Geophysical Research Abstracts, Vol. 9, 03712, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-03712

Fault rock generation & fault evolution in densely welded ignimbrites: the role of pre-existing joints & host rock fabric

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It has long been recognised that pre-existing and precursory structures such as joints play a fundamental role in the initiation and development of faults in the brittle crust. Furthermore host rock fabric can influence the nature of pre-existing structures, such as joint orientation and density, and as a result affect the mechanism of fault initiation and development. Much of the previous work examining the role of joints in fault growth has been carried out in carbonates, granites and sandstone. Here we present field data of small scale faults in densely welded ignimbrites from the island of Gran Canaria, Spain. A new model of fault growth and fault rock generation in ignimbrites is presented, which highlights the influence pre-existing joints and host rock fabric has on fault initiation and growth.

A series of faults cutting ignimbrites in Gran Canaria, Spain formed as a result of initial caldera collapse and were reactivated during subsequent eruption events. The fault population, ranging from 12 cm to 22 m of displacement, allows us to examine the evolution of the fault within a single ignimbrite unit. Fault growth, fault morphology and breccia clast size are controlled by pre-existing joints in the ignimbrite unit. The fault core grows by the incorporation of joint delineated slabs, thus, joint spacing will control slab width and the amount the fault core expands by during a slip event. Furthermore, joint spacing is itself controlled by the intrinsic rock fabric formed as a result of ignimbrite deposition; the fabric also exerts a control over breccia clast shape within the fault core. The fabric present in densely welded ignimbrites is a result of extreme flattening of fiamme to form cm-thick sub-mechanical layers within the larger unit, and joints are more closely spaced where these sub-layers are present. The inten-

sity of compaction decreases upwards in a unit, and therefore, so does the presence of sub-layers and joint density. This is mirrored in the structure of the fault core where narrow fault cores coincide with areas of high joint density regardless of displacement. Our model suggests that rock fabric is a major influence on the intensity of jointing and therefore, on fault growth and character of the fault core.