Geophysical Research Abstracts, Vol. 8, 05081, 2006
SRef-ID: 1607-7962/gra/EGU06-A-05081

Magnetic Field Visualization of Magnetic Minerals and Grain Boundary Regions using Magneto-optical Imaging

A.V. Bobyl (1-3), Y.Y. Podladchikov (1), H. Austrheim (1),

B. Jamtveit (1), T.H. Johansen (3), D.V. Shantsev (2,3)

(1) Physics of Geological Processes (PGP), University of Oslo, P. O. Box 1048 Blindern, 0316 Oslo, Norway, (abobyl@yahoo.com), (2) A.F.Ioffe Physico-Technical Institute, Polytekhnicheskaya 26, St.Petersburg 194021, Russia, (3) Department of Physics, University of Oslo, P. O. Box 1048 Blindern, 0316 Oslo, Norway

Magneto-optical imaging based on the Faraday-effect has been used to characterize magnetic minerals embedded in a nonmagnetic matrix. We have studied magnetite grains and magnetite-magnetite grain boundary regions in samples of skarns and serpentinites. The spatial distributions of the perpendicular component of the remanent magnetic field were measured at the surfaces of polished thinsections with 1 μm spatial resolution, after applying a magnetic field of 50-160 mT at room temperature. The images can directly reveal the shape and arrangement of magnetite grains in a nonmagnetic matrix. The sensitivity of the MOI can be improved by a procedure where MO images taken at different directions of global magnetization are subtracted to produce a ‘difference’ image**.** We demonstrate by extrapolation that this procedure can resolve magnetite-magnetite grain boundaries or magnetite stripes and grains down to a scale of 100 nm. Such a good resolution for an optical method is explained by the tendency of magnetic field to escape from a small gap (or grain) creating a sort of magnetic lens. As a result, the MOI can resolve gaps smaller than the optical wavelength, but a special procedure is then needed to determine the accurate value of the local magnetization. Quantitative analysis of the coercive field dependencies on the magnetite grain sizes or stripe width shows that they cannot be understood without proper account of the internal domain structure, chemical contents or thinsection fabrication procedure. Our size dependencies extracted from MOI data are in reasonable

qualitative agreements with earlier studies. We can conclude: 1) for the scarns the magnetic properties of grains do not depend on the gap (0.6-60 μm) between them, 2) for the serpentinites the magnetic properties of the stripes are size-dependent due to variations in chemical composition.