DEEP SEA Spy

With **Okto** the octopus
& **Marjo** the reseacher

Cycle 2

I'm a **deep sea explorer.**
I'd like to invite you on an extraordinary journey through the deep ocean. Together, we will explore the ocean depths, particularly the hydrothermal vents!
And, most important of all, I will explain how you can help scientists by becoming a deep sea spy yourself...

IDENTITY INFORMATION

Name :	Okto
Group :	Mollusca
Class :	Cephalopoda
Order :	Octopoda
Family :	Octopodoidae
Distinguishing characteristics :	8 tentacles, 2 large eyes, a well-developed brain
Mission :	Deep sea spy
Objectives :	To introduce you to the mysteries of the deep ocean so that you can become a deep sea spy

DEEP SEA EXPLORATION

Where to go to play ?
https://www.deepseaspy.com/

Type the URL address **https://www.deepseaspy.com/** in the navigation bar

Connect with your username and your teacher's password

Help Marjo to find and identify the animals

Move up the levels and win virtual figurines

Find some of the answers at
www.deepseaspy.com

DEEP SEA TOPOGRAPHY

The deep ocean

Oceans cover ¾ of the earth's surface, with an average depth of 4000 metres. The deep ocean accounts for 60% of this area.

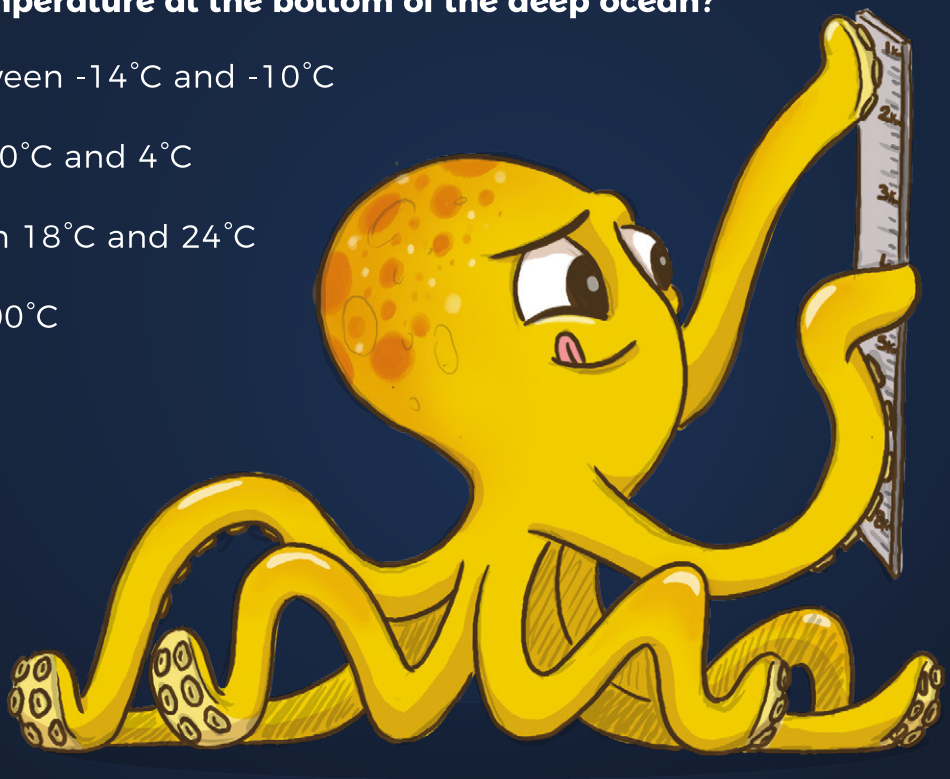
What is the maximum depth of the ocean?

