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WHEN THE EARTH QUAKES

THE STORY OF A SEISMIC WAVE



609a

HAVE FUN! DON'T ANNOY GRANDPA AND GRANDMA!

HAVE FUN IN HAWAII!



WHEN ARE THE 'RENTS COMING BACK?

IN FOURTEEN DAYS. THEY ONLY LEFT THIS WEEKEND!



MAYBE I KNOW SOMETHING THAT WOULD INTEREST YOU...

AND WHAT WOULD THAT BE?

A MINE!



TOURS TODAY

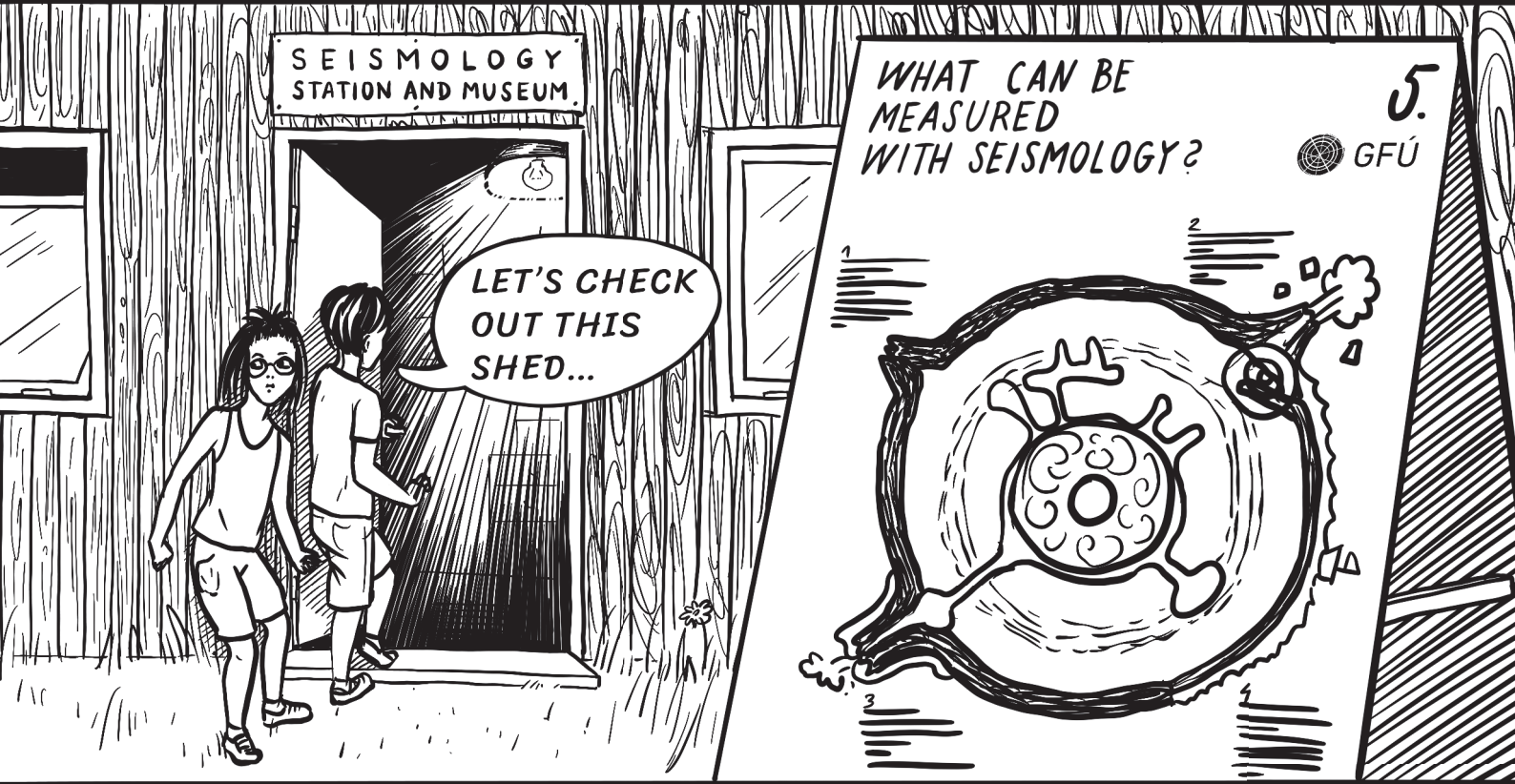
PROGRAM

TOURS TODAY PROGRAM



IT'S BORING IN HERE,
THERE'S ONLY DARKNESS
TO SEE.

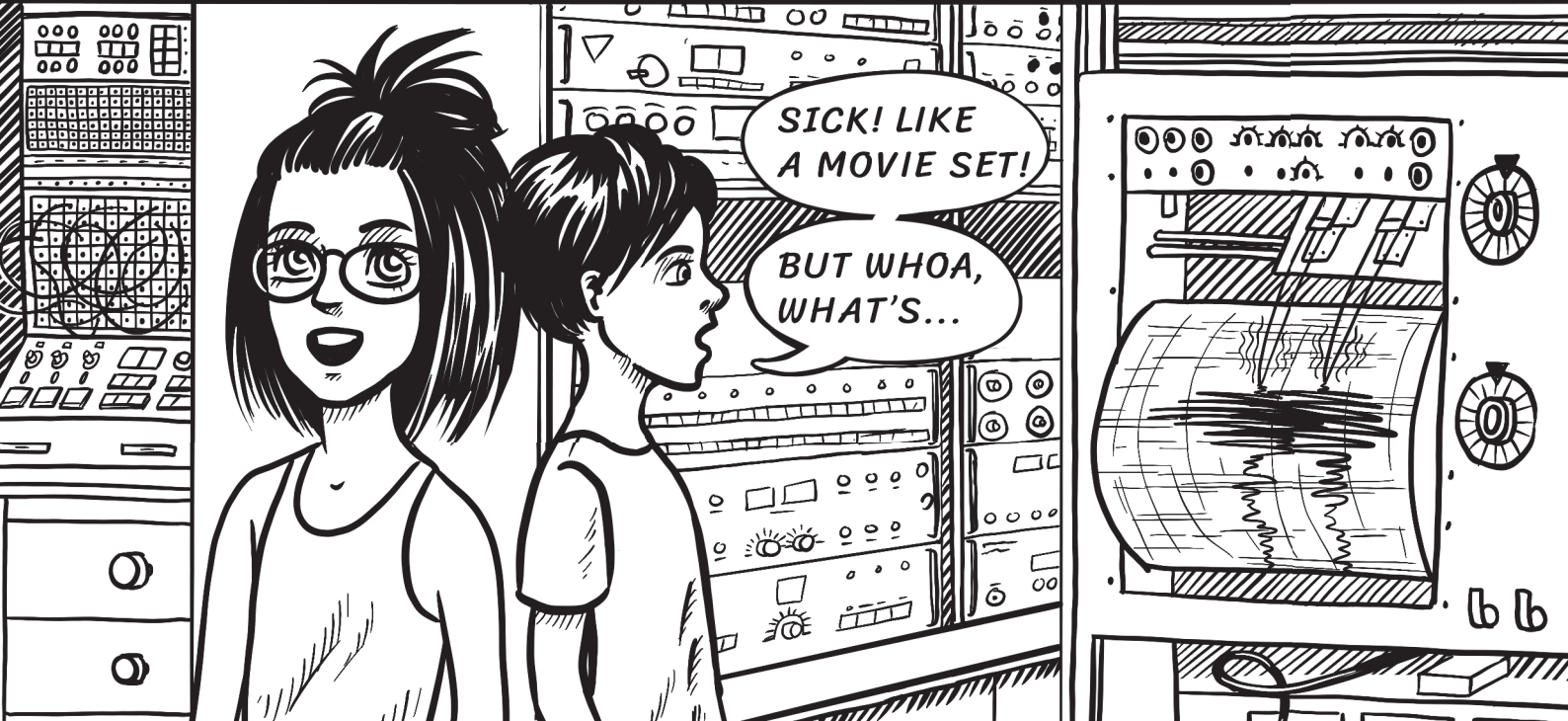
LET'S GO
SOMEWHERE
ELSE!



