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New insight into Antarctic Circumpolar Current evolution from the Maurice Ewing Bank and Georgia Basin, Southwest Atlantic

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The role of the Antarctic Circumpolar Current (ACC) in the thermal isolation of Antarctica and the Cenozoic development of Antarctic ice sheets is a major long-standing question. The Maurice Ewing Bank (MEB) and Georgia Basin contain thick sedimentary sequences and are well positioned in the subantarctic Southwest Atlantic to record the history of the ACC. In the modern ocean, the deep water masses Upper (UCDW) and Lower Circumpolar Deep Water (LCDW) flow across the shallower areas of the MEB (∼500–3000 m), while Antarctic Bottom Water (AABW) fills the deepest parts of Georgia Basin (∼ >3600 m) and flows northwards along the base of the eastern slope of MEB.
Here we report on multichannel seismic data acquired during RRS Discovery cruise DY087 in Jan-Feb 2018 on the southeastern flank of MEB and western Georgia Basin. Piston cores recovered during the expedition and previous Deep Sea Drilling Project sites provide tentative age constraints on seismic reflectors in the study area.
Initial interpretation of the DY087 seismic and piston coring data indicates a strong influence of bottom currents since the Oligocene on sediment deposition in the region. Many current-controlled features are observed along the slope from the top of MEB towards Georgia Basin, including elongated wedges, prominent sediment waves, eroded surfaces, buried and active channels, a giant sediment mound on the lower slope, and sheeted and plastered drifts. A major change in depositional patterns is recognised after the mid-Miocene. Subsequent sediment accumulation has been restricted to the lower slope and Georgia Basin, where exceptionally high sedimentation rates (up to 24 cm/kyr) are observed, with sediment having been delivered to the area by the bottom current emerging from the Falkland Trough. The top of MEB is strongly eroded by UCDW and LCDW sweeping over the region exposing Miocene and older strata. Further investigation through scientific drilling is needed to provide a more detailed timeline of ACC evolution.