Ber. Inst. Erdwiss. K.-F.-Univ. Graz	ISSN 1608-8166	Band 17	Graz 2012
IGCP 580, 4th Annual Meeting	Graz, 24-30th June 2012		

Lower–Middle Devonian boundary successions in the Holy Cross Mountains (central Poland): magnetic susceptibility as a tool for a short to long distance correlation

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The reconstruction of the facies development of the Kielce Unit (southern part) of the Holy Cross Mountains (HCM) during the early stage of the Devonian transgression is the subject of the project. The magnetic susceptibility (MS) record is used as a tool for precise correlation between several 40-90 m thick shallow-marine carbonate successions to track the step-by-step evolution of the Holy Cross Mountains basin during the latest Emsian and early Eifelian.

The main changeover in the sedimentation over the HCM area occurred during the Early–Middle Devonian interval, when 'Ic' pulse of transgression broke the continental to coastal clastic sedimentation and initiated the development of the carbonate platform (SZULCZEWSKI, 1995). Before the shallow-marine carbonate facies unified over the whole area, the great diversification of sedimentary environment occurred during the early Emsian/Eifelian boundary interval. It has been expressed in visible lithological variability (geographical distribution of facies and time of their appearances) even between nearby successions.

The appearances of conodonts controlled by the facies changes, limit the use of biostratigraphy as a precise correlation tool. It permits, however, to build the general biostratigraphic framework as the base to place the MS record in selected successions. The high-resolution MS measurement (in 10 cm intervals) of about 3500 rock samples (10 to 70 g weight) was carried on in five sections from the eastern and western part of the Kielce Unit of the HCM. The MS record was used in following ways:

(1) to trace the Emsian/Eifelian boundary over the HCM area. The MS record of the conodont-marked boundary interval (traced in the Zbrza section) allowed to find the corresponding deposits in other HCM successions, where biostratigraphic data are less precise (Brzeziny and Porzecze sections). The finding of the boundary was possible within different shallow-marine facies by the identification of the corresponding MS zones. The MS record of the Emsian/Eifelian boundary from the HCM does not agree with German susceptibility magnetostratotype and records of other sections investigated by ELLWOOD et al. (2006). This seems to be caused by different MS response on sea-level fluctuations in different sedimentary environments (MABILLE & BOULVAIN, 2007; DA SILVA et al., 2009). This limits the using of the MSEC method as facies-independent stratigraphic tool.

(2) to high-resolution correlation of the HCM Upper Emsian and Lower Eifelian deposits. In generally decreasing MS magnitude (progress of Ic transgression pulse), several third (>1 Ma) to fifth order (>10 ky) trends were distinguished within 5 sections. They were correlated in agreement with conodont framework.

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