# Experimental study of serpentinization and abiotic $CH_4$ production in martian conditions

**Conference Paper** · July 2021

DOI: 10.7185/gold2021.5061



**10 authors**, including:

Valentin Fortier
Université Libre de Bruxelles
**2** PUBLICATIONS **0** CITATIONS
SEE PROFILE

Veronique Dehant
Royal Observatory of Belgium
**569** PUBLICATIONS **7,741** CITATIONS
SEE PROFILE

Benjamin Bultel
Université Paris-Saclay
**26** PUBLICATIONS **316** CITATIONS
SEE PROFILE

Paulina Melo Bravo
Université Catholique de Louvain - UCLouvain
**1** PUBLICATION **0** CITATIONS
SEE PROFILE

# Experimental study of serpentinization and abiotic $CH_4$ production in martian conditions

**Valentin Fortier[1-2], Vinciane Debaille[1], Véronique Dehant[2-3], Benjamin Bultel[4], Damien Debecker[5], Paulina Paz Melo Bravo[5], Yasuhito Sekine[6], Shuya Tan[6], and Natsumi Noda[6].**

*[1]Laboratoire G-Time, ULB, Brussels, Belgium*
*[2]ELI, UCLouvain, Louvain-la-Neuve, Belgium*
*[3]Royal Observatory of Belgium, Brussels, Belgium*
*[4]CEED, UiO, Oslo, Norway*
*[5]MOST/IMCN, UCLouvain, Louvain-la-Neuve, Belgium*
*[6]ELSI, Tokyo Institute of Technology, Tokyo, Japan*

The presence of methane on Mars remains highly debated in particular with contrasted detection results from Curiosity rover [1] and TGO [2]. In addition, the possible methane cycle is also poorly known: source(s) and removal process(es) remain currently undefined; and it is not known yet if this methane emissions might be related to a biological activity. Because of orbital detection of serpentine on Mars [3], and of the mafic-ultramafic nature of Mars ancient crust, a putative abiotic candidate source is serpentinization associated with Sabatier reaction. The aim of this work is to experimentally study the production capacity of $H_2$ and mainly $CH_4$ by those abiotic processes in martian conditions to determine the viability of this origin.

Two different experimental setups are used in this work and will be presented. The first one is a flexible gold-cell type setup [4] nicknamed “Wet” in this study, running at the ELSI [5]. This type of setup, used in many previous similar studies, focuses on serpentinization and $CH_4$ production by Sabatier reaction in presence of liquid water. The second setup, nicknamed “Dry” in this study, is a gas reactor running at the IMCN [6]. This setup focuses on $CH_4$ production by Sabatier reaction in absence of liquid water. Preliminary results of the two experimental setups will be presented.

[1] Christopher R. et al., Mars methane detection and variability at Gale crater, Science, Vol. 347 (2015).
[2] Korablev O. et al., No detection of methane on Mars from early ExoMars Trace Gas Orbiter observations, Nature, Vol. 569, E2 (2019).
[3] Ehlmann B. L. et al., Geologic setting of serpentine deposits on Mars, Geophys. Res. Lett., 37 (2010).
[4] Seyfried W. E. et al., A new reaction cell for hydrothermal solution equipment, American Mineralogist, Vol. 64 (1979).
[5] Tan S. et al., The role of hydrothermal sulfate reduction in the sulfur cycles within Europa: Laboratory experiments on sulfate reduction at 100 MPa, Icarus, Vol. 357 (2021).
[6] Kim A. et al., CO2 methanation on Ru/TiO2 catalysts: On the effect of mixing anatase and rutile TiO2 supports, Applied Catalysis B: Environmental, Vol. 220 (2018).