The PESCADOR Seismic Experiment in the Gulf of California

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The PESCADOR seismic and geologic mapping project was aimed at defining crustal-scale extension and rift magmatism across multiple rift segments in the Gulf of California, assessing variations in extensional style along the length of the gulf, and interpreting these variations in terms of key parameters such as temperature, pre-rift structure, and extension rate. Multi-channel and ocean-bottom seismic data were acquired across three spreading segments in the southern gulf: the Guaymas, Alarcon, and San Jose del Cabo to Puerto Vallarta (Cabo-PV) segments. Data were also acquired along several margin-perpendicular transects. Analyses of data from individual transects can be found in Sutherland (2006)*, Brown (2007)*, and Paramo et al. (2008)*, and an initial synthesis of the crustal imaging is presented by Lizarralde et al. (2007). A principal finding is the surprisingly large variation in rifting style and magmatism between the imaged segments, ranging from wide rifting with minor syn-rift magmatism to narrow rifting in magmatically robust segments. These differences encompass much of the variation observed across nearly all other non-end-member continental margins. We explain this variation by invoking mantle depletion related to a pre-rift episode of ignimbrite volcanism to account for wide, magma-poor rifting and mantle fertility and possibly the influence of sediments to account for robust rift and post-rift magmatism. These factors may vary laterally over small distances in regions that have transitioned from convergence to extension, as is the case for the Gulf of California and many other rifts.

Figure: Map of the PESCADOR experiment layout and crustal profiles in the Gulf of California. Small white and red dots are ocean-bottom and land seismometer locations of the PESCADOR experiment; larger white and blue dots are instrument locations of the CORTES-P96 (Gonzalez-Fernandez et al., 2005) experiment; and yellow stars indicate the geologic constraints on northern Gulf spreading (Oskin et al., 2001). Approximate boundary of the post 14-Ma Gulf Extensional Province (GEP) is indicated by the bold dashed line. Crustal profiles from the Guaymas (Lizarralde et al., 2007), Alarcon (Sutherland, 2006)*, and Cabo-PV (Brown, 2007*; Paramo et al., 2008*) segments are shown, with extended continental crust shaded tan and new igneous crust shaded grey and stippled. These results, along with the seismic and geologic results from the northern gulf, define distinct structural domains within the GEP, with narrow rifting indicated by yellow shading and wide rifting indicated by blue shading.


*References listed in appendix A.