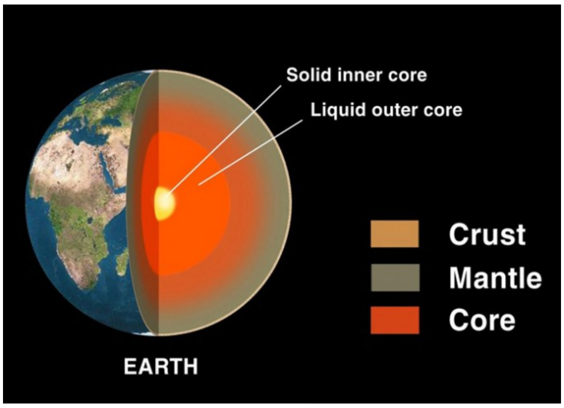
The Crystals at the Center of the Earth



Seismic waves traveling between Earth's poles move faster than those moving east-west, and now scientists think they may know why.

The iron alloys in the solid inner core of the Earth appear to have crystallized in such a way that it's easier for energy to pass on the north-south axis than on the east-west, as described in a new study led by Maurizio Mattesini, a geologist at the Universidad Complutense de Madrid, which appeared in the journal **Proceedings of the National Academy of Sciences**.

"The structure of the atoms looks different in one direction than the other," explained Norm Sleep, a Stanford geologist who was not part of the new study,

In the textbooks of yore, the Earth's inner regions like the mantle and core were presented as simple, fairly homogeneous regions. But the geology of the core is turning out to be much more complex as scientists make use of more and better seismographs to generate better data about how seismic waves travel through the planet.

The outer core is composed mostly of liquid iron. The inner core is solid ball about 750 miles in diameter, or a little less than the maximum width of the state of Texas, which formed as the Earth cooled over geologic time, said David Stephenson, a geologist at CalTech.

"The center of the earth is literally a crystal," said Stephenson. Over time, it grew and now is no longer a single crystal but an aggregate of them.

In the mid-1990s, geologists began to notice an interesting thing. Seismic waves traveling north-south were reaching their destinations about 3 percent faster than waves moving along east-west paths.

"It's one of these things that's been detected for some time but kind of why it occurs has been somewhat of a puzzle," Sleep said. They didn't know why, but then again, the middle of the globe is perhaps the most difficult place to gather data on Earth.

The new paper suggests that as the crystals formed, they received a particular alignment. That alignment, known as anisotropy, makes it easier for waves to travel in one direction than the other.

The most significant thing about the new paper, Stephenson said, is that the researchers were able to match up the results that seismologists have been getting on the speed of seismic waves through the core with new laboratory tests with particular kinds of iron crystals.

Image: NASA

"Hemispherical anisotropic patterns of the Earth's inner core" by Maurizio Mattesinia, Anatoly B. Belonoshkob, Elisa Buforna, María Ramíreza, Sergei I. Simakc, Agustín Udíasa, Ho-Kwang Maod, and Rajeev Ahujae in the **Proceedings of the National Academy of Sciences** DOI: 10.1073/pnas.1004856107

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