

## Rock boring fungi in subseafloor basalts

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Fossilized fungal hyphae in subseafloor basalts bear witness of extensive weathering and tunneling in vein and vesicle filling secondary mineralisations (carbonates and zeolites). The minerals have been chemically dissolved and penetrated by the fungal hyphae, which have produced and occur in complex mycelium-like networks within the minerals. The hyphae frequently branch and anastomoses between branches occur, a mechanism that is not fully understood. Rock boring hyphae in subseafloor basalts have been observed from two separate locations: the Emperor Seamounts, Pacific Ocean, and the volcanoclastic apron of Gran Canaria, Atlantic Ocean, thus, it is not an isolated phenomenon [1]. Selection towards Fe-rich carbonates (siderite) over Fe-poor carbonates (calcite) indicates a possible trophic strategy in a few samples. Otherwise, the strategy of tunnelling probably is due to migration through the system or acquiring of habitable space. Subseafloor, hydrothermal settings are dynamic environments characterised by extreme shifts in, for example, temperature or pH, thus, the tunneling can be a response mechanism to environmental stress. Fungi are known as a powerful geobiological agent in terrestrial environments that promotes mineral weathering and decomposition of organic matter. It is probable to assume that fungi would play a similar role in the ocean crust and mediate weathering and mobilization of elements.

[1] Ivarsson *et al.* (2011) *Astrobiology* **11**, 633-650.

## XAFS investigation for sorption mechanism in As(V) coprecipitation with ferrihydrite

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Coprecipitation method using ferrihydrite has been commonly applied to remove As(V) from acid mine drainage. However, the mechanism in coprecipitation is unclear. Therefore, it is demanded to clarify how coprecipitation of As(V) with ferrihydrite occurs in acid mine drainage.

In the previous paper, we investigated the sorption mechanism of dilute As(V) with ferrihydrite using three kinds of experimental studies for an artificial wastewater in which the ion strength was 0.05 and pH was 5; (i) sorption isotherm formation, (ii) zeta potential measurement and (iii) XRD analysis. We already confirmed that As(V) was formed a simple two-dimensional adsorption onto the surface of ferrihydrite when the initial As/Fe molar ratio was less than 0.4, whereas a surface precipitation of amorphous ferric arsenate was formed when the initial As/Fe molar ratio was more than 0.4 [1]. In this study, XAFS analysis was conducted to know more detail mechanism of As(V) sorption to ferrihydrite in coprecipitation process. Additionally, the effect of ionic strength to As(V) sorption mechanism with ferrihydrite in coprecipitation process was also discussed.

Both of XANES and EXAFS analysis on K-edge of As showed As(V) coprecipitates with ferrihydrite was mixture of As(V) adsorbed ferrihydrite and amorphous ferric arsenate. When the ion strength was 0.05 in an artificial wastewater containing As(V), estimated weight ratio of amorphous ferric arsenate in As(V) coprecipitates became above 0.5 when the initial molar ratio of  $As/Fe \geq 0.5$  was used. These results corresponded with results by XRD analysis. EXAFS analysis assuming one surface complex for As-Fe bond showed the coordination number of As to Fe in As(V) coprecipitates increased with increasing the initial molar ratio of As/Fe. Moreover, EXAFS analysis assuming three kinds of surface complexes for As-Fe bond showed the coordination number for 2.85 Å of As-Fe bond increased and it for 3.24 Å of As-Fe bond decreased with increasing the initial As/Fe molar ratio. All experimental data obtained in this study showed As(V) coprecipitation mechanism shifted gradually from As(V) complexation to the surface of ferrihydrite toward amorphous ferric arsenate.

On the other hand, when the ion strength was 0.5, the sorption density of As(V) to ferrihydrite obtained from coprecipitation process was lower than it at ion strength of 0.05. Results of XRD and XAFS analysis revealed that the formation of surface precipitation was prevented when the ion strength was high, whereas simple two-dimensional adsorption of As(V) onto the surface of ferrihydrite was not so prevented by the higher ion strength.

[1] C.Tokoro, Y.Yatsugi, H.Koga and S.Owada (2010) *Environment Science and Technology*, **44**, pp.638-643.