SEAFLOOR INSTABILITIES IN THE RHÔNE TURBIDITIC LEVEE COMPLEXES, WESTERN MEDITERRANEAN: MORPHOLOGY, TIMING AND EMPLACEMENT, AND POTENTIAL RELATIONSHIP WITH ACTIVE FAULTING

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The Gulf of Lion is a SW-NE oriented passive continental margin formed after the starting of the convergence between Europe and Africa in the Oligocene. The continental slope is incised by about 15 submarine canyons, feeding the distal Rhône sedimentary system. One of the distinctive features of the NNW-SSE oriented channel-levee complex is the presence of extensive areas of sediment deformation and erosion on the turbiditic levees and the presence of two large Mass Transport Deposits (MTDs) described in the literature as Eastern and Western MTD. The continental slope is dissected by several listric faults which have a dominant SW-NE strike and at times reach the seafloor. We present an integrated geophysical, geomorphological, sedimentological and geotechnical study of the deformation occurring in the Plio-Quaternary sediments of the turbiditic levees of the Petit-Rhône submarine valley. Nearly 180 km of ultra-high-resolution deep-towed multi-channel seismic data (SYSIF), collected during the PRISME2 cruise (DOI: 10.17600/13010050), allowed to obtain images of the internal structure of the deformed units with unprecedented details. These data are supplemented by multibeam bathymetric, sub-bottom profiler, and high-resolution seismic data collected aboard several French cruises. During the PRISME3 cruise (DOI: 10.17600/13030060), we obtained several transects of CPTU measurements and sediment cores in undisturbed sedimentary successions, in adjacent zones of evacuation, and in the MTDs. CPTU data provide in-situ information along two main SYSIF lines across undeformed and failed areas in both eastern and western turbiditic levees. The CPTU profiles show an 8-m thick draping unit with downwards increasing values of tip resistance, sleeve friction and undrained pore pressure. In sites penetrating MTDs, these parameters increase irregularly below 8 meters below seafloor (mbsf), underneath a peak corresponding to a coarser grained material. Coinciding sediment cores allowed to identify thin-bedded turbiditic facies (undisturbed sediment), as well as MTDs expressed either as contorted slumped or structure-less stiff units. On top of MTDs we identified coarser grained sediments likely corresponding to turbidite deposits, which is in good agreement with in-situ measurements. In this study, we attempt to 1) characterize distinct expressions of sediment deformation, their spatial and chronological distributions, 2) correlate them with undisturbed sediments to identify the source of wasted material and the nature and extent of potential weak layers at their base.

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