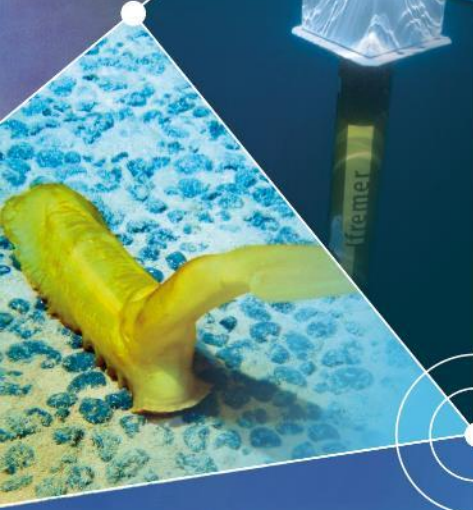
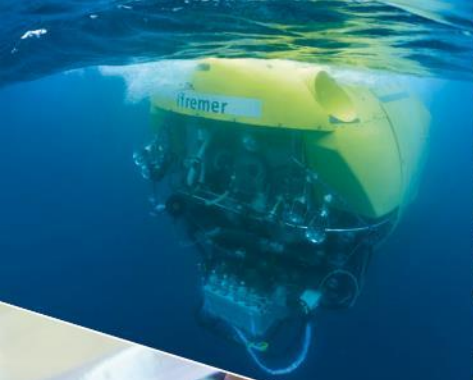




# AN UPDATE ON IFREMER'S EXPLORATION ACTIVITIES

DEVELOPMENT OF A FRAMEWORK FOR  
REMPs FOR POLYMETALLIC SULPHIDE  
DEPOSITS IN MID-OCEAN RIDGES  
UNIVERSITY OF SZCZECIN-GEOCENTRUM, 27-  
29 JUNE 2018



# Exploration strategy

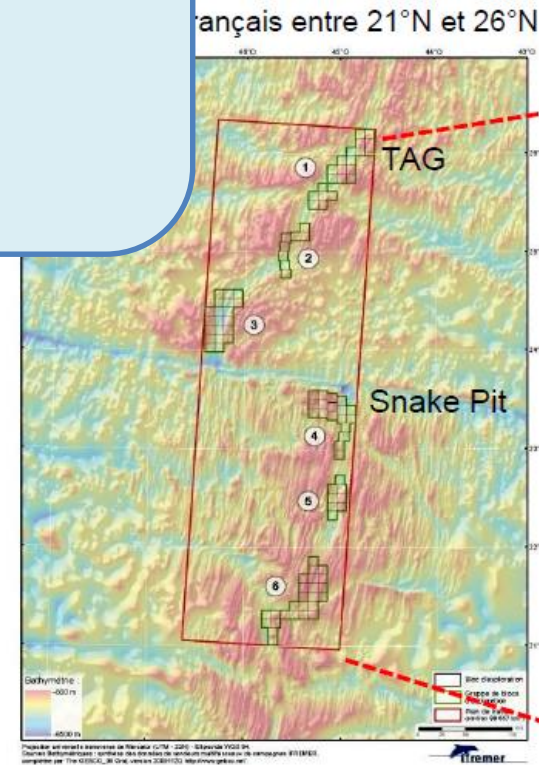
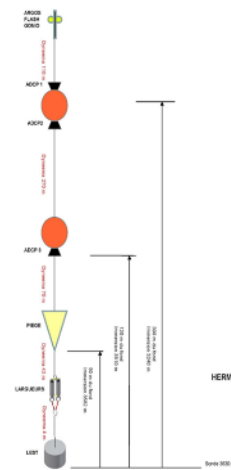
## 3 stages approach

### Geoscience:

1. Regional mapping and exploration
2. Local exploration – detailed studies of sites
3. 3D study of deposits

### Environment:

1. Descriptive biodiversity
2. Quantitative biodiversity
3. Fonctionnal biodiversity



# Exploration – Progress to date

= > Stages 1 & 2 initiated

- BICOSE - 2014, R/V Pourquoi Pas?



Centred on environmental aspects – TAG & Snake Pit areas

- LEVE-SMF - 2016, R/V L'Atalante



Regional mapping

- HERMINE - 2017, R/V Pourquoi Pas?



Regional and local exploration (TAG area) and plume characterisation

- BICOSE 2 – 2018, R/V Pourquoi Pas?

