Recognizing the forearc (serpentinite) component in volcanic arc magmas

JEFFREY G. RYAN[1] AND IVAN P. SAVOV[2]

[1]Department of Geology, University of South Florida, 4202 East Fowler Ave., Tampa, FL 33620, USA (ryan@shell.cas.usf.edu)
[2]School of Earth and Environment, The University of Leeds,15-19 Hyde Terrace , room B06Leeds LS2 9JT United Kingdom (i.savov@see.leeds.ac.uk)

A growing body of geochemical data for lavas erupted at convergent plate boundaries indicate inputs to arc source regions from a chemical reservoir very similar in its elemental and isotopic signatures to that of serpentinites and associated fluids erupting today in the Mariana forearc. This "forearc" component is distinguished by anomalous enrichments in the fluid-mobile elements (FME) B, As, Cs and (to a lesser extent) Rb, Sb, and Li; extremely elevated B isotopic ratios; moderately elevated $^{87/86}Sr$; and low abundances of Ba, K, and other large-ion lithophile elements. These selective elemental enrichments relate to the limited menu of species which can be mobilized in the H_2O-rich, silica-poor fluids generated in the shallow forearc, and they match to a great degree the elemental menu depleted from sediments and basalts during low metamorphic grade devolatilization in the Catalina Schist and other forearc metamorphic complexes [1].

Models for the involvement of serpentinite in arc magmatism include its transport to depths in subduction melanges [2], and the decomposition of slab-hosted serpentine at depth beneath arcs [3]. A problem with slab-hosted serpentine inputs is generating the variable FME enrichments seen in arcs, which best approximate the outfluxes from devolatilizing shallow slab materials, and not the species likely to be hosted in marine serpentinite. Models for forearc serpentine inputs may be tested to a first order by examining subduction settings where slab thermal structure, crustal thicknesses, and/or geometric constraints preclude shallow fluid releases into the forearc mantle. In both the Cascades and the western Trans-Mexican volcanic belt (TMVB), two "hot" subduction systems, FME abundances and B isotopic ratios are low, consistent with minimal inputs of a forearc-derived component. B enrichments in the TMVB increase eastward as cooler slab temperatures and longer slab travel times increase the likelihood of shallow fluid releases reaching the shallow mantle wedge.

[1] Bebout *et al.* (1999) *EPSL* **177**, 69-83. [2] Savov *et al.* (2007) *JGR* **112**, 1029/2006JB004749. [3] Ulmer & Trommsdorf (1995) *Science* **268**, 858-861.

Single-particle characterization of summertime Arctic aerosols collected at Ny-Ålesund, Svalbard

J. RYU, H. JUNG, H. KIM AND C.-U. RO*

Department of Chemistry, Inha University, YonghyunDong, NamGu, 402-751, Incheon, Korea (*correspondence: curo@inha.ac.kr)

There have been many studies on wintertime Arctic aerosols, but just a few studies on summertime Arctic aerosols. In addition, the composition of aerosol particles has been studied mostly with bulk chemical methods. In this work, a quantitative single particle analytical technique, named low-*Z* particle electron probe X-ray microanalysis [1, 2], was applied to characterize aerosol samples collected at a Korean scientific base located at Ny-Ålesund, Svalbard (78°55′N, 11°66′E). Major chemical species frequently encountered in the summertime Arctic samples are of marine, soil, and anthropogenic origins. Marine aerosols are observed as either genuine sea-salts or aged secondary aerosols such as $NaNO_3$ or Na_2SO_4. Some aluminosilicate particles contain nitrate and/or sulfate, suggesting that anthropogenic nitrogen and/or sulfur species were entrained in the soil-derived particles. Secondary organic particles are also significantly encountered.

According to backward trajectory analysis, in the first part of the sampling period (25-28 July), air-masses came from the Arctic Ocean and in the second part (28-31 July), they either had stayed near Spitsbergen island or came from the Greenland Sea. For samples collected when the air-mass arrived from the Arctic Ocean, marine aerosols predominated, where genuine sea-salts are the most abundant, followed by aged sea-salts. When the air-mass stayed near Spitsbergen island, soil-derived aluminosilicate particles are the most abundant, followed by anthropogenic secondary organic aerosols. This result indicates that the summertime Arctic aerosols are mostly influenced by regional sources.

[1] Kang *et al*. (2008) *Environ. Sci. Technol*. **42**, 9051. [2] Ro *et al*. (2005) *Environ. Sci. Technol*. **39**, 1409.