

ICELAND

Offshore Exploration



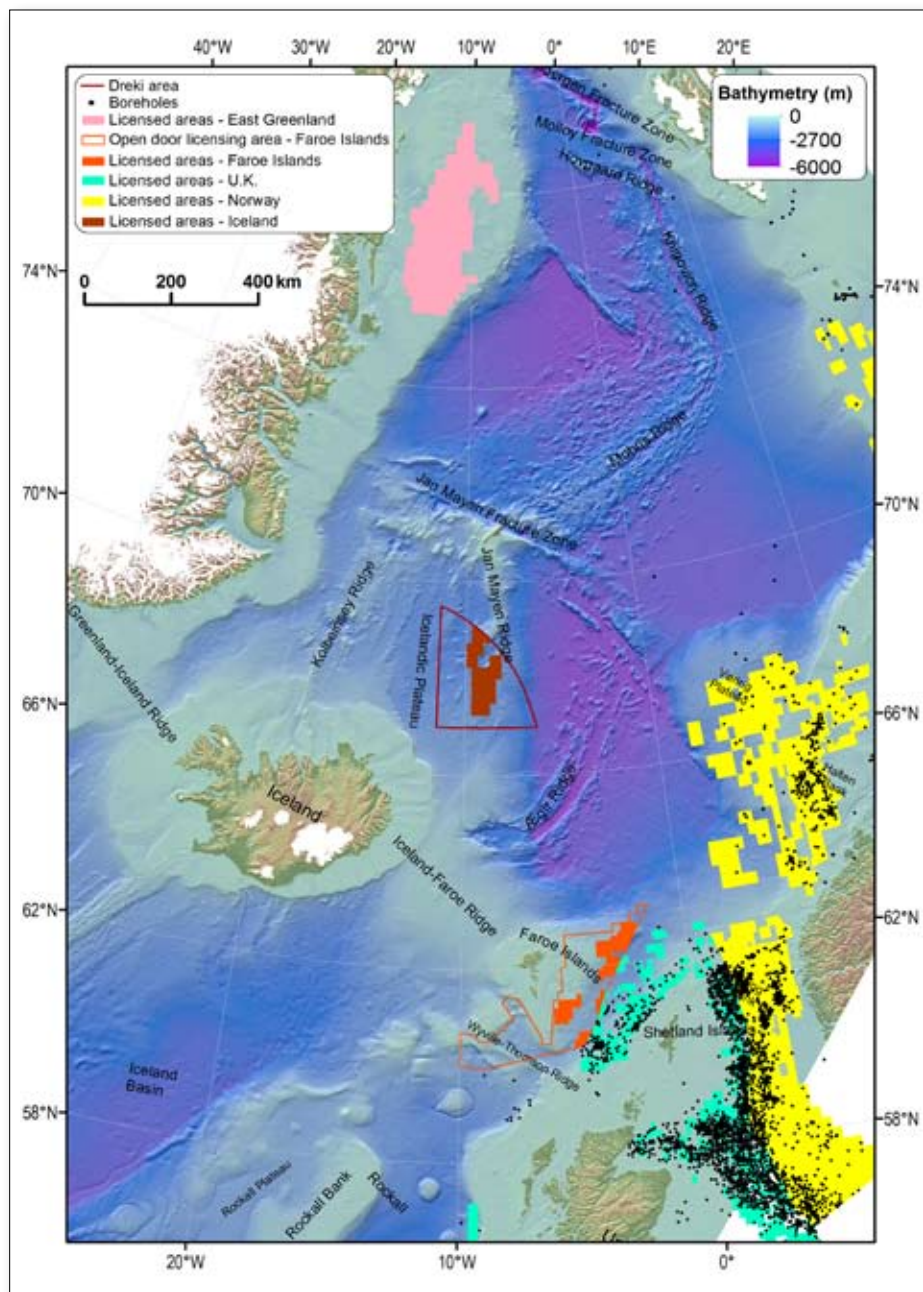


Iceland: beginning arctic exploration

- Geology similar to other areas on the North Atlantic Margin.
- Significant amount of geophysical data available.
- Recent research confirms pre-opening sedimentary rocks in the Dreki area - both reservoir and source rocks present.
- Sediment samples suggest active seepage of Jurassic oil and a working hydrocarbon system.

Licensing for hydrocarbons

- Exclusive licenses for the exploration and production of hydrocarbons in the Dreki area on offer in licensing rounds.
- Applications for prospecting licenses (e.g. for speculative surveys) accepted at any time.

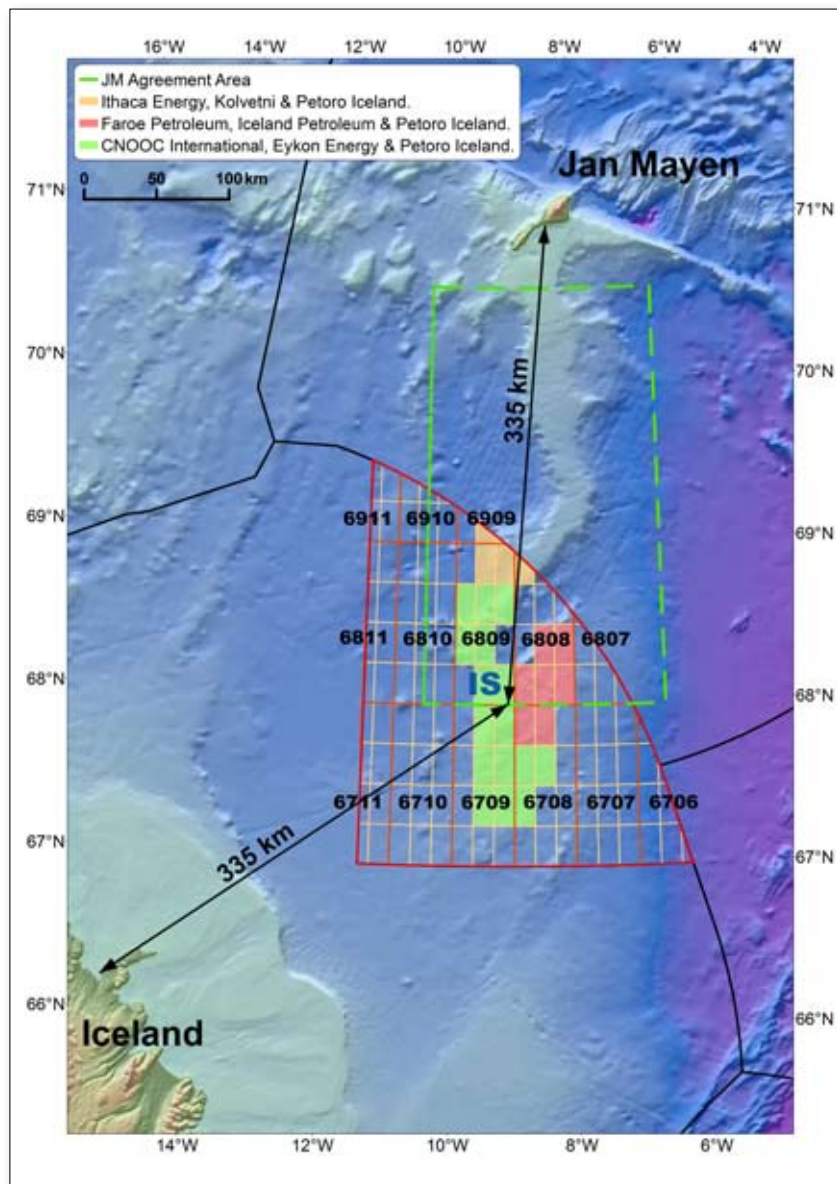


First exploration and production licences

- Three licences granted
 - **Faroe Petroleum (67.5%)**
Iceland Petroleum (7.5%)
Petoro Iceland (25%)
 - **Ithaca Petroleum (56.25%)**
Kolvetni (18.75%)
Petoro Iceland (25%)
 - **CNOOC International (60%)**
Eykon Energy (15%)
Petoro Iceland (25%)

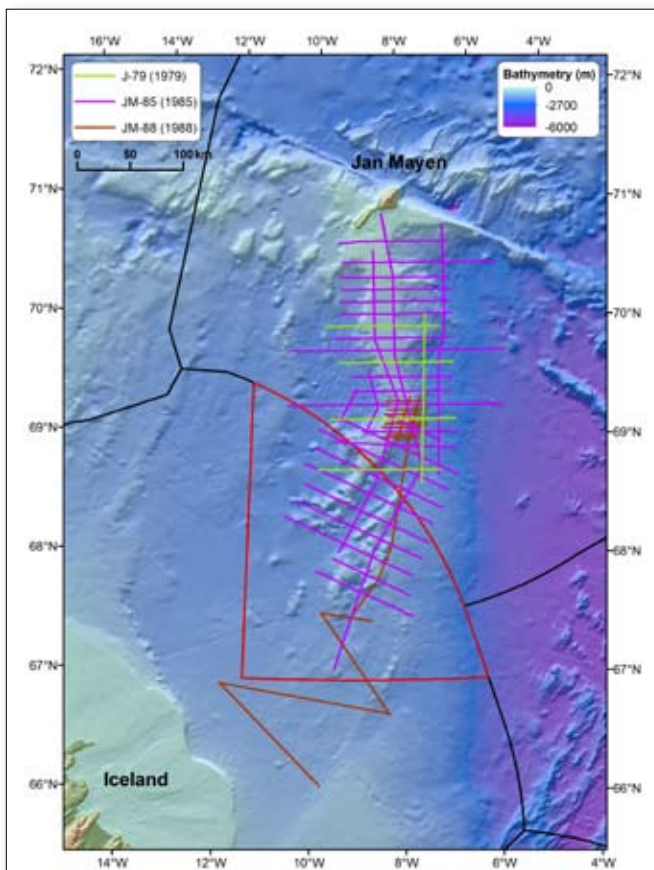
Licensing terms

- Duration of exploration licenses up to 12 years, may be prolonged to a maximum of 16 years.
- Following successful exploration, a priority can be granted for a production license for up to 30 years.
- Group applications (joint ventures) are welcome,
- standard Joint Operating Agreement provided.
- Transferable licenses, subject to official permission.
- Phased work programme possible, each phase with separate specification of rights and obligations.
- Annual contribution to an education and research fund.
- Agreement with Norway on the northernmost 30% of the area (12,720 sq. km).
- Norway may participate with up to 25% share in exclusive licenses within the agreement area.

