GRABEN SYSTEMS INCLUDING RIBBON FABRICS IN WESTERN OVDA TESSERA, VENUS; INTERPRETATION AS DYKE SWARMS. R. Dean[1], R.E. Ernst [1,2], H. El Bilali[1,2], K.L. Buchan[3], [1]Department of Earth Sciences, Carleton University, Ottawa, Ontario, Canada; raidendean@cmail.carleton.ca; richard.ernst@ernstgeosciences.com; hafidaelbilali@cunet.carleton.ca, [2]Faculty of Geology and Geography, Tomsk State University, Tomsk, Russia, [3]273 Fifth Ave., Ottawa, Ontario, Canada; kbuchan33@gmail.com

Introduction: Western Ovda Regio (Fig. 1) includes a large tessera terrain with intratessera basins, fracture (shear) zones and fold belts (e.g., [1, 2]). Extensional structures, including ribbon fabrics (herein interpreted as dyke swarms, following [3]) are widespread on the tessera. The Verdandi coupled corona-nova system (V in Fig. 1a) and its associated volcanic flows are located near the centre of the tessera. Several other coronae/novae (Fig. 1a) are scattered around the perimeter of the tessera with grabens (dykes) that in some cases can be traced onto the tessera.

In this study the ribbon fabrics and sparser graben sets have been mapped on the tessera terrain (Fig. 1a). Individual graben sets or 'subswarms' of differing trends are shown in different colours. For clarity, the line work is generalized in Figure 1b.

Ribbon fabric/dyke swarms: Dense ribbon fabrics are particularly prominent in the northern and western regions of the tessera, but generally absent in the central region in the vicinity of Verdandi corona (Fig. 1). The ribbon sets generally are not observed beyond the tessera in the surrounding volcanic plains or within most of the intratessera plains (Fig. 1).

It has been proposed that ribbon fabrics, especially in the outer marginal fold domain of tessera terrains, including that of western Ovda, may form a broad radial pattern (cf. Fig. 1 of [1] and Fig. 4 of [2]).

In this study the dense ribbon fabrics in the northern and western portions of western Ovda do appear to exhibit a broad radiating geometry with a focus near the centre of the tessera terrain. (Fig. 1). This could suggest the presence of a mantle plume beneath the tessera analogous to plume centres at the focus of giant radiating dyke swarms on Earth [4]. However, there are several instances where 'subswarms' clearly intersect (e.g., Fig. 2), demonstrating that they are of different age and not part of a single radiating system.

The most prominent ribbon fabrics of western Ovda are quite dense (Fig. 2), as has been described for ribbon fabrics in other tessera terrains in earlier studies [1]. Grabens in the densest ribbon fabrics are spaced ~500 m apart. This is roughly comparable to the density of dykes in some Proterozoic dyke swarms on Earth, especially within 500 km of the swarm focus of giant radiating dyke swarms such as the Mackenzie [5] and Matachewan [6] swarms of the Canadian Shield.

Occasionally, long linear pit chains are observed among and parallel to the ribbons. Pit chains are seen in association with dykes on Earth (e.g., [7]) and Venus (e.g., [8]).

Detailed history of graben sets in western region of western Ovda Tessera (location on Fig. 1):

In this region (Fig. 3a), we have identified five distinct graben sets (Fig. 3b) whose relative ages are determined from crosscutting relationships. From youngest to oldest they are:

1) A NNE-N arcuate (**Green**) graben (Fig. 3b). It is a circumferential graben linked to Nabuzana corona, located to the west (Fig. 1) (cf. [9]).

2) NW-NNW (**Orange**) grabens (Fig. 3b, c). They are often filled by plains lavas, and so are older than the plains.

3) NNE (**Purple**) grabens (Fig. 3b, c). They extend across the western area and slightly converge to the north where they are overlain by plains flows. This suggests that their magmatic center may be covered by these younger flows. NW-NNW (orange) grabens cut the NNE swarm (purple) (e.g., Fig. 3d) indicating that the NNE swarm is older.

4) N (**Blue**) 'ribbons' (Fig. 3b). They are dense, shorter, and thinner than the younger grabens previously discussed. They cut the WNW (pink) ribbons.

5) WNW (**Pink**) 'ribbons' (Fig. 3b). They are the oldest set. They are very irregular, so perhaps are not dykes. They could be subhorizontal layering (of volcanics or sediments) exposed by differential erosion (cf. [10]).