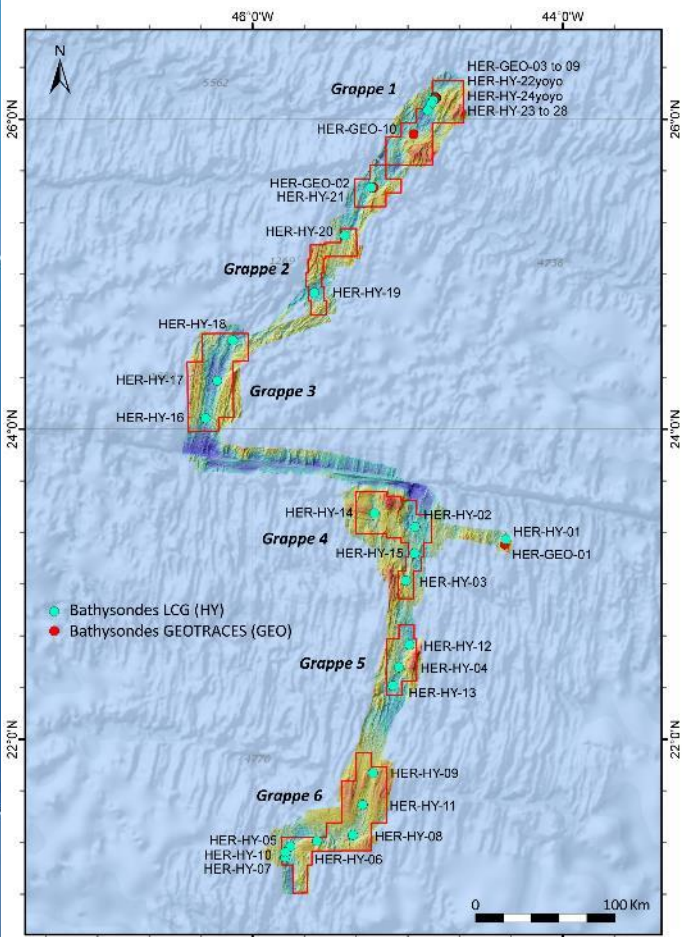


Centred on environmental aspects – TAG & Snake Pit areas

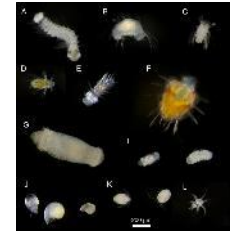
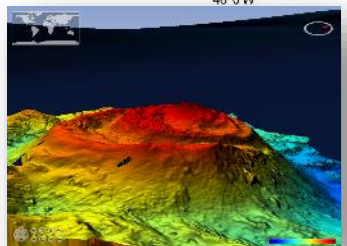
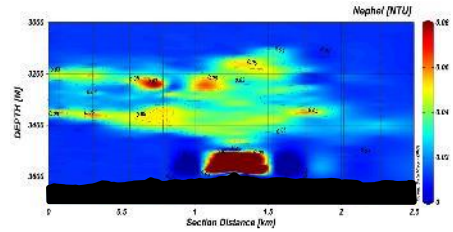
= > Not at the stage of defining a prospective mining area



# Exploration – Progress to date



- 98% mapping completed
- Anomalies detected in 7 locations along the contract area – potential new hydrothermal vents
- Local studies of TAG area (exploration of inactive mounds)
- Environmental sampling performed mostly in TAG and SNAKE PIT areas



