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The volcanic evolution of the Meseta del Lago Buenos Aires, Patagonia: subduction to slab window volcanism

IMANI GUEST[1], ALBERTO E. SAAL[1], SOUMEN MALLICK[1], MATTHEW GORRING[2] AND SUZANNE M KAY[3]

[1]Brown University
[2]Montclair State University
[3]Cornell University

Presenting Author: imani_guest@brown.edu

The Meseta del Lago Buenos Aires in southern Patagonia, a volcanic plateau formed from ~12 Ma to present, provides an opportunity to investigate the temporal evolution in volcanism as it transitions from the subduction of the Nazca plate to the formation of the slab window during the subduction of the Chile Ridge beneath South America. Here we report new major, minor and trace element contents, as well as Sr, Nd, Pb, and Hf isotopes of the MLBA lavas. Three distinct geochemical endmembers can be distinguished in the MLBA basalts: A depleted component similar to the south Atlantic MORB, a subduction-influenced endmember, and an enriched component akin to the EM1 mantle composition. Lavas older than ~ 1.5 Ma define a compositional continuum between the depleted and subduction endmembers, a trend that is also present in many other southern Patagonian plateaus regardless of their distance to the trench, age, and the composition of the continental blocks where they are located. In contrast, MLBA basalts younger than ~ 1.5 Ma uniquely define a transition into the EM1 mantle component at the time when this region was affected by the slab window.

The basalts' composition from all the southern Patagonia plateaus are consistent with that of the South Atlantic MORB influenced by the Discovery, Shona, and Bouvet mantle plumes rather than the lavas erupted within the Chile ridge. Although all endmember components defined by the plateau lavas are also present in the composition of southern Patagonia mantle xenoliths, it is hard to determine what endmember component, if any, truly represents the contribution of the enriched (metasomatized) subcontinental lithospheric mantle. The estimated pressures and temperatures of mantle-melt equilibration for the MLBA basalts indicates an increase in both parameters after the formation of the slab window that roughly correlate with the significant change in lava composition. A pronounced topography of the lithosphere-asthenosphere boundary or lithospheric foundering may be responsible for the temporal variation in composition and mantle-melt equilibration conditions of the erupted lavas, consistent with the present-day seismic information within the slab window region of southern Patagonia.