A POSSIBLE BIOGEOCHEMICAL MODEL FOR MARS. A. de Morais, Brazilian Center of Physics Research (Rua Dr. Xavier Sigaud, 150, 3º andar, LAFEX, Urca, Rio de Janeiro, RJ, 22290-180, Brasil, Email: antonioamore@yahoo.com).

Introduction: The planet Mars has been studied for several years, and recently, with sophisticated spacecrafts – orbiters and rovers – analyzing its atmosphere and surface, it has become clear that the red planet passed through great atmospheric and geological disturbances at some 2 Gyrs ago. Mars indeed had a significant quantity of liquid water flowing through its surface and subsurface at that time, and now it is an arid and cold planet with a very thin atmosphere. The lack of a moon with the size of Earth's Moon makes Mars to have its spin axis slowly oscillating, thus producing geological epochs with much differentiated climates. The extensive volcanism at that time much possibly created subsurface cracks and caves [1] [2] within different strata, and the liquid water could have been stored in these subterraneous places, forming large aquifers with deposits of saline liquid water, minerals, organic molecules, and geothermal heat – ingredients for life as we know on Earth [3]. At the subsurface, iron-rich clays, such as montmorillonite and kaolinite, possibly catalyzed several organic chemical reactions. Clay minerals are excellent catalysers, and catalyze peptide bond formation in fluctuating environments. And it was found that extensive mechanical distortion produced on freezing and drying of these clay minerals produces unusual luminescent phenomena, during wet/dry cycled reaction sequence. This dehydration-induced emission of burts of UV and visible light, with peak emission λ = 365 nm (decaying monotonically in several hours and several days) from clays is possibly related to its catalytic mechanism by means of electronic excitation, creating mobile or trapped holes and electrons in the lattice [4] [5]. So, here in this paper, I propose that with a possible biogeochemical evolution below Martian surface at around 2 Gyrs ago, using clays' catalytic properties and the light emitted from them, there is a possibility that life arose at Mars from biomolecules up to a very simple organism form – simpler than Earth's Archaea organisms – deep within subsurface aquifers. Such kind of simple organisms, within extreme environments, might have evolved a two-way form to use energy – one at great depths, using geochemical energy by sulfur redox; and other near to the surface using the light emitted from clays at wet/dry cycles. At the surface, gravity would pull colonies of those microorganisms to underground, and when at depths, plumes of hot water/hydrated hot molten material would rise those microorganisms near to the surface again, in long-term periodic cycles. Here on Earth, there are studies of Archaean thermophiles organisms, such as *Sulfolobus shibatae virus-like particles* (SSV1), which exhibit properties of double ways for a same function (as double proteinic coats, via DNA decoding) and likes to grow at 89ºC with UV light (a strong stimulant for SSV1 production [6]) [7] [8], and other Archaean which use more than two sources for a common metabolic pathway as *Sulfolobus acidocaldarius* (growing best in the water of volcanic calderas at about 75°C and at a pH range of 1 to 6), which oxidizes sulfur to sulfuric acid or can use Fe^{2+} or MnO_4^{2-} as electron acceptors while using glycolysis and the TCA cycle [9]. The idea of a “simple” microorganism using two different forms of energy sources is thus not so problematic. That hypothetical life could have lasted for some hundreds of millions years, 1 Gyr, and now be dormant or, much more possibly, fossilized inside sediment rocks at the subsurface of Mars. Future robotic and manned missions to Mars can search for possible biogeochemical signatures of fossilized colonies of such hypothetical microorganisms, below the Martian surface, within locations with hidrothermal past (and possible present) volcanic activity, using sedimentary petrological microscopy and NMR [10] – interesting to Astrobiology.

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