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Lunar magnetic anomaly concentrations at the antipodal regions

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The high resolution lunar-wide magnetic anomaly map derived from Lunar Prospector (LP) vector magnetometer data has revealed weak anomalies over the nearside large impact basins flooded by mare basalts. Stronger anomaly features are observed over many of the Nectarian and Pre-Nectarian aged lunar highlands. In particular, regions antipodal to some of the largest basin-forming impact craters show strong magnetic anomaly concentrations. Of the 43 basins investigated here, antipodal regions of 9 basins show these anomalous features with strengths in excess of 1-18 nT at LP's mapping altitude (30 km). These distinct anomalous concentrations were previously known to occur only at the antipodes of Imbrium, Orientale, Serenitatis, Crisium and Nectaris basins. The mean magnetic anomaly strength within each antipodal region, when plotted against increasing age of the antipodes, shows two age groupings with similar magnetic behavior. The first age grouping – (Imbrium, Orientale, Serenitatis, Crisium and Nectaris) is of Imbrium to Nectarian in age. This grouping is correlative with peak magnetic field enhancements between 3.6 and 3.9 Gyr, inferred from paleomagnetic data from the returned Apollo samples. The second age grouping (Lorentz, Coulomb-Sarton, Tranquillitatis and Cognitum) is of Mid to Early Pre-Nectarian age. This grouping has not been correlated to any known global magnetic field enhancement event, and needs further investigation to ascertain the origin of the anomalies. Although spatially adjacent, the magnetic field signatures of the Serenitatis and Imbrium antipodes exhibit distinct features, supporting the antipodal hypothesis. The absence of appreciable field enhancements at 34 other antipodes, however, indicates the importance of other processes, and superposition effects, that have operated on the Moon during its history.