法科学のツールとしての岩石磁気-掘り起こされた場所の特定-

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Rock magnetic analysis as a forensic tool to detect previously disturbed ground

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For a successful criminal conviction to occur, it is essential to locate forensically important evidence disposed of in soil. In this study, we attempted to use a rock magnetic method as a forensic search tool to detect evidence hidden in the ground. A 2.5 m long survey line was provided in the campus ground of Japan coast guard academy. A 0.1 m x0.2 m x0.7 m sized hole was created and was buried in the soil. Magnetic susceptibility (MS) was measured using a ZH instruments magnetometer at every 0.1 m along the line. Each sample position was measured six times. MS indicates relative higher values at the disturbed ground. A core sample of 7 cm length was collected by a soil sampler at around the disturbed ground. The grain size of the soil core is classified silty sand with granule, and it increases with burial depth. Dried soil samples were taken from the core at 1 cm intervals and were packed into 1 cm^3 plastic cubes. Rock magnetic measurements; MS, anhysteretic remanent magnetization (ARM), isothermal remanent magnetization (IRM), isothermal magnetization (Mrs), saturation magnetization (Ms), coercivity (Hc), and remanence coercivity (Hcr) were conducted for on the cubes. MS shows a peak at 2 cm in depth. ARM and SIRM indicate that the values gradually decrease with depth. It implies that the relatively high MS layer was at one time in the past exposed surface soil and as a result could be considered disturbed ground. In order to identify the magnetic minerals within the soil samples, thermomagnetic analysis (Js-T) was performed on four samples which are collected from the surface (0-0.2 m), middle (0.3-0.5 m) and deep soils (0.6-0.7 m) at the disturbed ground. All samples indicate that the declines of the decline in the MS curves at 580^{o}C and 680^{o}C. A slight inflection in the susceptibility curves at around 300^{o}C-400^{o}C is was also recognized. It suggests that this is due to the presence of maghemite and hematite. Almost all data plots in the pseudo-single domain (PSD) region for (titano-) magnetite on the Day plot (Mrs/Ms and Hcr/Hc). Magnetic grain size also increases with burial depth, and is consist with grain size distribution. The values of disturbed ground are located in the central part of all samples which are implied the all layer contribution. MS peaks have been recognized three month later when the disturbed ground was covered by weeds and the hole is undetectable. This result proves that MS can detect the location of disturbed ground even three months post-disturbance.