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.

CONFERENCES

GUDMANDSEN, P., *ed. Proceedings of the international meeting on radioglaciology, Lyngby, May 1970*. Lyngby, Technical University of Denmark, Laboratory of Electromagnetic Theory, 1970. viii, 170 leaves. [Proceedings of conference: 22 papers.]

[INTERNATIONAL ASSOCIATION OF HYDRAULIC RESEARCH.] *I.A.H.R. symposium: ice and its action on hydraulic structures, Reykjavik, Iceland, [8]–10 September 1970*. [Delft, International Association of Hydraulic Research, 1971.] [iv], [659] p. [Proceedings of symposium. For details of some individual papers see elsewhere in this list.]

GENERAL GLACIOLOGY

ADAMS, W. P. Snow in education or vice versa. *Proceedings of the* 28th *annual Eastern Snow Conference*, 1971, p. 9–16. [Discusses possibilities of snow as a useful medium in the teaching of various school and university subjects, mentioning recent developments in Ontario schools.]

BELCHER, D., *and others*. Mariner photography of Mars and aerial photography of Earth: some analogies, [by] D. Belcher, J. Veverka and C. Sagan. *Icarus*, Vol. 15, No. 2, 1971, p. 241–52. [Glacial moraines, sand dunes and thermokarst features were identified; evidence is presented in support.]

CRARY, A. P., *ed. Antarctic snow and ice studies II*. Washington, D.C., American Geophysical Union, 1971. ix, 412 p. (Antarctic Research Series, Vol. 16.) [For details of individual papers, see elsewhere in this list.]

DELSEMME, A. H., *and* MILLER, D. C. Physico-chemical phenomena in comets—III. The continuum of comet Burnham (1960 II). *Planetary and Space Science*, Vol. 19, No. 10, 1971, p. 1229–57. [Likely existence of halo of large ice particles surrounding the nucleus and their effect.]

DELSEMME, A. H., *and* MILLER, D. C. Physico-chemical phenomena in comets—IV. The C_2 emission of comet Burnham (1960 II). *Planetary and Space Science*, Vol. 19, No. 10, 1971, p. 1259–74. [Model assumes ice grains in halo vapourize "emitters".]

JAHN, A. *Lód i zlodowacenia* [*Ice and glaciations*]. Warszawa, Panstwowe Wydawnictwo Naukowe, [c1971]. 316 p. [Sections deal with glaciers, ground ice and floating ice (river, lake and sea).]

KOBAYASHI, T. Sukēto-rinku no kōri no chōsa [Investigation of ice in skating rinks]. *Seppyō*, Vol. 31, No. 5, 1969, p. 126–28.

KONOVALOV, G. V. *Glyatsio-geomorfologicheskaya kharakteristika zapadnoy chasti vostochnoy Antarktidy* [*Glaciological and geomorphological characteristics of the western part of eastern Antarctica*]. Leningrad, Gidrometeorologicheskoye Izdatel'stvo, 1971. 123 p. [Enderby Land and Dronning Maud Land.]

KUSUNOKI, K. Nankyoku no seppyō kenkyū [Glaciological research in the Antarctic]. *Shizenkagaku to Hakubutsukan*, Vol. 37, Nos. 9–10, 1970, p. 197–205.

SHARP, R. P., *and others*. The surface of Mars. 4. South polar cap, [by] R. P. Sharp, B. C. Murray, R. B. Leighton, L. A. Soderblom and J. A. Cutts. *Journal of Geophysical Research*, Vol. 76, No. 2, 1971, p. 357–68. [Implications of observations of physical features from Mariner photographs are discussed with respect to the physical nature, distribution, thickness and behaviour of the pole-cap frost.]

GLACIOLOGICAL INSTRUMENTS AND METHODS

ARDEN, R. S. Instrumentation for ice investigations in the Niagara River. (*In* [International Association of Hydraulic Research.] *I.A.H.R. symposium: ice and its action on hydraulic structures, . . . 1970*, [1971], paper 1.3, 16 p.) [Survey of instruments used to measure and record water temperature, and equipment to facilitate observation of frazil and anchor ice in natural water environment. Discussion, p. 15–16.]

EVENSON, E. B. A method for 3-dimensional microfabric analysis of tills obtained from exposures or cores. *Journal of Sedimentary Petrology*, Vol. 40, No. 2, 1970, p. 762–64. [Detailed description of technique.]

HARRISON, C. H. Radio-echo sounding: focusing effects in wavy strata. *Geophysical Journal of the Royal Astronomical Society*, Vol. 24, No. 4, 1971, p. 383–400. [An airborne system employing a wide downward-looking beam has produced records of the Antarctic ice sheet containing fault-like, near-vertical lines through the strata of partially-reflecting layers within the ice. Suggests that interpretation of lines as near-vertical faults is incorrect, and an explanation is given developing the geometry of specularly reflected echoes from a stack of continuous undulating strata.]

IVANOV, V. B. K voprosu opredeleniya orientirovki kristallov pri krupnozernistoy strukture l'da [Determining crystal orientation of coarse-grained ice]. *Vestnik Leningradskogo Universiteta*, Seriya Geologii i Geografii, 1971, No. 12, p. 150–52. [Using modified Brandis eclymeter and special goniometer table. English abstract, p. 152.]

SCHMIDT, R. A., *and* HOLUB, E. W. Calibrating the snow particle counter for particle size and speed. *U.S. Dept. of Agriculture. Forest Service. Research Note* RM-189, 1971, 8 p. [Laboratory calibration shows the photoelectric counter gives useful estimates of size and speed although adjustments will be necessary for optimum performance in the field.]

WEISS, H. V. Determination of selenium in glacial ice by radioactivation. *Analytica Chimica Acta*, Vol. 56, No. 1, 1971, p. 136–39. [Description of technique.]

PHYSICS OF ICE

BABCOCK, R. V. Traces and fields in ice. *Dissertation Abstracts International*, B, Vol. 31, No. 5, 1970, p. 2915. [Theoretical study of equilibrium distribution of ionic and Bjerrum defects in ice with electric field. Abstract of Ph.D. thesis, Carnegie-Mellon University, 1970. University Microfilms order no. 70-20893.]

BABCOCK, R. V., *and* LONGINI, R. L. Equilibrium structure of polarized ice. *Journal of Chemical Physics*, Vol. 56, No. 1, 1972, p. 344-53. [Theoretical study of distribution of ionic and Bjerrum defects.]

BALES, B. L., *and* KEVAN, L. EPR studies of multiple Ag^0 trapping sites produced in gamma irradiated frozen $AgNO_3$ ices. *Journal of Chemical Physics*, Vol. 55, No. 3, 1971, p. 1327–36. [At 77 K neutral silver is formed in several magnetically distinct sites. On heating these states decay. Results discussed in terms of L-defect formation.]

BALOW, M. J. Sputtering of ice grains in HII regions. *Nature, Physical Science*, Vol. 232, No. 33, 1971, p. 152–53. [Letter. Draws attention to an error in paper by W. G. Mathews, *Astrophysical Journal*, Vol. 157, No. 2, 1969, p. 583–99, which results in gross overestimate of sputtering.]

BAXTER, R. J. Eight-vertex model in lattice statistics. *Physical Review Letters*, Vol. 26, No. 14, 1971, p. 832–33. [Solution of statistical mechanical model which includes the 2-dimensional ice model as a special case.]

