VOLCANISM ON VENUS: LARGE SHIELDS AND MAJOR ACCUMULATIONS OF SMALL "DOMES"; G.G. Schaber and R.C. Kozak; U.S. Geological Survey, Flagstaff, Arizona 86001

The outer layers of the Venusian lithosphere appear to dissipate heat from the interior through mantle-driven thermal anomalies ("hot spots", "swells"). As a result, Venus exhibits diverse forms of "thin-skin" tectonism and magmatic transfer to and extrusion from countless numbers of volcanic centers (e.g., shields, paterae, domes) and volcano-tectonic complexes (e.g., coronae, arachnoids) [1]. We will summarize what is known about the distribution and morphologies of major Venusian shields, and describe the evidence for possible structural control of major accumulations as long as 5000 km of small volcanic "domes".

LARGE VENUSIAN SHIELDS- Approximately 40 major shields whose basal diameters exceed 200 km have been tentatively identified on Venus between lat 90° N. and 65° S. from analyses of PV, Venera 15/16, and Earthbased radar data. The gross morphologies and estimated volumes of ten major shields between lat 30° and 90° N. have been determined from Venera 15/16 data [2]. Nine of these shields have extremely low heights (0.7 to 2.3 km) despite large basal diameters (300 to 782 km); in this respect, the shields are similar to highland paterae on Mars (e.g., Hadriacia and Tyrrhena Paterae) and some paterae (e.g., Ra Patera) on Io. The tenth shield, Tepev Mons (western Bell Regio), is the notable exception. This shield is probably young [3]. It has a substantial height of 5.2 km and a basal diameter of 253 km, and it possesses a well-defined ring moat resulting from flexure of the lithosphere below the load [3].

Most large shields within the northern quarter of Venus are associated with the large concentration of coronae between lat 30° and 80° N. and long 238° and 272° and with Lakshmi Planum. The heights of 30 other shieldlike constructs (basal diameters >200 km) between lat 30° N. and 65° S. were found from PV altimetry to range between 0.8 and 3.9 km (average = 2.9 km). The larger Venusian shields, unlike the Tharsis shields on Mars, cannot achieve great heights, probably because of thermal conditions in the crust and lithosphere.

MAJOR ACCUMULATIONS OF VOLCANIC "DOMES"- Small (2- to 20-km-diameter) conical and domical landforms ("domes") are abundant on the surface of Venus; they are probably volcanoes [1]. Slyuta et al. [4] reported that domes in small "groups" (50-80 km across) and larger "clusters" (few hundred kilometers across) in some regions form "accumulations," which can extend for over 5000 km. Examples of accumulations have been identified in Tethus Regio and Atalanta and Niobe Planitiae; they are especially well developed between Akkruva Colles (northeastern Niobe Planitia) and Allat Dorsa ("Akkruva-Allat") and between Ananke Tesserae and Akkruva Colles ("Ananke-Akkruva"). Smaller concentrations of domes are found in Ganiki, Guinevere, Bereghinya, and Snegurochka Planitiae [4].

The largest lineal accumulation of small domes in the northern quarter of Venus, Akkruva-Allat, is best developed at Akkruva Colles (lat 45°; long 118°). It is 600-1000 km wide and extends northwest-southeast for over 5000 km from northeastern Niobe Planitia (lat 40°, long 135°) to Allat Dorsa (lat 65°, long 70°) [4]. Most of the Akkruva-Allat heavily domed terrain is about 1 km higher than the adjacent smooth plains; a lineal positive gravity anomaly as great as 25 mgal is associated with this dome accumulation [4,5]. The concentration of domes in the middle and southern parts of Akkruva-Allat reaches 2344 domes per 10^6 km^2, while the average number of domes within the entire area surveyed by Venera 15/16 (excluding areas of tesserae) is 200 per 10^6 km^2 [4].

The size, shape, and frequency distribution of domes within the Akkruva-Allat accumulation are similar to those of seamounts on the Earth's ocean floor, e.g., in the East Pacific Rise [4, 6-9]. Syluta et al. [4] concluded that some of the largest Venusian dome accumulations may be independent tectonic structures; however, they recognized no large-scale tectonic dislocations in the Akkruva-Allat and Ananke-Akkruva accumulations to support the idea that they are analogous to a linear heat anomaly of the ocean-ridge type. We have, however, recognized evidence for northeast- and northwest-trending structural control of these dome accumulations.

Most terrestrial oceanic seamounts are formed on very young, thin lithosphere that permits the passage of small volumes of magma; in older, thicker lithosphere, small magma bodies would cool before reaching the surface, although larger bodies might not. Thus, smaller seamounts are generally more abundant on the youngest, thinnest crust near a ridge crest, while the number of larger seamounts tends to increase on older, thicker crust away from the ridgecrest [6]. This suggests that small sources of melt exist near the ridge crests on the ocean floor to supply the small seamounts; sources of melt may also exist along the structures controlling the Anake-Akkruva and Akkruva-Allat accumulations. Such magma sources are likely trapped remnants of extended heat anomalies originating at considerable depth. The Magellan image and altimetric data can be used to better understand the origin of these and other dome accumulations and to confirm or reject their analogy to an oceanic spreading ridge.

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