NEAR-SURFACE SNOW SAMPLING DEVICES*

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ABSTRACT

Firn cores obtained by presently available coring augers are normally not continuous in the upper 2-3 m. In stable isotope studies it is very important to obtain continuous samples from the surface down, which therefore have to be collected from a pit wall. Two kinds of sidewall samplers have been designed and tested that make collection of samples to a depth of 2 m or more from the surface an easy and fast operation. A short description of these two sampling devices is given. It is hoped that such sampling devices will be used by all future field parties in order to obtain surface samples for stable-isotope studies.

Introduction

In recent years a new glaciological parameter has become extremely important in modern glaciological studies. This parameter is the 3-dimensional distribution of stable-isotope ratios O^{18}/O^{16}, or D/H (measured in permille deviation from a standard, i.e. δ values), in glaciers and other large bodies of ice.

As discussed in Dansgaard *et al.* (1973), knowledge of this parameter can reveal information on the past history of glaciers. In particular, climatic changes occurring in the past are recorded in the stable-isotope ratios. This very important information is obtained from ice or firn cores where corrections usually have to be made due to the flow of ice and the changes in the isotopic ratios in surface snow upslope from the drill site.

Thus in most cases information about the geographic distribution of surface snow δ-values is required for interpreting δ-profiles from ice cores. Unfortunately, existing data on the distribution of surface δ-values is sporadic and often not reliable because the collection of samples has frequently been made under non-ideal conditions. A device for obtaining such samples under controlled conditions is therefore urgently required.

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*Paper was presented by R.H. Thomas.

In order to facilitate sampling of surface snow for stable-isotope determination two kinds of samplers constructed at the present laboratory have been tested in both Greenland and Antarctica. Both samplers work in an already drilled hole, and there is no need to dig special pits.

Type 1 Sampler

This device is shown in Fig. 1. It is made from a perspex cylinder which attaches to a SIPRE auger drilling rod. A specially designed cutter on the side of the cylinder cuts the sample out of the wall of the drill hole as the sampler is moved up the hole. The sample then falls via a hole in the cylinder wall into a premarked sample bag, which is fixed to the bottom of the device. The samples obtained by this device are thus mean samples which are truly representative of the snow cover at the drill site. Samples can be taken at any depth in the drill hole.

The overall length of the sampler is 20 cm, it can go into an 11-cm or larger diameter hole, and it weighs 880 g. The cross section of the triangular-shaped sample is 3.5 cm^2; thus a 1-m-long sample represents 350 cm^3 of snow corresponding to approximately 100 g of water.

Experience shows that sampling is extremely easy and fast with this device. To drill a 2-m hole with a SIPRE auger and to sample the hole takes less than 15 min.

Field parties can thus collect several samples during a traverse without any significant burden to the field program.

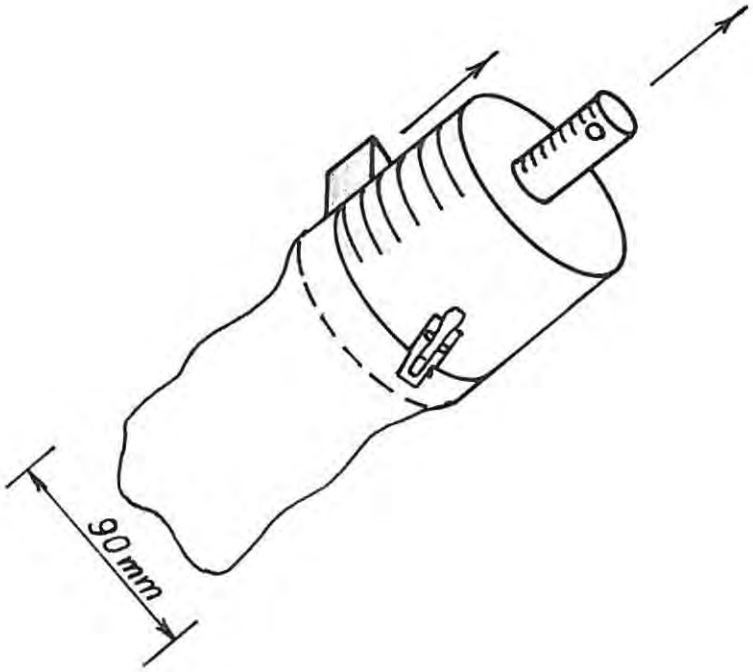

Figure 1. Type 1 Side-wall sampler.

Type 2 Sampler

Unlike the type 1 sampler, this type is made for obtaining more detailed profiles from the hole, and is therefore a much heavier and more complicated device (see Fig. 2). It consists of an 11-cm-diameter, 210-cm-long perspex tube with a long slit on one side of it. Inside the tube is mounted, on bearings close to the wall, a 6-cm-diameter, 200-cm-long half-cylinder "sawblade." It can be turned along its center, in the bearings mentioned, out through the long slit by turning the handle on top, at the same time the entire sawblade can be moved up and down 10 cm. By doing so with the sampler fixed in a borehole a half core of 6 cm diameter is then cut out of the wall of the hole. A sharp half-circular blade is at the same time turned into the wall right below the half cylinder sawblade, thus supporting the half core at the bottom.

The entire sampler is then taken out of the hole along with the 2-m half core which is well protected between the wall of the perspex tube and sawblade. Stratigraphic features can then be recovered from the half core which then is cut into an appropriate number of increments. Experience shows that even very soft and coarse layers of snow are undisturbed in the 2-m-long half-core sample.

In very low accumulation areas the upper 2 m of firn are often very soft and coarse grained, without any hard layers. Using the sampler in such areas has not given satisfactory results. Changes are now being made on the sampler that are hoped to improve greatly the performance of the device in soft snow.

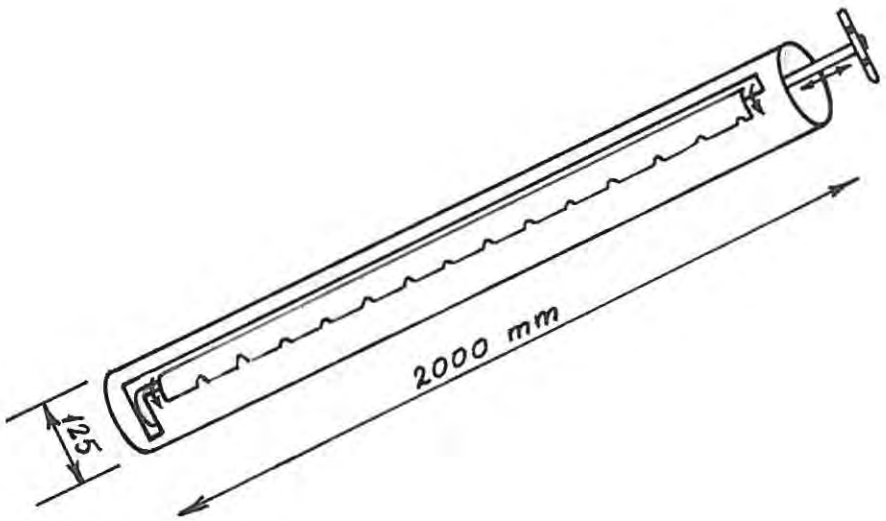

Figure 2. Type 2 Side-wall sampler.

REFERENCE

Dansgaard, W., S.J. Johnsen, H.B. Clausen, and N. Gundestrup, 1973, Stable isotope glaciology: *Meddelelser om Grønland*, v. 197, no. 2, 53 p.