CARTER, D. Brittle fracture of snow ice. (*In* [International Association of Hydraulic Research.] *I.A.H.R. symposium: ice and its action on hydraulic structures, . . . 1970*, [1971], paper 5.2, 10 p.) [Derivation of brittle fracture criteria for both tensile and compressive tests by means of energy balance considerations. Discussion, p. 9–10.]

CHESSIN, H., *and* VONNEGUT, B. Lattice spacings of pseudobinary solid solutions of silver bromide and silver iodide. *Journal of the American Chemical Society*, Vol. 93, No. 19, 1971, p. 4964–66. [Letter. Results for closest atom separations compared with that of ice and related to disregistry between ice and the solid solutions.]

CORIELL, S. R., *and others*. A non-linear analysis of experiments on the morphological stability of ice cylinders freezing from aqueous solutions, by S. R. Coriell and S. C. Hardy and R. F. Sekerka. *Journal of Crystal Growth*, Vol. 11, No. 1, 1971, p. 53–67. [Theory developed and applied to recent experiments; ice–water surface tension deduced.]

DAVY, J. G., *and* SOMORJAI, G. A. Studies of the vaporization mechanism of ice single crystals. *Journal of Chemical Physics*, Vol. 55, No. 8, 1971, p. 3624–36. [Experiments on rate of vaporization and effect of crystal orientation, doping and absorbed gases.]

EIBEN, K., *and* WIECZOREK, H. Reactions of electrons in irradiated ice. *Berichte der Bunsengesellschaft für physikalische Chemie*, Bd. 75, Nr. 7, 1971, p. 676–78. [Experimental study of reaction of electrons with excess protons in ice studied in alkali hydroxide glasses with aromatic carboxylic acids.]

EISELE, I., *and* KEVAN, L. Temperature dependence of the Hall mobility of electrons in glassy 10 M NaOH ice. *Journal of Chemical Physics*, Vol. 55, No. 11, 1971, p. 5407–09. [Letter. Mobility found to increase with decreasing temperature.]

ELDRUP, M., *and others*. Positron annihilation in γ-irradiated 10 M NaOH, glassy ice at 85° K, [by] M. Eldrup and O. Mogensen and L. Kevan. *Chemical Physics Letters*, Vol. 10, No. 4, 1971, p. 379–80. [Trapped electrons do not affect positron lifetime spectra.]

FINNEGAN, W. G., *and others*. Evaluation of ice nuclei generator systems, by W. G. Finnegan, P. St. Amand, L. A. Burkardt. *Nature*, Vol. 232, No. 5306, 1971, p. 113–14. [Discussion of various systems.]

GLEN, J. W. Total melting time in the ablating-slab problem. *Journal of Applied Physics*, Vol. 43, No. 1, 1972, p. 258. [Result obtained by Rogerson and Chayt, ibid., Vol. 42, No. 7, 1971, p. 2711–13, can be derived more simply from conservation of energy.]

GOLD, L. W. The failure of ice. (*In* [International Association of Hydraulic Research.] *I.A.H.R. symposium: ice and its action on hydraulic structures, . . . 1970*, [1971], paper 5.1, 8 p.) [Discusses cracking activity occurring in columnar-grained ice during creep and constant rate of strain tests, when a load is applied perpendicular to the long direction of the grain. Application to behaviour of ice round structures. Discussion, p. 7–8.]

GORNOSTANSKY, S. D., *and* KERN, C. W. Analysis of the D and ^{17}O quadrupole coupling constants in ice Ih. *Journal of Chemical Physics*, Vol. 55, No. 7, 1971, p. 3253–59. [Theoretical calculation of how hydrogen bond formation in the solid affects these constants relative to the vapour.]

GROSS, G. W. Freezing potentials in the system H_2O—NH_3—CO_2 at controlled concentrations. *Journal of the Atmospheric Sciences*, Vol. 28, No. 6, 1971, p. 1005–14. [Experiments show highest potentials occur when CO_2 concentration equals or exceeds that of NH_3.]

HOLZAPFEL, W. B. On the symmetry of the hydrogen bonds in ice VII. *Journal of Chemical Physics*, Vol. 56, No. 2, 1972, p. 712–15. [Theoretical study predicts a transition to symmetric hydrogen bonding at 350–800 kbar.]

HUTCHINSON, W. C. A., *and* MARTIN, P. F. Dependence of ice melting electrification on earlier freezing rate. *Nature, Physical Science*, Vol. 233, No. 43, 1971, p. 161. [Letter. Observations using water similar to rainwater.]

JAYAWEERA, K. O. L. F. Calculations of ice crystal growth. *Journal of the Atmospheric Sciences*, Vol. 28, No. 5, 1971, p. 728–36. [Calculations using electrostatic analogy of growth rates and masses at different times including effect of ventilation due to falling.]

KAMB, W. B., *and others*. Ordered proton configuration in ice II, from single-crystal neutron diffraction, [by] [W.] B. Kamb and W. C. Hamilton and S. J. Laplaca and K. Prakash. *Journal of Chemical Physics*, Vol. 55, No. 4, 1971, p. 1934–45. [Crystal structure analysis by neutron diffraction from D_2O single crystal of ice II.]

KAWABATA, K. Trapped electron in the irradiated single crystal of ice doped with some impurities: its formation and photobleaching at 77° K. *Journal of Chemical Physics*, Vol. 55, No. 8, 1971, p. 3672–81. [Experimental study on H_2O and D_2O crystals doped with fluorides shows colouration on gamma irradiation absent with other dopants.]

KIRGINTSEV, A. N., *and* SHAVINSKIY, B. M. Opredeleniye linii solidusa tverdykh rastvorov l'da i NH_4F napravlennoy kristallizatsiyey [Determination of the solidus line for ice and NH_4F solid solutions by directed crystallization]. *Izvestiya Akademii Nauk SSSR, Seriya Khimicheskaya*, 1971, No. 9, p. 1859–62. [Experimental results.]

KVAJIĆ, G., *and* BRAJOVIĆ, V. Anisotropic segregation of (K^+) by dendritic ice crystals. *Journal of Crystal Growth*, Vol. 11, No. 1, 1971, p. 73–76. [Measurement on freezing KOH solutions in various crystallographic directions.]

LAVROV, V. V. *Deformation and strength of ice. Translated by T. Pelz. Edited by G. N. Yakovlev*. Jerusalem, Israel Program for Scientific Translations, 1971. v, 164 p. [Translation of *Deformatsiya i prochnost' l'da*. Leningrad, Gidrometeorologicheskoye Izdatel'stvo, 1969.]

LE PETIT, J. P., *and* LAFARGUE, C. Mise en évidence et comportement de "molecules d'eau libres" dans la glace. *Comptes Rendus Hebdomadaires de Séances de l'Académie des Sciences* (Paris), Sér. B, Tom. 273, No. 12, 1971, p. 421–24. [Discontinuities in high frequency permittivity or its temperature derivative observed in ice at a series of definite temperatures.]

LUBKIN, G. B. Solution of eight-vertex model excites critical-point theorists. *Physics Today*, Vol. 24, No. 9, 1971, p. 17, 19–20. [Discusses importance of recent paper by R. J. Baxter, *Physical Review Letters*, Vol. 26, No. 14, 1971, p. 832–33, which solves a statistical mechanical model which contains the 2-dimensional ice model as a special case.]

