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Magnetic susceptibility of eastern Mediterranean marine sediments as a proxy for Saharan dust supply?

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ABSTRACT

Interpretations of magnetic susceptibility variations in circum-Saharan marine sediments have suggested a close relationship with Saharan dust supply, which assumes that dust dominates over the potential contributions from a variety of other sources and processes. To evaluate the importance of Saharan dust supply versus that of other potential sources of variability in magnetic susceptibility, we compile magnetic susceptibility data from eastern Mediterranean Plio-Pleistocene sequences at Ocean Drilling Program (ODP) sites 964, 966, 967 and 969, for comparison with other paleoclimatic and paleoceanographic proxy data for the same intervals. Our results demonstrate that magnetic susceptibility variations are linked to the supply of Saharan dust through some parts of the studied intervals, but seem to be predominantly controlled by the discharge of suspended matter from Eurasian rivers and the Nile. Depositional and diagenetic processes in the stratigraphic vicinity of ash layers and sapropels also affect magnetic susceptibility values. We conclude that magnetic susceptibility records can only be used as a proxy for Saharan dust supply in eastern Mediterranean sediments, and likely also in other peri-Saharan marine sediments, when this has been demonstrated by further analyses to be the only (or predominant) source of magnetic susceptibility variability.

1. Introduction

The magnetic susceptibility of marine sediments is routinely measured in paleoceanographic studies because it can be used to correlate sedimentary sequences, to identify missing or disturbed sediment sections, and to help unravel past paleoceanographic and paleoclimatic variations both in marine and terrestrial sequences (Verosub and Roberts, 1995; Hounslow and Maher, 1999). Of particular interest are magnetic susceptibility measurements obtained for deep-sea sediment cores both from shipboard and laboratory-based magnetic susceptibility meters, since they enable rapid, inexpensive and non-invasive measurements, and they allow compilation of long paleoclimate records at high (<3 cm) resolution (Robinson, 1990). Magnetic susceptibility measurements have become a popular tool in paleoceanographic studies of tropical African climate change. They have been used to characterize eolian Saharan dust transport into the tropical and equatorial Atlantic Ocean (Bloemendal and deMenocal, 1989; deMenocal, 1995; Bozzano et al., 2002), the Arabian Sea (Bloemendal and deMenocal, 1989; deMenocal et al., 1991; deMenocal, 1995), and the Mediterranean Sea (Hoogakker et al., 2004), or to construct age models in which a link with Saharan dust supply is assumed (Dinarès-Turell et al., 2003; Kuhlmann et al., 2004). The underlying rationale in these studies is that marine sediments deposited during past wet climate cycles have low susceptibility values as a result of decreased dust production in the Sahara, and vice versa (Bloemendal and deMenocal, 1989; deMenocal et al., 1991; deMenocal, 1995; Bozzano et al., 2002; Hoogakker et al., 2004; Kuhlmann et al., 2004). However, magnetic susceptibility values of sediments may be influenced by several factors (Hounslow and Maher, 1999), such as: 1) the amount and type of eolian magnetic (e.g. magnetite, hematite, goethite) and paramagnetic (e.g. clays) minerals; 2) the amount and type of authigenic magnetic and paramagnetic minerals; 3) diagenetic dissolution of magnetic minerals; and 4) dilution by diamagnetic biogenic (e.g. calcium carbonate, silica) and detrital (quartz) minerals. For relatively short sediment cores (e.g. <10 m) it is often possible to examine the role of diagenesis, carbonate dilution, and visible turbiditic and volcanic material in the magnetic susceptibility signal by comparing magnetic susceptibility with geochemical, mineralogical and sedimentological parameters (e.g. Bozzano et al., 2002; Hoogakker et al., 2004; Kuhlmann et al., 2004). However, for long sediment cores it is often difficult to "ground truth" magnetic susceptibility measurements. As a result, the reliability of some claimed records of Saharan dust supply (e.g. ODP sites 722/721, Bloemendal and deMenocal, 1989; deMenocal et al., 1991) has been subsequently contested, at least for some intervals, on the basis of detailed rock magnetic analyses (Bloemendal et al., 1993; Hounslow and Maher, 1999).

