OBJECTIVELY QUANTIFYING MARTIAN LOBATE CRATER EJECTA PATTERNS. C.S. Salvino[1] and D.M. Burt[2], [1]ASU School of Earth and Space Exploration, Tempe, Arizona, USA (chris.salvino@sharpmedicalproducts.com). [2]ASU School of Earth and Space Exploration, Tempe, Arizona 85287-1404 USA (dmburt@asu.edu)

Introduction: Asymmetric ejecta patterns are seen with some craters on Mars; the etiology is unknown but may be related to the volatiles in the subsurface [1-4]. In order to more fully explore these patterns an objective analytical tool is needed to quantify the asymmetry. To date, no published method to objectively quantify the asymmetry of the ejecta patterns has been developed. Such method should ideally be simplistic, reproducible, and expeditious in nature. Using a JMARS data set [5], 100 Martian craters with asymmetric ejecta patterns having a crater diameter of 1-40 km, in latitudes > (+) 60 to (-) 30 degrees were examined as well as 10 Lunar crater "controls". While not specifically quantified, both classic rampart and multilayer ejecta patterns were noted. 3 Methods of modeling crater asymmetry were developed and used on the target crater ejecta. Collectively these methods required visual projection of (1) a circle around the outermost aspect of the ejecta pattern, (2) a circle around the innermost aspect of the ejecta pattern and (3) an outline of the ejecta pattern itself. Each of the 3 models analytically relate the area of 2 of these 3 projections. A primary result was the finding that all 3 methods were fairly simple, consistent and quick and resulted in a numeric score relating to the degree of asymmetry. Secondary findings were that within this limited data set no statistical difference was seen within each of the 3 modeling methods with respect to crater latitude, diameter or elevation. In addition, visual inspection of the Mars vs Lunar controls revealed the studied Mars ejecta pattern to be subjectively more lobate/asymmetric; 2 of the 3 modeling methods analytically confirmed the visual interpretation of the ejecta patterns. While these modeling methods do not confirm subsurface volatiles; they could be a first step in objectively allowing comparison from one asymmetric crater to another. Further work should be done to improve the modeling and eventually lead to the possibility of correlation with volatiles as well as volatile concentration.

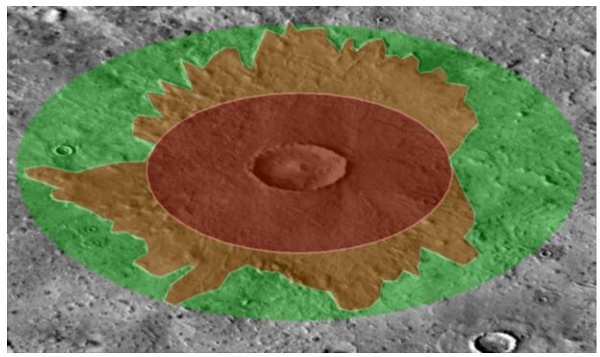

Fig. 1. Mars crater 62.828 N, 187.453 E, crater diameter 36.2 km. Representative example of one of the 100 data set craters showing the method of colorization to better identify the ejecta pattern, outer circle and inner circle. JMARS Image.

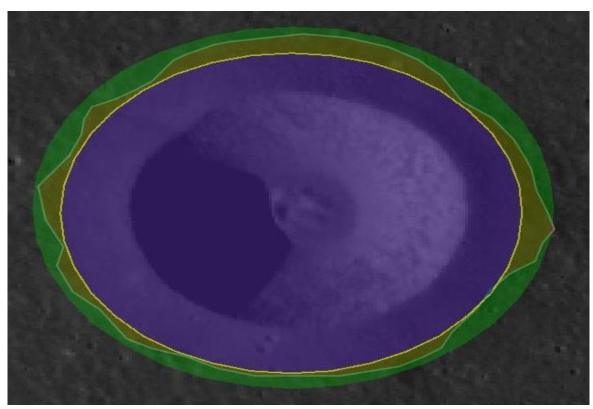

Fig 2. Lunar crater 33.01 N, 344.152 E, crater diameter 8.6 km. Representative of one of the 10 limited control craters showing the method of colorization to better identify the ejecta

pattern, outer circle and inner circle. JMARS Image.

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References: [1] K.H.G Hughson et al. (2019) *JGR Planets 124* (7), 1819-1839. [2] D.K. Weiss et al. (2013) *Geophys. Res. Let. 40*, 3819-3824. [3] D.K. Weiss et al, (2014) *Icarus 233*, 131-146. [4] D.K. Weiss & J.W. Head (2018) *Meteoritics & Planet. Sci.*, *53*(4), 741-777. [5] www.jmars.asu.edu (2021).