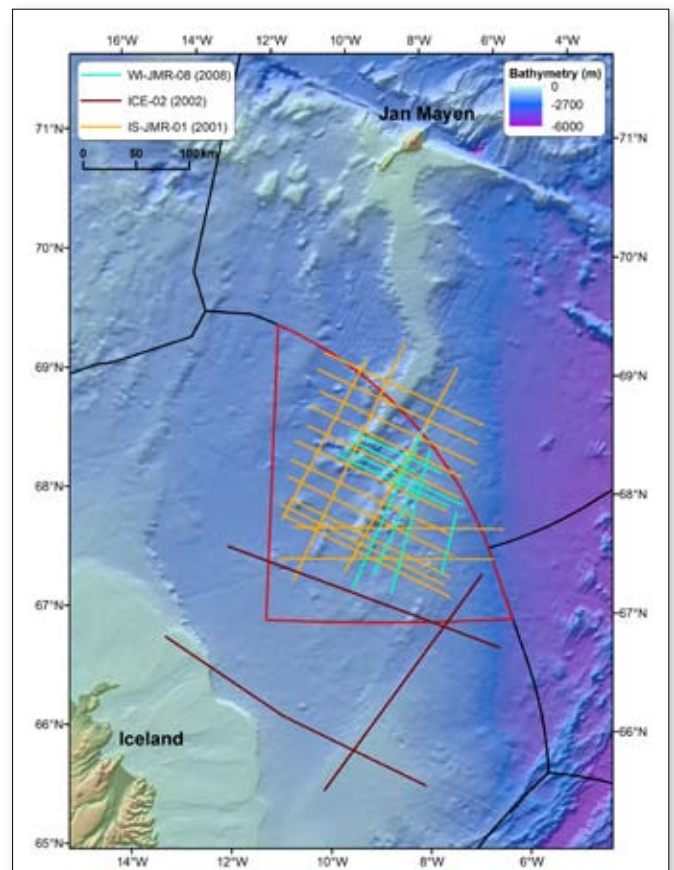


Exploration data

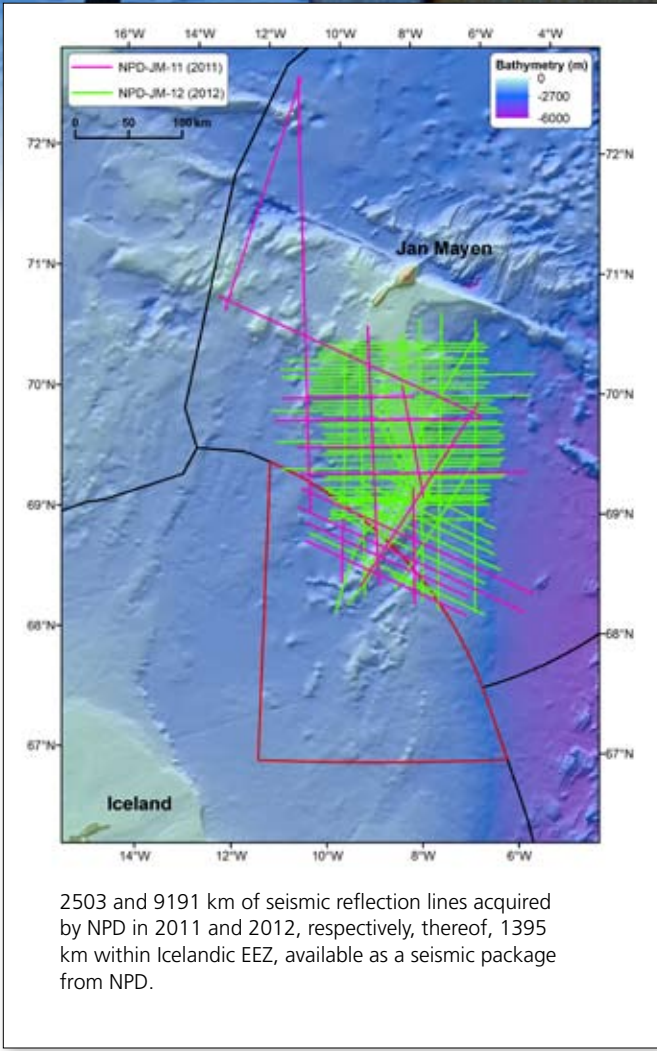
- Major sources for 2D seismic reflection data:
 - Norwegian/Icelandic governmental surveys in 1985 and 1988, available from Orkustofnun or NPD in Norway.
 - Spectrum reprocessing of the data from the 1985 and 1988 surveys, available from Spectrum.
 - InSeis survey in 2001, available from Orkustofnun.
 - Wavefield-Inseis survey in 2008 and reprocessed 2001 data, available from Spectrum.
 - TGS-NOPEC survey in 2002, available from Orkustofnun.
 - Norwegian governmental surveys in 2011 and 2012 available from NPD.
- Shallow boreholes from the Deep Sea Drilling Project and Ocean Drilling Program.
- Surface seafloor samples collected in 1974, 2010, 2011 and 2012.
- Report on sampling by TGS and VBPR in 2011 available for sale from VBPR. The report contains key information on the potential of the area.
- Rock samples collected in Icelandic EEZ by NPD in 2011 and 2012, accessible at NPD upon request to Orkustofnun.
- Locations and metadata shown in the Icelandic Continental Shelf portal: www.icsp.is



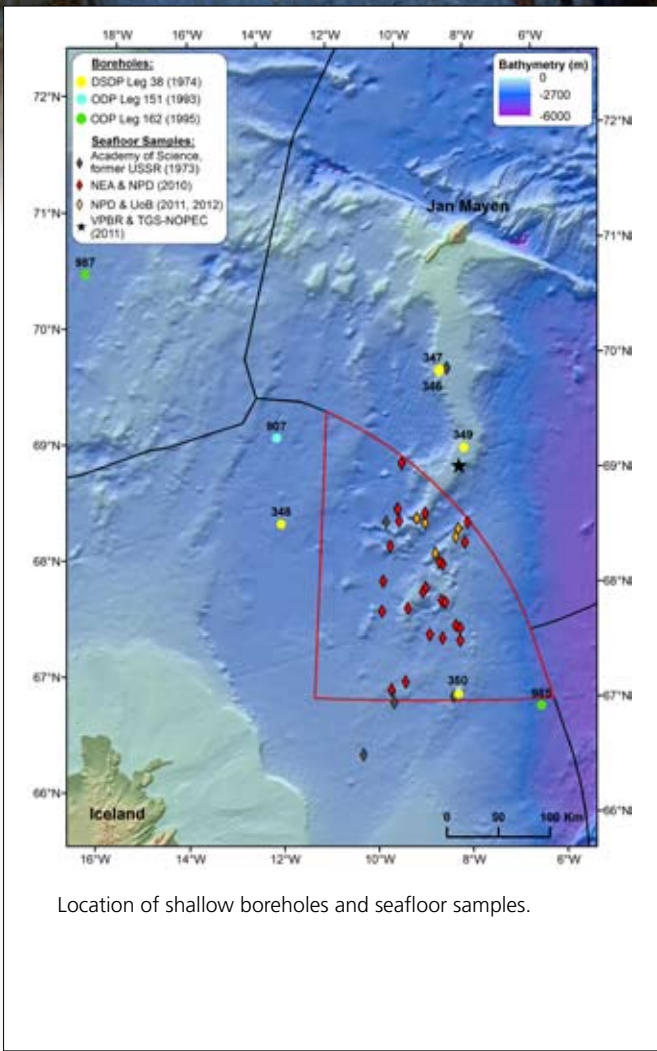
Approximately 5800 km of seismic reflection lines acquired by Norway in 1979, and by Iceland and Norway in 1985 and 1988. Reprocessed data of 1985 and 1988 surveys available from Spectrum.



3600 km of seismic reflection lines acquired in 2001 by InSeis and 2008 by Wavefield-Inseis. 800 km acquired by TGS-NOPEC in 2002.



2503 and 9191 km of seismic reflection lines acquired by NPD in 2011 and 2012, respectively, thereof, 1395 km within Icelandic EEZ, available as a seismic package from NPD.



Location of shallow boreholes and seafloor samples.

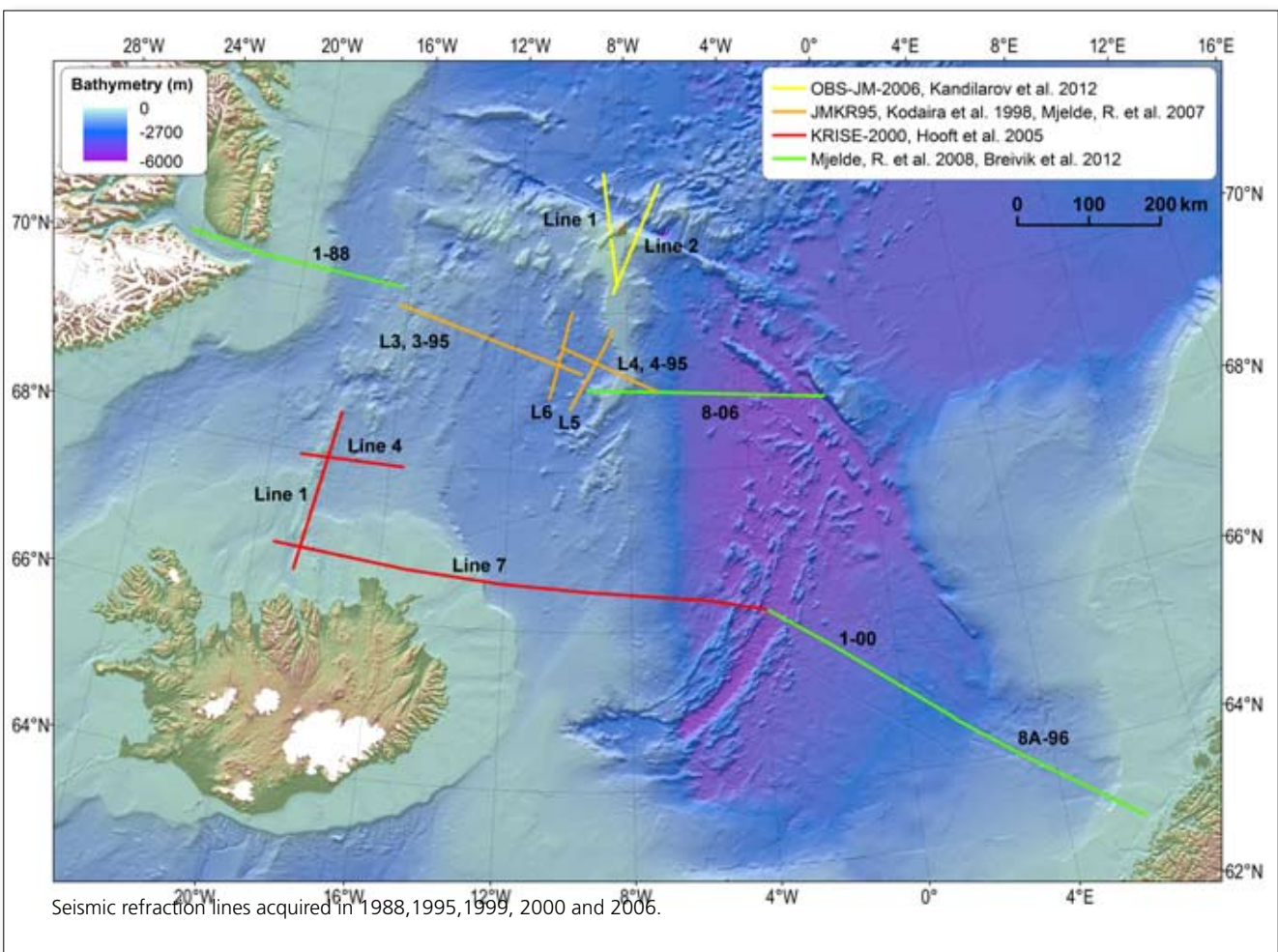
Crustal structure of the Jan Mayen Microcontinent

The Jan Mayen Microcontinent (JMMC) is a fragment of continental crust within the oceanic part of the western Eurasian Plate situated to the northeast of Iceland. The JMMC separates the two major regional oceanic basins: the Norway Basin to the east, generated during an early spreading activity along the Aegir Ridge, and the Jan Mayen Basin / Iceland Plateau to the west, formed during later breakup and oceanic accretion along the Kolbeinsey Ridge.

