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Cover: Polar wandering paths, based on the magnetic orientations of rocks of different ages, are a powerful tool for visualizing the course of continental drift before the formation of the last great supercontinent, Pangaea. Numbers in boxes are the dates, in millions of years, spanned by the curves. See p. 220. (Diagram, showing polar wandering paths for Europe, South Africa and North America, courtesy of Henry Spall)

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Search for the ultimate landmark

Earth's magnetic reference point may have moved

For some years geophysicists have been figuring out the past movements of the continents with respect to the main axis of the earth's magnetic field. (The magnetic field has a number of components of different strengths pointing in different directions. The average of these components, the "total" field, produces the magnetic north pole, which is currently located in northern Canada. But the largest single component of the field, the main axis, when averaged over time, coincides with the earth's axis of rotation. When rocks are formed they absorb all the components of the field, but geophysicists seek out the main component and use it as a reference point in reconstructing continental motions.) It has been tacitly assumed that the main magnetic axis has always approximated its present location.

There's always been a nagging doubt that the poles might also be moving. Now it appears the time has come when geophysicists will have to determine once and for all what is moving, and by how much.

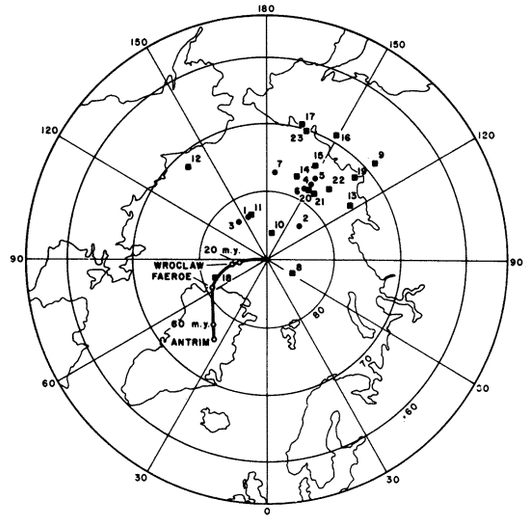
In the Sept. 8 NATURE, R. A. Duncan of the Australian National University, Nikolai Petersen of the Institute of Applied Geophysics in Munich, and R. B. Hargraves of Princeton University present evidence that the poles do wander—at least, with respect to the earth's mantle.

The crux of the problem was to find a fixed point of reference against which the movements of both poles and continents can be gauged. The earth's spin axis is one. Duncan, Petersen and Hargraves hypothesized that hot spots—upwardly convecting plumes of mantle material—might also be ideal candidates. They further proposed that certain areas of past igneous activity might be scars marking the paths where the crustal plate carrying a continent passed over a hot spot.

Most igneous activity occurs at mid-ocean ridges and at subduction zones—in short, at plate boundaries. There are some places, however, where igneous activity occurs far from plate margins, within the relatively stable and enduring crustal blocks called cratons. The researchers thought that the Thulean province between Iceland and northern Ireland and the Central European volcanic province might be plume scars. The Thulean province, which spans both continental and oceanic crust, was probably produced by the hot spot that now underlies Iceland.

By dating the igneous rocks along the two scars, the researchers determined when igneous activity was at its peak at each location. By inference, this was when that part of the plate passed over the plume.

Geophysicists had been inferring plate motions relative to the main magnetic poles from magnetic orientations of rocks. Duncan, Petersen and Hargraves worked in the opposite direction. Their study of plume scars had given them plate motions. Assuming that the magnetic pole was permanently centered on the earth's spin axis, they worked out a prediction of the magnetic pole path



Ideal versus real: If pole had not moved, the points would fall on the line.

Nature

that the continental movements they found should produce. The three plotted this predicted curve on the globe (solid line in the map) and compared it with pole positions predicted by paleomagnetic data alone (the numbered dots). The two did not match. The discrepancy, the investigators concluded, implies that the north pole of the main magnetic component apparently was located along the 123 E. meridian some 65 million years ago and has since wandered about 23 degrees.

Hargraves hastens to point out that "polar wander only has meaning if you talk about it with respect to the earth's surface—for example if you can say the pole was once over New York." Strictly speaking, their findings mean only that the mantle under the European plate has moved with respect to the earth's spin axis. He admits that "unless you accept the concept that the lithosphere can uncouple from the mantle, it is probable that the lithosphere also moved. Then you have true polar wander." Since mantle convection is generally considered to be a driving force behind plate motion, the idea of mantle uncoupling is a radical one.

