Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

SEM001-P01 Room:Convention Hall Time:May 26 10:30-13:00

Strained magnetite and its remanence properties of Vredefort crater granite

Kensaku Okuno[1], Norihiro Nakamura[1*]

[1]Earth Science Dep., Tohoku Univ.

Vredefort crater granite shows anomalous remanence properties with strong intensity and random orientations of the remanence. These properties were enigmatic but recent drilling study (Carporzen et al. 2010 AGU abstract) reveals the origin of these properties is of lightning strike for some underground samples which can easily be alternating-field (AF) demagnetized in less than 20mT. Still some rock samples show the presence of strong intensity and high coercive coarse magnetite grains which are resistive against stepwise alternating-field demagnetization up to 50mT in scanning MI magnetic microscopy analysis. Here we show a collaborative study of micro-Raman spectroscopy, magnetic Kerr microscopy and a magnetic force microscopy (MFM) for the highly resistive coarse magnetite grains in Vredefort granite. The micro-Raman spectroscopy study reveals the presence of magnetite with a A_{1g} mode (680 cm^{-1}) and hematite as a lamellae in the high coercive coarse-grained magnetite along $\{111\}$ plane which is same plane as twinning of magnetite. The magnetite A_{1g} mode shows an obvious blue-shift from normal magnetite of 667cm^{-1}. The magnetic Kerr microscopy and MFM studies of the same grain showed striped magnetic domain walls along $\{111\}$ plane. The same blue-shifted Raman mode of magnetite and the presence of striped domain wall have been observed in strained magnetite artificially deposited on $SrTiO_3$ film by Chen et al. (2008). Also their hysteresis study showed the strained magnetite has a larger coercivity, and they concluded that these observations result from the formation of more pinning centers induced by high density of defects grown along specific direction like $\{111\}$. Therefore, we can conclude analogically that our Vredefort magnetite is affected by strains due to impact and their strain-induced domain wall pinning causes high coercive strong intensity of the remanence of coarse-grained magnetite in Vredefort crater granite.