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Estimating the magnetized direction over the lunar magnetic craters and basins from Kaguya satellite data

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We estimated the inclination of the magnetized body beneath the lunar craters and basins with central magnetic dipole anomalies using an empirically developed formula. The central anomaly was inferred to result from the thermal remanent magnetization (TRM) of the impacted crust. Previous methods to determine the lunar magnetization from satellite observations invoked computationally intensive inversion methods subject to many uncertainties including data reduction errors involving the poorly understood external field effects on the observations.

We used the Zietz-Anderseren approach that determines inclination of the remanently magnetized prismatic crustal body from the ratio of the absolute minimum to maximum anomaly values. This approach uses inferred source prism parameters, whereas we develop an empirical formula involved in the source-to-observation distance and the width of the source's top surface. Other parameters like the thickness, the magnetization intensity and the depth of the source had influence on the anomaly ratio when the vertical cylinder source is assumed that seems especially relevant lunar impact craters or basins.

Using the formula, we estimated the inclinations along with the declinations determined from the line connecting the anomaly maxima and minima of vertical component Kaguya magnetic observations. The paleopole locations calculated from these empirically determined magnetization directions compared well with the paleopole estimates from previous crater and basin studies.