Phenomenology of Calderas on Venus; M.H. Bulmer[1], E.R. Stofan[2], J.E. Guest[1] ([1]Univ. London Obs. NW7 2QS, UK, [2] Jet Propulsion Laboratory, Pasadena, CA)

A preliminary global examination of the venusian surface imaged by Magellan SAR revealed a large number of calderas and volcano-tectonic depressions of different types and sizes[1]. A more comprehensive study of the data has begun. A database of calderas and large depressions on Venus has been designed to incorporate information on their morphological and morphometric aspects. The global survey has been conducted using Magellan C1 MIDR products. Thirty C1 MIDRS have been examined which extend in latitude between 7.64° N and 22.61° S. Measurements were taken from the digital SAR images and GTDR framelets using NIH Image and on the topographic map from the Pioneer Venus mission (V50M 6/60 RKT 1981 I-1324). Each record in the database has thirteen fields that provide data on the name, type[1], latitude, longitude, location, diameter, along and across-track length, height, basal altitude, vent distribution, associated lava flows and associated tectonics. A comments field also provides information on the data products and supplementary data on the caldera or large depression as well as its geological setting.

To date 100 calderas have been identified in the 30 C1 MIDRS examined. This indicates that there are many more calderas on the surface of Venus than the eighty-six that were identified (independent of those on large shield volcanoes) in the preliminary survey of Venus volcanism[2]. Based on examination of different caldera structures nine different morphological categories[1] can be identified. Of the 100 hundred calderas studies to date 52 fall into category i, that of a downsag (figure1). Calderas and large depressions range in size from the limit of SAR resolution up to four hundred kilometres (figure 2). Thirty seven of the total 100 calderas are 25 km in diameter or less and there is a general inverse trend in size and frequency. Calderas on the summits of volcanoes on Venus have similar characteristics to calderas on Earth, the Moon and Mars[3]. However, large volcano-tectonic depressions that range in size from 50 km to over 400 km are not seen on the Moon, Mars or Earth, though Io has calderas that range up to 200 km in diameter[4].

The distribution of post-caldera vents was characterised using categories devised by Walker[5]. A, a single vent which occupies a central or near central position; B, vents are distributed in a straight line (or near), or in a linear zone; C, single vent at or near the caldera margin; D, vents occur along an arcuate line paralleling the caldera margin; E, vents are scattered widely; F, a dome is present; G, vents are scattered and occur only on the floor of the caldera; and H, there is no evidence of associated vents. Figure 3 shows that the majority of calderas have post caldera vents associated with them. Most commonly calderas have vents that occur along a line paralleling the caldera margin. This is not surprising given that 47 calderas have concentric fractures and graben associated with them. This indicates that the fractures and graben have guided subsequent eruptions. However, 26 calderas have widely scattered vents suggesting that their locations were not related to a specific trend.

The preliminary findings of this study show that calderas on Venus are more common than has been previously suggested. Calderas associated with shields, cones and domes are morphologically and morphometrically similar to calderas on Earth. The larger collapse structures appear to be the venusian counterpart of terrestrial down-sag calderas.

References;[1] Bulmer et al (1992) *Lunar Planet Sci., XXIII,* 177-178. [2] Head et al. *J. Geophys. Res., 97,* 13,153-13,197. [3]Wood (1984) *J. Geophys. Res., 89,* 8391-8406. [4] Schaber (1982) *in Satellites of Jupiter.* pp556-557. [5] Walker (1984) *J.Geophys. Res., 89,* 8407-8416.

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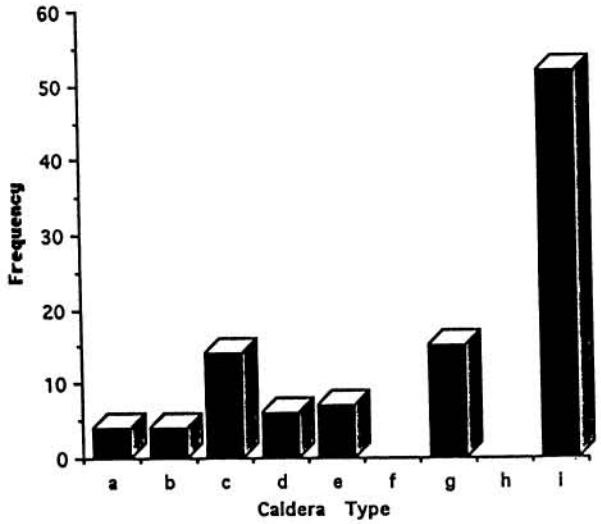

Figure 1 Histogram showing the frequency of different morphological types of caldera on Venus based on the scheme devised by Bulmer et al. 1992. Population 100.

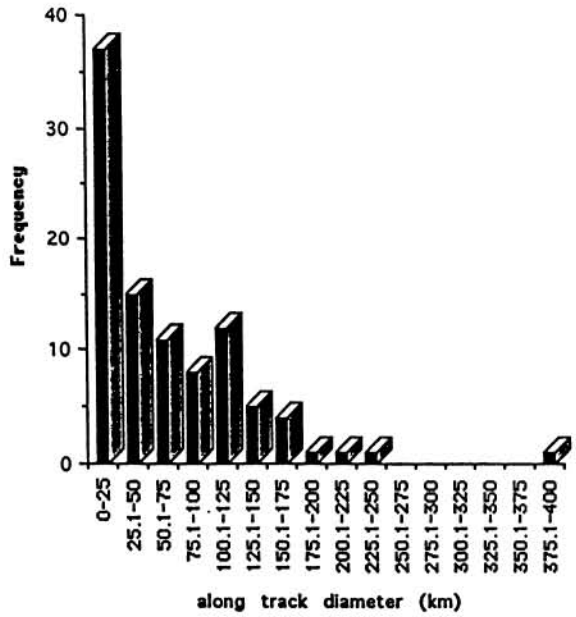

Figure 2 Histogram showing the frequency of along track diameters of 100 caldera on Venus.

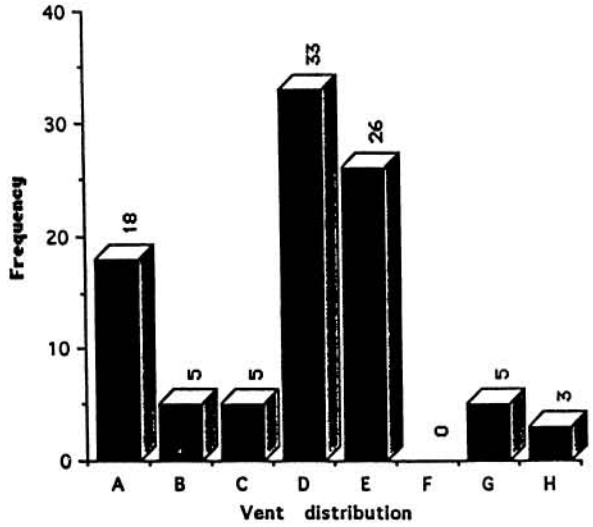

Figure 3 Histogram showing the frequency of the different categories of vent distribution of 100 calderas on Venus.