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Release of volatiles from Titan's interior: origin, evolution and consequences.

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Measurements of the carbon and nitrogen isotopic ratio as well as the detection of 40Ar and 36Ar by the GCMS instrument aboard the Huygens probe (Niemann et al. 2005) have provided key constraints on the origin of Titan's atmosphere, and indirectly on the evolution of its interior. Those informations combined with models of Titan's interior can be used to determine the story of volatile outgassing since Titan's formation. In absence of an internal source, methane, which is irreversibly photodissociated in Titan's stratosphere, should be entirely removed from the atmosphere in a time span of a few tens of millions of years. The episodic destabilization of methane clathrate reservoir stored within Titan's crust and subsequent methane outgassing could explain the present atmospheric abundance of methane, as well as the presence of argon into Titan's atmosphere (Tobie et al. 2006). The idea that methane is released from the interior through eruptive processes is also supported by the observations of several cryovolcanic-like features on Titan's surface by the Cassini VIMS (Sotin et al. 2005) and Radar (Lopes et al. 2006). Thermal instabilities within the icy crust, favored by the presence of ammonia, may explain the observed features and provide the conditions for eruption of methane and other volatiles. The origin of methane within the interior as well as the consequences of episodic outgassing for Titan's surface and atmosphere will be discussed.