COMPARATIVE MORPHOSTRUCTURAL ANALYSIS OF THE TERRESTRIAL PLANETS. V.J.Finn, V.R. Baker and G.Komatsu, Geosciences and Planetary Sciences, University of Arizona, Tucson, AZ 85721.

Morphostructural analysis began as a technique to analyze evolutionary sequences of landforms as controlled by tectonism and denudational processes. The procedure was initiated by geomorphologists in the Soviet Union and eastern Europe [1,2,3]. In the last 15 years Soviet geoscientists have extended this tool in combination with geophysical, geological, tectonic, and geochemical data to explore for petroleum and mineral deposits [4,5,6]. Because of its strategic value and problems of translation, modern morphostructural analysis is little known in the United States.

Morphostructural analysis deciphers the complex interactions of long-lived endogenic processes with surface relief. By analyzing lithospheric depth and geologic time along with areal landform analysis the technique greatly expands upon the usual surficial geomorphic analyses. It is especially useful in revealing concentric, circular or oval, and linear dislocations of basement rocks that on Earth are commonly obscured by sedimentary or volcanic cover, deformational events, or intrusions. The scale of the indicated morphostructures depends on different depths and scales of mantle thermal activity, including hot spots. Experience in the Soviet Union shows that morphostructural analysis allows the distinction of endogenetic (hot spot) from exogenetic (impact) origins.

In our preliminary application of morphostructural analysis to Mars and Venus we found it useful to analyze various types and combinations of endogenic concentric domes (Fig.1), using schemes such as those developed by Thomson and others [7]. The complex Martian tectonic bulges of Tharsis and Elysium and adjacent basins seem representative of long-term evolution of megaconcentric structures on a planet with a very thick lithosphere. In contrast, Venus, as interpreted from Venera 15/16 results [8], displays concentric structures on a variety of scales, probably related to its much thinner lithosphere and to a rich history of varying mantle hot spot activity [9].

We have extended our terrestrial experience in morphostructural analysis [10] to a preliminary analysis of Venus morphostructures. The northern hemisphere of Venus is divisible into mega-sectors characterized by different tectonic evolutionary regimes [11]. These sectors are the largest scale morphostructures on the planet. At smaller scales in hierarchical arrangement, there are numerous oval, circular, and linear morphostructures. These are similar to the well-documented Earth megastructure hierarchies (Fig.2). Our more detailed analysis of Ishtar Terra [12] illustrates the hierarchical arrangement of megaconcentric structures at intermediate scales.

It is our intention to overcome the problems that have limited communication of morphostructural analysis from the U.S.S.R. to the international scientific community. As a new tool in comparative planetary studies, it promises a fresh perspective on the genetic interpretation of planetary surfaces. By relating surface forms to long-acting endogenic processes, morphostructural analysis can both inspire and test model formulations of internal planetary geophysical processes.

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by N.T.Kochneva

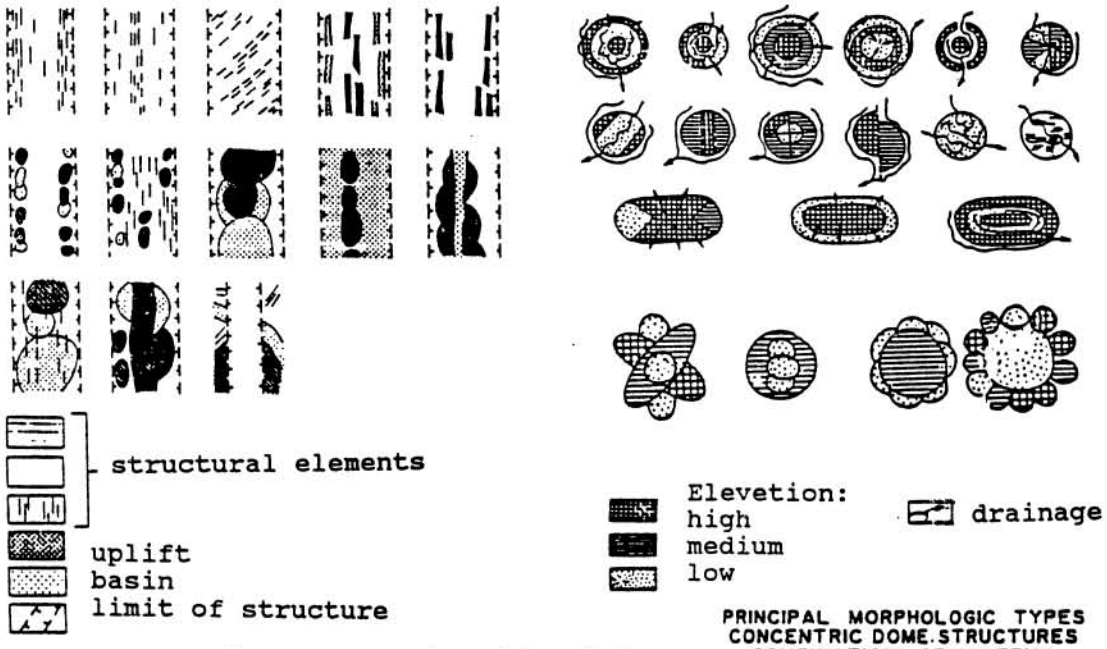

Fig.1. Morphological types of continental lineaments with inner arrangements

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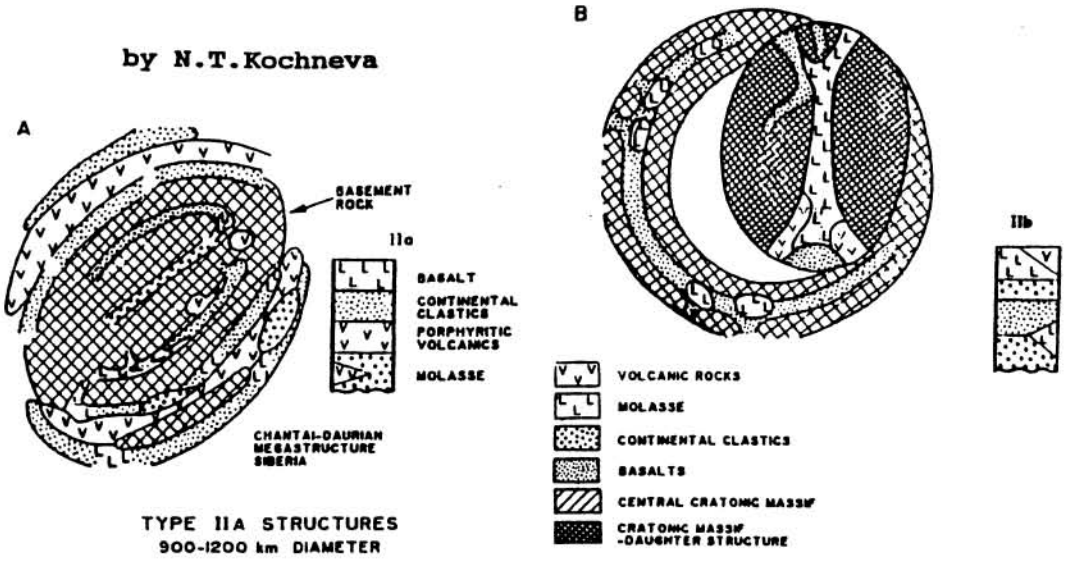

Fig.2.