Anisotropy of Magnetic Susceptibility and Magnetic Mineralogy Dataset from the Neogene Valdelsa Basin (Southern Tuscany, Italy)

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1. Licence

2. Citation

When using the data please cite:

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The data are supplementary material to:

Currently a paper is in preparation.

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3. Data description

This paleomagnetic study investigated the magnetic fabric and magnetic mineralogy of samples collected in the neogenic Valdelsa Basin, (Southern Tuscany). The primary aims were to characterize deformation processes and the investigate magnetic mineralogy phases. The first phase involved fieldwork on selected sections in the central-eastern sector of the basin, focusing on mudstone and silty mudstone lithologies. Using a battery-powered portable drill with a water-cooled diamond bit, approximately 120 oriented samples were collected, and the cores were oriented in situ using a magnetic compass. The samples were analyzed in the Roma-Tre paleomagnetic laboratory using several methods. Anisotropy of magnetic susceptibility (AMS) was measured on all samples using a KLY-3 (Agico) to define magnetic fabric and bulk susceptibility. This non-destructive measurement provides insight into potential deformational processes. Magnetic mineralogy was investigated through isothermal remanent magnetization (IRM) and thermal demagnetization methods after applying different fields to the core axis through a pulse magnetizer. The remanent magnetization was measured using a JR6 spinner magnetometer whereas the results were interpreted using Remasoft and Anisoft software. The AMS and magnetic mineralogy datasets are available in .txt format.

3.1. Site and sample coordinates

Section	Coordinate (RDN2008)		ID samples
	Latitude (N)	Longitude (E)	
Poggio Cavallo	43.572407	11.062975	VE02 01-41
Monte Molini	43.583557	11.017508	VE01 01-30
Specchi	43.575480	11.119696	VE04 01-17; VE05 01-12; VE06 01-03
Spoiano	43.546551	11.159318	VE03 01-24

3.2. Sampling method

The paleomagnetic sampling has been carried out on selected sections located in the central-eastern sector of the Valdelsa Basin (Southern Tuscany). Mudstone, silty mudstone and muddy siltstone are preferentially targeted for paleomagnetic samples. About 120 oriented samples have been collected using a battery-powered portable drill with a water-cooled diamond bit. The cores of 1 inch in diameter have been oriented in situ with a magnetic compass for the determination of geographic azimuth and the hade angle. Sample spacing has variable due to variation in lithology, indeed presence of coarser lithology in samples which has compromised the coherence of the core aren't sampled. Samples selected for the paleomagnetic analysis have been cut to obtain a core of ~2.5 cm in length in the paleomagnetic laboratory of Roma TRE University.

3.3. Analytical procedure

Laboratory: *Paleomagnetic Laboratory of Roma Tre University*

- The Anisotropy of Magnetic Susceptibility (AMS) has been measured in all the samples using a KLY-3 (Agico).
- Isothermal remnant magnetization (IRM) has been studied after the application of steps of crescent magnetic field along the z axis of the core. The applied fields are: 0, 10, 100, 200, 300, 400, 500, 700, 900, 1200, 1500, 2000 and 2700 mT through a 2G Enterprise Pulse Magnetizer 660L. After each step the remnant magnetization has been measured through a JR6 spinner magnetometer.
- Magnetic mineralogy has been studied also with the thermal demagnetization methods after the application on the core axis of different fields through the pulse magnetizer: x = 0.12 T, y = 0.6 T, z = 2.0 T. Samples have been thermally demagnetized with steps of 20, 120, 180, 250,

320, 360, 400, 480, 580, 630 and 670 °C. After each thermal step the remanent magnetization of the samples has been measured through a JR6 spinner magnetometer along the three axes.

3.4. Data processing

These data have been imported on Remasoft software for the interpretation of the magnetic mineralogy phases and on Anisoft for the Anisotropy of Magnetic Susceptibility.

4. File description

4.1. File inventory

The file *2025-028_Milaneschi-et-al_data.zip* includes the following folders:

- ***2025-028_Milaneschi-et-al_AMS***: Dataset of the Anisotropy of Magnetic Susceptibility (AMS) of the VE samples (V = Val, E = Elsa Basin);
    - *2025-028_Milaneschi-et-al_VE01.txt*
    - *2025-028_Milaneschi-et-al_VE02.txt*
    - *2025-028_Milaneschi-et-al_VE03.txt*
    - *2025-028_Milaneschi-et-al_VE04.txt*
    - *2025-028_Milaneschi-et-al_VE05.txt*
    - *2025-028_Milaneschi-et-al_VE06.txt*

