



Antarctica: Historic Drilling Campaign Reaches more than 1.2-Million-Year-Old Ice

The fourth Antarctic campaign of the “Beyond EPICA - Oldest Ice” project, funded by the European Commission, has achieved a historic milestone for climate science. An international team of scientists successfully drilled a 2,800-meter-long ice core, reaching the bedrock beneath the Antarctic ice sheet. These ice samples are expected to unveil, for the first time, critical details about Earth's climate and atmospheric history, extending beyond 800,000 years ago and showing a continuous record of the history of our climate as far back as 1.2 million years, and probably beyond. Coordinated by the Institute of Polar Sciences of the National Research Council of Italy (Cnr-Isp), the project aims to resolve one of climate science's most complex mysteries.

At the remote Little Dome C site in Antarctica, a research team representing twelve scientific institutions from ten European nations has just achieved a historic milestone for climate science. As part of the European-funded Beyond EPICA - Oldest Ice project, the team successfully concluded a decisive drilling campaign, reaching the depth of 2,800 meters—where the Antarctic ice sheet meets the bedrock.

The extracted ice preserves an unprecedented record of Earth's climate history, continuous information on atmospheric temperatures and pristine samples of old air with greenhouse gases spanning over 1.2-million-year-old ice and probably beyond.

“We have marked a historic moment for climate and environmental science” comments Carlo Barbante, professor at Ca' Foscari University of Venice, senior associate member of the Institute of Polar Sciences of the National Research Council of Italy (Cnr-Isp) and coordinator of Beyond EPICA. “This is the longest continuous record of our past climate from an ice core, and it can reveal the interlink between the carbon cycle and temperature of our planet. This achievement was made possible through the extraordinary collaboration of various European research institutions and the dedicated work of scientists and logistical personnel in the field over the last ten years.” The project also benefits from the synergy with the EU-funded ITN DEEPICE project, which contributed three PhD candidates to this field campaign.

“From preliminary analyses recorded at Little Dome C, we have a strong indication that the uppermost 2,480 meters contain a climate record that goes back to 1.2 million years in a high-resolution record where up to 13,000 years are compressed into one meter of ice”, reports Julien Westhoff, chief scientist in the field, postdoc at Copenhagen university. The principal investigator in the field, Frank Wilhelms, joint professor at Göttingen university and the Alfred Wegener Institute adds: “The right location was identified using cutting-edge radio echo sounding technologies and ice flow modeling. Impressively, we found the record that goes from 0.8 to 1.2 million years ago, exactly where it was

predicted to be, in the depth range between 2426 and 2490 meters, extending our previous twenty-year-old EPICA ice core record.”

Below the ice harbouring the climate record of more than 1.2 Myr, the lowest 210 meters of the ice core above the bedrock consist of old ice that is heavily deformed, possibly mixed or refrozen and of unknown origin. Advanced analysis could help test previous theories about the behavior of refrozen ice under the Antarctic ice sheet and reveal East Antarctica's glaciation history.

The European teams in the field have accomplished an impressive achievement: a total of more than 200 days of successful drilling and ice core processing operations across four field seasons in the harsh environment of the central Antarctic plateau at an altitude of 3,200 meters above sea level and with an average summer temperature of -35°C.

The ice core from Beyond EPICA will offer unprecedented insights into the Mid-Pleistocene Transition, a remarkable period between 900,000 and 1.2 million years ago when glacial cycles slowed down from 41,000-year to 100,000-year intervals. The reasons behind this shift remain one of climate science's enduring mysteries, which this project aims to unravel.

“The precious ice cores extracted during this campaign will be transported back to Europe on board the icebreaker *Laura Bassi*, maintaining the -50°C cold chain, a significant challenge for the logistics of the project”, says Gianluca Bianchi Fasani, senior researcher at ENEA-UTA (National Agency for New Technologies, Energy, and Sustainable Economic Development - Antarctica Technical Unit) and head of ENEA logistics for Beyond EPICA. “To reach this goal, a strategy was developed involving the design of specialized cold containers and precise scheduling of the National Antarctic Research Program (PNRA) air and naval assets”.

As soon as these ice cores are in Europe, the project will focus on analyzing the ice samples to uncover the Earth's climate and atmospheric history over the past 1.2 million years and probably beyond. In the most basal sections of the core, even older pre-Quaternary ice might be present. Dating of the underlying rocks will be undertaken to unravel when this region of Antarctica was ice-free for the last time.

