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Measuring the Curie temperature

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The measurement of Curie or Néel temperatures is one of the central techniques in rock magnetism, because it is a relatively fast and reliable method to determine the predominant magnetic minerals in natural samples, even if their concentrations are relatively small. Unfortunately, the results of different commonly used measurement protocols for the same sample can deviate enough to be confusing. Serious problems occur especially for studies which interpret differences in Curie temperatures obtained from $M(T)$- and $\chi(T)$- measurements, and many of these results must be questioned, or even disregarded. Primarily this is due to insufficient theoretical foundation, leading to incompatible T_C values when determinations by different measurements are evaluated by the same or similar methods. Using Landau theory for in-field magnetization measurements, high-temperature measurement procedures are studied to revise the common evaluation routines for $M(T)$- and $\chi(T)$-curves. While at least four different physical processes can contribute to the low-field initial susceptibility near the ordering temperature, each of which may influence the apparent position of T_C, high-field methods are better defined, but do not truly trace a second-order phase transition. Here, a series of theoretical calculations are compared to high-temperature VSM measurements of quarter-hysteresis loops, a procedure developed to efficiently measure several hysteresis parameters in a single heating cycle. This method is equally as fast as a typical T_C determination on a Curie balance and provides a considerable amount of additional information which can be modeled to obtain a more robust Curie Temperature.