- ***2025-028_Milaneschi-et-al_IRM***: Data analysed for the mineralogy investigation through Isothermal Remanent Magnetization (IRM) of the VE samples (V = Val, E = Elsa Basin);
    - *2025-028_Milaneschi-et-al_VE_01_IRM.DAT*
    - *2025-028_Milaneschi-et-al_VE_02_IRM.DAT*
    - *2025-028_Milaneschi-et-al_VE_03_IRM.DAT*
    - *2025-028_Milaneschi-et-al_VE_04_IRM.DAT*
    - *2025-028_Milaneschi-et-al_VE_05_IRM.DAT*

- ***2025-028_Milaneschi-et-al_Three-Axes***: Data analysed for the mineralogy along the three axes of the VE samples (V = Val, E = Elsa Basin).
    - *2025-028_Milaneschi-et-al_VE_01_3AX.DAT*
    - *2025-028_Milaneschi-et-al_VE_02_3AX.DAT*
    - *2025-028_Milaneschi-et-al_VE_03_3AX.DAT*
    - *2025-028_Milaneschi-et-al_VE_04_3AX.DAT*
    - *2025-028_Milaneschi-et-al_VE_05_3AX.DAT*

4.2. Description of data tables

4.2.1. Example of Anisotropy of Magnetic Susceptibility Tables

Header	Unit	Description
ID		Identifier for the measurement or sample
Specimen		Name or identification code of the specimen
Field	A/m or mT	Intensity of the magnetic field applied during the measurement
Frequency	Hz	Frequency of the alternating magnetic field applied
Kmean		Mean magnetic susceptibility
L		Degree of lineation, L=K1/K2
F		Degree of foliation, F=K2/K3
P		Degree of anisotropy, P=K1/K3
Pj		Degree of anisotropy
T		Shape parameter of the magnetic susceptibility ellipsoid
U		Uncertainty of the mean susceptibility This value is zero in the provided data, suggesting that uncertainty might be recorded elsewhere or not applicable in this data representation
Q		Shape parameter
E		Eccentricity of the ellipsoid
Kmax_Dec	Degrees	Declination of the maximum principal axis (Kmax) of magnetic susceptibility
Kmax_Inc	Degrees	Inclination of the maximum principal axis (Kmax) of magnetic susceptibility
Kint_Dec	Degrees	Declination of the intermediate principal axis (K int) of magnetic susceptibility
Kint_Inc	Degrees	Inclination of the intermediate principal axis (K int) of magnetic susceptibility
Kmin_Dec	Degrees	Declination of the minimum principal axis (K min) of magnetic susceptibility
Kmin_Inc	Degrees	Inclination of the minimum principal axis (K min) of magnetic susceptibility
FTest_F		F-statistic value for the significance test of the susceptibility ellipsoid
FTest_F12		F-statistic value for the significance test between K1 and K2
FTest_F23		F-statistic value for the significance test between K2 and K3

4.2.2. Example of IRM Tables

Header	Unit	Description
Sample		Sample identification
Decl	Degrees	Declination of the remanent magnetization
Incl	Degrees	Inclination of the remanent magnetization
Intensity	A/m	Intensity of the Isothermal Remanent Magnetization (IRM)
X	A/m	X (North) component of the remanent magnetization
Y	A/m	Y (East) component of the remanent magnetization
Z	A/m	Z (Vertical downwards) component of the remanent magnetization
Sigma	10−6 A/m	Estimated error in the intensity measurement
N		Number of individual measurements (spins) performed to determine the direction and intensity of the sample's magnetization
Moment	$A \cdot m^2$	Total magnetic moment of the sample
Mass	G	Mass of the measured sample
Volume	cm^3	Volume of the measured sample

4.2.3. Example of Three-axisTables

Header	Unit	Description
Sample		Sample identification
X	A/m	X component (North) of the remanent magnetization
Y	A/m	Y component (East) of the remanent magnetization
Z	A/m	Z component (Vertical) of the remanent magnetization
Intensity	A/m	Total remanent magnetization intensity, calculated from the vectorial combination of the X, Y, Z components
Decl	Degrees	Declination of the remanent magnetization
Incl	Degrees	Inclination of the remanent magnetization
Moment	$A \cdot m^2$	Total magnetic moment of the sample
Sigma	10−6 A/m	Estimated error in the intensity measurement
N		Number of individual measurements (spins) performed to determine the direction and intensity of the sample's magnetization
Mass	G	Mass of the measured sample
Volume	cm^3	Volume of the measured sample

5. Acknowledgements

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