

## ***Interactive comment on “Climate warming and vegetation response at the end of Heinrich event 1 (16 700–16 000 cal yr BP) in Europe south of the Alps” by S. Samartin et al.***

### **Anonymous Referee #2**

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Samartin et al. present a good and well written paper. The main question (clearly) addressed in this paper is the link between the early afforestation south of the Alps, and a climate warming that possibly occurred 1500 years before the onset of the Bolling. Samartin et al. used a powerful approach: the reconstruction of summer temperature independently of pollen from the Lake Origlio subfossil chironomid record. Temperatures were inferred using an expanded transfer function recently developed by Heiri et al. (2012). The temperature reconstruction inferred from the chironomid record unambiguously showed a climate warming of nearly 2–2.5°C at ca 16 000 cal BP. As concluded by Samartin et al., this would suggest that the early afforestation south of the Alps is climatically driven. From these results obtained at Origlio, Sammartin et al.

finally discussed the pattern of the Late Glacial climate change over Europe and the Mediterranean realm.

I am confident with the results produced in this study. I agree with what is said in the discussion and conclusion. That why I recommend this paper for publication in CPD. Nevertheless, I would recommend moderate changes before definitive publication, especially in the Discussion section. As stated by the authors, this study provides the first evidence for an early warming occurring at ca 16 000 cal BP south of the Alps. A similar warming was also found from continental archives in South-West France, Turkey and Israel. Therefore, the results presented by Sammartin et al. are of great importance for the understanding of climate and vegetation history in Europe. Given this importance, I think the reliability of the temperature reconstruction is not sufficiently assessed in the present form of the paper. The author should add a sub-section dealing with this issue (the reliability of the temperature reconstruction) in the Discussion section. Several items should be discussed:

1-The early warming corresponded to the Biozone ORE-2. This key biozone is composed of only 6 samples (with one sample with counts less than 50 Head-capsules). Furthermore, samples were not taken contiguously along the core (?). According to what is said in the “coring and sediments “ sub-section, I suppose that samples were 1 or 2 cm thick (see specific comments). ORE-2 is 33 cm thick. In other words, only ca 40 % of the sediment were analyzed ((6samples\*2cm)/33cm). Is this sampling design well suited to provide representative material (and data) for the whole unit?

2-In the sub-section “Interpretation of faunal trend”, the authors discussed the main changes in chironomid assemblages and their possible forcing factors. In their discussion (biozone by biozone), the authors identified several possible forcing factors according to the ecology of taxa: lake-level (profundal versus littoral taxa), temperature (cold versus warm-adapted taxa) and trophic level (oligotrophic versus mesotrophic taxa). The remaining questions which are not addressed in the discussion are: Is temperature the main forcing factor of changes in chironomid assemblages ? This is

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the pre-requisite for a relevant temperature reconstruction. What about the possible influence of possible confounding factors? Is there a risk for biases induced when inferring temperature from Origlio chironomid ? Could the disappearance of profundal taxa (with cold optima) and the appearance of littoral taxa (with warm optima) characterizing ORE-2 be explained at least in part by a lake lowering? Please note that in a previous study of record from Lake Accesa (Tuscany, Italy, Magny et al. 2006) evidenced a strong lake lowering before the onset of the Bolling. It was the main driving factor of the chironomid assemblages (Millet et al. 2007).

3-In their presentation of the vegetation history (p1619), author stated “This vegetational change stabilized the soils and the shift from sandy silt to silty gyttja shows that the erosional input into the lake significantly reduced”. The change in vegetation cover at ca 16000 cal BP induced a change in lake sediment (erosional input and probably OM type and amount). Can these changes in the watershed and induced changes in the lake sediment be a cause for chironomid changes independently of climate? OM analysis would be helpful: Are these data available ?

4-In the “results” section, Samartin et al. presented in a sub-section “Evaluation of the inferred temperatures” a detailed description of the reconstruction diagnostics. What do these results tell us about the reconstruction? Are there some specific parts of the record where we must be less confident with the reconstruction? This issue is briefly discussed (p1630, line 3: “However, a disagreement of ca 3°C is within the method inherent reconstruction error (+-1.5-1.6°C SSPE)”). 2.5°C was also the amplitude of the shift in temperature between ORE-1 and ORE-2 which is the key result of the paper and also stays “within the method inherent reconstruction error”. Is the change in reconstructed temperature between ORE-1 and ORE-2 really significant?

5-The reliability of the temperature reconstruction derived from the Origlio chironomid record is supported by the good concordance with d13C record from South-west of France (and Turkey). Nevertheless, a temperature reconstruction derived from chironomid record of a lake in the Western Pyrenees (Ech paleolake) has been recently

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published (Millet et al. 2012). This record covered the last ca 18 000 years. There is no trace of such an early warning in this temperature reconstruction. This is in apparent discrepancy with the speleothem record from south-west France (Genty et al 2006). Genty et al. favour the biogenic control for the observed calcite  $\delta^{13}\text{C}$  variations (changes in the soil (microbial activity) and vegetation (plant root respiration) above the cave). The  $\delta^{13}\text{C}$  variations are indirectly related to changes in climate. Other climate parameters than summer temperature may be involved in the  $\delta^{13}\text{C}$  variation in speleothem (seasonality, moisture . . .).

Minor comments: p1620: It would be useful to have more basic information about the sediment sampling: what was the thickness of the samples? Were they taken contiguously?

p1622: about chronology: It should be better to estimate the average 95% confidence interval of the calibrated ages taking into account the density of radiocarbon dates and the distribution of dated levels (e.g. by using CLAM).

p1626, line 8: I suppose the right sentence is “In many of the YD (ORE-4) and early Holocene (ORE-5) samples.

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