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Plio-Pleistocene CO_2 drawdown related to wildfire-induced terrestrial organic carbon burial

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The Plio-Pleistocene transition (1.5 to 3 million years ago, Ma) witnessed a ∼140 ppm drop in atmospheric CO_2 levels, leading to long-term global cooling and amplified glacial-interglacial cycles. While glaciation-induced continental weathering and terrestrial organic carbon (OC) burial are thought to be responsible for this CO_2 decline, they fail to explain these processes in mid and low-latitude regions [1]. The ecosystem responses due to wildfires and post-fire storms can elucidate these changes [2]. Here, we investigate the impact of wildfires on the terrestrial OC burial rate at regional and global scales from 4 to 1.5 Ma. Regionally, we applied a multi-proxy approach on Nicobar fan sediments, which document processes in South Asia, a nexus for terrestrial OC transport. Our results reveal a notable intensification of wildfires during the Plio-Pleistocene transition, accompanied by a 2.7-fold increase in continental erosion rates and a 2.4-fold rise in terrestrial OC burial flux compared to the early Pliocene. These findings align with the global wildfire stack (based on 19 records) and terrestrial OC (based on 23 record) burial flux, increasing from 2.29±0.48 Mt C a^{-1} in the early Pliocene to 3.52±0.80 Mt C a^{-1} at the Plio-Pleistocene transition. Our research underscores the pivital role of wildfires in atmospheric CO_2 drawdown during this critical transition period.

Reference:

[1] Herman et al., 2013. *Nature*, 504(7480), pp.423-426.
[2] Kashian et al., 2006. *Bioscience*, 56(7), pp.598-606.