

Glossary

- anadiagenesis:** A late diagenesis phase in which sediments become increasingly lithified during increasing burial (up to 10 km) causing interstitial fluids to migrate (usually upwards). It may be followed by tectonic metamorphism. Approximately equal to the phylomorphic stage.
- anhi-metamorphism:** Extremely low, barely detectable, grade of metamorphism in which sufficient phyllosilicate minerals become oriented by horizontal (tectonic) forces to be detectable from the alignments caused by burial (phylomorphism).
- ankerite ($\text{Ca}(\text{MgFe})(\text{CO}_3)_2$):** hexagonal; a ferroan form of dolomite
- apparent polar wander path:** Sequential plot of positions of virtual geomagnetic poles of varying age from a particular continent reflecting the motion of a plate relative to the axis of the Earth's dipole field.
- aragonite (CaCO_3):** hexagonal; mostly as a skeletal mineral of many molluscs, corals, etc., and forming most modern calcareous muds. Chemically unstable, inverts to calcite.
- ARM:** Anhyseretic remanent magnetization. A laboratory induced remanence caused by a weak DC field imposed on a sample being exposed to alternating field (AF) demagnetization.
- aulacogen:** A continental rift system that failed to continue to open beyond an initial stage.
- back-field coercivity (coercive force):** The reverse field strength required to reduce the induced field of a sample to zero.
- biogenic magnetite:** Magnetite grown within living organisms, e.g. magnetotactic bacteria.
- bioturbation:** The disturbance of a sediment as a result of organic activity, e.g. burrowing.
- bloch wall:** see domain wall.
- blocking temperature:** Temperature at which a magnetic grain undergoes the transition from magnetic unstable to magnetic stable.
- blocking volume:** Grain volume at which the transition occurs from super-paramagnetic to stable single domain.
- boundstone:** Carbonate rock comprising organogenic components, either bound together in the position of growth to form a rigid framework, or deriving from the lateral accumulation of their fragments (e.g. biogenic reefs and associated bioclastic deposits).
- Brunhes:** The current normal polarity chron, commencing 0.785 Ma ago.
- calcite (CaCO_3):** orthorhombic structure; a major constituent of most limestones, largely of direct organic origin or derived from aragonite; rarely as a chemical deposit in hypersaline conditions.
- Cartesian plot:** see orthogonal plot;
- cathodoluminescence:** Emission of light resulting from the bombardment of a phosphor by electrons. In carbonates, cathodoluminescence correlates positively with the ratio $\text{Mn}^{2+}/\text{Fe}^{2+}$.
- characteristic remanent magnetization (ChRM):** Usually defined for an individual specimen by principal component analysis, or by Fisherian averaged ChRM specimens to determine a site mean ChRM.
- chemical remanent magnetization (CRM):** Magnetization acquired during crystal growth
- chron:** The basic unit of time, $\geq 10^5$ years, during which the Earth's magnetic field was predominantly of the same polarity.
- coercivity:** The magnetic field required to reduce the external magnetic field of an object to zero.
- consistency index:** A measure of the consistency in the direction of a vector during demagnetization that is independent of the change in intensity of remanence (see mda). It is given by the maximum value of (range of treatment²) / (circular standard deviation) for three or more successive demagnetization vectors. (Originally the Stability Index of Tarling & Symons (1967).)
- crystalline remanent magnetization (CRM):** Magnetization acquired during crystal growth.
- Curie temperature:** The temperature at which a ferromagnetic mineral ceases to have ferromagnetic properties and has only paramagnetic properties.
- $\delta^{18}\text{O}$: The ratio of $^{18}\text{O}/^{16}\text{O}$ in a sample compared with that of the PDB standard.
- depositional remanent magnetization (DRM):** The remanence acquired by sediments as they are deposited from an aqueous or aeolian medium.
- detrital magnetite:** Allogenic (e.g. aqueous or aeolian) particles. The term is sometimes applied incorrectly to authigenic (e.g. bacterial) input at the time of sediment accumulation, as such particles can behave in the same way as truly deposited particles.
- diamagnetic:** Electrons in the ground state are paired and cause a zero net magnetic moment. Diamagnetic substances are repelled by magnets because an ambient magnetic field gives rise to a small net magnetic moment with a direction opposite that of the applied field.

