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When magnetite is truly magnetite?

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Magnetite (Fe_3O_4) is the most ubiquitous magnetic mineral in terrestrial rocks and also is present in extraterrestrial environments. Magnetite-bearing rocks provide an essential part of paleomagnetic record. At the same time, Fe_3O_4 can be formed in nature by about a dosen of pathways and therefore may serve as a potential indicator of rock-forming environments. All this warrants the central role of magnetite in rock magnetism.

In this talk, I will review the methods, both magnetic and non-magnetic, that are in common use to detect magnetite presence in rocks paying a particular attention to their limitations and caveats. I present a few examples showing that the simplictic approach which assumes that a magnetically soft phase with a Curie and/or unblocking temperature around 580°C is magnetite may be in error. Measurements at cryogenic temperatures to detect the Verwey phase transition appear by far the most reliable magnetic method to prove the presence of (near-)stoichiometric magnetite, and are able to discriminate the latter from e.g. cation-deficient Ti- or Al-substituted varieties.