INAND OUT-OF-SEQUENCE EVENT STRATIGRAPHY ACROSS THE DEVONIAN–CARBONIFEROUS BOUNDARY – A VIEW FROM THE SHELF IN S BELGIUM

Julien DENAYER[(1,@)], Bernard MOTTEQUIN[(2)], Cyrille PRESTIANNI[(2)], Edouard POTY[(1)]

[(1)] Université de Liège (Belgium)
[(2)] Institut royal des Sciences naturelles de Belgique (Belgium)
[(@)] julien.denayer@ulg.ac.be

The Devonian-Carboniferous Boundary (DCB) is known to be associated with one of the 'Big Five' extinctions of the Phanerozoic. It was also a time marked by a rapid change in deposition called Hangenberg event. In pelagic sections, the succession displays (1) an anoxic black shale unit (Hangenberg Black Shale HBS) recording the main extinction phase, (2) the Hangenberg Shale (HS), not anoxic, (3) the Hangenberg Sandstone (HSS), and (4) the Stockum Limestone (SL). The succession was interpreted as a transgressive pulse (HBS) followed by a rapid regression (HSS) and by the return to normal conditions of deposition. Consequently, the HSS was regarded as a sequence boundary. In Belgium, the DCB transition is well exposed in shelf settings and the HBS-SL interval corresponds to c.25 m of mixed carbonate-siliciclastic deposits, whereas in the French and German pelagic sections, the events are condensed in a c.4 m-thick succession. Events are thus best developed and separated in the Belgian neritic sections than in pelagic ones where they appear superimposed to each other. The latest Devonian Comblain-au-Pont Fm recorded a 3rd-order transgression that produced a switch from coastal siliciclastic to proximal carbonate-siliciclastic deposits with an increase of the carbonate content. This trend continues up to the lower member of the Hastière Fm (lowermost Tournaisian). Hence the Comblain-au-Pont and lower Hastière formations are regarded as the TST. The HST corresponds to the massive crinoidal rudstones of the middle member of Hastière Fm. The latter is capped by an erosion surface that is interpreted as the 3rd-order sequence boundary. The next sequence starts with the upper member of the Hastière Fm which is typically made of thin-bedded subnodular and crinoidal packstone. It grades into shale with the Pont d'Arcole Fm that recorded the maximum flooding zone of the sequence. Superimposed to the 3rd-order sequences are particularly well marked orbitally-forced precession cycles of c. 18.6 ka, appearing as regular c. 40 cm-thick couplets of limestone/calcareous shale beds. These couplets are interpreted as cycles deposited during alternations of dry periods (limestone) and wet periods (shale). The HBS event is variously developed in thickness and is sometimes not marked on shallow platforms. This local absence has often been interpreted as a stratigraphic gap. It is however more likely that the anoxic facies were triggered by a transgressive pulse that locally did not spread into shallow-water environments where carbonate facies rich in benthic fossils continued to develop. The HSS event, recorded as a sandstone bed in pelagic sections, is variously recorded at the base of the Hastière Fm in S. Belgium, either as a bioturbaded sandy siltstone bed in proximal sections, or as a horizon with limestone clasts and reworked fossils in more distal ones. This event was responsible for the final demise of the Late Devonian faunas. The HSS occurs sharply in the stratigraphic record and does not correspond to the long sea-level fall of a 3rd-order sequence boundary, but most probably to a short out-of-sequence event. After this short-lasting regressive phase, 'normal' settings returned with the deposition of the Hastière Fm.