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# Geothermal manifestations in the Tyrrhenian area: the role of faults in channelling superhot geothermal fluids

**Martina Zucchi**
University of Bari, Department of Earth and Geo-environmental Sciences, Bari, Italy (martina.zucchi@uniba.it)

Extensional tectonics and related magmatism affecting continental crust can favour the development of geothermal systems. Granitoids intruded in the upper crust represent the main expression of magmatism; they are strictly controlled by brittle structures during their emplacement and exhumation. The cooling of the magmatic bodies produce a thermal perturbation in the hosting rocks resulting in thermo-metamorphic aureoles of several meter thick, usually characterised by valuable ore deposits. After the emplacement and during the cooling stage such granitoids can promote the geothermal fluids circulation mainly through the fault zones. In case of favourable geological and structural conditions, geothermal fluids can be stored in geological traps (reservoirs), generally represented by rock volumes with sufficient permeability for storing a significant amount of fluid. Traps are confined, at the top, by rocks characterised by low, or very low permeability, referred to as the cap rocks of a geothermal system. Several studies are addressed to the study of fluid migration through the permeable rock volumes, whereas few papers are dealing with fluid flow and fluid-rock interaction within the cap rocks.

In this presentation, an example of fault-controlled geothermal fluid within low permeability rocks is presented. The study area is located in the south-eastern side of Elba Island (Tuscan Archipelago, Italy), where a succession made up of shale, marl and limestone (Argille a Palombini Fm, early Cretaceous) was affected by contact metamorphism related to the Porto Azzurro monzogranite, which produced different mineral assemblages, depending on the involved lithotypes. These metamorphic rocks were dissected by high-angle normal faults that channelled superhot geothermal fluids. Fluid inclusions analyses on hydrothermal quartz and calcite suggest that at least three paleo-geothermal fluids permeated through the fault zones, at a maximum P of about 0.8 kbar. The results reveal how brittle deformation induces fluid flow in rocks characterised by very low permeability and allow the characterisation of the paleo-geothermal fluids in terms of salinity and P-T trapping conditions.