

Some Petrological Effects on Subduction Dynamics

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Petrological and mineralogical factors exert important controls on subduction dynamics. Dynamical models of subduction indicate that processes such as slab buckling, slab stagnation, time-varying trench migration, and collisional slab detachment, as well as patterns of seismogenic stresses, all are significantly influenced by petrological factors. The role of petrology in such processes manifests primarily in two forms: through buoyancy forces (both thermal and petrological) and through rheology (of both crust and mantle). Specific petrological factors governing such subduction behavior include: effective Clapeyron slopes of phase transitions, extent of mineral metastability, oceanic crustal strength (hydration, etc.) and density, and mantle viscosity structure. The importance of such factors can be illustrated through generalized 2D models of subduction but also through regional models focused on (for example) Philippine Sea, Nazca, Sundaland, and Pacific subduction.