Swedish Polar Research Secretariat

Promotes the conditions for and coordinates Swedish research and development in the polar regions

Viability of crossing the North Pole with a submarine cable

Katarina Gårdfeldt, Professor
Director General, Swedish Polar Research Secretariat

SWEREF Brussels 2023-05-05

SWEDISH POLAR RESEARCH SECRETARIAT
POLARFORSKNINGSSEKRETARIATET

The Secretariat's mission

- Promote and coordinate Swedish polar research
- Follow and plan research and development
- Organise and lead research expeditions
- Create favourable conditions for polar research without fieldwork
- International negotiations and partnerships
- Represent Sweden in polar matters
- Issues permits according to the Swedish Antarctic Ordinance (2006:1111)

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Dagmar Egelkraut and Niklas Rakos collect water samples in Almbergarsjön in Abisko.

PHOTO **ANNA-KARIN LANDIN**

Research support

- Logistical support
- Support to minor extent (SiMO)

- Logistics planning and permitting issues
- Administrative support
- Safety training
- Lending of equipment and clothing
- Transports
- Communication solutions in the field

Polar regions

Arctic

A simple definition is north of the Arctic Circle

Antarctica

According to the Antarctic Treaty, south of 60 degrees

Swedish mountain areas

Sub-polar

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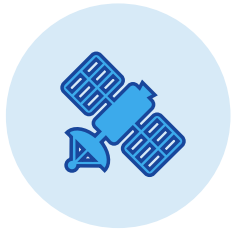
Partnerships

The Research Council

Swedish Maritime Administration



Swedish National Space Agency

Swedish Meteorological and Hydrological Institute

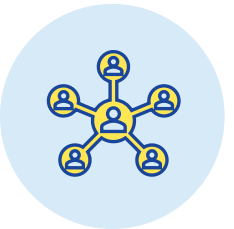
Swedish Agency for Marine and Water Management

Geological Survey of Sweden

Universities: nationally and internationally

EU

National and international organisations



Global networks of researchers

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Infrastructure

- Abisko Scientific Research Station
- Wasa and Svea Research Stations
- The icebreaker Oden

- The research platforms are continuously developed and adapted to meet the needs of scientists

Icebreaker Oden

- One of the world‘s most powerful icebreakers
- Four engines, 24,500 hp
- Versatile scientific equipment; research containers, scientific laboratories, deep ocean winches
- Researchers are able to use the vessel based on their needs
- Has been used for marine geology, oceanography, ecological research and atmospheric research in the Arctic and Antarctica
- Owned by the Swedish Maritime Administration, expeditions are organised by us

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Icebeaker Oden on the Arctic Ocean.
PHOTO **IDA KINNER**

In year1991 IB Oden was the first non nuclear powered research vessel to reach the North Pole together with the German PRV Polarsten

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Isbjörn, Norra ishavet.
FOTO **ÅSA LINDGREN**

Expeditions with IB Oden: Arctic

» 1991	IAOC 1991	North Pole
» 1996	Arctic Ocean -96	North Pole
» 2001	Arctic Ocean 2001	North Pole
» 2002	Arctic Ocean 2002	
» 2004	ACEX	North Pole
» 2005	Beringia 2005	North Pole
» 2007	LOMROG	
» 2007	AGAVE	
» 2008	SAT-test Tronföljar-resan	
» 2008	ASCOS	
» 2009	LOMROG II	North Pole
» 2011	EAGER	

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Expeditions with IB Oden: Arctic

- 2012 LOMROG III North Pole
- 2012 OATRC 2012
- 2013 OATRC 2013
- 2014 SWERUS-C3
- 2015 Petermann 2015
- 2015 OATRC 2015
- 2016 Arctic Ocean 2016 North Pole
- 2018 Arctic Ocean 2018 North Pole
- 2019 Nordvästpassagen 2019
- 2019 Ryder 2019
- 2021 Synoptic Arctic Survey 2021 North Pole