In this paper we present magnetic susceptibility data from eastern Mediterranean sediments, recovered at Ocean Drilling Program (ODP) sites 964, 966, 967 and 969, to show how other controls on magnetic

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susceptibility complicate interpretations in which high (low) susceptibility values are related to high (low) Saharan dust contents. Eastern Mediterranean sediments are characterized by the occurrence of organic-rich layers called sapropels, which mark the pace of an orbitally-driven climatic system that was exceptionally amplified due to the semi-enclosed nature of the Mediterranean basin. Formation of sapropels was controlled by ca 22 kyr periodic changes in the amount of solar energy received in the northern low- and mid-latitudes during summer insolation maxima (precession minima) (Emeis et al., 2000; Calvert and Fontugne, 2001). At these times, intensification (Rossignol-Strick, 1983; Lourens et al., 2001) and enhanced northward penetration (Rohling et al., 2002; Larrasoaña et al., 2003a) of the North African summer monsoon resulted in increased monsoonal precipitation, which led to formation of extensive river and lake systems in a "green Sahara" scenario (McKenzie, 1993; Szabo et al., 1995; Rohling et al., 2002, 2004; Smith et al., 2004). This resulted in decreased dust production in the Sahara (Middleton, 1985) and in increased riverine supply from the Nile and the wider northern African margin (NAM) (Rossignol-Strick, 1983; Lourens et al., 2001; Rohling et al., 2002; Larrasoaña et al., 2003b). Simultaneously, wetter conditions along the Eurasian margin (Rohling and Hilgen, 1991; Bar-Matthews et al., 1997; Tuenter, 2004) resulted in increased riverine supply from rivers draining the northern borderlands of the eastern Mediterranean (NBEM) (Wehausen and Brumsack, 2000; Foucault and Mélières, 2000). In contrast, drier climates in the circum-Mediterranean region prevailed during sedimentation of marls intercalated with sapropels at the time of boreal summer insolation minima (precession maxima) (Rossignol-Strick, 1983; Lourens et al., 2001). At these times, the weakened North African summer monsoon remained south of the central Saharan watershed (Rohling et al., 2002; Larrasoaña et al., 2003a), which resulted in decreased riverine discharge along the Nile and the NAM and in increased supply of Saharan dust (Rossignol-Strick, 1983; Lourens et al., 2001; Rohling et al., 2002; Larrasoaña et al., 2003a). Simultaneous drier conditions along the Eurasian margin (Rohling and Hilgen, 1991; Bar-Matthews et al., 1997; Tuenter, 2004) resulted in decreased riverine supply from rivers draining the NBEM (Wehausen and Brumsack, 2000; Foucault and Mélières, 2000).

Here we explore the specific processes (e.g. climate variability and diagenesis) that might influence the magnetic susceptibility signal of sapropel-bearing sediments by comparing magnetic susceptibility data from selected intervals of ODP sites 964, 966, 967 and 969 with geochemical (Wehausen and Brumsack, 1998, 2000; Lourens et al., 2001), mineralogical (Mélières et al., 1998; Foucault and Mélières, 2000) and magnetic (Larrasoaña et al., 2003a,b) data from the same intervals. Our aim is to test the appropriateness of using magnetic susceptibility of eastern Mediterranean sediments as a proxy for Saharan dust supply.

2. Materials and methods

Site 964 was drilled at a water depth of 3660 m on Pisano Plateau, which is a small bathymetric high located in the Ionian Basin at the foot of the Calabrian Ridge (Fig. 1) (Emeis et al., 1996). Sites 966 and 967 were drilled on the top (water depth of 926 m) and northern slope (water depth of 2553 m), respectively, of Eratosthenes Seamount, a prominent bathymetric high located in the Levantine Basin (Emeis et al., 1996) (Fig. 1). Site 969 is located at a water depth of 2200 m on the Mediterranean Ridge (Fig. 1).

Volume magnetic susceptibility was measured at 3–4 cm intervals on whole-round sections using a Bartington Instruments MS1 magnetic susceptibility meter on-board the *JOIDES-RESOLUTION*. Magnetic susceptibility data are available for sapropel 5 (S5) at sites 964, 966, 967 and 969, and for two selected intervals of sites 964 and 967 for which published magnetic, geochemical and mineralogical data are available. Magnetic data have been previously published by Larrasoaña et al. (2003a,b), and include the anhysteretic remanent

