FORMATION OF MARTIAN GULLIES: MECHANISM SUGGESTED. Y. Cedillo-Flores[1] and H. J. Durand-Manterola, Dept. Space Physics Universidad Nacional Autonoma de Mexico UNAM. Mexico City. Mexco. [1](yolanda@soho.igeofcu.unam.mx), [2](hdurand_manterola@yahoo.com.mx).

Introduction: The origin of the Martian gullies is uncertain and several theories had made traying to explain it. These theories to involve differents substances or materials. Mainly, next hypotheses have been proposed: liquid water [1] liquid CO_2 [2], fine granular flows [3].

We present a new model to explain the origin and probably the processes associates to the formation of the Martian gullies. Our model to involve fluidification gaseous of CO_2. We propose that in Martian slopes CO_2 snow and dust transported by winds are accumulate. During the Martian spring, sublimation of carbonic snow starts because of heat and weight of the frezze layer, causing the material mix it, fluidized and slide downslope by gravity. Then the gullies might be formed in eihter shorts or long stages, for example each Martian year or each obliquity planet changes.

Methods and experiments. We examined images of MOC (Martian Orbiter Camera) of the MGS (Mars Global Surveyor), THEMIS (Mars Odissey) and images of the Mars Express (ESA) European Spatial Agency spacecrafts. We reproduced Martian gullies formation using dry material and CO_2 ice to form granular flows.

Experiments. In the first step, we made a slope with volcanic sand and injected air inside the slope. The resulting effect was the sand fluidification that flows like a liquid and are formed the three typical features of a terrestrial gully: alcove, channel and fan (See figures 1 and 2). In this case the air would be equivalent to the CO_2 gaseous released by ice dry, on Mars.

In the second step, we used a receipient with CO_2 ice and sand. We did put granular dry ice inside a sand slope. Immediately the material flows but the slope it does not remain. It were formed gullies without channel. The material seems to “boils”, but when its colds, the effect dissapears.

In a third step we calculate sublimation in two ice dry samples. At low temperature less mass by area unit by time, its sublimes. It might be calculate the ice sublimation in an alcove of a Martian gully, the result was 125 Kg X sec.

Results . The effect observed, in both cases, after injecting air and sublimation of the ice dry, was that the sand does *flows* like a liquid downslope and almost all of the gullies were formed with the three of their tipical characteristics: alcove, channel and deposit area.

The first experiment shows gullies very silmilar to those observed in Mars surface. The second experiment with dry ice shows a feature alike a gully without channel

With the third experiment we also obtained the velocity of sublimation of dry ice was 1.4 X 10^{-3} kg/m^2/s at 20ºC and 1.18 X 10^{-3} kg/m^2/s at -16ºC. These results allow estimate that in an area of 100 X 100 meters, in Mars, the rate of CO_2 ice degassing would be 42 tons metric X hour, which we consider it is enough to fluidize the terrain.

Conclusions. It can be infered that CO_2 sublimation its might be occur in all Martian surface. In near polar latitudes annual sublimation might be very slow due the low tewmperatrures. And at low latitudes its does not forms huges amounts of CO_2 ice, nevertheless the environment it is cold enough for CO_2 becomes fluidized and gullies forms itself.

These features also it can be forms when the obliquity of Mars change and the ecuatorial zone to experience lower temperatures.

References:

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Figure 1. Gully reproduced at laboratory. It can be seen the fluidification effect of the dry sand when air is injected inside the slope. The length of the slope is roughly 20 cm.

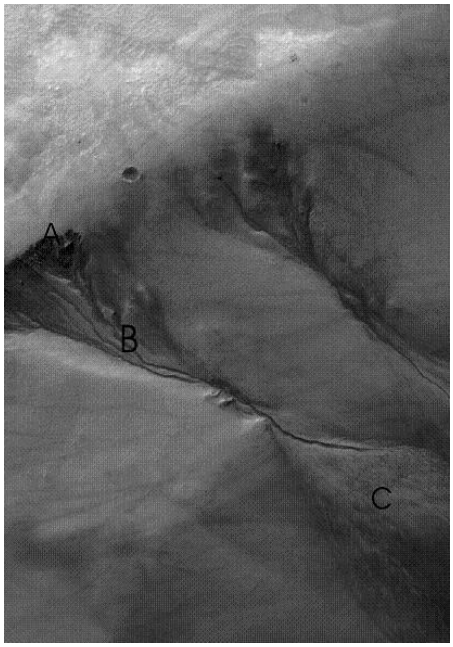

Figure 2. Martian gullies with the three typical features: alcove (A), channel (B) and fan (C).
MOC2-1466 Mars Global Surveyor (MGS) Mars Orbiter Camera (MOC) Credits. NASA/JPL/MSSS.