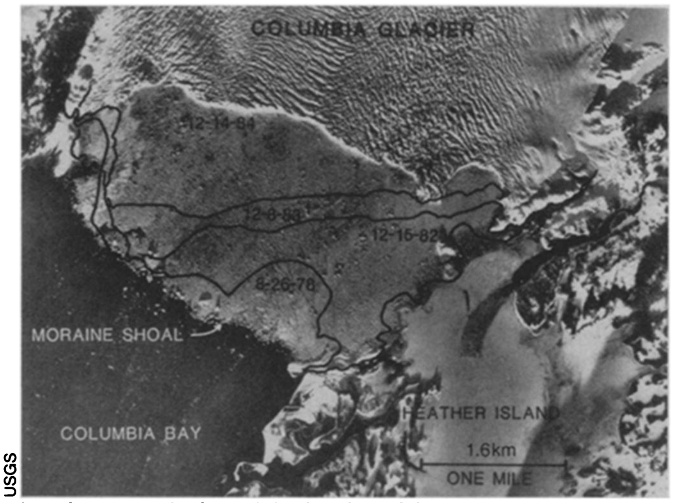
Columbia Glacier: The retreat is real



USGS

An aerial photo of Columbia Glacier taken last December. Dark lines mark the sea-side end of the glacier at dates in 1978, 1982 and 1983. Over that time the glacier has retreated by as much as 2.4 kilometers in some places. The marine shoal, or submerged ridge, keeps large icebergs from floating out into the bay.

A year ago geologists at the U.S. Geological Survey (USGS) announced that the Columbia Glacier in Alaska appeared to be in the initial throes of a dramatic and rapid retreat (SN: 1/21/84, p. 36). In a report released last week, the USGS researchers say they are now absolutely certain that their earlier diagnosis of disintegration was indeed correct. "Drastic retreat is now evident in all aspects of the glacier flow," says Mark Meier of USGS in Tacoma, Wash.

During the last year, the glacier shrunk 1,100 meters, almost twice the amount of retreat recorded the previous year. Meier's group reports that the average rate at which icebergs splintered off from the sea-side end of Columbia increased from 3 cubic kilometers per year (km^3/yr) in the second half of 1983 to 4 km^3/yr during the first nine months of 1984. This rate is four times greater than that measured at the end of 1977 and is expected to rise even more in 1985. While the glacier flow — the downslope movement of the ice toward the sea — has also increased, it has not been enough to keep pace with the breakup and expulsion of icebergs. So the disintegration of Columbia, the last of Alaska's 52 tidewater glaciers, is clearly under way.

The glacier retreat is generally following the numerical models developed five years ago. But Meier says that the onset of dissolution is later than expected and the speed of glacier flow is greater than predicted. Another surprise was that, for several months last winter and spring, a tongue of ice still attached to the glacier at its sea-side end seemed to float. In all previous observations, icebergs separated from Columbia (which is thought to extend all the way down to the bottom of its valley) before sections of the thinning glacier could float.

The 1984 measurements bolster USGS's earlier prediction that the 64-km-long glacier will retreat 32 to 40 km upstream over the next few decades. When this happens, says Meier, the map of Alaska will be very different. The retreat of Columbia will unveil a fjord longer and deeper than the nearby port of Valdez. Seawater will invade and mix with the freshwater and sediments from the glacier.

"As the fjord lengthens, its biota [plant and animal life] will evolve along with the physical structure of the water," says Meier. "No one's been able to study this sort of thing before.... This grand field experiment has enormous potential in oceanography and ecology in addition to all the glaciological implications."

—*S. Weisburd*

Three meteorites from the moon: How many launchings to earth?

It was less than two years ago that scientists finally decided that they knew for the first time where a single one of the thousands of meteorites collected on earth had actually come from. Even at a glance, it looked to some geologists like a piece of the moon, but researchers were uncertain whether any natural process—such as the impact of another meteorite — could really blast a rock fragment free of the gravity of so massive a body. It was only the extraordinary agreement of a host of scientific analyses (SN: 3/26/83, p. 196) that led to the final, firm conclusion.

Then, only 15 months later, as though the one startling example had somehow broken the ice, two more cases were identified (SN: 8/4/84, p. 70). Some researchers had already speculated that if one lunar chunk could be tossed all the way to earth, it had probably happened often. But still unknown is how often a sufficiently strong ejection from the lunar surface actually takes place.

Since last fall, therefore, a consortium of scientists has been working to find out whether the three meteorites from the moon represent scattered debris from a single, titanic event, or from three separate occurrences. But unlike the case of the first such chunk, whose lunar identity simply became more and more likely from the very first hints, the question of whether the other two are related to it—to be the key topic of a symposium in Tokyo next month—is looking anything but easy.

All three meteorites were recovered in Antarctica, one from the Allen Hills and the other two from the Yamato Mountains. "From our data," report Michael Lipschutz, Jane Dennison and Patrick Kaczaral of Purdue University in Lafayette, Ind., "Yamato 791197 and Allen Hills 81005 [the two samples receiving the most attention so far] did not come from the same lunar region, hence were launched from the moon in different impact events." If that conclusion, based on measurements of "volatile" elements that vaporize at relatively low temperatures, is borne out, it would be a vote of sorts for ejections from the moon being at least less rare than total flukes. It could also interest researchers wondering whether certain other meteorites may have come from Mars, though more gravity must be overcome there.

But according to Roman Schmitt of Oregon State University in Corvallis, who has been working with J.C. Laul of Battelle Northwest in Richland, Wash., on largely "refractory" or higher-temperature trace elements, the two lunar meteorites are "twins"—chips, one might infer after additional studies, off "the same old block."

Two rocks, both thrown all the way from the moon, differ markedly by one standard, yet are called "twins" by another. Could the differing volatile abundances be due to some kind of contamination that affected the now volatile-rich Yamato rock but not the one from the Allen Hills? It is possible, but unlikely, Lipschutz says, since two samples of Yamato 791197 vary by about 10-fold in seven different elements, an improbable amount of diversity within a given rock if the cause were some outside contaminant. Nor would it probably make much difference, he says, if the Yamato and Allen Hills meteorites were subjected to different amounts of weathering. (Other meteorites whose relative amounts of weathering have been well determined, he points out, show no corresponding difference in composition.)

Furthermore, there is a third lunar meteorite — Yamato 82192 — which may turn out to be more decisively different from the other two than they are from each other. The Allen Hills rock and Yamato 791197 are both black with "inclusions" of white, while Yamato 82192 is "pink, with a big beige splotch," Lipschutz says. Most of the U.S. researchers have yet to receive their samples of that one for study, but Kunihiko Nishiizumi of the University of California at San Diego notes that studies in Japan are indicating its composition to be "extremely different" from the other two.

— *J. Eberhart*

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