

Boost in activities prior to new Licence Round offshore West Greenland in 2004

The summer of 2003 has been the most active offshore South and West Greenland for many years as two seismic vessels have acquired nearly 9000 km of new seismic data. This activity is mainly driven by the upcoming licence round in 2004, but also the present licensee in the region, Canadian EnCana and NUNAOIL (the national Greenland oil company), have completed a comprehensive seismic programme within their licence area. The seismic data acquired off south Greenland are needed to make claims beyond 200 nautical miles as described in Article 76 of the UN Convention on the Law of the Sea but are also expected to give some very valuable information relevant for petroleum exploration in West Greenland.

2004 Licence Round opening 1 April, closing 1 October

In June 2003, the Greenland and the Danish governments agreed on a new licensing policy for Greenland including a Licence Round in 2004 for selected areas offshore West Greenland between approximately 63°N and 68°N. Four areas have been selected for licensing based on the presence of giant structures in favourable basinal settings, but industry feed-back has also been taken into account during final delineation of the areas. The round will be formally opened with a Letter of Invitation, and opening meetings on 1 April 2004 in Copenhagen and 6 April in Houston, Texas. Closing date for applications is 1 October 2004. [Read more inside.](#)

West Greenland oil – is a Jurassic source viable?

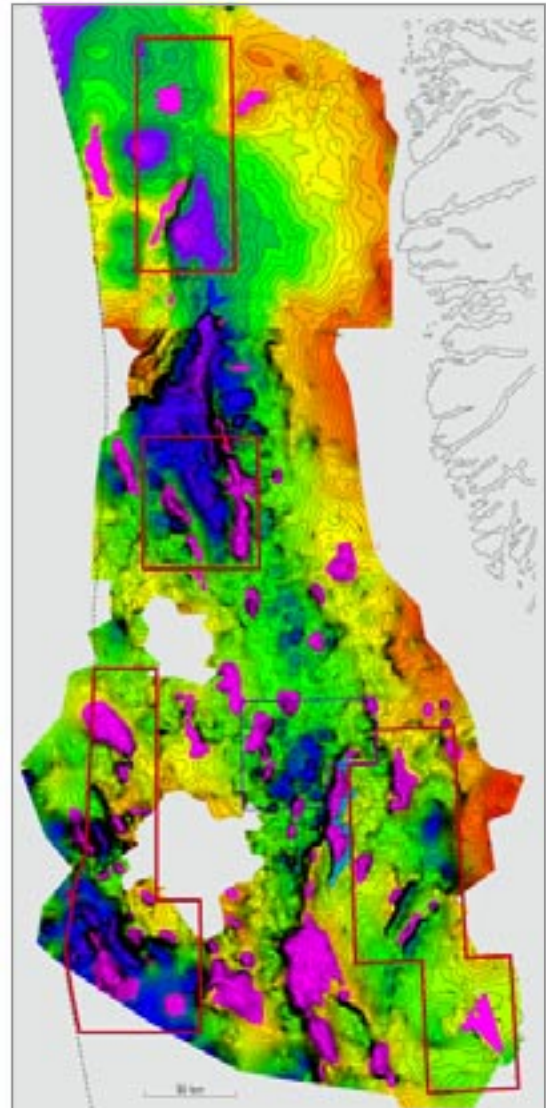
Recent analysis of age-specific biomarkers in oils from West Greenland seeps suggests source ages similar to Cenomanian–Turonian age oils from the Central Western Interior Seaway, or to Upper Jurassic sourced oils from the Jeanne d'Arc Basin and the North Sea. [Read more inside.](#)

Seismic acquisition offshore West Greenland – focusing on licensing areas

TGS-NOPEC, one of the leading geophysical companies, has acquired speculative seismic data offshore West Greenland since 1999, and in 2003 a major non-exclusive programme was finalised comprising more than 3000 km within the coming licensing round areas. [Read more inside.](#)

Sea-bed sampling programme: promising results spur further investigations

A pilot sea-bed sampling programme carried out off West Greenland in 2002 gave such promising results that a major programme was launched in 2003 to investigate a number of different prominent sea bed features. [Read more inside.](#)



Giant-sized structures (Mammoths) on mid-Cretaceous level offshore West Greenland.

