

Very Long-wavelength Convection, True Polar Wander and Supercontinent Cycles

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We show in this paper that mobile-lid mantle convection in a three-dimensional spherical shell with observationally constrained mantle viscosity structure, and realistic convective vigor and internal heating rate is characterized by either a spherical harmonic degree-1 planform with a major upwelling in one hemisphere and a major downwelling in the other hemisphere when continents are absent, or a degree-2 planform with two antipodal major upwellings when a supercontinent is present. We propose that due to modulation of continents, these two modes of mantle convection alternate within the Earth's mantle, causing the cyclic processes of assembly and breakup of supercontinents including Rodinia and Pangea in the last 1 Ga. Our model suggests that the largely degree-2 structure for the present-day mantle with the Africa and Pacific antipodal superplumes, is a natural consequence of this dynamic process of very long-wavelength mantle convection interacting with supercontinent Pangea. Our model explains the basic features of true polar wander (TPW) events for Rodinia and Pangea including their equatorial locations and large variability of TPW inferred from paleomagnetic studies. Our model also suggests that TPW is expected to be more variable and large during supercontinent assembly, but small after a supercontinent acquires its equatorial location and during its subsequent dispersal. *CitcomS* is used in this project.

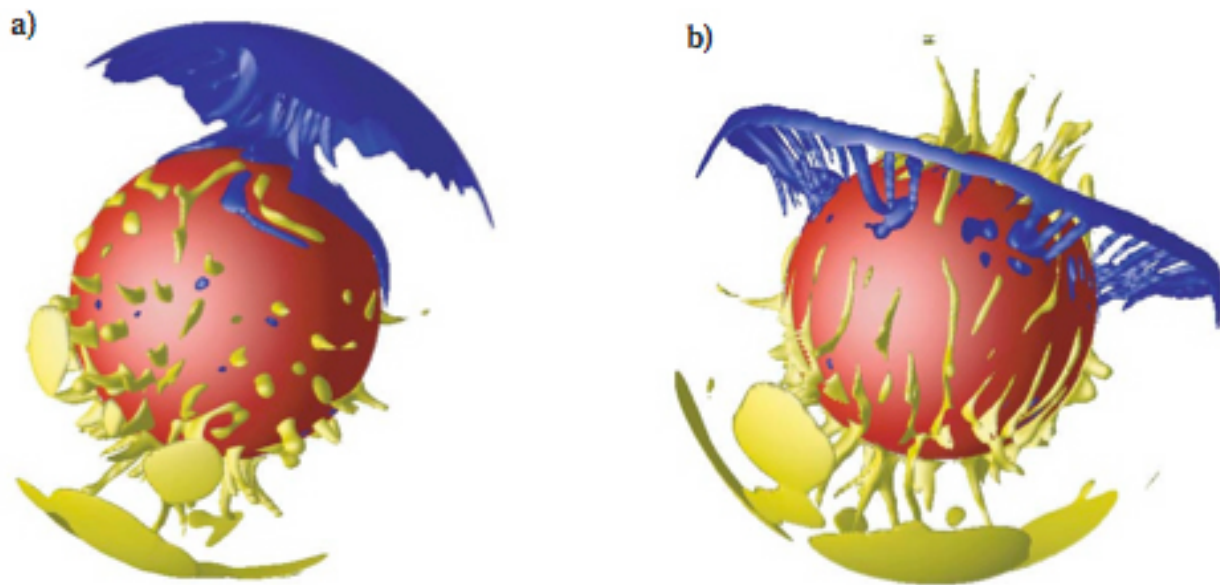


Figure: (a) Degree-1 convection with no continental blocks, and (b) Degree-2 convection with a supercontinent.

References

Zhong, S.J., N. Zhang, Z.X. Li, and J.H. Roberts, Supercontinent cycles, true polar wander, and very long-wavelength mantle convection, **Earth Planet. Sci. Lett.**, 261, 551-564, 2007.

Zhang, N., S.J. Zhong, and A.K. McNamara, Supercontinent formation from stochastic collision and mantle convection models, **Gondwana Research**, in press.