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# WHEN THE EARTH QUAKES

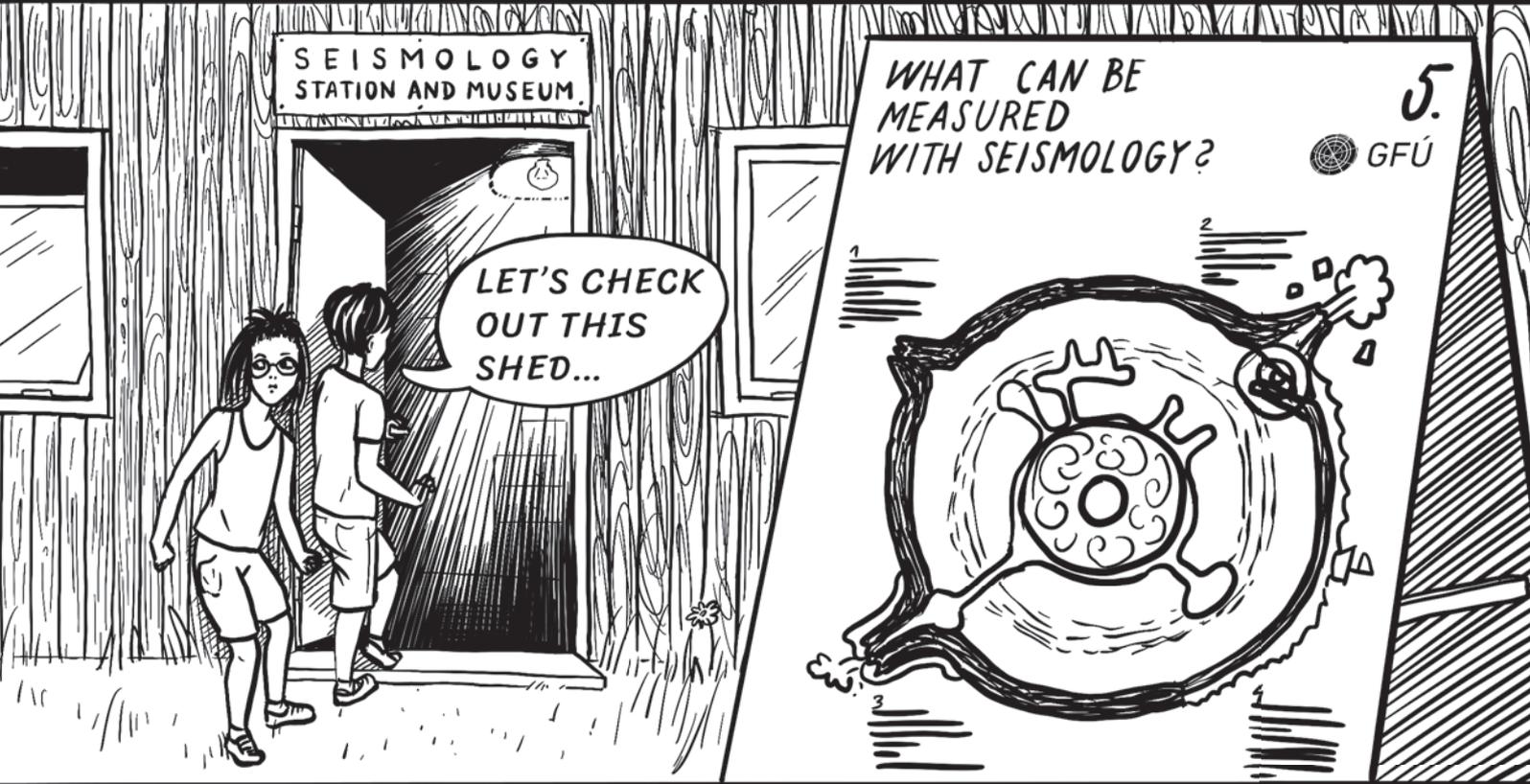
THE STORY OF A SEISMIC WAVE





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

LET'S GO  
SOMEWHERE  
ELSE!