SEISMOLOGY
STATION AND MUSEUM

WHAT CAN BE
MEASURED
WITH SEISMOLOGY?
GFU

LET'S CHECK
OUT THIS
SHED...



SICK! LIKE
A MOVIE SET!

BUT WHOA,
WHAT'S...

bb

...HAPPENING?!





ARE YOU AN ALIEN?!

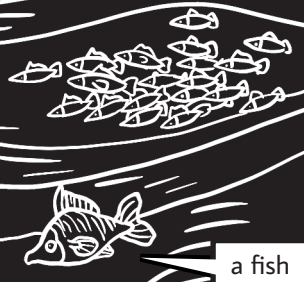
NO WAY, YOU'RE A SEISMIC WAVE? YOU JUST CLIMBED OUT OF THAT SEISMOGRAM!

BUT THEN YOU COULD BE FROM SPACE! THERE ARE SEISMOMETERS ON THE MOON AND MARS, TOO.

BUT I REMEMBER THAT I AM DEFINITELY FROM HERE.

I AM BORN OF MOVEMENT.
I ORIGINATED AT THE
POINT WHERE THE OCEAN
FLOOR RUPTURED, GRINDING
UNDER THE PRESSURE OF
TWO GIANT PLATES OF
THE EARTH.

FROM THIS FAULT,
I STARTED MY JOURNEY...



a fish

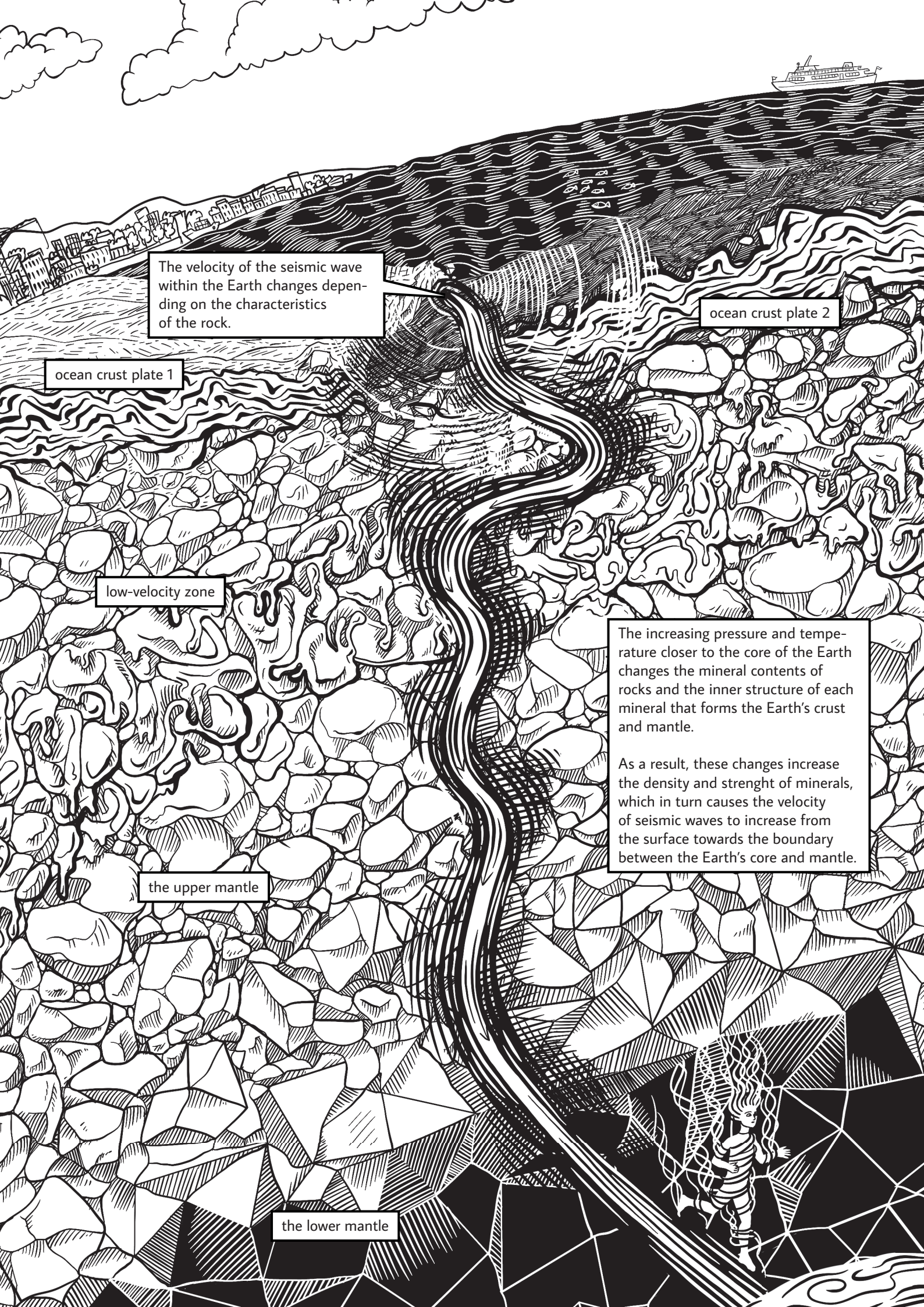
CRASH!

ocean crust plate 1

ocean crust plate 2

a fault





The velocity of the seismic wave within the Earth changes depending on the characteristics of the rock.

ocean crust plate 1

ocean crust plate 2

low-velocity zone

The increasing pressure and temperature closer to the core of the Earth changes the mineral contents of rocks and the inner structure of each mineral that forms the Earth's crust and mantle.

As a result, these changes increase the density and strength of minerals, which in turn causes the velocity of seismic waves to increase from the surface towards the boundary between the Earth's core and mantle.

the upper mantle

the lower mantle



ON THE WAY,
I PASSED A BOUNDARY,
WHICH CHANGED THE
DIRECTION OF MY
MOVEMENT.

I ALSO LOST SOME OF
MY STRENGTH.



AND THEN I EVENTUALLY
SANK DOWN. THE
ENVIRONMENT WAS
SUDDENLY MORE
VISCIOUS, AS IF IT
WERE MELTED.

HOW RELIEVED
I WAS ONCE
EVERYTHING
AROUND ME WAS
SOLID AGAIN!
I RAN FASTER
AND FASTER!



I SAW SOMEONE
BEHIND ME...

SHE WAS LIKE MY
SHADOW! YET ALSO
DIFFERENT...

the lower mantle



I RAN THE FASTEST I HAD DURING MY ENTIRE EXISTENCE!

WHEN SUDDENLY... CRASH!

AAAAA!!!

