Albedo Study of Depositional Fans Associated With Martian Gullies

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Introduction

Evidence for the presence of flowing liquid water on the surface of Mars in its recent past has been reported due to the discovery of geologic features resembling terrestrial water-carved gullies. Two possible mechanisms for the origin of liquid water on Mars in relation to these gully landforms have been proposed; melting of near surface ground ice and melting of subsurface ice by geothermal energy.

In both mechanisms reference to dissolved salts in the ice table are included as a possible factor in depressing the freezing temperature of water to a point low enough for liquid water to occur on Mars. It is reported that a 15-40% by weight of dissolved salts is required to accomplish this effect. This has been ruled out due to the lack of albedo evidence from the depositional fans located at the base of each gully. It is assumed that the percentage of salt necessary to accomplish the desired freezing point depression would be easily observable in the albedo of these fans due to the "white" color associated with salt evaporites.

Proposal

I propose an investigation of the albedo of these depositional areas comparing them to Martian soil containing various concentrations of dissolved salts.

Experimental Method

Part One: Using Adobe PhotoShop 5.0 I will produce luminosity histograms of the depositional areas and the adjacent soil areas. This will be done on a wide selection of MOC images taken by Mars Global Surveyor and Mars Odyssey in order to achieve statistical accuracy.

Part Two: Prepare brine solutions varying from 15-40% by weight and combine these with JSC-Mars 1 Martian soil simulator varying the degree of saturation for each sample. Allow the H_2O to evaporate and thoroughly mix the resultant combination of soil and salt to ensure a homogeneous composition. Photograph the samples and produce luminosity histograms as in Part One.

Part Three: Compare the results from Part One and Two above.

Figure 1. Example of Martian Gully formations with depositional fans at the base.

Figure 2. JSC-Mars 1 Simulated Martian soil.

Expected Results

Preliminary data indicates a definite change in luminosity between adjacent soil areas and depositional areas of the Mars Global Surveyor and Mars Odyssey images. It is expected that this trend will continue with the images obtained from using the JSC-Mars 1 soil with salt solution added.

Further Work

Perform IR Spectroscopy on the JSC-Mars 1 samples to determine the brine concentration necessary to produce an evaporite signature.

Acknowledgements

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3. Adobe Systems
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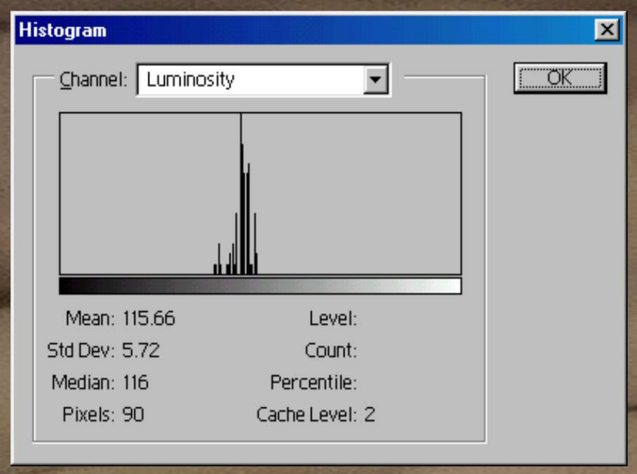

Figure 3. Histogram of soil adjacent to depositional area.

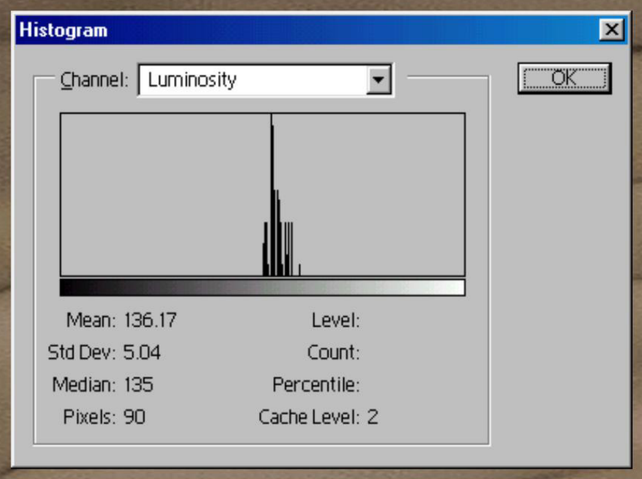

Figure 4. Histogram of depositional area

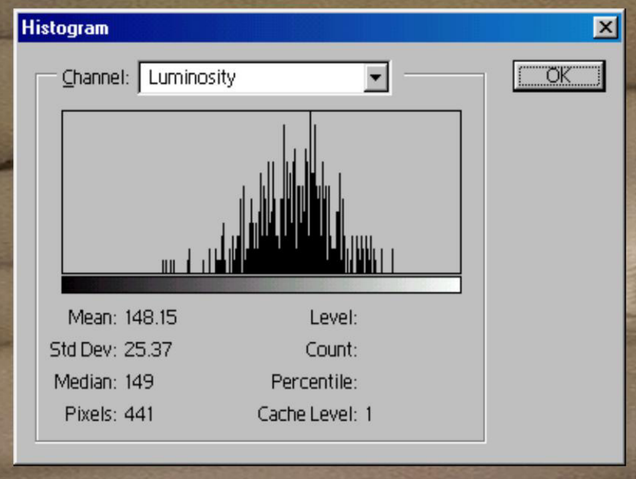

Figure 5. Histogram of JSC-Mars 1