The Arctic's Role in Global Change Program Planning Group (APPG)
Minutes of 1st Meeting
March 9-10, 2000
Sola Strand Hotel, Stavanger, Norway

Members present

Jan Backman	(U of Stockholm, Sweden)
Bernie Coakley	(Tulane U, New Orleans, USA)
Timothy Collett	(US Geological Survey, Denver, USA)
Dennis Darby	(Old Dominion U, Virginia, USA)
Jean Paul Foucher	(IFREMER, Brest, France)
Tim Francis	(Geotek Ltd, UK)
Mikhail Gelfgat	(Aquatic Co, Russia)
Martin Hovland	(Statoil, Stavanger, Norway)(**Chair**)
Michael Kaminski	(U College, London, UK)
Yngve Kristoffersen	(U of Bergen, Norway)
Chris Wiley	(Dept. of Fisheries & Oceans, Canada)
James Zachos	(U of California, Santa Cruz, USA)

Members absent

Anatoly Gorshkovsky	(Murmansk, Russia)
Wilfred Jokat	(Alfred Wegener Inst., Germany)
Jörn Thiede	(Alfred Wegener Inst., Germany)
Kozo Takahashi	(Kyushu U, Japan)

Liasons present

Hans Brumsack	(ESSEP, Oldenburg U, Germany)

Observers/Alternates/Guests

Rudiger Stein	(Alt. for Jörn Thiede, Germany)
J. Paul Dauphin	(Obs., NSF, USA)
Garrik Grikurov	(Obs., VNIIO, Russia)
Naja Mikkelsen	(Obs., Denmark/Greenland)
Ove T. Gudmestad	(Guest presenter, 10.03, Statoil, Norway)
Stein Sandven	(Guest presenter, 10.03, Nansen RSC, Bergen, Norway)
Roar Heggland	(Guest presenter, 09.03, Statoil, Norway)
Sverre Planke	(Obs., 10.03, Scient. Measurm. Panel, U of Oslo, Norway)

1. Introduction and mandate

Meeting began at 0930 AM with introductory remarks and round table brief introduction. Chairman stated the workscope and mandate of the Arctic Climate PPG as given by SCICOM:

"***Overall Goal***

To develop a mature science plan concerning those aspects of Arctic drilling that bear on global problems, particularly with respect to the climate system on time scales from decades to millions of years. This PPG will build on the existing Implementation Plan of the Nansen Arctic Drilling (NAD) program and will consist partly of NAD scientists.

Mandate

1. Design a scientific drilling strategy to investigate the role of the Arctic in influencing the global climate system. Besides climatic and paleoceanographic studies, this strategy may also address those aspects of the Arctic's tectonic development and magmatic history that may have significantly impacted global climate or that may otherwise relate to globally important problems.
2. Summarize the technical needs, opportunities, and limitations of drilling in the Arctic.
3. Encourage and nurture the development of drilling poroposals.

Timeline

This PPG will exist for 1 year and will be evaluated by SCICOM at the end of that year."

2. Member statements

The most of the first day (09.03) was used to let each member introduce himself and to state his speciality relevant for the PPG:

Martin Hovland (Chair): The main focus of this first meeting will be to find out where we stand with respect to short-term (2001-2006) and long-term (>2006) scientific Arctic drilling. What are the technical difficulties we have to solve? Which scientific objectives are most urgent and achievable in the short-range?

Jan Backman provided a status of the coring inventory so far in the Arctic Ocean. Whereas there have been acquired about 800 cores from sediments laid down over the last 1 Ma, there is only one other core with sediments aged at 36 Ma, from the Arctic Ocean. Thus, there is an incredible gap in data coverage from the period 1 Ma to about 35 Ma from the Arctic Ocean! Because this ocean is regarded as having a major influence on global climate, it is of great importance to acquire cores covering the Eocene through Pliocene interval.

Bernie Coakley provided an overview of geophysical data acquired during the SCICEX expeditions with US nuclear submarines, 1991 to 1999. The following areas were mapped to some extent with Chirp high resolution seismics, side scan sonars, and swath bathymetry: The Lomonosov Ridge, The Gakkel Ridge, and the Yermak Plateau. Fresh lava flows were even detected on the Gakkel Ridge. Because geophysical data obtained with surface vessels in the Arctic Ocean are very scarce, the SCICEX-acquired data are invaluable as site survey data for future Arctic drilling. The future of SCICEX is, however, uncertain and may not be continued, even if the investigated areas have only been partly mapped.

