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The Dominion Range ice core

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Localized-accumulation basins in the Transantarctic Mountains contain sites yielding ice-cores that provide highly detailed (seasonal to annual resolution, depending upon depth), several-thousand-year records of glacial history, climatic change, volcanic activity, and atmospheric chemistry. The scientific attraction of these sites, first, their geographic location with respect to other ice-core studies (which are most commonly recovered from inland sectors of the antarctic ice sheet) and second, the fact that Transantarctic Mountain sites are more directly comparable to glacial geologic records because the latter are usually based on studies in these mountains. Although the ice-core records from these sites cover shorter periods than glacial geologic records, they provide much finer resolution and hence allow more elaborate and direct comparisons to be made with modern Antarctica. Details gained from ice-core records in the Transantarctic Mountains, therefore, provide us with a better understanding of glacial geologic records. The most valuable ice-core records are those which are highly detailed and involve a number of different types of physical and chemical measurements because such records maximize the dating of the core while also providing the tightest resolution and interpretation.

During the 1984–1985 austral summer, we undertook a field program on the plateau of the Dominion Range (figures 1 and 2), a localized accumulation basin at the head of the Beardmore Glacier, Transantarctic Mountains. Studies conducted during the field program included: (1) development of an ice drainage map for the study region (figure 1), (2) radio-echo sounding in the general region of the drill site, (3) surface and detailed snowpit (6 meters and 1–2 meters deep) sampling, and (4) collection of a 201-meter core (in cooperation with the University of Nebraska's Polar Ice Coring Office) including on-site examination of the physical condition of the core, temperature, and density.

Although the laboratory portion of the study is not complete, we have finished the following components of the study.

- Development of ultra-clean firn/ice processing techniques for both the field (figure 3) and laboratory (Spencer et al. 1985).
- A map of ice-surface elevations and ice thicknesses in the region of the drill site.
- Physical measurements on the core including stratigraphy and thin-section analysis (in cooperation with T. Gow at the Cold Regions Research and Engineering Laboratory in Hanover, New Hampshire).
- Analysis of all surface and snowpit samples and selected sections of core for sulfate, nitrate, chloride, fluoride, sodium, reactive silicate, and total beta-activity and oxygen isotopes (in cooperation with P. Grootes of the University of Washington).

Preliminary statistical treatment of the snowpit and core segments analyzed to date suggest that: chloride, nitrate, sodium, and sulfate all display seasonal signals; time-series for chloride, sulfate, and sodium are all positively correlated while the nitrate time-series is negatively correlated with all of the latter; factor analysis reveals a strong association between chloride, sulfate, and sodium, and marked trends in the chemical time-series are apparent which can be attributed to volcanic input and changes in climate and atmospheric chemistry.

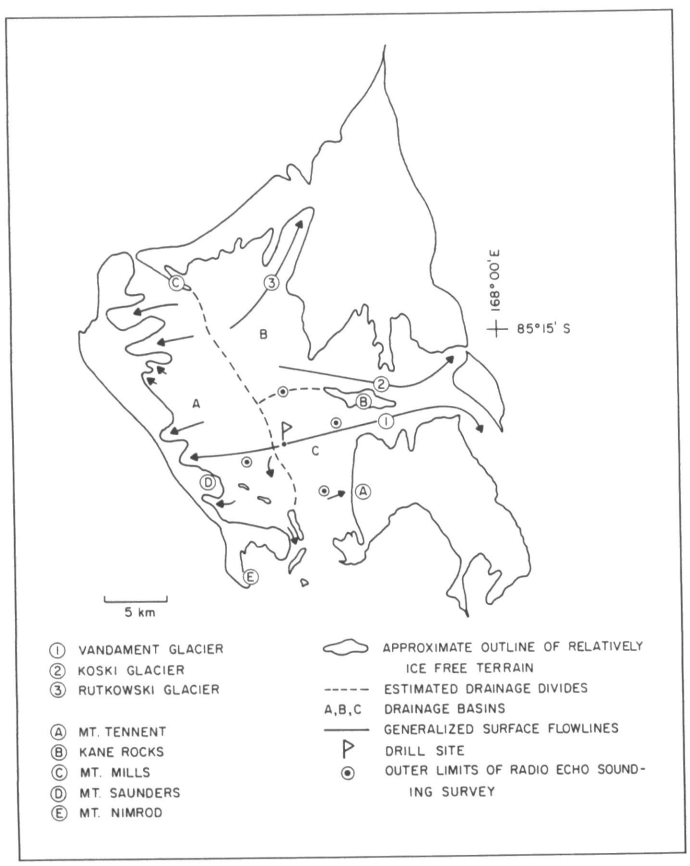

Figure 1. Location map. ("km" denotes "kilometer".)

