Geophysical Research Abstracts, Vol. 7, 01695, 2005
SRef-ID: 1607-7962/gra/EGU05-A-01695

Changes in local stress and volcanotectonic seismicity during the ongoing eruption of the Soufrière Hills Volcano, Montserrat

D.C. Roman (1), B.J. Baptie (2), L. Ottemöller (2), J. Neuberg (1)

(1) School of Earth and Environment, University of Leeds, United Kingdom, (2) British Geological Survey, United Kingdom (droman@earth.leeds.ac.uk)

The Soufrière Hills Volcano, Montserrat, has been in eruption since July 1995 and has been monitored by a local digital seismic network of up to eight instruments since October 1996. The entire eruption has been accompanied by high-frequency 'volcano-tectonic' (VT) seismicity, although the level of VT seismicity has varied significantly through the course of the eruption. Forward modeling of theoretical polarities and ground displacements for specified double-couple source geometries demonstrates that, despite relatively sparse seismic station coverage on Montserrat, unique and stable fault-plane solutions may be calculated for the VT earthquakes using standard methods. Following this, we repicked VT earthquakes recorded on the Montserrat Volcano Observatory digital seismic network and relocated them using a 1D velocity model. We also attempted to determine well-constrained double-couple fault-plane solutions for all relocated VT earthquakes. Relocated earthquakes from October 1996 to May 1998 occurred directly beneath the vent in a small volume extending to a depth of approximately 5 km BSL. VT seismicity accompanying dome growth during 1996-1997 is characterized by small swarms lasting from a few hours to a few days, separated by periods of low-level VT activity. Events during this period occurred over a wide depth range of 1-5 km BSL. In contrast, VT seismicity during a period of magma intrusion in April – May 1998 is characterized by a steadier rate of seismicity occurring in a restricted depth range of 2.5-3.5 km BSL. Well-constrained fault-plane solutions for VT earthquakes indicate primarily oblique strike-slip events. For swarm earthquakes during the dome-growth period, fault-plane solution pressure (p-) axes are oriented approximately parallel and/or perpendicular to the direction of regional maximum compressive stress around Montserrat. In contrast, fault-plane solution p-axes for

earthquakes accompanying intrusion have pressure axes oriented oblique to regional maximum compression. We hypothesize that the observed differences in earthquake rates, locations, and fault-plane solutions reflect differences in magma conduit dynamics during eruption and intrusion. Swarm earthquakes with fault-plane solution p-axes oriented perpendicular to regional maximum compression are thought to reflect local stresses induced by the inflation of the magmatic conduit system beneath Soufrière Hills.