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High resolution morphobathymetric analysis and short-term evolution of the upper part of the Capbreton submarine canyon (south-east Bay of Biscay – French Atlantic coast)

Hervé Gillet, Alaïs Mazières, Thierry Mulder, and Michel Cremer
Bordeaux 1 University, UMR 5805 -EPOC, Sedimentology, TALENCE, France (h.gillet@epoc.u-bordeaux1.fr)

The Capbreton Canyon stands out by its deep incision through continental shelf and slope and its present turbidite activity. The head of the canyon is anthropically disconnected from the Adour River since 1310 AD, but is located close enough to the coast to allow a direct supply by longshore drift.

Sedimentary processes in upper part of the Capbreton Canyon are poorly documented. Several evidences, including sandy slide scars in the head, suggest that this area plays a major role in triggering downstream gravity currents). However, no modern sedimentary activity in the upper canyon had so far been evidenced.

Our study is based on the analysis and comparison of several sets of multibeam bathymetric data acquired in 1998, 2010 and 2012 (up to 1.5 m resolution).

The morphobathymetric analysis brought the following key observations:
- The upper part of the canyon is characterised by a meandering talweg underlined by two kinds of terraces: (1) small elongated terraces standing only 10 to 15 m above the talweg axis and (2) large terraces standing 45 to 100 m above the talweg axis.
- The regular 1° longitudinal slope of the talweg is interrupted by several 10 m high knickpoints.
- The floor of the talweg shows some rough areas scattered with transversal bedforms similar to the sediment waves described in the Monterey Canyon upper part (Smith et al, 2005).

The morphological evolutions in the upper part of the canyon over the last 14 years especially affect the floor of the talweg:
- Between 1998 and 2010, we observe a downstream succession of accretion areas (up to 11m thick) and erosion areas (reaching -25 m). The largest and highest terraces remain stable over this period, whereas the smallest and lowest elongated terraces show active sedimentation (+5 to +8 m).
- Difference between 2010 and 2012 DEMs reveals three localized erosion spots corresponding to 200 m backward stepping of the knickpoints. Such observation confirms the active headward erosion in this part of the canyon.
- Conversely, the flanks of this part of the canyon do not show significant evolution. We did not observe any large lateral slide such as the canyon flank collapse recently recognised in the upper part of the Monterey or Cap Lopez canyons.

(1)Since the lateral sediment supply in the canyon seems to be limited (no significant evolution of the canyon wall), we consider that most of the sediments deposited in this area is supplied from the canyon head.
(2)We propose that the lowest elongated terraces are the remnant of sandy slides confined in the upper talweg and later overdeepened by the regressive erosion. This process contrasts with the downstream part of the canyon, where the terraces are constructed by the spilling of turbidity current.
(3)These results are consistent with the process evidenced in the head of the canyon and support the assumption that the turbidite processes in modern canyons are related to sandy mass sliding from the head of the canyon.