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## Multi-scale impacts of Antuco basaltic stratovolcano (Southern Andes, Chile) ca. 6.2 ka sector collapse: avalanche deposition, eruptive behavior transformation and hydrologic reconfiguration

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Reconstructing the complex processes triggered by catastrophic destruction of volcanoes on both their own magmatic system and the surrounding landscape, is a fundamental task for evaluating long-timescale volcanic hazards and controls on the development of volcanoes. Antuco stratovolcano (37.4°S, 71.4°W; Chile), is a dominantly basaltic composite edifice which original ca. 3300 m altitude edifice experienced a ca. 5 km<sup>3</sup> Bandai-type sector collapse at ~6.2 ka BP. We carried out field studies of its debris avalanche deposit (DAD), which was distributed to the W and consist of chaotic breccias, with a longitudinal facies transformation from 2 large proximal toread-block facies (4 & 9 km W from the scar) to megablocks, blocks and matrix facies in distal areas (up to 20 km from the scar). Basal facies are fine grained shredded rocks and contain substratum injections and clastic dykes. The surface of the avalanche is hummocky, and the size, internal architecture and lithology of hummocks vary with distance. At El Peñón and Manquel (10 to 20 km W from the scar) the DAD is overlaid by a sequence of dilute pyroclastic density currents (PDCs) containing juvenile ash and highly vesicular porphyritic basalt scoria fine to medium lapilli size. Further W, one of the latest dilute PDC gave ca. 3.4 ky BP in charcoal. These PDCs are separated from two thick, far-reaching basaltic andesite overlying lava flows (post-collapse Antuco basal flows) by a paleosol, and they show compositional features consistent with mixing of a highly zoned or compartmentalised magma storage system at <5km depth. Subsequently, that event was followed by the initiation of a renewed basaltic magmatic stage and cone regeneration at Antuco during the Late Holocene to the present. These observations plus the detailed study of the composition and texture of post-collapse products suggests a long-lasting reconfiguration of the plumbing system in response to depressurization induced by the sector collapse. The DAD also blocked the natural output of Lake Laja, increasing its level ca. 200 m and then triggering catastrophic outburst floods by dam rupture, preserved as alluvial beds interpreted as debris and hyperconcentrated flow deposits. The ancestral Laja lake outburst, eroded and redeposited tens of

meters of basaltic sediments and boulders as far as 120 km within the Central Depression, W from the volcano. Downstream, along the Itata and Biobío rivers (the latter fed by Laja River) at least two fluvial/alluvial terraces are formed by these volcanoclastic materials, 140-170 km WNW from Antuco volcano. These deposits develop laminar, cross bedded and flaser structures. In addition, fragments of pumice, charcoal and archaeological ceramics have been recognised in the sediments. Ceramics were likely produced at the Talcahuano-1 archaeological site (ca. 1.890 BP), in agreement with charcoal that provides a maximum age between 1.8 and 1.85 ky BP for the younger flooding events. The coupled investigation of the impacts produced by massive debris avalanches, especially at basaltic-arc stratovolcanoes, is important to understand their long-term system evolution and hazards.