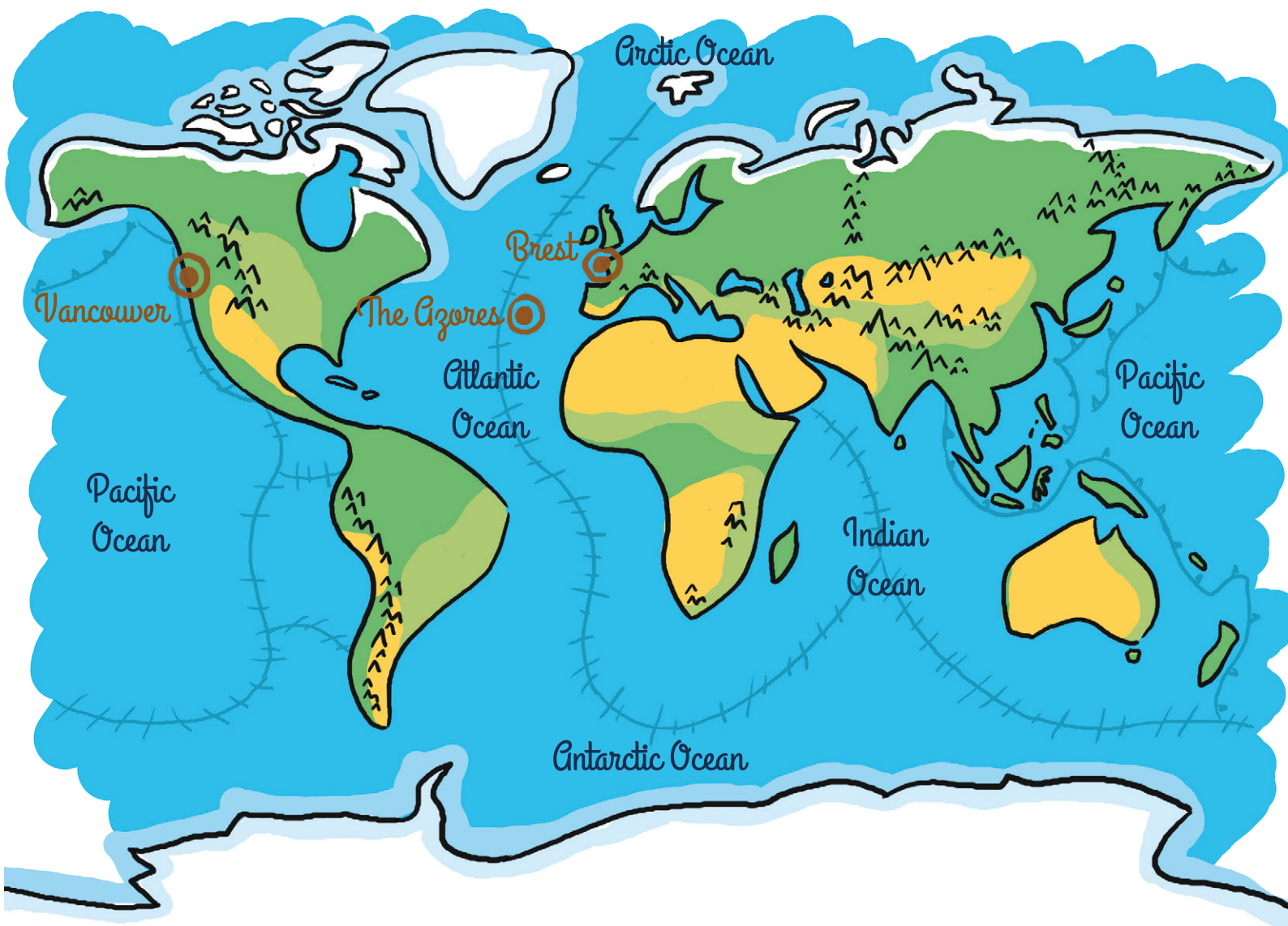
- [ ] 90 metres
- [ ] 900 metres
- [ ] 10 900 metres

Surface water temperature varies a great deal across the planet. Tropical waters are 25˚C while polar waters are about 0˚C. At the bottom of the ocean, temperatures do not change very much.

What is the water temperature at the bottom of the deep ocean?

- [ ] Very cold, between -14˚C and -10˚C
- [ ] Cold, between 0˚C and 4˚C
- [ ] Warm, between 18˚C and 24˚C
- [ ] Boiling, over 100˚C





Legend :

trenches

ridges

Additional information :

The distance between Brest and Vancouver is 7 700 km.

Did you know ?

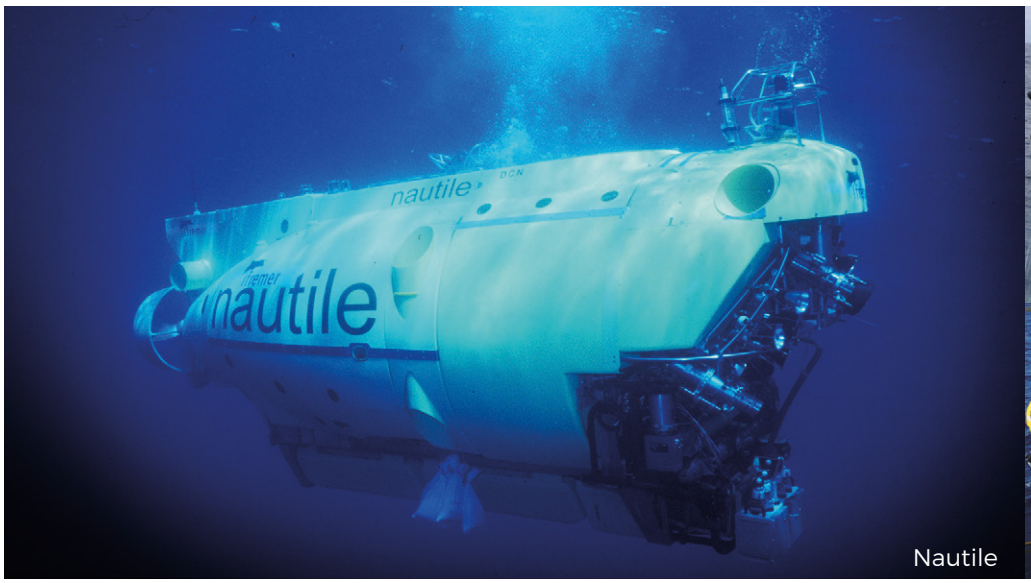
In the deep ocean
It's dark
It's cold
It's "deep"
It's "hungry"

