Les événements du passage Domérien-Toarcien entre Téthys occidentale et Europe du Nord-Ouest

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New paleontological, biostratigraphic and geochemical data around the Domerian-Toarcian boundary were collected in northern Midlle-Atlas (Morocco) and the Causses Basin (France). These detailed accounts are integrated in a wider paleogeographic framework (litterature survey and original observations) so as to sketch a revised and uniform stratigraphic scale at the substage and zonal level for the studied interval. However, this empirical and provisory zonation still needs refining and testing with Unitary Association methodology, as well as updating of taxonomic and stratigraphic data from crucial regions (e.g. Portugal).
Faunal revisions and correlations revealed an important stratigraphic gap from Uppermost Domerian to Lowermost Toarcian in European epicontinental seas. Due to this hiatus, lithological and biological changes may seem synchronous in NW-Europe, whereas they are clearly diachronous in peri-tethyan context. This first major crisis is linked to a brief Upper Domerian regressive episode and lead to partial exundation of European basins. The extinction of boreal ammonites (Amaltheidae) is clearly linked to the regression, while Tethyan Arieticeratinae and Protogrammoceratinae are still diversified (covariation) before disappearing too. Dactylioceratinae radiate in southern regions at the very end of the regressive trend. Their sudden appearance define the base of the Toarcian stage, preceding or accompanying the collapse of the carbonate productivity (transition to pelitic sedimentation, shift and fall of carbon isotopic ratios).
In Lower Toarcian times, ammonites follow the well-known transgression to conquer and radiate into European basins. Their evolution is controlled by covariation patterns and follows the generalised version of Cope's rule (size increase accommodated by changes in coiling).
As another consequence of sea-level rise, oxygen becomes exhausted through recycling of the organic matter accumulated by vegetation during low stand. The oceanic anoxic event (OAE) thus triggered, leads to a second faunal crisis. This extinction affects benthic organisms mainly. It is also recorded in the carbon isotopic record, as an almost synchronous positive peak at the global scale (huge quantities of «light» carbon were trapped in black shales).
Therefore two successive crisis have to be distinguished, differing in their causes and consequences :
- climatic cooling culminating in a glaciation and regression at the Domerian-Toarcian boundary favour benthos development, whereas ammonite respond to stress by diversification and/or extinction depending on their paleobiogeographic distribution
- in Lower Toarcian, complex climatic balancing lead to greenhouse conditions and transgression. Benthic organisms disappear due to the development of anoxia.
The short-lived activity of the Karoo-Ferrar large igneous province (LIP) is most probably the starting point of and common element between both crises. We propose a logical sequence of causes and consequences for this Domerian-Toarcian transition. The complex interplay of lithospheric, hydrospheric and biospheric factors result in a drastic global disturbance of bio-geo-chemical cycles, whose effects are eventually modulated by regional or local peculiarities.