
For children
over 8 years
INDONESIA'S
TECTONIC SECRET
kerja sama
jerman
DEUTSCHE ZUSAMMENARBEIT

DEAR KIDS,

Indonesia is situated at the junction of three tectonic plates. Therefore, we can find lots of volcanos and islands in the country. These conditions give also rise to frequent dangerous volcanic eruptions and tsunamis in Indonesia.

To protect ourselves, learning about these hazards from "young age" is very important. You should understand the geological conditions of Indonesia with its rich resources but also its hazard potential.

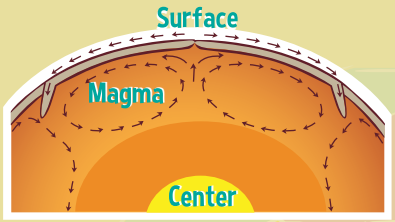
That is, why the Geological Agency of Indonesia has produced this book for you. We hope, that you can enjoy reading and learning about Indonesia's Tectonic Secret, which is so essential for us, who live in Indonesia.

Let's read and learn!

All yours,

kerja sama
jerman
DEUTSCHE ZUSAMMENARBEIT

THE JOURNEY OF THE CONTINENTS



We generally think of the surface of our planet as fixed and unchanging. But this is not true.

Our planet is made of different layers: the outer layer is the one that includes the surface we live on and also the oceans , while the inner layer, the center of the Earth is 6370 km away from us, passing through different other layers. Because the interior of the Earth is very hot, rock that normally forms the Earth´s surface is liquid. We call that liquid material magma. When volcanos erupt, the magma is forced to the surface. Once on the surface magma is called lava.

The surface of the Earth is broken into pieces. These pieces are called tectonic plates and they carry the continents and the oceans. In total , there are seven big tectonic plates: the Pacific Plate, the Antarctic Plate, the North-American Plate, the South- American Plate, the African Plate, the Eurasian Plate, and the Indo-Australian Plate. But there are also smaller ones which we call micro plates, and they have broken off from the bigger ones.

The tectonic plates are not fixed at all, but are floating slowly across the planet's surface, going at different speeds and in different directions. Like ice cubes in water, they are carried by the circulation of the magma inside the Earth. Sometimes the plates bump into each other, sometimes they slide past one another, and sometimes they even drift away from each other.

You can compare this a bit to a car accident. Sometimes, there happens a frontal crash, then the two cars are bend upwards. Sometimes two cars crash laterally and sometimes, a truck lifts a light car.

If two tectonic plates with different weight bump into each other, the heavier plate may slide underneath the lighter plate, We call this subduction. Where subduction happens, the largest earthquakes may occur.

FROM THE PAST → TO THE PRESENT

Because the tectonic plates and the continents on them are moving, our planet looked very differently 300 million years ago. At that time, the continents were still combined in one big piece making up the supercontinent Pangaea (pronounced Pan-jee-a). Over time Pangaea broke apart and continents began to drift away from each other.

Today, we can see the continents spread around the world, far away from each other. And somewhere in between Asia and Australia, Indonesia and its islands are located.

Even though the islands of Indonesia are older than you and me, they are very young compared to how long the Earth has been around. They were formed only about three million years ago, which is a long time after Pangaea split up.

INDONESIA'S PLATES

We can count seven large tectonic plates on the Earth, but for the region of Indonesia, four of them have major importance: the Eurasian Plate, the Pacific Plate, the Philippine Plate and the Indo-Australian Plate. Besides that, the Sunda Plate on which Indonesia is situated, plays an important role for the country.

The Sunda Plate is a small micro plate and if we have a closer look, it seems like it is sandwiched between the Indo-Australian Plate, the Philippine Plate and the Pacific Plate. Even though it is small, its meeting point with the Indo-Australian plate is the most important tectonic area of Indonesia. Here, the Indo-Australian Plate subducts underneath the Sunda Plate.

This movement causes most of Indonesia's big earthquakes.