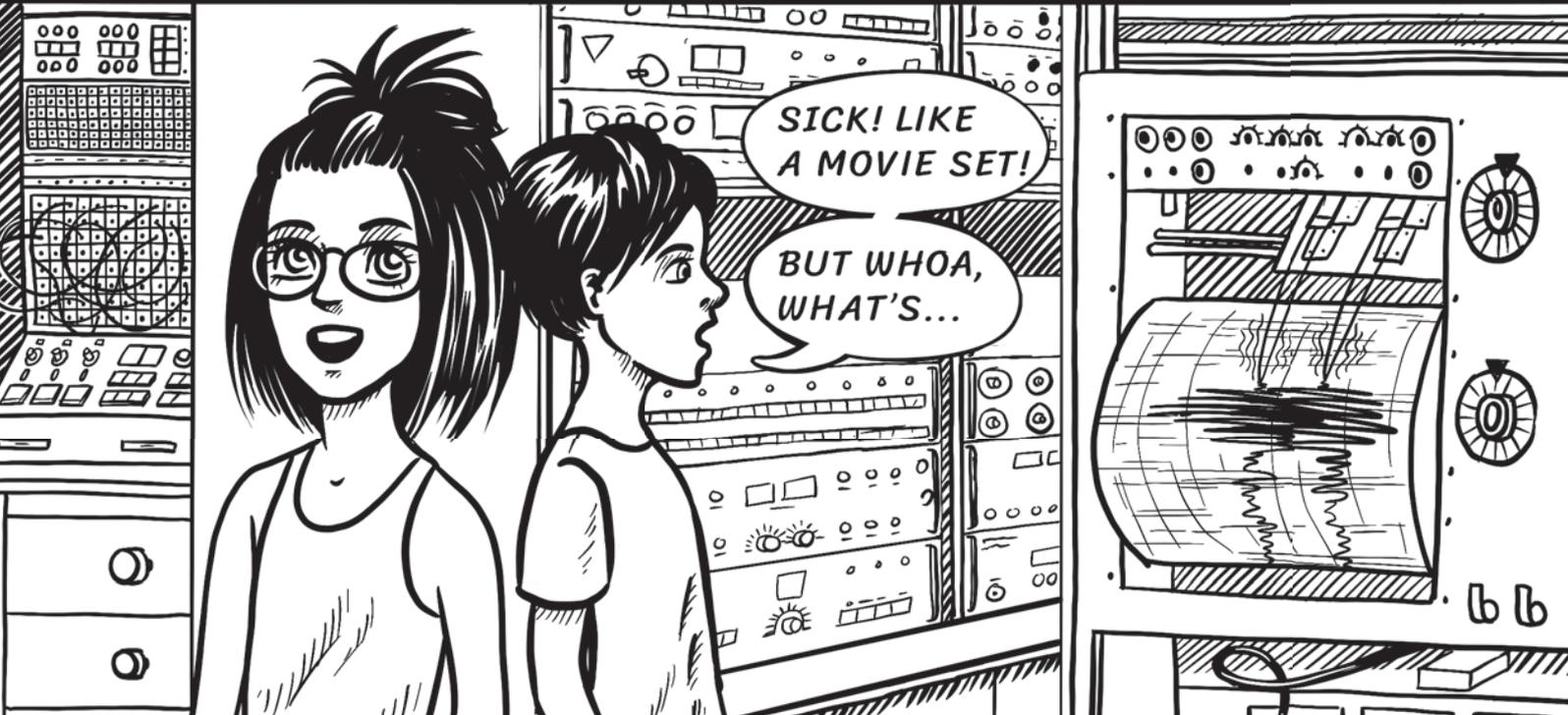


SEISMOLOGY  
STATION AND MUSEUM.

LET'S CHECK  
OUT THIS  
SHED...

WHAT CAN BE  
MEASURED  
WITH SEISMOLOGY?

GFU



SICK! LIKE  
A MOVIE SET!

BUT WHOA,  
WHAT'S...



bb

...HAPPENING?!





ARE YOU AN ALIEN?!

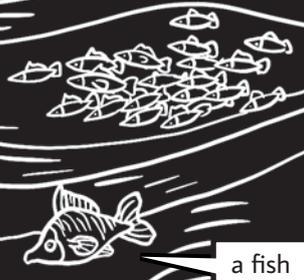
NO WAY, YOU'RE A SEISMIC WAVE? YOU JUST CLIMBED OUT OF THAT SEISMOGRAM!

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...



