

Discrimination of organic compounds and mineral particles by fluorescent microscopy for the detection of Martian life.

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The Viking mission searched life on Mars in 1976, but did not find apparent biological activities¹⁾. However, the detection sensitivity of the Viking instrument (GC-MS) has been found to be low, suggesting that organic compounds could exist on Martian surface. Recently the MSL Curiosity by NASA detected organic compounds²⁾. The Phoenix mission discovered H₂O ice³⁾ and possible liquid water flows were found at RSL (Recurring Slope Lineae) by MRO (Mars Reconnaissance Orbiter)⁴⁾. These findings suggested that life might exist on Martian surface.

We have proposed a life search program on the surface of Mars with a fluorescence microscope⁵⁾. This microscope is called Life detection Microscope (LDM) which detects microorganisms in more than 100 times higher sensitivity than the Viking GC-MS. In this program, we plan to use two fluorescent dyes SYTO 24 and propidium iodide (PI) in LDM. SYTO24 permeates cell membrane and stains organic compounds. PI also stains organic compounds such as nucleic acids, but it doesn't permeate cell membrane. Therefore, the combination of these two dyes makes it possible to differentiate the organic compounds surrounded by membranes (living cells) and dead cells.

However, there are some mineral particles have autofluorescence, possibly detected as false positives. In this research, in order to discriminate organic compounds from mineral particles, the autofluorescence of minerals were measured under various conditions.

Various kind of mineral specimens were finely ground with a glass pen washed with ethanol. Fluorescent images were obtained with a fluorescence microscope and a digital camera and their fluorescent intensities were measured by image analysis. We also examined fluorescent spectra of mineral particles using a diffraction grating. The results showed the fluorescent intensities and spectra of mineral particles were clearly different from the stained organic compounds. These methods would be useful to detect organic compounds among mineral particles.

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