Geophysical Research Abstracts
Vol. 12, EGU2010-12837-2, 2010
EGU General Assembly 2010

Sedimentation of an oblate ellipsoid subjected to magnetic forces

Josef Jezek (1), Stuart Gilder (2), and Dario Bilardello (2)

(1) Charles University, Faculty of Science, Prague, Czech Republic (jezek@natur.cuni.cz), (2) Ludwig Maximilians University, Munich, Germany

Recent models of sedimentation are mainly based on Stokes' approximation of body motion in a linear viscous fluid, and cannot therefore account for all effects occurring either in the laboratory or in nature. One of these effects is rotation of prolate or oblate particles perpendicular to the direction of gravity. Galdi and Vaidya (GV2001) showed that torque acting on a falling particle should be added to the Stokes description. They quantified torque in the form of an inequality and evaluated a controlling parameter, G, as a function of eccentricity for the case of a prolate ellipsoid. Their result is also relevant to clustering/flocculation that occurs during sedimentation. Clusters of inert material may capture magnetic particles, which changes the balance of magnetic and hydrodynamic forces. This idea was incorporated in some sedimentation models using spherical clusters (Tauxe et al., 2006; Jezek and Gilder, 2006). Using the results of GV2001, Heslop (2007) discussed how prolate clusters influence magnetic remanence, and in particular, the inclination. Mitra and Tauxe (2009) also used the torque of GV2001 in their models. Both Heslop (2007) and Mitra and Tauxe (2009) restricted their analyses to clusters of prolate ellipsoids, despite the fact that oblate ellipsoids are more commonly found in nature.

We present an evaluation of the GV2001 torque coefficient for the oblate ellipsoid. Our approach exploits Stokesian velocity fields described in Jeffery (1922) and Oberbeck (1879). The resulting G coefficient for oblate ellipsoids complements the discussion of Heslop (2007), and the corresponding torque can be added to the model of Jezek and Gilder (2006). Other aspects of re-deposition modeling will also be discussed.