Quaternary Turbidite Systems in Valencia trough (Western Mediterranean) and lake Baikal (Russia), a key to complex ancient turbidite sequences in Rift basins

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Valencia Trough is an aborted early to mid-Tertiary rift basin, 600 km in length, 150-250 km in width and 1000-2500 m in water depth, which divides the Ebro Iberian continental margin and the Balearic Islands off Spain. Late Pliocene to Pleistocene base-of-slope turbidite systems are developed transverse to the northeast to southwest rift structures on the prograding Ebro margin off the Ebro River delta. In the central Ebro margin, the large subaerial Ebro Canyon was eroded during the Messianian lowstand to 2200 m depth; it later filled with unstable postMessinian marine mud and underwent multiple failures forming chaotic unchanneled turbidite sequences in base-of-slope aprons during Pleistocene sea level lowstands. In the Ebro margin bordering the subaerial canyon, individual canyons and downslope channel-levee complexes of 50 km length generally developed from north to south one after the other with each succeeding sea level lowstand. Ebro channel-levee complexes were drained longitudinally by Valencia Valley in the central trough to form a deep-sea channel that fed Valencia Fan at its distal end. Valencia Fan developed a complete deep-sea fan system, with channel-levee complexes feeding into outer fan lobes, that formed parallel to rift graben structures of the Valencia Trough.

Lake Baikal is the world's deepest (1637 m) and oldest (mid-Tertiary) lake, with a length of 636 km and a width ranging from 30 to 87 km. The lake occupies a tectonically active rift basin and contains syn-rift turbidite system deposits that accumulate in three separate basins. Border faults, with scarp relief that ranges from 1500 to 2800 m, bound the northwest margins of each basin and accommodation zones form ridges that separate the basins. Unchanneled, sand-rich aprons up to several kilometers in diameter have been deposited at the base of the steeply inclined (10 to 45 degrees) border fault scarps and are fed from shoreline fan delta and alluvial fan sand sources. Basin margins adjacent to relatively small rivers or large Pleistocene glacial valleys contain sand-rich, channelized subaqueous fans that range in diameter from 5 to 15 km. In both the central and south basins, the Selenga River feeds larger and finer-grained subaqueous fan systems through faultcontrolled canyons. Numerous fan and apron turbidite systems prograde laterally onto basin floors where axial channels often drain sediment longitudinally.

The lithologic changes in Lake Baikal turbidites from late Pleistocene to Holocene time are similar to those in Valencia Trough marine turbidites. Thick (10-20 cm), medium to fine sand turbidites characterize Pleistocene deposits and these change abruptly to thin (2-5 cm), fine sand to silt turbidites that characterize Holocene deposits. Development of the Valencia Trough turbidite systems results as much from Quaternary climatic changes and increased sediment supply as from sea level lowstands. The changes in Lake Baikal Quaternary turbidite systems appear to be related entirely to effects of climatic change on sediment sources and supply rather than to lake level fluctuations.

There is lateral variation in controlling factors of tectonic setting and sediment supply along rift basin margins in both Valencia Trough and Lake Baikal. This results in synchronous deposition of a wide variety of turbidite systems in different areas of the basin floor. Consequently, the development of base-of- slope aprons, channel-levee complexes, subaqueous fans and axial valleys at different locations along the basin margins cause complicated variation in systems tracts from one basin floor area to another. The turbidite systems in Quaternary rift basins also differ from the general systems-tract models in which ancient turbidite sequences are shown to develop one after the other (e.g. slope fans after basin floor fans). Many Quaternary turbidite systems of rift basins, in contrast, develop coevally as complete growth systems of prograding slope wedges and canyons that continue into subaquous fans, then connect into axial valleys, and finally merge into basin plain sequences.