The Stratigraphic Evolution of a Salt-Influenced Rift System: The Middle-Upper Jurassic of the Halten Terrace, Offshore Mid-Norway

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Recent research into the tectono-stratigraphic development of rift systems has mostly concentrated in regions where extension occurs within brittle basement; however, the presence of an intra-stratal salt detachment will profoundly influence the development of fault systems and, consequently, the syn-rift stratigraphic response. Therefore, pre-existing models may not be applicable to areas such as the Halten Terrace, offshore Mid-Norway, where extension occurred in the presence of a thick (> 400 m), Triassic salt layer.

Jurassic faults on Halten Terrace are characterised by two distinct populations; (i) a NE-SW-striking group which are basement-involved; and (ii) a N-S-striking group which are developed in the cover and detach downwards into the salt.

Sediment thickness (isochron) mapping allows the temporal evolution of the rift-related fault systems to be constrained. An important result is that the topographic expression of the basement-involved faults may have been subtle throughout the Middle Jurassic due to displacement being accommodated by movement of the salt (i.e. soft-linkage) associated with the development of low-relief monoclines. With continued extension and formation of a through-going fault plane (i.e. hard-linkage), fault scarps rapidly formed. Such an evolutionary history may be expected to have a profound effect on the distribution of syn-rift sediment within the rift, with rapid linkage of fault segments after salt breaching resulting in relay ramp-related sediment entry points being short-lived and sediment supply being high due to degradation of rapidly growing scarps.

The evolution of the fault systems impacted the stratigraphic evolution of rift-initiation strata which are represented by the shallow marine, Middle Jurassic Garn Formation. This unit shows subtle thickness variations with monoclinal hangingwall depocentres in the proto-hangingwalls of the basement-involved normal faults. The Upper Jurassic is dominated by deep-water claystones of the Melke and Spekk formations, but fine-grained sandstones have been also encountered. These sands are located adjacent to present-day fault scarps, and are thought to represent small fan systems derived from local degradation of Middle to Lower Jurassic Garn and Ile Formation sandstones which formed low-relief fault scarps at this time. Regional-scale sediment supply is not thought to be important with local sediment supply dominating during the rift-climax.