The timing and mechanisms of S release during the 2014–15 CE Holuhraun and 1783–84 CE Laki flood lava eruptions, Iceland. A chalcophile isotope perspective.

C.R. GALLAGHER[*1,2], K.W. BURTON[1], P.S. SAVAGE[3], G.M. NOWELL[1], T. THORDARSON[2] AND B.F. HOUGHTON[4]

[1] Dept. Earth Sciences, Durham University, UK
[2] Inst. of Earth Sciences, The University of Iceland, Iceland
[3] SEES, University of St. Andrews, UK
[4] SOEST, The University of Hawaii at Manoa, HA, USA
[*] Corresponding author: catherine.gallagher@durham.ac.uk

Large Flood Basalt (FB) events induce significant atmospheric perturbations through the volatiles they release, but are infrequent, and thus poorly constrained, events. Smaller, more frequent, modern flood lavas are valuable analogues to constrain shallow conduit processes during FB eruptions. This study compares the timing and mechanisms of atmospheric sulphur (S) loading during the two most recent flood lava eruptions in Iceland:

1) The 2014–15 event at Holuhraun was Iceland's largest effusive eruption in the last 231 years. It created a lava flow field of 1.45 ± 0.04 km^3, and released 9.6Mt SO_2 atmopshere. This eruption has yielded, through near continuous on-site monitoring, an un-paralleled dataset for a flood lava eruption. The tephra fall and lava samples collected are linked to direct observations of changes in styles of vent activity.

2) The 1783–84 CE Laki eruption produced 14.7 km^3 of lava and 0.4 km^3 of tephra. It released 120Mt of SO_2 into the atmosphere, producing a significant hemisphere wide climatic impact. Activity at Laki propagated along a 27 km-long fissure in 10 eruptive episodes, both magmatic and phreatomagmatic. Contemporary accounts allowed for detailed reconstruction of the event.

Density and vesicularity analysis of juvenile eruptive products is used to compare and contrast eruption dynamics, and the modulating role of shallow conduit processes, during these events. The mechanism(s) of S release are identified using a combination of chalcophile isotope proxies and EMP analysis to fingerprint the speciation of S present upon eruption. The latter is of particular importance, as the type(s) of sulphur released into the atmosphere have different residence times and climatic impacts.