## Quaternary Turbidite Systems in Valencia trough (Western Meditterranean) 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.



## Neotectonics of the Sea of Marmara basin

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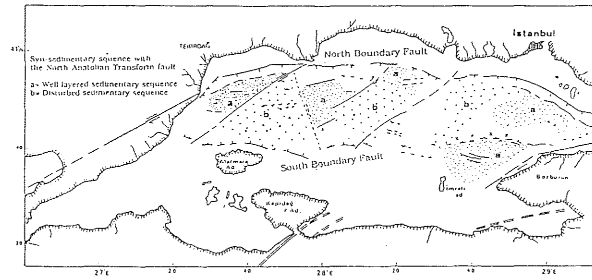
The Sea of Marmara is an inland sea with the areal extension of about 11,350 square km. It is connected with the straits of Bosphorus and Dardanelles to the Black Sea in the north and to the Aegean Sea in the south respectively. It has a very large continental shelf area with many islands. The southern shelf area is much larger than the northern one. There are three deep basins running in the E-W direction. These depressions have the depths : 1112 m in the west ; 1220 m in the middle ; and 1238 m in the east.

The Western Turkey extensional province is the westernmost of three major neotectonic provinces in Turkey that formed following the Arabian/Anatolian collision in the late Serravallian (≈12 Ma) (SENGOR *et al*, 1985). These around the Sea of Marmara (Gulfs of Izmit, Iznik, Gemlik; and Yenisehir-Bursa-Manyas and Saros) lie along the course of N and S strands of the North Anatolian fault, have very strong strike-slip components. The origin of these circum-Marmara grabens is apparently directly associated with the strike-slip tectonics of the North Anatolian fault (BARKA and KADINSKY-CADE, 1988).

Marmara region has different seismic characteristics from the rest of Western Anatolia and appears to act as a separate tectonic unit (CRAMPIN and EVANS, 1986, and EYIDOGAN, 1988). This region shows higher seismic activity than the Western Turkey in general, indicating that this region is partly under the influence of the western end of the North Anatolian fault which splays into a number of branches in and around the Sea of Marmara. Based on fault mechanism solutions, the Marmara block is being rotated and sheared in order to accommodate the right-lateral motion of the North Anatolian fault and extensional tectonics of the Southwestern Turkey province.

The northern side of the Sea of Marmara shows smoother gravity and magnetic anomalies. This area is locally isostatically compensated by an underlying zone of thinned crust with an overall crustal thickness of about 25-30 km. Viewed in their regional context, the magnetic anomalies over the basin, as evidence of recent volcanic activity, are much more likely to be caused by large buried ophiolite bodies, up to several kilometers thick.

The sedimentary sequence in the Sea of Marmara basin is made up of four different formations after the Upper Miocene determined from the single channel airgun seismic data (ÖZEL, 1992). The existance of two basic fault systems is observed: the first one has made up of normal faults at the either sides of the Sea of Marmara basin, extending in the E-W direction; and the secondary system is formed by the NE-SW trending, subvertical strike-slip faults. The E-W trending North Anatolian transform fault changes its direction to west-southwest in the Sea of Marmara, and it is understood that the pure strike-slip motion changes into the wrench fault with extension. The Fault system patterns indicate the surface affects of branches formed by the negative flower structures within the divergent wrench faults.




The map of fault systems and sedimentary distribution
(Fault systems modified from BARKA and KADINSKY-CADE, 1988)

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