# Role of three-dimensional mantle flow in magmatism at slab edges

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Adakitic volcanics associated with subduction-transform plate boundaries have been identified in numerous localities, including the eastern Alaska slab edge, the Kamchatka-Aleutian plate boundary corner, the Cascadia-San Andreas transform fault juncture, and the New Hebrides trench-Hunter Ridge [1, 2]. Three-dimensional (3D) models investigating the solid state flow in the mantle due to subduction of a slab edge predict toroidal flow around the slab edge and an upward flow component, which could lead to decompression melting within several hundred kilometers outward of the slab edge as well as contribute to melting of the slab edge. However, the position of the volcanics with respect to the slab edge and associated upwelling in the mantle has only recently been tested in 3D geodynamic models [3, 4]. We use 3D numerical models to investigate the role of rheology and slab geometry on the mantle flow and its implications for anomalous arc volcanism near two slab edges: the eastern Alaska slab edge and the slab edge in the easternmost New Hebrides [3, 5]. In the eastern Alaska region the Aleutian trench terminates at a near right angle into the Fairweather-Queen Charlotte transform boundary. In the eastern New Hebrides, the subduction zone makes a nearly 90 degree arcuate turn, such that the slab edge intersects with the back arc spreading center. The models predict localized rapid mantle velocities (greater than 80 cm/yr), which may contribute to the preservation of primitive magmas that can be brought to the surface. These models do not investigate the link between melt migration and solid state flow of the mantle, which is an important and complex process, but rather aim to place a framework for interpreting how the 3D solid state flow field may influence migration patterns in subduction zones.

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# The magnitude and composition of the delamination flux in arcs during continental crust formation

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As the bulk continental crust is not in equilibrium with a mantle assemblage significant volumes of mafic/ultramafic composition counterbalancing the andesitic bulk composition of the crust are missing. Significant volumes of such complementary compositions are exposed in the Kohistan Arc, NE Pakistan. We constrain the bulk composition of the Kohistan arc and constrain the volume and composition of rocks needed to balance the andesitic crust composition to a mantle derived melt using the cumulates exposed in Kohistan. The Kohistan bulk arc composition results very similar to global continental crust estimates indicating that modern arc activity is the dominant process that formed the (preserved) continental crust. Fitting the bulk Kohistan arc crust and the ultramafic cumulates exposed at base of the arc (dunites, wehrlites, websterites, cpx-bearing garnetites and hornblendites, and garnet gabbros) to primitive arc melts with calc-alkaline/tholeiitic, alkaline, and boninitic affinity from various island arcs demonstrates that delamination of wehrlites + garnet hornblendites ± garnet gabbros perfectly explains the evolution from a tholeiitic/calc-alkaline primitive high-Mg basalt to the continental crust. Mass balance demonstrates that volumes of delaminate similar or larger to the continental crust are required. Including these ultramafic cumulates into the estimates of mass fluxes at convergent margin significantly increases the volume of magma production rates in convergent magin setting. Compared to depleted mantle, the delaminate is enriched in Pb and low U concentrations (low mue composnent) and may compensate for the depleted mantle radiogenic lead composition.