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SOIL FERTILISATION BY GLACIAL MICROBIAL COMMUNITIES IN A MARTIAN ANALOGUE ENVIRONMENT

Abstract

Sending humans to Mars and the human colonisation of the planet have been the subject of extensive space research for decades. Human exploration of Mars may be achieved before the end of this century. However, developing the means to grow food on Mars remains one of the major challenges that needs to be overcome before this becomes a reality. A variety of techniques have been tested previously for life support systems in space and to produce food on Mars. This is the first study to use microbial communities for soil fertilisation by producing and recycling organic matter efficiently in simulated Martian conditions. Microorganisms from the surface of the Greenland Ice Sheet were mixed with Martian analogue sediment in the 'Martian casserole' simulation experiment at the Mars Desert Research Station in Utah, USA. These glacial microbes were known to produce significant amounts of organic matter when stimulated by minimal amounts of nutrients. In less than three months, these microbes were found to produce and accumulate organic carbon with concentrations up to 7.3 +/- 0.5 mgOC/g of sediment, despite the desert environment and anoxic conditions. The organic carbon production was dependant on photosynthetic activity, water saturation, nitrogen and phosphorous mining out of sediment, and nutrient recycling by heterotrophic microbes. These microbial communities are thus promising candidates for future soil fertilisation in Martian greenhouses, and even for terraforming the planet. Similar approaches could also be applied to developing soil fertilisation techniques for countries in the world struggling with nutrient deprived soils.