# Environmental studies – Progress to date

1. Descriptive biodiversity
2. Quantitative biodiversity
3. Fonctionnal biodiversity

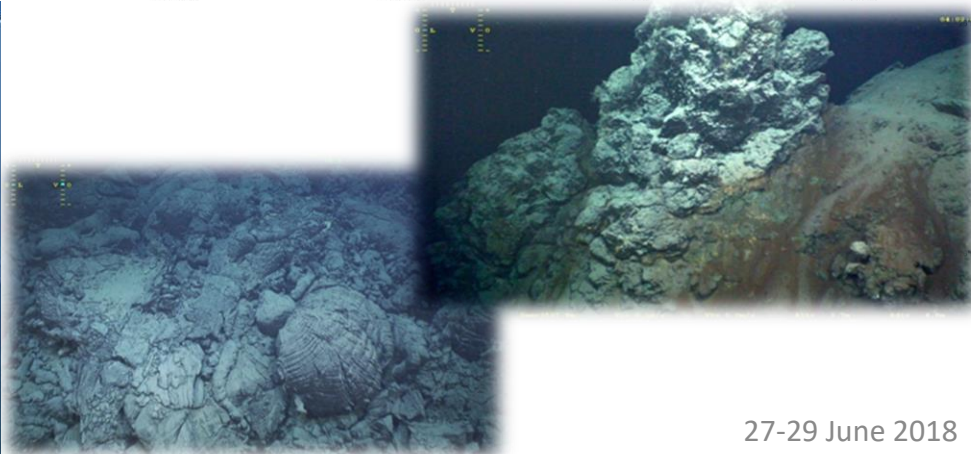
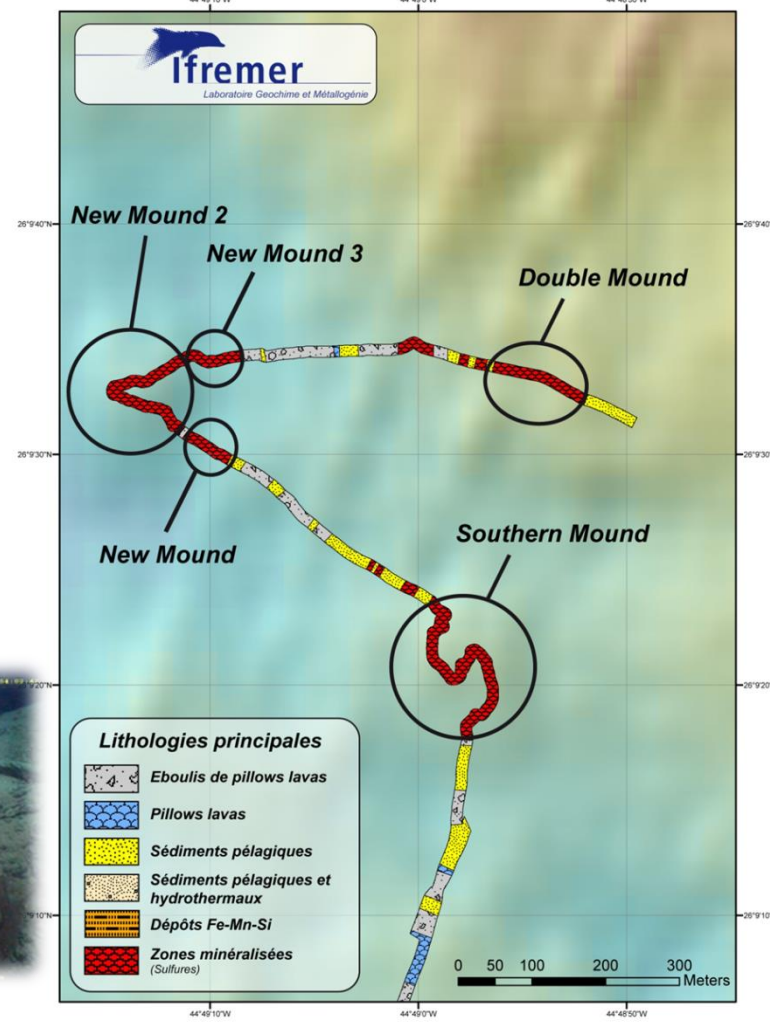
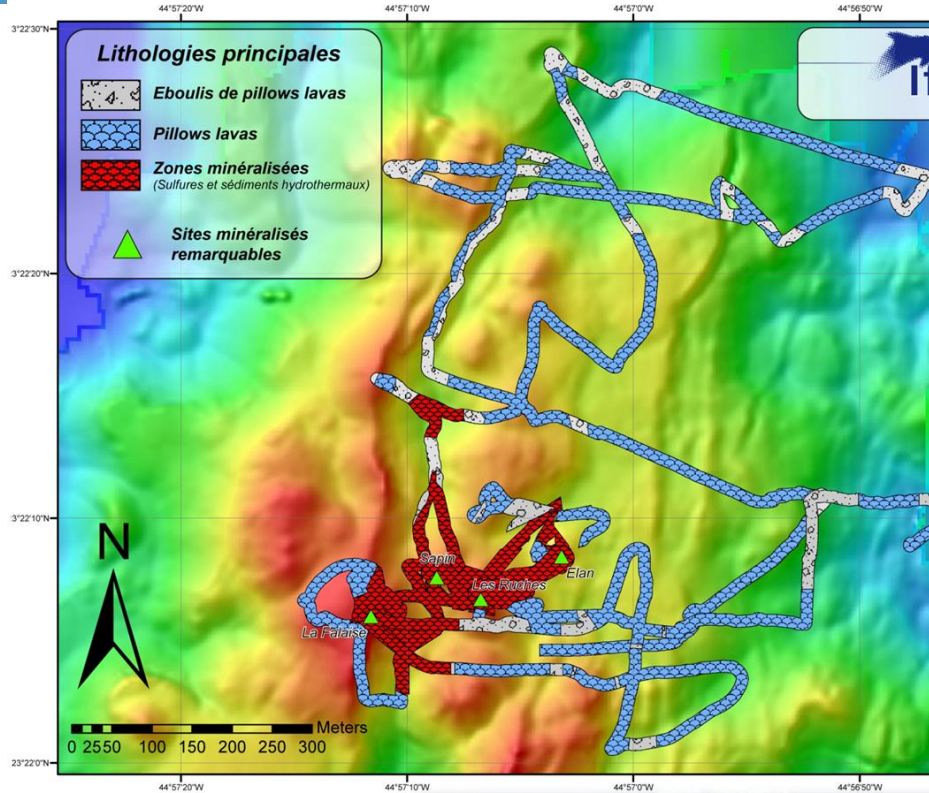
A vertical rectangular bar with a color gradient from yellow at the top to red at the bottom. The text "Non vent" is centered in the yellow/orange section, and "Vent" is centered in the red/orange section.

