more satisfactory explanation has been found (Whillans, in press). About 14,000 years ago the surface climate of the ice sheet warmed, and this warmth has been penetrating the ice sheet. The rate of penetration depends on the downward movement of ice and on conduction. Warmer ice can deform more readily, so the shearing and velocity of the ice is now faster than it was. A warming of about 8°C about 14,000 years ago explains why present-day velocities are too fast to maintain the ice sheet in its present configuration. This thinning in the central west antarctic ice sheet will continue and eventually will affect ice flow downglacier toward the Ross Sea.

Because the tilting of the Byrd Station core hole has been measured (Garfield and Ueda, 1976) it now is possible to model the ice flow and to calculate the depth-age relationship for the Byrd Station core with some reliability (Whillans, in preparation). At a depth of about 1,200 meters, the oxygen isotopic ratio of the ice changes by a large amount. This is attributed to the climatic change at the end of the last, Wisconsinan, glaciation. The time scale shows that the change began about 17,000 years ago, 3,000 years earlier than in north Greenland. Values similar to today's values were attained 10,000 years ago at both sites. The model also finds that the central ice sheet has thinned by about 200 meters because of the warming effect.

On a different topic, the variations in snow accumulation on the ice sheet near Byrd Station have been analyzed statistically (Whillans, in press, b) to assess how much of the variation in annual layer thickness along an ice core, say, must be caused by regional accumulation changes and how much by local variability. Sedimentary layers are expected to vary horizontally, over short distances, because of the presence or absence of drifts and sastrugi. Near Byrd Station the local effect has an approximately Gaussian distribution with a standard deviation of 0.02 meter of ice equivalent, which is enough to cause layers of separate seasons occasionally to be absent at a single site.

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Ross Ice Shelf Project 1977-78

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The 1977-78 Ross Ice Shelf Project (RISP) field season was marked by two major achievements: penetration of the ice shelf at the RISP drill camp J-9 (82°22.5′S. 168°37.5′W.), and completion of the Ross Ice Shelf Geophysical and Glaciological Survey (RIGGS).

RIGGS activity began 9 November with the opening of the field camp at Q-13. Ground-based measurements were conducted while awaiting the arrival of the chartered Twin Otter aircraft. Although the airplane did not arrive on site until 9 December and navigation instrument problems plagued the project, nearly all work planned was completed. Operating from camps located at Q-13 (78°57′S. 179°55′W.) and C-16 (81°05′S. 172°45′E.), 81 strain networks were revisited and 13 new sites were established, including 8 for geophysical measurements. Tidal gravity measurement was again conducted at J-9 and at a new site, O-19 (79°33′S. 163°18′E.).

At the J-9 drill site, the ice shelf was penetrated with the Browning flame-jet drill on 2 December. This first access hole was frozen and lost before any scientific measurements could be made beneath the shelf. Redrilling was completed on 14 December, and the access hole was used from then until 2 January. The hole was reamed every 3 to 4 days to keep it open during this period.

The wireline coring drill was moved after attempts to melt out the drill stem that became stuck last season. Wireline coring was completed to a depth of 170 meters when the season ended.

Reports in this issue describe the activities and preliminary results of the 16 projects involved in RISP.

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