MARGOLIS, G., *and others*. The performance of a continuous well stirred ice crystallizer, [by] G. Margolis, T. K. Sherwood, P. L. T. Brian, and S. A. F. Sarofim. *Industrial and Engineering Chemistry Fundamentals*, Vol. 10, No. 3, 1971, p. 439–52. [Observations on system show interrelation between various parameters in this system for water desalination.]

MINTON, A. P. Interactions between water molecules in the vapour and condensed phases. *Transactions of the Faraday Society*, Vol. 67, Pt. 5, 1971, p. 1226–41. [Theoretical study of intermolecular potential energies in systems of up to eight water molecules.]

NAYAR, H. S., *and others*. Creep of dispersions of ultrafine amorphous silica in ice, [by] H. S. Nayar, F. V. Lenel and G. S. Ansell. *Journal of Applied Physics*, Vol. 42, No. 10, 1971, p. 3786–89. [Steady-state creep rates of this material are much less than for pure ice. Activation energy is stress dependent.]

NOVIKOV, P. A., *and* VAGNER, YE. A. Issledovaniye mekhanizma teplo- i massoobmena pri sublimatsii v vynuzhdennom potoke razrezhennogo gaza [Mechanism of heat and mass transfer during sublimation in forced flow of rarefied gas]. *Inzhenerno-Fizicheskiy Zhurnal*, Tom 20, No. 4, 1971, p. 700–05. [Visual observations used to develop relations for sublimation rate and convective mass-transfer parameter as function of gas flow when ice sphere evaporates. English summary, p. 705.]

OGURO, M., *and* HIGASHI, A. Concentric dislocation loops with [0001] Burgers vectors in ice single crystals doped with NH_3. *Philosophical Magazine*, Eighth Ser., Vol. 24, No. 189, 1971, p. 713–18. [X-ray diffraction topographs used to locate dislocations. Loops attributed to non-uniform impurity distribution.]

PASTORI-PARRAVICINI, G., *and* RESCA, L. Symmetry analysis and electronic states in cubic ice. *Journal of Physics, C*, Vol. 4, No. 15, 1971, p. L314–17. [Theoretical analysis of two models, one with half hydrogens, other with definite proton positions.]

ROULLEAU, M., *and others*. The electrical nucleation of ice in supercooled clouds by M. Roulleau, L. F. Evans and N. Fukuta. *Journal of the Atmospheric Sciences*, Vol. 28, No. 5, 1971, p. 737–40. [Experiments on nucleation on an electrified wire.]

SALAITA, G. N., *and* ROBESON, A. Pulsed-neutron diffusion parameters in mixtures of heavy and light water and ice. *Nuclear Science and Engineering*, Vol. 46, No. 2, 1971, p. 214–22. [Results used to discuss discontinuities across the freezing phase transition.]

SANTUS, R., *and others*. Environmental effects on the deprotonation of indole derivatives in alkaline ices, by R. Santus, T. Montenay-Garestier, C. Helene, and M. Aubailly. *Journal of Physical Chemistry*, Vol. 75, No. 20, 1971, p. 3061–66. [Observations of fluorescence and its variation with small amounts of alcohol and their interpretation.]

SHARANIN, YU. I., *and others*. Electrochemical detection of excited states during pulse radiolysis of crystalline ice, by Yu. I. Sharanin, V. N. Shubin, T. E. Pernikova, V. I. Zolotarevsk[i]y, P. I. Dolin. *Nature, Physical Science*, Vol. 234, No. 44, 1971, p. 14–15. [Observation of a peak in electrical conductivity of ice single crystals a short time after pulse radiolysis.]

STEHLE, N. S. Adfreezing strength of ice. (*In* [International Association of Hydraulic Research.] *I.A.H.R. symposium: ice and its action on hydraulic structures, . . . 1970*, [1971], paper 5.3, [13] p.) [Adfreezing strength increased with decreasing temperature but lessened after being subjected to long term loads. It was affected also by type and shape of pile as well as by type of ice and temperature. Discussion, p. [6].]

STEINBERGER, E. H., *and* RAHAMIM, S. Electrical properties of ice. *Journal of Applied Meteorology*, Vol. 10, No. 3, 1971, p. 595–98. [Electrical conductivity, thermoelectric effect and potential difference at a junction with NaF-doped ice determined.]

SUN ZU-SHUNG *and* TIEN, C. Free convection heat transfer of a layer of liquid heated from below—effect of maximum density. *International Journal of Heat and Mass Transfer*, Vol. 14, No. 3, 1971, p. 505–09. [Experimental study.]

SWAMY, K. S. K., *and* WICKRAMASINGHE, N. C. Strengths of the fundamental bands of ice and solid hydrogen in composite grains. *Observatory*, Vol. 89, No. 969, 1969, p. 57–59. [Discussion of model of interstellar extinction for grains with ice mantles.]

TYSON, W. R. Elastic strain energy of dislocations in ice. *Canadian Journal of Physics*, Vol. 49, No. 16, 1971, p. 2181–86. [Calculations using anisotropic elasticity theory.]

VALI, G. Quantitative evaluation of experimental results on the heterogeneous freezing nucleation of supercooled liquids. *Journal of the Atmospheric Sciences*, Vol. 28, No. 3, 1971, p. 402–09. [Method of analysing experiments to give differential and cumulative nucleus spectra.]

YASHKICHEV, V. I. Model' kollektivnogo dvizheniya molekul vody v vode. IV. Izmeneniye chastoty smeshcheniya molekul pri plavlenii l'da [Model of the collective motion of water molecules in water. IV. Change in the frequency of molecular displacement during the melting of ice]. *Zhurnal Strukturnoy Khimii*, Tom 12, No. 2, 1971, p. 319–20. [Diffusion in ice attributed to displacement of $2H_2O$ molecular groups. Discussion of how this changes as ice melts.]

LAND ICE. GLACIERS. ICE SHELVES

AMBACH, W., *and others*. Ergebnisse von Isotopenmessungen am Gletscherbach des Kesselwandferners (Ötztaler Alpen), [by] W. Ambach, H. Eisner, H. Moser, W. Rauert [and] W. Stichler. *Annalen der Meteorologie*, Neue Folge, Nr. 5, 1971, p. 209–12. [Measurements of annual and daily fluctuations of the isotope content of run-off from the Kesselwandferner enabled calculation of the percentage of melt water discharged in the total run-off.]

BEITZEL, J. E. Geophysical exploration in Queen Maud Land, Antarctica. (*In* Crary, A. P., *ed. Antarctic snow and ice studies II*. Washington, D.C., American Geophysical Union, 1971, p. 39–87. (Antarctic Research Series, Vol. 16.)) [Measurements of ice thickness and surface elevation were obtained, also information on properties of subglacial terrain, from South Pole–Dronning Maud Land traverses, 1964–65 and 1965–66 summer seasons.]

BENTLEY, C. R. Seismic anisotropy in the west Antarctic ice sheet. (*In* Crary, A. P., *ed. Antarctic snow and ice studies II*. Washington, D.C., American Geophysical Union, 1971, p. 131–77. (Antarctic Research Series, Vol. 16.)) [Results of analysis of 16 refraction and reflection profiles, Marie Byrd Land–Ellsworth Highland 1957–61, and comments on ice crystal orientation.]

