The circulation of the Dead Sea brine in the adjacent regional aquifer

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Throughout the history of the Dead Sea lacustrine-hydrology system, brines have circulated between the lakes and the adjacent aquifers. The Ein-Qedem (EQ) hydrothermal saline springs system discharging at the western shore of the modern Dead Sea is the modern manifestation of this essential and continuous process. The EQ springs comprises the most significant source of Ca-chloride brine that currently discharges to the lake. The salinity of EQ brine is about half that of the modern Dead Sea brine (190 g/L versus 340 g/L, respectively) and it unique composition does not represent a simple mixing of modern Dead Sea and local freshwater. The chemical composition of EQ brine has remained virtually uniform during the last ca. 40 years, indicative of a large groundwater reservoir. Concurrent changes in EQ groundwater level and Dead Sea water level suggest a good hydraulic connectivity between the two brines.

Based on chronological (^{14}C and ^{81}Kr dating) and geochemical data, we argue that the EQ brine originated from the epilimnion of the last glacial Lake Lisan that recharged the marginal aquifer and circulated there until its discharge as the present EQ system. The recharge occurred during the time interval of ~38-16 ka, when the lake reached its highest stand of ~200±30 m below msl and was stratified for tens of thousands of years. This scenario is corroborated by hydrologic considerations that require high lake stand for penetration of EQ brine into the aquifer. Thus, the circulation of the Ca-chloride brine involves penetration to the groundwater during high stands and discharge back to the lake during lake low stands. The detailed description of the history of the EQ brine illuminates the mechanism of brine circulation in the Dead Sea Basin and its relation to the regional hydrology and climate change.