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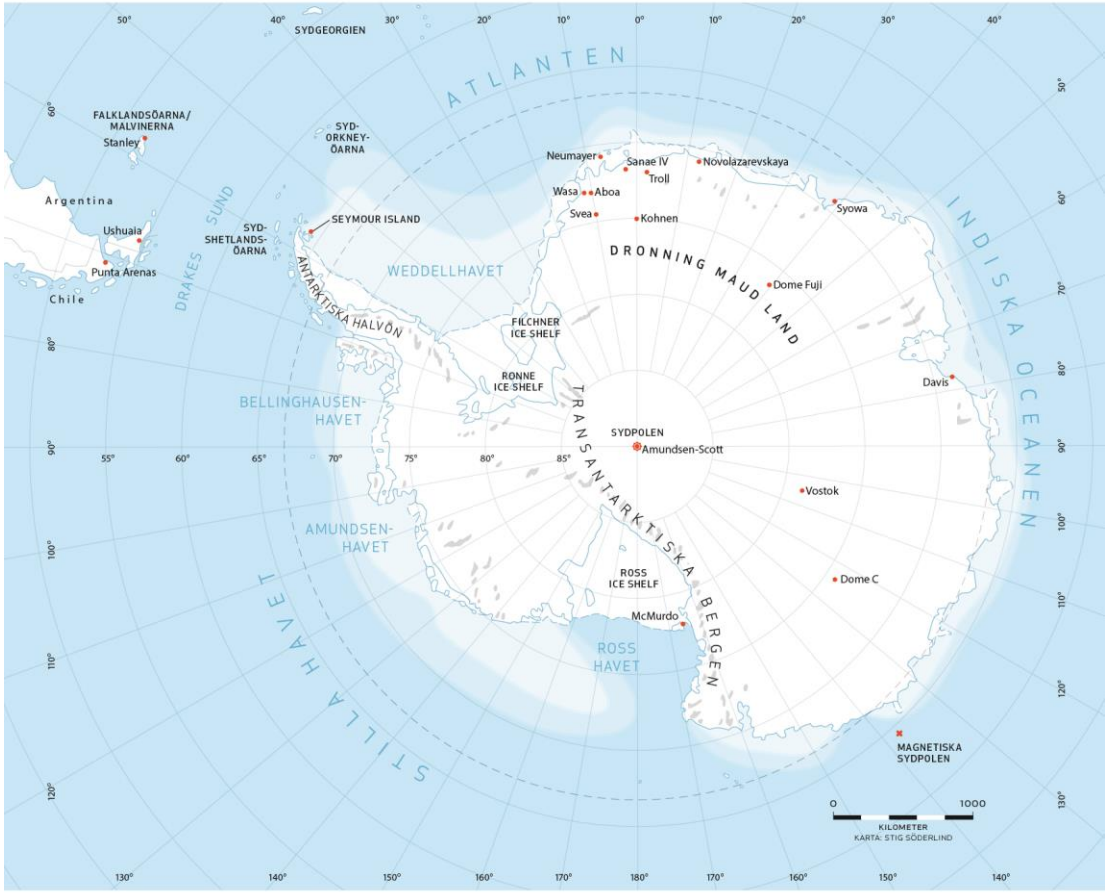
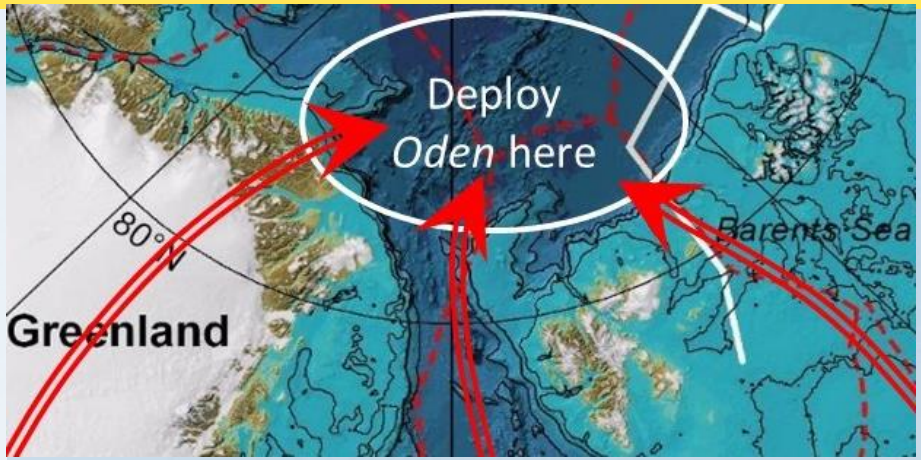
Expeditions with IB Oden: Antarctic

