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A new Ordovician sea surface temperature proxy: the eyes of pelagic trilobites

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Ordovician seawater temperature is of great relevance to palaeontologists investigating the causes of the Great Ordovician Biodiversity Event and palaeoclimatologists investigating the Early Palaeozoic Ice Ages. Recent studies indicate that ocean cooling leading up to the Late Ordovician glaciation may have started as early as the Mid or even Early Ordovician. A range of palaeontological isotope proxies have been used to interpret this including the oxygen isotope composition of conodont apatite and brachiopod calcite, although all are subject to problems with either diagenetic alteration or the analytical techniques used. This study assesses the suitability of the oxygen isotope data from epipelagic trilobites in the Early-Mid Ordovician. These trilobites are potentially the best source of Ordovician biogenic calcite from the pelagic realm. The large calcitic lenses of the eyes, where well preserved, can be used as a proxy for sea surface temperature, derived from oxygen isotopes (δ^{18}O). Preliminary studies have analysed Floian specimens of the widespread *Carolinites* from Spitsbergen. A diagenetic assessment indicates that some of the eyes are well preserved and can be distinguished from diagenetically altered eyes by their crystallographic structure and geochemistry. These well-preserved eyes have low δ^{18}O values of –8‰ to –7$\%_{,VPDB}$ and correspond to warm ocean temperatures, within the range of published estimates derived from other Early Ordovician proxies. Diagenetically altered specimens have δ^{18}O down to –10$\%_{,VPDB}$, suggesting alteration during deep burial at elevated temperatures. Ongoing studies focus on further isotope analyses and the examination of new Early-Mid Ordovician pelagic trilobites from mid to high palaeolatitudes.