

## Giovanni Zanchetta

Thanks to his review, we added and clarified specific changes.

Pag. 2226 line 13: *Just a general note of discussion out of the manuscript. The “possible short-term time-transgressive climate oscillations .....as reported by Di Rita and Magri, 2009, is very probably an artefact of different age model on different archives or due to the correlation of different climatic events. I suggest care in transform some based on dubious and very weak evidences in a sort of paradigm to be quoted (for the rest the paper of Di Rita and Magri, 2009 is an excellent paper).*

This reference has been given in the introduction as this part is a state of the art for southern Italy. The latitudinal shift evidenced by Di Rita and Magri is not mentioned in the discussion but this reference (together with other references) is used to show an almost synchronic event in southern Italy.

Pag. 2227 line 24: we added “following the direction of depression created behind the landslide body”

Pag. 2231 line 1-2: *“14C ages measured on terrestrial plant macrofossil”. In table 1 should be better specified if these are performed on wood, peat or charcoal. On the other and the use of bulk peat does not guarantee that all material considered use CO2 for photosynthesis from the atmosphere (i.e. not all material is strictly terrestrial). Nothing against it (we usually use what we have) but just to be consistent between table and text.*

The 14C ages have been made on terrestrial organic material: wood and charcoal. We corrected the Table 2 and in the text.

Pag. 2240 line 23: we change “see also Peyron et al., this volume”

Pag. 2242 lines 1-10. *This sequence of sentences is not very clear to me. Please can the authors be more explicit?*

We slightly simplified the text in order to make it more easily comprehensible for non-palynologists. We therefore simplified the discussion by not distinguishing tree line and timberline as they are almost mixed at the latitude of Trifoglietti (but more different in the Alps for example).

The Trifoglietti pollen record with NAP values near 60% (see above, section 4.2.2) suggests that the site was above the timberline at the beginning of the Holocene. At Monticchio (ca. 656 m a.s.l.), an abrupt expansion of the mesophillous forests is recorded for the beginning of the lateglacial interstadial (LGI) (Watts et al., 1996, Allen et al., 2002). There, deciduous oaks arrive at an optimum (with abundant *Tilia* and *Fagus* continuous pollen curves) just before the Younger Dryas (zone 2). Thus, it may be that, on the Catena Costiera Mountains around Lake Trifoglietti, the timberline ~~tree-line~~ reached at least the same altitude than in Monticchio. Nevertheless, the status above the timberline (~~and probably the tree-line~~) of Trifoglietti is surprising if we compare this site with those of the northern Apennines such as Prato Spilla A (1550 m a.s.l.) or Lago Padule (1187 m a.s.l.) (Lowe and Watson, 1993; Watson, 1996; Fig. 1) where *Pinus* and *Abies* are quite abundant during the LGI and where the very beginning of the Holocene is marked by expansion of deciduous forests and persistence of fir in the mountains.

Pag. 2244 line 25, we added Zanchetta et al., 2007 QSR and Leng et al., 2010 Biogeosciences.

Pag. 2246: line 15. *Using tephrostratigraphy (as complementary work of Giraudi et al., 2011) Zanchetta et al., in press QR indicate that re-growth of the Calderone Glacier on the Appenine probably started later than 5.7 cal BP.*

We used the reference from Giraudi et al., 2011 because it shows that, in general for Italy, environmental conditions start to change at ca 6000 cal BP, and more precisely that first evidence of periglacial conditions are observed at this time. Giraudi et al., 2011 brings a nuance which is “at ca 4500-4000 cal. BP, the re-advancement of the Calderone Glacier commenced, heralding the true beginning of the Neoglacial in the Apennines.” These ages for Glacier growth have been confirmed by Zanchetta et al., 2012. However, the word “Neoglacial” clearly refers to a beginning slightly marked in records (ca 6000 cal. BP) and a strongly marked phase starting at ca 4500-4000 cal. BP. We prefer not to enter in such a discussion in the present paper as it is not the topic of this MS.

Pag. 2246 line 25 we added Rasmussen et al., 2006 QSR.