Théodore Monod

SCIENTIFIC EXPLORATION OF THE DEEP OCEAN

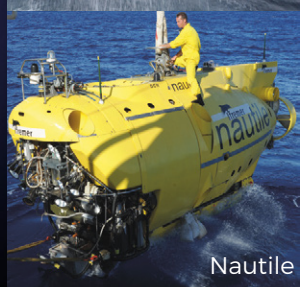
Scientists have always tried to understand how the deep ocean functions. They have many different submarines capable of going down very deep in the ocean. **Equipped with cameras and articulated arms**, these vehicles make it possible to study and collect the fascinating animals of the deep ocean.

Look at these exploration "vehicles".



Nautile

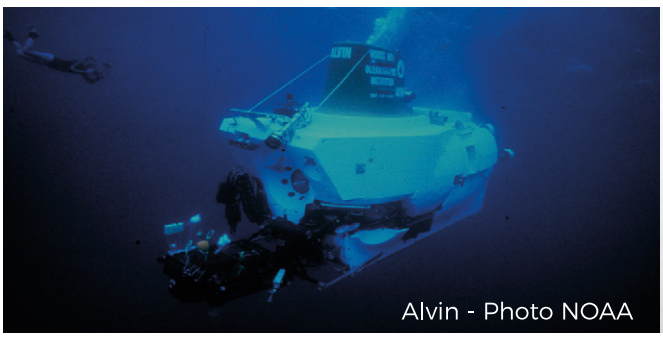
Victor 6000

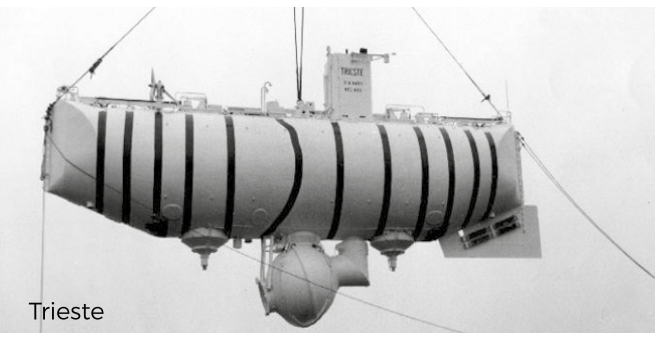


Nautile

What is the name of this submarine attached to a cable, put into service by Ifremer in 1998 and capable of exploring depths of up to 6000 metres?

The [redacted]

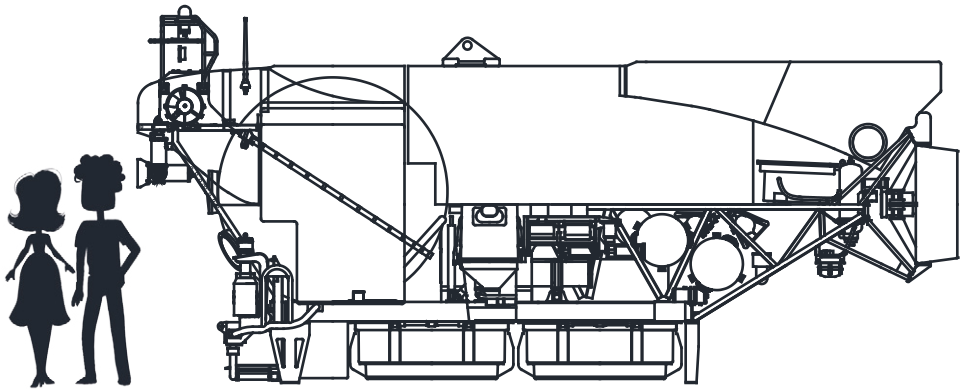

Alvin - Photo NOAA



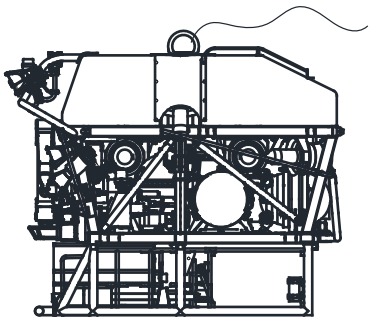
Trieste

SCIENTIFIC EXPLORATION OF THE DEEP OCEAN

Some submarines are manned and driven by pilots sitting in a titanium sphere. Others are controlled remotely from the surface. They are attached to the ship with a cable.



