CHARACTERISTICS AND GEOLOGIC RELATIONSHIPS OF SHIELD FIELDS VERSUS SHIELD PLAINS ON VENUS. D. M. Miller[1], and Tracy K.P. Gregg[1], [1]Department of Geology, 411 Cooke Hall, University at Buffalo, Buffalo, NY 14260 dianamil@buffalo.edu.

Introduction: The surface of Venus displays > 550 clusters of small (< 20 km basal diameter) shield volcanoes. Aubele [2] proposed the existence of 2 morphological classes of these Venusian shield clusters: shield fields (Fig. 1) and shield plains (Fig. 2). Shield fields consist of small shield volcanoes that are contained within a 10^3 – 150^2 km^2 region, whereas shield plains are shield volcanoes distributed over 10^3 – 10^6 km^2. Based on image interpretation, Aubele [2] stated that shield fields may have deep magma sources with low magmatic flux; comparitively, shield plains may have relatively shallow, and more widespread magma sources. Shield fields may be either stratigraphically older, younger, or concurrent with the plains units that surround them. In contrast, shield plains consistently appear stratigraphically above densely lineated plains and below wrinkle-ridged plains [3].

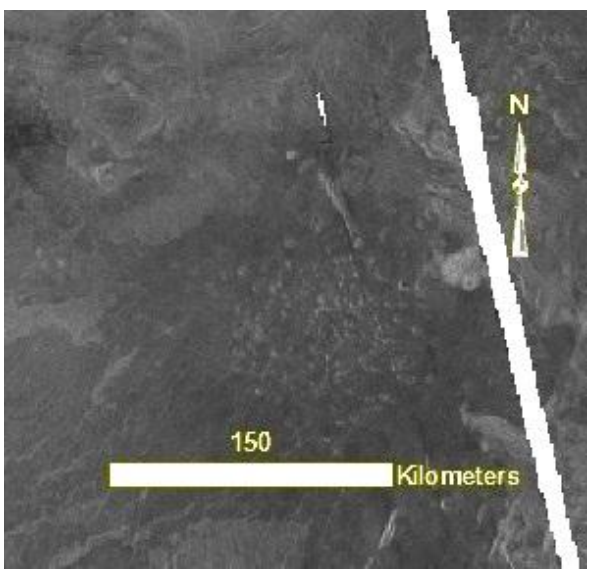

Figure 1. A Venusian shield field [2], centered at 52°S 302°W. (Right-looking CMIDR courtesy of mapaplanet.com.)

Hypotheses: Individual volcanic shields within shield plains have different morphological characteristics and spatial distributions than those contained in shield fields. These variations include: spacing between volcanoes, edifice shape, relationships with adjacent geologic and tectonic features, and lavaflow morphology and distribution. Geologic mapping and spatial analysis can be used to characterize and quantify Venusian shield clusters. Results of spatial analysis may reveal information about magma sources [cf. 2, 3].

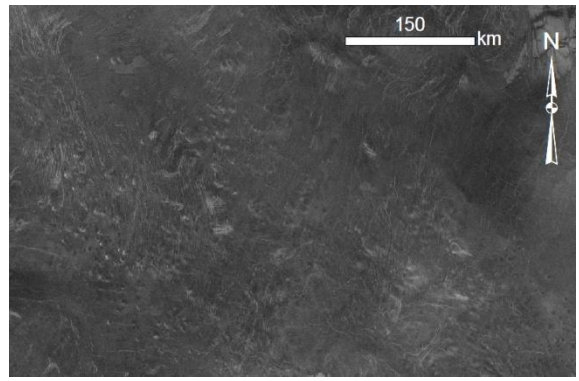

Figure 2. Venusian shield plains [2], centered at 38°N 119°W. (Right-looking CMIDR courtesy of mapaplanet.com)

Methodology: I will begin with a detailed study encompassing at least three shield plains and three shield fields. The shield plains and shield fields I will analyze have been determined by examination of USGS maps of Venusian quadrangles. I will use two methods: detailed mapping of each shield field and shield plain and a nearest-neighbor spatial analysis.

Mapping. I will constrain morphological characteristics and stratigraphic relationships in both shield fields and shield plains through geologic mapping. Detailed maps of individual shield plains or shield fields do not presently exist.

I will create local geologic maps at scales appropriate for the shield plains and shield fields, with detailed mapping of the feature and sketch mapping of the structures surrounding the feature. Maps will be based on Magellan (F-MIDR) images of the shield fields and shield plains and created with the ArcGIS software. A preliminary map is shown in Fig 3.

