

Active methanogenesis by a microbial consortium enriched from a meteorite impact crater

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Microbial methanogenesis is an important metabolic process in the terrestrial deep biosphere, as well as a biosignature in the search for extraterrestrial life on e.g., Mars where methane seeps from the Gale meteorite crater [1]. However, reports of active deep biosphere methanogenesis are generally scarce and are particularly lacking in Mars analogues, such as terrestrial meteorite impact craters. Here we show that microbial cultures enriched from indigenous populations at 400 m depth in the Devonian Siljan meteorite impact structure in Sweden actively produced methane from several carbon donors, including oil from the impact crater site itself. The metagenomic and metatranscriptomic data revealed a methanogenic consortium, that mediated methanogenesis via the methyl-reduction pathway. These results provide insights into methylotrophic methanogenesis in deep fractured meteorite impact structures on Earth and context for exploration of biosignatures in similar settings on Mars.

[1] Webster, C. R., *et al.* (2015). Mars methane detection and variability at Gale crater. *Science*, 347 (6220), 415–417.