Unusual behaviour in Earth's inner core explained

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News

Unusual behaviour in Earth's inner core explained

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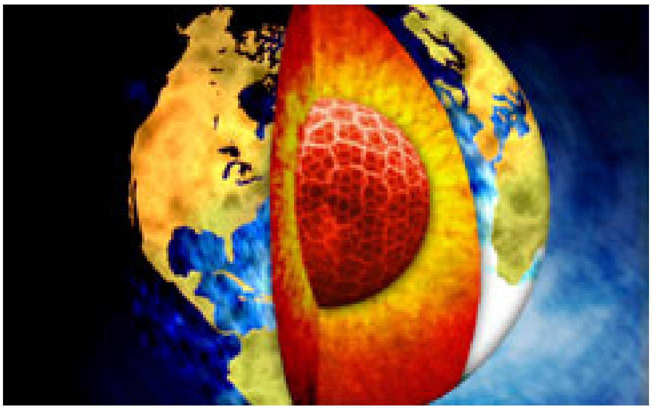
New research could help explain complex behaviour observed by scientist's in Earth's inner core.



The study, by an international team of researchers from Leeds, London and California, shows that rocks could be circulating in the inner core which may explain the unusual behaviour of seismic waves passing through it.

Observations of the inner core primarily come from seismology - studying the way waves generated during earthquakes move through the Earth. Seismic waves show different behaviour depending on which way and which hemisphere they pass through. Large differences in the time it takes these waves to travel through the inner core suggested to scientists that its structure might be more complex than previously thought.

Many simple models were proposed to try to explain these differences but none of them were able to provide an explanation, this new research fills in some of the gaps.

Being able to explain the complexities that the inner core exhibits is crucial to understanding how the deep Earth evolved. The growth of the inner core indirectly drives the motion in the outer core which in turn produces the Earth's magnetic field, so understanding the core is integral to understanding this phenomenon.

> 'Slow cooling of the whole Earth is causing the liquid outer core to solidify from the bottom up, adding to the edges of the solid inner core.'
> **Dr Chris Davies- University of Leeds**

The new study, published in *Geophysical Research Letters* suggests that differences in seismic wave behaviour may be caused by convection. Convection is the same process which means radiators can heat an entire room. As air near the radiator becomes warms it becomes less dense, this makes it rise and push the cool, denser air near the ceiling out of the way. The cool air is pushed near to the radiator where it warms, and the circulation continues. The same process happens inside the core.

'Slow cooling of the whole Earth is causing the liquid outer core to solidify from the bottom up, adding to the edges of the solid inner core. That material, at the top of the inner core, is denser than the material below,' says Dr Chris Davies, one of the authors of the study, from the University of Leeds, 'When you have dense material overlying light material the light material wants to rise and the dense wants to sink - making it unstable.' It is this instability which causes convection to occur.

Some researchers assumed the inner core was hotter in the centre and that this change in temperature – from the centre to the edge – could also cause convection as the cool material at the edge wants to sink.

But Davies says the convection is due to heavier, not cooler, material. 'We show the driving force of the convection is different to previous assumptions. Instead of the driving force being a difference in temperature, it's now a difference in composition.'

Previous work showed the inner core should be able to transfer most of its heat by passing it through to the next layer by conduction - where the heat moves but the material doesn't. But this would mean there wasn't enough heat left to cause convection. So, many scientists were dubious about convection as an explanation for the behaviour of the seismic waves.

'Whilst previous work put a dampener on the convection argument, and it seemed convection wasn't enough to prove these seismic anomalies, we show that convection could be behind the striking inner core complexity we observe.' says Davies. 'We show that this mechanism is possible, in principle.'

Inner core convection is a hot topic in deep Earth research at the moment and, while this study shows convection is possible in theory, the next stage is to know what this might look like in reality, using dynamic simulations.

SOURCE [1]

Links:
[1] http://planetearth.nerc.ac.uk/news/story.aspx?id=1402