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Thermochemical remanence in single-domain particle assemblages can lead to paleointensity overestimates

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Single-domain (SD) particle ensembles are the best studied systems in rock magnetism. Yet, even for this simple system, a complete theoretical treatment of the acquisition of thermochemical remanent magnetization (TCRM) is missing. Based on the SD theory of chemical-remanent magnetization (CRM), it is generally taken for granted that TCRM acquisition is less efficient than acquisition of a thermoremanent magnetization (TRM), and that consequently the paleofield intensity is inevitably underestimated when a TCRM is interpreted as a TRM.
Here it is shown that this conclusion holds only when a continuous chemical change (e.g. grain growth) takes place during remanence blocking. In cases where an initial TRM, at a later time and at lower temperature, is modified by chemical processes, the final TCRM can result in considerable paleofield overestimation when interpreted as a TRM. This is demonstrated for two different scenarios. First, partial grain dissolution after TRM acquisition and second, low-temperature oxidation. These mechanisms are not unlikely to occur in nature, and numerical experiments indicate that both would lead to perfectly straight Arai plots, which make such SD TCRMs indistinguishable from true TRMs in the Thellier experiment.