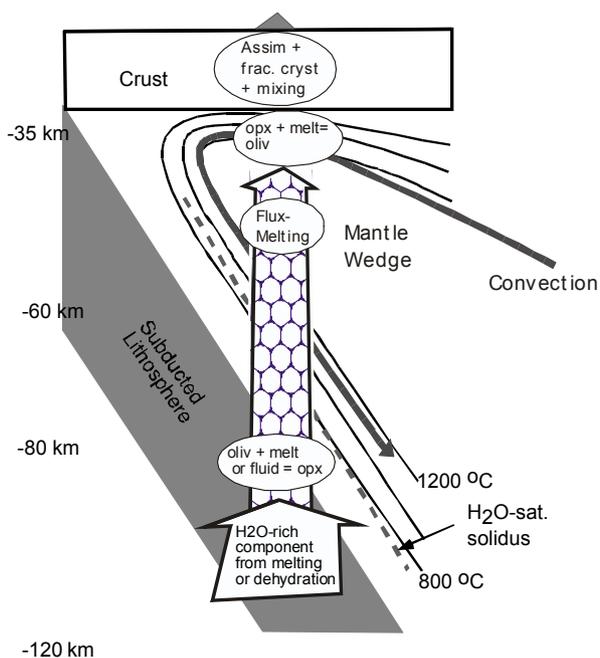


Volatile fluxes from subducted lithosphere: Unraveling the evidence preserved in primitive arc magmas

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The elemental contribution to subduction zone magmas from a fluid-enriched component released from the subducted lithosphere is a multi-step process. The Fig. shows a model of melt production. An H₂O-rich component is derived by dehydration of slab minerals and/or by melting of sediment or basalt. This H₂O-rich component ascends into the overlying mantle wedge where it is modified by reaction with the descending mantle, precipitating opx and stripping out SiO₂. The modified fluid-rich component ascends into shallower, hotter overlying mantle that exceeds the vapour-saturated solidus of peridotite where melting begins. Melting takes place throughout the mantle wedge by reactive porous flow, and continues to shallow depth where the melt again reacts with the mantle by dissolving opx and precipitating olivine. In this model exotic, supercritical fluids are not required.



Mass transport in S- and Cl-bearing magmatic-hydrothermal fluids

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Convergent plate magmas are genetically associated with hydrothermal mineral deposits and explosive volcanic eruptions. Most fluids that dissolve, concentrate, and transport ore metals and drive explosive volcanism in magmas overlying subduction zones are dominated by H₂O and CO₂, but the volatiles S and Cl also play significant roles in these processes because of their small and finite solubilities in felsic silicate melts. These latter volatiles are particularly important to processes of mass transport because chloride ions and oxidized/reduced sulphur species represent important ligands for complexation of metals in magmatic-hydrothermal fluids at shallow crustal conditions. The behavior of H₂O, CO₂, S, and Cl in magmatic systems has long been studied but important questions bearing on the timing of initial fluid exsolution, the composition and quantity of fluid, and how these fluids evolve with magma differentiation remain. We report results of new volatile solubility experiments for H₂O, SO₂, and Cl dissolution in Vesuvius phonolite melt at 200 MPa under oxidizing conditions, and how they bear on processes of magmatic degassing. In short, small quantities of SO₂ in phonolite melt lead to a dramatic reduction in the solubility of Cl in melt. In magmatic environments, this relationship facilitates the exsolution of Cl- and SO₂-charged brine with or without aqueous vapor at pressures (and depths in the crust) greater than previously understood, and has important implications for mass transport in hydrothermal fluids.