Late diagenetic versus near-primary isotopic compositions in Ordovician carbonate rocks and fossils: A Baltoscandian example

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The Ordovician was an important interval in Earth's history, characterized by major sea level fluctuations, carbon cycle and climatic perturbations, as well as a profound increase in marine biodiversity – the Great Ordovician Biodiversification Event (GOBE) (1-4)\cite{Sepkoski1981}. Recently, direct links between Ordovician climatic evolution and biotic turnover have been proposed, based on geochemical data obtained from the East Baltic \cite{Korte2020}. However, the potential impact of late diagenetic modification of the geochemical compositions remains to be evaluated. Based on calcitic fossil brachiopods and bulk rock carbonates, this study documents the Early (Floian) to Late Ordovician (Sandbian) carbon (C) and oxygen (O) isotope evolution on the Swedish island of Oland, which was situated in the central part of the Ordovician Palaeobasin on the palaeocontinent of Baltica. The near-primary nature of the carbon and oxygen isotopic trends and its potential palaeoenvironmental significance is evaluated using optical, chemical and statistical methods. The results suggest that diagenetic alteration may have shifted both C and O isotope compositions to higher values, in contrast to classical interpretations. Nevertheless, both long-term and shorter-duration C and O isotope trends of palaeoenvironmental significance are discernible. Carbon isotope compositions suggest that despite the influence of late diagenesis, prominent C isotope perturbations are robust enough to be recorded in both bulk carbonates and calcitic brachiopods. Our Baltic oxygen isotope record reveals a long-term increase in carbonate oxygen isotopic composition during the Ordovician – consistent with the general O isotope Phanerozoic trend \cite{1,2,6}, which is most pronounced in the Darriwilian (Middle Ordovician). Therefore, the Ordovician brachiopod fossils, although partially altered, preserve a record of Middle Ordovician climate amelioration; supporting recent suggestions of Middle Ordovician climatic cooling \cite{5,7}.
REFERENCES

- J. Veizer et al., $^{87}$Sr/$^{86}$Sr, $\delta^{13}$C and $\delta^{18}$O evolution of Phanerozoic seawater. Chemical geology 161, 59-88 (1999).