UNIVERSITY OF ALASKA FAIRBANKS VOL. 2 NO. 1 JANUARY 1990

PICO BULLETIN

Editor: John Kelley Technical Editor: D. Dahl

Dr. Luis Proenza
Vice Chancellor for Research

PICO AT THE UNIVERSITY OF ALASKA FAIRBANKS

The success of the first Greenland field season supported by the Polar Ice Coring Office since its move to the University of Alaska Fairbanks was due to the diligence and dedication of its staff. PICO technical and operational staff provided drilling and administrative services to twelve research programs, including GISP2, a multi-institutional project with a goal of retreiving an ice core over 3000m in length from the thickest portion of the Greenland ice sheet.

The successful completion of our first season is evidence of the expertise available to us in arctic research coordinated efforts and of the commitment of the University of Alaska Fairbanks to excellence in developing technical support facilities in support of polar research.

Technical expertise provided by UAF's Geophysical Institute and School of Engineering offered numerous opportunities for multi-disciplinary interaction and contributed greatly to the success of this past season.

We appreciate the participation of and contributions from the members of our science advisory board and look forward to further close association in fulfilling our obligations to the National Science Foundation Division of Polar Programs and the scientific community.

INTERNATIONAL COOPERATION

With the current international level of interest in paleoclimatic history, there is an increasing demand for ice cores from different areas containing stable and unstable isotopes. The Physics Institute Laboratory at the University of Bern, Switzerland uses these isotopes as tracers to track pollutants in both the atmosphere and water.

Natural stable and unstable isotopes are trapped in polar ice. Ice core analyses provide data on the paleoclimatic conditions on earth, and these data enable scientists to build computer models of atmospheric pollution. Polar ice has preserved the longest and most accurate record of paleoclimatic conditions available.

The Physics Institute Laboratory has been involved in paleoclimatic studies in the Arctic and Antarctic for 25 years, and possesses a great amount of expertise in the acquisition and analysis of ice cores.

Mr. Henry Rufli has been at the Institute for 20 years providing technical support in maintaining and upgrading the laboratory's equipment and in designing and developing field equipment such as complete ice drill systems and core processing facilities.

With PICO's primary task of providing the technical and logistical support required in the acquisition of these ice cores, we anticipate a continued close association with Mr. Rufli and the Institute and look forward to future collaborative efforts.

Note: Motivated by increasing pollution of the atmosphere by fossil fuel use and other anthropogenic effects, Henry Rufli is working on alternative energy solutions, running a small company that utilizes photovoltaic power systems of 1 to 10 kW. Several of these systems are already in use in Switzerland.

Henry Rufli has been designing solar-powered cars for 5 years. One is completely operational and has been in every day use for 4 years. The most current model is experimental and is the basis for an advanced new system currently being developed.

Henry Rufli is associated with the Physics Institute Laboratory of the University of Bern, Switzerland

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DIRECTOR'S COMMENTS

We celebrate our first year at UAF with a word of gratitude to the many faculty, staff and administrators who helped us through the transition period associated with the move from the University of Nebraska-Lincoln. Rebuilding a technical and operational support staff in order to support successfully an ambitious program during 1989 in Greenland, the development of the technical support system and deep ice coring drill as well as support of research projects in Antarctica were major undertakings. We developed close ties with the Geophysical Institute, School of Engineering and Institute of Marine Science and appreciate the assistance and advice of their faculties and staffs who comprise our advisory committee and provide us with shop and technical support.

Preparation for the Greenland Ice Sheet Project Two (GISP2) is of primary concern to us. We must provide all of the essential services to support the deep ice coring activities on the Greenland ice cap as well as a safe and comfortable facility for the GISP2 participants during the summer 1990 drilling season. The preparations included the search for an environmentally safe drilling fluid and the design and fabrication of a deep coring system. We have been in consultation with the GISP2 Science Management Office (SMO) at every stage of planning recognizing that the success of this project will require a strong and effective team effort. We look forward to an exciting new year and to the continued development of operational and technical services at PICO.

