Paleo-proxy Calibration of SST Variability in Soledad Basin, Baja California

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Abstract

Sediment records based on paleo-proxies driven by a combination of physics, chemistry, and biology document both the range of natural climate variability in the past as well as potential impacts in the future. This study focuses on a paleo-reconstruction for the southern limb of California Current which is known to respond to the El Nino Southern Oscillation (ENSO) as well as a related longer-term manifestation thereof, the Pacific Decadal Oscillation (PDO). Previous work on a 12-m core recovered from anoxic Soledad Basin has shown that a period of higher insolation centered on the mid-Holocene coincides with higher alkenone-derived sea-surface temperature (Uk-37 SST) as well as higher productivity inferred from a particular high concentration of redox-sensitive molybdenum (Mo). Whereas stronger summer insolation should promote upwelling of nutrient-rich water to the photic zone and therefore productivity, the higher Uk-37 inferred SSTs are surprising because nutrient-rich subsurface water is also cold.

This puzzle was investigated over the summer by studying part of a new 80-cm core from Soledad Basin that was sampled at ~3 mm resolution, dated using two independent methods, and shown to span the past century. The comparison of new Mo data from this core with historical records of SST anomalies for the region is broadly consistent with the puzzling long-term trend, i.e. an association of elevated productivity with elevated SSTs. There is, however, no such correspondence within a 10-yr section where the new Mo data overlap with a new high-resolution Uk-37 record from the same core. Whereas this inconsistency needs to be verified with the collection of additional Mo data, observation from this site to date challenge a number of assumptions widely used in paleoceanography and underline the need for calibration and use of multiple paleo-proxies.