Answer to the editor

Thanks to useful comments from 2 referees that were taken in account in the revised version, the manuscript was greatly improved. We develop the discussion on the relationship between clay mineral formation/neoformation and environmental conditions, as well as the interpretation of clay association in terms of terrigenous transfers. We also discussed more thoroughly the partition between eolian and river supply, by considering the potential influence of Tunisian local river supplies – through comparison with continental records - and their distribution through surface water circulation. We also precise that both eolian and river products may be redistributed by surface, intermediate and deep currents. The geochemical behaviour of selected elements is described in order to support their interpretations as eolian vs river proxy. Thank to the detailed remarks provided by both referees, we believe that the revised version of the manuscript give a expanded discussion about the partition between river and eolian inputs as well as on their paleoclimatic implications.

Point-to-point answers to the two reviews, as well as the modifications of the manuscript are detailed below.

Answer to Anonymous Referee#1

This paper presents a very nice data set of the mineralogical, geochemical and grain size evolution of sediments in a core from the Central Mediterranean. However some points are to be corrected or discusses (see below). The discussions on the origin of terrigenous particles (eolian vs riverine) and its climatic implications should be presented more clearly and discussed.

We would like to thank referee#1 for his /her appreciation of the manuscript and for his/her precise and pertinent comments and suggestions. We really appreciate the thorough review of the paper that considerably help improving the manuscript. We have taken in account all these remarks in the revised version of the manuscript by modifying the text as follow

MATERIALS AND METHODS

Remark#1

A brief presentation of the morphological setting of the core site would be interesting in order to have on look on the sedimentation conditions in this zone.

A brief presentation of the morphological setting was added to the text:

Page 2926, line 24 - The Siculo-Tunisian Strait separates the Tunisian and Sicilian continental shelves. Quaternary sedimentation on the southern part of the strait is controlled by marine and eolian supplies. The morphology of the Strait is characterized by two troughs separated by a relatively shallow sill, which likely constrains the westward flow of the deeper part of the saline Levantine Intermediate Water (Astraldi et al., 2002).

Remark#2

Also a brief description of the core itself would be useful along with references for more details.

A brief description of the core with references was added:

Page 2926, line 25 - The upper 6-meters of the core are composed of homogenous greenish grey clays, with some silty clay intervals between 440 and 430 cm and between 155 and 140 cm. The uppermost part of the core is composed of orange-brown clay (Rouis, 2010; Rouis et al., 2010). Smear-slides of sediments were taken all along the 6 upper meters of the core. Microscopic observations did not reveal any evidence of volcanic material.

Remark#3

Is there no evidence of volcanic deposits ?

There is no optical evidence of the presence of volcanic deposits. We add a sentence mentioning this point:

Page 2926, line 25 - Smear-slides of sediments were taken all along the 6 upper meters of the core. Microscopic observations did not reveal any evidence of volcanic material.

Remark#4

The description of the Mediterranean water circulation seems too much detailed in the text.

We simplified this section as follow:

Page 2924, line 12 - The Mediterranean Sea is a concentration basin where evaporation exceeds precipitation plus freshwater discharge. The surface Atlantic water entering from Gibraltar Strait transforms into Modified Atlantic Water (MAW) as it flows eastward (Fig. 1). The Levantine Intermediate Water (LIW) flows westward towards the Western Mediterranean (Fig. 1) via the relatively shallow Siculo-Tunisian Strait. The dense Eastern Mediterranean Deep Water fills the deep basin (>800 m depth) (Wüst, 1961; Pickard et Emery, 1982; Malanotte-Rizzli and Hodt, 1988; Klein et al., 1999). This general pattern is highly dependent on environmental conditions including eolian activity and precipitations distribution.

Remark#5

The clay minerals analysis protocol is also presented with too much details.

