COMPARATIVE ANALYSIS OF TOPOGRAPHY OF THE VENUSIAN RIFTS AND TERRESTRIAL CONTINENTAL RIFTS IN AFRICA. E.N. Guseva, Vernadsky Institute, 119991, Moscow, Russia, guseva-evgeniya@ya.ru

Introduction. Venusian rifts are known since Arecibo data [8] and were discovered in full extent during Magellan mission [9]. It was noticed that some rift zones on Venus resemble terrestrial continental rifts, for example, in Africa [6]. In both instances, rifts are morphologically prominent features, form regional system of deep canyons, and associate with regionally important dome-like uplands thousands of km across. The total horizontal extension in the East-African rift zone was estimated to be ~25-30 km [5] while the extension in the Venusians rifts appears to be significantly smaller, a few kilometers [estimates for Beta Regio - Connors and Suppe, 11.4 km; Kiefer and Swafford, 3 - 6.7 km; our estimates of total horizontal extension in the rifts are 2.3 to 7.7 km in Atla Regio and 2 to 7.1 km in Beta-Phoebe regions, 3].

In order to compare major topographic characteristics of rifts on Venus and Earth, I collected series of topographic profiles across and along rift valleys in Atla and Beta-Phoebe regions on Venus using GTDR topographic map (resampled to 4 px/km) and within the East-African Rift System (EARS) using GTOPO-30 data (resolution ~1 km/px).

Goals of the study. The main goal of my study was to acquire numerical parameters such as width and depth of rift valleys and height and extension of the regional rift-bearing uplands on both planets.

Results. Rift systems in Atla and Beta-Phoebe regions associate with large equidimensional dome-like topographic features that are ~ 2 km high and from ~1500 km (Atla) to ~2500 km (Beta) across (Fig.1). The Eastern branch of EARS (Kenya-Ethiopian Rift system) crosses at least two smaller dome-like uplands that are ~1.4 km high and from ~500 to 1000 km across (Fig. 1). The Atla and Beta-Phoebe rift systems are presented by triple junctions, which appear to be absent within the main portion of EARS to the south of the Afar triangle.

Individual branches of the Venusian rifts represent morphologically distinct zones of fractures and graben with deep (3-3.5 km for Atla Regio and 2-2.5 km for Beta-Phoebe) central depression (Fig. 2).

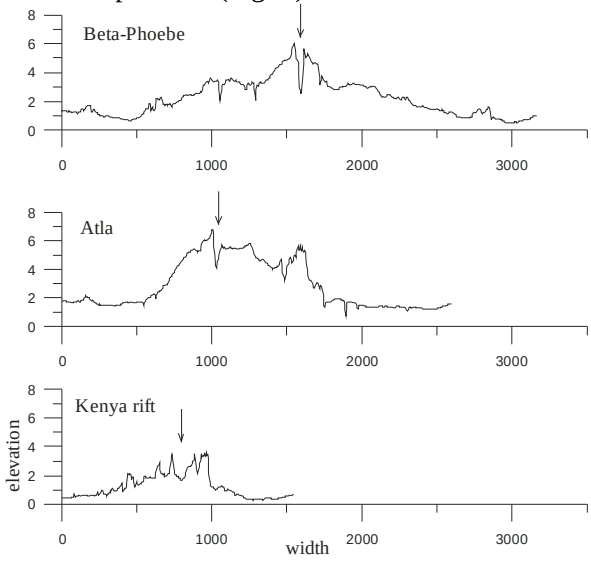

Fig. 1. Topographic profiles across the rifts of Atla and Beta-Phoebe system and Kenya rift.

On the Earth, zones of fracturing on the sides of the central valley, which is ~1-1.5 km (for Western and Eastern branch EARS), are mostly erased by erosion. The Atla and Beta-Phoebe regions are areas of powerful volcanic activity (end points of the BAT triangle) and are topped by large (a few hundred km across) shield volcanoes [eg.4, 2, 1].

Volcanic structures are poorly presented in the western branch of EARS but populate its eastern branch. Individual volcanoes there are smaller than on Venus, several tens of km across.

Widths of the central valleys of rifts on Venus and Earth are significantly different (Fig. 3). In Atla Regio, width of the rift varies from 170 to 282 km (mean is ~240±35 km). In the Beta-Phoebe region, the width varies from 127 to 324 km (mean is ~210±65 km). Width of the EARS rift valleys is significantly smaller: for the Kenya-Ethiopian branch it varies from 57 to 150 km (mean ~100± 30 km) and for the Nyasa-Tanganyika branch it is from 66 to 179 km (mean 105±33 km).

