



SCHOOL JOURNAL

MAY 2017



TITLE	READING YEAR LEVEL
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Who Froze Farrell Flint?	6
New Boots	6
Designed for Good	5
Becoming a Martian	6
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This Journal supports learning across the New Zealand Curriculum at level 3. It supports literacy learning by providing opportunities for students to develop the knowledge and skills they need to meet the reading demands of the curriculum at this level. Each text has been carefully levelled in relation to these demands; its reading year level is indicated above.

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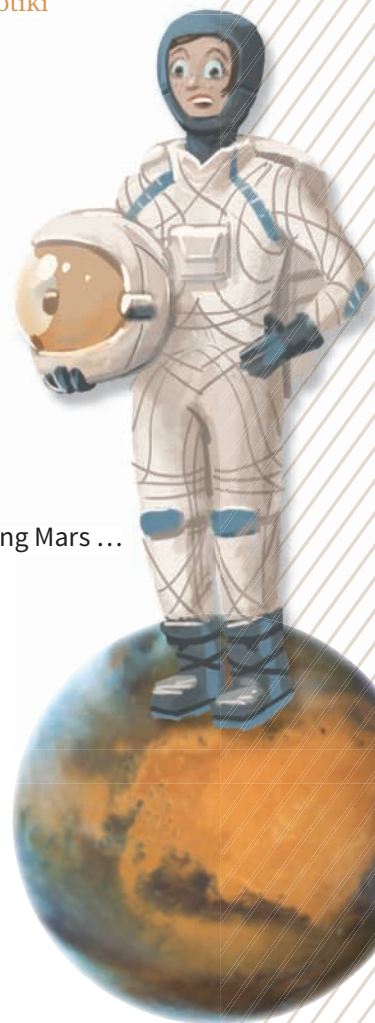
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Kōpūwai and the Clever Girl

*retold by
Brian Potiki*

This story is from Rapuwai, an ancestral iwi of Ngāi Tahu. It is set on the banks of the Mata-Au/Clutha River, in Otago, and comes from a time long ago when moa roamed the land and giant tuna swam in the rivers. Each summer, hunting parties would travel inland to gather this food. Sometimes, people would disappear. Whānau blamed Kōpūwai, the monster from the river who preyed on humans with his ferocious pack of two-headed dogs ...



Kaiamio knew the stories about Kōpūwai and his dogs. Where she came from, all the children did. The kaumātua gave constant warnings. Hunters bragged of close encounters. The girl hadn't meant to wander, but all week her party had been hunting moa, and it was her job to search for the giant bird's nests. She had been distracted. She hadn't noticed the dogs stalking.



It was no use putting up a fight. The dogs took Kaiamio to their master's cave. Kōpūwai was exactly as people said: a monstrous creature with the body of a man, the scales of a fish, and the head of a dog.

"Who have you brought me this time?" he growled to his dogs. "Ah-ha. A girl. You shall be my mōkai. You will do all my chores."





Fearsome though he was, Kōpūwai had one weakness. The warm north-west wind made him sleepy. He would yawn no matter what time of the day it blew. If he nodded off, the monster knew that his new mōkai would escape. So he made a taura from a long piece of plaited harakeke and tied it to the girl's ankle.

"Fetch water for me and my dogs," he said. "Day or night, when I tug on this taura, you will come."

Kōpūwai shoved a gourd into the girl's hands and leant closer. His scales glistened. His breath stank of fish. "Whakarongo. If you try to escape, I will have my dogs rip you to pieces."



Kōpūwai barked constant orders. “Kaiamio,” he would shout at first light, tugging on the rope. “He kai. Kia tere!”

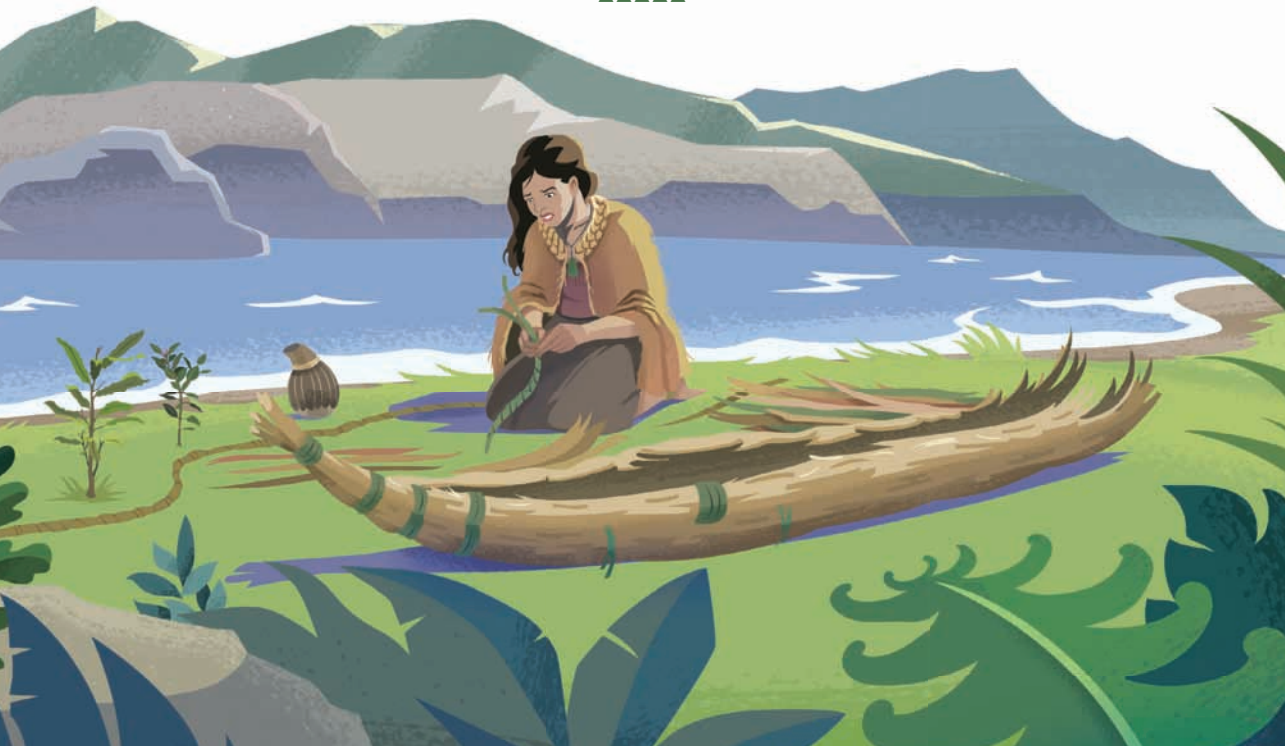
The girl would prepare food and take it to the cave entrance, where the monster liked to loll in the morning sun, scratching his dogs’ bellies. Kōpūwai would eat. Then he would be thirsty. “Kaiamio. He wai. Kia tere!”

Countless times each day, Kaiamio trudged down to the river. Sometimes she stole a moment to stand and watch the water flow. She would think of her whānau and dream of escape.



Time passed, but nothing changed. One end of the taura never left the monster’s hand; the other stayed firmly attached to his mōkai. Then one morning, Kaiamio was down on the rocks, filling her gourd, when she slipped. Her hand grasped a young sapling, as slim as a girl’s ankle. Pulling herself up, Kaiamio had a sudden idea.

Over the next few weeks, whenever she had a spare moment, Kaiamio collected the raupō that grew by the river and began to weave a mōkihi. When the raft was finished, she hid it beneath a rocky ledge, marking the place with a sharp stone. Then she waited for the north-west wind.

