Shock remanence structure of natural basalt and granite samples

*佐藤 雅彦[1]、黒澤 耕介[2]、加藤 翔太[1]、潮田 雅司[3]、長谷川 直[4]
*Masahiko Sato[1], Kosuke Kurosawa[2], Shota Kato[1], Masashi Ushioda[3], Sunao Hasegawa[4]

1. 東京大学、2. 千葉工業大学、3. 産業技術総合研究所、4. 宇宙航空研究開発機構
1. The University of Tokyo, 2. Chiba Institute of Technology, 3. National Institute of Advanced Industrial Science and Technology, 4. Japan Aerospace Exploration Agency

Knowledge of the evolution of magnetic field intensity is key to understanding the past evolution of planets. However, magnetic field paleointensity data of terrestrial planets such as Mars and Moon have been poorly obtained because of the lack of appropriate rock samples. To address the problem, we focus on shock remanent magnetization (SRM). There are many impact craters on surface of the terrestrial planets, and the magnetic field originated from the SRM of planetary crust can be measured by spacecraft magnetometer. The magnetic field paleointensity could be estimated using the magnetic field data observed over the impact craters. In order to estimate the magnetic field paleointensity from the observed magnetic field data, it is crucial to know a structure of the SRM, while the structure remains unclear due to the difficulty in experimental techniques. In this study, to reveal the structure of SRM, the SRM imparted sample was cut into a millimetre-sized cube and magnetic measurements were conducted for the cube samples. Basalt samples with cylindrical form and granite parallelepiped samples were used as a target. The basalt samples were subjected to alternating field demagnetization at 80 mT before the SRM acquisition experiments, while the granite samples with natural remanent magnetization were used for the SRM acquisition experiments. The two-stage light gas gun at the Institute of Space and Astronautical Science (ISAS) of Japan Aerospace and Exploration Agency (JAXA) was used for the SRM acquisition experiments. A magnetically shielded cylinder of 32 cm in diameter and 100 cm in length was set in a vacuum experimental chamber of the two-stage light gas gun. The magnetically shielded cylinder was constructed with three μ-metal layers, and the residual field in the cylinder was <0.3 μT. A solenoid coil of 26 cm in diameter was set in the magnetically shielded cylinder. Target sample was placed at the center of the solenoid coil. The applied field was set to be 0–100 μT. An aluminum sphere of 2 mm in diameter was used as the projectile. A nylon slit sabot was used to accelerate the projectile. The impact velocity was ~7 km/s, and the impact angle was fixed at 90° from the horizontal. After the SRM acquisition experiment, the target samples were cut into the cube using a small rock cutter. The stepwise demagnetization and remanence measurement of the cube samples were conducted with the superconducting quantum interference device magnetometer. Systematic changes in the remanence intensity and stability with increasing the distance from impact point were observed for the basalt sample. Now we plan to conduct magnetic measurements of the granite samples. In this talk, we will discuss the structure of SRM based on the results of magnetic measurements of basalt and granite samples.

キーワード：shock remanence、magnetic anomaly、planetary magnetism
Keywords: shock remanence, magnetic anomaly, planetary magnetism