Potassium in the Earth's core: New experiments in a deep magma ocean

M. A. BOUHIFD[1], D. ANDRAULT[1], G. PESCE[1], S. PETIGIRARD[2] AND C. RIVARD[3]

[1]Laboratoire Magmas et Volcans, CNRS, Université Blaise Pascal, 5 Rue Kessler, 63000 Clermont-Ferrand, France
[2]Bayreuth Geoinstitut, Bayreuth, Germany
[3]European Synchrotron Radiation Facility (ESRF), BP 220, 38043 Grenoble, France

Potassium (K) could be a main source of heat in the Earth's core, due to its radioactive disintegration. It remains controversial, however, how much K has entered the core at the early stage of the core-segregation from a deep magma ocean. Quantum mechanical calculations as well as experiments suggest a change in electronic structure of K with pressure (at ~30 GPa), which would enhance the tendency of K to alloy with other transition metals such as iron [see ref 1 and references therein] or nickel.

To provide new constraints on the K content of the core at the time of Earth's core formation, Laser-Heated Diamond Anvil-Cell (LHDAC) experiments were carried out to determine the partition coefficients of K (D_K) between molten silicates and iron alloy liquids (S-free and S-bearing alloys), between 25 and 65 GPa, 2500 – 3500 K, and at an oxygen fugacity about 2 log units below the iron-wüstite buffer. State of the art X-ray fluorescence (XRF) technique with a sub-micron beam (Beamline ID21 at the ESRF) has been used to determine the concentration of K in the iron-rich alloys and silicate melts. No pressure dependence of the D_K coefficients was found in the investigated conditions. The dominant controlling parameters appear to be the temperature and the chemical composition of the metallic phase, with D_K increasing with temperature, and with the sulphur and oxygen contents of the Fe-alloy liquid.

We will discuss all available high-pressure data to obtain the most constrained concentration of K into the Earth's core.

[1] Lee K.K.M. and Jeanloz R. (2003) *Geophys. Res. Lett.* **30**, 2212, doi:10.1029/2003GL018515.