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Preliminary biogeochemical assessment of EPICA LGM and Holocene ice samples

S. Bulat (1,4), I. Alekhina (1,4), D. Marie (2), D. Wagenbach (3), D. Raynaud (4), and J.R. Petit (4)

(1) Petersburg Nuclear Physics Institute, Molecular Radiation Biophysics, St Petersburg, Russian Federation (sergey.bulat@ujf-grenoble.fr), (2) Station Biologique, CNRS et Université Pierre et Marie Curie, Roscoff, France, (3) Institut für Umweltphysik, Heidelberg, Germany, (4) Laboratory of Glaciology and Geophysics of Environment CNRS-UJF, Grenoble, France

We are investigating the biological content (biomass and microbial diversity of Aeolian origin) of EPICA ice core within the frame of EPICA Microbiology consortium*. Two ice core sections were selected from EPICA Dome C and Droning Maud Land, both from LGM and Holocene. Preliminary measurements of DOC (dissolved organic content) and microbial cell concentrations have been performed. Both analyses showed the very low biomass and ultra low DOC content. Trace DNA analyses are in a progress.

The ice sections were decontaminated in LGGE cold and clean room facilities benefiting the protocol developed for Vostok ice core studies. The melt water was then shared between two party laboratories for a complementary approach in studying microbial content. Prior to biology the melt water was tested for chemical contaminant ions and organic acids, DOC and dust contents.
The biological methods included all the spectra of appropriate molecular techniques (gDNA extraction, PCR, clone libraries and sequencing).
As preliminary results, both LGM (well identified by dust fallout) and Holocene ice samples (EDC99 and EDML) proved to be extremely clear (i.e. pristine) in terms of biomass (less then 4 cells per ml) and DOC contents (less then 5 ppbC). There was no obvious difference between LGM and Holocene in cell counts, while LGM showed a bit high organic carbon content. The latter in terms of biology means ultra-oligotrophic conditions (i.e., no possibility for heterotrophic life style).
In fact no metabolizing microbial cells or propagating populations are expected at these depths at temperature -38oC and lower (limiting life temperature threshold is -20°C). Nevertheless some life seeds brought in Antarctica with precipitation could be well preserved because the age is rather young (21 kyr and less).
Trying to identify these aliens and document their distribution during last climate cycle the meltwater was concentrated about 1000 times down. The genomic DNA was extracted and very weak signals were possible to generate which are now under cloning. The signals were hard to reproduce because of rather low volume of samples. More ice volume is needed to get the biosignal stronger and reproducible. Meantime we are adjusting PCR and in addition testing DNA repair-enzyme cocktail in case of DNA damage.
As a preliminary conclusion we would like to highlight the following. Both Holocene and LGM ice samples (EDC99 and EDML) are very clean in terms of Ultra low biomass and Ultra low DOC content. The most basal ice of EDC and EDML ice cores could help in assessing microbial biomass and diversity if present under the glacier at the ice-bedrock boundary.

* The present-day consortium includes S. Bulat, I. Alekhina, P. Normand, D. Prieur, J-R. Petit and D. Raynaud (France) and E. Willerslev and J.P. Steffensen (Denmark)