Uranium isotopes, ocean anoxia, primary productivity and carbonate diagenesis

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Over the recent years, U isotopes in marine carbonates have been used widely in order to constrain global redox conditions in ancient oceans. In general terms, negative U excursions are interpreted as expansion of ocean anoxia resulting from enhanced primary productivity recorded as positive C isotope excursions (CIE). Unfortunately, the original U signature from carbonates is succeptible to be altered during the inevitable diagenetic transformations, questioning the veracity of ancient U isotope trends – are they a record of global ocean anoxia or the result of changes during diagenesis? Here we present U isotopic data from bulk carbonates together with brachiopod shells, the latter traditionally considered to be unaltered during diagenesis and truly preserving pristine records from seawater at time of deposition; in order to assess the diagenesis versus global signal question.

Results indicate that, based on the brachiopds signatures, the late Silurian oceans were more anoxic than today and stable across the Lau event CIE. However, results from bulk carbonates show geochemical and isotopic trends that could reflect local early marine diagenesis variations over time affecting the U signatures (i.e., fluid vs rock buffered). The lack of any signifcant negative U isotope excursion during the Lau event (the largest positive CIE over the Phanerozoic) questions the direct link between U isotopes and enhanced primary productivity coupled with the C excursions. The results presented here illustrate how U signatures can potentially be recording local, carbonate platform-scale changes ultimately linked to global environmental reconfigurations. In particular, marine regression and trangression cycles and their relationship with carbonate weathering and diagenesis.