# A new method for high-resolution bivalve growth rate studies in hydrothermal environments

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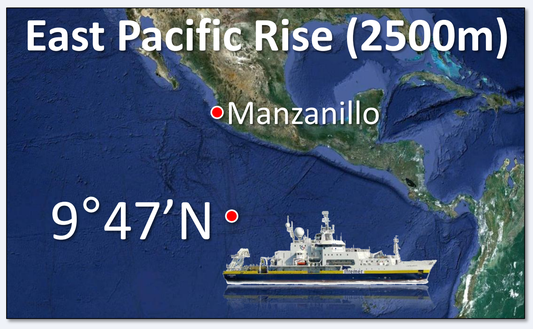
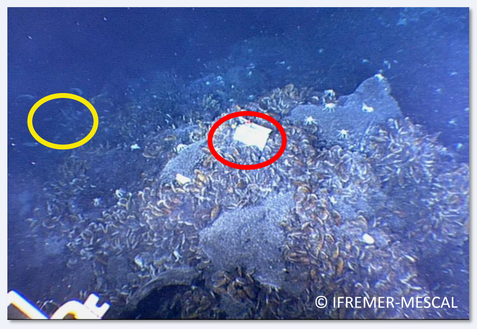
**The chemosynthetic fauna hosted by hydrothermal vents rely on highly variable energy supply.**

Among them, *Bathymodiolus* species usually dominate diffuse vent habitats, but little is known regarding their age and growth rates. Using for the first time *in situ* chemical staining combined with high-resolution microincrement analyses, this study allowed to describe shell growth patterns of *Bathymodiolus thermophilus* from the East Pacific Rise (EPR). The method will be used to investigate the relationships between the shell growth and the variability of the environmental conditions.

## SAMPLING SITE

Sampling was performed in the center (red circle) and at the periphery (yellow circle) of the mussel clump at an integrated study site.



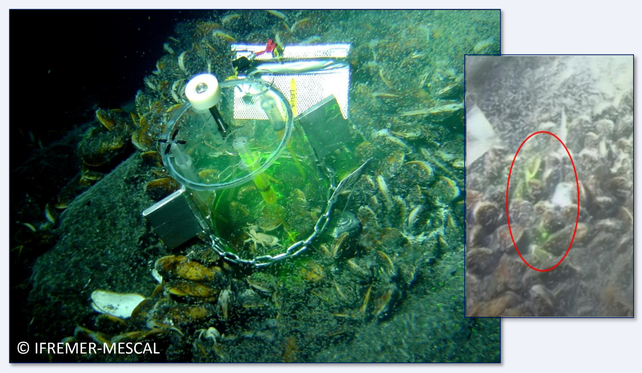




## IN SITU CHEMICAL LABELLING

Shells were marked 1h in their environment with calcein using a benthic chamber.

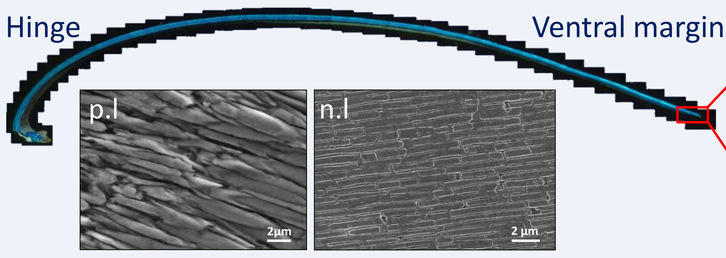
They were recovered after 10 days.

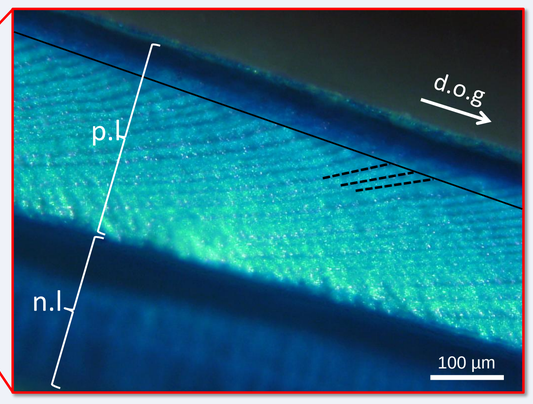
This approach minimizes disturbance of the individuals in their habitat.




