Long-term *vs* short-term variability of stable isotopes in brachiopods of the Silurian of Gotland (Sweden): Palaeoenvironmental implications

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The Silurian of Gotland consists of 440 m carbonate deposits, spanning the late Llandovery to late Ludlow epochs (431 to 411 m.y.). Repeatedly, uniform sequences of micritic limestones and marls are interrupted by complex-structured reefs and adjacent platform sediments. Previously, the alternation of facies is interpreted as the result of sea level fluctuations caused by a gradual regression with superimposed minor transgressive pulses. Ratios of stable carbon and oxygen isotopes in brachiopod shells (more than 370 specimens, esp. *Atrypa reticularis*) from the Silurian of Gotland, Sweden, have been analysed. Preservation of biological skeletal ultrastructures, observed in SEM-micrographs, and cathodoluminescence analyses indicate that usually no diagenetical alteration occurs.

The Silurian sequence of Gotland exhibits principally parallel carbon and oxygen isotope records corresponding closely to the topostratigraphic units. Lower values occur in periods dominated by deposition of marly sequences. Higher values are observed in periods dominated by reefs and extended carbonate platforms.The isotope ratios are influenced by local as well as global factors. The oxygen isotope ratios are interpreted to reflect palaeosalinity changes due to varying freshwater input, rather than changes in palaeotemperature. Consequently, the facies distribution of Gotland is interpreted as resulting from changes in terrigenous input caused by different rates of continental weathering and fresh water runoff rather than by sea level fluctuations. Periods of arid climate and therefore anti-estuarine downwelling of oxygenated surface water appear as short episodes of reef growing ($\leqslant 1.5$ m.y.) in an epoche characterized by a tropic humid climate, which causes an estuarine circulation and the upwelling of CO_2-rich deep water. Carbon isotope ratios are obviously connected to these changes in circulation by the advection of ^{13}C-rich surface water (arid episodes) or upwelling of ^{13}C-depleted deep water (humid episodes) of a Silurian ocean which itself reveals generally euxinic deep water conditions due to the burial of organic carbon in black shales.

Although the development of $\delta^{13}C$ and $\delta^{18}O$ values have been shown to be parallel in the secular changes, the underlying long-term trends show antiparallel courses. This fact indicates that the factors controlling the long-term trends in isotopes are different from those assumed to control the secular changes. The long-term trends in the Silurian of Gotland interrupt the general increase of both carbon and oxygen isotope values during the Palaeozoic.

References

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