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Deepwater Creeping Deformation Inducing Lateral Channel Migration on the Slope of an Eocene Margin, San Llorenç del Munt, Spain

The Eocene San Llorenç del Munt shelf margin, along the Catalan edge of the Ebro Basin in NE Spain, consists of a series of progradational clinoform sets, 60-150m thick. Spectacular outcrops allow the physical tracing of the deposits from fluvial floodplains with conglomeratic channels, across a narrow steep shelf into the adjacent deeper-water slope and basinfloor. Active progradation of deltas and strandplains built up the shelf margin and caused accretion of the adjacent slope. River mouth bars were prominent at the shelf margin, whereas the upper slope deposits are a sediment apron dissected by chutes, submarine channels and related levees. The channels, 5-10m deep, linked directly upslope to river distributaries and developed downslope from straight to sinuous in planform. Sinuous channels consistently migrate eastwards through time and feed small turbidite fans in the base of slope area. The fans are 5-15m thick, 1 km wide and extend into the basinfloor for 3 km, before merging into the basin shales. They consist of a network of channels and levees originated by a variety of high-density turbidity and sandy debris flows. Fan growth and migration occurred through distinctive phases of creeping along listric sliding planes that merge into thrusts at their toe and are paved by slumps and debris flow deposits. Deformation accompanied by fluid escape occurred at bed and bed-set scale (20-150cm) with limited downward displacement. Tectonic uplift and the eastward tilting of the basin are envisaged as the most plausible mechanism for slope creeping deformation and eastward lateral channel migration.