THE EURASIAN PLATE

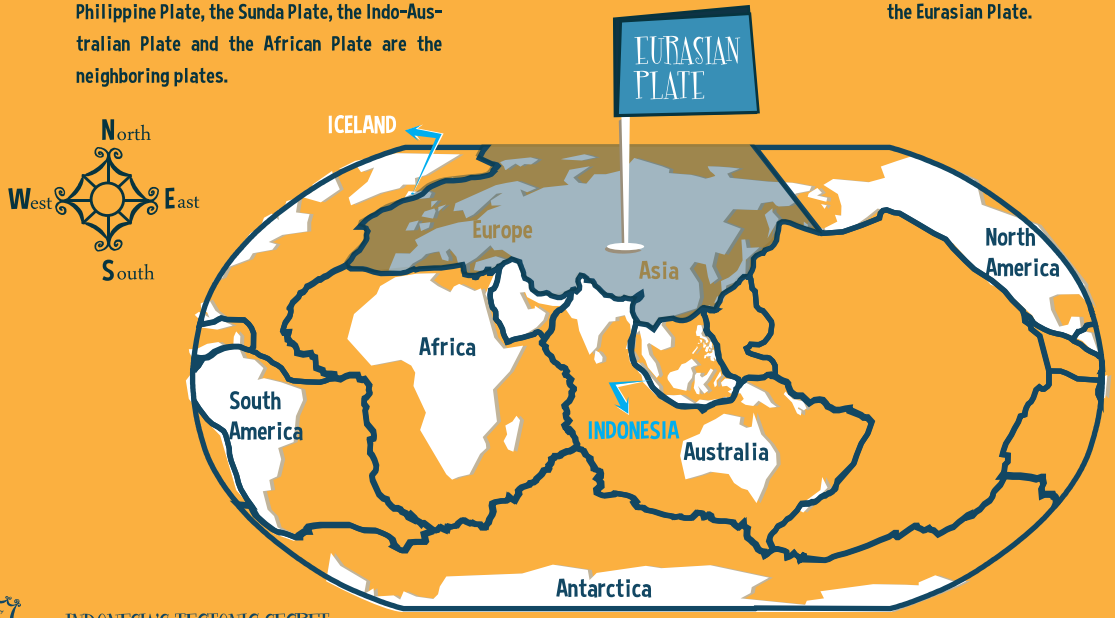
The Eurasian Plate is a tectonic plate which carries most of the contintent of Europe and Asia and moves more or less to the Southeast from the North Pole.

As it is so much to the north, it does not directly border Indonesia, but the southern tip comes close. The North-American Plate, the Philippine Plate, the Sunda Plate, the Indo-Australian Plate and the African Plate are the neighboring plates.

The Eurasian Plate is diverging from the North-American Plate and we can observe that on the surface. For example in Iceland, which is an island in the northern part of the world. Iceland is divided by a long ditch. One side is on the Eurasian Plate and the other side is on the North American Plate.

As the plates are moving away from each other, the ditch gets broader every year. Sometime in the future,Iceland will be not one island anymore, but will be split into two pieces.

However, it is a long way from Indonesia to Iceland, far to the North, on the other side of the Eurasian Plate.



THE PACIFIC PLATE

The Pacific Plate is the tectonic plate that lies under the Pacific Ocean, which has the deepest waters, with depths over ten kilometers. It is the only plate that does not carry any continent.

The Pacific Plate covers 103 million square kilometers, which is more than twice the size of Asia or almost 80 times the size of the island of Java. It is the largest plate on the planet.

The plate moves an average of ten centimeters per year, which is faster than your fingernails grow. Imagine how long your fingernails would be if you didn´t cut them for a year !

