimdannelse langs våre vassdrag vinterstid. *Norsk Geografisk Tidsskrift*, Bd. 23, Ht. 4, 1969, p. 201–04. [Formation of frost mist and hoar-frost along Norwegian coast and inland waters.]

SNOW

AUER, A. H., *jr*. Some large snowflakes. *Weather*, Vol. 26, No. 3, 1971, p. 101, 121–22. [Describes 3 to 6 cm diameter snow-flakes, which fell on 24 September 1970 at Laramie, Wyoming.]

[AVALANCHES.] Avalanches and avalanche defence. Translations of seventeen Russian articles. *Canada. National Research Council. Division of Building Research. Technical Translation* 1383, 1969, 162 p. [Articles translated from *Trudy pervogo Vsesoyuznogo Soveshchaniya po Lavinam*. Leningrad, Gidrometeoizdat, 1965, p. 58–83,

97–116, 131–91, 204–14; and from *Rudovodstvo po snegolavinnym rabotam (vremennoye)*. Leningrad, Gidrometeoizdat, 1965, p. 57–68, 179–87.]

Booth, B. J. Dew-point temperature as a snow predictor. *Meteorological Magazine*, Vol. 99, No. 1181, 1970, p. 363–67. [Correlation found between type of precipitation and dew-point temperature, dew-points of 0° and −1°C being critical values for, respectively, non-showery and showery precipitation.]

Clarke, P. C. Two snowstorms in a day. *Weather*, Vol. 26, No. 3, 1971, p. 122–24. [Two relatively heavy snowfalls from 2 separate causes in Surrey on 4 March 1970.]

Clouston, C. Snow rollers. *Meteorological Magazine*, Vol. 100, No. 1183, 1971, p. 63–64. [Note of observations which appeared in *Symon's Rainfall Circular* for March 1865.]

Damon, R. H., *jr.* White Mountain avalanche hazard. *Appalachia*, Vol. 36, No. 13, 1970, p. 40–51. [Routes in New Hampshire mountains, U.S.A., where avalanches are likely to occur.]

DeWalle, D. R., *and* Meiman, J. R. Energy exchange and late season snowmelt in a small opening in Colorado subalpine forest. *Water Resources Research*, Vol. 7, No. 1, 1971, p. 184–88. [Two-day melt of a late-lying snow-patch was largely due to net radiation and sensible heat exchange.]

Eichenlaub, V. L. Lake effect snowfall to the lee of the Great Lakes: its role in Michigan. *Bulletin of the American Meteorological Society*, Vol. 51, No. 5, 1970, p. 403–12. [30% of seasonal snowfall derived from lake–atmosphere interactions. Evidence suggests effect has increased recently, possibly owing to general cooling of winter temperatures.]

Federer, B. Neutron activation determination of the acrosol content of Greenland snow. *Pure and Applied Geophysics*, Vol. 79, 1970/II, p. 120–27. [Measurements of Na, Cl and SO_4 concentrations as a function of time showed that the SO_4 to Cl ratio in polar snow was 20 times greater than in sea-water, and that the concentrations of SO_4 and sea-salt are parallel in time over the period 1880–1968. Results are discussed.]

Ferguson, L. "Armored snowballs" and the introduction of coarse terrigenous material into sea-ice. *Journal of Sedimentary Petrology*, Vol. 40, No. 3, 1970, p. 1057–60. [Phenomenon described suggests mechanism for introduction of coarse and angular material into sea ice.]

Gardner, N. C., *and* Judson, A. Artillery control of avalanches along mountain highways. *U.S. Dept. of Agriculture. Forest Service. Research Paper* RM-61, 1970, [iv], 26 p. [Planning and operational procedure discussed.]

[International Hydrological Decade.] *Snow hydrology. Proceedings of the Workshop Seminar sponsored by Canadian National Committee for the International Hydrological Decade and the University of New Brunswick, February 28 and 29, 1968.* Ottawa, Secretariat, Canadian National Committee for the International Hydrological Decade, [1970]. xii, 82 p. [Contains the following papers: W. W. Jeffrey, "Snow hydrology in the forest environment", p. 1–19; D. M. Gray, "Snow hydrology of the prairie environment", p. 21–31; J. R. Meiman, "Snow accumulation related to elevation, aspects and forest canopy", p. 35–47; G. A. McKay, "Problems of measuring and evaluating snowcover", p. 49–62; W. Viessman, Jr., "The synthesis of snowmelt hydrographs", p. 67–75.]

Jumikis, A. R. Aerodynamic snow fences to control snowdrifting on roads. (*In* Snow removal and ice control research. Proceedings of an international symposium held April 8–10, 1970. [*U.S.*] *Highway Research Board. Special Report* 115, 1970, p. 210–19.) [Discusses various aspects of snow-drift control by fences, including where to put them and which kind to use.]

