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Earth's oldest microbial biomarkers in pillow lavas: a new geological setting in the search for early life

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Pillow lava rims and associated pockets of interpillow hyaloclastite from the ~3.5 Ga Hooggenoeg and Kromberg Formations of the Barberton Greenstone Belt (BGB) in South Africa and the 3.35 Ga Euro Basalt of the Pilbara Craton (EBP) in Western Australia contain micron-scale, mineralized tubes (mainly titanite-filled) that provide evidence of submarine microbial activity during the early history of the Earth. The tubes formed during microbial etching of glass along fractures, as commonly seen in the glassy pillow lava rims from recent oceanic crust. The margins of the tubes may contain organic carbon and many of the pillow rims exhibit isotopically light bulk-rock carbonate $d^{13}C$ values, supporting their biogenic origin. Overlapping metamorphic and magmatic dates from the pillow lavas (of the BGB) or direct dating of the titanite-filled tubules by *in situ* laser ablation muliti-collector-ICP-MS (of the EBP) suggest microbial life colonized these subaqueous volcanic rocks soon after eruption, i.e. for the BGB pillow lavas almost 3.5 billion years ago.

Archean microbial biosignatures preserved in pillow basalts from greenstone belts may have the potential to elucidate not only the presence of early life on Earth but also possibly the conditions under which life began on our planet.