THE DISTRIBUTION OF SUBSURFACE WATER AT HADRIACA AND TYRRHENA PATERAE AND SURROUNDING AREAS ON MARS FROM IMPACT CRATER MORPHOLOGY; M. G. Lancaster¹, and J. E. Guest¹, ¹University of London Observatory Annexe, 33-35 Daws Lane, London NW7 4SD, UK.

It is well established that the surface of Mars exhibits abundant evidence for the presence of either liquid or frozen water during the course of Martian history [for a review see 1, 2]. The origin, location, extent and transport of this water is of critical importance in the understanding of Martian geology and climate. In particular, the fluid appearance of rampart crater ejecta has been cited as evidence for subsurface ice at the time of impact [3]. Ejecta morphology has proven to be a useful tool for studying the distribution of subsurface ice on Mars [4, 5, 6, 7, 8, 9]. It is possible that in some regions the concentration and distribution of subsurface ice has been affected by volcanic processes, either in the melting and/or mobilisation of existing subsurface water, and/or in the injection of juvenile water into the martian crust. The presence of water may also have affected the style of volcanic eruptions on Mars, increasing the volatile content of rising magmas and generating explosive activity. We are currently investigating the abundance and role of water in the evolution of the volcanoes Hadriaca and Tyrrhena Patera and surrounding highlands northeast of the Hellas Basin. The morphology of these volcanoes has been attributed to explosive volcanism [10, 11, 12, 13], and to the presence of substantial amounts of water in the regolith at the time of their eruption. The location of Hadriaca Patera in a region containing channelled plains, debris flows, and pitted plains, together with the style of erosion of the volcano flanks suggests presence of volatile-rich surface materials or fluvial or periglacial activity [14, 15]. This work is a continuation of research undertaken by Cave [5, 6, 7] in the Elysium Mons Region, where ice was found to be enriched at depth in the Elysium Lavas. We are performing a similar analysis for the volcanics of Hadriaca and Tyrrhena Paterae. A database containing information on the location, size, morphology, ejecta characteristics and degradation state of several hundred impact craters displaying ejecta in the region of Mars between the equator and 40° S, and from 225° to 275° W is therefore being compiled.

For each crater the database contains entries for latitude, longitude, altitude, geological unit, local geology, rim to rim crater diameter, profile, outline, central feature, floor characteristics, floor albedo, rim character, crater preservation, crater modification, modification process, ejecta type, ejecta outline, ejecta preservation, ejecta features, ejecta albedo, ejecta fluid index, ejecta diameter, and ejecta mobility ratio. The location and dimensions of each crater and its corresponding ejecta were measured from the Mars Mosaicked Digital Image Models or MDIMs [16] at a scale of 0.231 m/pixel (1/256th degree/pixel). The elevation data are taken from the Mars Digital Terrain Model or DTM [16] at a scale of 0.943 m/pixel (1/64th degree/pixel). The geological units are those as defined by [13, 14, 17]. Each crater is also examined on screen in detail using individual medium resolution Viking Experiment Data Record
HADRIACA AND TYRRHENEA PATERAE: Lancaster, M. G. and J. E. Guest

(EDR) images from CD-ROM, which have a typical resolutions of about 230 m/pixel. The fluid index is a qualitative classification of the apparent degree of fluidity of crater ejecta on a scale of 0 to 5 [5]. This survey includes all craters at or above 2 km in diameter, the form and features of craters below this size are insufficiently resolved in the Viking data. Due to the variation of surface morphology and geology within the published geological units we define local geology according to a number of descriptors such as smooth deposits, dissected, hilly, lava flows, impact ejecta, etc.

Initial results suggest that nearly all craters which are sufficiently fresh and resolvable in the Viking digital imagery display rampart ejecta. In other words all the most recent geological units display evidence for subsurface ice through rampart ejecta. With a complete count of craters displaying fluid appearing ejecta we plan to establish correlations between crater characteristics and geological unit, altitude and distance from the volcanic centre. The mobility ratio is a quantitative measure of the ejecta mobility, defined as ejecta diameter divided by crater diameter [5]. It has been found that above a certain crater diameter the mobility ratio increases, indicating enhanced ejecta fluidity, interpreted as penetration into ice-rich layers at depth [5, 6, 7]. We intend to measure the onset diameter of enhanced ejecta mobility for different subsets of our data, in order to establish any correlations that exist with geological unit, latitude, altitude and distance from volcanic centres. By using crater depth-diameter relationships it will be possible to model the depth and extent of possible ice-rich layers beneath the surface.