Geophysical Research Abstracts,
Vol. 10, EGU2008-A-07757, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-07757
EGU General Assembly 2008

1 Source dynamics of the LP events occurred during the recent uplift at Campi Flegrei volcanic complex

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The uplift episode occurred in 2004-2006 at Campi Flegrei was accompanied by intense Long-Period (LP) activity, concentrated in the period 20-29 October 2006. Moreover on October 29^{th} a peak (the highest of the whole 2006) in the CO_2 flux was observed.

These signals consist of weak, monochromatic oscillations whose spectra depict a main peak at frequency ~ 0.8 Hz. This peak is common to all the stations of the INGV – Osservatorio Vesuviano seismic network, and not present in the noise spectra, thus suggesting that it mostly reflects a source effect.

By applying a clustering procedure to the signals associated to these LP (Saccorotti et al., 2007) it is possible to evidence the presence of a cluster with an higher number of events. In order to characterize the source dynamics of the these LP-events we performed a Seismic Moment Tensor Inversion. We performed double-couple (DC), deviatoric and full unconstrained inversion on the stacked signals of the cluster. The isotropic component from the full inversion of the moment tensor is about 40%. This value results significant from a jack-knife statistical test.

The best solution for the moment tensor can be visualized in a source-type plot (Hud-

son et al., 1989) and corresponds to a combined tensile crack and shear faulting mechanism.

To get more insight in the source mechanism we analysed the LP earthquakes by using the Sompi method (Kumazawa et al., 1990). This high-resolution spectral technique, that is based on a homogeneous autoregressive (AR) model, allows to retrieve the wave-element contained in the signals and characterized by a complex frequency *f–ig*, where f is the frequency and g is the growth rate. The quality factor Q is then calculated according to the relation $Q = -f/2g$. This parameter depends both on the fluid and on the rock matrix properties and could be used in order to constrain the characteristics of the fluids involved in the mechanism of the generation of the LPs. The temporal pattern of f and Q during the analysed period suggests a stability of the source mechanism generating the LP events.

We use Sompi results to derive the fluid properties and to constrain the crack dimensions. We consider both the case of a) foam (water-steam mixture with gas-volume fraction between 10% and 90%) and b) bubbly water (water-steam mixture with gas-volume fraction less than 10%). Under these hypotheses the most probable range for the crack length, L, is 35-125 m for the longitudinal $2L/3$ mode.

The results of the moment tensor inversion and of the Sompi analysis are consistent with the observed geochemical variations, suggesting as a possible LP source mechanism the opening and successive resonance of a fluid-filled crack.

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