

Ref.#: Ge_29

mburzynski@igf.edu.pl

ABSTRACT

Ferromagnetic carriers identification of selected metabasite rocks from Oscar II Land, Western Spitsbergen.

Mariusz Burzyński¹ Krzysztof Michalski² Krzysztof Nejbert³ Justyna Domańska-Siuda³

¹*Institute of Geophysics PAS- Centre for Polar Studies KNOW (Kajowy Naukowy Ośrodek Wiedzy) , Department of Magnetism, Poland,* ²*Institute of Geophysics PAS, Department of Magnetism, Poland,* ³*University of Warsaw, Department of Geology, Institute of Geochemistry, Mineralogy and Petrology, Poland,*

Two types of metabasites (metadolerites and metavolcanics) from metamorphic Proterozoic - Lower Paleozoic complex of Oscar II Land Western Spitsbergen) were selected for precise identification of their ferromagnetic content.

Previous “whole rock” petro-magnetic analysis, conducted in the course of PALMAG project (2012-2015) - SIRM (Saturation Isothermal Remanent Magnetisation) decay curves, three-component IRM (Isothermal Remanent Magnetisation) and VSM (Vibrating Sample Magnetometer) investigations revealed that metadolerites contain low-coercivity carriers with unblocking temperatures (Tub) around 300-350°C and 500-575°C pointing to pyrrhotite and low-Ti magnetite respectively. Metavolcanics contain more complex ferromagnetic assemblage dominated by high-coercivity minerals, with Tub below 200°C, around 575°C and above 650°C which can be related to goethite, low-Ti magnetite and hematite respectively. Optical microscopy observation, BSE (Back-scattered electron) images analysis and EPMA (Electron Probe Micro Analyzer) partly confirmed results of petro-magnetic experiments, questioned however existence of magnetite in metadolerites, pointing that in these rocks in the course of the Caledonian metamorphism magnetite has been subjected to intensive dissolution.

This should be noted that substantial limitation of the previously conducted petro-magnetic “whole rock” analysis is that they define magnetic properties of the mixture of all ferromagnetic minerals existing in the samples. The advantage of this study is separation of particular ferromagnetic minerals and conducting petro-magnetic analysis on mono-mineral ferromagnetic samples. Coercivity spectra of separated particles were measured on Vibrational magnetometer MICROMAG AGFM 2900-02 (Princeton Measurements Corp., USA).

In the first stage of experiment 4 samples of metadolerites from St. Jonsfiord and 2 samples of metavolcanics from vicinity of Farmhamna were crushed, grinded and sieved. It was possible to portion minerals according to grains gradation into four

groups: $\emptyset > 0.6$ mm, $\emptyset > 0.4$ mm, $\emptyset > 0.2$ mm, $\emptyset > 0.1$ mm. In the second stage Fe-rich particles were separated from non-magnetic ones using hand neodymium magnet. The last stage of separation was segregation of the magnetic phases according to their optical differences using stereoscopic microscope. Group of grains $\emptyset > 0.2$ mm was chosen as most suitable for further investigation.

7 different groups of grains has been distinguished from magnetic fraction in the process of separation. In the course of MICROMAG magnetometer analysis 3 groups of grains revealed paramagnetic or diamagnetic behavior. In the rest 4 groups (2 from metadolerites, 2 from metavolcanics respectively) shape and parameters of the hysteresis loops are characteristic for ferromagnetic minerals. 2 groups of ferromagnetic grains separated from metadolerites are characterized by low-coercivity (IRM curves saturated below 70-90mT, Hcr-coercivity of remanence - 20-30mT). Both groups of ferromagnetic grains separated from metavolcanics revealed high coercivity spectra (they saturate in the fields above 350-370mT, Hcr parameters - 90-110 mT).

Preliminary results of simultaneously conducted XRD (X-Ray Diffraction) analysis confirmed existence of hematite in metavolcanic samples. Further XRD analysis are in progress.

Presented study is part of PALMAG project (2012-2015): "Integration of palaeomagnetic, isotopic and structural data to understand Svalbard Caledonian Terranes assemblage funded" by Polish National Science Centre (NSC) - grant number 2011/03/D/ST10/05193