



Relamination and the Fate of Subducted Continental Material

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Most immature crust must be refined to attain the composition of mature continental crust. This refining may take the form of weathering, delamination, or relamination. Delamination and relamination both call upon gravity-driven separation of low-density felsic rock into the crust and high-density mafic rock into the mantle. Delamination involves foundering of rock from the base of active magmatic arcs. Relamination involves subduction (erosion) of sediment, arc crust, and continent crust in any convergence zone. Heating of the subducted material reduces viscosity, speeds metamorphic reactions, drives devolatilization, and causes melting. Melt separation and compression of the subducted material drives composition-dependent density differences: some rocks become denser than the mantle. If conditions permit, dense, low-SiO₂ material is returned to the mantle with the subducting slab, and buoyant, high-SiO₂ material is relaminated to the base of the upper plate. Relamination may be more efficient than lower crustal foundering at generating large volumes of material with the major- and trace-element composition of continental crust, and may have operated rapidly enough to have refined the composition of the entire continental crust over the lifetime of Earth. If so, felsic rocks could form much of the lower crust, and the bulk continental crust may be more silica rich than generally considered.