We simplified this section as follow:

Page 2927, line 24 - The analyses were performed according to the protocol described in Bout-Roumazeilles et al., (1999). XRD (X-ray diffraction) determinations were performed using a Bruker D4 Endeavor coupled with Lynxeye detector. Each clay mineral is characterized by its layer plus interlayer interval as revealed by XRD analysis (Brindley and Brown, 1980). The illite crystallinity, or Kübler Index is based on the expression of the width of the illite peak at 10Å and allows identifying the anchizone, the limit of diagenesis and the onset of the epizone. The presence of palygorskite has been confirmed by MET observations. Semi-quantitative estimation of clay mineral abundances, based on the pseudo-voigt deconvolution for the doublets illite-palygorskite (10Å-10.34Å) and kaolinite-chlorite (3.57Å-3.53Å), was performed using the software MacDiff developed by R. Petschick (2001).

Remark#6

Nothing is said on the determination of quartz abundance

A sentence was added in Materials and methods in order to clarify that point

Page 2928, line 21 - Quartz abundance is based on the intensity of diffraction measured at 4.25Å weighted by the clay-size fraction deposited on the oriented glass.

Remark#7

The elements analyzed with XRF-scanning should be presented in the methodology section (3-5) with an indication of their use in the elemental geochemistry section (4-3) : especially for Zr, Pd. The geochemical significance of the K/Al, Zr/Al, Ti/Al should also be given.

The methodology section was modified as follows:

Page 2929, line 4 - A series of element abundances – including K, Ti, Zr, Al -were measured were measured on U-channels using the Avaatech core scanner from the EPOC laboratory at the University of Bordeaux. The sediment was protected with Ultralene@ X-ray transmission foil in order to avoid contamination. The data were acquired at a 30 s count time, using 10kV voltage and 400 mA intensity. The results are expressed in counts per second, with a 2%

precision according to standard samples. Richter et al. (2006) gives technical details on the XRF scanning technique.

Moreover, a paragraph explaining the significance of the K/Al, Zr/Al and Ti/Al ratio was added in the elemental geochemistry paragraph (4-3) as follows:

Page 3930, line 22 - Zr/Al and Ti/Al are used as eolian proxies (Boyle, 1983; Grousset et al., 1989; Martinez et al., 1999) because Ti and Zr are conservative. Ti oxides are present in the silt and fine-sand fractions from highly weathered bedrocks. Due to its density and size, Ti is a main component of fine eolian dust together with quartz (e.g. Calvert and Pedersen, 2007). Due to its resistance to chemical weathering, and to its high specific gravity, Zr mainly belongs to the fine and medium sand fraction together with quartz. As a consequence, the Zr/Al ratio can be used as a grain-size proxy, and may be useful to retrace coarse eolian input (Calvert and Fontugne, 2001). K/Al is used to reflect the balance between aluminium-rich supply (kaolinite) and potassium-rich supply (illite and feldspars) (Schneider et al., 1997; Yarincik et al., 2000). In the Mediterranean, these ratios have been successfully used in estimating the respective river and eolian contribution to sedimentation (Jiménez-Espejo et al., 2007; Frigola et al., 2008; Rodrigo-Gamiz et al., 2011).

Remark#8

The grain size : do precise the « main mode » in the text.

We follow this recommendation.

Remark#9

The presentation of the different size classes evolution in the core in fig 3 is not easy to read as the different classes are not displayed in a logical, progressive pattern.

Following this remark, the presentation of different size classes has been changed in Fig. 3 in order to follow a more logical progressive pattern.

Remark#10

The terrigenous mass accumulation rate may be slightly underestimated as $CaCO_3$ is present in the terrigenous eolian fraction (and probably also in the riverine one). The biogenic $CaCO_3$ content in the core sediments is to be checked and compared to the Ca carbonate content of different dusts to verify if this bias is negligible

Taking in account that comments, we appended the paragraph concerning the MART calculation in the §3.2 as follow:

Page 2927, line 22 - The total $CaCO_3$ percentage was determined using a Bernard calcimeter and following standard procedures with a precision<5%. Total carbonate corresponds to the sum of biogenic carbonate plus detrital carbonates provided by eolian and riverine supply from Northern Africa. A recent review of the chemical composition of the main African mineral dust (Formenti et al., 2011b) indicates that dust originating from Tunisia and Algeria, and from the Mali-Algerian border contains up to 50% carbonates (Paquet et al., 1984; Coudé-Gaussen, 1991; Alastuey et al., 2005). A maximum carbonate content (5-70%) is evidenced in western Saharan dust (Avila et al. 1997; Khiri et al., 2004; Kandler et al., 2009). By contrast, dust from central Libya (O'Hara et al., 2006) is characterized by intermediate carbonate content (1-25%). Considering an eolian contribution toward the Mediterranean ranging from 10 to 50% (Loÿe-Pilot et al., 1986; Loÿe-Pilot and Martin, 1996; Guerzoni et al., 1997), carbonate of eolian origin may account for 2% to 35% of the sediment, whereas total carbonate ranges from 30 to 50% (Fig. 4). The importance of the eolian carbonate may lead to thus underestimated the MART, especially during the B/A when $CaCO_3$ represent 50% of total sediment, but should be less significant over the Holocene as the carbonate content is rather stable.

Remark#11

The Ca/Fe content is taken as a tracer of sources for eolian material, but if Ca is mainly biogenic, this ratio cannot be used for that purpose in the sediment. If this ratio is meaningful for aerosols or riverine suspended matter, this is probably not the case for these marine sediments and it should not be used in the paper.

We agree with this comment. The Ca/Fe ratio was supressed from both figures and text.

Remark#12

Is the volcanic material transformed in smectite in the marine environment as suggested 2928, line 18 ?

A paragraph was added in order to clarify that point:

Page 2938, line 18 - Considering the site location, a contribution from authigenic smectite should be discussed. Indeed, volcanic ashes deposited in deep-sea sediments are easily altered and may transform into smectite (Griffin et al., 1967). Formation of smectite at the expense of volcanic materials was evidenced near the Santorini archipelago in the eastern Mediterranean (Chamley, 1971).

Remark#13

References. Lacking references : Loÿe-Pilot et al., 1986 ; Martin et al., 1989 on the balance between riverine and eolian particles in the Mediterranean sediments- 2923 line 15.
Tomadin and Lenaz, 1989 on clay mineralogy and origin of sediments- 2923 line 17
Klein et al., 1999 -2925 line 3. Inapropriate references :Incarbonara et al., 2010 : concerns the Atlantic Eastern margin-2934 line 12. Lezine et al., 1995, Gasse et al., 2000 : concerns African tropics – 2935 line 4.
All lacking/inappropriate references were added/removed in both text and references.

Remark#14

For the late Holocene, the increase of Ti/Al, Zr/Al, quartz, kaolinite, etc… is given as synchronous with the rapid Climate cooling – 2940 line 8 and 9 - ; or this event peak around 1.2 kyr BP and the RCC is given at 3.5-2.5.
This is indeed a mistake and the increase of Ti/Al, Zr/Al and quartz in synchronous with the Rapid Climate Cooling event that occurred at 1.0-1.2 ka BP (Mayewski et al., 2004). The age of the RCC has been change in the text accordingly.

DISCUSSION ON EOLIAN VS RIVERINE ORIGIN

Remark#15

The possible contribution of local riverine sources is probably discarded too rapidly : the contribution of the Medjerda river extreme floods cannot be excluded (see for example : 25.106 t. in a few days : Claude et al., Cah. ORSTOM 1977), the MAW flow carrying the finest fraction east-and southeastward. Moreover the clay fraction of terrigenous load of the Medjerda river is mainly smectite like the Nile river's one…
We have taken this remark into account and we thus explore more extensively the riverine vs. eolian contribution. The discussion about the potential contribution of local rivers, as well as comparison with previously published Tunisian Holocene fluvial activity records, were added to the text as follow:
Page 2938, line 26 - Considering the location of the core, near from the Tunisian coast and directly under the MAV the enhanced supply of smectite may result from an increase

contribution of the Medjerda Oued, one of the main fluvial system draining Algeria and Tunisia, as its main stream is transported southeastward via the Mediterranean surface layer (Astraldi et al., 2002). The hydrological regime of an Oued is typically irregular, being seasonally modulated by precipitations regime, which may provoke major floods during heavy rainfall in winter and spring (Zahar et al., 2008). Even if the contribution of the Medjerda fluvial system to deep-sea sedimentation of the Siculo-Tunisian strait is relatively low, such major flood events may transport one-year discharge in a few days (Claude et al., 1977). Moreover, the Medjerda suspended loads are enriched in smectite (up to 50%) (Claude et al., 1977), which is consistent with the observed mineralogy of the sapropel S1 deposit.

