The main cause for the NW- oriented compression at Moskenes may be an intra-block effect of a progressive right-hand transtension in the late stage of rifting of the North Atlantic. The fractures at Moskenes, thus, developed as Riedel shears in between large ENE- striking transtensional faults (parallel to the Lofoten Ridge). Tertiary ridge push from the initial opening of the Atlantic Ocean is another possible factor. A third explanation for the complexity of fracture geometries at Moskenes is the degree of the right-hand shear component in the compressive strain field; pure shear is expected to yield conjugate fractures or parallel fractures, simple shear will create undulating shear zones. A final cause is the relative strength of the incremental stress axes, for example: $\sigma1 \sim \sigma2 > \sigma3$ may yield parallel tension fractures, while $\sigma1 > \sigma2 \sim \sigma3$ may yield conjugate fractures.
These results also imply that reservoir geologists must expect heterogeneous fracture patterns, and thus varying reservoir properties, at small scale.

Petrological evolution during near-isothermal decompression of high-pressure granulites, exemplified from the Lurio belt, northern Mozambique

Engvik, A.K. & Tveten, E.

Geological Survey of Norway, 7491 Trondheim (E-mail: ane.engvik@ngu.no, einar.tveten@ngu.no)

High-pressure mafic granulites occur in the Lurio belt of northern Mozambique, Eastern Africa. The mafic granulites contain the mineral assemblage Grt + Cpx + Pl + Qtz ± magnesiohastingsite. Garnet porphyroblasts show a zoning of increasing almandine- and spessartine-content and decreasing grossular- and pyrope-content from core ($Alm_{44}Py_{24}Gr_{30}Sps_2$) to rim ($Alm_{53}Py_{26}Gr_{18}Sps_4$). The zoning is interpreted as a retrograde diffusion zoning with preserved core chemistry representing the peak metamorphic composition. Mineral reaction textures occur in the form of monomineralic and composite Pl ± Opx ± amphibole ± Bt ± Mag coronas around garnet porphyroblasts. Geothermobarometry indicates peak metamorphic conditions up to 1.55 GPa and 905°C (Stage I), corresponding to crustal depths of about 50 km. Formation of Pl + Opx + Mag-bearing coronas surrounding garnet indicates a near-isothermal decompression of the high-pressure granulites into lower pressure granulite-facies conditions (Stage II). Development of Pl + amphibole-coronas enclosing the same garnet porphyroblasts, indicates a subsequent cooling into amphibolite-facies conditions (Stage III). Symplectitic textures of the corona assemblages indicate rapid decompression. Modelling based on the equation for characteristic length scale of diffusion and diffusion coefficients shows that the garnet porphyroblast of 5 mm size will homogenise by diffusion mechanisms in approximately 900.000 yrs at temperatures of 900°C. In the studied samples, the retrograde diffusion zoning in garnet occurs over a characteristic length of 500 µm. The modelling shows that the observed diffusion zoning could be achieved during less than 1 Myr at 750°C. At amphibolite-facies conditions, however, this requires a longer period, from 1-10 Myrs. The high-pressure granulite facies metamorphism of the Lurio belt, followed by rapid, near-isothermal decompression and subsequent cooling, is in accordance with a long-lived tectonic history accompanied by high magmatic activity in the Lurio belt during the late Neoproterozoic-early Palaeozoic East-African-Antarctic-Orogeny.

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ProGEO Norge

Erikstad, L.[1], Nakrem, H.A.[2], Dahlgren, S.[3], Markussen, J.[4], & Smith-Meyer, S.[5]

1) *NINA, Gaustadalléen 21, 0349 Oslo*
2) *NHM, Geologi, Pb.1172 Blindern, 0318 Oslo*
3) *Regiongeolog, Svend Foynsgt. 9, 3126 Tønsberg*
4) *Fylkesmannen i Oslo og Akershus, Miljøvernavdelingen, Pb. 8111 Dep., 0032 OSLO*
5) *NVE, Pb. 5091 Maj, 0301 Oslo*

Vern av geologiske og geomorfologiske områder har snart en 100-årig historie i Norge. I forvaltning av natur, landskap og ved avveiing mellom bruks- og verneverdier er forholdet til geomangfold og geologisk naturarv viktige, men forsømt i norsk naturforvaltning.
Den europeiske organisasjonen ProGEO har i 25 år hatt fokus på geomangfold og geologisk naturarv. Organisasjonen har både regionale og nasjonale undergrupper og fungerer som et viktig internasjonalt nettverk.
ProGEO "The European Association for the Conservation of the Geological Heritage" har følgende mål:

- To promote the conservation of Europe's rich heritage of landscape, rock, fossil and mineral sites.
- To inform a wider public of the importance of this patrimony, and of its relevance to modern society.

