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Martian Paleopoles from Joint Gravity/Magnetic Inversion

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Magnetic and gravity anomalies in selected regions between 50-180 degrees E along Mars' dichotomy boundary show similar spatial scales and a roughly constant amplitude ratio, suggesting their sources are correlated. This implies that the creation and/or modification of the magnetized crust may have also created density anomalies, potentially allowing paleopole determinations with stronger constraint. To test the density/magnetization correlation and its geologic implications, magnetic and gravity field data for this region were modeled as a series of 3 x 3 degree rectangular prisms with uniform depth and thickness. First the magnetic and gravity field data are inverted using various thick/thin and shallow/deep source models. Then, using the best-fit depth and thickness, the magnetic data were inverted for a full spectrum of paleopole positions in increments of 10 degrees longitude and 5 degrees latitude in order to find the paleopole position that gives the best match to the magnetic field observations, and those paleopoles that provide the highest number of prisms with significantly correlated or anti-correlated magnetization and density variations in subregions of the study area. These paleopole solutions are compared to the pole determined by the magnetic data alone to infer the geologic processes that affected the crust, and the implications for the dynamo history.