



Rodinia supercontinent break-up: Not a result of Superplume tectonics

Kamal K. Sharma

Government Postgraduate College, Sirohi (Rajasthan) 307001 India

Email: sharmasirohi@yahoo.com

The formation of the Earth's crust is a complex process, evolved over a long period. Upper mantle convection dynamics caused separation of low-density silicate minerals from the initial cooling melt. This resulted in the granitic continental part. These landmasses gradually accreted in the form of a supercontinent, which subsequently fragmented in the smaller continents.

The Rodinia supercontinent accreted between 1100 and 900 Ma. The history of supercontinent assembly and fragmentation is constrained through palaeomagnetic data from different landmasses along with other geological data. The assembly process caused development of orogens, melting anomalies and other thermal events under a compressional tectonic regime along continental margins. The formation of an insulative supercontinent changed the thermal pattern of the crust-mantle region. The change in upper-mantle thermal convection led to the breaking of the supercontinent at ca 750 ± 50 Ma along with decompressional melting through fractures resulting from extension. Large Igneous Provinces and other melting anomalies formed on the different landmasses at the time of Rodinia fragmentation.

Plate tectonics operated in response to thermal dynamics in the lithospheric part of Earth, and clearly explains the assembly and break-up of Rodinia during Neoproterozoic time. However, others have suggested a whole mantle thermal convection system from the core-mantle boundary, and the existence of a superplume at the time of Rodinia break-up. The superplume resulted mantle avalanches and ultimately continental rifting.

This superplume analogy does not explain the tectono-thermal energy required for the assembly of Rodinia; this can only be explained by plate dynamics. The same process accounts for break-up of the supercontinent under changed tectono-thermal conditions. There is an absence of widespread deep-seated Neoproterozoic ultramafic rocks in the Earth's crust, which should have arisen due to mantle avalanches. The Neoproterozoic melting anomalies constitute Large Igneous Provinces. Malani bimodal magmatism, with its dominant silicic component, shows the role of lithosphere rather than the core-mantle boundary region. Silicic magma is a low temperature melt and resulted from continental insulation heat build up and decompression on fragmenting continents.

The Neoproterozoic tectonothermal evolution of the crust during Rodinia assembly and fragmentation can only be explained by plate tectonic process. It does not have viable inputs from mantle avalanches and superplume tectonics.