**COMPLEX RIDGED TERRAIN -RELATED RIDGE BELTS ON VENUS: GLOBAL DISTRIBUTION AND CLASSIFICATION**; T. Törmänen, Department of Astronomy, University of Oulu, SF-90570 Oulu, Finland

56 features were identified in a global survey of complex ridged terrain (CRT) -related ridge belts. Nonrandom aerial distribution was observed with all of the CRT-related ridge belts located to the north of 20°S and increasing in number towards the north. In the equatorial highlands the only concentration of CRT-related ridge belts occurs along N and NE Ovda Regio and western Thetis Regio. Major areas of CRT devoid of related ridge belts (Beta , Phoebe, Alpha Regiones, and northern Lada Terra) are regions dominated by rifting, fractures, coronae, and volcanic features. A noticable concentration of ridge belts is located within a region 20°S-80°N,0°-150°E. Three classes of CRT-related ridge belts were defined: 1) Ridge belts directly in contact with CRT margins, 2) Ridge belts located apart from the CRT boundary, but whose shape and strike are affected by CRT, and 3) Ridge belts terminating against a margin of CRT. There does not appear to be any relation between ridge belt class and type of CRT margin. Some of the class 2 and 3 belts of the 20°S-80°N,0°-150°E region seem to be continuations of adjacent elongated blocks of CRT and could reflect the hypothesized basement of tessera-like material. Majority of class 1 and 2 ridge belts within this region parallel N or NE boundaries of large CRT plateaus or arc-like arrangements of tesserae. These relationships show that this region has been dominated by compressional stresses oriented perpendicular to the CRT boundaries, in N-S/NE-SW direction.

**Introduction.** Deformational belts on Venus were first identified from Venera 15/16 and Arecibo radar images [1-3]. Magellan radar images revealed that deformational belts fall into three morphological classes [4]. Class 2 belts, i.e. ridge belts [4] are generally thought to be results of compression and shortening [e.g. 4-8], probably fold-and-thrust belts [7,8]. It was earlier noticed that many ridge belts are associated with areas of complex ridged terrain (CRT, also called tessera) [1,7-9]. Plains ridge belts [6], general characterictics, distribution, and formation mechanisms of ridge belts [7,8,10] have been previously studied based on the Magellan data. In this paper we present the first results of an independ-ent global survey of CRT-related ridge belts and propose a classification scheme based on geometric relations between ridge belts and CRT areas. CRT-related ridge belts were mapped using the following criteria: 1) deformational belts domi-nated by ridges (fractures or grooves may be a minor component), 2) location adjacent to areas of CRT, and/or 3) belt formation and shape clearly affected by the presence of nearby CRT.

**Aerial distribution.** 56 CRT-related ridge belts were mapped from Magellan cycle 1 and 2 C1-MIDRs (all cycle 2 C1-MIDRs were not available for mapping). Identified ridge belts are shown on the map in Fig. 1 (marked with small arrows). A nonrandom distribution of CRT-related ridge belts is observed. 48 (86%) of the identified CRT-related ridge belts are located on the northern hemisphere and only 8 (14%) on the southern hemisphere. There are no CRT-related ridge belts south of 20°S within the mapped area. These results confirm an earlier observation that CRT-related ridge belts are concentrated to the northern hemisphere [7,10].This can be partly explained by the fact that blocks of CRT are more numerous on the northern hemisphere [11], and therefore there are more suitable areas for the CRT-related ridge belts. The number of CRT-related ridge belts and their normalized surface area increase towards the north [10].

In the equatorial highlands the only concentration of CRT-related ridge belts occurs along the northern and northeastern margins of Ovda Regio and western Thetis Regio (Fig. 1). Large areas around western Aphrodite Terra are deformed by an extensive system of dense swarms of fractures [4,12]. These extensional fractures are youngest tectonic features in the region [4,12]. Extensional stress regime has prevented large-scale ridge belt formation in the area, and fracturing may have also destroyed most of the possible older ridge belts.

There are only a few CRT-related ridge belts in Beta and Phoebe Regiones, and none were identified around CRT areas of Alpha Regio and northern Lada Terra. In both Beta and Phoebe CRT areas have been deformed by large rift zones and sets of fractures and embayed by lavas [e.g. 5,13,14]. Numerous volcanic features are found on the plains surrounding these CRT plateaus [15]. Compressional features of any kind are not common outside CRT in this region. Any signs of earlier compression along the CRT boundaries may have been destroyed by later tectonics and/or covered by lavas. Although there are no CRT-related ridge belts around Alpha Regio and northern Lada Terra, there are compressional ridge belts on nearby plains [4-6]. The lack of CRT-related ridge belts may be connected to the presence of large coronae and associated fracturing and volcanism. More than half of all mapped CRT-related ridge belts and largest part of surface area covered by them are located within a region bounded by latitudes 20°S and 80°N and longitudes 0° and 150°E. This region corresponds to the "0°-150°" cluster of tesserae, excluding Alpha Regio and CRT blocks south of 20°S, identified in [11]. This region contains majority of the CRT boundaries and thus most of the possible locations for CRT-related ridge belts.

