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Seasonal to "daily" growth bands in modern and fossil oyster shells detected by cathodoluminescence analyses. A time model for isotopic sclerochronology and paleoenvironmental reconstructions.

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Crassostrea oysters have been a common inhabitant of coastal and estuarine waters since Cretaceous. Their wide latitudinal distribution allows their shells to be used as an archive of paleoenvironmental variations. Physical and chemical record of oyster shells contains precious information on seawater temperature, salinity, eutrophication rate or metal concentrations. However, morpho-structural accretionary growth structures of the oyster shells cannot give all the time an evident sclerochronological profile, due to predation impact or ecophenotypic variation. Thus, we develop a powerful tool in order to identify a chronological scale during the growth of the shells.

A genetically homogeneous population of the *Crassostrea gigas* oyster from the French coasts was bred on different types of estuarine embayment along a large latitudinal gradient. At the same time, a daily control of environmental conditions (temperature, salinity, chlorophyll a, chemical and isotopic composition of sea water) was carried out. An experimental staining by Mn^{2+} was monthly performed to have a precise temporal marking during shell growth.

The cathodoluminescence (CL) analysis of the hinge section of the shells reveals seasonal, lunar, semi-lunar and "daily" natural fluctuations of the luminescence, which

is mainly controlled by seawater temperature changes. This sclerochronological approach offers new prospects in the study of modern and fossil mollusc shell population dynamics. Moreover, this process facilitates a microsampling strategy for the biogeochemical analyses of the shells. The comparison of the high resolution δ^{18}O and δ^{13}C profiles with measured seawater parameters confirms that:

1. the oxygen isotope composition is a reliable proxy for seasonal seawater temperature, even if the juvenile part of the shell seems to be affected by strong kinetic effects, related to ontogenetic processes.

2. the record of the shell δ^{13}C is mainly controlled by dissolved inorganic carbon isotope composition. Nevertheless, other factors like trophic conditions (i.e. quantity and quality of food supplies) could influence oyster δ^{13}C.

This approach was still conducted on a fossil oyster shell from the Thanetian of the Paris Basin. The CL of the shell of *Ostrea bellovacina* reveals similar fluctuations of the luminescence than in modern oysters. Deduced sclerochronological profile leads an estimation of 15 years life-span for this specimen and gives a precise chronological scale for isotopic investigations. The δ^{18}O seasonal contrast shows amplitude that cannot be attributed only to the summer – winter temperature range. In the tropical context of the Paris Basin during Paleocene, we also suspect a seasonal variation of salinity, probably controlled by tropical monsoon rainfalls.