Spatial Analysis: Baloga and others [4] proposed a model for a nearest-neighbor (NN) spatial analysis of geologic features. The model takes point locations of the desired features and compares them to the closest points (the nearest neighbor) to quantify spatial distributions; the input to the model is cartesian coordinates. A probability density curve is then plotted and can be identified as one of four distributions: classic Poisson NN, renormalized Poisson NN, scavenged, or classic logistic (Fig. 4). The skewness and kurtosis can also

be plotted to allow comparisons between different volcanic fields.

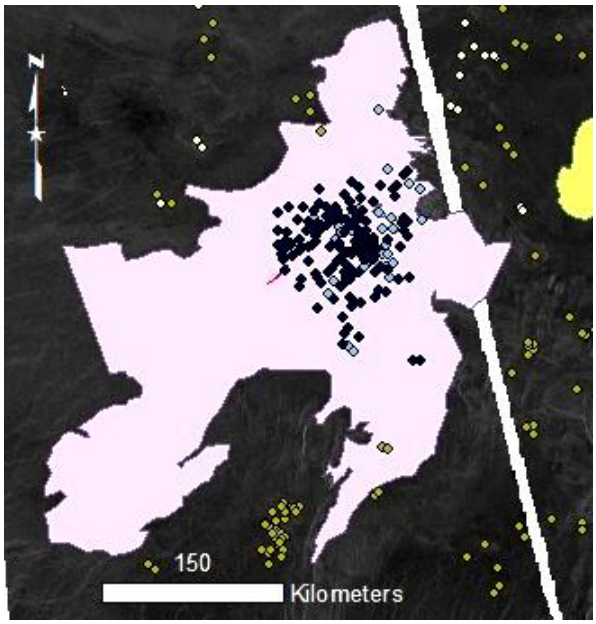

Figure 3: This is a slightly larger view of the same shield field as Fig 1, centered at 52°S 302°W. Blue dots are interpreted shields that are part of the shield field. Yellow dots are shields that are not part of the cluster. Yellow polygons are pancake domes, and the light pink polygon are cluster lava flows.

Beggan and Hamilton [5] created Geological Image Analysis Software (GIAS) to compute the same statistics of the Baloga and others' [4] model. A table of point locations is input in the program which then computes the NN statistics. Therefore, point locations of each shield volcano in each cluster must be identified. GIAS plots the probability density and the skewness and kurtosis.

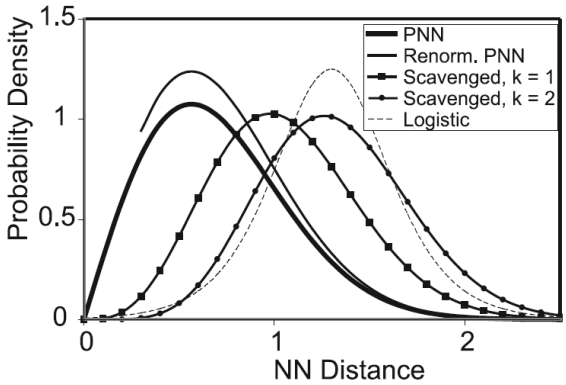

Figure 4: A graph showing examples of Poisson Nearest-Neighbor (PNN) distribution, Renormalized Poisson distribution (Renorm PNN), scavenged distributions, and classic logistic distribution (Fig. 3 from [4]).

The results of the probability density curve suggest variations in the magma sources of different clusters [4]. For example, a Poisson NN distribution suggests a completely random spacing of vents, and that no systematic process controls the location of vents [4]. An incomplete data set with an otherwise Poisson distribution results in the renormalized Poisson distribution. The scavenged distribution suggests that vents cannot form within a given distance of another vent as determined by how much of the magma source is used up for the area. The classic logistic distribution suggests a self-limiting population growth from resource consumption [4].

Expected Results: I will use the model from Baloga and others [4] to determine if shield plains and shield fields have different spatial distributions. When combined with the geologic mapping, significant geologic variations between the two types of shield clusters may be found. The spatial dissimilarities would indicate differences in the characteristics of the sources of shield fields versus the sources of shield plains [6].

References: [1] Crumpler L.S. et al. (1997) *Venus* II, pp. 697-756. [2] Aubele J.C. (2008) GSA Abstracts with Programs 40, 133-2. [3] Aubele J.C. (2009) *LPS XXXX* Abstract # 2396. [4] Baloga et al. (2007) *JGR 112*, E03002. [5] Beggan C. and Hamilton C.W. (2010) *Computers and Geosciences 36*, 539 – 549. [6] Shockey K.. (2009) *The Spatial Relationship within Fields of Shield Volcanoes and how they Compare on the Earth, Venus and the Moon: M.S. Thesis*, University of Buffalo.