

St. Petersburg State Mining Institute



ICE DRILLING BIBLIOGRAPHY

Part II: Russian Drilling Arctic and Non-Polar Regions Bibliography

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Russian Drilling Arctic and Non-Polar Regions Bibliography is considered to be the second part of the Ice Drilling Published Database compiled by the recommendation of the MEETING ON DEEP ICE CORE DRILLING (16-19 September, 2004, Schneefernerhaus meteorological observatory, Germany).

Russian Drilling Antarctic Bibliography consists from almost ninety references published mainly in Russian journals and collections of scientific articles such as Data of Glaciological Studies, Information Bulletin of Soviet Antarctic Expedition, Transactions of Soviet Antarctic Expedition, Transactions of Leningrad Mining Institute, etc. Some of them were written or translated to English (such references are marked by * in the front of the first author).

Most of the bibliographies are accompanied by the codes of the US literature databases (ReoRef, CRREL Acc., etc.). For example, the GeoRef database is compiled by American Geological Institute (AGI) and includes Antarctic Bibliography and Bibliography on Cold Regions Science and Technology [<http://www.coldregions.org/>]. All documents of the GeoRef database can be ordered through AGI's GeoRef Document Delivery Service [<http://www.agiweb.org/georef/dds/index.html>]. The world's largest collection of international polar databases, including CRREL's Bibliography on Cold Regions Science & Technology, is available only by CRREL employees. Non-CRREL employee should contact National Information Services Corporation (NISC USA) sales@nisc.com [<http://www.nisc.com>].

In order to help using of Russian Drilling Arctic and Non-Polar Regions Bibliography, all boreholes drilled by Russian researches are listed in Appendix.

Abbreviations of organizations

AARI	Arctic and Antarctic Research Institute
CAE	Complex Antarctic Expedition (since 1959 CAE became Soviet Antarctic Expedition)
IGAS	Institute of Geography of Academy of Sciences of the USSR (since 1992 IGAS became Institute of Geography of Russian Academy of Sciences)
IGRAS	Institute of Geography of Russian Academy of Sciences
LMI	Leningrad Mining Institute (since 1991 LMI was renamed St. Petersburg State Mining Institute)
MMI	Moscow Mining Institute
RAE	Russian Antarctic Expedition
SAE	Soviet Antarctic Expedition (since 1992 SAE became Russian Antarctic Expedition)
SPSMI	St. Petersburg State Mining Institute

1. ***Arkhipov, S.M.; Vaykmyae, R.A.; Vasilenko Ye.V et al. (1987):** Soviet glaciological investigations on Austfonna, Nordaustlandet, Svalbard in 1984-1985. Polar geography and geology. Vol.11 (1), p.25-49. (Text in English)
2. **Anonymous author (1986):** Sovetskie glyatsiologicheskie issledovaniya na Vostochnom ledyanom pole v 1984-1985 gg. [Soviet glaciological investigations on Nordaustlandet in 1984-1985] Akademiia nauk SSSR. Institut geografii. Materialy gliatsiologicheskikh issledovaniy [Academy of Sciences of the USSR. Institute of Geography. Data of Glaciological Studies] Vol. 56, p.10-26. (Text in Russian with English summary)
3. **Barkov, N.I.; Blinov, K.V.; Bugorkov, M.S.; Dmitriev, D.N. (1988):** Geofizicheskie issledovaniya v skvazhine glubinoi 460 m na lednike Vavilova (Severnaya Zemlya) [Geophysical investigations in 460-m deep hole on Vavilov Glacier (Severnaya Zemlya)] Geograficheskie i glyatsiologicheskie issledovaniya v polarnikh stranakh [Geographical and glaciological investigations in polar regions] Leningrad, Gidrometroizdat, p.14-24, 15 refs., 3 tables, 3 ill. USSR. (Text in Russian)

The results of inclination, hole diameter and temperature measurements in winter season of 1978/1979 are given. The amplitude of season temperature changes and coefficient of ice thermal conductivity according with measured temperature of active stratum were calculated. On the base of temperature distribution it is proposed that the thickness of Vavilov Glacier decreases with speed of 0.072 m/year. According with temperature calculations the thickness of permafrost under the glacier is 370 m.

4. **Bazanov, L.D. (1961):** Opyt kolonkovogo bureniya na lednikakh Zemli Frantsa-Iosifa [Core drilling experiment on glaciers of Franz Josef Land] Issledovaniya lednikov i lednikovikh raionov. Akademiia nauk SSSR. Institut Geografii. Mezhdudedomstvennyi Komitet po Provedeniiu MGG [Investigations of glaciers and polar regions. Academy of Sciences of USSR. Interdepartmental Committee on Realization of International Geophysical Year] Moscow, Vol.1, p. 109-114. 2 refs. USSR (Text in Russian with English summary)

CRREL Acc. No: 17020535, GeoRef Acc. No.: 19729, Record ID 17020535

5. **Bazhev, A.B.; Zagorodnov, V.S.; Rototaeva O.V. (1988):** Burovye raboty v oblasti pitaniya lednika Garabashi na El'bruse [Drilling operations in the ice-feeding region of Garabashi Glacier at Elbrus] Akademiia nauk SSSR. Institut geografii. Materialy gliatsiologicheskikh issledovaniy [Academy of Sciences of the USSR. Institute of Geography. Data of Glaciological Studies] Vol.64, p.11-12, 3 refs., 3 ill. USSR (Text in Russian)

The results of the drilling project on Garabashi Glacier at Elbrus (Central Caucasus) at the altitude of 3950 m above sea level are given. At the first stage, in 1987, full diameter thermal drilling and hand mechanical drilling of the firn zone were done. The second stage, in spring of 1987, included antifreeze core thermal drilling of two holes.

6. **Bazheva, V.Ya.; Krenke, A.N. (1970):** Stroenie ledyanoi tolshi Marukhskogo lednika (po rezul'tatam glubokogo burenia letom 1967 g.) [Ice structure of Marukh Glacier (by results of deep drilling on summer of 1967)]. Akademiia nauk SSSR. Institut geografii. Materialy gliatsiologicheskikh issledovaniy [Academy of Sciences of the USSR. Institute of Geography. Data of Glaciological Studies] Vol.17, p. 288-291. USSR (Text in Russian with English summary)
7. **Blinov, K.V.; Vasiliev, N.I.; Vostretsov R.N.; Talalay P.G.; Chistyakov V.K. (1994):** Eksperimental'nyye burovye i geofizicheskie raboty na lednike Vavilova (arkh. Severnaya Zemlya) [Drilling and geophysical operations on Vavilov Glacier (Severnaya Zemlya archipelago)] Tretii Mezhdunarodnyi Simpozium "Gornoye Delo v Arktike". Sankt-Peterburg, Oktyabr', 18-21, 1994: Tezisy dokladov [Third International Symposium "Mining in Arctic". Saint Petersburg, October, 18-21, 1994: Abstracts] Saint Petersburg, Saint Petersburg State Mining Institute, p.162. Russia (Text in Russian)

Particularities of drilling operations carried out on Vavilov Glacier from 1977 to 1988 are given. Results of bore hole logging including inclination, hole diameter and temperature measurements are also presented.

8. **Bobin, N.E., Vasiliev, N.I., Kudryashov, B.B., Stepanov, G.K., Talalay, P.G. (1988):** Mechanicheskoye burenie skvazhin vo l'du: Uchebnoe posobie [Mechanical drilling in ice: Text-book for students], Leningrad Mining Institute, 90 p. Leningrad. USSR (Text in Russian).

Mechanical ice drilling technology is reviewed. Theory of ice destruction at rotary drilling is given. Experiments results of ice cutting and recommendations for drill head designing are described. Description of electromechanical drill and special equipment designed for a conventional drilling rig is presented.

