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Volcanic gas emissions during active dome growth at Mount Cleveland, Alaska, August 2015

Cynthia Werner (1), Christoph Kern (1), John Lyons (2), Peter Kelly (1), David Schneider (2), Kristi Wallace (2), and Rick Wessels (3)

(1) U.S. Geological Survey, Cascades Volcano Observatory, Vancouver, WA United States (cwerner@usgs.gov), (2) U.S. Geological Survey, Alaska Volcano Observatory, Anchorage, AK United States, (3) U.S. Geological Survey, 12201 Sunrise Valley Dr MS 905 Reston, VA United States

Volcanic gas emissions and chemistry data were measured for the first time at Mount Cleveland (1730 m) in the Central Aleutian arc, Alaska, on August 14-15, 2015 as part of the NSF-GeoPRISMS initiative, and co-funded by the Deep Carbon Observatory (DCO) and the USGS Alaska Volcano Observatory. The measurements were made in the month following two explosive events (July 21 and August 7, 2015) that destroyed a small dome (∼50x85 m), which had experienced episodic growth in the crater since November, 2014. These explosions resulted in the elevation of the aviation color code and alert level from Yellow/Advisory to Orange/Watch on July 21, 2015. Between the November, 2014 and July, 2015 dome-destroying explosions, the volcano experienced: (1) frequent periods of elevated surface temperatures in the summit region (based on Mid-IR satellite observations), (2) limited volcano-seismic tremor, (3) visible degassing as recorded in webcam images with occasionally robust plumes, and (4) at least one aseismic volcanic event that deposited small amounts of ash on the upper flanks of the volcano (detected by infrasound, observed visually and in Landsat 8 images). Intermittent plumes were also sometimes detectable up to 60 km downwind in Mid-IR satellite images, but this was not typical.

Lava extrusion resumed following the explosion as indicated in satellite data by highly elevated Mid-IR surface temperatures, but was not identifiable in seismic data. By early-mid August, 2015, a new dome growing in the summit crater had reached 80 m across with temperatures of 550-600 C as measured on August 4 with a helicopter-borne thermal IR camera. A semitransparent plume extended several kilometers downwind of the volcano during the field campaign. A helicopter instrumented with an upward-looking UV spectrometer (mini DOAS) and a Multi-GAS was used to measure SO_2 emission rates and in situ mixing ratios of H_2O, CO_2, SO_2, and H_2S in the plume. On August 14 and 15, 2015, a total of 14 helicopter traverses made beneath the plume resulted in SO_2 emission rates ranging from 460 to 860 t/d. Four of the 14 measurements were made during a dedicated gas flight where emission rates varied between 480-580 t/d SO_2 over an approximate 20 minute period on August 15, demonstrating the short-term variability of emissions. Transects through the plume were also flown during the gas flight with the highest concentrations ($\sim$ 0.5 ppm SO_2) measured approximately 2.6 km downwind of the volcano. Volcanic CO_2 was at detection limits and in-plume concentrations exceeded background air by only 1- 1.5 ppm. Volcanic H_2O could not be resolved above atmospheric background and H_2S was not detected. Low molar C/S ratios derived from these data (< 3) are consistent with the presence of shallow magma in the system and the observed growth of a new lava dome. Gas emissions data will be compared with the low level background seismicity and infrasound from the Cleveland geophysical network.