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Envoyer

Organic Analysis of Peridotite Rocks from the MAR

Details

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- Identifier** P43C-1441
- Authors** [Bassez, M, Chimie, Universite de Strasbourg, IUT, 72 route du Rhin, Illkirch, France](#)
[Takano, Y, Japan Agency for Marine-Earth Science and Technology, Institute of Biogeosciences, Yokosuka, Japan](#)
[Ohkouchi, N, Japan Agency for Marine-Earth Science and Technology, Institute of Biogeosciences, Yokosuka, Japan](#)
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Abstract

At the bottom of the terrestrial oceans, where tectonic forces separate the lithospheric plates along mid-ocean ridges, the ultramafic rocks of the upper-mantle, the peridotites, are exposed to circulating seawater and the hydrolysis of their silicate constituents, the olivine and pyroxenes minerals, into serpentine, occurs at various degrees. The H₂, released during the serpentinization process, could react with the CO₂ embedded inside the rock, to form methane and saturated hydrocarbons, in the context of catalytic reactions involving hydrothermal CO₂. As a consequence, the simple molecules H₂O, H₂, CO₂, CH₄, could be present inside the rock and, with the N₂ of the environment and an activation source, they could lead to simple organic molecules of biological relevance. Serpentinized peridotite rocks located on hydrothermal sites could consequently contain organic molecules, including amino acids. Some similarities with the Murchison meteorite can be noticed and are described. In order to verify this hypothesis, we conducted preliminary experimental analyses of the organic content of two serpentinized peridotite rocks of the Ashadze (12° 58'N, 4,080 m) and Logatchev (14° 43'N, 2,970 m) hydrothermal sites in the Mid-Atlantic Ridge. The samples have been dredged on the seafloor in march 2007, during the French-Russian Ifremer Serpentine cruise. Polar and non polar fractions of the grounded samples have been analysed by gas chromatography/mass spectrometry techniques. We identify a wide variety of amino acids including protein and non-protein amino acids. Our analyses show that the identified amino acids are L-form predominant: for the Ashadze peridotite rock, for instance, the D/L ratio is 0.18. The results also show similarities with the values on D/L ratios found for sedimentary amino acids. We conclude in a biological origin for the identified amino acid peaks. However some peaks remain unidentified. We also detect long-chain n-alkane compounds (< n-C₂₈H₅₈) in the non-polar fraction under GC conditions up to

220°C. The GC/MS of the n-alkanes shows a decrease in intensity with increasing carbon number, which seems to be a characteristic of abiotic synthesis. However, we do not conclude yet in a biotic or abiotic origin for the identified n-alkanes. The analyses are described at: <http://www.mdpi.com/1422-0067/10/7/2986/pdf>

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