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- Deep sea discoveries, resources and technologies

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- integration of Magnetics And Gravity In Northern Exploration

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Editors:
Harald Brekke, NPD
Gunn Kristin Haukdal, NGF
Odleiv Olesen, NGU
Terje Thorsnes, NGU

Satellite measurements and global datasets in the Arctic: The benefits of the ASEP method

Wienecke, S.*, Fichler, C.*, Lundin, E.*, Stadtler, C.** and Gram, C**

*) Statoil ASA, TNE, Research and Development, 7005 Trondheim
**) Statoil ASA, TNE, Global Exploration Technology, 4035 Stavanger

For a global tectonic study in poorly explored areas there is a clear advantage in using the worldwide coverage of satellite data. The most important item that is addressed here is the investigation of the crustal architecture in terms of plate boundaries, oceanic-continental transition, large scale faults, failed ridges, lower crustal bodies and other tectonic elements.
The derived spatial distribution of equivalent elastic thickness (Te) indicates significant structural units within the crust as a function of their isostatic response. Te of the Earth's crust can be estimated using the analytical solution of the elastic plate called "ASEP method". This method overcomes drawbacks of spectral methods and allows the calculation of flexural rigidity and Te with a higher spatial resolution.
Input data include satellite measured seafloor topography and potential field data merged with airborne, surface and submarine data.
The Circum Arctic region is presented as a case example. Since satellite data are so readily available the ASEP is a powerful tool in areas with limited access to seismic data. Low costs and low environmental impact are also obvious advantages.
We used the Arctic Gravity Project data compilation that consists of free-air anomalies offshore and Bouguer anomalies onshore. Integrated 3D density modelling and Te calculation with the ASEP method allow us to identify regions with different petrophysical properties, which may reflect anomalous parts of the crust (e.g. sutures, rift zones, lower crustal bodies).
The regional structures and/or lineaments proposed by the Te distribution should always be calibrated against other data or methods in order to verify an interpretation. Our results have revealed an anomalous intraplate crustal structure. The features correlates well with other geo-scientific results (geology, paleo-geography and paleo-topography), as well as with results from the "pseudo gravity"-method combining the magnetic and gravity signal. Combining all observations the feature can be linked to the location of a proposed suture zone.
Global datasets of potential field data form important constraints on the crustal architecture, which in turn is a fundamental aspect in plate reconstructions. The Circum Arctic crustal thickness map derived by gravity inversion correlates very well with other results also brings out previously unknown or subtle features. An example is the improved definition of the Laptev rift.

The results of R\V "Academic Nikolai Strakhov" cruises in the north part of the Barents Sea and the Knipovich Ridge

Zayonchek, A.[1], Brekke, H.[2], Leonov, Ju.[1], Sokolov, S.[1], Mazarovich, A.[1], Hytorskoy, M.[1]

[1] Geological Institute RAS,
[2] Norwegian Petrolem Directorate

The main goal of these cruises organized by GIN RAS and NPD was to study the Late Mesozoic-Cenozoic tectono-magmatic history of the shelf and slope of the Barents Sea. During the study, three marine expeditions were carried out in the study area, i.e. the northern and southern parts of the Knipovich Ridge and the area between Svalbard and Franz Josef Land.
The complicated plate boundary in the northern part of the Norwegian-Greenland Sea reflects its complex opening history.
A regional continental Spitsbergen Shear Zone marked the plate boundary between Norwegian Sea and Arctic Ocean (Talwani and Eldholm, 1977). The magnetic anomalies are not coherent over long distances making their identifications difficult. It is well known that the Greenland and Hovgard Ridges are continental slivers related to fracture zones. However, the results of our cruises show that the Hovgard Seamount (east to the Hovgard ridge) may also consist of continental crust. Furthermore, our results show that the Hovgard Seamount is connected with the Hovgard Ridge by the Hovgard Fault Province. This means that the continental crust involved in the plate margin development between Svalbard and Greenland is of much larger areal extent than previously recognised (Myhre et.al, 1982; Lawer et al, 1990; Engen and Faleide, 2007).
The results of the cruise in the northern part of the Barents Sea have identified new geological features that have lead to a revision of our understanding of the area. The central part of the Erik Eriksen Trough (EET) system reveal extremely high heat flow (300-500) in connection with a bathymetric feature that could be interpreted as modern volcano. At the Hinlopen margin our data show an erosional unconformity and channels related to the EET.