Cross section of **Nautile**



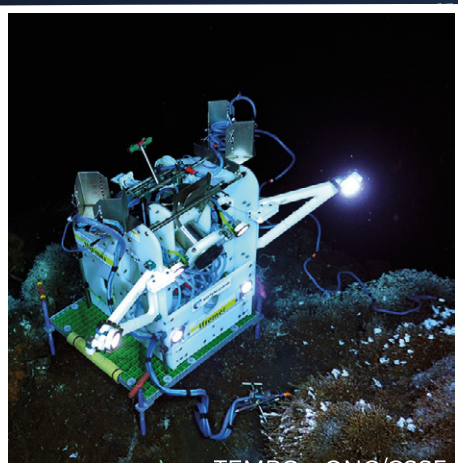
Cross section of **Victor 6000**

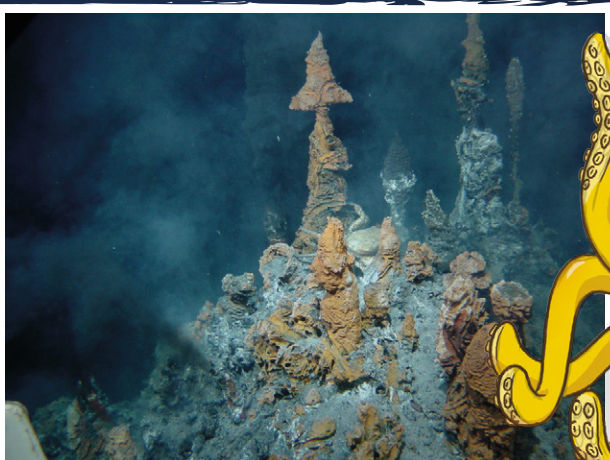
The _____ **is a submarine that takes a crew of 3 scientists.**

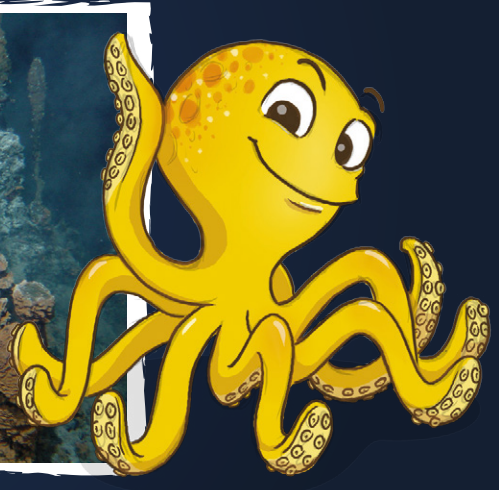
The _____ **is remote controlled from a ship.**

Did you know ?

Scientists have set up submarine observatories equipped with cameras on the Pacific and Atlantic ridges to observe the animals of hydrothermal vents.







THE GAME

https://www.deepseaspy.com/

Hi,

My name's Marjolaine. I study the species that live in the deep ocean, particularly those that live around the hydrothermal vents, along the great submarine mountain chains.
To do this, I use cameras that stay on the bottom of the ocean all year round.
They tell me a great deal about the lives of these animals!

MARJOLAINE MATABOS
RESEARCHER IN ECOLOGY
OF DEEP SEA ENVIRONMENTS

IDENTITY INFORMATION

Community : Scientific
Institute : Ifremer
Sub-group : Deep Sea Lab

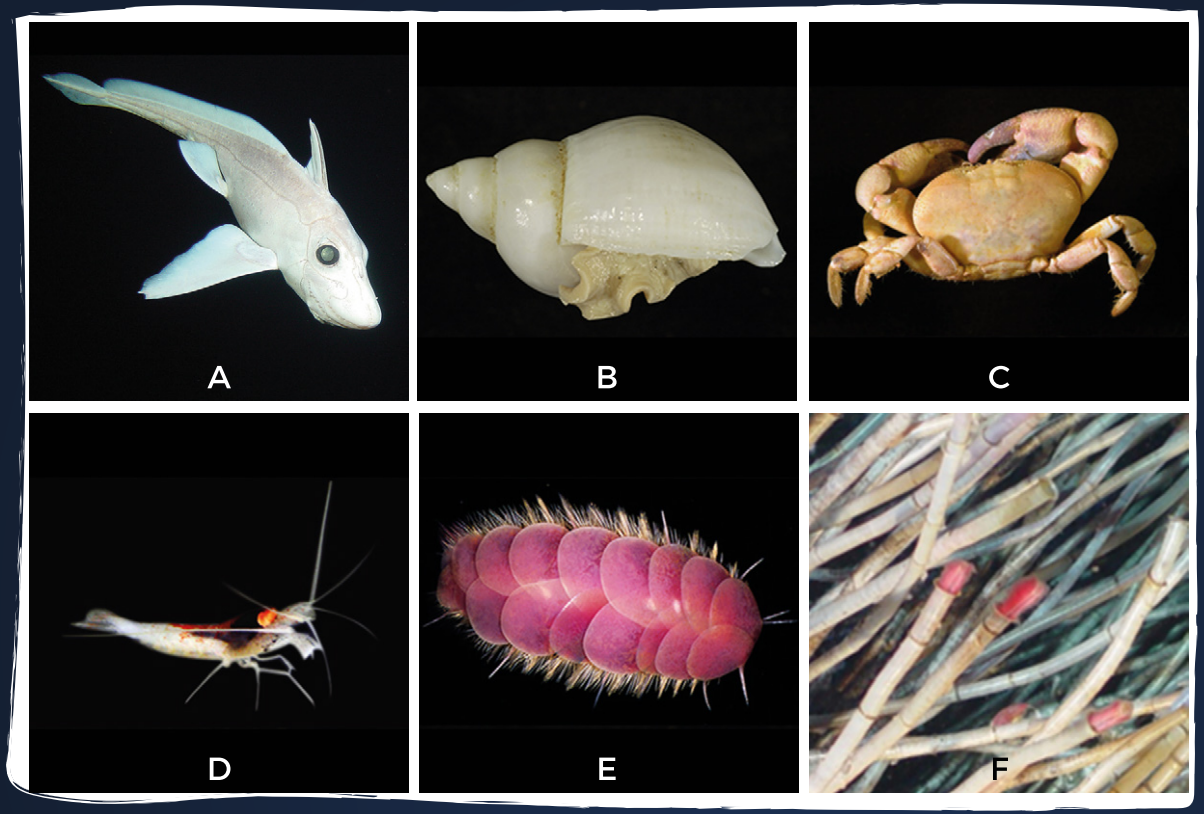
Mission : To understand deep sea biodiversity

