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Using cyclic steps on drift wedges to amend established models of carbonate platform slopes

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Hydroacoustic and sedimentological data of the western flank of Great Bahama Bank and Cay Sal Bank document how the interplay of offbank sediment export, along-slope transport, and erosion together shape facies and thickness distribution of slope deposits. The integrated data set depicts the combined product of these processes and allows formulating a comprehensive model of a periplatform drift that significantly amends established models of carbonate platform slope facies distribution and geometry. The basinward thinning wedge of the periplatform drift at the foot of the escarpment of Great Bahama Bank displays along- and down-slope variations in sedimentary architecture. Sediments consist of periplatform ooze, i.e. carbonate mud and muddy carbonate sand, coarsening basinward. In zones of lower contour current speed, depth related facies belts develop. In the upper part of the periplatform drift wedge in a water depth of 180 to 300 m and slope angles of 6° – 9° the seafloor displays a smooth surface. Parasound data indicate that this facies is characterized by a parallel layering. Basinward, the slope shows a distinct break at which the seafloor inclination diminishes to 1° to 2°. Downslope of this break, the drift wedge has a 3 – 4 km wide pervasive cover of bedforms down to a water depth of around 500 m. The steep flanks and internal stratification of the wavy bedforms face upslope, indicating upstream migration; the bedforms therefore share all the characteristics of cyclic step sedimentation. This is the first description of cyclic step sedimentation patterns in carbonate slope depositional systems. This new slope sedimentation model aids in understanding the complexity of carbonate slope sedimentation models with facies belts perpendicular and parallel to the platform margin. The new model sharply contrasts with existing slope facies models in which facies belts are solely positioned parallel to the platform margin.