Siluro-Devonian of Podolia, Ukraine: Paleobiological, Biostratigraphic, and Geochemical Aspects

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Source: Acta Palaeontologica Polonica, 57(4):793-794.
Published By: Institute of Paleobiology, Polish Academy of Sciences
DOI: http://dx.doi.org/10.4202/app.2012.1002
URL: http://www.bioone.org/doi/full/10.4202/app.2012.1002

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This series of papers contains the results of the research project (No. N N307 057834) from the Polish Ministry of Science and Higher Education

Preface

Acta Palaeontologica Polonica 57 (4): 793–794, 2012

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In the southern part of Podolia (southwestern Ukraine), on the steep escarpments of the Dniester River and its tributaries many prominent exposures of the Siluro-Devonian deposits are located. Because of the very complicated political history of the region investigations of them have been conducted irregularly and with long interruptions. Geologists of different nationalities have been involved but for long periods of time they did not have access to the whole territory. Initially the area was mainly studied by Polish geologists (see Szajnocha 1889; Kozłowski 1929), but only in western part of the region. Later on the investigations were conducted by geologists from the Soviet Union, including researchers from the Ukrainian Republic (see Nikifirova and Predtechenskij 1968; Nikiforova et al. 1972; Tsegelnyuk et al. 1983; Drygant 1984). Since the independence of the country (1991) the research has been carried out by Ukrainian workers (see Tsegelnyuk et al. 1983; Gritsenko et al. 1999; Drygant 2000, 2010; Voichyshyn 2011) who in recent years have often been cooperating with geologists from other countries (Uhman et al. 2004; Kaljo et al. 2007, 2012; Skompski et al. 2008; Małkowski et al. 2009; Olempska et al. 2011).

The Siluro-Devonian deposits exposed in Podolia have a total thickness in excess of 900 m, are rich in fossils and represent one of the most complete and continuous sequence of that age in the world. They provide a full record of the transition from the open marine conditions (Silurian) through marginal marine (Lochkovian) to alluvial (Old Red facies).

The main purpose of the reported project was to refine their biostratigraphy and to recognize the regional biotic response to the environmental changes influenced by the global changes in the oceanic biogeochemical cycles. However, exceptionally good preservation of the fossils in some layers also enabled some new, unexpected paleobiological observations.

Three expeditions of the Polish and Ukrainian participants of the project under the field guidance of Daniel Drygant allowed us to make the field investigations and collect samples for the geochemical, paleontological, microfacies and palynofacies investigations from fourteen sections. These samples were used in combination with materials collected during an earlier project involving the same participants sponsored by a NATO grant. Some of the results of the projects were published earlier (Małkowski et al. 2009; Baliński 2010; Olempska et al. 2011) and some are still in preparation.

Despite the great progress in the geological and paleontological recognition of the Podolian Siluro-Devonian, the region still needs comprehensive research of many intervals and still offers very attractive paleobiological perspectives.

The investigations conducted by Grzegorz Racki and co-authors were focused on the biotic response to the global isotopic events—Ireviken (early Wenlock) and Klonk (Silurian–Devonian transition). The authors came to the conclusion that the environmental evolution during the first event was not significantly influenced by the geochemical changes but was caused rather by a regional tectonic regime and eustatic sea-level fluctuations. In contrast, the perturbations of the Klonk event are reflected in carbonate crisis and significant increase of eutrophication, as well as the oxygen deficiency. The S–D environmental changes caused turnover in both groups of fauna—the benthic and pelagic. Some of the stratigraphically important brachiopod and conodont species became extinct. However, after this high stress episode, the Devonian carbonate ecosystem quickly recovered and new lineages of the both groups evolved.

The paper of Daniel Drygant and Hubert Szaniawski is devoted to the evolution of the early Devonian conodonts and the refinement of the Lochkovian biostratigraphy based on the fossils. Especially thoroughly investigated were the lowermost and the uppermost parts of the marine Lochkovian sequence, representing the S–D transitional beds and the uppermost marine Devonian beds preceeding ingression of the Old Red facies. The investigations enabled conodont zonation of the Podolian Lochkovian and its correlation with other regions, as well as the description of two new conodont species of potential importance for stratigraphy.

Paweł Filipiak and co-authors have made palynological and microfacies investigations of the upper part of the two sections in which the uppermost marine deposits occur. The authors stated that the taxonomic diversity of acritarchs decrease along the upper part of the section and that the chitinozoans gradually disappear, while the frequency of leiospheres increase. This shows a regressive environmental change, toward more brackish conditions. Also the changes in limestone microfacies demonstrates progressive transition from the shrinking, marine basin toward the brackish, muddy lagoon.

http://dx.doi.org/10.4202/app.2012.1002

Victor Voichyshyn and Hubert Szaniawski described, for the first time from Podolia, a dentigerous jaw bones of the earliest jawed fishes—the Acanthodi. One new genus and one new species were established. Besides these, three species are also described in open nomenclature. Certain morphological features are recognized as important for generic and specific diagnosis. Good preservation of the jaw bones is probably caused by secondary mineralization.

Andrzej Baliński presents the first detailed description of brachiopods from the classic and well dated section across the Silurian–Devonian boundary at Dnistrove. The author stated that the latest Silurian brachiopods represent an impoverished and relatively deep-water assemblages whereas the early Lochkovian reveals progressively improved conditions for these sessile shelly faunas. Two species, *Dayia bohemica* and *Dnestrina gutta* can be regarded as characteristic for the uppermost Silurian. Two new species and one new subspecies are established.

Ewa Olempska described the three-dimensionally preserved colonies of boring ctenostome bryozoans and microborings of "fungi". This is the first record of soft-tissue fossilization of boring bryozoans. The exceptional preservation is resulted by secondary phosphatization. New genus and species are established. Besides, described are phosphatized fungi-like endoliths co-occuring with the bryozoans. The material has been obtained by processing of the limestone samples in acetic acid.

All the results came into being thanks to the cooperation of the Institute of Paleobiology of the Polish Academy of Sciences and State Museum of Natural History of National Academy of Sciences of Ukraine and have been supported by the Polish Ministry of Science and Higher Education (grant no. N N307 057834).

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