EVIDENCE FOR EPISODIC TECTONIC CONSTRUCTION OF OVDA REGIO, VENUS; D. John Chadwick and Gerald G. Schaber, U.S. Geological Survey, Flagstaff, AZ 86001

Terrestrial continents grow laterally by the impingement of exotic terranes transported by the crustal movements of plate tectonics. Terrestrial-style plate tectonism apparently does not exist on Venus today [1], but significant lateral crustal movement has produced the linear fold and thrust belts that border many of the Venusian upland tesserae and Lakshmi Planum.

The cratering record on Venus suggests that the lowland areas of the planet were completely resurfaced by volcanism at about 0.3-0.5 Ga, and that subsequent volcanism was comparatively minor [2-4]. Thermal models suggest that Venus may have undergone such "catastrophic" resurfacing several times [5]. The distribution of the entire crater population is consistent with a statistically random one, both spatially and hypsometrically [3,4]. The highland tesserae regions of Venus must also have been resurfaced, largely by tectonism but supplemented by volcanism, during the same period as the volcanic resurfacing on the plains. Although all evidence of older resurfacing of the lowland plains was likely buried by the most recent resurfacing, the high elevation of the tesserae would have prevented inundation and may have preserved tectonic and volcanic evidence of older periodic global resurfacing episodes.

In this study, we are investigating Ovda Regio, a highland tessera region in the western part of Aphrodite Terra. Elevation of the tessera ranges from 1 to 4 km above surrounding Aino and Niobe Planitiae. Ovda is divided into two tectonic domains distinguished by the dominant trend in their compressive structures (Fig. 1). The western domain has experienced dominantly NNW-SSE compression; the eastern domain, mostly NE-SW and E-W compression. Each domain is subdivided into several subregions, based on the presence, abundance, and orientations of various lineaments, grabens, and folds. The tectonic fabric in the four western subregions appears to grow increasingly complex toward a central "core" region of the tessera. Two subregions to the north and one to the south are less complex, with the northernmost domain a relatively simple fold and thrust belt crosscut by orthogonal grabens. The western domain is bounded on the south by Ix Chel Chasma, an extensional rift. The eastern domain is divided into five subregions that also appear to grow in complexity toward an interior core (Fig. 1). One subregion to the west of this central region is composed of simple fold and thrust belts. To the east, three subregions whose tectonic complexity decreases progressively with distance from the core region. The eastern domain in bounded on the south by Kuanja Chasma.

We propose that the increasingly complex tectonic fabrics of discrete subregions in these two domains with distance from their tectonically simple and apparently young border-parallel fold and thrust belts suggest that Ovda Regio has been built in a piecemeal fashion, with fold belts adding to the lateral extent of the tessera during periods of high planet-wide tectonic and volcanic activity. The development of the fold belts may have accompanied downwelling and subduction under the tessera, as described by [6]. Interior subregions still contain border-parallel folds that are crosscut by younger grabens and possible strike-slip faults, suggesting that they were once simple fold and thrust belts like those now on the periphery of Ovda. In this model, interior subregions are "older" in the sense that they have existed as highlands for a longer period than other subregions, but extension within them has maintained a statistically random crater population on the tessera, as has volcanism on the plains. Crater destruction on the tessera is likely supplemented by volcanism; about 15% of Ovda is covered by relatively young volcanic deposits (Fig. 1).

In the youngest fold belts, a system of grabens--all orthogonal to the folds--has overprinted them. This pattern is similar to that in the Himalayas, where north-trending grabens have crosscut the east-trending mountain belts. Mercier and others [7] suggested that a change from compressive to extensional tectonism in the Himalayas in the late Miocene was the result of the change of the maximum principal stress direction from horizontal to vertical, due to the increase in the vertical principal stress caused by the weight of the elevated mass. In Ovda Regio, some subregions appear to have undergone several phases of such gravitational extension; in many cases, all traces of the original compressive fabric are gone. It is also possible that these core regions were once large, silicic, festoon flows, similar to the large flows south of Aphrodite Terra and atop Ovda itself, which are 400 m to 1.1 km high [8]. Such silicic piles would thicken the crust and behave as strain magnets, localizing compression during resurfacing events.