9. **Brichkin, A.V.; Mikheev, S.V.; Boev, A.V. (1967):** Ognevoye bureniye lednikov v visokogornikh usloviakh [Flame-jet drilling of glaciers in high-mountain regions] Izvestiya VGO [Proceedings of All-Union Geographical Society] Vol.99, No 2, p.147-148, 2 refs., 1 scheme, 1 photo. USSR (Text in Russian)

CRREL Acc. No: 22025557, Georef Acc. No.: 24311, Record ID 22025557

The description of special equipment for fire drilling in glaciers is given. A special jet burner with weight of near 3-4 kg was hoisted on steel cable and connected through three hoses with kerosene, oxygen and water drums. Two holes on Tuyuksu Glacier (Northern Tien Shan) has been drilled up to a depth of 33 and 23 m.

10. **Chistyakov, V.K.; Skurko, A.M.; Zemtsov, A.A.; Vasiliev N.I.; Solov'ev, G.N. (1988):** Eksperimental'niye burobie raboti na Severnoi Zemle v 1975-1985 gg. [Experimental drilling operations at Severnaya Zemlya in 1975-1985] Geograficheskie i glyatsiologicheskie issledovaniya v polarnikh stranakh [Geographical and glaciological investigations in polar regions] Leningrad, Gidrometeoizdat, p.33-42, 16 refs., 3 tables, USSR. (Text in Russian)

The results of 10-years field operations carried out by specialists of Leningrad Mining Institute at Severnaya Zemlya are described. Types of drills and depths of holes are given. The geophysical hole investigations in order to study dynamics and thermodynamics of Vavilov Glacier are also described.

11. **Golubev, G.N.; Dyurgerov, M.B.; Markin, V.A.; Berry, L.B.; Sukhanov, L.A.; Zolotaryev, E.A.; Danilina, A.V.; Arutyunov, Yu.G. (1978):** Lednik Jankuat [Jankuat Glacier]. Leningrad, Gidrometeoizdat, 184 p.
12. **Golubev, G.N.; Sukhanov, L.A.; Khromov, R.S. (1976):** Beskernovoye termoelektroburenie i ego primeneniye dlya izucheniya stroeniya lednika Jankuat [Full-diameter thermal drilling and its using for structure investigations of Jankuat Glacier]. Akademiya nauk SSSR. Institut geografii. Materialy gliatsiologicheskikh issledovaniy [Academy of Sciences of the USSR. Institute of Geography. Data of Glaciological Studies] Vol.28, p.96-104. USSR (Text in Russian with English summary)
13. **Kislov, B.V.; Nozdryukhin, V.K. (1975):** Estectvennaya zagryaznennost' firno-vedyanoi tolshi lednika Abramova po dannym kernovogo bureniya [Firn-ice background pollution of Abramov Glacier investigated by core drilling] Trudy SARNIGMI [Transactions of Middle-East Regional Research Hydro-Meteorological Institute]. Vol. 27 (108), p. 86-93. (Text in Russian)
14. **Klement'ev, O.L.; Korotkov, I.M.; Nikolaev, V.I. (1988):** Glyatsiologicheskie issledovaniya v 1987-1988 gg. na lednikovyykh kupolakh Severnoi Zemli [Glaciological investigations on ice caps of Severnaya Zemlya in 1987-1988] Akademiya nauk SSSR. Institut geografii. Materialy gliatsiologicheskikh issledovaniy [Academy of Sciences of the USSR. Institute of Geography. Data of Glaciological Studies] Vol.63, p.25-26, 3 refs., 3 ill. USSR (Text in Russian)

The results of crystallographic, isotopic, air bubbles and other investigations of ice core recovered on Akademiya Nauk and Vavilov Glaciers in 1987 and 1988 are given.

15. **Kravchenko V.V. (1984):** Bureniye ledyanikh massivov nebol'shoi moshnosti [Drilling through massive ice of small thickness] Akademiya nauk SSSR. Institut geografii. Materialy gliatsiologicheskikh issledovaniy [Academy of Sciences of the USSR. Institute of Geography. Data of Glaciological Studies] Vol.50, p.161-164, 2 refs., 4 ill., 2 tables USSR (Text in Russian with English summary)

CRREL Acc. No: 39002783, Georef Acc. No.: 96867, Record ID 39002783

The method of ice drilling by directed steam of hot water is described. The characteristics of the drilling equipment are given. The drilling rate with core is 0.2 m/min; the drilling rate without core rises to 1.5 m/min. Two modifications of portable boilers with external and internal heating of water are proposed. The equipment is recommended for ice drilling to a depths of 10 m. (Auth.)

16. **Krenke, A.N.; Menshutin, V.M.; Voloshina A.P.; Panov V.D.; Bazhev V.Ya.; Bazheva V.Ya.; Balaeva V.A.; Vinogradov O.N.; Voronina L.S.; Garelik I.S.; Davidovich N.V.; Dubinskaya N.M.; Macheret Yu.Ya.; Moiseeva G.P.; Psar'eva T.V.; Tyulina T.Yu.; Freidlin V.S.; Khmelevskoi I.F.; Chernova L.P.; Shadrina O.V. (1988):** Lednik Marukh (Zapadnyi Kavkaz) [Marukh Glacier (West Caucasus)]. Leningrad, Gidrometeoizdat. 255 p.
17. **Koryakin, V.S. (1981):** Marshrutami glyatsiologa [Routes of glaciologist] Moscow, Mysl', 128 p.

18. **Kudryashov, B.B.; Vasiliev, N.I.; Talalay, P.G.; Ufaev, V.V.; Denisov, G.V. (1989):** Bureniye skvazhin elektromekhanicheskim snaryadom na gruzonesushchem kabele [Drilling by electromechanical drill hoisting on cable] Mezhdunarodnyi Simpozium po bureniyu skvazhin v oslozhnennykh usloviyakh. Leningrad, Iyun', 5-9, 1989: Tezisy dokladov [International Symposium on Drilling in Complicated Conditions. Leningrad, June, 5-9, 1989: Abstracts]. Leningrad, Leningrad Mining Institute, p.104. USSR (Text in Russian)

The results of drilling by core electromechanical drill KEMS-112 on Vavilov Glacier are described. Three holes were drilled up to the depth of 89, 152 and 461 m.

19. **Kudryashov, B.B.; Chistyakov, V.K.; Vasiliev, N.I.; Talalay, P.G. (1991):** Drilling boreholes in glacial and subglacial rocks, with core selection by an electromechanical drill on a load-bearing cable [Burenie skvazhin s otborom kerna elektromekhanicheskim snaryadom na gruzonesushchem kabele v lednikovyykh i podlednikovyykh porodakh] Akademiia nauk SSSR. Institut geografii. Materialy gliatsiologicheskikh issledovaniy [Academy of Sciences of the USSR. Institute of Geography. Data of Glaciological Studies] Vol.71, p.165-170, 12 refs., 1 ill. USSR (Text in Russian with English summary)

CRREL Acc. No: 47002808, Record ID 133191

The results of field tests conducted on the Vavilov Glacier, Severnaya Zemlya, are presented. Specific characteristics of electromechanical drill KEMS-112 with a loaded cable, and the whole complex of surface technical devices for drilling boreholes with complete selection of core in ice sheets and subglacial rocks are described. Three boreholes of 90, 152 and 459 m deep, were drilled with a full recovery of the core in course of experimental studies of 1984, 1986 and 1988. The latter borehole reached the glacier bed and pierced the massif of frozen rocks, underlying the glacier to a depth of 4 m. The temperature of the massif was – 6 °C. Valuable information on the structure, composition and dynamics of the glacier, and its relations to the glacier bed has been obtained. (Auth.)

20. **Kudryashov, B.B., Vasiliev, N.I., Talalay, P.G. (1993):** Tekhnika i tekhnologiya bureniya skvazhin v lednikakh elektromekhanicheskimi snaryadami na gruzhonesushchem kabele [Technique and technology of drilling in glaciers by electromechanical drill hoisted on cable] Yubileinaya nauchnaya konferentsiya, posvyashchennaya 100-letiyu so dnya rozhdeniya F.A.Shamsheva. Sankt-Peterburg, Oktyabr', 7-8, 1993: Tezisy dokladov [Jubilee scientific conference devoted to 100-years anniversary of F.A.Shamshev. Saint Petersburg, October, 7-8, 1993: Abstracts] Saint Petersburg, Saint-Petersburg State Mining Institute, p.16. Russia (Text in Russian)

The construction and results of testing of electromechanical drill KEMS-112 are given.

