Deep dive into Earth's interior shows change isn't skin deep

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Credit: Flickr, Alicia Chenaux

They say it's what's on the inside that counts. And so it goes with the planet's surface; from mountain ranges to a river's drainage, the deep Earth has a profound influence on what's happening on top.

That's the key lesson from a study led by researchers at The Australian National University (ANU), which sheds new light on how Earth's

surface is shaped by what's happening deep inside our planet's interior.

The study focused on the Earth's changing landscape today, but could also offer a window into the ancient past.

The changes are driven by the movement of solid rocks inside the earth in a process called convection, which creates dynamic topography. The new study provides the best understanding yet of how dynamic topography works.

Lead author Associate Professor Rhodri Davies says as this rock moves around inside the Earth, it can shift the Earth's surface.

"Hot buoyant material rises, and cooler dense material sinks," he said.

"This pushes the Earth's surface up in some places, and draws it down in others."

According to Associate Professor Davies, this phenomenon is one of the key drivers of variation in the Earth's surface around the globe.

"It has an influence on many things, from the Earth's gravitational field to sea-level change," he said.

"There are some striking examples. We're reasonably confident this process played a role in the creating the western interior seaway, which once split what is now the United States roughly in half.

"It also likely played a role in reversing the drainage direction of the Amazon River, from west to east, and more locally, is tilting the Australian continent downwards towards Indonesia and New Guinea."

The research team hope to reconstruct the history of changes to the

Earth's landscape, and how it's evolved over space and time.

"This will provide further insight into the role of the Earth's interior in shaping the surface of our planet, particularly drivers of long-term environmental change," Associate Professor Davies said.

Despite its importance, there is much to be learned about the process of dynamic topography.

"There's been disagreement over whether changes to the Earth's surface are principally generated by processes in Earth's deep mantle, or those closer to Earth's surface," Associate Professor Davies said.

"Until recently, researchers had to rely on models to predict what the dynamic topography signal might look like.

"We've found that both deep and shallow processes need to be taken into account."

The research team included scientists from Imperial College London, University of Cambridge, Harvard University and Carnegie Institution of Washington.

Their paper has been published in the journal *Nature Geoscience*.

More information: D. R. Davies et al. Earth's multi-scale topographic response to global mantle flow, *Nature Geoscience* (2019). DOI: 10.1038/s41561-019-0441-4

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