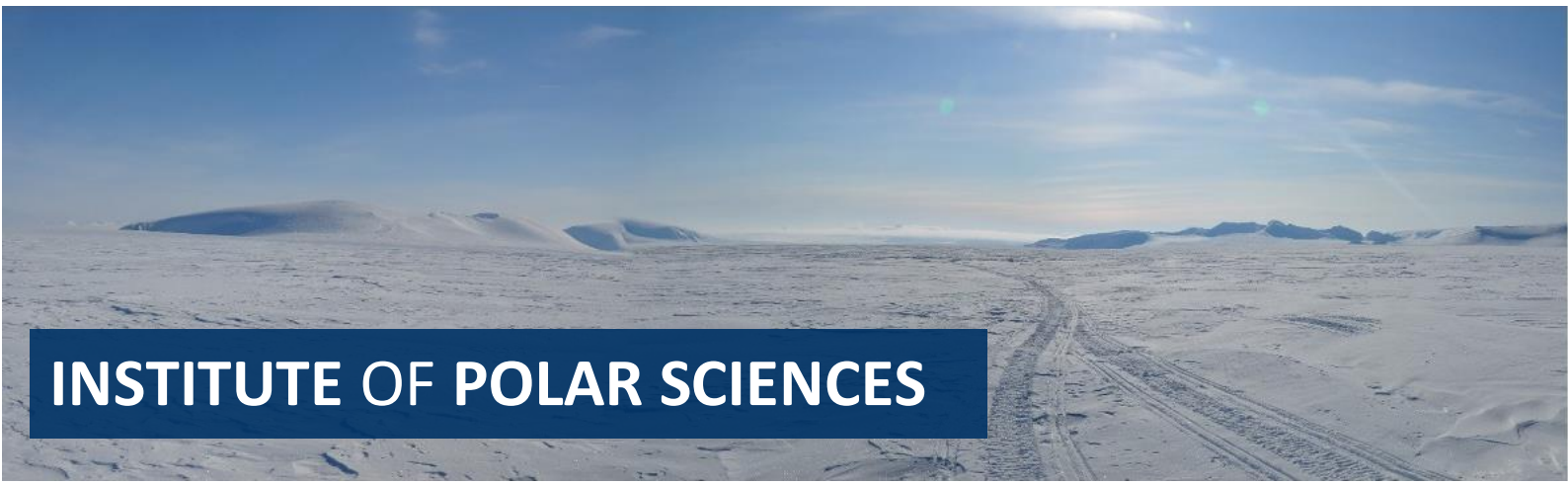


INSTITUTE OF POLAR SCIENCES

IN THIS ISSUE:

Under the spotlight

The HOLTHEDALFONNA ice field deep drilling (Svalbard)

Andrea Spolaor

Within the framework of the project "SENTINEL: The impact of sea ice diSappearance on highEr North aTlantic clImate and atmospheric bromiNe and mErcury cycLes", funded by the "*Programma di Ricerca in Artico*" with the support of the Ice Memory project, funded by MUR, and coordinated by the Institute of Polar Science (CNR); a group of researchers plans to collect a deep ice core, during spring 2023, from the Holthedalfonna Glacier.

In Svalbard there are few suitable sites for the recovery of well-preserved ice core records. Those that are suitable include the Austfonna ice cap, the Lomonosfonna, the Asgardfonna and the Holthedalfonna. The Holthedalfonna and the Lomonosvfonna are the most studied sites in the

(Credit: Andrea Spolaor CNR-ISP)

Svalbard archipelago. They have a well-preserved climate signal and are easily accessible because of their proximity to Ny-Ålesund (for the Holthedalfonna) and Longyearbyen (for the Lomonosovfonna).

The Holthedalfonna is located approximately at 80 km from the Ny-Ålesund research village, making all logistic operations easier. The summit of the Holthedalfonna, located at 1100 m a.s.l. has a high annual accumulation rate of 50 to 100 cm water equivalent (w.e) of snow per year.