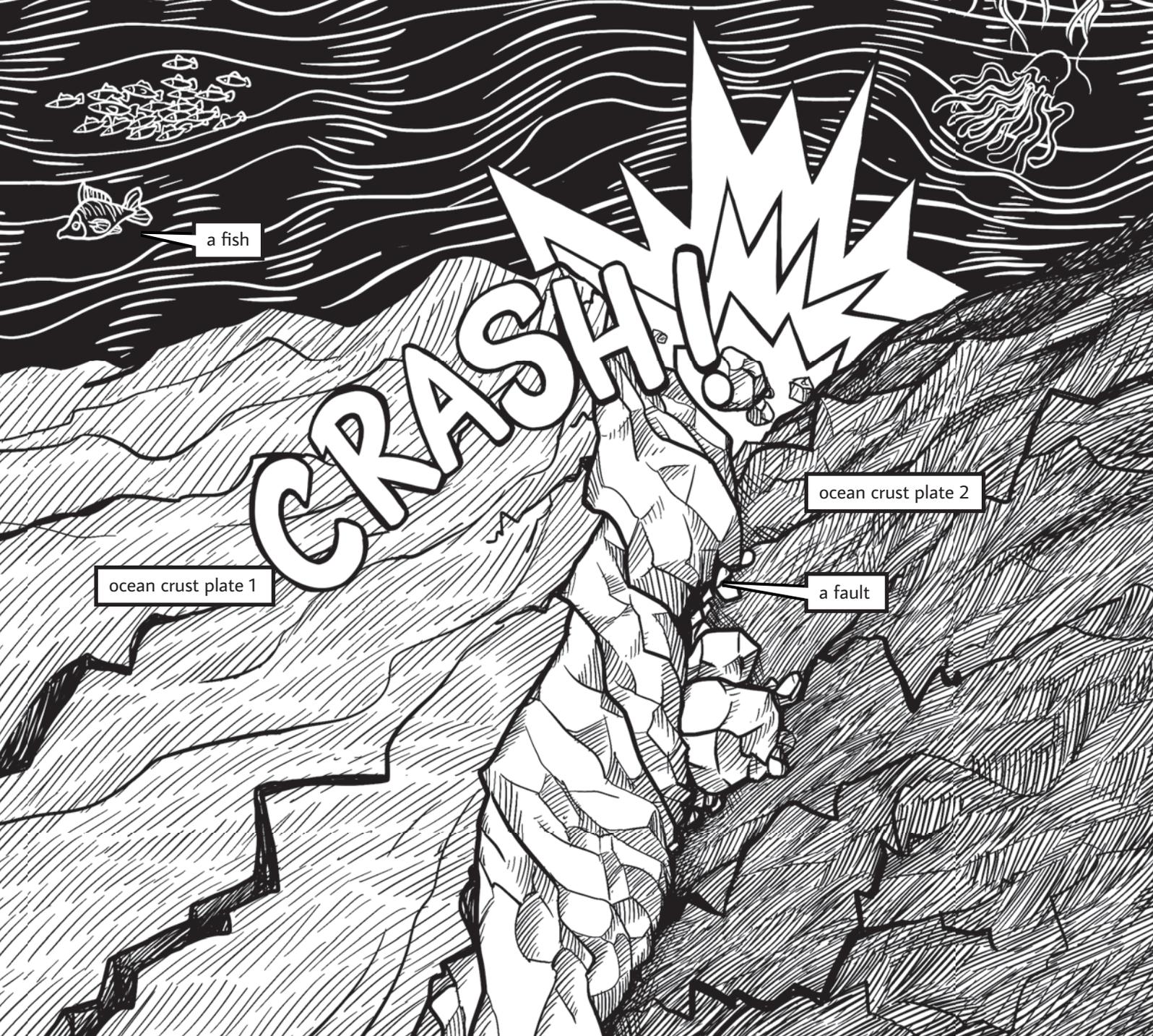
a fish

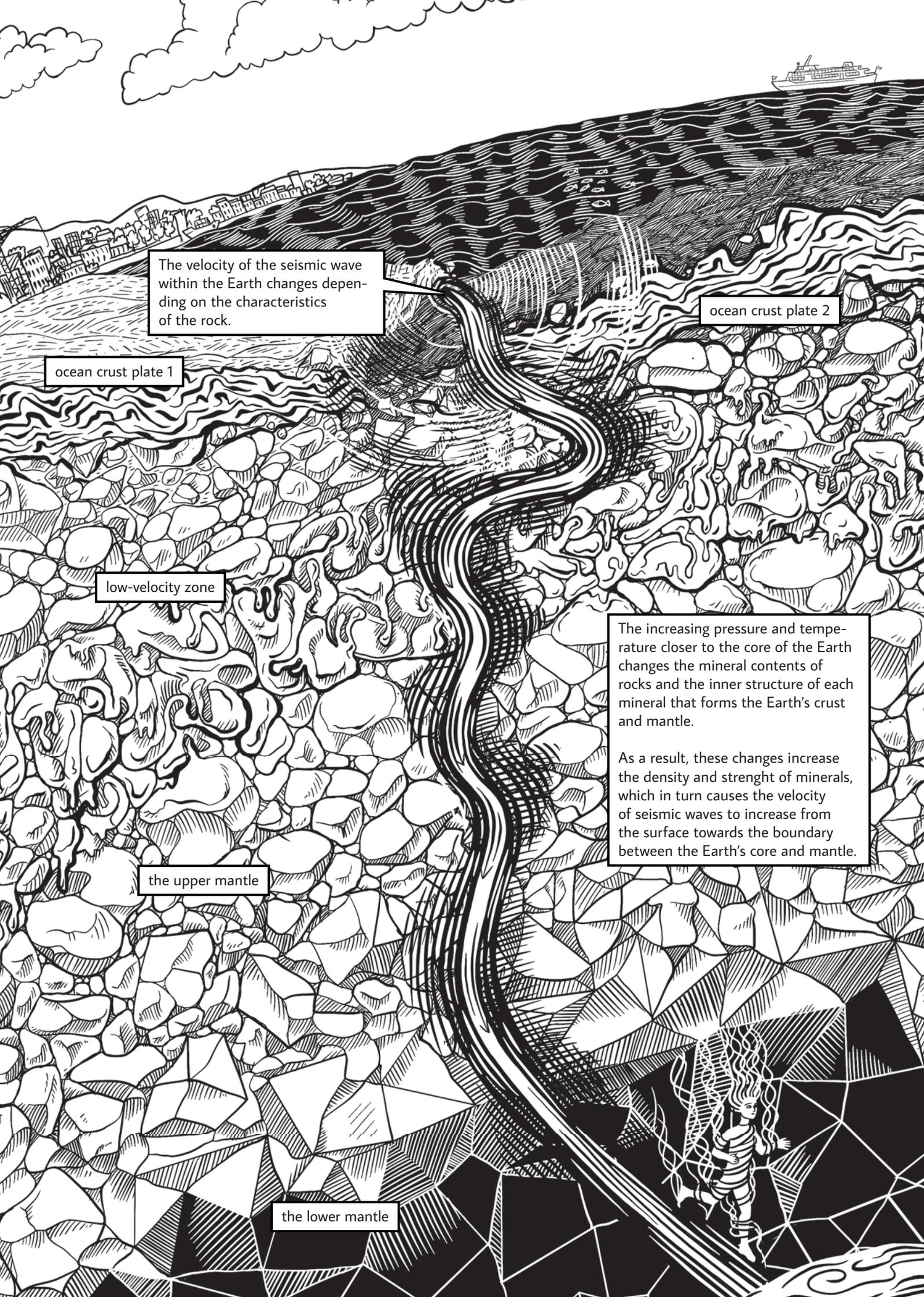
**CRASH!**

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!!!**

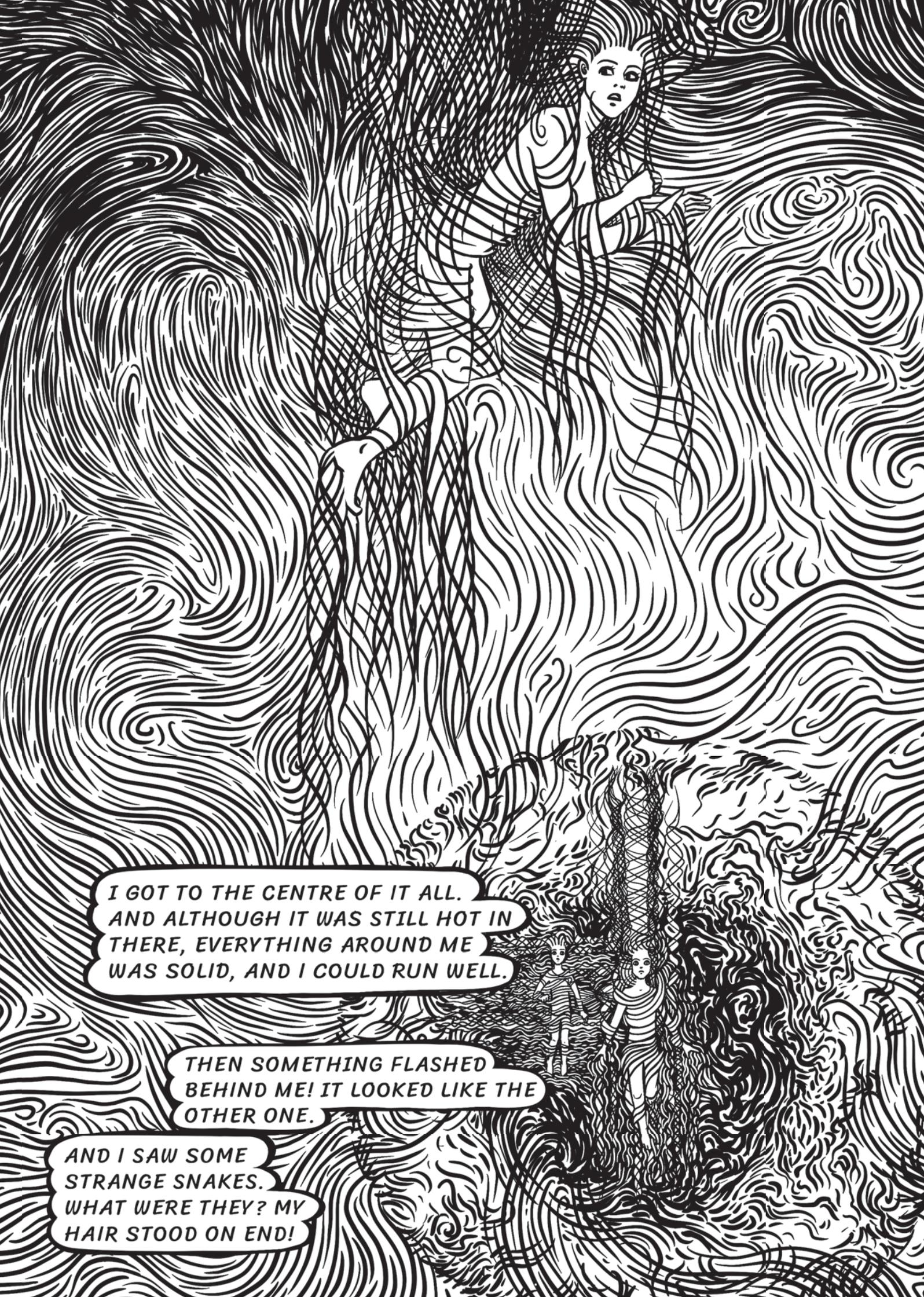