**Non vent**

**Vent**



# Non vent – Mapping lithology

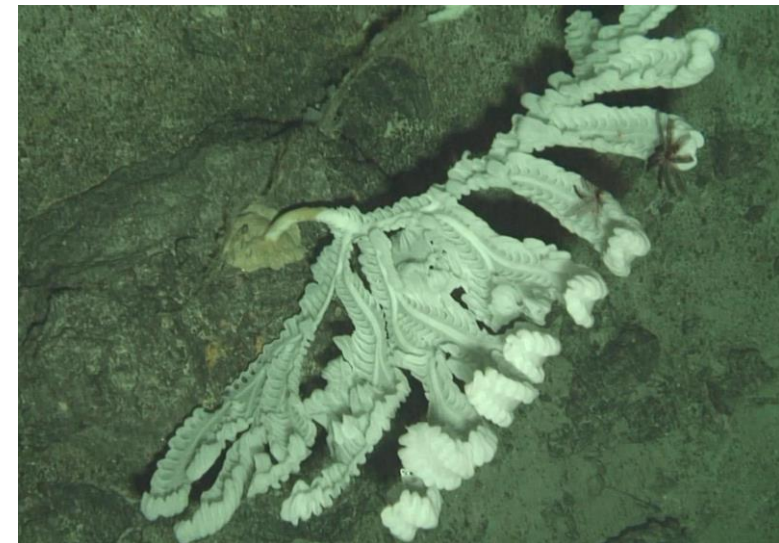




# Non vent – Census of biodiversity

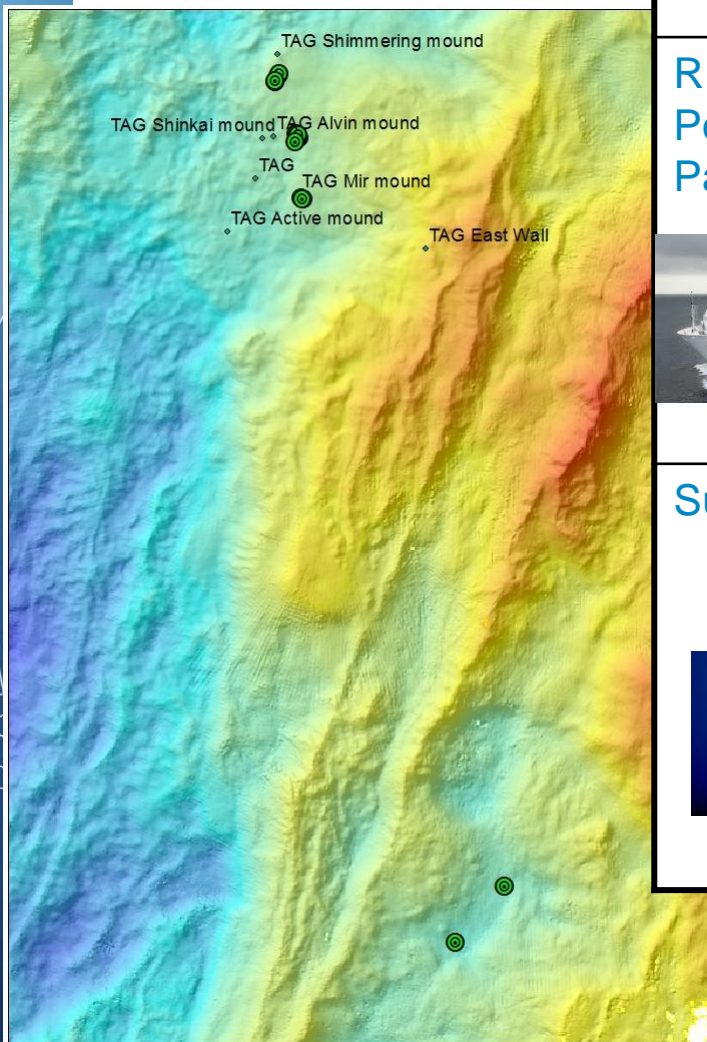
Megafauna: ROV Victor and HOV Nautilie dives  
A Catalogue of 67 morphotypes

