Deep heat unites the volcanoes of Europe

Between the Canary Islands and the Rhine River valley lie 1,500 kilometers of water, a handful of mountain ranges, and a half dozen national borders. But look below the surface and some common ground appears, according to a team of geoscientists.

Kaj Hoernle of the GEOMAR Research Center in Kiel, Germany, and his colleagues report evidence that much of North Africa and Europe sits above a massive upwelling of hot rock rising up through Earth's mantle.

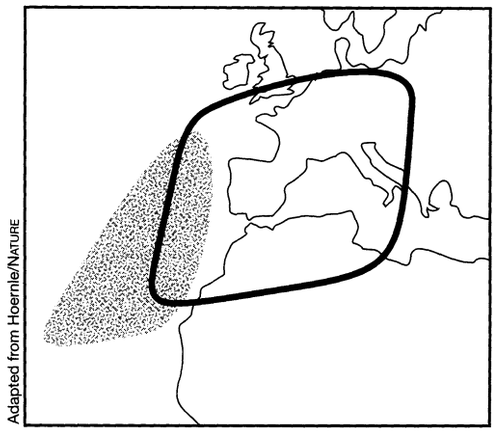
The ascending current feeds volcanoes across that broad region, revealing itself with a distinct chemical signature, according to the scientists. If future studies can confirm its existence, the deep feature will force earth scientists to revise their ideas about Earth's internal heat engine, the driving force for plate tectonics.

"This is a step beyond plate tectonics, which looks only at the surface of the Earth. This is something you might call global tectonics," says Hoernle, who collaborated with Yu-Shen Zhang of the University of California, Santa Cruz, and with David Graham of Oregon State University in Corvallis.

They describe their work in the March 2 NATURE.

The group made its discovery through a technique called seismic tomography, which uses earthquake waves to probe Earth's interior. In a global tomographic study, seismic waves showed a noticeable slowing when passing beneath the eastern Atlantic, western and central Europe, and North Africa. With seismic waves, low velocities signify low-density rock. Slow regions may be hot, or they may contain gases and fluids.

According to Hoernle, Zhang, and Graham, the low-density zone represents a broad sheet of upwelling rock coming from deeper in the mantle. Tomographic slices taken at different depths indicate that the sheet rises under the eastern Atlantic Ocean and then spreads eastward under Europe and Africa as it nears the base of the surface plates. They can trace the bottom of the structure as deep as 600 kilometers, near the bottom of the upper mantle.



Adapted from Hoernle/NATURE

Three scientists believe a sheetlike current rises through the mantle under North Africa and Europe. Shaded region indicates the current's position at a depth of 500 kilometers. Bold line shows how sheet has spread eastward at a depth of 100 kilometers.

Support for their theory comes from chemical studies of volcanic rock from the region overlying the low-density sheet. By looking at isotopic ratios for lead, strontium, and neodymium, the scientists compared rocks from various locations, including the Canary Islands off Africa, Sicily's Mt. Etna, and ancient volcanic formations in Germany's Rhine valley.

Although the rocks formed in markedly different geologic settings, they all share a common chemical fingerprint. To explain the similarity, Hoernle and his colleagues suggest that volcanic sites across Europe have all tapped the same broad zone of upwelling rock throughout the last 60 million years.

If confirmed, the discovery of a wide ascending sheet will force geoscientists to toss aside the textbook model of Earth, which holds that hot rock rises from deep in the mantle only in narrow cylindrical plumes, too small to detect with tomography.

The thin hot plumes are thought to explain the formation of the Hawaiian Islands and other chains of volcanoes. They also carry heat away from the planet's interior, forming part of the engine that pushes plates around Earth's surface.

Don't bet on a glut in the used-textbook market just yet, however. In comparable analysis of global tomographic data, seismologist Adam Dziewonski of Harvard University fails to find the low-velocity European structure reported by Hoernle and his colleagues. "As far as the seismic evidence is concerned, I am extremely suspicious about the whole thing," Dziewonski says.

— R. Monastersky

Jamming prostate cancer's transmission

Though most prostate cancers do not metastasize, seeding new tumors throughout the body, those that do become incurable. But data from a new animal study suggest the possibility of one day checking this cancer's potentially lethal spread with a nontoxic, fruit-derived dietary supplement.

The promising agent? Fragments of pectin — the gelling powder used for generations to set jams and jellies.

Three years ago, researchers at Wayne State University in Detroit chopped up branched molecules of citrus pectin to make linear, twiglike arrays of the sugar galactose. The fragments, they found, could bind to lectins, galactose-seeking proteins on the surface of cancer cells.

Ordinarily, lectins foster a cancer cell's adhesion to the blood vessel wall of any organ it attempts to colonize. By binding those lectins to pectin instead, the researchers had hoped to keep circulating cancer cells in the bloodstream until they died or could be eliminated.

And the strategy worked when researchers injected pectin fragments into mice along with cells from a deadly skin cancer (SN: 3/21/92, p.180). Neither untreated pectin nor galactose alone has proved antimetastatic.

Now the Wayne State team has turned its attention to prostate cancer. Why? Research has shown that when prostate cells turn cancerous, they elevate their production of galactose-binding lectins, notes study leader Kenneth J. Pienta, now at the University of Michigan in Ann Arbor.

In the March 1 JOURNAL OF THE NATIONAL CANCER INSTITUTE, his team reports that rats drinking pectin-supplemented water developed prostate metastases to the lung at about half the rate of rats drinking plain water. Moreover, Pienta points out, even when metastases did appear in the highest dose group (whose water contained 1 percent by weight of modified pectin), only about one-tenth as many nascent tumors developed as formed in other animals with metastases.

The nontoxic pectin doesn't affect the growth of established tumors. Rather, assays by Pienta's team suggest, pectin fragments indeed thwart metastasis by preventing tumor cells from adhering to blood vessel walls. Most encouraging, Pienta told SCIENCE NEWS, "we have demonstrated in our [assays] that the modified pectin appears to block several different types of cancer from adhering to blood vessels — including breast cancer, lung cancer, melanoma, kidney, and others."

"We would therefore predict that this [pectin supplementation] would work for just about any cancer — not just prostate," he says. His group has sent samples of the modified pectin to the National Cancer Institute for additional antimetastasis testing.

In the meantime, Pienta cautions cancer victims against attempting to medicate themselves with pectin. In its off-the-shelf form, he notes, "it's just a dietary fiber and will act like Metamucil. It's only our modification that allows it to be absorbed."

— J. Raloff