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Origin of Volcanic Seamounts Offshore California Related to Interaction of Abandoned Spreading Centers with the Continental Margin

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The numerous NE-SW trending volcanic seamounts at the continental margin offshore central to Southern California owe their existence to the complex tectonics that resulted when small spreading ridge segments intersected and partly subducted beneath the continental margin during the Miocene plate reorganization. A limited number of dredged samples had indicated multiple episodes of coeval, alkalic volcanism at geographically widely separated sites (Davis et al., 2002, GSA Bull. 114, 316-333). 450 new samples were collected from 8 seamounts from 37. 5°N to 32.3°N with MBARI's ROV Tiburon. Ar-Ar ages for 50 of these samples extend the ages of volcanism from 18 Ma to 2.8 Ma. The dominant whole rock compositions are differentiated alkalic basalt, hawaiite, and mugearite, but include minor benmoreite, trachyte, and rare tholeiitic basalt. This entire range of compositions is also present in glassy margins or in volcaniclastic breccias, except for the trachyte, which had no glassy margins. Trace element abundances and ratios (e.g. REE, Zr, Nb, Ta, Th, Ba, etc.) are typical for ocean island basalt, whether the seamount is located on the Pacific plate (e.g. Pioneer, Gumdrop, Guide, Davidson, San Juan, San Marcos) or on the continental slope (Rodriguez) or within the Southern Continental Borderland (Northeast Bank). Nine samples, predominantly from Rodriguez Seamount, show a calc-alkaline trend with

lower Nb, Ta, and higher Th. These samples may be erratics (Paduan et al., 2007, Marine Geology, in press). Sr, Nd, and Pb isotopic compositions plot within the Pacific N-MORB field for the northern seamounts (Pioneer, Gumdrop, Guide) but suggest progressively more radiogenic sources southward. There is considerable scatter at each site, especially with regard to $^{87}Sr/^{86}Sr$, despite severe acid-leaching of the samples. Isotopic and trace element compositions indicate sources that are heterogeneous at a small scale. Chondrite-normalized Ce/Yb suggest smaller degree of melting and more alkalic compositions with decreasing age, although there is again considerable scatter. Chondrite-normalized La/Sm versus Zr/Nb form a continuum from the seamount lavas to depleted N-MORB and E-MORB suggesting a common origin by decompression melting of a mantle source with randomly distributed enriched heterogeneities, which are incorporated to a greater degree with decreasing degree of melting. Based on symmetric magnetic anomalies, only Davidson Seamount has been identified as straddling a fossil spreading center (Lonsdale, 1991, AAPG Mem. 47, 87-125). However, the other seamounts along the continental margin with the same NE-SW orientation and similar geochemical characteristics probably originated in a similar setting, erupting lavas along zones of weakness in the ocean floor fabric related to past seafloor spreading. Small volumes of magma can apparently rise long after spreading ceases if there is enough enriched source component to facilitate melting combined with zones of weakness in the underlying ocean crust fabric and/or extensional tectonics.

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