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Rheology of shallow crust of large calderas and relation with eruptions: the Campi Flegrei caldera (Italy).

S. Carlino and R. Somma

Istituto Nazionale di Geofisica e Vulcanologia INGV, Sezione di Napoli -Osservatorio Vesuviano, Italy (carlino@ov.ingv.it)

This work analysed the relationship occurring between the rheology of the shallow crust (elastic or visco-elastic) and its inference on the magma storage vs eruption, at Campi Flegrei caldera (CFc) Southern Italy. Assuming a viscoelatic condition, below the CFc, the encasing rocks are subjected to stress (overpressure) produced by both new magma arrival within a deep magmatic chamber and/or fluid influx reaching a shallow "hybrid" source (magmatic-hydrothermal). This two cases are evaluated to understand when the condition for elastic failure (eruption) or viscous regime (magma storage) are achieved.

The boundary conditions (i.e. rocks viscosity, magma or fluid influx and volume of the source involved) are assumed taking into account the recent geophysical and volcanological investigations of the area and the previous caldera eruptive models.

Both magma and hydrothermal fluids are considered incompressible, while the wall rocks are assumed viscoelastic with different values of viscosity (μ_{wr} =10^{16} to 10^{19} Pa sec). The magma influx of deep chamber (volume range from 400 to 2000 km^3) is calculated considering that a 40 km^3 of magma recharge occurred between the last main explosive eruptions (Campanian Ignimbrite 39 Kyrs B.P. and Neapolitan Yellow Tuff eruption 15,6 Kyrs. B.P.) The obtained influx magma value (0,002 km^{3}y^{-1}) is in agreement with the average values inferred for others large calderas . In the case of shallow hybrid source (volume of only few km^3) the fluid influx has been considered from 0,009 to 0,02 km^{3}y^{-1} according to previous studies. The analysis show that, the viscous regime prevails for the deep magmatic source case, taking into account all the viscosity range; while for the shallower hybrid source the viscous regime is less dominant.

Furthermore, the results suggest that, at CFc, magma storage (viscous regime), rather than its eruption (elastic failure) is enhanced by different factors such as high geothermal gradient, wall rocks viscosity, heterogeneity of the crust and extensional tectonic strain rate of the area.