EPSC Abstracts,
Vol. 4, EPSC2009-478, 2009
European Planetary Science Congress,

Jet-like activity in the Inca City region of Mars: Rate of initiation of activity.

N. Thomas (1), G. Portyankina (1), C.J. Hansen (2), and G. Gfeller (1)

(1) Physikalisches Institut, University of Bern, Sidlerstrasse 5, CH-3012 Bern, Switzerland (Nicolas.thomas@space.unibe.ch / Fax: +41-31-631-4406)

(2) Jet Propulsion Lab.California Institute of Technology, 4800 Oak Grove Drive, Pasadena, California, USA

Abstract

The High Resolution Imaging Science Experiment (HiRISE) onboard Mars Reconnaissance Orbiter (MRO) has been used to monitor the seasonal evolution of several regions at high southern latitudes and, in particular, the jet-like activity which may result from the process described by Kieffer [1] involving translucent CO_2 ice. The Inca City region (81°S, 296°E) has been extensively imaged during the 2007 spring [2,3] and follow-up observations are now taking place throughout the 2009 spring. In this presentation, we concentrate upon the structure of the fan deposits, the observations of activity and specifically upon the initiation of activity.

Most fan sources become active within a period of 8 weeks at the beginning of southern spring. We have used HiRISE data to quantify this (Figure 1). The on-set is indeed rapid.

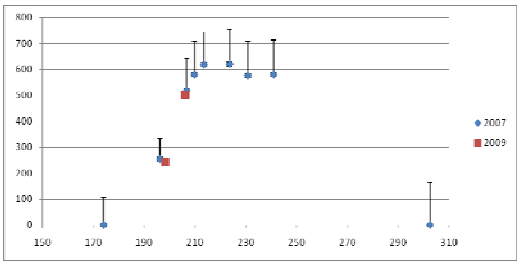

Figure 1 The number of active regions within a specific region of Inca City is shown as a function of Ls. Note the steep rise in the number of fan deposits up to Ls=210.

Data from 2009 shows similar behaviour. Activity is indicated by the production of dark deposits surrounded by brighter bluer deposits which probably arise from the freezing out of vented CO_2 [4]. These deposits originate from araneiform structures (spiders), boulders on ridges, cracks on slopes, and along linear cracks in the slab ice on flatter surfaces.

Some dark fans are observed to shorten enormously in length on a timescale of 18 days. We consider this to be strong evidence that outgassing was in progress at the time of HiRISE image acquisition [2] and it is possible to derive some crude estimates of the outgassing parameters from the observations.

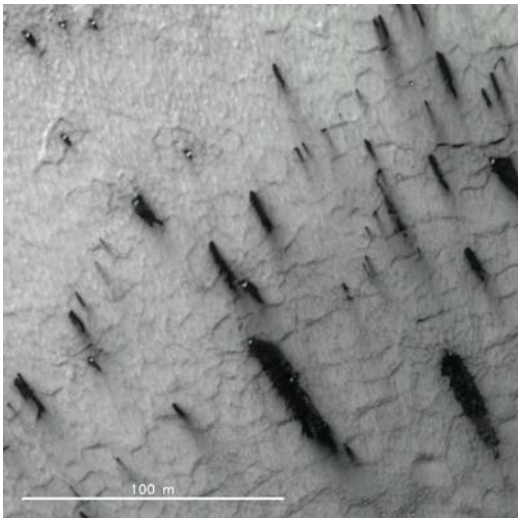

Figure 2 Note the boulders at the sources of several of the fan deposits.

The topographic context clearly plays a substantial role in determining the type of activity that occurs. Activity at spiders initiates at depression boundaries possibly as a result of stress on the CO_2 slab ice at these points. We infer that erosion by gas flow at these points increases the size of the spider with time.

EPSC Abstracts,
Vol. 4, EPSC2009-478, 2009
European Planetary Science Congress,

Similarly, fans are frequently associated with boulders on the surface (Figure 2). In order to quantify this, we have counted the number of fans in a specific area in several images. For each fan, we have assessed the nature of its source (boulder, fissure-like, point-like) and determined when it became active. An example plot is shown in Figure 3. This plot shows the remarkable result that almost all fans which had initiated before acquisition of the first image of Inca City in the 2007 southern spring had a boulder at their source. This trend weakened during the subsequent weeks until point-like source (with no boulders at the HiRISE resolution limit of around 25 cm) became the dominant source for fan activity.

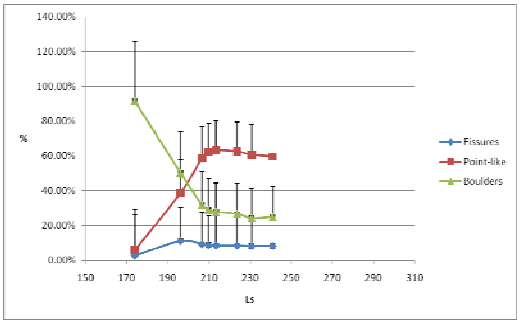

Figure 3 The nature of the source of a fan deposit within a specific area of Inca City expressed as a percentage of the total number of fans. Points where there are boulders dominate in the first weeks. Point-like sources (with no resolved boulder being present) then become dominant with time.

It is suggested that draping of the CO_2 ice slab over local topographic features produces areas of weakness in the slab ice. When the Kieffer mechanism starts to operate at the beginning of southern spring, the sublimed gas under the ice slab finds this area of weakness first and it is at these points where fan activity first initiates.

The presentation will expand upon this hypothesis. A comparison between 2007 and 2009 will also be presented.

Bibliography

[1] Kieffer, H.H., JGR, 112, E08005, doi:10.1029/2006JE002816, 2007.

[2] Thomas, N., C.J. Hansen, G. Portyankina, and P.S. Russell, HiRISE observations of gas sublimation-driven activity in Mars' southern polar regions: II. Surficial deposits and their origins, Icarus, accepted.

[3] Hansen, C.J., et al., HiRISE Observations of gas sublimation-driven activity in Mars' southern polar regions: I. Erosion of the Surface, Icarus, accepted.

[4] Titus et al., AGU Abstract P41A-0188, 2007