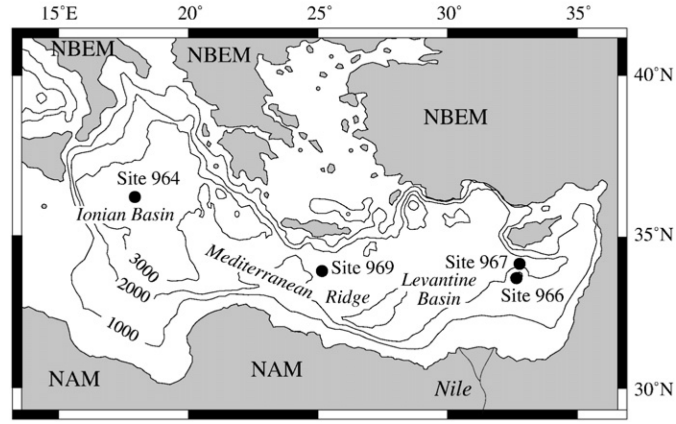

Fig. 1. Location of Ocean Drilling Program (ODP) Leg 160 sites 964, 966, 967 and 969, from which magnetic, geochemical and mineralogical data are shown in this work. NBEM = northern borderlands of the eastern Mediterranean; NAM = North African margin.

magnetization (ARM) and an isothermal remanent magnetization (IRM) imparted with an inducing field of 0.9 T and later AF demagnetized at 120 mT (IRM@AF). Down-core variations in ARM can be used to constrain the effect of non-steady state diagenetic processes on magnetic susceptibility variations via their control on magnetite concentrations (see van Santvoort et al., 1997, Kruiver and Passier, 2001, Larrasoaña et al., 2003b, and Garming et al., 2004 for a detailed explanation of the methods). IRM@AF values have been used as a proxy for hematite concentration, which is related to the amount of Saharan dust in eastern Mediterranean sediments (Larrasoaña et al., 2003a) regardless of diagenetic conditions (Liu et al., 2007). ARM results are available for the two selected intervals of sites 964 and 967, whereas IRM@AF data are available only for the correlative interval of Site 967.

Geochemical data, which are available for the selected interval of Site 967, have been published by Wehausen and Brumsack (2000) and Lourens et al. (2001). They include Ti and Mg to Al ratios, whose variations are linked to the relative contribution of Saharan dust and Nile sources (see Wehausen and Brumsack, 2000, and Lourens et al., 2001 for a detailed explanation of the methods). Mineralogical data, which are available for the selected interval of Site 964, have been published by Mélières et al. (1998) and Foucault and Mélières (2000). They include the concentration of airborne (palygorskite, kaolinite) and fluvially-derived (smectite, chlorite) clays (see Mélières et al., 1998, and Foucault and Mélières, 2000 for a detailed explanation of the methods).

All the data shown in this paper are presented using the revised metre composite depth (rmcd) sections established by Sakamoto et al. (1998) unless otherwise stated. Sapropel nomenclature is after Lourens et al. (1996), who proposed the naming of sapropels after their correlative summer insolation maxima (i-cycles).

3. Results

3.1. Magnetic susceptibility of sapropel S5 and surrounding sediments

S5 was deposited during the previous interglacial period at 124 ka during a maximum in northern summer insolation (cycle i-12) (Kallel et al., 2000; Calvert and Fontugne, 2001; Rohling et al., 2002, 2004). Magnetic susceptibility values of S5 are distinctively higher than those of surrounding sediments at sites 969 and 967 (Fig. 2C, D), but are lower (Fig. 2B) and intermediate (Fig. 2A) compared to non-sapropelic sediments at sites 966 and 964, respectively. Moreover, magnetic susceptibility minima are found down 40 cm (Fig. 2) beneath S5. In addition, magnetic susceptibility peaks are often related to ash layers intercalated within non-sapropelic sediments (Fig. 2A,D).

