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Architecture and depositional pattern of the gulf of Genova

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The behavior of gravity-flows processes in relation to morpho-bathymetric trends as well as the evolution of architecture and sedimentary facies in submarine canyons are crucial points in the understanding of turbidite systems. Furthermore, the potential connection/disconnection between the canyon area on continental slopes and the distal deposits in deep basins has a strong impact on the longitudinal connectivity of sand-prone bodies and could thus impact reservoir models.
In this contribution, we focused on the recent activity and the detailed analysis of sedimentary structures/architectures of two canyons located in the Gulf of Genova (Ligurian basin, north western Mediterranean). Since the Pliocene, this margin segment has undergone a tectonic inversion leading to the reactivation of inherited transverse structures and development of new fault systems. Such tectonic activity is responsible for the enhancing of gravity-driven processes on the continental slope. The aim of this work is to better constrain the effect of the morpho-bathymetric trends, linked to the uplift of the margin, on the architecture and depositional patterns along the canyons and at the canyon-basin transition. The results of this study are based on the integration and interpretation of multibeam bathymetry, seismic profiles (Chirp, High-resolution 24 and 72-channels data, deep-towed “Sysif” data) and cores collected during the MALISAR (2006, 2007) and PRISME cruises (2013).
In the Gulf of Genova, the two Polcevera and Bisagno canyons coalesce at about 2100m water depth to form the Genova valley that fed Ligurian basin. Currently, these canyons are disconnected from river mouths on land but canyon heads exhibit evidences for the recent triggering of abundant submarine landslides, representing a total eroded volume of 14.1km3. The main sediment processes active during the present-day sealevel hightstand are thought to be large ignitive turbidity currents resulting from the transformation of landslides. Within the canyon thalwegs, side-scan sonar (SAR) images combined with Chirp data allow discriminating three planform patterns: (1) Deposition of coarse/fine particles on scroll-bar-like features and downstream from knickpoints, on slope angle of 3-4°; (2) Erosion above previously deposited cohesive-flow material freezing in areas of slope angle 1-2° in the main canyon body; (3) Bypass over bedrock in areas of increasing slope angle to 4-5° along the last 30 km of the canyon mouth. This bypass zone is responsible for the disconnection between the canyon deposits and the distal basin accumulation.
The distal accumulation built at the mouth of the Genova valley. Here, it does not consist of a channel-levee system but of the stacking of lenticular bodies migrating by lateral compensation and retrograding within the canyon mouth in response of the margin deformation. The whole accumulation is about 640km2. The development of the accumulation is controlled by the growth of faults at the transition between the continental slope and the basin. From the core data, the youngest deposits consist of sandy to gravelly turbidites and debrites, about 30cm thick.