Ocean euxinia triggered the Late Ordovician mass extinction: Evidence from high-resolution data in South China

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The Late Ordovician mass extinction (LOME, ca. 445 Ma) was the first of the “Big Five” Phanerozoic extinction events and comprised two extinction pulses. Proposed kill mechanisms are still elusive. A more definitive understanding is hampered by poorly constrained temporal links between the extinction pulses and euxinia. Here, we utilize a combination of Fe speciation and trace metals to reconstruct high-resolution ocean redox conditions across a Late Ordovician to Early Silurian shelf-to-slope transect on the Yangtze Shelf Sea (a siliciclastic-dominated shelf basin in South China).

We identify six distinct Horizons (from A to F in ascending order) of evolving redox conditions, indicating two cycles of expanded euxinia (Horizon C and Horizon F). For Horizon C, representing the late Katian stage (the upper part of P. pacificus graptolite zones), most of samples have high FeHR/FeT ratios (>0.38) and relatively high Mo concentrations (>25 ppm), potentially reflecting the development of at least weak or intermittent euxinia. For Horizon F during the late Hirnantian Stage (M. persculptus graptolite zones), elevated FeHR/FeT, FePy/FeHR ratios and extremely high Mo concentrations (>80 ppm) strongly suggesting persistent euxinia. These two cycles of expanded euxinia corresponding to the two pulses of the LOME, suggesting a strong causal relationship.