M. W. McElhinny of the Australian National University has suggested a technique for determining, from vector analysis of plate motions, whether the lithosphere as a whole has moved with respect to the magnetic pole. When he applies his technique to the data and compares the results with the other team's findings for the mantle, it may eventually be possible to sort out all the individual motions. Says Hargraves: "We're all working furiously on that now." □

U.S. and Soviets: 30 joint projects on environment

Whatever ideologists on one side or the other may say, it is one world as far as nature is concerned; the lithosphere, the atmosphere, the hydrosphere and the biosphere are all connected and continuous for the entire globe. Last week's U.S.-Soviet agreement on joint environmental, ecological and geological studies (all subsumed under the rubric "environmental protection") takes a long step toward recognition of this reality.

Gordon J. F. MacDonald of the President's Council on Environmental Quality termed the agreement "an important breakthrough in principle which will enable the two countries to move forward in a vast variety of cooperative ventures." But MacDonald pooh-poohed the speculation, presented in editorial columns in the Washington Post and New York Times, that seismic devices to be installed by the two countries on the others' soil (near California's San Andreas Fault and in the Pamir Mountains of Soviet Central Asia) could be used for monitoring underground nuclear tests and thus could lead to a ban on such tests. "The discussions were purely environmental," he told SCIENCE NEWS. "The instrumentation is not the kind used for detecting small nuclear explosions." But he added that the new spirit signified by the agreement—which was based on the accords signed by Presidents Nixon and Podgorny last spring—could result in a new thrust of cooperation that might eventually go far beyond the environment.

The new agreement will involve joint U.S.-Soviet scientific teams working together in both countries; Soviet scientists will study air pollution in St. Louis and water pollution in Lake Tahoe; U.S. scientists will look at the same kinds of problems in Leningrad and Lake Baikal. Altogether there are 30 such projects involving the U.S.-Soviet teams.

And there appears to be a fair balance in what each nation will gain. U.S. scientists know more about urban air and water pollution (primarily because the United States has more of it), but Soviet scientists are more familiar with arctic and subarctic ecology (for the same reason). The U.S. emphasis in earthquake prediction research is on direct measurement of strain, the Soviet emphasis is on measurement of telluric and magnetic currents associated with the strain. Some studies—such as those in urban planning and growth—will probably cause ideological confrontations. This may have a salutary effect, too. Government agencies in both countries will want to be on their best behavior as they display their particular nation's way of doing things. □

Some surprises from under the Indian Ocean

The Deep Sea Drilling Project quietly entered its fifth year of operation last month during its 25th leg. Though the number of feet of sediments the Glomar Challenger has brought up from the ocean floor now number in the tens of thousands, the latest leg showed that earth scientists have not yet exhausted the ocean's

Hexachlorophene drama: Where are those drug regulations?

Last week the Food and Drug Administration banned the antibacterial drug hexachlorophene from virtually all American nonprescription drug and cosmetic products. This includes some 400 categories of deodorants, soaps, shampoos, toothpastes, cleansers and cosmetics involving thousands of brand names and hundreds of millions of dollars in retail sales.

It was a big decision, but easier than many the FDA has to make, because it rests on recent, and dramatic, clinical and animal evidence.

Hexachlorophene was widely used in nonprescription and cosmetic products for 30 years, both in the United States and abroad, until a year ago. Then several FDA scientists found, rather by chance, that hexachlorophene feeding produced brain changes in rats. Subsequently they studied 50 newborn infants in a New York hospital who were washed daily with hexachlorophene, according to normal hospital practice.

They found the babies absorbed the chemical into their bloodstreams through normal, unbroken skins. Several months later Sterling Drug Inc., the maker of the most widely used three percent hexachlorophene solution, pHisoHex, reported to the FDA—contrary to their own interests—that newborn monkeys washed daily with pHisoHex, like newborn humans, developed brain lesions. In January, the FDA, backed by the American Academy of Pediatrics, recommended that hospitals discontinue bathing infants with hexachlorophene.

The clincher for banning the chemical from nearly all products, however, came this summer, as the deaths of 39 infants in France were linked with the use of baby powder containing six percent hexachlorophene.

The hexachlorophene drama is worth noting, not just because a vast public health question is at stake but also because it underscores the lack of nonprescription drug regulations in the United States. The FDA has only a rough idea of how many nonprescription products are on the market, and little idea of which products contain hexachlorophene. Thus, in recalling and banning hexachlorophene, the FDA must rely on voluntary compliance from manufacturers and on spot checks of products on the counter. Legislation is pending that would require all nonprescription drugs to be registered, and their labels to list the chemicals they contain.