**Classification.** Based on the observations of locations the ridge belts and their relations to CRT three classes of CRT-related ridge belts were defined: 1) Ridge belts directly in contact with CRT margins. More than half (~32) of all identified CRT-related ridge belts belong to this class. They are typically curving belts of even width composed of paral-lel, closely-spaced curving or linear ridges. Ridge widths vary from a few hundred meters to several kilometers and lengths from few kilometers to several 10s of kilometers. Their topography may be very pronounced (heigths varying from a few hundred meters to several kilometers [7]) or they may be very hard to distinguish from Magellan altimetry data. Typical examples of these belts are the steep-sloped, almost 2 km high [7,16] ridge belt adjacent to NE Laima Tessera at 59°N, 60°E and the belt along northeastern Ovda Regio at 6°N,105°E. 2) Ridge belts located apart from the CRT boundary, but whose shape and strike are clearly affected by CRT (~20 belts). These belts include several ridge belts which are part of the large northern fan of plains ridge belts [1,2], e.g. a ridge belt at 68°N,230°E. Other belts of class 2 may be connected to groups of class 1 belts (e.g. at 7°N,112°E) or occur alone near a CRT block. Preliminary analyses do not show major differences in ridge belt or ridge morphology or dimensions between members of two classes. Future work will include more detailed studies of morphologies of ridge belts of classes 1 and 2 and possible refinement of the classification. 3) Ridge belts striking in a large angle and terminating against a margin of CRT. This class has only 4 identified members (triangles in

Fig.1). The belt located at 49°N,130°E differs from the other three: It appears to continue the trend of a distinct structure, a large N-S trough, of the CRT.

**Observations and implications of ridge belt - CRT relations.** There does not apper to be any relation between ridge belt class and type of CRT margin. Belts of classes 1 and 2 occur along both types of CRT margins: em-bayed and scarp-like [11]. Some of the class 2 and 3 belts within the 20°S-80°N,0°E-150°E region seem to be continua-tions of adjacent partly embayed elongated blocks of large arcuate CRT areas. These ridge belts could reflect the hypothe-sized basement of tessera-like material [11]. Majority of class 1 and 2 ridge belts within this region are located parallel to northern or northeastern boundaries of large CRT plateaus or arc-like arrangements of tesserae. These relationships show that this region has been dominated by compressional stresses oriented perpendicular to the CRT boundaries, and that dominant stress directions were N-S/NE-SW. Class 1 belts located NE of Tellus Regio, NE/E of Ovda Regio and some belts west of Thetis Regio parallel large ridges of the linear ridged terrain unit of CRT [4,17]. The belt ridges are smaller than the CRT ridges, but have very similar morphological characteristics with them. Ridges have been recognized to be the oldest structures within CRT [e.g. 17-19]. The presence of younger, but morphologic-ally similar ridges adjacent to these CRT ridges may give clues to the formation and/or deformation of CRT.

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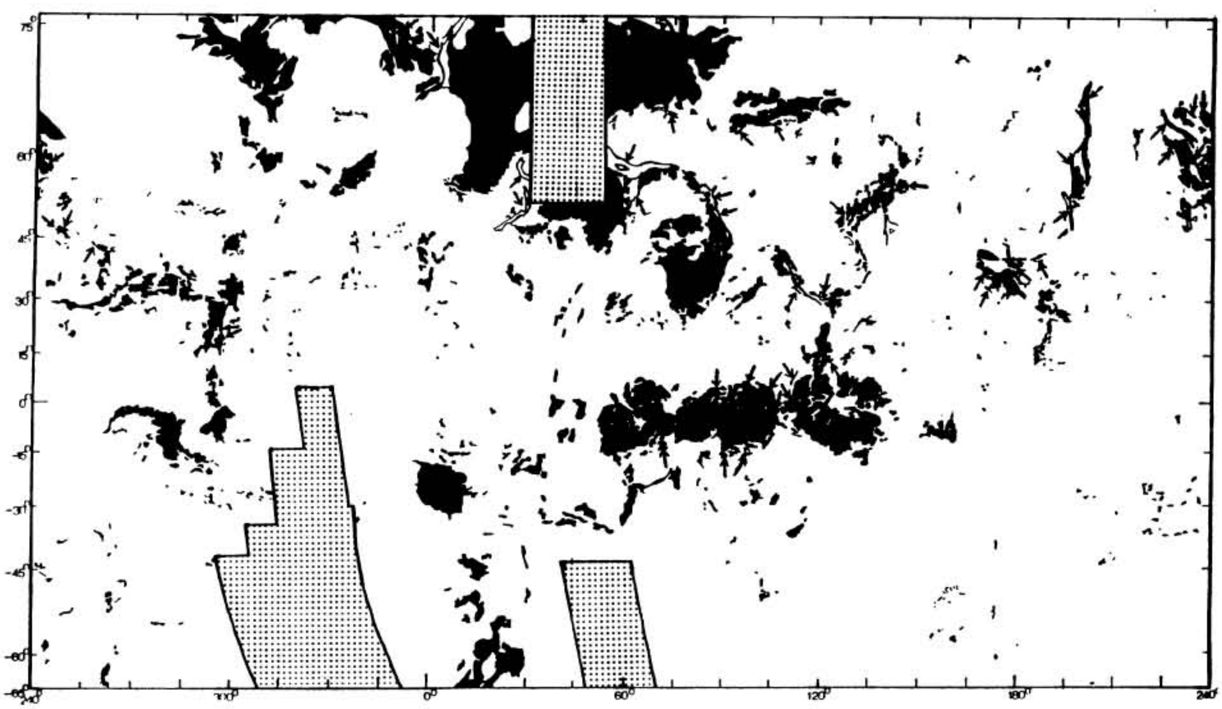

Fig. 1. Distribution of CRT-related ridge belts. Small arrows and triangles point to features. Base map modified from [11].