

Magmatic gas emissions at Holocene volcanic features near Mono Lake

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A line of silicic volcanism extends 45 km south from Mono Lake to Mammoth Mountain, a >55 ka dacitic edifice on the SW rim of the Long Valley caldera, and encompasses the Mono Craters volcanic chain (MCVC). The MCVC constitutes by far the largest volume of Holocene lava in the region, and gas and CO₂-rich water were encountered in a tunnel bored through the base of this chain in the 1930s. The most recent eruptions and intrusion-related uplift occurred north of MCVC, at Paoha Island in Mono Lake, within the past 300 years. While decades of study have focused on the input of gas to Mono Lake [1], we report on the first survey of gas efflux from the subaerial volcanic vents on Paoha Island and from the MCVC. We found only a small efflux of CO₂ (~0.1 t/d) from an area of thermal ground on Paoha Island but discovered a larger efflux (~11.6 t/d) from the summit of North Coulee, one of the youngest features in the MCVC. Average air-corrected $\delta^{13}\text{C-CO}_2$ (-4.72‰), $^3\text{He}/^4\text{He}$ (5.89 R_A), [He] (16 ppmv), and CO₂/³He (7.7 x 10⁹) values in the North Coulee gas are strikingly similar to those in fumarolic gas at Mammoth Mountain, and we propose that these values characterize magmatic gas throughout the region. The magmatic ³He input to Mono Lake is well constrained [2], and our CO₂/³He ratio suggests that the associated input of magmatic CO₂ is ~3.9 t/d. Magmatic CO₂ emissions total ~4 t/d for Mono Lake and Paoha Island and ~23 t/d for the MCVC, both totals substantially less than that observed at Mammoth Mountain (>100 t/d) and the Long Valley hydrothermal system (30-90 t/d). The CO₂ emissions may reflect intrusion rates of basalt beneath silicic magma chambers and, if so, present-day intrusion rates at Mammoth Mountain and the West Moat of the Long Valley caldera may exceed those in the Mono Basin. The CO₂ emission results suggest that onset of volcanism in the Mono Basin ~40 ka should be viewed simply as a new locus of basaltic intrusion and not necessarily a shift away from the Long Valley area.

[1] Broecker & Wanninkhof (2007) *Eos* **88**, 141-148 [2] Clark & Hudson (2001) *L&O* **46**, 189-196