

## Post perovskite is weaker than perovskite by experiment and simulation

David Dobson<sup>1\*</sup>, Simon Hunt<sup>1</sup>, Michael Ammann<sup>1</sup>, John Brodholt<sup>1</sup>, Donald Weidner<sup>2</sup>, Li Li<sup>2</sup>, Nico Walte<sup>3</sup>

<sup>1</sup>Earth Sciences, UCL, <sup>2</sup>MPI, Stony Brook, <sup>3</sup>BGI, Universitaet Bayreuth

The D double prime region at the core-mantle boundary of the Earth is thought to contain iron- and aluminium-bearing magnesium silicate in the calcium iridate structure. This recently discovered post-perovskite phase has been invoked to explain many of the anomalous seismic properties of D double prime. Recent studies suggest that the lowermost mantle is rheologically distinct from the overlying perovskite-dominated mantle, however no studies of post-perovskite rheology have been reported to date. Here we present results of laboratory studies aimed at measuring the strength of the low-pressure analogue phase calcium iridate as it transforms from perovskite to post-perovskite. Experiments were performed in pure shear geometry using d-DIA presses and real-time X-radiographic imaging of strain; further, quenching, experiments are consistent with the in situ results. The results suggest that perovskite is at least 5 times stronger than post perovskite and there is a further weakening by a factor of two which occurs during the transformation; these are minimum estimates of the weakening. These results are support results from ab initio simulations of chemical diffusivity in MgSiO<sub>3</sub> perovskite and post perovskite, which we also report here. If, as seems likely, a similar weakening occurs in lower mantle magnesium-silicate compositions this would have significant implications for the base of the lower mantle.

Keywords: D'', post perovskite, rheology, HPHT experiments, atomistic simulations