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

Introduction: The regional geology of the two Vega landing sites, where geochemical measurements on the venusian surface were made, was studied using Magellan C1-MIDRP imagery and MIT-processed altimetry for the large region which we will call the Vega region (22.90° N to 22.90° S and 154.12° W to 211.12° E). The results of the analysis were compiled in the form of a synoptic geologic map of about 1:10 m scale.

Description: The majority of this region is dominated by plains with an altitude level close to the mean planetary radius. The plains have several islands of tessera terrain. The plains and tessera terrains are dissected by a system of rift zones with volcanic centers at some of the rift junctions, including the well-known edifices of Ozza Mons and Maat Mons. One more well-known volcanic edifice, Sapas Mons, is located to the west of the rift zones.

Plains are typical venusian plains, but compared to the plains of the Venera region, they are less spotty with vast radar-dark and radar-bright units. At least three age units maybe distinguished within the plains. Older plains often have a fractured surface and low ridges about 10 km long. They occur mostly at the central-northern part of the region around the tessera block of Nokomis Montes. These plains are embayed by intermediate-age plains, which represent the majority of the plains found in the Vega region. They generally have a network of wrinkle ridges and other features typical of the venusian plains. The material in these intermediate age plains was sampled by the Vega 1 and Vega landers and determined to be a tholeiitic composition. The younger plains are associated with the rift zones. They are formed by lava flows either originating from the volcanic edifices of Maat and Ozza Montes, or from the rift zones with no morphologically prominent edifices. Their boundaries with the plains of intermediate age are unclear in many places. Typical characteristics of the younger plains are the absence of the wrinkle ridges network. This makes sense because the association of younger plains with the rift implies an extentional environment while the wrinkle ridges formation implies a compressional one.

Islands of tessera are present in several parts of the Vega region, perhaps representing a tessera basement underlying the plain-forming material. They are much less abundant here compared to the Venera region. This implies a larger thickness of the plain-forming lavas. Volcanic centers have been identified in several places on the plains with center to center spacing about 500 to 600 km, similar to the Venera region. But the center of the western part of the Vega region, the radar-dark lava flows form a large 1000 x 2000 km field, the southern end of which contacts the Dali Rift Zone. Inside this lava field there are several corona-like features (with the spacing also close to 500 km) which are probably the sources for the lava flows coalescing in the single lava field. The steep-sided volcanic domes are not typical for this region. We have mapped only one of them on the plain about 1,500 km southeast of Maat Mons.

Rift zones occupy a significant part (about 20%) of the region. The largest rift zone in the region is Diana Chasma. It travels along the southern margin of the region for more than 4000 km, and it consists of a peculiar combination of coronae and corona-like features, forming broad E-W trending chain, and linear fracture belts, which are typically expressed as topographic troughs. In the eastern part of the Vega region, the Diana Rift Zone becomes a
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A system of fracture belts trending SW-NE. At the broad area around 0° N latitude and 200° E longitude, there is a junction between Devana Chasma, Ganis Chasma, Parga Chasma, and two other unnamed rifts. At this junction are the two large volcanic edifices, Ozza and Maat Mons. Lavas from Ozza Mons flood some parts of the rifts fracture belts and are dissected by some rift-associated fractures. This implies contemporaneous tectonic deformations and volcanism. Lavas from Maat Mons are superimposed both on lavas from Ozza Mons and on rift-associated fractures. They are evidently the youngest volcanics of the area under study. Further north, a fracture belt in Ganis Chasma travels northward and then to the northwest. At the area around 17° N latitude and 196° E longitude, where a junction occurs between the Ganis Rift and two unnamed rift zones, there is a volcanic center with lava flows flooding the surrounding plains.

Within the rift zones of the Vega region, there are three impact craters with associated dark parabolic features. One of them, Von Schuurman, is superimposed on the Dali Chasma Rift. Another, Sitwell, is superimposed on the Ganis Rift and may have been followed by some rift-associated fracturing. The third one, Luxemburg, is superimposed on lavas of the Ozza edifice and dissected by Dali Chasma fractures, which, in turn, are covered by lavas from Maat Mons. This implies that at least the last stages of tectonic and volcanic activity associated with rift zones of the Vega region are contemporaneous to the formation of the craters which are young enough to preserve their associated radar-dark parabolic features. Those craters evidently belong to the youngest 10% of the venusian crater population [4], and this means that the rifting and rift-associated volcanism of this area were active here as recently as during the last 50 m.y. [5]

At 9° N latitude and 189° E longitude, the volcanic edifice of Sapa Mons looks as fresh and prominent as Ozza Mons and Maat Mons, but it has no visible association with the described rift zones. It rises about 2 km above the intermediate-age plains of Rusalka Planitia and its lavas cover the volcanics of the plains. Its flanks and the plains around it are disrupted by a radial fracture system. Sapa Mons seems to be an example of the volcanic activity as young as the activity of the rift zones of the Vega region. However, it probably originated from an ascending mantle plume that is not associated with the rift zones.

Conclusions: Geologic analysis of the Magellan images and altimetry for the broad region around the Vega 1 and 2 landing sites has shown that the dominant terrain of this area is volcanic plains. Three age units were identified within the plains and the Vega 1 and 2 landers both sampled the intermediate age plain. The plains formation was predated by the formation of tessera terrain which now forms several islands and probably occurs as a basement beneath the plain-forming material for the entire region. The formation of the intermediate age plain was followed by rifting and young volcanism, a significant part of which was associated with the rift zones. Stratigraphic relations of rift-associated features with very young impact craters show that the rift activity occurred in this area as recently as during the last 50 m.y..