(Credit: Andrea Spolaor CNR-ISP)

In 2005 a deep ice core was drilled at the top of the Holthedalfonna glacier reaching a depth of 125 m. This core allowed a reconstruction of the temperature variation for the last 300 years.

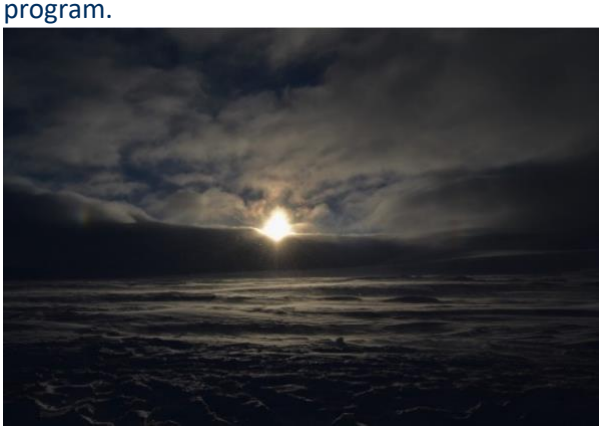
The record suggests relatively steady temperature conditions over the last three centuries with a slight flex during the so-called "little ice age" followed by a smooth increase since the 1980s. One of the advantages of the Holthedalfonna site

(Credit: Andrea Spolaor CNR-ISP)

is that the climate signal retrieved from the ice core can be compared with the historical instrumental dataset available in Longyearbyen (from 1899) and from Ny-Ålesund. Comparison between the water stable isotopes, and the longest instrumental record in Svalbard show they are very similar, suggesting the presence of a well-preserved climate signal in the Holthedalfonna ice at least until 2005.

However, the current warming rate occurring at the Svalbard Archipelago has the unavoidable consequence of increasing summer melting of the snowpack which might compromise the future use of this site for collecting well-preserved glacial climate archives. However, thanks to recent field observations, we can conclude that the climate signal is still preserved within the ice of the Holthedalfonna, however we also have observed a severe decrease in the quality of the climate signal where, for some specific years, it is not even visible anymore.

The aim of this drilling campaign is to collect a deep ice core from the Holthedalfonna summit to better understand the ongoing changes in the Svalbard archipelago. In particular, thanks to this glaciated archive we aim to reconstruct the atmospheric composition of the last 300 years. We also hope to reconstruct sea ice changes over the last 300 years north of Svalbard, investigate the degradation/preservation state of the climate signal compared to the 2005 core, investigate the role of sea ice dynamics on Svalbard biogeochemical cycles, and investigate the impact of Arctic amplification on the Svalbard environment. In collaboration with the NPI, the CNR and the University of Perugia, we also hope to reconstruct black carbon deposition and the history of microbial colonization. A second core taken at the site will be sent to e the Antarctic ice core safe deposit, as part of the Ice Memory program.



(Credit: Andrea Spolaor CNR-ISP)

HERE DIRIGIBILE ITALIA

I came as a neophyte

Simonetta Montaguti

I came to Ny-Ålesund as a neophyte on October 14th 2022 along with Federico Scoto, a CNR-ISAC research fellow. The sun had long since set, but there were still several hours of daylight each day. This allowed me to acclimatize with ease both within the village and at the different work sites, some of which I would visiting daily from now on.
I joined my colleague Ombretta Dell'Acqua, as acting station leader, and we were supported by the polar science doctoral student Simone Pulimeno from Ca' Foscari University.
At the station were two CNR-ISAC researchers, Antonio Donateo and Gianluca Pappaccogli, who were completing their activities as part of the Amundsen-Nobile Climate Change Tower Integrated Project.
Together with Simone, they helped Federico update the Gruvebadet snow measurement station, which is capable of measuring snowpack properties completely autonomously throughout the year.
Together with Federico we also installed in the all-sky camera in the light-sensitive cabin outside the village operated by Stefano Massetti of INAF, that observes the aurora. Federico introduced me to snowpack sampling that I had to do on a weekly basis at a site near the Gruvebadet atmospheric observatory and snow meter station.

