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Estimation of the geothermal potential of the Caldara di Manziana site in the Mts Sabatini Volcanic District (Central Italy) by integrating geochemical data and 3D-GIS modelling.

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High-enthalpy geothermal fields of Central Italy are hosted in deeply fractured carbonate reservoirs occurring in thermally anomalous and seismically active zones. However, the Mts. Sabatini volcanic district, located north of Rome, has an interesting deep temperatures (T), but it is characterized by low to very low seismicity and permeability in the reservoir rocks (mostly because of hydrothermal self-sealing processes). Low PCO_2 facilitates the complete sealing of the reservoir fractures, preventing hot fluids rising and, determining a low CO_2 flux at the surface. Conversely, high CO_2 flux generally reflects a high pressure of CO_2, suggesting that an active geothermal reservoir is present at depth. In Mts. Sabatini district, the Caldara of Manziana (CM) is the only zone characterized by a very high CO_2 flux (188 tons/day) from a surface of 0.15 km2) considering both the diffuse and viscous CO_2 emission. This suggests the likely presence of an actively degassing geothermal reservoir at depth. Emitted gas is dominated by CO_2 (>97 vol.%). Triangular irregular networks (TINs) have been used to represent the morphology of the bottom of the surficial volcanic deposits, the thickness of the impervious formation and the top of the geothermal reservoir. The TINs, integrated by T-gradient and deep well data, allowed to estimate the depth and the temperature of the top of the geothermal reservoir, respectively to ∼-1000 m from the surface and to ∼130°C. These estimations are fairly in agreement with those obtained by gas chemistry (818<depth<1235 m and 137<T<160 °C). Based on the data obtained in this study, the CM geothermal potential has been estimated to 48÷68 MW, which would represent ∼30% to ∼40% of the total thermal power estimated at regional scale for the Manziana geothermal system. Our results, suggest that the W-SW sector of Bracciano lake is the most thermally anomalous zone of the area. Geothermometers and the GIS model indicated a temperature range between 120 and 150°C, confirming the presence of a medium-enthalpy geothermal resource in the Mts. Sabatini, but only at CM the low depth of the geothermal reservoir (∼-1000m) makes this resource economically attractive.