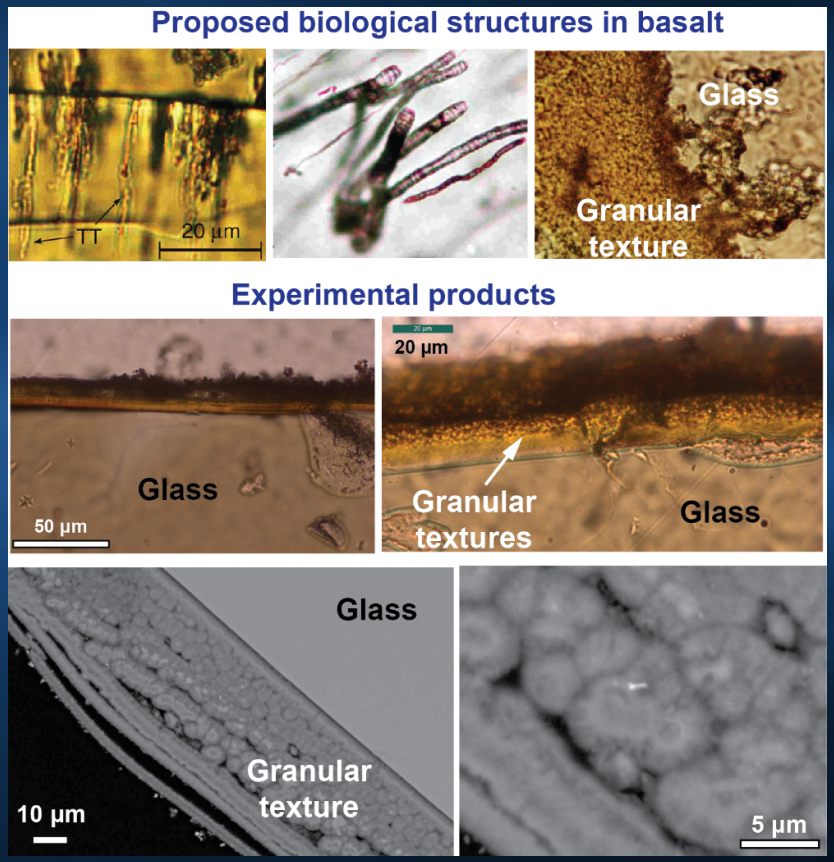
NASA Astrobiology Institute

Microtubules in Subsurface Basalts: Biological Origin or Not?

BACKGROUND: It has been proposed that microscopic tubules found in basaltic glass from the ocean crust are formed by microorganisms living in the deep subsurface. A direct connection with biological activity has not yet been demonstrated, however, an investigation into potential non-biological origins for these structures has received little attention. We conducted an exploratory laboratory experiment to determine whether tubules would form during hydrothermal seawater-rock interactions in the absence of biological activity.



THE RESEARCH: Reaction of basalt glass with artificial seawater for 48 days at 150ºC did not produce any structures resembling microtubules. However, the reaction did produce granular textures that resemble other features in subseafloor basalts that have been attributed to biological processes. The granular textures are far more prevalent in natural samples than the microtubules, so their formation by non-biological means may indicate that subsurface biological activity is less extensive than some studies have suggested.

TAKE-HOME: While the results do not conclusively resolve whether or not the microtubules have a biological origin, they do place some limits on the conditions that might allow their formation by non-biological processes.

Images: Staudigel et al., *Earth Sci. Rev.* (2008); Furnes et al., *G-cubed* (2001), and this work.

McCollom & Donaldson, *Astrobiology*, 19, 53-63 (2019).