Grazing and digestion of magnetotactic bacteria by ciliates

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Magnetotactic bacteria accumulate iron in cytoplasmic nano-sized magnetic particles called magnetosomes. Protozoa grazing on magnetotactic bacteria can potentially recycle the iron trapped in magnetosomes during the digestion in the predator. "*Candidatus* Magnetoglobus multicellularis" is a multicellular magnetotactic prokaryote that produces over a thousand greigite (Fe_3S_4) magnetosomes (estimated mass of iron = 1.2×10^{-12} g). In vitro experiments showed that the ciliate *Euplotes vannus* can graze and completely digest "*Ca.* M. multicellularis" [1] and its magnetosomes at a rate of 2.5 individuals . $ciliate^{-1}$. h^{-1}, potentially recycling 7.2×10^{-11} g of iron. $ciliate^{-1}$. day^{-1}. Thin section transmission electron microscopy showed that the prokaryotes are deposited within single vesicles in the cytoplasm of the ciliates. We used elemental mapping and electron energy loss spectroscopy to detect oxygen, iron and sulfur in magnetosomes at different stages of digestion. In partially digested magnetosomes, each particle is surrounded by an oxygen-rich electron-lucent shell. Oxygen can react with iron from greigite to form a shell of iron oxide [2] and this is possibly an intermediate step between the intact and the amorphous, almost completely digested magnetosome. Dissolution of magnetosomes by grazing protozoa seems to an efficient process to recycle iron.

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[1] Martins *et al.* (2007) *Environ. Microbiol.* **9**, 2775-2781. [2] Letard *et al.* (2005) *Phys. Scripta* **T115**, 489-491.

Double-layered polymorphs of $MAl_2Si_2O_8$ (M=Ba,Ca) and aluminosilicate melt structure

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Minerals serve as standards with known structure at the studying of glass and melt structures by physical methods: NMR, EXAFS, etc. $MAl_2Si_2O_8$ (M=Ca, Sr, Ba) are usually treated as a standard of the framework structure but they can also form phylosilicate modifications. These modifications have as a rule lower density and form at elevated temperatures ensuring better applicability to the melt and glass structure. We charaterize hexa-$BaAl_2Si_2O_8$ (layered) solid solutions with $BaAl_2O_4$ and SiO_2 synthesized from the melt and natural hexa-$CaAl_2Si_2O_8$.

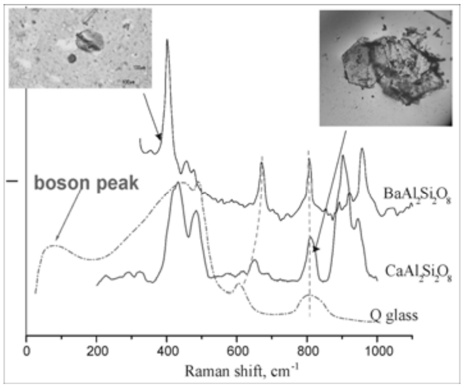

Figure 1. Raman spectra of the synthesized hexa-$BaAl_2Si_2O_8$, hexa-$CaAl_2Si_2O_8$ and silica glass [1].

Vibrational spectra of layered silicates are characterized by the presence of the band around 800 cm^{-1} in Raman and group of bands around 630-670 cm^{-1} in IR and Raman spectra. We prescribe these features to the vibrations associated with apperently vertical due to oxygen rotation T-O-T bonds connecting layers of the six-memered alumino-silicate rings in the mineral structure. We find similarity between Raman spectra of the studied phylosilicates and one of the silica glass [1] known as a structural analogue of the high temperature β-crystobalite with all T-O-T angles equal 180° [2]. Transition of aluminosilicate network to the locally layered topology is expected at the melting of anorthite.

[1] Sigaev *et al*. (1999) *J. Non Crystal. Solids* **248**, 141-146. [2] Keen and Dove (1999) *J. Phys.Condens. Matter* **11**, 9263.