

Tephra in Argentina establishes postglacial eruptive history of Laguna del Maule volcanic field in Chile

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The Laguna del Maule (LdM) volcanic field covers 500 km² of rugged glaciated terrain with Quaternary lavas and tuffs on both sides of the Argentina-Chile border in the Southern Volcanic Zone. At least 130 separate vents erupted >350 km³ of products since 1.5 Ma (Hildreth et al., 2010). These include a ring of 36 postglacial rhyolite and rhyodacite coulees and domes that erupted from 24 separate vents and encircle the lake, suggesting persistence of a large magma reservoir. The young, glassy, and largely non-overlapping lavas are difficult to date by ⁴⁰Ar/³⁹Ar. But whole-pumice and microprobe chemistry of downwind fallout in Argentina, and radiocarbon dating of intercalated soils, establish eruptive stratigraphy and timing of events for the postglacial eruptions at Chilean vents around Laguna del Maule.

A tri-country collaboration among the geological surveys of the United States, Chile, and Argentina, have now established that a wide area east of the volcanic field was blanketed by at least 3 plinian explosive eruptions from LdM sources, and by at least 3 more modest, but still significant, eruptions. In addition, an ignimbrite from the LdM Barrancas vent complex on the border near the SE corner of the lake traveled at least 15 km from source and now makes up a pyroclastic mesa at least 40 m thick. This ignimbrite (72-75% SiO₂) preceded a series of fall deposits that are correlated with eruption of several lava flows that built the Barrancas complex.

Recent ¹⁴C dates suggest that most of the preserved LdM fallout eruptions were between 7 ka and 3 ka. However, the oldest and perhaps largest fall unit yet recognized is correlated with the Los Espejos rhyolite lava flow that dammed the lake and yields a ⁴⁰Ar/³⁹Ar age of 19 ka and a (calibrated) radiocarbon age of 14 ka. Pumice clasts as large as 8.5 cm and lithics to 4 cm were measured 32 km ENE of source. It is the only high-silica rhyolite (75.5-76% SiO₂) fall layer yet found, correlates chemically with the Los Espejos rhyolite lava flow, and includes distinctive olivine-bearing lithics that are correlated with mafic lavas which underlie the Espejos vent. Extremely frothy pumice found near the vent is also consistent with the bubble-wall shards and reticulite pumice distinctive of the correlative fall deposit.

Another large rhyolite fall deposit (74.5% SiO₂), 4 m thick 22 km E of source, has pumice clasts to 9.5 cm and includes ubiquitous coherent clasts of fine, dense soil that suggests it erupted through wet ground; ¹⁴C dates (uncalibrated) yield ages <7 ka. Stratigraphic details suggest that pulses of fallout were accompanied by small pyroclastic flows. Ongoing field and lab work continues to build the LdM postglacial eruptive story. The numerous postglacial explosive eruptions from the LdM field are of significant concern because of ongoing 30 cm/year uplift along the western lakeshore, as measured by InSAR.