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Mass transport-related stratal disruption and sedimentary products

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From an outcrop perspective, mass transport deposit are commonly represented by “chaotic” units, characterized by dismembered and internally deformed slide blocks of different sizes and shapes, embedded in a more or less abundant fine-grained matrix. The large amount of data derived from geophysical investigations of modern continental margins have permitted the characterization of the overall geometry of many of these deposits, which, however, remain still relatively poorly described from outcrop studies of collisional basins.
Results of this work show that in mass-transport deposits an unsorted, strongly mixed, relatively fine-grained clastic matrix almost invariably occurs in irregularly interconnected patches and pseudo-veins, infilling space between large clasts and blocks. We interpreted the aspect of this matrix as typical of a liquefied mixture of water and sediment, characterized by an extremely high mobility due to overpressured conditions, as evidenced by both lateral and vertical injections. On a much larger scale this kind of matrix is probably represented by the seismically “transparent” facies separating slide blocks of many mass-transport deposits observed in seismic-reflection profiles.
The inferred mechanism of matrix production suggests a progressive soft-sediment deformation, linked to different phases of submarine landslide evolution (i.e. triggering, translation, accumulation and post-depositional stages), leading to an almost complete stratal disruption within the chaotic units.
From our data we suggest that most submarine landslides move because of the development of ductile shear zones marked by the presence of “overpressured” matrix, both internally and along the basal surface. The matrix acts as a lubricating medium, accommodating friction forces and deformation, thus permitting the differential movement of discrete internal portions and enhancing the submarine slide mobility.
Based on our experience, we suggest that this kind of deposit is quite common in the sedimentary record though still poorly reported and understood. Mutti and Carminatti (oral presentation from Mutti et al., 2006) have suggested to call these deposits “blocky-flow deposits”, i.e. the deposit of a complex flow that is similar to a debris flow, or hyper-concentrated flow, except that it carries also out-size coherent and internally deformed blocks (meters to hundreds of meters across) usually arranged in isolated slump folds. The origin of blocky flows is difficult to understand on presently available data, particularly because it involves the contemporary origin of coherent slide blocks and a plastic flow that carries them as floating elements over considerable run-out distances.
The recognition of the above-mentioned characteristics should be a powerful tool to discriminate sedimentary and tectonic “chaotic” units within accretionary systems, and to distinguish submarine landslide deposits transported as catastrophic blocky flows (and therefore part of the broad family of sediment gravity flows) from those in which transport took place primarily along shear planes (i.e. slumps, coherent slides), also highlighting a possible continuum from slides to turbidity currents.
The discussed examples fall into a broad category of submarine slide deposits ranging from laterally extensive carbonate megabreccias (lower-middle Eocene “megaturbidites” of the south-central Pyrenees), to mass transport deposits with a very complex internal geometry developed in a highly tectonically mobile basin (upper Eocene – lower Oligocene Ranzano Sandstone, northern Apennines).

References:
Mutti, E., Carminatti, M., Moreira, J.L.P. & Grassi, A.A. (2006) - Chaotic Deposits: examples from the Brazilian offshore and from outcrop studies in the Spanish Pyrenees and Northern Apennines, Italy. - A.A.P.G. Annual Meeting, April 9-12, Houston, Texas.