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Age and depositional environment for the Ediacaran Doushantuo phosphorites at Weng'an, South China: Constraints from Re-Os isotopes

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The Neoproterozoic Ediacaran Doushantuo Formation at Weng'an in South China is one of the most intensively investigated Ediacaran strata in the world. Phosphate-rich bed occurring in the upper part of the Doushantuo Formation contains unique phosphatized, three-dimensionally and cellularly preserved mircofossils known as the Weng'an biota [1].

Detailed paleontological, sedimentological and geochemical data on the sedimentary profiles of these critical Doushantuo units at Weng'an have greatly advanced our understanding of the evolution of multicellular life and the atmospheric–oceanic system during the Ediacaran period [2]. However, absolute age constraints for the Doushantuo Formation at Weng'an are rather limited.

Following a similar analytical procedure we published previously for organic-rich sediments [3], in this study we present a new Re-Os age of 591 ± 8 Ma for the carbonaceous black phosphorite occurring in the basal part of the fossil-bearing unit. In contrast to the Pb-Pb age of 572 ± 36 Ma reported previously [4], the new age provides more precise constraint for the timing of black phosphorite deposition, and more importantly, a minimum age constraint for the evolution of early metazoan at Weng'an. Since all the samples were collected from the basal layer of black phosphorite bed just above a subaerial exposure surface, this age therefore also represents a minimum age for this subaerial exposure event, which serves as an important marker for correlation of the Doushantuo Formation on the whole Yangtze platform in South China. This new Re-Os isotope age, together with a U-Pb zircon age [5] from an ash bed that occurs below the exposure surface at Zangcunping on the Yangtze Platform, constrain the age of this platform wide unconformity between 614.0 ± 7.6 Ma and 590.8 ± 8.3 Ma.

The Re-Os data provide further constraints on $^{187}Os/^{188}Os$ ratios of contemporary seawater during deposition of the black phosphorite unit, and together with other published Re-Os data, we can track the geological history of continental weathering intensity and oxidation of the atmosphere-ocean system during the Ediacaran using the initial Os ratios.

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