Geophysical Research Abstracts, Vol. 9, 07841, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-07841

Earthquake migration within a normal fault and implications on rock permeability

Francesco Pacchiani (1,2), and Hélène Lyon-Caen (1)

(1) Laboratoire de Géologie, Ecole Normale Supérieure, Paris, France. (2) Now at Istituto Nazionale di Oceanografia e di Geofisica Sperimentale, Borgo Grotta Gigante 42/C, 34010 Sgonico (TS), Italy (fpacchiani@ogs.trieste.it)

The deformation mechanisms in regions of extensional tectonics is a broad subject of research. We present the results of a study on the fault – fluid - earthquake relationship carried out with seismological data originating from the Corinth Rift, Greece. The western part of the rift is rapidly opening at the rate of 1.5 cm/yr in a N-S direction and this deformation is accompanied by a high seismicity rate that is recorded by the permanent Corinth Rift Laboratory Network (30x30 km^2). In this study we analyze a seismic crisis that occurred in 2001 and lasted about 3 months with 8 earthquakes of magnitude superior than 3.5, the largest event having a magnitude 4.2. This crisis occurred 6km south of the city of Aigion and comprises over 3000 events. To enhance the resolution of the earthquake location we relocated the earthquakes of the seismic crisis. We extracted 49 multiplets using a technique based on the coherency measure between two waveforms. The travel time delays between all pairs of events in a multiplet are computed by spectral cross-correlation, considering both P and S wave data. The geometry of the underlying structures at depth is estimated by calculating the poles of all possible 3-point planes, each hypocenter being a point. We show that this crisis is related to an up-to-now unrecognized fault, transverse to all major active normal faults, striking SW and dipping 40˚ to the northwest. The relocated seismicity reveals a peculiar geometry: between 8.5 and 6.5 km depth the seismicity is located on a single plane, above 6.5 km the seismicity appears to branch on different planes. The time-space analysis indicates a migration of the seismic activity towards the surface, perpendicular to the slip at a speed of 20 m/day. Considering the reasonable probability of over-pressurized fluids at depth and assuming that the propagation speed of a fluid pressure pulse can be estimated by the seismic migration, first order hydraulic

conductivity and permeability estimates can be expressed as a function of the migration velocity. This results in an estimate of the hydraulic conductivity of $1.15\ 10^{-5}$ m/s and of the permeability of $7\ 10^{-13}$ m^2, in good agreement with other observations in the region.