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Tracing of palaeoenvironmental changes during Jurassic in the Paris Basin: contributions of organic geochemistry

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During Jurassic, a tropical climate, a high atmospheric CO_2 level and a low bathymetry generate a significant carbonate production in the Paris Basin. However, this carbonate production is periodically interrupted by several episodes of clay sedimentation. These alternations of sedimentation follow a 2nd order cyclicity and the origin of these sedimentological changes remains unclear. To understand the control of these alternations, molecular biomarkers preserved in these deposits were studied. The detailed study of the molecular biomarkers preserved in these sedimentary rocks provides some relevant palaeoenvironmental and diagenetic information.
Jurassic deposits of the East and the North of the Paris Basin were investigated by Andra (the French National Radioactive Waste Management Agency) via different cores, like E432, E433 and A901. The composition of molecular biomarkers of these different cores was studied. Several events were recorded :
- three episodes of water anoxia in the lower Toarcian, the upper Bajocian and the middle Callovian. They were highlighted by the presence of the derivatives of isorenieratene (exclusively synthesized by anoxygenic sulfur bacteria) and a higher abundance of C35-hopane to that of C34-hopane. These three periods of anoxia could potentially be the cause of the interruption of carbonate production and the transition to clay sedimentation ;
- palaeofloristic changes materialized by variations in the distribution of vascular plant biomarkers. In this study, cadalene (Ca) and retene (Re) were specifically used. The former is a generic vascular plant biomarker, while the latter is more specific for conifers. A significant increase of the retene/cadalene ratio (Re/Ca) is synchronous with the installation of the Dogger and Oxfordian carbonate platforms. In the same way, a significant decrease of this ratio is correlated with the disappearance of these carbonate platforms. In addition, a more detailed study of vascular plant biomarkers has demonstrated that the increase of the Re/Ca ratio could be attributed to an increase in the Pinaceae (a conifer family) proportion in the continent, that reflects an increase in aridity (Hautevelle et al., 2006).
Furthermore, many similarities in the evolution of the Re/Ca ratio through Jurassic between the Paris Basin and the Carnarvon Basin (Australia; van Aarssen et al., 2000) show that a global climatic control may be recorded by biomarkers and could be responsible for the installation/disappearance of Jurassic carbonate platforms.
So, the study of molecular biomarkers has helped to highlight paleoenvironmental changes (water anoxia, climate fluctuations), which may explain the origin of these alternations of carbonate/clay deposits during the Jurassic in the Paris Basin.

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