Continuous lake sediments covering the Allerød-Younger Dryas Transition in The Netherlands indicate no increase in Iridium values

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We analysed two records obtained from selected lake deposits from the southern and northern Netherlands (figure 1). Both lake sequences comprise the Allerød-Younger Dryas Transition and show no indications of hiatuses or oxidation caused by periods of low lake level during the transition. The transition is marked by clear changes in lithology and vegetation composition as indicated by palynology. This lithological change and the change in vegetation, which is characteristic for the onset of the Younger Dryas have both been ^{14}C-dated at several locations in the Netherlands and yield an average age of 10,950 BP (see figure 3). Further age control was provided by the presence of both Laacher See Tephra and Vedde Ash in one of the sequences (Figure 2).

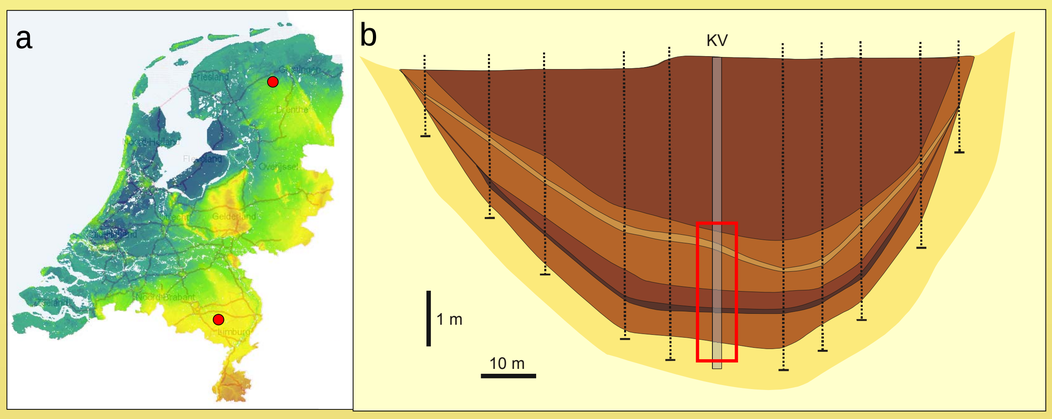

Figure 1: a) location of the two pingo remnants Kostverloren Veen (N) and Weerterbos Berkenven (S); b) cross section showing the organic (dark brown) fill of Kostverloren Veen with the sandy Younger Dryas aeolian influx (light-brown), and the Lateglacial part used for the pollen diagram (figure 2) in the red frame.

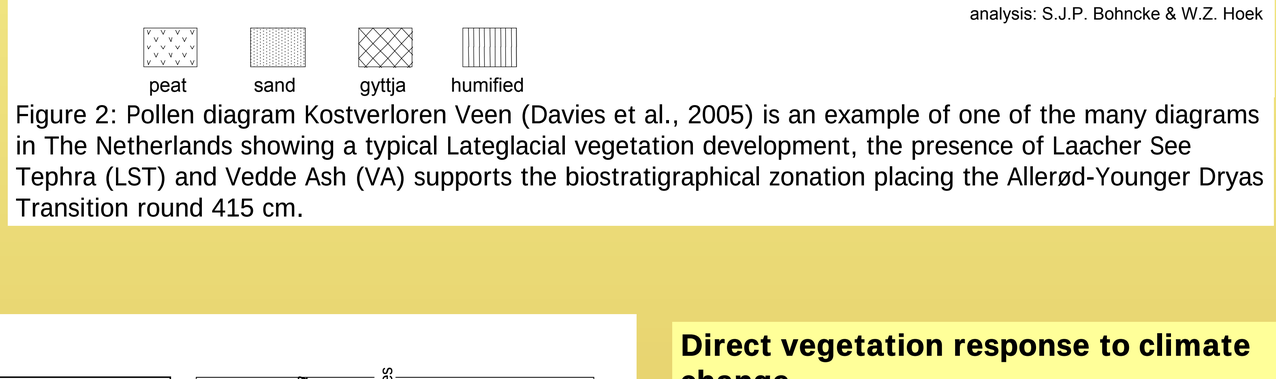

Figure 2: Pollen diagram Kostverloren Veen (Davies et al., 2005) is an example of one of the many diagrams in The Netherlands showing a typical Lateglacial vegetation development, the presence of Laacher See Tephra (LST) and Vedde Ash (VA) supports the biostratigraphical zonation placing the Allerød-Younger Dryas Transition round 415 cm.

