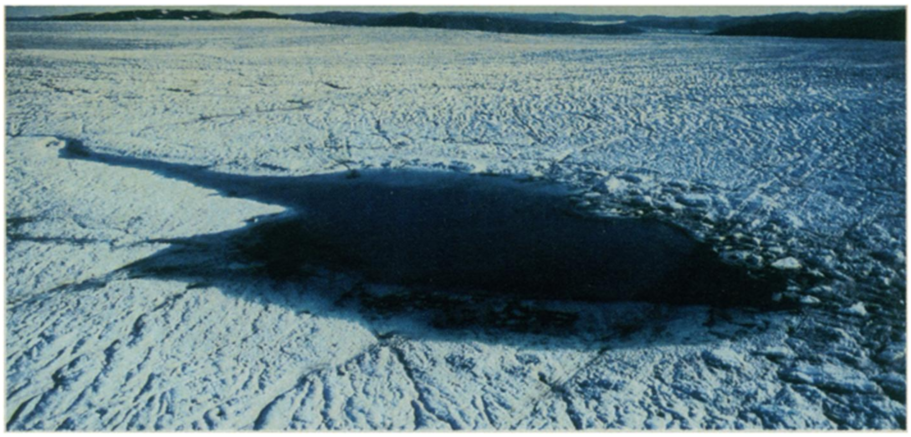
Pieces of the heavens on earth

Earlier this month, the Perseids meteor shower streaked the night sky with light, as Comet Swift-Tuttle passed by the earth. The millimeter-sized debris from the comet rained down on the planet to join the nearly 10,000 tons of extraterrestrial material that falls to earth every year. Locating and collecting these small chunks of comets, asteroids, moons and other bodies, once they have landed, is no easy task. "If you spend your entire lifetime wandering around, just looking for a meteorite," says Donald Brownlee, an astronomer at the University of Washington in Seattle, "the chance of your finding one is practically zero."

Unless, that is, you happen to be walking on the melt zone of the Greenland ice sheet. That's where Brownlee, Michel Maurette of the University of Paris and an international team of researchers discovered the richest deposit of extraterrestrial particles known on the surface of the planet. For scientists who rely on such particles to learn about comets and other bodies far off in the solar system, the find is a veritable gold mine.

According to Brownlee, the first extraterrestrial particles were discovered last century in samples dredged from the ocean floor. Since then, the major source of cosmic particles has been deep-sea sediments. But while hundreds of thousands of particles about 100 microns in diameter have been collected there, particles larger than 0.5 millimeter are scarce, accounting for only 10 parts per billion of the total sediment mass. These are needed for rare gas analysis, amino acid detection and other studies.

Maurette's group writes in the Aug. 22 SCIENCE that scientists had also recognized that small meteoritic particles could be collected in polar ice, but no one had expected them to be found in significantly concentrated quantities. As



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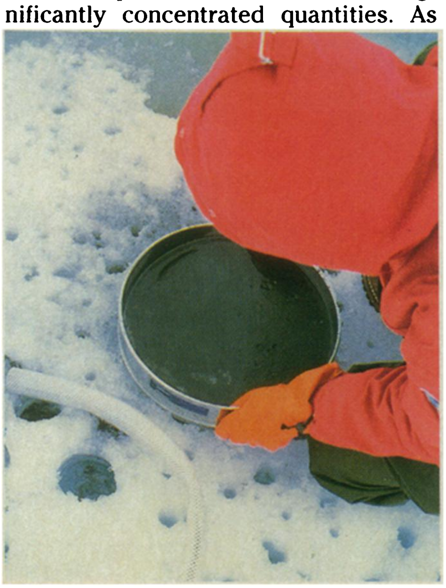

Maurette

In this ice lake in Greenland (above), researchers collected samples (below, left) from the richest deposit of cosmic dust on the planet.

Maurette and his co-workers discovered, however, cosmic dust has indeed been collected in highly concentrated deposits by Greenland's natural geologic processes. In particular, the dust that falls on the interior of Greenland is carried by glacial movement toward the margins of the continent. When the ice reaches a certain altitude, it melts. Each year lakes form in the same basins, and the particles settle to the bottom. In its July 1984 expedition, Maurette's group vacuumed up about 10 kilograms of cosmic sediments from the bottom of one such lake.

Preliminary laboratory work shows that the concentration of Greenland particles larger than 100 microns is 100 to 1,000 times that found in deep Pacific Ocean sediments. Brownlee says he expects that in future expeditions, the group will be able to retrieve hundreds of grams of particles larger than 0.5 millimeter, many of which may be unmelted.

The most important contribution of the Greenland deposits may be in providing remnants of the gas and dust that congealed to form the solar system more than 4 billion years ago. About 85 percent of the Greenland particles are compositionally related to carbonaceous chondrite meteorites, which are thought to closely match primitive solar system material, says Brownlee. In contrast, carbonaceous chondrites account for only 5 percent of the larger, kilogram-sized meteorites that are found on the ground.

In addition, Brownlee says the Greenland particles may contain a much higher fraction of cometary material than does the larger meteorite population; he reasons that cometary and other fragile meteoroids find their way to the earth mostly as dust because they cannot survive the fiery fall through the earth's atmosphere. "You can be absolutely sure that if you have a handful of particles from Greenland material, you've got pieces of Halley's comet, pieces of Kohoutek and pieces of Swift-Tuttle," he says.

— S. Weisburd

Cyanide cloud from lake?

This week the U.S. Agency for International Development (AID) sent teams of forensic pathologists and earth scientists to Cameroon to investigate a lethal gas cloud that escaped from Lake Nyos near the Cameroon-Nigeria border last weekend, killing at least 1,500 people. While scientists begin to unravel the cause of the cloud and the nature of the gases, a new theory, involving the release of cyanide, has emerged on how a deadly cloud from Lake Monoun — another volcanic lake, located 120 kilometers to the southeast — killed 37 people two years ago (SN:12/7/85,p.356).

An AID official told SCIENCE NEWS that Haraldur Sigurdsson, a volcanologist at the University of Rhode Island in Narragansett, suggested in a July 25 letter to AID that hydrogen cyanide in the Lake Monoun cloud might account for the deaths and for the red spots, chemical burns and bleeding from the noses and mouths of the victims. He proposed that cyanide formed a complex with iron dust in the lake bottom, and when something "overturned" the lake, bringing bottom waters toward the surface, the cyanide vaporized in concentrations that could kill in seconds. Asphyxiating carbon dioxide may have caused the cloud to explode from the lake and then remain near the ground. This process could be a hazard not only for Lake Monoun, Sigurdsson wrote, "but to many other stratified lakes where sudden overturn may occur with lethal effects."

Cyanide or other gases in Lake Nyos and Lake Monoun could have been formed by normal lake chemistry, including the decay of organic matter. An alternative explanation, says Joseph Devine, a lake geochemist at Brown University in Providence, R.I., and head of the AID geoscience team, is that the lethal gases were volcanic. The occurrence of two deadly clouds in two years, he says, might signal increased volcanic activity in the region.

— S. Weisburd