Neogene evolution of the California Current System

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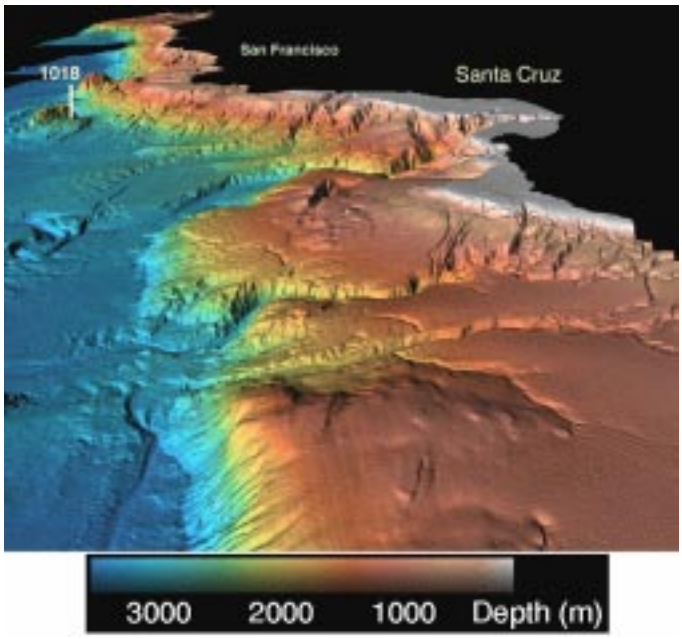
Understanding the sedimentary record of paleoceanographic change within the California current system is important for understanding how the North Pacific Ocean affects climate change. Regionally, such records can be used to better understand how large-scale climate processes affect precipitation in the western United States and primary productivity along the California continental margin. Until ODP Leg 167, this important region had not been explored with modern scientific drilling techniques. With one major exception, good, high-resolution, continuous sedimentary records had not been drilled along the California margin. Analysis of sediments from one site in the Santa Barbara Basin (Site 893, Leg 146) demonstrated decadal- to millennial-scale variations in intermediate and surface water properties linked to changes in N. Atlantic climate. Climate model simulations indicate that the NE Pacific surface ocean and land surface should respond strongly to Northern Hemisphere glaciation.

ODP Leg 167 drilled thirteen sites along the climatically-sensitive California margin to reconstruct the paleoceanographic history of the California Current system. These sites are arrayed in a series of depth and latitudinal transects to optimize reconstruction of the Neogene history of deep, intermediate, and surface ocean circulation and to understand the paleoclimatic and geochemical history of this region. High sedimentation rates make it possible to study paleoceanographic variability at submillenial scales at most sites, while high organic carbon burial helps to preserve paleoproductivity indices and organic biomarkers.

Shipboard measurements have identified general trends in the evolution of Pacific climate from the relatively warm latest Miocene to the cooler climate of the Pleistocene. Between 7 and 5 Ma, siliceous microfossils decreased sharply in abundance marking a major oceanographic change of unknown process but similar in timing to the end of siliceous deposition in the Monterey formation . Also intriguing is a mid-Pliocene biogenic CaCO3 production event, perhaps controlled by strengthened offshore upwelling beneath a stable surface ocean layer. We hypothesize that the production event is



Site 1018, one of the sites drilled by Leg 167 shown on the bathymetric map of Pratson and Haxby [1996]. It will be used to reconstruct paleoceanographic conditions off central California.

caused by enhanced subtropical gyral wind strength from 3.5 to 2.5 Ma, immediately prior to the appearance of major northern hemisphere ice sheets. The productivity events that we observe along the California margin are different in timing than those in either the subarctic or equatorial Pacific. The different regional responses will ultimately allow us to better understand climatic processes. Because regional oceanographic circulation patterns within the Pacific last for long periods of time (up to millions of years), stable oceanographic circulation patterns must exist even while the climate slowly drifts, or ocean circulation must respond in a stepwise fashion to tectonic changes in boundary conditions.

Reference:
Pratson, L, and W. Haxby, What is the slope of the U. S. continental slope? *Geology, 24,* 3-6, 1996.