Geophysical Research Abstracts
Vol. 18, EGU2016-4801, 2016
EGU General Assembly 2016

Giant magmatic water reservoir beneath Uturuncu volcano and Altiplano-Puna region (Central Andes)

Mickael Laumonier (1,2,3), Fabrice Gaillard (3,4,5), Duncan Muir (6,7), Jon Blundy (6), and Martyn Unsworth (8)

(1) Clermond Ferrand, Laboratoire Magmas et Volcans, Clermond Ferrand, France (mickael.laumonier@gmail.com), (2) Bayerisches Geoinstitut, University of Bayreuth, 95440 Bayreuth, Germany., (3) Université d'Orléans, ISTO, UMR 7327, 45071, Orleans, France., (4) CNRS/INSU, ISTO, UMR 7327, 45071 Orléans, France., (5) BRGM, ISTO, UMR 7327, BP36009, 45060 Orléans, France., (6) School of Earth Sciences, University of Bristol, Bristol BS8 1RJ, UK., (7) School of Earth and Ocean Sciences, Cardiff University, Cardiff CF10 3AT, UK., (8) 7Department of Earth and Atmospheric Sciences, University of Alberta, Edmonton, Alberta, Canada.

Volcanism at continental arcs is the surface manifestation of long-lived crustal magmatic processes whereby mantle-derived hydrous basalt magma differentiates to more silica-rich magmas by a combination of crystallization and crustal melting. What erupts is just a fraction of the total volume of magma produced by these processes; the unerupted, plutonic residues solidify and are inaccessible to direct study until millions of years of uplift and erosion bring them to the surface. In contrast, geophysical surveys, using electromagnetic and seismic waves, can provide real-time images of subduction zone magmatic systems. Several such studies have revealed that arc volcanoes are underlain by large partially molten regions at depths of >10 km, the largest known example being the Altiplano-Puna magma body (APMB) in central Andes. Interpreting such geophysical images in terms of amount, composition and distribution of partial melts is limited by our lack of knowledge of the physical properties of silicate melts at elevated pressures and temperatures.

Here we present high-pressure, in situ experimental data showing that the electrical conductivity of andesitic melts is primarily controlled by their dissolved water contents. Linking our new measurements to petrological constraints from andesites erupted on the Altiplano, we show that the APMB is composed of 10-20% of an andesitic melt containing 8-10 wt% dissolved water. This implies that the APMB is a giant water anomaly in the global subduction system, with a total mass of dissolved magmatic water about half of the water contained within the Adriatic Sea. In addition to the controls on the physical properties of the melts, the abundance of dissolved water governs the structural levels of magma ponding, equivalent to the depth of water saturation, where degassing and crystallisation promote partial melting and weakening of the upper crust. Unexpectedly, very high concentrations of water in andesite magmas shall impede their rise and eruption.