High-resolution assessment of the Valgu event: conodont diversity and δ\(^{18}\)O\(_{\text{phos}}\) during the early Telychian (Silurian) in the Baltic Basin

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The influence of global climate and oceanographic system dynamics over biological patterns throughout Earth's history is one of the main concerns in paleobiology. Periods that record changes in biodiversity of various magnitude are of particular interest in this field. Previous studies of major Silurian bioevents (e.g. Ireviken, Mulde and Lau) suggest that these events affected different faunas and have been correlated with positive carbon isotope (δ\(^{13}\)C\(_{\text{carb}}\)) excursions and positive shifts in oxygen isotopes (δ\(^{18}\)O\(_{\text{phos}}\)) ratios, suggesting there was a disturbance in the carbon cycle, a drop in temperature, and potential glaciations. However, the impact of the biological events has not been fully assessed, and the influence of climate change remains unclear.

Here, we focus on the Valgu event, a minor episode of proposed environmental and faunistic changes in the early Telychian, which has been recognized in Baltica and Laurentia paleocontinents by changes in conodont succession and a positive excursion in δ\(^{13}\)C\(_{\text{carb}}\). In this study, we assess a limestone-marl alternation core section in Estonia deposited below the storm wave base during the Valgu event. We test for a substantial decrease in the biodiversity of conodont communities, for extent perturbation in the carbon cycle, manifest in a positive δ\(^{13}\)C\(_{\text{carb}}\) excursion, and an abrupt positive δ\(^{18}\)O\(_{\text{phos}}\) shift, which might be indicative of rapid cooling and a rapid sea-level fall typical for glacio-eustatic cycles. To this aim, we measured bulk-rock δ\(^{13}\)C\(_{\text{carb}}\) as well as δ\(^{18}\)O\(_{\text{phos}}\) in monogeneric conodont samples and analyzed the conodont diversity from the event interval.

The lower part of the investigated section is characterized by shallow-water bioclastic limestones containing green algae. On top of this facies, a pronounced hardground indicates a gap in deposition and marks the boundary between the bioclastic limestones and the overlying sediments composed of nodular limestones and marls, which were deposited below the storm wave base. They show a positive carbon shift of ca. 1.4 ‰ during the Valgu interval, but no indication of an extreme change in the conodont biodiversity is evident. Likewise, the δ\(^{18}\)O\(_{\text{phos}}\) in conodonts remains constant in the section, arguing against cooling or glacially-driven sea-level fluctuations as drivers for the observed changes.