Geophysical and petrological constraints for ultramafic-alkaline-carbonatite magmatism in the Tajno intrussion, NE Poland

J.B.WISZNIEWSKA[1], E. KRZEMIŃSKA[1], Z. PETECKI[1], A.GRABARCZYK[2], DANIEL DEMAIFFE[3]

[1] Polish Geological Institute – National Research Institute, 4,Rakowiecka str., 00-975 Warsaw, Poland
janina.wiszniewska@pgi.gov.pl
[2] Faculty of Geology, University of Warsaw, Żwirki i Wigury 93,02-089 Warsaw, Poland
[3]Université Libre de Bruxelles (ULB), 50 av. F. Roosevelt, B1050 Bruxelles, Belgium

This Tajno alkaline massif (together with the nearby Ełk and Pisz intrusions) occurs beneath a thick Mesozoic-Cenozoic sedimentary cover. It has first been recognized by geophysical (magnetic and gravity) investigations, then directly by deep drilling (12 boreholes down to 1800 m). The main rock types identified as clinopyroxenites, syenites, carbonatites, have been cut by later multiphase volcanic /subvolcanic dykes. This massif was characterized as a differentiated ultramafic, alkaline and carbonatite complex, quite comparable to the numerous massifs of the Late Devonian Kola Province of NW Russia [1,2]. Recent geochronological data (U-Pb on zircon from an albitite and Re-Os on pyrrhotite from a carbonatite) indicate that the massif was emplaced at ca. 348 Ma (Early Carboniferous). All the rocks, but more specifically the carbonatites, are enriched in Sr, Ba and LREE, like many carbonatites worldwide but depleted in high field strength elements (Ti, Nb, Ta, Zr). The initial $^{87}Sr/^{86}Sr$ (0.70370 to 0.70380) and $\varepsilon Nd_{(t)}$ (+3.3 to +0.7) isotopic compositions of carbonatites plot in the depleted quadrant of the Nd-Sr diagram, close to "FOcal ZOne" (FOZO) deep mantle domain [1]. The Pb isotopic data ($^{206}Pb/^{204}Pb$ <18.50) do not point to an HIMU (high U/Pb) source. The ranges of C and O stable isotopic compositions of the carbonatites are quite large; some data plot in (or close to) the "Primary Igneous Carbonatite" box while others extend to much higher, typically crustal $\delta^{18}O$ and $\delta^{13}C$ values [1]

This study was possible thanks to the Polish Geological Institute-Polish – National Research Institute project 61.6701.1801.00.0 and through funding from Belgium Ministry of Science and Higher Education and PGI-NRI internal grants no.00.8520.1401.00.0

References

[1]Wiszniewska et al. 2020, Geol. Qurt., 64,2 in press.

[2]Demaiffe et al. 2013, Journal of Geology, 121 (1): 91-104.