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TITLE: Hydrodynamic controls on cold-water coral growth and carbonate-mound development at the SW and SE Rockall Trough Margin, NE Atlantic Ocean

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ABSTRACT:

Long-term (21-year) records obtained by seabed observatories (BOBO) and repeated (24-h) CTD casts show the presence of a highly energetic environment in and around two cold-water carbonate-mound provinces, on the Southwest and Southeast Rockall Trough (SW and SE RT) margin. Carbonate mounds, covered with a thriving coral cover, are embedded mainly in the Eastern North Atlantic Water (ENAW) and are observed in a confined bathymetric zone between 600 and 1000 m water depth. Cold-water corals seem to be restricted in their growth by temperature and food availability. The presence of living corals on top of the carbonate mounds appears linked to the presence of internal waves and tidal currents in the water column, and consequently carbonate mound structures are shaped by the local hydrodynamic regime. Mound clusters have an elongated shape perpendicular to the regional contours and corresponding to the direction of the highest current speeds. On the SW RT margin temperature, salinity and current speed reflect a diurnal tidal pattern, causing maximum temperature variations at 900 m depth of more than 3 °C. Current speeds up to 45 cm s⁻¹ occur, and a residual current of 10 cm s⁻¹ is directed along the slope to the southwest. At the SE RT margin the temperature of the bottom water fluctuates more than 1 °C with a semi-diurnal tidal cyclicity. Amplitudes of average and peak current speeds here are comparable with those measured on the southwest margin, but the residual current in this area is directed to the northeast. Tidal currents and internal waves at both margins force the formation of intermediate and bottom nepheloid layers and bring fresh food particles with increased velocity to the mounds. The distribution of corals in both mound areas is considered directly related to the presence of enhanced turbidity. An increase in temperature can be directly related to an increase in the amount of particles in the water column. Current velocity increases when a transition occurs from cold to warm waters. High current velocities prevent local sedimentation but provide sufficient food particles to the corals, so that the corals thrive at the mound summits.

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