(Credit: Simonetta Montaguti CNR-ISP)

On October 28th 2022, all the Italian researchers departed and I remained the only resident of Dirigibile Italia, which had now entered "monitoring" mode. Day light hours, quickly decreased day after day, until the arrival of the polar night in about the second week of November. With the darkness, field work and instrument maintenance continued at Climate Change Tower with the help of headlamps and increased attention while walking about the village.
The Ca' Foscari doctoral student Stefano Frassati joined me at the base in mid-November, but he unfortunately had to return to Italy after about two weeks.
Together with Stefano we participated in three outreach initiative organized for and with schools. the first was the "Futuro Remoto" event organised by the City of Science in Naples, the was the "Space to Space the Opposite Poles" project of the

Villasanta IC school who joined us from the Torrione Hall of the Autodromo Nazionale in Monza, and last was the "Science and Art: dialogue in words and music" event organized in the Convention Hall of the Rome headquarters of the CNR for the centenary celebrations.

During the winter months, not much snow fell and, it often rained. If the temperature dropped slightly, the excess water on the ground turned into a continuous sheet of ice that made any movement or activity difficult. Temperatures were not prohibitive, however, they reached a minimum of -18°C, while the wind often exceeded 20 m/s. The polar night gave us wonderful auroras that completely lit up the sky of Ny-Ålesund and made us literally speechless and with our noses in the air sometimes for several hours.

During my stay in Ny-Ålesund I had the opportunity to visit the Geodesic Observatory, the Zeppelin Observatory and the Sverdrup Station, home of the Norwegian Polar Institute.

(Credit: Simonetta Montaguti CNR-ISP)

I also accepted with great pleasure an invite to the Chinese base for their tea break. It had been a good three years since the Chinese colleagues had been at the science village because of the pandemic.

In December, the work pace in the village slowed down, leaving room for the many convivial Christmas activities. In merriment and music, Christmas and New Year's Eve passed.

In early January, the doctoral student Claudia Frangipani from the University of Chieti and Pescara arrived. Claudia helped me with routine atmospheric monitoring at the Gruvebadet lab, snow sampling, instrument maintenance at the CCT, and other activities around the tower itself. Together with her, and with the remote support of Mauro Mazzola, the new "Aerodynamic Particle Sizer Spectrometer" was installed at the Gruvedabet observatory.

(Credit: Simonetta Montaguti CNR-ISP)

At the end of January, I returned to Italy and left the post again to Ombretta Dell'Acqua who will carry on activities for the next three months.

The 2023 season kicks off

Mauro Mazzola

Measurement campaigns for the current year kicked off at our base in early March. As many as 37 proposals were submitted in the 2023 call for projects, including some related to the SIOS and INTERACT access programs. We expect a total of about 1,700 man-days during the year, which will be a new record for our base. Interest in the Arctic is growing fast, and a significant boost to the development of Italian Arctic research has been given by the Arctic Research Program, funded by the Ministry of University and Research. Interest is also confirmed by Minister Anna Maria Bernini's visit to Ny-Ålesund, that is scheduled for the end of March.

RESEARCH HIGHLIGHTS

The BioGeoAlbedo expedition

Biagio Di Mauro e Giacomo Traversa

By participating in the XXXVIII Antarctic Expedition, we had the opportunity to spend 55 days at Mario Zucchelli Station, located in Terra Nova Bay (North Victoria, East Antarctica). Our activities involved collecting samples of surface material and measuring its optical properties (Fig. 1) in the area of the Nansen Ice Shelf, Priestley Glacier and Hells Gate Ice Shelf. The campaign took place as part of the "BioGeoAlbedo" project, funded by the National Antarctic Research Program (PNRA) and coordinated by the Institute of Polar Sciences of the CNR. The University of Milano-Bicocca and the University of Genoa also participate in the project. The objectives of our project concern the study of the ablation zones of Antarctica and particularly the relationships between impurities of different kinds and the radiative properties of glaciers. The presence of impurities (biotic and abiotic) on glaciers has an important effect on surface radiative budgets, and may influence their melting.

