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Carbonate system across the Antarctic Polar Front in the Drake Passage

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Continuous determination of oceanic carbonate parameters was carried out across the Antarctic Polar Front in the Drake Passage during the 1998-1999, 2001-2002, 2002-2003, and 2003-2004 austral summers. A flowing pCO₂ system and an automated TA titration system were installed onboard of the Russian R/V Yuzhmorgeologiya for measuring pCO₂, pH, TA, and TCO₂. Sea surface pCO₂ was automatically measured every 2 minute by the flowing pCO₂ system, and TA values were determined every hour with the TA titration system. Water samples were also collected every hour to follow the changes in nutrients and chlorophyll concentrations along the cruise lines.

Sea surface temperature and salinity fluctuated greatly across the polar front. Strong variations were also observed in nutrient concentrations across the front. Silicate concentrations significantly increased traversing the frontal zone as well as increasing nitrate and phosphate concentrations toward the south. Higher surface pCO₂ values were observed along most of the cruise lines, while lower surface pCO₂ values were found at frontal zones in early Decembers. Clear correlation between pCO₂ and nutrients in the south of the Polar Front suggest that the biological removal of CO₂ is more efficient in the south of the front (the Silica Ocean) than in the north of the front (the Carbonate Ocean at least during the study periods).