the fluid outer core



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!

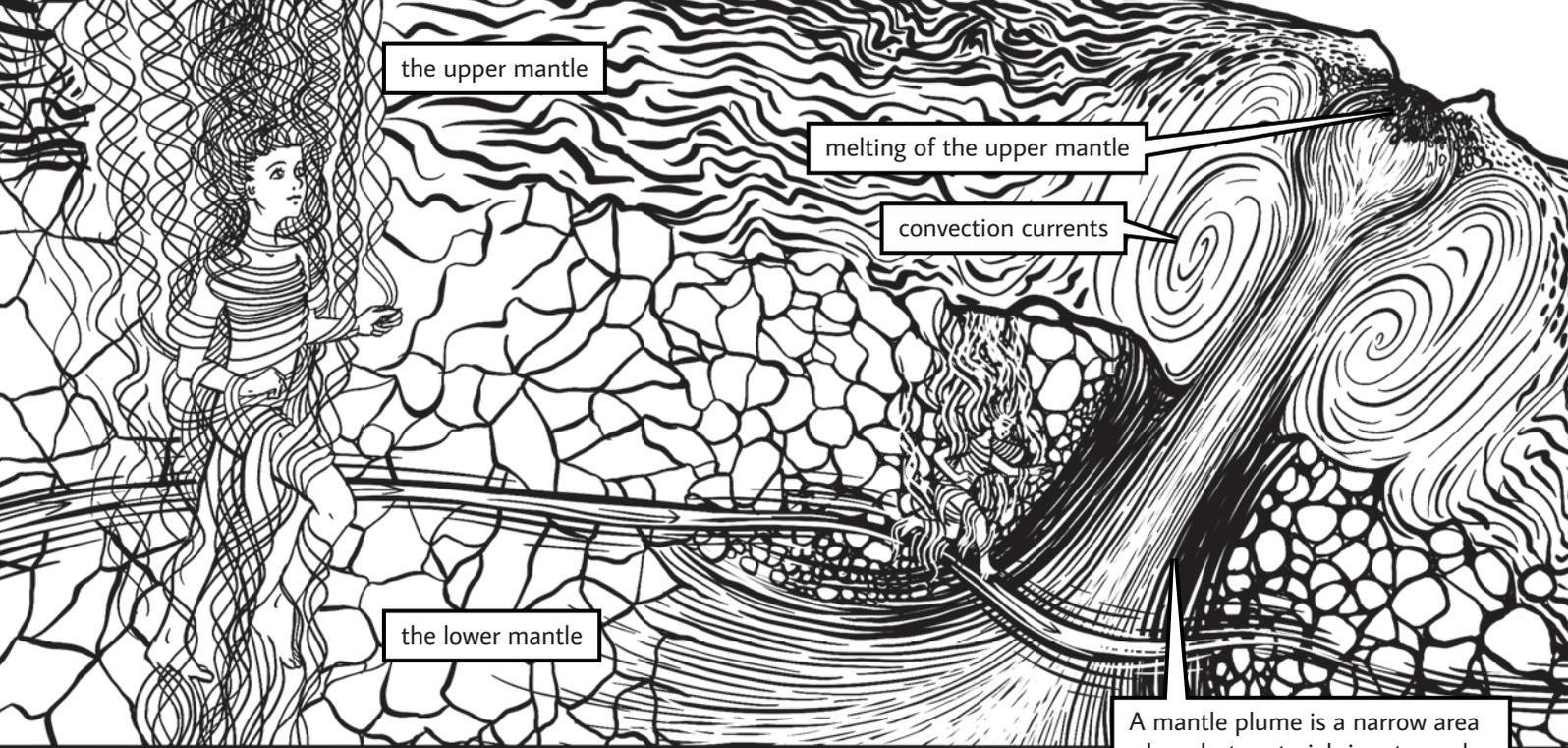
the solid inner core

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!