Figure 1: Measuring the optical properties of the surface with a spectrometer (Credit: ©PNRA)

During the campaign we carried out activities in collaboration with colleagues from various research institutes and universities (e.g., CNR-ISP Messina, UNIMI, CNR-INM Genoa). In total, we carried out 20 helicopter trips, 5 drone surveys and 2 underwater rover surveys. The preliminary results of the campaign are very encouraging. We detected the abundant presence of impurities (Fig. 2) and water in the liquid state on the analysed glaciers. In addition, we detected a very

Figure 2: Blue ice surface on the Hells Gate ice shelf affected by the presence of numerous impurities (cryoconite) (Credit: ©PNRA)

abundant presence of cryoconite on the ice. This dark sediment gets its name from the Greek *κρύον* (cold) and *κόνις* (dust), and it can aggregate to form characteristic cryoconite holes. Cryoconite induces a sharp decrease in the surface albedo of ice and can strongly modify the surface properties of glaciers in Antarctica by locally increasing melting. Until now, these kinds of processes had never been studied in this area of Antarctica. Our field activities were carried out simultaneously with the acquisition of optical satellite data from the PRISMA (ASI) and EnMap (DLR) missions. These data are comparable with point data acquired in the field and allow us to extend our investigations to areas not directly investigated in the field. Our research opens interesting prospects for studying the optical properties of glaciers on the margins of the Antarctic ice sheet and their role on future sea level rise.

The Mario Zucchelli Station. Photo by Angelina Lo Giudice CNR-ISP (Credit: ©PNRA)

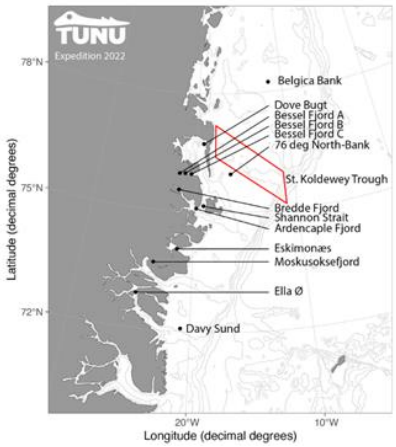
TUNU TEAM-Fish Program

Nicoletta Ademollo e Simonetta Corsolini

Finally, after two years of postponement due to the pandemic, on August 24, 2022, we embarked on the RV Kronprins Haakon that sailed from Longyearbyen, Svalbard, to North-eastern to carry

RV Kronprins Haakon in Besselfjord. (Credit: S. Iglesias)

out the TUNU VIII oceanographic campaign, celebrating the 20th anniversary of this international program, which was born on October 3, 2002. The TUNU Euro-Arctic Marine Fishes - Diversity and Adaptation (TEAM-Fish) program coordinated by UiT, The Arctic University of Norway, aims to expand knowledge about biodiversity, populations and communities of the Arctic seas. It has involved more than forty scientists and students from ten nations to date. The study area during these years has always included Arctic Norway, the Svalbard Islands, and north-eastern Greenland. The term TUNU, in

