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Structural Evidence from Dall Bank of Miocene Continental Rifting in the Southern California Continental Borderland

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Abstract

In October of 2003, intriguing northeast-trending faults displaying characteristics of rifting processes were imaged during a fish-habitat related high-resolution multibeam mapping survey of Dall Bank, a shallow submarine bank within the southern California Borderland. These structures are of extreme interest as they are aligned perpendicular to the dominant northwest-trending structural grain of the Borderland, and as such may represent an earlier phase of Borderland evolution. While the Borderland contains numerous examples of transtension-related extension including crustal thinning, unroofing of metamorphic rocks from deep levels, and possible incipient seafloor spreading, no intact rift-related structures on the magnitude of those at Dall Bank had been documented. During October of 2004 we returned to Dall Bank as part of a

NOAA-Northwest Fisheries Science Center Advanced Technologies cruise, providing us the opportunity to gather additional high-resolution multibeam and backscatter imagery, 3.5 kHz sub-bottom data, ROV recovered seafloor samples, and magnetic anomaly profiles. These new data included imagery of numerous possible intact volcanic cones, samples of basaltic and andesitic volcanic rocks, and additional imagery of the extensive network of normal faults, which provide compelling structural evidence of crustal extension. These data, coupled with recently released multi-channel seismic reflection data have allowed us to extend our picture of the spatial and temporal extent of the structures at Dall Bank. We now have the ability, through the use of these new data sets, to investigate the true nature of this feature in terms of its structural construction and its significance within the broader picture of Miocene-Recent Borderland tectonics.

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