Preparing for the 2004 Licence Round

Exploration news: more seismic data, giant structures, deep basins and possible Cenomanian–Turonian or Jurassic source rocks

Following the West Greenland 2002 Licence Round, in which EnCana together with NUNAOIL was awarded a 3985 km² licence, activity has been high preparing for a new licence round. Since summer 2001, approximately 11,000 km of seismic data have been acquired confirming a much more widespread distribution of connected deep basins recognised only locally on earlier surveys in the region.

A major interpretation effort was carried out by the Survey on behalf of the Bureau of Minerals and Petroleum during spring 2003. All available modern seismic data (more than 50,000 km) were used in order to map possible 4-way dip closures larger than 100 km² (so-called Mammoths) – each capable of holding more than 5 billion barrels of oil in place. These maps, which formed the basis for the selection of licensing areas, were presented and discussed with the industry at a meeting in Copenhagen on 10 April 2003. Industry feedback on the licence areas and timing of a round has also been taken into account.

Further promising results useful for exploration were achieved by the 2002 pilot sea-bed sampling programme and from detailed geochemical analysis of West Greenland oils in early 2003 (see below). Both provided evidence of the possible presence of Lower Cretaceous and Jurassic successions in the sedimentary basins off West Greenland.

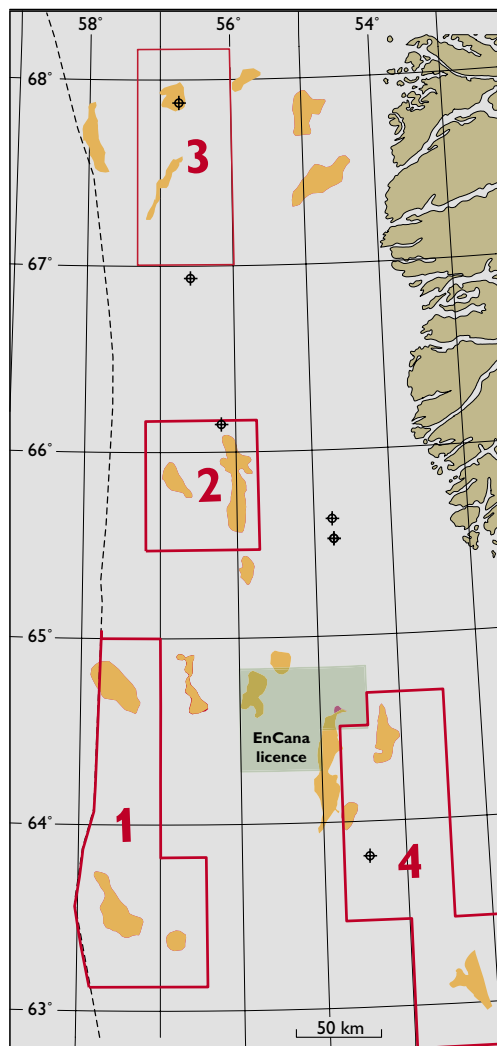
The 2004 Licence Round

In June, the Greenland and the Danish governments agreed on a new licensing policy for Greenland that includes a licence round in 2004 for selected areas offshore West Greenland between approximately 63°N and 68°N.

The round will be formally opened with a Letter of Invitation and the opening meeting is hosted on 1 April 2004 in Copenhagen, followed by a meeting on 6 April in Houston, Texas. Closing date for applications is 1 October 2004 and new licences are expected to be granted at the turn of the year. The Letter of Invitation and details on the opening meetings will be announced in 2004 on the BMP website: www.bmp.gl (News Desk).

Four licence areas, all characterised by the presence of giant structures in favourable basinal settings, have been selected for the round.

- 1 Parts of Lady Franklin Basin between approx. 63°N and 65° N covering approx. 10,500 km².
- 2 Kangaamiut Basin and Ridge around 66°N covering approx. 4900 km².
- 3 Parts of Ikermiut Fault Zone/Sisimiut Basin between approximately 67°N and 68°N covering approx. 7000 km².
- 4 Parts of the Atammik and Fylla Structural Complexes between approx. 63°N and 64°N covering approx. 11,200 km².



2004 licensing areas with mapped giant structural leads (> 100 km²).