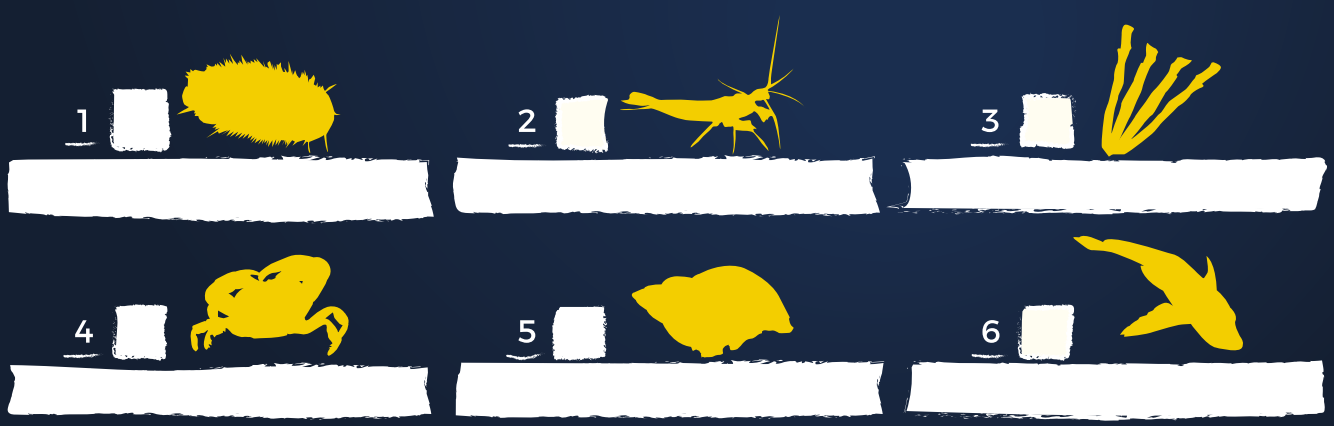
THE GAME

https://www.deepseaspy.com/

The observatories on the ocean ridges have different cameras that make it possible to monitor deep sea animals.

Help our scientist, Marjo, to identify these species.
Match each species with its silhouette.
Fill in the corresponding letter and name.