- diagenesis:** All changes in physical and chemical properties in a sediment occurring between deposition and tectonic metamorphism. Diagenetic changes can form a continuum of modifications from the early stages when the sediment is still in or close to its ambient depositional environment (syndiagenesis), to those occurring during deep burial (anadiagenesis). The term also includes chemical and textural changes occurring when deeply buried sediments are raised to shallow burial conditions (epidiagenesis), including surface exposures where such changes merge into weathering processes.
- dolomite ($\text{CaMg}(\text{CO}_3)_2$):** hexagonal; normally as secondary replacement of other carbonates, usually caused by the entry of Mg-rich fluids; when it replaces calcite there is a reduction in volume of up to 13%.
- dolostones:** A carbonate rock mostly composed of dolomite and generally derived from profound diagenetic modifications (dolomitization).
- domain:** A region within a magnetic mineral in which the individual atomic magnetic moments are parallel to each other.
- domain wall:** A thin zone (c. $0.1 \mu\text{m}$ thick) between domains, usually magnetized in opposite directions, within which the electron spin magnetic vectors cant over between the vector directions in the two adjacent domains.
- drift deposit:** A sediment deposited in association with glacial ice, including glacial lake sediments.
- epidiagenesis:** Changes in mineralogy and crystalline forms in a sedimentary rock when it reached different environmental conditions, usually as a result of uplift, and may lead to increasing weathering effects.
- epitidal:** The upper part of the tidal zone; subject only to occasional brief submersion.
- event (geomagnetic):** A brief interval, $< 10^5$ years, when the Earth's magnetic field was opposite to that of the chron in which it occurred.
- Fisher statistical analysis:** A statistic model which simulates a two-dimensional Gaussian distribution as a three-dimensional distribution of unit vectors on a sphere (Fisher 1953). This allows the estimation of the precision of the mean direction by k if $N > 7$ (which varies between unity and ∞) and by α_{95} , the radius of a cone centred on the mean direction and defining a cone within which there is a 95% probability that the true mean direction lies. The scatter can similarly be defined by a circle, centred on the mean direction, with a radius α_{63} (the circular standard deviation) which includes 63% of the vectors (if they have a Fisherian distribution).
- flysch:** Heterogeneous, mostly fine-grained sedimentary rocks in the Alpine region (Swiss dialect for slaty rocks subject to sliding).
- goethite ($\alpha\text{-FeOOH}$):** Imbalanced anti-ferromagnetic mineral (lattice distortions or proto-hematite inclusions create spin imbalances that cause a net magnetic moment) with saturation magnetization $< 1 \text{ A/m}$, i.e. among the weakest magnetic minerals. However, it has very high coercivity, but is chemically unstable at temperatures above 100°C , usually transforming to hematite in oxidizing conditions and to magnetite in reducing conditions.
- grainstone:** Grain-supported carbonate sediment or rock without matrix.
- halmrolysis:** In clastic sediments, the early diagenetic processes involving changes in the clay minerals and including the formation of glauconite.
- hematite ($\alpha\text{-Fe}_2\text{O}_3$):** Imperfect anti-ferromagnetic mineral (magnetic moments of atoms not exactly antiparallel, leading to a weak net magnetic moment) with saturation magnetization of $2 \times 10^3 \text{ A/m}$, i.e. considerably weaker than magnetite but of much higher stability.
- ilmenite (FeTiO_3):** This mineral is normally paramagnetic at room temperature.
- isothermal remanent magnetization (IRM):** Remanent magnetization resulting from short-term exposure to strong magnetizing fields at constant temperature, usually room temperature.
- Kiaman Reversed Superchron:** A prolonged period of reversed polarity between about 320 and 250 Ma.
- limnology:** The study of all characteristics of lake and ponds (generally, but not exclusively, fresh water).
- locomorphic phase:** The phase of diagenesis when early cementation occurs.
- loess:** Wind-blown silts, fine sands and clay deposits.
- mda:** Mean diagonal angle (Kirschvink 1980) defining the degree of linearity of a vector; usually between 0° (perfectly linear) and 5° (reasonably linear).
- MAD:** See mda.
- magnesite (MgCO_3):** A hexagonal carbonate; usually occurs as a minor component in skeletal aragonite and calcite.
- magnetite (Fe_3O_4):** A cubic (spinel) ferrimagnetic mineral with a Curie point of 575°C . The most strongly magnetic of the common iron oxides, but of lower coercivity than hematite and goethite.
- Matuyama:** The last reversed polarity chron ending 0.785 Ma years ago.