- 2006/07 Oden Southern Ocean
- 2007/08 Oden Southern Ocean
- 2008/09 Oden Southern Ocean
- 2009/10 Oden Southern Ocean
- 2010/11 Oden Southern Ocean



ARTofMelt 2023

- In May and June 2023, the expedition will be carried out, starting from the North Atlantic part of the Arctic Ocean.
- North of the ice edge, the purpose is to get to the areas where warm air from the south penetrates the Arctic and affects the melting period.
- The expedition aims to study the effects of episodic transport of warm and humid air from the middle latitudes to the Arctic.



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Isbrytaren Oden i Norra ishavet sommaren 2015.
FOTO **IDA KINNER**

GEOEO 2024

- In August and September 2024, the expedition will be carried out to northern Greenland and the adjacent Arctic Ocean and the Lincoln Sea.
- GEOEO is focused on understanding the dynamic history and impact of the marine cryosphere on future climate change, and its implications for marine and terrestrial ecosystems in Northern Greenland and the Arctic Ocean.
- The focus is also on investigating how the ice sheet in Northern Greenland can contribute to global sea level rise.

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Isbrytaren Oden i Norra ishavet sommaren 2015.
FOTO **IDA KINNER**

Strategic planning and multi vessel approach

The Swedish Polar Secretariat (SPRS) has successfully developed a multi vessel approach for complicated operations in the central Arctic Ocean, examples are:

» The Arctic Ocean Coring Expedition 2004 (ACEX) successfully conducted

» Planning of the Arctic Ocean Paleoceanography, ArcOP 2022ArcOP (post phoned)

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The Arctic Ocean can be divided into three basic ice regimes besides the year around open water areas:
- Central Arctic with dense pack ice year around
- Marginal-ice zone with broken-up ice
- Areas with first-year ice and land-fast ice.

1. Icebreakers: vessels constructed to protect and assist other vessels in the ice. The vessels are built for very aggressive operation in ice, (i.e. IB Oden and PRV Polarstern).

2. Icebreaking vessels: vessels that for its own progress may operate aggressively in ice. (i.e. icebreaking research vessels RV Akademik Fedorov, RV Sikuliaq and S.A. Agulhas II).

3. Ice classed vessels: vessels that are ice-strengthened and may follow icebreakers and even proceed on their own in lighter ice conditions, (e.g. RV Maria S Merian). 1.

