Geophysical Research Abstracts, Vol. 9, 07886, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-07886

The experimental constraints on peperite formation and relationship to explosive volcanism: a new approach

W.S. Downey (1), O. Spieler (2), C.S. Shaw (1), and D.B. Dingwell (2)

(1)Department of Geology, University of New Brunswick, P.O. Box 4400, Fredericton, New Brunswick, E3B 5L2 Canada (warna.downey@unb.ca)

(2) Department für Geo- & Umweltwissenschaften Sektion Mineralogie, Petrologie und Geochemie, Ludwig-Maximilians-University, Theresienstrasse 41, D-80333 Munich Germany

The interaction of magma with wet sediment is very common, especially in subaqueous volcanic environments. The presence of peperite provides field evidence for the mechanisms of magma-water/sediment interactions and is relevant to understanding within-vent processes that occur during Surtseyan explosions. Peperites can be useful in paleoenvironmental reconstruction and relative timing of events because it demonstrates that magmatism and sedimentation was contemporaneous or nearly so. The presence of peperites along the upper contact of a concordant igneous body helps distinguish true lavas from intrusive bodies.

The textural variations produced during sediment-magma interactions and the relation of peperite formation to explosive breccias has been examined via field relations. The study of peperite is important for understanding magma-water interactions and explosive hydrovolcanic hazards as, the mixing mechanisms that precede explosive eruptions are analogous to fluid coolant interactions (FCI) that occur during peperite formation. In addition, there is virtually no information on the role of sediment and magma rheology in the development of peperites. Such information is key to understanding a specific class of explosive eruptions and the rock textures produced.

Experimental research on peperite formation is still in its infancy. Previous studies have used computer simulations and scale model volcano experiments using magma analogue materials to model magma/wet sediment interactions, as well as simulant liquids into water at geologically relevant velocities. This is first study that attempts

to use silicate glasses as analogue materials providing an experimental basis for analyzing and adapting numerical simulations concerning peperite formation.

The experimental design consists of a pressurized autoclave containing a molybdenum furnace (up to 0.4 GPa and 1300 ºC) with an internal crucible for melting the silicate glasses. The melt will be injected into a sediments column via a ceramic conduit. The injection will be driven by gas pressure in an experimental setting similar to a beer keg. Silicate melts of varying compositions will be used as the magma source to produce gas-rich explosions by interaction with water-saturated sediment (sand and mud) to produce peperite. The composition, viscosity, and water contents of both the sediments and magma will be changed incrementally, as well as the pressure and temperature of the experiments, to assess the effect of these parameters on the texture of peperite. The textures of the peperites produced in these experiments will be compared to (1) earlier analogue experiments and (2) natural peperites from a variety of locations worldwide.