CASSINI/VIMS OBSERVATIONS OF TITAN DURING THE T20 FLYBY. C. Sotin[1,2], S. LeMouelic[1], R.H. Brown[3], J. Barnes[3], L. Soderblom[4], R. Jaumann[5], B.J. Buratti[2], R.N. Clark[6], K.H. Baines[2], R.M. Nelson[2], P. Nicholson[7] and the VIMS Science team, [1]Laboratoire de Planétologie et Géodynamique, Université de Nantes, 44322 Nantes, France, [2]Jet Propulsion Laboratory, California Institute of Technology, Pasadena, USA. [3]Lunar and Planetary Lab and Stewart Observatory, University of Arizona, Tucson, USA. [4]U.S. Geological Survey, Flagstaff, AZ, USA, [5]Institute of Planetary Exploration, DLR, Germany. [6]U.S. Geological Survey, Denver, USA. [7]Cornell university, Ithaca, NY, USA. [Christophe.Sotin@univ-nantes.fr]

Introduction: Since its insertion in Saturn's environment in July 2004, the Cassini spacecraft has realized 20 Titan flybys. Three instruments can see through the haze: the ISS camera thanks to the infrared channel, the SAR (Synthetic Aperture Radar) and the Visual and Infrared Mapping Spectrometer (VIMS) [1]. During the first flyby, the VIMS showed its great potential to map and to characterize Titan's surface despite scattering by haze particles and strong absorption of light by methane contained in the atmosphere [2]. Six infrared windows provide images of Titan's surface and its spectral properties. At closest approach, the spatial resolution can be as good as 250 m/pixel, a resolution similar to that of the radar swaths. Because the VIMS capabilities were unexpected before the first observations, the VIMS had never been the prime instrument at closest approach before the T20 flyby that happened on 24 October 2006. This paper reports on the findings of this flyby.

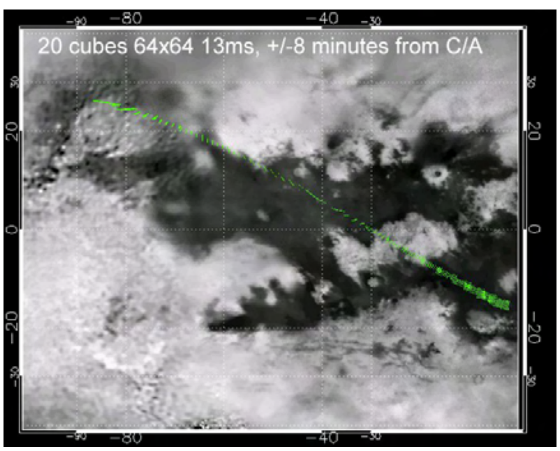

Figure 1: The green line shows the line mode used to observe Titan's surface during the T20 flyby.

Observations: T20 was a very good flyby because the phase angle was on the order of 20 deg. The observation started before closest approach and included a push broom mode (Figure 1) that had never been experienced before. In this mode, the number of pixels per line was set up such that every line was contiguous to the previous one. A first 'noodle' of 1864 lines, about 1500 km long, was obtained [3]. A couple minutes after closest approach, the pointing was set up to obtain a 64.64 high-resolution image at the boundary between bright and dark terrains in an area known as Bohai Sinus [4]. Then, a second 'noodle' of 581 lines of 64 pixels, less than 1000 km long, was acquired. A mosaic of 8 cubes of 64.64 pixels then followed this observation over the South Pole.

The findings include observations of clouds in the lower atmosphere, morphologic features produced by exogenic processes and other features that are best explained by endogenic processes. The area observed by VIMS crosses two SAR swaths and the combination of the two data sets is a powerful tool to better characterize Titan's surface.