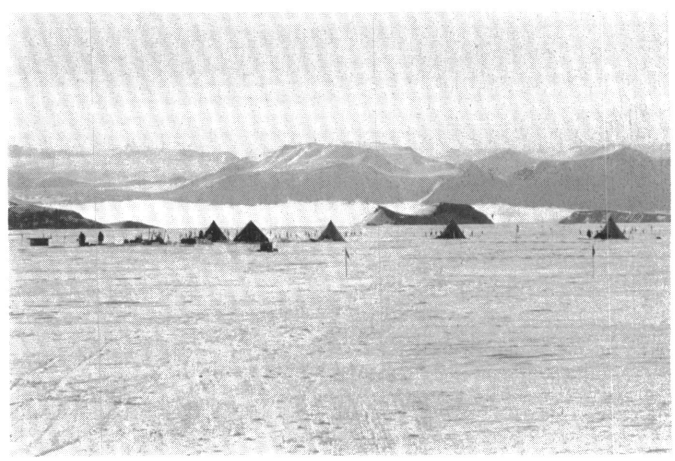

Figure 2. Dominion Range field camp.

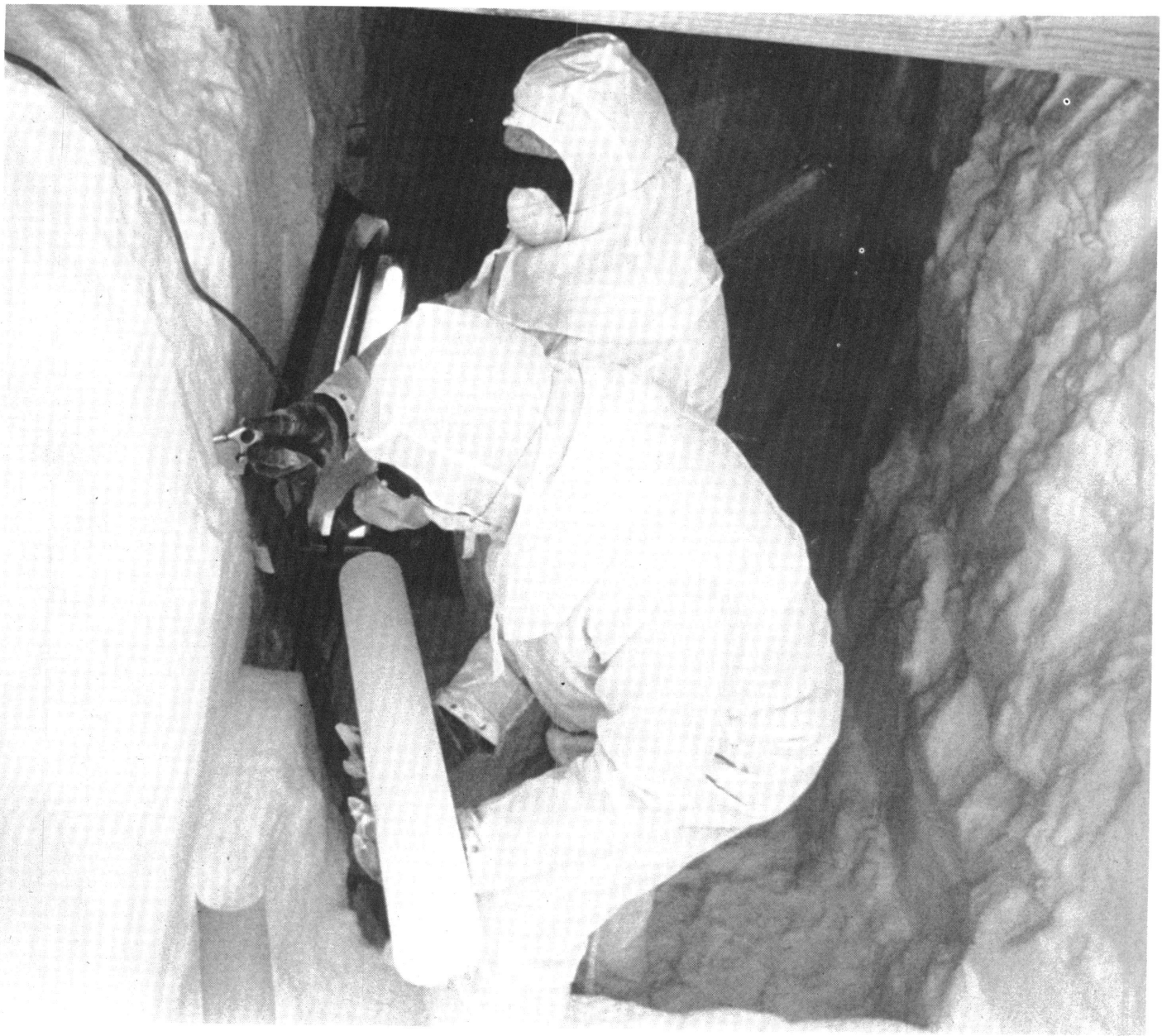

Figure 3. Sample handling in the field.

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Reference

Spencer, M.J., W.B. Lyons, M. Twickler, and P.A. Mayewski. 1985. Contamination control for polar ice core samples. *EOS Transactions*, 66(46), 895–896.