Pag. 2247. *The discussion on reduction in precipitation between ca. 8.2-7.5 ka is particularly interesting because data in the Central Mediterranean (e.g. Adriatic Sea) seems to suggest that this event lasts more than the so-called 8.2 ka event. Moreover, there are data that suggest a clear events identifiable as the 8.2 (quoted references), but other could suggest some occurring at 8.2 (8.6) but also younger. So the event 8.2-7.5 could be a mix of different events which need to be resolved in details. I have also the general impression that in some records quoted (e.g. Ariztegui et al., 2000) the main concern is chronology. So some events lasting some centuries are the mix between more than one event, but in some cases it is a real problem of chronological expansion of a short events. In the list of citation is surprisingly lacking Siani et al., (2001 Science) and Siani et al., (2010 JQS), in which the problem of chronology is very well discussed. These papers are the base for the work of Siani et al 2012 (quoted). Here the sapropel interruption is identified unequivocally with 8.2 event (whereas in other marine cores the chronologies are more dubious) and it correspond to a clear temperature reduction.*

We used Ariztegui's reference as it integrates both marine and terrestrial data, so that it is a valuable link between our record and marine records from around Italian peninsula. We added: “Around the Italian Peninsula, marine sequences from the Adriatic and Tyrrhenian Seas also reveal a bi-phased Sapropel 1 interrupted at ca. 8200 cal. BP (Siani et al., 2010) or from ca. 8000 to 7500 cal. BP (Ariztegui et al., 2000), marked by changes in faunal, organic and isotopic contents. According to Siani et al. (2010; this volume), short-term SST cooling spell recoded in MD90-917 core is responsible of the resumption of deep-water formation and re-oxygenation phases in the South Adriatic basin at 8.2 ka during the S1 interruption.

According to Sangiorgi et al. (2003), surface waters in the Adriatic Sea (as reflected by core AD91-17; Fig. 1) were relatively unaffected by lowered temperatures, but winter winds were responsible for the sapropel interruption and associated water mixing, and re-oxygenation. On the basis of SST records from core BS7938 in the Tyrrhenian Sea, Saffi et al. (2004) reported a short cooling episode (labelled SCE5 event) of about 2-2.5° C from ca. 8200 to 7500 cal. BP. Ariztegui et al. (2000), using terrestrial (i.e. Lakes Albano and Nemi in central Italy; Fig. 1) and marine data (i.e. core MC82-12 in the Tyrrhenian Sea) came to the

conclusion that both continental and marine realms underwent a reduction in precipitation and/or fluvial inflow from ca. 8200 to 7500 cal. BP. During this time, the impact of more frequent outbreaks of Siberian dry winter air masses in the eastern Mediterranean may have extended toward south Italian Peninsula. In MD90-917, the SSTs drop of about 3° C during the cold 8.2 ka event, is followed by a short-lived centennial lighter cooling (1° C) between 7.8 and 7.5 ka at the time of sapropel S1b (Siani et al., this volume). It can therefore suggest that several short events added and/or mixed during the time interval 8200-7500 cal. BP due to low temporal resolution and chronological uncertainties.

Pag. 2247 lines 19-20. *I'm not so sure that this is clearly seen in oxygen isotopes from Carburangeli speleothem by Frisia et al (2006): it is more an "ensemble" of evidences (petrography, isotopes, growth ect).*

We wrote in the MS "which may be compared with the two successive cool and dry events recorded at ca. 8200 and 7500 cal. BP in oxygen-isotope records from speleothems in northern Sicily (Frisia et al., 2006)" because these authors indicated that "The wet phase was interrupted by two periods of multi-century duration characterized by relatively cool and dry winters centered at ca. 8200 and ca. 7500 yr ago, highlighted by low  $\delta^{13}C$  and  $\delta^{18}O$  values" (see abstract).

We added "in carbone- and oxygen-isotope records"

Pag. 2249 we added Roberts et al., 2011 (The Holocene) in the discussion about the presences of some general period of dry condition in Eastern Mediterranean.

Pag. 2249. We added Drysdale et al., 2006 (Geology) about dry event at ca 4-4.2 ka.