VENUS: ESTIMATES OF ABSOLUTE TIME DURATION OF CORONA ACTIVITY. A. T. Basilevsky[1], J. Raitala[2] and J. W. Head[3], [1]Vernadsky Institute, Moscow, 119991 Russia atbas@geokhi.ru, [2]Astronomy, Oulu University, Finland, [3]Department of Geological Sciemces, Brown University, Providence, R.I., USA.

Introduction: This study is a continuation of our previous work [1, 2] in which time durations of astra-novae activity were estimated through photogeologic analysis of the Magellan images of Venus. In that work images of 78 astra were studied as well as all 49 craters with dark parabolas (DP) and 114 craters with clear dark halo (CH). It was found that 1) faults radiating from 7 astra cut one or more DP or CH craters and 2) that formation of these astra started before or close to the time of emplacement of regional plains with wrinkle ridges. As has been shown in a number of studies [3-7], CH craters formed more recently than ~0.5T ago, and DP craters formed more recently than 0.1-0.15T ago, where T is the mean age of the surface of Venus estimated to be about 0.5 to 1 b.y [e.g., 8-10]. In other studies it was found that regional plains with wrinkle ridges were emplaced during a relatively short time period, close to the mean surface age of Venus [e.g., 11-13]. Therefore, in relation to those 7 astra it was concluded that they were active since the time about 1T ago, through the time 0.5T and 0.1-0.15 T ago, that is, several hundred million years.

Observations and Analysis: In the present work we first looked, through the USGS nomeclature maps of Venus locating the same subpopulation of DP and CH craters and selected for further study those craters which were superposed on coronae or were located within 300 km of the nearest corona. Using this approach we have found 55 corona-crater pairs. In 15 cases craters were superposed on different elements of spacially accociated coronae. In 40 cases craters were located at distances from 30 to 300 km from the corona annulus (mean distance was found to be ~160 km). Then, these pairs were studied using Magellan images (resolution 75 m/px), trying to determine if the selected DP and CH craters are deformed by faults or embayed/flooded by lavas originating from the coronae.

In this analysis of the 55 corona-crater pairs we have found 6 coronae whose tectonic/volcanic activity affected the neighboring DP or CH craters. Three of them (coronae Minone, Audhulma and Gertjon) are among the 7 astra mentioned: they have both an obvious annulus and prominent stellate systems of faults and thus can be considered both as coronae and as astra. One corona-astrum of that sort (Junkgova) was missed in our current study because a crater affected by its faults is located much further (1000 km) than the distance limit we used (300 km). Three other astra of the seven astra mentioned (Wohpe, Jokwa, and Becuma) have no circular/ovoidal annulae and thus are not considered by us as coronae.

Three other coronae whose tectonic/volcanic activity affected neighboring DP or CH craters are Jord Corona, coupled with Tarbell Patera, Arthemis Corona, and Nott Corona.

Jord Corona/Tarbell patera. Jord Corona (D = 130 km) is outlined by pdf/fb structures and embayed by regional plains with wrinkle ridges. Tarbell Patera, centered at the eastern part of Jord Corona annulus, is a source of extended lava flows of pl type. The Jord-Tarbell pair may represent the evolution of the same manle plume. They both, however, are located along the Kalaipahoa Linea rift zone (Figure 1) so it is not clear if the Tarbell-associated young lavas represent the Jord-Tarbell individual mantle plume or if they are associated with the Kalaipahoa Linea rift. Crater Alcott (59.5°S, 354.4°E, D = 66 km), which belongs to CH type, is severely flooded by the Tarbell associated lavas.

