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Thermal fluctuation fields in basalts and the Barbier plot

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Néel's thermal fluctuation field (H_f) is central to thermoremanent acquisition models, which are key to our understanding of the reliability of palaeomagnetic data, however, H_f is poorly quantified for natural systems. We report H_f determinations for a range of basalts, made by measuring rate-dependent hysteresis. The results for the basalts were found to be generally consistent with the space of the Barbier plot, which is characterized by the empirically derived relationship; $logH_f \propto 1.3logH_C$ (where H_C is the coercive force), obtained from measurements on a wide range of different magnetic materials. Although the basalts appear to occupy the correct position within the space of the Barbier plot, the relationship within the sample set, $logH_f \propto 0.54logH_C$, is different to the Barbier relationship. This difference is attributed to the original Barbier relationship being derived from a wide range of different synthetic magnetic materials, and not for variations within one material type. We consider the relationship between H_C and the activation volume, v_{act}, i.e., $H_C \propto v_{act}^{-0.78}$ for our sample set. This compares favourably with theoretical predictions, and with previous empirical estimates based on the Barbier plot, i.e.,$H_C \propto v_{act}^{-0.73}$.