In sub-humid to sub-arid environments, enhanced moisture availability likely promotes the development of vegetation which prevents soils from erosion whereas enhanced fluvial dynamic occurs during dry conditions (Rohdenburg, 1989 ; Zielhofer et al., 2008). The Oued Medjerda experienced humid conditions between 11 and 7.8 ka cal BP with soil formation around 9.5 ka cal BP (Zielhofer et al., 2002). Such moist conditions are generally not supporting enhanced fluvial activity, unless rainfall is characterized by as strong seasonality. Pollen assemblages show the expansion of temperate trees and shrubs between 10.1 and 6.6 ka – i.e. open oak forest with heath underbrush or maquis and Asteracae-Poacae-Cyperacae steppe - while Mediterranean vegetation only developed after 6.6 ka cal. BP suggesting wetter conditions during Sapropel S1 resulting from increased winter precipitation (Desprat et al., 2012). Strong winter precipitations may thus be responsible for moisture availability during the Sapropel S1, sustaining the expansion of vegetation and triggering seasonal fluvial discharge, that may be responsible for the enhanced detrital supply observed in the Siculo-Tunisian strait. However, the rather large sediment supply observed in the Tunisian Strait makes the long-term contribution of the Medjerda Oued unrealistic over the whole Sapropel S1. Indeed, sedimentation rate, smectite concentration, as well as the Zr/Al ratio and grain-size distribution suggest that the terrigenous supply during S1 was multiphased (Figs. 5c and d). Especially, the smectite contribution is maximum between 6.8 and 6 ka cal BP, with the Zr/Al – suggesting enhanced river supply - ratio peaking at 7 and 6.5 ka cal BP. Enhanced fluvial activity has been evidenced in the Medjerda fluvial system between 6.6 and 6 ka BP (Zielhofer et al., 2008) suggesting that the Medjerda Oued may be responsible for the observed terrigenous supply over that interval.

Page 2935, line 4 - Fluvial archives evidence the development of arid conditions in Tunisia (Zielhofer et al., 2002 ; 2004 ; 2008 ; Faust et al., 2004) between 12.4 and 11.8 ka BP, attributed to the Younger Dryas. The Medjerda fluvial system was particularly active, characterized by aggradation, with sand deposits and high sedimentation rates in the mid-floodplain (Zielhofer et al., 2007). Such fluvial dynamic may also be responsible for the major increase in the Zr/Al ratio observed around 12.5 ka BP in the Sicilian-Tunisian Strait (Fig. 4). However, increase fluvial dynamic within the floodplain is not likely associated with enhanced terrigenous supply through the northern outlet, since the runoff was probably severely altered due to increased aridity and overall reduced precipitations.

Page 2940, line 11 - The sedimentation rate displays a sharp decrease at 5.5 ka BP, evidencing a major modification of environmental conditions. The late Holocene is characterized by increased palygorskite and quartz contents, while the kaolinite shows a progressive increase starting at 3 ka BP at the expense of smectite, associated with a high Ti/Al ratio. These observations suggest enhanced eolian supply that may be linked with the development of arid conditions on the North African continent. This interpretation is supported by the occurrence of arid periods (Fig. 4) in Tunisia around 4.7 ka, 3.0 ka, 1.6 ka, 1.1 ka and 0.4 ka (Faust et al., 2004) evidenced by major modifications of fluvial dynamics in the Medjerda Oued and associated with late Holocene North Atlantic coolings (Faust et al., 2004 ; Zielhofer et al., 2008).

Remark #16

Clarify and discuss the term of marine supply with the support of present day circulation of water and particles in the Mediterranean sea. If particles from the Nile river may be brought by marine circulation to the Sicilian Strait this is also the case for eolian dusts deposited in the Eastern Mediterranean, which are also smectite rich.