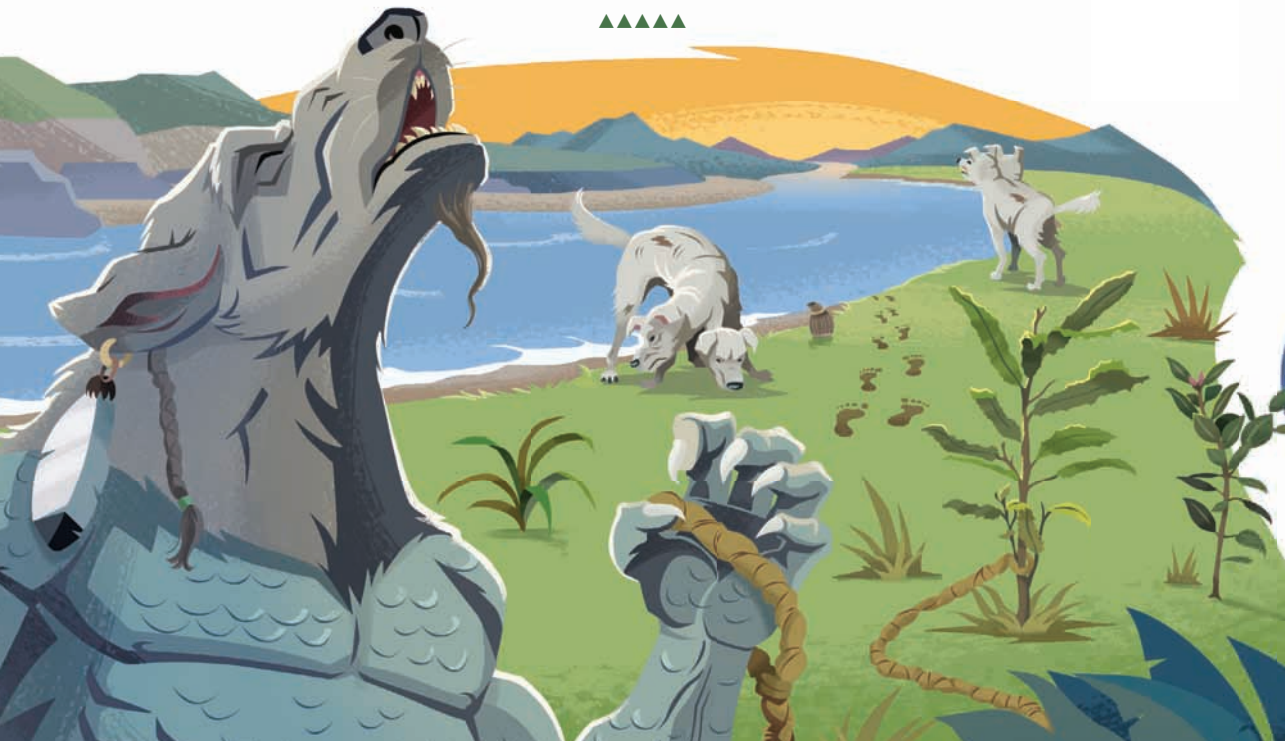


When the wind came, Kaiamio was ready. She scrambled down to the river and found the stone. Working quickly, she cut through the harakeke rope and tied it to the sapling. Without wasting another second, she launched the mōkihi into the river and let the current carry her away.

Kōpūwai woke when the sun was high overhead. He yanked the taura. Down at the river, the sapling bent, then straightened, bent then straightened. "Kia tere!" he yelled. Twice, three times ... but the girl never came.

Kōpūwai fumed. No one made him wait – and certainly not a mōkai. He called for his dogs. They slithered ahead down the bank, leaping over one another in a tumble of fur and slobber. Down by the river, Kōpūwai found the rope tied to the sapling and the abandoned gourd. Footprints in the mud led to the water's edge. The monster howled in anger. He had been tricked.

It wasn't in Kōpūwai's nature to do nothing. He dipped his snout into the fast-flowing water. He would drink the river dry to recapture his mōkai. Over and over, the monster took enormous gulps. His belly swelled to contain its load, but the river was too big. There was too much water. The clever girl was gone.



Kaiamio escaped back to her people on the coast. After hearing her story, several of the bravest planned revenge. They would kill the monster while he slept – his dogs too. They would show no mercy.

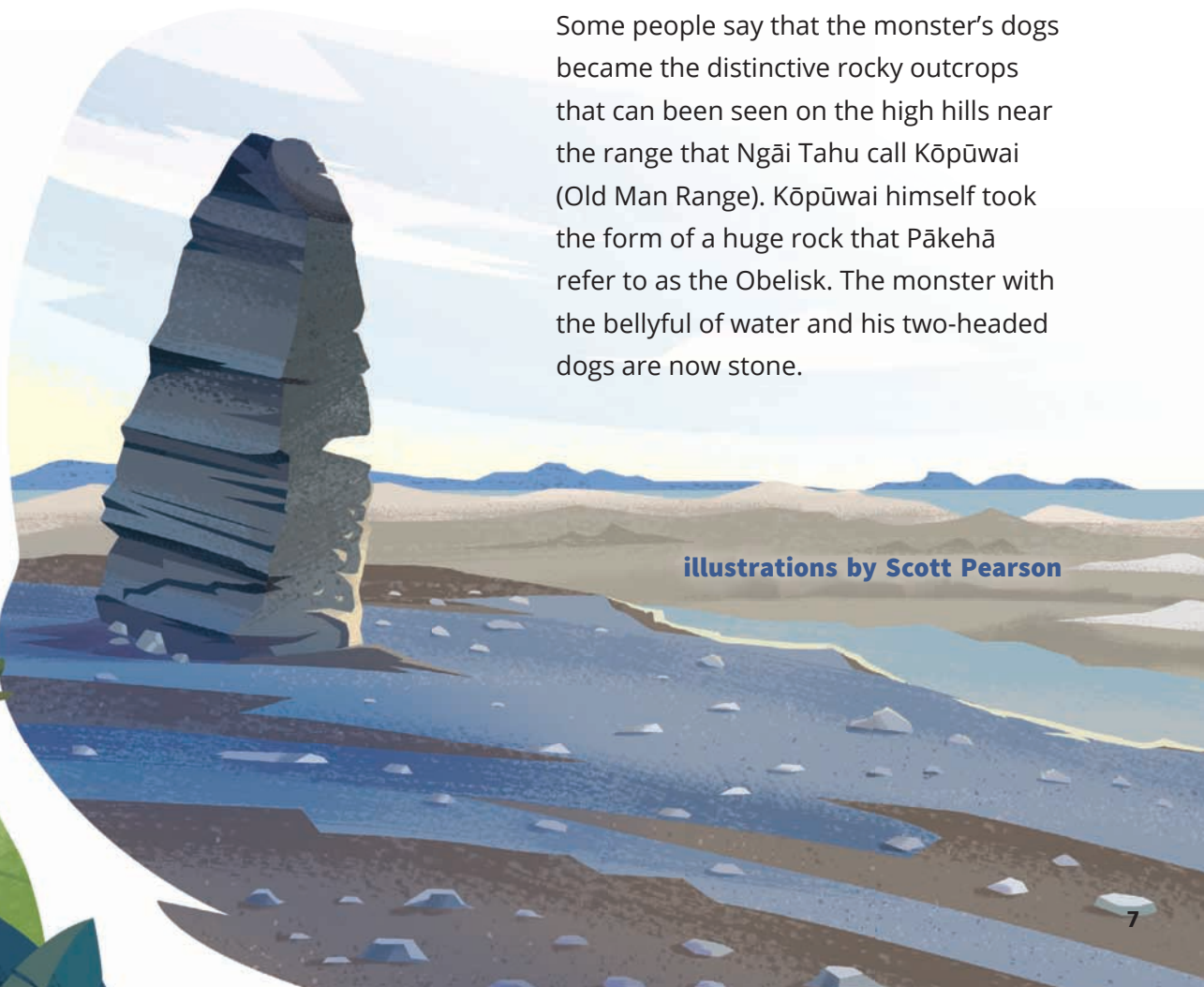
Together the hunters travelled the familiar route inland and waited for the north-west wind to blow. When they were sure that Kōpūwai was asleep, they carefully laid bundles of dry brush and kindling in the cave entrance. Finally they set it alight with a flaming torch.

As the fire took hold, the first dog, both heads howling in terror, burst from the dark. It flew through the bush and leapt into the river, quickly followed by a second dog, then a third. Those left in the cave, including their owner, perished.



Some people say that the monster's dogs became the distinctive rocky outcrops that can be seen on the high hills near the range that Ngāi Tahu call Kōpūwai (Old Man Range). Kōpūwai himself took the form of a huge rock that Pākehā refer to as the Obelisk. The monster with the bellyful of water and his two-headed dogs are now stone.

illustrations by Scott Pearson



DESIGNED FOR

BY PHILIP CLEAVER



“That’s it!” Has the answer to a problem ever hit you out of the blue? It once happened to designer Craig Bond. He’d been thinking about ways to power a new pest trap and was stuck. One day, he was out biking and got a flat tyre. A stranger offered to pump up the tyre using a small canister of compressed gas. Within seconds, the tyre was inflated ... and Craig had his idea.

GOOD



THE PERFECT TRAP

Craig had studied **industrial design** at university. This was where he met Stu Barr and Robbie Van Dam. All three classmates enjoyed the outdoors and had seen the damage caused by possums and other pests. Around 2007, they began to talk about designing a new kind of pest trap – one that would work better than traditional models. “We had high hopes,” says Craig. “We wanted our trap to be a big leap for conservation.”

Along with the use of poison, traps have always been an important part of pest control in New Zealand. But traditional traps are heavy and difficult to use in rugged country. They are also powered by springs, which have to be reset by hand. This involves a lot of extra work. To be truly efficient, the three designers knew that their model had to be self-setting. They had other goals too. They wanted their trap to be lightweight, durable, affordable, and reliable. Most important of all, the trap had to be humane. Pests had to die quickly, with little pain.

industrial design: the design of products that will be made in large numbers, usually in a factory

