Chemical composition of Archaean hydrothermal fluids from the Dresser formation (Pilbara Drilling Project, Australia)

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The environmental conditions that prevailed during the Archaean are poorly known. Understanding such conditions (e.g., composition and temperature of the Archaean atmosphere and oceans) is essential to assess the possibility of a biologic activity at that time.

Pristine drill core samples (Pilbara Drilling Project) from the 3.525 Ga chert-barite deposit of the Dresser Formation allowed investigating fresh samples preserving primary fluid inclusions unaffected by surface weathering. Dresser Formation has been interpreted as an evaporitic basin strongly affected by hydrothermalism, thus raising the possibility that several fluid populations of different origin can be trapped as fluid inclusions in the samples studied. Foriel et al. [2] investigated individual fluid inclusion composition in intrapillow quartz pods overlying the chert-barite deposit using synchrotron X-ray microfluorescence technique and showed the occurrence of three different populations of fluids: a Ba-rich and a Fe (+Ba)-rich fluids of hydrothermal origin , and a metal-depleted fluid interpreted to represent the «North Pole Seawater» endmember.

Using the same analytical procedure, we have determined the chemical composition of primary fluid inclusions trapped in hydrothermal quartz from vacuolar komatiitic basalt sampled 100 m deeper than intrapillow quartz pods, at the base of the Dresser formation. The three end-member fluids seen in [2] are also present in the studied samples, but in different proportions, the metal-depleted fluid being siginifcantly less abundant. These results suggest gradual dilution of deeply derived hydrothermal fluids by a metal-poor component of surficial origin towards the top of the sequence, hence supporting the view that the Dresser Formation is ideally suited for investigating surface early Archean sub-surface processes.

References

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[2] Foriel J., Philippot P., Rey P., Somogyi A., Banks D. and Ménez B. (2004) EPSL, 228, 451-463.