- To advise, in our countries and in Europe as a whole, those responsible for protecting our Earth heritage
- To organise and participate in research into all aspects of planning, science, management and interpretation that are relevant to geoconservation.
- To involve all countries in Europe, exchanging ideas and information in an open forum, and taking a full part in conservation in a global setting, including the formulation of conventions and legislation.
- To work towards an integrated European listing of outstanding geoscience sites, thus enabling full support to be given to the work of other international bodies, as well as to national initiatives towards site protection.
- To achieve an integrated approach to nature conservation, promoting a holistic approach to the conservation of biological and physical phenomena.

Det er nå dannet en nasjonal ProGEO gruppe i Norge som vil ha som formål å styrke arbeidet med forvaltning av Norges geologiske naturarv og å sikre at geomangfoldet får en rettmessig plass i norsk naturforvaltning (på linje med biologisk mangfold).
Den faglige spennvidden favner om alle geofag og strekker seg fra vern av små geologiske forekomster til forvaltning av det geofaglige elementet i verneplan for vassdrag. Verdensarvområder og lokalt viktige undervisningsområder danner ytter-punkter langs en verdiskala. Helheten er viktig og det ligger store utfordringer og muligheter innen forvaltning av geomangfoldet, blant annet innenfor vekstområdet geoturisme.

Referanse

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Influence of lower crustal flow on the post-rift subsidence of a basin

Gac, S.[1], Austegard, A.[1] , & Huismans, R.S.[1]

1) *Department of Geology, University of Bergen, Alle gaten 41, 5007 Bergen*

Extension of the continental lithosphere results in the formation of sedimentary basins such as the Vøring basin offshore Norway. Kinematic models are used to reconstruct the basin geometry and the thermal evolution through time. In kinematic modelling, the deformation does not result from rheology and applied boundary conditions but is purely geometric and depends on assumptions on the style of deformation. Pure shear deformation is commonly assumed in these approaches (McKenzie, 1978). Dynamic processes, such as lower crustal flow, can not be computed in kinematic modelling. But these processes might have large influence on the style of deformation and, eventually, on the basin reconstruction. In order to assess the amplitude of these processes it is necessary to implement dynamic modelling. Dynamic modelling approaches allow self consistent computation of deformation and provide insight in the factors controlling variations in the style of deformation.
Here, dynamic modelling is used to assess the amplitude of post-rift lower crustal flow and its influence on basin reconstruction. The lower crustal flow is driven by pressure gradients which arise from heterogeneous distribution of masses in the crust. In kinematic reconstruction of basins, each sediment layer is removed one by one in order to determine the geometry of the basins at different post-rift stages. At each stage, the subsidence pattern is computed making assumptions on sediment compaction, thermal properties and isostasy. However, simple computations show that the removing of varying sediment thickness layers induces pressure gradients which result in a horizontal lower crustal flow. If strong enough, this lower crustal flow modifies the repartition of masses in the crust and has consequences on the subsidence pattern. Therefore, in kinematic modelling, the subsidence might be overestimated over thinner crust and underestimated over thicker crust.
Simple numerical models of a post-rift basin are run. The geometry of the basin is prescribed. The crust is constituted with 2 layers, a constant viscosity lower crust and an elasto-plastic upper crust. The gravity and isostasy are fully taken into account. The deformation of the basin is computed before and after input of a sediment layer. A kinematic reconstruction of the basin before reconstruction is then implemented. In order to assess the amplitude of lower crustal flow and its influence on post-rift subsidence, the subsidence of the reconstructed basin is compared to the subsidence of the dynamic model before sedimentation. Models are run for different values of the main controlling parameters (viscosity of the lower crust, thickness of the lower crust, density and thickness of the sediment layer, sedimentation rate…).

References

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