Dr. John Kelley, Director

GREENLAND ICE SHEET PROJECT TWO (GISP2)

GISP2 is a National Science Foundation funded effort to retrieve an approximately 3000-meter-deep core, which will yield a high resolution, 200,000 year history of global change. This record will include two interglacial and two glacial periods and will be the longest available record from the Northern Hemisphere. GISP2 is the most ambitious U.S. glaciological project of its kind to date.

Started in January 1989, the GISP2 Science Management Office (SMO) was created to coordinate and represent many scientific investigations (15 at present). Specific goals of the SMO are to:

- provide an operational and administrative center that is responsive to the science requirements of the researchers;
- coordinate scientific activities and integrate them with drilling and logistic support provided by PICO;
- design and construct a Core Processing Line for use at the GISP2 camp;
- represent GISP2 nationally and internationally; and
- implement the GISP2 Executive Committee's policies on sample distribution, data exchange and publications.

The GISP2 Science Management Office is located at:

The Institute for the Study of Earth,
Oceans and Space (EOS)
University of New Hampshire
Durham, NH 03824-3525

PHONE: (603) 862-1991
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TELEX: (23)7407969 GISP UC

Dr. Paul Mayewski, Director

SIPLE COAST DEEP DRILLING PROGRAM

The demonstration of the very rapid motion of the West Antarctic Ice Streams has added an important new element to earlier concerns over the instability of the West Antarctic Ice Sheet.

The National Science Foundation supported Siple Coast Project, begun in 1983 and consisting of a team of Caltech researchers led by Barclay Kamb and Hermann Engelhardt, has the objective to measure the balance and configuration of the ice draining into the Ross Ice Shelf Basin of West Antarctica. The major goal of this project is to predict the likely future behavior of this region and its relation to sea level rise and climatic change.

In order to better identify and understand the physical mechanisms that control the ice flow in the fast moving areas, a deep drilling program in Ice Stream B was started in the 1988-89 field season. The Caltech team was able to complete five boreholes to the bed of Ice Stream B, 1030 m deep, using a fast hot-water-drilling technique. They found that the base of Ice Stream B is wet. The basal water pressure is very high, near the flotation level, which is an important condition for rapid ice stream flow. Pressure and temperature sensors were placed in the ice for year-long data acquisition. The stored data were recovered during the 1990 field season.

The samples of bottom sediments consist of mostly fine rock materials, silt, sand and some clasts up to 6 mm in size. These samples contain microfossils of Miocene/Pliocene age, hence this part of the West Antarctic Ice Sheet did not exist 4.5-5.5 million years ago.

Drs. Barclay Kamb and Hermann Engelhardt are associated with the Division of Geological and Planetary Sciences at the California Institute of Technology in Pasadena, California

1989 GREENLAND OPERATIONS

Supporting a total of 12 NSF-sponsored research programs, 1989 proved to be the largest and most ambitious Greenland field season to date since PICO began providing Greenland support services in 1975. A total of 97 individuals from various U.S. and European institutions were involved in field activities accounting for a total of 2,879 personnel days in Greenland.

Of the many successful projects receiving PICO operational support in 1989, several milestones deserve particular attention. The 1989 Camp Century Borehole Logging Program draws to an end a four year collaborative effort of B. Lyle Hansen (PICO) and Niels Gundestrup (University of Copenhagen) to log the three deep boreholes of Dye 3 and Camp Century in Greenland and Byrd Station in Antarctica. This project will provide valuable insight into the deformation properties of deep ice within polar ice sheets.

Using hot water to probe the depths of the Jakobshavn Ice Stream in western Greenland, researchers from the University of Alaska Fairbanks Geophysical Institute and the Federal Institute of Technology in Zürich, Switzerland, completed several drill holes to depths near 1600m in an effort to determine the mechanisms of fast moving ice. These access holes, which received instrumented cable strings, are to date the deepest hot water holes ever drilled.