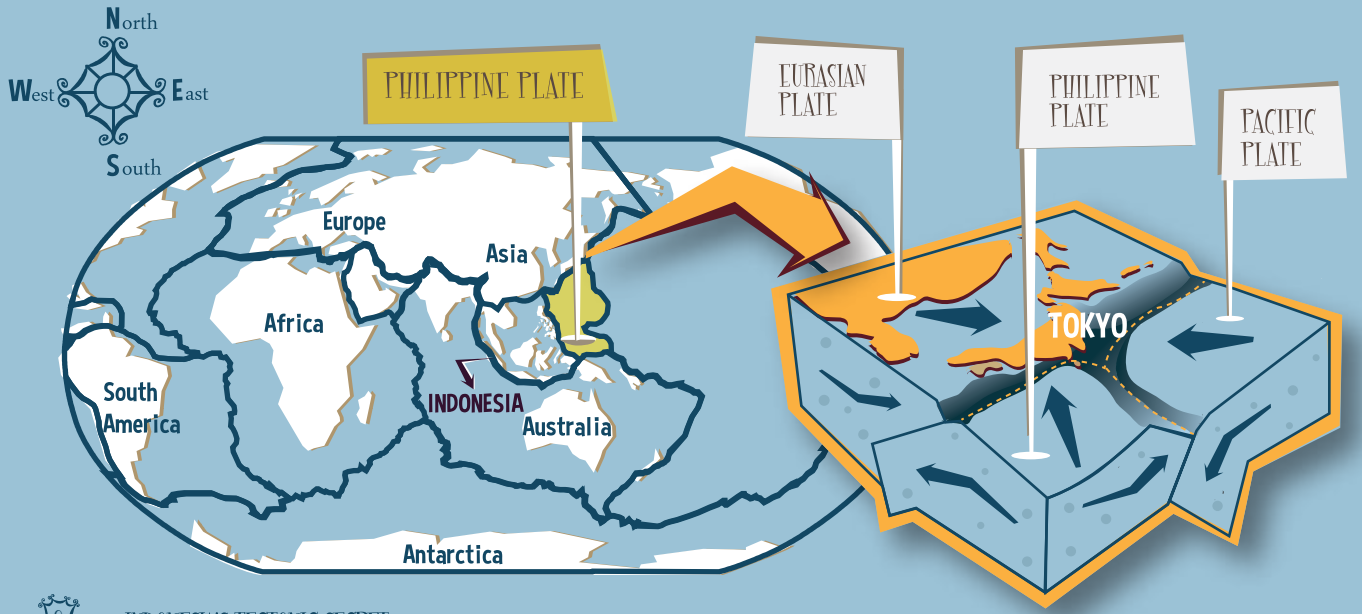
The Pacific Plate is subducting all its neighboring plates, which makes it a very important plate for geological hazards like earthquakes, volcanos and tsunamis. As you can see on the map, the Pacific Plate gets pretty close to Indonesia, in the East of the country.

THE PHILIPPINE PLATE

The Philippine Plate is a tectonic plate that is covered mainly with the waters of the Philippine Sea, which is part of the Pacific Ocean.

To its West, the Philippine Plate is subducting the Sunda Plate. Because Indonesia is situated on the Sunda Plate, this subduction effects the country by causing a high number of earthquakes, especially in the East.

Near Tokyo, the capital of Japan, the Philippine Plate meets the Eurasian and the Pacific Plate, which also can be very dangerous for the inhabitants as big earthquakes are likely to occur in the area.

