Goldschmidt 2000
September 3rd–8th, 2000
Oxford, UK.

Journal of Conference Abstracts
Volume 5(2), 855

Trace Element and Isotopic Characteristics of Primitive Melt Inclusions from Mt. Shasta, California

Estelle Rose (erose@whoi.edu)[1], **Nobumichi Shimizu**[1], **Graham Layne**[1] & **Timothy Grove**[2]

[1] WHOI, MS#23, 360 Woods Hole Road, Woods Hole, 02543, USA
[2] M.I.T., Dept. E.A.P.S., 77 Massachusetts Avenue, Bldg. 54-1224,Cambridge, MA 02139, USA

Introduction

Primitive basaltic andesites (Mg# up to 0.73) occur as small satellite cones in the Misery Hill (sample 85-44 aged 80-120 ky) and the Sargents Ridge (sample 95-15 aged 10-80 ky) stages of activities near the summit of Mt Shasta. Melt inclusions hosted in high Mg-olivines (Fo 89.3 to 90.2 for 85-44; Fo 87.8 to 90.3 for 95-15) from the primitive basaltic andesites were analysed for trace elements (Li, Be, B, Ti, Rb, Sr, Y, Zr, Nb, Ba, REE) and isotopic compositions of B and Pb using Cameca IMS 3f and 1270 ion microprobes.

Large trace element variations among melt inclusions are observed in each sample. The whole rock compositions are nevertheless consistent with mixture of melts sampled as melt inclusions. Therefore studying olivine-hosted melt inclusions represent the closest approach for studying melting and melt migration processes beneath Cascades and for studying source materials involved in magmatism of the Cascadia subduction system, which may represent a young and hot end-member of subduction system.

Results

95-15 melt inclusions are characterized by large variations in trace element patterns: one end-member composition displays (La)n =170; (La/Sm)n=15; Sr/Y=220; the other has (La)n =60; (La/Sm)n=2; Sr/Y=40. 85-44 melt inclusions are characterized by much less fractionated REE and lower abundances of incompatible trace elements; (La/Sm)n=0.6~2.0, (La)n<10. B/Be ratios are low for both sample suites (7.9 for 85-44, 7.2 for 95-15), characteristic for young-hot subduction for the Cascade system, derived from advanced dehydration and depletion in "fluid-mobile" components.

Melt inclusions in 95-15 display $\delta^{11}B$ variations from -10.1 to -1.1 permil whereas $\delta^{11}B$ in melt inclusions from 85-44 are on the average enriched in ^{11}B with a range from -5.2 to +13.1 permil. These variations are larger than those previously reported for other arc lavas (Hauri et al, 1999). The Pb isotopic data ($^{208}Pb/^{206}Pb$ vs $^{207}Pb/^{206}Pb$) show that melt inclusions from 85-44 overlap with the isotopic compositions of MORB glasses from the Juan de Fuca and Gorda Ridges (Hegner & Tatsumoto, 1987; White et al., 1987). Melt inclusions from 95-15 are distinct and are shifted towards the HIMU end-member and are overlapping the Gorda basin sediment domain (Church, 1976).

Discussion

B is an excellent tracer of crustal recycling at subduction zones, because it is highly concentrated in subducting sediments and altered oceanic crust (AOC) relative to the overlying mantle wedge, and is extremely mobile during both partial melting and dehydration. Moreover, subducting sediments and AOC have very distinct $\delta^{11}B$, -8.5 permil, (Ishikawa & Nakamura, 1993) and +8.0 permil (Spivack & Edmond, 1987), respectively. The B and Pb isotopic and concentration mass balance is dominated by slab-derived components, either fluid or melt. Primitive basaltic andesites analysed here possess contrasting geochemical characteristics, including B and Pb isotopic compositions, reflecting diversity of slab-derived fluid compositions and types of slab materials involved. Observed geochemical characteristics for 85-44 melt inclusions are consistent with relatively advanced degree of melting of the wedge mantle modified by fluid derived from subducting oceanic crust. In contrast, 95-15 inclusions could involve sediment-derived fluid/melt. Involvement of fluids of diverse provenance and composition in close proximity in space and time may indicate that subducting materials are locally heterogeneous and that the wedge mantle is modified quite heterogeneously on local scales.

Church SE, *Earth Planet. Sci. Lett*, **29**, 175-188, (1976).
Hauri E, Tomascak P & Lassiter J, *V. M. Goldschmidt Conf. Abs*, 118, (1999).
Hegner E & Tatsumoto M, *J. Geophys. Res*, **92**, 11380-11386, (1987).
Ishikawa T & Nakamura E, *Earth Planet. Sci. Lett*, **117**, 567-580, (1993).
Spivack AJ & Edmond JM, *Geochim. Cosmochim. Acta*, **51**, 1033-1043, (1987).
White WM, Hofmann AW & Puchelt H, *J. Geophys. Res*, **92**, 4881-4893, (1987).