Hydrogeochemical study of thermo-mineral waters in Lisbon region (Portugal): contributions for hydrogeological conceptual models

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In the Lisbon region, Portugal, existing thermo-mineral waters have been historically exploited in balneological centers. However, currently, the majority is abandoned or is dilapidated (Acciaiuoli, 1952; Lopo-Mendonça et al., 2004; Ramalho e Lourenço, 2006). Physical-chemical composition of these thermo-mineral waters have been briefly characterized by previous studies (Andrade, 1932; Acciaiuoli, 1952; Almeida, 1952), showing a complex diversity of hydrochemical facies (HCO3-Na, HCO3-Ca, SO4-Ca and Cl-Na) and mineralization contents (between 0.5 and 6 g/L). These characteristics have been firstly correlated to different aquifer lithologies, recharge conditions and local vs regional flowpaths (Almeida et al., 1991; Lopo-Mendonça et al., 2004; Ferreira et al., 2011; Carvalho et al., 2013). Some of these thermo-mineral waters are probably related to deep circulation through sedimentary aquifers of limestone and sandstone formations, which are lacking a hydrogeological conceptual model, except for the Estoril thermal water (Lopo-Mendonça et al., 2004).

The main objective of this study was to identify and quantify the processes related to the hydrochemical and mineralization complexity of these thermo-mineral waters in order to define or update their hydrogeological conceptual models. In this work we present new physical-chemical and isotopic data (stable and radioactive) from 20 thermal and/or mineral waters sampled (15 wells, 3 springs and 1 borehole) in the Lisbon region between March and June and November to December of 2013. The results obtained show that mineralization is mainly controlled by water-rock interaction processes, as well as by mixing process with saline waters from different origins (seawater, ancient groundwater, etc.). A significant positive correlation between sodium and chloride concentrations and salinity parameters has also been identified. Stable isotopes signatures show a meteoric origin and in some cases a minor fractionation signature related to seawater mixing, calcite precipitation and/or gypsum dissolution.

Keywords: thermo-mineral waters, hydrogeological conceptual model, Lisbon, aquifer.

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