

Establishment of the modern Antarctic Circumpolar Current

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The Antarctic Circumpolar Current (ACC) plays today a key role in the global ocean, the Antarctic ice sheet and thereby the global climate system. The timing of the onset of the strong, deep-reaching ACC flow remains controversial, representing a fundamental gap in our understanding in the evolution of the global ocean circulation, and its role on the paleoclimate. Here, we present coupled records of neodymium isotope ratios (ϵNd) generated from fossil fish teeth/bone debris, biogenic silica and mean grain size of sortable silt from pelagic sediments recovered from the Deep Sea Drilling Project Site 278 on the South Emerald Basin. Our data provide critical insights on the establishment of the modern-like strong, deep-reaching ACC through changes in the evolution of the Circumpolar Deep Water on the Pacific side of the Tasmanian Gateway, from the middle Oligocene to the Pleistocene (~31-1 Ma). Around the Pliocene-Pleistocene transition, the ϵNd values at Site 278 converge with the values of the present-day Circumpolar Deep Water. This is nearly coeval with a major step-like increase in the mean grain size of sortable silt and biogenic silica records suggesting a causal relationship between the development of the modern-like homogenous Circumpolar Deep Water ϵNd values in the Southern Ocean and the establishment of the strong, deep-reaching ACC.