



The Panamanian island arc and Galápagos hotspot: A case study for the long-term evolution of arc / hotspot interaction

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New age and geochemical data ($^{40}\text{Ar}/^{39}\text{Ar}$, major and trace elements, Sr-Nd-Pb isotopes) from igneous rocks throughout Panama are used to reconstruct magmatic and tectonic evolution of the southern Central American landbridge from the late Cretaceous. Formation of the Panamanian island arc on the western edge of the Caribbean Large Igneous Province dates back to the Early Late Cretaceous (88.3 ± 0.5 Ma). Accretion of small plateaus from the Galápagos hotspot (84.1 – 78.0 Ma) occurred in the Late Cretaceous leading to backstepping of the volcanic front. The Paleocene to Eocene arc (63.8 – 47.2 Ma) was continuous from east to west Panama. At the same time a paleo-Galápagos hotspot track subducted beneath central and southern Costa Rica and western Panama, leaving a belt of accreted ocean islands, seamount volcanoes and fragments of submarine aseismic ridges extending from Quepos (Costa Rica) to the Azuero Peninsula (Panama). Pb isotopic composition of Paleocene subduction-related rocks from the Azuero Peninsula confirms the subduction of a hotspot track nearby. Northward migration of the western Panamanian arc took place from the Early Eocene to Early Oligocene ($\sim 50 - 30$ Ma) possibly resulting from shallowing of slab dip and tectonic erosion induced by the subduction of a paleo-Galápagos hotspot track. Tectonic erosion rates of $84 - 96 \text{ km}^3 \text{ Ma}^{-1} \text{ km}^{-1}$ for the Panamanian arc between 50 - 30 Ma are estimated. Elevated Pb isotope ratios (enriched Galápagos-type geochemical signature) in arc rocks on Azuero in the Middle Eocene (~ 45 Ma) and in eastern Panama in the Early and Middle Miocene (21.9 – 12.4 Ma) suggest eastern migration of the subducting hotspot track. The Paleocene to Late Eocene arc is offset to the north in eastern Panama relative to western Panama; however, the Miocene arc forms a continuous arc from western to eastern Panama, suggesting left-lateral dis-

placement between the Late Eocene and Early Miocene (40 - 22 Ma) in the Panama canal region. We propose that the shift of the subducting hotspot track from Azuero to the east may have induced the left-lateral displacement. In the Pliocene through Holocene (4.5 ± 0.17 to 0.1 ± 0.08 Ma) volcanism was restricted to low volume eruptions of alkaline and adakitic magmatism in western Panama primarily in the forearc region of the Miocene arc (south of the Cordillera Central). Accretion of Galápagos Hotspot-track terranes (17 – 21 Ma), confirms the subduction of a hotspot track during the last 5 Ma. In conclusion, the interplay between the Galápagos hotspot track and the Panamanian subduction zone can explain the variations in the geochemistry of arc rocks through time and has a significant impact in the tectonic evolution of Panama.