E221-033 **Room: 303** **Time: May 18 15:30-16:00**

Detection of the Mars convection pattern from magnetic anomalies

Gunther Kletetschka[1]; P.J. Wasilewski[2]; N.F. Ness[1]; T. Adachi[1]; V. Mikula[1]

[1] Department of Physics, Catholic University of America; [2] NASA Goddard Space Flight Center

Intense magnetic anomalies over the Mars surface indicate that during the early history of Mars large portions of Mars crust formed in the presence of global magnetic field. Absence of a global field on Mars brings a unique opportunity of detection of magnetic anomalies of residual crustal magnetic fields. Such fields create insights about the rock forming processes. On Earth such rock forming processes are hidden by active geo-dynamo. Such dynamo emphasizes induced magnetic carriers masking the remanence carriers and the rock-forming processes are difficult to figure out. Absence of dynamo on Mars allow us to use magnetic acquisition principles when interpreting satellite magnetic anomalies. Distribution magnetic anomalies on Mars can be divided into three zones. Zone 1 is where the magnetic signature is negligible or of low intensity. Zone 2 is the region of intermediate crustal anomalies and Zone 3 is where there are magnetic anomalies of extreme magnetic intensity. Crater demagnetization behavior suggests that rocks with large magnetic coercivity generate magnetic anomalies within the Zone 3 (located near the South Pole). TRM analyses with terrestrial rocks suggest that elongation of magnetic minerals and compositional banding significantly enhances the TRM acquisition intensity. Both magnetic coercivity and intensity values near the South Pole suggest presence of a deformation and compositional zoning of the rock in the deeper section of Mars crust. Magnetic anomaly intensity indicates large volumes of rocks with high coercivity and elongated magnetic carriers. Mylonitic fabric (compositional bands) is considered to develop in the down-welling zones where the density contrast aids the distribution of large zones of ductile deformation. In these zones elongated magnetic carriers mimic the foliation, thereby intensity and time stability. Such model allows association between the intensity of magnetic anomalies and down-welling large-scale convection pattern. The following is the description of a five steps plausible model of crustal formation on Mars consistent with magnetic data. 1. Early thermal differentiation forms the planet Mars with northern hemisphere containing up-welling and southern hemisphere containing down-welling mantle materials; 2. Highly volatile content of early composition rapidly forms a low-density crustal plate near the down-welling zone and associated topographical relief (dichotomy). 3. Internal magnetic dynamo allows origin of both remanent and induced magnetism once the crust cools below blocking and Curie temperatures of magnetic minerals (400-600C). Fabric of the magnetic minerals determines the level of observable magnetic anomalies. Mylonitic fabric significantly enhances the efficiency of thermal magnetizing processes and therefore the level of observable magnetic intensity. Downward moving direction of cold crust shifts the Curie geotherm deeper and thickens the depth of crust that can retain remanent magnetization. Both of these processes enhance the level of magnetization above the down-welling zone and should cause enhancement of observable magnetic signature form the satellite altitude. 4. When crust accumulates over the southern down-welling zone (the crustal dichotomy reaches approximately extent seen today), a volume of the liquid core becomes small causing mantle convection to stop. Associated crustal formation processes stop along with existence of magnetic dynamo. 5. Heat accumulated in northern hemisphere can still escape in the form of superplumes, causing formation of Tharsis and Elysium.