Plate tectonics: What set the Earth's plates in motion?

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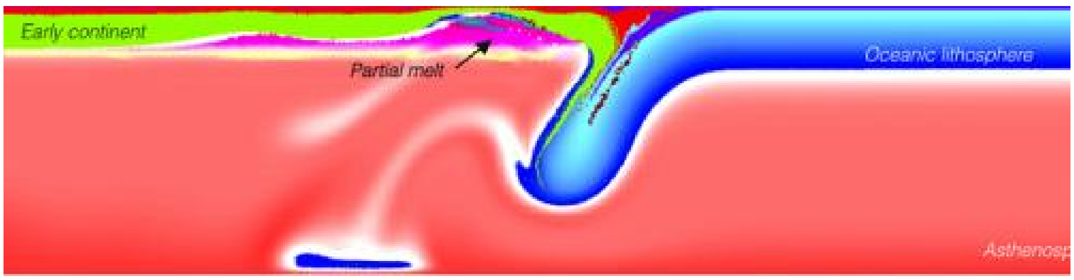

A snapshot from the film after 45 million years of spreading. The pink is the region where the mantle underneath the early continent has melted, facilitating its spreading, and the initiation of the plate tectonic process. Credit: Patrice Rey, Nicolas Flament and Nicolas Coltice.

The mystery of what kick-started the motion of our earth's massive tectonic plates across its surface has been explained by researchers at the University of Sydney.

"Earth is the only planet in our solar system where the process of plate tectonics occurs," said Professor Patrice Rey, from the University of Sydney's School of Geosciences.

"The geological record suggests that until three billion years ago the earth's crust was immobile so what sparked this unique phenomenon has fascinated geoscientists for decades. We suggest it was triggered by the spreading of early continents then eventually became a self-sustaining process."

Professor Rey is lead author of an article on the findings published in *Nature* on Wednesday, 17 September.

The other authors on the paper are Nicolas Flament, also from the School of Geosciences and Nicolas Coltice, from the University of Lyon.

There are eight major tectonic plates that move above the earth's mantle at rates up to 150 millimetres every year.

In simple terms the process involves plates being dragged into the mantle at certain points and moving away from each other at others, in what has been dubbed 'the conveyor belt'.

Plate tectonics depends on the inverse relationship between density of rocks and temperature.

At mid-oceanic ridges, rocks are hot and their density is low, making them buoyant or more able to float. As they move away from those ridges they cool down and their density increases until, where they become denser than the underlying hot mantle, they sink and are 'dragged' under.

But three to four billion years ago, the earth's interior was hotter, volcanic activity was more prominent and tectonic plates did not become cold and dense enough to spontaneously sank.

"So the driving engine for plate tectonics didn't exist," said Professor Rey said.

"Instead, thick and buoyant early continents erupted in the middle of immobile plates. Our modelling shows that these early continents could have placed major stress on the surrounding plates. Because they were buoyant they spread horizontally, forcing adjacent plates to be pushed under at their edges."

"This spreading of the early continents could have produced intermittent episodes of plate tectonics until, as the earth's interior cooled and its crust and plate mantle became heavier, plate tectonics became a self-sustaining process which has never ceased and has shaped the face of our modern planet."

The new model also makes a number of predictions explaining features that have long puzzled the geoscience community.

More information: Spreading continents kick-started plate tectonics, *Nature*, dx.doi.org/10.1038/nature13728

Provided by University of Sydney

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