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Pacing and Pathways of Carbon Sequestration in a Warm Pliocene Ocean

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The ocean plays a notable role in the global carbon cycle due to its ability to take up and store large amounts of carbon. In fact, it is estimated that one-third of anthropogenic carbon emissions have been absorbed by the global oceans since the start of the industrial revolution. Predicting the fate of this carbon within the marine realm, particularly the extent and duration of sequestration, proves challenging due to interactions with multiple physical and biological mechanisms and associated temperature-sensitive feedbacks. Previous work focused in the warm Pliocene, a common analogue for a warm climate state similar to present, suggests that enhanced ventilation at mid-depths in the North Pacific influenced patterns of carbon storage and recycling in that basin [1,2,3,4]. However, rapid recycling via temperature-sensitive biological mechanisms may have also been at play, the extent to which remains to be fully explored.

Here, we use a data-model approach to examine rapid versus slow levers during warm Pliocene conditions. Specifically, we expand on the circulation hypothesis to include a new Pliocene-like model simulation with an integrated temperature-dependent remineralization scheme. Using a compilation of new and existing $d^{13}C$ and $d^{18}O$ proxy data from multiple locations within the Pacific Basin, we reconstruct water column profiles for comparison. These results offer important insight that will improve our ability to gauge and predict the near and long-term fate of marine carbon reservoirs, particularly in the context of ongoing warming in our modern climate.

[1] Ford, H. L., Burls, N. J., Jacobs, P., Jahn, A., Caballero-Gill, R. P., Hodell, D. A., & Fedorov, A. V. (2022). *Nature Geoscience*, *15*(8), 658-663.

[2] Shankle, M. G., Burls, N. J., Fedorov, A. V., Thomas, M. D., Liu, W., Penman, D. E., Ford, H. L., Jacobs, P. H., Planavsky, N. J., & Hull, P. M. (2021). *Natur*e 598, 457-461.

[3] Thomas, M. D., Fedorov, A. V., Burls, N. J., & Liu, W. (2021). *Geophysical Research Letters*, 48(10).

[4] Burls, N. J., Fedorov, A. V., Sigman, D. M., Jaccard, S. L., Tiedemann, R., & Haug, G. H. (2017). *Science Advances*, 3(9).