8th International Symposium
on Andean Geodynamics
(ISAG)

# The temporal evolution of the Ecuadorian volcanic arc during the last 1 Ma

**P. Samaniego[1, 2], M. Bablon[3], M. A. Ancellin[1, 4], S. Hidalgo[1], X. Quidelleur[3], I. Vlastelic[1], F. Nauret[1], L. Le Pennec[1], H. Martin[1], D. Narvaez[1,2], E. F. Rose Koga[1], S. Santamaria[1, 3], C. Liorzou[5], M. Gannoun[1]**

*[1]Laboratoire Magmas et Volcans, Université Clermont Auvergne-CNRS-IRD, Clermont Ferrand, France*

*[2]Institito Geofisico, Escuela PolitécnicaNacional, Quito, Ecuador*

*[3]GEOPS, Université Paris Sud*

*[4]Institute of Earth Sciences, University of Iceland, Reykjavik, Iceland*

*[5]Laboratoire Géoscience Océan, Université de Bretagne Occidentale, Brest, France*

When looking at the whole Andean arc, one of the most striking characteristics of the Ecuadorian segment of the Northern Volcanic Zone (NVZ) is the large number (up to 85) of Quaternary volcanic centres. This arc segment results from the subduction of the Nazca plate below the South-American lithosphere that also includes the aseismic Carnegie ridge and the Grijalva Fracture zone. The Ecuadorian volcanoes are distributed along the Western Cordillera, the Interandean Valley, the Eastern Cordillera and the subandean zone. As a result, the volcanic arc is up to 120 km-large and develops on a thick (up to 50 km) and heterogeneous crust consisting in oceanic-like terrains to the West and continental-like terrains to the East.

The geochemical studies performed over the last 20 years allow us to constrain three main geochemical patterns. Firstly, an across-arc zonation of incompatible trace elements that reflects a progressive decrease of both the subduction component of magmas and the mantle melting away from the trench. Secondly, it exists a marked difference in Sr-Nd-Pb-O isotopic signature that correlates with the different crustal structures of both Cordilleras. Thirdly, an overall adakitic signature that has been interpreted either in terms of slab partial melting and the subsequent metasomatic reactions in the mantle wedge or as due to lower crustal processes associated with high-pressure fractionation and/or melting. More recently, Ancellin et al. (2017) and Narvaez et al. (2018) pointed out significant along-arc geochemical variations on whole-rocks and olivine-hosted melt inclusions, which they related to a change in the subduction component, specifically the ratio between the aqueous fluids vs. siliceous melts ascending through an interacting with the mantle wedge.

However, one of the unresolved key questions is the timing of the Ecuadorian arc development. In order to overcome this lack of chronological data, we designed an ambitious project focusing on three main across-arc transects. More than 100 new, high-quality, K-Ar ages were obtained on groundmass samples. It appears that, if in northern part of the arc, some edifices emplaced at ca. 1-1.2 Ma, most volcanoes developed during the last 500 ka. These new data evidence that the Ecuadorian arc has acquired its current configuration in relatively recent times, as a result of the southern migration of the Grijalva Fracture Zone (Bablon et al., 2019). These chronological data help to better constrain the geochemical evolution described at several edifices of the arc and allow us to discriminate the role of both the subduction and crustal processes in continental arc magma genesis, highlighting the fact that these processes are not mutually exclusive.

Ancellin M.-A., Samaniego P., Vlastélic I., Nauret F., Gannoun A.M., Hidalgo S. (2017). Geochemistry, Geophysics, Geosystems 18, DOI:10.1002/2016GC006679.

Bablon M., Quidelleur X., Samaniego P., Le Pennec J.L., Audin L., Jomard H., Blaize S., Liorzou C., Hidalgo S., Alvarado A. (2019). Tectonophysics vol.751, p.54-72.

Narvaez D.F., Rose-Koga E.F., Samaniego P., Koga K., Hidalgo S. (2018). Contribution to Mineralogy and Petrology 173, p.80.