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Mass transport complex in confined intra-slope basins: the case study of the Epiligurian Specchio unit (Northern Apennines, Italy)

Kei Ogata (1), Emiliano Mutti (2), Roberto Tinterri (2), and Gian Andrea Pini (3)

(1) Department of Artic Geology, UNIS (Univesity Centre in Svalbard), Longyearbyen, Norway (kei.ogata@unis.no), (2) Dipartimento di Scienze della Terra, Università degli Studi di Parma, Parma, Italy (emiliano.mutti@unipr.it, roberto.tinterri@unipr.it) , (3) 4 Dipartimento di Scienze della Terra e Geologico-Ambientali, Università di Bologna, Bologna, Italy (gianandrea.pini@unibo.it)

The tentative comparison of data coming from ancient and modern submarine landslides examples, as those provided by field-based surveys of exposed orogenic belts and geophysical studies of current continental margins, is not often a trivial task. This is mainly because of the resolution limits and scaling problems between these two approaches, and for the limited occurrences of comparable geodynamic contexts (i.e. collisional/convergent versus divergent margin settings). This is particularly evident for accretionary systems, where several controlling factors combine to produce "chaotic units" (i.e. rock assemblage characterized by different degrees of lithologic mixing and structural disorder) at the different scales.

This study has been carried out on an ancient mass transport complex (MTC), known as the Specchio Unit among the Apennine geologists, developed on the leading edge of a complex submarine accretionary prism. This unit occurs within the lower Rupelian turbidite-like deposits of the syn-orogenic Eocene-Oligocene Epiligurian succession, cropping out in the eastern side of the Northern Apennines (Italy) as isolated sedimentary remnants (i.e. outliers), representing the local syn-tectonic infill of intra-slope basins (i.e. piggy-back, wedge-top systems) developed on top of the translating Ligurian Nappe (i.e. proto-Apenninic accretionary wedge).

This MTC has been subdivided into five sub-units, representing at least two distinct MTDs: the lower ones, of local significance, derived from the southern sectors, and the upper ones, of basin-wide extent, derived from the northern sectors. The largest MTD reaches an inferred volume of involved dry material of about 150 km3. The vertical stacking of these sub-units and the progressively "shallow-water" character of the internal components seems to represent the episodic deposition of closely spaced events, originated through a retrogressive failure process involving progressively more proximal areas (i.e. form relatively more open-marine to coastal environments).

Careful observations carried on the internal elements of these units (i.e. matrix and blocks), which include both slump- and debris flow-like facies (i.e. blocky-flow deposits), allow the interpretation of such sedimentary bodies as generated by catastrophic processes. The influence exerted by structural confinement on the slide emplacement is recognizable mainly in term of forced slide direction, localized over-thickening, substrate coupling (i.e. bed erosion in a sedimentological sense) and margin-induced strain partitioning. In particular, this study highlights the likely occurrence of a generalized lateral buckling (compression + transpression), almost perpendicular to the main sliding direction, and an overall unidirectional shearing in the longitudinal sense, giving important information on the slide kinematics.

This study also contributes to the understanding of the local intra-slope basin configuration, highlighting different depositional environments (in terms of facies associations and compositions) between the pre- and post-slide sedimentary successions, and the possible existence of an overall shallow level tectonism (gravity-related?) linked to a rearrangement of the regional tectonic framework (i.e. accretionary wedge frontal dynamics).