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Investigating the Dynamics of the Pacific Antarctic Circumpolar Current – Initial Results from International Ocean Discovery Program Expedition 383 (DYNAPACC)

Frank Lamy, Gisela Winckler, Carlos Zarikian, and Expedition 383 Scientists

The Antarctic Circumpolar Current (ACC) is the world's strongest zonal current system that connects all three major basins of the global ocean, and therefore integrates, forces and responds to global climate variability. In contrast to the Atlantic and Indian sectors of the ACC, and with the exception of drill cores from the Antarctic continental margin and off New Zealand, the Pacific sector of the ACC lacks information on its Cenozoic paleoceanography from deep-sea drilling records.

To advance our knowledge and understanding of Miocene to Holocene atmosphere-ocean-cryosphere dynamics in the Pacific and their implications for regional and global climate and atmospheric CO₂, IODP Expedition 383 recovered sedimentary sequences at: (1) Three sites located in the central South Pacific (Sites U1539, U1540 and U1541); (2) two sites at the Chilean Margin (U1542, U1544); and (3) one site from the hemipelagic eastern South Pacific (U1543) close to the entrance to the Drake Passage. Age control based on magneto and bio-stratigraphically constrained orbital tuning of physical properties in the Plio-Pleistocene sediments is remarkable, with Sites U1541 and U1543 extending the record back to the late Miocene, and Site U1540 to the earliest Pliocene. Pleistocene sedimentary sequences with high sedimentation rates in the order of 40 cm/kyr were drilled in the Central South Pacific (U1539) and along the Chilean Margin. Taken together, the sites represent a depth transect from ~1100 m at the Chilean margin (U1542) to ~4070 m in the Central South Pacific (U1539), and allow reconstructing changes in the vertical structure of the ACC – a key issue for understanding the role of the Southern Ocean in the global carbon cycle- to be investigated. The sites are located at latitudes and water depths where sediments will allow the application of a wide range of siliciclastic, carbonate, and opal-based proxies to address our objectives of reconstructing, with unprecedented stratigraphic detail, surface to deep ocean variations and their relation to atmosphere and cryosphere changes through stadial-to-interstadial, glacial-to-interglacial and warmer than present time intervals.