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Self-reversal of thermoremanent magnetization synthesized magnesian chromites and titanomagnetites

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Paleomagnetic research of rocks earth crust show that the reverse magnetization of ferromagnetic minerals occur as often as the direct magnetization. One possible reason is the reverse magnetization occurred in the past geomagnetic field inversions. There is an alternative theory of magnetization rock opposite to the direction of the geomagnetic field, - reversal of magnetization, which may occur either during cooling ferrimagnetic or by oxidation during the succeeding life of rock geology. Possible mechanisms of inverse magnetization were considered theoretically L. Neel [1]. For single-phase ferrimagnetics they were offered several options for behavior of the temperature dependence of the spontaneous magnetization, which is the sum of the magnetizations of the two sublattices oppositely directed a change in temperature can vary from positive to negative values associated with different temperature variation of spontaneous sublattice magnetizations. Neel mechanism self-reversal supposes the compensation point. Ferrimagnetic minerals $(1-x)Fe_3O_4\ xMg_2TiO_4$, the most common arrays alkaline ultrabasic rocks and carbonatites have a spinel structure in which metal cations occupy octahedral and tetrahedral sites. According to the most probable distribution of $Fe^{3+}(Mg_{2x}Ti_xFe^{2+}_{1-x}Fe^{3+}_{1-2x})O_4$ for compositions x<0.3 according to the Neel's theory can calculate the value of «x», in which the magnetic moments of saturation of the sublattices are equal and therefore compensated. This value is x=0.286 [2]. Chromospinelide series $(1-x)Fe_2CrO_4\ xFeCrMgO_4$ compose a number of types of chromite deposits. They are the bearers of rock magnetization some kimberlite pipes are widely distributed in deep gabbro and peridotite, and lunar rocks and meteorites. On the proposed cation distribution - $Fe^{3+}(Fe^{2+}_{1-x}Mg_xCr)O_4$ magnetic moments of the sublattices be compensated for the composition $Fe_{1.5}Mg_{0.5}CrO_4$ (x=0.5) [2]. The magnetic properties of the synthesized minerals above series of experimental data show an incompatibility with the alleged theoretical concepts according ferrimagnetism Neel. For chromespinelides $Fe_2CrO_4 - FeCrMgO_4$ depending on σs (x) minimum is observed spontaneous magnetization at x=0.7, indicating that the proximity of this composition to composition with compensated ferrimagnetic sublattices [3]. Compositional dependence of $\sigma_s(x)$ for magnesian titanomagnetite $Fe_3O_4 - Mg_2TiO_4$ shows a linear decrease of the spontaneous magnetization of the composition, i.e. for this series sublattice compensation absent [4]. At the same time, self-reversal of magnetization for some compositions presented a series of spinels observed after heating to 600°C ferrites in the air. Self-reversal of thermoremanent magnetization chromespinelides explained the formation of a gradient in the distribution of metal cations, which occurs when a single-phase oxidation of minerals [3]. In magnesia titanomagnetites is due to the self- spin exchange interaction decay phases - hemoilmenites magnesia having a different degree of ordering of the ions [4]. In natural minerals rather characterized by the presence of inhomogeneities caused by the phase transformation occurring for a long time. Consequently, self-reversal on the proposed mechanisms is quite possible for natural minerals and can occur at any stage of life rock.

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