A REGIONAL ANALYSIS OF MARTIAN CRATER POPULATIONS. A. Woronow, Lunar & Planetary Lab, Univ. of Arizona, Tucson, Az.

An automated technique has been developed to locate regions having "abnormal" crater populations (1). The data set for this study consists of all craters with diameters between 10 and 250 km lying between 60°N and 60°S latitudes. Evidence from this study supports the contentions that (a) time variations have occurred in the crater production function, (b) a substantial number of endogenic craters occur in the regions of the major volcanic constructs, and (c) craters as large as 20 km diameter have been obliterated south of 30°S latitude.

The procedures for making the analyses are as follows: A tight curve (>95% confidence level) is fitted to the crater population's size-frequency distribution in the region of interest. Then each 5° x 5° square within that region is statistically tested for a departure from the overall regional trend (the test is made only on the distribution function, not on the crater density). If a single 5° square does not contain at least 10 craters, adjacent squares are included until at least 10 craters can be tested. Therefore, while areal resolution can vary, a minimum statistical resolution is maintained. If the test area fails the specified test, a box is drawn around the area and a dot is placed in the center of the original 5° square.

Figure 1 shows the results of searching for small-crater excesses compared to the planetwide crater population. The northern plains most strongly display an excess of 10 to 25 km diameter craters. This is consistent with the populations of lunar craters which have a more negative average slope index on the mare than on the highlands (-3 vs -2.5 differential). This difference was attributed to time variations in the crater production function for the moon (2), and the same interpretation seems valid for Mars.

The results from fitting just the crater population of the northern plains and then searching for further excesses of small craters is shown in Figure 2. At the 95% c.l., relative excesses in the 10 to 15 km range are observed to coincide with many of the major volcanic constructs (Hecates Tholus, Tyrhena Patera, Tharsis Montes, and the area north of Olympus Mons and west of Alba Patera). Because these regions could be quite young, they may be displaying still more recent time variations in the impacting population. The more likely explanation, however, is that there are many as yet unrecognized endogenic craters in these regions with diameters in excess of 10 km.

Again using the planetwide population as the reference, Figure 3 shows areas which have a relative dearth of craters in the 10 to 20 km diameter range (90% c.l.). The area south of 30°S latitude has been previously recognized as an area where craters of less than 10 km diameter have been obliterated (3). Much of this area apparently has lost craters as large as 20 km diameter.

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References: