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REE compositions in fossil vertebrate dental tissues indicate biomineral preservation

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Rare earth element (REE) abundances have been measured in a number of Palaeozoic and Mesozoic dental tissues using Laser Ablation Inductively Coupled Plasma Mass-spectrometry (LA-ICP-MS). Fossil vertebrates analysed comprise scales and tesserae of Silurian and Devonian acanthodians, chondrichthyans, galeaspids, mongolepids, thelodonts, as well as teeth of Cretaceous lungfish and marine reptiles. The evaluation of fossil preservation level has been made by semi-quantitative spot geochemistry analyses on fine polished teeth and scale thin sections, using Energy Dispersive X-ray Spectroscopy (EDS). Fossil teeth and scales with significant structure and colour alteration have shown elevated heavy element concentrations, and the silicification of bioapatite has been common in their tissues. Stable oxygen isotope measurements (δ18O) of bulk biomineral have been conducted in parallel, and showed comparatively lower heavy oxygen values in the same fossil tissues with stronger visible alteration. Significant difference in REE concentrations has been observed between the dentine and enamel of Cretaceous plesiosaurs, suggesting the enamel to be more geochemically resistant to diagenetic overprint.