Numerical modelling of Early Earth

Geodynamic exploration of emergence and evolution of Hadean paleogeography

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Project description

The origin of life remains one of the greatest mysteries in science. While many theories have been proposed, no single explanation has yet gained universal agreement. That's where the PRELIFE consortium comes in (https://www.originscenter.nl/prelife/). PRELIFE unites experts across a wide range of disciplines from astronomy, biology, chemistry, computer science, earth and planetary sciences, education, mathematics, to physics. PRELIFE will explore two fundamental questions: *How did life emerge on Earth, and how common are the conditions elsewhere in the universe?*

The proposed research is part of one of 15 projects inside PRELIFE and is named "Geodynamic exploration of emergence and evolution of Hadean paleogeography". This project aims to evaluate (i) what relief may have existed and on what timescales in the course of the Hadean, and (ii) using scenarios for ocean volume on the early Earth, whether land may have existed and what it could have looked like when life emerged. In particular our goal is to evaluate scenarios through numerical modelling of mantle dynamic and lithosphere (de)formation processes, using the range of possible Hadean compositions and mantle temperature evolution.

A new Python numerical code is currently being developed to carry out this research. One of the objectives is to implement the necessary ingredients for the research at hand, i.e. compressible flow, complex rheologies and melting. The student is expected to help with the implementation, run tests and benchmarks, and ultimately produce a first set of models for the Hadean Earth with an eye on surface evolution.

Job requirements

The student should ideally have a background in geophysics (continuum mechanics, rheology) as well as Python programming skills.