THE "MISSING" IMPACT CRATERS ON VENUS; D. H. Speidel, Dept. Geol., Queens College, CUNY, Flushing, NY 11367

The size-frequency pattern of the 842 impact craters of Venus measured to date [1] can be well described (across four standard deviation units) as a single log normal distribution with a mean crater diameter of 14.5 km. This result was predicted in 1991 [2] on examination of the initial Magellan analysis [3]. If this observed distribution is close to the real distribution, the "missing" 90% of the small craters and the "anomalous" lack of surface splotches [4] may thus be neither missing nor anomalous.

The cumulative frequency curve of impact crater diameters (Fig.1) illustrates a familiar pattern: the crater diameter size-frequency relationship can be described as approximating a power law in the large sizes. For diameters below about 50 km, the deviation from this power law increases as the diameter decreases, producing the knee or rollover effect displayed. When the individual size-frequencies are plotted however, the pattern seductively appears to approximate a normal distribution.

By using probability graphs [5], the diameters of 842 craters of Venus can be well described by the straight line in Fig. 2 for all but the largest 1% and the smallest 1% of the diameters -- a range of 4 standard deviation units around the mean. But what is the relationship of the OBSERVED to the REAL?

It could be coincidence that a steadily increasing number of smaller and smaller craters starting at about 50 km diameter have been destroyed in the exact proportion necessary to give an apparent log normal distribution. It is to be expected that the dense atmosphere of Venus has strongly affected the production of craters, selectively screening the greater amount of smaller craters. The surface "splotches", assumed to be produced by air blasts from disintegrating impactors [1,4], could be evidence of such atmospheric screening. But the 367 splotches tabulated [4] are nowhere near enough in observed number for the expected power law distribution. Where are the several thousand that would be produced instead of 16 km craters? The approximately 10,000 instead of 8 km craters? They are not observed in anywhere near the number expected if the size-frequency power law holds. The number of splotches is not, however, inconsistent with the observed log normal size distribution of craters.

I think that the missing craters and missing splotches can be satisfactorily explained by accepting that the observed distribution approximately the real one, that it is not the craters that are missing but the impactors. What you see is what you got. The implication that Venus crossing impactors would have the same type of log normal distribution is consistent with recently described distribution for terrestrial craters and Earth crossing asteroids [6].

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Fig. 1. Size-frequency of Venus impact craters. Cumulative values are open circles. Individual bin values are solid circles. Data from [1].

Fig. 2. Probability distribution of Venusian impact craters. Data from [1]. Mean (+/- 1s) is measured from the straight line at 50 (16, 84) cumulative percent values. This distribution covers 89% of Venus' surface.