REGIONAL VARIATION OF ONSET DIAMETER IN THE NORTH OF ELYSIUM, MARS.
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Martian crater is characterized by fluidized craters such as the rampart crater. Onset diameter, which is the critical diameter separating ordinary craters and fluidized craters, is considered to be related to the depth of groundwater/permafrost layer. The excavating depth of crater corresponding to the onset diameter is expected to suggest the discontinuity of volatile distribution which makes fluidized ejecta. We studied the size distribution of fluidized craters in high resolution Viking images at the North of Elysium Region, and found the existence of onset diameter. This indicates that the upsurface depth of volatiles is an order of tens' meters. This value is different from the previous estimation which is an order of hundreds' meters.

Data and Geological Setting: The basic data set reported in this study is size distribution of fluidized craters and ordinary craters in the North of Elysium volcanic complexes. This working area was located at the boundary among the Elysium Mons's lava flow, the Hecates Tholus pyroclastic cone, the knobby plains, the grooved plains, and smooth plains. These geologic provinces are classified based on the topographic features [1]. According to the interpretations about the formation of the provinces, this area is divided into two. These are initial form built up by Elysium volcanoes and the modified terrains from it. These modifications are caused by groundwater/sediment activities such as creeping, sapping, etc. The extent of the working area is about 350 x 100 km squares. Viking digital images in CDROM were used (Volume name; VO-1012, frame numbers 086A01 to 086A54). The resolution ranges from 38 to 41 m/pixel. We classified craters in this area into two types; fluidized one and ordinary one, and explored the size-frequency characteristics.

Criteria and Method: Fluidized craters in this study are defined as follows; 1) There is an enormous fluidized structure such as flow units, ramparts, radial grooves, and flower-like outline. 2) There are mounds around a crater with distal cliff. Conversely the continuous ejecta of typical ordinary crater vanishes smoothly outward. 3) There is a continuous ejecta whose traveling length is much larger than the crater diameter [2].

In our study the onset diameter is the diameter separating two types of crater in their size distributions. This is upper limit diameter of ordinary craters, and also lower limit of fluidized ones. We recognize the existence of the onset diameter if the range of transition zone is regarded as about 100 m.

Cratering excavation down to the volatile layer supplies volatiles to the ejecta. Based on the relationship between crater diameter and depth [3], the onset diameter can be converted to the depth of upsurface of groundwater/permafrost. If all craters are fluidized craters [Fig. 2. (1)] then the onset diameter is smaller than the lower limit of resolution, i.e. the level of volatiles is very close to the surface. Conversely if all craters are ordinary craters [Fig. 2. (3)] then the onset diameter cannot be determined by craters in the basic data set, i.e. the surface layer is dry.

Results: The set of histograms in Fig. 1 & 2 shows several examples. The onset diameter is clearly recognized in the left histogram of Fig. 1. On the other hand there are some frames which don't show clear separation [the right one of Fig. 1]. Most of the latter cases are located at the physiographic boundary. Some of them can be explained by underground disorder such as volcanisms. A frame sequence of Fig. 2 indicates diverse variation of the onset diameter. (1) is obtained at the Elysium lava flow, (2) is at the boundary between (1) and (3), (3) is the fresh beginning of grooved Plains, (4) is at the basin in mouth of grooves. These variations linked with physiographic features are clue to understand the history of this volcanic region. The discharge of volatiles[4] suggests a process to form the dried surface layer.

Discussion: The present result is different from the previous works in terms of the scale of onset diameter; km size in Kuzmin et al. [5], whereas hundreds meters in the present work. In our data it is hard to recognize the onset diameter of km scale. This may reflect the difference in the resolution of the image. The degradation of crater causes...
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a hindrance in the onset diameter determination. Because some fluidized craters’ lobes are easily erased by running water or aeolian erosions, they might be miscounted as ordinary ones.


Fig. 1 The left is obtained in a part of 086A36, the right is a part of 086A39. The left shows clear evidence of the existence of the onset diameter, while the right does not.

Fig. 2 The sequences of variation examples of the onset diameter determinations. These are parts of frames in 086A36, 35, 10.