REGIONAL GEOLOGY OF THE VENERA LANDING SITES: TENTATIVE RESULTS OF PHOTOGEOLOGIC MAPPING; A.T. Basilevsky[1], and C.M. Weitz[2]; 1) Department of Geological Science, Brown University, Providence, RI 02912. Permanent affiliation is with the Vernadsky Institute, Moscow, 117975, Russia; 2) Jet Propulsion Laboratory, Pasadena, CA 91109.

Introduction: The regional geology of the five *Venera* landing sites, where geochemical measurements and TV observations on the venusian surface were made, was studied based on the photogeologic analysis of the Magellan C1-MIDRP imagery for the large area that we will call the *Venera* region (38° N to 22.6° S and 268° to 344° E). The results of the analysis were compiled in the form of a synoptical geologic map at about 1:10 M scale. MIT-processed Magellan altimetry was also used for the analysis. [1]

Description: The majority of this region is dominated by plains with an altitude close to the mean planetary radius of 6051.84 km [1]. The northwestern part of the region is dominated by the Beta Regio domical uplift and the southwestern part by Phoebe Regio. Beta and Phoebe Regios and some plains are dissected by long fracture belts associated with rift zones.

Plains of this region, where material was sampled by the *Venera 8, 9, 10, 13* and *14* landers, represent typical plains of Venus [2], with features of several types: lava flows and volcanic domes, ridges and fractures, coronae and corona-like features, islands of tessera, impact craters, and radar-dark debris mantles and wind streaks. The following is a short description of some of these features of the plains.

Islands of Tessera on most of the *Venera* region plains are usually several tens of km across and many are located approximately a few hundred km from each other to form clusters of tesserae with the distance between the clusters about 1000 to 1500 km. The tessera islands are embayed by the plains and are evidently the outcrops of a tessera basement underlying the plains. In the tessera clusters, the thickness of the plain-forming material is on the order of the topographic range within tessera terrain at distances of a few hundred km, which is some hundred meters. Between the tessera clusters, the plain thickness must be larger.

Fields of lava flows, clusters of gentle-sloped volcanic domes, and coronae and corona-like features represent the visible centers of volcanic activity. The total number of these centers on the *Venera* region plains is about 30. They form clusters of 2 to 5 centers with the average center to center distance in the clusters about 500-600 km, and cluster to cluster distance about 1000 to 2000 km. If these clusters of volcanic activity are related to the ascending plumes of the mantle material, which are essentially thermal diapirs, then the center to center distance may be used for estimating the depth of the feeding layer for the diapirs. According to the model by [3], the feeding layer depth is about 40% of the average distance between the diapirs. This gives a depth for the feeding layer in the *Venera* region as deep as 200 to 250 km.

Steep-sided domes, whose presence at the *Venera 8* and *13* areas correlates with nontholeiitic composition of the surface material [4], are present in many localities on the plains. The total number of steep-sided domes in the region is 48. A significant part of them form clusters with 2-6 domes in each and a typical 30-40 km dome to dome distance. Part of the domes are a few hundred km from each other, and a few are isolated from other ones by distances from 1000 to 2000 km. In most cases the steep-sided domes are associated with the previously discussed centers of volcanic activity. If the observed volcanic centers are placed over magma chambers, the differentiation of magma in the chambers and/or assimilation by magma of the material of the lower crust of Venus might be a mechanism to generate the viscous lavas which formed the steep-sided domes.

Beta Regio is a domical topographic rise about 2000 km across whose summit stands 4-4.5 km above the adjacent plains. Its geologic description was recently updated by Senske *et al.* [5], who confirmed early interpretations that Beta Regio represents uplifted terrain over an ascending mantle plume, *e.g.* [6]. The uplifted area is mostly made of a mosaic of tessera

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and embaying plain, which was sampled by the *Venera 9* spacecraft. Geologic mapping of the *Venera 9* site has shown that the plain was formed before the Beta uplift [2]. The southern summit of Beta is a volcano, Theia Mons, sitting at the junction of three branches of the Devana Chasma Rift. Theia Mons' summit and flanks are covered by lavas which are among the youngest volcanic units of the area.

South of Beta Regio, the Devana Chasma Rift Zone travels about 3000 km through the plains, generally southward, and then splits into several less prominent fracture belts as it enters the eastern boundary of the Phoebe Regio topographic uprise and the adjacent plain. North of Phoebe Regio, the rift zone has two associated volcanic centers with lava flows covering the adjacent plains. The distance between these two volcanic centers is about 1000 km. At the triple junction of the rift zones at the southeast end of Phoebe Regio, there is one more rift-associated volcanic center with lavas embaying the surrounding tessera terrains and volcanic plain. All these rift zones appear very young, which is supported by the fact that the crater Bonheur on the plain between Beta and Phoebe Regiones is dissected by the fractures from the rift zone. Bonheur is a crater with low emissivity material on its floor, which is believed to be evidence that the crater is very young [7].

The Phoebe Regio Uplift is a 1000 x 2000 km island of tessera terrain which is embayed by the adjacent plains. This tessera looks similar to the tessera of Beta Regio and both large and small islands of this terrain extend from the eastern flank of Beta to the large block 800 km island east of Phoebe. This large tessera block east of Phoebe has its eastern part dissected by several other rift zones, and at their junction there is another volcanic center with lavas embaying the tessera and the adjacent plains. Bindschandler *et al.* [8], based on consideration of *Magellan* imagery and *Pioneer Venus* gravity data, interpreted Phoebe Regio as a surface expression of mantle coldspots or a region of downwelling. Our mapping shows that in the recent geologic period, Phoebe Regio definitely was not a downwelling area because the rift zones dissecting it are evidence of extension. The downwelling hypothesis may be applied to the formation of the tessera, composing Phoebe, but because Phoebe tessera is just one of several large islands of tessera in this region, the coldspot theory should be tested on a much broader area.

Conclusion: Geologic analysis of the *Magellan* imagery and altimetry for the broad region, where the *Venera 8,9,10,13*, and *14* landers made geochemical measurements of the surface material, has shown that the dominant terrain of this area is volcanic plains. The plain-forming material sampled by the *Venera* landers represents mostly tholeiitic basalts with some amount of nontholeiitic volcanics. The plains flooded the preexisting tessera terrain, which may underlie all of the region under study. It is not clear now whether the plains were formed by overlapping lava flows from numerous volcanic centers, or whether the majority of the plain-forming materials were formed by some events of larger scale and the observed centers represent only the last stages of the plain-forming volcanism in this area. The plain-formation was followed by the domical uplift of Beta Regio over the ascending mantle plume and by rifting and associated volcanism, which represent the youngest traces of endogenic geologic activity in this region.

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