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Deep sea sedimentation processes and geomorphology: Northwest Atlantic continental margin

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Deep-sea sedimentation processes impart a fundamental control on the morphology of the western North Atlantic continental margin from Blake Spur to Hudson Strait. This fact is illustrated by the variable patterns of cross-margin gradients that are based on extensive new multibeam echo-sounder data informed by subbottom profiler and seismic reflection data. Erosion by off-shelf sediment transport in turbidity currents creates gullies, canyons and channels and a steep upper slope. Amalgamation of these conduits produces singular channels and turbidite fan complexes on the lower slope, flattening slope-profile gradients. The effect is an exponentially decaying “graded” slope profile. Comparatively, sediment mass failure produces steeper upper slopes due to head scarp development and a wedging architecture to the lower slope as deposits thin in the downslope direction. This process results in either a “stepped” slope, and/or a significant downslope gradient change where MTDs pinch out. Large drift deposits created by geostrophic currents are developed all along the margin. Blake Ridge, Sackville Spur, and Hamilton Spur are large detached drifts on disparate parts of the margin. They form a linear “above grade” profile along their crests from the shelf to abyssal plain. Deeper portions of the US continental margin are dominated by the Chesapeake Drift and Hatteras Outer Ridge; both plastered elongate mounded drifts. Farther north, particularly on the Grand Banks margin, are plastered and separated drifts. These drifts form “stepped” slope profiles, where they onlap the margin. Trough-mouth fan complexes become more common along the margin with increasing latitude. Sediment deposition and retention, particularly those dominated by glacigenic debris flows, characterize these segments producing an “above grade” slope profile. Understanding these geomorphological consequences of deep sea sedimentation processes is important to extended continental shelf mapping in which gradients and gradient change is a critical metric.