Scallop shells as geochemical archives of paleo-ecological processes in temperate coastal ecosystems

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Résumé

It is now widely accepted that human activities affect the structure and functioning of coastal ecosystems. One of the most significant consequences are related to changes in nutrient input that can induce changes of trophic conditions (up to eutrophication) and disturbances of phytoplankton dynamics, keystone of the functioning of coastal ecosystems. This includes changes in primary production levels, in bloom frequency, and in the composition of microalgal communities.
However, this global outlook conceals major temporal and spatial disparities. As conventional monitoring time-series are quite sparse and scattered, biological records of environmental variability are relevant tools to gain insight into phytoplankton dynamics over larger temporal and spatial scales. In this context, bivalve mollusk shells, and especially scallops (Pectinidae), appear as valuable biogenic archives as they form their external calcium carbonate skeleton periodically, leading to the formation of concentric growth lines that can be used as chronological landmarks.

Here, we present results of a interdisciplinary project (EVECOS-CHICOS) dealing with skeletal growth rates and geochemical information archived in shells of the great scallop Pecten maximus in the Bay of Brest (France). This species is known to form daily growth lines between March and November visible on its shell surface.
Several scallops were collected each year since 1987 in the Bay of Brest in order to investigate their daily shell growth rates over the year. In addition, some of them were analyzed for their shell geochemical composition. We focus here on results dealing with carbon and oxygen isotope composition, and barium, lithium, and molybdenum concentrations in shells. Comparison of these high-resolution geochemical time-series with results of extensive environmental surveys of physical, chemical and biological parameters carried out in the Bay of Brest with a weekly resolution highlighted that temperature, hypoxia and phytoplankton dynamics can explain the incorporation of these elements and isotopes in shells, that can in turn be used as powerful archives for paleo-ecological processes in coastal waters.

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