## CALIBRATION OF *B. THERMOPHILUS* GROWTH PATTERN

Shells are cut along their maximal growth axis.



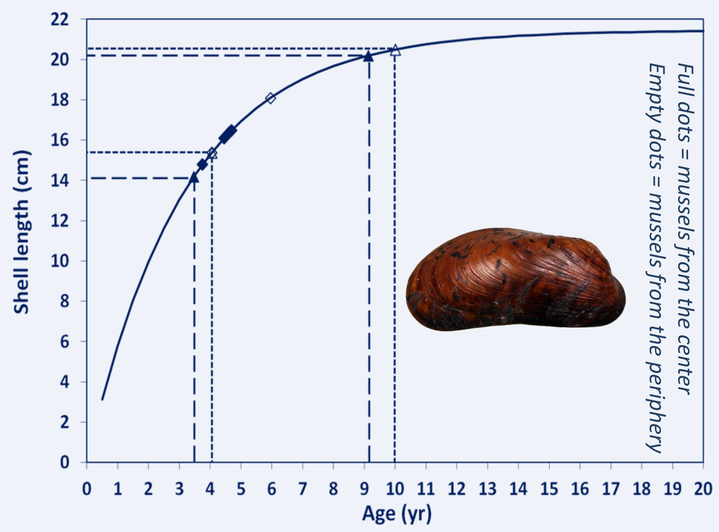




*p.l : external prismatic layer (calcite)*
*n.l : inner nacreous layer (aragonite)*
*d.o.g : direction of growth*

The coloration reveals growth microstructures (striae = black dashed lines) and allows counting and measuring the width of increments (distance between two successive striae).

## GROWTH RATE MODEL

### Von Bertalanffy growth model



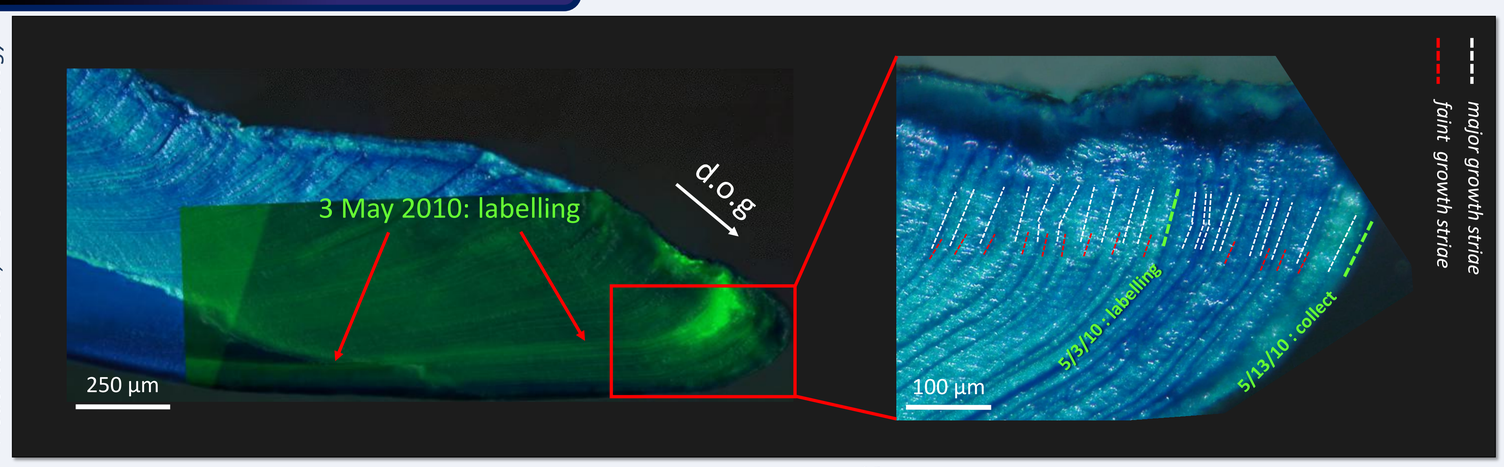

Largest shell collected = 20.5 cm, maximum age should reach **10** years old.