Acknowledgments: Magellan SAR images from https://astrogeology.usgs.gov/search/?pmitarget=venus

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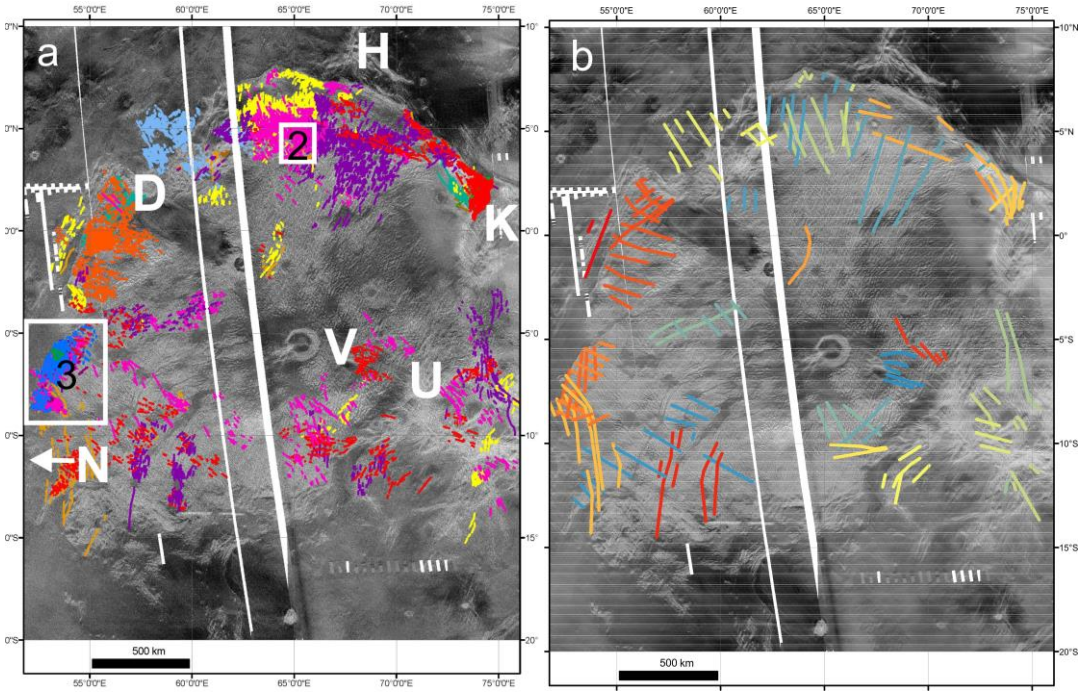

Figure 1*: (a) Selected geological features of western Ovda Regio. Mapped graben sets, mostly associated with ribbon fabric, distinguished using different colours. V = Verdandi, D = Disani, H = H'uraru, K = Kaltash, N = Nabuzana and U = unnamed corona-nova systems. Boxes indicate the locations of Figs. 2 and 3. (b) Generalized graben sets.*

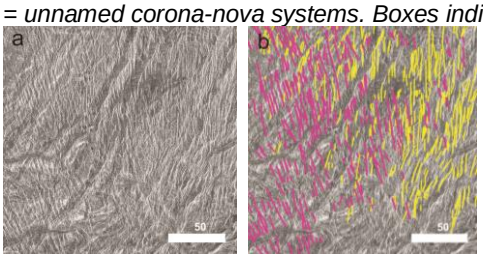

Figure 2*: (a) Example of dense ribbon fabrics. Image located in Fig. 1a. (b) Mapped grabens with two distinct trends in the same area. Image from JMARS.*

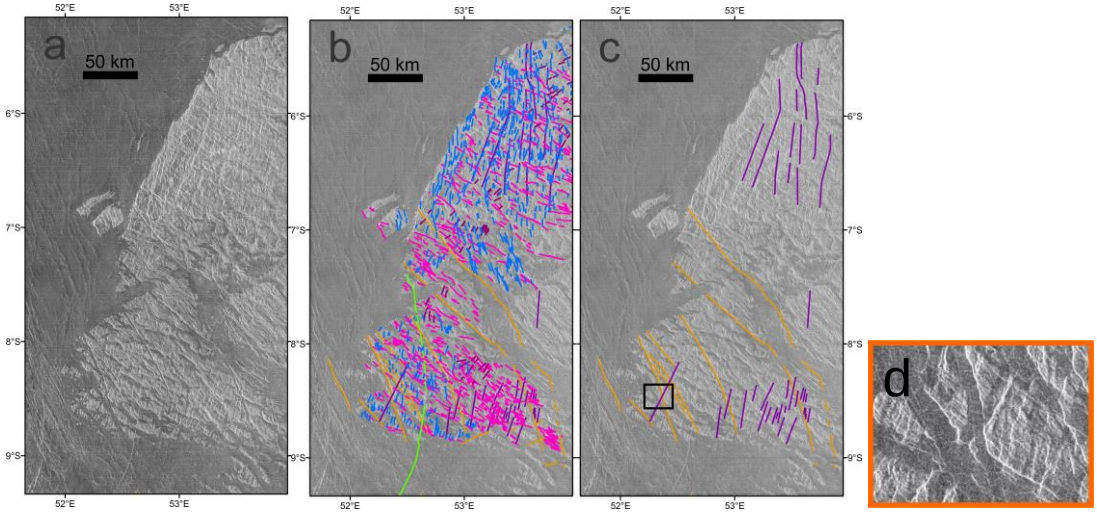

Figure 3*: (a) Western region of western Ovda tessera. Image located in Figure 1a. (b) All mapped graben sets in the same area. (c) Only NW-NNW (Orange) and NNE (Purple) graben sets in same area. (d) Details of NW-NNW grabens crosscutting a NNE graben (location given by black box in part (c). Image from JMARS.*