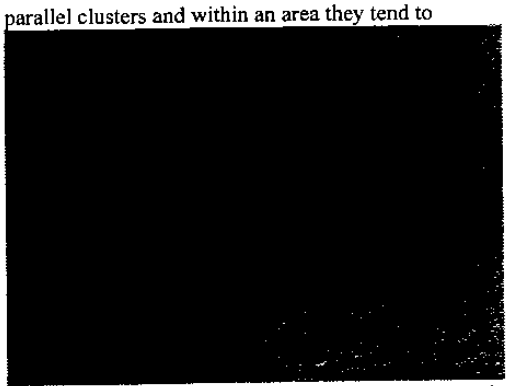
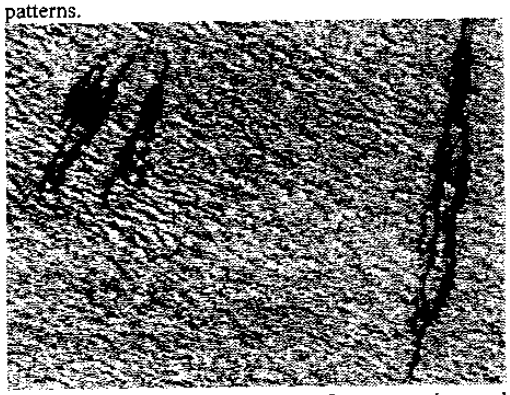
CURRENTLY FLOWING LIQUID ON MARS. T. Motazedian[1] and S.K. Boss[1,2]. [1]Arkansas-Oklahoma Center for Space and Planetary Sciences, Fayetteville AR 72701; [2]Department of Geosciences, University of Arkansas, Fayetteville AR 72701.

Introduction. Striking surface features on Mars appear to indicate currently flowing liquid. Thousands of dark streaks found in craters and valleys on Mars bear the signature of liquid flow.

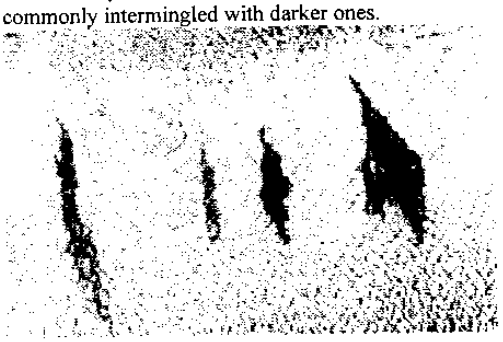
Characteristics. These dark streaks are found in the vicinity of Olympus Mons. The coordinates of this area span from 90°W to 180°W longitude and 30°S to 30°N latitude. The dark streaks often occur in parallel clusters and within an area they tend to



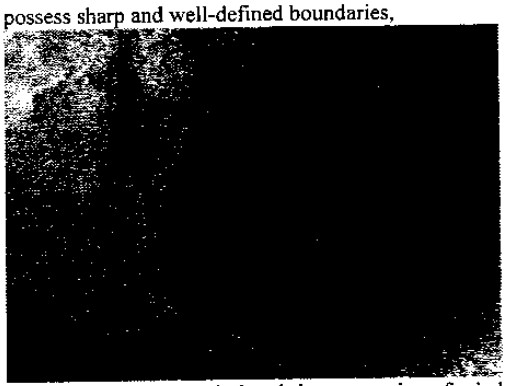
originate from a common horizon. They occur only on rough disturbed terrain, never on flat smooth plains. They always form on slopes, mostly inside craters and valleys, but also in ridge fields. The dark streaks exhibit no preferred orientation with respect to slope aspect. They always originate at point sources and spread out downslope. Some taper off again to form long narrow bars, while others continue to get wider, forming wedge shapes. Some fraction of the dark streaks demonstrate strong anastamosing patterns.



