An explanation of some effects of the titanomagnetite solid solutions ($Fe_{3-x}Ti_xO_4$) based on the magnetic susceptibilities, the Curie temperature measurements, and the Mössbauer spectra measurements

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A b s t r a c t: The natural titano-magnetites (Ti-Mt-es) from basaltic rocks were investigated. The titanomagnetite solid solutions with high content of ulvöspinel (x ≈ 0.6 to 0.8, and $T_C \approx 80$–110° C) have attained very high values of volume magnetic susceptibility. These Ti-Mt-es are in a superparamagnetic (SP) state. No typical multi-domain structure was developed in these Ti-Mt-es. In some basaltic rocks the Ti-Mt-es with two or more magnetic phases are frequently present. One phase is probably of the original state and the second one has been created due to the so called low temperature oxidation (below 350° C) of original Ti-Mt-es. This second titano-maghemite magnetic phase is characterized by the inversion temperature. In this magnetic phase a stable domain structure of multidomain mode probably developed. Both these Fe-Ti magnetic phases are in a contact with each other. Experimentally it has been proven that mutual magnetostatic interactions between the SP particles and those with the developed domain structure exist. These interactions have probably strongly influenced also the behaviour of the activated material during realization of the Mössbauer spectroscopy and so, the Mössbauer spectra of such material are non-Lorentzian, and very broad. Preferably the octahedral positions have occurred on the Mössbauer spectra of the original Ti-Mt-es at room temperatures, while the tetrahedral positions are characteristic at LNT for the same sample of the Ti-Mt.

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