

Os isotopic compositions of basaltic andesites and hawaiites of the Mexican Volcanic Belt

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The east-to-west-trending Mexican volcanic belt is a complex active continental arc related to the subduction of the Rivera and Cocos plates beneath western Mexico. The basement beneath the arc is Grenville-age continental crust in eastern and central Mexico and Triassic age oceanic crust in western Mexico. Where the basement is old continental crust, the arc has large stratovolcanoes and cinder cones. In western Mexico, where the basement is young oceanic crust, the arc consists of cinder cones and fissure basalts. In western Mexico, the volcanic arc contains basaltic andesite, alkali basalt, andesite, hawaiite and mugearite. The hawaiite and mugearite are unusual rocks for continental-arc settings suggesting that both hydrous, fluid-enriched sub arc mantle and oceanic island type mantle may be present beneath western Mexico (Righter and Carmichael, 1992).

Basaltic andesite and hawaiites were analysed for Re-Os isotopes in an effort to constrain the source region of their melts. The Os isotopic system is ideal for this question because the system has been shown to be robust to changes in the mantle by metasomatizing fluids, and the incompatibility of Re gives the asthenospheric and lithospheric mantle, as well as the crust, distinct Os isotopic compositions over time.

Olivine and magnetite phenocrysts from basaltic andesite and hawaiites, as well as whole rocks, were analysed for their Re and Os concentrations and isotopic compositions. Osmium concentrations range from about 10 ppt for the whole-rock powders to over 500 ppt for an olivine separate. Rhenium concentrations vary from 300-500 ppt for whole-rocks and olivine separates to several parts-per-billion for magnetite-rich separates. The $^{187}\text{Os}/^{188}\text{Os}$ initial isotopic ratio for basaltic andesites and hawaiite range from c. 0.15 to 0.25. The elevated isotopic composition of these rocks indicates that the primary mantle-derived magmas have been contaminated by the crust. In this region, the arc is underlain by Triassic oceanic crust and a thick sequence of Mesoproterozoic sediments derived from nuclear Mexico. The osmium data indicate that modelling of the magmatic systems in the Mexican volcanic arc in western Mexico need to take into account that the overall compositions of the primary mantle-derived magmas have been altered by the assimilation crustal components.

References

- Righter, K. and Carmichael, I.S.E. (1992) *Geol. Soc. Amer.*, **104**, 1592–607.