Paleo- and rock magnetic data from cores MSM33-53-1, M72-5-22GC4, M72-5-25GC1, Black Sea

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1. Licence

2. Citation

When using the data please cite:

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Liu, J., Nowaczyk, N. R., Frank, U., & Arz, H. W. (2018). A 20–15 ka high-resolution paleomagnetic secular variation record from Black Sea sediments – no evidence for the 'Hilina Pali excursion'? Earth and Planetary Science Letters, 492, 174–185. https://doi.org/10.1016/J.EPSL.2018.04.014

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3. Abstract

This data publication includes paleo and rock magnetic data from three sediment cores, MSM33-53-1, M72-5-22GC4, M72-5-25GC1, collected in the southeastern Black Sea during the marine expeditions M72/5 of the German research vessel *RV METEOR* (in 2007) and MSM33 of the German research vessel *RV Maria S. Merian* (in 2013). The data are supplement to Nowaczyk et al. (2020) and have already been described in Liu et al. (2018, 2019, 2020), Liu (2019) and Nowaczyk et al. (2012, 2013).

The cores were sampled at intervals between 1.7 and 3.0 cm. Core M72/5-22GC4 was also continuously subsampled using u-channels. All material was subjected to detailed paleo- and rock

magnetic analyses. As a main result the Laschamps geomagnetic excursion at around 41 ka could be revealed (Nowaczyk et al., 2012, 2013, Liu et al., 2020). This feature of the geomagnetic field was characterized by a short but full reversal and very low intensities of the Earth's magnetic field. However, data is more or less compromised due to the post-depositional precipitation of the magnetic iron suphide greigite (Fe_3S_4), mainly depending on water depth of the coring sites. Provided data demonstrate the impact of greigite as well as the differences between discrete sample and u-channels (Nowaczyk et al., 2020).

Data are provided as several ASCII files providing most relevant rock magnetic and paleomagnetic parameters, the age model as well as detailed information on the location, water depth, cruises and dates.

3.1. Geographic Location of the sediment cores

Datum: WGS84

Core Name	Station No.	Latitude DD° MM.dd	Longitude DD° MM.dd	Latitude DD.dddd	Longitude DD.dddd
MSM33-53-1	MSM33_851-1	42° 05.011' N	36° 37.366' E	42.0835	36.6228
M72-5-22GC4	M72/5_620-1	42° 13.54' N	36° 29.53' E	42.2257	36.4922
M72-5-25GC1	M72/5_628-1	42° 06.21' N	36° 37.43' E	42.1035	36.6238

4. Data Description

4.1. Sampling method

Clear plastic boxes of 20×20×15 mm were pressed into the split halves of the generally 1 m long sections of the sediment cores. U-channels of 110 cm length and an internal cross section of 20×20 mm were sampled parallel to discrete samples (only core M72-5-22GC4).

4.2. Analytical procedure

Discrete samples were treated the following way: Measurements of low-field magnetic susceptibility (k-bulk) were performed with an AGICO MFK-1S susceptibility meter. Measurements of the natural remanent magnetization (NRM) and of the anhysteretic remanent magnetization (ARM) were performed with a 2G 755 SRM long-core cryogenic magnetometer. ARMs were imparted with a 2G660 single-axis alternating field (AF) demagnetizer using 100 mT alternating field and 50 µT static field. NRMs and ARMs both were stepwise demagnetized with the in-line 3-axes AF demagnetizer of the cryogenic magnetometer. AF steps for NRM: 0, 5, 10, 15, 20, 30, 40, 50, 65, 80, 100 mT. AF steps for ARM: 0, 10, 20, 30, 40, 50, 65, 80 mT.

Iso-thermal remanent magnetizations (IRM) were imparted with a 2G 660 pulse magnetizer using 1500 mT for producing a saturation magnetization and -200 mT for remagnetization of the low-coercive fraction. Measurements were performed with a Molyneux spinner magnetometer.

NRMs of u-channels were measured in steps of 1 cm along the u-channels, extending 10 cm over both ends. AF demagnetization was done similar to discrete samples.

4.3. Data processing

NRM demagetization data was analyzed using principal component analysis (PCA) according to Kirschvink (1980). The slope of NRM intensity versus ARM intensity, slope(NRM/ARM), of common AF demagnetization steps lying along a straight line was determined using linear regression. Variations in the slope(NRM/ARM) values are an estimate of relative paleointensity variations of the Earth's magnetic field.

In order to discriminate samples being dominated by low-coercive minerals (magnetite, Fe_3O_4 and greigite, Fe_3S_4) from samples being dominated by high-coercive minerals (mostly hematite, Fe_2O_3), the S-ratio was calculated using $S=0.5\times(1-[IRM(-200\ mT)/IRM(1500\ mT)])$. S-ratios range from 0 to 1, with: dominance of magnetite/greigite: $0<<S\leq1$, and dominance of hematite: $0\leq S<<1$.

