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

Journal of Conference Abstracts
Volume 5(2), 729

Arc Mantle Xenoliths and Their Quaternary Andesite Host Rocks Near El Peñon, Central Trans Mexican Volcanic Belt: a Trace Element and Radiogenic Isotope Study

Samuel Mukasa (mukasa@umich.edu)[1], **Dawnika Blatter** (dblatter@uclink4.berkeley.edu)[2] & **Alex Andronikov** (andron@umich.edu)[1]

[1] Department of Geological Sciences, University of Michigan, Ann Arbor, Michigan, 48109-1063, USA
[2] Dept. of Geology and Geophysics, University of California, Berkeley, CA 94720, USA

Hydrous ultramafic xenoliths and cpx megacrysts from a Quaternary hbl andesite erupted along a fault escarpment near El Peñon in the Central Trans Mexican Volcanic Belt provide a rare glimpse into the upper mantle beneath an active continental arc. These materials represent lithospheric mantle affected by the Oligocene to Early Miocene subduction of the Farallon Plate, and by the Middle Miocene to Recent subduction of the Cocos Plate, both beneath the North American Plate. Composed of amph-rich spinel lherzolite and Cr-oliv websterite, the xenoliths are among the most oxidized mantle peridotites yet described (Dlog FMQ +1.5 to +2.4) (Blatter and Carmichael, 1998). The mineralogy of the spinel lherzolites indicates that the rocks are residues of mantle melting while that of the Cr-oliv websterites suggests a cumulate origin. Although devoid of veins and dikes except at the contacts with the host andesites, these xenoliths exhibit ample evidence for metasomatism, including the occurrence of multiple generations of amph.

We report trace element concentrations and radiogenic isotopic compositions for the host andesites, peridotite xenoliths and cpx megacrysts determined by a variety of methods. PM-normalized trace element abundances for fifteen lavas show remarkable uniformity (with La_n/Yb_n = 5.6-12.7) in spite of their large ranges in SiO_2 (52.05-63.50 wt%) and MgO (2.80-8.86 wt%). The one exception is the sample with the lowest SiO_2, which has greater enrichments in the LREE and MREE as well as in Ba, Th, and U relative to the rest of the samples. All of the lavas analyzed exhibit negative anomalies for the HFS elements Nb, Ta and Hf, typical of arc magmas.

REE abundances for the cpx and amph in the peridotites cover a wide range, especially for the LREE. The patterns have a variety of shapes indicative of depletion and enrichment, attesting to the complexity of the mantle wedge above subduction zones. In some hydrous samples, both amph and cpx are highly depleted in the LREE (La_n/Sm_n = 0.10-0.21), which suggests that this is an early-generation amph that is actually residual after melt extraction. Yet in others, a convex pattern with the MREE higher than the LREE and HREE is conspicuous. In one sample, cpx displays a flat pattern at 4-5x chondrite, except for Nd which has a small negative anomaly. The corresponding amph abundances have overall abundances of >10x chondrite and a dissimilar convex pattern. It therefore appears that the inflection at Nd for the cpx pattern was caused by metasomatism. Of the two cpx megacrysts analyzed, one has LREE-enriched patterns that show no significant variation between the core and rim. The other has a convex REE pattern for the core and an LREE-enriched pattern for the rim. This feature suggests reaction between the megacryst and the host lavas. Similar non-equilibrium between cores and rims has been observed for some of the cpx grains in the peridotites. The cpx rims in this case have patterns and absolute abundances similar to those of the lava phenocrysts. Overall, the convex pattern is dominant in the peridotite cpx grains. This pattern most likely developed by local, subduction-related metasomatism followed by some melting.

The isotopic compositions of Sr, Nd and Pb have been determined for five of the host lavas and the two cpx megacrysts; the peridotite xenoliths are not big enough to allow isotopic determinations by conventional TIMS methods. The host lavas have $^{87}Sr/^{86}Sr$ values with a range of 0.703376±18 - 0.704435±18 and $^{143}Nd/^{144}Nd$ of 0.512824±23 - 0.512915±22. On Pb covariation diagrams, the host rocks fall in the Pacific MORB field for $^{208}Pb/^{204}Pb$ vs. $^{206}Pb/^{204}Pb$, but are slightly above it for $^{207}Pb/^{204}Pb$ vs. $^{206}Pb/^{204}Pb$. These values are very similar to those of the cpx megacrysts we have analyzed and to those of western Mexico volcanoes (Wallace and Carmichael, 1994) in the same arc. It does not appear from these results that components from subducted sediments are well represented in either the host lavas or the reacted cpx megacryst. However, the Pb isotopes display a time-integrated record of high U/Th requiring sufficient time for the in growth of U-derived radiogenic Pb isotopes. This feature may have been acquired by the ageing of metasomatized mantle wedge prior to its fragmentation and transportation to the surface from the zone of melting beneath the arc.

Blatter DL & Carmichael ISE, *Geology*, **26**, 1035-1038, (1998).
Wallace PJ & Carmichael ISE, *Contrib. Mineral. Petrol.*, **117**, 345-361, (1994).