A mechanism for preservation of ~3.5 billion-year-old microbial alteration textures in pillow basalts from the Barberton Greenstone Belt

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Numerous studies of volcanic basaltic glass from the oceanic crust have demonstrated the importance of endolithic microbes in the alteration process. Microbial dissolution features are ubiquitous within the upper few hundred meters of modern oceanic crust, having been discovered in basalts of all ages, wherever fresh glass is preserved. Recent work in ophiolites and greenstone belts has extended the evidence for microbial alteration of oceanic basalts as far back as the Archean in ~3.5 Ga pillow lavas from the Barberton Greenstone Belt (BGB) in South Africa [1]. The BGB pillow lavas are metamorphosed to greenschist facies but are exceptionally well-preserved and undeformed in places. The formerly glassy rims of the BGB pillow lavas are easily recognized in outcrop and contain micron-sized, microbially generated, tubular structures mineralized by titanite. These structures are interpreted to have initially formed during microbial etching of the originally glassy pillow rims. Here we present new data from pillow lavas in recent oceanic crust and Phanerozoic ophiolites that elucidates an early and effective mechanism for the preservation of delicate microbial etching textures. We demonstrate that titanium is enriched in areas of microbial dissolution of basaltic glass. Early seafloor hydrothermal circulation of calcium- and silica-bearing fluids soon after formation of the microbially etched tubes causes the residual titanium to be sequestered in titanite. The early precipitation of sub-micron titanite grains within the biologically etched tubes serves as an agent for preservation that may persist for geologically extended periods of time in the absence of later penetrative deformation.

References

[1] Furnes et al., (2004) *Science* **304**, 578.

Dinosaur soft tissues

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In the summer field season of 2003, the Museum of the Rockies recovered elements of the oldest recorded Tyrannosaurus rex at the base of the Hell Creek Formation in Eastern Montana. Demineralization of bone tissues from the femur of this animal revealed the presence of soft, transparent and pliable soft tissues. In addition to the soft vessels, three populations of microstructures with cell-like morphology and internal structure were identified. These microstructures exhibited at least two different modes of preservation. Preliminary analyses indicate that original molecular components may be preserved as well. We examine the modes and degree of preservation, and discuss possible biogeochemical and environmental interactions that may have contributed to preservation.