Paleomagnetic and rock magnetic study of Lower Devonian sediments from Podolia, SW Ukraine: remagnetization problems

M. Jeleńska[1], M. Kądziałko-Hofmokl[1], V. Bakhmutov[2], I. Poliachenko[2], P. Ziółkowski[3]

[1] Institute of Geophysics, Polish Academy of Sciences, Warsaw, Poland

[2] Institute of Geophysics, National Academy of Sciences of Ukraine, Kiev, Ukraine

[3] Faculty of Geology, University of Warsaw, Warsaw, Poland

Corresponding author: bogna@igf.edu.pl

Abstract: Paleomagnetic study of the Silurian-Devonian sedimentary sequence in Podolia (Ukraine) exposed in the basin of the Dniester River may provide pole position for this time from a region other than Scotland and Scandinavia. For paleomagnetic study the Lower Devonian deposits were sampled in seven outcrops from grey limestone of the Tiverskaya series and red beds (sandstone) of the Dniestrovskaya series, part of the Ustechkovskaya suite. The remanent magnetization of specimens were measured in two laboratories – in the Institute of Geophysics, Polish Academy of Science, Warsaw and in the Institute of Geophysics of the National Academy of Sciences of Ukraine, Kiev. Two components of NRM were revealed. The first component (TP and UP), recognized in almost all samples from Tiverskaya series and from the Ustechkovskaya suite, has an SSW declination and negative inclination. Pole positions calculated from these directions lie in the Permian segment of Apparent Polar Wander Path (APWP) for Baltica/Stable Europe. The second component was isolated at the end of the thermal demagnetization path for red sandstone (UD) and in only a few samples of grey limestone (TD). This component has an SW declination and positive inclination, and gave pole positions close to Devonian segments of APWP. The hypothesis that TD and UD components are primary Devonian magnetization was supported by fact that they were recognized in different sediments – limestone and sandstone. They were carried by different magnetic minerals – magnetite in the case of grey limestone, and hematite in the case of red beds. Anisotropy of magnetic susceptibility (AMS) fabric of red sandstone and these samples of grey limestone that preserved Devonian magnetization are typical for sedimentary structure, with minimum axes of AMS perpendicular to the bedding plate. In spite of similar remagnetized directions obtained for both rock units, the mechanisms involved for acquisition

of secondary components were different. In grey limestone from the Tiverskaya series, usually only one component was isolated in single sample. Magnetic carriers represent magnetite, which occupies the SD+MD field in the Day/Dunlop plot characteristic for unaltered rocks. In red beds, the Devonian direction was isolated as a second component at the end of thermal demagnetization path. The unblocking temperature spectra for the secondary component are characteristic of fine-grained pigmentary hematite. Variscan orogeny and Upper Devonian-Carboniferous overburden involved tectono-thermal events induced by elevated heat and fluids flowing along the edge of the Trans-European Suture Zone (TESZ). The sequence of sediments along the Dniester – the younger red beds lying near to the TESZ zone and the grey limestone buried deeper than the red beds – justifies the assumption that remagnetization of red beds could be caused by fluid flows, whereas grey limestone could be remagnetized during burial diagenesis. The age of maximum paleotemperatures induced from K-Ar dating (about 300 Ma) is in excellent agreement with the pole positions of TP and UP on APWP.

Key words: Paleomagnetic study, Devonian sediments, rock and mineral magnetism, remagnetization mechanism