Internal Geometry of Mass Transport Deposits (MTDs) in Modern and Ancient Carbonate Systems

J. Le Goff, T. Mulder, A. Slootman, T. Cavailhes, E. Ducassou, V. Hanquiez,
J. Jaballah, and J. J. G. Reijmer

ABSTRACT

Large sub-tropical carbonate platforms export vast quantities of sediment onto their adjacent slopes. Mass transport deposits (MTDs: including slides, slumps and debrites) and calciturbidites occur within carbonate slope deposits. In this study, MTDs of The Bahamas are compared with those of the Cretaceous Apulian carbonate margin. The characterization of the internal architecture of MTDs in seismic is crucial toward accurate paleoslope reconstructions in outcrop. Vice versa, outcrop studies provide the details of strata reworking within these massive sediment bodies at meter to kilometer-scale. In addition to a longitudinal continuum of deformation, MTDs show evidence of vertical partitioning of the mass-flows.

Mass-wasting processes can be assessed from strain partitioning in MTDs, recording longitudinal (along-slope) and lateral (slope-parallel) heterogeneities. Three deformational domains are defined based on the dip-oriented continuum of structures: extensional (headwall domain), translational (body domain), and contractional (toe domain). Confined MTDs are limited by steep and deep lateral margins that mark the boundaries between failed deposits and undisturbed strata. In unconfined MTDs, resedimented material can overstep the frontal ramp and lateral margins, forming prominent fold structures in response to layer-normal and layer-parallel shearing. The internal architecture of the toe domain reveals vertical strain-partitioning expressed in seismic as the stacking of high-amplitude continuous and discontinuous, and chaotic low-amplitude reflectors revealing an increasingly reworked pattern upwards. Such vertical segregation is also observed in outcrop, with partitioning occurring along diffuse or sharp sub-horizontal *internal shear surfaces*. As strata reworking increases with transport distance, top-down reorganization of failed strata occurs during failure. The uppermost plastic, more mobile part of MTDs deforms the underlying, poorly lithified strata. Intense folding here is testified by recum-

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bent folds and interfold limb break-off. The lower part of MTDs exposes non-coaxial folds indicative of movement direction. The *basal shear surface* is characterized by fault-propagation folds and incipient folding.