



Greenland's future exploration opportunities

A new licence round has just been held in Greenland and an exploration and exploitation licence was signed in Nuuk – the capital of Greenland – on October 8, 2002. The granting of this licence was based on an application from the major independent Canadian oil and gas company, EnCana (see below). The licence round was part of the Government of Greenland's hydrocarbon strategy published in 1999. One of the main targets was the establishment of more attractive exploration and exploitation terms in order to increase the investments in this geologically very interesting area. Interest from the oil industry in this large and highly under-explored frontier region has grown during recent years, mainly as a consequence of the wealth of seismic data recently acquired west of Greenland, showing hitherto unknown deep sedimentary basins, large structures and other exciting features. Many companies have evaluated exploration possibilities based on new data and exploration models. Positive feedback from a number of large companies is encouraging for upcoming exploration. Therefore, it is the intention to continue to invite oil companies to explore for hydrocarbons in Greenland. At present, BMP and GEUS are evaluating the new data in order to focus future interest on specific areas. BMP will visit companies that show an interest in Greenland exploration during the next couple of months and is planning a seminar on Greenland exploration opportunities in Copenhagen during March/April 2003 for invited companies. New facets of the exploration potential resulting for this re-evaluation will be presented to the public at the AAPG Annual Meeting in Salt Lake City in May 2003. The governments of Greenland and Denmark will subsequently evaluate the further steps for exploration and licensing policy, including upcoming invitations to apply for new licences. Individual oil companies and groups are encouraged to evaluate the hydrocarbon potential offshore West Greenland at a reduced up-front cost, since TGS-NOPEC has recently introduced a new commitment and payment schedule in addition to the traditional pricing structure.



Drilling into Greenland's future. Despite the Statoil well, Qulleq-1, drilled in 2000 was dry, it provided the essential data for other companies to be able to establish the necessary framework for continuing exploration efforts off West Greenland.

New licence offshore West Greenland awarded to EnCana and NUNAOIL

The West Greenland 2002 Licence Round was closed on 16 July 2002. Following negotiations in August and political approval by the Greenlandic and Danish governments in September, a licence to EnCana – a leading independent company – was signed on October 8. NUNAOIL, the national Greenland oil company, is participating in the licence as carried partner during the exploration phase.

The licence area covers 3985 square kilometres and is located approximately 200 kilometres west of Nuuk. Most of the licence is within the southern part of the Nuuk Basin, but the easternmost part also encompasses parts of the Atammik Structural Complex (see map). Water depths range from 200 to 1000 metres and no wells have previously been drilled in the area.

Results from the Qulleq-1 well, about 50 km south of the EnCana licence, and seismic mapping formed a good basis for selecting the area in the Nuuk Basin. In the Qulleq-1 well, drilled by Statoil in the summer of 2000, a thick, hitherto unknown succession of reservoir sandstones of Santonian age was encountered. In West Greenland, a Cenomanian–Turonian or maybe even older source rock is anticipated to exist in a system of deep connected basins. This source rock interval is expected to be mature in large parts of the Nuuk Basin. The thick sedimentary succession also favours the existence of older source rocks in stratigraphic intervals that remain presently undrilled. Furthermore, large structures are known to be present in the area. Based on stratigraphic evidence from the Fylla area, sealing and timing of generation and migration seem optimal for forming large accumulations.

Seismic data acquisition continues offshore West Greenland

Four seismic surveys offshore West Greenland have just been completed (late October). The surveys were designed to infill last year's survey in the Lady Franklin Basin (GRC02) but also to test other potential hydrocarbon provinces like the areas in the northern Open Door Area between 68°N and as far north as 73°N (GREEN02 and DW02), and an area west of Kap Farvel, the southern tip of Greenland (KF02) (see map).

The GRC02-survey was carried out as a joint-venture project between TGS-NOPEC and BMP. It is a follow-up on last year's major programme, *GreenCan2001*, which acquired 2829 km of seismic data in Greenland and Canadian waters (see Ghexis no. 20). These data revealed the presence of deep sedimentary basins with large structures in the northern part of the Labrador Sea, partly in areas that earlier have been suggested

to consist of oceanic crust. The new survey is mainly acquired in the deep-water region between 62° and 64° N (see map). These new data will be of major importance for the development of new tectonic models for the region.

