Station Fossil Dating

ICE CORES

Ice cores, cylinders of ice drilled out of glaciers and polar ice sheets, have played an important role in revealing what we know so far about the history of climate. The United States scientists embarked on a new ice coring project in Greenland with a wide range of state of the art analyses in the hopes of resolving questions about how the climate system functions. Drilling for The Greenland Ice Sheet Project Two* (GISP2) began in 1989. When they reach the bottom of the ice sheet, 3000+ meters thick, in 1992 they will have recovered the longest, most detailed, continuous record of climate available from the northern hemisphere stretching back 200,000 years or more through two glacial/interglacial (cold/warm) cycles.

How can a history of climate be reconstructed from an ice core? When snow falls it carries with it the compounds that are in the air at the time, compounds ranging from sulfate, nitrate and other ions, to dust, radioactive fallout, and trace metals. When snow falls in a place where temperatures above freezing are rare (there is only a hint of any melting at the GISP2 site in the 750 year record recovered to date), such as in polar regions or at high altitude, the snow from one year falls on top of the previous year without melting.

As each year's snowfall is buried by successive years' snowfall, the constituents contained in the snow are buried along with it. By drilling down from the surface of an ice sheet and analyzing snow from greater and greater depths, a history of the compounds in the air can be obtained. Further, snow that is deeper than 80 meters at the GISP2 site turns into ice from the weight of the snow above it, and trapped in the ice are small bubbles of air. Thus, in addition to trapping compounds from the air, an ice sheet traps a small sample of the air itself. This trapped air is also analyzed and provides information about the composition of the atmosphere at the time the ice formed. Sediments also accumulate very slowly relative to snow on an ice sheet. This results in much longer records from sediment cores, but a much-reduced ability to resolve short-term changes. While periods of hundreds to thousands of years might be resolved in a sediment core, annual and even seasonal resolutions are possible with ice cores. On the other hand, sediment cores can provide records, which are as long as several million years compared with the several hundred thousand years of ice cores. Because of these differences, sediment cores and ice cores provide complimentary climate information; ices cores provide high resolution, direct information and sediment cores lower resolution, less direct records, but from much longer time periods.

What did you learn?

1. Describe how ice cores work (COMPREHENSION RI 8.1)
2. What can the climate tell about the living things in an environment (APPLICATION RI 8.3)?
3. Why is it useful to be able to describe the climate in addition to age the material in an environment? (ANALYSIS RI 8.3)