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Storage/Release of Geologic Carbon Influenced Pleistocene Glacial/Interglacial Atmospheric pCO2 Cycles

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For over 100 years scientists have puzzled over the mechanisms responsible for the repeated climate changes known as Ice Ages. A breakthrough was achieved when ice cores and marine archives revealed that the Ice Ages were paced at 100kyr intervals in alignment with Earth's eccentricity cycle for the past million years. A second breakthrough was achieved when ice core records revealed that the Ice Ages were accompanied by ~80-90ppm variations in atmospheric pCO_2. But after decades of research the mechanisms responsible for those atmospheric pCO_2 variations remains an open and unresolved puzzle.

Here we present new findings that challenge the long-standing paradigm that geologic processes that regulate carbon exchange between the Earth's interior and exterior act too slowly to have influenced the ocean and atmosphere carbon budgets on glacial time scales. The evidence includes large $\Delta^{14}C$ excursions found in biogenic sediments in each of the Ocean basins at the last glacial termination. These excursions point to a sustained release of ^{14}C-dead carbon spanning several thousand years. In the Atlantic, Pacific and Indian Ocean the excursions are found near seafloor deformation features, including pockmarks that are indicative of gas-rich fluid release from sub-surface reservoirs. In the eastern equatorial Pacific, the $\Delta^{14}C$ excursions are associated with enhanced hydrothermal metal concentrations including Fe, and Z that point to a hydrothermal source. Our ongoing research seeks to identify the storage and release mechanisms that operate on these carbon reservoirs on glacial time scales and to put constraints on the amount of carbon released at the last glacial termination. While the amount of carbon released from these geologic sources remains an open question for now, it is clear that geologic processes have affected changes in the global carbon budget on glacial time scales.