- micrite**: Carbonate muds composed of clay-sized particles ($\geq 4 \mu\text{m}$).
- mudstone**: A general term for a fine-grained sedimentary rock, including clay, shale, silt and argillites. A (lime) mudstone is a mud-supported carbonate sediment or rock containing $<10\%$ of grains $>0.02 \text{mm}$ (see also micrite).
- multi-domain (MD)**: Containing several magnetic domains, each with a domain wall that can usually move when a weak magnetic field is applied. Usually grains $>3 \mu\text{m}$.
- N**: The number of observations, usually specimen, sample or mean site determination. In Fisherian statistical analysis, $N \geq 7$ is desirable for reliable statistics, and $N \geq 5$ is desirable in the analysis of individual vectors for linearity and consistency.
- neomorphism**: A phase of diagenesis involving changes in crystal properties including recrystallization with change in mineralogy and recrystallization into other minerals (polymorphism), e.g. aragonite to calcite, dolomite to calcite, etc.
- NRM**: The natural remanent magnetization of a sample or specimen. This usually comprises both magnetically soft and hard components, from which the soft components are removed by incremental partial demagnetization by heating or AF fields applied in zero external magnetic field.
- orthogonal projection**: During progressive demagnetization, vector endpoints are simultaneously projected on two orthogonal planes, horizontal and vertical. The length of the vector expresses the intensity of magnetization remaining after each demagnetization increment. (See also Zijdeveld diagram.)
- packstone**: Grain-supported carbonate sediment or rock, with some intergranular matrix.
- palaeo-direction**: Expected magnetization at a particular place on the surface of the Earth calculated from a given pole position assuming an axial geocentric dipole.
- PDB standard**: A Cretaceous belemnite of the PeeDee Formation of South Carolina, USA, used as the standard for oxygen isotope ratios.
- peritidal**: In or around a tidal-flat environment.
- phyllomorphic phase**: Late-stage diagenesis during deep burial, usually associated with an increase in phyllosilicates; in this phase, the orientation of the new minerals is related to vertical (burial) pressures, whereas the onset of anecho-metamorphism is marked by their orientation relating to tectonic forces.
- polymorphism**: A change of crystal shape, e.g. aragonite to calcite, without necessarily a change of chemical composition.
- post-depositional remanent magnetization (PDRM)**: The remanent magnetization acquired following deposition, usually considered to occur by rotation of magnetic grains, within interstitial water or air, by the Earth's magnetic field. The name could include other remanences, but is generally confined to those acquired immediately after deposition.
- principal component analysis (pca)**: The analysis to derive the average direction of three or more vectors isolated successively by partial demagnetization. The linearity of the mean vector is defined by the mean diagonal angle (see mda) (Kirschvink 1980).
- pseudo-single domain**: A magnetic domain that behaves as a single-domain particle. There are many possible forms, such as a partially pinned microstructure within a multi-domain grain.
- redoxomorphic phase**: The early phase of diagenesis when deposited materials begin to equilibrate with their environment
- relaxation**: Decay of the remanent magnetization of a magnetic grain or an assemblage of magnetic grains.
- relaxation time**: The time taken for $1/e$ of a magnetization to relax into the new direction of a weak field, usually at ambient temperatures. It is a function of mineralogical composition, grain size and temperature.
- remanent magnetization or remanence**: Stable magnetization recording past action of magnetic fields that have acted on the rock.
- rutile (TiO_2)**: Titanium oxide.
- secular variation**: Variation of the Earth's magnetic field over time scales greater than 1 year, but excluding the 22 year sunspot cycle. Attributable to processes interior to the Earth.
- sediment**: Solid material settled down from a state of suspension or solution and composed of grains (detrital particles or grains) and generally of matrix (fine detritus).
- siderite (FeCO_3)**: Hexagonal, iron carbonate, often as concretions and oolites.
- single domain (SD)**: A grain containing only one magnetic domain, usually around $1 \mu\text{m}$ dimensions.
- stability index**: See consistency index.
- superchron**: Long period, $>20 \text{Ma}$, of unchanged geomagnetic polarity.
- superparamagnetic**: A ferromagnetic grain that has strong paramagnetic properties, but loses any remanence over a few minutes. Usually associated with sub single-domain sized grains.
- syndiagenesis**: The diagenetic processes affecting sediments before deep burial (i.e. at depths $<100 \text{m}$), including alterations before the

grains finally settle as well as the early stages of compaction and cementation. In clastic sediments, it includes changes in the clay minerals and glauconization. In carbonate sediments, it includes a range of mineralogical and textural changes caused by variations in the original depositional environment or by the passage of fluids through pore spaces.

syngensis: The same as syndiagenesis.

Tesla (T): Unit for magnetic flux density; $T = Wb/m^2$ (Weber/metre²).

TRM: Thermal remanent magnetization. The magnetisation acquired during cooling, in a weak magnetic field, usually from a temperature at or above the Curie temperature.

varves: Laminated sediments such as in glacial lakes where freezing-over results in fine clay winter laminae and coarser summer layers.

virtual geomagnetic pole (VGP): Pole of a geocentric dipole corresponding to an observed direction of magnetization.

viscous remanent magnetization (VRM): The magnetization acquired by a substance lying in a weak magnetic field for prolonged periods. The intensity is generally a function of log time.

wackstone: A mud-supported carbonate sediment or rock with >10% grains.

weak magnetic field: Generally a field comparable in strength with that of the Earth, i.e. less than or about 100 μ T.

Zijderveld diagram: A Cartesian (orthogonal) plot of changes in a vector during partial incremental demagnetization. The conventional plot illustrates the horizontal component in terms of the north (x) component of remanence against the east (y) component, and the vertical (z) component against either x or y (Zijderveld 1967). The so-called 'modified' Zijderveld diagram shows the same horizontal component, x v. y , but plots z against $h = \sqrt{(x^2 + y^2)}$ so that the vertical part of the plot illustrates the inclination.

References

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