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NORDISK MINERALSYMPOSIUM 2003

Ressurser - Kunnskap - Verdiskapning

- Hvilken betydning vil de geologiske ressursene i Norden ha i fremtiden
- Verdiskapning i bergindustrien – betydning for bedriften, lokalsamfunnet, regionen og nasjonen
- Kunnskap som forutsetning for verdiskapning

Ekskusjoner til lokale mineralprodusenter

Verdalskalk

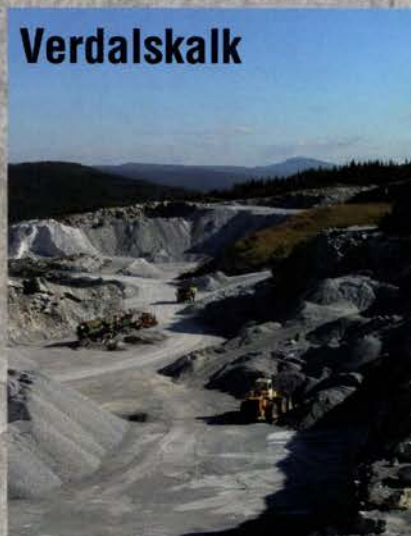


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Radisson SAS Royal Garden Hotel



Øppdalskifer

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Norges geologiske undersøkelse



NORSK BERG
NORSK BERGEIERSKAP



SINTEF

Preface

This volume of the Norwegian Journal of Geology-Norsk Geologisk Tidsskrift is a collection of papers that stem from research conducted during the five-year Basin Analysis and applied Thermochronology on the Mid Norwegian shelf (BAT) project (1998-2002). The project was a cooperative endeavor between the Geological Survey of Norway and eight petroleum companies, Norsk Agip, BP, ChevronTexaco, ConocoPhillips, ExxonMobil, Norsk Hydro, Shell and Statoil, with research affiliates at the University of Oslo and the Norwegian Petroleum Directorate. The project has focused upon generating an internally consistent and complete tectonic history of the Mid Norwegian shelf and adjoining onshore areas, from Late Paleozoic through Recent times.

As the project has drawn to a close in 2002, the researchers in the BAT study have clearly felt that the project scope, the degree of interdisciplinary integration, and very importantly, the enthusiastic engagement and dedicated interest shown by our industry sponsors, were in many ways unique. In this regard, we felt it necessary to assemble and present some of the more important scientific results of the project in a multidisciplinary medium that is easily accessed by our project sponsors. At the same time, we wanted to demonstrate some of the potential advantages of onshore-offshore, industry-institute, applied and basic research to a broader geoscience audience. A natural outcome of these thoughts, from both philosophical and practical standpoints, was to consider publication of a collection of scientific papers in a Norwegian geoscience journal - the Norwegian Journal of Geology was the medium chosen for this purpose.

The BAT project has spanned a research spectrum that has included structural geology onshore and offshore, deep crustal structure and basin architecture, potential field (gravity and magnetics) data and interpretations, plate reconstructions, and isotope geochronology. The collection of papers presented herein is a sample of results from research in some of these theme areas. The first two papers, Deep structure of the Mid Norway rifted margin by Osmundsen et al., and Orogen-parallel extensional denudation of the Caledonides; an overview by Braathen et al., present regional structural interpretations, respectively, offshore and onshore Mid Norway, grounded in a common theme of the kinematics and history of the deep structural template that has guided passive margin development. Osmundsen et al. use interpretations from high-quality, deep seismic data to address deep crustal structural geometries as controls on offshore basin architecture. Braathen et al. describe the regional kinematics of onshore Mid Norway geology through the history of crustal-scale shear-

and extensional detachments of Paleozoic age. The reactivation of these large-scale syn- and post- 'Caledonian' structures in basin evolution offshore are emphasized in both contributions.