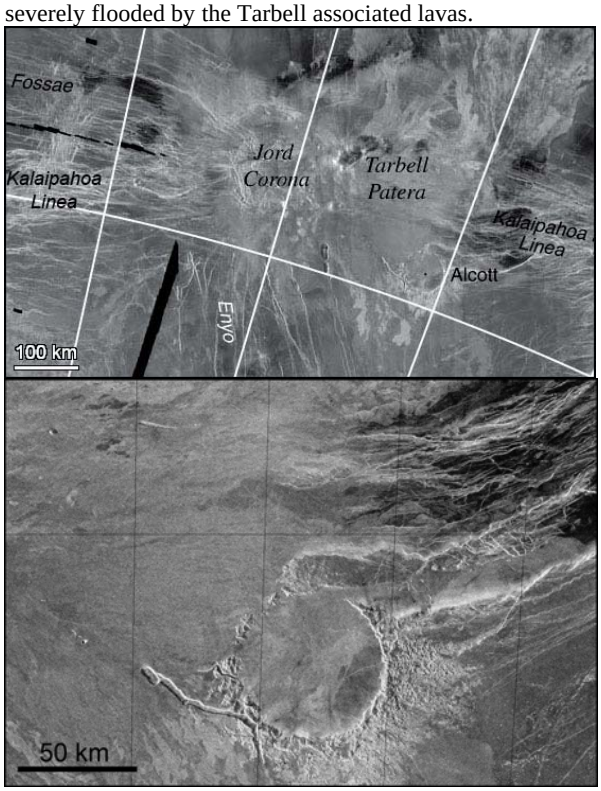

Figure 1. Top, portion of the USGS V61 nomenclature map showing Jord Corona, Tarbell Patera and the Kalaipahoa Linea rift zone. Bottom is the Magellan image showing Alcott crater flooded by lavas coming from the Jord-Tarbell area. Darkening in the upper right is part of the radar dark halo of crater Alcott.

Arthemis Corona. This is the largest corona on Venus (D = 2600 km) which has in its core ancient pdf-like structures predating the wrinkle-ridged plains and whose prominent annulus is outlined by rift-like structures (Figure 2). The CH crater Behn (32.4°S, 142°E, D = 25 km) is close to the inner edge of the eastern part of the corona annulus and is cut the rift-like structures of the annulus.

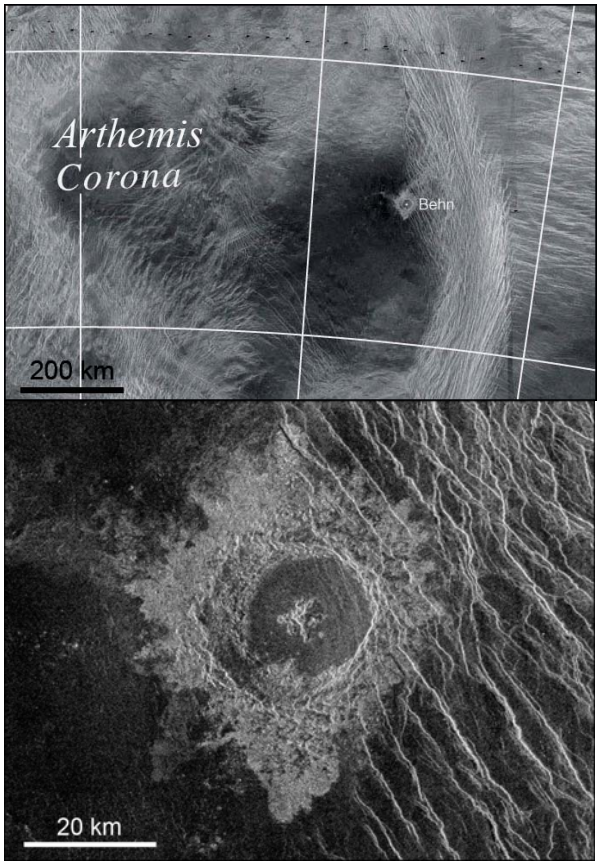

Figure 2. Top, portion of the USGS V48 nomenclature map showing crater Behn inside the eastern part of the Arthemis Corona. Bottom, Magellan image showing crater Behn whose ejecta and part of its floor are deformed by the corona annulus faults.

Nott Corona. This is a relatively small corona (D = 150 km) in the southwestern outskirts of the CH crater Isabella (29.8°S, 204.2°E, D = 175 km) (Figure 3). The corona has the ovoidal annulus mostly outlined by wrinkle ridges with localities of radial pdf–type structures, as well as astrum-like stellar structures, locally cutting the crater ejecta. In the northeastern part of corona there is a 20 x 30 km field of young lavas which postdate the astrum-like structures.

