Geophysical Research Abstracts
Vol. 16, EGU2014-1022-4, 2014
EGU General Assembly 2014

Magnetic properties of xenoliths from Yakut kimberlite pipes

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Lower continental crust is poorly known due to its limited availability. One source of information about the formation of the lower crust is the study of xenoliths found in kimberlites, mainly peridotites, eclogites and other rocks made by the kimberlite magma to the surface from great depths. Magnetic methods can solve problems related on the one hand, the definition of the phase composition of natural ferrimagnetics responsible for the magnetic properties of rocks, and on the other - with the establishment of the thermodynamic conditions in which they were formed - their genesis. For example, in [1, 2], there were differences in the magnetic properties of kimberlites taken from tubes with different diamond productivity.

In this work, studies have been conducted of the magnetic properties and mineralogy of xenoliths from 10 Yakut kimberlit pipes, courtesy of Doctor of Geological and Mineralogical Sciences V. K. Garanin.

Found that the natural remanent magnetization (NRM) and magnetic susceptibility (k_0) of the investigated samples varies widely: NRM = (0.002-12.59) A/m, k_0 = (0.23-59.9)*10^{-3} SI. Magnetic properties vary by species: average NRM peridotites (0.002-0.32) A/m order of magnitude smaller eclogitic rocks (0.58-12.59) A/m. Thermomagnetic analysis (TMA) of the test samples showed the presence of xenoliths of the ferromagnetic phase with a Curie point close to T_c magnetite. Because of the high correlation between the values of NRM, k_0 and ferrimagnetic saturation magnetization (SM) can be inferred that the magnetic properties of the rocks studied at temperatures above ambient is basically determined by the concentration of magnetite in them. Besides magnetite TMA were also identified ferrimagnetic phase with Curie temperatures from -50°C to -125°C.

Mineralogical analysis performed on three samples of peridotite tubes Udachnaya, Yubileynaya and Mir and two samples of eclogite tubes Udachnaya and Komsomolskaya, showed that at temperatures below room temperature magnetic properties of peridotites due ferrishpineles with high content of chromium, titanium and aluminum; eclogitic rocks – due hemoilmenites.

Among the studied xenoliths, peridotites from the tubes with high diamond productivity (Udachnaya, Mir, Yubileynaya) are characterized by low values of NRM, k_0, SM and high paramagnetic contribution. We conclude that the concentration of magnetite in them is very small, and the magnetic properties peridotite above room temperature are determined mainly paramagnetic minerals.

This work was supported by RFBR grant No. 11-05-00740.

Literature:

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