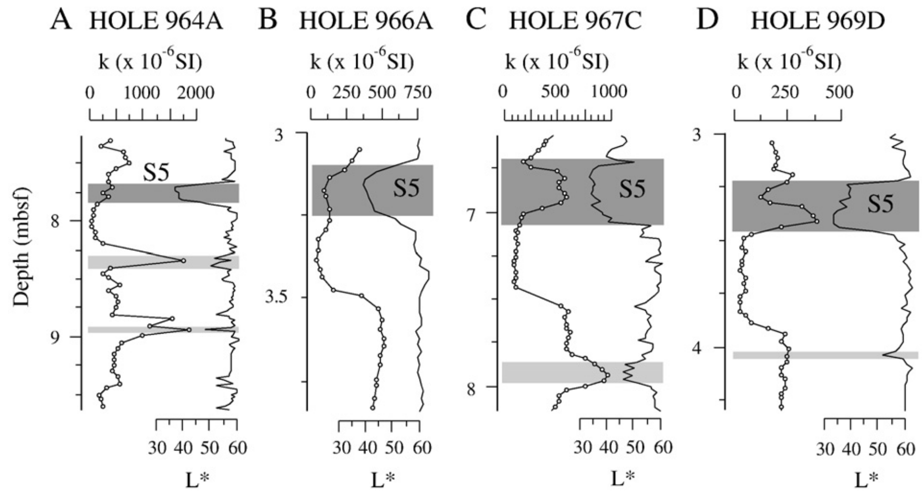

Fig. 2. Magnetic susceptibility records across sapropel S5 and surrounding sediments at ODP sites 964, 966, 967 and 969. S5 (dark grey bar) and ash layers (light grey bars) are delineated using the *L** parameter (Sakamoto et al., 1998) (low values indicate dark colours associated with organic matter). Magnetic susceptibility and *L** records are plotted using the metres below sea floor (mbsf) depth scale (Emeis et al., 1996).

3.2. Magnetic susceptibility vs climate proxy records for ODP Site 967

The interval of 75.4–86.0 rmcd in ODP Site 967 includes 8 visibly identifiable sapropels deposited between ca 2.9 and 2.4 Ma (Fig. 3). Six of the sapropels occur within a distinctive cluster in the middle of the interval, with a mean spacing between sapropels of ~50 cm. The other two sapropels occur in the lowermost part of the studied interval, separated from each other by ~100 cm. The age model for this interval is based on correlation of the distinctive sapropel pattern and the Ti/Al curve to a northern hemisphere summer insolation target curve (Lourens et al., 2001), and is consistent with biostratigraphic, paleomagnetic and oxygen isotopic data (Staerker, 1998; Richter et al., 1998; Kroon et al., 1998).

Sapropels are characterized by low Ti/Al and Mg/Al ratios (Fig. 3D,E) and low IRM@AF values (Fig. 3B), whereas non-sapropelic sediments are characterized by high Ti/Al and Mg/Al ratios (Fig. 3D,E) and high

