Seasonal variation in biological methane production in a subglacial ecosystem

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Reports of seasonal plumes of methane emanating from the near sub-surface of Mars have fueled speculation that they may be the result of biological activity. The biological production of methane is catalyzed by a unique group of anaerobic archaea, the methanogens. Common to all methanogens is a unique metabolic pathway that enables methane production from a limited number of substrates such as H_2 + CO_2, formate, CO, methanol, methylamines, and acetate. Methanogens live close to the thermodynamic limit of life, a problem exacerbated at extremes of cold temperature. Here, we present genetic, physiological, geochemical, and thermodynamic data in support of the presence of a unique and active assemblage of methanogens in the near freezing (~0-1°C) and oligotrophic subglacial environment of Robertson Glacier, Alberta, Canada. Dominant methanogens present in the RG sediments may constitute a new order that bridges the physiologically distinct *Methanomicrobiales* and *Methanosarcinales* lineages. Methane flux measurements (2011) indicate seasonal variation in the release of methane from this permanently cold extraterrestrial analog environment.

What are the ^{146}Sm-^{142}Nd reference parameters for the Earth?

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Since the first publication of high precision ^{142}Nd/^{144}Nd ratios in chondrites [1], different early Earth differentiation models have been proposed. The excess in ^{142}Nd measured in terrestrial samples relative to the average chondrite value requires that all terrestrial rocks sampled by volcanism over the Earth's history come from a geochemical reservoir characterized by a super-chondritic Sm/Nd ratio. Some authors proposed that the complementary enriched reservoir has been lost during the Earth's accretion [2,3] whereas others suggested that a hidden reservoir may have been preserved in the deep Earth [1,4]. The measurement of stable Sm and Nd isotope ratios in chondrites has created additional confusion in the interpretation of ^{142}Nd deviation. Different groups of chondrites clearly have different ^{142}Nd signatures and variations in stable Sm and Nd isotopes were found [5-7], all of which likely reflect different mixtures of r-, s-, and p-process nucleosynthetic products.

We will present a summary of the data available on Sm-Nd systematics of chondrites as well as new data obtained on enstatite chondrites (whole rocks and leaching experiments), achondrites and CAIs from CV3 chondrites. On the basis of these results, carbonaceous chondrites must be considered as a minor constituent of the Earth. Enstatite chondrites overlaps with the terrestrial ^{142}Nd/^{144}Nd ratio. CAIs Sm/Nd-^{142}Nd/^{144}Nd isochrons pass through the terrestrial value.

Considering the level of precision now achieved on Sm-Nd isotope measurements and looking at the results obtained on stables Sm and Nd isotopes our opinion is that the Earth-chondrite difference in ^{142}Nd suggests that silicate part of Earth experienced a very early differentiation event. However these models will be discussed considering these new results.

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