Abstract ID : **149**

Evaluating in situ microbial production of greenhouse gases in subglacial environments of Greenland Ice Sheet: new insights from the Camp Century basal ice section

Content

Basal ice is a key component of ice cores since it may provide insights on rheological conditions on ice sheet dynamics. It also represents a limit to the downward extension of climate records [1], and it is an indicator of subglacial conditions. Large amounts of carbon dioxide (CO2) and methane (CH4) (up to 130,000 and 6,800 ppmv, respectively) together with depleted O2 concentration (down to a few %) were reported in the basal ice of the GRIP and Dye3 ice cores [2,3]. Such high CO2/O2 and CH4/O2 ratios suggest microbial production of greenhouse gases, either in the subglacial environments (i.e., underlying sediments or in the basal ice itself) or in the soils prior to the ice-sheet build-up, which can later be transmitted to the ice by diffusion and shearing/folding processes. Here, we document the in-situ production of greenhouse gases in the subglacial environments by analysing gas concentration (N2, O2, CO2, N2O, and CH4) in the basal ice layer at Camp Century (Northwest Greenland). This layer consists in 14 meters of alternating bands of clear and debris-laden ice, sitting above 3.5 meters of underlying sediments, with a total gas content which progressively decreases toward the bed (from 65 down to 34 ml kg-1 at STP) [4,5]. Preliminary results (few data points) reveal a CO2 concentration varying from 3,000 to 10,700 ppmv in clear ice and debris-rich layers respectively [4]. Gas composition is currently measured at ~5cm resolution on 30g ice samples for N2, O2, Ar, CO2, CH4 and N2O. Depending on the gas concentrations, we also plan to perform isotope analysis (N2O and CH4) to provide further information on the sources and sinks of these potent greenhouse gases.

[1] Tison et al., 2015, The Cryosphere 9, 1633. [2] Souchez et al., 2006, Geophys. Res. Lett., 33, L24503. [3] Verbeke et al., 2002, Annals of Glaciology 35, 231-236. [4] Herron and Langway, 1979, Journal of Glaciology 23, 193-206. [5] Christ et al., 2021, Proc. Nat. Acad. Sci. USA 118, e2021442118.

Primary authors: ARDOIN, Lisa (ULB); TISON, Jean-Louis (Laboratoire de Glaciologie, Université libre de Bruxelles); RÖCKMANN, Thomas (Institute for Marine and Atmospheric Research, Utrecht University, Utrecht, Netherlands); Dr BLARD, Pierre-Henry (Université Libre de Bruxelles); BLUNIER, Thomas (Centre for Ice and Climate, Niels Bohr Institute, University of Copenhagen); DAHL-JENSEN, Dorthe (CPH); Dr SAPART, Célia (Université Libre de Bruxelles); STEFFENSEN, Jorgen Peder (Physics of Ice, Climate and Earth, Niels Bohr Institute); Prof. FRIPIAT, François (Université Libre de Bruxelles)

Presenter: ARDOIN, Lisa (ULB)

Track Classification: The Oldest Ice challenge, and the preservation of climatic signals in the deepest ice