Unraveling temperature and hydrological conditions of salt deposits by measuring the speed of sound in halite fluid inclusions: the case of the Last Interglacial Dead Sea

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Salt deposits found throughout the geological record and across the globe are witnesses of extreme paleoclimatic and paleoenvironmental conditions. However, little is known about the hydrological conditions that gave rise to these deposits, and the role of temperatures is even less constrained. Here we have used a new technique, Brillouin spectroscopy, to investigate the paleoenvironmental and paleoclimatic conditions that led to the deposit of a thick salt sequence in the Dead Sea during the Last Interglacial (LIG, ~135,000 to 115,000 years before present). Through measuring the speed of sound inside halite fluid inclusions (FIs), this method provides the parent brine temperature and salinity at the moment of crystal growth. We applied it to several tens of halite intervals from the 450-meters-long core 5017-1 drilled in 2010-2011 in the deepest part of the Dead Sea in Palestine within the framework of the Dead Sea Deep Drilling Project (DSDDP). The application of Brillouin spectroscopy to this record provides a unique quantification of temperature and hydrological changes in this area during the LIG and outlines a radically new narrative for the climate of the region during this period. The example of the Dead Sea shows that Brillouin spectroscopy on halite FIs is in position to provide valuable data to test the efficiency of climate models and to better understand the processes that lead to the deposition of salt giants.