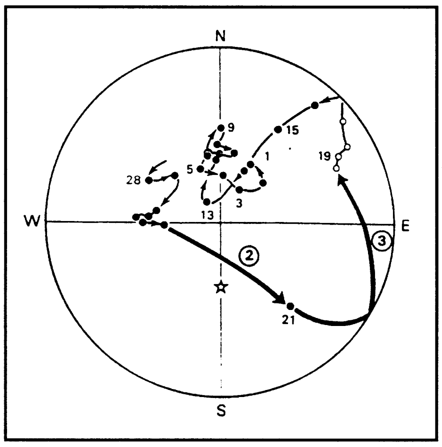
Earth's Magnetic Field Follies Revealed

Boy Scouts would have gotten horribly lost 16 million years ago. So, too, pilots, ship navigators, and anyone else who tried to rely on the geomagnetic field to find their way. Earth's field was shifting direction so rapidly back then that compasses would have lost all utility, according to new evidence gleaned from ancient lava flows in Oregon.

Over an 8-day span, the orientation of the ancient field rotated at the astounding rate of 6° a day, report Robert S. Coe of the University of California, Santa Cruz, and Michel Prévot and Pierre Camps of the University of Montpellier in France. If that happened today, compass needles would swing from magnetic north toward Mexico City in little over a week. Such a change is 1,000 times faster than the slow magnetic wanderings currently measured.

The findings, described in the April 20 NATURE, veer far from the textbook image of how Earth works, making them hard for geophysicists to accept. "To a theoretician like myself, these results are almost inconceivable," says Paul H. Roberts of the University of California, Los Angeles.



Coe, Prévot, and Camps/NATURE

Dots on a compass grid track ancient shifts in magnetic field direction.

Earth scientists lack a firm understanding of the geomagnetic field, but they agree on a few simple ideas. According to current theory, swirling currents of molten iron within Earth's outer core create a dynamo that powers the magnetic field. Once every few hundred thousand years, the field flips its orientation, swapping north pole for south pole. These so-called magnetic reversals take about 10,000 years from start to finish.

Scientists find evidence of the reversals in the magnetic grains of rocks formed at the time. When lavas erupt or when sediments drop to the seafloor, mobile grains align themselves with the field's orientation. As the rocks harden, they lock in a record of the field at a particular moment.

A decade ago, Prévot and Coe found evidence of extremely rapid field changes within lavas at Steens Mountain in Oregon. Scientists regard Steens Mountain as the best record of a magnetic reversal because the volcano spewed out 56 separate flows during that episode. The rock layers provide time-lapse snapshots of the reversal.

Within one particular flow, Prévot and Coe discovered that rock toward the top showed a different magnetic orientation than did rock lower down. They interpreted this to mean that the field shifted about 3° a day during the few days it took the single layer to cool.

Most geophysicists questioned the original finding, arguing that the Steens Mountain lavas may not have faithfully recorded the actual field directions, says Ronald T. Merrill of the University of Washington in Seattle. Scientists wondered whether the lava flow became remagnetized long after it cooled, thereby altering the original orientation of magnetic grains in the rock.

In their present study, Coe, Prévot, and Camps analyze a different lava flow in detail and then consider five possible alternative explanations. They conclude that the flow did not become remagnetized. In fact, the field changed faster than they had originally thought. They suggest that full reversals take thousands of years but that the field can display brief bursts during a reversal.

The researchers may not convince their critics entirely, but their analysis will swing the geophysical community closer to their viewpoint. "They are some of the best experimentalists in the world. They've made it much more difficult to be a skeptic," Merrill says.

The study will also force theoreticians to explain how the core creates such rapid shifts. "It's a problem. We're talking about something that happens in weeks and that shows the core to be violently active in terms of the magnetic field," says Kenneth A. Hoffman of California Polytechnic State University at San Luis Obispo. —*R. Monastersky*

Latex allergies from right out of thin air?

An estimated 17 million people in the United States suffer allergic reactions to products derived from the milky sap of the rubber tree. Because this latex allergy develops only after some sensitizing contact with rubber, health care workers were one the first populations recognized to face a major risk. Surgical gloves, elastic bandages, blood-pressure cuffs, catheters, and adhesive tape are among the growing list of latex-based medical supplies.

Many consumer products also rely on latex — notably, kitchen gloves and condoms. Yet some people develop latex allergy with seemingly no significant exposure to such products. Why?

A team of California researchers offers one novel suggestion: air pollution.

At Experimental Biology '95 in Atlanta last week, the team presented data showing not only that latex occurs in urban air and roadside dust, but also that it includes components recognized by human and rabbit antibodies to latex.

Though latex concentrations collected by air filters in Long Beach and Los Angeles "were very small" — 0.2 microgram or less per cubic meter of air — "we were surprised to find any," points out M. Michael Glovsky, medical director of Huntington Memorial Hospital's asthma and allergy center in Pasadena.

Moreover, he explains, because people can inhale these fine, airborne particles deeply into their lungs' small airways, "they may accumulate. So, theoretically, one could become sensitized" (see related story, p.254).

Saline extracts of ground-up pieces of car and truck tires and of rubber gloves elicited the same type of antibody responses.

In the January JOURNAL OF ALLERGY AND CLINICAL IMMUNOLOGY, P. Brock Williams and his colleagues at the Allergy Respiratory Institute of Colorado in Denver identified worn-tire particles — again recognized by latex antibodies — as the apparent source of most latex in the outdoor air they analyzed.

It should have been obvious that tires would shed latex into the environment during normal wear, notes allergist Timothy J. Sullivan of Emory University in Atlanta. Yet he says many researchers initially had a hard time accepting the Denver group's findings.

But the new data from Glovsky's team "add substantially to proving that latex is out there and that it potentially can cause allergic reactions," he believes.

Moreover, he notes, such findings may partially explain a previously perplexing observation by his group: that about 6 percent of the people entering the Emory Clinic with allergic rhinitis (runny nose) and asthma possess antibodies to latex. —*J. Raloff*