# Halite fluid inclusions reveal seasonal temperature variability in the Middle East during the last interglacial

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Past variations in seasonality help to understand climate mechanisms in continental environments and to predict future scenario with ongoing climate warming. Seasonality (i.e., summer - winter) depends on complex atmospheric circulation patterns and controls the hydrochemistry of lakes wherein sediment deposits represent single events or periods of stable lake conditions by different lithological facies (i.e., clay, gypsum, salt, carbonates). Various methods exist in order to analyze climate proxies (i.e., temperature) that are derived from chemical, physical or organic properties of geological records.
However, direct and precise measurements of past water temperatures in lake sediments are still lacking. This results in a need to estimate past hydrological conditions (i.e., $\delta^{18}O$ of water) for paleoclimate interpretations, rather than interpreting absolute datasets. Therefore, there is a need to directly determine paleo water temperatures in geological lake sediments especially in salty environment where other proxies (fauna) are scarce.
Saline lakes accumulate salt layers (i.e., halite), controlled by local seasonal conditions. During halite growth, small water droplets (fluid inclusions; FIs) with a specific density are entrapped in crystal defects of the host mineral. The density depends only on the temperature at time of entrapment, thus FIs can record initial lake water temperatures. Brillouin Spectroscopy is a precise and direct method to obtain the entrapment temperature of FIs (and so the water temperature in which halite formed). This method was applied on an evaporitic series from the hypersaline Dead Sea where a bore core yields annual halite deposition cycles during the begin of the last interglacial (~ 130 ka). Analogues found in the modern Dead Sea are interpreted to be controlled by summer and winter processes. We thus measured the entrapment temperatures of primary FIs for an interval of three consecutive years in coarse halite deposits.
We found a seasonal signature in each halite layer by "warming upward" cycles, with lowest and highest entrapment temperatures at the base and the top of each layer, respectively. Both minimum and maximum temperature data are 2-4 °C lower than modern Dead Sea deep lake waters, however our data indicate that seasonality was about as twice as high as today.

**Mots-Clés :** fluid inclusions, seasonality, halite, entrapment temperatures, Dead Sea, Brillouin Spectroscopy

Merci de ne rien inscrire dans cette zone et ne pas modifier les marges des pieds de page et entêtes.