THERE IS FLOWING WATER IN STREAKS IN GUSEV CRATER ON MARS. T. A. Krupa, chlorophylgreenrevelation12.14@gmail.com

Introduction: There are a tremendous number of dark streaks in the region where the Spirit rover landed in Gusev crater on Mars. The streaks are on the order of about 1.5 km long and 40 m wide.

The SAGA computer Geographic Information System (GIS) was used to analyze some of the streaks in Gusev. HIRISE image PSP_001513_1655 - the Columbia Hills region - was used along with the corresponding DEM that specifies ground elevation (altitude) coordinates for each pixel in the image. 3D images of streaks were made by draping the 25 cm/pixel HIRISE image over a 3D terrain mesh created from the corresponding 1m/pixel DEM.

Results: All the analyzed streaks gave similar results. The following results are for the streak that's directly to the left of the Spirit rover landing site.

A GIS slope analysis shows that terrain inside the streak slopes at a greater angle than terrain outside the streak.

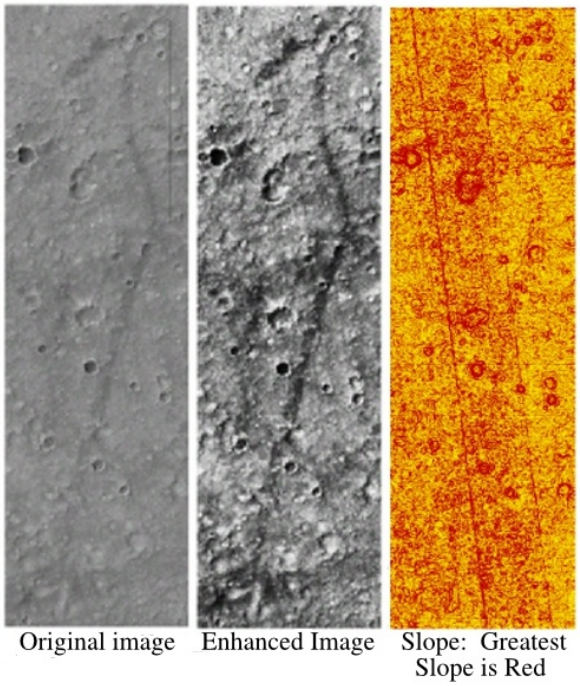

Fig. 1 Terrain inside streak slopes at a greater angle.

A GIS profile curvature analysis shows that terrain inside the streak is more concave and convex than terrain outside the streak – there are sharper peaks and valleys within the streak.

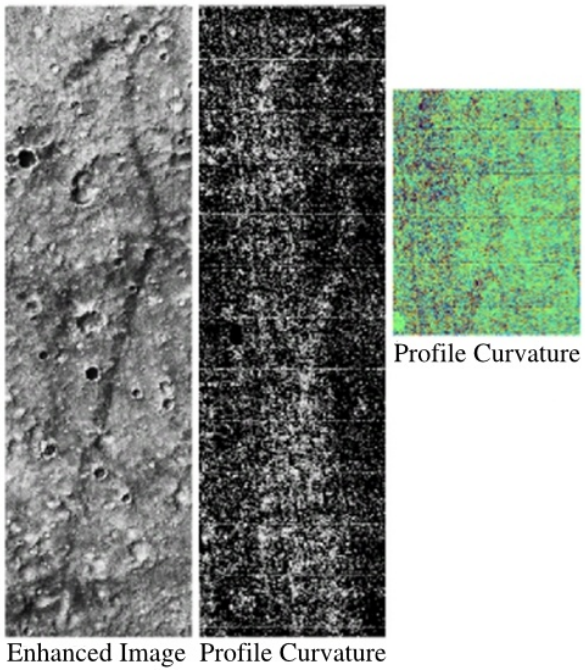

Fig.2 Terrain in streak has sharper peaks and valleys.

There are numerous small mounds in the streak. The mounds are on the order of about 0.5 meters high and 12 meters wide. The mounds aren't visible in normal images. But they can be seen in 3D images if the terrain height is stretched. In the following images the terrain height is exaggerated by a factor of 40.

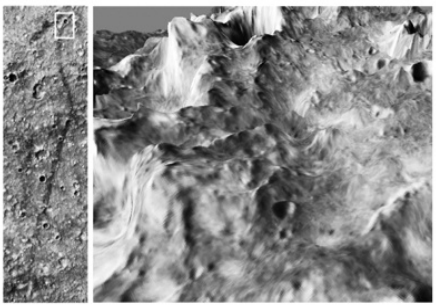

Fig. 3 3D image of top portion of streak

Many mounds in the streak have dark peaks; and dark linear features extend from the dark peaks down toward the base of the mounds.

