Deciphering the Early Triassic paleocean using stable oxygen isotopes in conodont bioapatite

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In the aftermath of the most catastrophic mass extinction on Earth, the Early Triassic was a period of major environmental perturbations and climatic oscillations as well as regional variations controlled the ecological recovery during this time interval [1, 2]. To complement this perspective, the bioapatite of well-preserved conodonts (CAI of 1) was analysed as a proxy to estimate relative sea water temperatures. The analytical approach is based on stable isotope analyses of oxygen in phosphate ($\delta^{18}O_{PO4}$) in two ways: a classical method of silver phosphate microprecipitation and *in-situ* measurements by secondary ion mass spectrometry (SIMS). High $^{18}O/^{16}O$ ratios were measured in samples from the Early Spathian, which correspond to the lowest paleotemperature range found (25 to 27 ºC). This range corroborates with paleotemperatures estimated by clumped stable isotope compositions of brachiopods from the same stratigraphic layers and that allow the water $\delta^{18}O_{VSMOW}$ values to be estimated at –1 ‰. Basal Late Smithian conodonts from low-latitude sites have $\delta^{18}O_{PO4}$ values that give higher water temperatures (32 to 39 ºC). Assuming similar habitats and temperatures for the same conodont species sampled from high paleolatitudes their $\delta^{18}O_{PO4}$ values give $\delta^{18}O_{water}$ values of about –3.5 ‰. The estimated paleolatitudinal offset (–1 *vs* –3.5 ‰) is similar to that for modern seawater $\delta^{18}O$ values between low and high-latitudinal waters [3]. Within the errors of the methods used, these results support Early Triassic offshore seawater temperatures that were biologically feasible.

[1] Song *et al.* (2011) *Geology* **39**, 739-742. [2] MacLeod (2014) *GSA Special Paper* **505**, 1-28. [3] LeGrande & Schmidt (2006) *Geophys. Res. Lett.* **33**, L026011.