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Geochemical evidence for the origin of the Manihiki Plateau

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The Manihiki Plateau formed during Early Cretaceous time in the central Pacific Ocean. Cretaceous large igneous province (LIP) formation in the Pacific Ocean vastly exceeded that during Cenozoic time, perhaps reflecting a fundamentally different mode of mantle dynamics. Therefore, geochemical investigations of these LIPs, which include the Shatsky Rise, Hess Rise, Magellan Rise, Manihiki Plateau and Ontong Java Plateau, can reveal mantle sources and magmatic processes dominant during the Cretaceous period.

Geophysical surveys and dredging of the Manihiki Plateau were carried out during an August/September 2003 Ocean Research Institute (Univ. Tokyo) Hakuho-Maru cruise (KH03-01 Leg 5). The Manihiki Plateau is made up of three smaller plateaus, two of which are separated by the NNE-SSW-trending Danger Islands Troughs. Three of four dredges (Dredges 2-4) recovered basement rock from the eastern wall of the Danger Islands Troughs and the northern part of the eastern high plateau. Samples from Dredge 3 have high abundances of large ion lithophiles and light rare earth elements (REE). Chondrite-normalized REE patterns for these basalts are steep and resemble REE patterns found in some other Cretaceous Pacific plateaus, such as in some dredged samples from Shatsky Rise and drilled Hess Rise basalts, but dissimilar to the flat patterns observed in the contemporaneous Ontong Java Plateau and in drilled basalts from the older Shatsky Rise. Conversely, most incompatible trace element abundances are very low in Dredge 2 and 4 basalts and these samples also have U-shaped REE patterns. This may suggest a mantle source that was previously depleted by extensive melting and later highly metasomatized. The imprint of extensive alteration on most Manihiki basalts makes additional speculation difficult on the basis of incompatible elements alone. Major elements and radiogenic isotopes will also be examined to further investigate the mantle sources for this major Cretaceous Pacific plateau.

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A 70 Myr history for the Caribbean Large Igneous Province: Implications for the origin of LIPs

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It is commonly accepted that Large Igneous Provinces are formed through catastrophic volcanic events occurring over vast areas (up to 2500 kilometers in diameter) within a few million years. New 40Ar/39Ar age and geochemical data from fresh volcanic glass from the Nicoya Peninsula, Costa Rica show that volcanism associated with the Caribbean Large Igneous Province lasted 70 Myr (69-139 Ma). The geochemistry and paleomagnetic inclinations of the Caribbean Large Igneous Province lavas are consistent with derivation from the Galápagos hotspot, which would make it one of the longest-lived hotspots on Earth. Our results further imply that plume head events don't only occur at the initiation of hotspots and that Large Igneous Provinces such as the Caribbean may form through multiple events of a pulsing plume or through continuous volcanism over long time scales. The Nicoya Peninsula was located at the northern edge of the gateway between the Pacific and the proto-Caribbean (the southern tip of the Chortis Block subduction zone). Pieces of the oceanic plateaus were accreted at Nicoya as they were inserted between the Americas, recording some of the earlier history of the Caribbean.