Timothy Collett reviewed some of the new results gained on gas hydrates. He talked about the Mallik gas hydrate well, and the role of methane as a future climate (radiatively active) gas that will probably dominate over CO2. Since about 20 % of the World's gas hydrate inventory exists in the Arctic, it is important to acquire some knowledge on what role marine gas hydrates and in particular Arctic marine gas hydrates may play in future climate change.

Dennis Darby stated that there is evidence that the Arctic seems to play an important role in initial cooling in the North Atlantic prior to Heinrich events (massive iceberg discharges into the N. Atlantic from Canada). During the last 30 kyr, the Arctic ice sheets rapidly collapsed and discharged enough icebergs into the N. Atlantic to cause this cooling. Furthermore, there is new evidence of several warm intervals during the Holocene in the western Arctic Ocean with the largest (a 6^{o}C increase) at about 6000 years ago and lasting about 500 years. These fluctuations might follow a natural climate cycle that is amplified in the Arctic sediment record that will provide insight into the warming we are now witnessing. It is therefore of the utmost importance to acquire many high-resolution climate records from the Arctic, i.e to drill in high sedimentation drift locations.

Tim Francis has been involved in the development of the Hyace hydrate coring device. With long operational experience from the ODP, he stated that the most important question is on how to drill. What technology systems are needed to gain our scientific objectives.

Michail Gelfgat provided a review of Russian and other platforms currently available for Arctic scientific drilling. There is currently no dynamically positioned (DP) vessel equivalent to the Joides Resolution capable of keeping station in Arctic Ocean ice conditions (even with ice-breaker support). A compromise can, however, be done by reducing the requirements to geotechnical size drilling rigs. In so doing, it should be possible to make up a system capable of acquiring some hundred of metres of core even in thick ice conditions at up to 1500 m water depth. Thus, a similar system as that used to drill from the ice of lake Baikal (1998) consists of a 90mm inner core barrel diameter complete coring system, with light-weight aluminium drillpipes.

Chris Wiley provided a review of the Canadian platforms utilized in the Canadian Beaufort Sea and the availability of platforms both remaining from the Beaufort and currently within the Canadian Coast Guard. He stated that historically Arctic drilling requires a "system" rather than a single vessel - and as a result it is extremely expensive. For example the "Kulluk" has DP with anchors and winches. In severe ice conditions it needs four (4) ice breakers for "ice management". For shallow water (less than 500 m water depth) there are available systems whereby we can drill in the Arctic today - however, any ODP initiatives will have to compete for availability with the oil industry. There is a current proposal to ODP utilizing an Arctic class 4 barge built for the Beaufort Sea ("Sea Empress", "Arctic Kiggiak") utilizing two icebreakers for ice management. As with the "Kulluk" this is an anchored unit. When working in the Arctic Ocean it is very important to involve the native community at an early stage of planning.

Michael Kaminski stated that because most forams conserved in the sediments of the Arctic Ocean are of the agglutinated type, we still do not have a workable biostratigraphy for the Neogene of the Arctic. To drill a biostratigraphic site, therefore has very high priority.

Jean Paul Foucher stated that heat flow transfer in the sediments of in the Arctic Ocean is largely unknown. How much gas hydrates and permafrost is there in the Arctic Ocean and how do these conditions affect the heatflow? Furthermore, there are areas of active fluid flux which need to be studied and compared to other such areas. The use of Cork observatories in the Arctic will also become a scientific objective in the future.

James Zachos reviewed the marine oxygen isotope curve, going back to about 70 Ma BP. It was constructed from about 10,000 data points (of which none are from the Arctic ocean!). It shows the warmest period to be the Late Paleocene Thermal Maximum (LPTM), which has an excursion on the isotope value indicating a methane greenhouse condition, possibly caused by the destabilization of marine gas hydrates. So far, we only have climatic (SST, precipitation) information for the Antarctic Ocean (about 8 degrees C warming), but assume that the climate the Arctic Ocean was severely affected as well by this rapid warming. The LPTM is a very important climate marker that needs to be sampled in the high north! It is possibly present on the Lomonosov Ridge. He also showed new oxygen isotope data for marine molluscs collected from Ellesmere Island (~80°N). They indicate late Paleocene coastal SST of 10°C for the Arctic. They represent the only quantitative constraints on SST for the high northern latitudes (>65°N) for the entire Paleogene.

Yngve Kristoffersen emphasised the following points: The main challenge is to perform drilling in the Arctic on a limited budget. When we go there, for ODP, we have to guarantee results as we cannot afford to fail. We need a short-term and a long-term plan. Getting to some of the main objectives will require some new technology. We probably have to start at the periphery (moderate ice conditions) and work our way into more difficult areas as we gain experience.

