The long and hot way from brightness anomalies to compositional information – high temperature laboratory spectroscopy for VIRTIS on Venus Express. Jörn Helbert[1], N. Müller[1,2], A. Maturilli[1], G. Piccioni[3] and P. Drossart[4] [1]Institute for Planetary Research, DLR, Rutherfordstrasse 2, 12489 Berlin, Germany (joern.helbert@dlr.de), [2]University of Muenster, Germany, [3] INAF-IASF Roma, Italy, [4] LESIA - Observatoire de Paris, France

Introduction: Analyzing the surface composition of Venus from remote-sensing measurements is a challenging task. Recently we have reported on brightness variations in the near infrared wavelength range observed with VIRTIS on VenusExpress [1,2]. The implication is that this brightness variations might be correlated to emissivity variations of the surface material. The next step to verify this hypotheses is to obtain data in the relevant spectral range at temperatures typical for the surface of Venus. We are currently upgrading the Planetary Emissivity Laboratory (PEL) at Deutsches Zentrum für Luft- und Raumfahrt (DLR) in Berlin [3,4]. The upgraded PEL allows to measure the emissivity of planetary analog materials grain sizes fractions from less than 25 microns all the way to bulk samples and at temperatures of more than 400°C, typically for the surface of Venus. The PEL development follows a multi-step approach. We are currently testing a new calibration target that will allow obtaining emissivity data on the full range from 1 to 50 microns with a usable signal-to-noise ratio. In beginning of 2009 the installation of the new planetary simulation chamber will take place.

Here we will discuss data in the range from 1 to 1.4 microns which covers the atmospheric windows used for the surface observations from VIRTIS on VenusExpress. We will focus especially on which measurements are necessary to verify our earlier hypotheses of compositional variations on the surface of Venus.

VIRTIS on VEX: The imaging spectrometer VIRTIS is the flight spare of the instrument of the same name of the Rosetta mission. It was refitted to be part of the Venus Express mission currently in orbit around Venus. VIRTIS observes nightside thermal emissions at the wavelengths of several atmospheric windows. In three of these windows atmospheric transparency is sufficient to allow a measurable amount of radiation originating from the surface thermal emission to escape [6]. Surface emissivity in this near infrared range is indicative of surface mineralogy, observation of the atmospheric windows presents an opportunity to characterize the surface mineralogy globally [1,2,7].

Emissivity variations: The emissivity variation inferred from the VIRTIS data is to some extend correlated with geomorphological features established from Magellan radar images. Most general result is that tessera highlands have a tendency to emit less than than other highland areas of the same altitude. This might indicate felsic surface composition of tessera highlands, e.g. anorthosite or granite [1,8].

Some, but not all volcanic edifices show increased emissivity. Large lava flows in the Lada terra – Lavinia planitia region also show an increased thermal emission. In particular Cavilaca and Juturna fluctus,

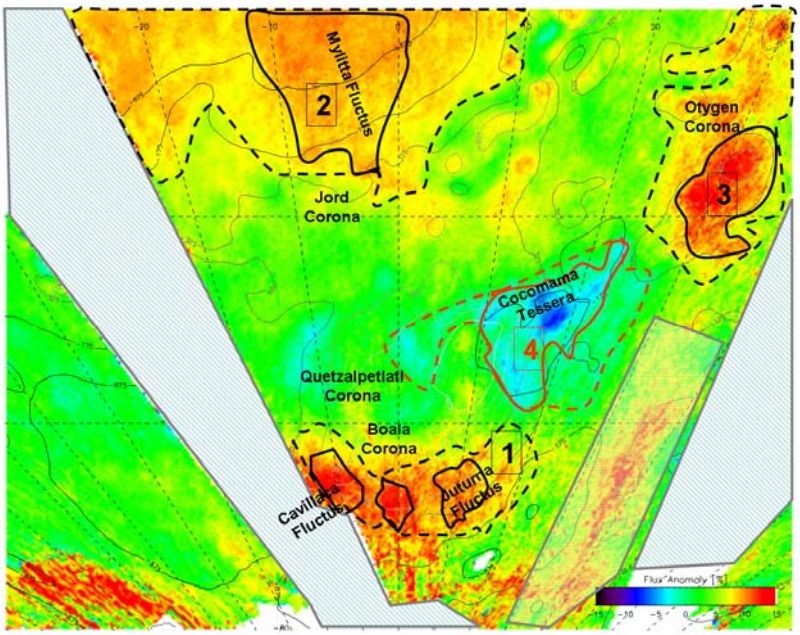

Figure 1 Example of VIRTIS surface data for the Quetzalpetlatl corona - for details see [2]

emanating from Boala corona (70S 0E) inside Quetzalpetlatl corona, are characterized by an increased IR flux (Fig 2) [2].

This might be consistent with the large scale extrusive volcanism of ultramafic composition. Alternatively the increased emission found at volcanic units, characterized as relatively young, might be due to increased surface temperature, but no compelling evidence for active volcanism was found looking at individual images.

Supporting laboratory work: In order to make an mineralogical interpretation of the VIRTIS surface data we need emissivity spectra of analog materials obtained at temperatures typical for Venus.

Figure 2 Top: Schematic view of the new planetary simulation chamber- Bottom: Chamber casing at manufacturer

For this task the PEL is currently ongoing a major upgrade. A new planetary simulation chamber is installed. The main highlight of this chamber is a new induction heating system. This system has been tested extensively [3] and will now be permanently installed in the new chamber. It will allow to heat the samples to temperatures of up to 700K allowing measurements under realistic conditions for the surface of Venus.

The whole system is under vacuum to avoid alteration of the sample due to reaction with atmospheric gases during the heating process. Samples will be selected based on the applicability to Venus. Cooperations have been started to weather the samples in simulated Venusian atmosphere conditions prior to measuring their spectra.

Summary: VIRTIS on Venus Express has provided us with a unique new data set on the surface of Venus. This data is highly complementary to exisiting datasets from earlier missions to Venus.

In order to interpret this new dataset a completely new set of laboratory work is necessary. So far no laboratory in the world is capable of meaursing routinely the emissivity of samples at Venus temperatures in the range from 1-1.2µm. The PEL after the conclusion of the current upgrade will for the first time provide a database of spectra in this range, greatly enhancing the scientific return of VIRTIS on Venus Express.

References: [1] Müller, N., Helbert, J. et al (2008) *JGR* in press. [2] Helbert, J., Müller. N. et al. (2008) *GRL*. [3] Helbert, J. et al. (2009) *LPSC XL*, this meeting. [4] Maturilli A., Helbert, J. et al. (2008) *PSS, 56*, 420-425. [6] Carlson R. W. et al. (1991) *Science*, 253:1541–1548. [7] Hashimoto, G. L. and Sugita S. (2003) *JGR*, 108:13–18 [8] Hashimoto G. L. et al. (2008) *JGR* In press