j2 Remanent magnetizations in igneous and sedimentary rocks < inclination, declination, polarity; volcanic and sedimentary strata >

> [Claude Servais Mathias Pouillet (pronounced *poo yay*) (1791-1868)] in 1832 ... called the transition temperature from ferromagnetism to paramagnetism the 'magnetic limit'. The magnetic limit he determined experimentally for Nickel was 350ºC approx. compared to the 340ºC approx. later found [1892-5] by [Pierre] Curie [1859-1906]. Pouillet's discovery was mentioned in most physics books published in France around 1870. We have found no mention of Pouillet by Curie [although] it is unlikely that Curie was unaware of Pouillet's work.
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> —P. Jössang and A. Jössang.[1]

A rock commonly retains an imprint of Earth's magnetic (geomagnetic) field that was passing through it when it originated.[2] Recorded is the intensity (strength) of the geomagnetic field, the inclination (dip) and the declination (azimuthal direction) of the geomagnetic field lines, and the geomagnetic polarity (direction of geomagnetic north) be it normal (as today) or reversed.

Igneous rock thermal remanent magnetization is acquired *after* a magma or a lava is crystallized, and during its further cooling as a rock. The magnetization is acquired by a paramagnetic mineral in the rock as each type of these cools through its Curie point—the precise temperature above which the mineral's magnetism is lost, and named to honor Pierre Curie. Paramagnetic minerals in igneous rock are commonly accessory iron- and iron-titanium oxides such as magnetite (Fe_2O_3), solid solutions of magnetite and ulvospinel (Fe_2TiO), hematite (α-Fe_2O_3), solid solutions of hematite and ilmenite ($FeTiO_3$), maghematite (γ-Fe_2O_3), goethite (α-FeO.OH), and some sulfides such as pyrrhotite (FeS). The geomagnetic field that was passing though a paramagnetic mineral is recorded at the moment of its acquired magnetization and this remains unless the mineral is heated again to above its Curie point.

Measurements of remanent magnetization directions in recent lava flows confirm that these are usually to within 5º of the existing geomagnetic field direction at the site. The orientation, intensity, and retention (resistance to demagnetization), of an igneous rock's thermal remanent magnetization is proven to be remarkably stable in spite of other components of magnetization acquired later, such as a "viscous" magnetization acquired in geologically recent times by exposure to the present geomagnetic field. These subsidiary magnetizations are usually less resistant to "magnetic washing," which is the incremental heating of an igneous rock specimen in the laboratory toward a temperature at which all its magnetization is lost. The last magnetization to be retained is assumed to be the original direction of the geomagnetic field at the time the rock cooled below that Curie point.

Sedimentary remanent magnetization is acquired during the initial accumulation of clastic sediments by the incorporation of detrital-magnetite grains. These settle with their polarity oriented in the direction of the geomagnetic field at the site of accumulation. Later, if the geomagnetic field changes, these grains, as part of a sedimentary rock, cannot move and so they continue to record in each sedimentary layer the direction that the geomagnetic field had at the time each accumulated. Marine sediments, lake sediments, and certain clays are most-studied for this type of remanent geomagnetism.

After a sediment has accumulated, chemical remanent magnetization can be acquired by diagenetic changes: oxidation or reduction, a phase change, dehydration, recrystallization (for example: folded meta-sedimentary rocks), or precipitation of natural cements (for example: red beds, which are detrital sediments cemented by iron oxides). ❑