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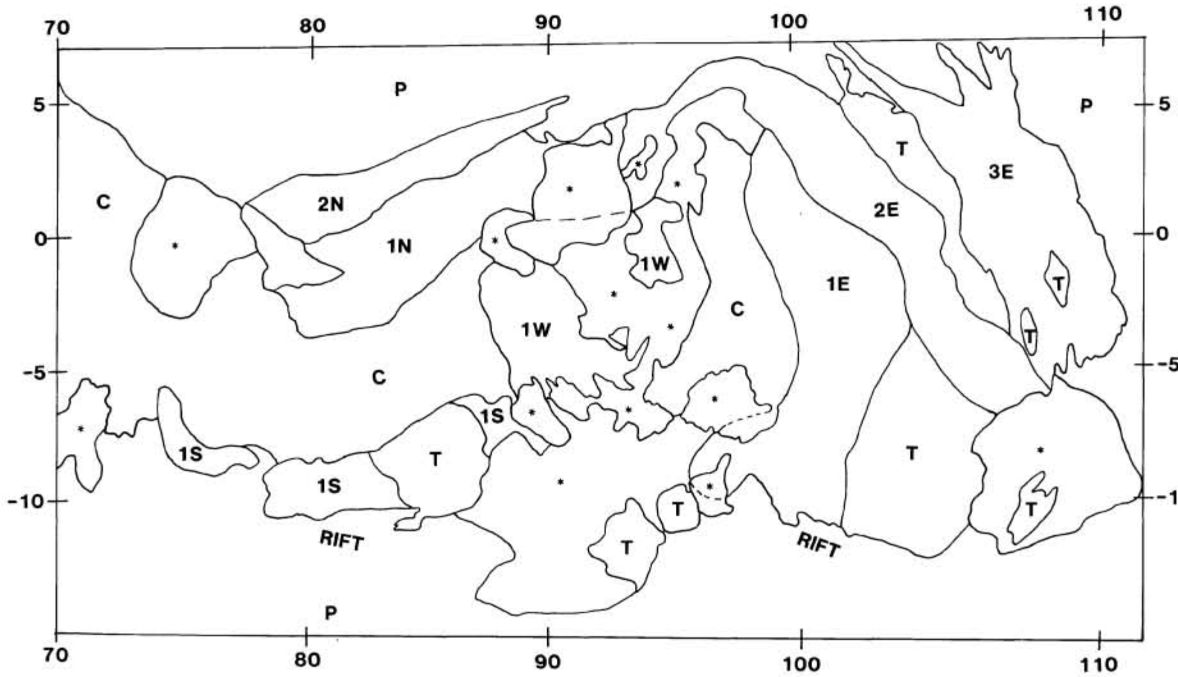

Figure 1. Sketch map of Ovda Regio, showing subregions in the western domain (C, 1N, 1S, 2N) and eastern domain (C, 1W, 1E, 2E, 3E). The core regions (C) have the most complex tectonic fabrics, whereas subregions near the borders (2N, 1S, 3E, 1W) of the domains are relatively simple fold and thrust belts. Border-parallel folds are largely destroyed by grabens but still visible in subregions 1N, 2E, and 1E, suggesting that they were once on the periphery of Ovda. The same number in different subregions (i.e. 1N, 1W, 1S, and 1E) does not necessarily imply the same age for these subregions. "T" denotes small, complex tessera blocks that are apparently entrained in the fold belts. An asterisk (*) shows areas where volcanic deposits, coronae and arachnoids have masked the tectonic pattern of the tessera. Dashed lines denote buried contacts between subregions.