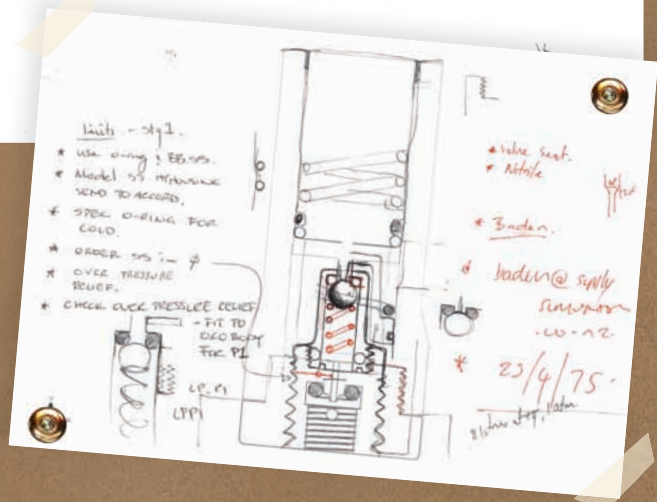
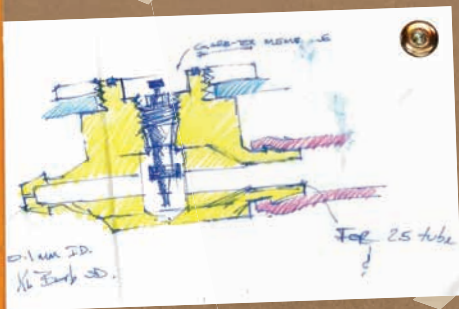
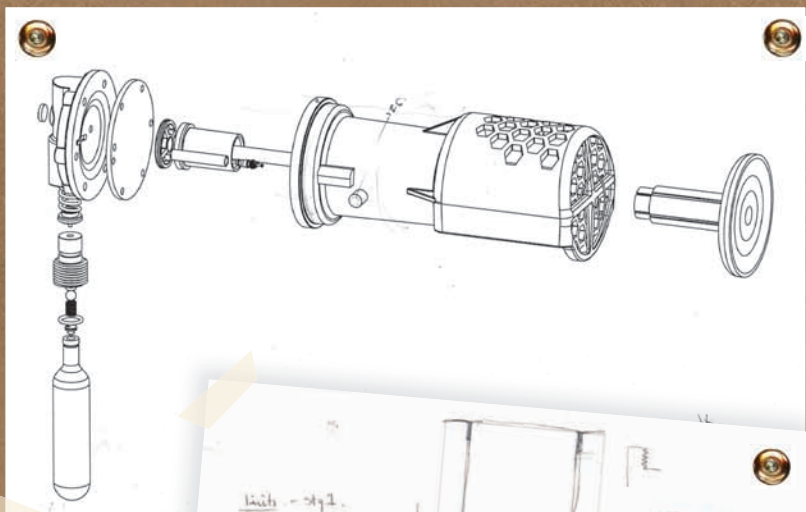
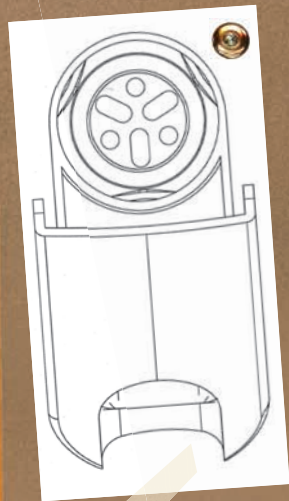
THE PEST PROBLEM

Our ancestors didn't come to Aotearoa alone. They came with rats, kuri, mice, ferrets, cats, stoats, possums, deer, pigs, and goats ... to name just a few. Some of these species, such as deer, were brought for sport. Possums and ferrets were brought for their fur. Ship rats and mice were stowaways.

These introduced creatures have had a huge impact on our environment. The kiore or Pacific rat, which was brought to New Zealand by the East Polynesians around 1300, contributed to the extinction of some native bird species before Pākehā arrived. Bird numbers declined further when Europeans came with their species, such as stoats. These are especially dangerous predators because they can climb trees and swim.

Then there are possums. New Zealand is said to have around 30 million. Like stoats, possums prey on baby birds and birds' eggs – although the most serious damage they cause is to native trees. Possums eat a huge number of leaves. This can stress a tree so much it will eventually die. Some forests have lost all of their rātā and kāmahī, two of the possum's favourite species. Possums also eat flowers, berries, and seedlings. This prevents regrowth. It also means less food for native birds.





A HUNDRED IDEAS

Craig, Stu, and Robbie decided to brainstorm a hundred different ways a trap could reset itself. “It was a big number,” says Stu, “but we wanted to explore all our options.” There was an idea for a solar-powered trap. There was one inspired by a mechanical system used in old watches. Designs with the most promise were taken to the next stage: the **prototype**. “An idea could only be taken so far on paper,” Stu says.

“The best way to figure out if a trap design would work was to make it and test it. The idea had to be made real.”

Then the stroke of luck: Craig got his flat tyre. Compressed gas was cheap and accessible – it might be a great way to power a trap. But the big question was how exactly would this system work? The friends didn’t know it, but finding the best design would be a long way off.

prototype: an early version of a product that can be tested and improved

DESIGN AND REDESIGN

Designing a self-setting trap that used gas became the team's focus. There were a lot of false starts. "At first we took a traditional trap for smaller pests and tried to modify it," Stu remembers. "These traps trigger when a rat or stoat steps on a steel plate." There were problems with this design. The trap sometimes misfired, and it didn't kill quickly enough. "We decided to try again with a possum trap," says Stu.

To get the best result, the team needed to know more about possums. How did they behave around traps? What did they like to eat? To learn the

answers, Robbie had a great idea: filming possums in the bush. From watching the footage, the friends learnt that possums used their paws to hold on to the trees. They also poked their heads into the traps. Learning things like this limited the need for guesswork when it came to refining the design.

To attract possums, the team also researched the best **lure**. "In the end, we decided to employ a **biochemist**," Stu says. "Again, we found out things we'd never have learnt on our own – like possums are attracted to cinnamon. They can smell it a long way off."

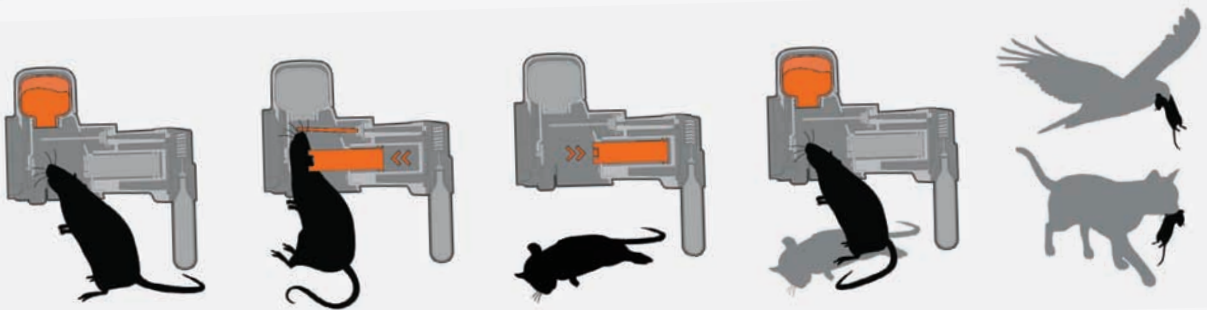
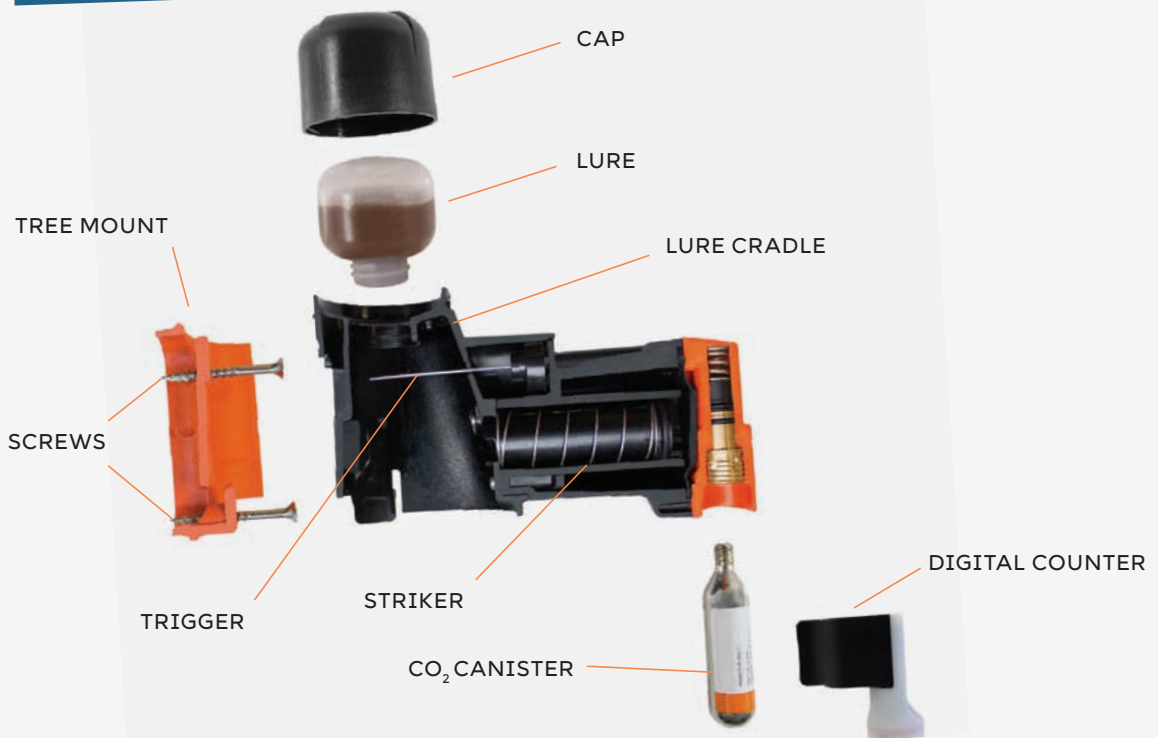
THE FINAL MODEL

After three years, in 2010, the friends finally had a trap they were happy with. Their new model was self-setting and gas powered – and designed to fire when a possum bit on a trigger. This meant the animal's head was in the right place to be killed instantly. The trap was humane, and it was also efficient. A small canister of compressed gas was enough to kill twelve times.

