AN HYPOTHESIS TO EXPLAIN THE PRESENCE OF AMINO ACIDS IN THE TAGISH LAKE METEORITE

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The carbonaceous chondrite meteorite Tagish Lake contains prebiotic organic matter abiotically synthesized and associated with magnetite. Four samples were analyzed [1]. They are composed of olivine- and pyroxene-bearing chondrules in a porous matrix of phyllosilicates, sulfides, magnetite and carbonates. The total abundances of amino acids decrease in the order 5.6 ppm for 11 h specimen, 0.9 ppm for 5b, 0.04 ppm for 11i and under detection limit for 11v, with an abundance of the nonprotein amino acid α- aminoisobutyric acid in specimen 11 h of 0.2 ppm, while an earlier analysis of D/L-α-ABA reported the value of 84 ppb [2] and another analysis reported a total amount of amino acids less than 0.1 ppm [3]. Glycine is the most abundant amino acid in 11 h and upon the isotope value $\delta^{13}C = +19\,^{0}/_{00}$ it is suggested to be of extraterrestrial origin. In 11 h, the enantiomeric ratios of alanine, β-amino-n-butyric acid and isovaline were racemic, while nonracemic isovaline was detected in 5b, with an L-enantiomeric excess ~ 7%, and no isovaline was identified in 11i. An hydrothermal alteration inside the parent body is proposed.

The above reported mineral assemblage can be representative of the anoxic hydrolyses and carbonations of ferro-magnesian silicates associated with the hydrolysis of iron(II) monosulfide, with production of hydrothermal H_2, as described by M.P. Bassez since 2013 [4] on the basis of thermodynamic calculations and E-pH diagrams analyses. It is shown that magnetite arises mainly from the anoxic hydrolysis of iron(II)- monosulfide at high T (250°C) (eqs 10, 10' & 11 of table 2 in [4]). This hydrolysis is highly endothermic, but can occur within the heat produced by the carbonations of the Fe- & Mg- silicates and by the hydrolysis of the Mg- silicates. The minerals which are formed are Fe(III)- phyllosilicates, ferric trihydroxide, goethite, hematite, and carbonates, as products of the carbonation and hydrolysis of Fe(II)Mg- silicates and magnetite as product of the hydrolysis of Fe(II)- monosulfides (cases 2 & 4 of table 3 in [4]). It is shown that these minerals, that I call geobiotropic minerals, can form in symbiosis with an assemblage of amino acids ressembling the prebiotic macromelecules produced in Kobayashi's experiments [5].

This demonstration leads consequently to the hypothesis that the amino acids of the Tagish Lake meteorite might form in symbiosis with hydrothermal hydrolyses and carbonations of Fe(II)Mg- silicates associated to Fe(II) mono-sulfides, in the process called geobiotropy.

References:

[1] Herd D. K. C. et al. 2011. *Science* 332:1304. [2] Kminek G. et al. 2002. *Meteoritics & Planetary Science* 37:697–701. [3] Pizzarello S. et al. 2001. *Science* 293:2236–2239. [4] Bassez M. P. 2017. *Origins of Life and Evolution of Biospheres,* DOI 10.1007/s11084-017-9534-5, on line March 31, http://rdcu.be/qxSs, & refs of MP Bassez herein. [5] Kobayashi K. et al. 1998. *Origins of Life and Evolution of Biospheres* 28:155–165.