In order to clarify that point, some precisions were added throughout the text to indicate that water masses mainly carry reworked clay particles primarily transported toward the Mediterranean through river and/or eolian supply.

Page 2938, line 26 - Smectite may alternatively be supplied from the eastern Mediterranean basin where abundant smectite is originally supplied by the Nile River (Ventakatarathnam and Ryan, 1971; Stanley and Wingerath, 1996; Foucault and Mélières, 2000; Hamann et al., 2009) and, to a lesser extent by eolian processes, since Saharan dust deposited in the eastern Mediterranean basin is composed of kaolinite associated with smectite (Chester et al., 1977). In that context, the Levantine Intermediate Water likely redistributes smectite-rich fine-grain size particles as it flows westward in the sub-surface layers across the Siculo-Tunisian Strait (Fig. 1).

Page 2939, line 12 – Alternatively, smectite may also be redistributed from the Adriatic Sea by the dense Eastern Mediterranean Deep Water (EMDW) flowing at depth across the Siculo-Tunisian Strait (Fig. 1). However, this hypothesis is not supported by data since the major low salinity episode that occurred around 7.7 ka BP likely resulted from a massive discharge of the Po River which mainly carries illite and chlorite (Combourieu-Nebout et al., this volume; Tomadin, 2000).

Remark#17

As a consequence the partition between eolian and riverine material is perhaps not as simple as assessed by the authors.

Taking in account this comment, a better case was made on discussing the partition between eolian and riverine material throughout the text, with specific emphasis on the potential contribution of the nearby Medjerda Oued since the last glacial.

Page 2940, line 10 - The hypothesis of enhanced eolian activity during this interval is supported by an increase in palygorskite and quartz content, observed between 1.15 and 0.65ka BP (starting at 1.7 ka BP) in the Alboran sea (Rodrigo-Gamiz et al., 2011) and by several evidences of arid continental conditions over the Mediterranean North Africa among which vegetation in Tunisia (Brun, 1992; Stevenson et al., 1993), terrestrial archives in Morocco (Zielhofer et al., 2010) and Tunisian fluvial archives (Faust et al., 2004 ; Zielhofer et al., 2002 ; 2004 ; 2008).

Page 2938, line 12 - The overall evidences of increased moisture availability in the Mediterranean during the Sapropel SI rule out an eolian origin for smectite over that time interval.

Page 2935, line 4 - Fluvial archives evidence the development of arid conditions in Tunisia (Zielhofer et al., 2002 ; 2004 ; 2008 ; Faust et al., 2004) between 12.4 and 11.8 ka BP, attributed to the Younger Dryas. The Medjerda fluvial system was particularly active, characterized by aggradation, with sand deposits and high sedimentation rates in the mid-floodplain (Zielhofer et al., 2007). Such fluvial dynamic may also be responsible for the major increase in the Zr/Al ratio observed around 12.5 ka BP in the Sicilian-Tunisian Strait (Fig. 4). However, increase fluvial dynamic within the floodplain is not likely associated with enhanced terrigenous supply through the northern outlet, since the runoff was probably severely altered due to increased aridity and overall reduced precipitations.

Page 2940, line 8 - The sedimentation rate displays a sharp decrease at 5.5 ka BP, evidencing a major modification of environmental conditions. The late Holocene is characterized by increased palygorskite and quartz contents, while the kaolinite shows a progressive increase starting at 3 ka BP at the expense of smectite, associated with a high Ti/Al ratio. These observations suggest enhanced eolian supply that may be linked with the development of arid conditions on the North African continent. This interpretation is supported by the occurrence of arid periods (Fig. 4) in Tunisia around 4.7 ka, 3.0 ka, 1.6 ka, 1.1 ka and 0.4 ka (Faust et al., 2004) evidenced by major modifications of fluvial dynamics in the Medjerda Oued and associated with late Holocene North Atlantic coolings (Faust et al., 2004 ; Zielhofer et al., 2008).

