

## T14C-06: Sr Isotopes in Western Aleutian Seafloor Lavas: Implications for the Source of Fluids and Geochemical Decoupling of Trace Metals from Water



Monday, 12 December 2016

17:15 - 17:30



Moscone South - 304

Sr provides unique constraints on subduction magma source models because it is a fluid-mobile element that is abundant and relatively unradiogenic in arc volcanic rocks. It is common for arc basalts to be 3-4-times more Sr-rich than similarly evolved MORB (Sr/Nd = 30-50 vs 10-15 in MORB) yet Sr isotopes in arc basalts are usually offset from MORB only slightly ( $^{87}\text{Sr}/^{86}\text{Sr} \sim 0.7034$  vs 0.7028 for MORB). This is a puzzle because abundant sources of subducted Sr in sediment (GLOSS II  $^{87}\text{Sr}/^{86}\text{Sr} = 0.712$ ) and altered oceanic crust ( $^{87}\text{Sr}/^{86}\text{Sr} = 0.704\text{-}0.705$ ) are more radiogenic than average arc basalts globally ( $^{87}\text{Sr}/^{86}\text{Sr} \sim 0.7034$ ). This is exemplified by lavas in the oceanic Aleutian volcanic arc, where data patterns reveal the need for a source component with  $^{87}\text{Sr}/^{86}\text{Sr} \sim 0.7028$  and Sr/Nd  $\sim 100$ . This component cannot be a fluid produced by dewatering of altered oceanic crust, which should have  $^{87}\text{Sr}/^{86}\text{Sr} > 0.704$ . The likely source is an eclogite melt, which – after reaction with the mantle wedge – is well represented by primitive, high-Sr lavas from the western Aleutians. End-member samples are magnesian rhyodacites (SiO<sub>2</sub> ~69%, Mg# > 0.65) with ~1400 ppm Sr,  $^{87}\text{Sr}/^{86}\text{Sr} < 0.7027$  and Sr/Nd > 100. Formation of this end-member probably involves small degrees of fluid-saturated melting of MORB eclogite, minimally affected by prior seawater alteration. The aqueous fluid flux for melting must have come from a separate source, probably via dewatering of serpentinized peridotite within the mantle section of the subducting plate, which would carry little Sr or other metals, due to their low abundances in serpentinite. This example suggests that Sr, Pb, K, Rb and other incompatible trace elements in Aleutian lavas come primarily from partial melts of subducted basalt and sediment, and so are decoupled from H<sub>2</sub>O derived from dehydration of serpentinite at sub-arc depths in subducting oceanic lithosphere. Boron may be an exception, because of its high abundance in serpentinite. These source characteristics may help explain widely variable incompatible trace element abundances together with restricted variability for H<sub>2</sub>O inferred from least-degassed melt inclusions in the global arc database (Plank et al., 2013 – EPSL).

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