Crustal structures are characterized by a 10-20 km thick main northern ridge of the JMMC, and extremely thinned and stretched continental crust along the western flank of the JMMC, associated with small amounts of extrusive basalts within the sedimentary sequences of the Jan Mayen Basin (line JMKR95-L4). This area of down to 3 km thinned crust is classified as transitional crust, where the lower crust decreases significantly down to almost zero.

The extensional deformation of the JMMC is dominated by westward facing listric and normal fault systems, whereas the southern part is affected by a further extension, subdividing the JMMC into several smaller ridges that are also referred to as the Southern Ridge Complex.

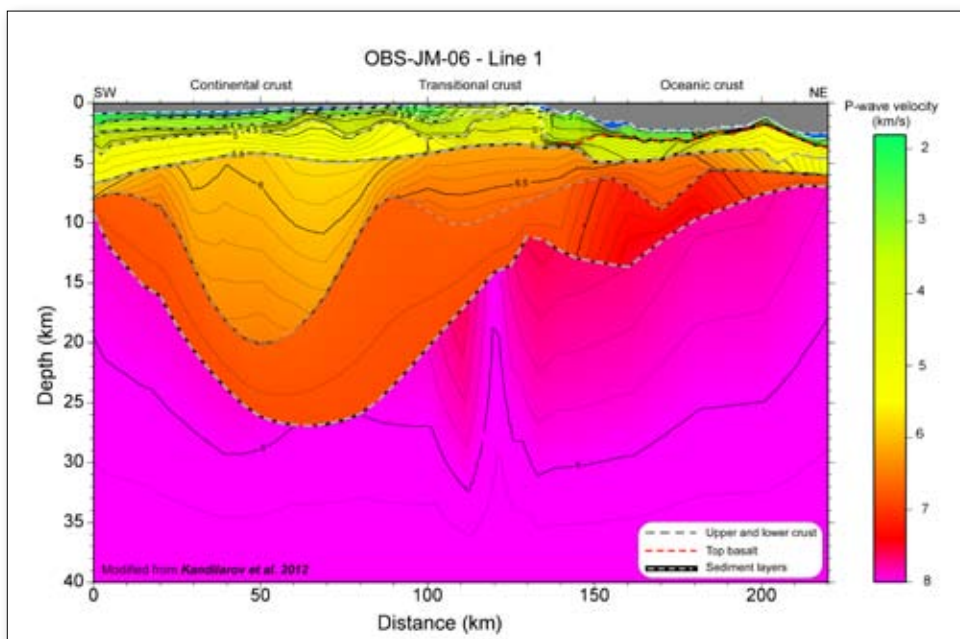
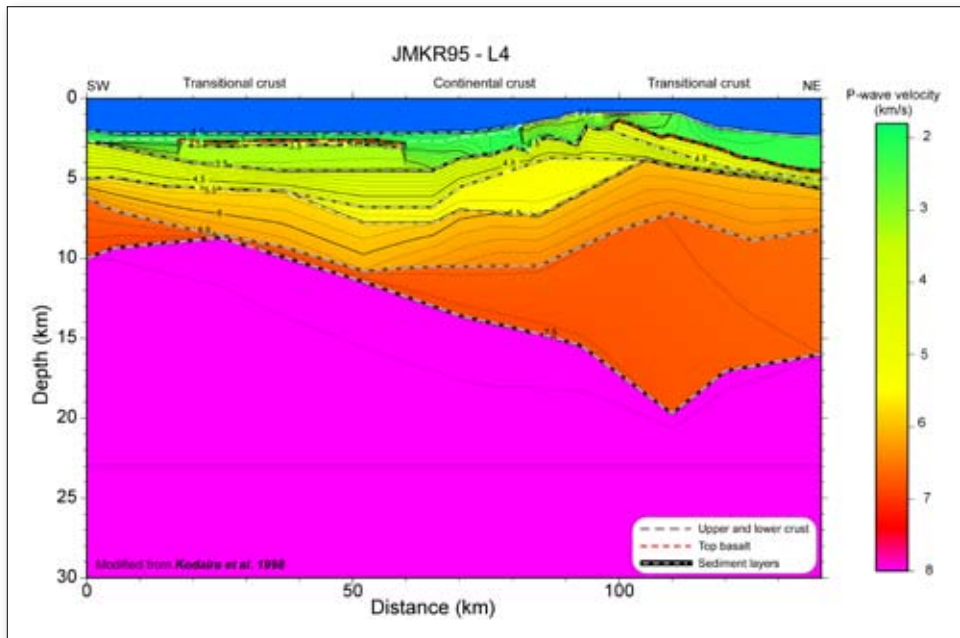
Crustal thickness decreases gradually from ~15 km of transitional crust at the microcontinent edge, to ~4 km of oceanic crust near the axis of the Aegir Ridge. The eastern flank of the JMMC, south of the Eastern Jan Mayen Fracture Zone, is a part of the conjugate margin to the Møre Basin. Extensive volumes of basaltic rocks were produced during the initial continental breakup in the Late Paleocene with regionally extensive flood basalts on-lapping the adjacent continental margins (Seaward Dipping Reflectors; SDR), and volcanic systems and intrusions along the eastern flank of the JMMC



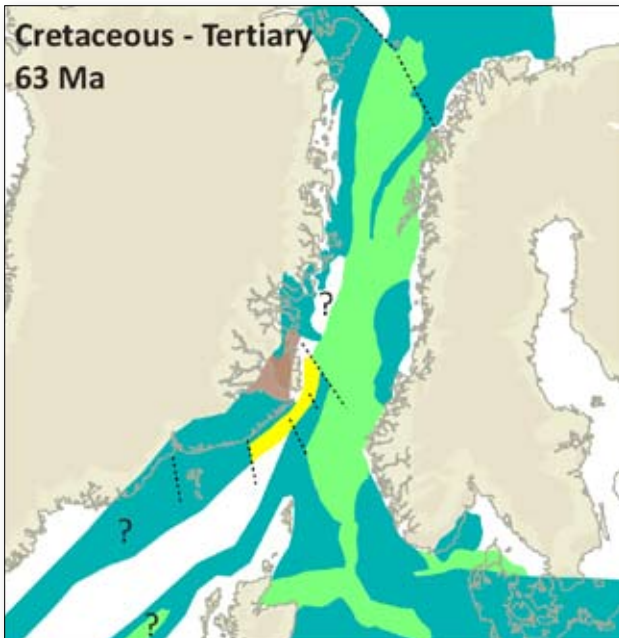
during the Eocene epoch (Peron-Pinvidic et al., 2012 and Blischke et al., 2012). This zone is classified as transitional crust with crustal thickness of up to 15 km (line JMKR95-L4; Kodaira et al., 1998).

The oceanic crust thickens towards the Jan Mayen Island volcanic complex and the area around the West Jan Mayen Fracture Zone (WJMFZ; line OBS-JM-2006-Line 1), with an oceanic crust thickness increasing up to 11

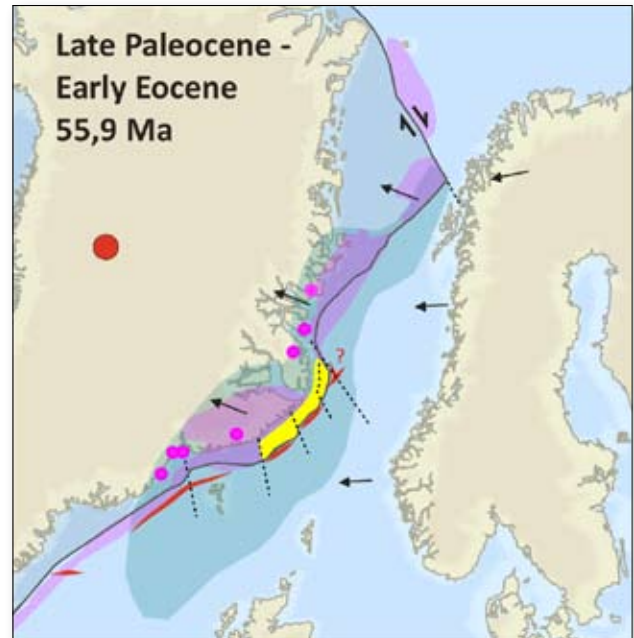
km. This thickening is explained by increase in volcanic activity due to the proximity of the WJMFZ and the Mohns Ridge (Kandilarov et al., 2012). Up to 20 km thick continental crust is observed in the southern part of OBS-JM-2006-Line 1 that is located on top of the main ridge area. Along the same line, crustal thickness rapidly thins out towards the stretched and thinned crust along the western flank of the JMMC within the Jan Mayen Basin.



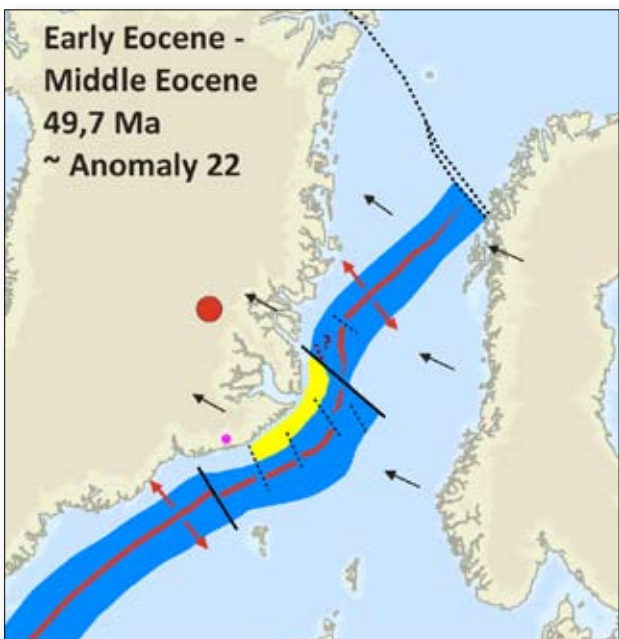
Tectonic history



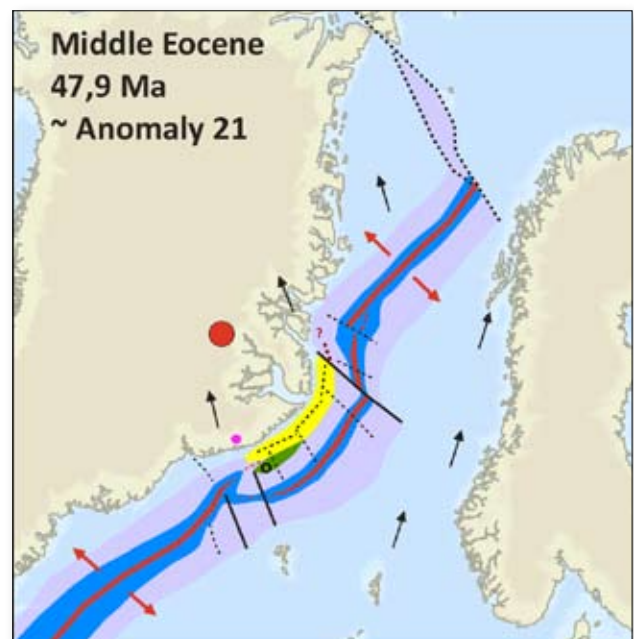
- Prior to the onset of seafloor spreading in the northeast Atlantic, the basins of East Greenland, western Norway, Shetland and the North Sea, were located in close proximity, forming very deep marine basins that are overlain by shallower marine platform and basins of the ~Late Triassic – Jurassic rifting structures.