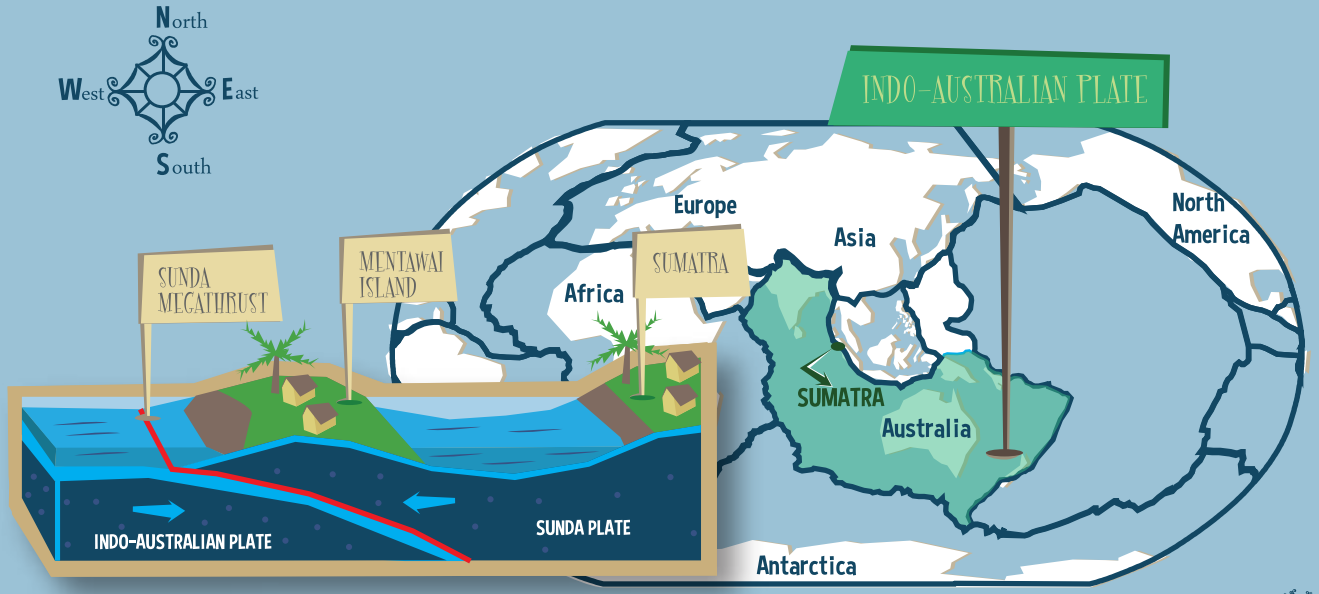


THE INDO – AUSTRALIAN PLATE

The Indo-Australian Plate is a major tectonic plate, including the continent of Australia with its surrounding ocean and extending all the way to India. As such a big, whole plate, it was formed 43 million years ago, when the Australian Plate and Indian Plate came together.

The plate drifts roughly to the North from Antarctica and slides under the Sunda Plate. This subduction area is called Sunda Megathrust and it impacts Indonesia importantly, especially Sumatra.

Recently, we have witnessed several big earthquakes, one of them in April 2013 in Sumatra. Scientists believe that the Indo-Australian Plate, which merged 43 million years ago, is in the process of splitting into two plates again. New plates will be generated sooner or later and Indonesia will be changing.



