The 59th GRC & The 4th MEXT Shin-Gakujutsu "Core-Mantle Coevolution" International Frontier Seminar

Carbon-bearing magmas and material transport in the deep Earth's mantle

Dr. Konstantin Litasov (V.S. Sobolev Institute of Geology and Mineralogy)

Date: 11.17.2016 (Thur.) 16:30 – 18:30

Venue: Meeting Room #486, Science Research Bldg 1, Ehime Univ.

The models considering fast mantle upwelling without an addition of volatile-bearing components are failed due to high melting temperatures of mantle silicates. Thus, considering mantle plumes one should add fusible component to the system. Some mechanisms, such as melt percolation or hydraulic fracturing, are applicable for lithospheric depths and cannot be considered as reliable for deeper mantle with high plasticity and low porosity. The most likely mechanism, which can operate in the deep mantle to assist plume ascent is the stress-driven dissolution-precipitation, however, the possible fusible component of plume melt in the deep mantle is a matter of debates. Here, I discuss possible compositions of melt in the upwelling mantle, which can drive material transport under superplumes and hot spots originated from the transition zone or from the core-mantle boundary of the Earth.

An important requirement for plume motion would be stress-induced melting and dissolution-precipitation of the fusible component at the front and rear of the plume, respectively. For this process one would have a volatile-bearing melt with low solubility of silicates (5-10%, but not zero) at the temperature of mantle geotherm. The possible candidates are alkali-bearing silicate, hydrous silicate, carbonatite, and hydrocarbon-bearing melts. Alkaline silicate melt and hydrous silicate melt cannot be considered, since a huge amount of silicate can be dissolved in these melts and the process of plume ascent will be terminated by progressive reactions with the surrounding silicate matrix. Carbonated or carbonatite melt is a likely candidate, especially for transition zone. In the lower mantle, however, hydrocarbon-bearing melt can be the best candidate for the liquid portion of a mantle plume arising from the core-mantle boundary.

CoreMantle Coevolution

Contact: Prof. Taku Tsuchiya
tsuchiya.taku.mg@ehime-u.ac.jp

EHIME UNIVERSITY GRC GEODYNAMICS RESEARCH CENTER