Further information:

Enquiries concerning **licence terms or the licensing policy** may be directed to:

Mr. Jørn Skov Nielsen, Head of Department, Bureau of Minerals and Petroleum

Phone +299 34 68 06; e-mail: jsn@gh.gl, or download from the BMP website: www.bmp.gl

Enquiries concerning **petroleum exploration potential and data-coverage**, should be directed to:

Mr. Flemming Getreuer Christiansen, Head of Department, Geological Survey of Denmark and Greenland

Phone +45 3814 2727; e-mail: fgc@geus.dk.

During the summer of 2003, TGS-NOPEC acquired an additional 3500 km of seismic data within three of these areas (see below).

Competitive terms for the licensing round will be announced in the Letter of Invitation and presented at the opening meetings. However, the terms will essentially be based on the existing Model Licence and a standard JOA, and comprise a corporate tax of only 30%, a favourable surplus royalty regime, and a carry on 12.5% of the national oil company, NUNAOIL, during the exploration phase (see www.bmp.gl).

Seismic acquisition 2003

A deep focus on 2004 licence areas

This year, nearly 9000 km of seismic data were acquired off western and southern Greenland. This prompted, for the first time ever in Greenland waters, the need for two seismic vessels that have collected data until the end of November thereby extending the normal seismic season considerably.

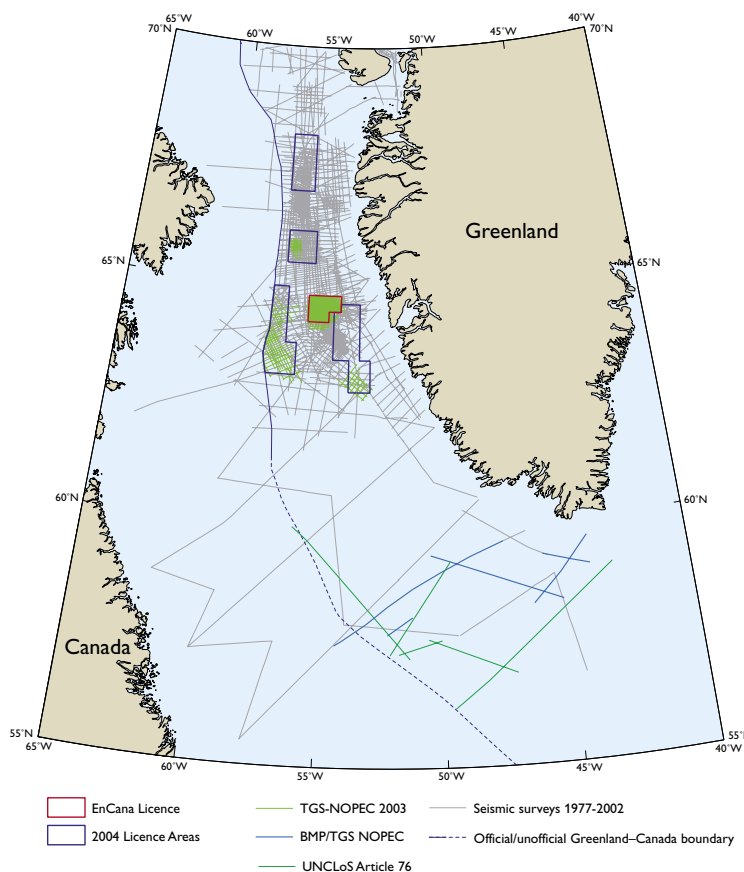
TGS-NOPEC continued its longstanding commitment in Greenland by acquiring approximately 7400 km of non-exclusive data. Acquisition was within the new venture areas (c. 3100 km) to provide a better regional grid, to cover actual giant structures and to delineate deep basins. Furthermore, c. 3200 km were acquired within EnCana's licence area and c. 1100 km as part of longer-term activities off southern Greenland. Additionally, approximately 1500 km were acquired by GEUS off south Greenland as part of preparations for staking claims beyond 200 nautical miles as described in Article 76 of the UN Convention on the Law of the Sea.

Following the success in earlier years of using a long streamer to acquire information on hitherto unknown deep structures and basins offshore West Greenland, an even longer streamer of 6000–8000 m was used this year.

