Critical role of water in formation of Continental Crust

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Continental arcs are the sites of production of continental crust, but the origin of these magmatic systems is not well understood. Although a number of processes have been suggested to be important, the role of water migrating from slab to surface during subduction has been underappreciated. Directly below the Moho, hot (~1100°C) hydrous basaltic magmas fractionate as they cool to the regional geotherm at 750 to 800°C, ultimately to solidify as mafic underplates. Cooling and fractionation causes water to exsolve and ascend, triggering fluid-fluxed melting of overlying mafic underplates and other crust. Melting of mafic underplates buffers temperatures and generates the voluminous juvenile low-K melts of Cordilleran batholiths. These granitoid magmas comprise a low-temperature slurry of melt and residue, and recrystallise into silicic mush during adiabatic ascent. Such hydrous mushes are intermittently infused by hotter, more mafic magmas, which hybridise and facilitate ascent and, potentially, eruption. Fluid-fluxed melting overcomes many of the general petrological and geochemical problems associated with models dominated by fractional crystallisation. The role of water during repeated episodes of mafic underplating is critical for generating the juvenile granitoid infrastructure of the continents.