Shelf-derived mass-transport deposits: origin and significance in the stratigraphic development of trench-slope basins, active Hikurangi margin, New Zealand

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Continental shelves supply some of the greatest mass-wasting events recorded worldwide. Sea-level variations and high sedimentation rates are commonly inferred to be the main causal mechanisms, thereby underestimating the role of tectonics in triggering slope destabilization, downslope mass-movement and deposition of the associated shelf-derived sediments into deep-water settings. Along active margins however, tectonics predominate and exert a crucial control on the stratigraphic development of the related confined intra-slope basins (e.g., trench-slope basins). In this context, we developed an original approach using a combination of photogrammetry, traditional fieldwork (e.g., detailed sedimentary sections) and taphonomic data to thoroughly map and characterize the Middle Miocene shelf-derived mass-transport deposits (MTDs) outcropping in the southern emerged portion of the Hikurangi subduction wedge (Whareama and Te Wharau basins, North Island of New Zealand). With these methods, our study brings high-resolution, outcrop-scale insights on the nature of the reworked sediments (e.g., lithofacies), the modalities of development and emplacement (i.e., pre-conditioning factors and causal mechanisms) and the related depositional environments. Results show that periods of repeated regional tectonic activity (shortening, uplift, related seismicity) in such compressional settings not only affect and control the emplacement of shelfal environments but also drive the recurrent generation and destruction of oversteepened slopes, which in turn, favour the destabilization and collapses of the shelves and their substratum. Here, these events produced both large- and small-scale shelf-derived sediment mass-failures and debris flows, which eventually broke down into a series of coalescing, erosive, genetically-linked surging flows downslope. The associated MTDs have a regional footprint, being deposited across several trench-slope basins. Recognition of tectonic activity as another causal mechanism for shelf failure (in addition to sea-level fluctuations, high-sedimentation fluxes) has implications for both stratigraphic predictions and understanding the tectonostratigraphic evolution of deep-marine fold and thrust belts.

Mots-Clés : active margin, tectonics, trench-slope basins, shelf-derived material, mass-transport deposits

Merci de ne rien inscrire dans cette zone et ne pas modifier les marges des pieds de page et entêtes.