# Mass independent sulfur signature in Archean orogenic Au deposits

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Sulfur plays a critical role in the formation of most mineral systems. The source of sulfur in orogenic gold systems has been controversial. [1] emphasise metamorphic devolatilisation of sedimentary rocks in greenschist to amphibolite facies as a primary source of sulfur. Conversely, [2] prefer a mantle source and exclude the presence of crustally derived sulfur in Archean orogenic systems mainly on the basis of an apparent lack of mass independent fractionated sulfur ($\Delta^{33}S$).

The Neoarchean Paulsens orogenic Au system in the Hamersley Basin of the northern Capricorn Orogen, Western Australia, is situated within a sequence of mafic volcanic and sedimentary rocks, primarily black graphitic shale with fine interbeds of siltstone and minor sandstone lenses. Mineralisation is lithologically bound by the Paulsens Gabbro and exists in massive pyrite and as free gold associated with massive pyrrhotite and graphitic stylolites.

Sulfur isotope analysis by fluorination was performed on pyrite and pyrrhotite bearing samples that were selected to be representative of the overall diversity of mineralisation in the deposit. We report $\Delta^{33}S$ values of between 0.215 and 0.448, $\Delta^{36}S$ values of between -1.01 and -0.03 and $\delta^{34}S$ values of between -0.027 and 0.720 (reported in permil relative to Vienna Canyon Diablo Troilite ,V-CDT).

Even if a mantle component cannot be ruled out, these data clearly show that crustally derived sulfur – most likely Archaean sedimentary pyrite [3] - plays a crucial role in the formation of the Paulsens orogenic system It is unclear whether the primary source is locally derived by nearby black shale hosted pyrites or from other deeper and not exposed sulfur resrvoirs.

[1] Phillips & Powell (2010) *Met. Geol.* **28**, 689-718. [2] Xue *et al* (2013) *Geology* **41**, 791-794. [3] Farquhar *et al* (2010) *Econ. Geol.* **105**, 509-533