Geophysical Research Abstracts, Vol. 5, 09869, 2003

MAGNETIC ANISOTROPY OF OBSIDIAN

J. Matzka, D. Krása, A. Nichols and D. B. Dingwell

Department of Earth and Environmental Sciences, Ludwig-Maximilians-Universität München, Germany (matzka@geophysik.uni-muenchen.de)

Obsidian can contain anisotropically oriented microlites. Knowledge of this anisotropy allows to constrain flow conditions during the obsidian emplacement. We used rock magnetic methods to characterize the magnetic microlite fraction and determined the anisotropy of the magnetic hysteresis parameters of two obsidian hand samples from Tenerife and Forgia Vecchia on Lipari. Our study aims at the cause of and the relationship between the anisotropy patterns of different magnetic parameters for the individual obsidians, which are similar for both samples. Curie temperatures (545 °C and 560 °C) indicate a close-to-magnetite microlite composition. Hysteresis parameters suggest a mixture of large (>10 μm) multidomain grains (which are also observable by microscopy) and a significant amount of elongated single-domain (SD) particles of submicrometer size. The degree of anisotropy for the remanence parameters H_{CR} and M_{RS} is higher than for the coercivity H_{C}, indicating that the anisotropy is caused by the elongated SD particles. Generally, the anisotropy ellipsoids of the hysteresis parameters are oblate for M_{RS} and H_{C} and prolate for H_{CR}, and the short axis for oblate and the long axis for prolate ellipsoids are parallel. By considering a simple SD magnetization model, the mean grain elongation can be estimated and the above described anisotropy patterns for the hysteresis parameters can be explained. Additionally, the anisotropy of the orientation of the long axis of the SD particles can be directly inferred from the M_{RS} anisotropy ellipsoid, indicating that the long axis of the particles is preferentially oriented within a plane. For one sample (Tenerife), where the flow surface is exposed on the hand sample, we find this plane to be parallel to the surface of the obsidian flow.