BENTLEY, C. R. Seismic evidence for moraine within the basal Antarctic ice sheet. (*In* Crary, A. P., *ed. Antarctic snow and ice studies II*. Washington, D.C., American Geophysical Union, 1971, p. 89–129. (Antarctic Research Series, Vol. 16.)) [Discusses implications of a low-amplitude seismic echo reflecting from a horizon a few hundred metres above the bottom of the ice sheet. Widely observed in Marie Byrd Land–Ellsworth Highland region.]

BENTLEY, C. R., *and* CHANG, F.-K. Geophysical exploration in Marie Byrd Land, Antarctica. (*In* Crary, A. P., *ed. Antarctic snow and ice studies II*. Washington, D.C., American Geophysical Union, 1971, p. 1–38. (Antarctic Research Series, Vol. 16.)) [Observations on topography of ice sheet and subglacial terrain, from over-snow traverses in 1959 and 1960.]

BUDD, W. F., *and others. Derived physical characteristics of the Antarctic ice sheet. Mark 1, by W. F. Budd, D. Jenssen and U. Radok*. Melbourne, University of Melbourne, Meteorology Dept., 1971. xv, 178 p. (University of Melbourne. Meteorology Dept., Publication No. 18.) [Characteristics include temperature and velocity distribution, age of ice, particle paths and patterns of flow, and state of balance.]

BUDD, W. F., *and* RADOK, U. Glaciers and other large ice masses. *Reports on Progress in Physics*, Vol. 34, No. 1, 1971, p. 1–70. [Deals especially with recent advances in flow properties of ice, dynamics of large ice masses, thermodynamics of polar ice masses and long-term changes in large ice masses.]

CHAPMAN, W. H., *and* JONES, W. J. Analysis of ice movement at the Pole station, Antarctica. *U.S. Geological Survey. Professional Paper* 700-C, 1970, p. C242–C246. [Average movement computed to be 19 m/year in a direction parallel to 37° W meridian.]

COLLINS, S. G. Exploration on a surging glacier. *Explorers Journal*, Vol. 49, No. 2, 1971, p. 124–29. [Visits to Rusty Glacier (here unofficially named "Fox Glacier"), Yukon Territory, Canada, in anticipation of its surge.]

DANSGAARD, W., *and others*. Reinterpretation of deep ice temperatures, [by] W. Dansgaard, S. J. Johnsen [and] C. C. Langway. *Nature, Physical Science*, Vol. 233, No. 37, 1971, p. 40. [Points out inaccuracies in Budd, Jenssen and Radok's report (ibid., Vol. 232, No. 30, 1971, p. 84–85).]

DEWART, G. Gravimeter observations on Anvers Island and vicinity. (*In* Crary, A. P., *ed. Antarctic snow and ice studies II*. Washington, D.C., American Geophysical Union, 1971, p. 179–90. (Antarctic Research Series, Vol. 16.)) [Data used to estimate regional gravity anomaly and thickness of part of the island ice cap, 1967.]

ETO, T. Seismic studies during the JARE South Pole traverse 1968–69. (*In* Murayama, M., *ed. Report of the Japanese traverse Syowa–South Pole 1968–1969*. Tokyo, National Science Museum, Polar Research Center, 1971, p. 115–24. (Japanese Antarctic Research Expedition Scientific Reports. Special Issue No. 2.)) [Difficulty was experienced, during measurement of ice thickness by seismic reflection shooting at 100 km intervals, with prolonged noise on cold firn after detonation.]

HARRISON, C. H. Radio echo records cannot be used as evidence for convection in the Antarctic ice sheet. *Science*, Vol. 173, No. 3994, 1971, p. 166–67. [Criticizes Hughes' use of radio echo records as evidence for convection plumes in the Antarctic ice sheet (ibid., Vol. 170, No. 3958, 1970, p. 630–33).]

HOINKES, H. C. Über Beziehungen zwischen der Massenbilanz des Hintereisferners (Ötztaler Alpen, Tirol) und Beobachtungen der Klimastation Vent. *Annalen der Meteorologie*, Neue Folge, Nr. 5, 1971, p. 259–64. [Method described for estimating mass balance of Hintereisferner from daily observations of Vent climatological station (1893 m).]

[ITALY: GLACIERS] *Comitato Glaciologico Italiano. Archivio fotografico. Catalogo generale. [Sezione 1—ghiacciai italiani.]* [Torino, Comitato Glaciologico Italiano, 1970.] [95] leaves. [First part of the general catalogue of the photographic archives of the Comitato Glaciologico Italiano, listing particulars of photographs of Italian glaciers.]

JIRACEK, G. R., *and* BENTLEY, C. R. Velocity of electromagnetic waves in Antarctic ice. (*In* Crary, A. P., *ed. Antarctic snow and ice studies II*. Washington, D.C., American Geophysical Union, 1971, p. 199–208. (Antarctic Research Series, Vol. 16.)) [Measurements in floating and grounded ice of different thicknesses and temperatures. Differences in average velocity are related to differences in average density of the ice column. Implications for ice thickness measurements discussed.]

JOHN, B. S., *and* SUGDEN, D. Creeping streams of ice. *Geographical Magazine*, Vol. 43, No. 12, 1971, p. 853–57. [Short informative account of glacier systems for the layman.]

KIVER, E. P., *and* MUMMA, M. D. Summit firn caves, Mount Rainier, Washington. *Science*, Vol. 173, No. 3994, 1971, p. 320–22. [Describes system of steam-formed ice caves in a volcanic crater.]

LAMBERT, G., *and others*. Balance of ^{90}Sr over Antarctica: existence of a protected area, [by] G. Lambert, B. Ardouin, E. Brichet and C. Lorius. *Earth and Planetary Science Letters*, Vol. 11, No. 4, 1971, p. 317–23. [Study of firn cores from Terre Adélie and from Mirny–"Vostok" showed area of low contamination around "Vostok" and "Crest" stations. Implication discussed.]

LANG, H. Über den Einfluss meteorologischer Faktoren auf den Schmelzwasserabfluss. *Annalen der Meteorologie*, Neue Folge, Nr. 5, 1971, p. 213–14. [Discusses relationship between glacier run-off and meteorological factors.]

LANGWAY, C. C., *jr., and others*. Deep drilling into polar ice sheets for continuous cores, [by] C. C. Langway, Jr., A. J. Gow and B. L. Hansen. (*In* Quam, L. O., *ed. Research in the Antarctic. A symposium presented at the Dallas meeting of the American Association for the Advancement of Science—December, 1968*. Washington, D.C., American Association for the Advancement of Science, 1971, p. 351–65. (Publication No. 93.)) [Describes drilling programmes and methods in Greenland and Antarctica, and summarizes results.]

MESSEL, S. Mass and heat balance of Omnsbreen—a climatically dead glacier in southern Norway. *Norsk Polarinstitutt. Skrifter*, No. 156, 1971, 43 p. [Observations in 1966–70. Comparison with some other Norwegian glaciers.]

MILLER, K. J., *ed. The Cambridge Staunings Expedition 1970. Vol. 1. General report and the glaciological projects*. Cambridge, University of Cambridge. Dept. of Engineering, 1971. 66 leaves. [Field work on Roslin Gletscher, East Greenland: determination of depth of ice by radio echo sounding and temperature profiles.]

MOREV, V. A., *and* SHAMONT'YEV, V. A. Eksperimental'noye bureniye lednikovogo pokrova (Experimental drilling of the ice cover]. *Informatsionnyy Byulleten' Sovetskoy Antarkticheskoy Ekspeditsii*, No. 78, 1970, p. 102–04. [Bore hole 210 m deep near Mirny, 1968.]