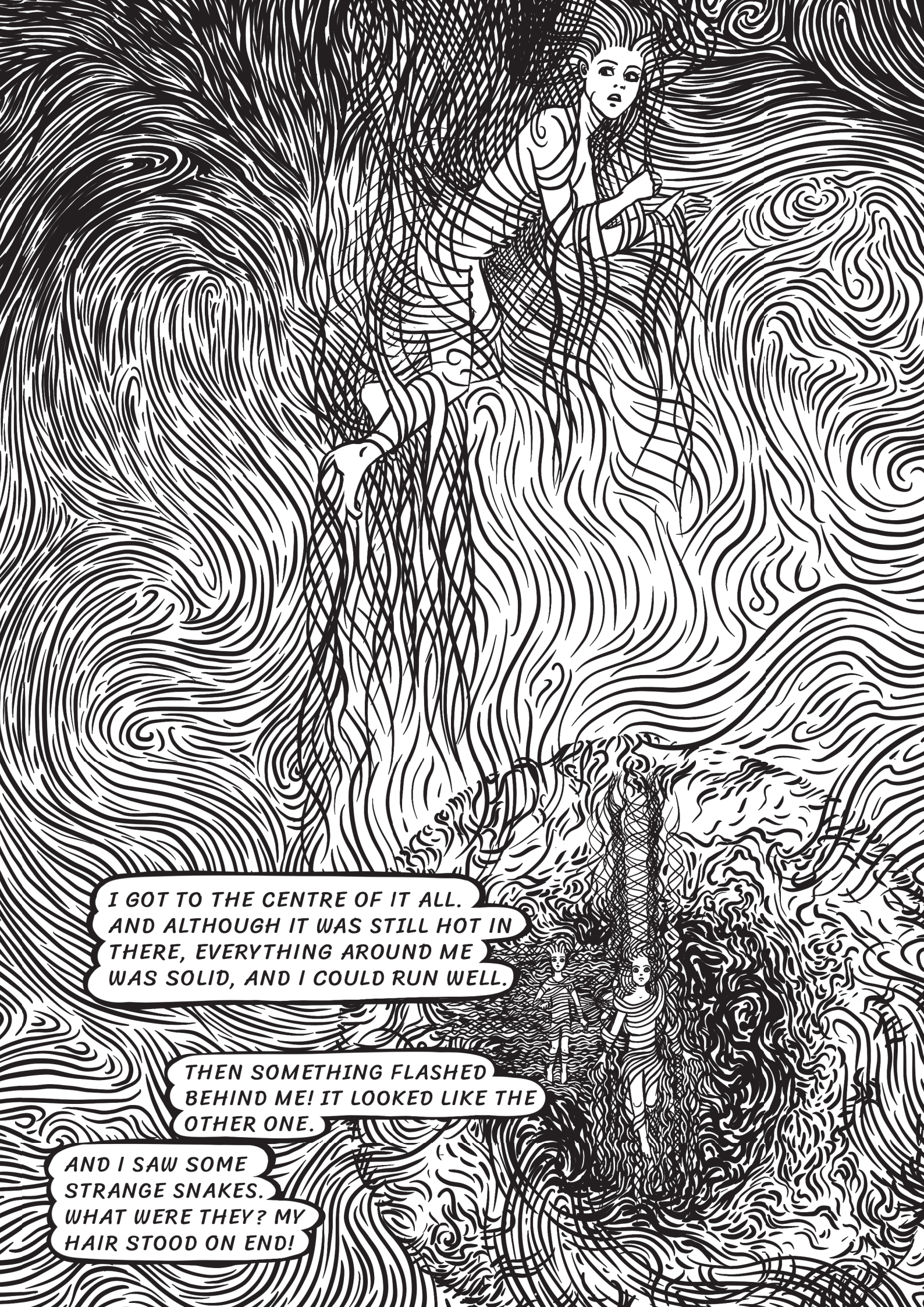
the fluid outer core



I COULD HARDLY MOVE!
I KNEW THAT IF I WERE TO STOP IN THAT GLOWING SLUDGE, I WOULD DISAPPEAR.

I MUST GET AWAY!

BUT WHAT ABOUT THE OTHER ONE?
SHE PROBABLY DIDN'T MAKE IT...
SHE PERISHED!



I GOT TO THE CENTRE OF IT ALL.
AND ALTHOUGH IT WAS STILL HOT IN
THERE, EVERYTHING AROUND ME
WAS SOLID, AND I COULD RUN WELL.

THEN SOMETHING FLASHED
BEHIND ME! IT LOOKED LIKE THE
OTHER ONE.

AND I SAW SOME
STRANGE SNAKES.
WHAT WERE THEY? MY
HAIR STOOD ON END!



IS THAT YOU? I THOUGHT
YOU DISAPPEARED!
AND YOU CAME BACK!
BUT HOW...?

HERE, AT THE
BOUNDARY, I ROSE
FROM SOME OF YOUR
STRENGTH. LOOK!

WHO ARE YOU?

I AM YOUR
SISTER!

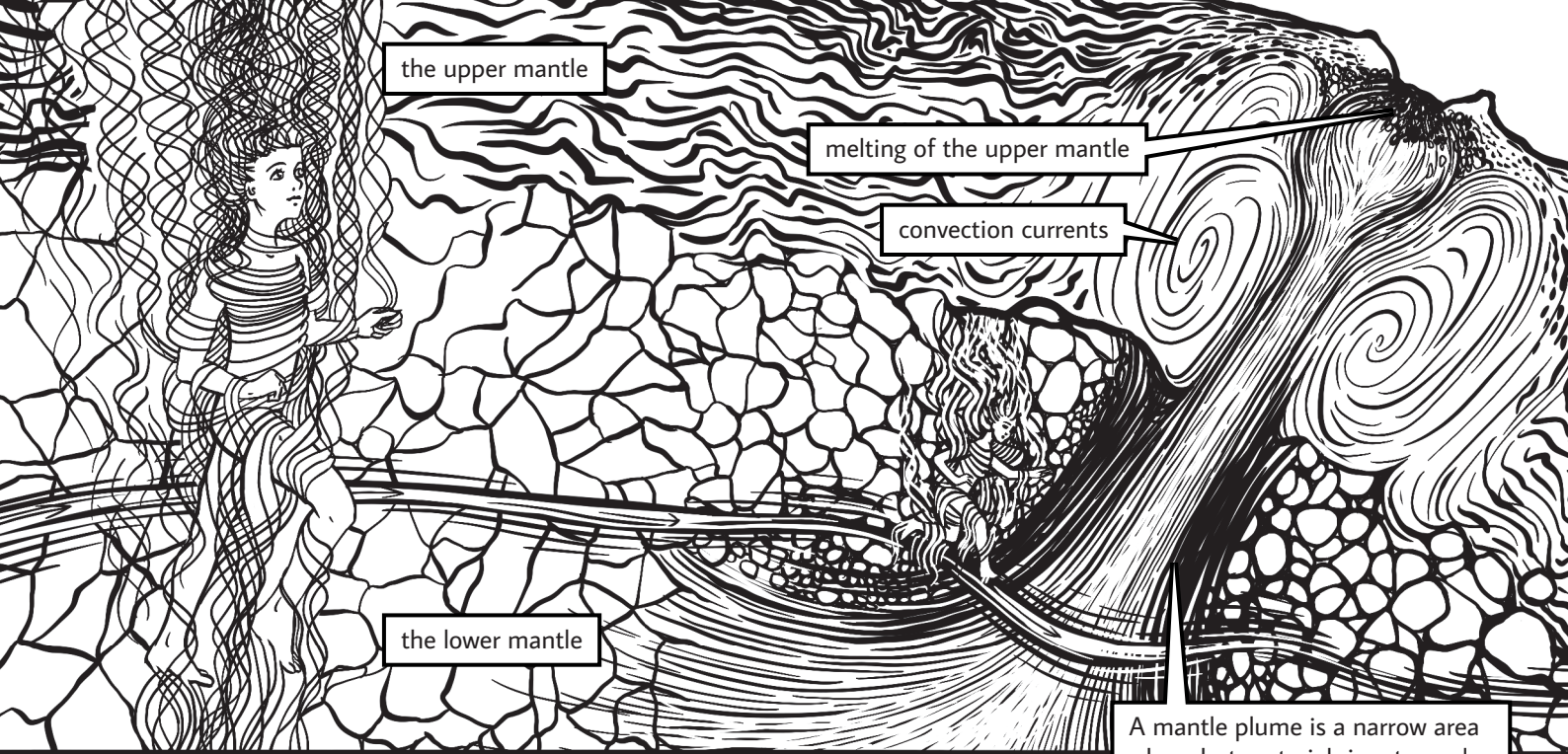
the solid inner core

the fluid outer core

HEY, WHERE ARE YOU
RUNNING TO SO FAST?

YOU KNOW THAT
WE CAN'T STOP...





the upper mantle

melting of the upper mantle

convection currents

the lower mantle

A mantle plume is a narrow area where hot material rises towards the Earth's surface.

