# Snow in the Earth's core

M. LASBLEIS[1*], J. HERNLUND[1], S. LABROSSE[2]

[1]Earth Life Science Institute, Tokyo Institute of Technology, Tokyo, Japan. (*correspondance: marine.lasbleis@elsi.jp)

[2]LGL-TPE, Ecole Normale Superieure de Lyon, Lyon, France

Seismic observations of the Earth's core reveal a complex structure: radial and lateral heterogeneities in seismic anisotropy and attenuation in the solid inner core, but also discrepancies between observed P-wave velocity and homogeneous PREM model in the deep liquid outer core. In this work, we focus on the 200km anomalous layer at the bottom of the outer core that exhibits seismic velocities lower than the PREM model. It has been interpreted as a layer depleted in light elements, whereas the usual model considers that light elements are expelled at the surface of the inner core by freezing of the outer core alloy. Recent models of core formation argued for an early stratified liquid core, and the stratified layers at the top and bottom of the outer core could be a vestige of this primordial stratification. However, freezing of the inner core at the inner core boundary releases light elements that provide buoyancy fluxes that would mix the stratified liquid above with small scale buoyant plumes. We consider here that the freezing of iron alloy and thus releasing of light elements occurs in volume in the liquid and not at the inner core boundary. We consider the dynamics of such a mixture of iron solid particles and iron liquid, and show that this is a stable state for some area of the parameters space. The fall of particles through the stratified layer is destabilizing the layer, while the equilibrium between solid and liquid particles stabilizes the compositional stratified profile. This mechanism is thus a very good candidate to explain the stability of the F-layer, under a vigorously convective outer core.

We developed a theoretical framework to study instabilities in such snow mechanisms, and this work can be extended to study similar processes in either primitive core (for early freezing of oxides) or in other planetary bodies.