Geophysical Research Abstracts
Vol. 12, EGU2010-7911-1, 2010
EGU General Assembly 2010

Investigation of Seferihisar-Balcova geothermal area by environmental isotopes.

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The Seferihisar-Balçova Geothermal area (SBG) is located in western Turkey, along a N-S trending fault system and is defined by two major geothermal systems topographically separated by the Seferihisar Horst: the Seferihisar (SG) in the south and Balçova (BG) in the north. The temperatures of cold, hot springs and shallow wells vary between 16 and 70°C and reach 138°C in drilled wells. In these areas, the geothermal waters are used for balneological purposes and district heating.

Previous hydrochemical and istopes analyses indicated that the geothermal waters have two main origins: (1) meteoric waters (heated groundwater) and (2) seawater. Heated groundwater types with low total dissolved solids (TDS) content are found in the BG geothermal field whereas the thermal waters in SG originated from a mixture of seawater and local meteoric groundwater.

In this presentation, stable environmental isotopes are used to investigate the distribution of recharge areas, to determine the origin of the waters, the evaporation ratios and the seawater contribution. New samplings are carried out in both SG and BG systems and in the recharge areas of the Horst. A deflection trend in the cold waters of Balçova reflect altitude effects of the BG and the contribution of both geothermal and sea waters. According to the elevation vs. D diagram, the SG waters recharge from groundwater flow at about 200-300m altitude whereas the BG deep geothermal waters recharge from 800-1000. d18O shifting in these diagrams indicates that meteoric water has been heated at great depths before rising to the surface, likely driven by buoyant forces. Therefore deep-reaching regional flow from the horsts toward the coastal aquifers also determines the geothermal behaviour of the SBG. Circulation of ascending thermal waters at different depths could also explain the variation in salinity of BG and SG water samples.

In summary, all isotopic analyses strongly suggest that density-driven convective flow within permeable fractured areas, forced convection imposed by the horst and seawater intrusions are likely to be the major transport processes in the SBG. These results are well supported by numerical modeling of density-driven flow presented in the HS7.6 session.