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Resolving the tectonic settings of the Hamersley and Griqualand West basins using geochemical, isotopic and geochronological analysis of ash deposits

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The Hamersley Basin in Western Australia and the Griqualand West Basin in South Africa provide some of the best records of the Earth's surface environment during the Archean Proterozoic transition. During this time several global events are thought to have taken place, including a possible Snowball glaciation and the Great Oxidation Event. Although these basins have been previously linked, the details of their connection remain unclear due to their ambiguous tectonic context. Fortunately, ash-rich layers have been found throughout the two basins that contain zircon and apatite crystals. Zircon has previously been used to date the deposition of the sediments throughout the stratigraphy, generating high resolution age-depth information. Here, we use Hf isotope compositions in these dated zircons and the trace element compositions of apatite and zircon to refine the tectonic environment driving magmatism to better understand volcanism surrounding these basins. Trace elements concentrations and Hf isotopes were measured on residual washes from previously published U-Pb column chemistry along with supplementary measurements using laser ablation. The combination of new and published U-Pb ages, Hf isotopes and trace element ratios imply that the volcanic rocks deposited in these basins was derived from a continental arc setting. Also, the zircon from the two basins exhibit similar trace element trends through time, suggesting that the basins were in close proximity ca. 2.5 − 2.45 Ga. Zircon compositional data suggest an intermediate to mafic source for the volcanism in both basins with the depth of magma genesis potentially shifting to a deeper location over time. Hf isotope data in the Hamersley Basin depict a gradual shift towards less depleted εHf values over time. Trace element analyses from apatite in the Hamersley Basin will also give insight on the volcanic source of the ashes but also on the oxidation state of the arcs that created these ashes. Finally, new CA-ID-TIMS data helped us constrain possible large-scale glaciation during the Paleoproterozoic.