Geophysical Research Abstracts, Vol. 7, 05580, 2005
SRef-ID: 1607-7962/gra/EGU05-A-05580

Seismic Velocities, Volumetric Strain and Acoustic Emissions during Etna Basalt Deformation.

S. Vinciguerra (1), S. Stanchits (2), G. Dresen (2)

(1) Osservatorio Vesuviano-Istituto Nazionale di Geofisica e Vulcanologia, Via Diocleziano 328, 80124, Naples, Italy (Tel ++39 081 6108442; Fax. ++39 081 6108351; e-mail: vinciguerra@ov.ingv.it); (2) GeoForschungsZentrum Potsdam, Department 3.2, Telegrafenberg D423, 14473 Potsdam, Germany;

Etna constitutes one of the most important natural volcanic laboratories. Simultaneous inversion of P and S wave arrivals is a crucial technique to carry out seismic tomography in volcanic areas. P and S wave velocity increases and decreases have been interpreted as due to cooling intrusive bodies or molten rocks. However, despite the improvement in local seismic tomography techniques, no corresponding direct measurements are available and there is a paucity of quantitative experimental data. We report the results of simultaneous laboratory measurements of P-wave velocities and Acoustic Emissions (AE) during compressional triaxial tests performed at 10-60MPa confining pressure on cores of Etna lava flows. Samples were driven to failure by both single and multiple load cycles to induce damage accumulation, in order to simulate progressive edifice weakening under the cyclical magma pressurisation. Eleven piezoelectric transducers mounted on the rock samples allowed to record AE and to monitor changes of velocities. Analysis of the polarity of first motion of AE events allowed to discriminate between tensile, shear and pore collapse source types. Vp and Vs velocity values of about 4.2 and 2.8 km/s respectively were found at 60MPa confining pressure followed by a rapid increase by about 30% and 15% during initial loading of basalt. High stress anisotropy was induced by the applied load. A remarkable percentage of shear events (30-50%) was observed during compaction. Decrease of axial and radial velocity components is noticed at the onset of dilatancy, marked by inversion of volumetric strain. However AE onset is delayed, suggesting that initially preexisting microcracks might reactivate aseismically . Decrease of confining pressure to 40MPa and load cycling caused a decrease of Vp and Vs with initial values of about 4.0 and

2.6km respectively. Same percentage of inversion of volumetric strain was found during this stage, while the onset of AE was further delayed (Kaiser effect), and portion of tensile events further decreased. Decreasing confining pressure to 20MPa led to Vp and Vs initial values of about 3.5 and 2.4 respectively. Rock failure was abrupt during the last loading cycle. Shear type events progressively increased, while AE rate increased only at peak load . These results indicate that crack density of Etna basalts is very high and that velocities can be different with respect than those generally assumed in tomographic studies of Etna.