

Investigating Past El Niño Southern Oscillation Conditions in the Eastern Equatorial Pacific

Sydney Smith¹, Jerry McManus^{2,3}, Celeste Pallone^{2,3}

¹Department of Geology, Amherst College, ²Department of Earth and Environmental Sciences, Columbia University, ³Lamont-Doherty Earth Observatory, Columbia University

The El Niño Southern Oscillation (ENSO) is a climate variation that occurs in the Eastern Equatorial Pacific (EEP) ocean, which influences the position of the thermocline today. The ENSO cycle is split into three states: a normal state, an El Niño state, and a La Niña state. Each one is marked by different sea surface temperatures (SST). This project investigates past conditions in the EEP by reconstructing the mean position of the thermocline: a layer in the ocean where temperature rapidly changes with depth. In the modern ocean, the thermocline is shallower in the east, where SSTs are cool, and deeper in the west, where SSTs are warm. The temperature proxy used to determine past thermocline positions is the isotopic composition of oxygen in foraminifera ($\delta^{18}\text{O}$). Foraminiferal $\delta^{18}\text{O}$ increases with depth in the water column, as temperature decreases and density increases. Two species with contrasting depth-habitats were analyzed; *G. ruber* and *N. dutertrei*. When the thermocline shifts, it changes their difference in $\delta^{18}\text{O}$. The forams were collected from two deep-sea sediment cores. The first was Ocean Drilling Program (ODP) Leg 202 Site 1239 (0.67°S, 82.08°W, 1414 m) drilled in the east near the coast of Ecuador. The second was ODP Leg 138 Site 849 (0.10°S, 110.31°W, 3858 m) toward the west. Rather than identifying specific ENSO events, this method provides insight into the position of the thermocline and therefore the mean state of the EEP during the Holocene and last glacial period.