CRATER MORPHOLOGY VARIATIONS IN THE ELYSIUM REGION: IMPLICATIONS FOR ICE DISTRIBUTION ON MARS

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INTRODUCTION: Variations in crater morphology have been attributed to differences in target strength, depth of excavation, presence of near surface volatiles, and environmental conditions (1,2,3,4). Rampart craters and other features which may be a result of the presence of sub-surface ice have been observed in the Elysium Volcanic province (5). The Elysium area contains diverse crater types and covers a range of latitude, altitude and surface type and age. Therefore there are several factors that could have influenced crater morphology. The aim of this study is to search for trends in the distribution of various crater characteristics and to evaluate the usefulness of crater morphology as an indicator of sub-surface ice.

METHOD: Using mosaics of Viking frames of similar resolution in the region (155–245°, 15°S–47.5°N) (at a scale of 1:1 250 000) the centre co-ordinates of each crater over 1.875 km in diameter have been digitised. Data files were then constructed that contained measurements (such as crater diameter, shadow depth estimates, average diameter(s) of ejecta blankets) and other relevant details. The characteristics of the craters' morphology recorded include: profile, central features, rim nature (continuous, buried *etc.*), rim condition (fresh, terraced, degraded *etc.*), ejecta type and surface texture (for each component of multiple blanket ejecta), designated geological unit according to (6), and local target nature (*e.g.* lava flow, crater ejecta, channel floor). A "confidence" factor was also included since the precision of interpretation varied with resolution, although wherever possible the descriptive details were confirmed by checking the highest resolution images available.

These data files are being processed and plots are being obtained that indicate average or dominant crater characteristics as a function of latitude, altitude, geological unit, crater diameter and local target nature. The radial distance from eruption centres is also being used as a possible factor since volatiles may have been driven off by increased heat flux near Elysium Mons (5). The results may be displayed as simple graphs, histograms, grey-scale maps or location plots, depending on the nature of the information.

DISCUSSION: In this manner the dominant factors that determine crater morphology can be ascertained for this region. In order to reduce the statistical errors, a large number of craters of all morphological types has been included. The area of study has been limited to that which has also been mapped and surveyed in depth by the authoress. Such a knowledge of the area under consideration provides both an initial understanding of the variables that exist and require investigation, and a check on the possible reasons for correlation or otherwise with individual parameters (or combinations).

This work forms part of a detailed investigation of Elysium in which all possible indications of the presence of ice (craters, channels, chaotic and knobby terrain, volcano eruptive styles) are being assessed. This information will be compared with any trends in the crater morphology that appear to indicate the location of ice. If the craters appear to be diagnostic of ice location and depth then a 3-D map of ice distribution can be constructed. This, and any indication of surface physical characteristics gained from the crater survey, will be included in models of the Elysium channels currently under construction.

Comprehensive studies of the age, nature and distribution of each ice-related landform will enable further constraints to be placed on the importance, timing and distribution of ice in Elysium. The data aquisition, manipulation and display systems have been formulated so that similar studies of other regions of Mars can be made. In a future project the Hellas volcanic region will be investigated using the same technique, thus allowing comparisons to be made between two volcanic provinces of different ages and geological settings.

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