BRIGHT TRANSIENT SPOTS IN GANIKI CHASMA, VENUS E.V. Shalygin[1], W.J. Markiewicz[1], A.T. Basilevsky[1,2], D.V. Titov[3], N.I. Ignatiev[4], J.W. Head[5], [1]Max-Planck-Institut für Sonnensystemforschung, 37191 Katlenburg-Lindau, Germany, [2]Vernadsky Institute, 119991 Moscow, Russia, [3]ESA-ESTEC, SRE-SM, Noordwijk ZH, The Netherlands, [4]Space Research Institute, Moscow, Russia, [5]Brown University, Providence, RI, USA

Introduction: Discovery of ongoing volcanic activity on Venus would have major implications for understanding processes in its interior, surface and atmosphere. The surface of Venus has signs of geologically recent volcanism [1-3], the atmosphere evolution models include volcanic activity as a source of various gases [4], but no ongoing volcanism has been reliably registered so far. Recently there were published works on potential recent volcanism on Venus [5,6]. These, however, did not give any direct and unambiguous evidence for the ongoing or very recent volcanic activity but only offered rather suggestions or indications. In data obtained by Venus Monitoring Camera (VMC) onboard the ESA Venus Express (VEx) we found a few transient phenomena in Ganiki Chasma that we interpreted as evidence of present volcanic activity.

Ganiki Chasma is a NW branch of a cluster of young rift zones with associated volcanism in Atla Regio [7]. The characteristics of one of the volcanoes of this region, Maat Mons, suggest that its activity occurred within the last tens of millions of years [1-3]. Its youth increases the chances for present day volcanic activity in this region and on the planet in general, but does not prove it.

VMC observations: VMC takes images in four spectral channels; one of which, centered at 1.01 μm, registers the night-side thermal emission from the planetary surface [8]. At this wavelength and mean temperature of the surface of ~ 740 K the radiation flux from the surface strongly depends on the surface temperature. This, in principle, provides the possibility to detect higher surface temperature associated with volcanic eruption or another similar activity.

VMC is able to image the surface only on the night side when VEx is in the planet's shadow. Observations are performed in nadir geometry or very close to it at latitudes from ~ 30°N to ~ 20°S. Therefore every particular surface point might be observed from at least 3 consequent VEx orbits during a given eclipse season. But VMC has only one spectral channel for the surface observations, that makes impossible to deduce optical thickness of the Venus atmosphere at the same time as the surface properties. Therefore only certain orbits, where cloud opacity variations are rather small, can be used [9]. These factors limit the feasibility to detect and/or to determine the properties of a transient phenomenon.

Here we discuss VMC observations of an area 5°N – 25°N, 180°E – 200°E (fig. 1). VMC has performed 36 observational sessions in this area. From these data we constructed orbit-wise mosaics and from them computed the maps of relative surface brightness. Analyzing these maps one can see several bright features that are present at the same locations in several consequent orbits and disappear afterwards. These bright spots are seen in the original VMC images and mosaics, but the contrast in the emissivity maps is higher making them more visible.

The bright spots are located at the edges of the rift zone. The most prominent feature (marked by "A" and shown in fig. 2) is seen in mosaics from VEx orbits 793 and 795. Unfortunately the next observation here was done only from orbit 903, that is, 108 days afterward, and we do not know what happened with this feature in between. There are two more bright spots ("B" and "C") that behave in a similar way: they are bright in images obtained from two or three consequent orbits and are not visible in orbits long before or after.

Possible explanations: The bright spots in VMC images and mosaics can be explained by presence of hot matter at or just above the surface. We considered possible observational or data processing artifacts but eventually rejected them.

- Bright spots caused by the camera. The spots are present in several VMC images in each affected orbit. The spacecraft rotates/moves during the imaging, thus in every other image the given point at the surface is pictured at different pixels. It is unlikely that the brightening in the camera will follow this scheme.

- Incorrect pointing information in the region with large altitude gradients. In this case, every artificially bright spot should be coupled with an artificial dark "ghost", that is not observed. Also, there are other places along the rift with similar altitude gradients where no bright spots were seen.

- "Holes" in the clouds. In super-rotating atmosphere of Venus it is unlikely that a hole does not move for several tens of hours, but just changes shape and transparency. It may be true, however, if the cause of the "hole" is some active process at the surface.

Conclusions: In several observational sessions VMC detected transient bright spots at the edges of Ganiki Chasma that appeared and disappeared at the time scale of few days. These phenomena can be interpreted as indication of some localized process that releases hot matter. This could be either lava, gas, or a combination of both. We rule out instrumental effects or cloud inhomogeneity as possible causes of the transient bright spots. We are searching for similar events in other rift zones.