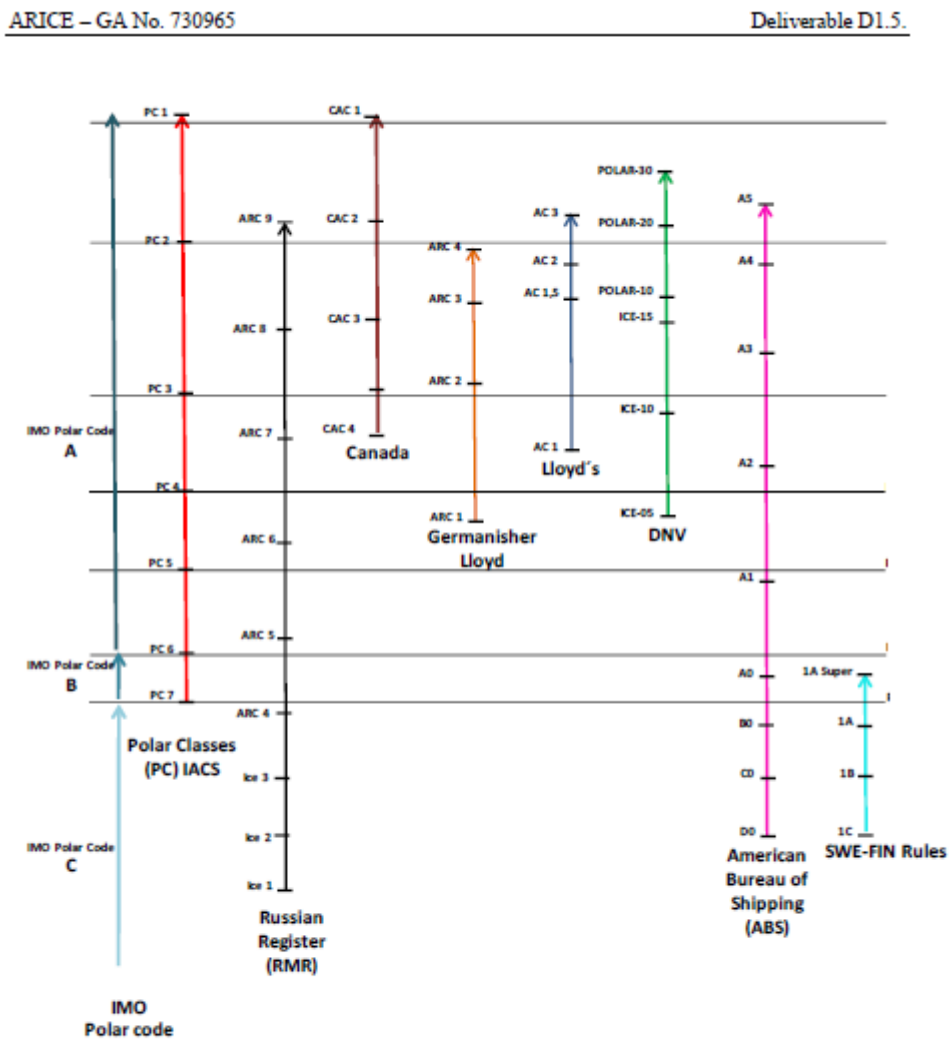
