Orbitally forced sequences in the Lower Carboniferous and the onset of Carboniferous glaciations at the Tournaissian Viséan boundary

Edouard Poty, Bernard Mottequin, Julien Denayer

Unité de paléontologie animale et humaine, Université de Liège, Allée du 6 août, Bâtiment B18, Sart-Tilman, B 4000 Liège 1, Belgium. E-mail: e.poty@ulg.ac.be; bмоттеquin@ulg.ac.be

Investigations realized in the Belgian Tournaissian and Viséan to record the sedimentary cycles allowed to the recognition of eustatic third-order cycles (Hance et al., 2002), which were later extended to Poland and South China. Most of them could correspond to eccentricity cycles, of about 2.4 Ma (Poty et al., 2013). Shorter cycles were also recognized and differences in their nature and stratigraphic distribution were enhanced. The Lower Tournaissian (Hastarian substage) and the lower part of the Upper Tournaissian (Ivorian substage) show only short cycles, not grouped in bundles, considered as due to only one orbital parameter corresponding to precession cycles (Poty et al., 2013). They correspond to alternations in monsoon and dryer climates, without strong marked changes in the sea level. Similar cycles are recognized in the rest of the Upper Tournaissian.

The latest Tournaissian third-order sequence (sequence 4 of Hance et al., 2002) is characterized by a very high high-stand system tract, and a flooding of lowlands previously emerged (« Avins event » of Poty, 2007). This very high sea level caused good connections between marine basins, and thus favours the widespread of foraminifers, brachiopods and corals, through Australia, Japan, China, and the rest of Eurasia. Its falling stage systems tract is characterized by a very strong fall in the sea-level and is considered as corresponding to the development of an ice-cap and to a heralding change to the Carboniferous climate with glaciations. This low sea-level persisted during the earliest Viséan, and the third-order sequence 5 of Hance et al. (2002) never reached the shallow marine platforms previously covered by the latest Tournaissian sea. It is from the base of this third-order sequence 5 that a marked fourth (obliquity) and/or fifth-order (eccentricity) cyclicity developed. These latter sequences are the same than the ones recorded in the Middle (Livian substage) and the Upper Viséan (Waramuntian substage). The transition between the Tournaissian monsoon climate and the Viséan climate with glaciations is well documented in sections in the Dinant vicinity where the Tournaissian precession cycles passe to eustatic obliquity-eccentricity cycles.

Therefore, it can be concluded that the onset of the Carboniferous glaciations is as early as the Early Viséan and not in the Late Viséan as usually considered.

References