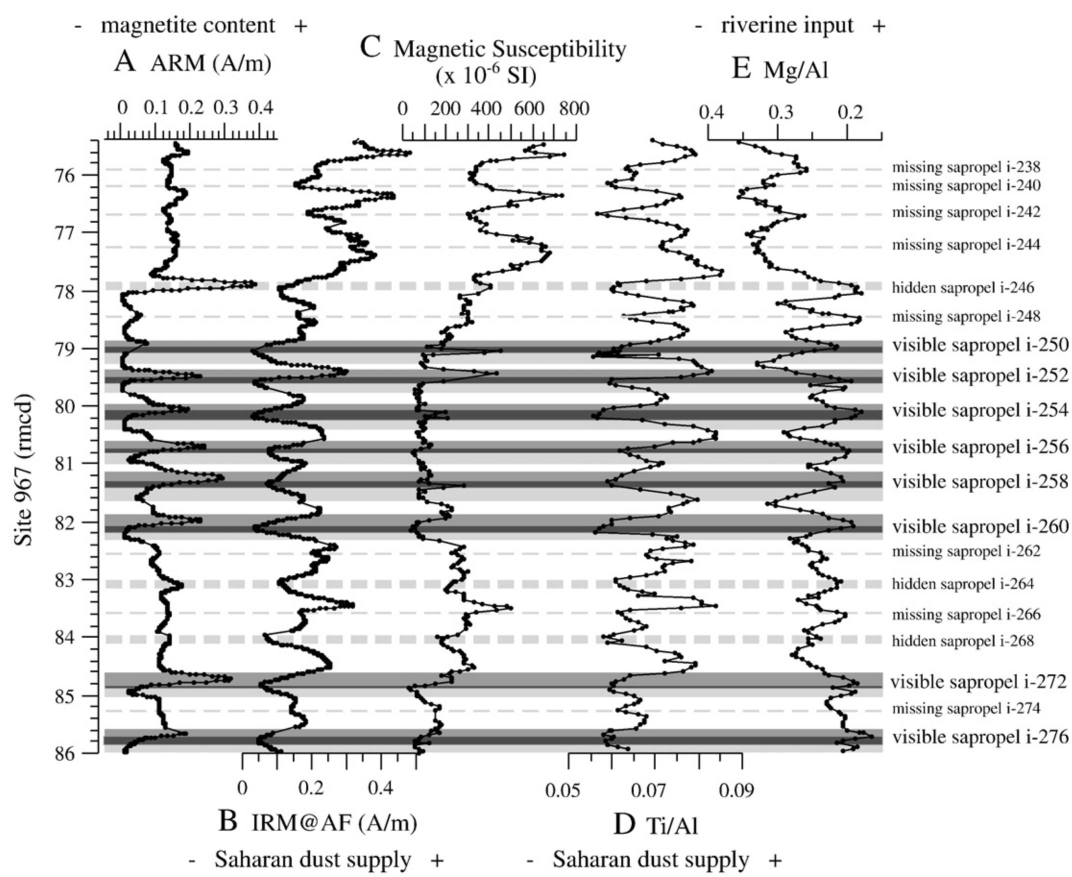

Fig. 3. (A,B) Magnetic (after Larrasoaña et al., 2003a), (C) magnetic susceptibility, and (D, E) geochemical results (after Wehausen and Brumsack, 1998, 2000; Lourens et al., 2001) for the studied interval from ODP Site 967. Dark grey bars indicate the positions of visible sapropels. Dark grey shading indicates the position of diagenetic fronts below (dissolution fronts) and above (oxidation fronts) sapropels. Thick and thin grey dashed lines mark the positions of hidden and missing sapropels (Larrasoaña et al., 2006), respectively. Sapropel stratigraphy is after Lourens et al. (2001) and is depicted using the revised metre composite depth (rmcd) scheme of Sakamoto et al. (1998).

IRM@AF values (Fig. 3B). Distinctively low (<0.05 A/m) ARM values within and down to 15 cm below sapropels indicate the reductive dissolution of magnetite in sapropels and in underlying dissolution fronts due to anoxic conditions that prevailed during sapropel formation (van Santvoort et al., 1997; Kruiver and Passier, 2001; Larrasoaña et al., 2003b) (Fig. 3A). ARM peaks up to 15 cm above the sapropels indicate the new formation of magnetite in oxidation fronts that developed on top of sapropels when bottom-water re-oxygenation terminated their formation (Kruiver and Passier, 2001; Larrasoaña et al., 2003b; Garming et al., 2004). Away from sapropels, similar combination of dissolution (low ARM values) and/or oxidation (high ARM values) fronts is evident in some intervals (i-246, i-264, i-268) (Fig. 3A). These intervals have low Ti/Al, Mg/Al and IRM@AF values, among other properties that are typical of sapropels, and can be interpreted as sapropels that have been completely erased by post-depositional oxidation. The presence of these so-called hidden sapropels (Larrasoaña et al., 2006) would have remained unnoticed if geochemical and magnetic data had not revealed their presence.

Apart from sapropels, other intervals (i-238, i-240, i-242, i-244, i-248, i-262, i-266 and i-274) are also characterized by minima in Ti/Al and IRM@AF values and maxima in Mg/Al ratios. A lack of ARM peaks and/or minima associated with these intervals indicate that no diagenetic fronts developed. Combined with the overall weak prominence of the Ti/Al, Mg/Al and IRM@AF minima, this suggests, in turn, that sapropels did not form at these positions because climate and oceanographic conditions did not change sufficiently, resulting in so-called "missing sapropels" (Larrasoaña et al., 2006).

Magnetic susceptibility values range between 50 and 750×10^{-6} SI through the studied interval of ODP Site 967 (Fig. 3C). Some visible (i-260, i-272, i-276), hidden (i-264, i-268) and missing (i-238, i-240, i-242) sapropels have distinct magnetic susceptibility minima with values as low as 50×10^{-6} SI that coincide with minima in the Ti/Al and IRM@AF records. In contrast, some visible (i-250, i-254, i-258) and hidden (i-246) sapropels are characterized by high susceptibility values (of up to 450×10^{-6} SI) that correlate with minima in the Ti/Al and IRM@AF records and in the Mg/Al curve.

3.3. Magnetic susceptibility vs climate proxy records for ODP Site 964

The studied interval of ODP Site 964 contains 6 visibly identifiable sapropels that range between ca 3 and 2.8 Ma in age (Fig. 4). Four of these sapropels cluster within the lower half of the interval, where they are separated from each other by ~50–60 cm. The two remaining sapropels appear with a spacing of ~120 cm in the upper part of the studied interval. Correlation of the sapropel pattern to a boreal summer insolation target curve provides an astronomically-tuned age model for the interval (Emeis et al., 2000) that is consistent with biostratigraphic, paleomagnetic and oxygen isotopic data (Sprovieri et al., 1998; Staerker, 1998; Richter et al., 1998; Howell et al., 1998).

