High-resolution paleomagnetic and environmental reconstruction from sediments using scanning magnetic microscopy

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High-resolution paleomagnetic and environmental magnetic records from marine and lacustrine sediments play fundamental roles in our understanding of the geomagnetic field and climate change. These data make it possible to reconstruct past changes in Earth's magnetic field and environment on centennial to decadal scales. High-resolution records are often acquired through study of sediments accumulated at high rates (e.g. tens of centimeters to meters per thousand year). In this presentation, we use scanning magnetic microscopy equipped with superconducting quantum interference device (SQUID) to reconstruct high-resolution paleomagnetic records from sediments accumulated at moderate to low rates (e.g. few centimeters per thousand year), taking advantage of the few hundred-micron spatial resolution permitted by the SQUID microscopy. We study the natural remanent magnetization (NRM) of thin sections of sediments from lakes in the UK and Japan as well as from the Japan Sea. NRM of the samples is typically scanned at 100-micron spacing along the surface of thin sections before and after stepwise alternating field (AF) demagnetization. NRM measurements are followed by measurements of laboratory-induced magnetizations including anhysteretic remanent magnetization (ARM) and isothermal remanent magnetization (IRM) before and after the same AF demagnetization steps used for NRM. We will compare the SQUID microscopy-acquired paleomagnetic and environmental magnetic data with those obtained from deconvolved u-channel sample measurements. We will also discuss the potentials and challenges of ultra-high resolution paleomagnetic reconstruction from sediments using SQUID microscopy.

Keywords: scanning SQUID microscopy, paleomagnetism, environmental magnetism, high resolution records