The exciting discoveries of the Harvard University paleontological expedition to Jameson Land East Greenland are described in this issue.

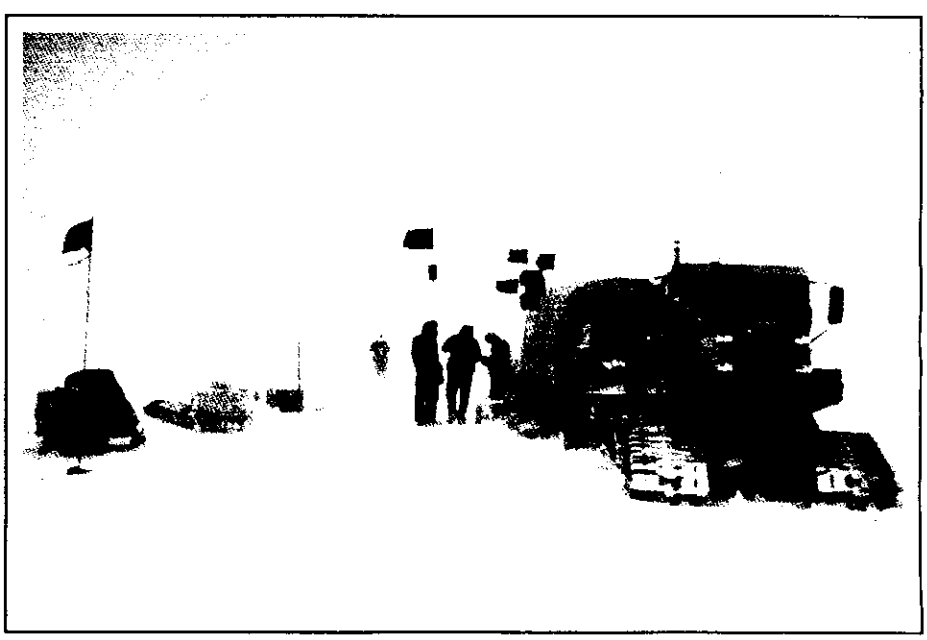
Through research publications and increasing coverage in the popular press issues of Global Warming and the Greenhouse Effect have spawned new debate among scientists, the general public and policymakers alike. This reaction is in response to evidence of an increase in levels of carbon dioxide, nitrous oxide, methane and chlorofluorocarbons in the earth's atmosphere. As a result of fossil fuel combustion and increased agricultural and human activity these "greenhouse" gases are capable of absorbing and radiating back to earth long-wave infrared radiation. It is thought that this trapped heat or "greenhouse effect" will contribute to global warming. To assess the effect and implications an increase of these gases have on the global temperature, a better understanding of the earth's climate history is required. Nowhere is there a more detailed or well preserved record of the earth's climate history than that which is trapped as snow and ice in the polar ice sheets of Greenland and the Antarctic.

The Greenland Ice Sheet Project Two (GISP2) has as its goal to drill and recover an ice core from the entire thickness of the Greenland Ice Sheet (over 3,000m). The resulting core will provide researchers with the longest record of the earth's climatic history ever recovered in the northern hemisphere, dating back nearly 200,000 years.

After several years of site selection activity in central Greenland, 1989 marks the first year of GISP2 science activities at the chosen site near the summit of the ice sheet. 1989 programs involved investigators from eleven universities and institutes from the U.S. Supported by PICO drilling and operations personnel, investigators collected over 500m of ice and snow for detailed chemical and physical studies. Deep drilling and other atmospheric studies will continue at the GISP2 site on a seasonal basis through 1992.