Sapropels from the studied interval of ODP Site 964 have distinctive minima in palygorskite and kaolinite abundances (Fig. 4C,D) and maxima in smectite and chlorite (Fig. 4E,F) contents. In contrast, sediments intercalated between sapropels are characterized by distinctive peaks in palygorskyte and kaolinite contents (Fig. 4C,D) and distinctive minima in smectite and chlorite abundances (Fig. 4E,F).

Distinctively low (<0.05 A/m) and high (>0.2 A/m) ARM values are found down to 50 cm below and up to 20 cm above sapropels, where dissolution and oxidation fronts are located, respectively (Fig. 4A). At about 100.05 rmcd, an ARM peak indicates an oxidation front (i-278) in a position where no sapropel is visibly identified (Fig. 4B). This interval has low palygorskite and kaolinite contents and high abundances of smectite and chlorite, among other properties that are

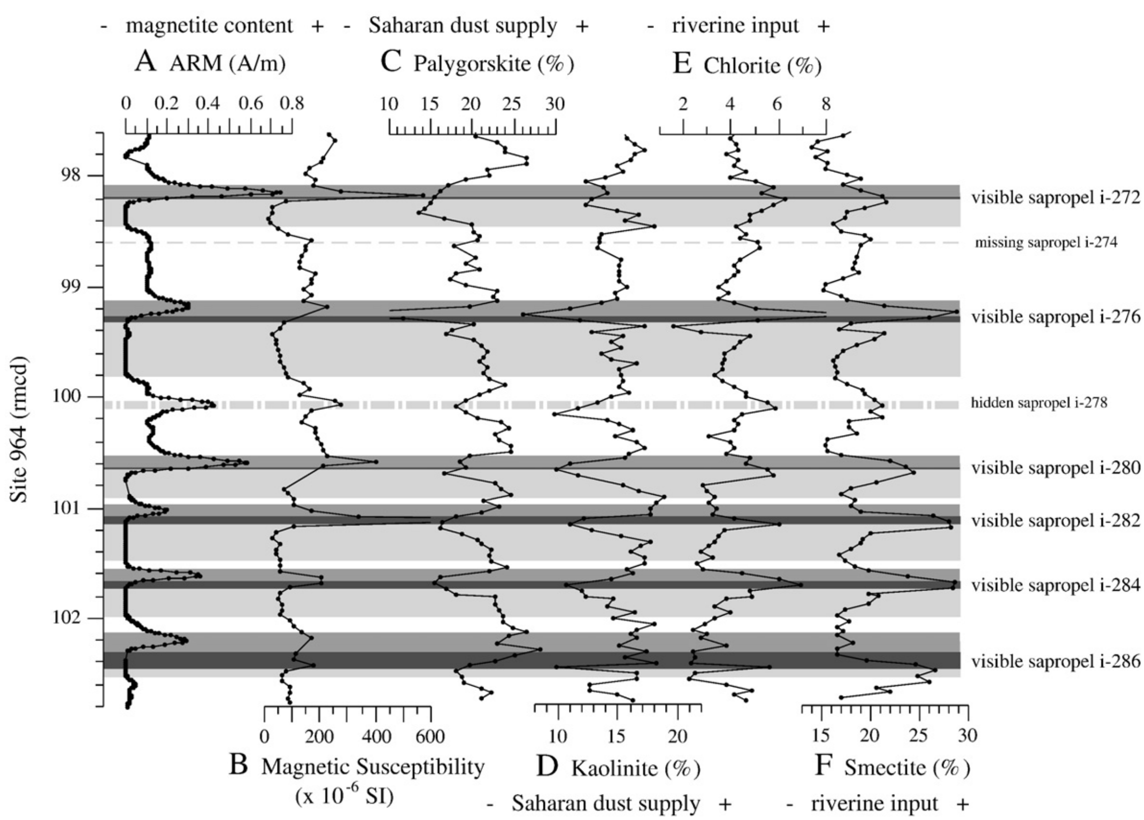

Fig. 4. (A) Magnetic (after Larrasoaña et al., 2003b), (B) magnetic susceptibility, and (C–F) mineralogical results (after Méliêres et al., 1998; Foucault and Méliêres, 2000) for the studied interval from ODP Site 964. Dark grey bars indicate the positions of visible sapropels. Dark grey shading indicates the positions of diagenetic fronts below (dissolution fronts) and above (oxidation fronts) sapropels. Thick and thin grey dashed lines mark the positions of hidden and missing sapropels (Larrasoaña et al., 2006), respectively. Sapropel stratigraphy is after Emeis et al. (2000) and is depicted using the revised metre composite depth (rmcd) scheme of Sakamoto et al. (1998).

