



## The Late Devonian bio-crisis and brachiopods: Introductory remarks

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The aim of this volume is to present the extinction and survival patterns of articulate brachiopods, in particular the demise of Atrypida near the Frasnian-Famennian (F-F) boundary in the Northern Hemisphere. During the Late Devonian there was a decline of low-latitude stromatoporoid-coral reefs and shelly benthic faunas, within which the reef-related articulates are commonly cited as one of the major victims of this mass extinction (see e.g., McGhee 1996; Walliser 1996). However, the decline phase in atrypid history has been until now only erratically recognized and no detailed documentation at the species level has been performed (Copper 1986; Racki *et al.* 1993).

The starting point for the comprehensive palaeontological investigation presented in this volume are the Devonian fossiliferous sequences of the Holy Cross Mountains (Central Poland), which have been extensively studied for many fossil groups with regard to facies and ecostratigraphical aspects (Racki 1990; Racki *et al.* 1993). Preparation of the papers presented here was possible due to the research project directed by Grzegorz Racki during 1993–1996, funded by the State Committee for Scientific Research (6 P201 019 05), which enabled an extensive international cooperation of brachiopod specialists from Poland, Belgium, Russia, China, Canada and USA.

In this issue, a summary of the late Givetian and Frasnian atrypid stratigraphy and taxonomy is given for Central and Western North America, followed by surveys of late Frasnian atrypids for the Ardennes, for the Holy Cross Mountains, for the South Urals, South Timan and Kuznetsk basins, and for South China; the last area is of crucial significance for a discussion of possible Famennian atrypid refuges. In addition, the progress in study of common athyridids and rhynchonellids from the Holy Cross Mountains resulted in two papers that contributed to elucidation of the apparent continuity of these articulate orders across the F-F boundary, especially within still poorly known deeper-water brachiopod biofacies (see Racki *et al.* 1993). The general evaluation of the F-F mass extinction and the concluding review of the data available for the Late Devonian benthic extinction and survival, are focused on the pattern of atrypid demise.

The volume is not intended to be an exhaustive review of Late Devonian brachiopod taxonomy, and overall diversity and extinction all around the world. I hope that the detailed regional analyses presented here are the first step in understanding the extent and causation of the major Late Devonian bio-crisis. The terminology used in this volume is as follows (Fig. 1):

**Kellwasser (KW) Crisis.** — The late Frasnian to earliest Famennian stepdown biotic turnover, manifested primarily during the two late Frasnian eustatic-hypoxic Kellwasser events (Schindler 1993), that culminated in the presumed ecosystem collapse near the F-F transition (F-F Event *sensu stricto*; see Walliser 1996). It is emphasized that a complex combination of profound sea-level and climatic variations, with concomitant nutrient poisoning and mostly related anoxia, as well as rapid tectonic subsidence, was the most probable immediate cause of the collapse of Frasnian carbonate ecosystems (see discussion in Copper 1998; Racki 1998, in press).

**Lower Kellwasser (KW) Event (= Late Frasnian Event; Walliser 1996).** — Hypoxic-transgressive pulse in the early Late *Palmatolepis rhenana* Zone, recorded in the Lower KW Horizon (Limestone).

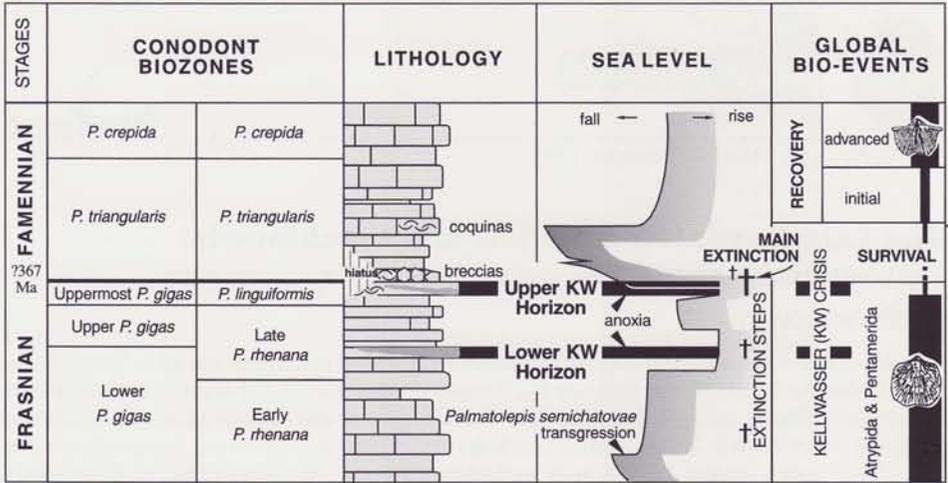


Fig. 1. Diagram presenting principal features of the Frasnian-Famennian event stratigraphy, showing composite sedimentary record, and major eustatic and biotic events (based on Racki in press: fig. 6), with reference to the global brachiopod succession.

**Upper Kellwasser (KW) Event.** — Catastrophic hypoxic episode in the late *Palmatolepis linguiformis* Zone, paired with profound eustatic fluctuations (rapid sea-level rise quickly reversed in a catastrophic fall; Sandberg *et al.* 1988, 1992), recorded in the Upper KW Horizon (Limestone).

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# Location of studied areas presented in this issue against the Late Devonian (363.0 Ma) palaeogeography

*Courtesy of J. Golonka, adapted*