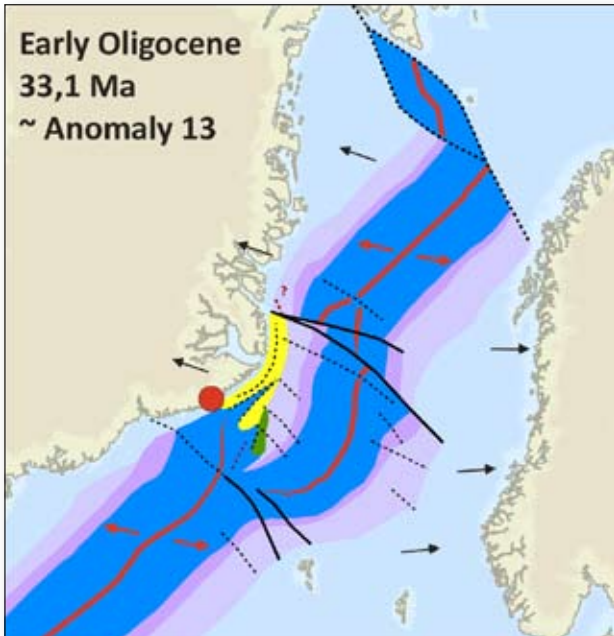
- Onset of sea floor spreading between Greenland and Eurasia plates.
- Greenland and Norway begin drifting apart.
- Large volumes of volcanic rocks extruded onto the rifted margins.



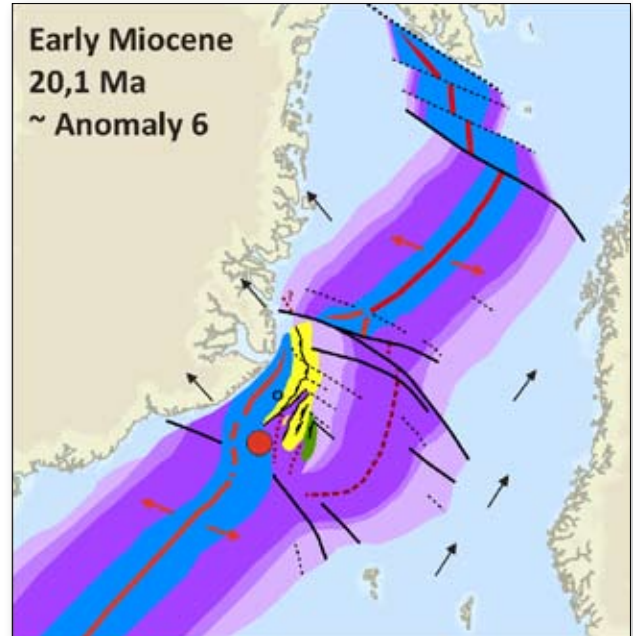
- Complex faults at the eastern boundaries of the Jan Mayen Ridge initiated during period of continental drift and spreading ridge formation of the Aegir Ridge to the east of the JMMC.



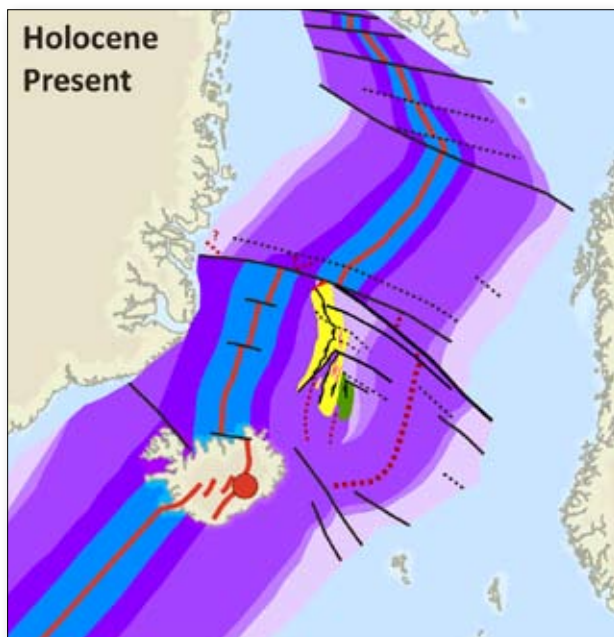
- Increased volcanic activity along the eastern margins of the JMMC.
- Increased extension within the JMMC.



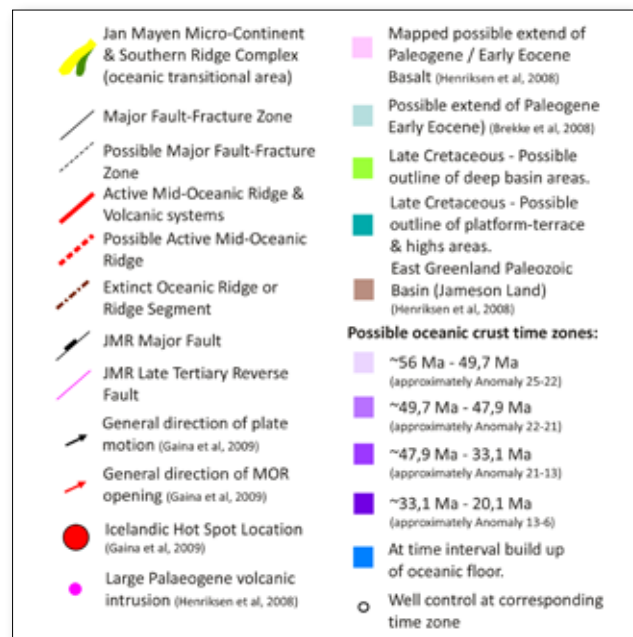
- Propagation of Kolbeinsey Ridge northwards into the East Greenland margin
- Extension and break-up within the Greenland margin.
- Extinction of the Aegir Ridge.



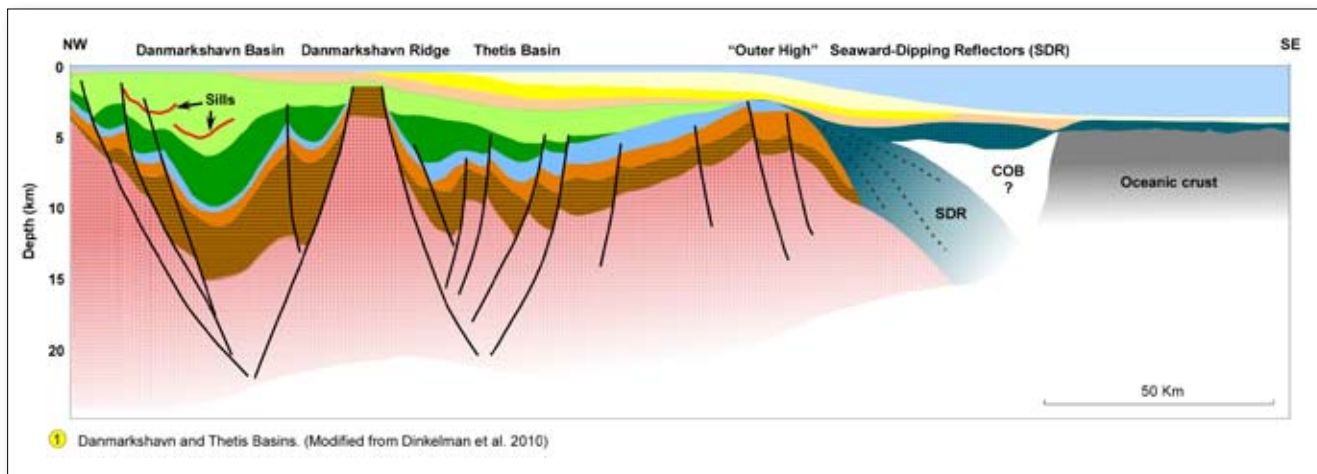
- Seafloor spreading along the entire Kolbeinsey Ridge.
- Complete separation of the JMMC.



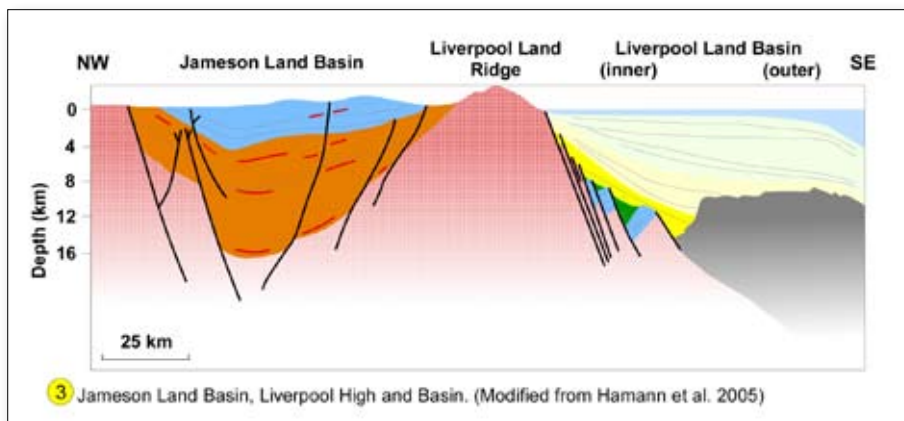
- Continued drift of the JMMC from Greenland as a result of seafloor spreading on the Kolbeinsey Ridge.



