HABITABILITY OF BODIES OF WATER ON ANCIENT MARS: ATTENUATION OF UV RADIATION FROM AQUEOUS SOLUTIONS OF MINERALS FOUND ON MARS.

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Unlike the Earth, the atmosphere of Mars does not provide protection to the planet's surface from UV irradiation due to the low column abundance of ozone. Finding a protected environment from UV radiation is essential to the study of the existence of life on Mars. Geological evidence indicates that there was once liquid water on ancient Mars; thus, it is possible that dissolved minerals leached from the surrounding bedrock into these bodies of water could act as a shield against UV light for life just below the surface [1]. This project investigated the possibility of UV attenuation in brines that may have existed on Mars.

Different studies show that some minerals like Olivine, Jarosite, Pyroxene, Hematite and Basaltic rocks had a significant part in formation of mineralogical components in some parts of Mars like Merdiani Planum and Eagle Crater [2,3]. We dissolved simple salts found in these compounds, such as $FeSO_4$ and $MgCl_2$, in water to simulate the aqueous environment of ancient Mars at concentrations ranging from 1 to 30% by weight depending on the solubility of the compound. UV light was provided by a pulsed xenon source, which was passed through samples along a 1 cm path length, and the amount of absorption was detected. Absorption cross-sections of the aqueous solutions are derived from Beer-Lambert's Law:

$$I(\nu)=I_o(\nu)e^{-ML\sigma(\nu)}$$

where ν is the wavelength of light in nanometers, M is the molar concentration of the solution, L is the path-length through the solution in centimeters, $I_o(\nu)$ is the intensity of light before passing through the sample, $I(\nu)$ is the intensity of light after passing through the sample, and σ is the absorption cross-section. Due to experimental constraints, our detectable spectral range was from 200 to 400 nm.

From our preliminary results, UV absorption depends most strongly on the choice of cation (note the difference in the vertical axis between Figures 1 and 2), and that aqueous iron would provide the best chance at shielding possible life on ancient Mars.

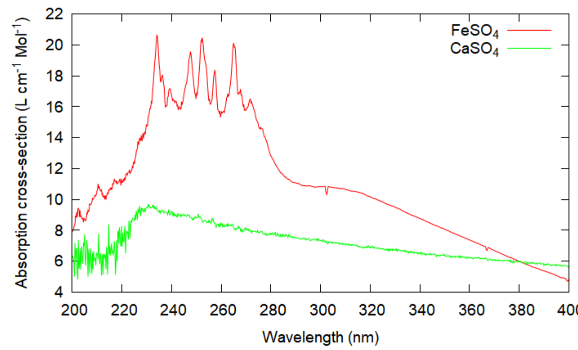

Fig 1: Absorption cross-section of dissolved minerals that have been detected on Mars that strongly absorb UV light.

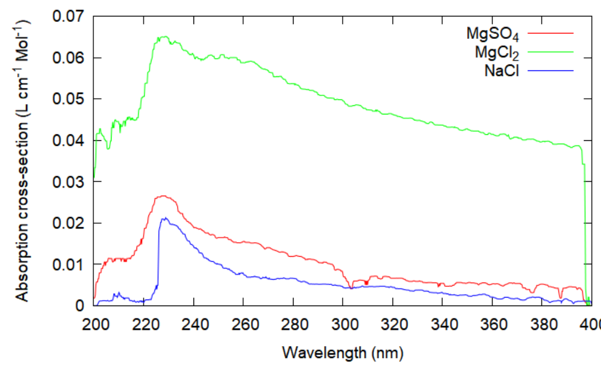

Fig 2: Absorption cross-section of dissolved minerals that have been detected on Mars that weakly absorb UV light.

Once strongly absorbing minerals have been identified, follow up experiments with bacteria samples will be performed to test the survivability of life in these aqueous solutions under UV radiation.

References:

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