Methanogenesis with dunite as the only source of H_2 and Ni

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The deep, sub-surface oceanic crust has the potential to sustain a methanogenic deep biosphere through aqueous weathering of ultramafic minerals (serpentinization) and the concomitant production of H_2 and release of essential trace metals [1-4]. Until now, however, no studies have been able to experimentally show that methanogens could actually grow on altering ultramafic minerals. Here we show that the archaeal strain MAB1 (strain isolated at SLU, *M. bourgensis* strain MAB1):

1) grows for 427 days with dunite as sole source of H_2
2) grows for 427 days with dunite as sole source of Ni
3) grows faster with dunite as only source of Ni
4) survival of MAB1 for 427 days with no added Ni or H_2

A set of experiments was prepared in which dunite powder was added to a Ni-depleted growth medium together with MAB1. The selection of MAB1 was made because of its ability to grow at extremely low H_2 pressures as well as its flexibility to grow in both nutrient rich and nutrient poor environments. A slow but clear growth could be observed already after 50 days. After 305 days a distinct difference could be observed between the olivine and non-olivine experiments. In some of the experiments, MAB1 survived over 1 year even without any added H_2 or Ni. Our results indicate that methanogenesis in the deep oceanic crust is possible and may be much more robust than previously thought. Our results have implications on a serpentinization-driven deep biosphere on Earth and possibly on other planets.

[1]Hellevang H. (2008) *Int. J. of Astrobiology* **7**,157–167 [2]Klein F. et al.(2009) *Geochim Cosmochim Acta* **73**, 6868–6893 [3]McCollom, T.M., 2007, *Astrobiology* **7**, 933-950 [4]Nealson et al. (2005) *Trends in Microbiology* **13**, 405–410.