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The SushiBar: An automated system for paleomagnetic investigations

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We present a new, automated system based on a three-axis superconducting magnetometer and a custom-made coil designed to experiment on cylindrical specimens used in typical paleomagnetic investigations. The system, which resembles a sushi bar, facilitates stepwise alternating field demagnetization of up to 99 samples per loaded track. It also enables researchers to explore magnetic properties using an anhysteretic remanent magnetization (ARM) in any coercivity window up to peak alternating fields of 95 mT with direct current bias fields up to 0.17 mT. For example, partial ARM (pARM) spectra characterize magnetic grain size distributions in rocks, yet rarely are pARM spectra measured because the complete curve for one sample takes at least two hours to acquire manually. The SushiBar achieves 99 such curves in slightly less than 100 hours. Using the SushiBar, we measured the pARM sprectra, as well as the viscosity and anisotropy of ARM in three discrete switching field windows, of continental sediments from the Xishuigou section (western China). The average grain size remains constant along the 2200 m-thick section, yet magnetic viscosity varies systematically from bottom to top of the section; samples with high magnetic viscosities also have higher proportions of non-viscous material on average. Principal anisotropy axis directions from the lowest switching fields correlate well with principal axis directions from anisotropy of magnetic susceptibility. Principal axis directions defined at higher switching fields systematically deviate from those at lower switching fields, perhaps defining the fabric of the remanence carrying grains.