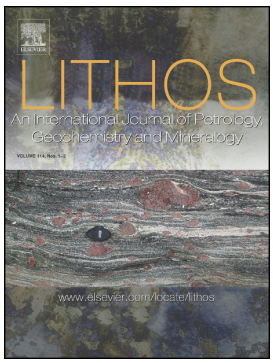

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Age Progressive Volcanism Opposite Nazca Plate Motion: Insights from Seamounts and Drowned Islands on the Northeastern Margin of the Galápagos Platform

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Abstract

We present new geochemical and $^{40}Ar/^{39}Ar$ analyses from seven seamounts located off the northeastern margin of the shallow Galápagos Platform. Initial volcanism at 5.2 Ma created a small island (Pico) over the current location of the hotspot with geochemically enriched lavas. There is no further record of magmatism in the study area until 3.8 to 2.5 Ma, during which four roughly conical volcanoes (Sunray, Grande, Fitzroy, and Beagle) formed through ~~from~~ ~~the~~ eruption of lavas derived from a depleted mantle source. Sunray, Fitzroy, and Grande were islands that existed for ~3 m.y. ending with the submergence of Fitzroy at ~0.5 Ma. The youngest seamounts, Largo and Iguana, do not appear to have been subaerial and were active at 1.3 Ma and 0.5 Ma, respectively, with the style of edifice changing from the previous large cones to E-W elongate, composite structures. The progression of magmatism suggests that Pico erupted near 91.5°W near the location of the Galápagos plume while the others formed well east of the plume center. If the locations of initial volcanism are calculated using the eastward velocity of the Nazca plate, there appears to be a progression of younger volcanism toward the east, opposite what would be expected from a fixed mantle plume source. The rate that initial volcanism moves eastward is close to the plate velocity. A combination of higher temperature and geochemical enrichment of the thickened lithosphere of the Galápagos platform could have provided a viscosity gradient at the boundary between the thick lithosphere and the thinner oceanic lithosphere to the northeast. As this boundary moved eastward with the Nazca plate, it progressively triggered shear-driven mantle upwelling and volcanism.

1. Introduction

The Galápagos magmatic province in the eastern Pacific consists of subaerial volcanoes that