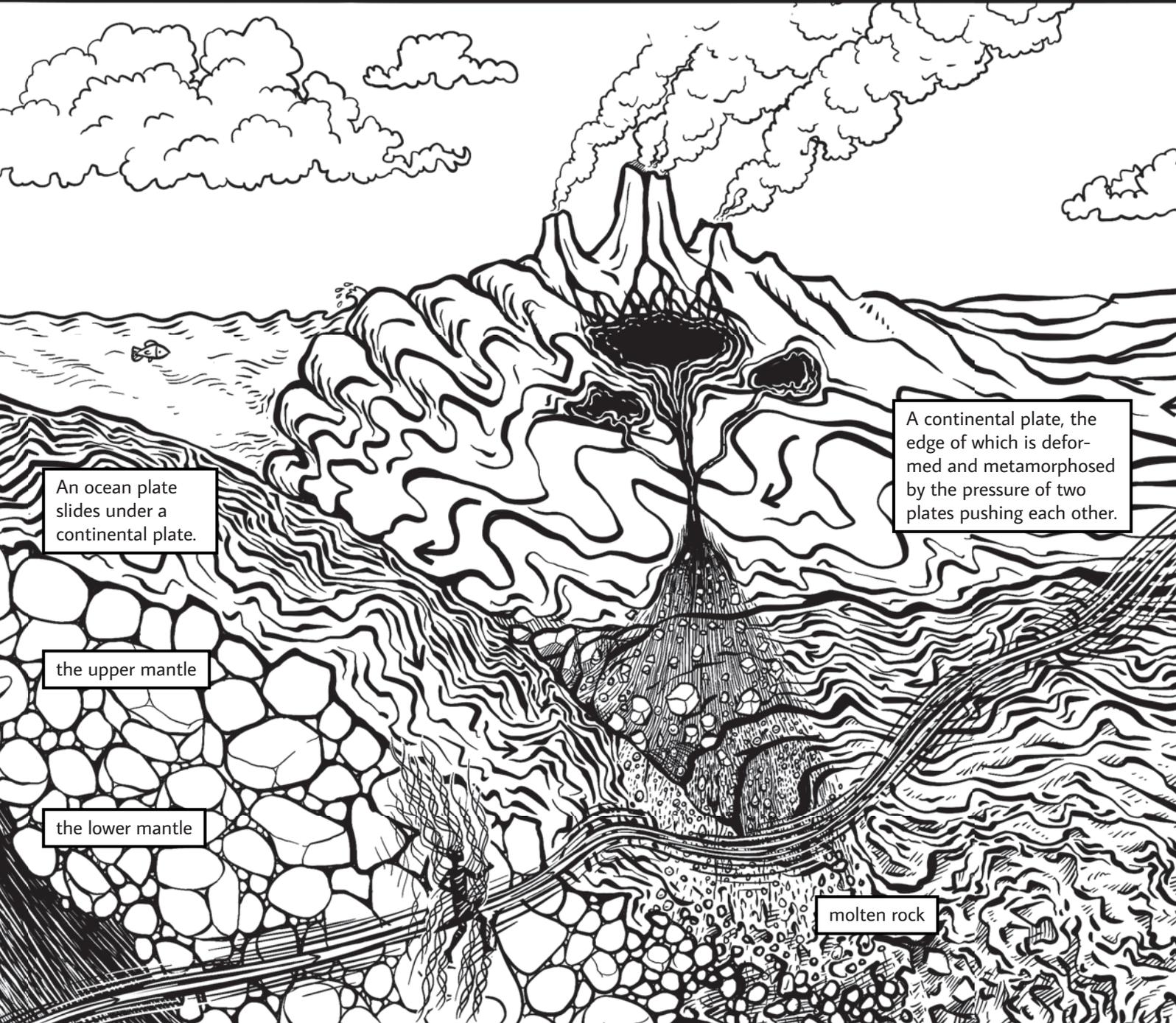
AND THIS STRENGTH  
DOES NOT JUST  
DISAPPEAR,  
THIS MOTION  
DOES NOT STOP!

FOR A WHILE, I COULD  
RUN BETTER.

the upper mantle

globules of melt

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



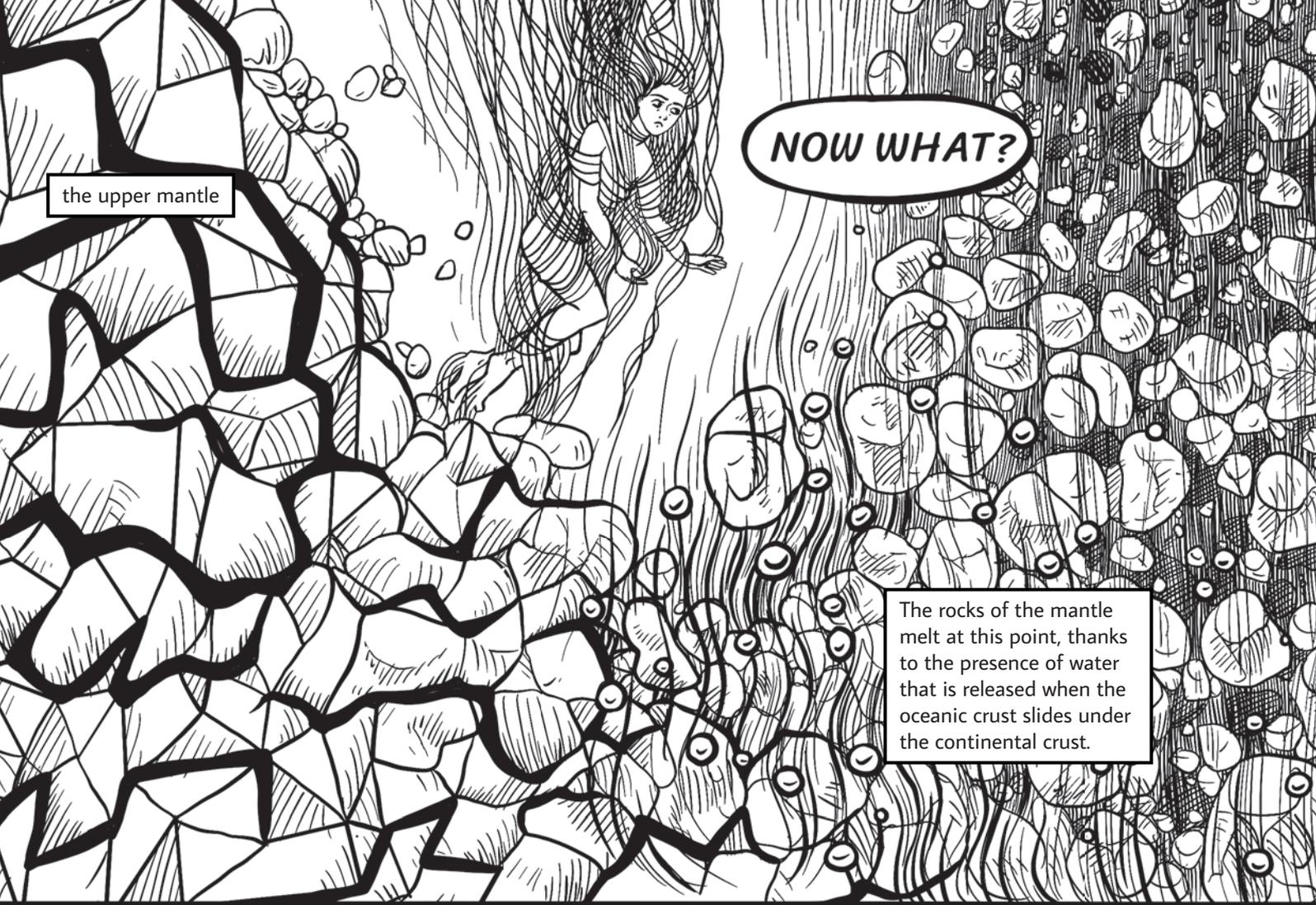
An ocean plate  
slides under a  
continental plate.