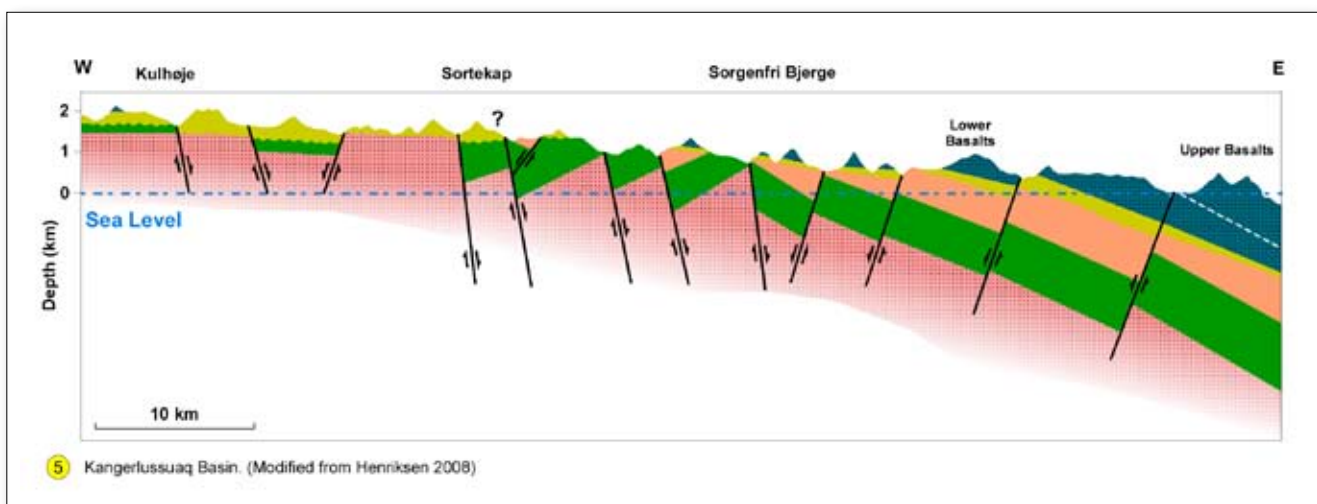
Geological cross sections



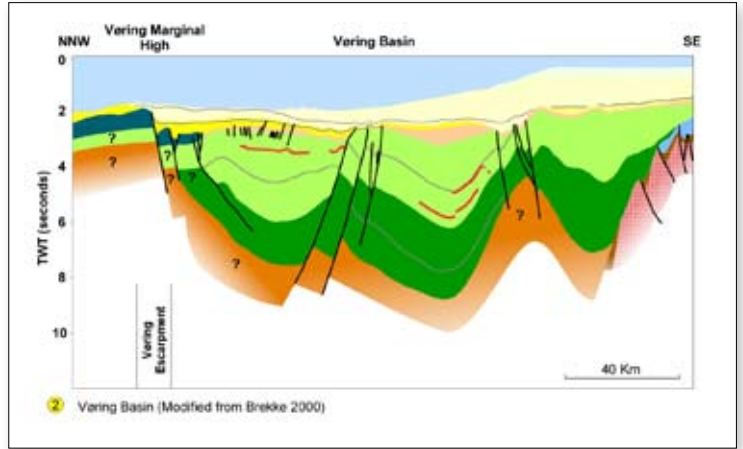
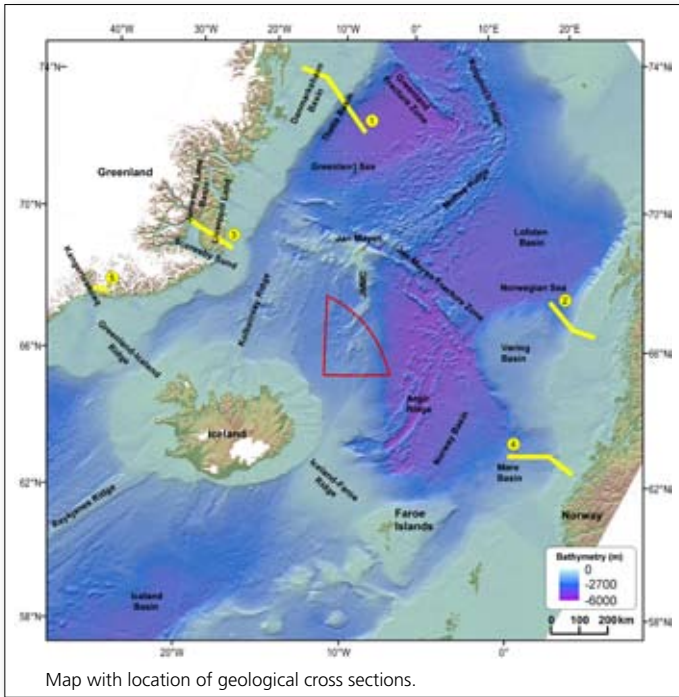
- The Danmarkshavn and Thetis basins have thick sections of Mesozoic and Palaeozoic sediments, and are the best direct analogue for the JMMC, although with a thicker stratigraphic section.
- Extensive syn-rift faulting is observed on both sides of the Danmarkshavn Ridge.
- Folding and doming have affected the area, leading to the development of potentially large hydrocarbon traps.



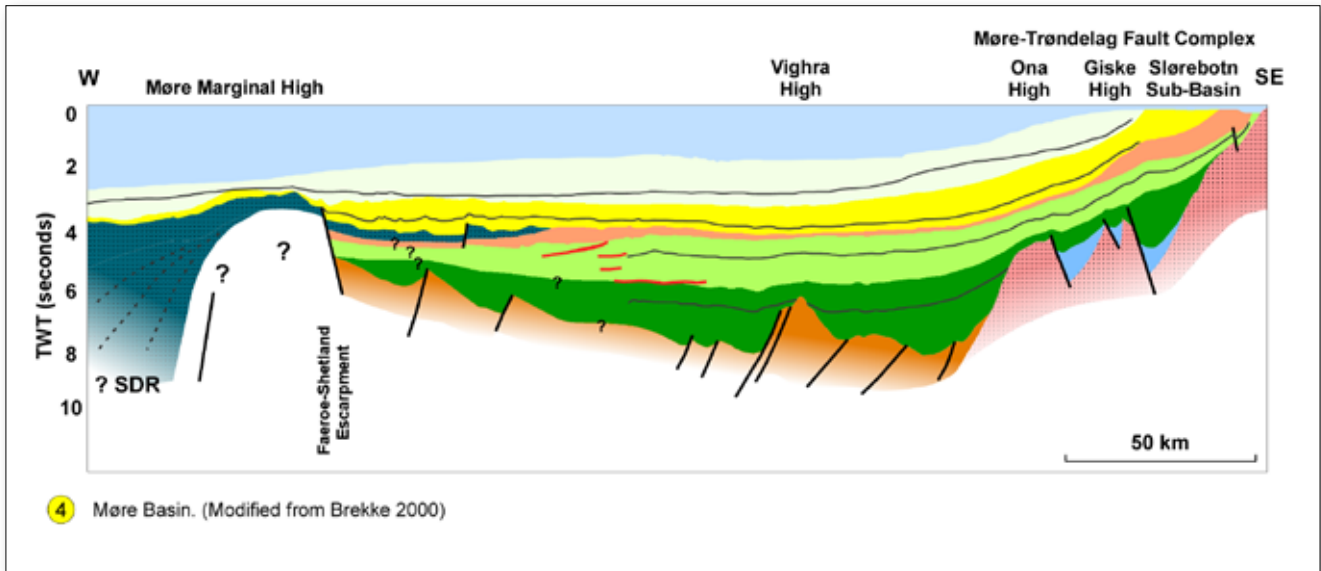
- The Liverpool Land Basin and High are thought to be the direct western margin of the Jan Mayen Ridge.
- The basins have preserved sequences of Upper Permian, Triassic and Jurassic sediments with some thin layers of mapped Cretaceous and Lower Paleocene sediments.
- The Jameson Land Basin has very similar characteristics to the Danmarkshavn Basin, with a thick Late Paleozoic to Mesozoic sediment sequences.



- Kangerlussuaq Basin consists of faulted 600-700 m thick Cretaceous and Paleocene sediments overlain by thick section of plateau basalts.
- The basin is younger than the other basins on the East Greenland coast and is thought to be an independent extension.



- The Møre and Vøring Basins contain very thick cretaceous sediments, which thin out towards the marginal high area at the western margin of the basins.
- The crust beneath the basins was stretched and thinned significantly over an exceptionally wide rift area in the late Mid-Jurassic-Early-Cretaceous periods.

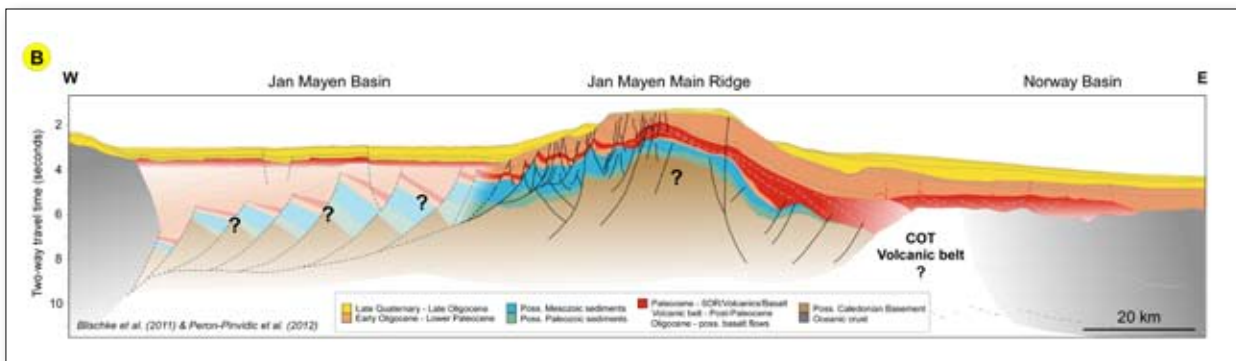
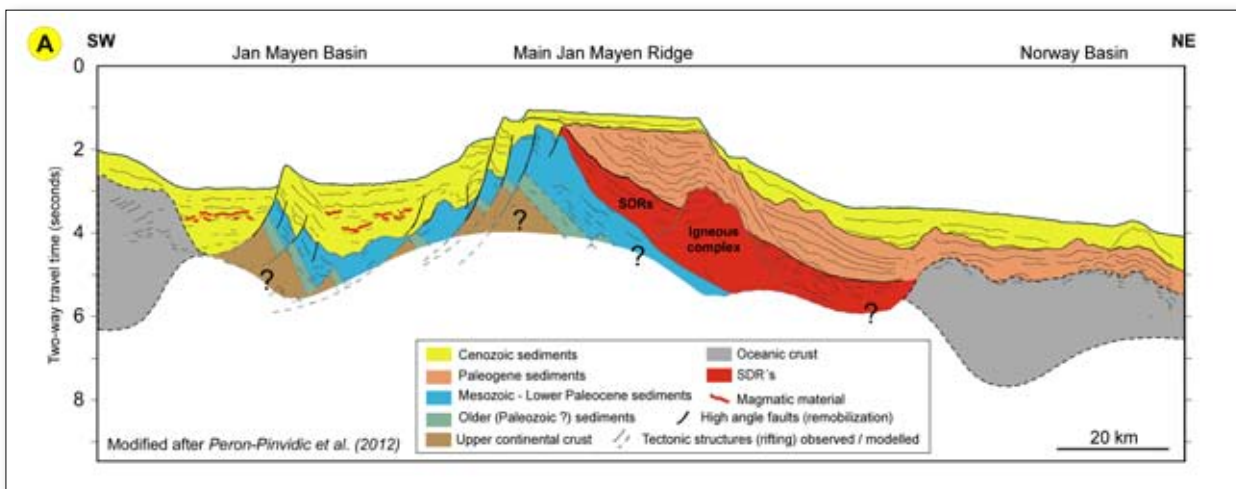


Legend:

- Intra Quaternary
- Intra Quaternary to Middle Miocene (Mid Tertiary Unconformity)
- Middle Miocene (Mid Tertiary) to Top Paleocene (Early Tertiary)
- Middle Paleocene (Early Tertiary - Floodplain Sediments)
- Lower Paleocene
- Upper Cretaceous
- Mid Cretaceous
- Lower Cretaceous - BCU, Cretaceous undiff.
- Jurassic & Triassic
- Permian - Devonian, Paleozoic undiff.

- Paleozoic Basement
- Caledonian Crystalline Basement
- Paleocene - Volcanics / Basalts
- Seaward-Dipping Reflectors (SDR)
- Oceanic crust
- COB (Continental-Ocean Boundary)
- Sills and dykes
- Fault - Fracture Zones
- Unit subdivision, general formation dip direction
- Unconformity

Jan Mayen Ridge cross sections



The Jan Mayen ridge is a complex system, probably influenced by the Norway Basin Fracture Zone and the East and Central Jan Mayen Fracture Zones.

