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High-pressure experiments on the stability of methane hydrates in the H_2O-NH_3-CH_4 system with applications to Titan's cryovolcanism.

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The current methane abundance in Titan's thick atmosphere cannot be explained without the existence of replenishment processes. Indeed, the intense photochemistry taking place in the atmosphere would destroy the 2-5% CH_4 amounts measured by the GCMS onboard the Huygens probe [1] within 10-100 Myr [e.g. 2]. Among the several hypotheses that could explain this replenishment, release of methane during cryovolcanic events seems highly likely. The VIMS [3] and Radar instruments [4] onboard the Cassini spacecraft have brought substantial evidence for cryovolcanic features on Titan's surface. A numerical model has shown the possibility to release CH_4 by dissociating methane clathrate hydrates at depth, due to interaction of a clathrate layer with warm ice intrusions [5]. However, the effect of volatile compounds, dissolved (e.g. N_2) or in solution (e.g. NH_3), would most certainly play a major role in cryovolcanic processes. High-pressure low-temperature experimental investigations on the effect of ammonia on methane hydrates' dissociation are conducted within an optical sapphire-anvil cell. Preliminary results have been previously presented, which lead to contradictory interpretations so far [6,7]. As further experiments are being performed, the reliability of the experimental measurements and the reasons for observing discrepancies in the results can be adressed with more and more confidence. This poster will discuss the experimental issues encountered in the H_2O-NH_3-CH_4 system, up-to-date experimental results, as well as their implications for Titan's cryovolcanism.

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