boundary, says Bloxham. In this fashion, the mantle is directly influencing the flow of the inner core and, in turn, the earth's magnetic field.

The proposed anticontinents along the boundary may be key to this relationship, he adds. "If you have continents at the core-mantle boundary, they will serve as blankets, suppressing the flow of heat from the core."

Hand in hand with the new inner-earth discoveries come some important theoretical questions that remain unanswered. Scientists wonder in particular whether the anticontinents would be thermal or chemical structures—a distinction with important implications. These areas might be cool patches of rock, or they might be composed of unique material that has accumulated at the boundary, in a manner analogous to what has happened at the earth's surface.

Thomas Jordan, a seismologist at the Massachusetts Institute of Technology, is one of many scientists who believe unique material must have accumulated at the interface between core and mantle, because there is a density difference between the two regions.

"If you have a density interface, material just gets stuck there. It can move around on the boundary, but it doesn't really get remixed," he says.

If this chemical boundary layer does exist between core and mantle, some scientists suggest it formed early in earth's history, when a (theoretically) homogeneous planet began to separate itself into distinct regions. Alternatively, some say chemical reactions between the mantle and core continue even today. In this case, they would be constantly adding to an ever-growing boundary layer.

Another outstanding question is whether material from the core-mantle boundary reaches the earth's surface. Many scientists think extremely hot areas along this boundary spawn plumes of material that rise to the surface, thereby forming the so-called hotspots of the earth's crust. Over tens of million of years, hotspots eat holes into the traveling plates, creating linear tracks of volcanoes and seamounts such as the Hawaiian Island chain (SN: 10/17/87, p.250).

If hot regions along the core-mantle boundary are the source of the material erupted at hotspots, this would indicate an interaction between the core and the earth's surface — a long-distance communication crossing thousands of miles of mantle, says Olson, who has created models to study mantle plumes.

Traditionally, the inner earth has attracted the scrutiny of only a small minority of earth scientists, largely because near-surface processes are so much more accessible. But as researchers begin to tie together the core, mantle and crust, more scientists are turning their gaze toward the distant interior.

Particularly intriguing is new research suggesting earth's surface may actually reveal signs of motion in the core. This work falls under the aegis of geodesy — the field that precisely measures the habits, shapes and size of the planet.

At the geophysical meeting last month, geodesist Marshall Eubanks of the U.S. Naval Observatory in Washington, D.C., reported that fluid moving in the outer core should produce swells and other features that would be visible at the surface through such measuring techniques as Very Long Baseline Interferometry (VLBI), which uses radio signals from quasars to determine distances. On the basis of sketchy calculations, he proposes that large patches of the earth's surface may rise or fall by a full centimeter over several decades, which is technically within the resolving power of VLBI. These deformations, perhaps several thousands of kilometers in area, should be noticeable on land and in the oceans, says Eubanks, who is working on the project with Coerte Voorhies of the NASA Goddard Space Flight Center in Greenbelt, Md.

A second potential method of tracing core motion involves the earth's rotation axis. Since changes in the core would affect the inertia of the planet, scientists should also be able to discern these core processes through shifts in the rotation axis, says Eubanks. Working independently of Eubanks, James B. Merriam of the University of Saskatchewan in Saskatoon also proposed recently that motion in the rotation axis may lead to insight about the core.

At present, scientists interested in this part of the earth have only limited access to their quarry, mostly through seismic and geomagnetic studies. "It's so hard to get information about the core that any way you can get information, you're likely to provide some real science," says Eubanks. "Even if you could just get a crude idea, the knowledge of the core is so crude that you could make a very great gain for science."

Scientists have only recently focused on the earth as a whole rather than as a patchwork of autonomous, unrelated sections. But as the idea of an interconnected earth develops, researchers say it is drawing together the disparate parts of the geosciences. "It's generating if not interdisciplinary research, at least an interdisciplinary attitude because of the complexity of these interactions," says Olson. "The fact that there are physical problems and chemical ones, the fact that the data are seismological while the inferences are geodynamical, [means] no one person can handle the whole thing." □

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Archimedes' Revenge: The Joys and Perils of Mathematics—Paul Hoffman. In readable essays the author sketches for the nonmathematician the range and scope of mathematics. Gives a glimpse of some of the things that mathematicians, pure and applied, actually do. Attempts to convey a sense of the limits of mathematical knowledge. Sometimes, says the introduction, knowledge is limited because a field is young; in other cases it is because the mathematical problems are extraordinarily difficult. Norton, 1988, 285 p., illus., $17.95.

The Dark Matter: Contemporary Science's Quest for the Mass Hidden in Our Universe — Wallace Tucker and Karen Tucker. Not all the mass of the universe can be accounted for by the luminous matter observed in the galaxies. This book describes for the general reader scientists' search for the solution to the mystery of missing mass or dark matter. Discusses the possible sources of dark matter that scientists are investigating. Morrow, 1988, 254 p., illus., $16.95.

In Praise of Imperfection: My Life and Work — Rita Levi-Montalcini, translated by Luigi Attardi. An autobiography of this fascinating woman who won the Nobel Prize in Medicine in 1986. In scientific research she feels the factors essential for attaining personal success and fulfillment are total dedication and a tendency to underestimate difficulties, which causes one to tackle problems that other, more critical and astute persons opt to avoid. A volume in the Sloan Foundation Science Series. Basic, 1988, 220 p., illus., $18.95.

Interactions: A Journey Through the Mind of a Particle Physicist and the Matter of This World — Sheldon Glashow with Ben Bova. According to this 1979 Nobel Prize winner, "My greatest discovery was that science can be more than a mere hobby. . . . People would actually pay me to do what I most wanted to do: to satisfy my own curiosity." This book, he goes on to say, is about "the search for the ultimate portrait of the universe, as seen through the eyes of one of the searchers." Traces for the general reader the history of modern physics from the discoveries of Einstein and Bohr in the early 20th century to the most recent advances in particle physics. In special sections set apart from the text are detailed discussions of the more complex concepts of physics for those who wish to probe deeper into the mysteries of subatomic physics. Warner Bks, 1988, 345 p., illus., $19.95.

The Science of Structures and Materials — J.E. Gordon. A beautifully illustrated, readable, interdisciplinary examination of the strength of structures and materials by this leading materials scientist. Shows how the same mechanical principles that underlie the strength of natural structures like tendons and muscles apply to human-made structures like skyscrapers, bridges, ships and aircraft. Provides an introduction to biomechanics, the study of mechanical behavior of living things, and points out how this new science benefits areas ranging from heavy construction to orthopedic surgery. Sci Am Bks (W H Freeman), 1988, 217 p., color/b&w illus., $32.95.