

Greigite : a biomineral of hydrothermal chimneys?

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Greigite Fe_3S_4 is a sulfide containing both Fe^{2+} and Fe^{3+} ions. It has been reported at hydrothermal sites as a minor phase. Thermodynamic calculations using a geochemical software (Chess) performed on hydrothermal fluid compositions show that no greigite is predicted to precipitate. On the other hand, we have observed in experiments that abundant greigite precipitates at 85°C on hyperthermophilic archaea (*Thermococcales*) isolated from chimneys, at the surface of cells and on extrapolymeric substances. It is well known that greigite can form as a result of interactions between pyrite and zero valent sulfur and that *Thermococcales* can carry sulfur vesicles [1] but in this case there are no evidences of a relation between vesicles, sulfur and greigites. Moreover, some cells of *Thermococcales* having not contained any sulfur are surrounded by abundant greigites. Instead, we observe that greigite is systematically growing at the expense of iron (III) phosphates which are formed in the immediate vicinity of the cells. Thermodynamic calculations are consistent with this pathway of greigite formation which provides a mechanism of greigite biomineralization in hydrothermal chimneys.

[1] Gorlas E, Marguet E, Gill S *et al.* (2015) *Biochimie*, 118, 356-364.