Beyond vent fauna, the uniqueness of sponge grounds

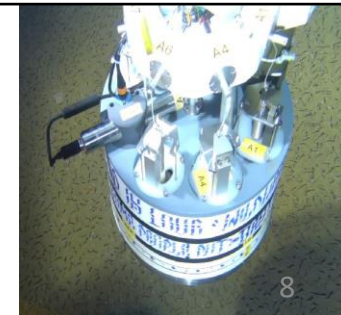


- ✓ Corbari et al, 2018 Amphipod *Dulichiosis diana* sp. nov.
- ✓ Mapstone et al 2017 Two deep-living rhodaliids (Cnidaria, Siphonophora);
- ✓ Sabroux et al 2017 Ammotheidae (Arthropoda: Pycnogonida)

# Non vent – The fauna of inactive vents



Vehicle	Equipment	Purpose
R.V. Pourquoi – Pas? 	Box corer 0,25 m <sup>2</sup>	Macro-endofauna
	Megacorer ø 10 cm	Meiofauna & sediments / pore water
	Epibenthic sledge	Macro-epifauna
Sub. Nautille 	Blade corer 300 cm <sup>2</sup>	Macro-endofauna
	Tube corer ø 5.5 cm	Meiofauna & sediments / pore water
	Benthic chamber	O <sub>2</sub> , CO <sub>2</sub> and nutrient fluxes





# Hydrothermal vents – Habitats and communities

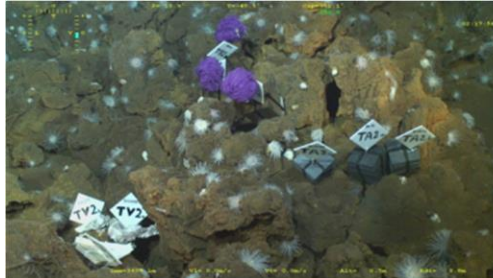
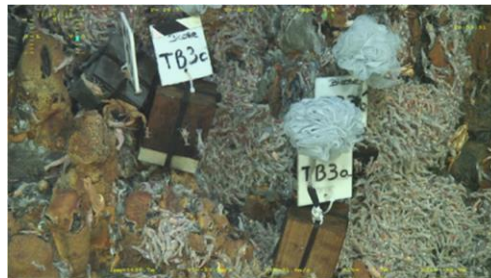


**Shrimp, mussel and anemone  
– dominated assemblages:**

Characterisation of the  
chemistry of each assemblage



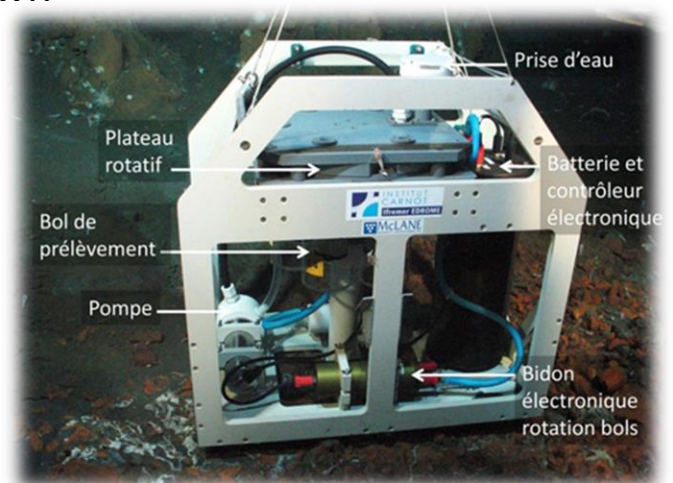
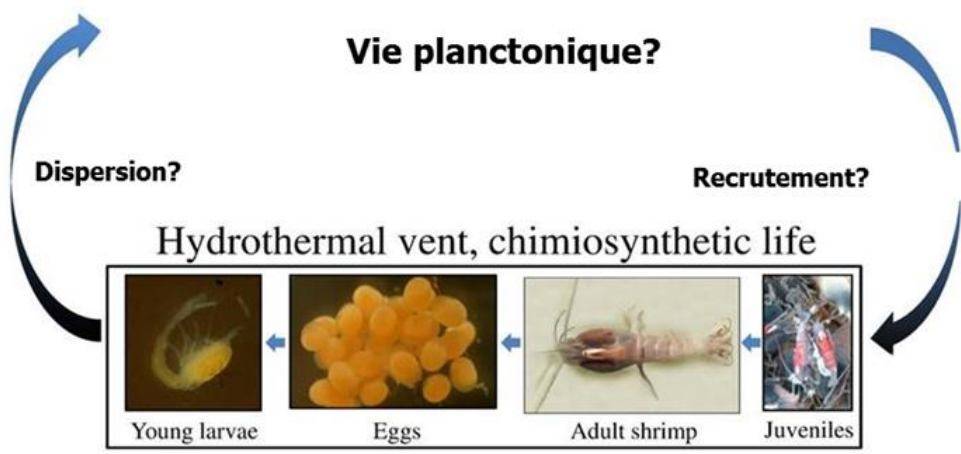
Description of  
meio/macro-benthic  
communities