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VINOGRADOVA, N. F. Metodika dolgosrochnogo prognoza poyavleniya plavuchego l'da na nizhnem Yeniseye i r. Angare [Method of long-range forecasting of the appearance of floating ice on the lower Yenisey and Angara]. *Trudy Gidrometeorologicheskogo Nauchno-Issledovatel'skogo Tsentra SSSR*, Vyp. 67, 1970, p. 99–108.

VOROB'YEV, V. N. Kharakteristika ledovogo rezhim v rayone stantsii Bellinsgauzen v 1968 g. [Character of the ice regime in the area of "Bellingshausen" station in 1968]. *Informatsionnyy Byulleten' Sovetskoy Antarkticheskoy Ekspeditsii*, No. 78, 1970, p. 40–45. [Ice and snow cover conditions on fast ice in Bransfield Strait.]

VOTRUBA, L. Accumulation et courbe de remous sous le champ de glace sur la rivière Vltava. (*In* [International Association of Hydraulic Research.] *I.A.H.R. symposium: ice and its action on hydraulic structures, . . . 1970*, [1971], paper 3.5, 8 p.) [Study of ice jams in Vrané reservoir, Czechoslovakia.]

WEEKS, W. F., *and* KOVACS, A. The morphology and physical properties of pressure ridges: Barrow, Alaska, April 1969. (*In* [International Association of Hydraulic Research.] *I.A.H.R. symposium: ice and its action on hydraulic structures, . . . 1970*, [1971], paper 3.9, 8 p.) [Cross-sectional profiles, internal structures, temperatures, salinities and brine volumes obtained from eight pressure ridges in fast ice and pack ice. Two ridges described in detail. Discussion, p. 8.]

WIGLE, T. E. Investigations into frazil, bottom ice and surface ice formation in the Niagara River. (*In* [International Association of Hydraulic Research.] *I.A.H.R. symposium: ice and its action on hydraulic structures, . . . 1970*, [1971], paper 2.8, 16 p.) [Well-illustrated account of initial investigations into relationship between ice formation in the river and meteorological parameters. Discussion, p. 16.]

YAMAOKA, I. Estimation of incipient ice formation date of reservoirs in Hokkaido by use of a time series of daily accumulated air temperature. (*In* [International Association of Hydraulic Research.] *I.A.H.R. symposium: ice and its action on hydraulic structures, . . . 1970*, [1971], paper 2.2, 9 p.) [Describes method of estimation of date of formation of ice on reservoirs in this region of Japan; satisfactory results were obtained over 5 years. Discussion, p. 9.]

YEFREMOVA, N. D. Metod dolgosrochnogo prognoza vskrytiya r. Obi nizhe s. Kolpashevo i r. Irtysha nizhe g. Pavlodara [Method of long-range forecasting for the break-up of ice on the Ob' below Kolpashevo and the Irtysh below Pavlodar]. *Trudy Gidrometeorologicheskogo Nauchno-Issledovatel'skogo Tsentra SSSR*, Vyp. 67, 1970, p. 37–49.

YESKIN, L. I. Raspredeleniye aysbergov v indookeanskom sektore Yuzhnogo Okeana [Distribution of icebergs in the Indian Ocean sector of the Southern Ocean]. *Trudy Sovetskoy Antarkticheskoy Ekspeditsii*, Tom 54, 1971, p. 163–79.

YESKIN, L. I. Raspredeleniye morskikh l'dov v indookeanskom sektore Yuzhnogo Okeana [Distribution of sea ice

in the Indian Ocean sector of the Southern Ocean]. *Trudy Sovetskoy Antarkticheskoy Ekspeditsii*, Tom 54, 1971, p. 145–62. [Results from 1966–67.]

YESKIN, L. I., *and* SAVATYUGIN, L. M. Sostoyaniye pripaya i usloviya razgruzki d/e "Ob' " na reyde Mirnogo letom 1968–69 g. [State of the fast ice and unloading conditions of *Ob'* at Mirny roadstead in the summer of 1968–69]. *Informatsionnyy Byulleten' Sovetskoy Antarkticheskoy Ekspeditsii*, No. 79, 1970, p. 70–75.

GLACIAL GEOLOGY

ANDREWS, J. T. Ambiguous "glacial" striae formed near waterbodies: discussion. *Canadian Journal of Earth Sciences*, Vol. 8. No. 10, 1971, p. 1331–32. [Comments on McLellan's article (ibid., Vol. 8, No. 4, 1971, p. 477–79).]

ANDREWS, J. T., *and* ESTABROOK, G. Applications of information and graph theory to multivariate geomorphological analyses. *Journal of Geology*, Vol. 79, No. 2, 1971, p. 207–21. [Use of these methods illustrated by a discussion relating to the cross-valley moraines of Baffin Island.]

ANDREWS, J. T., *and* SMITH, D. I. Statistical analysis of till fabric: methodology, local and regional variability (with particular reference to the north Yorkshire till cliffs). *Quarterly Journal of the Geological Society of London*, Vol. 125, No. 500, Pt. 4, 1970 [for 1969], p. 503–42. [Problems and methods discussed and results presented. Discussion includes within- and between-site variability, design of sampling scheme for till fabric analysis, regional pattern of ice movement, and origin of a till fabric.]

ARBEY, F. Glacio-tectonique et phénomènes périglaciaires dans les dépôts siluro-ordoviciens des Monts d'Ougarta (Sahara Algérien). *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences* (Paris), Sér. D, Tom. 273, No. 10, 1971, p. 854–57. [Compares glacial and periglacial features of the Siluro-Ordovician deposits in the Ougarta mountains, Algeria, with those of Quaternary deposits of Schleswig-Holstein and Jutland.]

ARMSTRONG, J. E., *and others*. Use of trend surfaces in till fabric analysis: discussion, [by] J. E. Armstrong and W. H. Mathews and A. J. Sinclair. *Canadian Journal of Earth Sciences*, Vol. 8, No. 9, 1971, p. 1163–67. [Discusses paper by Roberts and Mark (ibid., Vol. 7, No. 4, 1970, p. 1179–84).]

BEAUMONT, P. Stone orientation and stone count data from the lower till sheet, eastern Durham. *Proceedings of the Yorkshire Geological Society*, Vol. 38, Pt. 3, No. 16, 1971, p. 343–60. [Results indicate a general direction of Pleistocene ice movement from WNW to ESE in this area.]

BERGERSEN, O. F. Undersøkelser av steinfraksjonens rundingsgrad i glasigene jordarter. *Norges Geologiske Undersøkelse*, No. 266, 1970, p. 253–62. [Relates roundness of pebbles in eastern Norway to mode and length of transport. English abstract, p. 252.]

BERGERSEN, O. F., *and* GARNES, K. Evidence of sub-till sediments from a Weichselian interstadial in the Gudbrandsdalen valley, central east Norway. *Norsk Geografisk Tidsskrift*, Bd. 25, Ht. 2, 1971, p. 99–107. [Suggests that sediments are interstadial deposits which were not removed by a later ice advance.]

BERNARD, C. Les marques sous-glaciaires d'aspect plastique sur la roche en place (p-forms): observations sur la bordure du bouclier canadien examen de la question (I). *Revue de Géographie de Montréal*, Vol. 25, No. 2, 1971, p. 111–27. [Observations on subglacial abrasions and marks along the eastern edge of the Canadian Shield.]

