Geophysical Research Abstracts
Vol. 21, EGU2019-6217, 2019
EGU General Assembly 2019

Pacific Ocean Respired Carbon Storage: Reconciling proxies and interpretations

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As the largest reservoir of carbon actively exchanging with the atmosphere on glacial-interglacial timescales, the deep ocean has been identified as the likely location of carbon dioxide sequestration during Pleistocene glaciations. Not only is the total magnitude of ocean carbon storage important, but examining individual watermass carbon storage also has the potential to shed light on attendant changes in ocean circulation and biogeochemical processes. Thus, spatially resolved reconstructions of respired carbon storage are critical for improving our understanding of glacial-interglacial climate change and the feedbacks and mechanisms responsible for amplifying insolation forcing.

Because of the stoichiometric relationship between respiratory carbon storage and dissolved oxygen concentrations, proxy data reflecting watermass oxygenation are of value in addressing questions about glacial carbon storage. Significant amounts of new data have resulted from the recent application of novel and classic proxies for watermass oxygen concentrations including aU, $\Delta\delta$13C, δ15N, and I/Ca. Unfortunately, these new records continue to foster conflicting interpretations about the watermass(es) containing the respired carbon.

Here, we critically evaluate the relative strengths and limitations of existing deep water oxygen proxies and use our findings to reconcile data about the watermasses associated with respiratory carbon storage over the past glacial cycle. We combine new aU and $\Delta\delta$13C data from the eastern and southeastern Pacific with previously published results to propose a picture of glacial carbon storage and Pacific watermass structure that is internally consistent. We also use our proxy evaluation to suggest best practices for future proxy reconstructions and their interpretation.