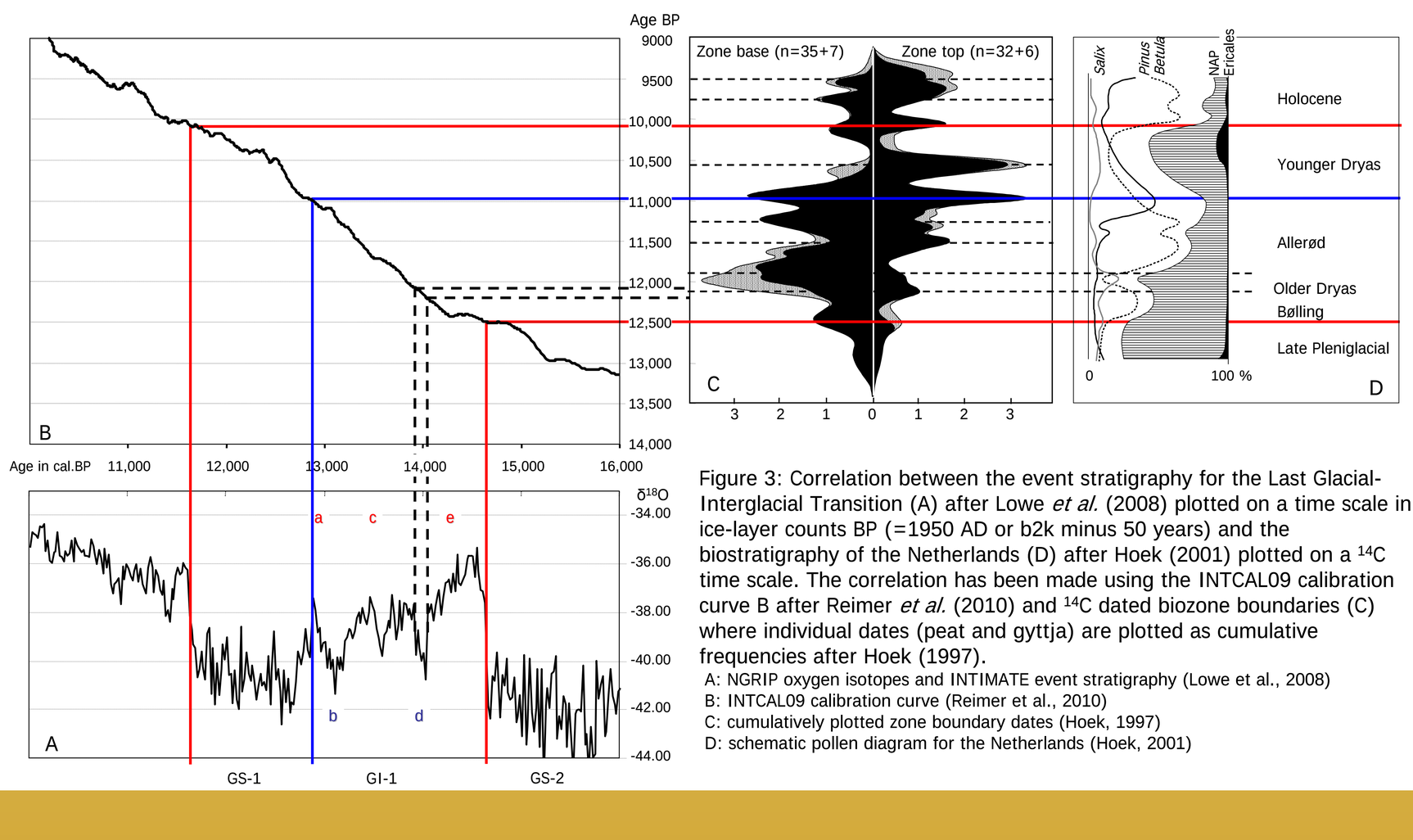

Figure 3: Correlation between the event stratigraphy for the Last Glacial-Interglacial Transition (A) after Lowe *et al.* (2008) plotted on a time scale in ice-layer counts BP (=1950 AD or b2k minus 50 years) and the biostratigraphy of the Netherlands (D) after Hoek (2001) plotted on a ^{14}C time scale. The correlation has been made using the INTCAL09 calibration curve B after Reimer *et al.* (2010) and ^{14}C dated biozone boundaries (C) where individual dates (peat and gyttja) are plotted as cumulative frequencies after Hoek (1997).

