Earth Science

Rock flows when ice goes

Professor Lidenbrock and his faint-hearted nephew climbed straight into the maw of the Icelandic volcano Snaefellsjökull in Jules Verne's classic *Journey to the Center of the Earth.* Geologists are now following that fictional path, using the same volcano to explore the planet's interior.

Analyses of lava at Snaefellsjökull reveal that climate changes occurring 15,000 years ago dramatically affected processes deep within the Earth, report Björn S. Hardarson and J. Godfrey Fitton of the University of Edinburgh in Scotland. Their study, discussed in the Sept. 5 NATURE, focuses on the end of the last ice age, when Iceland lost its 2-kilometer-thick blanket of ice.

According to theory, the melting of that heavy load should have decreased the pressure on Earth's mantle, making it easier for the solid mantle rock to melt. Hardarson and Fitton find support for that theory in their analyses of the lava from Snaefellsjökull. Concentrations of certain elements in the rock suggest that mantle melting doubled when the ice load disappeared, they report.

"This is the first time anyone has ever observed climatic change to have any effect on the behavior of mantle processes," Fitton told SCIENCE NEWS.

Radar spots speeding ocean currents

You're cruising down the freeway at 70 miles per hour when a patrol car emerges from a hiding spot and sets off in pursuit with lights flashing. The radar gun has struck again.

The same basic principal that enables police to monitor motorists may soon enable scientists to monitor ocean currents off U.S. coasts. This fall, researchers plan to test a new radar system, called Ocean Surface Current Radar (OSCR), at Cape Hatteras, N.C., and Miami. The instrument relies on Doppler radar, which can determine the speed of an object. Normal radar gauges only distance.

Scientists have used OSCR extensively in Europe, but the upcoming tests represent the first demonstration of the device in the United States, says Duncan Ross of the University of Miami. At present, U.S. researchers studying currents must use buoys or satellites, but neither of these methods can provide detailed maps of water movement over a wide area — a task for which OSCR was designed, he says.

Ross, an investigator in the U.S. project, believes OSCR can help scientists understand beach erosion, the health of fisheries and the movement of pollution through the water. Better knowledge of currents could help explain, among other things, how syringes get washed up on beaches along the Atlantic Coast, he says.

The radar system uses two transmitters stationed several kilometers apart on a beach. Positioned perpendicular to each other, the transmitters send out radio signals over a patch of water and receive the signals reflected back by ocean waves. The system then produces a map of currents in the region. While OSCR has a range of 40 kilometers, similar systems could have a much greater range, says Ross.

New wings take to the sky

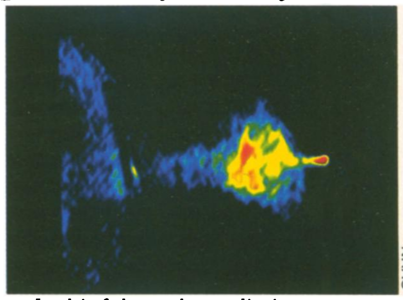
With expectant eyes turned skyward, a crew of engineers will gather in California's Mojave desert later this month to watch the first flights of the prototype for *Perseus*, an unmanned airplane designed to reach higher than any other nonmilitary plane (SN: 3/2/91, p.136).

NASA is considering using several of these probes to explore the ozone layer and possibly the Antarctic ozone hole — a region inaccessible to other research planes. Aurora Flight Sciences Corp. in Manassas, Va., developed the low-altitude prototype and plans to start building the actual *Perseus* next month.

Space Science

Pulsar hints at supernova asymmetry

The geometry of a fan-shaped supernova remnant called G5.4-1.2 has fascinated radio astronomers for nearly a decade: Its structure resembles a crossbow launching an arrow. In 1985, Australian researchers linked a nebula sitting at the tip of the arrow with a nearby pulsar — a rapidly rotating, radio-emitting neutron star.



In this false-color radio image, the red, arrow-shaped region (extreme right) shows the location of the rapidly moving pulsar. The blue region resembling a crossbow (left) is part of an expanding shell of gas created by the supernova explosion.

Now, two radio astronomers in the United States have determined that the pulsar lies within the arrow, where its energetic emissions likely power the nebula's radio broadcasts.

Using the Very Large Array radio telescope near Socorro, N.M., the U.S. team also traced an elongated trail of radio signals leading from the crossbow to the arrow. These suggest that the pulsar was indeed shot out of the supernova remnant. By estimating the pulsar's age (about 15,000 years) and the distance it seems to have traveled from the crossbow to the arrow, the scientists infer that this relatively youthful pulsar races along at an astonishing 2,300 kilometers per second, or 0.5 percent of the speed of light. This would make it by far the fastest neutron star ever found.

The pulsar, a Milky Way resident known as PSR 1757-24, appears to move so rapidly that it has overtaken the expanding shell of debris created at its birth during the supernova explosion. Pulsars form as gravity squeezes the remains of a massive, exploded star. Researchers often think of this squeezing as a symmetric process in which all sides of the dying star experience the same amount of compression.

But the speed and direction of PSR 1757-24 suggest that the compression may have occurred asymmetrically — for example, with more material raining onto the shrinking star from above than from below. Such a scenario may best explain this pulsar's unusually forceful expulsion from the remnant, asserts Shrinivas R. Kulkarni of the California Institute of Technology in Pasadena. He coauthored the new study with Dale A. Frail of the National Radio Astronomy Observatory in Socorro. They describe their findings in the Aug. 29 NATURE.

The pulsar's velocity, the precise nature of its association with the supernova remnant, and the validity of the asymmetric model all remain uncertain, observes Adam Seth Burrows, a theoretical astrophysicist at the University of Arizona in Tucson. Nonetheless, he says, the new work suggests that "symmetric models might have to be discarded."

Burrows notes that many effects, such as the transfer of heat and mass during a supernova explosion, could create asymmetric conditions. Indeed, studies over the past few years have convinced him that asymmetry may be "central to the [supernova] mechanism," he told SCIENCE NEWS.

If other pulsars are as speedy as the bow-and-arrow pulsar appears, this might help explain why astronomers find only a handful of them in the vicinity of supernova remnants, Burrows adds.

Kulkarni and Frail plan to continue radio observations of PSR 1757-24 for several more years in order to monitor its motion and directly measure its velocity.