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Testing for the effects of depositional rates in multiproxy models of environmental and faunal change: the Silurian Lau $\delta^{13}\text{C}$ excursion

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The Silurian is characterized by several extinction events, among them the late Ludfordian Lau event, which mainly affected conodont and graptolite communities. This event was followed by the strongest global positive $\delta^{13}\text{C}$ excursion of the Phanerozoic. This event has been first recognized in the classical succession in Gotland, Sweden, where a continuous increase in $\delta^{13}\text{C}$ values of up to nearly 9 ‰ from the upper När Formation to the Eke Formation is observed. It has been attributed to large scale carbon cycle perturbations. This time period is also characterized by a regression and associated changes in sedimentation and deposition rates. This raises the question to what extent these factors contribute to the observed changes in faunal diversity and geochemical proxies.

A mechanism linking changes in seawater chemistry and the faunal turnover has been proposed based on a high abundance of malformed acritarchs observed during the onset phase of some Phanerozoic isotope excursions including the Lau isotope excursion. Malformations during the late Silurian Pridoli event coincide with a significant increase in trace metal content measured in fossils and host rock, which suggests the teratology to be caused by metal pollution. However, also in the case on an increase in the trace metal content the contribution of changing depositional rates has not been quantified.

Models developed in the field of stratigraphic paleobiology have demonstrated that changing deposition rates have a substantial influence on the stratigraphic distribution of fossils. In the same sense, element concentrations can be altered by changing deposition rates, which may dilute or condense the primary element signal. For this study, concentrations of different trace elements were measured across a profile in an outcrop Bodudd (Gotland) which exposes the Lau isotope excursion from the upper När to the Eke Formation. Using a newly developed statistical method, the effects of changing deposition rates were quantified and the measured element signal corrected for these effects. This method uses a deposition model to transform the measured element signal, which is a function of the stratigraphic height in the outcrop, back into a temporal rate. The temporal rate reflects the primary element signal and is defined as a function of time instead of stratigraphic height. Thus, the effect of changing deposition rates is accounted for. Approximate deposition models were created based on Th concentrations measured across the profile, which act as a proxy for the rate of terrestrial input, and based on the chitinozoan

yield, which reflects deposition rates. Pre- and post-transformation element patterns were compared for different deposition models and evaluated with respect to their ability to preserve element peaks.