Similarities and differences between the Venusian rifts and EARS. The preliminary analysis of the topography and morphology of

rift zones in Atla and Beta-Phoebe regions and in EARS shows the following similar features of rifts on the two planets. 1) Rifts occur within large regional-scale uplands. 2) The uplands represent centers of volcanic activity except for the Western branch of EARS where volcanism appears to be subdued. The formation of the dome-like uplands in association with rifts and voluminous volcanism is consistent with and suggest the existence of mantle plumes under the areas of rifting on both Venus and Earth [7].

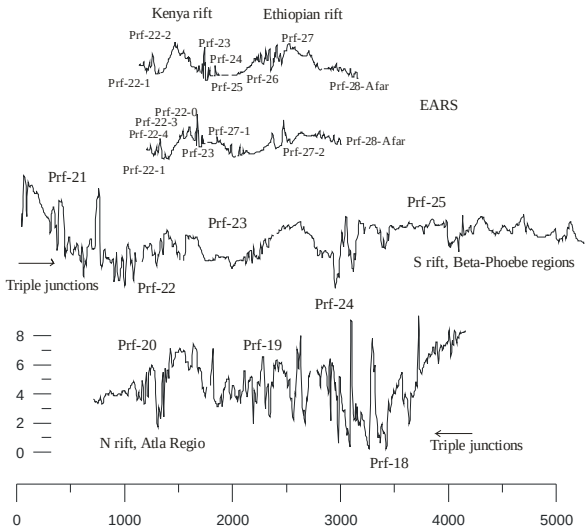

Fig. 2. Topographic profiles of the rifts branches − Atla and Beta-Phoebe system and Kenya-Ethiopian Rift system.

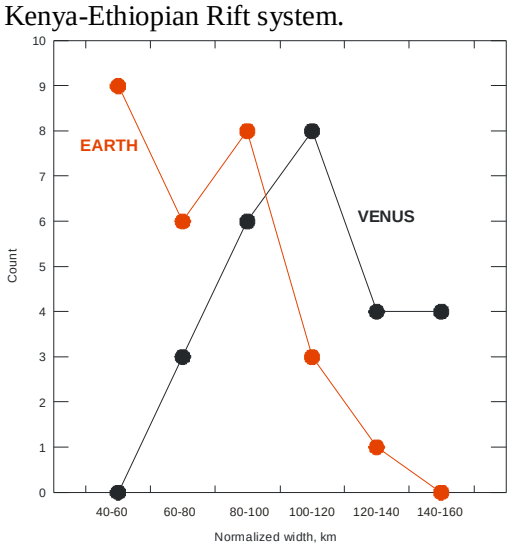

Fig. 3. Topographic data the normalized widths of the central valleys of rifts on Venus and Earth.

The main difference between the Venusian and terrestrial rifts is the width of the central rift valley. Rifts on Venus are almost two times more wide than rifts on Earth. Being normalized by the height of the rift-bearing upland, the width of the Venusian rifts is still ~30% larger. The systematically larger width of rifts on Venus may suggest that thickness of lithosphere in Atla and Beta-Phoebe regions on Venus is larger than thickness of the continental lithosphere in Eastern Africa. An alternative explanation is that Venusian rifts formed during larger time and represent more developed structures than their terrestrial counterparts. Currently, I assess these two possibilities.

Acnowledgments. I acknowledge collaboration with Basilevsky A. T. and Krassilnikov A.S. at early stage of this work and help of Ivanov M.A.

References. [1] Basilevsky A. T., Head J.W. (2000), *JGR*, V. 105, P. 24583-24611, [2] Crumpler, L. S. and J. Aubele, Volcanism on Venus, *in: Encyclopedia of Volcanoe* (2000), P. 727-770, [3] Guseva, E.N. (2007), *Vernadsky-Brown*, 44, [4] Head, J.W., L.S. Crumpler, J.C. Aubele, J.E. Guest, and R.S. Saunders, (1992), *JGR*, V.97, P. 13153-13197, [5] Kazmin V. G. The Rift structure of East Africa (1987), P. 205, [6] McGill, G.E., Steenstrup, S.J., Barnon, C., Ford, P.G. (1981) *JGR*, V. 8, P. 737-740, [7] Nikishin A. M. (1992), Riftogenez in geological history of terrestrial planets// Diss., V. 2, [8] Schaber, G.G. (1982), *JGR*, V. 9, P. 499-502, [9] Solomon S. C. et al. (1992), *JGR*, V. 97, P. 13199-13256.