Volcanic flux rate and fluxes of highly incompatible elements

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In our recent paper in G³ (Carr et al., 2007) we use geology, geochronology and geochemistry to better constrain the fluxes of highly incompatible elements cycling through the Central American subduction zone. Our major result is a lack of variation in the subduction derived fluxes of Cs, Ba, K, Pb and Sr along the volcanic front from Nicaragua to Costa Rica, a region where most slab signals decrease substantially. We determined an extrusive volcanic flux by measuring the volumes of volcanic centers and determining the start of the current episode of volcanism. Forty-five new $^{40}Ar/^{39}Ar$ ages verified a well-defined pulse of volcanic activity all along the Costa Rican volcanic front beginning at 600 ka. With the exception of Arenal, the Costa Rican volcanic centers all have lava fields in the 600–500 ka age range (Gans et al., 2003*, Gillot et al., 1994*; Alvarado et al., 1992*; Carr et al., 2007). We estimated element flux by multiplying extrusive volcanic flux by the subduction-derived component of the average lava. We have recently obtained new geochemical data on central Costa Rican lavas in the 5 to 15 Ma age range that have a depleted mantle signature. Therefore, the Galapagos-like geochemistry first erupted in central Costa Rica only in the last 5 myr. The simplest explanation for the OIB signature in central Costa Rica is a melt or fluid coming from Galapagos-derived seamounts like those currently subducting offshore. Alternatively, a model where subduction dip angle controls melting of a veined mantle wedge could also explain the arrival of an OIB signature to the volcanic front, if the dip angle became more shallow over time. With respect to the fluxes of Ba and other highly enriched incompatible elements, the change in mantle composition raises the central Costa Rican fluxes by 30 to 60%, within the range of our estimated error.

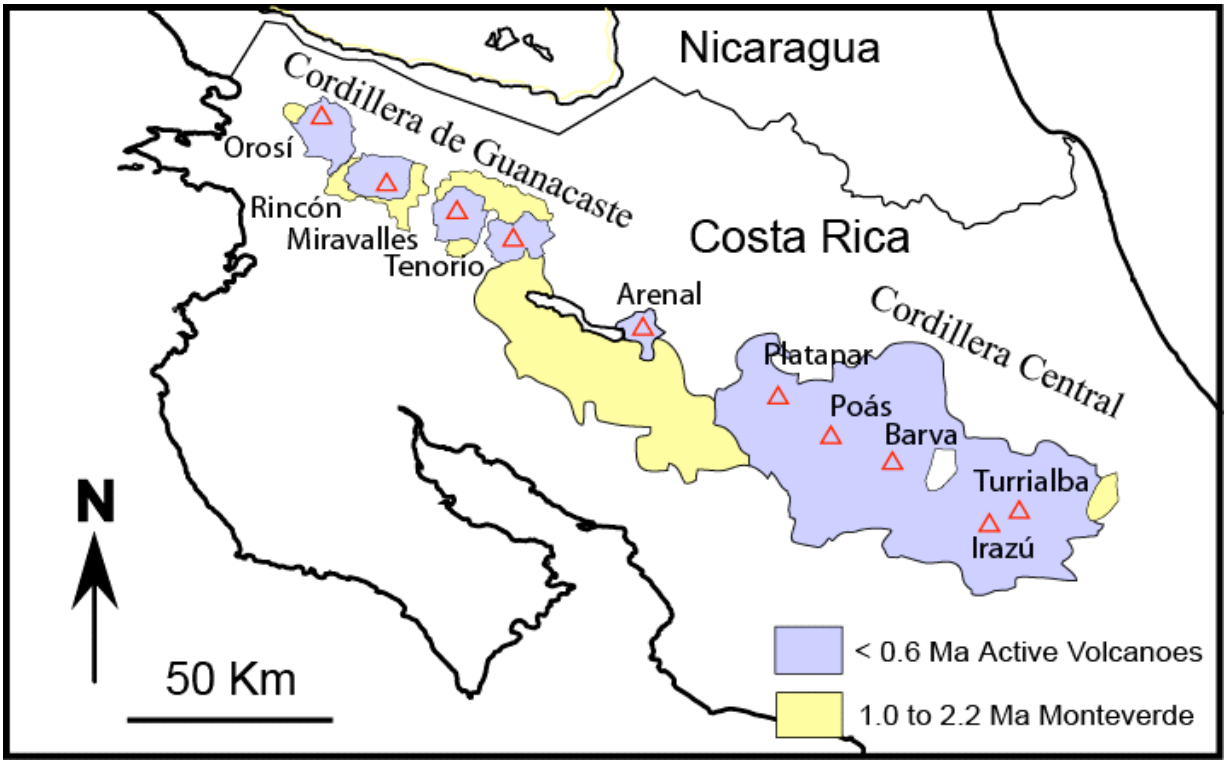

Figure: Modern and Monteverde age volcanic fronts in Costa Rica. The contacts between these two age groups were substantially clarified by our geochronological work.

Carr, M. J., I. Saginor, G. E. Alvarado, L. L. Bolge, F. N. Lindsay, K. Milidakis, B. D. Turrin, M. D. Feigenson, and C. C. Swisher, III (2007), Element fluxes from the volcanic front of Nicaragua and Costa Rica, Geochem. Geophys. Geosyst., 8, Q06001, doi:10.1029/2006GC001396.

 *References listed in appendix A.