Magnetic study of individual Fe-Ti oxides separated from the rhyodacite of the Haruna Volcano (Japan) and the dacite ash of Mount Pinatubo (Philippines)

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A b s t r a c t: The behaviour of the magnetic ilmenite-hematite (Ilm–hem) and titanomagnetite (TM) fractions separated out of the Haruna rhyodacite and the Pinatubo dacite ash was studied in both, high temperature (25–600°C) and low temperature (-190–0°C) intervals. While the Ilm–hem phases of original non-separated fractions of the Haruna rhyodacite were not detectable, very precise results have been obtained on the mutually separated Ilm–hem and TM magnetic fractions. The rhombohedral Ilm–hem and cubic TM are the main magnetism carriers in the samples investigated. The individual phases of the Ilm–hem are present in the range of $T_C \approx$ 200–290°C, and the compositional parameter y ≈ 0.55–0.40). The three different phases of T_C and compositional parameter x have been revealed for the TM: $T_C \approx$435°C (x=0.24), $T_C \approx$450–465°C (x = 0.17) and $T_C \approx$ 510–530°C (x = 0.11–0.08). The magnetic phase of $T_C \approx$435°C (x=0.24) was probably transformed on the Ilm-hem phase during temperature treatment. The last TM phase with $T_C \approx$ 510–530°C (x = 0.11–0.08) corresponds to the most oxidized phase with high portion of non-stoichiometric magnetite. This phase has shown the Verwey transition temperature at - 150 to - 140°C. Some samples of TM from rhyodacite pumice of the Haruna locality have shown an unknown transition temperature at about - 100°C within the low temperature interval. Both, this unknown and the Verwey transition temperatures have not been so far revealed in the Haruna rhyodacites. Samples dominantly with separated Ilm–hem have shown only the stable self-reversed thermoremanent magnetization (SR TRM), the samples containing dominantly separated TM, have shown only normal remanent magnetization. In the sample of the TM, with a small amount of the Ilm-hem non-consistent directional and magnetic stability and non-preferable polarity of the remanent magnetization have occurred. A source of this inconsistency is supposed to

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be a mutual magnetic interaction among different Fe-Ti minerals influenced by temperature. The SR TRM of samples showed conspicuous increasing of the intensity down to liquid nitrogen temperature, but, after heating, the intensity of the SR TRM of the sample was very near that before the cooling. Presented results have enriched our knowledge about the composition and a peculiar behaviour of the Fe-Ti oxides, which are able to acquire the self-reversed TRM in the rocks.

Key words: separated Ilm-hem and TM fractions, Haruna rhyodacite, Pinatubo dacite ash, self-reversal TRM, Verwey temperature of TM