Favourable price structure relieving up-front costs

Greenland data are available from GEUS, NUNAOIL, Fugro-Geoteam and TGS-NOPEC at favourable conditions enabling companies to assess large areas at a very reasonable price.

The modern TGS-NOPEC database from 1999–2003 of approximately 25,000 km is covered by a special prize scheme at reduced up-front cost. Data held at GEUS comprise both released company data and government funded data (totaling 22,000 km) and are sold at 10 USD per kilometre for whole surveys and 20 USD per kilometre for individual lines. NUNAOIL data from 1994–1998 (approximately 5800 km) are available at a total price of 34,000 USD. For further information, see GhexisOnline or contact individual data owners.



GEUS data: Christian Marcussen, Øster Voldgade 10, DK-1350 Copenhagen K, Denmark.
Phone: +45 3814 2509, e-mail: cma@geus.dk

NUNAOIL data: Arne Rosenkrands Larsen, P.O. Box 579, DK-3900 Nuuk, Greenland.
Phone: +299 328703, e-mail: arl@nunaoil.gl

Fugro-Geoteam data: Fugro-Geoteam AS, Hoffsveien 1C, P.O.Box 490, Skøyen, N-0213 Oslo, Norway.
Phone +47 2213 4600, e-mail: mail@fugro.no

TGS-NOPEC data: Jens Christian Olsen, Veras Alle 7, 2720 Vanløse, Denmark.
Phone +45 3874 5950, e-mail: jenschristian.olsen@tgsnopec.no



Geophysical Atlas of West Greenland Basins: second edition in preparation

The first edition of the Geophysical Atlas of West Greenland Basins, produced in 2002 by Volcanic Basin Petroleum Research (VBPR) and TGS-NOPEC in co-operation with GEUS, has proved to be a very valuable reference for oil companies planning to initiate regional evaluations of West Greenland and adjacent Canadian waters. A revised version of this atlas incorporating all relevant new data is presently being prepared, and will be available in April 2004.

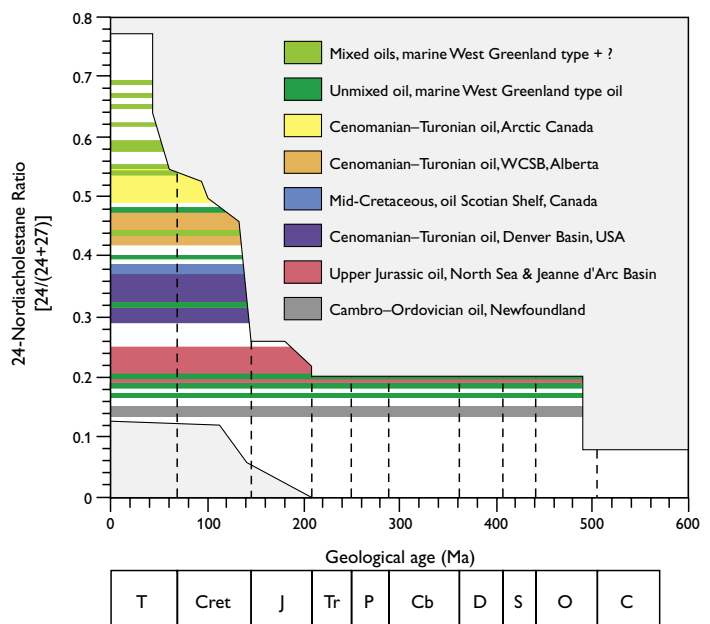
The atlas will include summaries of the geological framework and petroleum systems including an up-to-date evaluation of source rock data, an overview of available seismic and well data, and a comprehensive bibliography. Furthermore, the atlas includes plate reconstructions and various regional gravity and magnetic maps, as well as integrated seismic-gravity-magnetic interpretations of selected key regions including special studies on the 2004 licensing areas as well as deep possible Jurassic, Triassic and Palaeozoic basins.

For further information on price etc, contact Jens Christian Olsen, TGS-NOPEC, e-mail: jenschristian.olsen@tgsnopec.no

The presence of Mesozoic source rocks – is a Jurassic source viable?