BERNARD, C. Les marques sous-glaciaires d'aspect plastique sur la roche en place (p-forms): leur rapport avec l'environnement et avec certaines marques de corrasion (II). *Revue de Géographie de Montréal*, Vol. 25, No. 3, 1971, p. 265–79. [Further observations on subglacial abrasions and marks along the eastern edge of the Canadian Shield.]

BLAKE, D. H., *and* LÖFFLER, E. Volcanic and glacial landforms on Mount Giluwe, Territory of Papua and New Guinea. *Geological Society of America. Bulletin*, Vol. 82, No. 6, 1971, p. 1605–14. [Field work shows that there were probably two major glacial periods on this extinct volcano and that some subglacial volcanic activity occurred.]

BURROWS, C. J., *and* ORWIN, J. Studies on some glacial moraines in New Zealand. 1. The establishment of lichen-growth curves in the Mount Cook area. *New Zealand Journal of Science*, Vol. 14, No. 2, 1971, p. 327–35. [Method was promising, though not very precise, for determining the ages of surfaces in young moraines.]

CALKIN, P. E. Glacial geology of the Victoria Valley system, southern Victoria Land, Antarctica. (*In* Crary, A. P., *ed. Antarctic snow and ice studies II*. Washington, D.C., American Geophysical Union, 1971, p. 363–412. (Antarctic Research Series, Vol. 16.)) [Study of deposits and other features enable some suggestions to be made about earlier glaciations.]

CHUMAKOV, N., *and* CAILLEUX, A. Glaciation et éolisation dans l'est et le nord de l'Europe à l'Éocambrien. *Revue de Géomorphologie Dynamique*, 20e An., No. 1, 1971, p. 1–4. [Discusses extensive Eocambrian glaciation of northern and eastern Europe and evidence for occurrence of strongly erosive wind.]

CLAPPERTON, C. M. Antarctic link with the Andes. *Geographical Magazine*, Vol. 44, No. 2, 1971, p. 124–30. [Glacial geology and Pleistocene glaciation of South Georgia.]

CLAPPERTON, C. M. The location and origin of glacial meltwater phenomena in the eastern Cheviot Hills. *Proceedings of the Yorkshire Geological Society*, Vol. 38, Pt. 3, No. 17, 1971, p. 361–80. [Melt-water channels are abundant where Pleistocene ice movement was across the trend of ridges and valleys. Origin of complex systems of landforms is discussed.]

CONNALLY, G. G. Pleistocene mountain glaciation, northern Vermont: discussion. *Geological Society of America. Bulletin*, Vol. 82, No. 6, 1971, p. 1763–66. [Supports Wagner's theory (ibid., Vol. 81, No. 8, 1970, p. 2465–69) that glaciation took place here.]

CRARY, A. P. Thickness of ice and isostatic adjustments of ice–rock interface. (*In* Quam, L. O., *ed. Research in the Antarctic. A symposium presented at the Dallas meeting of the American Association for the Advancement of Science—December, 1968*. Washington, D.C., American Association for the Advancement of Science, 1971, p. 341–49. (Publication No. 93.)) [Reviews indirect methods of determining ice thickness, effect of ice load on crust and mantle, and erosion of the continent by the ice sheet in the past few million years.]

CROWELL, J. C., *and* FRAKES, L. A. Late Paleozoic glaciation: part IV, Australia. *Geological Society of America. Bulletin*, Vol. 82, No. 9, 1971, p. 2515–40.

FOSTER, H. D. Sarn Badrig, a submarine moraine in Cardigan Bay, North Wales. *Zeitschrift für Geomorphologie*, Bd. 14, Ht. 4, 1970, p. 475–86. [Dominated by glacial erratics from Merionethshire so is probably a medial moraine marking the line of confluence between the Welsh ice cap and the Irish Sea ice sheet.]

FRAKES, L. A., *and* CROWELL, J. C. Late Paleozoic glaciation: I, South America. *Geological Society of America. Bulletin*, Vol. 80, No. 6, 1969, p. 1007–41. [First in a series of articles on palaeoclimatology and on the configuration and palaeogeography of Gondwanaland during the late Palaeozoic.]

FRAKES, L. A., *and* CROWELL, J. C. Late Paleozoic glaciation: II, Africa exclusive of the Karroo Basin. *Geological Society of America. Bulletin*, Vol. 81, No. 8, 1970, p. 2261–85.

FRAKES, L. A., *and others*. Late Paleozoic glaciation: part III, Antarctica, [by] L. A. Frakes, J. L. Matthews [and] J. C. Crowell. *Geological Society of America. Bulletin*, Vol. 82, No. 6, 1971, p. 1581–1604.

GERHOLD, N. Glaziale und perigale [*sic*] Ablagerungen in den westlichen Ötztaler Alpen. *Tiroler Heimatblätter*, Jahrg. 46, Ht. 4–6, 1971, p. 31–35. [Describes, with the aid of photographs, some glacial deposits observed in the western Ötztal Alps, Austria.]

GOURINARD, Y. Les moraines de la basse vallée du Carol entre Latour et Puigcerda (Pyrénées orientales franco-espagnoles). *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences* (Paris), Sér, D, Tom. 272, No. 25, 1971, p. 3112–15. [Suggests dates of formation of moraines in the Carol valley, east Pyrenees.]

HANTKE, R. Die spätwürmeiszeitlichen Stadien auf der schweizerischen Alpennordseite. *Eiszeitalter und Gegenwart*, Bd. 21, 1970, p. 71–80. [Investigations of Late Würmian readvance stages of glaciers on the northern slope of the Swiss Alps show that correlations may be made between the different glacier systems.]

HARRIS, S. A. The Waterloo kame-moraine, Ontario, and its relationship to the Wisconsin advances of the Erie and Simcoe ice lobes. *Zeitschrift für Geomorphologie*, Bd. 14, Ht. 4, 1970, p. 487–509. [Detailed field investigations permit conclusions to be drawn about the formation of this kame-moraine and the effect of its presence upon subsequent glacial advances.]

JOHN, B. S., *and* SUGDEN, D. S. Raised marine features and phases of glaciation in the South Shetland Islands. *British Antarctic Survey Bulletin*, No. 24, 1971, p. 45–111. [Describes four distinctive landform groups and examines the significance of their interrelationships in the landscape evolution of this region. Evidence from elsewhere in Antarctica and Fuego-Patagonia is compared with this.]

KELLAWAY, G. A. Glaciation and the stones of Stonehenge. *Nature*, Vol. 233, No. 5314, 1971, p. 30–35. [Suggests that ice sheets rather than human activity brought bluestones to Salisbury Plain from South Wales.]

KICK, W. Das Eis der Erde und die Geodäsie. *Zeitschrift für Vermessungswesen*, 96 Jahrg., Ht. 11, 1971, p. 476–87. [Discusses the deformation of the geoid and alterations in mean sea-level by changing ice masses.]

KRÜGER, J. Till fabric in relation to direction of ice movement. A study from the Fakse Banke, Denmark. *Geografisk Tidsskrift*, Bd. 69, Halvbd. 2, 1970, p. 133–70. [Shapes and orientation of pebbles indicate direction of ice movement.]

