Mineralogical contraints on the temperature profil of the deep Earth

D. ANDRAULT[1], G. MORARD[2] AND M. MEZOUAR[3]

[1]Laboratoire Magmas et Volcans, OPGC-UBP-CNRS-IRD, Clermont-Ferrand, France.
[2]Institut de Minéralogie, de Physique des Matériaux et de Cosmochimie, UPMC-CNRS, Paris, France.
[3]European Synchrotron Radiation Facility, Grenoble, France.

Our knowledge on the Earth's deep interior remains limited by a poorly contrained temperature profile. Significant temperature uncertainties disable a precise refinement of the lower mantle mineralogy based on the seimic profiles. It also raises questions about the nature of the seimic anomalies in the D"-layer and its potential control on the mantle dynamics.

In the upper mantle, the seismic discontinuities provide precise anchor points for the temperature (i.e. [1]). Then, an adiabatic temperature gradient is classically extrapolated from these anchor points into the lower mantle. Accordingly, the temperature accuracy decreases with depth. Major uncertainties arise in the lowermost mantle. The bridgmanite (Bg) to post-Bg transition has been tentatively used to contrain the temperature profile above the core-mantle boundary (CMB) [2]. However, it does not solve adequatly all seismic features, in part due to the complex crystal chemistry of the (Al,Fe)-bearing Bg [3] [4].

In this presentation, we will use recent reports on the melting behavior of different silicates [5] [6], pure Fe [7] and Fe-alloys [8] to refine the temperature at the CMB. Based (i) on the seismic features pointing out partial melting in the D"-layer and (ii) using an appropriate mixture of light elements for the Fe-alloy in the outer core, we will show that all arguments converge to a CMB temperature of 4000+/-300 K. It yields a temperature change of ~1300 K in the D"-layer.

[1] Katsura *et al*. *PEPI* **183**, 212-218 (2010). [2] Hernlund *et al*. *Nature* **434**, 882-886 (2005). [3] Andrault *et al*. *EPSL* **293**, 90-96 (2010). [4] Catalli *et al*. *Nature* **462**, 782-785 (2009). [5] Andrault *et al*. *Science* **344**, 892-895 (2014). [6] Nomura *et al*. *Science* **343**, 522-525 (2014). [7] Anzellini *et al*. *Science* **340**, 464-466 (2013). [8] Morard *et al*. *CRAS-Geoscience* **346**, 130-139 (2014).