The 455th Geodynamics Seminar

Numerical simulations of thermochemical mantle convection with drifting supercontinent in two-dimensional cylindrical geometry

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Abstract

In this study we are conducting numerical simulations of thermochemical mantle convection in 2-D cylindrical geometry with a highly viscous lid drifting along the top surface, in order to investigate the interrelation between the motion of surface supercontinent and the behavior of chemical heterogeneities initially imposed in the lowermost mantle.

Our calculations show that assembly and dispersal of supercontinents occur in a periodic manner when the chemically distinct material is sufficiently denser than the surrounding ones at the base of the mantle. The motion of surface continents is significantly driven by strong upwelling plumes originating around thermochemical piles (or small studs on a global layer above the CMB) in the lowermost mantle. These piles or studs in the deep mantle are formed by the balance between the negative buoyancy of chemically dense materials and the viscous drag of convecting flows largely induced by the cold subduction from the top surface. In addition, the piles or studs laterally move in response to the motion of continents and subduction at the top surface, which in turn laterally move the upwelling plumes leading to the breakup newly formed supercontinents. Our findings imply that the dynamic behavior of chemically dense materials in the lowermost mantle is the key to the understanding of the relationship between the Wilson cycle on Earth's surface and the convecting structures in the Earth's mantle, through modulating the occurrence and locations of upwelling plumes.

詳細は当センターホームページ: http://www.grc.ehime-u.ac.jp/をご覧ください
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