Geochemical signature of PTB sediments in the Perth Basin reveals a toxic ocean at the end of Permian and anoxic ocean in Early Triassic

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The Permian-Triassic boundary recorded in marine sediments from the Redback 2 drill hole in the Perth basin, Western Australia, is marked by a lithological change from massive bioturbated dark-grey mudstone to dark-grey mudstone, characterized by microbial laminated texture and the presence of minor carbonate layers. The boundary is also marked by an absense of framboidal pyrite and presence of euhedral pyrite, and by a change from D. parvithola to K. saeptatus spore-pollen palinofacies. LA-ICPMS analysis of pyrite for 16 elements reveals a 2-350 times enrichment relative to the shale matrix. Framboidal syngenetic pyrite is the most enriched, followed by diagenetic pyrite. The compositions of framboidal pyrite are used as an ocean trace element proxy in black shales [1]. The pyrite of Late Permian is enriched 2-300 times in Co, Ni, Pb, Bi, Tl, Ag, As, and Sb compared to Triassic pyrite. We infer the pulses of additional enrichment by an order of magnitude in Co, Ni, As and Tl below the PTB to be a result of polution of the oceans caused by the voluminous Siberian Traps eruptions.

Whole-rock paleo-redox indicators (Mn, P, Fe/Al and Mo/Al), change from low in Late Permian to high in Triassic, suggesting a change in oxygenation of bottom waters. This is in agreement with a larger diversity of sulphide minerals, including Cu-Zn-Cd phases, as well as the pyrite framboid size distribution suggesting anoxic-euxinic conditions for the post-extinction Triassic Ca-enriched mudstones.

Euhedral pyrite from the PTB interface is distinguished by positive Bi-Te and delta^{34}S anomalies.

The averaged trace elements composition of pyrite for the Phanerozoic, assessed by LA-ICPMS on over 3000 sedimentary pyrites, is proposed as a possible reference range of elemental abundance for normalization patterns for pyrite as an analogue of NASC for whole rock.

[1] R. R. Large *et al*, Trace element content of sedimentary pyrite as a new proxy for deep-time ocean–atmosphere evolution. *Earth. Planet. Sci. Lett.* **389**, 209 (2014).