The Origin of Banding in BIFs: I. Ge-Si and REY systematics in the Neoarchean Temagami IF, Canada

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The origin of the prominent banding in *banded* iron-formations (BIF) is still controversially discussed, with some suggesting a primary depositional and others a secondary diagenetic origin. Germanium and Si show coherent behavior in igneous and clastic rocks, but are fractionated during weathering and hydrothermal water-rock interaction, resulting in slightly lower Ge/Si in river waters and significantly higher Ge/Si in marine hydrothermal fluids compared to their respective source rocks. While siliceous precipitates show little fractionation of Ge and Si relative to ambient water, experiments showed preferential scavenging of Ge onto ferric hydroxides, which is also observed in some Fe oxide deposits. Nevertheless, Fe oxide bands with high Ge/Si in BIFs are considered to have formed during times of intense marine hydro-thermal activity, while low Ge/Si (meta)chert bands precipitated during times of hydrothermal quiescence and dominant riverine input into the ocean. This model is, however, controversially discussed and needs verification due to potential Ge-Si fractionation by the Fe oxides.

I*n situ* microscale analyses by Laser Ablation High-Resolution ICP-MS of the exceptionally pure and pristine 2.7 Ga old Temagami IF reveals the origin of the banding of BIFs. REY patterns for the Fe- and Si-bands show minor but systematic differences in La/Yb, but not in Y/Ho between the bands, i.e. no evidence of diagenetic redistribution. Ge-Si-Fe data follow a conservative 2-component mixing line between a low-Ge/Si, low Fe/Si endmember and a high Ge/Si, high Fe/Si endmember. The systematic difference of up to one and a half orders of magnitude between the Ge/Si of adjacent magnetite and metachert layers is similar to the difference between modern riverine and hydrothermal Ge/Si, suggesting marine hydrothermal fluids and continental runoff as dominant element sources in the Fe- and Si-bands, respectively. Our data reveal that the ultrapure Temagami BIF is an archive that allows to investigate whether these two types of BIF bands also show other source-specific trace element or isotope characteristics, which will reveal a depositional (i.e. source-related) or diagenetic control on Ge/Si, and clarify the origin of the banding of BIFs. This will be presented in an accompanying presentation.