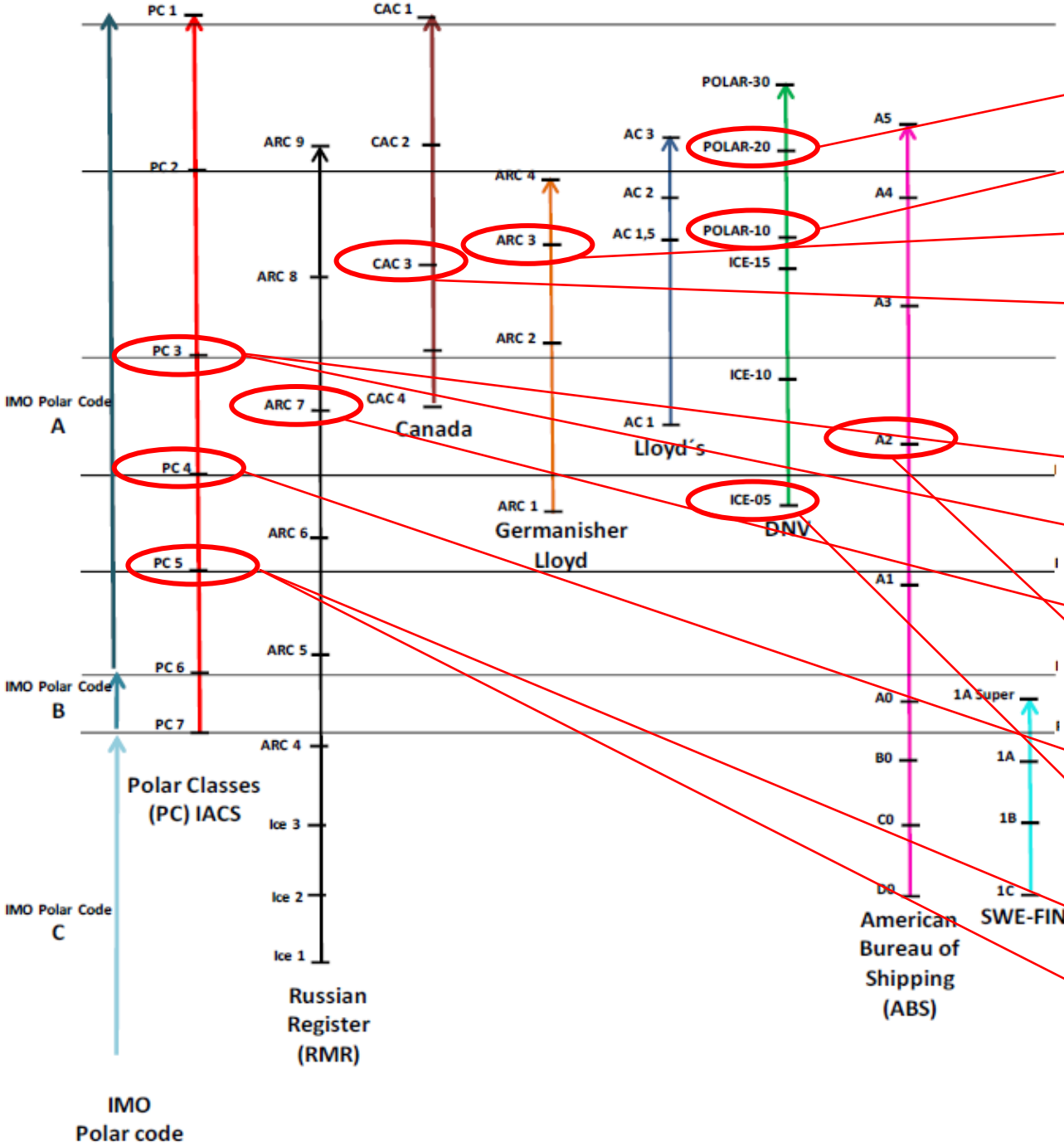


