Mantle metasomatism by sediment-derived melts: an experimental study

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We investigated reactions between sediment-derived melts and depleted peridotite in a series of "sandwich" experiments in the piston-cylinder at 2 GPa and 800-1100°C, in which a layer of sediment, the source of the melt, is overlain by a layer of peridotite, representing the mantle wedge. Our natural sediment starting materials contained variable amounts of water and carbonate and included ~~a~~: USGS marine mud standard (MAG-1), a calcareous metapelite from the western Alps, and a granite composition approximating "average continental crust". We also conducted a corresponding series of sediment-melting experiments at similar P-T conditions in order to define the initial composition of our sediment melt.

Partial melts produced from all three sediment types are granitic *sensu stricto,* peraluminous, and possess trace element signatures comparable to typical arc lavas. The interface between sediment and peridotite in our experiments is in every case characterised by a discretely layered reaction zone containing variable amounts of: orthopyroxene (adjacent to the peridotite), phlogopite ± Al-rich diopside ± dolomite ± magnesite ± pyrope-rich garnet. The thickness of this zone decreases with increasing temperature, and corresponds with a decrease in the proportion of phlogopite, which disappears above 1000 °C. Although the reaction zone shields the sediment melt from further interaction with the peridotite, the presence of secondary minerals (i.e. magnesite, dolomite, diopside, enstatite) further into the peridiotite layer show that high-T aqueous fluids are still capable of efficiently transporting some solute into the peridotite beyond the reaction zone.