THEN, I WEAKENED AGAIN...
I LOST A LOT OF STRENGTH
ALONG THE WAY...

IT WAS TOO HOT. I SLOWED
DOWN. I WAS SCARED THAT
I WOULD NOT MAKE IT,
THAT I WOULD NOT
GET OUT. THAT I COULD NOT
RUN AS FAST AS I COULD
AT THE START...



BUT I WAS REALLY
STRONG WHEN
I WAS BORN!

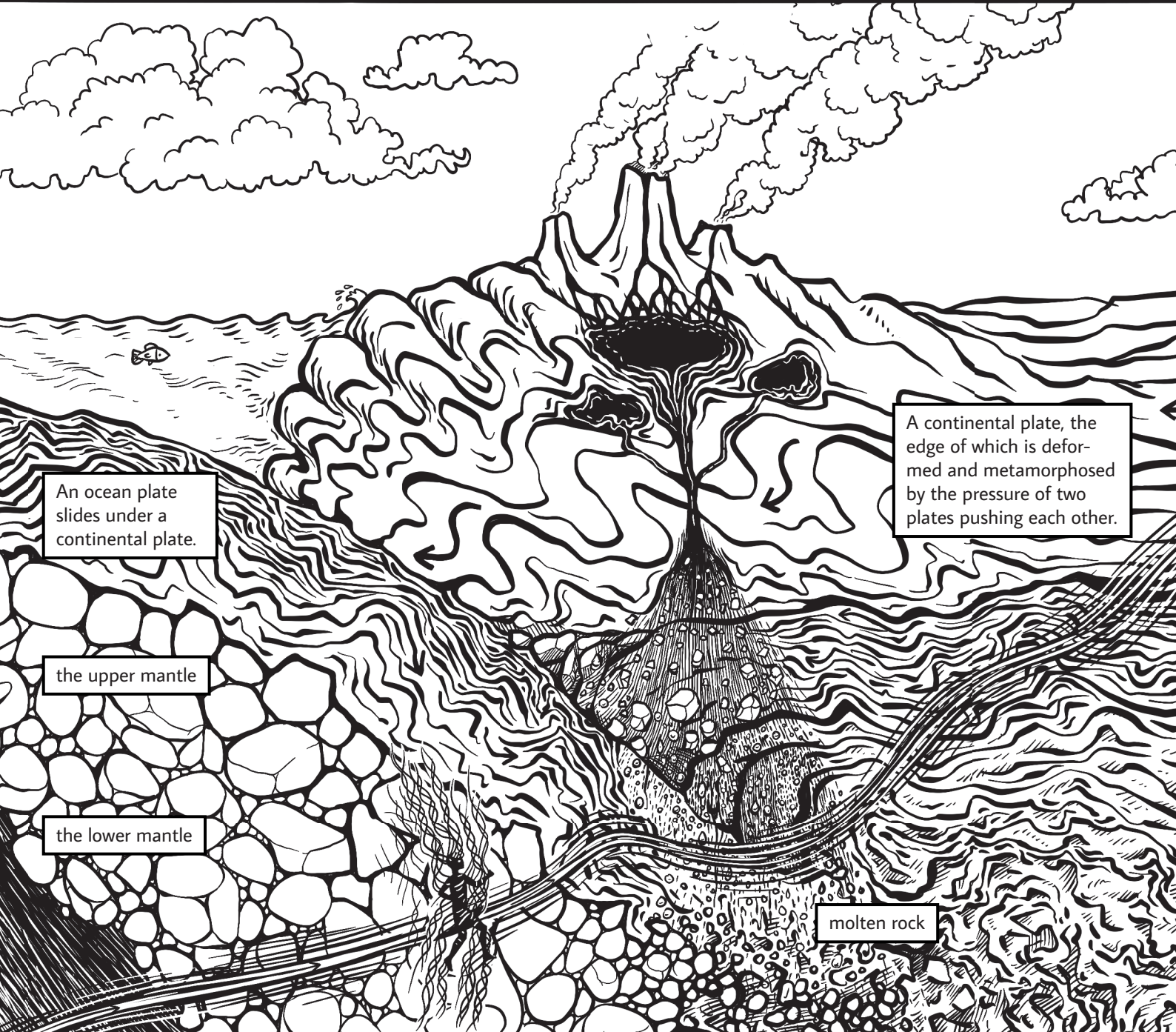
AND THIS STRENGTH
DOES NOT JUST
DISAPPEAR,
THIS MOTION
DOES NOT STOP!

FOR A WHILE, I COULD
RUN BETTER.

the upper mantle

globules of melt

BUT THEN, THAT HEAT
AGAIN... PLUS, IT WAS
PARTIALLY LIQUID!



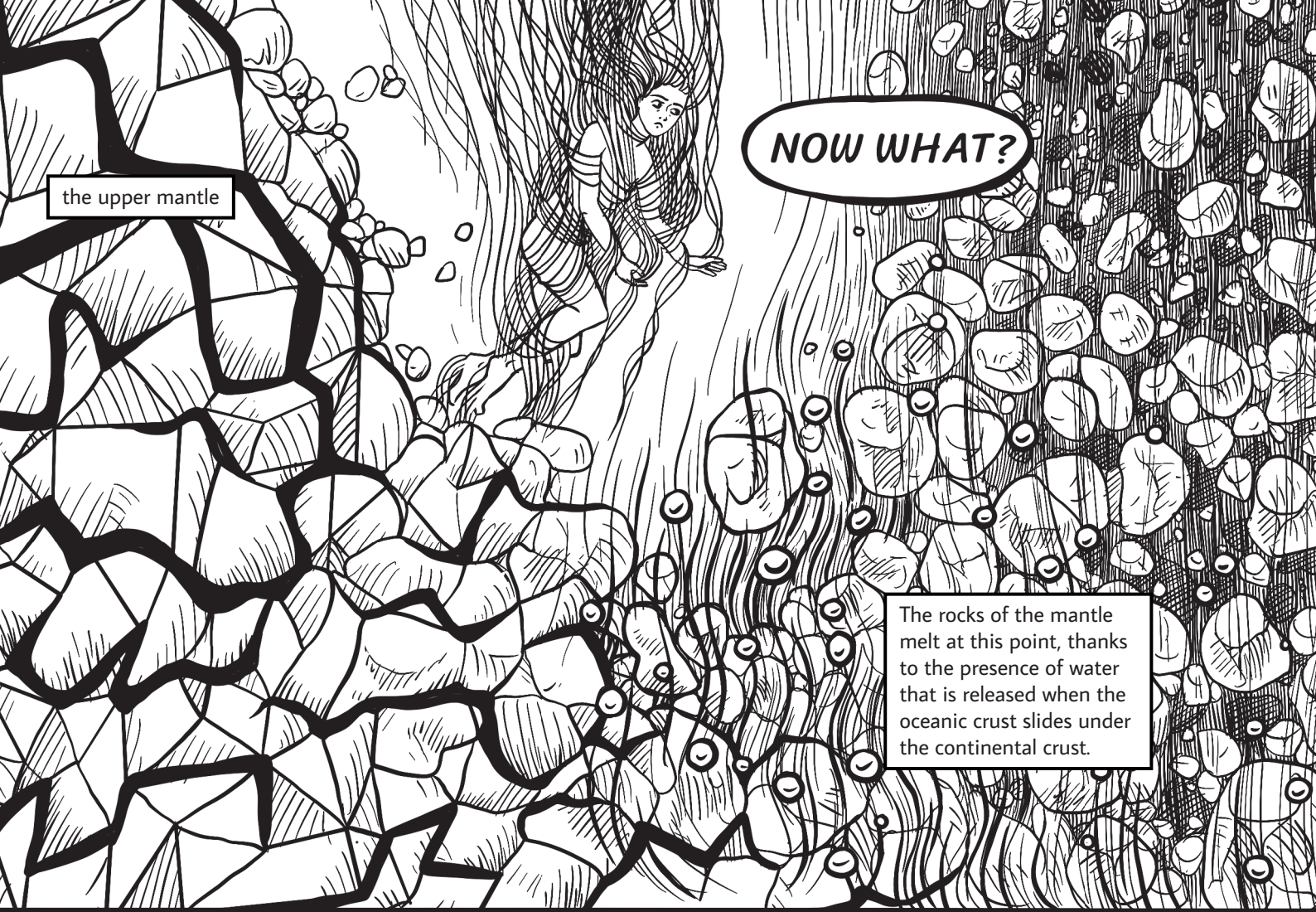
An ocean plate
slides under a
continental plate.

