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Elevated ^{14}C values across the Laschamp geomagnetic excursion in Lake Lisan, indicate a reorganization of the global carbon cycle

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The Laschamp geomagnetic excursion (LE) is considered as a global stratigraphic marker. The LE dated to 40±1 ka predates shortly the HE4, a massive ice-rafting event in the North Atlantic that coincides with disappearance of the Neanderthal. Higher production of cosmogenic nuclides (^{10}Be, ^{36}Cl, ^{14}C) in response to the weaker geomagnetic field shielding has been previously indicated. Here, we present a high-resolution AMS ^{14}C coupled with U-series dating and laminae counting of the LE-HE4 interval in Lake Lisan – the last Glacial precursor of the Dead Sea. Although coincidental with the LE, very high atmospheric ^{14}C levels approaching $\Delta 14C \sim 1500‰$ were observed in sediments deposited during or shortly after the LE. This dramatic change in the atmospheric C14 content is on the level of anthropogenic 'bomb peak' and cannot be explained by geomagnetic factor only. Major reorganization of the global carbon cycle that was associated with the H4 event is required.

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The Copenhagen ice core dating initiative: A time microscope on past abrupt climate changes

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The Copenhagen ice core dating initiative is a 5 year research project sponsored by the Carlsberg Foundation. Using a very detailed and comprehensive dataset from the analysis of the recently completed 3085m long NorthGRIP icecore, the aim of the project is to identify individual annual layers throughout the last glacial period and into the Eemian interglacial.

Due to melting of the ice at bedrock at the NorthGRIP site the annual layers in the core are 1 cm or thicker in the whole record. Using high resolution profiles of 7 different types of impurities, each having a seasonal variation, and the high resolution record of visual stratigraphy it is possible to resolve the annual layers.

Dating can be obtained by simple layer counting; but the most important feature is that we may study the 25 recorded abrupt climate changes in the last glacial period including the last termination and the termination of the Eemian on a year by year basis. This will lead to new insights in the dynamics of the climate system.

The dataset also allows us to locate layers that have a changed chemical composition from volcanic eruptions. These layers are being analysed for possible content of volcanic tephra. A number of tephra layers have been found, and geochemical and morphological analysis has lead to identification of several volcanic eruptions.

The identified volcanic tephra layers will provide important tie points between the Greenland ice cores and terrestrial and marine sediment records. In the analysis of abrupt climate changes which are bracketed by volcanic eruptions, a comparison of ice core, terrestrial and marine sediment records can be done in a straight forward manner without the previous problems with different dating and time scales.