RHEOLOGICAL STRATIFICATION OF THE CRUST
AND STRESS SOURCE FOR THE SEISMICITY AT MT. VESUVIUS

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The aim of this paper is to define the internal structure of the volcanic complex of Mt. Somma-Vesuvius and to understand the driving process of the local seismicity. To define the thermal state of the crust, a conductive stationary model with a source formed by two co–axial cylinders coinciding with the crater axis was utilized. The top of the above cylinder (radius = 0.5 km) is located at 4 km of depth, while the top of the lower cylinder (radius = 6 km) is located at 8 km of depth with a temperature of 900°C according to boundary conditions obtained by geophysical and geothermal explorations. The thermal field model shows that the 350–400°C isotherm corresponds to the lower boundary of seismogenetic volume at 4 km depth beneath the crater axis, in good agreement with experimental studies which identify at these temperatures the limiting values for the occurrence of seismicity (Scholz, 2002). This thermal field allows us to define the rheological stratification model at the volcanic area, which shows that the brittle-ductile transition is located at about 4 km below the crater axis, while at 6 km away from the crater is located at a depth of about 10 km. This structure suggests that the driving forces of volcanic activity could be associated to uprising of a ductile layer which connects the upper mantle to the volcanic feeding system, unlike previous works which associate the source of the volcanic activity to a closed magma chamber confined in the shallow crust.

To understand the physical state of this part of the crust was analyzed the mechanism of generation of local seismicity and a model of stress field acting on the rocks was performed. This shows that the lithostatic compression of the crust together with the overpressure due to the loading of volcanic edifice are able to exceed the frictional strength of the crust until a depth of 3 - 4 km and to generate the observed seismicity.