21. ***Kudryashov, B.B., Vasiliev, N.I., Talalay, P.G. (1994):** KEMS-112 electromechanical ice core drill. International Workshop on Ice Drilling Technology, 4th, Tokyo, April, 20-23, 1993. Proceedings. Edited by O. Watanabe; Tokyo. National Institute of Polar Research. Memoirs. Special issue, No.49, p.138-152, 10 refs., 9 ill., 4 tables. Japan (Text in English)

GeoRef Acc. No: 182365, CRREL Acc. No: 48005340, Record ID 50924

Design of the KEMS-112 electromechanical ice core drill (Russian abbreviation of core electromechanical drill; number 112 means final hole diameter) and results of drilling, borehole and core studies carried out on Vavilov Glacier, Severnaya Zemlya, and at Vostok Station are described. Characteristics and a description of the KEMS-112 drill suspended on a cable, and its surface technical devices, are given. In 1984, 1986 and 1988, the KEMS-112 drill was used for core drilling on Vavilov Glacier to depths of 89, 152 and 461 m. The last borehole reached the bed of the glacier and pierced subglacial frozen rocks to a depth of 2.3 m. In 1989 at Vostok Station a deep borehole drilled by a thermal drill was deepened by the KEMS-112 drill from a depth of 2428 m to 2546 m. (Auth.)

22. **Mikheev, S.V. (1971):** O burenii l'da ognevym sposobom [About ice drilling by flame-jet drilling] Akademiia nauk SSSR. Institut geografii. Materialy gliatsiologicheskikh issledovaniy [Academy of Sciences of the USSR. Institute of Geography. Data of Glaciological Studies] Vol.18, p.160-163, 6 refs., 4 ill., 1 table. USSR (Text in Russian with English summary)

CRREL Acc. No: 28000445, GeoRef. Acc. No.: 45611, Record ID 28000445

In 1969 we performed a drilling of the ice by flame on the glacier Tuiuksu, Zaili Ala-Tau at the altitude of 3500-3600 m above sea level. A petrol-air-atomizing burner of the rocket type was used as a drilling equipment. It was suspended steel cable and lowered into the hole by winch. The weight of the whole

drilling equipment is about 600 kgs. The motor with compressor weights 180 kgs. The motor power is 8 h.p., the compressor output equals to 0.62 m³/min. Four holes have been drilled. The drilling rate decreases with increasing of the hole depth. The penetration rate is 13.7 m/h. (Auth.)

- 23. Morev, V.A. (1976):** Elektrotermobury dlia bureniia skvazhin v lednikovom pokrove [Electric thermal drills for glacier core drilling] Akademiia nauk SSSR. Institut geografii. Materialy gliatsiologicheskikh issledovaniy [Academy of Sciences of the USSR. Institute of Geography. Data of Glaciological Studies] No.28, p.118-120, 2 ill., 1 table. USSR (Text in Russian with English summary)

Ant. Acc. No: 18601, GeoRef Acc. No: 62343, Record ID 31004195

The article contains designs and general specifications for thermoprobes and thermal core drills developed by the Arctic and Antarctic Institute. The results of glacier drilling in the Caucasus, the Pamirs, Severnaia Zemlia, and the Antarctic with this equipment are discussed. (Auth.)

- 24. Morev, V.A., Pukhov, V.A. (1981):** Eksperimental'nye raboty po bureniuu kholodnykh pokrovnykh lednikov termoburovymi snariadami AANII [Using AANII thermodrills in experimental drilling of cold ice sheets] Trudy Arkticheskogo i Antarkticheskogo nauchno-issledovatel'skogo instituta [Transactions of Arctic and Antarctic Research Institute] Vol. 367, p.64-68, 1 table. Leningrad. USSR (Text in Russian)

CRREL Acc. No.: 36001592, GeoRef Acc. No.: 82423, Record ID 36001592

The results of drilling operations on Vavilov Glacier in 1974-1979 are given. At this time 11 bore-holes were drilled by electric thermal point ETI-1 and antifreeze thermal electric drill ETB-3. The deepest holes with depths of 459 m (May, 1977) and 556 m (April-May, 1979) reached the bedrock of the glacier.

- 25. *Morev, V.A.; Pukhov, V.A.; Yakovlev, V.M. (1981):** Burenie skvazhiny na lednike Vavilova, Severnaya Zemlya [Core drilling through Vavilov Glacier, Severnaya Zemlya] Akademiia nauk SSSR. Institut geografii. Materialy gliatsiologicheskikh issledovaniy [Academy of Sciences of the USSR. Institute of Geography. Data of Glaciological Studies] Vol. 40, p.154-157, 2 refs., 2 ill. (Text in Russian with English summary). Eng. transl. in: Data of glaciological studies: chronicle discussions. Edited by G.A. Avsiuk, p.252-256, 1988. New Delhi, Amerind Publishing Co. United States

Originator No: TT 81-52175, CRREL Acc. No: 42002728, GeoRef Acc. No.: 110308, Record ID 42002728

The method of thermo-drilling of boreholes, then filled up with antifreeze solution is described. This permits to drill deep boreholes in cold glaciers. The new thermo-drilling equipment intended for the drilling of cold (down to -60 °C) glaciers was tested. The paper contains results of drilling in the central parts of the Vavilov Dome (Severnaya Zemlya) down to the depth of 556.5 m. (Auth.)

- 26. Morev, V.A., Klement'ev, O.L., Manevskii, L.N., Raikovskii, Yu.V., Tolstoi, A.I., Yakovlev, V.M. (1988):** Glyatsio-burobye raboty na lednike Vavilova v 1979-1985 gg. [Ice drilling on Vavilov Glacier in 1979-1985] Geograficheskie i gliatsiologicheskie issledovaniya v polarnykh stranakh [Geographical and glaciological investigations in polar regions] Leningrad, Gidrometroizdat, p.25-32, 9 refs., 3 tables, USSR. (Text in Russian)

The description of the drilling operations carried out by specialists of Arctic and Antarctic Research Institute together with Institute of Geography in the edge and central parts of Vavilov Glacier is given. The antifreeze thermal drilling technology is briefly described. The results of the hole temperature and inclination measurements are also given.

- 27. Psar'eva, T.; Tsykin, E.N.; Tsykina, T.A. (1968):** Eksperimental'naya 150-metrovaya skvazhina na lednike Bezengi [Experimental 150-m deep borehole on Bezengi Glacier] Akademiia nauk SSSR. Institut geografii. Materialy gliatsiologicheskikh issledovaniy [Academy of Sciences of the USSR. Institute of Geography. Data of Glaciological Studies] Vol. 14, p.93-97, 5 refs. USSR (Text in Russian)

CRREL Acc. No: 23005387, GeoRef Acc. No: 29463, Record ID 23005387

- 28. Punning Ya.-M.K.; Martma T.A., Tyugu K.E.; Vaikmyae R.A.; Purshe M.; Pinglo F. (1985):** Stratifikatsiya lednikovogo kerna s Zapadnogo ledyanogo polya na Severo-Vostochnoi Zemle [Stratification of ice core from Vestfonna Ice Dome, Nordanstlandet]. Akademiia nauk SSSR. Institut geografii. Materialy gliatsiologicheskikh issledovaniy [Academy of Sciences of the USSR. Institute of

Geography. Data of Glaciological Studies] Vol. 52, p.202-205, 13 refs., 3 ill. USSR (Text in Russian with English summary)