References: [1] K. B. Klose et al. *JGR* 97.E10 (1992), pp. 16353–16369. [2] A. T. Basilevsky. *GRL* 20.10 (1993), pp. 883–886. [3] R. G. Strom. *Lunar Planet. Sci.* 1993, pp. 1371–1372. [4] M. A. Bullock et al. *Icarus* 150.1 (2001), pp. 19–37. [5] N. V. Bondarenko et al. *GRL* 37.23 (Dec. 8, 2010), p. L23202. [6] S. E. Smrekar et al. *Science* 328.5978 (2010), pp. 605–608. [7] M. A. Ivanov et al. *PSS* 59.13 (2011), pp. 1559–1600. [8] W. J. Markiewicz et al. *PSS* 55.12 (2007), pp. 1701–1711. [9] A. T. Basilevsky et al. *Icarus* 217.2 (2012), pp. 434–450.

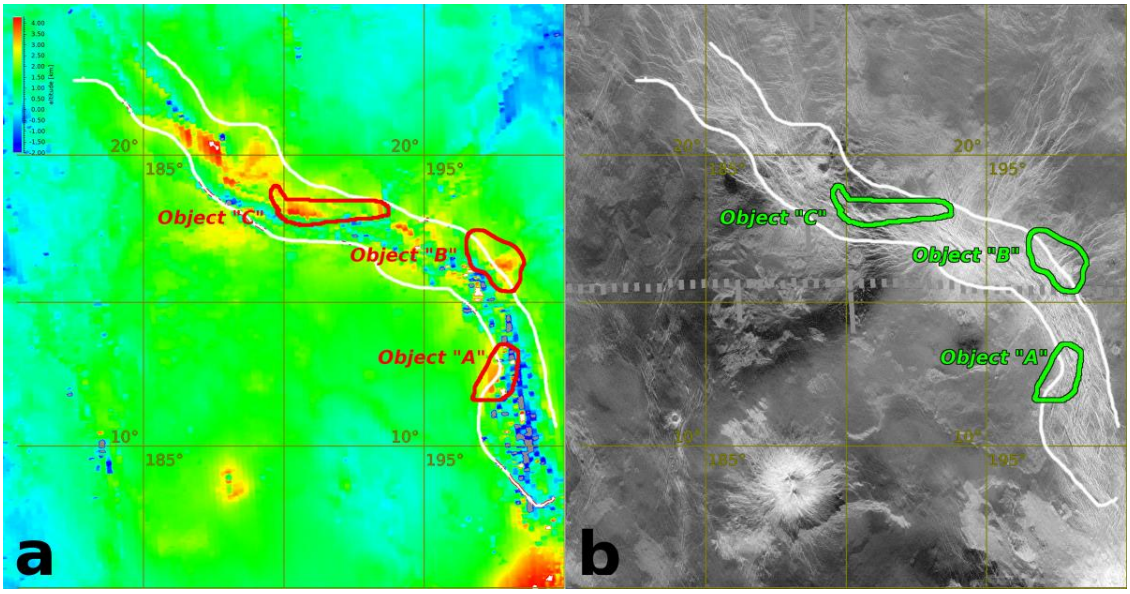

Figure 1: Study area: topographical map (a) and SAR albedo map (b).

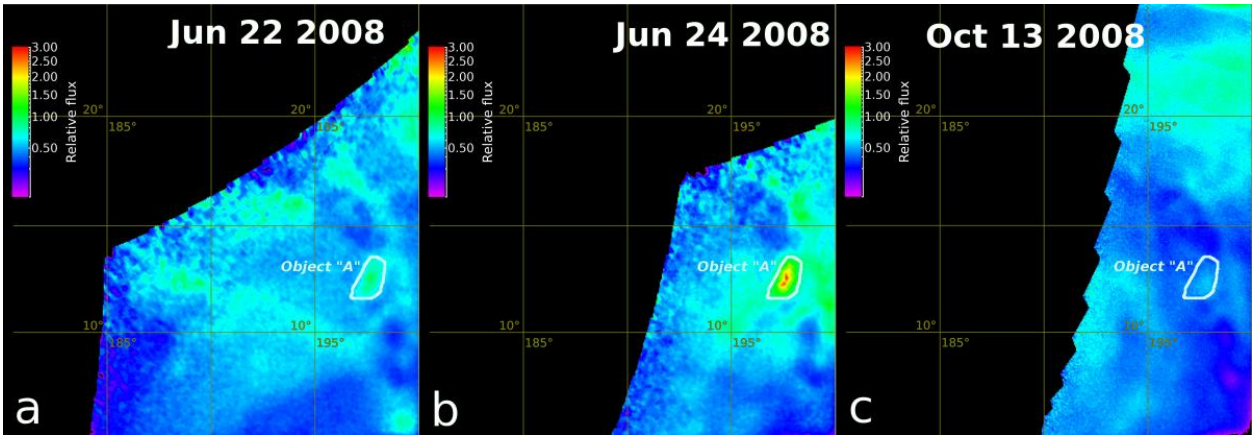

Figure 2: Retreived maps of relative thermal flux from the surface for orbits 793 (a), 795 (b), 906 (c).