

## **Using carbon isotopes, trace metals, and microfossils to understand the Late Devonian Kellwasser events**

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While categorized as one of the “Big Five” mass extinctions, the causes of the Late Devonian biodiversity depletion (LDBD) event are poorly understood. The Kellwasser Events are two globally expressed black shale horizons associated with the LDBD and the Frasnian/Famennian boundary. The Kellwasser horizons have been interpreted as a signal of widespread marine anoxia correlated with elevated metazoan extinction rates. In Western New York, the Kellwasser horizons were deposited in the epeiric sea of the eastward-shallowing Appalachian Basin. While larger body fossils are mainly absent, organic-walled microfossils are abundant and provide a nearly continuous record through the events. In order to better understand the LDBD, we sampled multiple horizons and localities of both the Upper and Lower Kellwasser events in Western New York. From these samples, we analysed microfossil abundance and morphology, trace elements, TOC, and  $\delta^{13}\text{C}$  of both bulk kerogens and individual microfossils. Our  $\delta^{13}\text{C}$  results show that there is a consistent offset between organic-walled microfossils and coeval bulk kerogens. We speculate that the isotopic difference may be the result of  $^{13}\text{C}$ -enriched surface DIC due to a strong biological pump. Coupled with trace element, TOC, and fossil data, we suggest high productivity may have contributed to deleterious environmental conditions, including low oxygen, that played a role in the LDBD.