29. **Ryumin, A.K.; Nozdryukhin, V.K.; Emel'yanov, Yu.N.; Morev, V.A. (1974):** Stroenie lednika Abramova po dannym radiolokatsionnogo zondirovaniya [Structure of Abramov Glacier according with radar sounding] Trudy SARNIGMI [Transactions of Middle-East Regional Research Hydro-Meteorological Institute]. Vol. 14 (95), p. 27-35 (Text in Russian)
30. **Samoilov, O.I.; Zagorodnov, V.S. (1985):** Struktura l'da i l'doobrazovanie na subpoliarnom lednike [Ice structure and ice formation on a subpolar glacier] Akademiia nauk SSSR. Institut geografii. Materialy gliatsiologicheskikh issledovaniy [Academy of Sciences of the USSR. Institute of Geography. Data of Glaciological Studies] Vol. 52, p.54-61. 19 refs. (Text in Russian with English summary)

CRREL Acc. No: 40001058, Record ID 99211

31. **Savatyugin L.M., Zagorodnov V.S. (1987):** Glyatsiologicheskie issledovaniya na lednikovom kupole Akademii Nauk [Glaciological investigations on Akademiya Nauk Glacier] Akademiia nauk SSSR. Institut geografii. Materialy gliatsiologicheskikh issledovaniy [Academy of Sciences of the USSR. Institute of Geography. Data of Glaciological Studies] Vol. 61, p.228. (Text in Russian)

The results of glaciological investigations carried out in June-October, 1986 on Akademiya Nauk Glacier, Komsomolets Island, Severnaya Zemlya archipelago, are briefly described. At this time the deep hole up to the depth of 561 m had been drilled using antifreeze thermal unit.

32. **Savatyugin, L.M.; Arkhipov, S.M, et al. (2000):** Rossiisko-Germanskije glyatsiologicheskie issledovaniya na Severnoi Zemle i priligauchshikh ostrovakh [Russian-German glaciological investigations on Severnaya Zemlya and neighboring islands] Akademiia nauk SSSR. Institut geografii. Materialy gliatsiologicheskikh issledovaniy [Academy of Sciences of the USSR. Institute of Geography. Data of Glaciological Studies] Vol. 91, p.150-162. (Text in Russian with English summary)
33. **Sukhanov L.A., Morev V.A., Zotikov I.A. (1974):** Potativnye ledovye elektrobury [Portable thermoelectric ice drills] Akademiia nauk SSSR. Institut geografii. Materialy gliatsiologicheskikh issledovaniy [Academy of Sciences of the USSR. Institute of Geography. Data of Glaciological Studies] Vol. 23, p.234-238, 5 refs., 1 table, 2 ill. (Text in Russian with English summary)

CRREL Acc. No: 30003767, Record ID 57285

The article deals with the construction of thermodrills, the characteristics of the equipment and the ways to use it to study temperate mountain glaciers. As a result of three seasons of field studies on mountain glaciers with the aid of this equipment it is suggested to use the data on the speed of thermodrilling as one of the methods to study internal structure and regime of the glaciers (the thickness of firn layers, the density profile of it, the thickness of ice layers dusted with fine debris, the location and the sizes of internal crevasses, moulins and so on). Drilling-speed data of some repeated drilling through the same moulins could be used to study temperatures and stresses within glaciers. (Auth.)

34. **Suslov, V.F.; Akbarov, A.A.; Emel'yanov, Yu.N.; Nozdryukhin, V.K.; Kislov, B.V.; Inogamova, S.I.; Arapov, P.P. Kharitonov, G.G.; Gerasimova, Z.A.; Heupokoev, V.A.; Aliev, O. (1980):** Lednik Abramova [Abramov Glacier]. Leningrad, Gidrometeoizdat. 208 p.
35. **Tsykin, E.N. (1962):** Metodika izmereniya temperatury lednikov, primenyavshaysya Institutom Geografii AN SSSR v issledovaniyakh Mezhdunarodnogo geofizicheskogo goda [Methods of temperature measurements used by Institute of Geography at researches of International Geophysical Year] Akademiia nauk SSSR. Institut geografii. Materialy gliatsiologicheskikh issledovaniy [Academy of Sciences of the USSR. Institute of Geography. Data of Glaciological Studies] Vol. 6, p.113-127. USSR (Text in Russian)
36. **Tsykin, E.N. (1963):** L'egkie buroviye shtangi dlya bureniya na glubiny 6-7 m i 12-15 m [Light-weight drill rods for drilling to the depth of 6-7 and 12-15 m] Akademiia nauk SSSR. Institut geografii. Materialy gliatsiologicheskikh issledovaniy [Academy of Sciences of the USSR. Institute of Geography. Data of Glaciological Studies] Vol. 7, p.135-136. USSR (Text in Russian)

CRREL Acc. No.: 26003124, GeoRef Acc.No.: 41161, Record ID 26003124

37. **Tsykin, E.N. (1963):** Buroviye shtangi s sharnirnym sochleneniem [Hinged drill rods] Akademiia nauk SSSR. Institut geografii. Materialy gliatsiologicheskikh issledovaniy [Academy of Sciences of

the USSR. Institute of Geography. Data of Glaciological Studies] Vol. 7, p.137-139. USSR (Text in Russian)

CRREL Acc. No.: 26003125, GeoRef Acc.No.: 41162, Record ID 26003125

- 38. Tsykin, E.N. (1963):** Burovyie stakany dlya l'da i firna [Core barrels for ice and firn] Akademiia nauk SSSR. Institut geografii. Materialy gliatsiologicheskikh issledovaniy [Academy of Sciences of the USSR. Institute of Geography. Data of Glaciological Studies] Vol. 7, p.139-140. USSR (Text in Russian)

CRREL Acc. No.: 26003126, GeoRef Acc. No.: 41163, Record ID 26003126

- 39. Tsykin, E.N. (1966):** Udarno-kanatnoye bureniye lednikov [Cable-churn drilling in glaciers] Akademiia nauk SSSR. Institut geografii. Materialy gliatsiologicheskikh issledovaniy [Academy of Sciences of the USSR. Institute of Geography. Data of Glaciological Studies] Vol. 12, p.239-248, 19 refs. USSR (Text in Russian)

CRREL Acc. No.: 23000903, GeoRef Acc. No.: 25148, Record ID 23000903

- 40. Tsykin, E.N. (1970):** Opisaniye portativnoi burovoy ustanovki dlya udarno-kanatnogo bureniya lednikov na glubiny do 200 m [Description of portable drilling rig for cable-churn drilling in glaciers up to depths of 200 m] Akademiia nauk SSSR. Institut geografii. Materialy gliatsiologicheskikh issledovaniy [Academy of Sciences of the USSR. Institute of Geography. Data of Glaciological Studies] Vol. 16, p.257-262. USSR (Text in Russian)

CRREL Acc. No.: 36001251, GeoRef Acc. No.: 82082, Record ID 36001251

- 41. Tsykina, G.A.; Vilesov, E.N. (1963):** O temperaturnom rezhime lednika Tuyksu Tsentral'nyi [About temperature regime of the Central Tuyksu Glacier] Issledovaniya lednikov i lednikovikh raionov. Akademiia nauk SSSR. Institut Geografii. Mezhdudedomstvennyi Geofizicheskii Komitet pri Prezidiume AN SSSR [Investigations of glaciers and polar regions. Academy of Sciences of USSR. Interdepartmental Geophysical Committee At Presidium of Academy of Sciences of USSR] Moscow, Vol.3, p. 56-66. USSR (Text in Russian)

- 42. Vasiliev, N.I.; Blinov K.V.; Denisov G.V.; Markov A.N.; Talalay P.G., Ufaev V.V. (1989):** Burenie i issledovaniye skvazhiny na lednike Vavilova (Severnaya Zemlya) v 1988 godu [Drilling and logging of the borehole on Vavilov Glacier (Severnaya Zemlya) in 1988] Akademiia nauk SSSR. Institut geografii. Materialy gliatsiologicheskikh issledovaniy [Academy of Sciences of the USSR. Institute of Geography. Data of Glaciological Studies] Vol. 67, p.249, (Text in Russian)

The results of drilling by electromechanical drill KEMS-112 on Vavilov Glacier in 1988 are briefly described. The hole has been drilled through the glacier up to the depth of 459 m and penetrated into subglacial bedrock to the depth of 4 m. The characteristics of drilling operations in ice and subglacial rocks are given. The results of borehole logging (inclination, hole diameter and temperature) are also described.