MacCallum, R. E., *and* Chelchowski, W. Snow formations. *Weather*, Vol. 26, No. 3, 1971, p. 120. [Two photographs, one of snow rollers and the other of patterns in drifted snow.]

Marcus, M. G., *and* Ragle, R. H. Snow accumulation in the Icefield Ranges, St. Elias Mountains, Yukon. *Arctic and Alpine Research*, Vol. 2, No. 4, 1970, p. 277–92. [Snowpack record for 13-year period summarized and interpreted, with particular emphasis on the 1964–65 glacier balance year.]

Markin, V. A. K kharakteristike usloviy akkumulyatsii snezhnykh osadkov na lednikovom pokrove Shpitsbergena [Characteristics of snow accumulation on the ice cover of Spitsbergen]. *Trudy Arkticheskogo i Antarkticheskogo Nauchno-Issledovatel'skogo Instituta*, Tom 294, 1970, p. 39–50. [Observations 1965–67.]

Matveyev, A. A. Chemical hydrology of regions of east Antarctica. *Journal of Geophysical Research*, Vol. 75, No. 18, 1970, p. 3686–90. [Results of determination of the chemical composition of samples of atmospheric precipitation, snow, and ice, collected from 3 distinct zones (coastal strip, oasis, inland), are compared and discussed.]

Mellor, M. Brief review of snowdrifting research. (*In* Snow removal and ice control research. Proceedings of an international symposium held April 8–10, 1970. [*U.S.*] *Highway Research Board. Special Report* 115, 1970, p. 196–209.) [Present ideas on basic mechanisms of snow transport outlined and related to engineering research on snow-drift control measures.]

Perla, R. I. On contributory factors in avalanche hazard evaluation. *Canadian Geotechnical Journal*, Vol. 7, No. 4, 1970, p. 414–19. [Results from Utah for large avalanches indicate that precipitation intensity and wind direction are the most important factors.]

Perla, R. I., *and* LaChapelle, E. R. A theory of snow slab failure. *Journal of Geophysical Research*, Vol. 75, No. 36, 1970, p. 7619–27. [New model proposed wherein critical value of maximum principal stress evaluated at the tensile zone is coupled to inability of slab to sustain basal stress.]

Pruitt, W. O., *jr.* Some ecological aspects of snow. (*In Ecology of the subarctic regions. Proceedings of the Helsinki symposium [held 25 July to 3 August 1966]*. Paris, UNESCO, 1970, p. 83–97. (Ecology and Conservation, 1.)) [Adaptation by animals and plants to taiga and tundra snows; these 2 types of snow cover are described in some detail.]

Radok, U. Wissenschaft gegen das eisige Schneefegen! *Polarforschung*, Bd. 7, Jahrg. 40, Nr. 1–2, 1970, p. 73–88. [Reviews mechanism of snow drifting.]

Schaerer, P. A. Planning defences against avalanches. *Canadian Geotechnical Journal*, Vol. 7, No. 4, 1970, p. 397–404. [Design of defence system depends on objectives of defence, terrain, and characteristics of avalanches. Economical and operational factors discussed.]

SCHMIDT, R. A., *jr.* Locating snow fences in mountainous terrain. (*In* Snow removal and ice control research. Proceedings of an international symposium held April 8–10, 1970. [*U.S.*] *Highway Research Board. Special Report* 115, 1970, p. 220–25.) [Transport of snow by wind and airflow over irregular terrain must both be considered; several individual cases are discussed.]

THEAKSTON, F. H. Model technique for controlling snow on roads and runways. (*In* Snow removal and ice control research. Proceedings of an international symposium held April 8–10, 1970. [*U.S.*] *Highway Research Board. Special Report* 115, 1970, p. 226–30.) [Laboratory model tests on snow drifting, illustrating patterns of drifting round fences and buildings. Implications discussed.]

TUSHINSKIY, G. K., *ed. Lavinoopasnyye rayony Sovetskogo Soyuza* [*Regions of the Soviet Union where there is danger from avalanches*]. Moscow, Izdatel'stvo Moskovskogo Universiteta, 1970. 199 p. [Estimated danger in various mountain areas.]

VOLODNICHEVA, N. A. Snezhnyy pokrov Kamchatki [Snow cover of Kamchatka]. *Informatsionnyy Sbornik o Rabotakh po Mezhdunarodnomu Geofizicheskomu Godu*, No. 15, 1970, p. 113–31. [General characteristics of heavy snowfall area.]

WILGAIN, S. *Radioactivité atmosphérique artificielle. Base Roi Baudouin, 1 fév. 1966–31 déc. 1966. Détermination du Sr-90 et du taux d'accumulation de la neige en un point situé à 100 km au sud de la Base Roi Baudouin.* Bruxelles, Exantar, 1969. 35 p. (Expédition Antarctique Belgo-Néerlandaise 1966.) [Measurement of strontium-90 fall-out at ground level and its vertical distribution in a snow sample.]