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A not-so-big crisis: re-reading Silurian conodont diversity in a sequence-stratigraphic framework

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Conodonts are extensively used in Ordovician through Triassic biostratigraphy and fossil-based geochemistry. However, their distribution in rock successions is commonly taken at face value, without taking into account their diverse and poorly understood ecology. Multielement taxonomy, ontogenetic and environmental variability, difficulties in extraction, and relative rarity all contribute to the general lack of quantitative studies on conodont stratigraphic distribution and temporal turnover. With respect to Silurian conodonts, the concept of recurrent conodont extinction events – the so called Ireviken, Mulde and Lau events – has become a standard in the stratigraphic literature. The concept has been proposed based on qualitative observations of local extirpations of open-marine pelagic or nekto-benthic taxa and temporary dominance of shallow-water species in the Silurian succession of the Swedish island of Gotland. These changes coincided with positive carbon isotope excursions, abrupt facies shifts, "blooms" of benthic fauna, and changes in reef communities, which have all been combined into a general view of Silurian bio-geochemical events. This view posits a deterministic, reproducible pattern in Silurian conodont diversity, attributed to recurrent ecological or geochemical conditions. The growing body of sequence-stratigraphic interpretations across these events in Gotland and other sections worldwide indicate that in all cases the Silurian "events" are associated with rapid global regressions. This suggests that faunal changes such as the dominance of shallow-water, low-diversity conodont fauna and the increase of benthic invertebrate diversity and abundance represent predictable consequences of the variation in the completeness of the rock record and preservation potential of different environments. Our studies in Poland and Ukraine indicate that the magnitude of change in the taxonomic composition of conodont assemblages across the middle Silurian global regression and the hypothesized Mulde Event is proportional to the associated facies shift. Quantitative data on facies distribution of individual conodont species combined with sequence stratigraphic architecture provides a testable model for the impact of sea-level changes on perceived conodont diversity in a section or basin. This approach highlights the need for quantitative data on conodont distribution in their environmental context, their integration into conodont-based stratigraphy and geochemistry, and for the regular use of Occam's razor to interpretations of paleobiodiversity.