Figure 1. Comparison of ice classes according to regulating bodies IMO Polar Code, IACS PC, some national ice classes as well as to classification societies Germanischer Lloyd, Lloyd´s and Det Norske Veritas (DNV). The table was first drafted by Central Marine Research and Design Institute (CNIIMF) in Russia and has been modified by Arctic Marine Solutions AB, Sweden.



Oden

Kronprins Haakon

Polarstern

Amundsen

Healy US medium icebrekaer, one of the strongest icebreakers*

Nuyina

Xue Long II

Akademic Treshnikov

Nathaniel B. Palmer

Sir David Attenborough

Laura Bassi

Sikuliaq

Agulhas II


Arctic Ocean Coring Expedition 2004 (ACEX)

Co-Chiefs:
Jan Backman, Stockholm University
Kate More, University of Rhode Island

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IODP
INTEGRATED OCEAN DRILLING PROGRAM

Tromsö-Tromsö:
7 August – 14 September, 2004

Slide composed by Prof Martin Jakobsson, Stockholm University

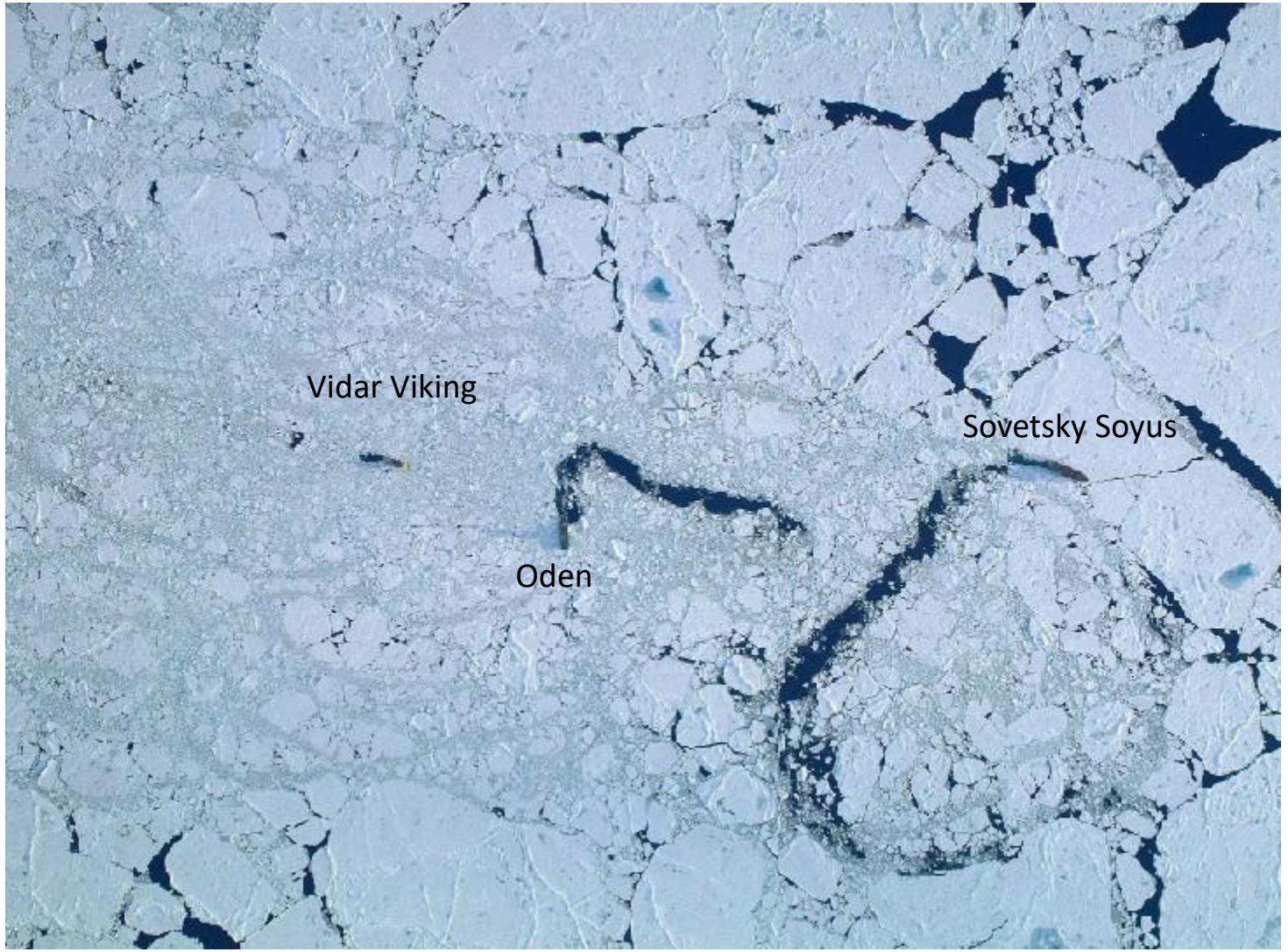
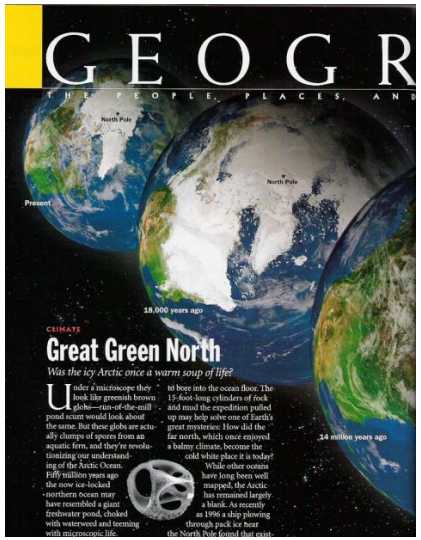


Foto: Per Frejvall

Slide composed by
Prof Martin Jakobsson,
Stockholm University

Scientific impact:

- 166 peer-review publications listed on IODP web site from 2005-2019.
- 15 Nature/Science articles



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Prof Martin Jakobsson,
Stockholm University

Some results from ACEX…..

- 428 m was drilled through the sediments of the Lomonosov Ridge
- Subtropical conditions were found in the sediments about 55 million years ago
- Huge occurrences of Azolla spores show fresh surface water in the Arctic Ocean 49-50 million years ago.
- The first signs of sea ice were about 47 million years ago.
- The Fram Strait opens up enough 17.5 million years ago to evolve the Arctic from a large lake to a ventilated ocean

