

The organic record of Oceanic Anoxic Events: Toarcian vs Cenomanian-Turonian

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Abstract

The Mesozoic is marked by periods of profound climatic and paleoceanographic changes of the planet, representing major environmental perturbations and global carbon cycle disturbances, the so-called oceanic anoxic events (OAEs). These events are usually characterized by the deposition of sediments rich in organic matter (OM) which further validates the importance of the characterization of these organic records (e.g. Jenkyns, 2010). Furthermore, the high variability in the expression of these global events could be related to regional factors, which can be assessed through the study of the organic fraction of these records. With these premises is made a discussion about the organic variability, especially focused on petrographic observations, of two major OAE's that differ in origin, extension and geochemical signature, the Toarcian (T-OAE) and the Cenomanian-Turonian (OAE2) events.

For the T-OAE is analyzed a N-S transect of the Toarcian epicontinental seaway to enable the establishment of relationships of confinement, salinity and OM concentration. For the OAE2 the focus is on sections recording the Atlantic and Tethyan affinities to discuss the origin of the anoxia. The T-OAE organic record is characterized by the already established trend in TOC (van de Schootbrugge et al., 2005), with higher values being present in the more northern basins of the European epicontinental seaway (e.g. Dotternhausen) and diminishing towards the south, with lower values registered in the more external basins (e.g. Lusitanian Basin). This is coupled by a decrease in the degree of amorphization of the OM, and a variation in the origin of the

amorphous OM, that culminates in its disappearance in the more external Lusitanian Basin (Fonseca et al., 2018; Rodrigues et al., 2016).

The OAE2 organic record is marked by high variability, especially connected to differences in oceanic circulation dynamics that differ in the Tethyan and Atlantic domains (e.g. Trabuco-Alexandre et al., 2010). The TOC content of this event reaches higher values than the ones associated with the T-OAE (>30 wt.%), with the organic associations being dominated in the majority of the sections by amorphous OM. Nevertheless, the origin of this component differs and is very much controlled by local conditions. Differences in productivity, connected to the occurrence of intense upwelling in the Atlantic domain, are also observed.

The organic facies variability and the differences in paleoenvironmental depositional contexts observed in the studied sections are associated with the regional character of both the T-OAE and the OAE2. These are mainly attributed to differences in paleogeography, paleogeomorphology and oceanic circulation patterns. Furthermore, there are clear differences in the organic content of both events, showing that is not only their origin, extension and geochemical characteristics that differ but also their organic signature.

References

- Fonseca, C., Mendonça Filho, J.G., Lézin, C., Duarte, L.V., Fauré, P., 2018. Organic facies variability during the toarcian oceanic anoxic event record of the Grands Causses and Quercy basins (southern France). *Int. J. Coal Geol.* 190, 218-235.
- Jenkyns, H.C., 2010. Geochemistry of oceanic anoxic events. *Geochem Geophys* 11, Q03004.
- Mendonça Filho, J.G., Gonçalves, P.A., 2017. Organic matter: concepts and definitions, chapter 1. In: In: Suárez-Ruiz, I., Mendonça Filho, J.G. (Eds.), *Geology: Current and Future Developments. The Role of Organic Petrology in the Exploration of Conventional and Unconventional Hydrocarbon Systems*, vol. 1. Bentham Science Publishers, United Arab Emirates, pp. 1–33.
- Rodrigues, B., Duarte, L.V., Mendonça Filho, J.G., Santos, G.L., Oliveira, A.D., 2016. Evidence of terrestrial organic matter deposition across the early Toarcian recorded in the northern Lusitanian Basin, Portugal. *Int. J. Coal Geol.* 168, 35-45.
- Trabuco-Alexandre, J., Tuenter, E., Henstra, G.A., van der Zwan, K.J., van de Wal, R.S.W., Dijkstra, H.A., de Boer, P.L., 2010. The mid-Cretaceous North Atlantic nutrient trap: Black shales and OAEs. *Paleoceanography* 25, PA4201.
- van de Schootbrugge, B., McArthur, J.M., Bailey, T.R., Rosenthal, Y., Wright, J.D., Miller, K.G., 2005. Toarcian oceanic anoxic event: An assessment of global causes using belemnite C isotope records. *Paleoceanography* 20, PA3008.