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SOIL CRUSTS ON MARS; H.J. Moore, U.S. Geological Survey, Menlo Park, CA, 94025.

Three distinct soillike materials sampled by the Viking landers (VL) on Mars are (in order of increasing strength): (1) drift, (2) crusty to cloddy, and (3) blocky [1]. Relative strengths of these materials are manifested by footpad penetrations during landing (VL 1), depths of deep holes, motor-currents during sampling, sampler backhoe penetrations, comminutor motor-currents, impact pits, trench tailings, and successful acquisitions of the coarse fraction (only blocky material). Cementation by S and Cl compounds [2] probably contributes to the relative strengths. This is shown in Fig. 1 where the weight percent of $SO_3 + Cl$ of each material is plotted against their relative strengths. A similar result is obtained using SO_3 alone, but not Cl which is deficient in VL 2 samples. Although analytical uncertainties are large, VL 2 samples of surface crusts appear to have more $SO_3 + Cl$ (samples U-1,5; about 8.8%) than those from depth (U-6,7; about 8.1%).

Morphological evidence for crustification of the soillike materials parallels their $SO_3 + Cl$ contents. Undisturbed drift material is fractured showing that it has cohesion and deformation of the surfaces at the tips of shallow sample trenches produces relatively smooth bulges of the surface with some evidence for a thin, weak crust; but the tailings of the trenches are composed chiefly of lumpy masses and fines. Undisturbed crusty to cloddy material is fractured into tile-like prismatic units and deformation of the surface at the tips of shallow sample trenches commonly include thin tile-like units of crust and/or thicker prisms of soillike material; tailings of trenches commonly include a chaotic array of thin slabs of crust and fines. Undisturbed blocky material, which is usually covered by a thin layer of fines and clodlets, is also fractured into prismatic units and deformation at the tips of shallow trenches include thick tabular clods which are best illustrated by the reddish tabular clods on the XRFS funnel at the end of the mission [1].

Processes involved in the formation of the crusts are not understood, but they appear to occur at the surface-atmosphere interface and crust development may be a function of time. The processes are near-surface ones because "waterline" ledges of crust were present on rocks displaced by the samplers [1,3]. Process appear to be a function of time because the weakly-developed to almost non-existent crusts of the younger drift material (superposed on blocky material) contrast with the well-developed crusts of the older blocky material. There may also be a latitudinal effects because the Cl contents at Lander 1 are larger than those at Lander 2.

The role of crusts in martian eolian processes is not fully appreciated. Crusts form structural units with variable mechanical stabilities that affect the eolian erodibility of

SOIL CRUSTS ON MARS; H.J. Moore

the soillike materials [4]. The responses of the soillike materials to erosion by engine exhausts during landings [1,5,6] and the Dust Storm of Sol 1742 [7] are more akin to those of arable soils on Earth [4] than sand. As on Earth, soillike materials exposed to the wind are more prevalent than sands.

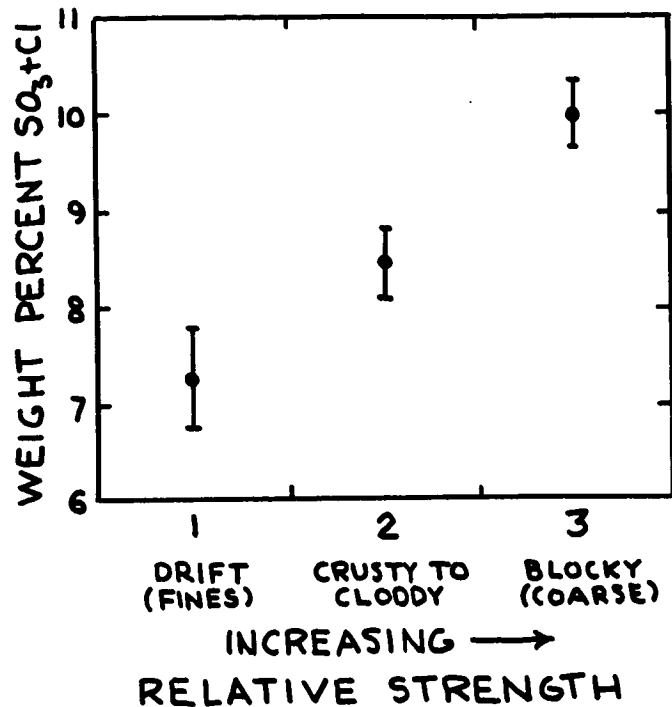


Figure 1. Comparison between weight percent $SO_3 + Cl$ in drift, crusty to cloddy, and blocky (coarse fraction) materials and their relative strengths. Sample numbers of Clark [2] are: drift (C-1,6,7,8), crusty to cloddy (U-1,2,4,5,6,7), and blocky (C-2,5,13). One sample of fines (C-8; 6.6%) has been included with drift material, but this does not significantly alter the relations. A VL 1 bulk sample (C-9; 8%) is excluded because it appears to include drift and blocky materials.

REFERENCES

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