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The Chilean Fjords

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The Chilean fjords, located between 41˚ and 56˚ S, extend for 1,600 Km and cover an area of 241,000 km^2 with a large number of islands, basins, and gulfs, formed by glacial erosion during the Quaternary and tectonic sinking of the Central Chilean Valley. The fjord region lies mostly under the influence of the main Southern Hemisphere atmospheric circulation pattern, the Southern Westerlies, which in turn, are closely linked to changes within the tropical climate system and climate conditions in coastal Antarctica. High annual rainfall in the fjord region (1,000-7,000 mm year^{-1}) and high mean annual river discharges ($\sim$2,500-3,500 m^3 s^{-1}) greatly enhance the supply of terrigenous sediment which leaves its mark in the sedimentary record. The fjord and offshore waters are also highly productive, generating fine-grained sediments with 1-4% organic C that accumulate at high sedimentation rates (up to $\sim$0.8 cm yr^{-1}, at the sediment surface). Both freshwater and marine microfossils are abundant in sediment cores, allowing assessment of variability in freshwater input through time which in turn is tied to precipitation on land and river runoff into the fjords. At 44˚S, sedimentary evidence for the past 2,000 years point to a shift from a drier period (before 900 yr BP) to a wetter period (after 750 yr BP); this change happened abruptly over a short time span of $\sim$150 years. For the last century, the observed overall decrease in the contribution of continental "proxies" into the fjords since the 1970s was related to a decrease in fluvial contribution and precipitation over the past $\sim$ 30 years. The main anthropogenic influence in the fjord region relates to a rapidly growing salmon farming in the internal fjords of the X region (41˚30'S-44˚S). Currently, salmon aquaculture is also expanding into the southern XI and XII regions. Salmon aquaculture may generate accumulation of organic matter promoting exhaustion of oxygen, change

of natural nutrient cycles, methanogenesis and sulfide production, thus altering the chemical composition of the sediments and the ecological structure of the macrobenthos. The sediment geochemistry of the Chilean fjords has received attention in the last decade, mainly with the support of the Chilean Cimar-Fiordos Program (National Oceanographic Committee) in the area between Puerto Montt (42˚ S) and Cape Horn (56˚ S). However, few sediment cores have been recovered from the Chilean Fjord region. Two important expeditions that yielded undisturbed box-, gravity-, Kasten-, and jumbo piston cores were carried out in November 2000 (CIMAR FIORDO 7 Cruise) and June-July 2005 (RVIB Palmer Cruise NBP0505), as collaboration among a suit of institutions including the University of Concepción, Woods Hole Oceanographic Institution and Rice University, among others. The collection of cores gathered during both expeditions allows for detailed reconstruction of the Holocene period, necessary to address questions concerning the origins of Southern Hemisphere climate variability. Preliminary radiocarbon dating of cores obtained from three fjord systems during NBP0505 cruise in 2005 shows a dramatic latitudinal variation in sedimentation rate.