

Water geochemistry to estimate reservoir temperature of Stabio springs, Switzerland

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The Mendrisiotto region located in Southern Switzerland and close to the Italian border, is characterized by the presence of a thick sequence of Mesozoic limestones and dolostones above a volcanic rocks from Permian (Bernoulli, 1964). Within the carbonates, fractures and dissolution processes increased limestone permeability and favored the widespread presence of springs. The presence of few localized H₂S and CH₄ bearing springs is known from historical times in Stabio. Its localization is related to the faulting affecting the area (Balderer et Al., 2007). These waters were classified by Greber et Al. (1997) as Na-(Ca)-(Mg)-HCO₃-Cl-(SO₄) type with having a total dissolved solid content in the range of 0.8 and 1.2 g l⁻¹. According with Balderer et Al. (2007) the stable isotopic composition deviates from the global meteoric water line (IAEA, 1984) being the values of δ¹⁸O and δ²H respectively 0.8 ‰ and 5‰ lower than the normal shallow groundwater of the area. The values of δ¹³C of TDIC (-1.54‰, 1.44 ‰) indicate exchange with CO₂ of thermo - metamorphic or even Mantle origin. While 14C in TDIC (7.95, 26.0 pMC) and ³H (1.1 ±0.7, 3.1±0.7 TU) indicates uprising of deep water along faults with some mixing.

To estimate reservoir temperature, a new sampling was conducted in 2015 for chemical and isotopic analysis. The sampling was carried out from the only source that allows getting water directly from the dolostone in order to avoid mixing. Although some differences are noticed respect to previous studies, the results show a substantial agreement for stable isotopic composition of water, δ¹³C and 14C of TDIC. Reservoir temperature was calculated by using several geothermometers. The results show a great variability ranging from 60 °C using Silica to more than 500 °C using cationic (Na – Ca) geothermometers; indicating that besides mixing, exchange processes and chemical reactions along flow path affect results.

This study was partially funded by Azienda Elettrica Ticinese

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