Early feedback from users was positive. The traps were easy to use and reliable. Best of all, data from the

field showed that the new traps worked better than the traditional traps, even when the old ones were regularly cleared and reset. These findings were backed up by the trappers themselves. One trapper said the same trap killed three possums in one night. But for the three designers, the ultimate proof was the recovery of native species in the places where their traps were being used. Spurred on by success, the team went on to design a smaller self-setting model to catch rats and stoats.

THE (RAT) TRAP



1. The rat smells the lure.

2. The trigger is moved by the rat, firing the striker.

3. DEAD!
The trap resets itself.

4. A new rat smells the lure.

5. The dead bodies are scavenged.

biochemist: a scientist who studies the chemical processes in living things
lure: something that is used to attract an animal

ROOM TO IMPROVE

Today, around thirty thousand of Craig, Stu, and Robbie's traps are in use in New Zealand. Most are the smaller model, although their possum trap is still popular. In recent years, the small trap has even been used in Hawai'i and Puerto Rico, where there are problems with rats. The traps have also been adapted to use with pests that aren't found in New Zealand, such as mink.

To keep up with demand, the initial team of three has grown. The friends now employ seventeen people, all of whom have different skills and ideas.

When it comes to design, there's always room for improvement. "We're satisfied with our traps," says Robbie, "but we still look ahead." The new slow-release lure dispenser is a great example of recent innovation. "It means the lure now lasts for six months instead of one."

Now the team is talking about using drones. Could they be used to drop the traps in the bush or even to replace the gas canister and lure? At the moment, trappers have to do this work.





PEST FREE?

The self-setting traps are an exciting development for pest control in New Zealand. The three friends hear amazing stories all the time. In one part of Fiordland National Park, it took only two months to reduce a large rat population to zero.

In 2016, the government announced the goal of making New Zealand pest-free by 2050. The plan is to start with our three “worst” pests: rats, stoats, and possums. “Eliminating these three pests – and all the others – is possible,” Craig says, “although my guess is we’ll need completely new technology, maybe something we can’t yet imagine. But a pest-free New Zealand ... it’s definitely worth aiming for.”



ALVIN AND ME

BY CHRIS TSE

A week before Alvin arrived, I got summoned to the principal's office. I was a good kid. I never got into trouble. I was sure I'd done nothing wrong. But still, I couldn't help worrying ...

Mr Tyson explained that there was a new boy starting. He needed a friend – someone to show him round, to help settle him in.

“You speak Cantonese, don't you, Chris?” Mr Tyson asked.

I did, but only at home. Never at school. Speaking another language only drew attention. I didn't want that.

... ..

New students weren't uncommon at my school, but they came from other parts of New Zealand – never Hong Kong. My entire class was buzzing, but on the morning Alvin was introduced, he didn't say a word. He played with his shirt cuff and stared at his shoes, avoiding eye contact. He looked like he might burst into tears at any second.

Mrs Harrison showed Alvin to the empty desk next to me. She explained to the class that I was going to be his buddy but we were all to make him welcome. Alvin looked relieved to see a Chinese face. I told him my name and said that I could speak Cantonese – if I had to.

“Thank you,” Alvin said. He spoke so quietly that, at first, I wasn't sure he'd said anything at all.

... ..

My parents owned a Chinese takeaway and grocery shop. When we had shared lunches at school, my mum would deliver crispy prawn crackers and golden wontons, sticky with sweet-and-sour sauce. They were devoured. When I was old enough, I worked at the shop after school and on weekends, doing my homework in between serving customers and bagging rice.

As I grew older, I was given more responsibilities: the banking, opening and closing the shop, taking orders. I had a very different childhood from all the other kids I knew. I wished I could hang out more, like my friends, but working in the shop was a way to help my parents. Like I said, I was a good kid.

... ..



I wasn't much help to Alvin. He barely spoke a word that first week, although he seemed to be coping OK. Occasionally, Mrs Harrison came over to check. She commended me for being a good buddy. Obviously the fact Alvin wasn't in tears or hadn't run away was seen as success.

Alvin did ask some questions. He especially wanted to know about my family. He struggled to understand when I spoke in English, which meant I reluctantly had to switch to Cantonese.

"What do you two talk about?" Tom asked one lunchtime.

"Nothing," I said, shrugging off his question. "Schoolwork."

... ..

Alvin sat on our bench by the jungle gym every lunchtime. He was so quiet we sometimes forgot he was there, but he always listened and watched intently. He was like a person studying for an exam. Sometimes Alvin laughed when we laughed. One day, he finally said something. We were talking about our favourite cartoon, the *Transformers*. In the middle of a debate about the coolest robot, Alvin spoke.

"What's 'cool'?" he asked.

"Cool means cool," said Johnny helpfully.

"It means something is really, *really* good. It's cool," offered Tom.

Alvin thought about this, but he remained uncertain.

"Cool," he kept repeating. "The transformer robot is cold?"



I tried to explain in Cantonese, but I found myself becoming as confused as Alvin. I could tell that it amused the others to hear me speaking another language, and embarrassment washed over me. I told Alvin that if he didn't understand by now, he never would. He lowered his face and returned to his quiet self. I felt awful. I was meant to be his buddy. I worried that one of the boys would tell Mrs Harrison I'd been unkind to Alvin – or, worse, they'd tell Mr Tyson.

Later that day, after the final bell had gone, Alvin asked me if it felt strange to be different. The question surprised me. I told him that I wasn't different. I'd known most of these kids since my first day of school. Sometimes I got teased, but I tried not to let it bother me. The fact that I looked Chinese made me an easy target, but it was no different from teasing Tom about his curls or Johnny for being short.

Alvin studied my face. His sad brown eyes said that something was bothering him.

“I look different, like you, but I *feel* different, too.”

I didn't know what to say.



I thought about our conversation for days. I especially thought about it when my parents spoke to me in Cantonese. How *were* Alvin and I different: from everyone else ... but also from each other? Looking at the two of us, how would a person know which boy was from New Zealand and which boy was from Hong Kong? We were both Chinese on the outside – but I'd been born in Lower Hutt, the same as my mum. Her father had moved to New Zealand as a young boy from Canton. I grew up spending a lot of time with my mum's parents – they looked after me while my parents worked. My dad's family also came from China. When my brother was born, my other grandmother moved to New Zealand to help out, too. So yes, I looked Chinese – like Alvin – but I hardly ever *felt* Chinese. Actually, I didn't know how I felt. Different from other kids, sometimes ... but mostly the same.



Alvin's first days became weeks, then months. Soon enough, it felt as though he'd always been at our school. His English improved. He began to open up and talk about his old life. He would point to the sky, saying that some of the buildings in Hong Kong were so tall you couldn't see the top. None of us had seen a city like that. We loved hearing those stories.

Alvin eventually drifted into his own circle of friends. After that, the only time I really spoke to him was on a Saturday. His parents sometimes came to our shop to buy sheets of dried bean curd and shrimp paste. Alvin would come, too, and we'd sit behind the counter, talking. To be precise, Alvin did most of the talking. He seemed so relaxed now – nothing like the timid boy I'd first met. He even teased me about my Cantonese. According to Alvin, it wasn't that good, but he'd never liked to say.

... ..



It's been years since I've seen Alvin. Sometimes, when I hear the word "cool", I think about him. Looking back, I see that even though I was meant to help Alvin, he actually helped me. He made me realise that I wasn't the same as everyone else. More than that, I finally understood that there's no such thing as "the same". We all have different stories.

It's because of Alvin that I began to learn about my family history. I found out why my grandfather started a new life in New Zealand. I also researched where my ancestors came from – where I came from. Alvin helped me to become the person I hadn't known how to be. Now, I'm no longer afraid to speak Cantonese in public. I can probably thank Alvin for that too. He was right. I need the practice!



Thumbprints

Mum left Sāmoa in 1952.

To'ono drove her to the harbour in a jeep
abandoned by American marines.

I have a sepia photo of that day –
everything's the colour of spilled coffee,
though Mum had black hair and green eyes.

She was nineteen, so excited.

She wore a white Pālagi frock, leis around her neck.

Her mother cried when the *Matua* tipped over the horizon.

Her father refused to wave goodbye –
incarcerated for ten years in Aotearoa
before he had a single grey hair.

The first time on Motuihe Island,
the second on Matiu
because his father was German.

Mum arrived in Auckland on a hazy autumn morning
with a letter of introduction from the family priest,
an empty stomach, wobbly legs.

At the police station, she gave her thumbprint
and was issued with an identification booklet,
to be carried at all times.

*There are strict rules about what you can and cannot do, the officer says.
According to New Zealand law, you are an alien.*

Serie Barford

SAVAI'I

'UPOLU



BECOMING A MARTIAN

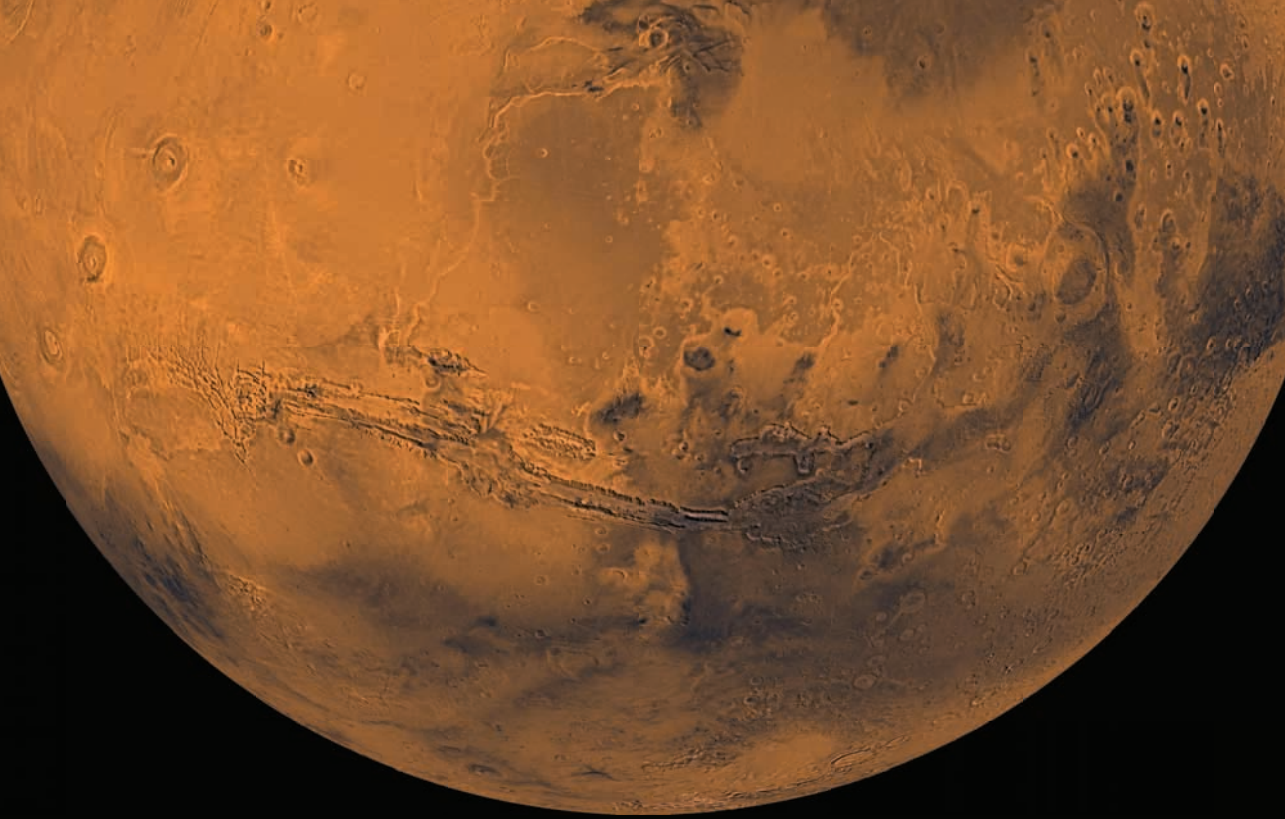
by Clare Knighton

Seventy thousand years ago, our first ancestors left Africa to discover the world. Three thousand years ago, the first intrepid sailors began to cross the vast Pacific Ocean. In 1969, Neil Armstrong and Buzz Aldrin set foot on the moon. We have exploration in our DNA. Now, some people want to visit Mars ...

Boots on Mars

On average, Mars is around five hundred times further away than our moon, and it takes eight months to get there. Any mission to Mars can only leave Earth – or return from Mars – every twenty-six months, when the two planets are at the closest point in their **orbits**. This means the first astronauts to Mars will be gone a long time. Still, plans for people to travel there are under way. Some people think “boots on Mars” will happen as soon as 2024.

These first people to Mars will be highly trained, but after that ... who knows? Perhaps they'll ask for volunteers to be the first Martian settlers. Before you put your hand up, though, there are lots of problems to solve. And you'll definitely want to make sure they've been sorted! Earth has everything you need to survive: oxygen, water, food, and shelter. These things aren't so easy to find on Mars.



Meet Mars

Place in solar system: Fourth planet from the sun

Mass: One-tenth of Earth's mass

Diameter: Half of Earth's diameter

Length of day: 24 hours, 39 minutes

Length of year: 687 Earth days

Gravity: One-third of Earth's gravity

Surface pressure: 0.6 kPa (1 percent of Earth's)

Temperature: -55°C on average (but varies from -133°C at the poles in winter to 27°C at the equator in summer)

Atmosphere: Carbon dioxide (95.3 percent), nitrogen (2.7 percent), argon (1.6 percent), oxygen and other gases (less than 1 percent)

Fresh water: A tiny amount flows on the planet's surface

Moons: Two (Phobos and Deimos)

Geological features: Mars is known as the Red Planet because of its colour (caused by large amounts of **iron oxide**). Other features include polar ice caps, Olympus Mons (the largest volcano in the solar system), and Valles Marineris (one of the largest canyons in the solar system).

1. The Oxygen Challenge

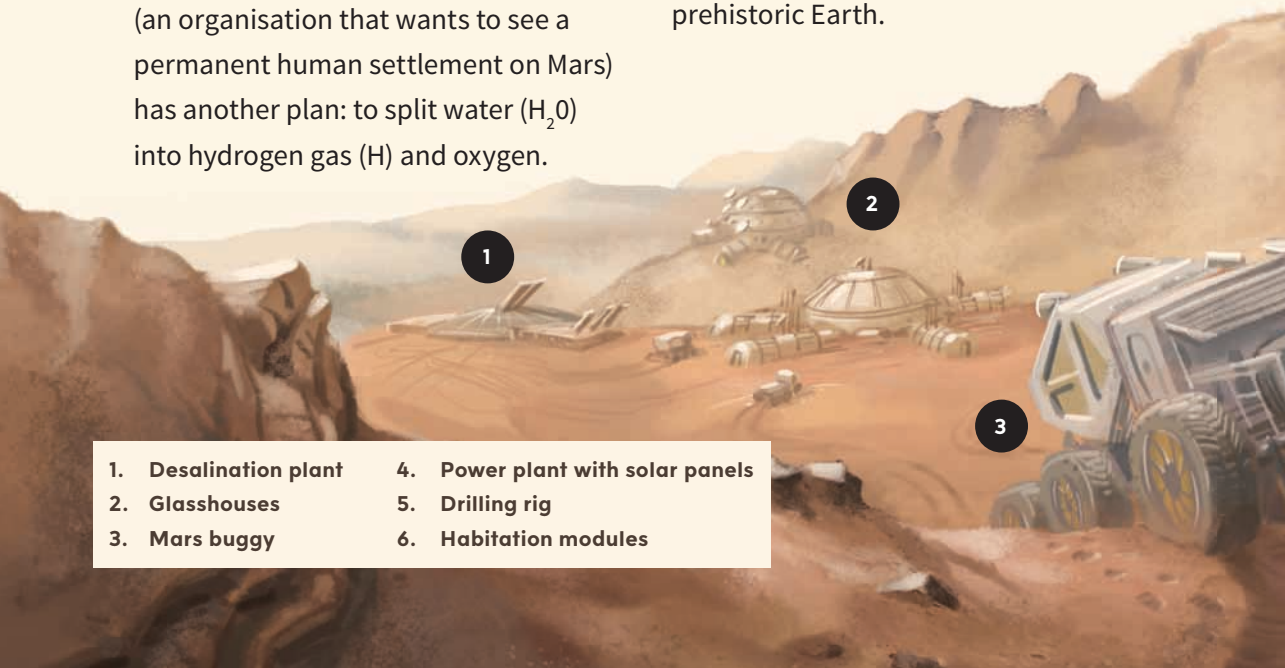
The air on Earth contains a lot of oxygen (around 21 percent). Your body uses this oxygen to burn fuel to make energy. On Mars, the atmosphere is 95 percent carbon dioxide. Breathing this would mean certain death because the carbon dioxide would replace the oxygen in your red blood cells. You would last around two minutes.

Possible Solutions

Carbon dioxide (CO_2) is made up of both carbon and oxygen. NASA has a machine called MOXIE, which uses electricity to split carbon dioxide into carbon monoxide (CO) and oxygen (O). NASA intends to send this machine to Mars in 2020. The Mars One mission (an organisation that wants to see a permanent human settlement on Mars) has another plan: to split water (H_2O) into hydrogen gas (H) and oxygen.

Both these methods can provide oxygen, but they require lots of energy. There are ways to get this energy, like using a special kind of solar panel that can make electricity from the sun. However, this idea isn't trouble-free. Mars has dust storms, which can last many months. These storms would seriously affect the amount of electricity the panels could make.

There's also the option of magma in one of the volcanoes on Mars – although it's doubtful any are still active. The magma's heat could be used to make steam. Steam is a source of energy used by geothermal power stations on Earth. But perhaps the easiest solution is to just rely on bacteria and plankton. Over millions of years, these living organisms would eventually convert CO_2 into oxygen – just like they did on prehistoric Earth.

- 
1. Desalination plant
 2. Power plant with solar panels
 3. Mars buggy
 4. Glasshouses
 5. Drilling rig
 6. Habitation modules

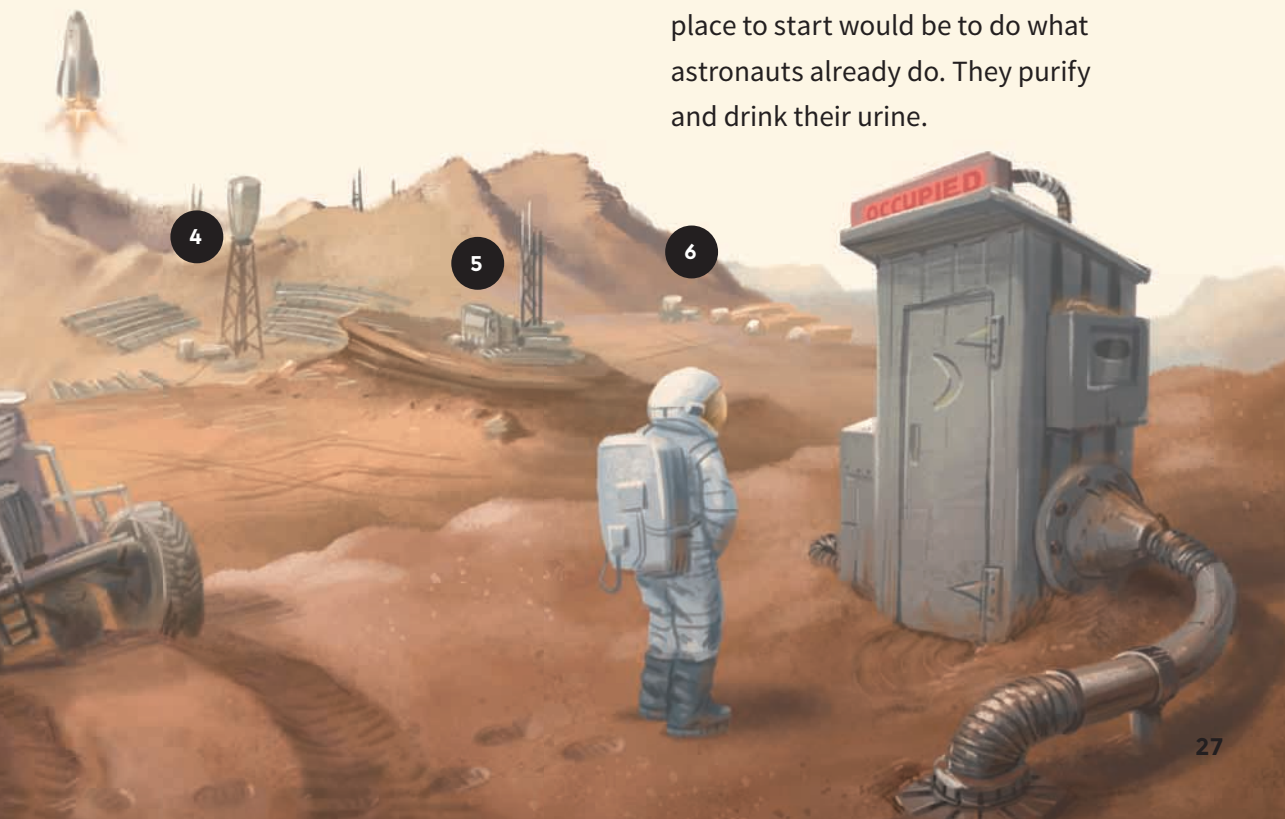
2. The Water Challenge

It doesn't rain on Mars. This means the planet has no rivers or lakes. Water is found as ice in the polar ice caps, but these ice caps are covered in a thick layer of frozen carbon dioxide.

Martian rovers have discovered more ice – underground. A tiny amount of water flows on the planet's surface, but only when the temperature is warm enough, and this water is full of **toxic salts**. Don't think you can just bring a supply of fresh water from Earth. Water is very heavy and takes up a lot of space. It would be an impossible task.

Possible Solutions

You could look for water by drilling deeper into the ground. Another option is to dig up the underground ice and use heat to turn it into vapour. This vapour could be condensed back into drinking water. Even though it's too cold to rain, water vapour is also present in the atmosphere on Mars. One energy-efficient way to get this vapour would be to extract it straight from the air. Then there are the polar ice caps, although water from these would need to be treated using a **desalination plant**. Of course, once you had drinking water, you'd need to recycle as much as possible. A good place to start would be to do what astronauts already do. They purify and drink their urine.



3. The Food Challenge

If settlers brought their own food, it would need to last for twenty-six months until the next supply rocket arrives. Each person's supply would weigh around 5 tonnes. Again, that's not a good use of space or rocket fuel. One obvious solution would be to grow food on Mars, but there's no soil. Instead, the planet's surface is covered in ground-up rock. This has too few of the nutrients that plants need. There's also the problem of the atmosphere, which contains too much carbon dioxide. And Mars is extremely cold. Plants won't grow.

Possible Solutions

On Earth, we already have a way to grow crops without soil. It's called hydroponics. Martian crops could also be grown in special nutrient-rich water. However, if you're serious about living on the Red Planet, you'd need to make the climate more like Earth's. A warmer Mars would mean a better chance of more flowing water. Plants could grow without lots of special equipment.

So how do you change a planet's climate? One idea is to use giant mirrors. These could orbit Mars and direct sunlight onto the polar ice caps, thawing all that carbon dioxide. Why would you do this? Because carbon dioxide is a greenhouse gas, which traps heat. The gas would act like a giant blanket. Eventually it would be warm enough for plants to grow. Just be prepared to wait thousands of years ...

4. The Shelter Challenge

The atmosphere of Mars is a hundred times thinner than Earth's. As well as being poisonous to breathe, a thinner atmosphere means very little air pressure. Without air pressure pushing against us, the gas in our organs would swell up and stop our blood flowing. If that's not enough to put you off – don't forget Mars is also very cold.

Radiation is another danger. Earth's atmosphere and magnetic field protect us from **solar particles**, but Mars doesn't have an atmosphere, and its magnetic field is very weak. Martian settlers would be exposed to harmful levels of cancer-causing radiation.

Possible Solutions

Any shelter built on Mars would need to be **pressurised** and have airlocks. These would separate indoors from outdoors. The first settlers could live in their landing module. Extra inflatable modules could be added for more space, but these modules would need to be buried to protect them from radiation. Another option is to live in caves or underground lava tubes. When they go outside, settlers would need to wear spacesuits. NASA is already working on the next generation of spacesuit. These will keep astronauts comfortable – and alive!



Your Boots on Mars?

Now that you know the facts, do you still want to be a Martian? How would you feel about spending eight months in a tiny space with a bunch of strangers – and that’s just getting there! How long could you stand living in a colony that contained just a handful of people? It can take up to twenty-two minutes for a signal to travel from Mars to Earth. There would be no phone calls or Skype. Could you cope with just texts and email?

The biggest question of all: would you be willing to put your faith in machines – the ones that make all your oxygen, grow all your food, and supply all your water? The ones that stand between you and death! What if they broke? Does the excitement outweigh the danger? For some people it will. After all, exploration’s in our DNA.



Glossary

desalination plant:

a place where water containing salt (usually sea water) is turned into fresh water

iron oxide: a compound that contains iron and is similar to rust

kPa (kilopascal): a unit of measurement for pressure

Martian rovers:

robotic vehicles that travel across the surface of Mars

orbits: the curved “flight paths” that objects follow in space around a star or planet

pressurised: using artificially controlled air pressure so that people can breathe

solar particles:

particles that come from the sun and contain radiation

toxic salts: chemicals containing metals and acids that are poisonous to people





HARITINA MOGOSANU: STARRYTELLER

by Clare Knighton

Meet Haritina Mogosanu: astrobiologist, science communicator, president of the Mars Society in New Zealand, and “starryteller”. In 2012, she was commander of the first New Zealand mission to the Mars Desert Research Station in the United States.

What happens at the Mars Desert Research Station?

The research station is in the Utah Desert, where the environment is similar to that on Mars. Six-person crews stay at the station for two weeks, learning what it might be like to live and work on the planet. We wore spacesuits and helmets whenever we went outside, ate dehydrated food, and communicated with the outside world by radio. We lived in the “hab”. This is a two-storey cylinder with bunk rooms, living areas, and laboratories. We spent our time studying geology, biology, and astronomy and learning about the challenges of living together in a small space – just like astronauts do!

What was your experience like?

It was my one big chance to feel like an astronaut, and the experience changed my life. It was just me and five other people, the hab, and nothing else. I thought about my priorities and what's important to me. I also realised that we're all human beings travelling together on a blue waka called Earth.

What was the most difficult part?

Being at the station is nothing like a nine-to-five job. You're there 24/7, and it's a completely foreign environment. Sometimes it felt scary being in such an unfamiliar place.

How do you think the first Martian settlers will cope?

Finding this out is one of the main reasons the Mars Desert Research Station was established. The first settlers will need an enormous amount of self-discipline! Extreme isolation is always very difficult. It will be hard for people not to argue in such a pressure-cooker situation. I think being able to connect with family and friends back on Earth will be very important.

Where did your interest in Mars come from?

I'm equally interested in space and world peace (after all, Mars was the Roman god of war). An international settlement on Mars is something that could unite the human race. We have the chance to plan how we might live together without conflict. Although the conditions on Mars are very inhospitable, it's still the most likely place for people to live compared with the other planets in our solar system. (Recently, I also discovered that one of my great grandfather's family names was Marziali!)

So, would you go?

Of course! I would love to – but only if I had a return ticket.







I get the call-out at dawn. An emergency at ToppLabs. Half an hour later, I'm standing in the foyer of the most famous research centre on Mars, the place where brilliant scientists study underground Martian bacteria. And they don't just study them. They develop ingenious ways to use them.

The people here are smart all right. Well, today, I'll have to be smarter.

I wait nervously until Doctor Topp herself emerges. She looks puzzled.

"Can I help you?"

I flash my Red Planet Police card. "Minnie Sharp. Detective."

"They sent a *kid*?"

It's 2117 – and some adults still can't accept young people in my line of work. I try not to let it get to me. "I'm the right person for the job," I assure her. "Take me to the crime scene."

Doctor Topp leads me down a corridor and pushes open a door marked Cryogenic Storage Room. "In here, we study how materials behave at very low temperatures," she explains.

There is an enormous glass freezer. Inside that freezer lies a man, pale and still as ice. I know his face from the news. Farrell Flint.

Doctor Topp looks shaky. "I arrived early this morning, and here he was – locked in and frozen stiff."

It seems a fair description of his situation.

"He's working on a very exciting project," Doctor Topp continues, "encoding secret messages inside bacteria. He believes we can use antibiotics to decode those messages. Earth spy agencies are desperate for the technology. We could make a fortune."

"Is he ... dead?"

Doctor Topp shrugs. "Not necessarily. Bacteria can be frozen for years, then brought back to life. We do it all the time. But a *human*? We'd have to defrost him very slowly. And it might not work ..."

"Who uses this room?" I say.

"Farrell, me, and three other scientists. They all worked late last night. I went home."

"I'll need to interview them," I say.



Felonius Flint's lab room has stinking muck heaped on every bench.

"Why would anyone freeze my brother?" he wails.

"Farrell is your brother?" I ask. Interesting. "Do you get on?"

"Of course."

"Always?"

"Always! Even though people consider him the better scientist."

Interesting again. "Are you sure they think that?"

"It's obvious. I spend my days trying to turn Martian rock into compost, and it doesn't matter which bacteria I try - nothing works. The whole project is a failure."

"Just how jealous of your brother are you?" I ask.

Felonius looks me in the eye. "All right. *Very* jealous."

"No further questions," I say.



In the next lab room, Carey Love clutches a jar of squirming white larvae. "I'm trying to find cures for diseases," he explains. "I test Martian bacteria on these larvae."

"That must be very rewarding."

"No," Carey says. "It's awful." He stares into his jar. "The things I have to do to these poor, defenceless creatures. Unspeakable things. Every day. To thousands of them." He begins to weep.

"That's tough. I'm sorry."

"Some days, I don't think I can go on. These poor, poor baby waxworms."

"Have you told anyone about how you feel?"

"Only Farrell. He kept saying 'Tell Topp'. But I was scared she'd fire me."

I pause. "Did you worry that Farrell might tell her himself?"

"All the time."

"Did you ever think about *stopping* him from telling her?"

Carey is silent for a second. "Yes!" he finally sobs.

"Thank you for your time," I say.





- Bright liquids bubble in the third lab room. They smell delicious. Mirtha Dare-Sweetly welcomes me in. "I use Martian bacteria to create fizzy drinks," she says, peering at a test tube of golden liquid. "Mmm. My finest brew yet."
"What will you do with it?"
"My half-brother on Earth is a very successful businessperson. He says selling the drink will make millions."
"Really?"
"Yes. Even Farrell liked the idea."
"What do you mean *even* Farrell?"
Mirtha sighs. "Farrell was always banging on about the environment. He said conservation on Mars was more important than anything. *Such* a dreamer! But he liked the idea of the drink factory because it will be on Earth. His precious Mars will be safe from any pollution." Mirtha lowers her voice and leans closer. "Of course, Doctor Topp found his attitude infuriating."
"Oh?" I say.

“A travel company wants to bring tourists here for caving adventures. But *some* people – mostly Farrell – think our caves contain undiscovered bacteria. He worried that tourists would disturb the cave ecosystem and was planning a campaign to keep them away.”

“And Doctor Topp didn’t like that?”

Mirtha lowers her voice again. “She’s scared the government will think we’re troublemakers. They might even shut the lab down. This place is Topp’s life. She worries dreadfully.”

“Thank you, Mirtha,” I say. “You’ve been very helpful.”

I march into Topp’s office. “Truth time,” I say. “*You* wanted Farrell gone because he was threatening to protest against the new cave tours.”

“Excuse me?” she says.

“You came in early this morning, lured Farrell into the freezer, and locked him in.”

“I *knew* kid detectives were a bad idea,” says the doctor. “Firstly, Farrell and I had a long talk yesterday about SpaceDare – the travel company. He convinced me we need to stop them. I’m going to fight for our caves and their bacteria, and I’ll take the consequences.

“Secondly, that freezer works very slowly. If I’d locked Farrell in this morning, he wouldn’t be frozen yet. But he is, which means someone did it last night.”

I’m mortified. For a few terrible seconds, it seems true – I’m as wrong for this job as anyone can be.

Then I have a thought: if Farrell froze slowly, then he had some time to ...

“Doctor Topp,” I say, “take me back to the freezer.”



I peer through the glass, scanning the scene. There!
I motion to Doctor Topp. "That black thing in Farrell's pocket ...
what is it?"

"His bacterial coding machine."

"I assume you know how to use it?"

We take the coding machine from Farrell's frozen pocket and hurry
to his lab. Doctor Topp opens the box, removes a transparent slide, and
places it in another box – the decoder.

Seconds pass. Then one word appears on the decoder's screen: Mirtha.

"I don't understand," gasps the doctor.

"I do," I say.

"Mirtha *Dare-Sweetly*," I say. "I charge you with the freezing of Farrell Flint."

Mirtha's jaw drops. "Why would I do that?"

"Maybe because you're related to the person who runs *SpaceDare*
caving adventures? Maybe because that person is, in fact, your half-
brother, the successful businessperson on Earth. Fizzy drinks are only
half the story."

The sudden fury on Mirtha's face tells me I'm right.



I go on. "You wanted Farrell out of the way so your half-brother could continue with his tourism venture, whatever its impact. Perhaps he was even paying you to get rid of Farrell."

Mirtha looks around for an escape, but Doctor Topp blocks the door.

After I call for back-up, and Mirtha is taken away, Doctor Topp shakes my hand. "You *were* the right person for the job, Minnie," she says.

I smile as if I knew it all along. "Speaking of the right people ... can I make a suggestion?"

Two weeks later, I receive a message from Doctor Topp. She's taken my advice: Carey has been given Mirtha's job, fermenting drinks. He's much happier. Meanwhile, Felonius's unsuccessful compost project has been put on hold. He's taken over Carey's work on disease. *He* doesn't mind doing unspeakable things to waxworms ... as long as he's helping the human race.

Best of all, Farrell has been successfully thawed. Not only is he working on his coding project, now he's heading up a new division at Topplabs: investigating how cryogenics might save the human race.


As for SpaceDare, the business went bust. No one wanted to go on one of their tours once they heard what Mirtha and her half-brother had done. The undiscovered bacteria of Mars are safe. For now.



New Boots

by Tim Jones





“Why me?” Charlie muttered to himself. “Why me, why me, why me?”

“Waimea? We’re nowhere near Waimea,” Mr Ngaia said. “You should have studied the map, Charlie. You’re way out.”

“I have a map!” said Jason.

Of course he did, Charlie thought. Too-eager Jason had brought everything. His pack was almost as big as him. It was making him pant with every step.

Charlie’s own pack was fine, but he was hungry, and his new boots pinched. Plus his mates were way ahead, having a great time – and here he was stuck at the back with Mr Ngaia and the new kid. Charlie had plans to race Kaine and Isaiah to the hut. At this rate, he was going to be last.

Charlie turned to Mr Ngaia. “I’ve kept Jason company all the way. Can I catch up with the others now?”

Mr Ngaia shook his head. “Remember the Scout law. Be positive. Accept challenges ... who knows the rest?”

“I should,” Jason said. “Accept challenges if they’re not too hard – maybe?”

Charlie snorted. “Accept challenges with courage,” he recited. “Be a friend to all.”

“Exactly,” said Mr Ngaia. “And your challenge, Charlie, is to stay with Jason all the way to the hut.”

“But *you’re* here.”

“My job is to bring up the rear. Your job is to stay with Jason.”

They walked on in frosty silence. Far above, the sun was setting over the Alps, tinting the snowy peaks a soft pink. Kea wheeled high above the fringes of the forest. The air was cool and smelt of dirt and leaves. Charlie couldn’t enjoy any of it.

Mr Ngaia called for a stop. While they rested, he tried to break the ice. “So, Jason,” he said. “Why did you join Scouts?”

To ruin my life, Charlie thought.

“Dad,” said Jason. “He reckons I read too much.”

“And how about you, Charlie?”

“Dad too,” said Charlie.

Mum let Charlie play video games after he’d done his homework, but his dad – who had him at weekends – was forever dragging him outside to do stuff. “She’s letting you go soft,” he told Charlie. “I knew this would happen.”

It was his dad who contacted the local Scout troop. Charlie still remembered the two huge rows his parents had about it. His mum didn’t have time to take him, and his dad never helped out during the week.

“It’ll be dark soon,” Mr Ngaia said. “Let’s get going.”

“OK!” said Jason. But when he tried to get his pack on his shoulders, he couldn’t do it. “It’s too heavy!” he wailed.

“What have you got in there?” asked Mr Ngaia. “Let’s take a look.”

There was a camp stove and a gas canister. A packet of chocolate biscuits. A tent.

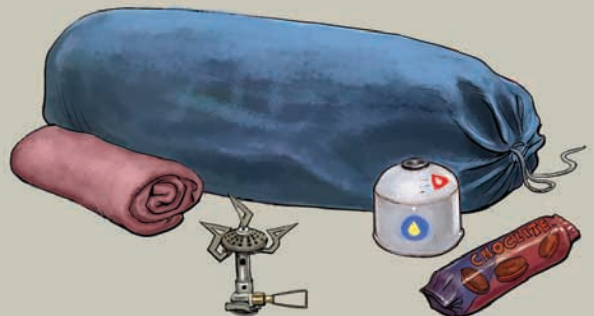
“A tent?” demanded Charlie.

“Can’t you read? The notice said we were staying in a hut.”

“I know,” said Jason, “but Mum thought it might come in handy.”

Mr Ngaia took the tent, stuffing it with difficulty into his own pack. Charlie took the stove and the gas and Jason’s three pairs of rolled-up socks. By the time they started off, it was getting dark. Charlie was glad of Mr Ngaia’s powerful torch.

They walked on, Charlie’s boots pinching harder with the added weight. He hadn’t wanted to wear them. He didn’t want blisters. But Dad insisted. “I didn’t pay top dollar so you could leave them behind. You need to harden up, Charlie.”



Finally, they saw the hut, silhouetted against the last of the light. Smoke rose from the chimney. Light poured from the windows. Somewhere in the distance, a kea squawked, mocking them.

Maria spotted their footsore party first. “Man, what happened to you guys?” she asked.

“Jason’s pack did,” replied Charlie. He pulled off his boots and threw them on the verandah. Then, at last, he went inside.



After lights-out, Charlie lay next to Jason. He was tired, sore, and resentful. All the good bunks – the ones on top next to Charlie’s mates – had been taken. He listened to the sounds around him: Maria and Alison whispering, Isaiah telling Kaine a ghost story that Charlie couldn’t hear properly. Then Jason started snoring – the final straw. Charlie rolled over and punched him on the arm.

“Why did you hit me?” came Jason’s quavering voice.

“You need to harden up,” said Charlie. “And if you can’t do that, at least shut up.”

“Shut up yourself,” said Jason.

After that, silence.

Charlie woke suddenly. Faint morning light filtered through the windows. He heard a noise: thump, roll, bang. A pause. Then thump, roll, bang again. The thump and the roll came from the roof. The bang was right outside the door.

And was there something else? A squawk? Laughter?

Jason was awake, too, and he looked frightened. "What is it?" he whispered.

"You'll be too chicken to find out," Charlie said, "but I'm not." As he clambered out of the bunk, the noise came again. This time it was duplicated: two thumps in succession, then the sound of two objects rolling heavily down the roof. One stopped, while the other kept on rolling before crashing to the ground.

Another squawk. Something scabbled on the roof, and the second object completed its roll-and-crash mission. Charlie threw the door open, and Mr Ngaia followed. The other Scouts trailed out to see what was going on.

They were confronted by birds, at least half a dozen of them.

Big, strong, brightly coloured kea. And there, on the ground between them –

"My boots!" Charlie cried.

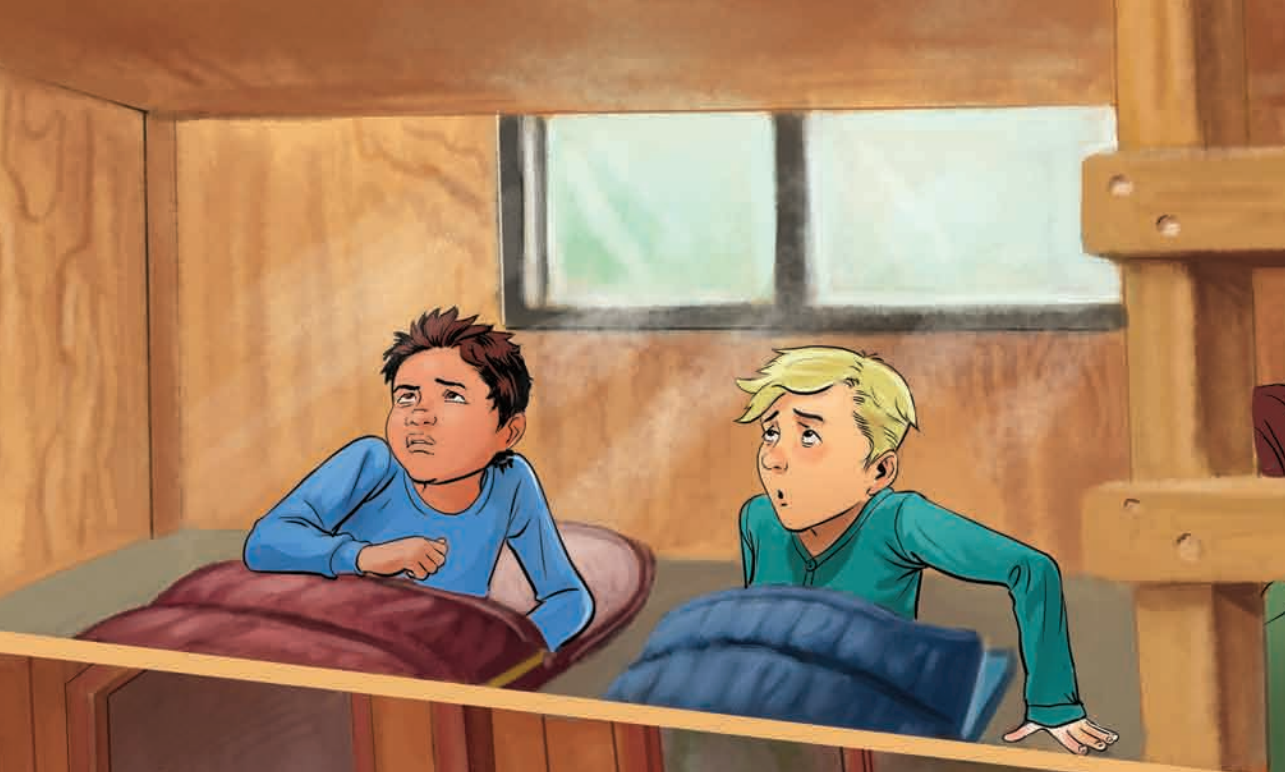
Before he could react, one of the kea grasped the right boot in its powerful claws. With a vigorous flap, it flew up and dropped the boot onto the hut roof. It rolled down the steep slope, crashing right at Charlie's feet.

It was only then that he realised two of the other kea were tearing long, V-shaped strips from his other boot's lining. Even the tough, outside leather was suffering.

"No!" Charlie wailed. He rushed at the birds, and they flapped and squawked their way into the air, laughing. They wheeled once above the hut before disappearing towards the mountains.

Charlie examined his new boots, now ruined. What would his dad say? What would his dad do? He felt tears prick at his eyes.

"Didn't you hear me say not to leave valuables on the porch?" asked Mr Ngaia. But Charlie had been too busy feeling furious with Jason to pay attention.



“Why me?” Charlie muttered to himself as he stumbled on another rock. “Why me, why me, why me?”

At least this suck tramp was almost over. They were back at the river flats. He could see the line of trees that edged the car park at the end of the road. But here he was, miles behind the others, stuck with Mr Ngaia – and Jason, of course. Charlie was limping. His boots squeaked with every step. He couldn’t wait to swap them for the trainers he’d left in the car.

“I bet you’re glad I had that duct tape,” said Jason for the tenth time.

After the kea, Charlie had thought things couldn’t get any worse, but they did. It was Jason who’d saved him ... Jason’s mum who’d packed a roll of duct tape in case Jason’s tent got ripped ... Jason who’d tipped the contents of his pack onto the floor to find it.

It was Jason who’d taped Charlie’s boots up; Jason who’d lapped up the attention for saving the day. And now Jason walked beside Charlie as if they were best mates.

“Hey, Charlie. Charlie!”

“Yes,” Charlie said wearily.

“It was good I had a pocket knife too. That duct tape wouldn’t have been much use without it, eh?”

“Jason,” said Mr Ngaia. “I think Charlie’s said thank you enough times already.”

“Oh. OK, then,” said Jason.

For a few minutes, there was peace. The only sounds were Charlie’s squeaking boots, the occasional piping of birds, the chuckling of the river in its gravel bed ...

“I’m looking forward to the drive back,” Jason said.

Charlie let that one pass. He could imagine all too well what the drive back would be like: three hours of teasing from Isaiah and Kaine. When that was over, there would be an evening spent waiting for his father’s inevitable question.

“So how were the new boots?”



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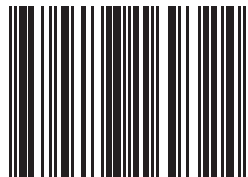
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