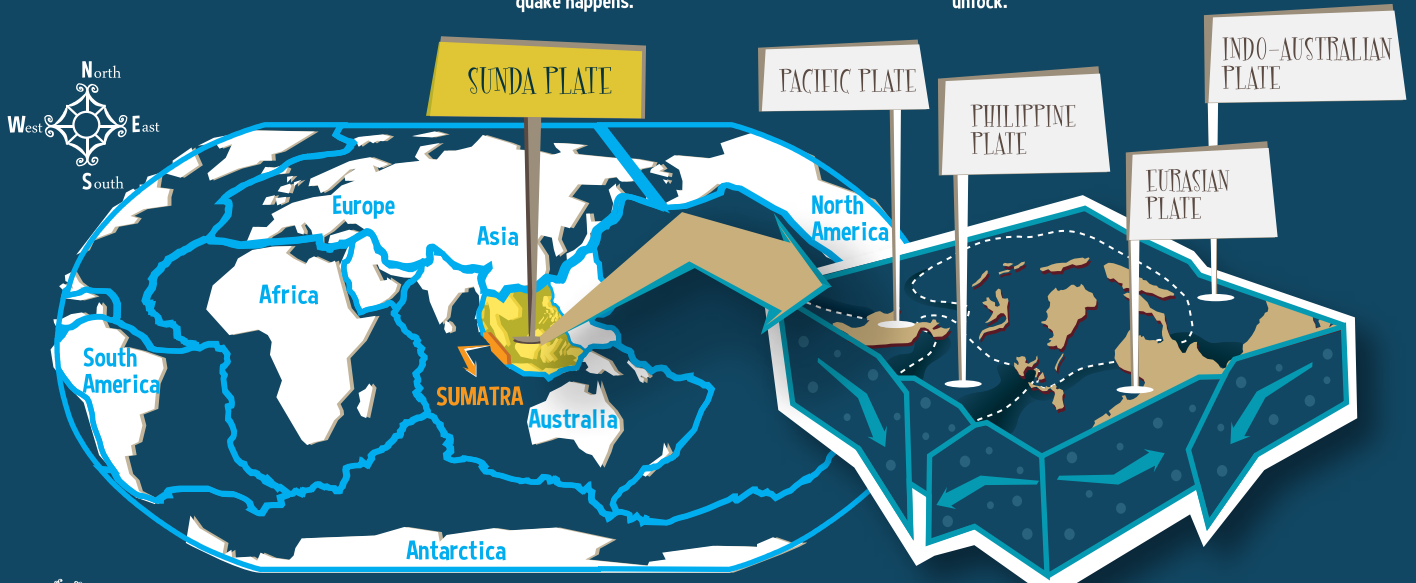
THE SUNDA PLATE

The Sunda Plate, which was only recently defined as a single micro plate, is still often mentioned as part of the Eurasian Plate. It is the tectonic plate on which most of Southeast Asia is located, including Indonesia.

From three sides (South, West and East) surrounding plates are subducting.

Along the west coast of Sumatra, the Indo-Australian Plate is moving towards and sliding underneath the Sunda Plate, building up the Sunda Megathrust. Here, the two plates are hooked together. As each plate pushes in a different direction, the rocks that they are made of bend more and more until the power is so strong, that they break apart suddenly. This is when an earthquake happens.

You can compare this kind of tension to a door that is held closed by a lock. You pull on it to try and open it, but the door doesn't open. Instead, pulling with the help of your brother, the lock might break as you are very strong together. The door comes free all of a sudden and you stumble backwards. This sudden movement is similar to what happens when the two hooked plates unlock.



WHY IS THIS IMPORTANT TO US?

Due to the movement of the tectonic plates, Indonesia is a place where we find a high number of so-called seismic activities, which means, that in Indonesia, we have a lot of active volcanos. Devastating earthquakes and tsunamis can also occur, which can put our lives in danger. We call all of these geological hazards.

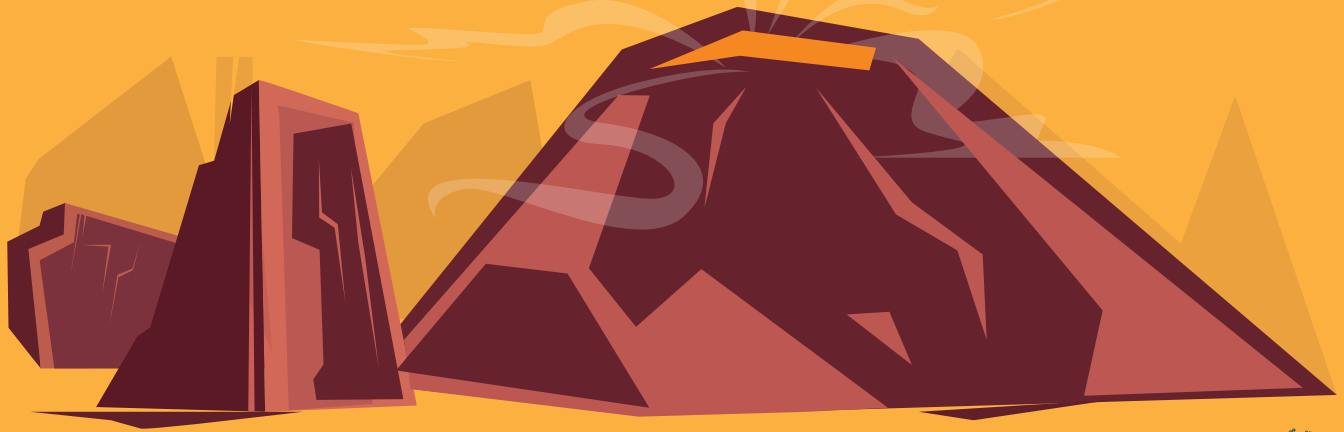
Because we cannot stop these very powerful processes, we have to adapt, prepare and protect ourselves, depending on where and how we live.