- 43. Vasiliev, N.I.; Talalay P.G. (1992):** Kolonkovyi elektromekhanicheskii burovoy snaryad: Konstruktsiya i resul'taty ispytaniy [Electromechanical core drill: construction and results of tests] II Mezhdunarodnyi Simpozium po bureniyu skvazhin v oslozhnennykh usloviyakh. Sankt-Peterburg, Iyun', 2-7, 1992: Tezisy dokladov [Second International Symposium on Drilling in Complicated Conditions. Saint Petersburg, June, 2-7, 1992: Abstracts]. Saint Petersburg, Saint-Petersburg State Mining Institute, p.120. USSR (Text in Russian)

Construction of electromechanical ice core drill KEMS-112 and results of testing on Vavilov Glacier (Severnaya Zemlya) and Vostok Station (East Antarctica) are briefly described.

- 44. *Vasiliev, N.I., Kudrayashov, B.B., Talalay, P.G., Chistyakov, V.K. (1993a):** Core drilling by electromechanical drill. Polar Record, 29 (170), p.235-237, 10 refs. United Kingdom (Text in English)

GeoRef Acc. No: 134959, CRREL Acc. No: 47004576, Record ID 48732

Core drilling is considered to be the most effective method of studying glaciers and sub-glacial rock. Thermal drills suspended on cables are very simple in construction and enable the drilling of deep boreholes in firn and ice. However, mechanical drilling is characterized by lower energy consumption and a higher rate of penetration. Moreover, drilling of sub-glacial rock and ice containing mineral inclusions becomes possible only by using electromechanical drills suspended on cables. These types of drills, used at Vostok Station beginning in Mar. 1989, and their effectiveness are described.

45. **Vasiliev, N.I.; Zhigalyev, S.P.; Zubkov, V.M.; Talalay, P.G.; Chistyakov, V.K. (1993b):** Burenie neclubokikh skvazhin v lednikakh [Shallow drilling in glaciers] Akademiia nauk SSSR. Institut geografii. Materialy gliatsiologicheskikh issledovaniy [Academy of Sciences of the USSR. Institute of Geography. Data of Glaciological Studies] Vol. 77, p.74-77, 7 refs., 4 ill. (Text in Russian with English summary)

Technical properties of new lightened thermal drills, core electromechanical and portable auger drills intended for the drilling of shallow boreholes in glaciers are shown. Results of the first field tests on the glaciers of Severnaya Zemlya, the Caucasus, Tien-Shan, Codar Range and on the ice of the Gulf of Finland are presented. The total depth of the boreholes drilled by portable thermal drills is 454 m. Recommendations on extensive practical application of the developed technical devices for glaciological studies are given. (Auth.)

46. **Vasiliev, N.I.; Kudryashov, B.B.; Zubkov, V.M.; Vostretsov, R.N.; Dmitriev, A.N.; Krasilev, A.V.; Savatiugin, L.M.; Miller, H.; Fritsche, D. (2001):** Rezul'taty bureniya skvazhiny na lednike Akademii Naul (Arhipelag Severnaya Zemlya) [Results of drilling on Akademiya Nauk Glacier (Severnaya Zemlya archipelago)] V Mezhdunarodnyi Simpozium po bureniyu skvazhin v oslozhnennykh usloviyakh. Sankt-Peterburg, Iyun', 11-15, 2001: Tezisy dokladov [Fifth International Symposium on Drilling in Complicated Conditions. Saint Petersburg, June, 11-15, 2001: Abstracts]. Saint Petersburg, Saint-Petersburg State Mining Institute, p.9. Russia (Text in Russian)

The results of drilling operations on Akademiya Nauk Glacier are briefly described. In 1999-2001 according with Russian-German project the hole has been drilled using electromechanical drill KEMS-132 up to the depth of 724 m. The hole pieced into subglacial rocks.

47. **Vilesov, E.N.; Shabanov, P.F. (1961):** Iz opyta bureniya na visokogornikh lednikakh [Drilling experiment on high-mountain glaciers] Glyatsiologicheskie issledovaniya v period MGG. Zailiiskii i Dzhungarskii Alatau [Glaciological investigations during IGY. Zailiiskii i Dzhungarskii Alatau] Alma-Ata, Izd-vo Akad. nauk Kazakhskoi SSR [Alma-Ata, Publisher: Academy of Sciences of Kazakh Soviet Socialist Republic] Vol. 1, p.31-35. USSR (Text in Russian with English summary)

CRREL Acc. No.: 19022268, GeoRef Acc. No.: 21304, Record ID 19022268

48. **Zagorodnov, V.S.; Zotikov, I.A.; Barbash, V.R.; Mikhalyev B.I. (1976):** O termobureni na lednike Obrucheve [Thermal drilling on the Obruchev glacier] Akademiia nauk SSSR. Institut geografii. Materialy gliatsiologicheskikh issledovaniy [Academy of Sciences of the USSR. Institute of Geography. Data of Glaciological Studies] Vol. 28, p.112-118, 6 ill. (Text in Russian with English summary)

CRREL Acc. No: 31004194, Record ID 62342

Results of thermo-drilling of boreholes on the Obruchev glacier are considered. Special equipment for the report of drilling velocity was used. Obtained data on position of sub-glacial bed-rock, information on internal structure of glacier sequence, inhomogeneous layers, position of the lower firn line, the level of inner glacial waters and its changes in time are given. (Auth.)

49. **Zagorodnov, V.S. (1981):** Issledovanie stroeniia i temperaturnogo rezhima shpitsbergenskikh lednikov s pomoshch'iu termobureniia [Using thermal drills in studying temperature regime of Spitsbergen glaciers] Akademiia nauk SSSR. Institut geografii. Materialy gliatsiologicheskikh issledovaniy [Academy of Sciences of the USSR. Institute of Geography. Data of Glaciological Studies] Vol. 41, p.196-199 (200-202?), 3 refs. (Text in Russian with English summary)

CRREL Acc. No: 36003403, Record ID 84234

50. ***Zagorodnov, V.S.; Zotikov, I.A. (1981a):** Kernovoe burenie na Shpitsbergene [Core drilling at Spitsbergen] Akademiia nauk SSSR. Institut geografii. Materialy gliatsiologicheskikh issledovaniy [Academy of Sciences of the USSR. Institute of Geography. Data of Glaciological Studies] Vol. 40, p.157-163, 4 refs., 5 ill. (Text in Russian with English summary) Eng. transl. in: Data of glaciological studies: chronicle discussions. Edited by G.A. Avsiuk, p.257-266, 1988. New Delhi, Amerind Publishing Co. United States

Originator No: TT 81-52175, CRREL Acc. No: 42002729, Record ID 110309

Methods and results of deep (down to 200 m) thermal drilling of boreholes at Svalbard glaciers are described. Due to hot point drilling in 1975, 1976 with the help of "Speedograph" and also due to core drilling comprehensive information on the glacier structure, their thermal regime, the presence and dynamics of water inside glaciers has been obtained. Results of radio echo sounding of these glaciers have been

specified. The curve of the changes in drilling speed together with depth is compared to structure of firn-ice sequence and temperature distribution along the ice divide between the East Grönfjord and Fritjof glaciers, and on the Lomonosov Plateau. In the latter case the inverse temperature gradient was measured, causing the occurrence of frazil ice in the alcohol solution. (Auth.)

