Magnetic mineralogy and anomalous magnetic susceptibilities of basalts from central and southern Slovakia

O. Orlický
Geophysical Institute of the Slovak Academy of Sciences[1]

A b s t r a c t : The volume magnetic susceptibilities and the magnetic Fe-Ti phases of basalts from volcanic fields of central and southern Slovakia were studied. On the contrary to our images and the theory, the titanomagnetites (Ti-Mt-es) with high content of ulvöspinel posses the highest values of magnetic susceptibilities (κ) among of other Fe-Ti oxides in basalts. Theoretically, end member - magnetite (Fe_3O_4) is in ferrimagnetic state with the resultant magnetic moment = 4 μ_B. Ulvöspinel (Fe_2TiO_4, as the other end member Ti-Mt is in antiferromagnetic state with the resultant magnetic moment = 0 μ_B. With increasing content of the ulvöspinel in the Ti-Mt the resultant magnetic moment should have been normally lowered and the magnetic susceptibility as well. An idea about the superparamagnetic state behaviour of these Ti-Mt-es has been accepted to explain this discrepancy between experimental data and the theory. The products of low-temperature oxidation, cation-deficient Ti-Mt-es, including their inverse temperature magnetic phases have been selected and described in the article. On the basis of displacement of the oxygen ions from the crystalline lattice of the Ti-Mt and so of gradual disappearance of the so called indirect AB exchange interaction (loss of transmitting negatively charged media between metallic ions of A and B sublattices) explains the so far unsolved problem of decreasing κ of Ti-Mt in the interval down to liquid nitrogen temperature.

Key words: high magnetic susceptibilities, superparamagnetism, magnetic phases, inversion temperatures

[1] Dúbravská cesta 9, 845 28 Bratislava, Slovak Republic; e-mail: geoforky@savba.sk