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Mapping Palaeostructure And Palaeobathymetry Along The Norwegian Continental Margin

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The technique of 3D-flexural backstripping has been used to derive a sequence of map restorations, back to the Base Cretaceous, for a major segment of the Norwegian Atlantic margin. The restorations cover the full extent of the Møre and Vøring Basins, a margin segment over 600km in length and 200-300km in width. The map restorations depict both surface palaeobathymetry and subsurface palaeostructure. The new 3D-modelling has been supplemented by more traditional forward and reverse 2D modelling of selected transects across both basins.

The 3D-backstripping is itself an extension of the established 2D technique (Roberts et al 1998) and incorporates the following geodynamic input:

- Layer-by-layer removal of the stratigraphic sequence, accompanied by sediment decompaction and incorporating long-term eustasy.
- Isostatic unloading, applying flexural isostasy in 3D, thus allowing for 3D variations in stratigraphic and structural geometry to be acknowledged.
- Reverse thermal subsidence modelling of two rift events, assigned to the Palaeocene and Base Cretaceous. β-factor for the Palaeocene breakup event has been mapped along the margin.
- Regional uplift/subsidence related to the Iceland mantle plume.

This range of input allows a complex geodynamic model for the margin to be established and has resulted in the earlier (2D) conclusions of Roberts et al (1997) and Walker et al (1997) being extended into 3D and mapped along the margin.

It is not yet possible to incorporate magmatic addition to the crust (extrusion and underplating) within the modelling, but this will be addressed by the work of the iSIMM project (see separate posters), in which we are all participants. The 3D models have, however, been validated by restoring the basalts of the Vøring Marginal High back to sea-level at the end of the Palaeocene.

Using the 3D models we have investigated:

- The palaeobathymetric history of the margin, back to the Base Cretaceous. The importance of reverse modelling thermal subsidence for reliable palaeobathymetric estimates is emphasized.
- Depositional patterns in the constituent basins, supplemented by decompacted isochore maps.

- The timing and spatial variation of extensional (fault-block) activity along the margin. There is a striking contrast between the outer Møre and outer Vøring Basins.
- The tectonic significance of the main Tertiary domes (Helland Hansen, Ormen Lange). In particular we have been able to isolate the tectonic and depositional/compactional elements to the growth of these structures

In addition we have used the isostatic component of the modelling to investigate whether flexural-isostatic equilibrium has been restored after the geologically-recent removal of the Storegga Slide from surface of the Møre Basin. The conclusion is that a significant component of rebound is still to occur and allowance for this must be made within the best-case 3D models.

Roberts, Lundin & Kusznir 1997. Journal of the Geological Society, pages 551-557
Roberts, Kusznir, Yielding & Styles 1998. Petroleum Geoscience, pages 327-338
Walker, Berry, Bruce, Bystøl & Snow 1997. Journal of the Geological Society, pages 537-544