51. **Zagorodnov, V.S.; Zotikov, I.A. (1981b):** Vnitrilednikovie kanaly [Englacial channels] Akademiia nauk SSSR. Institut geografii. Materialy gliatsiologicheskikh issledovaniy [Academy of Sciences of the USSR. Institute of Geography. Data of Glaciological Studies] Vol. 41, p.200-202, 6 refs., 3 ill. (Text in Russian with English summary)
52. **Zagorodnov, V.S.; Samoilov, O.Iu. (1982a):** Glubinnoe stroenie shpitsbergenskikh lednikov [Internal structure of Spitsbergen glaciers] Akademiia nauk SSSR. Institut geografii. Materialy gliatsiologicheskikh issledovaniy [Academy of Sciences of the USSR. Institute of Geography. Data of Glaciological Studies] Vol. 44, p.58-64, 18 refs., 4 ill. (Text in Russian with English summary)

CRREL Acc. No: 37001659, Record ID 86758

SUMMARY (p.64)

53. **Zagorodnov, V.S.; Zinger, E.M. (1982b):** Gliatsiologicheskie raboty na Severo-Vostochnoi Zemle [Glaciological investigations on North East Land] Akademiia nauk SSSR. Institut geografii. Materialy gliatsiologicheskikh issledovaniy [Academy of Sciences of the USSR. Institute of Geography. Data of Glaciological Studies] Vol. 43, p.30, 5 refs. (Text in Russian)

CRREL Acc. No: 36003864, Record ID 84695

54. **Zagorodnov, V.S.; Samoilov, O.Iu.; Raikovskii, Yu.V.; Tarusov A.V.; Kuznetsov, M.N.; Sazonov, A.V. (1984):** Glubinnoe stroenie lednikovogo plato Lomonosova na o. Zap. Shpitsbergen [Deep structure of the glacial Lomonosov Plateau on western Spitsbergen] Akademiia nauk SSSR. Institut geografii. Materialy gliatsiologicheskikh issledovaniy [Academy of Sciences of the USSR. Institute of Geography. Data of Glaciological Studies] Vol. 50, p.119-126, 10 refs., 4 ill. (Text in Russian with English summary)

CRREL Acc. No: 39002777, Record ID 96861

SUMMARY (p.126)

55. **Zagorodnov, V.S.; Arkhipov, S.M.; Macheret, Yu.Ya.; (1985):** Reconstructions of ice-formation conditions on a subpolar glacier from core analyses [Rekonstruktsiia uslovii l'doobrazovaniia na subpoliarnom lednike po rezul'tatam issledovaniy kerna] Akademiia nauk SSSR. Institut geografii. Materialy gliatsiologicheskikh issledovaniy [Academy of Sciences of the USSR. Institute of Geography. Data of Glaciological Studies] Vol. 53, p.36-44, 22 refs. (Text in Russian with English summary)

CRREL Acc. No: 40002074, Record ID 100227

56. **Zagorodnov, V.S.; Zinger, E.M.; Troitskii, L.S.; Arkhipov, S.M. (1987):** Zavershenie glubokogo bureniya na Vostochnom ledyanom pole [Completion of deep drilling on Nordaustlandet] Akademiia nauk SSSR. Institut geografii. Materialy gliatsiologicheskikh issledovaniy [Academy of Sciences of the USSR. Institute of Geography. Data of Glaciological Studies] Vol. 61, p. 184, 1 ref. (Text in Russian)

The results of glaciological investigations carried out by Institute of Geography on Austfonna, Nordaustlandet are briefly given. In June. 1987 the deep hole up to bedrock on the depth of 566.7 m had been drilled with antifreeze thermal electric drill.

57. ***Zagorodnov, V.S. (1988):** Recent Soviet activities on ice core drilling and core investigations in Arctic region. Bulletin of glacier research, No. 6, p.81-84. Japan. 4 refs. (Text in English)

CRREL Acc. No: 42003627 Record ID 111207

58. **Zagorodnov, V.S.; Savatiugin, L.M.; Morev, V.A. (1989a):** Temperaturnyi rezhim lednika Akademii Nauk na Severnoi Zemle [Temperature regime of the Akademiya Nauk Glacier, Severnaya Zemlya] Akademiia nauk SSSR. Institut geografii. Materialy gliatsiologicheskikh issledovaniy [Academy of Sciences of the USSR. Institute of Geography. Data of Glaciological Studies] Vol. 65, p.134-138, 5 refs., 2 ill. USSR (Text in Russian with English summary)

CRREL Acc. No: 44000348, Record ID 116905

The results of temperature observations in the borehole drilled by a thermodrill in the central part of the Akademia Nauk Dome, Severnaya Zemlya, are presented. It has been revealed that three days after the end of drilling the temperature of ice is recovered. It has been established earlier that in the borehole filled with water-alcohol antifreeze through the year the temperature is the same as in the borehole with no filler. Due to the horizontal flow of melt water the firn sequence, the temperature in the two boreholes located at a distance of 30 m from one another, differed at a depth of 12.85 m by 1.2-1.5 °C. The inverse temperature gradient in the upper portion of the profile is related to the warming of glacier sequence due to the increasing melting through the last 130-170 years. During the Little Ice Age, the melting was two times less than at present, and the temperature of the surface made up -15.5 °C, which is 6 °C lower than at present. In the central area of glacier the air temperature rise in the firn zone by 1 °C in summer caused the temperature rise in the glacier sequence near the surface by 6 °C; the warming in the marginal part was evidently insignificant; the cooling of the sequence is quite possible. (Auth.)

- 59. Zagorodnov, V.S. (1989b):** Antifriz-termicheskoe kernovoe burenie arkticheskikh pokrovnykh lednikov [Antifreeze-thermal core drilling in arctic ice sheets] Akademiia nauk SSSR. Institut geografii. Materialy gliatsiologicheskikh issledovaniy [Academy of Sciences of the USSR. Institute of Geography. Data of Glaciological Studies] Vol. 66, p.143-149, 5 refs., 5 ill. (Text in Russian with English summary)

CRREL Acc. No: 46003681, Record ID 128676

Deep boreholes which reached the glacier bedrock at the depths of 566.7 and 761 m, respectively, were drilled by a core antifreeze electrothermodrill on ice caps of Austfonna, the Nordaustlandet, and Akademia Nauk, Severnaya Zemlya, in 1985-1987. The authors summarize the experience of applying electrothermodrills to the studies of structure and hydrothermal regime of glaciers, describe the equipment and results of drilling. The difficulties arising in course of drilling and the ways to avoid them are also discussed. Successful experiments of decreasing the inclination of the bore-hole and drilling a new hole for obtaining additional core from the near-bottom sequence of glaciers are also described. The main advantages of the antifreeze-and-thermal technology glacier drilling are small sizes and weight of equipment, simplicity of operating and reliability in work, insignificant energy consumption and a relatively high quality of the core. Comparatively simple methods made it possible to change the direction of the drilled bore-hole, which will allow to obtain additional core from the near-bottom sequence of a glacier. (Auth.)

- 60. *Zagorodnov, V.S. (1989c):** Antifreeze-thermodrilling of cores in arctic sheet glaciers. International Workshop on Ice Drilling Technology, 3rd, Grenoble, France, Oct. 10-14, 1988. Proceedings. Ice core drilling. Edited by C. Rado and D. Beaudoin, p.97-109. Publisher: Grenoble, France. Centre National de la Recherche Scientifique. Laboratoire de Glaciologie et Geophysique de l'Environnement. France. 7 refs. (Text in English)

CRREL Acc. No: 45001462, Record ID 122570

In 1985-87 two Arctic sheet glaciers: Austfonna (Nordaustland) and Akademia Nauk (Severnaya Zemlya) were cored with antifreeze electrothermal drill down their beds at 566.7 m and 761 m depth, respectively. The paper discusses the use of electrothermal drills for studies of the structure and hydrothermal regime of glaciers. It deals both with the equipment and results. The difficulties of drilling are also discussed, as well as ways to cope with them. Experiments on the reduction of bore hole inclination and on drilling of an additional bore hole to obtain an extra core from the bottom glacial stratum are described. (Auth.)