the upper mantle

the lower mantle

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

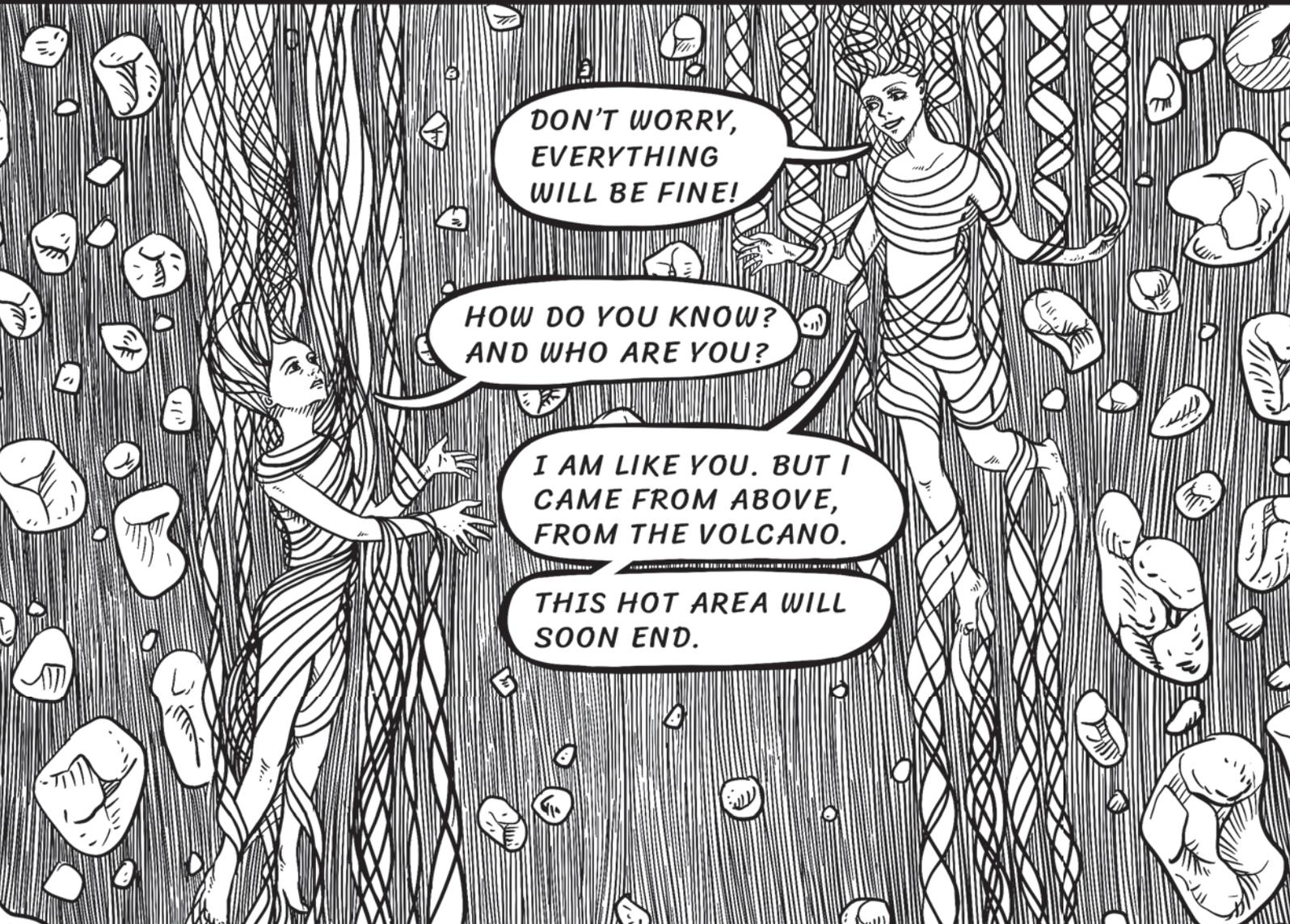
molten rock



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.

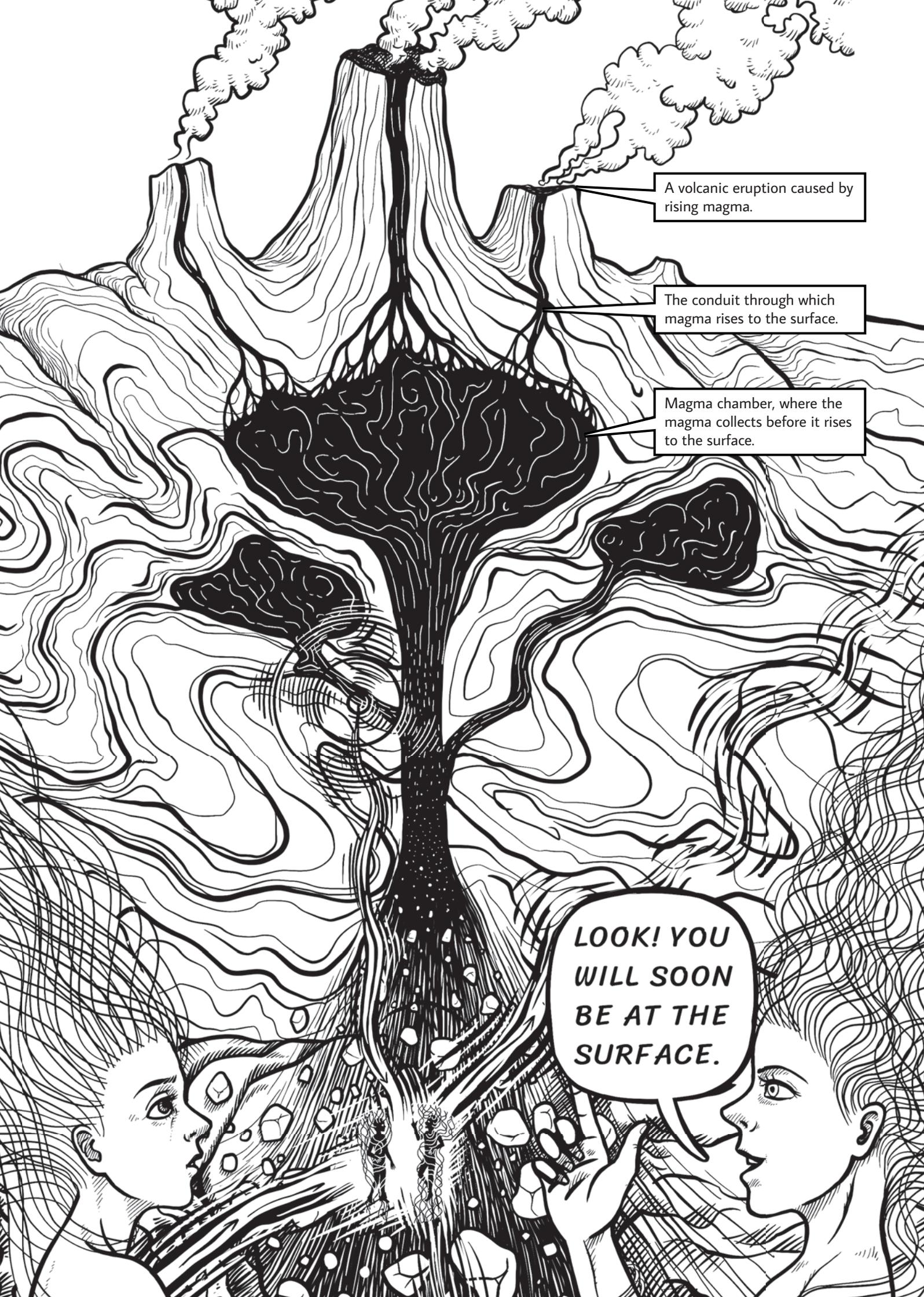


**DON'T WORRY,  
EVERYTHING  
WILL BE FINE!**

**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

TRRRR

WH/RRR

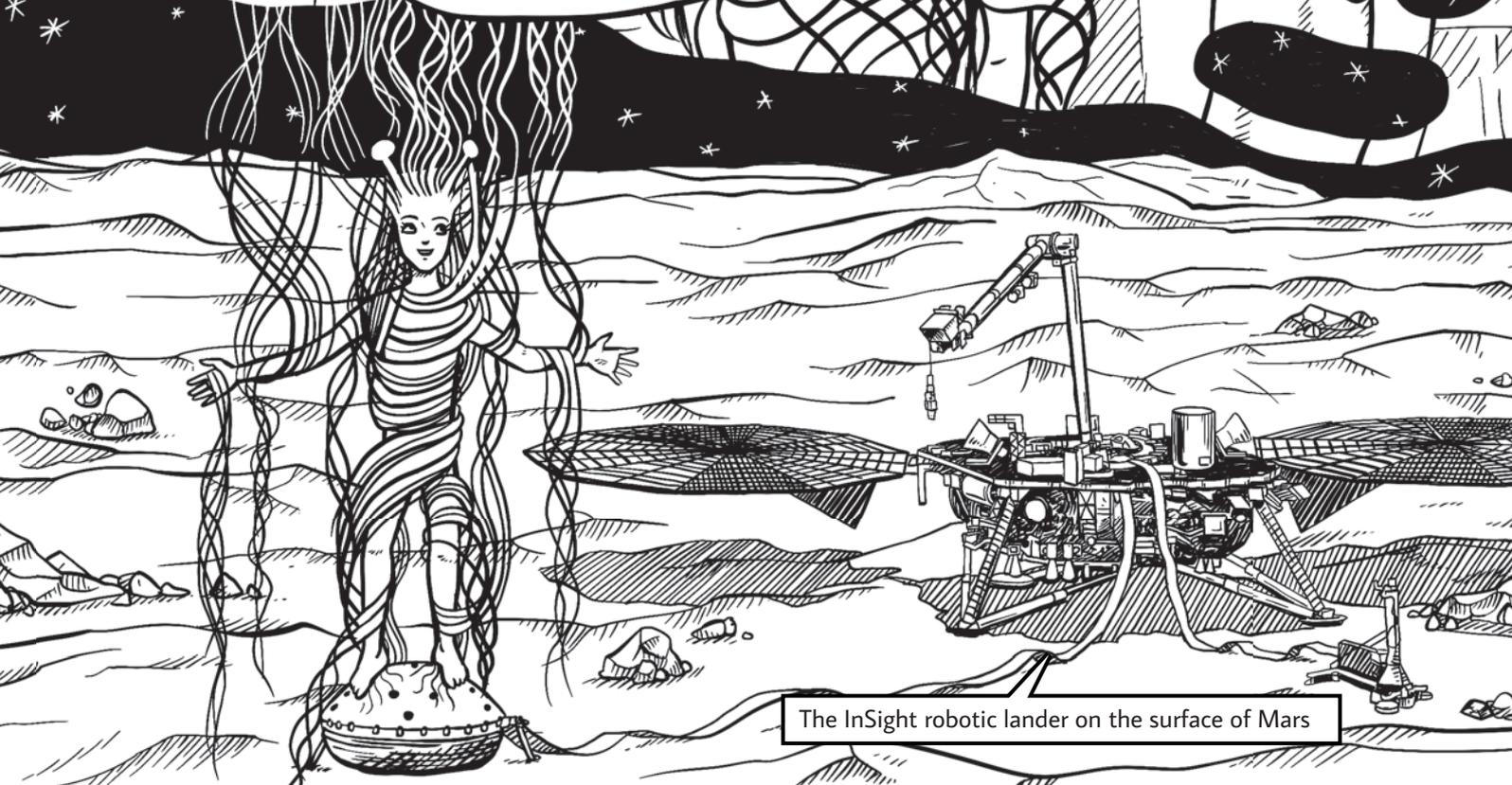
THIS SHAKING IS ME, THE P-WAVE! AND I CAN DO THIS, FOR EXAMPLE...



