A multi-isotope investigation to understand the origin of thermal water in the Şavsat (Artvin) geothermal area, Turkey

FATMA GULTEKIN[1], B. MELIH SUBASI[2], ESRA HATIPOGLU TEMIZEL[3], ARZU FIRAT ERSOY[4]

[1]Karadeniz Technical University, Trabzon, Turkey, fatma@ktu.edu.tr
[2]Karadeniz Technical University, Trabzon, Turkey, mlh_subasi@hotmail.com
[3]Karadeniz Technical University, Trabzon, Turkey, hatipogluesra@gmail.com
[4]Karadeniz Technical University, Trabzon, Turkey, arzufirat@gmail.com

The oldest unit in the study area is volcanic rocks composed of dacites and rhyodacites of Late Cretaceous age. The Paleocene-Early Eocene unit is characterized by flysch composed of limestone, sandstone, tuff and claystone alternations. Eocene units consist of augite basalt, andesite type volcanic rocks, volcanoclastic rocks and turbiditic rocks including mudstone-siltstone-sandstone alternation. These units are overlain by Late Miocene aged sedimentary rocks. The youngest unit in the area is the Pliocene-Pleistocene volcanic rocks. The thermal waters in the Ilıca-Şavşat geothermal fields have outlet temperatures about 40°C in well. The pH, electrical conductivity (EC) and the total dissolved solids (TDS) values are 6.64, 6207 µS/cm and 3224 mg/L respectively in thermal waters. The purpose of this study is to describe the origin of thermal water as well as to indicate the sources of carbon and sulphur dissolved in those thermal springs. In terms of δ^2H and $\delta^{18}O$ values, hot waters, surface waters and spring waters are located in different areas. Thermal waters in the field have more negative δ^2H and $\delta^{18}O$ values than cold waters. These low values indicate that thermal waters recharged at the higher altitude than cold waters. According to tritium data (0.75 TU), thermal waters are relatively older than cold water in the study area. Carbon isotopic composition of DIC indicate that carbon originates from freshwater carbonates and metamorphic CO_2 in the thermal waters. $\delta^{34}S$ in dissolved sulphate is sourced from volcanic sulphide (SO_2) and Cenozoic $CaSO_4$ in hot water while it is from magmatic rocks, oil and coal in cold waters.

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