The GREEN02 and DW02 surveys were acquired in the northern Open Door Area – an area where licences can be applied for on a first-come, first-served basis. In this region (68°–71°N), seismic coverage is relatively poor (and old) but tie-lines are now available to 12 seconds TWT from the 2002 Licence Round Area in the south to the northern areas of Baffin Bay (north of 71°N) where the KANUMAS group of companies hold a preference position (see map). The surveys have been acquired to follow the trend of recently recognised very deep basins northwards along the Ungava/Ikermiut Fault Zone, and to delineate some previously recognised large leads and prospects with DHIs (see e.g. Ghexis nos 16 and 20). Onshore oil-seepage has been extensively documented on Disko and Nuussuaq and hydrocarbon generation is therefore known to have occurred in the region. The distinct deep basinal trend from the Ungava Zone towards the onshore seep area suggests a continuation of these source rocks. Therefore, these new surveys are very interesting for a first assessment of the exploration potential of this large region. Some of the previous problems on seismic penetration through the Paleocene volcanics in the area also seem to be partly solved. The GREEN02 survey was acquired by NUNAOIL and TGS-NOPEC on a joint-venture basis whereas the DW02 survey was acquired by BMP and TGS-NOPEC on a joint-venture basis.

The KF02 survey was planned in order to test the presence of possible sedimentary basins that are outlined by gravity data. Such basins could comprise Lower Palaeozoic sediments comparable to those known from western Newfoundland where hydrocarbon discoveries have been made. Alternatively, models including thick successions of Carboniferous half-grabens like in East Greenland or with Cenozoic sediments could be suggested. BMP and TGS-NOPEC acquired the KF02 survey on a joint-venture basis.

Processed data are anticipated to be available from TGS-NOPEC in the beginning of 2003.