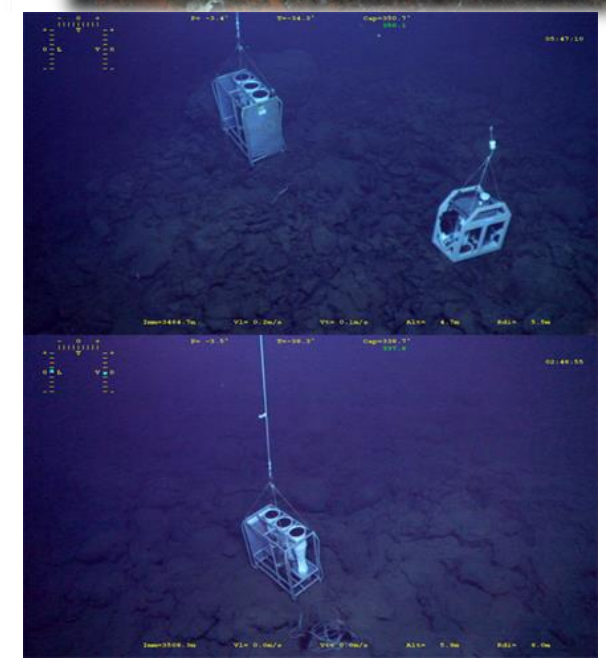
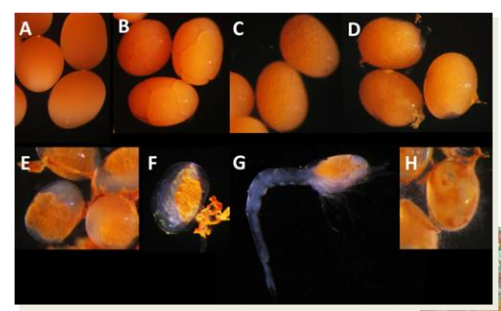
Colonisation patterns of  
experimental substrates

