

# The convection planform of a dense chemical layer with higher bulk modulus

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The two Large Low Velocity Provinces (LLVPs) in the base of lower mantle are the prominent features in all shear wave tomographic models. Their shear wave speed anomaly and bulk sound speed anomaly are anti-correlated. They form a degree-2 pattern, and their margins spatially coincide with the reconstruction of the eruption sites of Large Igneous Provinces of past 250 Myrs. This suggests that the LLVPs are not short-term transient, but long-term stable, chemical structures. Moreover, it appears that the LLVPs did not significantly shift around laterally over the past 250 Myrs.

The stability of dense chemical structures at the base of the mantle has been well studied. These studies concentrate on the vertical movement of the chemical structures. However, in this project, we will investigate the lateral movement of the chemical structures. We use CIG's CitcomS v3.0.3 with two modifications: a) the mesh is adjusted so that when tracer module is used, the mesh still can be partitioned in azimuthal direction; b) the chemical density anomaly is allowed to change radially to simulate the effect of the bulk modulus anomaly.

We found that with reasonable values of bulk modulus and chemical density anomalies, the chemical structures are dome-like and survive for hundreds of million years. Warm upwellings rise from the top and margins of the structures, while cold downwellings occur near the perimeter of the structures or where the structures are absent. The structures have a degree-2 pattern in most models, and degree-3 in a few models. This is likely controlled by the initial conditions. Nonetheless, the convection planform is always stable, in a sense that the location of upwellings and downwellings do not change much with time.

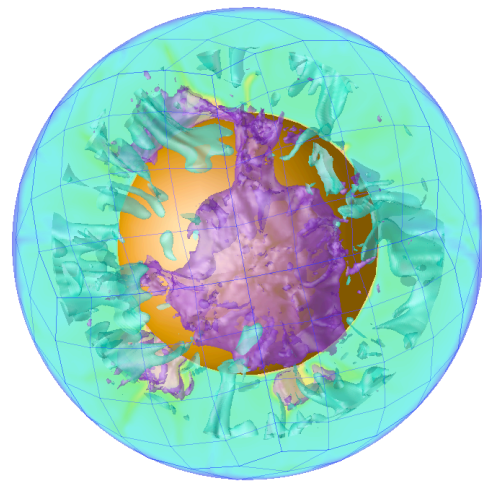


Figure (right) shows the chemical structures (purple) and the cold downwellings (cyan) in the lower mantle. The chemical structures stay roughly at the same location until gradually entrained.

**Reference:** Tan, E., W. Leng, S. Zhong, and M. Gurnis, The convection planform of a dense chemical layer with higher bulk modulus, *in preparation*.