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Tephrochronology in the area east of Puerto Cisnes and Coyhaique, Chile: Implication for volcanic hazards

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Tephra from Late Glacial and Holocene explosive eruptions of the five large volcanoes (Melimoyu, Mentolat, Macá, Cay, and Hudson) and Minor Eruptive Centers (MEC) in the southern part of the Southern Volcanic Zone (SSVZ) of the Andes have been observed in 19 sediment cores from lakes and bogs in the area east of Puerto Cisnes, Coyhaique and Cochrane. Correlation of >70 tephra layers based on lithostratographic (layer thickness, grain size), petrochemical (trace-elements) and petrographic (glass color and morphology, mineralogy) data allow for correlation of some of the tephra across the cores, identification of their source volcano, and estimation of the magnitude of the explosive eruptions that produced these tephra. The suggested source volcanoes for these tephra include Hudson (34 events), Mentolat (18 events), Melimoyu (7 event), Macá (1 event) and either Macá, Cay or some of the many minor monogenetic eruptive centers in the area (12 events). Among these >70 explosive eruptions, the largest include four from Hudson (H0 >20 km3 at ~17,400 cal yrs BP; H1 > 18 km3 at ~8,000 cal yrs BP; H2 >5 km3 at ~4,000 cal yrs BP; H3 >3 km3 in 1991), one from Mentolat (MEN1 >5 km3 at ~7,700 cal yrs BP), one from Melimoyu (MEL2 >1 km3 at ~1,680 cal yrs BP), and one from Macá (MAC1 or D3 >1 km3 at ~1,440 cal yrs BP). Tephra from six of these large eruptions (H1, H2, H3, MEN1, MAC1 and MEL2) have also been observed in outcrop, but none of the other >55 smaller eruptions have, indicating the potential importance of lake and bog sediment records in constraining the frequency of explosive eruptions of Andean volcanoes. The data indicate that future eruption of the volcanoes of the SSVZ pose a possible threat to regional population centers as well as the rural agricultural economy.