FIFTY YEARS OF HYDROTHERMAL ALTERATION AND SEAWATER EXCHANGE AT SURTSEY VOLCANO, ICELAND

RHODES, J. MICHAEL[1*], BRYCE JULIA G.[2], JERCINOVIC, MICHAEL[1], FAHNESTOCK, M. FLORENCIA[2] AND JÓNASSON, KRISTJÁN[3]

[1]Dept. Geosciences, Univ. of Mass. Amherst, MA 01003, USA (*corresponence; jmrhodes@geo.umass.edu)
[2]Dept. Earth Sciences, Univ. New Hampshire, Durham, NH, 03824 USA
[3]Icelandic Inst. Natural History, Gardabær, Iceland

Surtsey volcano burst explosively out of the Atlantic Ocean, off the coast of Iceland, creating the island of Surtsey between November 1963 and June 1967. Twelve years later, in 1979, the eastern volcanic cone (Surtur-1) was drilled and cored to a depth of 181 m, documenting volcano growth and the extent of hydrothermal interaction of basaltic tephra with seawater [1]. These authors found that replacement of tephra with palagonite and authigenic minerals was temperature dependent, corresponding with high (~ 140 ^{o} C) temperatures caused by the intrusion of lava feeder dikes late in the eruption. Our study, comparing these cores with original tephra samples, shows that, despite extensive hydrothermal alteration, whole-rock major, trace and isotopic data (Sr, Nd, Pb) record only modest exchange of elements between tephra and hydrothermal fluids in the upper, hotter, 140 m of the core prior to 1979. Below 140 m, in a cooler zone of coarse porous tephra, extensive elemental exchange has occurred, involving the loss of Ca, K, Rb, Sr with addition of MgO, S and Na, accompanied by seawater Sr isotopic signatures. In August and September, 2017, with support from the International Continental Drilling Program (ICDP), three new holes drilled at the same site recovered 157 and 187 m of vertical core and 354 m of oriented inclined core. Data from these cores, to be presented here, will document the nature, extent and rates of hydrothermal and seawater reaction with basaltic tephra at Surtsey over the last 50 years.

[1] Jakobsson and Moore (1986), *Geol. Soc. Amer.* **97**, 648-659.