The subsequent two papers, Bridging the gap between the onshore and offshore geology in the Nordland area, northern Norway by Olesen et al., and A study of basement structures and onshore-offshore correlations in Central Norway by Skilbrei et al., take the deep crustal interpretations a step farther through description and interpretation of potential field (gravity and magnetic) data in the on- and offshore Mid Norway and broader Scandinavia areas. Olesen et al. compare gravity data in the Nordland region and southern Norway to propose different interpretations for the relatively recent uplift and high topography characteristic of these two regions. Modeling of gravity and magnetic data focused in the Nordland region has allowed interpretation of large, linear faults as transfer zones in the Lofoten area. Skilbrei et al. use magnetic and gravity data to trace onshore, crustal-scale detachments into proposed offshore continuations that lie beneath the sedimentary cover off Mid Norway. Their probable control on basin architecture links back to the deep seismic interpretations of Osmundsen et al. Estimated depths to tops of magnetic and gravity sources have facilitated generation of the top-to-basement surface for the Mid Norwegian shelf. The implications of both the structural and potential field studies are incorporated into Greenland - Norway separation: A geodynamic model for the North Atlantic by Mosar et al. where a structural model for the Scandinavian North Atlantic passive margin from Permo-Carboniferous through Present is proposed.

Moving into the realm of geothermochronology, the final three papers address different temporal and thermal aspects of the two sides of the passive margin - Mid Norway and importantly, East Greenland. Nordgulen et al. use U-Pb geochronology and structural data from the vicinity of the Kollstraumen detachment, Mid Norway, to propose a Siluro-Devonian history for the juxtaposition of the Helgeland Nappe Complex and a gneiss-cored basement culmination, the Central Norway basement window. The history of this detachment is especially important when seen in light of its trace into the offshore regions as indicated by potential field and deep seismic interpretations (Osmundsen et al. and Skilbrei et al.). The $^{40}\text{Ar}/^{39}\text{Ar}$ geochronology method was applied in two different ways in the final two papers by Eide et al. and Hartz et al. The former paper moves to the northern end of the Helgeland Nappe Complex and presents a data set documenting the Devonian-Carboniferous timing of ductile extensional shearing and unroofing related to motion on the Nesna Shear Zone. The Nesna Shear Zone is another large-scale crustal feature that appears to have continuations

into the basement of the Trøndelag Platform. A slightly different application of the $^{40}\text{Ar}/^{39}\text{Ar}$ method is illustrated in the Hartz et al. contribution whereby detrital white-mica, single-grain laser $^{40}\text{Ar}/^{39}\text{Ar}$ ages from Permian to Cretaceous sedimentary packages in the Hold with Hope region, East Greenland, are compared to $^{40}\text{Ar}/^{39}\text{Ar}$ cooling ages from nearby granitic domains. The paper demonstrates use of the $^{40}\text{Ar}/^{39}\text{Ar}$ method as a provenance tool in an onshore region that many use as an analogue for offshore, Mid Norway sedimentary basins.

An important theme is the making of a mountain belt – the Caledonides – and its subsequent disintegration through time. The collision between Greenland and Scandinavia – referred to as the Late Silurian to Early Devonian Scandian Orogeny – is a recurring theme in the papers. Recent research has shown that collisional contraction and thrusting of nappes hundreds of kilometers onto the Baltoscandian margin is intimately associated with (initial) extensional collapse of the orogen. Therefore, models describing the breakdown of the Scandinavian Caledonides must be tied to a thorough understanding of the collision and its effect on the rocks in different structural positions or - from foreland to hinterland. The timing of this event and its effect on rocks at different crustal levels remains to be precisely determined, and as yet there is no consensus concerning the use of terms such as late-, latest- or post-Scandian. To resolve these issues will be an important research theme in the years to come.

The scientific results published in this volume are founded on long traditions of mapping and structural work through which an enormous amount of data have been gathered. One of the successes of the project has been the integration of these data with new structural and geochronological data obtained onshore as well as offshore. The project has shown that adequate maps and regional knowledge are required, not only for successful integration of data sets, but also to identify key areas where additional mapping must be conducted prior to collection of samples for analytical work needed to test new ideas and hypotheses.

In closing, we note that the Norwegian geoscience community is small, relative to many others worldwide, but that it is remarkably strong internationally in numerous disciplines and has great potential to become stronger. This potential can only be realized through continued multi-disciplinary research and dedicated effort on the part of universities, national institutes and industry to maximize and maintain links between different research fields and across organizational boundaries. This is a challenge, but one well worth the effort.

Trondheim,
December 2002

Elizabeth Eide
Øystein Nordgulen

