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Relamination and the Differentiation of Continental Crust

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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. Although delamination and relamination both call upon gravity-driven separation of felsic rock into the crust and mafic rock into the mantle, delamination involves foundering of rock from the base of active magmatic arcs, whereas relamination involves the (diapiric) underplating of subducted sediment, arc crust, and continent crust to the base of the crust in any convergence zone. 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. Seismic wavespeeds require that only $\sim$10–20% of the lowermost 5–15 km of continental crust must be mafic; combined heat-flow and wavespeed constraints permit continental lower crust to have 49 to 62 wt% SiO_2.