Mean growth rate ranges between **4.2** (young) and **1.1 cm.yr$^{-1}$** (old).

This fast growth rate is consistent with the instability of the environment in this section of the EPR (repeated eruptions) and the observed recolonization rates.

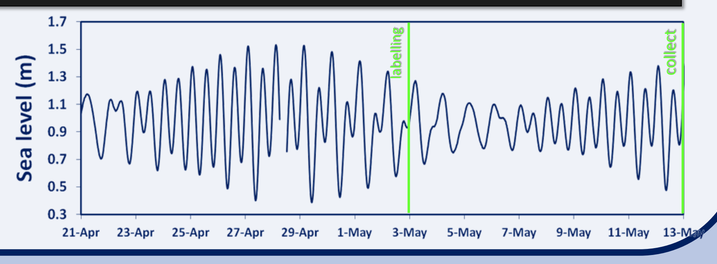
## INCREMENT CYCLICITY

10 ± 2 growth striae are formed in 10 days (5/3/10 – 5/13/10).

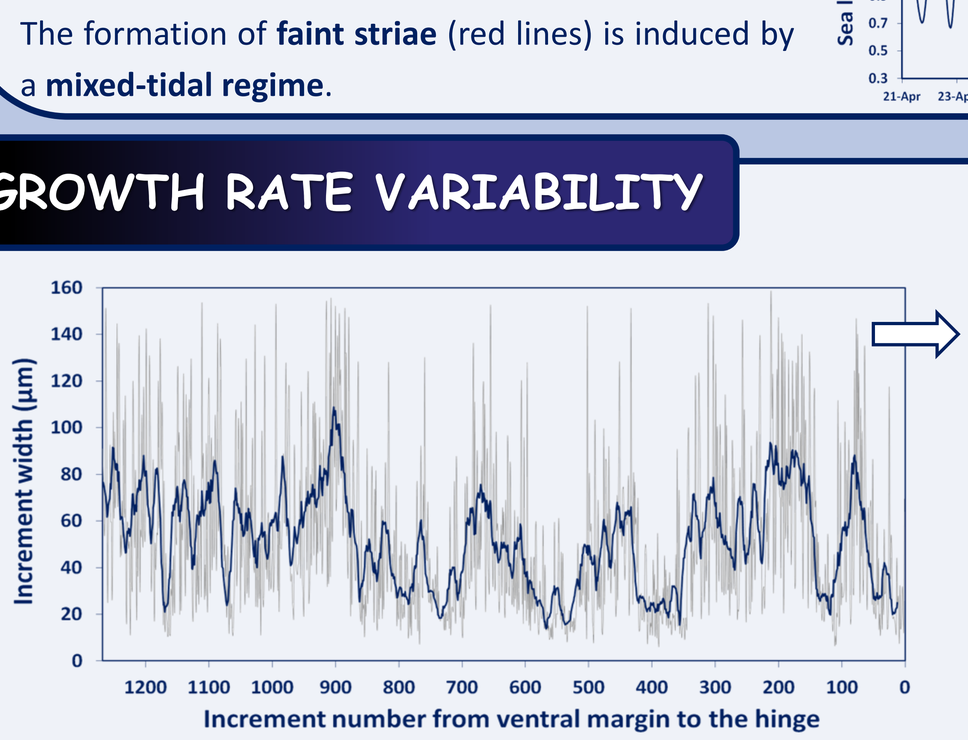



*B. thermophilus* grows according to a **circalunidian rhythm**, with one increment formed each day.

The formation of **faint striae** (red lines) is induced by a **mixed-tidal regime**.




## GROWTH RATE VARIABILITY




A large variability of the increments width during growth is observed.

*B. thermophilus* display **tide-related growth rate** variability.




## CONCLUSION

*Nedoncelle et al., 2013 MB*

*In situ* chemical staining is a powerful tool to study hydrothermal bivalve growth rates in their natural environment.

*B. thermophilus* fast growth rate appears influenced by microscale environmental variability driven by tidal forcing.

*B. thermophilus* have a similar maximum age than *B. brevior* (North Fiji Basin, *Schöne and Giere, 2005*) but grows faster.

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