Response of Turbidite Dispersal Systems to Intrabasinal Normal Fault Growth and Progressive Confinement: Outer Moray Firth, North Sea, UK

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Turbidite dispersal pathways are significantly affected by complex seafloor topography generated during the development of small (few 10s Km wide) tectonically controlled basins. We investigate changes in turbidite distribution and architecture in response to extensional fault growth and confinement in sub-basins of the Moray Firth, North Sea.

Depositional patterns of the Claymore Sandstone Member, a syn-rift turbidite lobe system, are reconstructed within the evolving North Halibut Graben sub-basin. Structural analysis suggests that the basin formed through the interaction of NE-SW and E-W fault trends. Seismic cross sections and isochron maps of the syn-rift sequence demonstrate that sedimentation was initially concentrated in the hangingwall of NE-SW trending faults and that subsequent propagation of E-W faults resulted in a shift of the overall depocenter.

Sedimentological analysis suggests that variations in the turbidite system are directly related to the changes in basin-floor geometry described. Well correlations reveal initial lobe building in the south followed by a northward shift around the time of E-W fault propagation. Core interpretations illustrate the effects of basin confinement on facies architecture. Turbidite deposits captured by the E-W fault trend are thicker, sandier and more amalgamated than their less confined counterparts. Variations in lobe thickness can be linked to fault displacement rates and slumps become more common as propagation continues.

Our observations indicate that structural evolution of extensional sub-basins can have a significant effect on contemporaneous turbidite sands. The initiation, growth and interaction of intrabasinal normal faults, in particular, can lead to progressive confinement of turbidite dispersal systems.