Composition law of oblique anhysteretic remanent magnetization and its relation to the magnetostatic interaction

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The basic properties of oblique anhysteretic remanent magnetization (OARM) acquired in a weak and steady magnetic field with an arbitrary angle to the alternating field direction were studied. OARM and rock-magnetic experiments were conducted on samples of basalt, granite, and sediment containing non-interacting single-domain (SD), interacting SD, pseudo-single-domain, and multidomain low-Ti titanomagnetites. The intensity of OARM (M_{OARM}) systematically increased or decreased with increasing angle between alternating and steady field directions (θ_{SF}), while the angle between alternating field and OARM directions (θ_{OARM}) increased with increasing θ_{SF} for all samples. During stepwise alternating field demagnetization, the OARM vector shows a single component parallel to the steady field direction for θ_{SF} = 0˚ ($ARM_{\parallel}$) and 90˚ ($ARM_{\perp}$). The median destructive field of $ARM_{\perp}$ is larger than that of $ARM_{\parallel}$. For intermediate angles (θ_{SF} = 30˚, 45˚, and 60˚), the OARM vector was not parallel to the applied steady field; instead, it gradually increased with coercivity. These experiments indicate that the OARM vector is approximately given by the sum of two orthogonal magnetizations coinciding with $ARM_{\parallel}$ and $ARM_{\perp}$, respectively. Thus, the OARM vector can be determined by acquisition efficiencies of $ARM_{\parallel}$ and $ARM_{\perp}$ in an individual sample. Based on these experiments and associated rock-magnetic measurements, non-interacting SD samples show lower $ARM_{\perp}/ARM_{\parallel}$ ratios, compared to other samples. This result suggests that OARM can be used as a conventional tool to detect non-interacting SD particles in the paleomagnetic samples.

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