- 61. Zagorodnov, V.S.; Sin'kevich, S.A.; Arkhipov, S.M. (1990a):** Gidrotermicheskii rezhim ledorazdel'noi oblasti Vostochnogo ledianogo polia, o. Severo-Vostochnaia Zemlia [Hydrothermal regime of the ice-divide area of Austfonna, Nordaustlandet] Akademiia nauk SSSR. Institut geografii. Materialy gliatsiologicheskikh issledovaniy [Academy of Sciences of the USSR. Institute of Geography. Data of Glaciological Studies] Vol. 68, p.133-141, 13 refs., 9 ill. USSR (Text in Russian with English summary)

CRREL Acc. No: 45001752, Record ID 122860

The temperature of the glacier sequence was measured in the bore-hole drilled on the ice-divide of the dome in June, 1987, which reached the bed at a depth of 566.7 m. The reciprocal temperature gradient in the upper part of the borehole indicates the non-stationary temperature regime of the glacier. As compared to the previous Little Ice Age the temperature of the sequence at present has grown by 6-7 °C. In the basal, 70-meter thick layer the temperature conditions are unstable. That is caused by the income of water from under the glacier, which is evidently highly mineralized. (Auth.)

62. **Zagorodnov, V.S.; Klement'ev, O.L.; Nikiforov, N.N.; Nikolaev, V.I.; Savatiugin, L.M.; Sasunkevitch, V.A. (1990b):** Hydrothermal regime and ice formation in the central part of the Akademiya Nauk Glacier, Severnaya Zemlya [Gidrotermicheskii rezhim i l'doobrazovanie v tsentral'noi chasti lednika Akademii Nauk na Severnoi Zemle] Akademiia nauk SSSR. Institut geografii. Materialy gliatsiologicheskikh issledovaniy [Academy of Sciences of the USSR. Institute of Geography. Data of Glaciological Studies] Vol. 70, p.36-43, 18 refs., 3 ill. USSR (Text in Russian with English summary)

CRREL Acc. No: 46003403, Record ID 128398

The results of complex investigations of ice-formation process in the period of field studies of 1986 and 1987 made on the Akademiya Nauk Ice Dome, Komsomolets Isl., Severnaya Zemlya, are analyzed in the paper. Snow surveys, studies of the firn-ice sequence in the pits and in the core of a deep borehole by structural-stratigraphic methods, determination of the content of tritium and ^{210}Pb , electric conductivity and optical density measurements of ice made it possible to reveal the conditions typical of a sub-cold firn subzone in the area of "Mir" field station (80°30' N, 94°50' E, 810 m a.s.l.). The annual accumulation in the central part of the dome is in average 43-44 g/cm². (Auth.)

63. ***Zagorodnov, V.S.; Arkhipov, S.M. (1990c):** Studies of structure, composition and temperature regime of sheet glaciers of Svalbard and Severnaya Zemlya: methods and outcomes. Bulletin of glacier research, No.8, p.19-28. Japan, 8 refs. (Text in English)

CRREL Acc. No: 45000195, Record ID 121303

64. **Zagorodnov, V.S.; Arkhipov, S.M.; Bazhev, A.B.; Vostokova, T.A.; Korolyev, P.A.; Rototaeva, O.V.; Sin'kevitch, S.A.; Khmelevskoi, I.F. (1991):** Stroenie, sostav i gidrotermicheskii rezhim lednika Garabashi na El'bruse (Structure, composition and hydrothermal regime of the Garabashi Glacier on Elbrus) Akademiia nauk SSSR. Institut geografii. Materialy gliatsiologicheskikh issledovaniy [Academy of Sciences of the USSR. Institute of Geography. Data of Glaciological Studies] Vol. 73, p.109-117, 8 refs. (Text in Russian with English summary)

CRREL Acc. No: 49005541, LC call no: GB2401.M37, Record ID 189895

The results of the analysis of the ice core from a 76-m deep borehole, drilled to the bed of the Garabashi Glacier, the Elbrus, in its accumulation area, demonstrate that stable infiltration-recrystallization ice-formation of the warm type has taken place at the altitudes of about 3950 m a.s.l. during the last few decades. (Auth.)

65. ***Zagorodnov V.S., Thompson, L.G.; Kelley, J.J.; Koci, B.; Mikhalev, V. (1998):** Antifreeze thermal ice core drilling: an effective approach to the acquisition of ice cores. Cold regions science and engineering, 28(3), p.189-202. 31 refs. Netherlands. (Text in English)

CRREL Acc. No: 53003507, Record ID 218437

Antifreeze thermal electric drills have a long history of ice drilling in temperate, subpolar and polar glaciers. Shallow, intermediate and deep ice cores have been obtained in Arctic, Antarctic and high elevation glaciers. Many merits and drawbacks of antifreeze thermal technology have been discovered over the past 25 years. A modified version of the antifreeze thermal electric ice coring drill has recently been developed and tested in the laboratory and in the field for use with ethanol-water solution. This thermal drill reduces thermal stresses in an ice core by a factor of 5 compared to that of conventional thermal drills and produces good quality ice core. The new drill was used to obtain a 315-m ice core in Franz Josef Land in the high Russian Arctic. (Auth.)

66. **Zagrivnyi, E.A., Zemtsov, A.A., Kononov, Yu.B., Moiseev, B.S., Petukhov, P.A., Skurko, A.M. (1981):** Opyt byreniya-plavleniya skvazhin, zalitikh nezamerzayushchey zhidkostiu, v Antarktike i Ark-tike [Experience of drilling by melting of holes filled by non-freezing liquid in Antarctica and Arctic]. Zapiski Leningradskogo Gornogo Instituta [Transactions of Leningrad Mining Institute], Vol. 86, p.79-83, 6 refs., 1 ill. Leningrad. USSR (Text in Russian)

During 20 SAE (1974-1975) drilling of hole #2 was continued with the TBZS-152 thermal drill in the interval from 142-450.4 m, 199 drilling runs were completed with the following mean parameters: core length 1.55 m and penetration rate 2.6 m/h. Results of drilling by thermal drill TBZS-152 at Vavilov glacier up to a depth of 462.2 m in 1977 are given.

67. **Zemtsov, A.A.; Men'shikov, N.G. (1988):** Kompleks tekhnicheskikh sredstv dlya otbora prob na uglerodnyi analiz iz ledovikh tolshch [Ice sheet sampling devices for carbon analyzing] Zapiski Len-

ingradskogo Gornogo Instituta [Transactions of Leningrad Mining Institute], Vol. 116, p.78-81, 5 refs., 1 ill. Leningrad. USSR (Text in Russian)

Special devices for CO₂ sampling from boreholes drilled in ice sheets are described. Test samplings were carried out on Vavilov Glacier (Severnaya Zemlya) from the holes with depths of 52, 100 and 200 m and at Vostok station (Antarctica) from the holes with depths of 200 and 205 m.

- 68. Zotikov, I.A.; Razumeiko, N.G. (1966):** Raspredelenie temperatur v lednikakh kupolakh Zemli Fta-tsa-Iosifa kak otrazhenie kolebanii klimata [Temperature distribution in ice caps of Franz-Josef Land as reflection of climate changes] Akademiia nauk SSSR. Institut geografii. Materialy gliatsiologicheskikh issledovaniy [Academy of Sciences of the USSR. Institute of Geography. Data of Glaciological Studies], Vol. 12, p.274-276, 3 refs., 1 ill. (Text in Russian)

Table 1

DRILLING IN 1955-1969

Year	Site	Organization	Interval of drilling, m	Type of drilling equipment	Bibliography
1957-1959	Churlyenis Glacier (Franz Joseph Land)	?	few holes with depths from 20 to 82 m	Self-propelled drilling rig SBU-150-ZIV	Bazanov, 1961
1955-1959	Franz Joseph Land	IGAS	117 holes (max 52.6 m)	Handle ice drills BL-40, BL-52, BL-72	
1956-1957	Terskii Alatau (Tien Shan)				
1957-1958	Pirin (Bulgaria)				
1957-1959	Zailiiskii Alatau (Tien Shan)				
1958-1959	Novaya Zemlya				
1958-1960	Polar Urals				
1963	Elbrus (Central Caucasus)	IGAS	6 holes from 28 to 40 m	Cable-churn drilling rig	
1964	Tuiuksu Glacier (Northern Tien Shan)	Kazakh Polytechnic Institute	0-33 0-23	Jet-fire drill	Brichkin et al., 1967
1965	Karabatkak Glacier (Terskii Alatau, Tien Shan)	IGAS	49 m	Cable-churn drilling rig	
1966, 1967	Bazengi and Marukh Glacier (West Caucasus)	IGAS	10 holes from 30 to 150 m		
1969	Tuiuksu Glacier (Northern Tien Shan)	Kazakh Polytechnic Institute	0-28 0-53.5 0-72 0-53	Jet-fire drill	Mikheev, 1971