LASCA, N. P. Moraines in the Hemnefjord area, western Norway. *Norges Geologiske Undersøkelse*, No. 266, 1970, p. 62–69. [Results of radiocarbon dating and conclusions drawn from these.]

LLIBOUTRY, L. A. Rheological properties of the asthenosphere from Fennoscandian data. *Journal of Geophysical Research*, Vol. 76, No. 5, 1971, p. 1433–46. [Discusses existing theories of isostatic uplift and shows that Van Bemmelen and Berlage's solution is valid for the uplift of the central area of Fennoscandia between 7200 and 2000 B.C. enabling study of influence of nonlinear viscosity to be made.]

MCKENZIE, G. D., *and* GOLDTHWAIT, R. P. Glacial history of the last eleven thousand years in Adams Inlet, southeastern Alaska. *Geological Society of America. Bulletin*, Vol. 82, No. 7, 1971, p. 1767–82. [Thick sections of Wisconsin and younger deposits exposed in this recently deglaciated area enable some detailed observations to be made.]

MCLELLAN, A. G. Ambiguous "glacial" striae formed near waterbodies: reply. *Canadian Journal of Earth Sciences*, Vol. 8, No. 10, 1971, p. 1332. [Comments on Andrews' discussion (ibid., Vol. 8, No. 10. 1971, p. 1331–32).]

MARGOLIS, S. V., *and* KENNETT, J. P. Cenozoic paleoglacial history of Antarctica recorded in subantarctic deep-sea cores. *American Journal of Science*, Vol. 271, No. 1, 1971, p. 1–36. [Cores examined for surface features on quartz sand grains, percentage of ice-rafted sand grains, and species diversity of planktonic foraminifera. Conclusions discussed.]

MATUSZKIEWICZ, A. J. Nowe poglądy na pochodzenie zlodowaceń [New opinions on origin of glaciations]. *Czasopismo Geograficzne*, Tom 42, Zeszyt 3, 1971, p. 245–52. [Reviews recent (1964–68) theories of the causes of glacial periods. English summary, p. 251–52.]

MEYERHOFF, A. A., *and* TEICHERT, C. Continental drift, III: late Paleozoic glacial centers, and Devonian–Eocene coal distribution. *Journal of Geology*, Vol. 79, No. 3, 1971, p. 285–321. [Evidence suggests that the continents and ocean basins have been in their present positions since late Carboniferous or earlier time.]

MEYERHOFF, A. A., *and* TEICHERT, C. Discussion of paper by D. I. Gough, "Did an ice cap break Gondwanaland?". *Journal of Geophysical Research*, Vol. 76, No. 17, 1971, p. 4038–44. [Criticizes Gough's suggestion (ibid., Vol. 75, No. 23, 1970, p. 4475–77), maintaining that no such ice sheet existed at that time. Reply by Gough, p. 4045–46.]

MÖRNER, N.-A. Comparison between Late Weichselian and Late Wisconsin ice marginal changes. *Eiszeitalter und Gegenwart*, Bd. 21, 1970, p. 173–76. [Sequence of ice marginal changes in the Erie, Ontario, lobe area compared to that for southern Scandinavia. Good correlation suggests a close climatic control of global validity.]

MÖRNER, N.-A. The Plum Point interstadial: age, climate, and subdivision. *Canadian Journal of Earth Sciences*, Vol. 8, No. 11, 1971, p. 1423–31. [Radiocarbon dates from Scarborough Bluffs, Toronto, suggest that the most temperate part of this interstadial coincided with the Denekamp interstadial in Europe.]

NAGL, H. Zur eiszeitlichen Vergletscherung der Seckauer Tauern. *Mitteilungen der Österreichischen Geographischen*

Gesellschaft, Bd. 113, Ht. 1–2, 1971, p. 25–33. [Study of glacial geology, particularly moraines, in this region of Austria suggests extent of glaciation during Riss and Würm periods.]

Nichols, R. L. Glacial geology of the Wright Valley, McMurdo Sound. (*In* Quam, L. O., *ed. Research in the Antarctic. A symposium presented at the Dallas meeting of the American Association for the Advancement of Science—December, 1968.* Washington, D.C., American Association for the Advancement of Science, 1971, p. 293–340. (Publication No. 93.)) [Detailed description of the features of this valley, review of current knowledge, and discussion backed by author's own observations.]

Niewiarowski, W. Ułożenie kamieni w utworach morenowych ostatniego lądolodu na terenie dolnego Powiśla [Stone arrangement in the till of the last inland ice in the lower Vistula region]. *Zeszyty Naukowe Uniwersytetu im. Mikołaja Kopernika w Toruniu*, Nauki Matematyczno-Przyrodnicze, Zeszyt 26, Geografia 8, 1971, p. 31–49. [Stone orientation, and its relation to the deglaciation of this area. English summary, p. 49.]

O'Connell, R. J. Pleistocene glaciation and the viscosity of the lower mantle. *Geophysical Journal of the Royal Astronomical Society*, Vol. 23, No. 3, 1971, p. 299–327. [Investigates the response of the Earth to large-scale deformations imposed by the load of Pleistocene ice sheets and the change in sea-level occasioned by their melting.]

Ohlson, B. Bedrock and Quaternary deposits of the Loukinen basin in western Finnish Lapland. *Fennia*, 90, No. 2, 1969 [pub. 1971], 35 p.

Olszewski, A. Kemy okolic Łowinka w środkowej części Wysoczyzny Świeckiej [The kames in the neighbourhood of Łowinek in the central part of the Świecie moraine plateau]. *Zeszyty Naukowe Uniwersytetu im. Mikołaja Kopernika w Toruniu*, Nauki Matematyczno-Przyrodnicze, Zeszyt 26, Geografia 8, 1971, p. 15–29. [Describes kames of this area and compares with those of the southern part of the plateau. English summary, p. 29.]

Paskoff, R. État résumé des acquisitions récentes sur le Quaternaire chilien. *Cahiers de Géographie de Québec*, 15^{e} An., No. 35, 1971, p. 289–315. [Recent advances in knowledge of Chilean Quaternary discussed.]

Paterson, K. Weichselian deposits and fossil periglacial structures in north Berkshire. *Proceedings of the Geologists' Association*, Vol. 82, Pt. 4, 1971, p. 455–67. [Field investigations show occurrence of deposits probably from Late Weichselian glaciation. Considerable evidence of frost heaving.]

Powell, D., *and* Saxena, M. N. Tillite horizons in the Chamba Himalayas of Himachal Pradesh, north India. *Journal of the Geological Society* (London), Vol. 127, Pt. 6, 1971, p. 595–98. [Describes tillites of a Lower Carboniferous or older glacial deposit.]

Price, R. J. The development and destruction of a sandur, Breidamerkurjökull, Iceland. *Arctic and Alpine Research*, Vol. 3, No. 3, 1971, p. 225–37. [Build-up and destruction of a sandur in association with buried ice over a short period of time (1961–65).]

Roberts, J. D. Late Precambrian glaciation: an anti-greenhouse effect? *Nature*, Vol. 234, No. 5326, 1971, p. 216–17. [Discusses possible cause of late Pre-Cambrian glaciation.]

Roberts, M. C., *and* Mark, D. M. The use of trend surfaces in till fabric analysis. *Canadian Journal of Earth Sciences*, Vol. 7, No. 4, 1970, p. 1179–84. [Shows that it is possible to use trend surfaces as the basis for construction of ice flow maps.]