As in past years the research and support efforts of the NSF and PICO would be difficult were it not for the continued support of the following organizations:
Danish Commission for Scientific Research in Greenland, Headquarters United States Air Force (HQ USAF), Headquarters Military Airlift Command (HQ MAC), Headquarters USAF Space Command (HQ AFSPACECOM), The 109th Tactical Airlift Group (109th TAG), Sondrestrom Air Base, Greenland (1015th ABS), Thule Air Base, Greenland (1012th ABG), McGuire Air Force Base, NJ (WRI), Alaska Air Command, Eielson AFB, U.S. Army, Fort Wainwright, U.S. Army Cold Regions Research Engineering Laboratory (CRREL), 4700 Operations Support Squadron (4700 OSS), Felec Services, Inc. (FSI), Dewline Station Dye 3 (DYE3), GreenlandAir A/S (GLAIR), GreenlandAir Charter A/S (GLACE), The Royal Greenland Trade Department (KNI), The Danish Meteorological Institute and STATOIL.

Kent Swanson
Senior Logistics Manager



1987 Central Greenland traverse party (photo: B. Boller)

DGASP: YEAR-ROUND AIR SAMPLING ON THE ICE SHEET

The DYE3 Gas and Aerosols Sampling Program (DGASP), a multi-institutional effort led by Dr. Clifford I. Davidson of Carnegie-Mellon University and supported by the National Science Foundation Division of Polar Programs concluded in August 1989, representing the first time air sampling was conducted continuously over a year on the Greenland Ice Sheet. Previous efforts involved sampling only during the summer for limited time periods. Because DYE3 closed permanently in November 1989, there may not be another convenient opportunity to conduct this type of program throughout the year.

DGASP included a number of researchers who worked in shifts, spending periods of two to six weeks collecting samples, and represented several institutions: Carnegie-Mellon University (Cliff Davidson, Jean-Luc Jaffrezo, Frank Boscoe, Robert Gandley and Chitsan Lin), University of New Hampshire (Jack Dibb and Byard Mosher), University of Rhode Island (Niel Tindale) and the Finnish Meteorological Institute (Risto Hillamo). The samples obtained include aerosols collected on filters, air collected in canisters, individual ice crystals and snowflakes, fresh snow and older surface snow. Continuous monitors were used to measure condensation nuclei, ozone and light scattering by airborne particles. Snow from several snowpits was also collected and will be analyzed for anions, cations, organic acids, trace elements, radionuclides and carbon compounds by laboratories in the U.S., France, Finland and Denmark.

Analyses of these data will provide scientists with valuable information on concentrations in the air and snow during all seasons. This will enhance our understanding of chemical constituents in the GISP2 and GRIP deep cores, and of sources and atmospheric transport pathways that bring these constitutents from the mid-latitudes to the arctic regions.

Collecting Snow Samples at DYE3 under the program directed by Dr. Clifford I. Davidson, Department of Civil Engineering, Carnegie-Mellon University (Photo courtesy of Dr. C. Davidson)

UAF SUPPORT

A major contribution to the success of this year's field season was the participation of Drs. Mark Tumeo and Kevin Curtis of the University of Alaska School of Engineering.

As an authority on health and safety issues in the Arctic, Dr. Tumeo provided expertise in our pursuit of an environmentally and occupationally safe drilling fluid for use in the acquisition of ice cores. With his and Dr. Thomas Gosink's (School of Fisheries and Ocean Sciences) assistance we were able to identify a fluid that meets all stated criteria, including maintaining the integrity of the core.

With experience in arctic engineering, Dr. Curtis was instrumental in the design and development of both temporary and permanent structures scheduled for construction on the summit of the Greenland ice sheet during the next field season.

Although no formal agreement exists, we are in the process of developing a Memorandum of Understanding with the School of Engineering and we have had extensive interaction with both Drs. Tumeo and Curtis as well as with the Dean and department heads. PICO looks forward to future interactions with the faculty of the School of Engineering and appreciates their contributions.

The Geophysical Institute's machine shop is one of the best equipped and expertly staffed facilities of its kind in Alaska, offering several years of cumulative experience in the design, development and maintenance of machinery and equipment. Under the supervision of Larry Kozycki the staff provides support to PICO's mission of ice core drill development and fabrication.

