

## Methane in Martian atmosphere: observations by PFS and possible significance.

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I shall review here the PFS finding of methane in Martian atmosphere from the 2004 Science paper, through the study of its variations, to the mapping studies presented at the international workshop held in Frascati on November 2009. In 2004 we demonstrated that methane was present in Martian atmosphere with an average mixing ratio of  $10 \pm 5$  ppbv, but it was very much variable from 0 to 35 ppbv, with longitudinal variations and a max abundance east of 30 degrees longitude. The seasonal variations were studied in a paper of Planetary and Space Science in 2008. At the workshop in Frascati we identified the source which is in the sublimating remnant polar cap in northern summer, and we also studied the vertical profiles of methane using the limb measurements of PFS: the conclusion was that we need the concept developed by E.Chassefiere (2009) what is sublimating from the ice is not only the water vapour and the methane as gas, but rather the clathrate hydrates nano particles, and they participate to the global circulation and eventually precipitate in the seasonal polar caps. When the seasonal polar caps sublime, the nano particles break and release new methane. For this reason the maximum of methane is observed in northern spring and over the sublimating northern remnant polar cap.

Concerning the significance of methane, we may say that, first being the source in the northern remnant polar ice, the methane cannot be the original methane of when the planet was formed, but must be created in the last few million years. The lifetime of methane cannot be of the order of 300-600 years, because then it would be uniform all over the planet, but must be of the order of few months or 2-3 years. The mechanism which has been generating methane can be either life, or serpentinization: life in water ice has been observed on Earth (Greenland). Serpentinization is a process in which some aquifer interacts with minerals (olivine) to produce methane and some other gases. Conclusion is either there is life inside the northern polar ice on Mars, or under the polar cap there is liquid water which is interacting with rocks producing methane, which gets trapped in the ice.

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