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Submarine canyon morphologies and evolution on a modern carbonate system: the Northern Slope of Little Bahama Bank (Bahamas).

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The recent CARAMBAR cruise (Nov. 2010) on the northern slope of Little Bahama Bank (LBB, Bahamas) provided new seafloor and subsurface data, that improve our knowledge on carbonate slope systems. The new high-resolution multibeam bathymetry data (Kongsberg EM302 echosounder) and very high resolution (3.5 kHz/Chirp subbotom profiler) seismic data show that the upper LBB slope is dissected by 18 canyons. These canyons evolve sharply into short channels opening to depositional fan-shaped lobes. These architectural elements form a narrow carbonate gravity system extending over 40 km along the LBB slope.

The features previously described as small linear canyons have a more complex morphology than originally supposed. The several architectural elements that can be distinguished share similar characteristics with siliciclastic canyons. The average morphological features of the canyons are: minimum and maximum water depths of 460 and 970 m resp., mean length = 16.3 km and sinuosity = 1.14. Canyons are floored with flat elongated morphologies interpreted as terraces. Some of these terraces are located at the toe of slide scars on canyon heads and canyon sides which suggest that they result from sediment failures. On the Chirp seismic data, wedge-shape aggrading terraces interpreted as “internal levees” can be observed. These terraces would then be formed by overbanking of the upper part of turbidity currents. Between 530 and 630 m water depth, some canyons exhibit an amphitheater-shaped head with a head wall height ranging from 80 to 100 m. The wall edges of these canyon heads consist of coalescing arcuate slump scars, which suggests that the canyons formed by retrogressive erosion. Other canyons show an amphitheater-shaped head that evolves upslope into linear valleys incising the upper slope between 460 m and 530 m water depth. The onset and the spatial distribution of these linear valleys seem to be influenced by sediments transported from oolitic shoals of Walker Cay located 5 km upstream toward the upper slope. Indeed, upslope the canyon heads, the reflectivity map shows low backscatters characteristic of fine grained sediments within small elongated depressions (3-5 km long, 1-5 m deep) that are probably-formed by the flow of sediments coming the platform.

These initial results allow a preliminary model of the canyon evolution to be proposed with two stages: (1) a first stage controlled by retrogressive erosion, generating several slides and collapses finally forming the amphitheater-shaped canyon heads, (2) a second stage of retrogressive erosion influenced on the upper slope by the sediment input from the platform along small erosional depressions located seaward of the carbonate bank. These small depressions can locally merge with the canyon heads.