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New insights into submarine geomorphology and depositional processes along the George V Land continental slope and upper rise (East Antarctica)

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Swath bathymetry collected by the Italian Antarctic Program (PNRA), in the offshore of the George Vth Land, document evidence of cascading, cold and dense bottom currents, inside continental slope canyons, and suggest an active role of the sea floor morphology on modern and ancient process.
The continental slope is incised by canyons locally heading to the shelf edge and bounding sedimentary ridges of Miocene age(ref1,2). Erosion by bottom water masses, up to present times, exhumed or prevented the burial of such relict sedimentary ridges originated by glacial processes. Dense shelf water is formed by coastal polynyas and is exported over the shelf break to produce Antarctic Bottom Water (AABW)(ref3,4). This locally formed AABW (often referred to as Adélie Land Bottom Water) is detected by CTD and mooring measurements up to about 3200 m of depth, in the Jussieu canyon and further to the west(ref5). The speed of the ALBW is enough to transport fine sand and silt from shallow to deep water. Evidence for exporting sediment off the shelf via bottom water, through the Holocene, is inferred by sedimentological and geophysical studies(ref6,7).
Morphologic and geological data in the slope and rise confirm that the Jussieu canyon is a main conduit of high energetic bottom current, in present times as well as in the past(ref1,7). Coarse grain material and turbidites (up to 1 meter thick) were sampled from the canyon levees at 2500 and 3000 meters of water depth(ref1). At a depth of 2600 m, the Jussieu canyon converges with two canyons into a single branch, showing a meandering trend, up to about 3200 m of water depth. The asymmetry of the meandering section and the internal geometry of its levees are typical expressions of differential erosion and deposition from downslope flows.
Sediment waves characterise the western flank of the Wega Channel, at depth of 2400-2800 meters, to the east of the Jussieu canyon(ref1). The waves are composed by fine grained sediments whose source is identified in the George V Land rocks and in the continental shelf(ref8). The waves formed under the action of weak and constant, downslope bottom current, since MIS 11(ref9,10), documenting the occurrence of shelf originated bottom current also in this channel. No significant component of shelf-originated, bottom water is detected at the head of the WEGA channel. The current that originated the sediment wave field in the WEGA channel must then be fed by the ALBW flowing inside the Jussieu branches in the upper slope, deviated to the east. This process likely happens at water depth of about 2600, where the continental slope decreases its steepness and the branches of the upper Jussieu canyon converge into the single meandering channel-levee, in the lower rise. This abrupt morphologic bend likely forces part of the cascading water mass confined inside the canyons to thickens and to overspill the flanks and to flow down the WEGA channel, until it reaches equilibrium with its surroundings.
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