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Structures in the Deep Mantle: Implications for the Onset of Plate Tectonics and the Viscosity Structure

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Recently deep structures have been studied intensively. The observed large anomalies with reduced seismic velocities (LLSVPs) beneath Africa and the Pacific are obtained in numerical models as an initial dense layer at the core-mantle boundary (CMB) is pushed up to piles by the convective flow (e.g., McNamara et al., EPSL 229, 1-9, 2010). Adding a dense CMB layer to a model featuring active plate tectonics, Trim et al. (EPSL 405, 1-14, 2014) find that surface mobility is strongly hindered by the dense material and can even vanish completely for a CMB layer that has a too high density or too large a volume.
In a further study we employed a fully rheological model in which oceanic plates form self-consistently. We observe that an initial dense CMB layer strongly affects the formation of plates and therefore the onset time of plate tectonics.
In a systematic 2D parameter study of thermochemical convection we discuss the resulting viscosity structure and time of plate initiation.