Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

PPS23-22 Room:A02 Time:May 26 11:30-11:45

Magnetic anomalies, dynamo and true polar wander of the Moon

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Applying the latest advanced paleomagnetic technique to the Apollo samples, it is now well established that the Moon once had an ancient core dynamo operated from 4.2 to 3.56 billion years ago, or even younger age. Because these results are based on paleointensity retrieved from unoriented samples, any directional information cannot be obtained. Instead, we focus on the magnetic anomalies on the Moon. Since the magnetization of the lunar crust in the magnetic anomalies could be records of an early core dynamo of the Moon, the magnetic anomalies may yield directional information of the lunar paleomagnetic field. Here we present results of our global survey of magnetic anomalies on the lunar surface using magnetometer data acquired by the Lunar Prospector and Kaguya spacecraft. Using an iterative inversion method, we extract magnetization vectors from well-isolated magnetic anomalies and derive the positions of paleomagnetic poles. We find two distinct clusters of the resultant paleomagnetic poles: one near the present rotation axis and the other at mid-latitude (Takahashi et al., 2014). The result is consistent with a dipole-dominated lunar magnetic field generated by a core dynamo that was reversing the polarity. It is also implied that the Moon experienced a polar wander event. Additional inversion results for well-isolated central magnetic anomalies based on the surface vector mapping method (Tsunakawa et al., 2014) suggest existence of the third cluster of the lunar magnetic pole.

References

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Keywords: magnetic anomaly, dynamo, core, polar wander