

Where had the primordial continent gone?

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There are no Hadean rocks on the Earth's surface. This indicates (1) there was no continents on the primordial Earth, or (2) continents were present in the Hadean but lost afterwards. It is well-known that Moon surface was covered by anorthositic continental crust with KREEP basalts with ca. 50-60km thickness. Those rocks are the fractionated final residues of magma ocean after the giant impact at 4.56Ga.

The Earth must have been completely melted if giant impact was correct, but due to 6 times larger gravity, the thickness of anorthositic continents must be 21 km. Moreover, during the consolidation of magma ocean, bulk of anorthositic blobs could be transformed into (1) zoisite+kyanite+quartz, (2) grossular+kyanite+quartz, (3) grossular +kyanite+coesite, (4) grossular +kyanite+stishovite, in 300km depth.

Absence of TTG rocks in the Hadean and nearly absent in early Archean less than 5% among the surface of present continents must be caused by extensive tectonic erosion by subducting slabs which are present even today at trench. Therefore, it is wrong to believe that low-density granite must have accumulated on the surface once formed on the surface of the Earth.

Density calculation of anorthosite, MORB, harzburgite, and pyrolite using first principles calculation showed that anorthosite was heavier if it convected at depth in mantle transition zone. If it turns into lower mantle, it becomes to be heaviest among those as mentioned above, suggesting the stability field at D" layer on the bottom of mantle which is right above CMB.

However, it depends on the geothermal gradient on which phase change of Al₂O₃ occurs to determine whether or not the heaviest among all rocks at CMB. Depending on cooling the CMB, meta-anorthosite could have been buoyant particularly after the mantle overturn at 2.7-2.6Ga.

Before the overturn, if the basal magma ocean was present in the Archean, the lost primordial continents must have been melted into basal magma ocean where anorthosite-KREEP basalts mixed with FeO-enriched primordial basal magma ocean. The possible bulk chemistry can be estimated, though qualitatively; it must be super-enriched in anorthositic component. It can be expressed in Ca-Pv, Mg-Pv, Ferro-periclase as major components.

When, mantle overturn occurred at 2.7-2.6Ga, low-temperature materials of upper mantle must have cooled down the basal magma ocean to consolidate to crystalize Ca-Pv rock, bi-mineral Ca-Pv + Mg-Pv rock, and the tri-mineral Ca-Pv + Mg-Pv + FM periclase rock. According to the formation of these rocks, those three rocks would have been behaved differently, although depends on not only density but also mass.

Assuming the enough volume of Ca-Pv rocks, those rocks may be floating in mid-depth of lower mantle.