Members of the machine shop's staff participate in PICO's technical services meetings and are closely involved in the design, development and maintenance of the drill system. The staff produces conceptual designs and detailed drawings of modifications to the equipment which are submitted for review and, if appropriate, implementation by the engineering group and drilling crew. The implementation of these modifications often requires that the machine shop fabricate new parts for the drill.

PICO and the Geophysical Institute have a mutual agreement in the form of a Memorandum of Understanding and we look forward to a high level of interaction.

PEREGRINE FALCON STUDIES

A frequent visitor to the NSF/PICO office at Sondrestrom, Greenland is Dr. William G. Mattox of the Ohio Department of Natural Resources. Dr. Mattox, supported by the U.S. Army Chemical Research, Development and Engineering Center of Aberdeen Proving Ground, Maryland has been conducting studies on the nesting of peregrine falcons near Sondrestrom, Greenland each summer since 1972. Each summer, 4 or 5 two-man teams backpack throughout the area to visit known peregrine nest cliffs, as well as other promising cliffs.

In the late 1960s a decline in the population of the falcon was confirmed. The reasons for the decline have been shown to be DDE and other chlorinated hydrocarbons which affect calcium metabolism in the bird and result in thin eggshells, breakage and resultant lowered productivity. Because the falcons of Greenland migrate to Central and South American wintering grounds each winter, they have also been impacted by the use of pesticides and other pollutants in various parts of the world.

The project began in 1972 when a 5-man team located 9 active cliffs and banded 13 young. By the end of the 1989 season, 970 peregrines had been banded by this project. 45 of these were recovered (4.6%); 31 were captured and released by banders, and 14 had been shot or found dead. In 1989, the 18th field season was completed and perhaps more is now known about peregrines in Greenland than in any other northern region. Last summer the regular survey teams located 60 pairs of peregrines at 74 nest cliffs. At 51 of these cliffs falcons raised a minimum of 154 young for an average of 3.0 young per producing cliff and 2.6 young for all pairs. The team banded 139 young, 23 more than in the record-setting 1988 season. Six new peregrine nest cliffs were discovered, at some of which no previous breeding can be confirmed. These new nesting cliffs present strong evidence that the breeding population is increasing. Although the falcons still carry significant levels of pollutants, apparently the levels are not high enough to impact reproduction. Blood samples from adults and nestlings in Greenland have provided the ground truth for ongoing DNA gene probes which can provide natal origin of peregrines captured during migration or on the wintering grounds.

Dr. William G. Mattox is associated with the Greenland Peregrine Falcon Survey of Columbus, Ohio

A two-man team setting out for a known peregrine falcon nesting cliff to band chicks in summer, 1989. (Photo: D. Dahl)

PICO WILDERNESS MEDICINE

Work in polar regions is demanding, both physically and mentally, and often requires long hours in severe weather conditions. To minimize the possibility of life-threatening situations at remote camps, PICO will be offering a course that will certify its field staff in the areas of Cardiopulmonary Resucitation and Advanced First Aid and as First Responders. The latter will be tailored to the needs of PICO and will address issues of long-term patient care, remote rescue techniques and survival skills with an emphasis on cold injuries. PICO staff consider the obligation to provide professionally trained personnel essential to ensure the safety of individuals involved in research projects in both Greenland and Antarctica.

Steven Peterzen
Field Operations Manager

US/USSR WORKSHOP ON GLACIOLOGICAL RESEARCH

In November Dr. John Kelley and Mr. Jay Sonderup attended a US/USSR workshop held in Washington, DC under the auspices of the National Science Foundation and the Soviet Academy of Sciences to foster cooperative research in all aspects of glaciological and ice core research. The workshop was designed to encourage activities which fall under the bilateral Memorandum of Understanding on Cooperation in the Field of Basic Scientific Research.

As a result of this workshop a joint recommendation was drafted and signed. The participants recommended the following:

- The exchange of information and specialists in those fields of glaciological science whose elaboration will contribute to the better understanding and solution of global environmental problems; and

- To hold a number of joint thematic workshops for the elaboration of cooperative projects.

