Examination of a lunar dynamo hypothesis using Lunar Prospector and Kaguya magnetometer data

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One of the objectives of magnetic field observation around the Moon is to examine if the Moon once had a global magnetic field of core origin. For this purpose, we have conducted a systematic study of modeling the lunar crustal magnetic field, called the lunar magnetic anomaly, based on a dipole source assumption. We focus on small-scale, isolated anomalies, which allow us to model them by dipole sources. Using Lunar Prospector and Kaguya magnetometer data obtained during low altitude observation periods, it is found that not only the well known, strong magnetic anomalies such as Reiner Gamma, Descartes and Crisium Antipode anomalies (>>10 nT below 20 km altitude), but also relatively weak anomalies (Airy, Crisium, Hartwig, Heaviside, Hayford, Krasovskiy Mendel-Rydberg, Moscoviense, Sirsalis, Stoffler and so on) including some currently unnamed anomalies of ˜10 nT below 20 km altitude can be modeled using single- or multi-dipole sources. Six source parameters, the position (longitude, latitude and depth) and three components of magnetization, are inverted iteratively. It is confirmed by inversions using a vertical prism instead of a dipole as a source body that magnetization direction is not sensitive to the assumption regarding the shape of magnetization source. Then, the obtained magnetization directions are mapped into distribution of paleo-poles to discuss the ancient lunar dynamo hypothesis. It is found that anomalies associated with the Nectarian-aged impact basins tend to concentrate around the selenographic poles, while those associated with the pre-Nectarian basins do not. These results might imply that the paleo-poles derived from the Nectarian magnetic anomalies are records of a stable lunar core dynamo.