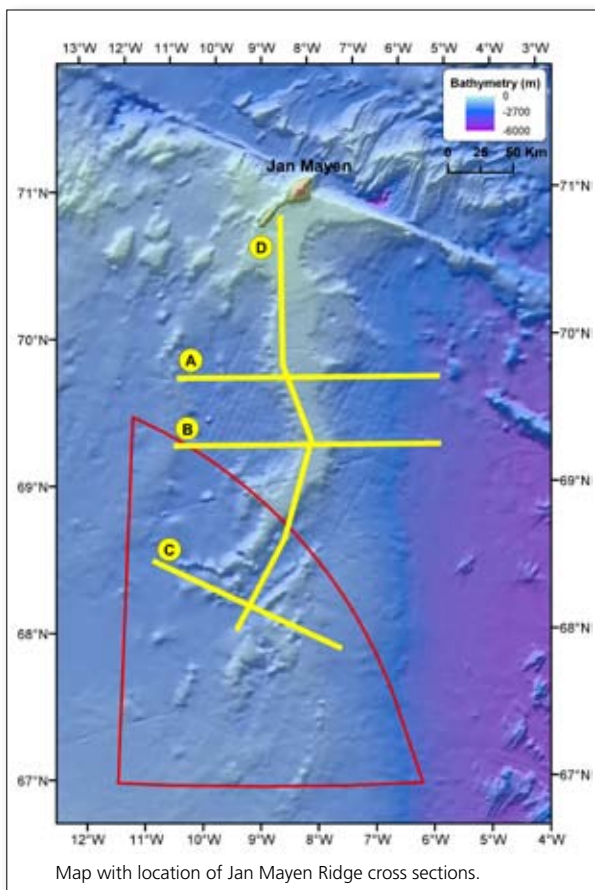
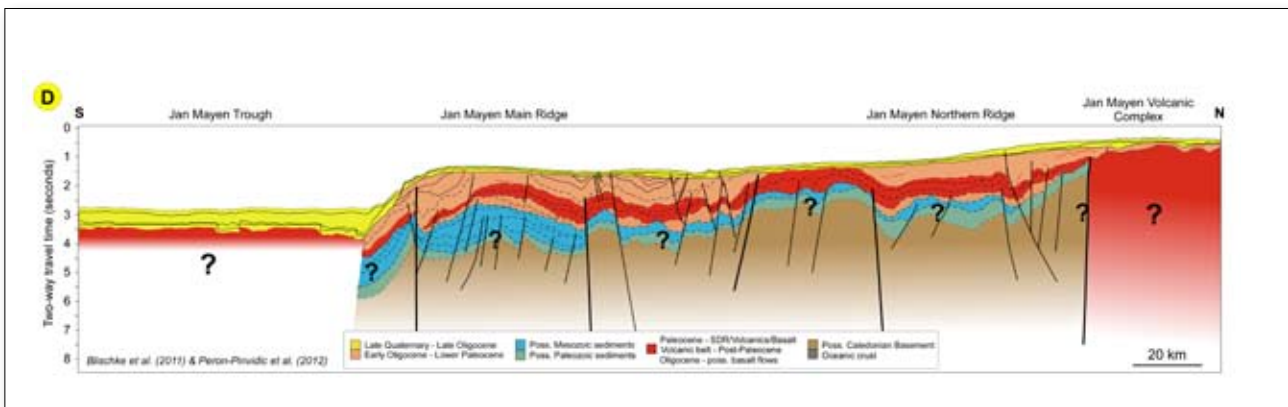
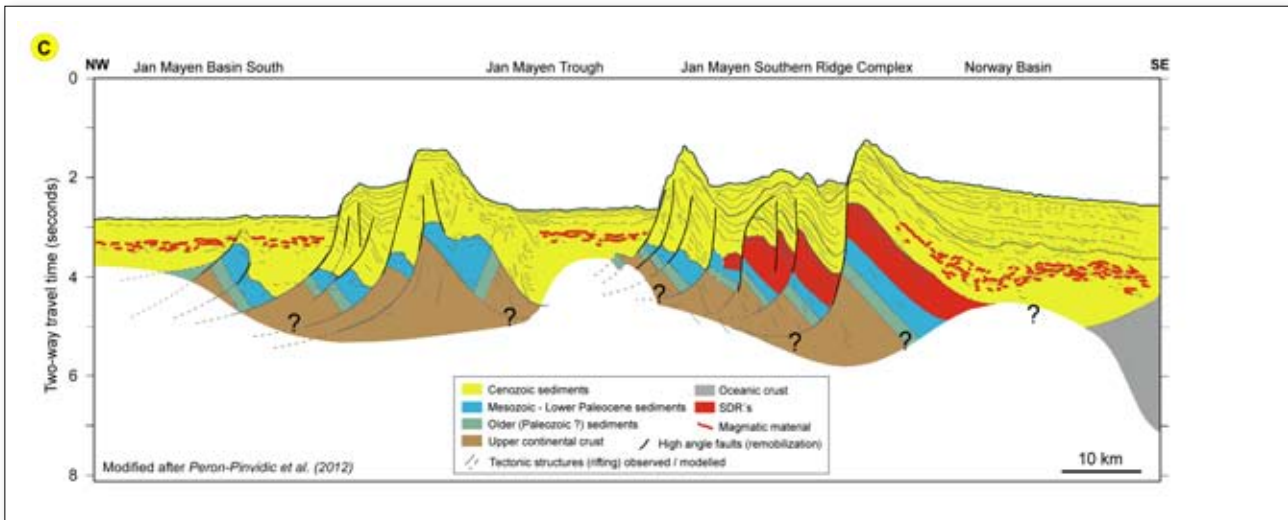
The main northern ridge (sections A, B & D) of the Jan Mayen microcontinent is well defined, continuous and flat-topped. It stands higher than the Southern Ridge Complex (sections C & D) which is strongly affected by normal faulting, generating numerous separated fault blocks and a generally more complex structure, increasing southwards.

The Jan Mayen Trough (section D) is believed to consist of buried grabens, intersected with rift basalt or intrusive and volcanic deposits of a failed rift system from the rift transition between the Aegir and the Kolbeinsey rift systems (Blichke et al., 2011; 2012). The northern boundary of the Jan Mayen Ridge (section D) is along the Western Jan Mayen Fracture Zone that cuts through the ridge just south of the Jan Mayen Island. The southern part (section C) is made up of several smaller

ridges which become indistinct towards the south and finally disappear at 67°N beneath young sediments and lavas (Blichke et al., 2011). It is impossible to define the southern extent of the ridge with any certainty, but recovery of Jurassic zircon xenocrysts from basalts in eastern Iceland may indicate a continuation of the microcontinent into the Icelandic shelf to the south (Scott et al., 2005).

The northern main ridge block has a distinct asymmetric structure (sections A & B), where its eastern margin dips steeply towards the deep Norway Basin, almost undisturbed by faulting, while its western margin is down-faulted towards the Jan Mayen Basin.

The eastern margin of the ridge (sections A, B, C & D) is covered by SDRs and igneous complexes or basalt lavas that are thought to be the top Paleocene marker. The youngest igneous event can be seen as a flat lying, opaque reflection seismic marker on sections that cover the Jan Mayen Basin and the Jan Mayen Trough. It is



Map with location of Jan Mayen Ridge cross sections.

believed to consist of extensive sheets of flat-lying, shallow lavas and / or intrusive that cover the underlying structures in a very shallow and wet sediment of possibly Early Miocene age (e.g. Peron-Pinvidic et al., 2012a; 2012b), formed during the period of the JMMC - Mid-East-Greenland breakup volcanism and the establishment of the Kolbeinsey Ridge. This opaque reflection seismic marker obscures sub-basalt interpretations and allows only a hypothetical view of the structures in the Jan Mayen Basin.

The western margin (sections A, B & C) is a system of listric and normal fault blocks, down-faulted towards the Jan Mayen Basin. The faults developed due to the rapid extension prior to the opening of the Kolbeinsey ridge system between the Mid Eocene to Oligocene.

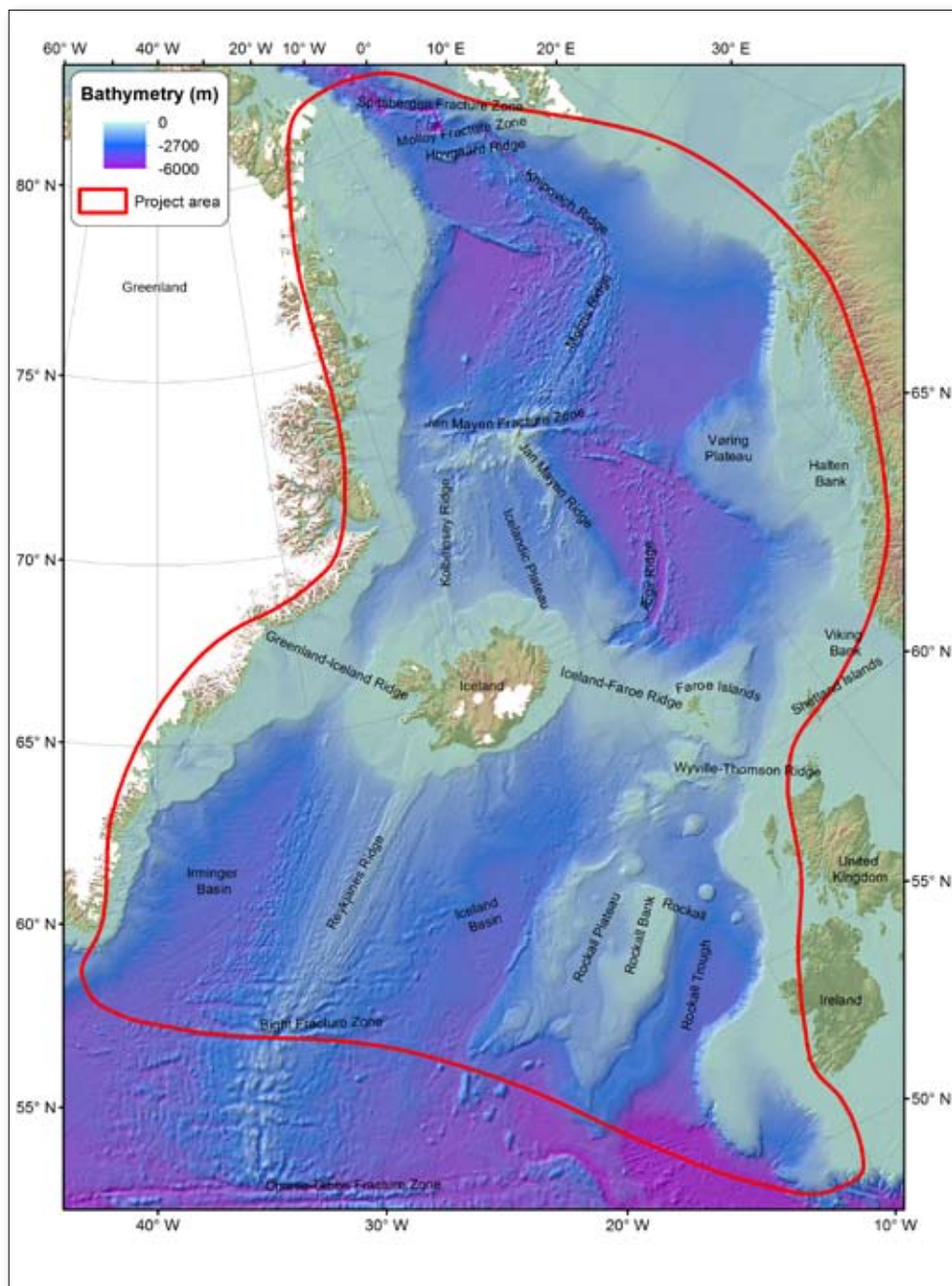
Sub-Paleocene strata and the Jan Mayen basin fills and structures are inferred based on correlation to revised refraction data (Breivik et al., 2012 and Kandilarov et al., 2012) and analogue comparison along the conjugate margins of the micro continent, with the Jameson Land Basin to the west and the Møre Basin to the east.



