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Benthic foraminifera habitats and carbon isotopes: new perspective from thermodynamic constrains on intermediate waters respiration

J.C. Herguera (1), E. Peltzer (2), and P. Brewer (2)

(1) CICESE, Oceanography, Ensenada, Mexico (herguera@cicese.mx, 52 646 1750545), (2) MBARI, Moss Landing, California, USA (etp3@mbari.org, brpe@mbari.org)

The aim of this presentation is to explore the importance of low oxygen concentrations and elevated elevated levels of pCO2 at intermediate depths below an eastern boundary current and the depth distribution of benthic foraminifera habitats and its implication as a new paleoproxy for respiration in the ocean. The relatively high levels of primary production in eastern boundary current regions enhances the export to depth of organic carbon and fuels the consumption of dissolved oxygen and an increase in the ambient partial pressure of carbon dioxide by microbial activity. The combination of these two effects and ocean circulation lead to a decrease in the thermodynamic respiration capacity at intermediate depths in the eastern North Pacific. Here we use an ocean respiration index (RI) that combines the partial pressure of O2 and CO2 instead of their molar concentrations. This expression, while generic, is linear in energy: higher values of RI represents an increase in the energy available from respiration, while lower RI values either due to lower pO2 and/or higher pCO2 in these waters imply conditions when oxygen is harder to use, and the effects are most evident in the absence of macrofaunal benthic organisms at these intermediate depths. It has been known for the past two decades on the vertical habitat segregation between species of deep-sea benthic foraminifera within a few cm below the sediment water interface. These different habitat depths are captured in the carbon isotopic composition of their calcitic shells, that reflect the carbon isotopic gradient of the dissolved inorganic carbon at depth. Here we will explore the relationship between the carbon isotopic composition of epi- and endobenthic foraminifera and the RI and discuss its implications for paleoceanographic reconstructions.