Plume-Lithosphere interaction during Archean

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There are many open issues regarding the continental crust generation during Archean, and most of them are focusing on the application of uniformitarian models (i.e. magmatic arc-system), or on vertical deformation triggered by mantle plumes. The plume model has become more popular recently, but it cannot be tested using geological and geochemical data alone, and numerical modelling is required to understand the physical and chemical processes behind it.
Numerical modelling together with petrological forward modelling have been useful tools to understand Archean dynamics, but the bulk of the work on such topic neglected the third dimension. Therefore, many important features related to the magmatic processes, such as the structure of the primordial continental crust and the interaction of the plume with the lithosphere have been hampered and are not yet fully explored.
Here we show our preliminary work on the plume-lithosphere interaction using Archean like conditions, combining the state-of-the-art of the thermodynamic modelling with the 3D petro-thermo-mechanical code LaMEM. As part of the preliminary work, we focus on the effect of a rising plume on the lithosphere, changing its volume, the initial composition of the crust and relative thickness. We will test whether it can promote a tectono-metamorphic deformation of the primordial crust and whether it can potentially affect the stability of the crust and trigger drips and delamination. We also compare the 3D with earlier 2D results.