NAG-TEC: Northeast Atlantic Geoscience Tectonostratigraphic Atlas

NAG-TEC is a multinational research project of nine Geological Surveys in Northern Europe with the purpose of developing a new tectonostratigraphic atlas of the North Atlantic region, with an emphasis on conjugate margin comparison.

All relevant information that has been acquired in recent decades on the Northeast Atlantic will be reviewed, coordinated and published in an Atlas. In addition, all data will be made available in digital form so they become more easily accessible within geographic information systems (GIS).





It is anticipated that the project will increase knowledge on the geological development of the Northeast Atlantic; including the rifting history, spreading rate and direction, volcanism and sedimentation. The project should also provide new insights into the palaeomagnetism, gravity anomalies, geochemistry and crustal heat flow. The practical gains are likely to be information on possible natural resources and their potential for exploration, including the possibility of oil and gas resources.

The new Atlas will provide:

- Quantitative analysis of key basin parameters.
- Regional correlations of key stratigraphic units, unconformities, and geologic formations.
- An understanding of the connectivity and similarities between known prospective regions and unexplored areas.
- Comprehensive analysis of conjugate margin pairs.

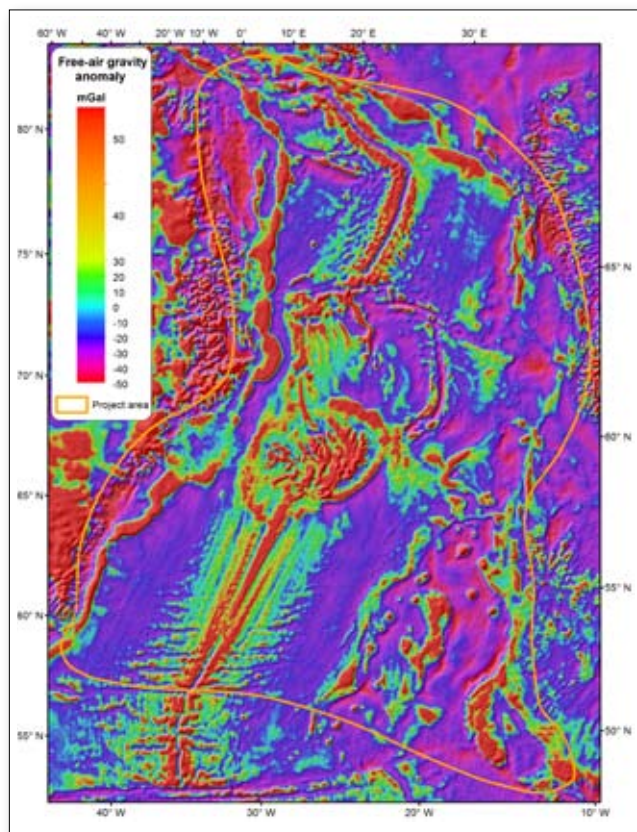
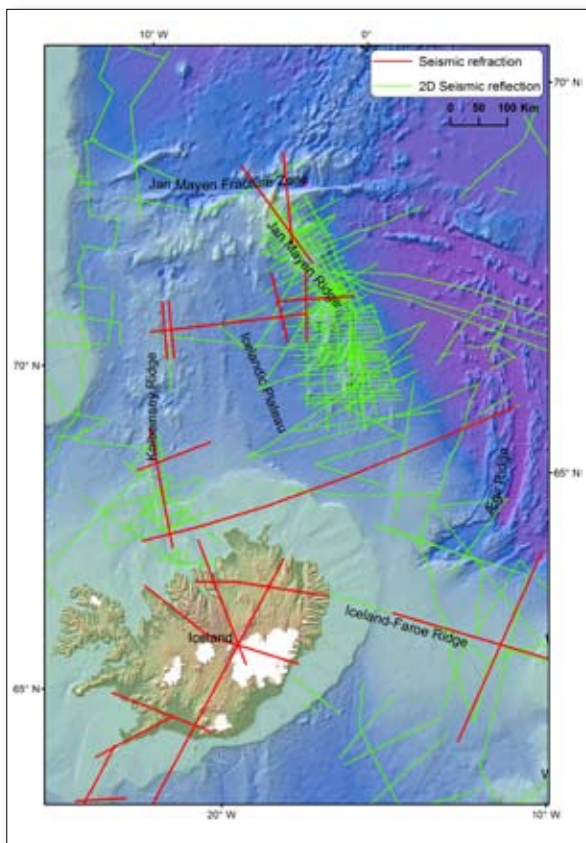
Key outcomes:

- Build an understanding of full-rift system:
 - Comprehensive analysis of conjugate margin evolution.

- Quantitative constraints on key basin parameters:
 - Crustal thickness.
 - Subsidence and uplift history.
 - Burial and exhumation history.
 - Key unconformities and their interpretation.
 - Interaction between volcanic events and sediments.
 - Importance of pre-existing structure.
- An understanding of the basin response to magmatic seafloor spreading.
- More accurate reconstructions to better constrain sediment sources and sinks through time.
- Constraints on continent-ocean transition zones.
 - Deep water basin evolution.
- A unified stratigraphic and structural framework.
- Regional correlations and comparisons can de-risk exploration in poorly known areas.

The project will form the essential knowledge base for setting regional exploration priorities for the next decade and beyond.

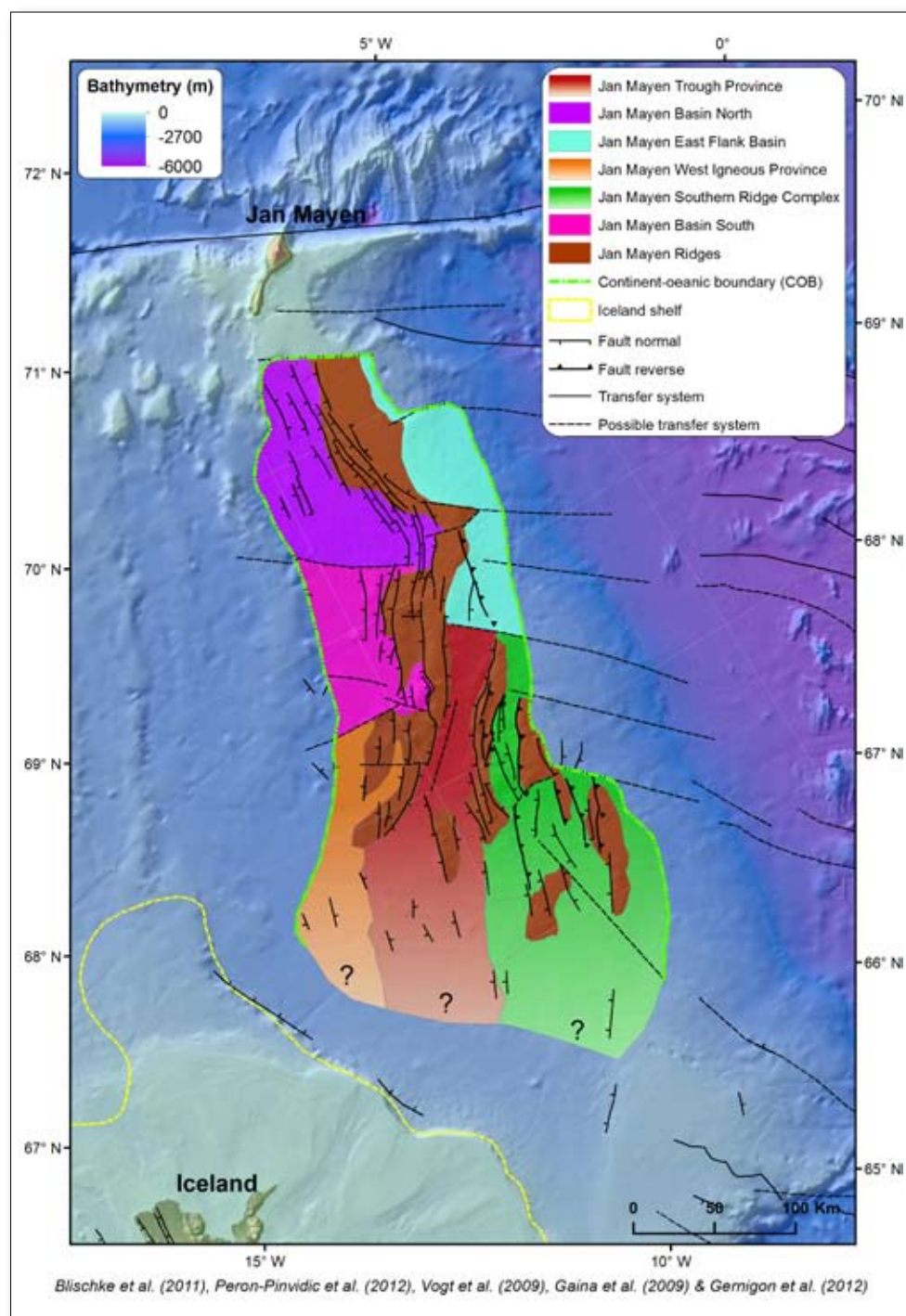
Website: <http://nagtec.org/>



Structural Elements

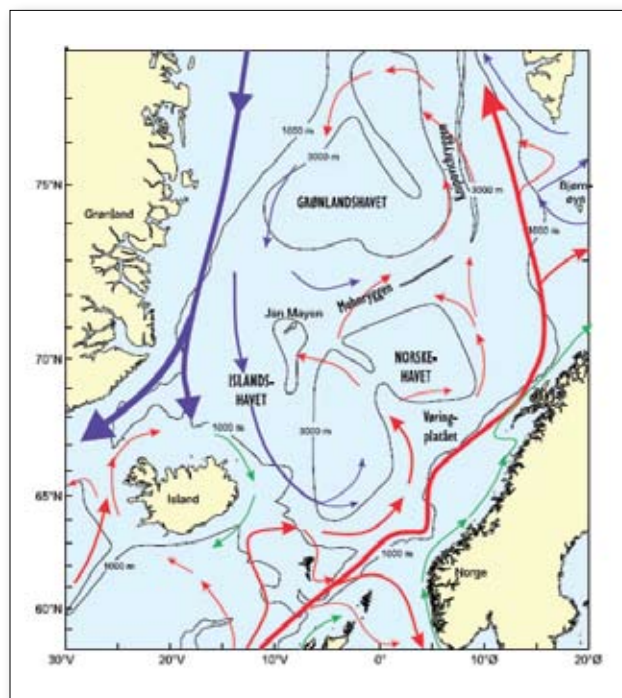
Traditionally the Jan Mayen Ridge has been subdivided into the Main Ridge and the Southern Ridge Complex with associated listric and normal extensional fault patterns. The structural model indicates that the JMR itself is subdivided into smaller blocks with small highs and lows that were activated during the opening of the Aegir Ridge. The blocks on the western flank show indications of uplift during the Paleogene-Early Neogene, and near to

complete erosion of the central highs along the Southern Ridge Complex that are covered with very thin marine sediment during the post-rift time. This uplift process is most likely connected to the rifting and opening along the Iceland-Faroe Transfer system, where the transition occurred from the Aegir Ridge system to the Kolbeinsey Ridge system.