A continental plate, the
edge of which is deformed
and metamorphosed
by the pressure of two
plates pushing each other.

the upper mantle

the lower mantle

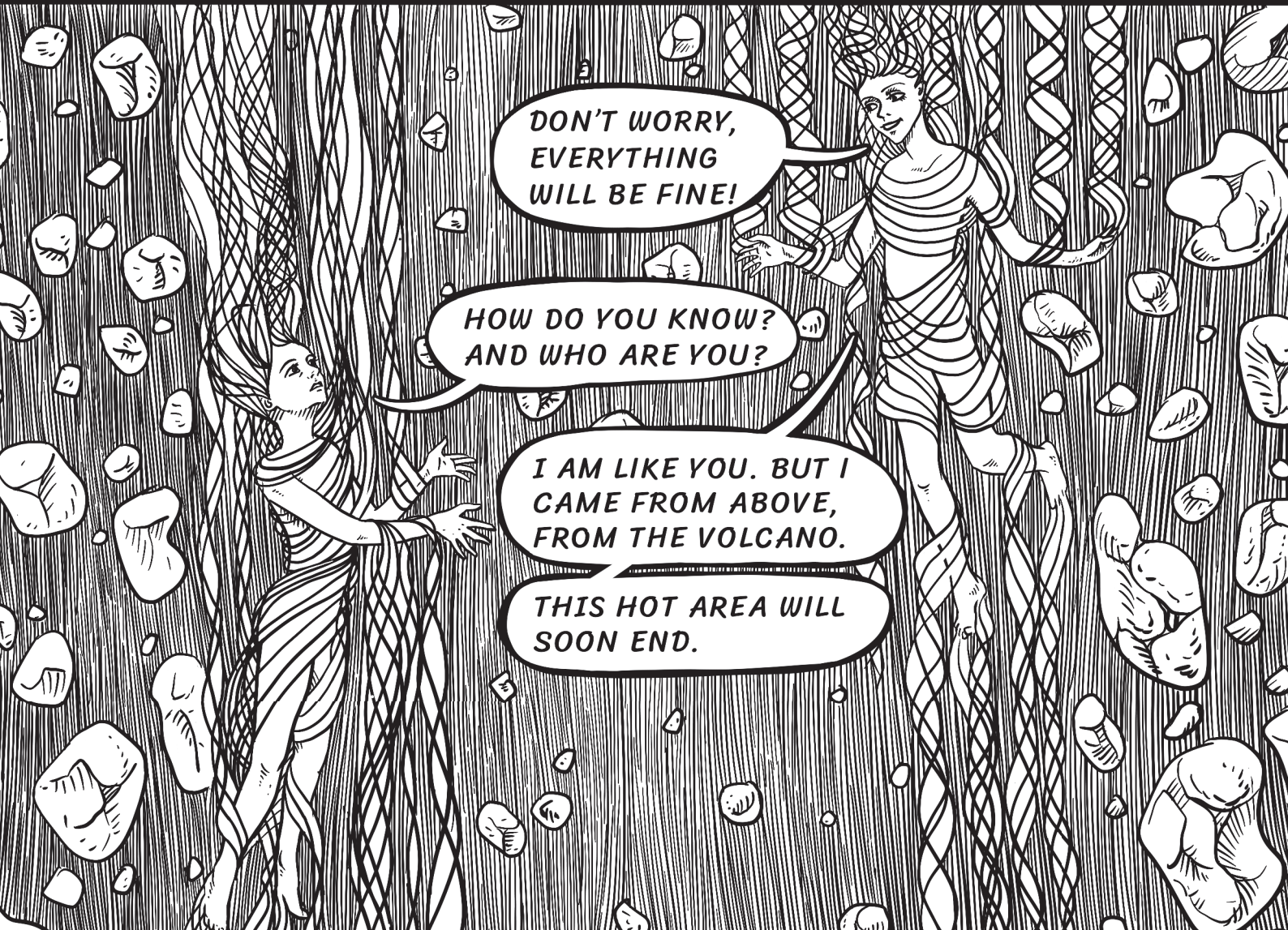
molten rock



the upper mantle

NOW WHAT?

The rocks of the mantle melt at this point, thanks to the presence of water that is released when the oceanic crust slides under the continental crust.

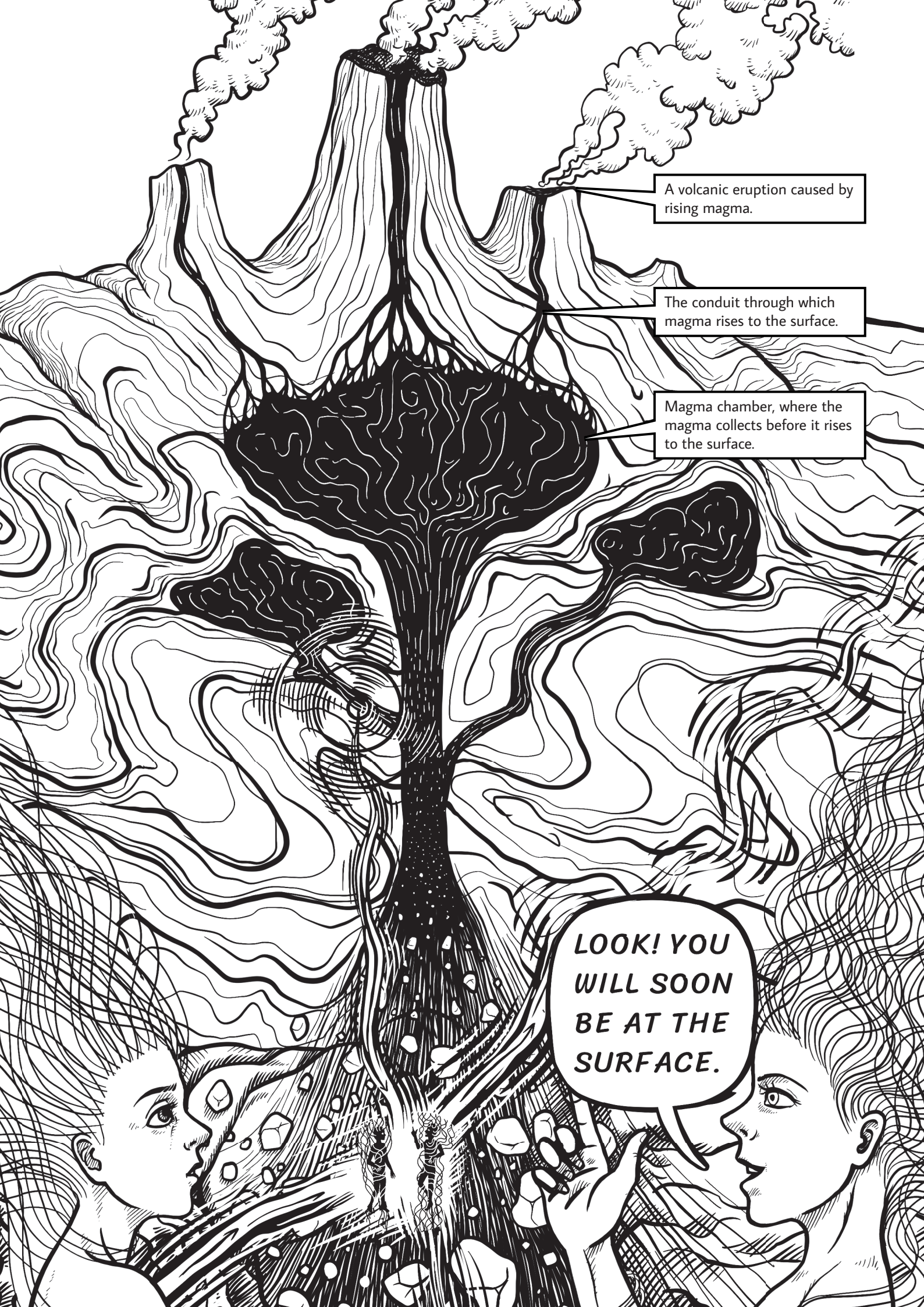


DON'T WORRY, EVERYTHING WILL BE FINE!

