"SPIDERS" ON VENUS : RING COMPLEXES

A.L.Sukhanov. Geological Institute, Academy of Sciences of the USSR

"Spiders"is the name given to concentric structures from 20-40 to 150-180 km across, surrounded as a rule by numerous subradial ridges and radiobright stripes. The ridges and stripes cut the relief and are interpreted as surface manifestations of magmatic dikes. Dikes as a whole follow the directions of regional structures but nearing spiders they often gather toward it as magnetic lines near the magnetic pole. When spiders are close together dikes intersect making complex cobweb-like nets. But one can find a spider without a web, and vice versa, the characteristic pattern of subradial bunches of dikes can surround not a spider but a minor volcanic center.

The structure of a spider consists of 2-3, hardly more, concentric saucer-like disks or half-disks superimposed one on another, with a central dome or crater. The simplest case is represented by a single sagged cake. Usually the material of the inner disk does not stretch over the elevated brim of the outer disk as if met with a barrier, but sometimes the inner material flows out covering the depressed section of the outer ring. There are forms where one can see only an annular wall or a scarp, sometimes incomplete or covered with later lavas. There are also cases when a massive dome is surrounded by a narrow "collar"of a wall at the base.

At some places one can see that the outer disk material overlaps part of the dikes, but some dikes cut the outer ring, and all of them are absent near the central dome or crater. So the material becomes younger nearing the center of the structure.

Some elongated complex spiders have veen formed as a result of step-by-step displacement of the active center, when younger concentric walls and domes overlap older annular structures left aside. The total displacenent of 3-4 phases reaches 200-300 km. The picture resembles the formation of a volcanic ridge, when lithospheric plate moves above a hot-spot; but such displacement does not manifest itself in the structure of spiders not very far away.

Spiders are located mainly on volcanic plains and are either slightly elevated above the plain level or submerged in gentle depressions, the depth of depression being sometimes 0.5-1.0 km at 100-200 kilometers' distance from the center of the structure.

About 80 spiders have been discovered on the whole area studied (the exact number depends on the definition of some forms transitional from spiders to volcanoes or coronae). For the most part they are concentrated in three large "herds", and some are connected with ridged belts. The locations of spiders concentration seem to be determined by transsections of broad systems of regional faults of NW and NE directions. But each spider does not seem to be connected with any defini-

© Lunar and Planetary Institute • Provided by the NASA Astrophysics Data System

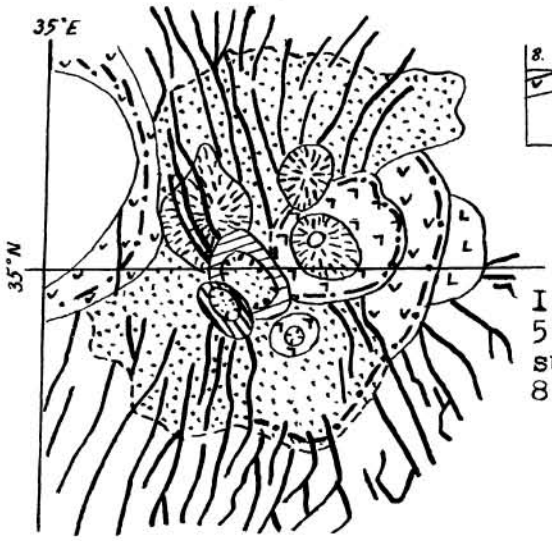
"SPIDERS" ON VENUS : RING COMPLEXES
A.L.Sukhanov

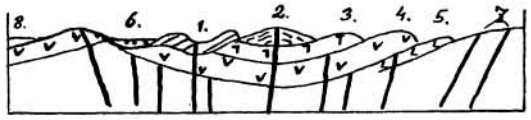
te fault : they are dispersed chaotically in isometric areas that might have been characterized by increased permeability of the lithosphere.

The mechanism of spider formation looks as follows. Lava effusions take place above the relatively shallow magmatic chamber creating a rounded platform - the base of the future spider. Perhaps, it is accompanied by doming, as structures of the surrounding terrain can be seen sometimes on the edges of the elevated spider. After partial discharge of the chamber its roof collapses and the platform subsides in the middle. A new volcanoe emerges in the depression; its lavas may or may not stretch the now elevated edges and they overlap the dikes intruded at the first stage. Then the cycle repeats, and at the same time the whole structure submerges as well as the adjacent terrain. And so the volcanic construction grows in depth rather than in height.

Spiders on Venus resemble volcano-plutonic ring complexes and resurgent cauldrons on the Earth, differing by prevalence of radial dikes, constructions dimensions and by subsidence amplitudes. It is natural to suppose that such characteristics of venusian structures depend on the lesser thickness of its lithosphere and near-surface position of large magmatic chambers.

Perhaps this could also explain the fact that there are few large volcanoes on Venus and they are of small height. Here we see either giant elevations like Beta or Ulfrun, or uncountable domes no more than several kilometers across; and up to now only about 30 volcanoes with base diameters of 50-200 km have been found on the whole area; as a rule their height is less than 0.5 km. It seems plausible that the thin heated lithosphere of Venus could not support the burden of large volcanoes, and the central-type volcanoes on Venus are replaced to a certain extent with subsided spiders structures.





I:4 000 000

One of the biggest spiders west of the Bell dome

I - calderas; 2 - domes; 3,4, 5,6 - volcanical sheets of successive stages; 7 - dikes; 8 - lava plains.

Cross-section along 35°N lat.

© Lunar and Planetary Institute • Provided by the NASA Astrophysics Data System