

## Experimental study of serpentinization and abiotic CH<sub>4</sub> production in martian conditions

VALENTIN M FORTIER<sup>1,2</sup>, VINCIANE DEBAILLE<sup>2</sup>,  
VÉRONIQUE DEHANT<sup>1,3</sup>, BENJAMIN BULTE<sup>4</sup>, DAMIEN  
P DEBECKER<sup>1</sup>, PAULINA PAZ MELO BRAVO<sup>1</sup>,  
YASUHITO SEKINE<sup>5</sup>, SHUYA TAN<sup>6</sup> AND NATSUMI  
NODA<sup>6</sup>

<sup>1</sup>Université Catholique de Louvain-la-Neuve (UCLouvain)

<sup>2</sup>Université Libre de Bruxelles (ULB)

<sup>3</sup>Royal Observatory of Belgium (ROB)

<sup>4</sup>Universitetet i Oslo (UiO)

<sup>5</sup>Tokyo Institute of Technology, Earth-Life Science Institute

<sup>6</sup>Tokyo Institute of Technology

Presenting Author: [valentin.fortier@uclouvain.be](mailto:valentin.fortier@uclouvain.be)

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<sub>2</sub> and mainly CH<sub>4</sub> 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<sub>4</sub> 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<sub>4</sub> production by Sabatier reaction in absence of liquid water. Preliminary results of the two experimental setups will be presented.

[1] Christopher R. et al. (2015), *Science* 347, 415-417.

[2] Korabev O. et al. (2019), *Nature* 569, 517-520, E2.

[3] Ehlmann B. L. et al. (2010), *Geophys. Res. Lett.* 37.

[4] Seyfried W. E. et al. (1979), *American Mineralogist* 64, 646-649.

[5] Tan S. et al. (2021), *Icarus* 357.

[6] Kim A. et al. (2018), *Applied Catalysis B: Environmental* 220, 615-625.