The Little Dome C camp was deployed and sustained thanks to the highly effective logistics provided by the French Polar Institute and the ENEA, utilizing both their expertise and the various means of transport at their disposal. These included aircraft for transporting personnel to Mario Zucchelli Station and onwards to Concordia Station, and the traverse between Dumont d'Urville and Concordia Stations for heavy cargo, as well as the provision of the French and Italian ships *L'Astrolabe* and *Laura Bassi*, respectively.

Participants in the 2024/2025 campaign: Université Libre de Bruxelles (BE): Lisa Ardoin; University of Bern (CH): Barbara Seth and Lison Soussaintjean; AWI (DE): Matthias Hüther, Manuela Krebs, Gunther Lawer, Johannes Lemburg, Martin Leonhardt, and Frank Wilhelms; University of Copenhagen (DK): Julien Westhoff; CNRS (FR): Marie Bouchet and Ailsa Chung; IPEV (FR): Inès Gay; ENEA (IT): Danilo Collino and Michele Scalet; Cnr-Isp (IT): Federico Scoto. The Beyond EPICA (European Project for Ice Coring in Antarctica) - Oldest Ice project, coordinated by the Institute of Polar Sciences of the National Research Council of Italy (Cnr-Isp), has been funded by the European Commission and supported by national partners and funding agencies in Belgium, Denmark, France, Germany, Italy, Norway, Sweden, Switzerland, The Netherlands, and the United Kingdom.

To learn more about Beyond EPICA Oldest Ice project: <https://www.beyondepica.eu/en/>

Photos and Videos of the Field Campaigns:

Download latest photos:

<https://drive.google.com/drive/folders/1YHkb2L5MmKQ9Me8kISWvIaBwTNBrjqIA?usp=sharing>

Beyond EPICA Field Seasons Gallery: <https://www.beyondepica.eu/en/gallery/field-seasons/>

In brief

What: The fourth Antarctic campaign of the Beyond EPICA - Oldest Ice Project has reached the bedrock beneath the Antarctic ice sheet

Further information (*contact details for professional use only, not to be disclosed*):

Project Coordinator: Carlo Barbante, Ca' Foscari University of Venice, Cnr-Isp; e-mail: barbante@unive.it, mob. + 39 333 437 3372;



Universiteit
Utrecht



This project has received funding from the European Union Horizon 2020 research and innovation programme under grant agreement No. 815384

The project has also been supported by national partners and funding agencies in Belgium, Denmark, France, Germany, Italy, Norway, Sweden, Switzerland, The Netherlands and the United Kingdom.

Scientific National Contact Points

1. **Lead Partner** - ISP-CNR -The Institute of Polar Sciences of the National Research Council of Italy (Italy) – **Project Coordinator** - Carlo Barbante (Ca' Foscari University of Venice and Cnr-Isp, e-mail: barbante@unive.it)
2. AWI - The Alfred-Wegener Institute (Germany) - Frank Wilhelms (AWI and Göttingen University), e-mail frank.wilhelms@awi.de
3. UKRI-BAS - The British Antarctic Survey (UK) - Robert Mulvaney, e-mail: rmu@bas.ac.uk

4. IPEV - The French Polar Institute (France) – Yan Ropert-Coudert, e-mail: Yan.Ropert-Coudert@ipev.fr
5. ENEA - The National Agency for New Technologies, Energy and Sustainable Economic Development (Italy) – Gianluca Bianchi Fasani, e-mail: gianluca.bianchifasani@enea.it
6. CNRS - The National Scientific Research Centre (France) – Frédéric Parrenin, e-mail: frederic.parrenin@univ-grenoble-alpes.fr
7. UU - The Utrecht University (Netherlands) – Roderik van de Wal, e-mail: r.s.w.vandewal@uu.nl
8. NPI - The Norwegian Polar Institute (Norway) – Elisabeth Isaksson, e-mail: elisabeth.isaksson@npolar.no
9. SU - The University of Stockholm (Sweden) – Margareta Hansson, e-mail: margareta.hansson@natgeo.su.se
10. UBERN - The University of Bern (Switzerland) – Hubertus Fischer, e-mail: hubertus.fischer@climate.unibe.ch
11. UCPH - The University of Copenhagen (Denmark) – Dorthe Dahl-Jensen, e-mail: ddj@nbi.ku.dk
12. ULB - The Brussels University (Belgium) – Frank Pattyn, e-mail: fpattyn@ulb.ac.be