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Presentation Abstract

Title **Solar Insolation Driven Variations of Mercury's Lithospheric Strength**

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Abstract Mercury's coupled 3:2 spin-orbit resonance in conjunction with its relatively high eccentricity of ~0.2 results in a surface variation in annual average solar insolation and thus equatorial hot and cold regions. This results in an asymmetric temperature distribution in the lithosphere and a long wavelength lateral variation in lithosphere structure and strength that mirrors the insolation pattern. We employ a thermal evolution model for Mercury generating strength envelopes of the lithosphere to demonstrate and quantify the possible effects the insolation pattern has on Mercury's lithosphere. We find the heterogeneity in lithosphere strength is substantial, increases with time, and is accentuated by the differential timing of the mantle contribution to the lithosphere strength. For example, by the end of late heavy bombardment (~4 Ga) we find a difference in brittle-ductile transition depth of 6 km between the hot and cold equatorial thermal poles and 24 km between the hot equatorial pole and the latitudes ±90°. We also find that a crust thicker than that of the Moon or Mars and dry rheologies for the crust and mantle are favorable when compared with estimates of brittle-ductile transition depths derived from lobate scarps. Regions of stronger and weaker compressive strength imply that the accommodation of radial contraction of Mercury as its interior cooled, manifest as lobate scarps, may not be isotropic, imparting a preferential orientation and distribution to the lobate scarps. Although many of the parameters of the model are poorly constrained for Mercury, the overall lithospheric heterogeneity remains regardless of the choice of parameters. The latitudinal surface temperature variation experienced by Mercury is not unlike that of the Earth's Moon presently and thus one should expect an analogous latitude dependence on lithospheric strength to have developed over time on the Moon as well. Funded by the NSF Astrophysics Research Grants program (AST-0709151).