# Hydrothermal vents – Life cycles, dispersal and connectivity

Life cycle of even the best studied taxa is poorly known

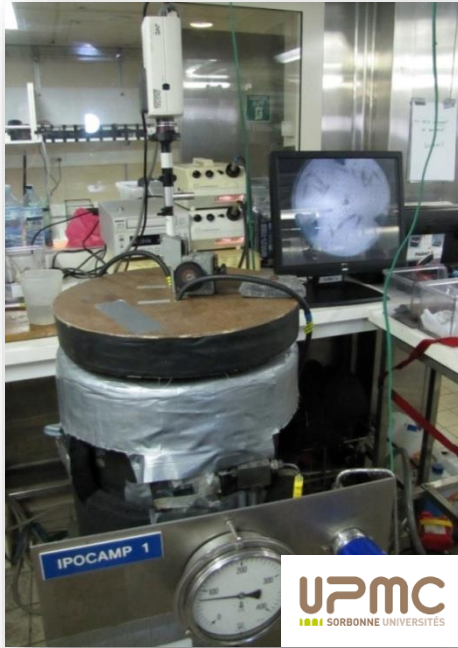


Particularly the ecology of larval stages



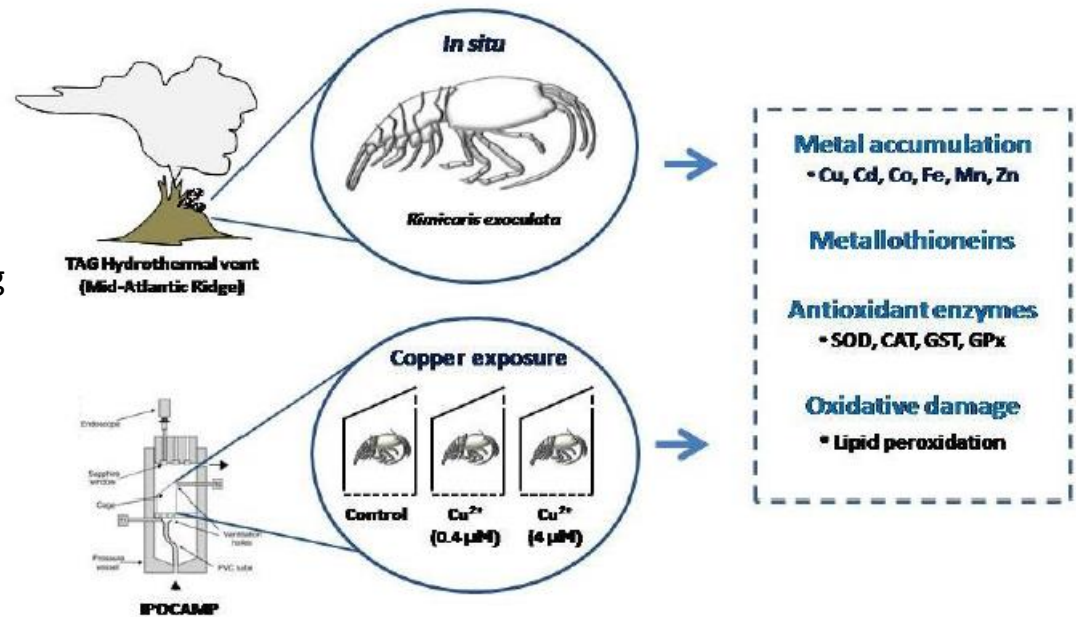


# Hydrothermal vents – Physiology of vent organisms



- The physiology of host-symbiont relationships
- Physiological and behavioural adaptations to living at hydrothermal vents
- Ecotoxicological experiments

Auguste, M., et al. (2016). "Development of an ecotoxicological protocol for the deep-sea fauna using the hydrothermal vent shrimp *Rimicaris exoculata*." *Aquatic Toxicology* 175: 277-285.



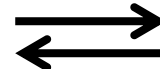
# Active to inactive vents – Geomicrobiology



← **Microorganisms**

Facteurs physico-chimiques

?

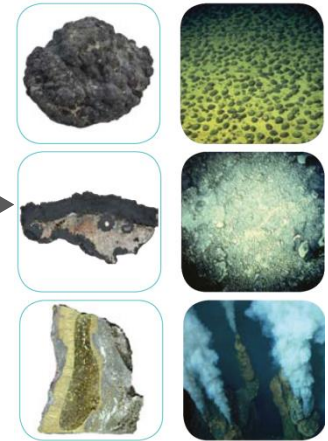


**Minerals**

?