PALEOCLIMATIC IMPLICATIONS OF THE PARTITION BETWEEN RIVERINE AND EOLIAN PARTICLES

Remark#18

If the distinction between riverine and eolian material is not so straightforward, an other difficulty could arise from the fact that eolian dust is- for the present days and also in the past (« pluvial phases ») – mainly deposited by wet deposition (Loÿe-Pilot et al. 1986, 1996 ; Bergametti et al. 1989 : Coudé-Gaussen 1987). So the link eolian deposition-climate should be considered carefully.

We have taken this remark into account and this point is now discussed in the text as follow :

Page 2932, line 15 - The relation between enhanced supply of eolian particles and climate is complex. Indeed, Saharan dust is produced through deflation/erosion processes that prevailed during arid periods and /or associated with intense eolian activity, when scarce vegetation cover favours soils erosion. Production of Saharan dust particles is favoured by the presence of little consolidated soils that mainly formed during former humid period. Moreover, while arid conditions favour the erosion and transportation of dust, major deposition occurs as wet deposit with precipitation (Bergametti et al., 1989; Guerzoni et al., 1992; Loÿe-Pilot et al., 1986; Loÿe-Pilot and Martin, 1996). In that sense, enhanced eolian dust input is mainly related to wind activity, and indirectly related to aridity which limits vegetation cover, promotes soils erosion and increases dust availability. The studied area is characterized by strong seasonal contrast with warm and dry summers and cool and wet winters, with moisture being advected from the Atlantic ocean. Increased aridity/ summer-like conditions in the Mediterranean would thus favour dust production and export toward the Mediterranean. Dust washing from the atmosphere would thus been controlled by moisture advection from the Atlantic during winter. However, a recent study evidenced that, although dust is mainly removed from the atmosphere by precipitations and occurred as major « wet deposits », gravitational settling processes leading to more frequent and recurrent « dry deposits » may also contribute significantly to dust deposition (Skonieczny et al., 2011; 2013).

Remark#19

Finally the reader have the impression that the evolution of the different studied parameters in the core is complex and that the climatic signal is not so simple to retrieve from the data. It seems that the authors partly use the general knowledge of the climatic evolution of the last post-glacial period in the Mediterranean and northern Africa to interpret their data rather than the reverse. This imply to re-write the paper more clearly.

We agree with this comment, and the aim of that paper was indeed to use our dataset in order to give new insight on the respective eolian and riverine contributions in the Siculo-Tunisian Strait since the last glacial -in the frame of the well-known general climatic evolution of the Mediterranean – which may help to decipher the complex east-west and north-south climatic patterns evidenced in several recent studies. As mentioned by the reviewer, the terrigenous record is complex and part of the signal may be controlled by local phenomenon. For that reason, we do not wish to extrapolate interpretation arising from a single core at a regional scale, but we rather try disentangling the local terrigenous signal in the light of the general climatic knowledge of the Mediterranean. Thank to the detailed remarks provided by the Referee#1, we believe that the revised version of the manuscript give a expanded discussion about the partition between river and eolian inputs as well as on their paleoclimatic implications.

ANY TECHNICAL REMARKS

Remark#20

Do not begin the abstract with « The objectives were ». -2922, line 1-

-2922 lines 3 and 4 : « the atmospheric versus riverine contributions to sedimentation » : circular discourse (=line1).

We modified the text as follow:

Page 2922, line 2 - A multiproxy study –coupling mineralogical, grain-size and geochemical approaches – was used to tentatively retrace eolian and fluvial contributions to sedimentation in the Sicilian-Tunisian Strait since the last glacial.

Remark#21

-2922 lines 6 and 7 : « and particles provenance has been modified since Last Glacial » : this sentence is strange at this place.

We discarded this part of the sentence as follow:

Page 2922, line 6 - The eolian supply is dominant over the whole interval, excepted during the Sapropel S1 when riverine contribution apparently became significant.

Remark#22

-2922 line 26 : « 5.7 kyr » : add « BP ».

Done

Remark#23

-2924 line 3 to 5 : not very clear.

We modified the paragraph as follow to clarify the text.