HOW DO YOU KNOW? AND WHO ARE YOU?

I AM LIKE YOU. BUT I CAME FROM ABOVE, FROM THE VOLCANO.

THIS HOT AREA WILL SOON END.



A volcanic eruption caused by rising magma.

The conduit through which magma rises to the surface.

Magma chamber, where the magma collects before it rises to the surface.

LOOK! YOU WILL SOON BE AT THE SURFACE.

BACK AT THE STATION

AND HOW DID YOU MAKE IT ALL THE WAY HERE?

I RAN ALL THE WAY TO THE SURFACE - AND THEN...

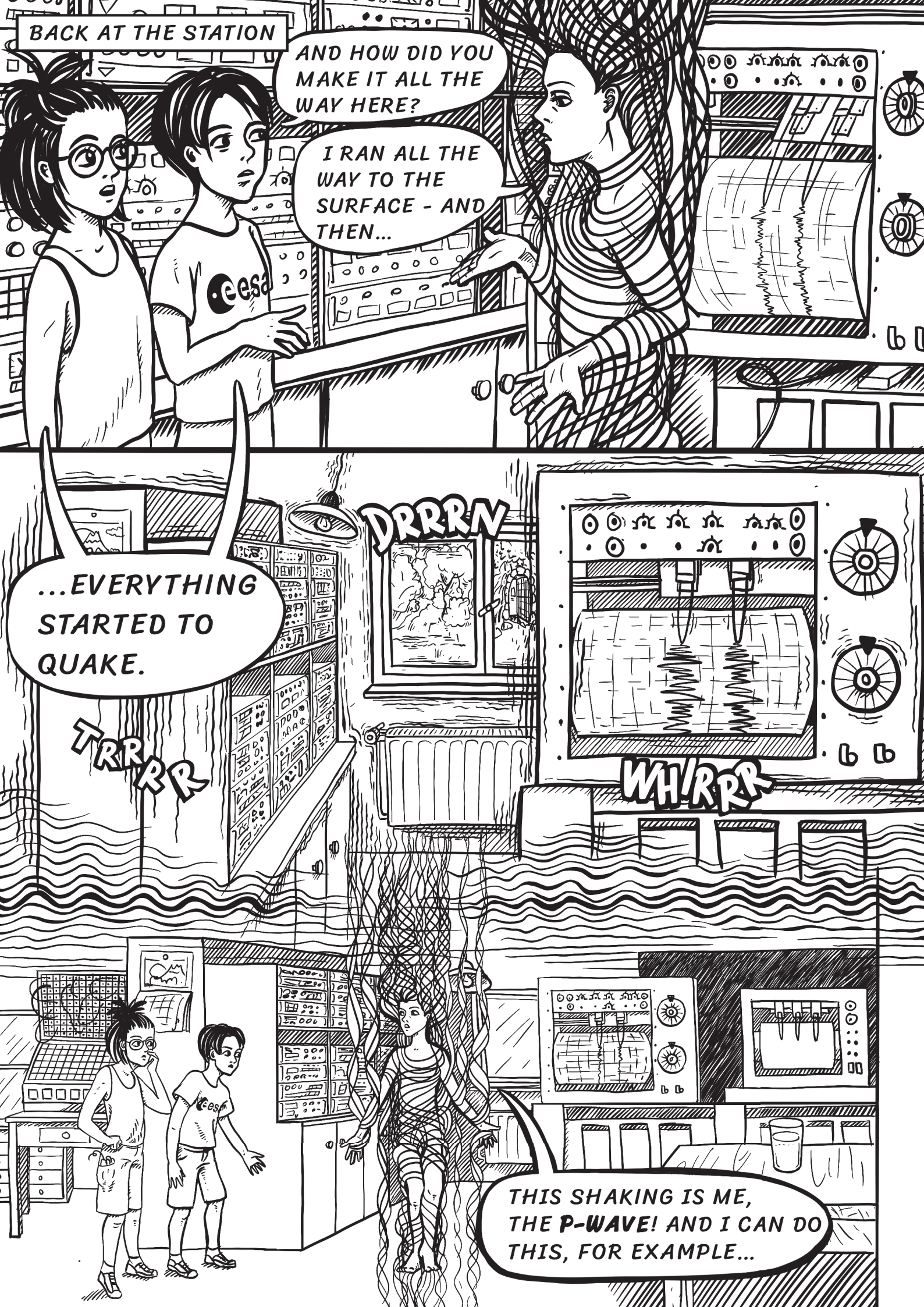
...EVERYTHING STARTED TO QUAKE.

DRRRN

TRRR

WH/RRR

THIS SHAKING IS ME, THE P-WAVE! AND I CAN DO THIS, FOR EXAMPLE...



