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Development of an adjustable bias field MI magnetic microscope and observation of NWA 1756 (LL3.10) primitive ordinary chondrite

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A scanning magnetic microscope with an adjustable bias field magneto-impedance (MI) sensor has been developed to image surface stray magnetic fields of weakly magnetized geological samples. Due to an interaction between magnetic minerals and a bias field (50 uT) of the MI sensor, the previous magnetic image shows an artifact of the induced magnetization. Moreover, the previous long (5.0 mm) amorphous wire resulted in a diffused magnetic image. To solve these problems, the new instrument employs a 30 um diameter, short (2.5 mm) amorphous wire-based MI sensor with a field-adjustable bias coil (0 - 50 uT), driven by a custom driving circuit. Although the actual driving mechanism of the present MI sensor is unknown, this instrument can make a fine resolution (300 um) magnetic image without the artifacts. Using this instrument, a 2 mm slab of NWA 1756 (LL3.10) primitive ordinary chondrite was observed. Microscopic observations confirmed that this sample contains two cm-scaled lithologies: a fragmented type-3 lithology (lithology A) and a nearly completely shock-melted lithology (lithology B). Magnetic images showed 50 of sub-mm- to mm-scaled magnetic anomalies within lithology A, whereas lithology B contains only 2 magnetic anomalies. The directions of the most anomalies are westward or downward, which are probably magnetized by terrestrial weathering and/or metamorphism. However, the magnetized minerals have not completely identified even in the spatial resolution of 300 um. These results suggest that the newly developed scanning MI magnetic microscope is a powerful tool to describe the mm-scaled magnetic structure, but further studies are needed to contribute to the paleomagnetic study of the

meteorites.