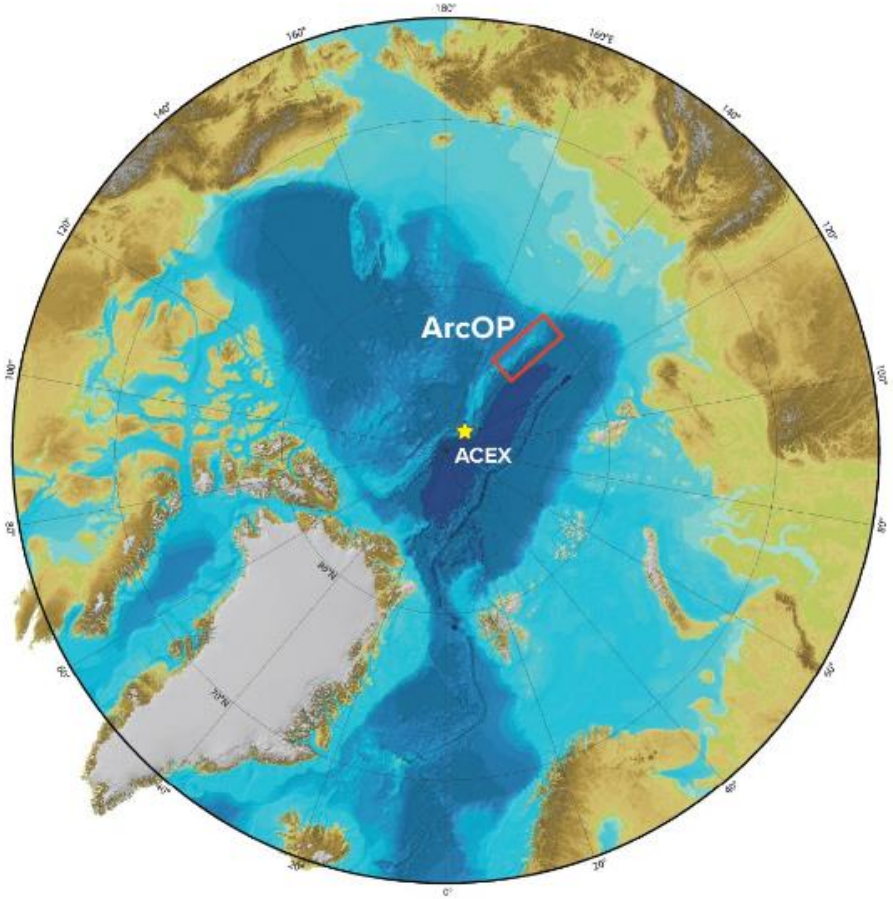
Slide composed by Prof Martin Jakobsson, Stockholm University

Arcop - step-change in reconstructing the detailed history of climate change in the central Arctic Ocean over the last 50 million years

Arcop is a unique and challenging expedition. A fleet composed of a scientific drillship supported by two icebreakers was planned for 2022 to make drilling possible in this permanently ice-covered region. Such a multi-vessel approach was employed by SPRS on behalf of ECORD for the first time during the ACEX Expedition in 2004.

Press release: Expedition will reveal how the climate has changed over 50 million years

