

The recycling of Dead Sea brine through the marginal aquifers

B. LAZAR¹, N. WEBER^{1,2}, Y. YECHIELI^{2,3}, I. GAVRIELI², G. ANTLER^{4,5}, M. STEIN^{1,2}

¹Institute of Earth Sciences, The Hebrew University, Jerusalem 91904, Israel (boaz.lazar@mail.huji.ac.il)

²Geological Survey of Israel, 32 Yesha'ayahu Leibowitz, Jerusalem 9371234, Israel

³Department of Hydrology and Microbiology, Zuckerberg Center, Ben-Gurion University of the Negev, Sede Boker 8499000, Israel

⁴Interuniversity Institute for Marine Sciences, Eilat 88103, Israel

⁵Department of Geological and Environmental Science, Ben Gurion University of the Negev, Beer Sheva 84105, Israel

Radiocarbon dating of the Dead Sea sediments was first done by Wally Broecker [1], who identified the potential of this hypersaline lake as a paleohydrological recorder. Here, we report on ¹⁴C and ⁸¹Kr ages of the hot-saline brines discharging at Ein Qedem (EQ) shore to the Dead Sea. Along with the chemical composition of the brine, the ages (ranging between 35-16 ka) suggest that the brine originated from the surface layer of the last glacial Lake Lisan. We provide a conceptual hydrological model for the long-term deep circulation of the brine in the marginal aquifers of the Dead Sea. Variations in lake levels are driving the brine flow into and out of the regional aquifer. During high lake stand period of the last Glacial MIS2 (e.g., ~170 m bsl,) the lake's epilimnion recharged the marginal aquifers. During lake's low stand of the post glacial and Holocene periods (lake level of 400±30 m bsl), the hydrostatic pressure of the lake's water column was released, and the EQ brine ascended from the depth and discharged to the lake. Large gypsum structures deposited during the past ~ 3 ka were recently exposed at the retreating Dead Sea shores. Thermodynamic calculations and the stable isotopes of sulfur and oxygen of the gypsum minerals ($\delta^{34}\text{S} = 14\text{-}17\text{‰}$ and $\delta^{18}\text{O} = 14.5\text{-}16.5\text{‰}$) suggest that EQ brine was associated with the formation of these gypsum structures.

[1] Begin ZB., Broecker WC, Burchbinder B, Druckman Y, Kaufman A., Magaritz M., Neev D. (1985). Dead Sea and Lake Lisan levels in the past 30,000 years. Geological Survey of Israel. Report, 29, 1-18.