Facteurs physico-chimiques

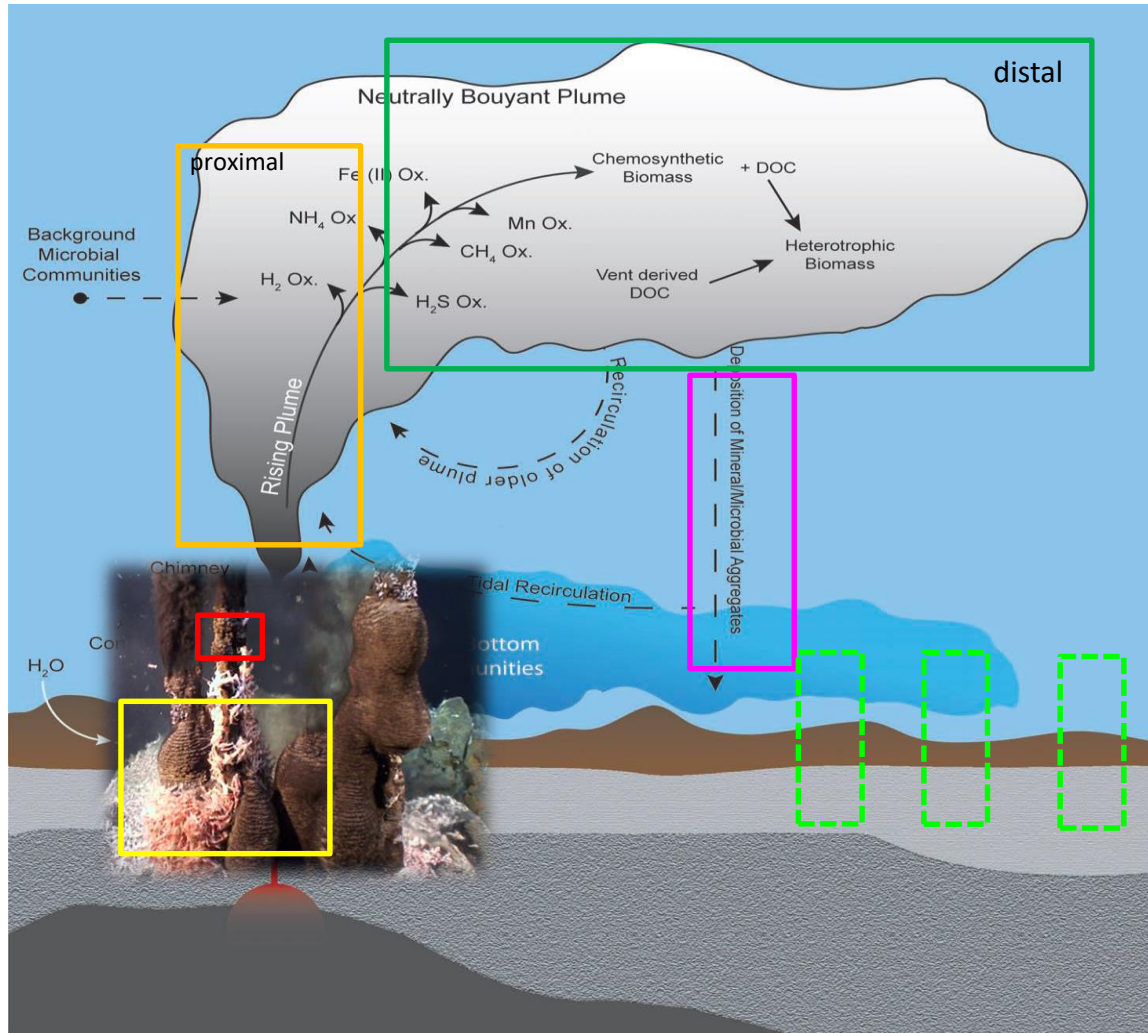
Mineral resources



- ✓ Colonisation of hydrothermal mineralisations by micro-organisms
- ✓ Physico-chemical factors controlling colonisation
- ✓ Metabolisms associated with colonising micro-organisms



# Active to inactive vents – The ecology of the plume



Larval pump  
CTD & Niskin bottles  
Pressurised bottles –  
Activity measurements

*in situ measurement and sampling*  
Larval pump  
Pressurised bottles

Sediment traps  
ADCP

*in situ measurement and sampling*  
Pressurised bottles

Fauna and micro-organisms sampling in sediments  
Sediment and pore water sampling

*in situ measurement and sampling*  
Larval pump  
Pressurised bottles

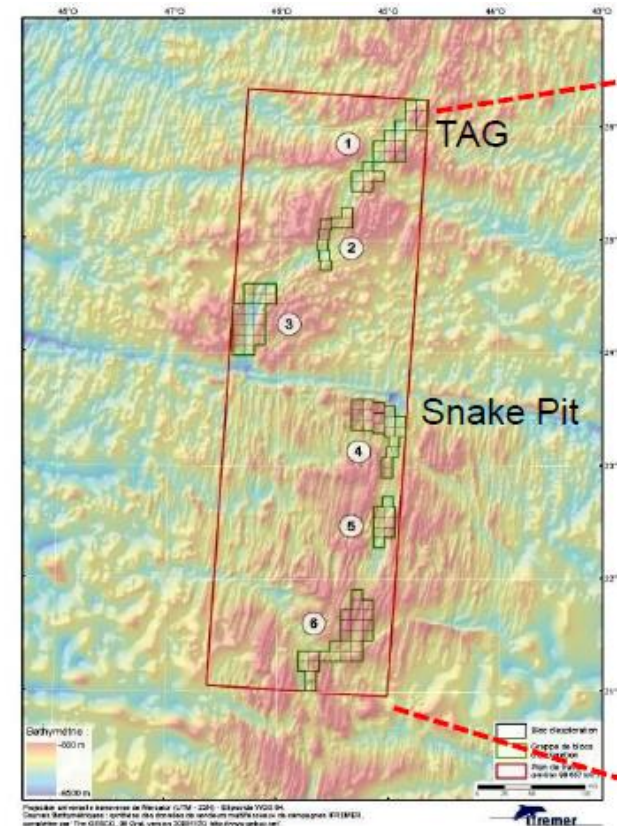
# Environmental management

IRZ/PRZ not set up as potential mining sites are not defined

**Vulnerable Marine Ecosystems:** Active sulphide mounds are VMEs

**On-going reflexions for Environmental Management Strategy on Ifremer's contract:**

- Definition and boundaries of an active site / sulphide mounds
- Activities that can and can not be carried out on active sulphide mounds
- Etc.





Thank you

