

# Continental magmatism caused by lithospheric delamination

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## **ABSTRACT**

Ductile delamination of continental lower lithosphere via Rayleigh-Taylor instabilities can produce continental magmatism with a range of major- and trace-element compositions and volatile contents. Here I investigate the process of delamination, resulting upper-mantle flow patterns, topographic expression, and, most significantly, the potential for the delaminating material to dehydrate as it sinks. The delamination process can produce a heterogeneous, locally hydrous upper mantle, as well as short-duration eruptive episodes of hydrous, alkali-rich magmas in the absence of subduction, subsidence during eruption, and shallow, dry melting under cratonic lithosphere. Delamination has been inferred from increases in crustal heatflow and seismic tomography in specific regions, from rapid regional uplift, and from the appearance of signature high-potassium magmas. A dense lower-lithospheric region may develop through melt injection and transformation into eclogitic phase assemblages, through thickening and cooling of a lithospheric root, or through accumulation of mafic phases in magma chambers. Lower-crustal and mantle compositions that result from arc magmatism are likely to exceed the mantle density by 50–250 kg/m<sup>3</sup>, corresponding to ~1%–5% density contrast. Density contrasts as small as 1% are sufficient to drive gravitational Rayleigh-Taylor instabilities.