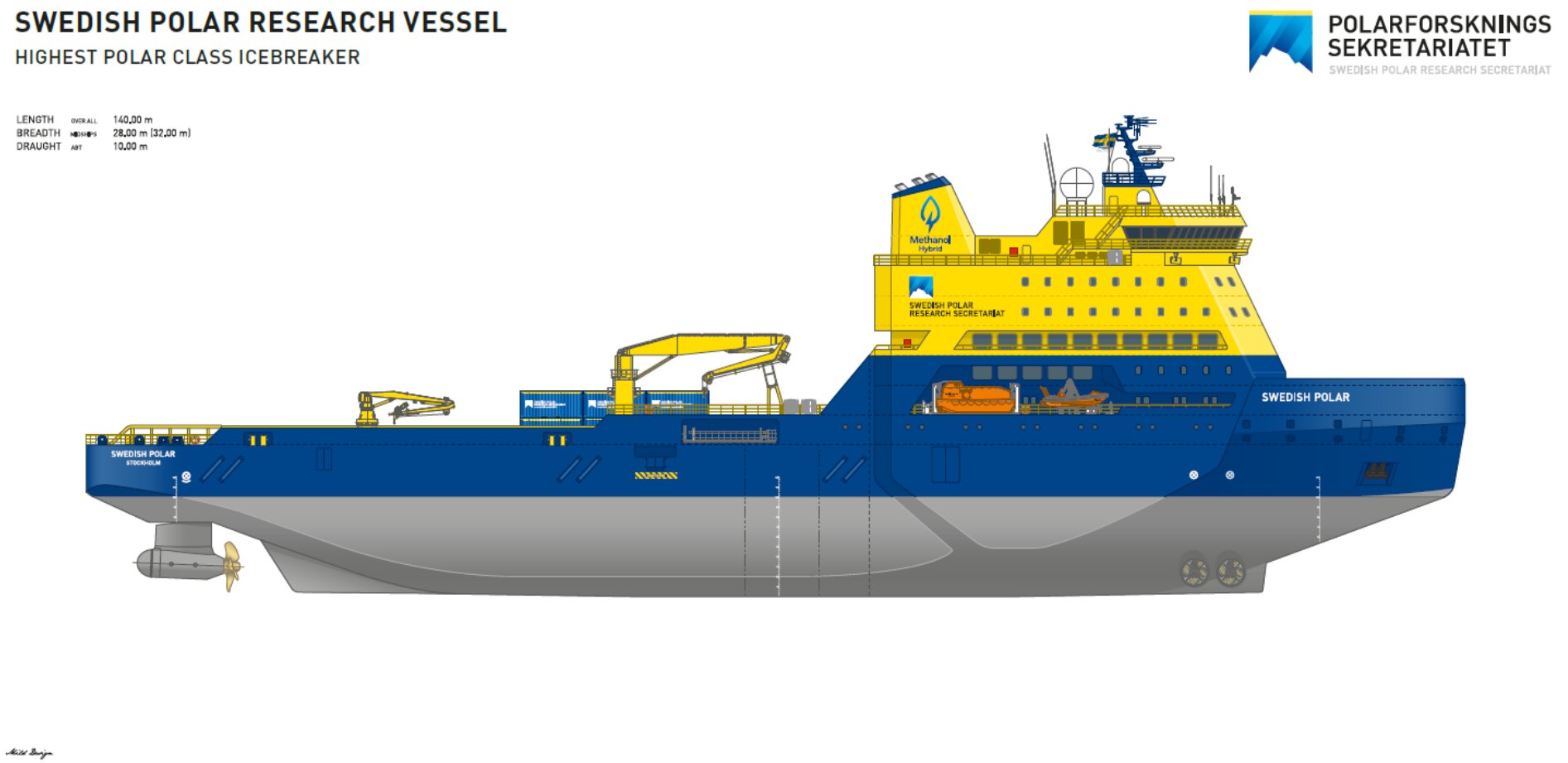
In 2022, the European Consortium for Ocean Research Drilling (ECORD), the Swedish Polar Research Secretariat (SPRS) and Arctic Marine Solutions (AMS) will jointly conduct an expedition of the International Ocean Discovery Program (IODP), focused on the Arctic Ocean – a key location in global climate change.


ArcOP
ACEX
0 500 1.000 2.000 Km
Arctic Coring Expedition (ACEX, 2004)
ArcOP working area with potential drill sites
Bathymetric and topographic tints (Meters above and below Mean Sea Level)
-5000 -4000 -3000 -2500 -2000 -1500 -1000 -500 -200 -100 -50 -25 -10 50 100 200 300 400 500 600 700 800 1000

Map: ECORD


РОСМОРПОРТ

SPRS ambition: a climate neutral research ice breaker PC1



Multipurpose climate neutral icebreaker for science & polar logistics : Main characteristics

- Climate-neutral (fossil-free) fuel, eg e-methanol from biogenic/renewable sources via CO2 and H2 in combination with hybrid populsion and power
- No soot, minimum carbon footprint
- Silent ship

- Lenth around 140 m
- Flexible lab setup (20’ containers) & storage
- Moon pool
- Dynamic Position System DP2
- Large aft deck, flexible use
- PAX 100+

- All year-round use

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Polar Connect –a multi vessel approach in the Central Arctic Ocean (CAO)

We will apply a three-vessel set up successfully designed for our earlier operations at the north pole:

1. IB Oden will map the seabed in CAO prior the cable laying operation to locate optimal positioning of the cable path
2. An ice strengthened cable vessel will be supported with far and near ice management by two strong Swedish icebreakers PC1 and PC2+ respectively
3. Estimated time for cable vessel 30+ days in heavy ice (2-3 kn)
4. System for connections and maintenance will be planned for
5. Plan for remediation
6. Full technical report will be delivered by SPRS to VR SUNET NORDUNET i September 2023

International collaboration is our method!

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