The ratio of IRM(1500 mT)/k-bulk was calculated in order to further discriminate between magnetite and greigite. By lab experience with Black Sea samples, values of IRM(1500 mT)/k-bulk < 10 kA/m indicate magnetite and values >(>) 10 kA/m indicate the additional presence (dominance) of greigite.

Data records from the cores were correlated to the oxygen isotope stratigraphy of NGRIP according to Svensson et al. (2008).

5. File description

5.1. File inventory

File	Content
MSM33-53-1_meta_data.dat	ASCII file with core location, water depth, etc.
MSM33-53-1_rockmag.dat	ASCII file with rock magnetic parameters
MSM33-53-1_palmag_filtered.dat	ASCII file with paleomagnetic data
MSM33-53-1_ages.dat	ASCII file with age model
M72-5-25GC1_meta_data.dat	core location, water depth, etc.
M72-5-25GC1_rockmag.dat	ASCII file with rock magnetic parameters
M72-5-25GC1_palmag_filtered.dat	ASCII file with paleomagnetic data
M72-5-25GC1_ages.dat	ASCII file with age model
M72-5-22GC4_meta_data.dat	core location, water depth, etc.
M72-5-22GC4_rockmag.dat	ASCII file with rock magnetic parameters
M72-5-22GC4_palmag_filtered.dat	ASCII file with paleomagnetic data
M72-5-22GC4_ages.dat	ASCII file with age model

5.2. File naming convention

The files names follow the convention commonly used in the German marine geoscience community. Each file name is headed by the ID of the sediment core the data has been derived from. This heading information is needed to distinguish between the various cores taken by the various research vessels.

- **MSM33-53-1**: sediment core code - **MSM**: reseach vessel 'Maria S. Merian', **33**: cruise 33, **53-1**: station 53 event 1
- **M72-5-22-4**: sediment core code – **M:** reseach vessel 'Meteor', **72-5**: cruise 72- leg 5, **22-4**: station 22 event 4
- **M72-5-25-1**: sediment core code – **M**: reseach vessel 'Meteor', **72-5**: cruise 72- leg 5, **25-1**: station 25 event 1

5.3. Description of data tables

5.3.1. File names *_meta_data.dat

Column header	unit	Description
Station-No.		Running number of ship stations of any kind
Core-ID		Running number of geological stations only (core)
Latitude	DD" MM.mm' N	Geographic coodinates WGS84
Longitude	DD" MM.mm' E	Geographic coodinates WGS84
Core length	cm	Length of recovered sediment sequence
Date	yyyy-mm-dd	Day of recovery
Time	hh:mm:ss	Time of recovery
elevation	m	Negative because water depths is given
Location	-	Name of Ocean, etc.
campaign	-	Expedition code
Basis	-	Research vessel
gear	-	Coring gear used for recovering sediments

5.3.2. File names *_rockmag.dat

Column header	unit	Description
Depth	cm	mean sampling depth in cm
J(NRM)	mA/m	Intensity of the natural remanent magnetization NRM
k-bulk	none, given in 10^{-6}	Magnetic bulk susceptibility
J(ARM)	mA/m	Intensity of the anhysteretic remanent magnetization ARM
J(IRM)	mA/m	Intensity of the iso-thermal remanent magnetization IRM
S-ratio	none	Non-linear proxy for the ratio of low-coercive (e.g. magnetite) to high-coercive minerals (e.g. hematite) in one sample.
J(IRM)/k-bulk	kA/m	Ratio of IRM(1500 mT) to k-bulk for discrimation between greigite (high ratios) and magnetite (low ratios) in one sample

5.3.3. File names *_palmag_filtered.dat

Column header	unit	Description
Depth	cm	mean sampling depth in cm
Incl	°	Inclination of the characteristic remanent magnetization ChRM, determined by principal component analysis
Decl	°	Declination of the characteristic remanent magnetization ChRM, determined by principal component analysis
slope(NRM/ARM)	none	Relative paleointensity determined from the slope of NRM intensity versus ARM intensity of common demagnetization levels, determined by linear regression

5.3.4. File names *_palmag_filtered_u-channel.dat

Column header	unit	Description
Depth	cm	Measuring position along 110 cm long u-channels with a cross section of 2×2 cm
J(NRM)	mA/m	Intensity of the natural remanent magnetization NRM, measured with 2G 755 SRM cryogenic magnetometer
Incl	°	Inclination of the characteristic remanent magnetization ChRM, determined by principal component analysis
Decl	°	Declination of the characteristic remanent magnetization ChRM, determined by principal component analysis

5.3.5. File names *_ages.dat

Column header	unit	Description
Depth	cm	mean sampling depth in cm
Age	Ka	Age of stratigraphic level

6. References

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