Multiple sulfur isotope geochemistry of the Paleoarchean Onverwacht Suite, Barberton Greenstone Belt, South Africa

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Sulfur mass independent fractionation (S-MIF) in the Archean sedimentary rocks could be a useful new tracer for Archean sulfur cycles. Farquhar et al. (2000) first discovered that Archean sedimentary rocks before 2.4 Ga have $\Delta^{33}S$ anomaly, whereas no such anomaly was found in the younger samples. This contrast implies the rise of atmospheric oxygen content that fundamentaly changed atmospheric sulfur cycle. Recently, detailed $\Delta^{36}S/\Delta^{33}S$ slope analysis provide an insight into the atmospheric changes in the abundances of gas species, such as SO_2, CO_2, CO, CH_4. High-resolution stratigraphic studies provide a detailed view into the late Archean marine sulfur cycle, which can help our understanding of both atmospheric and biological processes. To compare early and late Archean, it is necessary to investigate stratigraphical and petrological aspects with variations of the multiple sulfur isotopes before 3.0 Ga. We have studied Palaeoarchean sedimentary sulfides that are well preserved in the Barberton Greenstone Belt, South Africa. Sulfur isotope analysis of extracted sulfides show a clear MIF ($\Delta^{33}S > 1‰$) and $\delta^{34}S$-$\Delta^{33}S$-$\Delta^{36}S$ correlation. The Noisy Complex, which consists of fluvial sediments and diamictities, show negative $\Delta^{33}S/\delta^{34}S$ correlation with a $\Delta^{36}S/\Delta^{33}S$ slope of -0.9. On the other hand, the Kromberg Complex, which comprises deep marine sediments, have positive $\Delta^{33}S/\delta^{34}S$ with a scattered $\Delta^{36}S/\Delta^{33}S$ slope. The $\Delta^{36}S/\Delta^{33}S$ slope changes from -0.6 to -0.9 within a single stratigraphic sequence. Stratigraphic change in $\delta^{34}S$-$\Delta^{33}S$ trend possibly reflects variation in local environments and/or microbial sulfate reduction activity. The $\Delta^{36}S/\Delta^{33}S$ change may suggest perturbation of atmospheric gas species from early to late Archean.