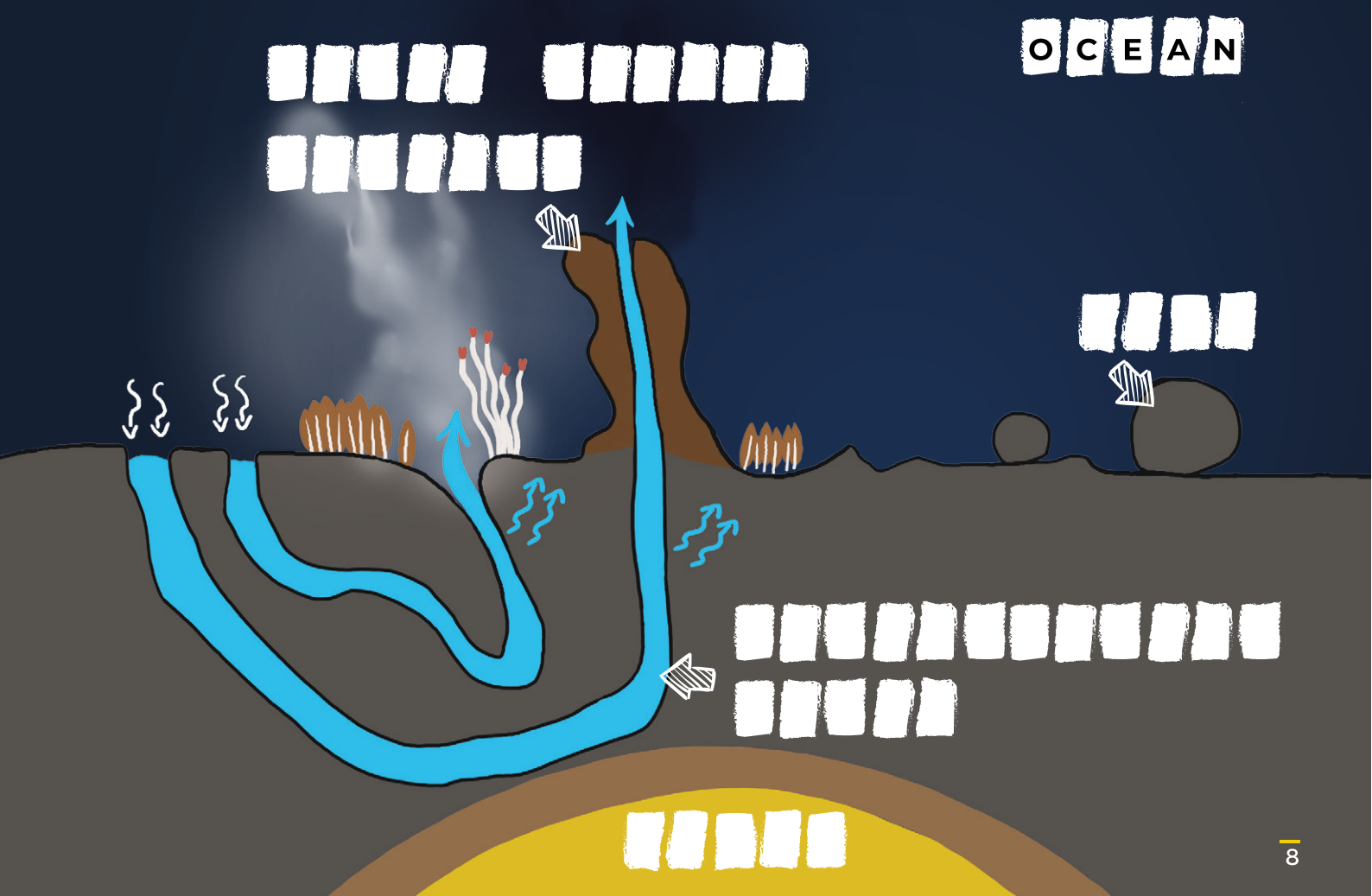
HYDROTHERMAL VENTS

Oases at the bottom of the ocean

Hydrothermal vents were discovered in 1977. They are real submarine geysers located along the ocean ridges. This discovery revealed the existence of rich animal communities in the deep ocean.

Along the submarine mountains, seawater penetrates into the ground, then goes down towards the magma chamber. On this journey, the water heats and is transformed. The hydrothermal fluid made this way rises to the surface to form “black smokers”. The fluid ejected can reach **temperatures of 400 °C.**

Put the right names on the parts of the cross section of the hydrothermal vent :
Magma / Ocean / Black smoker chimney / Rock / Hydrothermal fluid



THE MICROORGANISMS

At the base of the food chain

As there is no light in the deep ocean, there are also no algae! The primary consumers of hydrothermal vents, equivalent to herbivores on land, feed from bacteria.

The mussels *Bathymodiolus azoricus* form beds. They are attached to the substrate by solid anchoring filaments (byssus). They can feed thanks to bacteria in their gills and filter the water.

Did you know ?

They are capable of moving at 2.5cm/h! To do this, they constantly renew their byssus, and move by pulling themselves along the new filaments.

The worm *Ridgeia piscesae* lives in a tube that allows it to protect itself. It doesn't have a mouth, digestive tube or anus. Its body is like a big bag housing the bacteria that feed it.

Ridgeia - V. Tunnicliffe

Ridgeia - ONC/CSSF

REMARKABLE ADAPTATIONS

Animals of hydrothermal vents have special characteristics for resisting environmental variations such as temperature (2°C to 50°C), or concentrations of mineral elements or oxygen.

The limpet *Lepetodrilus fucensis* feeds on bacterial films, which grow on the shells of the tube worms' tubes. It has a radula equipped with tiny teeth.

What is the limpet's diet?

The crab *Segonzacia mesatlantica* is an opportunist because it lives on carrion and easy prey (mussels, shrimps and polychaete worms).
It is a solitary and territorial animal.

What is the crab's diet?

The pycnogonid, or sea spider, a close cousin of our spiders, lives in groups in clumps of ***Ridgeia*** worms.

