The Consumption Rate of a Natural CO_2 Pulse: Lessons from the Middle Miocene

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This study evaluates the CO_2 evolution on decadal-timescale after a rapid carbon injection during the Middle Miocene. The increased level of CO_2 during mid-Miocene has been linked to massive volcanic activities – the Columbia River basalt flow found in the NW United States. The enormous volume of magma emplaced during the formation of the Columbia River Basalt Group has delivered large masses of CO_2 into the atmosphere in a relatively short period. In northern Idaho, an ancient lake (the Clarkia Miocene Lake) was formed as a consequence of basalt eruption that dammed the local drainage. Rapid sedimentation in the Clarkia Lake presumably recorded the history immediately following the CO_2 spike. While volcanic ash zircon U-Pb dating placed the Clarkia deposit to the warmest phase of the Miocene, elemental ratios measured by micro-XRF scanning of the Clarkia Site P-33 samples suggest that the sedimentation rate is about 1 cm/yr. We reconstructed atmospheric CO_2 using the finely laminated, macrofossil-rich Clarkia Lake sediments. CO_2 is estimated by the fossil plant $\Delta^{13}C$ method applied to two drought-intolerant conifer species. The reconstructed CO_2 variations with decadal-scale resolution following a natural CO_2 pulse help us to better understand the fate of the fossil-fuel CO_2 release in the Anthropocene.