In Indonesia, the government is responsible for warning us and also, if necessary, evacuating us to safe places. In addition, the government has passed laws to prevent people from living in places that are considered to be too dangerous. The government also has issued instructions on how to build houses that will be stronger in an earthquake.

Everyone should know about this and ensure that they follow the rules that the government has set down.

Besides that, it is important, that every single person knows how to behave when such events happen. We call this preparedness.

Naturally, this preparedness is different from place to place, and it is not the same for all hazards.



EARTHQUAKES AND US

Earthquakes are resulting from the movement of the tectonic plates and affect all islands of Indonesia.

We experience most of them in the subduction zones near the plate borders.

Sometimes during an earthquake the ground is shaken strongly, sometimes less. And while weak shakes can be observed more often, heavy earthquake are rare, but are generally more dangerous.

Also, the same earthquake can be felt differently, stronger or weaker, from place to place. Scientists talk about intensities.

As you may have already observed , houses are often damaged differently by the shocks. After an earthquake, it may be that one house is destroyed, while the house next door is not. This is not necessarily due to poor construction, but could be due to the different types of soil the houses are built on.

Safety Message

To reduce the danger of destruction, our goverment has made requirements for construction, so that a house remains stable during an earthquake and does not collapse onto our heads. We call this a "Building Code". When building a house, it is very important that we follow these rules for our own safety.

To be safe, we also have to act correctly if an earthquake occurs. It does not help to panic, but we should try to find a safe place in the house or get to an open area outside, so we do not get hit by falling objects.

Some schools practice the correct way of behavior during an earthquake. That practice is called a drill. And it is part of your own preparedness.

Does your school practice drills for earthquakes, too?

If not, you should ask your teacher about it!

TSUNAMIS AND US

Tsunamis are usually triggered by an earthquake under the ocean. This causes very high waves to sweep across the ocean and onto land, flooding coastal areas.

On December 26th in 2014 a large earthquake occured beyond Sumatra which caused a disastrous tsunami that hit several countries. As you probably learned in school, Banda Aceh was affected specially hard at that time. Far more than a hundred thousand people lost their lifes, only in Indonesia. Today, people are scared whenever an earthquake occurs, but not all quakes lead to a tsunami.

In order to deal with this hazard, it would be safest, to stay away from the ocean. But most of us enjoy spending our time at the beach. Still, how we behave can be the key to our well-being.

Safety Message

First of all, be ALERT: In case of a tsunami , there are certain observations to be made. You may feel a strong earthquake and/or observe that the water of the ocean is receeding. If you observe this, you should immediately leave the beach and go to higher ground or to a high rise building.

In some cities at the coast, there are government warnings such as sirens, that sound to warn citizens of impending danger and to go to a safe place. In order to find the way easily, many cities have installed tsunami evacuation route signs. Indonesia has the same signs all over the country. Follow those signs in case you hear the siren sound.

If you or your parents have a cell phone, you can also subscribe for an international warning system for example www.cwarn.org. In case of a tsunami alert for your area, you receive a warning by SMS. This service is FREE!

Do you already know the evacuation routes in your city?

Check it out, because It Is Important for your safety!

US AND VOLCANOS

Volcanos are products of the tectonic plates' movement. They are usually situated along the bordes of the plates. