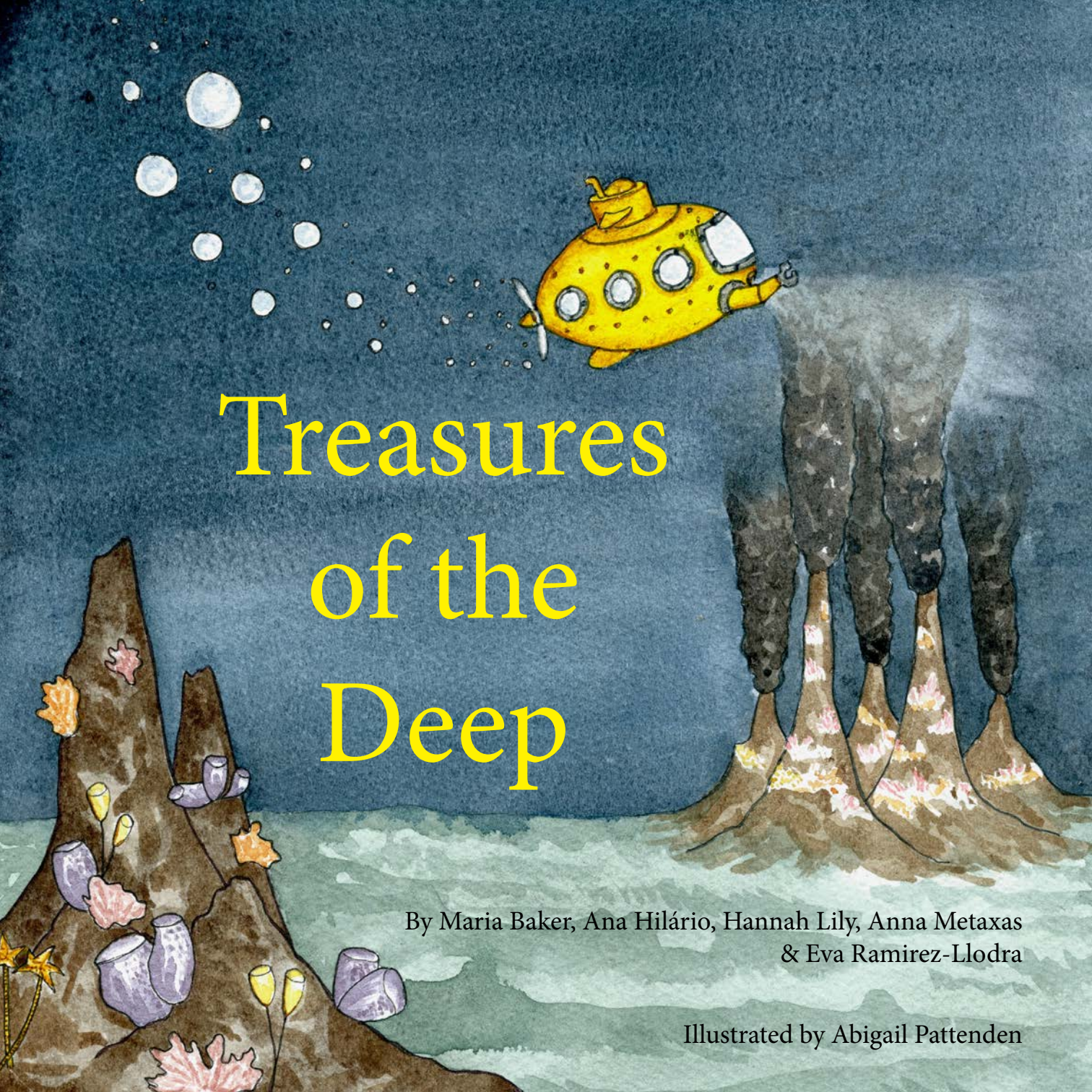


Treasures of the Deep

By Maria Baker, Ana Hilário, Hannah Lily, Anna Metaxas & Eva Ramirez-Llodra

Illustrated by Abigail Pattenden

Treasures of the Deep

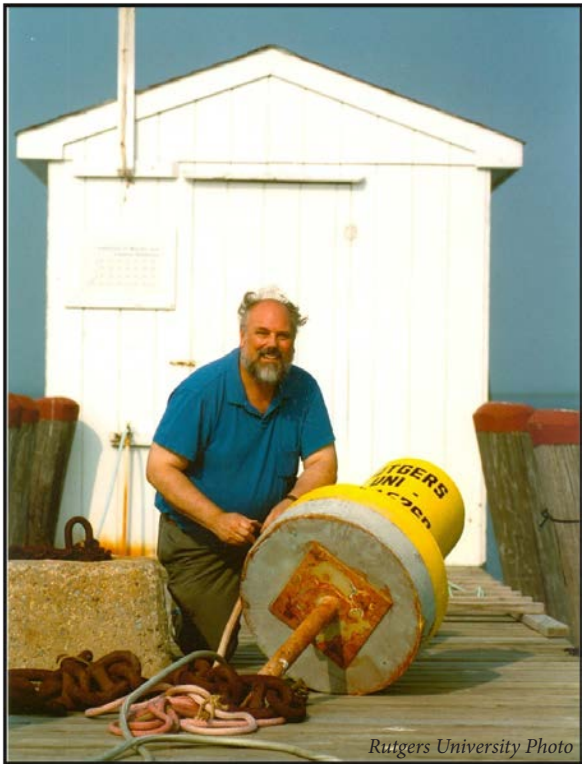
By Maria Baker, Ana Hilário, Hannah Lily, Anna Metaxas & Eva Ramirez-Llodra

Illustrated by Abigail Pattenden

The Commonwealth in association with DOSI DEEP-OCEAN STEWARDSHIP INITIATIVE UNIVERSITY OF Southampton IN DEEP

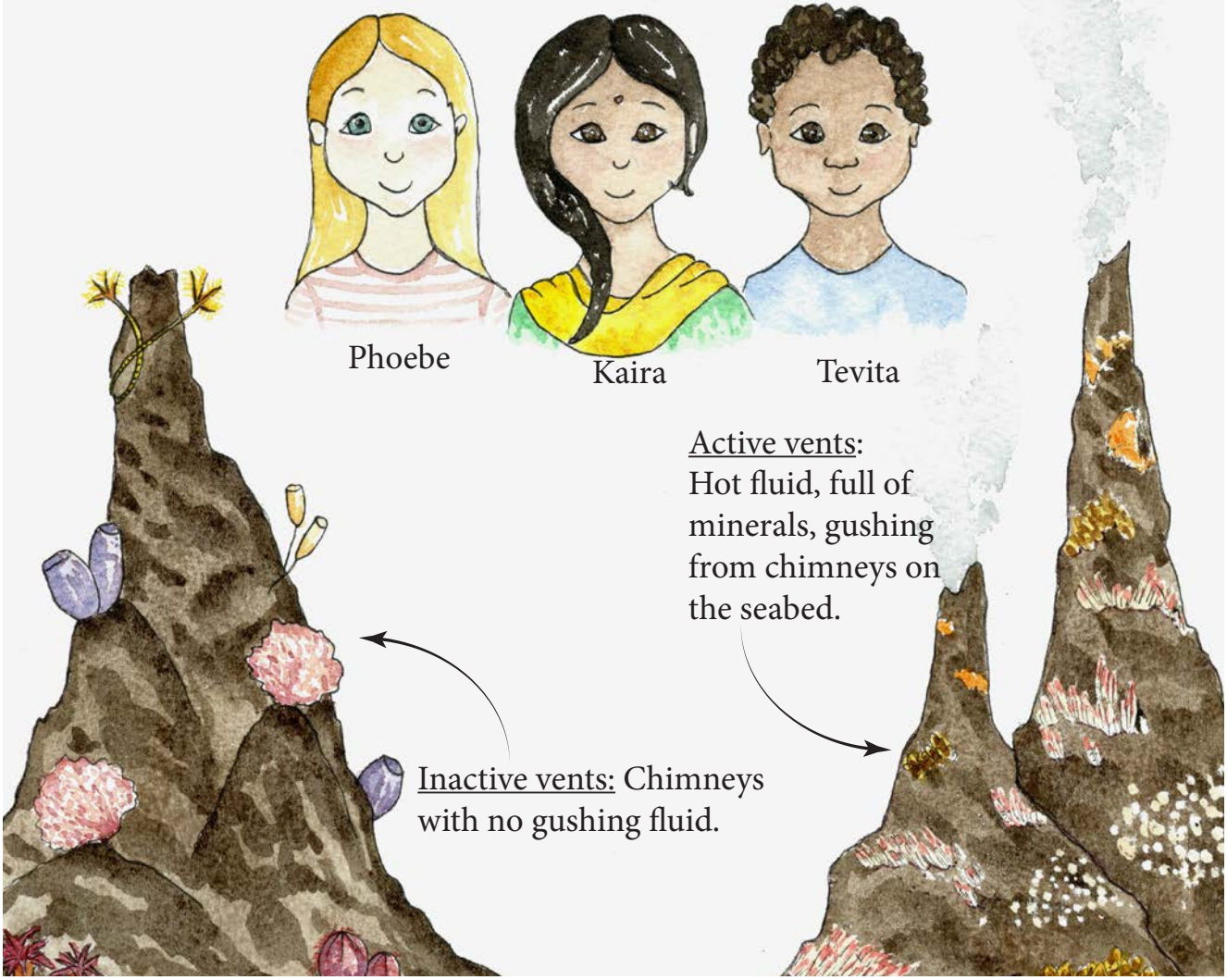
This work has received funding from the Commonwealth Secretariat.
ISBN: 978-1-9161279-1-3

Dedicated to Fred Grassle (1939 – 2018)



The first explorer of life at hydrothermal vents

Before we start our story, let's meet the ocean explorers and the deep-sea world they are about to discover:

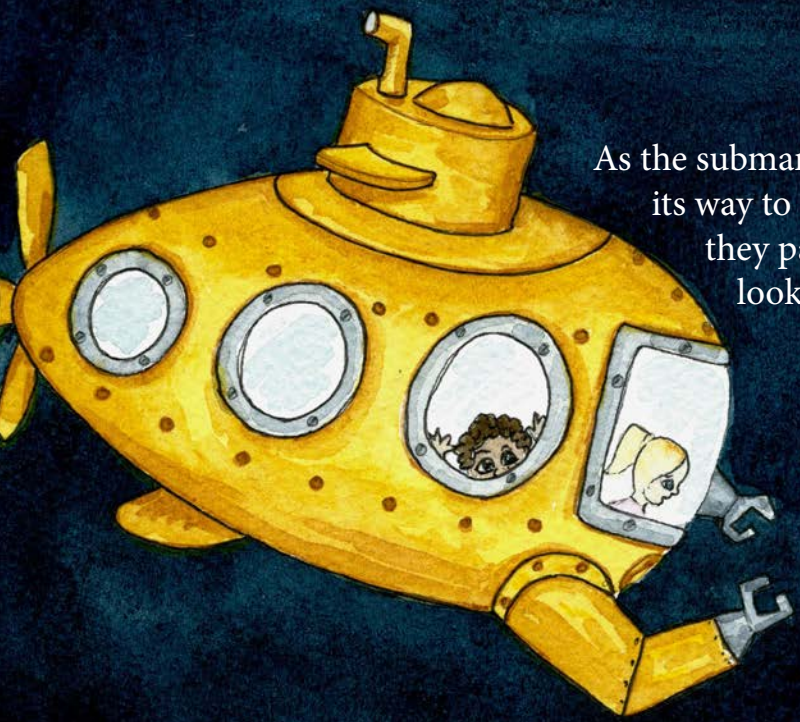


“Prepare to dive!”

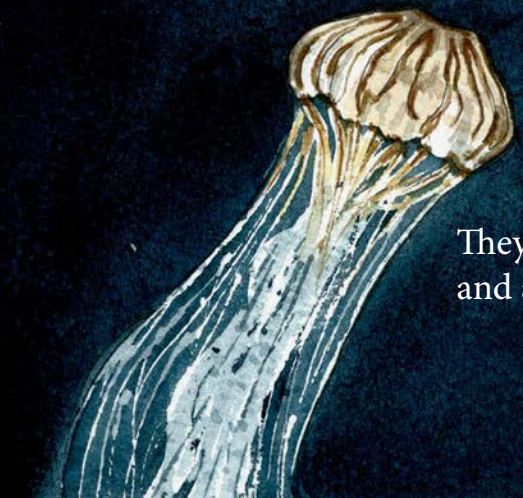
The team were pretty sure they would find copper, zinc, gold, silver and other valuable treasures in the rocks at the bottom of the ocean - and who knows what else?! They couldn’t wait to investigate this hidden deep-sea world.


"Are you sure we have packed everything we need?!"

Down and down they travelled through the twilight zone into the dark, cold waters of the deep.



As the submarine creaked and pinged its way to the bottom of the ocean, they passed many funny-looking creatures.



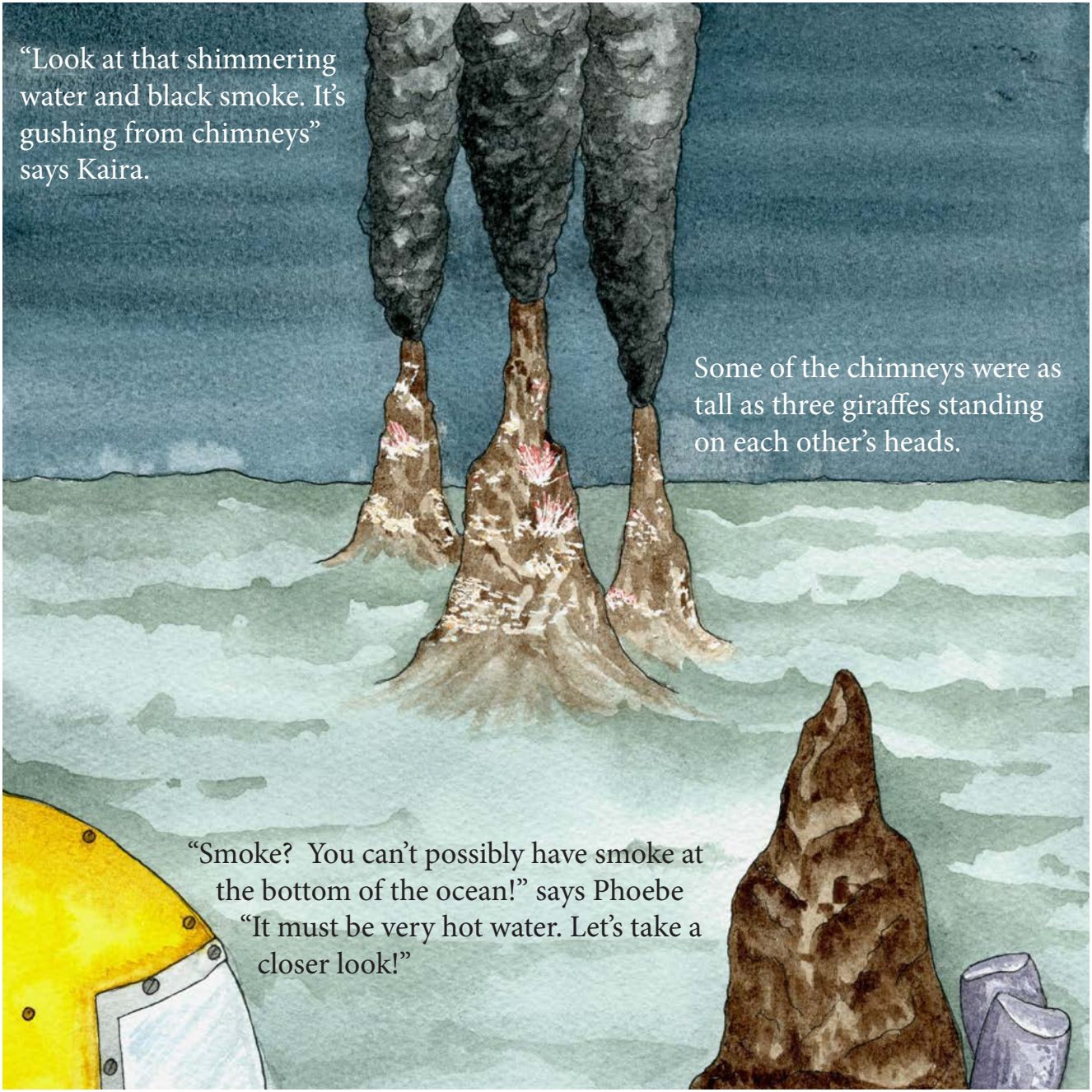
They saw siphonophores, jellyfish, and a grumpy-looking anglerfish.

Some of them shone and flashed – what a spectacular display!

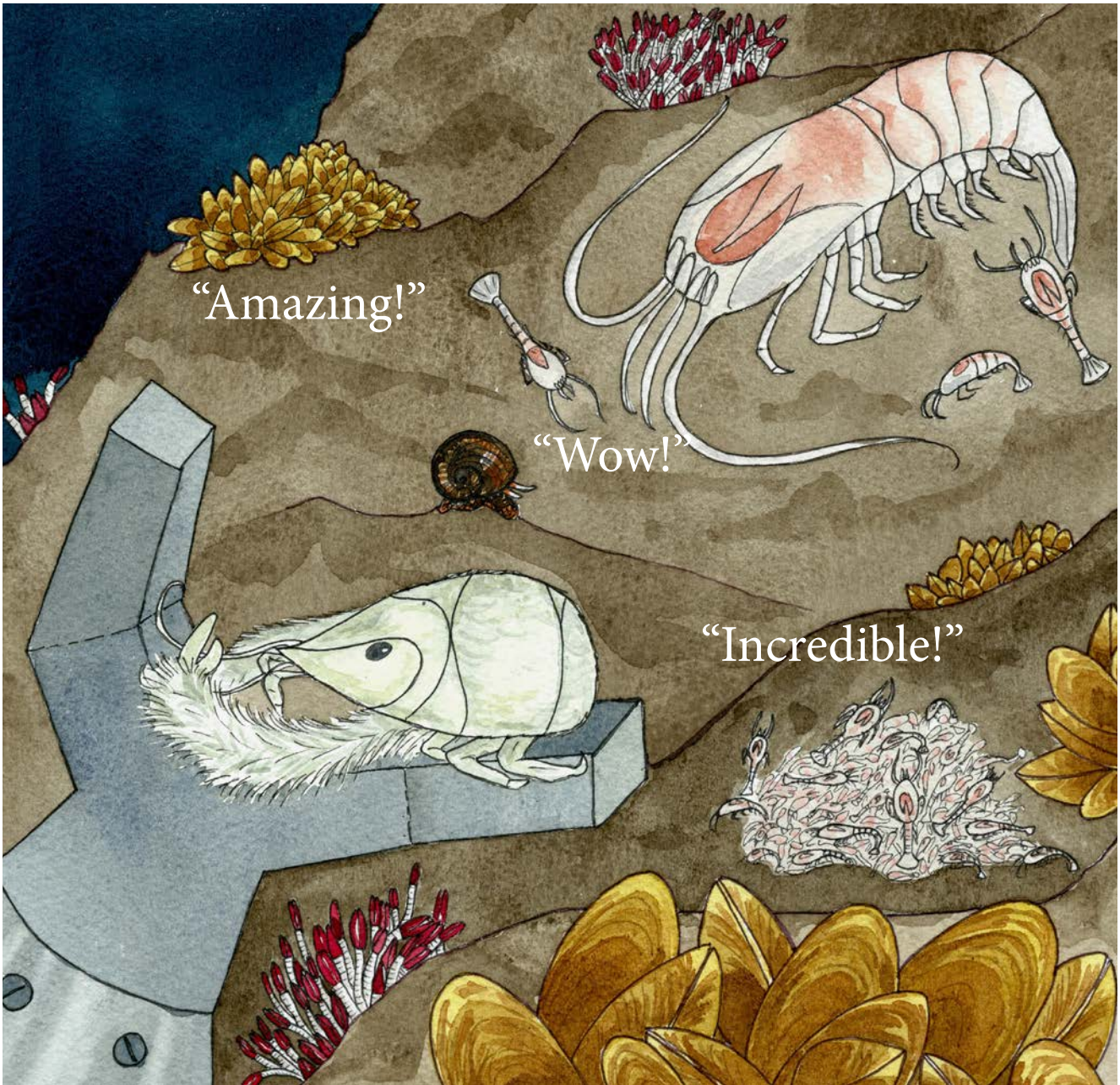
"I've read about this!" exclaims Phoebe. "This light is called bioluminescence. In the dark ocean, animals are able to light up so they can communicate with each other - animals like these comb jellies, squid and this viperfish"

Finally, after two hours, the bottom of the ocean came into view. They were almost 3000 metres below the sea surface. “It’s getting really chilly in here!” says Tevita.

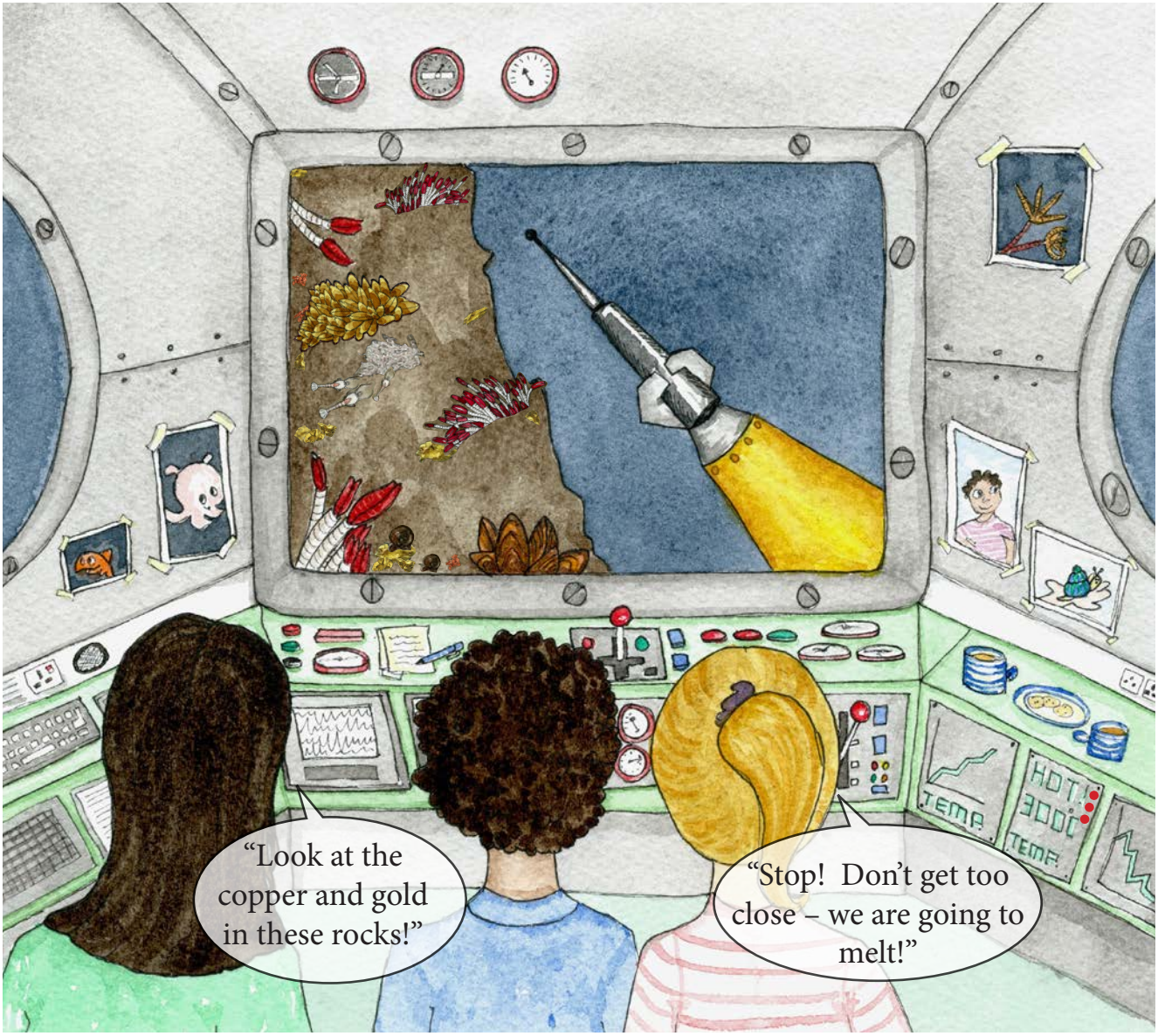
“Wow! Are those corals? I swim around the beautiful coral reef of my island, but I didn’t know corals lived so deep and in such cold waters.”


"Look at that shimmering water and black smoke. It's gushing from chimneys" says Kaira.
Some of the chimneys were as tall as three giraffes standing on each other's heads.
"Smoke? You can't possibly have smoke at the bottom of the ocean!" says Phoebe
"It must be very hot water. Let's take a closer look!"

"Wait! What is that?" asks Tevita. They couldn't quite believe their eyes. The smoking chimney was crawling with bizarre and exotic animals. They saw yeti crabs, mussels, shrimps, tubeworms, stalked barnacles and snails.

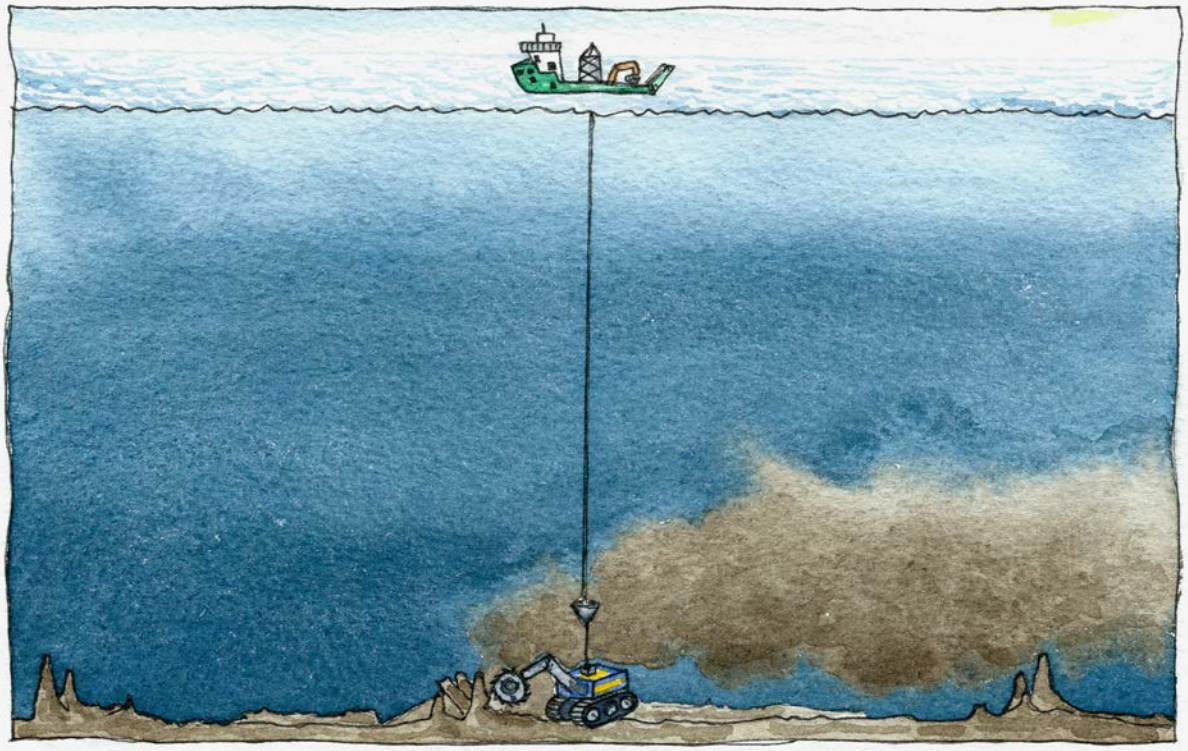


"It's like an oasis! What sort of animals are these?" asks Kaira. The explorers were captivated. "How can they survive in such a harsh place?" "It's so cold in the surrounding water, but so hot in the black fluids - 300°C!"



“OK team - I think we need to stop and think. Life in the ocean is so astonishing - we need to know more about the treasures in this place - about the minerals AND the animals!” says Tevita.

“Does anyone know how to collect the mineral treasure?” asks Phoebe.



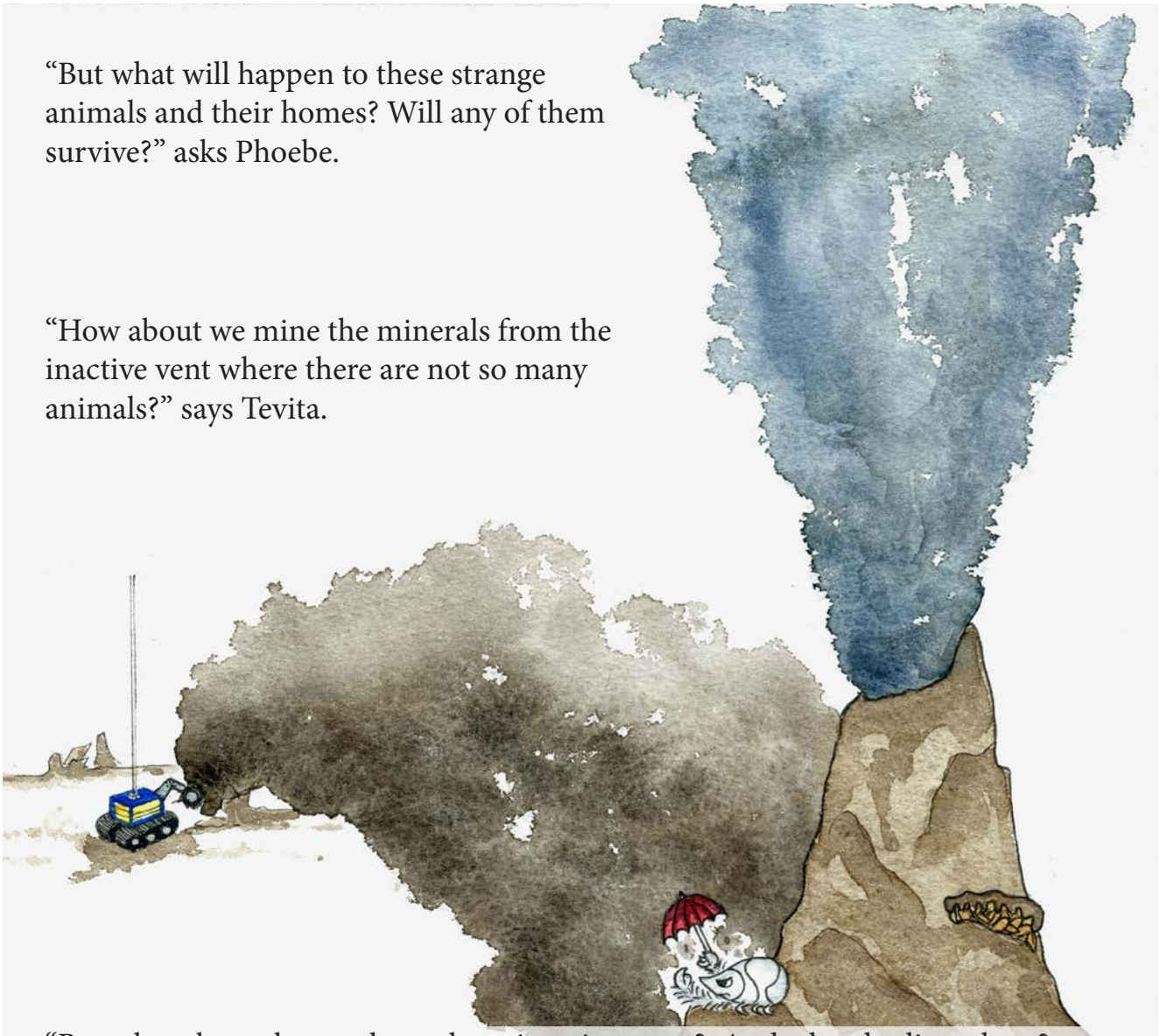
"I do." replies Kaira. "It's called mining. Huge robot machines will cut up the rock on the seafloor flattening the mined area and creating clouds of mud.

The rock will then be sucked up a very long pipe onto the ship.

After that, the minerals will be taken out from the rock so they can be used. Some of them are worth a lot of money."

“But what will happen to these strange animals and their homes? Will any of them survive?” asks Phoebe.

“How about we mine the minerals from the inactive vent where there are not so many animals?” says Tevita.

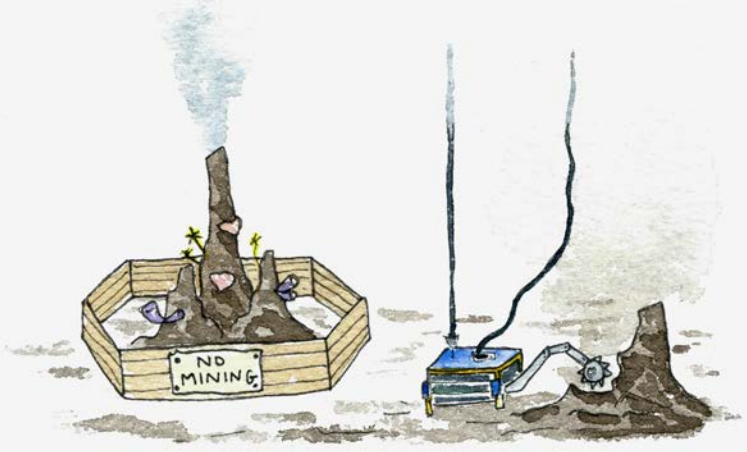


“But what about the corals on those inactive vents? And who else lives there? Could the cloud of mud spread far and wide, affecting other animals? They probably have important jobs to do to keep our oceans healthy” says Kaira.

“Perhaps some will be able to move away to another home and maybe their old home will eventually recover” wonders Tevita.

“Surely those huge machines will be really noisy – do you think that will affect the whales that swim through here?” says Phoebe.

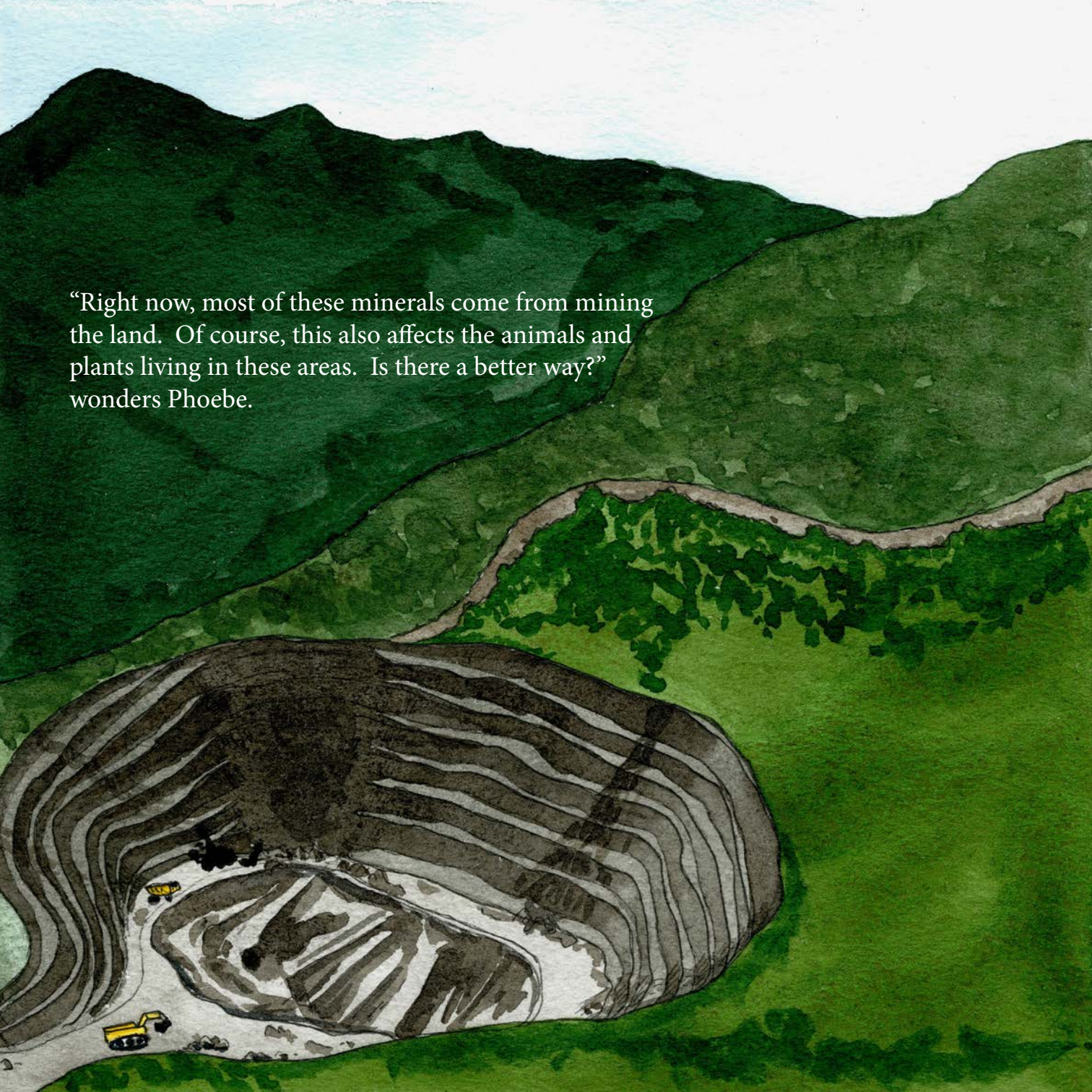
"My mum designs wind turbines, solar panels and electric-car batteries and she needs the minerals to make them work", explains Kaira.



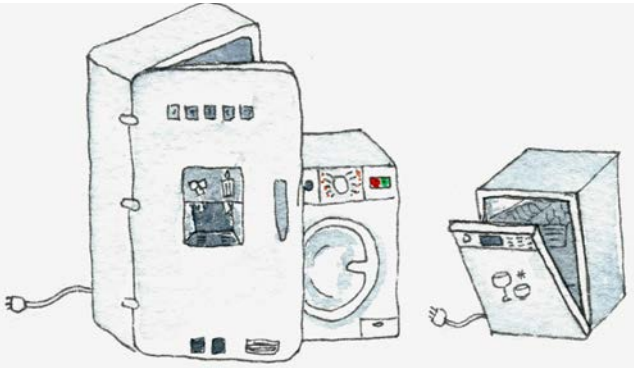
"What if we just take some of the minerals and leave the rest of the animals' home untouched?" suggests Tevita, "like a nature reserve."

The group had a lot of thinking to do and they had a feeling this was not going to be an easy decision! After all, we all use these minerals every day for things like electricity, batteries, phones, computers, even the submarine they are travelling in.

“Maybe with some of the money made from mining the mineral treasures we could build a new school and hospital on the island. That would be good!” says Tevita, “But if mining happens close to land, it could affect the animals and plants in the sea, the fish we catch to eat or sell, and even put off visitors from coming to our island.”

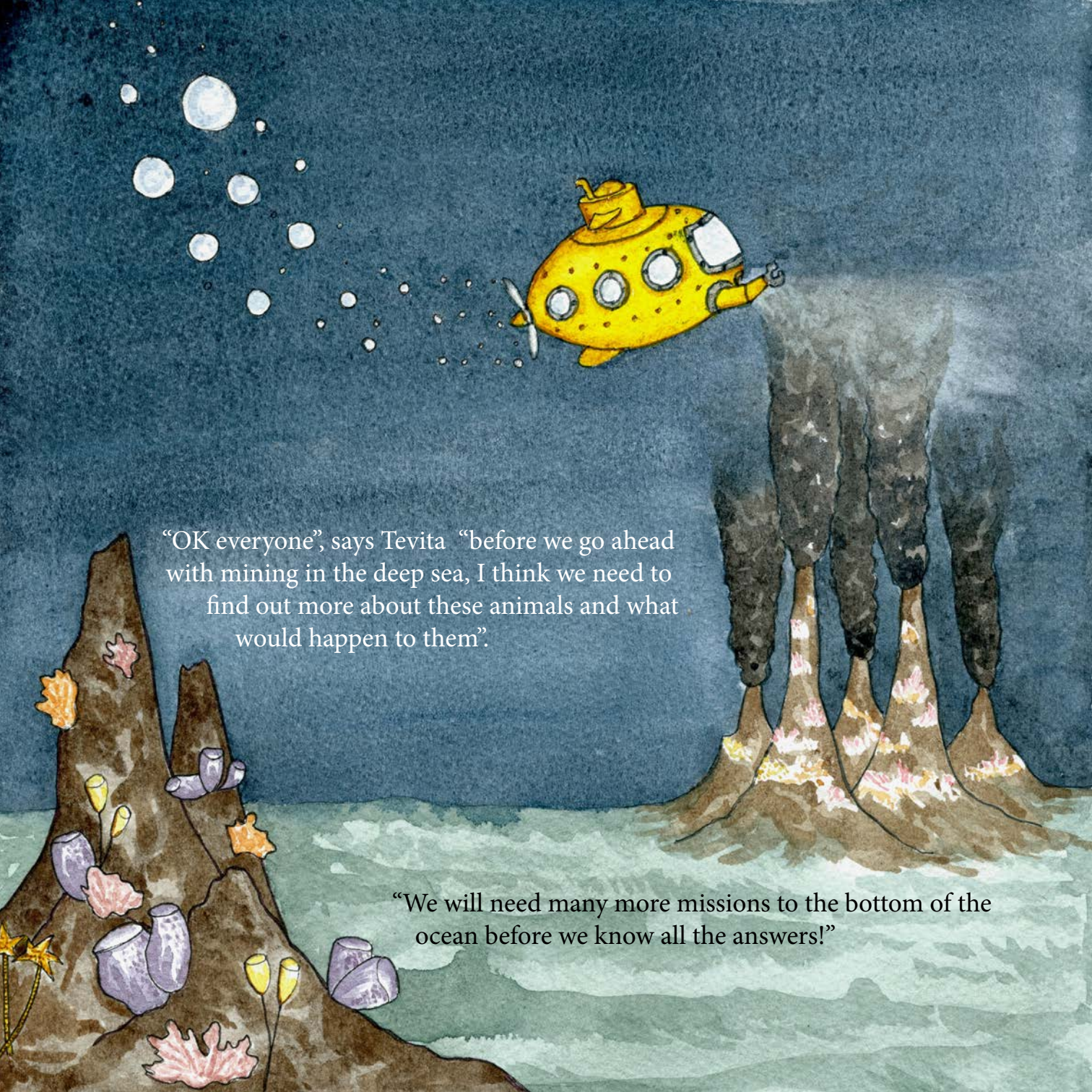


"Right now, most of these minerals come from mining the land. Of course, this also affects the animals and plants living in these areas. Is there a better way?" wonders Phoebe.

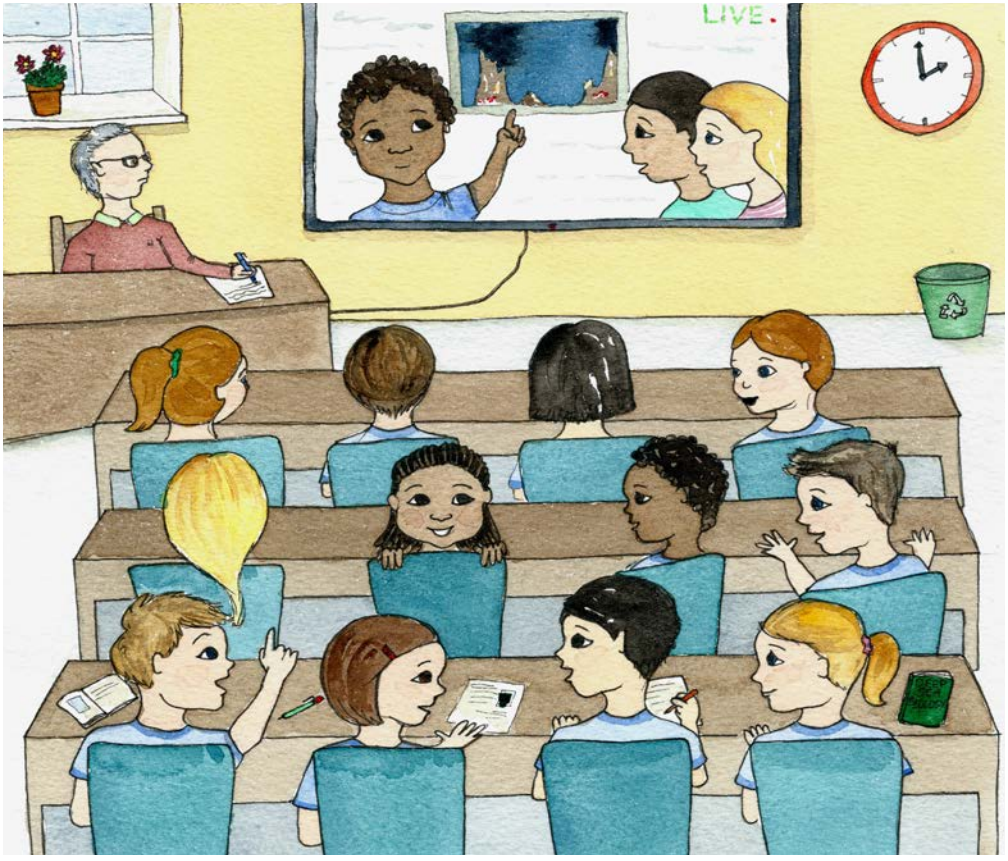


"Can we reuse and recycle what we already have, like we do with paper? We do have a lot of old fridges, TVs and cables…… maybe we could take the minerals we need out of them and re-use them?" suggests Tevita.

"Perhaps we can also work out ways to use fewer minerals in our lives" says Kaira. "Do we need to replace our phones and computers so often? Maybe the new designs of the future can use fewer minerals in the first place!"


"OK everyone", says Tevita "before we go ahead with mining in the deep sea, I think we need to find out more about these animals and what would happen to them".
"We will need many more missions to the bottom of the ocean before we know all the answers!"

The three explorers reported back to their schools about their mission. Their stories sparked much excitement among the children.



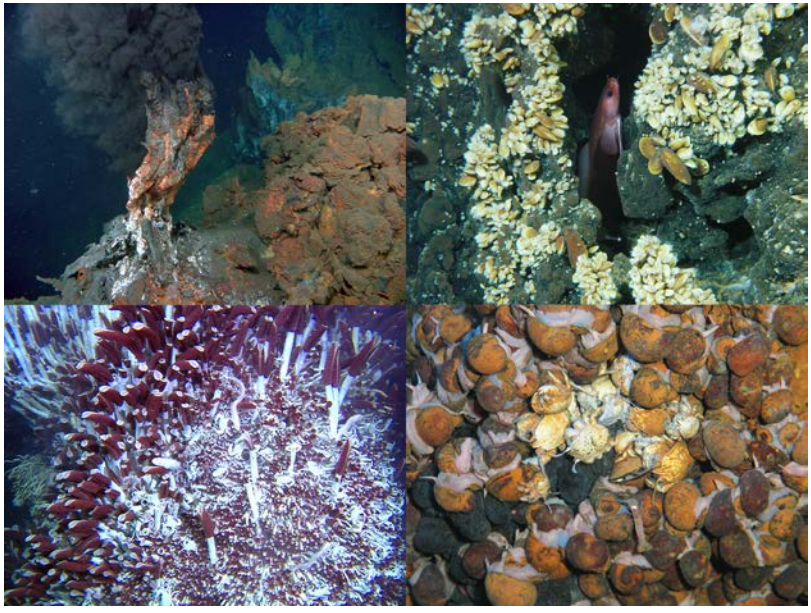
"I think you are going to need some more recruits for your team!" says Matthew.
"Wow! You found so many treasures!" says Sammy. "Count me in for the next mission to the bottom of the ocean!".
"Me too!" enthuses Karabou, "I want to build mining machines that avoid harming animals as much as possible".
"I want to study law and make sure that rules are in place and pirates can't take the treasure that belongs to everyone on Earth" says Alfred.

"Do YOU want to help find the answers?!"

What would you do? Collect the mineral treasure even though it may harm the animals? Find a way to collect some of the minerals without harming all of the animals? Or leave all treasures (animal and mineral) undisturbed, which may mean changing how you use the minerals that we have already extracted?

Information for Parents and Teachers

International experts are assisting national governments and the International Seabed Authority (an international organisation established under the 1982 United Nations Convention on the Law of the Sea) to produce rules and regulations on how we should use our deep-ocean mineral resources for the good of humankind, and to benefit people living in developing countries. The Commonwealth Secretariat works with the many Commonwealth Governments, which are located in every continent and ocean of the world, to help design those rules. The Governments work together under the Commonwealth Blue Charter to balance the three important goals of environmental protection, benefit sharing and economic development. The Deep-Ocean Stewardship Initiative works to ensure the latest scientific knowledge of the animals and habitats is considered in the rules.



Hydrothermal vent ecosystems showing a black smoker from the Mid-Atlantic Ridge (top left), a bed of the mussel *Bathymodiolus* with a fish at the Mid-Atlantic Ridge (top right) (both © SEHAMA 2002. FCT, PDCTM 1999/MAR/15281), dense aggregations of the tubeworm *Rifita pachyptila* from the East Pacific Rise (bottom left © R. Lutz) and dense aggregations of the gastropods with some *Kiwa* crabs from Indian Ocean vents (bottom right © Uni. Southampton).

It is important to protect ocean health and sustainably use resources for future generations.

Industry is currently exploring the possibility of extracting the following mineral resources from the deep ocean:

Seafloor massive sulphides from hydrothermal vents, as illustrated in this story, are mostly found on mid-ocean ridges, volcanic arcs and back-arc basins around the world. They occur at 500-5000 meters depth in both national and international waters. They comprise copper, gold, silver, zinc and lead. Microbes found at vents use hydrothermal chemicals in the same way plants use the sun's energy to support life, and often live in association with animals, providing food for them. This is why hydrothermal vents are home to high numbers of large animals, which have extraordinary adaptations to their environment.

Image of the seafloor (50 cm across) in the abyssal Pacific showing nodules and large deep-water prawn (*Bathystylodactyloidea*). © D. Jones, UK National Oceanography Centre.

Polymetallic nodules are found on abyssal plains in waters ranging from 4000 to 6000 metres. The highest quantities have been found in the Pacific Ocean. These nodules are potato-sized and are rich in manganese, nickel, copper and cobalt. Here, there is a high diversity of mostly small animals that live in the sediment, between and on the nodules. Most of these animals are new to science. For example, one of the most common animals on nodules, a small sponge, was discovered in 2017.

Cobalt crusts are found on seamounts at depths between 400 and 4000 metres. They are rich in cobalt, nickel and platinum. According to current knowledge, the Pacific Ocean has the most promising sites for mining. In these environments, corals, sponges and a variety of other invertebrates are found in high numbers.

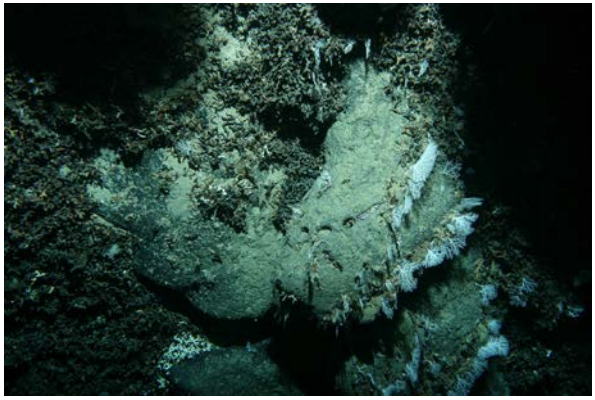


Image of a cobalt-rich crust seamount in the Pacific showing corals. © National Institute of Water & Atmospheric Research, New Zealand.

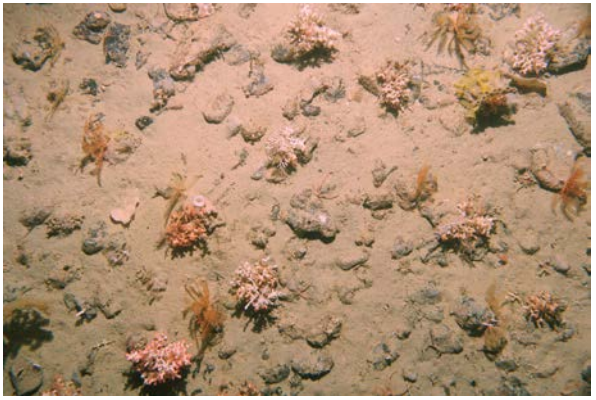


Image of the seafloor with phosphorite nodules off New Zealand, showing associated animals that include sessile filter feeders like corals and sponges and mobile crabs, amongst others. © National Institute of Water & Atmospheric Research, New Zealand.

Phosphorite nodules are found on continental margins between 200 and 400 meters depth. They are much smaller than polymetallic nodules and, so far, they have been found off New Zealand, Mexico and Namibia. These minerals are often found in areas where fisheries occur along with a wide variety of invertebrate species.

As with seabed mining, there are other activities in the world that, when done on industrial scales, also have to balance exploitation and conservation, for example, agriculture, aquaculture and fisheries. The impacts and management of these activities are further complicated by climate change and pollution. The deep ocean is particularly difficult and expensive to explore and monitor, which makes deep-sea mining a tricky issue to manage.

The Commonwealth in association with DOSI DEEP-OCEAN STEWARDSHIP INITIATIVE University of Southampton IN DEEP

Funded by the Commonwealth Secretariat
ISBN: 978-1-9161279-1-3