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Carbonate Clumped isotopes of sediment-hosted concretions reveal glacially driven erosion, paleo-fluids and paleo-carbon cycling on the West Greenland Margin

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Carbonate concretions provide a unique record for reconstructing the post-depositional history of a sedimentary system. Because they form at a range of depths, and potentially millions of years after initial sediment emplacement, their carbon, oxygen and clumped isotope values record the mobility of carbon, changes in fluid composition, and their relationship with the geothermal gradient[1, 2]. Coupled with "absolute" radio-isotope dates for concretions, these values can then be interpreted in relationship with the depositional age model, providing quantitative data on the magnitude of erosional unconformities and the evolution of fluid geochemistry over time. Dual-clumped isotope analyses of these carbonate phases provide an independent constraint on the expression of kinetic isotope effects[3, 4], and allows for more accurate reconstruction of paleo-geothermal temperatures. We have applied this approach to sediments recovered from the West Greenland Margin in 2023 by IODP Expedition 400[5], and use these data to provide minimum estimates for how much material was removed by glacial erosion from the Miocene to present day. We constrain the sources of DIC, and gain insight into the bio-geochemical mechanisms that formed these diverse structures.

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