STYLES OF DEFORMATION IN ISHTAR TERRA AND THEIR IMPLICATIONS.
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Ishtar Terra is 2500 km wide and 3-10 km above the mean level of the planet, with an apparent depth-of-compensation of 130 km, thus requiring support by broad mantle flows. The response of the surface revealed by the Magellan imagery appears to reflect a distributed deformation. Upper mantle tectonics is manifested through a broken-up surface (where not covered by lava flows): "chip tectonics", as though the resisting layer were only a few kilometers thick.

The northernmost of the convergent zones ringing western Ishtar, Freyja Montes, is dominated in its higher parts by bright E-W bands, apparently compressional folds. On the outward slope are many closely spaced NW-SE graben superimposed on the banded terrain. On the inward slope, ENE-WSW fractures end in the west at a series of dark rhombs, apparently depressions. Whether the fractures are preexisting or are entirely responses to contemporary compression is unsure. At the change in direction of Freyja, around 340° E, there is a zone of complexly intersecting faults, trending NW and NE: suggesting a distributed shear. The southeastern limit of Freyja is a large dome intersected by at least three sets of graben.

Danu Montes, the southern border of Western Lakshmi, has less relief and more widespread volcanism and extension than Freyja. In the arm west of 335° E folding occurs near the crest, while graben and normal faults occur to the south at right angles to the slope. Numerous graben form a secondary NE-SW trend. Volcanism is evidenced by pits and flooded features. The arm east of 335° E is dominated by NE-SW folding and thrust faulting. Compressional ridges paralleling this arm extend well into Lak-shmi Planum. One large graben, 20 x 75 km, at 60° N, 338° E, trends NE-SW; smaller graben and pit chains trend NW-SE to W-E. NW-SE trending faults crosscut the SW portion of the large graben, showing that compression continued after graben formation. The higher relief of the eastern arm and the presence of a NE-SW trend on the plains to the south and on Lakshmi Planum are consistent with NW-SE compression, current or more recent than the compression forming the western arm.

Lakshmi Planum west of 340° E is dominated by smooth plains, with a low density of impact craters compared to most of the area imaged early in the project. The plains in the south, where elevations are only 3 km above the mean level, are the smoothest and most featureless. To the north, as the elevation rises above 3.5 km, central Lakshmi is dominated by the caldera Sacajawea, 240 km wide and 1-2 km deep. North of Sacajewea, at elevations above 4 km, there appear ridged terrains, evidencing episodes of deformation embayed by later volcanism. These rigged terrains are more extensive to the east of 340° E, but there also appear extensional features associated with the scarps and basins to the north and south and Maxwell Montes to the east.

The "Scarp and Basin" Province, 340°-360° E, is markedly different from the regions to east and west. On the south, there is no mountain belt: not even small compressional features. The tectonic fabric is dominated by graben and collapse features trending NW-SE or parallel to the scarp. Along the northern scarp, an extension of Maxwell Montes rises 1 km or more above

Lakshmi. A few mare-like ridges can be seen running parallel to this high on the Planum surface. The outward slope of the Maxwell extension is dominated by graben, typically less than 5 km in width and striking N-S. The basins to the north and south of Lakshmi both have slightly elevated (<0.5 km) regions cut by numerous graben and heavily embayed by more recent plains deposits. In the south, these smooth plains deposits are cut by numerous wrinkle ridges trending E-W, indicating a mild N-S compression. In the north, the graben form an arcuate set. These annular graben appear to be crosscut by radial and N-S trending graben. Throughout the north basin, the relationshipo between heavily deformed terrains and plains is one of embayment, although numerous individual tectonic features are observed to cut the plains, particularly extensional features in the vicinity of the northern and southern scarps.

Maxwell Montes has the most spectacular relief on Venus, with a peak 11 km above the planetary mean, rising 7 km in only 200 km above Lakshmi Planum. The crest of Maxwell and its western slope are marked by intense thrusting and folding, with bright lineaments spaced 5-12 km apart, suggestive of a competent layer only 1-3 km thick. In most of western Maxwell-- south of 68° N-- the higher resolution Magellan imagery does not reveal marked extensional features or volcanism-- but a possible exception are faint wrinkles of less than 1 km spacing, at about 45 angle to the main pattern. Hence Maxwell appears to be sustained by contemporary vigorous compression in the direction SWW-NEE. In Lakshmi Planum to the west, a trench and several graben are parallel to the Maxwell front, suggestive of underthrusting. This west front is a segment of a sinous lineament running all the way from 55° N to 75° N. Plausible models of Maxwell entail appreciable thickening of the crust, which must be rather weak in its lower layers, as evidenced by the voluminous volcanism trigged by the 80-km impact crater Cleopatra. The NW slopes of Maxwell, north of 68° N, exhibit a rectilinear grid of extensional features, suggestive of gravity slumping on this flank of the the compressive belt. To the south flank, around 62° N are some much fainter suggestions of slumping.

Conclusions. The three mountain belts clearly result from convergent motions, with a sequence in the abundance of extensional features most-to-least of Danu-Freyja-Maxwell, perhaps indicative of an oldest-to-youngest age sequence. The markedly different character of Lakshmi Planum-- especially the embayed ridged terrains-- suggests that it is over a relatively ancient craton, even though it has been largely resurfaced by recent lava flows. The tectonic details of the mountain belts indicate a competent layer only kilometers thick. But the marked change in character between the mountain belts (east and west) and the intervening basin & scarp provinces suggest significant spatial variations in mantle deformation over distances of a few hundred kilometers, arising from flow patterns and resistance thereto. It is still unsettled as to whether Ishtar Terra is upflow or downfow; from the Magellan imagery, both appear to exist. We await better gravity data, as well as more detailed analyses and comprehensive syntheses of the imagery.