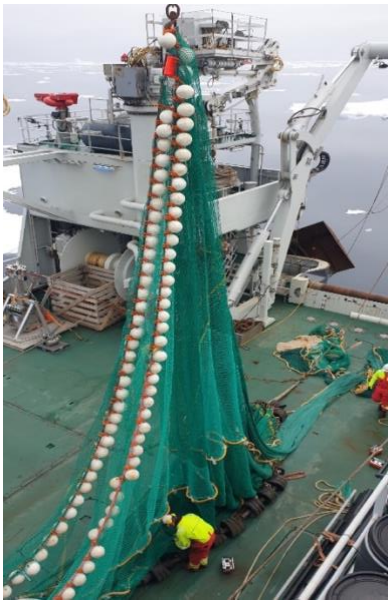


The operational area of the TUNU-VIII Expedition

modern Greenlandic, has both geographical (referring to East Greenland) and anatomical (referring to the spine) meanings; the program adopts both meanings, as the research activities, which began in Northeast Greenland, have always had the ambition to represent the spine for the study of marine fishes in the entire European Arctic area (Christiansen J.S., 2012). TUNU aims to integrate various disciplines to answer broader questions about the evolution of Arctic ecosystems in the context of global change and increasing anthropogenic impact. Specifically, we sampled sediments, benthic organisms, and fish from several fjords along a latitudinal gradient (N to S) to assess the dynamics of contaminants

(Credits: S. Corsolini UniSi e N.Ademollo CNR-ISP)

and their bioaccumulation in trophic networks. The results will be correlated with those from the same species collected offshore and with those from previous expeditions.



Campelen bottom trawl. (Credits: S. Corsolini UniSi e N. Ademollo CNR-ISP)

COMMENT

The PRA conference: the Arctic seen through the lens of scientific research

Jessica Marzaro

A 360 degree window to observe the Arctic ecosystem: is our best summary of the special day dedicated to the Arctic Research Program (PRA), hosted at the National Research Council headquarters in Rome on the 9th of February. The PRA Conference - The Challenges of Research was an occasion for discussing and analysing in-depth different aspects of the Italian scientific commitment in the Arctic.

(Credit: Jessica Marzaro CNR-ISP)

The CNR President Maria Chiara Carrozza remarked that "The Arctic and research in the Arctic is an extremely important issue, not only scientifically, but also its impacts on society, on monitoring of climate change and on the delicate balances in international geopolitics."

Representatives of the Ministries of University and Research and Foreign Affairs and International Cooperation also emphasized the dual strategic

(Credit: Jessica Marzaro CNR-ISP)

role of the Arctic for Italy: on the exceptional role it plays in research and innovation, and the delicacy of the Arctic area for international and social interest.

The director of ISP Carlo Barbante also emphasized that the current climate crisis we are experiencing is not only an issue of scientific interest, but a phenomenon that affects many spheres including global, social, economic and productivity. The Arctic is extremely delicate as acts as a "sentinel" ecosystem of change, it is an example of international and scientific diplomacy for safeguarding and conserving an area deeply threatened by climate change. An area where not only the environment, but also the indigenous peoples and cooperation between states are in danger.

Conservation of this delicate ecosystem relies on scientific knowledge of the place, but also on international efforts to ensure the implementation of policies aimed at protecting the Arctic, as DSSTTA Fabio Trincardi pointed out during the panel discussion.

Precisely for this reason, the second part of the day was totally dedicated to the presentation of researchers' projects in the Arctic: not only from the CNR, but also the Universities (Ca' Foscari, La Sapienza, Federico II) OGS, INGV and the partner institutes of the different projects. A national and international network to look at the Arctic environment through the lens of interdisciplinary research, which crosses and enhances different research fields.

(Credit: Jessica Marzaro CNR-ISP)

POSTCARDS FROM THE FIELD ……

Photo by Leonardo Langone and Patrizia Giordano. (Credit: ©PNRA)

