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The Thermal Waters of Jordan

I. Sass and R. Schäffer

TU Darmstadt, Institute of Applied Geosciences, Chair of Geothermal Science and Technology, Schnittspahnstrasse 9, 64287 Darmstadt, Germany (sass@geo.tu-darmstadt.de)

In a recent field campaign all known natural hot spring areas of Jordan were investigated. Their hydrochemical properties including some fundamental isotopes were measured. Jordan's thermal springs can be classified into four thermal provinces (Nahr Al-Urdun, Hammamat Ma'in, Zara and Wadi Araba province), with similar hydrochemical and geologicalsettings.

Thermal springs of Hammamat Ma'in and Zara province are situated on prominent faults. Reservoir temperature estimation with the Mg-corrected Na-K-Ca geothermometer indicates temperatures between 61 °C and 82 °C. Even taking into account the increased geothermal gradient at Dead Sea's east coast, the water's origin has to be considered mainly in deeper formations. Carbon dioxide, emitted by tertiary basalts situated close to the springs, may be responsible for gas lift. Mineralisation and δ^{18}O-values indicate, that the spring water's origin is mostly fossil, i.e. not part of the global water cycle. It is shown, that ground water mining led to a shift within δ^{18}O-ratio during the last 30 years due to a reduction of shallow water portion in addition to a dislocation of the catchment area. Ground water mining will impact the thermal spring productivity and quality anyway in the future. Present-day precipitation rates and catchment areas in Dead Sea region are by far not sufficient to explain relative high discharge. For the Hammamat Ma'in Province is documented, that discharge and maximal spring water temperatures are constant during the last 50 years, showing marginal seasonal oscillation and negligible influence by short-term climatic changes.

The water characteristics of Hammamat Ma'in and Zara province are related. However, Zara waters feature systematically less ion concentration and lower temperatures due to a stronger influence of vadose water. The springs of Nahr Al-Urdun province are recharged mainly by shallow groundwater. Thus temperature and mineralisation is lower than at the springs at the Dead Sea. Thermal waters of Wadi Araba province show the lowest mineralisation due to their origin of mostly sandstones. The main ion's proportion and δ^{18}O-ratio indicate a mixture of fossil and vadose groundwater.