Spy satellite plumbs secrets of Antarctica

In the frostiest campaign of the Cold War, the Central Intelligence Agency pointed covert satellite cameras toward Antarctica to map the frozen continent. Thirty-five years later, scientists are using declassified photographs from that mission to gain unparalleled insight into the behavior of Antarctica's icy cover.

A comparison of the CIA photographs with more recent data reveals that a giant river of Antarctic ice has slowed 50 percent in 3 decades, a much bigger change than scientists had expected. The discovery, reported in the Jan. 30 SCIENCE, complicates attempts to predict whether melting Antarctic ice will contribute to rising sea levels in the next century, say scientists.

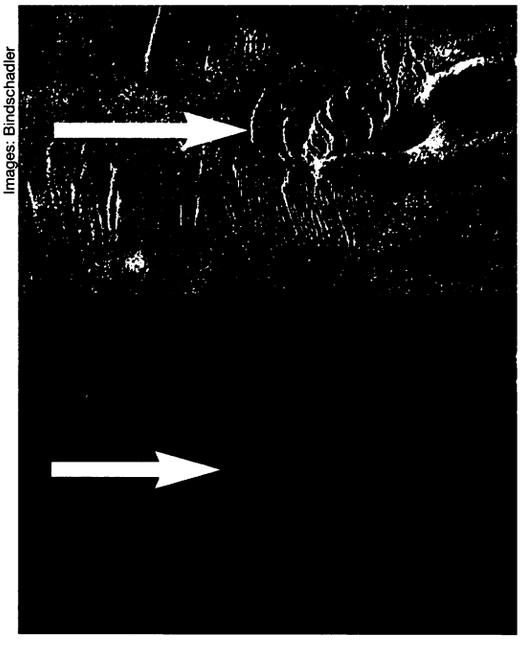
"It makes our life harder," says study author Robert Bindschadler, a glaciologist at NASA's Goddard Space Flight Center in Greenbelt, Md.

The Antarctic analysis is the first scientific study to mine information from the formerly secret pictures, says Bindschadler. In 1995, President Clinton signed an order declassifying all intelligence satellite photography taken before 1972.

The CIA's Corona satellites carried large spools of film into space. After photographs were taken, the satellites jettisoned the exposed film, which was then snared in midfall by military planes. During 1963, the CIA photographed giant rivers of ice, called ice streams, which drain into the Ross Ice Shelf.

Up to 80 kilometers across and hundreds of kilometers long, ice streams flow 10 to 100 times faster than the ice along their banks. Scientists consider the streams critical to the stability of the ice sheet covering West Antarctica. If the streams were to speed up, they would drain ice from the interior of the continent and deposit it on the floating ice shelves, thus raising global sea levels (SN: 2/13/93, p. 104).

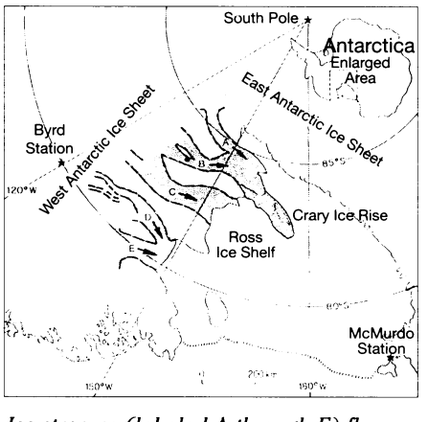
Images: Bindschadler



Satellite images from 1963 (top) and 1980 track the movement of a crevasse (arrows) in Ice Stream B.

Bindschadler and Patricia Vornberger of General Science Corp. in Laurel, Md., compared satellite images to measure how far key features had moved over the decades. They calculate that Ice Stream B—one of the five leading into the Ross Ice Shelf—was traveling at about 970 meters per year in 1963. Researchers on the ice in 1984 and 1985 observed that the ice was then moving at only 471 m per year, less than half as fast. Over this same period, the ice stream widened by 4 km, much more than researchers had anticipated.

The combination of changes surprised Antarctic specialists—theory predicts that ice streams should behave in the opposite way. The relatively slow-moving banks of the ice stream are thought to restrict its flow. As the stream widens, the banks move away from the center of the stream and the ice there should flow faster, says Charles F. Raymond of the University of Washington in Seattle. "It's clear that it's not that simple," he says. *—R. Monastersky*



Ice streams (labeled A through E) flow into the Ross Ice Shelf.

Hormone signals the death of fat cells

Consider it an odd form of liposuction. A new study suggests that the body has a direct way of eliminating fat—the hormone leptin. When injected into the brains of rats, leptin triggers the animals' fat cells to commit suicide.

While the details remain obscure, the discovery of this cellular self-sacrifice may suggest new ways of treating obesity, says study coauthor Clifton A. Baile of the University of Georgia in Athens.

After finding several years ago that some strains of obese mice are deficient in either leptin production or the ability to recognize the hormone, investigators have rushed to understand leptin's roles in the human body. Leptin secreted by fat cells travels to the brain, where it seems to help regulate appetite and some aspects of the body's metabolism.

Obese rats injected with leptin, for example, eat less, burn more energy, and lose dramatic amounts of weight. Studies have also shown that leptin causes cells to shed or metabolize their fatty molecules (SN: 5/3/97, p. 271).

Prompted by colleague Hao Qian, Baile and his research group looked at whether leptin also induces fat cells to undergo apoptosis, an internal program culminating in suicide.

After injecting leptin into the brains of rats for several days, the scientists examined samples of the animals' fatty tissues. Cells committing suicide exhibit a characteristic fragmentation of their DNA. This apoptotic signature appears in the fat tissue of leptin-treated rats but not in their other tissues or in untreated rats, the investigators report in the February ENDOCRINOLOGY.

Other tests revealed that the leptin-treated rats experienced several times more apoptosis than the untreated rats. Moreover, when the scientists looked at fat tissue from leptin-treated rats, they saw additional signs of apoptotic cells.

The new work definitely "raises the notion that one mechanism by which leptin acts is to actually kill off fat cells rather than metabolically alter them," says Jeffrey S. Flier of Beth Israel Deaconess Medical Center in Boston.

Flier nonetheless remains skeptical that the body normally eliminates fat cells in this way. It's probably rare, he says, that leptin concentrations would be high in the brain but not in the blood.

Baile agrees but argues that this artificial situation may nevertheless have identified an unrecognized way in which the body can lose weight—the specific destruction of fat cells.

When applied directly to fat cells, leptin does not cause cell death. Baile suggests that the hormone tells the brain to induce suicide in fat cells. The brain may deliver this death sentence either by sending electric impulses through nerves connected directly to fat cells or by releasing an apoptosis-inducing protein into the blood.

Such a protein would be an obvious candidate for development as an anti-obesity drug, says Baile. He and his colleagues are now investigating whether the blood-borne signal is tumor necrosis factor-alpha, a protein that other researchers have found can induce fat cells to commit suicide. *—J. Travis*