Geophysical Research Abstracts
Vol. 18, EGU2016-9356, 2016
EGU General Assembly 2016

The evolution of the Dead Sea brine during the last 220 ky as revealed by porewater Cl-, Na+ and δ18O in ICDP deep core

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The chemical composition of pore brines extracted from 456 m long core drilled by the ICDP during 2011 in the deep basin (water depth of 300 m) of the Dead Sea provides a history of the evolution of the Dead Sea brine during the last 220 ky. The vertical profiles of chloride (Cl-) sodium (Na+) and oxygen isotopes (δ18O) in the core show that during that period the bottom water mass (hypolimnion) of the lake was always hyper-saline and its salinity did not dropped below $\sim$70 % of that of the modern Dead Sea. The lake underwent three major hyper-arid periods that lasted altogether about 30 ky and deposited $\sim$150 m of halite and gypsum. These periods were the last two interglacials and the postglacial till present. During the last glacial and particularly during MIS2 ($\sim$31-17 ka BP) the salinity of the lake dropped substantially due to excess input of freshwater as indicated by the decrease in Cl- and Na+ of the hypolimnion. The δ18O at the same period increased to maximum of $\sim$7‰ (3‰ higher than today). The variations in Na+ and Cl- during the "freshening" period suggest that halite dissolution, probably due to the rise of mount Sedom diapir, "buffered" the brine from further drop in salinity. The dilution of the brine was slow and lasted more than 10 ky probably due to continuous turbulent mixing of the hypolimnion with the less saline high δ18O epilimnetic brine that underwent "normal" evaporation. The low δ18O during high salinity -halite deposition- periods is attributed to "reversed" behavior of δ18O during evaporation of high salinity brine. Massive precipitation of halite during the last 10 ky decreased sharply the Na+/Cl- ratio of the Dead Sea from $\sim$0.7 to its present value of $\sim$0.2. A similar low value was reached during the last interglacial, at $\sim$120 ky. Both periods mark the most mature evaporative state of the lake during the last 220 ky.