Table 2

AARI AND IGRAS THERMAL DRILLING

Year	Site	Interval of drilling, m	Type of drilling equipment	Bibliography
1969	Marukh Glacier (West Caucasus)	20 m (?)*	Thermoelectric point*	Sukhanov et al., 1974
1970, 1971	Jankuat Glacier (Central Caucasus)	few holes with total depth of 405 m (max 111 m)*	Thermoelectric point "Elektroigla ETI-1"	Sukhanov et al., 1974
1972	Abramov Galacier (Pamirs)	few holes with total depth of 375 m (max 175 m)*	Thermoelectric point "Elektroigla ETI-1"	Sukhanov et al., 1974
1972	Abramov Galacier (Pamirs)	0-113	Thermal drill LKTBM-1**	Sukhanov et al., 1974
1972	Jankuat Glacier (Central Caucasus)	few holes with total depth of 160 m (max 51 m)*	Thermoelectric point "Mikroteb-1"	Sukhanov et al., 1974
1973, 1974	Obruchev Glacier (Polar Urals)	28 holes with total depth of 1426 m (max 137 m)*	Thermoelectric point "Elektroigla ETI-1"	Morev, 1976; Zagorodnov et al., 1976
		0-86	ATED	
1974	Vavilov Glacier (Severnaya Zemlya)	5 holes with total depth of 224 m (max 80 m)	Thermoelectric point "Elektroigla ETI-1"	Morev and Pukhov, 1981
1975	Vavilov Glacier (Severnaya Zemlya)	0-60	Thermoelectric point "Elektroigla ETI-1"	Morev and Pukhov, 1981
1975	ice-divide area between East Gr�nfjord and Fritjof glaciers (Spitsbergen)	few holes	Thermoelectric point "Elektroigla ETI-1"	Zagorodnov and Zotikov, 1981
		0-201	ATED ETB-3	
		201-211.1	Thermoelectric point "Elektroigla ETI-1"	
1976	Lomonosov Plateau (Spitsbergen)	0-201	ATED ETB-3	Zagorodnov and Zotikov, 1981
?	Amundsen Plateau (Spitsbergen)	?	ATED ETB-3	Zagorodnov, 1981
?	Fritjof glacier (Spitsbergen)	0-335?	ATED ETB-3	Zagorodnov and Samoilov, 1982a
1976	Vavilov Glacier (Severnaya Zemlya)	0-17 0-15	ATED ETB-3	Morev and Pukhov, 1981
1976	Vavilov Glacier (Severnaya Zemlya)	0-310	Antifreeze thermoelectric point*	Morev and Pukhov, 1981
1977	Vavilov Glacier (Severnaya Zemlya)	0-459	ATED ETB-3	Morev and Pukhov, 1981
1979	Vavilov Glacier (Severnaya Zemlya)	0-556	ATED ETB-5 and ETB-3	Morev and Pukhov, 1981; Morev et al., 1981; Morev et al., 1988
1980	Vavilov Glacier (Severnaya Zemlya)	4 holes from 10 to 25 m	ATED ETB-3	Morev et al., 1988
		0-57	Thermoelectric point "Elektroigla ETI-1"	
1982	Vavilov Glacier (Severnaya Zemlya)	0-468.5 0-146	ATED ETB-3	Morev et al., 1988
1982	Lomonosov Plateau (Spitsbergen)	0-35	Thermoelectric point "Elektroigla ETI-1"	Zagorodnov et al., 1984
		0-31	ATED ETB-3	
		0-135		
1983	Vavilov Glacier (Severnaya Zemlya)	0-467	ATED ETB-3	Morev et al., 1988
1984	Vavilov Glacier (Severnaya Zemlya)	0-110	Thermal drill ETB-130***	Morev et al., 1988
1985	Vavilov Glacier (Severnaya Zemlya)	0-102	Thermal drill ETB-130***	Morev et al., 1988
1985	Austfonna (Nordaustlandet, Spitsbergen)	0-204	ATED ETB-3	Sovetskie..., 1986; Arkhipov et al., 1987; Zagorodnov, 1989b; Zagorodnov, 1989c; Zagorodnov et al., 1990a
1986	Akademiya Nauk Glacier	0-561 0-13	ATED ETB-3	Savatyugin and Zagorodnov, 1987;

1986	(Severnaya Zemlya)	0-561 0-13	ATED ETB-3	Klemet'ev et al., 1988; Zagorodnov, 1989a; Zagorodnov, 1989b; Zagorodnov et al., 1989c; Zagorodnov et al., 1990b
1987		222-761		
1987	Austfonna (Nordautlandet, Spitsbergen)	0-566.7	ATED ETB-3	Zagorodnov et al., 1987; Zagorodnov, 1989b; Zagorodnov, 1989c; Zagorodnov et al., 1990a
1987	Garabashi Glacier (Elbrus, Central Cau- casus)	two holes with depth of 73.2 and 77.7 m	Thermoelectric point*	Bazhev et al., 1988; Zagorodnov et al., 1991
1988		0-76.7 0-76.0	ATED ETB-3	

*Full diameter without core

**Thermal drill without special equipment for sucking or dissolving of melted water.

***Dry core thermal drill

Table 3

LMI (SPSMI) DRILLING

Year	Site	Interval of drilling, m	Type of drilling equipment	Bibliography
1977	Vavilov Glacier (Severnaya Zemlya)	0-91.8	Thermal drill TBZS-152M	Zagrivnyi et al., 1981; Barkov et al., 1988 Chistyakov et al., 1988; Zemtsov and Men'shikov, 1988; Blinov et al, 1994
1977		0-51	Thermal drill TBZS-152M	
1977		0-462.2	Thermal drill TBZS-152M	
1978		0-27.5	Thermal drill TBZS-152M	
		27.5-45.3	Thermal drill TBS-93	
		45.3-49.3	Thermal drill TBS-93VCh	
1978		0-130	Thermal drill TBSK-93	
1979		0-460	Thermal drill TBZS-152M	
1979		7 holes with total depth of 35 m (max 13.4 m)	Thermal drill MTBS-66	
1979		4 holes with total depth of 26 m (max 16.8 m)	Thermal drill TBZS-152M	
1979		0-52.4	Thermal drill TBZS-152M	
		52.4-95.5	Thermal drill TBSK-93	
1980		0-80	Thermal drill TBZS-152M	
1981		0-52	Thermal drill TELGA-152M	
1981		0-410	Thermal drill TBZS-152M	
1983		0-200	Thermal drill TELGA-152M	
1983		0-100	Thermal drill TELGA-152M	
1984		0-30	Thermal drill TELGA-152M	
		30-89	Electromechanical drill KEMS-112	
1985		0-50	Thermal drill PTBS-112	
1986		0-36.9	Thermal drill TELGA-152M	Bobin et al., 1988 Kudryashov et al., 1989; Vasiliev et al., 1989; Kudryashov et al., 1991; Vasiliev and Talalay, 1992; Kudryashov et al., 1993; *Vasiliev et al., 1993a; *Kudryashov et al., 1994; Blinov et al., 1994
		36.9-151.8	Electromechanical drill KEMS-112	
1988		0-32.2	Thermal drill TELGA-152M	
		32.2-461.6	Electromechanical drill KEMS-112	
1983	Dzhungarskoye Firn Plateau (Central Caucasus)	0-93	Thermal drill MTBS-76	Vasiliev et al., 1993b
1999	Akademiya Nauk Glacier	0-53.9	Electromechanical drill KEMS-132	Vasiliev et al., 2001
2000	(Severnaya Zemlya)	53.9-504.7		
2001		504.7-724		