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Seismic geomorphology of mass transport deposits influenced by halokinesis: Insights from the Levant Basin, offshore central Israel

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Submarine mass-wasting is a crucial process responsible for remobilizing massive sediment volumes into deep-water settings and for shaping the architecture of continental margins. Three dimensional seismic reflection data of the post Messinian overburden, spanning 1350 km^2 at the lower slope, off central Israel has enable characterization of the geometry and internal architecture of three stacked basal late Pliocene Mass transport deposits (MTDs: MTD-1, MTD-2 and MTD-3). These MTDs span between 351-752 km^2, have sediment volumes of ~35-94 km^3 and maximum thicknesses ~225-300 m. Interpretation of the MTDs suggests north-westward sediment routing into offshore central Israel. Seismic attribute analysis reveals that these deposits consist of distinct internal seismic geomorphologies, implying varying kinematic dynamics and degree of deformation. MTD-1 (oldest) is homogenous with chaotic and low amplitude seismic facies. MTD-2 is heterogeneous with compartmentalization of high amplitude anomalies within a low amplitude background. These high amplitude domains correspond to blocky seismic facies comprising of >30 rafted blocks and other poorly-deformed strata encapsulated within a highly deformed matrix. However, the brightening observed around some blocks are not restricted to regions with halokinetic-related faults detaching in the fluid rich Messinian evaporite substratum, deforming the pre-failure slope series and the MTDs. MTD-3 exhibits maximum thickness in divergent mega-scours terminating into frontal ramps. It is internally characterized by low-moderate amplitude patches with some arcuate seismic facies, mappable syn-depositional thrusts and erosional shadow remnants. A high amplitude sinuous paleo-channel trending northwards is well imaged incising the top of MTD-3 towards the toe region. Our result shows that each MTD is unique in seismic fingerprint and likewise extends the understanding of the nature of MTDs under a halokinetic template. The blocks and other high amplitude elements characterized here may contain fluid pockets of hazard concern to deep-water exploration targeting the sub-salt reservoirs in this prolific hydrocarbon province.