Photo by Maria Papale CNR-ISP

Photo by Warren Cairns CNR-ISP

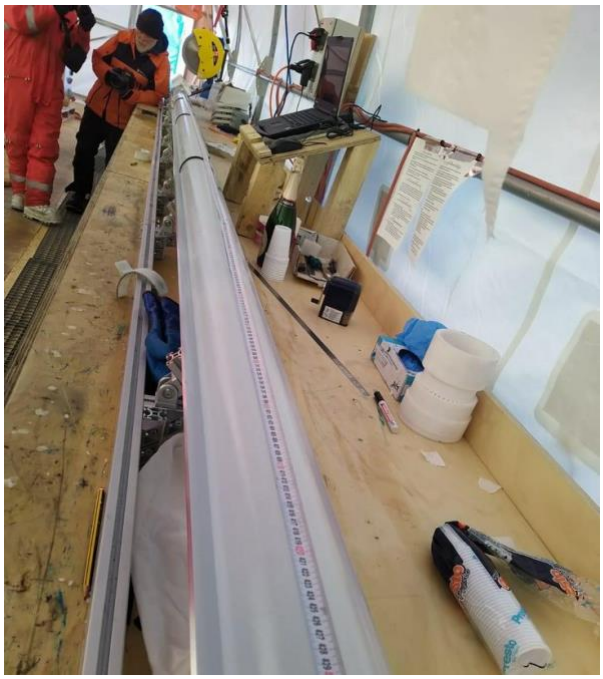
Photo by Alessandro Padovani-Haapar film

POLAR CHRONICLES

Beyond EPICA: from the field to the web, an 808-metre drill

Chiara Venier, Clara Turetta and MST

The 3rd Beyond EPICA field season in Antarctica has just finished. Daily reports from the field were published on the Beyond EPICA project website by the Management Support Team (MST), reporting the progress reached by the field team, as well as the problems faced during the long field campaign.



(Credit: ©PNRA/IPEV)

Beyond EPICA is a project funded by the European Commission under the Research and Innovation Action Programme with a budget of around €11 million for seven years of activity (six initially, extended to seven after the campaign cancellation due to COVID). The project is coordinated by the Institute of Polar Sciences; the PI Carlo Barbante, Director of ISP, leads a consortium of twelve partners and four third parties from ten European and non-European countries. The main objective of the project is to retrieve a continuous ice core down to the bedrock from the Antarctic Plateau, at the Little Dome C camp (34 km from Concordia station). This core should cover the climate history of the Mid Pleistocene Transition and beyond, where glacial and interglacial cyclicity changed from 40,000 to the current 100,000 yr.

The field work began with the installation of the deep ice drilling system and its fine-tuning. The drilling system of the Alfred Wegener Institute, with the support of the Danish system as a backup, has been adapted to the present ice conditions, operating with 3.5 m- long drill barrels. In the last days of this campaign, 4.5-m-long drill barrels were tested, allowing the retrieval of a single 4.52-metre-long ice core.

At the end of January 2023, after 7 weeks of work, a depth of 808.47 meters was reached, recovering ice that preserves information on the climate and atmosphere of the last 49,300 years.

(Credit: ©PNRA/IPEV)

The MST followed and supported the participants of the 2022-23 field campaign, for several months before the field campaign even started. Assisting in the preparation of their trip to the remote camp and the intensive work of preparing for the campaign itself. During the field activities, the MST followed and shared both the difficult moments and the day-to-day achievements of the great results of this first deep ice drilling campaign.

Now that the campaign is over, the work doesn't end here, we are waiting for the first samples to arrive in Europe together with the Laura Bassi research vessel.

A meeting is already scheduled in March to discuss this campaign and how to plan the next one with the lessons learnt from this year.

We will take a short break and then back to work with the preparation of the 2023-24 campaign!

UPCOMING EVENTS

- SOOS Symposium 2023. The first Southern Ocean Observing System (SOOS) Symposium will be held from 14-18 August 2023 in Hobart, Tasmania. Call for abstracts close the 24 March 2023.

- The XIII SCAR Biology Symposium will be held from July 31st to Aug 4th, 2023 in Christchurch, New Zeland. The goal is to bring together the world's leading scientists and early career researchers in Antarctic Biology for the first face-to-face SCAR meeting in 3 years. Deadline for abstracts: 21 March 2023.

