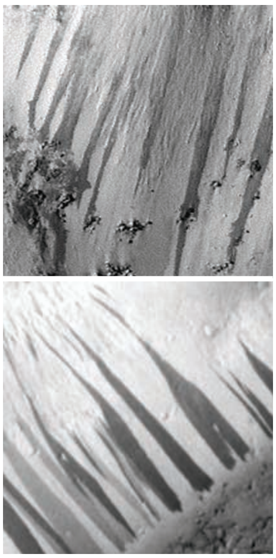
Nice vantage point. In the Dry Valleys of Antarctica, snowmelt makes Mars-like dark streaks by seeping in and flowing downhill to dampen and darken the surface.

Bringing Martian Streaks And Gullies Down to Earth

For all their dramatic visual appeal, the gullies of Mars are proving mighty enigmatic. They *look* as if they were cut the other day by rivulets of water seeping from crater walls and cliff faces. But in geology, looks aren't everything. Seven years after discovering gullies, planetary geologists still disagree about where the water comes from and even whether water was involved at all. Add in the even more contentious dark streaks that mark other martian slopes, and you've got no end of debate over the recent history of water on the Red Planet.

At the meeting, planetary geologist James Head of Brown University and colleagues offered a down-to-earth resolution of the gully-and-streak conundrum. If a cold, dry Mars works the way the hyperarid and perennially frigid Dry Valleys of Antarctica do, they said, streaks and gullies are both shaped by flowing water, the one from below and the other above and below.



Twins? Streaks in Antarctica (*top*) and on Mars (*bottom*) bear a strong family resemblance.

During a 3-month field season this past austral summer, Head and colleagues took a close look at Dry Valley dark streaks that from orbit and from a helicopter appear "very, very comparable to things seen on Mars," Head said. Like martian streaks, these are dark, stretch down steep slopes, and show no sign of relief across a streak. On Mars, researchers have typically invoked some sort of surface flow: an avalanche of dry dust that unveils a darker substrate, a cascade of wet debris, or the flow of an erosive spring.

In Antarctica, nothing whatsoever flows on the surface to form a streak. Scarce, windblown snow accumulates in pockets near the tops of slopes, melts in the warmest and sunniest part of the summer, seeps down a few tens of centimeters into the loose rocky debris that passes for soil, and runs downhill on top of a layer of ice-encased rock. When the unseen water encounters less-porous, finer-grained soil, it wicks upward to dampen the surface and darken it.

In the next talk, Joseph Levy of Brown spoke for the same group about Dry Valley gullies. A gully works much as a streak does, he said, but with water supplied so fast that it flows both through the soil and on the ground's surface. On higher, steeper slopes, the greater flow cuts a channel, and lower down it deposits fans of sediment.

The Antarctic Dry Valley examples are "the best analogs I've seen," said planetary scientist Oded Aharonson of the California Institute of Technology in Pasadena. And Head's streak presentation was "a great talk," says planetary scientist Robert Sullivan of Cornell University. Still, no one considers the case closed. Sullivan, for one, finds a dearth of snow and ice on the slopes above the martian streaks; he wonders how there would be enough water to even dampen the soil. And Aharonson asks how dark streaks could stay damp for decades on Mars. As Sullivan notes, "We don't have things entirely figured out."

Warped Shorelines On a Rolling Mars

Some planetary scientists see remnants of shorelines where oceans lapped onto land early in Mars's history, but the putative shorelines wander over martian hill and dale. They diverge by a kilometer and more from the single sea-level elevation that an ocean would have traced out. But a group of geophysicists reported at the meeting that they have found a plausible explanation for warped ancient shorelines: Mars rolled on its side, twice, in response to a huge ocean basin emptying.

The new view relies on the ready mutability of vast spinning objects. Tape a penny to the top of a ball floating in water, and the ball will roll over until the penny is at the bottom, the weighted ball's most stable position. Do the same thing to a ball spinning in space, and the ball—while still spinning as before—will roll until the penny is at the ball's rotational "equator," the most stable position for a spinning, weighted ball. Now imagine your spinning ball is a chunk of rock the size of Mars and the added weight is an ocean's worth of water. Because rock is not entirely rigid, the roll that takes the ocean toward the equator will also raise rock into

CREDITS (TOP TO BOTTOM): JAMES HEAD, BROWN UNIVERSITY; IKONOS IMAGE COURTESY OF JAMES GARVIN, NASA/GSFC; MSSS/JPL/NASA