Looking for signs of early life

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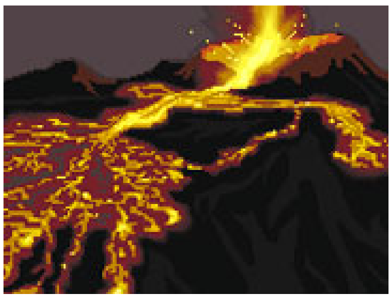

(PhysOrg.com) -- Deciphering the very early history of life on Earth is difficult. In the darkest recesses of the first billion years there are no 'body' fossils - no physical remains. Instead, scientists use chemical signals left behind in the rock record.

Methanogens are single cell microorganisms that make their energy by converting either simple organic compounds or carbon dioxide and hydrogen to methane. Nickel, an important nutrient for these organisms, may be a useful chemical signal to pinpoint the early origins of life on Earth, according to researchers at the University of Bristol, UK, and Penn State University, US.

Dr Vyllinniskii Cameron, lead author on the paper published recently in *PNAS*, said: "Life has had a profound chemical impact on our planet - the most spectacular effect being the high oxygen content of our atmosphere, which is a result of photosynthesizing algae, plants and some bacteria producing oxygen as a waste product.

“But photosynthesis as a means of producing energy for life is a relatively new kid on the block in terms of evolution, probably originating no more than about 2-2.5 billion years ago. Before that, other life modes such as methanogens dominated.”

Methanogens and their metabolisms are probably key to development of the early Earth. Not only are they one of the most primitive organisms on Earth, but their waste product - methane - may have been the dominant greenhouse gas on the early planet. Many scientists believe that it was methane that made early temperatures on Earth equable, despite the fact that the Sun was about 30% weaker in the early stages of the Solar System.

A chemical marker for methanogens in rocks is therefore to be greatly sought after. Cameron and colleagues suggest that the isotopes of nickel may represent such a marker.

Fractionation of an element into its component stable isotopes occurs because each isotope is slightly different in mass. Biological organisms tend to favour one isotope over another and preferentially create stores of heavy or light isotopes that researchers can measure. The presence of a specific isotopic fraction can indicate that a biological process took place. Previous researchers have looked at transition metals other than nickel as potential biomarkers.

For this work the researchers did not look at ancient fossil cells, but grew modern day methanogens in the laboratory, controlling their habitat and recording their rate of methane production. They showed that these microbes take up the isotopes of nickel in a very specific way, suggesting that a search for this distinctive nickel (bio)signature might serve as a marker for the existence of methanogens on the early Earth -

and, perhaps, on other planets.

More information: A biomarker based on the stable isotopes of nickel by Vyllinniskii Cameron, Derek Vance, Corey Archer and Christopher H. House. *PNAS*, July 7, 2009. www.pnas.org/content/early/200 … /0900726106.abstract

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