Preliminary study of growth increments of the Peruvian mollusc shell *Trachycardium procerum* (Bivalvia) throughout the last half-million years

Gosselin M.J.[1, 2], E.Fernandez[3], N. Guzmán[1], C.E. Lazareth[1], L. Ortlieb[1]

(1) IRD, PALEOTROPIQUE, Centre IRD d'Ile de France, 32 avenue Henri Varagnat, F-93 143 Bondy Cedex (France).
(2) ED 392 Diversité du vivant, Université Pierre et Marie Curie, Bât A, Et 4, Pte 407, Case 057, Quai St Bernard, F-75252 Paris Cedex 05 (France).
(3) IMARPE Instituto del Mar del Peru, Esq. Gamarra y Gral Valle S/N, Chucuito, Callao - Apartado postal 22, Lima (Peru).

INTRODUCTION

Bivalve shell as proxy of El Nino event

Bivalve shell can be used to reconstruct recent and past environmental variations at high-resolution time scale. During processes of growth increments, carbonate structure can record daily to seasonal information on environmental variations such as food supply, water temperature or chemical composition.

One important cause of global climate variability, intensively manifested every few years in the East Pacific, is the El Niño phenomenon (EN). Along the Peruvian coasts, positive sea surface temperature anomalies reaching several degrees during few months severely affect the nearshore environment and local ecosystems.

Since the beginning of the 80's many scientists are dedicated to the understanding and modelisation of this phenomenon in the aim to anticipate its occurrence and thus limit and reduce its ecological and socio-economical impacts.

Trachycardium procerum

To investigate the occurrence and intensity of past EN events, scleroclimatological studies are developed on several species of coastal molluscs.

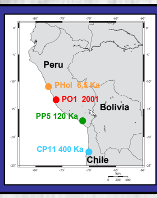
The marine bivalve *Trachycardium procerum* is a subtidal filter feeder living in muddy shallow bays and presents interesting characteristics for sclerochronological tool :

- it is found in numerous fossil assemblages on Peru and Chile coasts.
- its growth rhythm is sensitive to ecological variations and well adapted to environmental changes occuring during EN events.

Actual distribution of *T. procerum*

OBJECTIVES

To investigate the potential of *T. procerum* as a recorder of El Niño events, the structure of Quaternary shells from different time periods has been studied (2005 AD, 2001 AD, 6 500 BP, 120 000 years and 400 000 years).



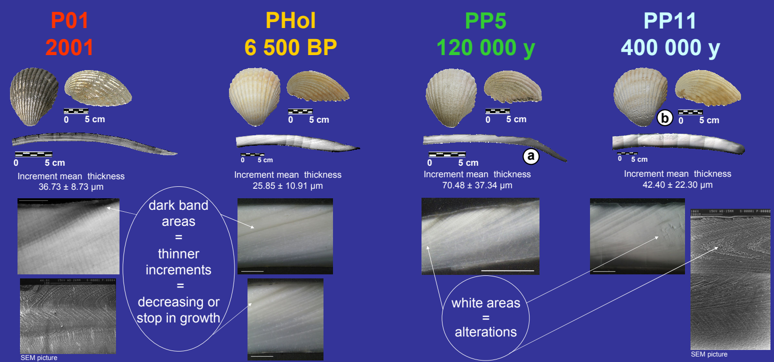
In this preliminary sclerochronological study we assessed :

1. the shell capacity to preserve the reading of growth line patterns whatever its age.
2. the daily growth pattern of a marked modern shell and ancient shells.
3. the diagenetic evolution of ancient shells with the purpose of future geochemical investigations.

RESULTS

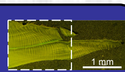
1 To study growth lines, thin sections of shells were prepared. Each valve was cut perpendicularly to the axis of maximum growth using a linear precision saw. One half valve is glued on a glass slide with epoxy resin and cut again to obtain shell slices of 300-700 µm thick. Then, thin sections were polished with decreasing size grits from 70 to 1 µm.

Slides were observed under an optical microscope (magnification 40-100x) and a scanning electron microscope (SEM) to investigate growth patterns and shell microstructures.



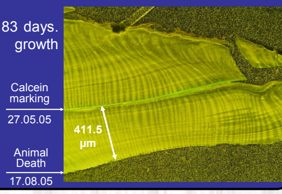
Except for change of growth orientation (PP5, a) or some surface damage (PP11, b) no major morphological differences were found between the four shells at the macroscopic scale. Shell thin sections present all similar growth line patterns. Growth decrease could be linked to environmental stress like temperature and oxygen variations or to a change in physiological parameters like filtration or reproduction.

2 *T. procerum* from Lagunillas (Peru, 2005) marked with calcein (50 ppm) during 3 hours. Thin sections are observed under fluorescence blue light (460-490 nm).



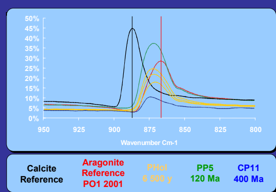
Shell grew 411.5 µm during 83 days. 40 pairs of black/white growth increments were observed.

A daily growth increment of 5.14 ± 2.89 µm was formed during a three-month period in austral fall-winter season.



3 A Fourier Transform InfraRed (FTIR) has been used to reveal qualitative mineralogical composition of shells. FTIR spectra of punctual samples were acquired and compared to aragonite and calcite reference spectra to check if diagenetic processes have affected the studied shells.

P01 has a characteristic aragonite spectrum. Within the same shell, FTIR spectra are quite homogenous. The studied shells present lightly different spectra compared to the reference signal, probably due to presence of minor elements. However no calcite has been observed even in the oldest shell CP11 (400 MA).



CONCLUSION

1 Growth lines are still readable for all Quaternary shells of the Peruvian bivalve *Trachycardium procerum*. Thus, this species can be used as a good sclerochronological tool. Moreover, variations observed in growth cycles, resulting of environmental events, open perspectives in the study of El Niño events.

2 Modern marked shells exhibit a mean increment thickness of 5 ± 3 µm. This result is lower than the 46 ± 27 µm found in ancient and non marked shells. Effort should be made on methods to both develop a minimum stressing marking technique and to standardize inter-shell measures of increment growth.

3 Some structural alterations have been observed, particularly in Pleistocene shells (PP5, PP11). Even if alteration partially hide the growth increments, shell is still compose of aragonite form.

Microstructures have been relatively well preserved in the last few hundred thousand years, but increasing number of morphological alterations observed in older shells might impose to be careful if geochemical investigations have to be done on the shells.

This study was financed and conducted in the frame of the EU-project CENSOR (Climate variability and El Nino Southern Oscillation:Impacts for natural resources and management, contract 511071) and is CENSOR publication 0034.

Gosselin Marc, Fernandez E., Guzman Nuria, Lazareth Claire E., Ortlieb Luc (2006)

Preliminary study of growth increments of the peruvian mollusc shell Trachycardium procerum (Sowerby, 1833)(Bivalvia) throughout the last half-million years

In : Malchus N. (ed.), Pons J.M. (ed.) International congress on bivalvia : abstracts. Organisms Diversity and Evolution Electronic Supplement, 6 (4; suppl. 16), 39

International Congress on Bivalvia, Barcelone (ESP), 2006/07/22-27

ISSN 1439-6092