EPSC Abstracts,
Vol. 4, EPSC2009-177, 2009
European Planetary Science Congress,
© Author(s) 2009

Sinuous gullies on Mars : Distribution, mechanical properties and consequences for gullies formation

N. Mangold (1), A. Mangeney (2) F. Bouchut (3) D. Baratoux (4) A. Lucas (2)

(1) LPGNantes, CNRS, FRANCE, (2) IPGParis, CNRS, France, (3) ENS Paris, France, (4) OMP Toulouse, France

Recent gullies are erosional landforms developed on hillslopes in recent Martian time (less than 10 My). The nature of the fluid that created the erosion was initially considered as debris flows, but this is still under discussion. Indeed, hypotheses invoking only dry granular slides explain many characteristics of the gullies channels, their size, length, presence of levees and terminal deposits. We focused our interest to the presence of sinuous gullies, which channels present bends similar to meanders of rivers, with the difference that they occur into a steep slope for a channel, i.e. typically 10 to 20 degrees. The sinuosity of sinuous gullies reaches 1.25, despite it is usually between 1.05 and 1.2 (the sinuosity is the ratio between the true gullies shape and the straight line between channels top and bottom). The sinuous shape over such slopes is typical of a fluid flow that is not reproducible neither in dry granular flows, nor in a classical river stream. Sinuous gullies are found in most regions where straight gullies are found. The only difference comes from the orientation of gullies which is strongly poleward, even in regions where the equatorward orientation are found for many straight gullies are found. Several characteristics can be used to estimate the stream velocity and viscosity from these bends. Especially, the presence of levees that are dissymmetric in the bend is used to measure that the flow is relatively slow (1-3 m/s) with a high viscosity (from 100 to 10,000 Pa.s). This viscosity is typical of debris flows containing minor proportions of liquid water compared to solid debris, but it is far above the viscosity of river streams, even with high sedimentary flux. The fact that sinuous gullies are found in most regions where straight gullies are found justify the use of these gullies as a tool to better understand the formation of all gullies on Mars. Sinuous gullies formed by debris flows on poleward facing slopes are better explained by models invoking obliquity changes in the recent past.