Geophysical Research Abstracts,
Vol. 11, EGU2009-8010, 2009
EGU General Assembly 2009

Low-temperature magnetic transition temperatures of synthetic titanomagnetite-ilmenite$_{ss}$ assemblages

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An increasing amount of data on low-temperature magnetic properties of Fe-Ti oxides is meanwhile available. They show that low-temperature magnetometry has a high potential in characterising the magnetic mineral assemblage, especially for basaltic rocks. We present low-temperature magnetic transition temperatures of synthetic Fe-Ti oxide assemblages in which the ilmenite solid solutions ($0.7 < X_{ilm} < 1$) have compositions near to the ilmenite endmember ($FeTiO_3$) and titanomagnetites have intermediate to Fe-rich compositions ($0 < X_{usp} < 0.8$). These compositions are ubiquitous in natural basic magmatic rocks. The magnetic transition temperatures of ilmenite$_{ss}$ and titanomagnetite were identified using a combination of frequency-dependent AC in-phase and out-of phase susceptibility and saturation magnetization in the temperature range of 5 and 300 K, combined with hysteresis measurements at defined temperatures. We shall focus on the determination of critical transition temperatures such as the isotropic point (T_i) of titanomagnetite (between 50 and 100 K in the investigated compositional range), as well as the spin glass temperature and the transition to superparamagnetic behaviour for ilmenite$_{ss}$. All these transition temperatures are characterised by frequency dependent out-of phase susceptibility signals and we shall discuss their significance for the interpretation of low-temperature magnetometry data in natural rocks. We shall also present data concerning the Curie and Neel temperatures for the investigated Fe-Ti oxides and discuss how the different transition temperatures can be discriminated.