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Volcanologic and petrologic evolution of Antuco-Sierra Velluda, Southern Andes, Chile

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Abstract

The Andean Southern Volcanic Zone comprises more than 30 active arc front volcanoes that grew over periods of hundreds of thousands of years. Quantifying the rates at which these volcanoes grow is key to appreciating geological hazards, clarifying petrologic evolution, and exploring possible relationships between volcanism, ice loading, and climate. The integration of precise geochronology and geologic mapping, together with new lava compositions and volume estimates, reveal the evolution of the Antuco-Sierra Velluda volcanic complex at 37.2°S. Thirty-one new ⁴⁰Ar/³⁹Ar age determinations illuminate a punctuated eruptive history that spans at least 430 kyr. Sierra Velluda comprises ~130 km³ and began to grow prior to 426.8 ka. A lacuna in the volcanic record between 343.5 and 150.4 ka coincides with glaciations associated with marine isotope stages (MIS) 10 and 8, although shallow intrusions were emplaced at 207.0 and 190.0 ka. Antuco began to grow rapidly on the northeast flank of Sierra Velluda, erupting more than 60 km³ of lava during three phases: (1) an early phase that began at 150.4 ka, (2) a post-MIS 2 phase between 16.3 and 6.2 ka, and (3) a post-sector collapse phase after 6.2 ka. Volcanism has been continuous during the last 100 kyr, with an average rate of cone growth during this period of ~0.46 km³/kyr that has accelerated by about 50% during the past 6 kyr.

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