Did you know ?

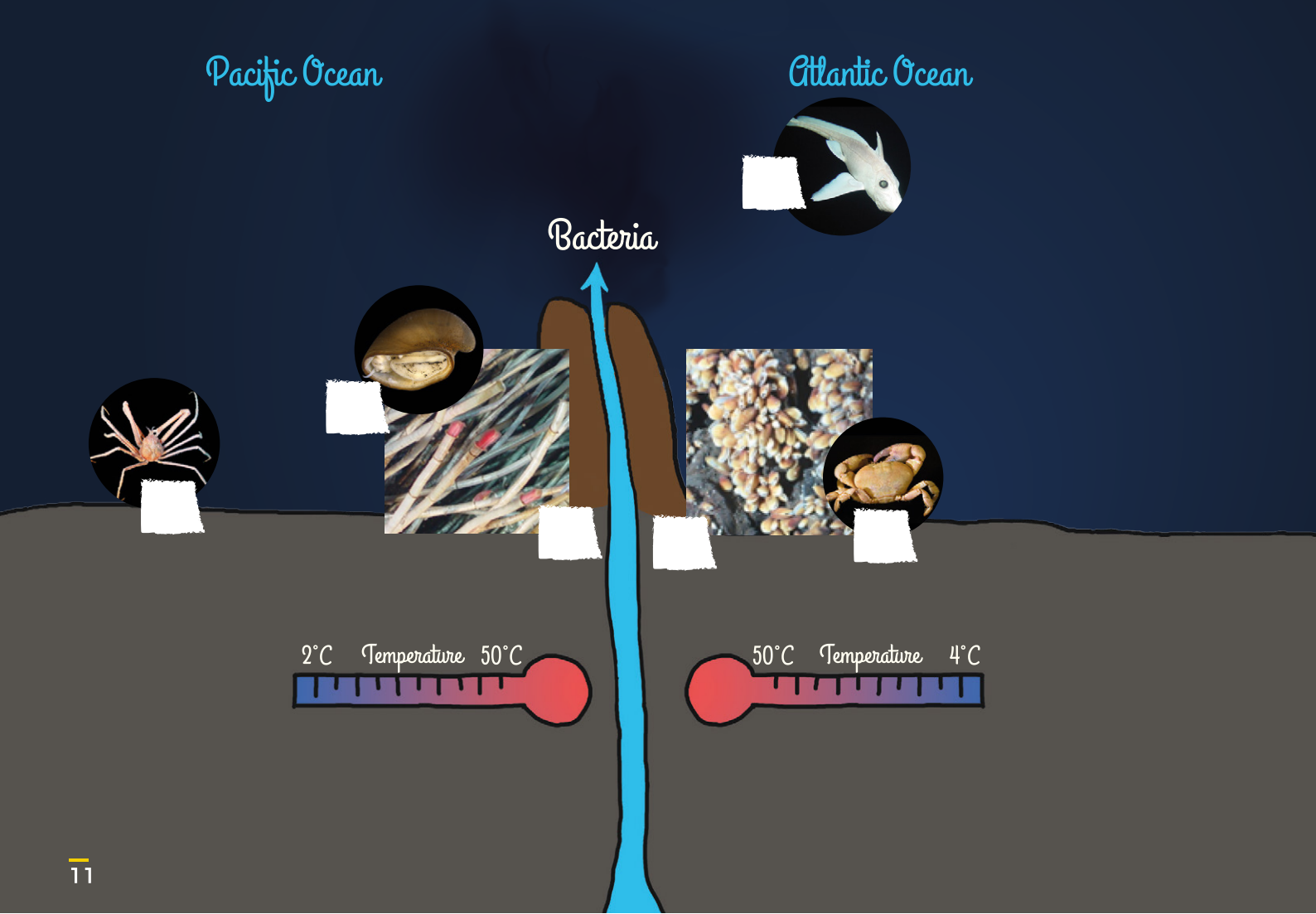
It's the dads who look after the babies !

A RICH ECOSYSTEM

The animals live in different places around the hydrothermal vents depending on the temperature and food availability.

Place the following animals on the hydrothermal vent.

1. Clumps of tube worms *Ridgeia piscesae*
2. Limpet
3. Mussel *Bathymodiolus azoricus*
4. Spider crab
5. Crab
6. Chimera fish



GLOSSARY

Tectonic plates

The earth's crust (on land this is the ground and under water it is the ocean floor) is divided into several plates that "float" on the surface of our planet. Under these plates, we find molten rock or magma, a viscous substance constantly in motion. 'This motion causes the plates (called tectonic plates) to collide (which is what forms the mountains), to separate, allowing the magma to rise up between them (ocean ridges), or to overlap (subduction zones).

Magma

Magma is molten rock. It's pressure and high temperature that cause the Earth's crust and mantle to melt. When the pressure becomes too great, the magma breaks through the Earth's crust to form volcanoes.