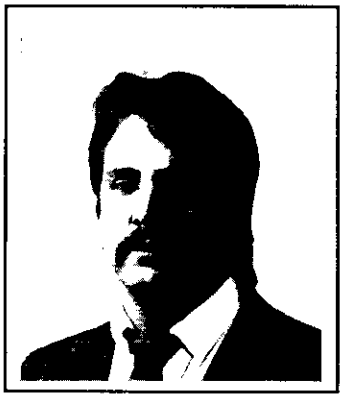
The National Science Foundation and the Soviet Academy of Sciences, Institute of Geography at Moscow coordinate these efforts on behalf of the scientific community in order to assist in these endeavors and to strengthen the links between Soviet and US glaciologists.

Jay Sonderup
Assistant Director

PICO WELCOMES NEW TECHNICAL SUPPORT AND OPERATIONS STAFF TO UAF

Jay Klinck

Mr. Jay Klinck, Remote Camp Manager, comes to PICO with several years' experience in establishing and maintaining remote camp sites in Greenland and Antarctica. Working closely with the PICO staff and GISP2 Science Management Office, Mr. Klinck will coordinate logistical and operational efforts in support of the GISP2 deep drilling project on the summit of the Greenland ice sheet.



Steven Peterzen

Mr. Steven Peterzen, Field Operations Manager, joins the PICO operations staff in the coordination of NSF-sponsored Greenland field activities and management of the NSF/PICO support facility in Sondrestrom, Greenland. Mr. Peterzen has several years' experience working in polar environments both as field staff and educator, supporting NSF programs in both Greenland and the Antarctic.

Terry Gacke

Mr. Terry Gacke, Assistant Field Operations Manager/Carpenter, operates a small business specializing in arctic building techniques. Mr. Gacke worked with the UAF engineering department in the design and development of the structures currently being planned for use at the summit of the Greenland Ice Sheet. He will further assist in the construction of the buildings on site and assist field operations management efforts in Sondrestrom.

Mark Wumkes

Mr. Mark Wumkes, PICO Field Engineer, has several years' experience drilling in the Arctic and Antarctic and has participated in several sea ice research projects . Mr. Wumkes recently returned from Antarctica where he provided technical drilling support to a project at Byrd Station led by Dr. Chester Langway of the State University of New York. A description of the results of this work appears in this issue.

Tyler Burton

Mr. Tyler Burton and Mr. Victor Mimken (photo unavailable), both students at the UAF School of Engineering, received intensive training as drill technicians at the GISP2 site at the summit of the Greenland ice sheet during the 1989 field season. Mr. Mimken recently returned from Antarctica where he provided technical support to the Byrd Station drilling program. Also participating in this year's Greenland and Antarctic field seasons was Mr. Jay Kyne, an engineering student who worked in the Polar Ice Coring Office at the University of Nebraska-Lincoln (photo unavailable). *(Photos: J. Coccia)*

NATIVE STUDENT RECRUITMENT

A major factor contributing to the success of future ice coring is the availability of specialized staff capable of designing, developing, maintaining and operating the various drill systems required to obtain core from high-latitude arctic and subarctic regions. PICO recognizes this obligation and continues to offer training which is necessary to maintain this level of staffing. PICO administrators recently attended a meeting of the American Indian Science and Engineering Society (AISES), from which we hope to recruit future engineers and technicians to participate in our efforts.

BYRD SURFACE CAMP--ANTARCTICA 1989

In October and November 1989 PICO personnel Mark Wumkes, Victor Mimken and Jay Kyne participated in a researech project at Byrd Station, Antarctica (80°01'S, 119°32'W, elevation 1500m). PICO supplied technicians and equipment to acquire a 4" diameter core for a research project led by Dr. Chester Langway, Jr. of SUNY-Buffalo who is conducting stable isotope ratio studies and electroconductivity measurements on the ice.