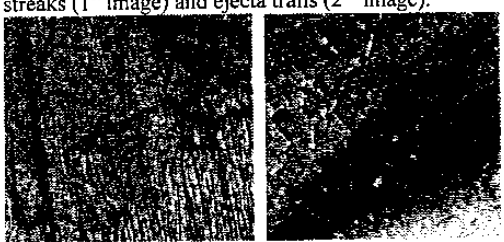
They acquiesce to any type of topography and passively overlay all other surface features, such as eolian dunes, without disturbing them. There is no relief of any kind associated with these features. These dark streaks appear to be the youngest of all Martian surface features, as they are never cratered or overlain by other features. Faded streaks are commonly intermingled with darker ones.



Comparison. These dark streaks differ from other dark Martian features in a number of ways. They possess sharp and well-defined boundaries,



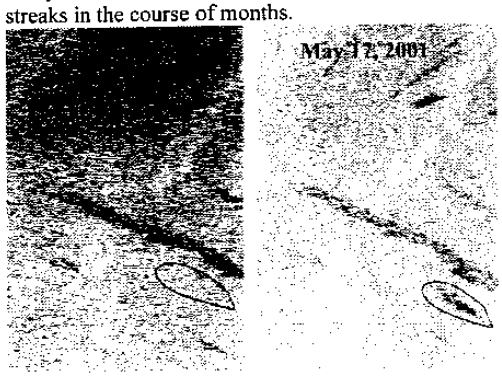
as opposed to the gradational, hazy margins of wind streaks (1st image) and ejecta trails (2nd image).



They also show a more uniform, heavily-saturated darkness than other features. Unlike wind streaks, these dark streaks follow specific patterns in distribution, location, shape, and direction. Unlike ejecta trails, these dark streaks always occur on

slopes, beginning at a higher elevation and flowing downhill.

Monitoring of specific areas over time show changes in the dark streaks. Time-series images of many locations show development of new dark streaks in the course of months.



This demonstrates the existence of a currently-active, short-term process of surface change on Mars.

Theories. There are a number of possible processes which could have formed these features. Wet or dry mass movements, such as debris flows or dust slides, could be stripping away the light-colored dust to reveal darker surface material beneath. However, this theory is problematic for a number of reasons. No deposits or materials are ever found near the streaks. The dark streaks overlay eolian dunes and other surface features without disturbing them in the least or providing any relief, which is not typical of mass movements. The streaks yield no erosional effects. The point source origin of all the dark streaks is another characteristic which is inconsistent with mass movement, as is the tendency of the streaks to form in parallel clusters. Some of the shapes of these dark streaks (such as the anastamosing patterns) indicate dynamic fluid processes uncharacteristic of gravity-driven mass movements. Also, one would expect to find mass movement generated features all over the planet, not just in one specific area.

Eolian processes do not identify closely with these features, because of the sharply-defined boundaries and uniform shading of these dark streaks. The streaks bear distinctive shapes (bar-shaped, wedge-shaped, and anastamosing) which are never replicated by haphazard wind streaks and dust-devil tracks. The specific distribution of these streaks (downslope in craters and valleys) represents another major difference from the unsystematic plains-sweeping action of the wind.

Liquid flow appears to be the most promising candidate for explaining these features. These dark streaks (1st image) bear affinity to the ancient Martian gullies formed by groundwater sapping (2nd image).

These streaks originate from distinctive geologic horizons below the surface, where the water or ice table has been intersected by crater and valley walls. The point source origin of the dark streaks seems to point to piping of groundwater. The anastamosing tendencies of some of the dark streaks are almost impossible to explain in the context of anything other than liquid flow. The fact that these streaks provide no relief holds consistent with liquid gently seeping through the surface. The presence of faded streaks indicates perhaps older flows which are drying out while fresh flows continue to form.

Subsurface water, either from liquid aquifers or melted ground ice, is released and is wetting the surface, creating these dark streaks. The distinctive distribution of the streaks indicates either a localized water source or a local trigger for water release. Some form of geothermal activity occurring in the vicinity of Olympus Mons could be causing the melt and/or release of liquid water from ground ice or liquid aquifers.

The mechanism which would allow liquid water to flow on the Martian surface is among many areas which need future exploration.

References. www.msss.com