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Regional oceanographic framework and water mass circulation along the Drake Passage Gateway

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A new compilation showing the regional oceanographic framework and water mass circulation between the Weddell Sea and the Bellingshausen Sea through the Scotia Sea is presented. This compilation (Hernández-Molina et al., in press) will be useful to explain the regional oceanography, but especially to compare with geological and paleoceanographic changes along the Drake Passage/Scotia Sea gateway in the context of the PLATES & GATES project for the International Polar Year (2007/08). The main water masses in this area are largely part of the eastward-flowing Antarctic Circumpolar Current (ACC), which represents the principal connection between the basins of the South Atlantic, South Pacific and Indian oceans. The ACC comprises bottom-reaching fronts characterised by high velocities, namely, from north to south: the Subantarctic Front (SAF), the Polar Front (PF), the Southern Antarctic Circumpolar Current Front (SACCF), and the Southern Boundary of the ACC (SB). Oceanographic cross-sections show that these fronts are not vertical but dip to the north. Among the deep water masses in the Southern Ocean, two distinct components can be distinguished: 1) The voluminous Circumpolar Deep Water (CDW), flowing mostly eastward with the ACC and sub-divided into Upper and Lower varieties (UCDW and LCDW); 2) Antarctic Bottom Water (AABW), the deepest water mass around the Antarctic continent (but without a circumpolar distribution), which is produced through brine rejection on the continental shelf and super-cooling of shelf waters under floating ice shelves. The main source of AABW is thought to be the Weddell Sea. AABW in the Weddell Sea is composed of the Weddell Sea Bottom Water (WSBW) and the Weddell Sea Deep

Water (WSDW). A relatively cold and fresh branch of the WSDW spills over the South Scotia Ridge, spreads westward through Drake Passage, and fills the bottom of the South Shetland Trench. After passing the Hero Fracture Zone it loses its identity through mixing with the overlying LCDW. A branch of LCDW that has left the ACC in the southeast Atlantic and circulated in the Weddell Gyre, also flows along the slope on the southern flank of the South Shetland Trench above the WSDW. This water mass continues southwestward along the Antarctic Peninsula's Pacific margin. This modern oceanographic regime was set up in general terms, once (a) a deep water pathway was established in Drake Passage, (b) gaps opened between the continental and arc fragments to the east in the Scotia Sea to allow a complete, full-ocean-depth ACC to develop, and (c) gaps opened in the South Scotia Ridge to allow WSDW and LCDW to escape from the Weddell Gyre into the Scotia Sea, and then to flow westward.

Hernández-Molina, F.J., Larter, R. D., Rebesco, M., Maldonado, A., 2004. Miocene reversal of bottom water flow along the Pacific Margin of the Antarctic Peninsula: stratigraphic evidence from a contourite sedimentary tail. Marine Geology. In press.

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