Contacts at TGS-NOPEC for 2002 data offshore West Greenland

Check also www.tgsnopec.no for further information

Jens Christian Olsen
Veras Alle 7
DK-2720 Vanløse
Denmark

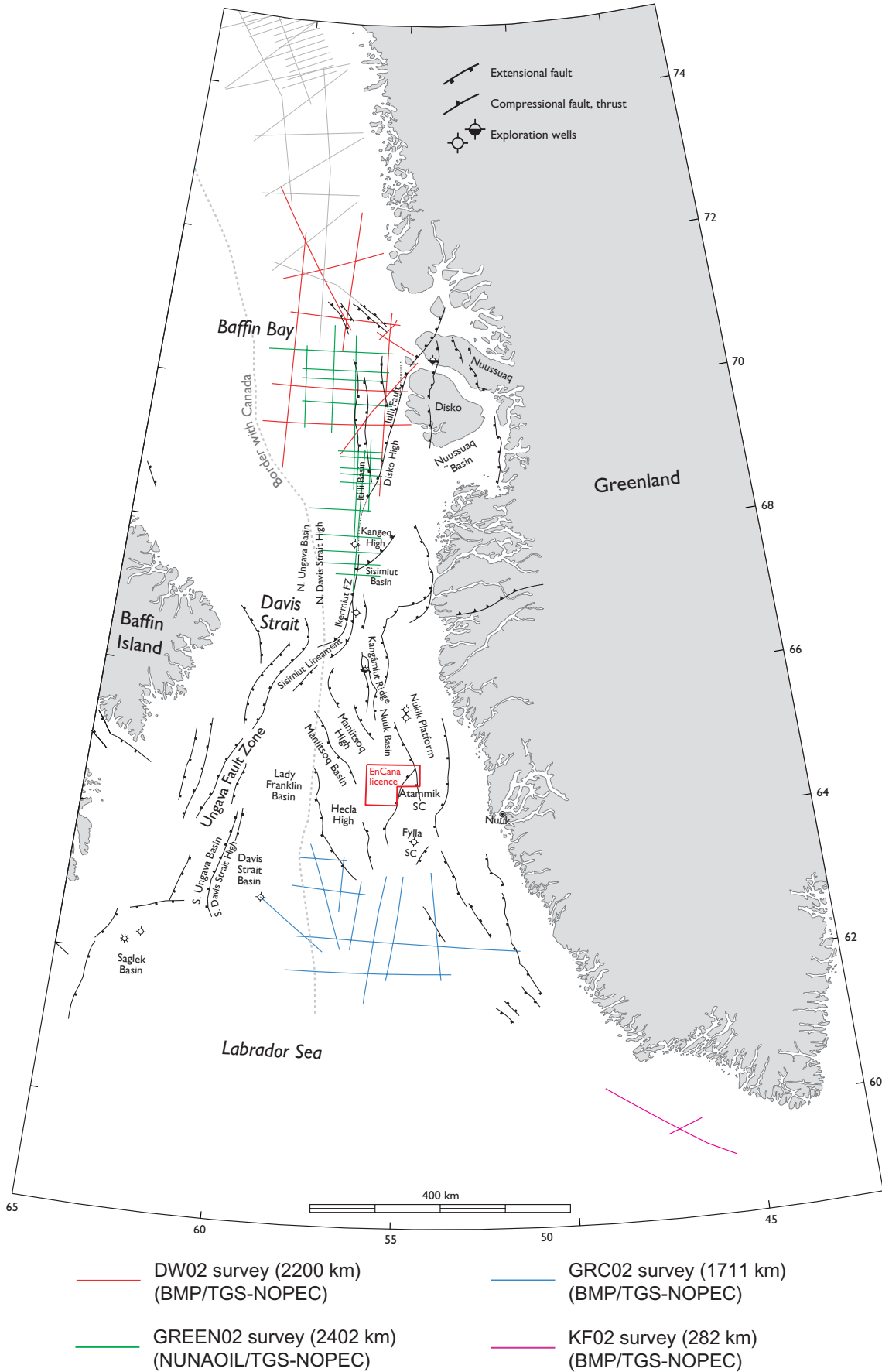
Phone: +45 3874 5950
Fax: +45 3874 9489

E-mail: jenschristian@tgsnopec.no

Jørn Christiansen
Baarsrudveien 2
N-3478 Nærnesnes
Norway

Phone: +47 3129 2011

E-mail: jorn.christiansen@tgsnopec.no

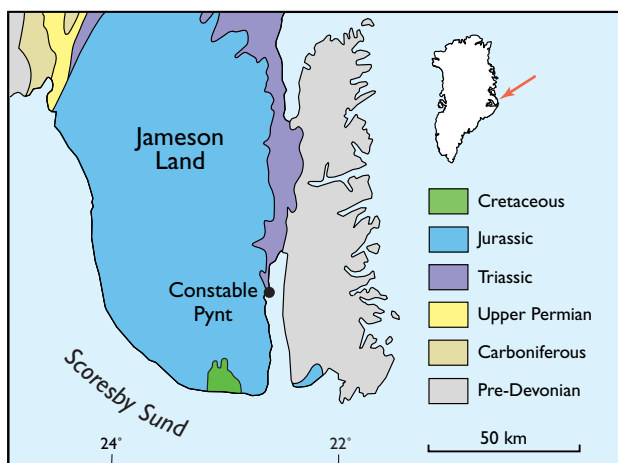


Map showing the new EnCana licence and the distribution of seismic surveys carried out during summer 2002. The major structural elements and sedimentary basins off West Greenland is also shown. The KANUMAS and Baffin Bay surveys (grey) are older surveys displayed in order to show the ties towards the north.

Industry excursion to East Greenland: analogues for the Norwegian shelf and the Faroes

As a special service to the petroleum industry, GEUS arranges field excursions to relevant localities in Greenland. This summer, a five-day excursion was arranged for Norsk Agip with focus on the Upper Palaeozoic – Mesozoic geology of the East Greenland rift basins. The excursion was planned in close dialogue with Norsk Agip in order to address key questions relevant to the participants and the Norwegian licence blocks in question. The Mesozoic rift basins of Greenland and Norway were closely linked prior to Palaeogene break-up and long-distance correlation between formations on the Norwegian shelf and East Greenland is often possible. In addition, conceptual play models developed from surface geology might lower exploration risks in both mature and frontier hydrocarbon provinces.

The airport at Constable Pynt/Nerlerit Inaat on the shores of Hurry Inlet in central Jameson Land provides comfortable although somewhat primitive accommodation, including excellent meals and access to a small meeting room.



Helicopter charter on a daily basis was co-ordinated between the Danish Polar Center (DPC) and AirAlpha. GEUS and DPC provided the logistic platform, and instructed in field behaviour and safety rules evolved through decades of field work in East Greenland

Classical outcrop localities may be reached by helicopter on one-day trips from Constable Pynt. Among those are Upper Permian reef build-ups and marine source rocks, Lower Triassic tectonically-controlled submarine fan complexes, Lower and Middle Jurassic shallow marine sandstones, Upper Jurassic slope apron and deep marine gravity flow sandstones and finally, lowermost Cretaceous shelf margin deltas and slope deposits. The Arctic outcrops provide seismic scale analogues as well as detailed sedimentological and stratigraphical information.

The beautiful and at times overwhelming Greenlandic nature made a lasting impression on the participating geologists and geophysicists. Although days of low clouds and an unexpected 'first snowstorm of the year' hampered visits to some localities, the overall impression was that of a great success or, as later expressed by one of the participants, 'the Greenland localities will undoubtedly be referred to and aid the understanding of the exploration potential of the licence'.

GEOLOGICAL SURVEY OF DENMARK AND GREENLAND (GEUS)

Øster Voldgade 10 • DK-1350 Copenhagen K • Denmark

Tel: +45 3814 2400 • Fax: +45 3814 2050 • e-mail: ghexis@geus.dk • website: www.geus.dk

BUREAU OF MINERALS AND PETROLEUM (BMP)

Government of Greenland • P.O.Box 930 • DK-3900 Nuuk • Greenland

Tel: +299 34 68 00 • Fax: +299 32 43 02 • e-mail: bmp@gh.gl • website: www.bmp.gl