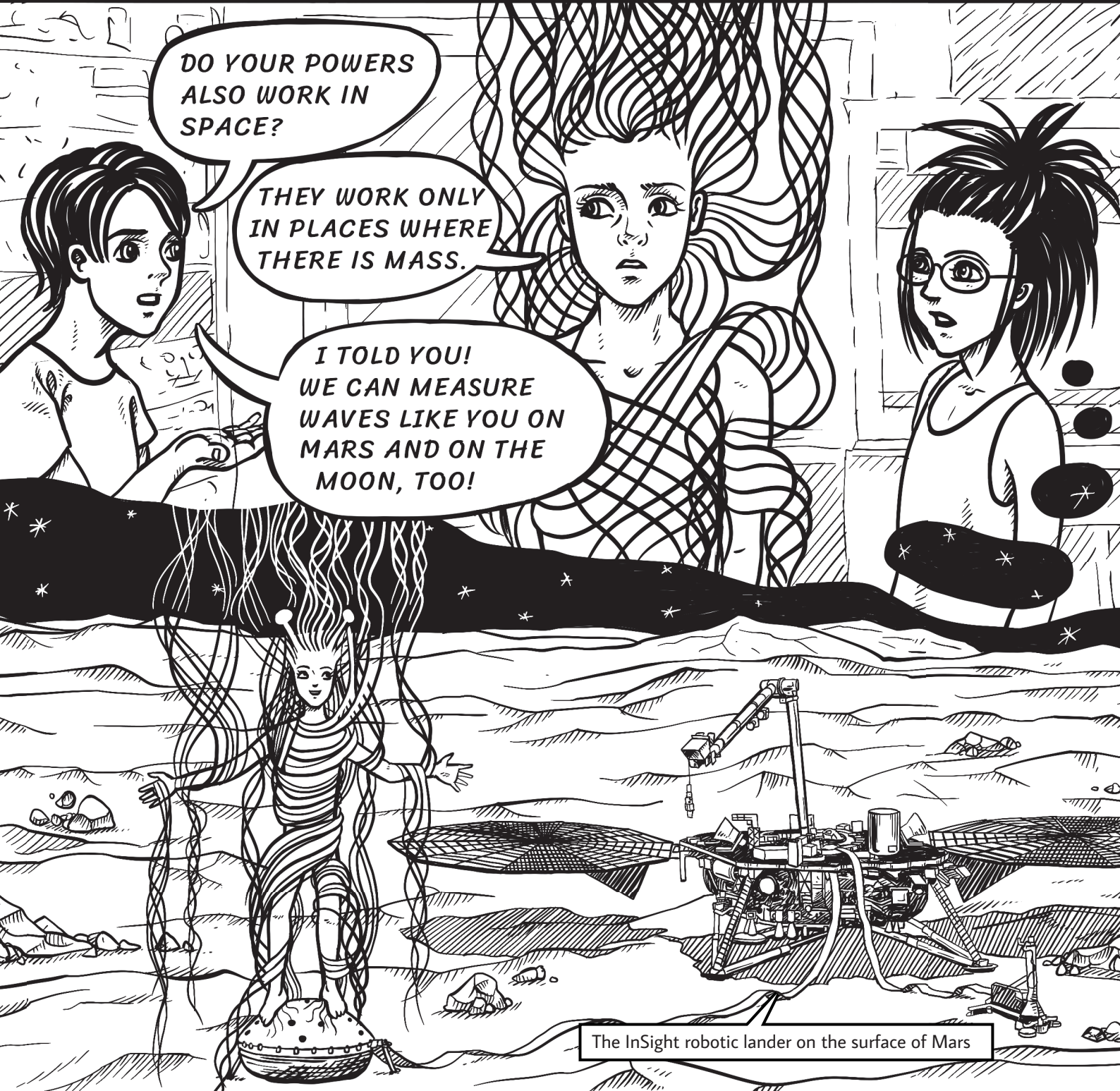


...OR THIS!

DO YOUR POWERS ALSO WORK IN SPACE?

THEY WORK ONLY IN PLACES WHERE THERE IS MASS.

I TOLD YOU! WE CAN MEASURE WAVES LIKE YOU ON MARS AND ON THE MOON, TOO!



The InSight robotic lander on the surface of Mars



SO...

LOOK!

THAT'S MY
SISTER, *S-WAVE*!



WE FINALLY MEET
AGAIN!

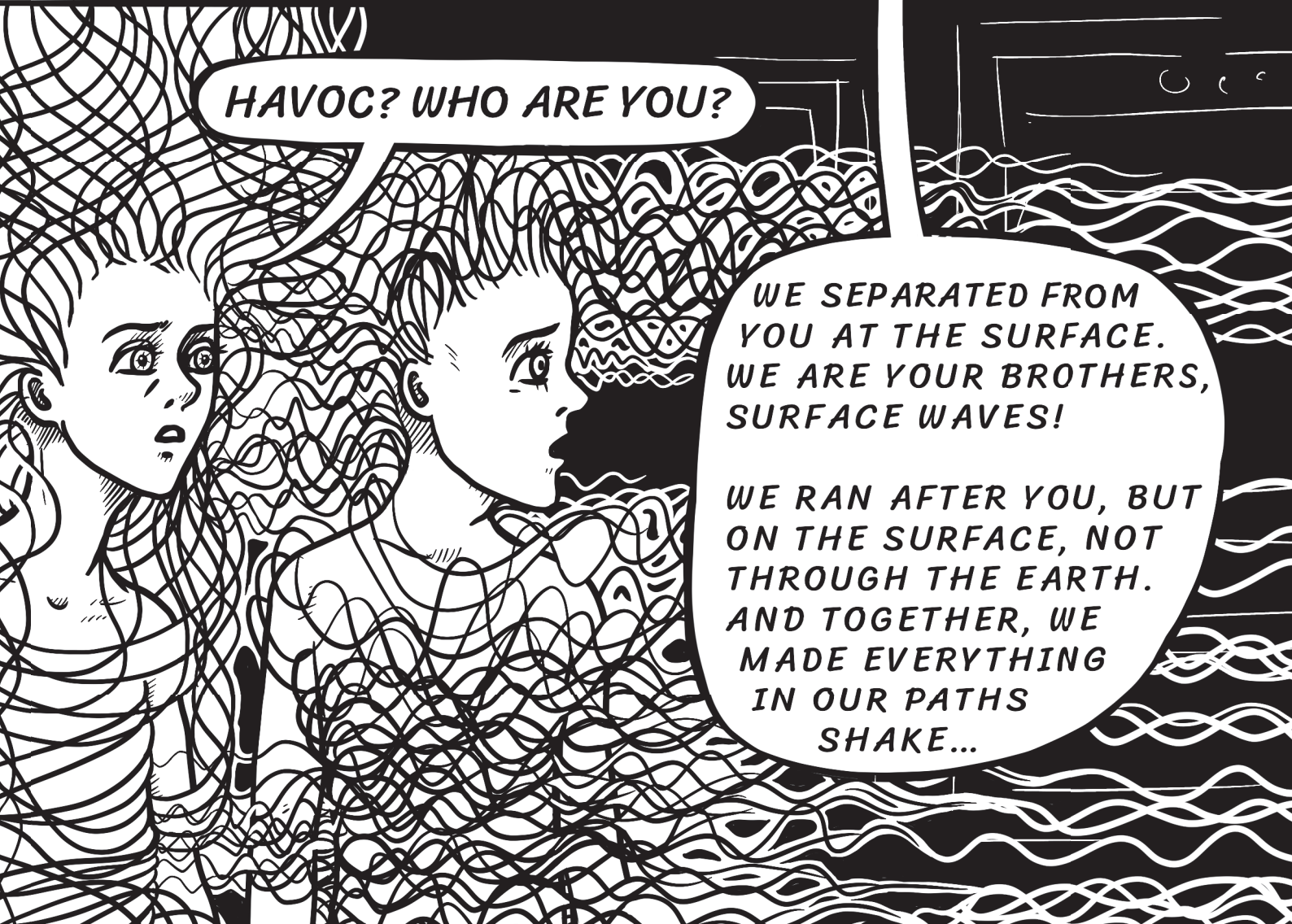
I WAS SCARED
THAT SOMETHING
HAPPENED TO YOU!

I MISSED YOU. I TRIED
TO CATCH UP WITH YOU,
BUT YOU ARE TOO FAST.



HEY SISTERS,
THERE YOU
ARE!

THAT WAS
SOME HAVOC
WE WREKED,
HUH?



HAVOC? WHO ARE YOU?

WE SEPARATED FROM
YOU AT THE SURFACE.
WE ARE YOUR BROTHERS,
SURFACE WAVES!

WE RAN AFTER YOU, BUT
ON THE SURFACE, NOT
THROUGH THE EARTH.
AND TOGETHER, WE
MADE EVERYTHING
IN OUR PATHS
SHAKE...

... WE CAUSED AN EARTHQUAKE!





AND WE SAW THE OCEAN FLOOR RUPTURE IN THE PLACE THAT PEOPLE CALL THE PACIFIC OCEAN.

THE OCEAN FLOOR? THAT IS HOW TSUNAMIS ARE FORMED! WHAT ABOUT MUM AND DAD?!

