Emplacements of the flow-like features on Mars: Wet or dry processes?

Hideaki Miyamoto[1]; Jose Alexis Palmero Rodriguez[2]; Kouichi Nishimura[3]; Tetsuyuki Ishii[4]

[1] Geosystem Engineering, Univ. Tokyo; [2] Earth and Planetary Sci., Tokyo Univ; [3] NISIS, NIED; [4] Earth and Planetary Sci., Univ. of Tokyo

http://www.geosys.t.u-tokyo.ac.jp/miyamoto

A wide variety of flow-like features have been identified on the surface of Mars. These include lobate debris aprons, dark and bright slope streaks, debris flow-like features, lineated valley fill, fretted terrain, gullies, landslides, and other loosely-defined, viscous flow-like features. The formational processes of these features are in many cases controversial, especially in terms of the mechanisms to keep their fluidities. Almost every feature can be plausibly explained both dry and wet hypotheses, and in fact a number of different hypotheses have been proposed for the possible lubricant agent for these features, such as surface water, groundwater, ice, brines, liquid CO2, granular dispersive pressure, vapor, and hydrate. Some of the features are fairly young, and thus understanding the nature of the emplacements of these features would include important keys in understanding current states of the surface of Mars.

Numerous researchers discuss the stability of ice and water on Mars. At this moment, the possibility of the presence of water on martian surface can go either ways, since some important issues, such as the effects of water chemistry and fine dist particles on the stability, are not well understood. Although no direct observations of the abundant atmospheric water is present, the gamma-ray flux detected by Mars Odyssey space craft show the concentrations of subsurface hydrogen (i.e., likely water), providing the most direct detection of ground water/ice. Nevertheless, the cold surface conditions on Mars favors cold, dry processes rather than wet (and thus warm) processes.

We are testing these hypotheses by taking several different approaches; (1) geological and geomorphological study based both on image analyses and on the field/image studies of terrestrial analogs; (2) geophysical modeling considering the effect of topographic confinements; and (3) laboratory experiments of analogue materials, such as ice particles. In this talk, we will review the currently-prevailing hypotheses without any preference of wet or dry processes and present the importance in estimating rheological properties from the three-dimensional flow patterns to constrain the nature of the flow-like features.