- SETAC EUROPE 33rd annual meeting 30 April – 4 May 2023, Dublin, Ireland. The meeting will be held as a fully-fledged face-to-face meeting, featuring limited virtual participation possibilities.
  Track: 3. Environmental chemistry and exposure assessment: analysis, monitoring, fate and modelling.
  Session Title: Climate change in Arctic and Antarctica and its effect on legacy and emerging micropollutants in abiotic and biotic environmental compartments

- SeaSAR 2023 - 02-06 May 2023, University Centre in Svalbard (UNIS), Longyearbyen, Svalbard. The main objectives of the workshop are to review the state-of-the-art in SAR-based geophysical parameter retrievals, to identify knowledge gaps and deficiencies, to identify distinct needs for validation and to propose novel approaches for advancing scientific research and applications. No participation fees will be charged.

- ICCE 2023 - 18th International Conference on Chemistry and the Environment, towards a pollution free society, 11 - 15 June 2023, Venice, Italy. Deadline for abstracts: March 24th, 2023. The conference will provide a unique information and communication platform for environmental scientists and a forum of professional exchange with colleagues in toxicology, analytical chemistry, microbiology, geosciences and other related disciplines.

- The Sixth European Conference on Permafrost (EUCOP6) - June 19-23, 2023, Puigcerdà, Spain. Early bird registration until the end of March 2023.

- 2023 SCAR SC-HASS Conference: The Antarctic for a better world, 22 - 24 June, Lisbon, Portugal. The goals of the Conference are to provide a space for exchanging information about research in the Antarctic Humanities and Social Sciences; to stimulate and organize research ideas; to promote the development of future collaborations. Registration is currently open!

- XXI INQUA 2023 - 7-13 July 2023, Rome, Italy.
  Session 84: Extending the limits of ice core science beyond new analytical, conceptual and inter- disciplinary frontiers.
  Session 167 INQUA-MARE: Pole to pole teleconnections as registered in Antarctic and Arctic Holocene Archives

- IUGG General Assembly - The 28th IUGG General Assembly will be held 11-20 July 2023 at the CityCube Berlin in Berlin, Germany. This General Assembly is a special opportunity for participants from around the world to come together and discuss the full range of geodetic and geophysical themes. Online Registration Form.
  Cryosphere Sessions 12-16 July 2023.

- 4th International PalaeoArc Conference August 27th– 30th, 2023. The conference will be held in the Hof cultural center in Akureyri (Iceland) from the 27th to the 30th August 2023, followed by a 3-day NORDQUA excursion in northern Iceland between August 31st and September 2nd**. PalaeoArc** is an international research network which aims to better understand the climatically induced environmental changes in the Arctic from the Quaternary to the present-day. Abstract deadline 15 March 2023. Registration opens 1st April 2023.

- INStabilities & Thresholds in ANTarctica (INSTANT), 11-14 September in Trieste, Italy. The SCAR INSTANT Conference will take place in Trieste, Italy from 11-14 September 2023. Day 1-3 are reserved for each INSTANT theme; day 4 will focus on key priorities with external partners and stakeholders. Abstract submission closes 3rd April 2023. Registration is open.

- #ArcticPlastics2023, the 2nd international symposium on plastic pollution in the Arctic & Sub-Arctic regions, 22-23 November 2023 - Reykjavík, Iceland. The symposium will evaluate the present extent and nature of plastic pollution in the Arctic and Sub-Arctic regions and discuss its impact on ecosystems and communities. Abstract submission deadline: 1 May 2023. Early bird registration is open.

- First Level University Master's Course in Sustainable Development, Geopolitics of Resources and Arctic, 17 April - 15 December 2023. The Italian Society for International Organization – SIOI and Unitelma Sapienza, in agreement with the Italian Ministry of Foreign Affairs and International Cooperation, CNR, UiT – The Arctic University of Norway and Nord University of Bodø, organize the University Master's Degree in Sustainable Development, Geopolitics of resources and Arctic Studies.

Cape Hallet - midnight sun. Photo by Patrizia Giordano (Credit: ©PNRA)

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