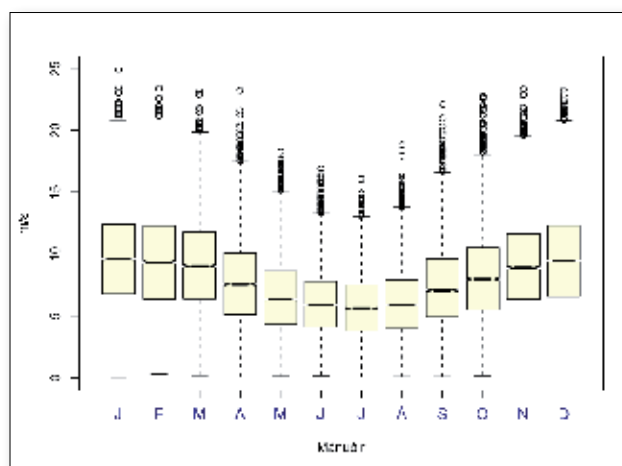
Environmental conditions

- Mean summer temperatures 5 to 8°C, winter temperatures -2 to 0°C
- Yearly precipitation about 700 mm, winter lows with up to 25 to 30 cm daily snow.
- Mean summer wind speed ca 6 m/s, winter wind speed ca 10 m/s.
- Frequent fogs during summer.
- Some occurrences of icing in the winter months.
- No danger of sea ice under present climatic conditions.
- Wave heights lower than at the west-coast of Norway, 100 year wave height about 12 m.
- Buoy for meteorology and wave conditions was operated for one year.
- Mooring with ADCP and traditional current meters for oceanography was operated for one year.
- Occasional catches of pelagic fish stocks (capelin, herring) in the area.
- No known demersal fish catches.
- Only relatively common species of whales and sea birds.
- Bathymetry and benthic fauna were investigated in summer 2008 and demersal fish in 2009.



Currents

The area is within a cell of anticlockwise flowing, relatively weak branches from the cold and warm main ocean currents in the north and south.

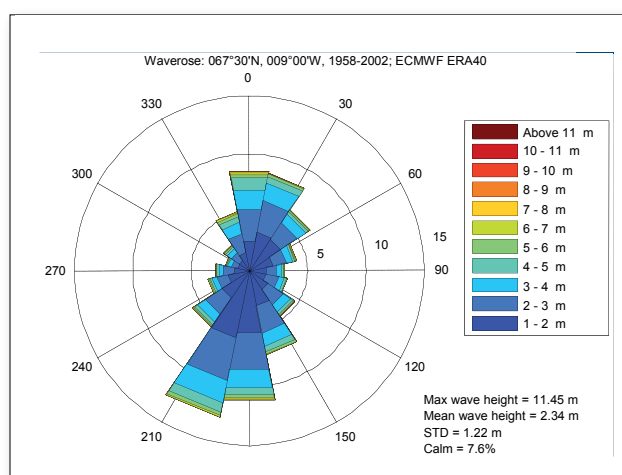


Wind speed

Distribution of wind speed in the Dreki area is shown for each month. Half of the observations are within the box, the median is shown with a horizontal mark.

Wave heights

Wave heights in the Dreki area are lower than at the west-coast of Norway, 100 year wave height is about 12m. The main wave direction is from the SSW and S. Outliers are indicated by circles.



Taxation of hydrocarbon extraction in Iceland

The tax regime of hydrocarbon extraction is based on the following four taxes/fees:

- a. **General Corporate Income Tax** which is currently 20% of the company's profit.
- b. **Area Fee** which is charged for concessions for exploration and production of hydrocarbons. For the first six years the permit is in force the licensee shall pay an annual fee of ISK 10,000 per sq. km of the concession area. The annual fee increases by ISK 10,000 per sq. km each additional year. However, the annual fee shall never exceed ISK 150,000 per sq. km. No area fee is paid for a prospecting license.
- c. **Production Levy** which is calculated on the market value of hydrocarbons processed from the resource. The levy rate is fixed at 5%. The levy is treated as a deductible operational cost.
- d. **Special Hydrocarbon Tax** which is levied on the profit that is generated by the activity. The tax rate is progressive relative to the profit ratio which is the ratio between the total income and the tax base. The tax rate of the special hydrocarbon tax, as a percentage is calculated as follows: Profit ratio x 0.45. As an example; if the profit ratio is 40% the tax rate is 18% (40×0.45).

It is assumed that all the parties involved in hydrocarbon extraction will be liable to other taxes and other public dues that are normally levied in Iceland under the laws and regulations in force at any given time. However, there are several notable exceptions; the most important is that the hydrocarbon extraction activities will be exempt from VAT. Furthermore, rules on loss and depreciation in Iceland are favorable to the hydrocarbon industry.



Legal framework

- EU legislation has been transposed in many important areas into Icelandic law, as Iceland belongs, with Norway, Liechtenstein and the EU countries, to the European Economic Area (EEA).
- Icelandic Parliamentary Act No.13, 2001, on Prospecting, Exploration and Production of Hydrocarbons applies to petroleum activities.
 - Transposes into Icelandic law EU directive 94/22/EC on the conditions for granting and using authorizations for the prospecting, exploration and production of hydrocarbons.
- Other relevant EU legislation, including issues of health, safety and environment (HSE), has been transposed into Icelandic law.
- Iceland has ratified the OSPAR convention on the protection of the marine environment of the North-East Atlantic as well as the international MARPOL protocol for the prevention of pollution from ships.

Facts about Iceland

- Republic with 320,000 inhabitants.
- Member of the Schengen Area and cooperation by a special agreement with the EU.
- Member of NATO, strong ties with North-Atlantic neighbours and other Nordic countries.

Orkustofnun – The National Energy Authority of Iceland

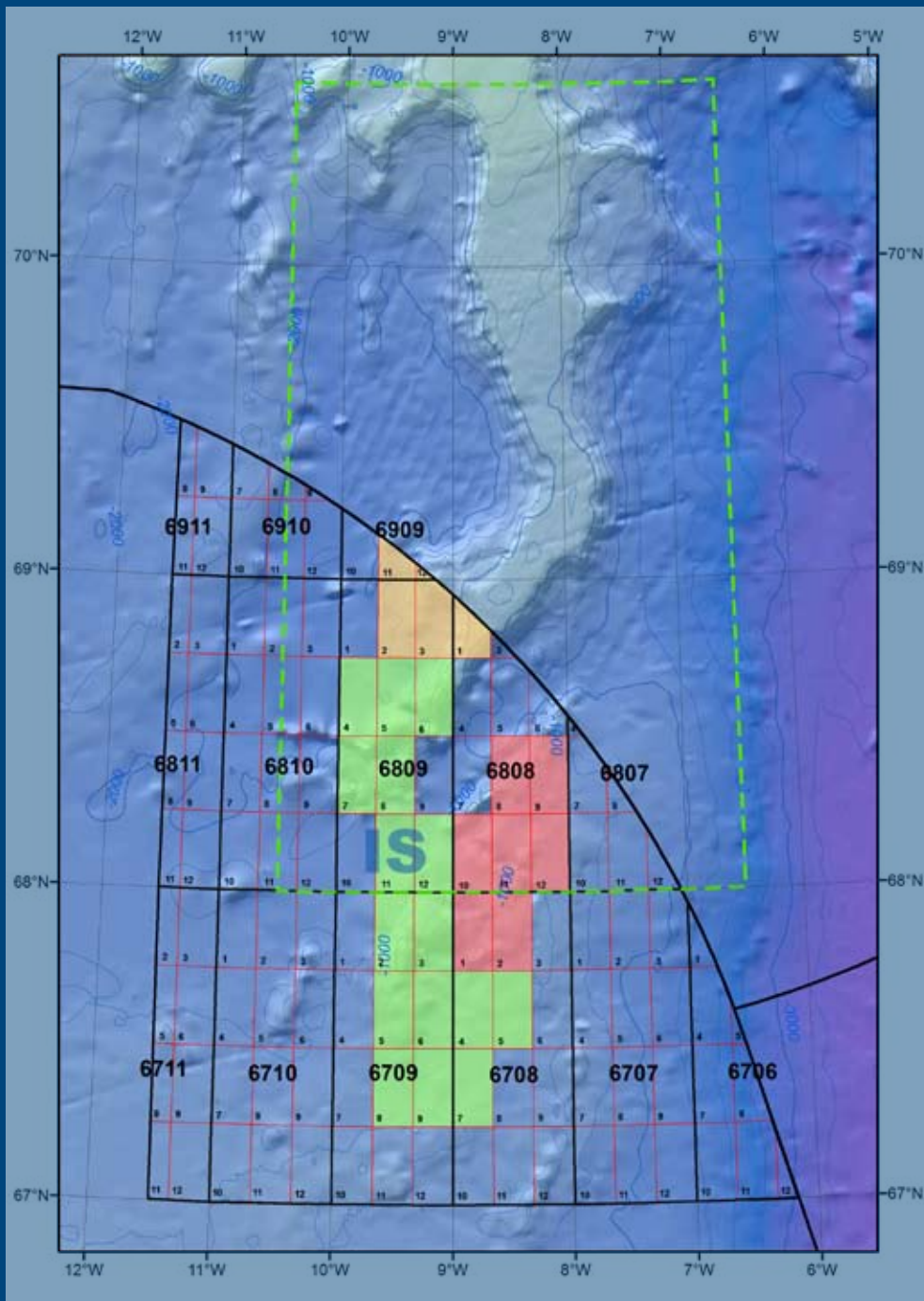
Orkustofnun is a government agency under the Ministry of Industries and Innovation. Its main responsibilities are to advise the Government of Iceland on energy issues and related topics, license and monitor the development and exploitation of energy and geological resources, regulate the operation of the electrical transmission and distribution system and promote energy research. Orkustofnun has been instrumental in the execution of government policy regarding exploration and development of geothermal resources, and in advising communities, companies, individuals and foreign governments about their utilisation of these resources. The United Nations University Geothermal Training Program (UNU-GTP) is run as a separate unit within Orkustofnun.

ÍSOR – Iceland GeoSurvey

ÍSOR, is a leading provider of scientific and technical expertise to the geothermal industry in Iceland and abroad. ÍSOR offers consulting services worldwide on most aspects of geothermal exploration, development, and utilization as well as groundwater studies, marine geology and environmental monitoring. ÍSOR provides training and education on these and related issues. ÍSOR is a self-financing, state-owned, nonprofit institution. It receives no direct funding from the government and operates on a project and contract basis like a private company. ÍSOR is based on six decades of continuous experience in the field of geothermal and hydropower research and development. During this period ÍSOR has provided consulting, training, and scientific services to the Icelandic power industry and the Icelandic government, as well as to numerous foreign companies and governments worldwide.

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Grensásvegur 9
 IS-108 Reykjavík
 Iceland

Main Contacts:
 Mr. Kristinn Einarsson, ke@nea.is
 Mr. Thórarinn S. Arnarson, thorarinn.sveinn.arnarson@nea.is
 Tel: +354 569 6000 | Fax: 354 568 8896
 www.nea.is / www.isor.is