Geochemical evidence for complex preeruption configuration of a silicic magma chamber associated with Los Humeros caldera, Mexico

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The >15 km^3 late Pleistocene Zaragoza ignimbrite from Los Humeros caldera volcano in central Mexico shows complex (rhyodacite-andesite-rhyodacite) compositional zoning, including mingled and rare mixed pumice (dacite-D). Petrographic and microprobe analyses of coexisting glass and phenocrysts provides evidence of crystal-liquid equilibrium and disequilibrium conditions in multiple types of magmas at the time of eruption. Highly resorbed calcic plagiocase (to An_{82}) mantled by more sodic plagioclase suggests that pre-eruptive mixing between andesitic and plagioclase-bearing basaltic magma was followed by equilibrium crystallization within the resultant hybrid magma. A broad co-genetic relationship between the rhyodacite and basaltic andesite-trachyandesite magmas is indicated by overlapping Nd-, Sr- and Pb-isotopes, major- and trace-element covariation patterns, and the association in space and time. Differences in phenocryst chemistries indicate that the andesite-trachyandesite (A-TA) magma was at least 80˚C hotter than the rhyodacite (RD) magma at the time of the eruption. We propose a model (Fig. 1) where the ignimbrite eruption started tapping rhyodacite and then andesite from a zoned magma chamber. This was followed by a complex syn-eruptive mechanical mixing between a fairly uniform reservoir of rhyodacite, with a pre-eruptive heterogeneous (hybridized) mafic reservoir formed from andesites and andesite-trachyandesites, possibly in the form of semi-connected high-melt lenses within a partially consolidated crystal mush. Episodic replenishment of basaltic magmas occurs periodically.

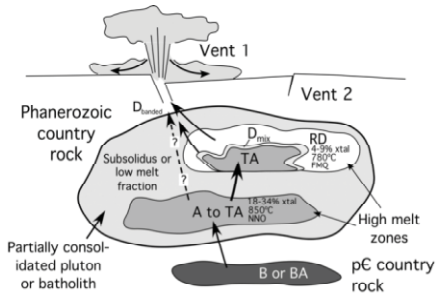

Figure 1: This shows our preferred pre-eruption magma reservoir model for the Zaragoza ignimbrite.

Lead, Cadmium and Copper concentrations and Lead isotopic distribution in seawater, sediments and coral reefs in Kuwait

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Objective and Methods

The objective of this study was to reconstruct detailed input chronologies of trace metals in the Kuwaiti marine environment, influenced by the Shatt al-Arab River's load, using water, sediment cores and corals. Pb, Cd and Cu concentrations in seawater and sediments were determined by plasma mass spectrometry using isotope dilution for seawater and Indium internal standardization for "Graney leach" sediment extracts. Pb isotopic distributions in seawater and sediments were determined using multicollector magnetic sector plasma mass spectrometry after anion exchange purification of Pb.

Results and Discussion

Pb, Cd and Cu concentrations in seawater are high in the northern stations, including Kuwait Bay, Awhah and south of Bubiyan Island. They show combined anthropogenic and riverine sources, while waters near two coral reefs near Kubar and Qaruh islands show high Pb, but low Cd and Cu. Surface sediment samples show metal enrichments in Kuwait Bay as expected for elements with anthropogenic enhancements; the 206/207Pb isotope data shows a large range, hinting to a mix of natural and leaded gasoline sources, or other sources, with a negative correlation of 206/207Pb in sediments vs. Pb in seawater and a decreasing trend into Kuwait Bay.

Analyses of the concentration and isotope distribution of Pb in the upper ~60-cm sediment strata and on porite corals are in progress.