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Contrasted pressure effects on sulfur-oxidizing activity of *Thiobacillus thioparus* and *Thiobacillus denitrificans*

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Carbon capture and storage technologies are crucial for reducing carbon emission from power plants as a response to global climate change. The CarbFix project (Iceland) aims at examining the geochemical response of injected CO_2 into subsurface reservoirs. After an injection of a fast-flowing CO_2-rich fluid in March 2012 that provoked the dissolution of the host-basalt, Trias *et al*. [1] showed that subsurface groundwater microbial communities indeed reacted quickly to the anthropogenic injection of CO_2-rich water. It reduced bacterial diversity and induced the development of iron-oxidizing bacteria, among others. Two months after the injection, under more anaerobic conditions, *Thiobacillus* species bloomed, suggesting an important role of the latter sulfur-oxidizing bacteria after CO_2 injection into basalt. The potential role of the subsurface biosphere has been little investigated up to now in such systems. Here, we used *Thiobacillus thioparus* and *T. denitrificans* that likely became abundant at the CarbFix1 pilot site after injection of CO_2 and purified geothermal gases in basaltic aquifer at 400-800 m depth (4–8 MPa). The capacity of *T. thioparus* and *T. denitrificans* to oxidize thiosulfate was measured by Raman spectroscopy as a function of pressure up to 10 MPa. The results show that the growth and metabolic activity of *T. thioparus* are influenced by the initial concentration of the electron donor thiosulfate. It grows best at low initial concentration of thiosulfate and best oxidizes thiosulfate into sulfate at 0.1 MPa with a yield of 14.7 %. *T. thioparus* is piezosensitive and sulfur oxidation stops at 4.3 MPa [2]. Interestingly, *T. denitrificans* appears to be piezotolerant up to 8 MPa at least, uses a metabolic pathway for thiosulfate oxidation with tetrathionate as an intermediate, that is different from *T. thioparus.* The metabolic activity of *T. denitrificans* increases and evolves as a function of pressure to 8 MPa. These results indicate that autotrophic sulfur oxidizing species can thereby react to the injection of acidic fluids down to 430 m and 800+ m depth and may contribute to induced biogeochemical cycles during subsurface energy operations.

[1] Trias et al., 2017. doi : 10.1038/s41467-017-01288-8

[2] Osman et al. 2021. doi:10.1111/1758-2229.12922