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

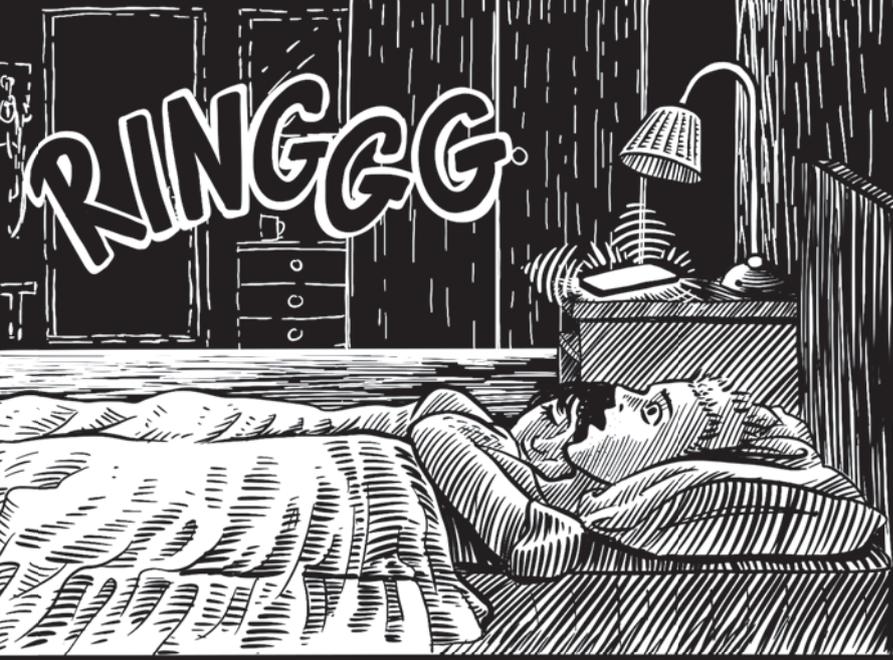
BUT WHAT IF NO ONE NOTICED THE WARNING?

WE NEED TO CALL THEM IMMEDIATELY!

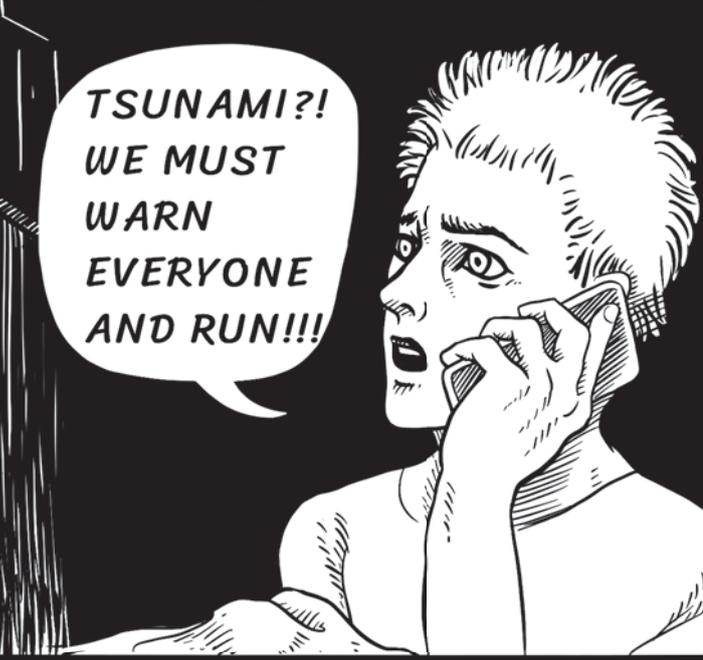
RINGGGG



# RINGGG



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





P-WAVE



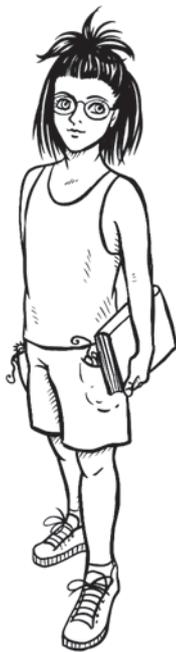
S-WAVE



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](http://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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