The goal was to obtain a core up to 200m in length from the old Byrd drill site extending the record to a depth that can be tied to the existing Byrd core and providing a continuous record dating back approximately 100,000 years.

The first 90m of the original core were taken with a thermal drill and produced core that could not be used for many sampling procedures. The next 40m, taken with the U.S. Army CRREL core drill, were sampled and analyzed until there was virtually no core remaining.

Another facet of the project was to obtain firn core to a depth of 25m at two locations, 12 and 25 km upstream, to compare the remote cores with the main Byrd core to determine the extent of contaminants that may be present due to human activities at Byrd Surface Camp.

The main core was completed on 28 November when a depth of 163.5m was reached providing a record that dates back to about 700 AD. The drill was then dismantled and moved to the 12 km remote site on 29 November and to the 25 km remote site on 1 December. After successful completion of the project the team departed Byrd Station on 5 December.

PICO drillers at Byrd Station, Antarctica during the 1990 field season (Photo: M. Wumkes).

Mark Wumkes
Field Engineer

THE INUIT CIRCUMPOLAR CONFERENCE

The initial membership of the Inuit Circumpolar Conference (ICC), consisting of the Inuit of the U.S. (Alaska), Denmark (Greenland) and Canada founded and participated in the first ICC held at Barrow, Alaska in June 1977. The purposes of the Conference are:

- to promote Inuit rights;
- to ensure Inuit participation in political, economic and social institutions on the international level;
- to promote greater self-sufficiency and ensure the endurance and growth of Inuit cultures and societies for present and future generations;
- to promote long-term management and protection of arctic and sub-arctic wildlife, environment and biological productivity; and
- to promote wise management and use of non-renewable resources incorporating such resources in the present and future development of Inuit economies while protecting other Inuit interests.

The Fifth Assembly of the Inuit Circumpolar Conference was held in July at Sisimiut, Greenland. The theme was Inuit Unity as, for the first time in the history of the Conference, representatives of the Soviet Inuit were present. Also present, representing the University of Alaska, was Dr. John Kelley, accompanied by Bonnie Crandall and Dorothy Dahl.

Since there are many aspects of ICC that are consistent with U.S. Arctic research policy, interacting with the Inuit community in mutually beneficial international cooperation is highly appropriate.

With PICO's goal of obtaining approximately two and one half miles of core from the vast natural laboratory that is Greenland, it is our intention to meet the needs of the scientific community in an environmentally and humanly responsible manner, without damaging the integrity and fragile stability of the arctic environment in which we work.

Dorothy Dahl
Administrative Assistant

LETTERS:

The Polar Ice Coring Office (PICO), during its fifteen years at the University of Nebraska-Lincoln, brought to the glaciology community a number of innovations and successes. The development of a light-weight auger increased the acquisition of ice core by providing easier access to a greater range of locations by way of its greater mobility. The addition of a solar power pack contributed substantially to the success of this equipment.

One need only look at the current inventory of drilling equipment to recognize the greatly increased capability of the U.S. to obtain cores and to provide open holes for a variety of scientific applications. The instrumentation capable of logging existing holes is an essential element of the equipment currently in the PICO inventory. Additionally, since the introduction of the RISP wireline system (now apparently a source of spare parts), drill types and functions have expanded in different geographic localities such as China, Alaska and Peru, as well as Greenland and Antarctica.

The move of PICO to the University of Alaska Fairbanks comes at a time when the major accomplishment of the PICO staff will be to complete the design and development of a drill capable of recovering core from the thickest portions of the Greenland and Antarctic ice sheets. The evolution of such a drill will be the result of the efforts of several people from many countries, universities and agencies. Hopefully it will put the U.S. ice coring capabilities at the cutting edge (no pun intended) of ice core recovery and analysis.

For many of us the successful development and operation of this "deep drill" will be the finale to several decades of cooperative discussion, design and testing. We wish those who have accepted this responsibility the very best.

Robert Rutford

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