USING ANALOG FLOW EXPERIMENTS TO MODEL MORPHOLOGIES DEVELOPED DURING EPISODIC DOME GROWTH: A CASE STUDY OF MOUNT ST HELENS, 1980-1986

Kathryn Altman and Rachel Teasdale
Geological & Environmental Sciences, CSU, Chico, Chico, CA 95929-0205, kaltman6@gmail.com

From 1980 to 1986 the dacite dome at Mount St. Helens was emplaced as a series of 17 events, identified by different growth rates, volumes, height to diameter ratios, emplacement rates and morphologies (Swanson, 1989). Rates of emplacement characterize three periods with fastest growth between October 18, 1980 and the end of 1981, intermediate growth rates between March 1982 and March 1984 and slowest growth until the end of the emplacement events in 1986 (Swanson, 1989). The shape of the dome changed from 1980 to 1986 as a function of magma viscosity, tensile strength of the hot core, and thickness of the outer shell (Swanson, 1989). The height to diameter ratios (h:d) recorded throughout the growth of the dome have been used to quantify the changes in the shape of the dome. The dome was flatter during the first period of emplacement then by June 1981, the dome to steepened (Swanson, 1989). Analog models presented here aim to reproduce the emplacement of the domes based on observations and data recorded at Mount St. Helens from 1980 to 1986. Flow experiments use a slurry of PEG (poly-ethelyne glycol) mixed with kaolin powder that is pumped into a tank of cold water (Fink and Griffiths, 1998). PEG is liquid at room temperature and solidifies in the cold water. Kaolin powder, added to the PEG, increases the PEG viscosity to be comparable to dacite domes. Observed and recorded data from Mount St. Helens are used to constrain analog flow model parameters such as slope, effusion rate, and PEG viscosity in an attempt to recreate the dome morphologies observed in the 1980 to 1986 episodes. Dome morphologies in experiments vary with the crustal thickness developed during experiments. The thickness of dome crust increases when the difference between water temperature and the slurry are large. Dome crust thickness controls the h:d ratio, which are used here to characterize dome morphology. The h:d ratio of experiments are very close to those measured at Mount St. Helens, so are considered good representations of dome growth events. Ongoing work investigates multiple episodes of dome emplacement using solid structures in the tanks to represent previously emplaced dome edifices.