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Isotopic constraints on fluid evolution and ore precipitation in a sediment-hosted Pb-Ag-Ba-Zn-Cu-Au deposit in the Capricorn Orogen, Western Australia

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Abstract

The Abra Pb-Ag-Ba-Zn-Cu-Au deposit in the Capricorn Orogen, Western Australia is primarily a lead and silver resource currently estimated at 47.8 Mt (indicated and inferred) of 7.3-10.1 % Pb and 18-28 gt^{-1} Ag, although significant Cu-Au zones are also identified. The deposit is unique within sediment-hosted Pb-Zn deposits for its low Zn content, significant Cu-Au zone and high Fe content, providing a case study where the source of fluid and ore-forming processes are contentious. The combination of whole-rock hydrogen and oxygen isotope data, in situ oxygen isotope data in quartz, and in situ sulphur isotope data of pyrite and chalcopyrite, has been used to reconstruct a complex history of overprinting, involving stages of sedimentation, diagenesis and hydrothermal activity. The host sedimentary rocks consist of detrital quartz ($\delta^{18}O$ ~11-18 ‰) and whole rock $\delta^{18}O$ values (~9-16 ‰) reflecting the combined composition of detrital and authigenic minerals, diagenetic-metamorphic exchange, chlorite and iron content. Quartz in recrystallised chemical sedimentation, quartz cementation, and quartz-barite veins at low temperatures (~100-250°C) involved