Hydrothermal fluid

On oceanic ridges, where two tectonic plates are moving apart, seawater penetrates into the ground by the cracks. When it comes into contact with the rocks of the mantle and the magma, this water is transformed: it loses its oxygen and magnesium needed for life, becomes loaded with heavy metals and radioactivity and heats to more than 400°C. It is then known as hydrothermal fluid. It rises to the Earth's crust once more where it forms geysers known as hydrothermal vents.

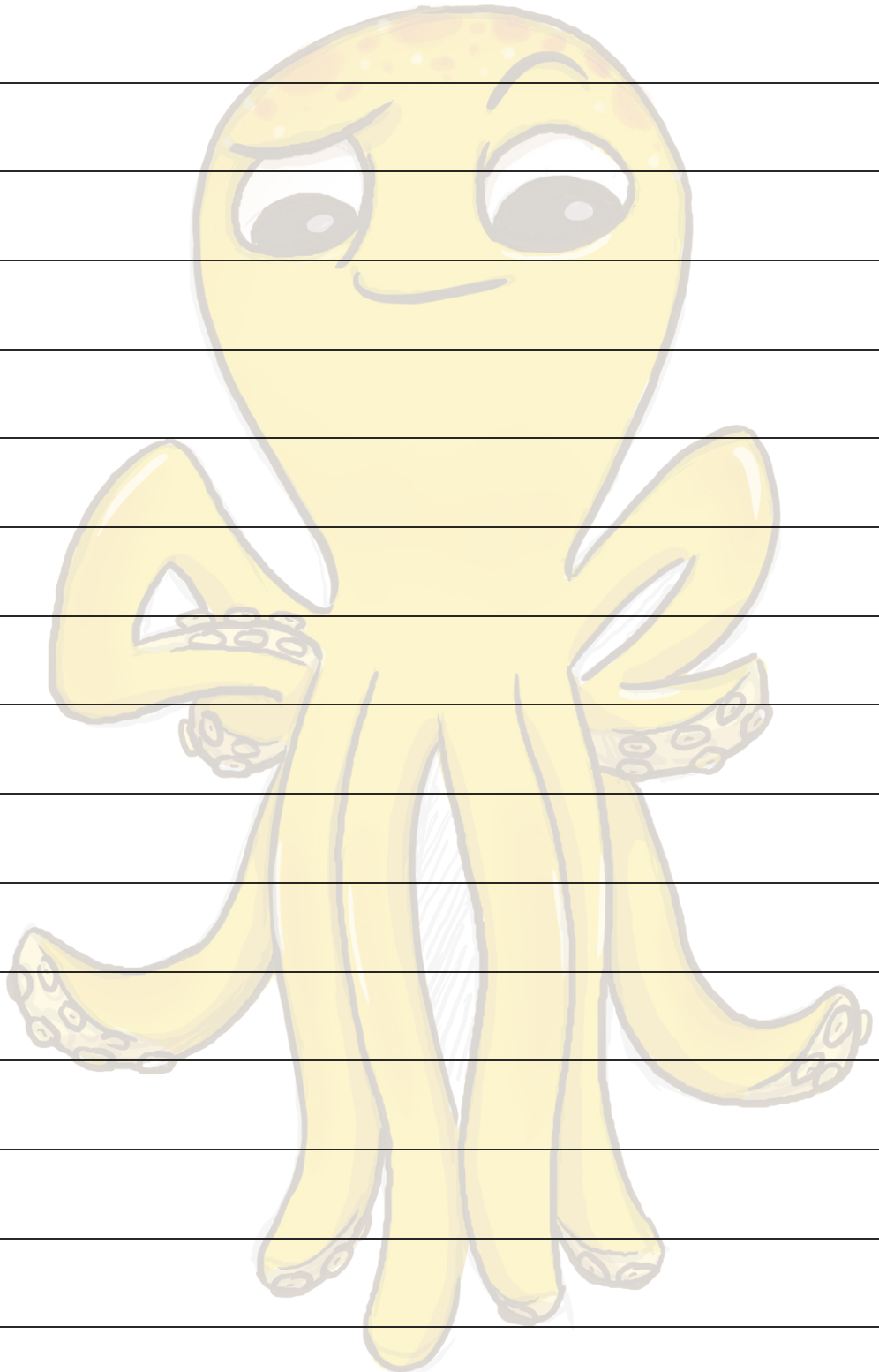
Smokers

When the hydrothermal fluid emerges from the earth's crust forming large underwater geysers, the metals in the water precipitate when they come in contact with the cold water. They then become solid, forming great chimney-like structures known as smokers.

- Some figures on the deep sea environment -

The ocean covers nearly three quarters of our planet.

The deep ocean environment includes all of the marine environment below 200m, where the light can no longer reach. Three quarters of the ocean are "deep". The deep ocean contains 95% of the inhabitable volume of the planet.



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DEEP SEA Spy

Océanopolis Brest

plus ENVRI

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