AFM MEASRUREMENTS OF MARTIAN SOIL PARTICLES.

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Introduction: The MECA microscopy experiment[1] comprised an optical and a scanning force microscope [AFM]. In the AFM, a small tip mounted to a vibrating spring-lever raster scans the surface. The resonance frequency of the cantilever shifts as a function of the force gradient between sample and tip. During probing of the sample, this is used as a servo signal to control the distance from the sample. The servo signal plotted as function of the x-y tip position represents therefore a 3D iso-interaction map of the sample's surface, usually referred to as the topography. The remaining frequency shift in the cantilever resonance is called the "error signal" because it indicates how well the feedback loop could stabilize the frequency, i.e. lock to constant interaction.

Operations: The AFM of the MECA instrument suit has executed 85 experiments of which 26 were needed for calibration and for initially defining operational parameters. Of the remaining experiments about half (28) returned images where at least a signature of particles could be discerned.

On sol 98, we successfully cleaved the first tip and cantilever, which was contaminated by that time, and continued operation with the second probe.

In many cases, the digital feedback was saturated and the only or main information returned was found in the error signal. It is not possible to get absolute height information of the particles in those cases, however, horizontal dimensions and shape plus relative height can still be retrieved.

Experimental results: A complication in interpreting the AFM data is the so called tip-sample dilation, which refers to the fact that when scanning high aspect ratio features, the AFM tip shape gets convolved into the measurement. This leads to an increased lateral size and could also falsify the shape; the height is usually not affected as long as the tip is stable.

We observed spheroidal and platy particles of which examples are shown in figure 1 and 2. The full collection of all the AFM data which contains information about particles will be presented. The size distribution derived from these images was used in combination with the results from the optical microscope to assess the whole range from 100nm to 200µm (c.f. T.W. Pike et al; this workshop).

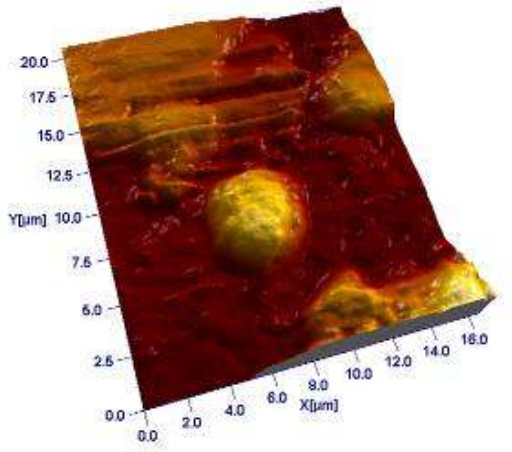

Figure 1: This picture shows an example of a spheroidal particle (in the center) and more platy particles on the top side.

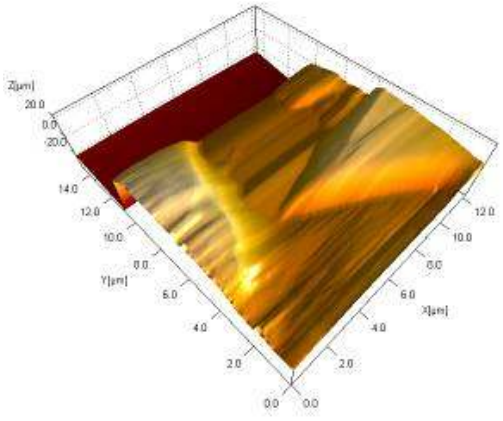

Figure 2: This picture shows parts of platy particles of which the right one appears as denticulated.

References:

[1] M Hecht et al (2008) *Microscopy capabilities of the Microscopy, Electrochemistry, and Conductivity Analyzer*, Jour. of Geophysical Research - Planets 113 Article Number: E00A22 (2008)