IS 1000 KM^2 THE MINIMUM AREA FOR USEFUL MODEL AGES ON MARS? N. O'Leary[1], D. Hill[2], , A. Hager[1], O. Ukiwo[2], A. Duffy[2], C. Akers[2] and A. D. Schedl[2] [1]Department of Geology, Marshal University, oleary9@marshall.edu, [2]Department of Chemistry and Physics, West Virginia State University, schedlad@wvstateu.edu .)

Introduction: Model ages are useful in deciphering the history of planets and understanding the processes that are active on planets. This is why it is important to know the minimum areas for useful model ages. Landslides near Valles Marineris (VM) are an example of small area features that it would be useful to date. We determined isochron ages of 44 landslides >400 km^2 in area [1]. The results were surprising, almost 50% have isochron ages of ≤1.0 Ga, and so are these actual ages or an artifact of erosion? Warner et al. [2] suggest that ≈1000 km^2 was the minimum area for useful model ages. We will test this idea by comparing the age distributions of two populations of degradation state 3 impact craters, those ≥40 km in diameter and those 25 to 40 km in diameter.

Valles Marineris is ≈3.5 Ga or younger [3]. Robbins et al. [4] developed a classification scheme based on the degradation state of impact craters and a database of 400,000 craters. In previous studies, we found that crater degradation states of craters near VM are related to age [5]. 90% of craters of degradations states 1 and 2 are older than 3.5 Ga, whereas degradation state 3 craters range from 1.0 to 3.6 Ga. The number of craters of degradation state 4 near VM are small in size, ≤30 km diameter, and relatively few in number. Preliminary ages degradation state 4 craters are <1.0 Ga.

Methods: Since we are interested in applying the results of this work to landslides in VM, we examined degradation state 3 craters lying near Valles Marineris. To control for climate we considered craters lying between ±30° north and south latitude. In this region aeolian geomorphic processes are dominant [6] and ice cemented regolith has a uniform thickness of 1.5 km. North and south of these latitudes the ice cemented regolith thickens [7]. Using these criteria we identified 38 craters ≥40 km in diameter and 39 craters 25-30 km in diameter. We determined model ages using Craterstats II [8] and crater counted CTX images using JMars.

Results: Figure 1 shows the age frequency distribution for craters ≥40 km in diameter. This age distribution shows an exponential decline in the frequency of impact craters with time.

Figure 2 shows frequency distribution of the isochron ages for craters 25-40 km in diameter. The age distribution is best describes as sinusoidal or multimodal.

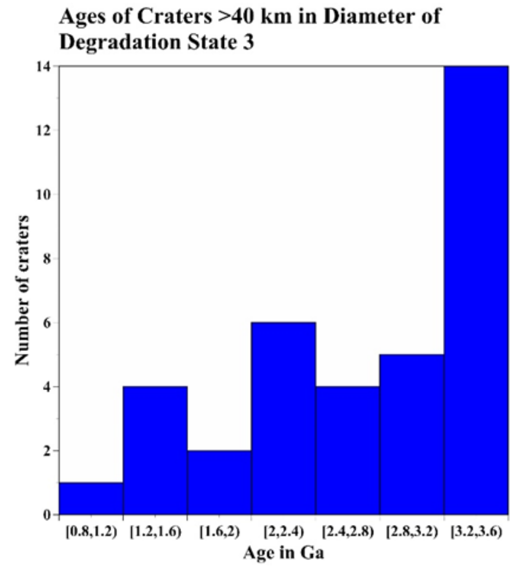


Figure 1

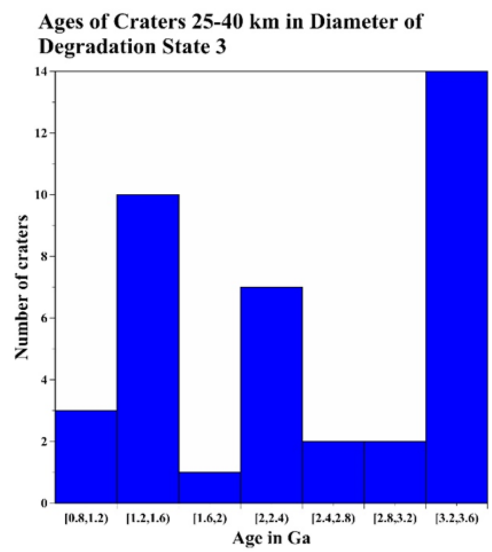


Figure 2

Interpretation: To test the hypothesis that the two age distributions were the same we applied a Kolmogorov-Smirnov test [9]. We obtained a (D) value = 0.225 and the (p) value =0.263. Thus there is a 26% probability that the two age distributions are the same. When dealing with small areas there are two problems: 1) cratering is a random process, and large craters have a low probability and thus may not make it into the data set. 2) Erosion removes smaller craters from the data set. Thus we have poorly defined isochrons for some of the craters in the 25 to 40 km diameter size range as shown in Figure 3.

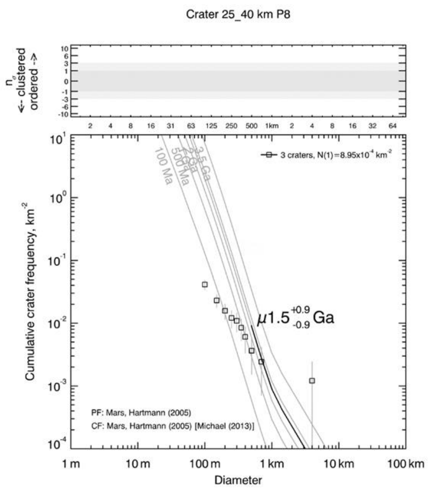
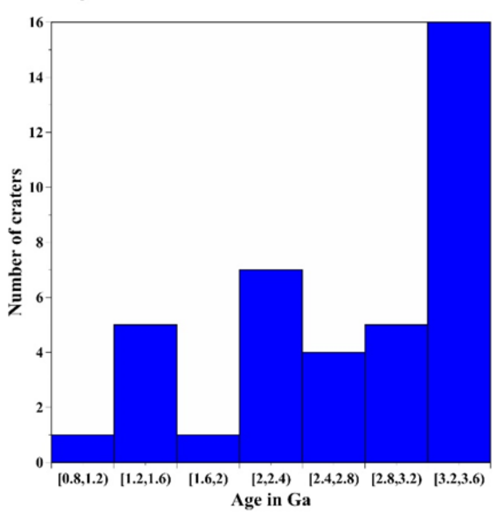


Figure 3: Age Regression Plot of Crater P8 showing a ≥ 1 km outlying data point. This outlying data point indicates an unreliable isochron age**.**

To correct for these affects, we determined ages from the aerial density of craters ≥ 1 km in diameter [10]. Figure 4 shows the new results for craters 25 to 40 km and this shows a more of an exponential curve. When the Kolmogorov-Smirnov test is applied to this age frequency distribution, the (D) value = 0.3354 and the (p) value = 0.999. These results indicate that the ages for the >40 km diameter craters and 25 to 40 km diameter craters are drawn from the same age distribution. Thus, the two populations are the same. This results suggests that many of the ages for Valles Marineris landslides are unreliable [1].

Ages of Craters 25-40 km in Diameter of Degradation State 3 Neukum Correction



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