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Low Entalpy Geothermal suitability of north Sardinia (Italy)

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This note focus on geothermal potentialities of north Sardinia, where several positive thermal anomalies occur along with geolithological and climatic conditions, which make the area specifically suitable for geoexchange.
Sardinia consists of a Variscan basement metamorphosed at different grade and further intruded by a late orogenic batholith. Above this basement, since Mesozoic time, a composite sedimentary and volcanic succession occurs, with maximum thickness of 2-3 Km in correspondence of some extensional and strike-slip Cenozoic basins. The volcanic activity consists of a calcalkaline cycle with crustal component, which started in the late Eocene and ended in the Serravallian; another, mantle derived, alkaline-transitional cycle took place during Pliocene and ended in the middle Pleistocene.
Several evidences of geothermal circuits occur in northwestern Sardinia, where some springs characterized by anomalous water temperatures and/or chemical-physical features (e.g., high salinity and carbon dioxide content) were known. In addiction those already exploited (e.g., S. Lucia, S. Martino), new springs and boreholes characterized by positive anomalous water temperatures (in the range of 24 and 35 °C) have been highlighted during our recent surveys. These waters are warmer than the homoeothermic level temperature (where no seasonal variations are recorded), which in the area is 15-16 °C.
Considering the absence of active volcanism, the anomalous temperatures must be generated by the uprising of deep meteoric water along a plumbing network of crustal faults that bound the extensional as well as the strike slip basins. Rainwater heated for geothermal gradient can upwell rapidly interacting with surface aquifers that, hence, experience heating at different degree.
The physical characteristics (i.e. thermal conductivity, open porosity, permeability etc) of the rocks cropping in north Sardinia, regardless the positive thermal anomalies, are profitably suitable for exploiting the subsoil thermal inertia to store thermal energy in summer and recover it in winter by the geoexchange. In fact the widespread Variscan granites of the batholith, cropping in the northeastern side have very good thermal conductivity values (in the range of 2,5 and 3,5 [W/(mK)]) and the volcanic rocks mostly occurring in the northwestern side show good values (>2 [W/(mK)]). Besides the rock thermal conductivity, occurrence of aquifers can improve the thermal geo-exchange due to the formation of convective cells.
The field surveys and lab characterization of the different rocks collected in north Sardinia evidenced the suitability of its north western side for many uses typical of low enthalpy water (teleheating, greenhouse, SPA etc.) Furthermore, taking into account the thermal favorable thermal conductivity values of granites outcropping in the north east, good results can be attained by borehole-heat-exchangers.