Gamma ray stratigraphy of the middle Silurian Mulde Event in the Bartoszyce IG1 borehole (NE Poland)

JAROCHOWSKA, E.[1], MUNNECKE, A.[1] & KOZŁOWSKI, W.[2]

(1) GeoZentrum Nordbayern, Fachgruppe Paläoumwelt, Universität Erlangen, Loewenichstrasse 28, Erlangen, D-91054, Germany; *e.jarochowska@student.uw.edu.pl*, *axel.munnecke@gzn.uni-erlangen.de*
(2) Faculty of Geology, University of Warsaw, 93 Żwirki i Wigury Str., 02-089 Warsaw, Poland; *woko@uw.edu.pl*

The Mulde Event (Wenlock, Silurian) is recorded globally in low to mid-latitudes as a double-peaked positive stable carbon isotope excursion, and is associated with an extinction affecting selectively pelagic and hemipelagic fauna, particularly conodonts, graptolites and marine phytoplankton. With respect to graptolites, this extinction, affecting approximately 95 % species, is known as the *lundgreni* event. The biotic crisis precedes the onset of the stable carbon isotope excursion and is recorded as three stepwise extinction events, referred to as Datum points 1, 1.5 and 2 with respect to conodonts (CALNER & JEPPSSON, 2003; JEPPSSON & CALNER, 2003) and corresponding to the (1) *Cyrtograptus lundgreni*, (2) *Testograptus testis*, and (3) *Monograptus flemingii-Pristiograptus dubius* graptolite extinctions (PORĘBSKA et al., 2004). The survival interval immediately following the final step of the extinction is characterized in diverse sections by abrupt lithological changes and the dominance of low-diversity disaster fauna.

In the Paleozoic Baltic Basin developed on the East European Craton, a detailed record of the *lundgreni* event has been provided by PORĘBSKA et al. (2004) based on the Bartoszyce IG1 borehole, drilled in the Peribaltic Syneclize, NE Poland. The rocks represent outer shelf facies: grey, sparsely bioturbated marlstones. The middle Silurian deposits accessible in this borehole have been formed in times of a rapid subsidence rate, providing a thick and continuous sedimentary record of this interval. Data from different sections in the same basin, as well as global eustatic curves, indicate very rapid regression coincident with the extinction interval. The stepwise character of the extinction might reflect not only the temporal structure of the biotic crisis, but may also result from staggering dynamics of the sea-level fall. However, apparent facies homogeneity hinders direct sequence-stratigraphical interpretations.

In order to gain insight into the changing dynamics of the deposition rate and influx of terrigenous material, we have performed spectral gamma-ray measurements on the core interval spanning the *lundgreni* to *Colonograptus praedeubeli* graptolite zones (approx. 75 m). Depending on the core completeness, measurements were collected at the resolution of one to three data points for each core meter, using a portable gamma-ray spectrometer placed in a lead-screened container. Preliminary results revealed a very low variability of K concentration in the studied interval (average 39.38 % of the total dose, SD 4.00 %) and, consequently, its low correlation with Th concentration (average 31.44 % of the total dose, SD 7.01 %). The concentrations of Th and U (average 29.04 % of the total dose, SD 7.5 %) allowed to distinguish metre-scale cycles characterized by mirrored concentrations trends: decreasing U content and increasing Th content, interpreted as shallowing-upward cycles capped with progradational surfaces. At the bottom of the *testis* biozone we have identified a pronounced flooding surface, and a major progradational surface at the boundary between the *testis* and the *flemingii-dubius* biozones, suggesting that the entire *testis* biozone corresponds to deposits of a highstand systems tract or, alternatively, of a forced regression systems tract. This interpretation would place the sequence boundary predicted by CALNER et al. (2006) at the LAD of *T. testis.* The following *flemingii-dubius* to lowermost *dubius* interval, which precedes the onset of the $\delta^{13}C$ excursion, is characterized by low total dose rates and low (depleted) Th and (baseline) U contents and the presence of laminated deposits rich in organic matter.

Through an application of spectral gamma-ray logging to provide a rough sequence-stratigraphic framework, we aim to integrate existing geochemical and biostratigraphical data with an interpretation of sea-level dynamics during the Mulde Event.

References

CALNER, M. & JEPPSSON, L. (2003): Carbonate platform evolution and conodont stratigraphy during the middle Silurian Mulde Event, Gotland, Sweden. Geological Magazine, 140: 173-203.

CALNER, M., KOZŁOWSKA, A., MASIAK, M. & SCHMITZ, B. (2006): A shoreline to deep basin correlation chart for the middle Silurian coupled extinction-stable isotopic event. GFF, 128: 79-84.

JEPPSSON, L. & CALNER, M. (2003): The Silurian Mulde Event and a scenario for secundo-secundo events. Transactions of the Royal Society of Edinburgh: Earth Sciences, 93: 135-154.

PORĘBSKA, E., KOZŁOWSKA-DAWIDZIUK, A. & MASIAK, M. (2006): The *lundgreni* event in the Silurian of the East European Platform. Palaeogeography, Palaeoclimatology, Palaeoecology, 213: 271-294.