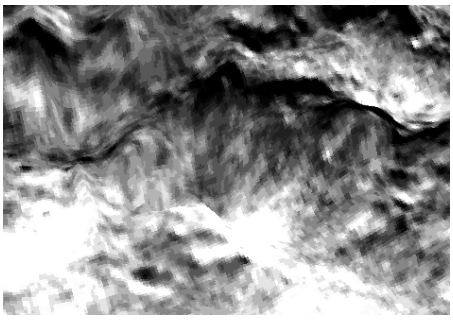

Fig.4 Dark peaks and downward oriented linear features

A computer GIS channel network algorithm with parallel processing was used to determine if the dark linear features on the mounds could have been formed by flowing water. The algorithm detected the pathways where water would flow if water was present in the streak. The channel analysis revealed water flow channels that are superimposed on these dark linear features on the mounds - as seen in this animation: https://anonmgur.com/up/a0306e35ab58ba4786cb2a24d93b5562.gif

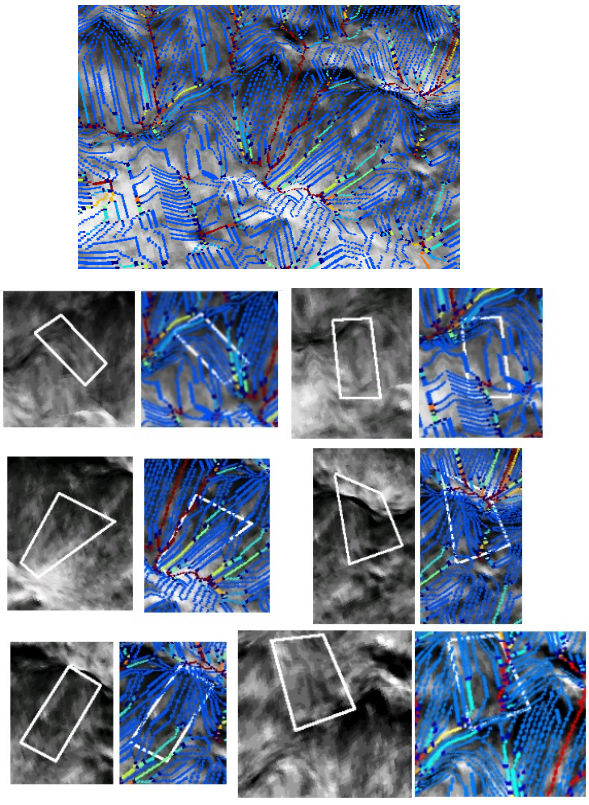

Fig.5 Channels co-localize with dark linear features

The close correlation between the shapes and positions of the water flow channels and the shapes and positions of the dark linear features on the mounds were formed by flowing water.

It is possible that the mounds are pingos. Pingos are found on Earth in the far North where the temperature is often below freezing. Pingos are formed from repeated freezing and thawing of water saturated soil in contact with underground ice. In warm weather the ice in the soil can melt and flow down the mounds eroding channels into their sides.

The dark shade of the streaks is mainly due to the dark peaks and dark water flow channels on the mounds. A Mars Express/HSRC true color image [1] shows that most of the streaks in this region are green. This means that the dark peaks and dark water flow channels on the mounds are really green.

Fig.6 Mars Express/HSRC true color image (with vertical length stretched). Spirit rover landing site is slightly to right of center. Columbia Hills is slightly to left of center.

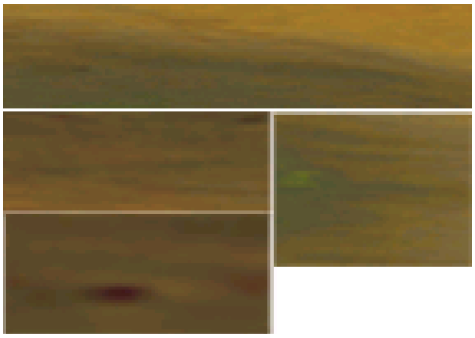

Fig.7 Closeup of streaks. In bottom left image the center streak intersects the Spirit rover driving pathway from the rover landing site to Bonneville Crater (dark ellipse).

References:

[1]http://www.esa.int/var/esa/storage/images/esa_multimedia/images/2004/02/crater_gusev_-_hrsc_image_16_january_2004/9955103-2-eng-GB/Crater_Gusev_-_HRSC_image_16_January_2004.jpg