Page 2924, Line 3 - Grain-size distribution, which is primarily driven by physical processes (erosion, deflation, transportation, settling) will help constraining the main transportation modes (Ehrmann et al., 2007; Montero et al., 2009; Sionneau et al., 2010).

Answer to N. Kallel (Referee)

We thank N. Kallel for his appreciation of our work and for his valuable comments, that help us improving the quality of the manuscript. We follow his recommendations by modifying the text in order to complete the discussion and to clarify some points in the revised version of the manuscript.

Remark#1

A weak point of the paper is in the discussion that does not address the interaction between climate and depositional environments of clay and other minerals. For example the Palygorskite is neoformed today in salty and confined environments in southern Tunisia.

We agree with this comment, and precisions concerning the interaction between climate and depositional environments of clays were added in the text:

Page 2931, line 19 - Palygorskite is typical of arid and sub-arid environments from the Mediterranean characterized by chemically restricted conditions (Singer and Galan, 1984; Chamley, 1989). In these Mg-rich environments, alternating moist and drought periods promotes chemical concentration and favours the authigenic formation of palygorskite when evaporitic conditions prevailed (Singer and Galan, 1984). Saharan dust-blown particles contain palygorskite reworked from Neogene North African deposits, in addition to present-day neoformed palygorskite (e.g. Chamley, 1989; Coudé-Gaussen et al., 1982; Molinaroli, 1996, Regaya, 1984; 1992; Elloy and Thomas, 1981). The observed changes in clay mineralogy are rather abrupt, and are thus considered to primarily reflect varying terrigenous provenance/transportation patterns, because alteration/weathering processes are often slow (Thiry, 2000). But interaction between climate (rainfall/temperature) and the neoformation of clays has to be taken in account, because these processes are quite rapid in such evaporitic environments. However, an overview of the main sources of palygorskite related to their geological ages suggests that ancient formations constitute the main source of palygorskite, even if contribution from present-day neoformed palygorskite may be locally of importance (Verrecchia and Le Coustumer, 1996).

Remark#2

The disappearance of this mineral during the Holocene wet period is not surprising. So I do not agree with the authors that use the absence of palygorskite in the sediment during the last sapropel as an indicator of distant origin of the smectite.

We agree that this part of the text may be confusing. In order to clarify the discussion, we modified the discussion as follow:

Page 2938, line 20 - The enhanced supply of smectite may also be eolian, originating from Tunisian loesses, which are characterized by their high content in smectite and palygorskite (Fig.1) (e.g. Bout-Roumazeilles et al., 2007). However, smectite and palygorskite display opposite variations during the sapropel, suggesting that they are not reworked from the same geological formation.

Remark#3

The studied core presents also a record of the surface water oxygen isotope composition (directly linked to salinity, Essallami et al., 2007). This record indicates precisely the timing of the last wet period in the Central Mediterranean Sea. It would be interesting to add this record to the figures and to integrate it in the discussion.

We totally agree with the referee about the pertinence of using the salinity record. We added this record on Figs. 3 and 5d, and modified their legends accordingly. We now use the oxygen and carbon isotope record and the $\Delta\delta_W$ record (Essallami et al., 2007) to constrain the water masses hydrological properties and the salinity decrease associated with the sapropel event in the studied core, and to support the proposed interpretation.

Page 2927, line 13 - We compare our data with previously published $\delta^{18}O$ and $\delta^{13}C$ records and with the reconstructed salinity ($\Delta\delta_W$) from core MD04-2797 (Essallami et al., 2007). These data will help constraining the hydrologic properties of the overlying water masses and evidencing alterations of freshwater input/evaporation budget in the Central Mediterranean. The reliability of the $\Delta\delta_W$ reconstruction is high when sea-surface temperature (SST) changes are small (Essallami et al., 2007).

Page 2935, line 18- Salinity is low during the YD in central Mediterranean (Fig. 3), as during cold events – H1-, suggesting enhanced contribution of less saline waters originating from the Atlantic Ocean (Essallami et al., 2007).

Page 2937, line 10 - The $\Delta\delta_W$ signal shows a decrease between 9 and 6.5 ka BP including the deposition of sapropel S1 (Fig. 5d).

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