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Oldest methanogens from subseafloor hydrothermal environment, South Africa

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Subsurface habitats on Earth host an extensive extant biosphere and likely provided one of Earth's earliest microbial habitats. Here, we present ~3.42-billion-year-old carbonaceous filamentous microfossils as investigated over a range of scales (optical microscopy, Raman, ToF-SIMS, STEM, EELS, nano-XRF and XANES), that inhabited a palaeo-subseafloor hydrothermal vein system [1] of the Barberton greenstone belt (BGB) in South Africa. We demonstrated that the studied filaments likely provide the oldest direct evidence for subsurface methanogens. These findings strengthen the concept of hydrothermal springs as the likely site of life's origin, and expand the frontiers of the habitable early Earth.

[1] Hofmann, C. Harris Silica alteration zones in the Barberton greenstone belt: a window into subseafloor processes 3.5–3.3 Ga ago. *Chem. Geol.* **257**, 221–239 (2008).