Methane retained by carbon dioxide and water ices

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Introduction: Methane can interact efficiently with ices present in Mars. Water and/or carbon dioxide can retain methane well over its sublimation temperature. Laboratory experiments show different interactions depending on the formation conditions of the ices.

Experimental: A closed cycle of Helium Cryostat consents to deposit ices in a high vacuum system. Relevant mixtures are deposited at low temperatures. Density and refractive index are determined during deposition by means a quartz crystal microbalance and a double laser interferometric technique. They unveil the structure of the ices formed. After deposition, the sample is warmed up and methane desorption is monitored by the QCMB and the interferometric system.

Results: Methane release is delayed to higher temperatures because it interacts with less volatile molecules present in Mars, such as CO_2 and H_2O. Structural processes such as crystallization and compaction, influence the methane atmosphere-surface relationship.
Methane co-deposited with carbon dioxide desorbs at three main temperatures in our system. The first desorption occurs when carbon dioxide crystallizes, the second one around the temperature were the pores start to collapse, and finally when carbon dioxide sublimes (Luna et al 2008[1], Satorre et al 2009[2]). A similar behavior is produced when a methane-water ice is formed and warmed up (McCoustra 2004[3])
The presentation will show results already published and those we expect to obtain in an ongoing research focused on Mars.

References:
[1] Luna, R., Millán, C., Domingo, M. and Satorre, M.Á., ***Astrophys Space Sci*** *314,* 113–119, 2008.
[2] Satorre, M.Á. Luna, R., Millán, C., Santonja, C. and Cantó, J., **Planetary and Space Sci** *57,* 250-258, 2009.
[3] Collings, M.P., Anderson, M.A., Chen, R., Dever, J.W., Viti, S., Williams, D.A.; McCoustra, M.R.S., **MNRAS** *354,* 1133-1140, 2004.

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