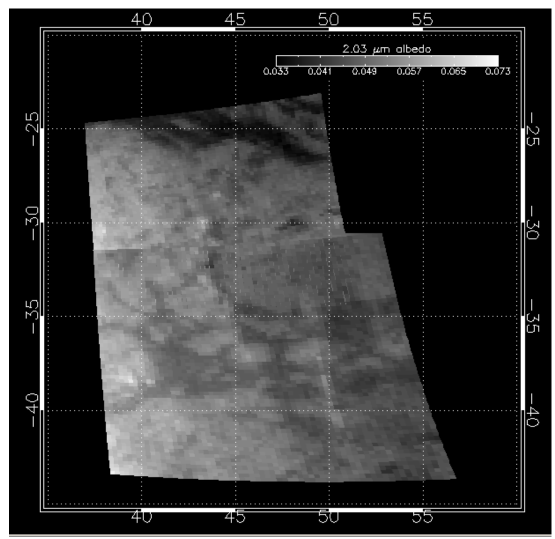

Figure 2: Observation of bright lineaments on this 2 images mosaic. The images are obtained at 2.03 µm.

As an example, Figure 2 shows an area imaged just after the second noodle. Two North-South bright lineaments show up. They seem to cross the dark regions although the western one seems to be offset by a SW-NE dark 'channel' suggesting a tectonic control. The length of these lineaments is on the order of 200 km. Shading across these lineaments is observed at the different wavelengths and suggest topographic heights on the order of 1 to 1.5 km. This suggests that they are mountain ranges. One can note bright points along these lineaments. In addition, clouds are observed at the South of these mountain ranges. These clouds may be orogenic clouds.

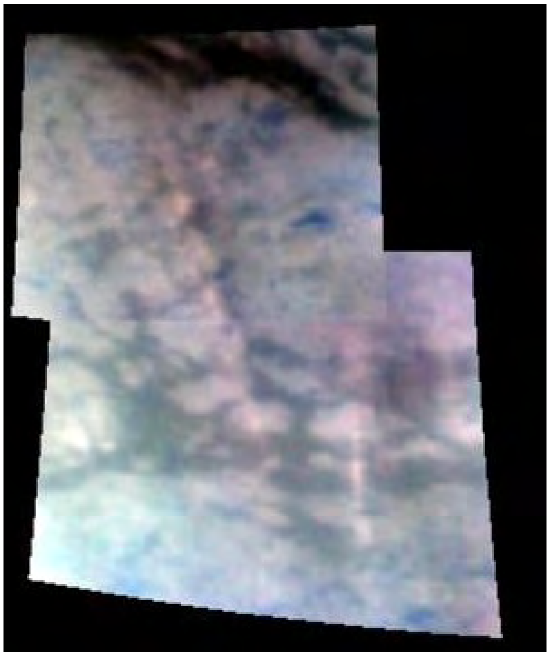

Figure 3: False colour mosaic of the area displayed in Figure 2. 1.24 µm is blue, 2.03 µm is green and the 5 µm window is red.

One interpretation is that Titan's contraction, as it cools down, generates compressive stresses that can break the ice upper crust and lead to the upwelling of hot water ice. During this upwelling, methane clathrates are destabilized, creating overpressures and release of methane in Titan's atmosphere.

The different areas that can be seen on Figure 3 are being analyzed in order to extract their spectral characteristics.

The South Pole also revealed interesting features including a bright spot that displayed spectral characteristics quite different from those of clouds. Different kinds of terrains are also seen by the VIMS and a geological mapping of the South Pole is being conducted.

Conclusion and Perspectives: This T20 observation has provided us a wealth of data that are processing. These first high-resolution images are very useful for characterizing the diversity of morphological structures that have been observed on Titan's surface. Such features include dunes, lakes, channels, impact craters, domes, cryovolcanic flows, bright spots and mountain chains. The distribution of these features will allow us to construct models of Titan's evolution.

Bibliography : **[1]** Brown R.H. et al (2003), *Icarus, 164, 461*. **[2]** Sotin C. et al. (2005), *Nature, 435, 786-789*. **[3]** LeCorre L. et al., 2007, LPSC 38. **[4]** Jaumann R. et al., 2007, LPSC 38.