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A conductive thermal model of a magma chamber: applications at Vesuvius and Campi Flegrei magmatic systems.

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A 2D finite difference scheme is proposed to solve the problem of the heat transfer inside and around a magma body. In particular, the numerical solution allows to account for periodic inputs of magma from the underlying asthenosphere to the deep reservoir. Moreover, the displacement of the boundary separating the melt and the solid magma, in the reservoir and the conduit, due to magma crystallization, is computed with an ad hoc fixed grid scheme. The numerical scheme is used to predict the thermal evolution of the deep magma chamber below Mt. Vesuvius, since 40ka till today using a periodic refilling of the reservoir at time intervals of 4 ka. The thermal modelling results are consistent with geophysical and geothermal data of the Vesuvian area and support the crustal contamination hypothesis for most of the Vesuvian magmas.

The numerical code here presented is stable, flexible and at low computational cost and has been used also to simulate the DEEP thermal regime at the Campi Flegrei caldera, considering that the deep magmatic reservoir, whose top is located at 8-10km of depth, has been fed by repetitive arrivals of mantle-derived magmas since at least 400ka ago, and it in turns fed shallower reservoirs of different size, in particular the large Campanian Ignimbrite and Neapolitan Yellow Tuff magma chambers.