Geophysical Research Abstracts
Vol. 14, EGU2012-5848-1, 2012
EGU General Assembly 2012

Insight into Mars' Paleodynamo by Modeling Gravity and Magnetic Anomalies in the Southern Highlands

C. Milbury (1), G. Schubert (2), C. A. Raymond (3), S. E. Smrekar (3), and B. Langlais (1)

(1) Université de Nantes, Laboratoire de planétologie et de géodynamique de Nantes, Nantes, France (cmilbury@ucla.edu), (2) UCLA, Department of Earth and Space Sciences, Los Angeles, California, USA, (3) Jet Propulsion Laboratory, California Institute of Technology, Pasadena, California, USA

In the analysis I model crustal magnetic anomalies near the Tyrrhenus Mons and Syrtis Major volcanoes and the heavily cratered highlands between Arabia Terra and the Hellas impact basin. I first map the gravity anomalies in each region to identify the locations of anomalous crustal density. The gravity data are inverted to determine the depth and thickness of the layer, which are used as inputs to the magnetic inversion to reduce the inherent non-uniqueness in the horizontal position of magnetic sources. Magnetic anomalies are modeled where there is a gravity minimum or maximum in close proximity to a peak in the total magnetic field. Geologic processes such as magmatism, cratering, and serpentinization produce gravity and magnetic anomalies. All three components of the low altitude and mapping altitude magnetic field data are inverted using the same conjugate gradient iterative technique used by Langlais et al. (2004) and Langlais and Purucker (2007). The resulting paleopoles span a range of latitudes for sources below Noachian and Hesperian aged crusts. Magnetic sources that favor low latitude paleopoles are generally located below or immediately adjacent to Noachian surface units, and sources that favor middle to high latitude paleopoles are located below or immediately adjacent to Hesperian features. The cluster of paleopoles near the geographical pole associated with younger units is strong evidence that the dynamo was active during the Hesperian. Opposite polarities of paleomagnetic poles clustered in the same region are strong evidence for reversals of the magnetic field in the Noachian and Hesperian. The paleopole distributions determined support the case for true polar wander, magnetic reversals, and a dynamo that remained active into the Hesperian.