Millennial-scale variability in arc volcanism: Insights from Volcán Mocho-Choshuenco, Chile

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New work on the eruptive record of Mocho-Choshuenco Volcano, Chile (39º55'S 72º2'W), reveals clear evidence for systematic millennial-scale variations in post-glacial eruption rate and erupted compositions. This large arc volcano was extensively glaciated during the last glacial period, and offers a rare chance to explore how an arc volcano responds to the rapid unloading of ice. We have identified deposits from 75 post-glacial explosive eruptions since ca. 18 kyr, ranging in size from < 0.1 - 5 km^3. Melt compositions range from basaltic-andesite to rhyolite, erupted in a variety of styles (from widespread Plinian to small Strombolian events). We identify three main phases of activity: phase 1 (early post-glacial) was characterised by high eruption rates (2.2 km^3/kyr), large eruptions (VEI ≥ 5), evolved melts (dominantly rhyolites and dacites), and the lowest magmatic temperatures; phase 2 showed eruption rates a magnitude lower than phase 1 (0.1 km^3/kyr), small eruptions (VEI ~ 3) and mafic melts (dominantly basaltic-andesites); phase 3, the most recent explosive activity comprises high eruption rates (2.0 km^3/kyr), a range of eruption sizes (VEI 3 to 5) and intermediate melts (dominantly andesitic and dacitic).

We suggest that this systematic temporal shift in eruption behaviour reflects changes in crustal storage and processing of magma, in response to the unloading of ice and accompanying changes in crustal stress regimes. Following rapid post-glacial evacuation of stored, evolved magmas that had accumulated during the glacial period, the crustal plumbing system is recharged with primitive magmas, before recovering towards a new 'steady-state'. We suggest that, along arc, other volcanoes may show similar time-dependent post-glacial responses