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Synrift Catchment and Fan Development at Normal Fault Relays

It is widely known that the stratigraphic development of rift basins is controlled by the evolution of normal fault arrays. Of particular interest to the petroleum industry are relay zones between adjacent normal fault segments. These areas are often assumed to contain large catchment-fan systems capable of delivering significant amounts of clastic sediment to hangingwall basins. While it is generally agreed that the fault segment propagation, interaction and linkage history is a first-order control on the patterns of sedimentation in relay zones, few studies have attempted to place constraints on footwall catchment evolution and hence sediment supply via relays. We discuss the temporal and spatial constraints on relay drainage evolution by comparing field and DEM studies of active Basin and Range faults with results of a landscape evolution model.

Our results show that footwall catchment evolution is highly dependent on the fault configuration and linkage history. Slow propagation of segments into an overlapping geometry allows for growth of relay catchments; whereas rapid establishment of a linked fault geometry gives rise to capture and diversion of relay zone drainage. Large catchment-fan systems in relays form when the timescale of linkage is relatively long (~1 my), comparable to the time required to establish the catchments. Along rapidly linked faults, large fan volumes adjacent to relays may indicate either diversion of a regional fluvial system through evolving relays or local lithological control on fan size.