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title: **Hydrothermal model of the Euganean Geothermal Field (EGF) — NE Italy**

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INTRODUCTION

The Euganean geothermal field (EGF) is the most important thermal field in the northern Italy. It is located in the Veneto alluvial plain, southwest of Padova (NE Italy). The EGF extends on a plain band of 36 km^2 located immediately northeast of the Euganei Hills. In this area about 100 mining claims and more than 400 wells have been drilled. Thermal waters are mainly used for cure and wellness, with a subsidiary use as energy to heat hotels and greenhouses. At present about 250 wells are active and the total average flow rate of thermal fluids is about 17 Mm^3/year. The aim of this study is to reconstruct the structural constraints driving the thermal waters flow and to apply a mathematical groundwater flow and heat transport simulation model.

THE CONCEPTUAL MODEL OF EGF

In 1976, Piccoli et al. proposed a conceptual model for the hydrothermal circuit of the Euganean thermal waters based on field observations and chemical analyses of the hot waters, later improved by Gherardi et al. (2000) (Fig. 1). The thermal groundwaters are of meteoric origin and infiltrate at about 1500 m a.s.l. in the Pre–Alps, 70 km to the north of the Euganei Hills. The waters reach a depth of about 3000 m and warm up by a normal geothermal gradient, flowing into a fractured carbonate reservoir. Near the Euganei Hills, the waters intercept a regional fault system (Schio–Vicenza fault system) that act as a barrier for the groundwater flow. The high fracturing of the rocks in this area allows the hydrothermal fluid to rise quickly.

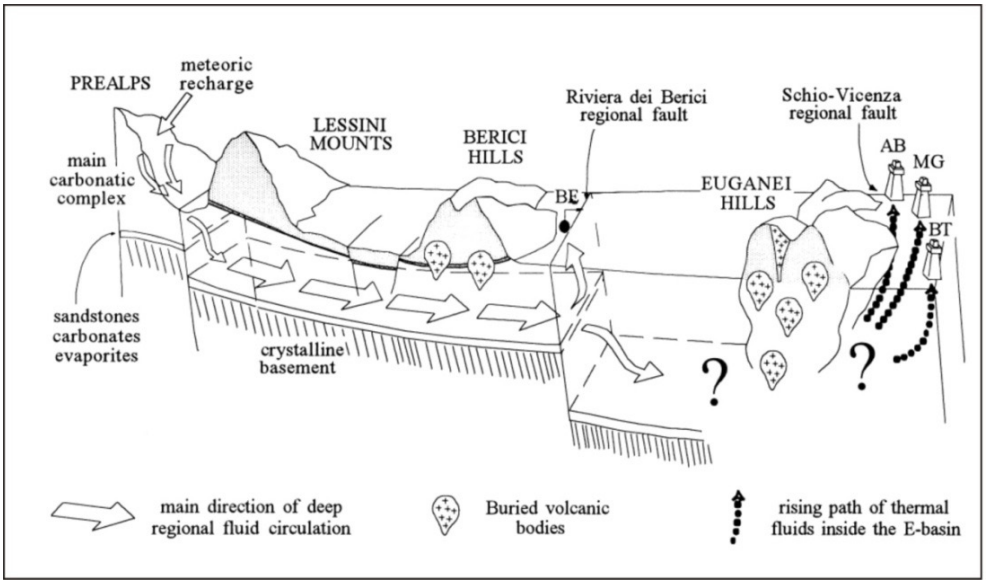

Figure 1. Hydrogeological model of the hydrothermal circulation in the Euganean area (from Gherardi et al., 2000). The outflow may be controlled by a local extensional zone developed at a bend of the Schio-Vicenza fault.

Physical and chemical parameters of the EGF were statistically analyzed by Fabbri and Trevisani (2005). The temperature of thermal waters ranges from 60°C to 86°C, and their TDS is approximately 6 g/L with a primary presence of Cl and Na (70%) and secondary of SO_4, Ca, Mg,

HCO_3, SiO_2. Tritium and ^{14}C AMS measurements suggest a residence time of much more than 60 years, probably in the order of some thousand years.

Recently, Zampieri et al. (2009) propose that the EGF is located near an extensional geological structure linked to the Schio–Vicenza fault system. The local extensional regime, caused by the structure, and the recent activity of the fault system enhance the outflow of the thermal fluid. Evidence of this structure is given by some seismic sections, that we use as starting point for the subsurface geological reconstruction of EGF using 3D modelling techniques.

We use the software Hydrotherm (Kipp et al., 2008) to perform a starting mathematical hydrothermal model of the EGF. Hydrotherm simulates thermal energy transport in three-dimensional, two-phase, hydrothermal, ground-water flow systems. The governing partial differential equations, which are solved numerically, are (1) the water-component flow equation, (2) the thermal-energy transport equation. Finite-difference techniques are used for the spatial and temporal discretization of the equations.

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