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Tropical Pacific Climate Variability from the Late Pleistocene to Holocene: A Multi-Proxy Study of Sedimentary Records From the Southern Gulf of California

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We investigate the climate variability during the Late Pleistocene and Holocene in the Tropical Pacific Ocean from multi-proxy studies of the marine sedimentary sequence in gravity Core G1 drilled from the western slope of Pescadero Basin in the Gulf of California, which provide records on millennial time scales covering the past 48,000 cal yr BP. Core sequence is dominated by silty clay sediments, with glauconites being common from the top until 70 cm depth. Three visible layers of volcanic ashes are found between ∼25-30 cm, ∼85-87 and ∼110-120 cm. The tephra layers range in composition from basaltic trachy-andesite to trachy-andesite. The age model is based on four AMS radiocarbon dates which were converted to calendar years by applying the Calib. 6.0.1 Radiocarbon program. Sedimentation rates were estimated between calendar calibrated radiocarbon dates and ranged from 0.05 mm/yr near the top of the core, 0.03 mm/yr in middle-bottom and 0.06 mm/yr below 145 cm. The average sedimentation rate estimated is ∼0.045 mm/yr for the past 48,000 years.

Radiolarian assemblages, major elements oxides and magnetic susceptibility are used as proxies of oceanographic and climatic variability. Factor analysis identified two factors (radiolarian assemblages) containing ∼68% of the information of radiolarian data. Factor scores show which species are grouped together to form the two assemblages determined by the Q mode analysis. Two major climatic regimes during the last 48,000 cal years BP are documented. The Factor 1 explains the 11.66% of total variance and depicts their highest factor loadings in the lower- middle part of the core from ∼47,700 to ∼17,000 cal yr BP, showing a few pulses from 15,000 to ∼7000 cal yr BP. The factor is dominated by Arachnocorallium calvata, Phormostichoartus corbula, Phorticium pylonium, Cycladophora davisina and Siphocampe lineata with factor scores of 3.19, 2.84, 2.26, 1.28, and 1.12, respectively, suggesting cold conditions and longer residence time of a water mass with analogue properties to California Current Water inside the gulf. Factor 2 explains the 56.19% of the variance. The highest factor loadings are depicted in to the middle to upper part of the core, from ∼23,000 to 900 cal yr BP, showing significant pulses in the lower part of the core. The species composition is dominated by Tetrapyle octacantha with factor score of 5.33 that suggest warm pulses related with D/O events.

The log of magnetic susceptibility shows its highest values in the upper part of the core suggesting a major concentration of magnetic minerals which may be transported by fluvial, pluvial and eolic processes. Concentrations of major element oxides were determined, i.e. SiO2, Al2O3, TiO2, Fe2O3, CaO, MgO, Na2O, K2O, MnO and P2O5 with a Siemens SRS 3000 wavelength dispersive X-ray fluorescence.

We suggest that changes in oceanic and climatic conditions are related to latitudinal migration of the high pressure systems and the Intertropical Convergence Zone (ITCZ).