For many years the presence of an oil-prone source off West Greenland was challenged by the industry. However, the question shifted focus towards age, distribution and potential of the source when active oil seeps were found onshore West Greenland on the Nuussuaq peninsula in 1992. Five different oils – each with their own characteristics – were reported by the Survey in 1999. One of these is a typical marine shale-derived oil with a possible regional distribution. Geochemical analysis suggests that it may have been generated from Cenomanian–Turonian age marine shales, equivalent to the very prolific source rocks of the Kanguk Formation on Ellesmere Island, Nunavut, Canada, but it has not yet been drilled in West Greenland. Three of the other oils were generated from deltaic source rocks of Albian, Campanian and Paleocene ages and one is of unknown origin.

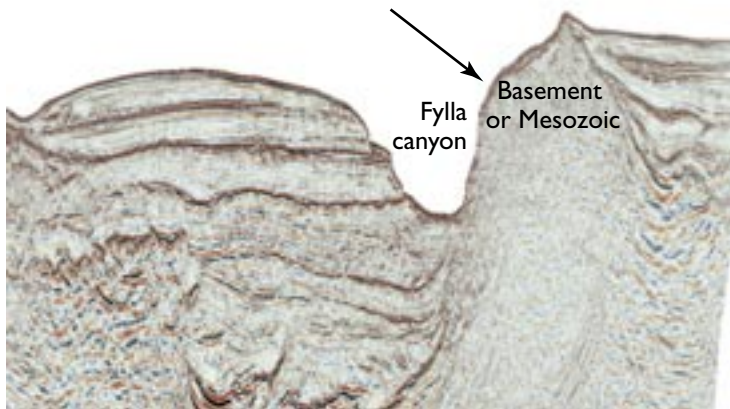
In March 2003, a major analytical program on North Atlantic and Arctic oils was initiated by GEUS when it acquired new tandem GC-MS-MS analytical facilities that allowed analysis of age-specific 24-cholestane biomarkers to be carried out. A suite of oil samples of Cenomanian–Turonian source age from the Denver and Alberta Basins and the MacKenzie Corridor – all situated within the wellknown “Cretaceous Western Interior Seaway“ of North America, plus a series of oil samples of Cambro-Ordovician, Jurassic and Cretaceous source age from the western North Atlantic region and the North Sea were analysed to serve as a reference to which West Greenland oils could be compared. The results show that mixtures of the marine oil and other oil types yield relatively young source rock ages, whereas pure marine oil samples yield source ages similar to oil of Cenomanian–Turonian age from Cretaceous Western Interior Seaway, or to Upper Jurassic sourced oils from the Jeanne d’Arc Basin and the North Sea. These data have been presented to the industry at the 10 April meeting in Copenhagen and at the ICAM-meeting in Halifax in October. For more information, contact Jørgen Bojesen-Koefoed at GEUS (e-mail: jbk@geus.dk).



Comparison of composition of age-specific biomarkers in West Greenland oils with oils of known source rock age showing that unmixed marine West Greenland oils show affinities with Cenomanian–Turonian oils and Upper Jurassic oils.

Sea-bed sampling programme: testing Mesozoic basins, seamounts and seeps

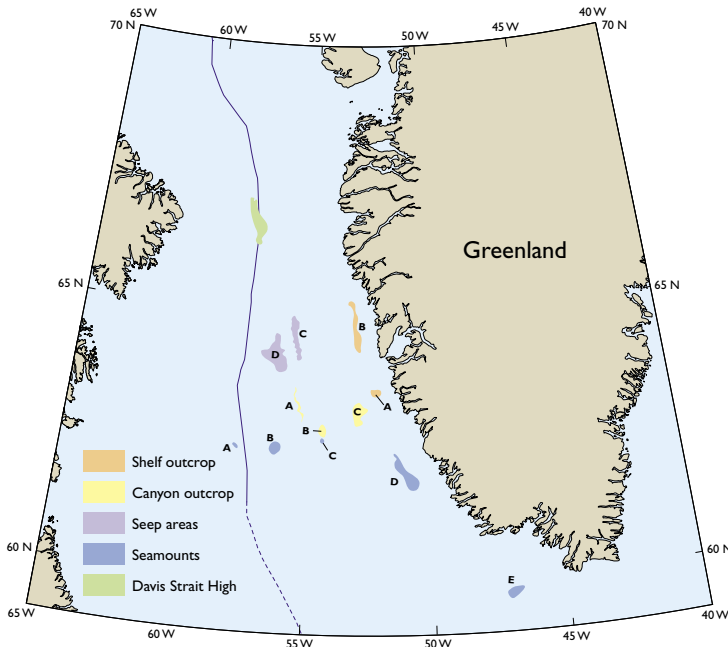
Already in the year 2000, results from the Qulleq-1 exploration well on the Fylla Structural Complex suggested that Lower Cretaceous or even older strata could be present in the deepest parts of the basins within the area. The well reached TD in Santonian reservoir strata, well above the base of the sedimentary succession, and throughout the well, reworked palynomorphs of Carboniferous, Triassic and Jurassic (Kimmeridgian) age were present.



