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Strong kinetics effects on Sr/Ca ratios in the calcitic bivalve *Pecten maximus*

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Many studies have shown that Sr/Ca ratio in abiogenic calcite is not thermodynamically controlled, but is kinetically controlled, opposite to what is found in most biogenic and abiogenic aragonite [1]. However, to date, no studies have proved the existence of such a kinetic effect in calcitic bivalve shells (e.g., [2, 3]).

In the present study, Sr/Ca ratios have been analyzed by high resolution ICP-MS (HR-ICP-MS) in the shell of 4 juveniles (age class I) of the calcitic bivalve *Pecten maximus*. Daily shell growth of this species has been extensively studied over the past ten years [4, 5]. In particular, this species shows distinct decreases of shell growth due to phytoplanktonic events during the annual cycle. This offers the unique opportunity to discriminate environmental (temperature, salinity) versus kinetic controls on shell Sr/Ca ratios at the growth microstriae level.

We found that Sr/Ca ratios were variable among individuals that grew at the same location and time, illustrating that a biological rather than an environmental control must occur. Although daily growth rate is correlated to shell Sr/Ca ratio, it explains only half of the shell Sr/Ca variations ($p<0.0001$, $r^2=0.53$). Combining both daily grow rates and shell size better predicts the Sr/Ca ratios of the different individuals ($r^2 = 0.74$), suggesting that kinetic factors are not only related to a linear daily shell growth extension, but also to the total quantity of carbonate precipitated for a given day. Finally, a combination of these two parameters (shell size and daily growth in-

crement) in a ‘shell surface area daily increment’ explains 74% of Sr/Ca ratios in the shell of *P. maximus* juveniles ($p<0.0001$). In contrast, the addition of salinity, temperature and shell Mg/Ca ratios only improved the model by 5%, confirming the weak environmental control on Sr/Ca partitioning in calcitic bivalve shells.

[1] Morse & Bender 1990 Chem. Geol. 82 : 265-277; [2] Klein et al 1996 GCA 60: 4207-4221 ; [3] Vander Putten et al 2000 GCA 64:997-1011; [4] Chauvaud et al 1998 JEMBE 227 : 83-111 ; [5] Lorrain et al 2000 JMBA UK 80: 667-673.