



Carbonate slope gully system on the Westside Great Bahama Bank

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Gullies are commonly observed on submarine slopes along many continental margins. They are generally small, straight, shallow channels with a depth that does not exceed a few tens of meters. They form on relatively steep slopes. They are important features for downslope sediment transfer from the outer continental shelf to the continental slope and rise.

Data collected during the first leg of the Carambar cruise (Nov. 1st – Nov. 15th, 2010) on the RV “Le Suroît” show that the western slope of the Great Bahamas Bank is characterized by the presence of gullies that extend about 100 km from North to South along the carbonate platform. Gullies appear on the upper slope at approximately 410 m water depth in a carbonated mud-dominated environment. Their initiation follows the presence of sediment waves. They extend over a 3° steeped slope down to 610 m water depth. The gully heads are not connected to the platform and to any significant carbonate depositional system. They are relatively linear, sub-parallel, with a symmetric to asymmetric V-shaped cross section and incision does not exceed 30 m. Average gully length and spacing are 400 and 800 m respectively.

A detailed morphometric study based on EM302 multibeam bathymetry and very-high resolution seismic data (Chirp sub bottom profiler) combined with a statistical analysis allowed the gullied slope to be divided into two distinct areas. (1) The northern area characterized by regularly-spaced gullies (spacing varies from 750 to 800 m from North to South). They are generally linear and sub-parallel with an average length of 4 km. Their depth are usually lower than 10 m. Asymmetry is greater in the central region of gullies (northern flank is steeper than southern flank) and seems to be correlated with an increase in gully depth and a decrease in gully spacing. (2) The southern area is characterized by irregularly-shaped gullies that are usually truncated by a large 40 m high N-S deformation escarpment. Gullies have depth values similar to the northern area. The average gully spacing is about 650 m above the escarpment and is more variable downslope with values locally greater than 800 m. As in the northern area, gullies are asymmetrical.

Preliminary interpretation of very high-resolution seismic profiles shows that gullies are recently draped by continuous layers of transparent, low-amplitude reflectors preserving the gully morphology. In details, seismic profiles show that dissymmetric gullies are filled with relatively-high amplitude reflectors overlaid by a low-amplitude transparent drape. More regular gullies show permanent aggradation due to the staking of regular sediment drape. The abrupt appearance of gullies, their shortness, the presence of sediment waves close to the gully head and their small incision seems consistent with a genesis by density cascading as suggested by Wilson and Roberts (1995). However, vertical change in sedimentation, change in gully spacing and gully asymmetry remain to be explained.