

Palaeoecology of the Upper Tournaisian crinoidal limestones of S Belgium

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The Tournaisian stage is often considered as the golden age of crinoids. In southern Belgium, upper Tournaisian crinoidal limestones are known in the Condroz area (Ourthe Formation) and in the Soignies area (Soignies Member), where it was quarried as a building and carving stone under the name “Petit Granit”. Despite its apparent monotony, five crinoidal and peloidal wackestone to grainstone microfacies are identified throughout the unit. The crinoidal limestone deposited as amalgamated tempestites that accumulated under the fair-weather wave base along a gently sloping shelf. An estimation of the crinoid carbonate production rate in both sedimentation areas was calculated based on geological and biological hypothesis. A value of c. 1200 cm³/m².y is proposed for the Ourthe Formation, based on an assumption that the density of crinoids was 15 individuals per square metre. The crinoid density was lower in the HSA possibly due to its deeper situation, as also suggested by the dominance of wackestone-packstone microfacies. Isopach map shows that the Ourthe Formation reaches a maximal thickness in the Ourthe valley area and thins westwards and northwards. These local variations in thickness are tentatively interpreted by variations in subsidence due to synsedimentary block faulting.

The modern taxonomy of crinoids is based on the morphological characters of the crown (calyx, arms), but complete calyxes are extremely rare in the “Petit Granit” due to hydrodynamic disarticulation. Hence, the parataxonomy based on the morphology of columnals, developed by MOORE & JEFFORDS (1968), was used on disarticulated crinoid columnals in thin sections. Though not perfect, this analysis provides a good rough approach of the diversity. It reveals an unexpectedly diverse crinoidal meadow where several genera and species co-existed. The identified crinoid taxa are of several size classes and were seemingly distributed following a vertical tiering model to maximise the capture of food particles from the water column. Moreover, it appears that the taxonomic composition of the meadow evolves vertically during the deposition of the “Petit Granit”.

Beside the crinoids, the fauna was dominated by suspension feeders (brachiopods, bryozoan, sponges, tabulate and rugose corals) adapted to an agitated environment and a relatively soft ground. The trilobites and palaechinids were the dominant benthic macrophages, the latter being known as a predator of crinoids. Rare nektonic predators (holocephalan chondrychthian, actinoceratoids) were occasional dwellers of the crinoidal meadows showing that the ecosystem was relatively complex. Moreover, it witnesses the recovery of the marine environment after the collapse of the reefal ecosystem at the end of the Devonian, when the echinoderms became the dominant carbonate producer in neritic environments, replacing the stromatoporoids.

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MOORE, R.C. & JEFFORDS, R.M. (1968): Classification and nomenclature of fossil crinoids based on studies of dissociated parts of their columns. – *University of Kansas, Paleontological Contributions, Echinodermata*, **9**: 1–86.