THE SURFACE TEXTURE OF THE MARTIAN SOIL FROM THE SOVIET SPACECRAFT MARS-5 PHOTOPOLARIMETERS - A. DOLLFUS and M. DESCHAMPS, Observatoire de Paris, FRANCE, and L.V. KSANFOMALITI, Institute for Space Research IKI, Moscow, URRS.

The soviet spacecraft MARS-5 orbited planet Mars in February 1974; two on board photopolarimeters VPM-I and VPM-II (1) analyzed the degree of polarization and the photometric intensity along five tracks extended over 100° in longitude in the Thaumasia (MC-25) and Argyre (MC-26) quatrangles of Mars (2), (3). VPM-I recorded the measurements at a phase angle of 60° in 9 wavelengths from 3420Å to 7490Å at a rate of one measurement every 5 seconds at each wavelength. VPM-II measured at phase angle 90° for a single wavelength at 5920Å but at a rate of one measurement every 0.55 second. The areas aimed at the planetary surface covered a diameter of around 20 Km and were positioned with an accuracy of a few kilometers. The scans are documented for surface features, albedos markings and geomorphology by the TV images taken during the same period by the two cameras on board the spacecrafts MARS-4 and MARS-5, and also with the MARINER and the VOYAGER images.

Photopolarimetric characterizations of the Mars surface texture : Telescopic determinations of the degrees of polarization P as a function of the phase angle V produce a curve (black dots in fig. 1) with a negative value (electric vector parallel to the scattering plane) for $V < 25°$ (4). The shape of the curve, together with the spectrophotometric data, were shown to be characteristic of a surface comminuted in small grains and rich in iron oxydes (5), (6), (7); these results were checked later by the VIKING landers.

The average of all the VPM-I measurements at 5920Å produces the open circle in fig. 1; the result for VPM-II gives the crossed-circle. The polarization curve is extended up to its maximum P_{max}, an important parameter which occurs around V=100°. With VPM-II, values of P_{max} were determined for a large number of small areas at the surface of Mars.

Values of P_{max} are related to the albedo and to the surface texture, in ways which were explicited by the analysis of a large variety of lunar, terrestrial, meteoritic and artificial samples (8,9,10,11) and by the theory (12,13, 14) in which the micro-texture is described by a parameter EXT. The comminuted soils of lunar fines correspond to a texture parameter EXT=0.15, and disclose a linear relationship between P_{max} and Albedo in a log-log coordinates (line a-b in fig. 2) for all the range of albedos found on the Moon (0.06 to 0.24). Coarser grained pulverized rocks (EXT=0.20) give a line c-d which is displaced toward larger values of P_{max}. Still coarsed structures ($EXT > 0.25$) lie in a domain still more displaced along P_{max} in fig. 2.

In order to characterize the martian soil, simultaneous pairs of values of P_{max} and A were derived from the VPM measurements and plotted in fig. 2. For 41 areas, 21 of them fit the line a-b corresponding to the lunar fines and the value EXT=0.14 (dark dots in fig. 2); 8 areas fit the line b-c characterizing a slightly coarser surface with EXT=0.20 (dark squares); 9 areas lie in between (triangles); none of the measurements reaches the domain for $EXT > 0.25$. The conclusion is that, at the scale of a few tens of kilometers, despite the great variety of martian terrains and geomorphological units analyzed, the surface of Mars appears everywhere as a finely or even very finely comminuted soil.

Regional sensing of the martian soil : A detailed analysis of the regional distribution of the P_{max} determinations produces the following trends :
- The regions covered by eolian deposits characterized by wind streaks and splotches are usually finely comminuted like the lunar surface; the average

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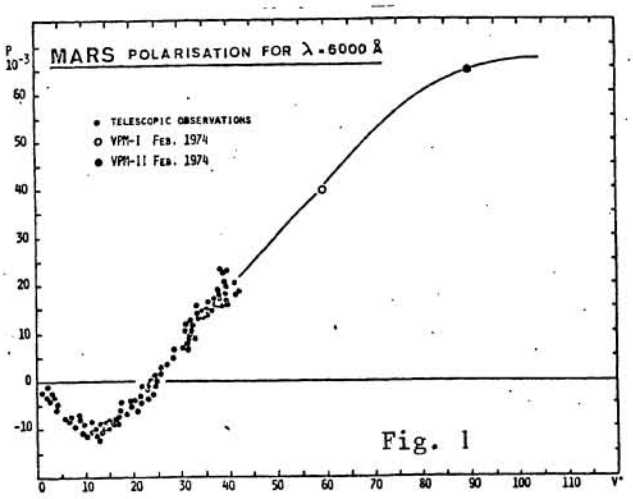

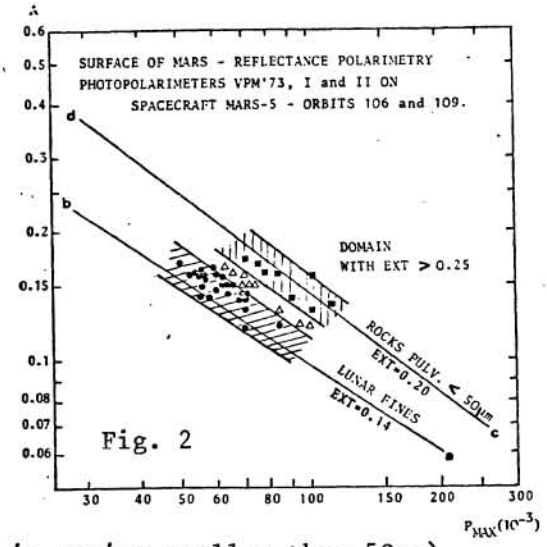

grain size (half of the cumulative weight in grains smaller than 50μm) is comparable to terrestrial loess rather than sand-dunes for which EXT is around 0.2.

- The fractured terrains processed by tectonic activities such as Claritas Fossae, Thaumasia Fossae or Ogygis Rupes, have a coarser soil which includes larger grains (EXT value of around 0.2).
- Still coarser soils, if any, have to be limited to areas smaller than the scanning aperture size.

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