typical of sapropels, and can therefore be interpreted as a hidden sapropel (Larrasoaña et al., 2006). Between sapropels i-272 and i-276, the lack of significant variation in sediment properties indicates that no sapropel formed during i-274 because climatic and oceanographic conditions did not change sufficiently ("missing sapropel").

Magnetic susceptibility values have maxima of up to 700×10^{-6} SI in most of the visible sapropels (i-272, i-282, i-284, i-286), and in the hidden (i-278) sapropel (Fig. 4B). These maxima coincide with the lowest contents of palygorskyte and kaolinite and with the highest abundances of smectite and chlorite. Magnetic susceptibility values peak up to 20 cm above some visible sapropels (i-276, i-280), coinciding with maxima in the ARM record (Fig. 4A,C). For other sapropels (i-272), magnetic susceptibility values seem to mimic ARM variations (Fig. 4A,B).

4. Discussion

4.1. Mineralogical source of magnetic susceptibility in eastern Mediterranean sediments

Mineralogical data from the studied interval of ODP Site 964 enable determination of the mineralogical source of the magnetic susceptibility signal. The main paramagnetic minerals at this site, and in the rest of the Ionian Basin, correspond to clays such as palygorskyte, kaolinite, smectite, chlorite and illite (Méliêres et al., 1998; Foucault and Méliêres, 2000). This clay mineral assemblage is similar in composition to that characterizing the Levantine Basin (Dominik and Stoffers, 1978), where ODP Site 967 is located. We are unaware of published values for the bulk magnetic susceptibility of kaolinite and palygorskite. Magnetic susceptibility of chlorite and smectite, which are dominant in high-susceptibility intervals of ODP Site 964, usually range between 200 and 400×10^{-6} SI (see Collinson, 1983; Borradaile et al., 1987), and, in the case of chlorite, can reach values of up to 1550×10^{-6} SI (Borradaile et al., 1987). The widespread occurrence of these two paramagnetic minerals throughout the eastern Mediterranean Sea can therefore explain the low to moderate ($<500\times10^{-6}$ SI) magnetic susceptibility values of most eastern Mediterranean sediments (Figs. 2, 3B, 4B), even when diluted by other (presumably weaker) paramagnetic (kaolinite, palygorskite and K and Na silicates) and diamagnetic (quartz and carbonate) minerals that constitute the bulk of the sediment (Méliêres et al., 1998; Foucault and Méliêres, 2000). However, higher magnetic susceptibility values (e.g. $>500\times10^{-6}$ SI) in other specific intervals, such as at 8.3 and 8.9 mbsf at Site 964 (Fig. 2A) and 75–78 rcmd at Site 967 (Fig. 3), suggest that magnetic minerals can sometimes dominate the magnetic susceptibility signal (e.g. Rochette, 1987).

4.2. Sedimentary processes controlling magnetic susceptibility of eastern Mediterranean sediments

Magnetic susceptibility values are positively correlated with proxies for Saharan dust supply in the lower (82–86 rmcd) and upper (75–78 rmcd) studied intervals of Site 967, where some visible (i-260, i-272, i-276), hidden (i-264, i-268) and missing (i-238, i-240, i-242) sapropels have distinct magnetic susceptibility minima that coincide with minima in the Ti/Al and IRM@AF records. This suggests that variations in magnetic susceptibility throughout these intervals are related to fluctuations in the amount of Saharan dust supply. Within most of these two intervals, eolian clay minerals such as palygorskite and kaolinite are likely to be the main contributors to magnetic susceptibility. However, high susceptibility values between 500 and 750×10^{-6} SI suggest a predominant contribution from a magnetic mineral, most likely eolian hematite, in some specific horizons characterized by high dust contents (e.g. 75.6, 76.4 and 77.4 rmcd).

