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**North Atlantic controlled depositional cycles in MIS5e layered sediments from the Dead Sea basin**

**Figure 1.** Hopper crystals forming in the brine air interface of the Dead Sea. Photo taken from the drilling rig during the ICDP drilling operation at November 2010. There no scale available but each white dot is 0.5-1.5 cm in diameter.

**Figure 2.** Thickness in cm of each white layer in both core section 91\_2 and 120\_1. The dashed red line marks where the combination was made. Section 91\_2 represents the end of the last interglaical (LIG) and core 120\_1 represents the beginning of the LIG.



**Figure 3.** ESEM analysis on a dissolved salt crystal from brown lamina No. 5 of the thick section 91\_2 (Fig. 3). The red dot marks where the analysis was done. The plot shows the intensities of the noted elements and the table comprises the values. The crystal analyzed shows high Mg and Cl content and may be carnallite.





Elem Wt % At % K-Ratio Z A F

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 O K 45.94 62.92 0.1417 1.0474 0.2944 1.0003

 NaK 4.50 4.29 0.0227 0.9772 0.5150 1.0025

 MgK 9.44 8.51 0.0600 1.0008 0.6337 1.0025

 ClK 31.27 19.33 0.2831 0.9410 0.9570 1.0054

 K K 8.84 4.95 0.0756 0.9439 0.9060 1.0000

Total 100.00 100.00

**Figure 4.** PCA analysis on the μXRF readings from core section 1\_A\_120\_1\_1 Above the scree plot indicates that the first component is the last one found to be influential on the variance of the elemental counts. Below, the loading plot that depicts which elements are positive or negative with the first component on the x axis and the second component on the y axis. These geochemical observations are similar to those of section 91\_2 excluding Ti.

**Figure 5.** Compilation of the PCA first component from core section 1\_A\_120\_1\_1 with the core image. Cyan line is the loading of the first component, where it is low in the white layers and high in the brown layers.

**Figure 6. Section 120\_1 and its sulfur counts that indicate the presence of gypsum (red line) and PC-1 which indicates where there is brown layer (blue line). The depth is cm in the section, where the left side is the upper side of the section. In the upper side of the section the peaks of gypsum do not co vary with PC-1 rather they peak above and below the brown layer. Suggesting that some of the white layers in the upper part of the section contain gypsum.**

**Figure 7.** Compaction and mass balance which help estimate the deposition rate in undated halite sediments of the DSDDP core.



It was hypothesized by Neugebauer et al. (2014) that the changes between white and brown layers of the halite sequences are seasonally deposited due to summer evaporation and winter flooding, respectively. We suggest the following model to test whether the well laminated last interglacial halite deposits (*lh* facies) also shows annual deposition.

A sediment trap deployed at 270 m water depth in 1981-1983 recorded a yearly halite deposition rate of 3 g/cm2 with layer thickness of 3 cm ([Stiller et al., 1997](#_ENREF_18)). Assuming similar limnological conditions, the density of modern, single-year halite deposit is ~1 g/cm3. This value is not the density of the lake sediment, but the density of a hypothetic layer of halite that accumulates over one year at the bottom of the lake (stage A), before it cements and becomes a rock salt (stage B). Halite layers in the core actually form rock salt units, with a typical density (2.17 g/cm3). Thus, the maximum compaction of a single modern annual halite layer to form a rock salt can be estimated from these two end members. We use the following conservation of mass equation:

$$h\_{f}=\frac{h\_{i}\*ρ\_{i}}{ρ\_{f}}$$

where, hi and ρi are the initial thickness and density, respectively, and hf and ρf are the final thicknesses and densities, respectively. Considering the abovementioned parameters, we calculate that an annual modern halite deposit would have reached a final thickness of ~1.38 cm. Thus, we suggest that on average, each 1.38 cm of compacted halite represents near to one year with similar limnological conditions as in present day. These are extreme arid conditions with lake level draw down of about 1m/y. To test this model and to be able to use it as a basis for any further calculation, we compare our estimation with the measurement of layer thickness in a thin section, which is 8.2 cm long (Fig. 3 manuscript). This section, therefore, represents approximately 8/1.4 ≈ 5.7 years according to the model. There are almost 5 cycles in this thin section, that may be due to an arid winter where no wet deposition of detritus occurred in the Dead Sea and we miscount the years (see white layer 2).

 Therefore, our calculation suggests that each white-brown couplet probably represents an annual deposition, with halite and clastics deposited during the summer and winter seasons of the last interglacial, respectively. A cycle is thus defined as couplet of brown and white laminae. Thickness of these cycles is measured between two brown layers (Fig. 3 manuscript), with exact location marked as peaks of the first PCA component (depth 1250 to 1170; Fig. 6 manuscript).