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Proposal of positioning method using a magnetized thin-film dot for scanning SQUID microscopy

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We have developed a scanning superconducting quantum interference device (SQUID) microscope (SSM) for imaging magnetic field distribution of geological rock samples. The rock sample, which is processed into a thin section and glued on a glass with non-magnetic resin, is placed on a XY table under the SQUID microscope, and is scanned. The distance between the SQUID and the sample can be calibrated with magnetic field generated with a dc-current applied to a thin and long wire. However, the position of the sample for the SQUID must be determined in another way. Positioning the magnetic field image for the structure of the sample is necessary for analysis of the magnetic field distribution. We propose a positioning method using a thin-film magnetized circular dot as a magnetic dipole marker.

Considering expected special resolution of about 200 μm or smaller, we designed four kinds of single circular dots with different diameter, which are 10 μm, 50 μm, 75 μm, 100 μm. We adopted FeCo as a material for the dot. A 500-nm-thick FeCo layer was deposited on a silicon substrate with DC-sputtering and was formed into circular dots with lift-off process. After forming the dots, the Si substrate was diced into square chips with the size of 3.5 mm $\times$ 3.5 mm, where each chip has a single dot. Scanning the 25-μm dot with the SQUID microscope, we obtained dipole-like field of ˜10 nT, which is large enough as a magnetic maker.

We plan to attach this chip with the dot adjacent to the sample on the sample holder. Finally, we can superimpose the magnetic field pattern on an optical image of the sample.

Keywords: SQUID microscope, geological thin section, positioning, magnetized dot, thin film