Roberts, M. C., *and* Mark, D. M. Use of trend surfaces in till fabric analysis: reply. *Canadian Journal of Earth Sciences*, Vol. 8, No. 9, 1971, p. 1167–69. [Reply to discussion by Armstrong and others (ibid., Vol. 8, No. 9, 1971, p. 1163–67) of Roberts and Mark's paper (ibid., Vol. 7, No. 4, 1970, p. 1179–84).]

Robinson, G., *and others*. Trend surface analysis of corrie altitudes in Scotland, [by] G. Robinson, J. A. Peterson and P. M. Anderson. *Scottish Geographical Magazine*, Vol. 87, No. 2, 1971, p. 142–46. [Results suggest that high local components of variability, and hence high importance of local factors in cirque location, are characteristic of lower maritime glacial environments.]

Rowlands, P. H., *and* Shotton, F. W. Pleistocene deposits of Church Stretton (Shropshire) and its neighbourhood. *Journal of the Geological Society* (London), Vol. 127, Pt. 6, 1971, p. 599–622. [Results of detailed field investigations suggest behaviour of Quaternary glaciers.]

Rudberg, S. The areas of bare rock in Fennoscandia. *Acta Geographica Lodziensia*, No. 24, 1970, p. 389–97. [Discusses occurrence and causes of distribution. Areas concerned may have been more strongly eroded by the inland ice sheet than other parts.]

Ryder, J. M. Some aspects of the morphometry of paraglacial alluvial fans in south-central British Columbia. *Canadian Journal of Earth Sciences*, Vol. 8, No. 10, 1971, p. 1252–64. [Discusses mode of formation of these fans of mountainous regions that have recently undergone glaciation and compares with fans of arid regions.]

Shchukin, I. S. Bylo li pokrovnoye chetvertichnoye oledeneniye v gornykh stranakh umerennykh shirot [Were there Quaternary ice caps in mountainous areas in temperate latitudes]? *Vestnik Moskovskogo Universiteta*, Ser. 5, 26 God, [No.] 3, 1971, p. 19–34. [Concludes that they occurred only rarely.]

Sissons, J. B., *and* Brooks, C. L. Dating of early postglacial land and sea level changes in the western Forth valley. *Nature, Physical Science*, Vol. 234, No. 50, 1971, p. 124–27. [Evidence obtained enables graphs of relative sea-level changes and hence land uplift to be drawn for this area of Scotland.]

Stewart, D. P. Pleistocene mountain glaciation, northern Vermont: discussion. *Geological Society of America. Bulletin*, Vol. 82, No. 6, 1971, p. 1759–60. [Does not agree with Wagner, ibid., Vol. 81, No. 8, 1970, p. 2465–69, that glaciation definitely took place in this region.]

Tipper, H. W. Glacial geomorphology and Pleistocene history of central British Columbia. *Canada. Geological Survey. Bulletin* 196, 1971, [xiv], 89 p., 8 maps. [Physiographical and glacial features of the region as a whole and glacial geology of each map area individually are described and the glacial history is discussed.]

Trenhaile, A. S. Drumlins: their distribution, orientation, and morphology. *Canadian Geographer*, Vol. 15, [No.] 2, 1971, p. 113–26. [Reviews and discusses present knowledge and refers to drumlins in southern Ontario.]

Turekian, K. K., *ed. The late Cenozoic glacial ages*. New Haven and London, Yale University Press, 1971. xii, 606 p. (Yale University. Mrs. Hepsa Ely Silliman Memorial Lectures, [Vol. 43].) [Includes the following papers: H. W. Menard, "The late Cenozoic history of the Pacific and Indian Ocean basins", p. 1–14;

W. Dansgaard, S. J. Johnsen, H. B. Clausen and C. C. Langway, Jr., "Climatic record revealed by the Camp Century ice core", p. 37–56; C. Emiliani, "The amplitude of Pleistocene climatic cycles at low latitudes and the isotopic composition of glacial ice", p. 183–97; K. Hunkins, A. W. H. Bé, N. D. Opdyke and G. Mathieu, "The late Cenozoic history of the Arctic Ocean", p. 215–37; W. S. Broecker, "Calcite accumulation rates and glacial to interglacial changes in oceanic mixing", p. 239–65; G. H. Denton, R. L. Armstrong and M. Stuiver, "The late Cenozoic glacial history of Antarctica", p. 267–306; S. C. Porter, "Fluctuations of late Pleistocene alpine glaciers in western North America", p. 307–29; B. C. McDonald, "Late Quaternary stratigraphy and deglaciation in eastern Canada", p. 331–53; A. L. Bloom, "Glacial-eustatic and isostatic controls of sea level since the last glaciation", p. 355–79; M. Ewing, "The late Cenozoic history of the Atlantic basin and its bearing on the cause of the ice ages", p. 565–73.]

WAGNER, W. P. Pleistocene mountain glaciation, northern Vermont. *Geological Society of America. Bulletin*, Vol. 81, No. 8, 1970, p. 2465–69. [Presents evidence for local valley glaciers in the Green Mountains; presence of an ice cap seems unlikely.]

WAGNER, W. P. Pleistocene mountain glaciation, northern Vermont: reply. *Geological Society of America. Bulletin*, Vol. 82, No. 6, 1971, p. 1761–62. [Comments on Stewart's discussion (ibid., Vol. 82, No. 6, 1971, p. 1759–60) of author's theory (ibid., Vol. 81, No. 8, 1970, p. 2465–69) that glaciation took place in this region.]

WARWICK, G. T. Caves and the ice age. *Transactions of the Cave Research Group of Great Britain*, Vol. 13, No. 2, 1971, p. 123–30. [Discusses effects of glacial erosion and deposition, ground ice and other periglacial phenomena and melt water on cave formation, and concludes that colder periods were times of slower development of cave systems.]

YOSHIDA, M., *and others*. Dai jū-ji-nankyoku-chiki-kansokutai de hakken shita morēn-fīrudo [Newly found inland moraine fields near "Syowa" station in 1970]. [By] M. Yoshida, Y. Ageta and M. Yagi. *Nankyoku Shiryō: Antarctic Record*, No. 39, 1971, p. 55–61. [Description; origin suggested.]

FROST ACTION ON ROCKS AND SOIL. FROZEN GROUND. PERMAFROST

ANISIMOVA, N. P. *Formirovaniye khimicheskogo sostava podzemnykh vod talikov na primere tsentral'noy Yakutii* [*Formation of the chemical composition of subsoil water in thawed areas in permafrost on the basis of central Yakutiya*]. Moscow, Izdatel'stvo "Nauka", 1971. 195 p.

BROSCHE, K.-U. Neue Beobachtungen zu vorzeitlichen Periglazialerscheinungen im Ebrobecken. *Zeitschrift für Geomorphologie*, Bd. 15, Ht. 1, 1971, p. 107–14. [Investigations show presence of periglacial features in Ebro basin, Spain.]

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NARUSE, R., *and others*. Nankyoku Shōwa kichi okeru sekisetsu to kaihyō kansoku [Observations of snow accumulation and sea ice at "Syowa" station, Antarctica]. [By] R. Naruse, Y. Endō, T. Ishida [and] Y. Ageta. *Nankyoku Shiryō: Antarctic Record*, No. 40, 1971, p. 57–64. [In English. Summarizes observations made from March 1967 to January 1970.]

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