2002 sample locality at the western slope of the Fylla canyon bordering the Fylla Structural Complex. Samples revealed not only Lower Cretaceous strata, but also spores and pollen assemblages suggesting the presence of Middle–Upper Jurassic strata.

A preliminary sea-bed sampling programme was thus initiated by the Survey in 2002 to test the possibility of sampling old sedimentary successions in some of the very deep canyon systems present offshore West Greenland. The 2002 programme was carried out in the canyon bordering the Fylla Structural Complex. A couple of samples were collected on the deeper slope of the canyon and revealed not only Lower Cretaceous strata as anticipated, but also spores and pollen assemblages suggesting the presence of Middle–Upper Jurassic strata.

To follow-up on these very promising results, BMP decided to fund a major sea-bed sampling programme in 2003. This was carried out by GEUS during three weeks in August with additional sponsorship by NUNAOIL.



Sample objectives of the 2003 sea bed sampling programme.

well as a couple of prominent seamounts in the area. Thirty-six sea bottom samples were collected using dredging, gravity coring, and video-controlled grabbing combined with video transects of selected sample sites. To optimise sampling and later interpretation, deep-towed side scan (long and short range) and seismic acquisition were carried out on the Davis Strait High, in the seep areas and on the seamounts.

Analysis of data is currently in progress and results are expected to be available early in 2004. A continuation of the project is anticipated in 2004 with collection of additional geophysical data and samples in selected areas.



The main aim was to investigate possible sea-bed exposures of inverted Palaeozoic and Mesozoic basins on the Davis Strait High and in the canyon systems. Furthermore, some interesting possible hydrocarbon seep structures (pock-marks etc.) were investigated as



The Jurassic of Denmark and Greenland – a milestone publication from GEUS

This new book from GEUS synthesises 15 years of geological research on the Jurassic rocks of Denmark and East Greenland. These rocks record the evolution of two discrete portions of the Mesozoic rift complex, now separated by the North Atlantic Ocean.

The Jurassic of Denmark and adjacent areas occurs mostly in the subsurface and research has thus focused on the wealth of borehole and reflection seismic data resulting from over thirty years of hydrocarbon exploration. The Jurassic of East Greenland, in contrast, is exposed in spectacular cliffs along fjords and mountainsides and has come to be regarded as a unique 'field laboratory', particularly amongst those working on the Norwegian shelf – the conjugate margin of East Greenland,

The book – published as the first volume of the Survey's new bulletin series – contains 28 articles, preceded by a short overview article. Following detailed chronostratigraphic and biostratigraphic reviews of the Jurassic of Northwest Europe, the successions of Denmark and East Greenland are subjected to a range of stratigraphic, sedimentological, structural and geochemical studies that together provide the basis for a detailed comparison of the Jurassic evolution of the East Greenland and Danish sedimentary basins.

The Jurassic of Denmark and Greenland

Geological Survey of Denmark and Greenland Bulletin vol. 1, 948 pp.

Edited by Jon R. Ineson and Finn Surlyk.

For more information, visit the GEUS publications website: www.geus.dk/publications/bull

The Palaeogene and Neogene offshore southern West Greenland

Volume 20, issue 9 of Marine and Petroleum Geology, which is planned to be published in mid January 2004, is dedicated to the Palaeogene and Neogene of offshore southern West Greenland. A detailed mapping and facies analysis of seismic sequences is presented together with five papers on various biostratigraphic aspects. See: <http://www.elsevier.com>

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