Slab melt metasomatism beneath the North Andean Volcanic Zone? Insight from Antisana volcano rocks (Ecuador)

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Antisana is a massive strato-volcano from the the North andean Volcanic Zone (NVZ). Historically active, eruption phenomena were witnessed by Alexander Von Humboldt in the eighteenth century. This volcano is part of the Eastern Cordillera in Ecuador and lies 80 km southeastward from Quito. It heights 5758 m and is caped by an important summit glacier descending to *c.* 4800 m.

Two edifices are generally recognized: on the southeastern, hardly accessible Amazonian flank, the old edifice is partly dismantled by two calderic events and on the northwestern side, the recent edifice displays a smooth topography. Geochemical data about this volcano were scarce until our work and generally limited to major elements and some Sr isotopic ratios concerning exclusively rocks from the most recent part of the volcano. A sampling of both edifice has been recently undertake wich allows now a more global view of Antisana volcano.

Antisana volcano is dominantly formed of highly potassic calc-alkaline andesites. But petrologic diversity range from medium-K basaltic andesites to highly evolved high-K dacites.

All Antisana rocks display a relative Nb enrichment compared to 'normal' calc-alkaline lavas and also show geochemical characterisrics (high La/Yb and Sr/Y, low *HREE* and Y) typical of adakites, i.e. slab melting products (e.g. Defant and Drummond, 1990). Nevertheless, the eastern position of Antisana volcano in the NVZ and the estimated depth of the wadatti-benioff zone beneath it (*c.* 140 km) theorically do not allow to enfigure direct slab melting. In fact, geochemical characteristics of Antisana rocks are often intermediate between true adakites (low *HREE* and Y) and normal potassic calc-alkaline rocks (strong K and LILE enrichments). Thus, we envision that Antisana rocks could be produced by partial melting of a mantle previously metasomatized by slab melts. This metasomatism could well occur under the Western Cordillera where more typical adakites were find and where thermodynamic conditions are more compatible with slab melting. This hypothesis would well explain many characteristics of Antisana rocks: the Nb enrichment – as slab melts are supposed to bring Nb in the mantle; the K and LILE enrichments; and the *HREE* depletion that would be due to the presence of metasomatic garnet in the source. At least, it is necessary to envision melting of the mantle wedge as we have found on Antisana volcano rocks with low Yb concentrations and low SiO2 concentrations (<54%) that can not be derived from the direct melting of oceanic crust with realistic partial melting degrees.

Antisana rocks should not be the result of melting of underplated sub-continental crust, as it was proposed for mio-pliocene adakitic-like rocks of the Cordillera Blanca in Peru (Atherton and Petford, 1993). Low Sr isotopic values (0.7043–0.7045) and geochemical data are not consistent with such an hypothesis. Isotopic data also demonstrate that crustal contamination plays a minor role in Antisana rocks evolution despite the thickness of continental crust beneath this volcano (40–50 km).

New isotopical data (Pb) will be discussed to better constraint the petrogenesis of these magmas that frequently characterize volcanoes of Ecuador

References

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