

Three layers model of continents and whole mantle dynamics

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We propose a new model of three layers model of continents, 1) surface TTG continent, 2) mantle transition zone TTG continents, and the third anti-crust with meta-anorthosite right above the CMB in the Archean, and without meta-anorthosite in the upper parts of lower mantle after the mantle overturn at 2.6-2.7Ga. Our model is based on the First Principle Calculation along the geotherms in the Archean and Phanerozoic for the major rocks in the mantle.

The Archean double-layered mantle convection led an inevitable demise of catastrophic mantle overturn at 2.7-2.6Ga, and frozen the basal magma ocean over 90%, to enable the meta-anorthosite as a major rock component in the third continent. However, the subsequent cooling by the dropping cold materials from the upper mantle narrowed the stability field of Al₂O₃ phase, reducing the density to rise up into the mid-mantle depth around 1500-2000km depth range. This could be a prolonged duration of magmatic activity after 2.7Ga over a few hundred m.y.