BUT WE DIDN'T MEAN TO! WE JUST RAN IN ALL DIRECTIONS; WE CANNOT MOVE IN ANY OTHER WAY...

a tsunami

an earthquake

a fault

the ocean

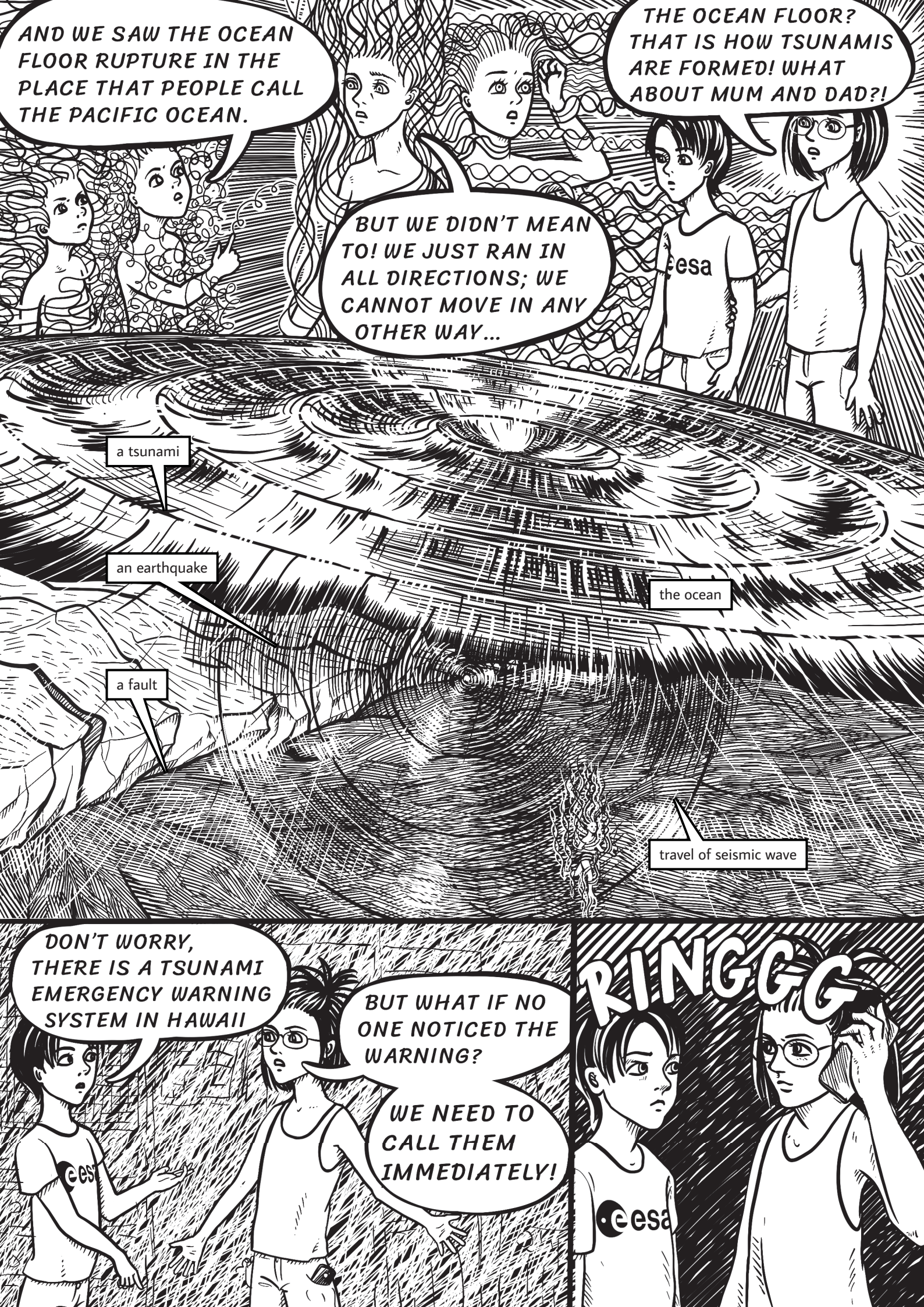
travel of seismic wave

DON'T WORRY, THERE IS A TSUNAMI EMERGENCY WARNING SYSTEM IN HAWAII

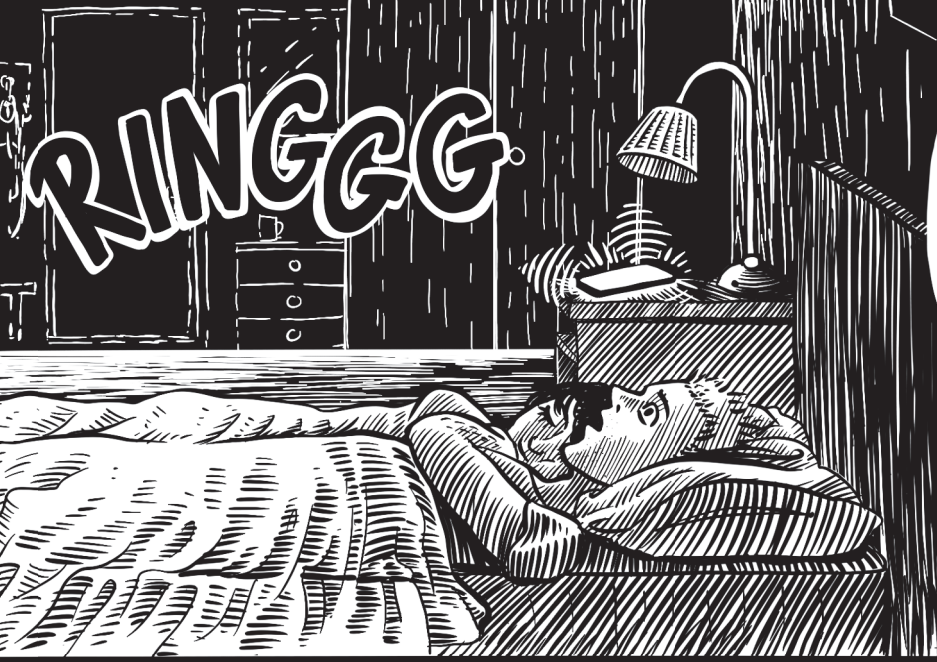
BUT WHAT IF NO ONE NOTICED THE WARNING?

WE NEED TO CALL THEM IMMEDIATELY!

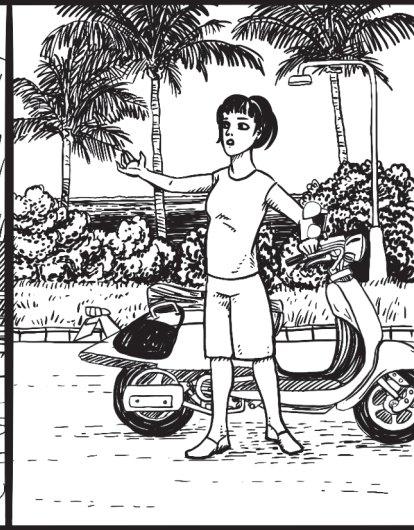
RINGGG



RINGGG



TSUNAMI?!
WE MUST
WARN
EVERYONE
AND RUN!!!





P-WAVE



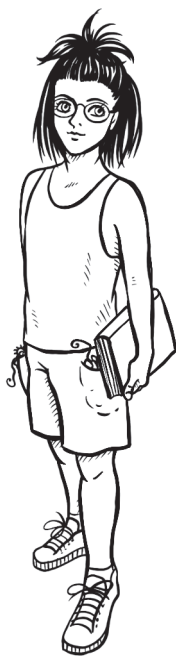
S-WAVE



L-WAVE



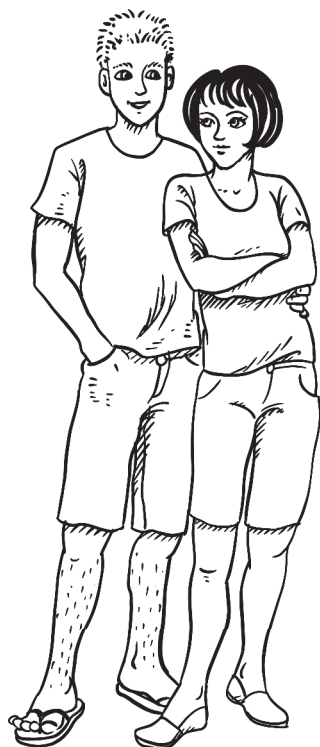
R-WAVE



SISTER



BROTHER



PARENTS



FIND OUT
NEXT TIME IN
2021



When the Earth Quakes, The Story of a Seismic Wave

Illustrations: Karolina Kučerová

Text: Lucie Lukačovičová

Concept: Matěj Machek, Petr Brož

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Would you like to learn more about earthquakes and the travel of seismic waves?
Then visit www.ig.cas.cz/komiks.

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We have hidden three differences in the colourful city and the black-and-white devastated city,
can you find them?

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