Discussion: The 55 coronae studied represents a random sample consisting of about 10% of the coronae on Venus [e.g., 14]. So conclusions from this study may be applied to the total corona population of Venus. From the above considerations it follows that four of the six coronae considered in this study (Minone, Audhulma, Gertjon and Nott) are not related to rift zones and may be considered as representing the time evolution of individual mantle plumes. It is interesting that all four of these coronae have astrum-like components. We suspect that the activity of two coronae (Jord and Arthemis) may be influenced by rift zones. They do not have astrum-like components.

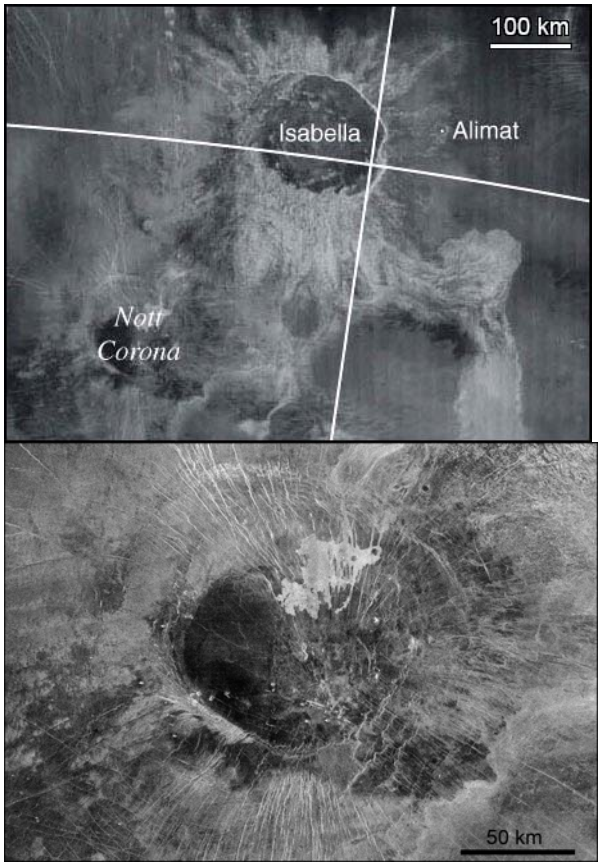

Figure 3. *Top, portion of the USGS V50 nomenclature map showing crater Isabella and Nott Corona. Bottom, Magellan image showing details of Nott Corona.*

Conclusions: In this study we have found 6 coronae whose activity lasted from (or earlier than) the time of emplacement of regional plains with wrinkle ridges, that is, about T ago, through the time 0.5T ago and 0.1-0.15T ago (that is, for several hundred million years). Four of the six coronae which represent the evolution of individual corona-astrum-forming mantle plumes have astrum-like components.

References: [1] Basilevsky A.T. et al. (2008) *LPSC XXXIX*, Abstract #1055. [2] Basilevsky A.T. et al. (2009) *Icarus*, (in press). [3] Arvidson R.E. et al. (1992) *JGR*, 97, 13303-13317. [4] Campbell D.B. et al. (1992) *JGR*, 97, 16249-16277.. [5] Izenberg N.R. et al. (1994) *GRL*, 21, 289-292. [6] Basilevsky A.T. & Head J.W. (2002) *JGR*, 107, doi:10.1029/2001JE001584. [7] Basilevsky A.T. et al. (2003) *GRL*, 30, doi:10.1029/2003GL017504. [8] Phillips R.J. et al. (1992) *JGR*, 97, 15923-15948. [9] Strom R.G. et al. (1994) *JGR*, 99, 10899-10926. [10] McKinnon W.B. et al. (1997) in *Venus II*, The Univ. of Arizona Press, 969-1014. [11] Basilevsky A.T. & Head J.W. (1998) JGR, 103, 8531-8544. [12] Basilevsky A.T. & Head J.W. (2000) PSS, 48, 75-111. [13] Ivanov M.A. (2008) *LPSC XXXIX*, Abstract #1017. [14] Stofan E.R. et al. (1997), in *Venus II*, The Univ. of Arizona Press, 931-965.