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Atacazo – Ninahuilca Volcanic Complex Adakites: New geochemical and oxygen isotopic data.

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Recent studies on the Quaternary Ecuadorian volcanic arc (EVA) reveal the occurrence of both "classic" calc-alkaline and adakitic magmas (Bourdon et al., 2002; Samaniego et al., 2002; 2005). Even though the temporal geochemical change is well established, the detail of adakite petrogenesis is still actively debated. The discussion is focused on the relative role played by slab-melts, mantle metasomatism (by fluids and silicic melts) and the crustal contamination. Most of these studies are classically based on major and trace element geochemistry. We tentatively propose to discuss the role played by crustal contamination using oxygen isotopic geochemistry. This study is focused on the Atacazo-Ninahuilca volcanic complex (ANVC).

ANVC is located in the Western Cordillera of Ecuador (WCE) 10 Km South of Quito. This complex consists in two old edifices (Carcacha and Atacazo) and eight recent dacitic external (La Viudita and Gallo Cantana) and intracaldera domes (Arenal I and II, La Cocha I and II, and Ninahuilca Chico I and II).

The older part of the complex (Carcacha and Atacazo) consists into two pyroxene andesites, with subordinated amphibole. SiO_2 ranges between 57.28 and 62.30 wt%. By contrast, La Viudita and Gallo Cantana domes consist in very homogeneous high - SiO_2 dacites (66.18 to 67.04 SiO_2 wt%) such that they do not draw any differentiation trend. They are made up of pl+amph+opx+mag. The intra-caldera domes (62.88–66.07 SiO_2 wt%) consist in pl+amph+opx+mag$\pm$bio$\pm$ilm dacites. No clear correlations between SiO_2 and other major elements are observed. In N-MORB normalized multi-element diagrams old and new lavas show identical patterns for all elements but HREE: the old lavas are HREE-rich whereas the younger ones (dacitic domes) are HREE-poor. As the most discriminating characteristic of adakites is their low HREE-content, it has been concluded that the ANVC illustrates a temporal change in the magmatism from typical calc-alkaline (metasomatized mantle wedge melting) to adakitic (subducted slab melting). This temporal change in single edifices has already been described in other Ecuadorian volcanics (Samaniego et al., 2005).

The ANVC andesites and dacites have $\delta^{18}O$ values ranging between 7.6 ‰ and 8.8 ‰ VSMOW, while other WCE volcanoes magmas exhibit even larger ranges (7.0-9.0 ‰). These compositional ranges are higher than those predicted for mantle-derived arc magmas and comparable to those of the Central Andean Zone Cenozoic magmas for which ^{18}O-enrichment has been related to continental crust assimilation via AFC processes (James, 1984). The WCE basement consists mainly of accreted oceanic plateau basalts and more locally of felsic intrusive rocks. $\delta^{18}O$ values of the widespread oceanic plateau basalts range from 6.0 to 8.0‰, indicating that they cannot be the contaminant responsible for the observed ^{18}O-enrichments of the ANVC and WCE magmas. On the contrary, the felsic intrusive rocks, that have higher $\delta^{18}O$ in the range 7.9-13.7 ‰, may account for the oxygen isotopic characteristics of ANVC. However, these felsic contaminants cannot be involved at the scale of the Western Cordillera of Ecuador because of their scarcity within the basement. Furthermore $\delta^{18}O$ values of the ANVC and WCE magmas are globally not correlated with SiO_2-contents or any differentiation index, and are independent of the age of the edifices, suggesting that the change from calc-alkaline to adakitic cannot be related to crustal contamination. Thus, beside of crustal contaminations, the role of melts from ^{18}O-enriched subducted slab in the genesis of Ecuadorian adakites must be explored.