A: NGRIP oxygen isotopes and INTIMATE event stratigraphy (Lowe et al., 2008)
B: INTCAL09 calibration curve (Reimer et al., 2010)
C: cumulatively plotted zone boundary dates (Hoek, 1997)
D: schematic pollen diagram for the Netherlands (Hoek, 2001)

Direct vegetation response to climate change

In The Netherlands, a considerable number of ^{14}C-dated Lateglacial pollen diagrams has been used to determine the chronology of the Lateglacial vegetation development. The onset of the Lateglacial Interstadial falls between 12,500 and 12,450 ^{14}C yrs BP (Hoek, 2001). The start and end of the Younger Dryas Stadial in the Netherlands, have been dated at 10,950 and 10,150 ^{14}C yrs BP, respectively. The changes in vegetation are often coinciding with clear changes in lithology.

There is a remarkable similarity between the major zone boundaries and the transitions between GI-1, GS-1 and the Holocene, corresponding with, respectively, 12,500, 10,950, and 10,150 ^{14}C yrs BP as ^{14}C-dated in The Netherlands (see Figure 2).

This is implying a direct response of vegetation to the large scale, and rapid climate changes between stadial and Interstadial conditions.

Results: no Iridium increase

The timespan between Laacher See Tephra (LST) and Vedde Ash (VA) is between 895 and 759 years based on the position of the Vedde Ash in the Greenland ice cores (Rasmussen et al., 2006) and LST in Germany (Brauer et al., 1999) which is deposited some 170 years before the onset of the Younger Drays. With the Vedde Ash present at 345 cm and LST at 429 cm, and considering a relative constant sediment accumulation rate, the boundary should be between 409-413 cm. Indeed we find here a clear change in both pollen and sediment composition. Consecutive 2cm-samples over the transition were taken and analysed for the occurrence of Iridium and other elements by Christian Koeberl (Vienna).

No elevated values of Iridium could be found in Kostverloren Veen (figure 4) and Berkenven (not presented here), which means that our results are not supporting the Younger Dryas Impact hypothesis.

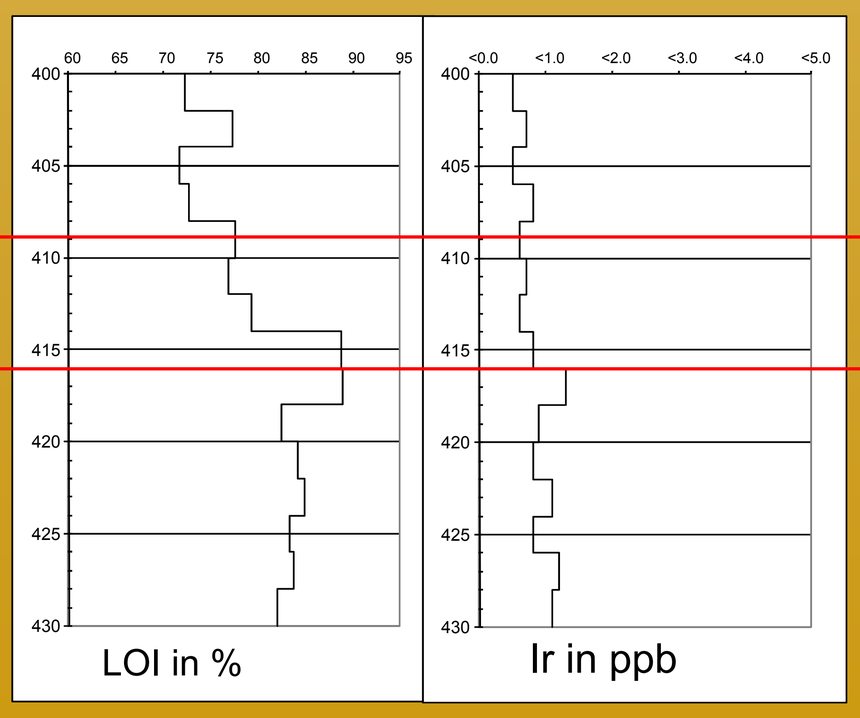

Figure 4: Measured values for Loss on Ignition (LOI) from the Kostverloren Veen sequence indicating an decrease in organic material at 414 cm, related to the increased influx of Younger Dryas aeolian sand which is closely coinciding with the position in the pollen diagram of figure 1. The red box indicated the position of the Allerod-Younger Dryas boundary as calculated based on the occurrence of LST and Vedde Ash. Furthermore, the Iridium values indicate no disturbances in accumulation rates, only a slight decrease in influx of Iridium possibly related to an increase in accumulation rate can be deduced.