

THE POLAR ICE-CORE STORAGE FACILITY AT USA CRREL*

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Since the inception of the U.S. polar ice-core drilling program, the U.S. Army Cold Regions Research and Engineering Laboratory (USA CRREL) has been responsible for the central storage and curatorial activities of the ice cores recovered in the Office of Polar Programs/National Science Foundation (OPP/NSF) Arctic and Antarctic research programs (Table 1).

The main purpose of the central ice-core storage facility is to handle, process, catalog and distribute the ice cores drilled in the polar regions (Lange, 1973; Langway and Hansen, 1970; Langway *et al.*, 1970; Ueda and Garfield, 1968, 1969a, 1969b) to OPP-approved recipients for glaciological research. Under an agreement with OPP, the ice cores are stored at USA CRREL and in a commercial freezer facility; a technician handles and catalogs them. A core data bank is maintained for retrieval and information exchange, and starting with the Dye 3 ice core, is being computerized.

Between 1956 and 1968, USA CRREL had within its own physical plant the cold room capacity to store the ice cores. With the advent of core drilling through both the Greenland and Antarctic ice sheets in 1966 and 1968, respectively, USA CRREL's available storage capacity was exceeded and a nearby commercial outlet was located.

Within the present USA CRREL cold room complex a 15 feet (4.6 m) by 25 feet (7.6 m) room, 16 feet (4.9 m) high, maintained at $-34 \pm 2^{\circ}\text{C}$ is reserved solely for the storage of ice cores and other surface samples (Room 161, Fig. 1). Approximately 400 5-foot (1.5 m) core tubes from selected depths over the profiles of the various ice cores listed in Table 1 are stored in Room 161. These cores are used in USA CRREL's in-house ice-core analysis program as well as for out-of-house needs. Adjacent to and having the same dimensions as the storage room (Room 160, Fig. 2) is the cold laboratory ($-10 \pm 2^{\circ}\text{C}$) used for core processing, chemical cleaning of cores, various physical property studies (within a dust-free hood), and photography.

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Table 1
Arctic and Antarctic Ice-core Inventory

Year Drilled	Location	Drilling Method	Depth of Drilling, m
<i>PRE-IGY</i>			
1956	Site 2, Greenland	Rotary	305
1957	Site 2, Greenland	Rotary	411
<i>IGY</i>			
1958	Byrd Station, Antarctica	Rotary	308
1959	Little America V, Antarctica	Rotary	256
<i>POST-IGY</i>			
1961	Camp Century, Greenland	Thermal	185
1962	Camp Century, Greenland	Thermal	235
1966	Camp Century, Greenland	Electromechanical	1375
1968	Byrd Station, Antarctica	Electromechanical	2164
<i>GISP</i>			
1971	Dye 3, Greenland	Thermal	372
1973	Station Milcent, Greenland	Thermal	398
1974	Station Crete, Greenland	Thermal	405

The bulk of the ice cores are stored at a commercial storage facility in Littleton, New Hampshire, 60 miles (96 km) north of USA CRREL. A total of 820 square feet (76.2 m²) of floor area is rented consisting of three racks 16 feet (4.9 m) high (Fig.3). Each rack is 40 feet (12.2 m) long and divided into 13 units in length and 5 units in height. Each unit holds between 17 and 22 core tubes which vary in diameter to accommodate the 4 inch (10.2 cm) to 4-7/8 inch (12.4 cm) diameter ice cores. As many as 20,000 core tubes can be stored here. The ice cores are sheathed in polyethylene tubing and contained in specially constructed near-vacuum-tight aluminum-foiled tubes in the field. The commercial cold-storage facility is kept at $-24 \pm 2^{\circ}\text{C}$ using ammonia as the refrigerant. It has a complete back-up system and a separate power plant. The entire building was constructed and insulated to remain below freezing for 8 days after a power failure. In addition, sufficient refrigerated trailers are always available in the event of a catastrophe.