Rudiger Stein stated that the entire Arctic Ocean is very important for the World's organic carbon budget. Only the Laptev Sea contains about 1% of the global carbon budget. The main missing information from the Arctic Ocean are long continuous cores, spanning some significant time periods beyond the last couple of millions of years.

Garrik Grikurov provided an update on the German/Russian cooperation in the Laptev Sea.

3. Brief discussion

The second day started with a brief discussion on how to continue. It was decided that the Chairman should assign each member with tasks to solve before the second meeting, so that that meeting can run effectively.

4. Guest presenters

Two guests had been called in to provide some information bearing on Arctic ice conditions and on new technology employed in the Arctic.

Stein Sandven from the *Nansen Remote Sensing Centre* in Bergen gave a presentation on ice prediction and monitoring using satellite data. Whereas visual systems are dependent on daylight conditions, the thermal radiation and active radar systems can operate independent of

daylight and cloud cover. The ERS SAR (synthetic aperture radar) has a resolution of about 100m. The newer Canadian RADARSAT has a resolution of 45 - 50 m and is used on most expeditions now for ice condition forecasting. Sandven said that since 1978, when NRSC started monitoring ice conditions, the amount of sea ice in the Arctic has been reduced by about 3%. Furthermore, there is evidence that the multi year ice is decreasing at a rate of about 7% per decade!

Ove Tobias Gudmestad from the engineering department in *Statoil* gave a review over petroleum industry activity in the Arctic Ocean. Whereas the ODP would like to drill in up to 5000 m of water, the petroleum industry is only working in shallow water up to 200 m and extensively use ground-based (rigid) platforms. Testing of most designs to go into the Arctic Oceans is done in ice tanks of Hamburg University and elsewhere.

5. Statement from J. Paul Dauphin, NSF

In order to help this PPG understand the planning structure of ODP and IODP, J. Paul Dauphin offered to provide an overview of the future planning as it has been stated so far. It has now been decided that USA and Japan will go ahead on an equal basis, with USA responsible for a riserless vessel, also after the start of IODP. The plan is to select a new vessel by 2003 and to convert her to IODP-standards by 2004. Japan will be responsible for providing a riser vessel. The plan here is to construct the vessel by 2004 and start operations in 2006.

The transition between ODP and IODP during 2003 is intended to be "seamless". This transition will be looked after by the International Working Group (IWG) and the International Plannning Subcommittee of IODP (IPSIC). It is still uncertain how Europe will contribute, but it is expected that their responsibility might be for some of the alternate platforms (i.e. platforms for special short-term drilling) for drilling in the Arctic and on continental shelves.

A model being considered by IPSC is that each country or group of countries is economically responsible for operating the vessels or platforms, such that the comingal funds can be set aside for the Science Funding only.

6. Assigned tasks for the next meeting

The three main tasks that the Chairman needs help on for the next meeting are as follows:

A) Provide some high-priority science plans and include at least 3 other aims or goals with the drilling besides the main scientific objective.

B) Provide a list of systems available for Arctic drilling, complete with technical specifications and capabilities (up to 2000 m water depth and 500 m penetration).

C) Provide a detailed list of aspects we need to plan for expecially in Arctic drilling: i.e. Safety, Pollution, Politics, Logistics, etc.

Members of the Arctic Climate PPG were assigned the following tasks:

Task A)	Cenozoic objectives:	James Zachos, Michael Kaminski, Jan Backman Naja Mikkelsen
	High resolution coring:	Dennis Darby
	Site surveys:	Bernie Coakley
	Mesozoic objectives:	Rudiger Stein / Jörn Thiede
	Tectonic evolution:	Bernie Coakley, Yngve Kristoffersen, Wilfred Jokat, Jörn Thiede
	Hydrates/Fluids/Microbiol.:	Timothy Collett, Jean Paul Foucher
Task B)	Hardware systems and availability:	Chris Wiley and Michael Gelfgat
Task C)	Specifics of Arctic drilling:	Tim Francis, Naja Mikkelsen.

7. Next meeting

Permission will be sought to stage the next meeting in Calgary (host Chris Wiley) as this is the hub of Canadian Arctic engineering and of the Arctic Marine Geology Group, where we would like to seek some advice and information.

Permission will be sought to stage the next meeting on June 26 and 27, 2000.

1st Arctic Climate PPG meeting completed on 10.03.2000, 1500 PM.

(Finally approved Minutes of 1st meeting approved on 26.07.2000).
M. Hovland (signed)