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Holocene tephra succession of Puyehue-Cordón Caulle and Antillanca volcanic complexes, southern Andes (40-41 °S)

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Holocene tephra deposits in Chile and Argentina (40-41 °S) up to 100 km east of Puyehue-Cordón Caulle and Antillanca volcanic complexes comprise at least five voluminous (~1 to ~8 km3) pyroclastic-fall layers that preceded several recently deposited Cordón Caulle pumice falls. Three fall layers are derived from Puyehue volcano, whereas two are sourced from the Antillanca complex, 20 km to the south. The oldest tephra (~10.5 ka), consists of deeply weathered orange dacitic pumice lapilli. At ~ 7 ka comprises dacitic pumice and its age is equivalent to a rhyodacitic dome exposed in the Puyehue summit crater. A complex eruption consisting of a conspicuous compositionally-zoned tephra that is dominated by white rhyodacitic pumice lapilli and capped by black basaltic andesitic scoria. It also comprises a pyroclastic density current that is likely the result of the collapse of the Plinian column associated with the zoned eruption, together with lithic rich and scoriaceous deposits. Mineralogical, geochemical, and Sr isotope evidence, plus the isopach maps, confirm that this sequence of eruptive events is sourced from Antillanca at ~1.9 ka. The total volume of this eruptive sequence exceeds 8 km3, making it the largest Holocene eruption from either volcanic complex and one of the largest Andean eruption during the Christian Era. This eruption was likely responsible for the formation of a 4.5 km diameter caldera. A distinctive younger unit in the region is a voluminous rhyodacitic pumice fall (~1.1 ka), above which a series of several alternating dark lithic and pumice lapilli beds accumulated. This eruption destroyed ~3 km3 of rhyodacitic domes at Puyehue's summit. Historic explosive activity at the nascent Casablanca volcano and along Cordón Caulle, including the 2011-2012 eruption, the largest from this fissural zone, emphasizes an increased risk for volcanic hazards in central Chile and Argentina.