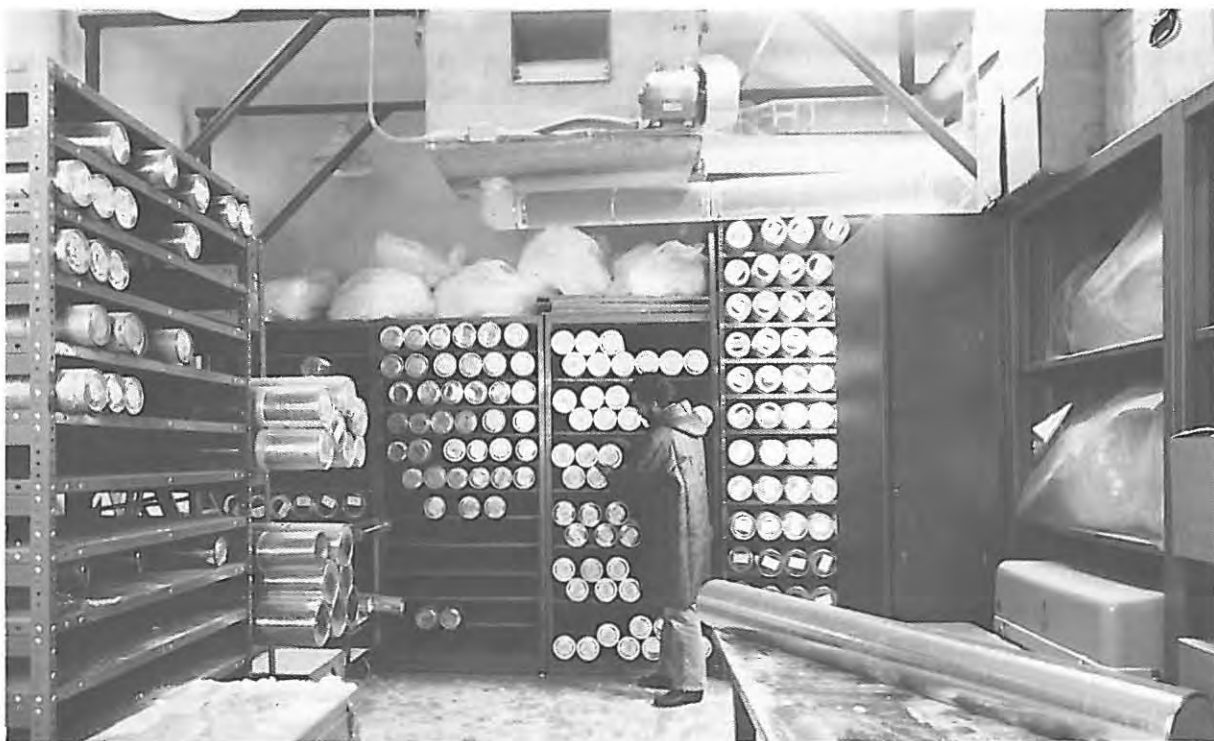


Figure 1. Cold room 161 at USA CRREL used exclusively for ice core and other polar sample storage. Temperature of storage is $-34 \pm 2^{\circ}\text{C}$.



Figure 2. Cold room 160 at USA CRREL used for ice-core processing and study. Temperature of laboratory is $-10 \pm 2^{\circ}\text{C}$.

Numerous samples of Arctic and Antarctic cores have been supplied to investigators around the world, and results of studies have been published in various trade journals (see bibliography by Langway and Gow, 1968). These investigations encompass all three components of the material making up an ice core: entrapped air, the ice itself and foreign matter—both particulate and dissolved. Many analytical techniques for analysis of the recovered cores have been developed, but recognizing the extreme value of the cores, as well as the limitations of any particular laboratory in total analytical technology, an integrated and cooperative analysis program has been built in which a large number of investigators have participated. Main participation is presently being shared by three interrelated groups, each responsible for a particular analytical area:

USA CRREL	Physical and chemical analyses
University of Copenhagen	Stable isotope and particle analyses
University of Bern	Radioactive isotope and gas analyses

In addition to the above, the Ohio State University Institute of Polar Studies is developing a particle analysis laboratory under OPP sponsorship. Various other investigators have and are performing specific studies on the different ice cores using grants from other federal, state, educational and private institutions (Langway, 1974).



Figure 3. Commercial ice-core facility north of USA CRREL. On the right are Camp Century, Greenland, ice cores. In the center is fork-lift truck emplacing a crated shipment of ice cores from Byrd Station, Antarctica. Core racks are 40 feet (12.2 m) long, 5 feet (1.5 m) wide and 16 feet (4.9 m) high. Temperature of storage is $-24 \pm 2^{\circ}\text{C}$.

Concurrent with development of glacier drilling technology, USA CRREL and the University of Copenhagen have developed a core stratigraphy and logging routine and surface pit/ice-core correlation system which assures accurate and consistent recording of stratigraphic features providing a firm chronological, geochemical and isotopic datum for all studies.

Samples of the ice cores are made available to any interested scientist that is funded through OPP for this purpose or has an on-going research effort that would benefit from obtaining polar ice core samples. To obtain samples, in the first case, submit proposal through OPP. In the latter case, write to the author.

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