In the middle part of the studied interval of Site 967 (78–82 rmcd), and throughout the studied interval of Site 964, magnetic susceptibility shows an opposite relationship with proxies for Saharan dust supply and a positive correlation with proxies for riverine suspended matter (Figs. 3, 4). Thus, some visible (i-250, i-254, i-258) and hidden (i-246) sapropels from Site 967 display magnetic susceptibility peaks that correlate with minima in the Ti/Al and IRM@AF records, which indicate lowest dust contents (Lourens et al., 2001; Larrasoaña et al., 2003a), and with minima in the Mg/Al curve, which are indicative of highest contents of Mg-poor Nile suspended matter (Wehausen and Brumsack, 1998, 2000) (Fig. 3). A similar situation is found in the studied interval of Site 964, where most of the visible sapropels (i-272, i-282, i-284, i-286) and the hidden (i-278) sapropel have susceptibility maxima that coincide with minima in palygorskite and kaolinite abundances, indicating low dust contents (Méliêres et al., 1998; Foucault and Méliêres, 2000), and peaks in chlorite and smectite (Fig. 4B). Chlorite and smectite are delivered into the Ionian basin by rivers from the NBEM (Venkatarathnam and Ryan, 1971; Wehausen and Brumsack, 2000; Foucault and Méliêres, 2000). Smectite is also delivered by the river Nile, but it is dispersed from there within the eastern Levantine Basin (Venkatarathnam and Ryan, 1971) and therefore is unlikely to contribute significantly to sedimentation at Site 964. Consequently, the correlation between magnetic susceptibility and chlorite/smectite abundances indicate a dominant control of fluvial suspended matter from NBEM rivers on the magnetic susceptibility signal of sediments from Site 964.

In addition to fluvial runoff, other sedimentary sources and processes complicate interpretations in which high (low) susceptibility values are related to high (low) Saharan dust contents. Thus, magnetic susceptibility peaks of up to 1800×10^{-6} SI are often related to ash layers deposited around sapropel S5 (Fig. 2A,C), which indicates that magnetite is dominating the susceptibility signal. Moreover, magnetic susceptibility peaks above some visible sapropels from sites 967 (i-252 and i-256, Fig. 3C) and 964 (i-272, i-276 and i-280, Fig. 4B) coincide with maxima in ARM. In other cases, such as sapropel S5 at sites 964 to 969 (Fig. 2) and sapropel i-272 at Site 964 (Fig. 3B), magnetic susceptibility displays distinctive minima just below the sapropels. These results suggest that diagenetic processes related to oxidation and dissolution of magnetite at diagenetic fronts (van Santvoort et al., 1997; Kruiver and Passier, 2001; Larrasoaña et al., 2003b; Garming et al., 2004) exert a dominant control on magnetic susceptibility values in the stratigraphic vicinity of sapropels. To describe the full range of the diagenetic imprint on magnetic susceptibility values, probable formation of the magnetic iron sulphide greigite in some strongly anoxic sapropels, such as S5 at sites 967 and 969 (Fig. 2C, D), also needs to be considered to explain their relatively high ($400–500\times10^{-6}$ SI) magnetic susceptibility (Roberts et al., 1999).

5. Conclusions

Comparison of magnetic susceptibility data with proxy records of paleoclimate and paleoceanographic variability indicates that the magnetic susceptibility signal of sapropel-bearing eastern Mediterranean sediments do not always conform to the common interpretation that relates high susceptibility values to high Saharan dust supply. Whereas this is the case for some short parts of the studied intervals (e.g. Site 967), magnetic susceptibility variations seem to be predominantly controlled by the discharge of suspended matter from the Nile and rivers draining the northern borderlands of the eastern Mediterranean. Magnetic susceptibility values are also influenced by diagenetic formation and dissolution of magnetite at diagenetic fronts developed around sapropels, and also by the presence of volcanic ash layers. Taken together, our results demonstrate that the magnetic susceptibility of eastern Mediterranean sediments cannot be used as a proxy for Saharan dust supply. This conclusion likely applies also to peri-Saharan sediments from the Atlantic Ocean and the Arabian Sea because they might have been deposited under comparable climatic and oceanographic contexts. From this perspective, and in corroboration of the conclusions of Hounslow and Maher (1999), we recommend the use of magnetic susceptibility as a proxy for Sarahan dust supply in eastern Mediterranean sediments in particular, and in peri-Saharan marine sediments in general, only when their reliability can be rigorously confirmed throughout the length of the studied sedimentary sequence.

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