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Geology and Temporal Survey of Ontario Lacus on Titan from 2005 to 2009.

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In June 2004 and July 2005, the ISS multispectral camera onboard the Cassini spacecraft imaged a 235 km-long and 75 km-wide dark feature near the south pole of Titan (McEwen et al., 2005). By comparison with other landforms observed near Titan's North Pole with the Radar instrument (Stofan et al., 2007), this feature has been interpreted as a hydrocarbon-filled basin and named Ontario Lacus. Other observations of the basin, by the VIMS hyperspectral camera in December 2007 and the Radar altimeter in December 2008 may also be consistent with a liquid-covered basin (Brown et al., 2008, Barnes et al., 2009) lying in an extremely flat depression (Lorenz et al., 2009). In March 2009, VIMS acquired new hyperspectral cubes with a spatial resolution similar to those of 2007. Finally, the new Radar observations in SAR mode in June and July 2009, 3 months after the latest VIMS observation, provided the first spatially resolved images of the basin.

By merging all these data sets, we performed an integrated geomorphological study of Ontario Lacus and its surroundings. Comparisons with optical and radar satellite images of analogous landforms in the Etosha Basin, a semi-arid region located in Namibia, allowed us to produce an interpretative geological map of Ontario Lacus in 2009. We also checked for potential surface changes of the basin between 2005 and 2009, i.e. during the austral summer and autumn.

Our interpretative geological map shows that the basin is surrounded mostly by flat plains, except in the north where mountains are present (rough areas with dendritic valleys and triangular facets in the SAR images). The typical radar-dark signature of liquids is present over half the surface of the basin only. Channels are present both in the T38 VIMS infrared and Radar images of the basin's interior. This suggests that the floor of the basin, most probably composed of (perhaps soggy) sediment, is not covered by liquids over its whole surface. The joint study of Radar/infrared images of the Etosha region acquired during the dry season demonstrates that liquid-free surfaces can appear dark at the radar wavelength and could thus explain the radar-darkness of certain portions of Ontario's floor.

A radar-bright border curving along the eastern shore of the basin can be interpreted, by analogy with similar landforms observed in Namibia, as "lunette-dunes", which form by accumulation at downwind basin borders of fine sediments provided by wind deflation of exposed and desiccated lake floors. This unit can be reconciled with 5μm-bright areas in the VIMS images.

Finally, by using a derivative method to automatically detect contours at the spatial resolution of ISS and VIMS, we observe no significant change of the basin contour between 2005 and 2009. This lack of changes is consistent with our explanation of the geology of Ontario Lacus as a flat basin only partially filled by liquids. Potential changes in the extension of the liquid infill have therefore to be searched inside the basin rather that along its margins.