



CO₂ diffuse degassing and geothermal conditions in the area SW of Mts. Sabatini volcanic district, Central Italy

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Active high-enthalpy geothermal fields of Central Italy with fractured carbonate reservoir occur in zones that are thermally anomalous, deeply fractured, seismically active and with a high CO₂ flux reflecting high PCO₂ in the reservoir that maintains its permeability. The Mts. Sabatini volcanic district, north of Rome, an area with no seismicity, has interesting deep temperatures (T) but no permeability in the reservoir mostly because of hydrothermal self-sealing. At Caldara of Manziana (CM), the main gas manifestation of the area, a total diffuse CO₂ release of 118 tons/day from 0.15 km² has been estimated in August 2006 by a detailed CO₂ flux survey (838 measures). This value is lower than the 160 tons/day found in 1996 by Rogie et al. (2000), but confirms that CM is a very huge CO₂ degassing site considering that a relevant though unknown viscous release from many discrete vents has to be added to the diffuse CO₂ flux. Gas is dominated by CO₂ and its composition has been used to infer the physical conditions of the source, finding T= 260-270 °C and PCO₂ = 400-500 bar. These values are similar respectively to the reservoir T estimated by thermal gradient drilling (205 °C) and the lithostatic P inferred at the reservoir top. The CM depression could have been generated by one (or more) phreatic (hydrothermal) explosions occurred when the deep fluid P exceeded the lithostatic load. The high PCO₂ in the pressurized reservoir prevented reservoir fracture sealing and maintains a sustained CO₂ flux at the surface.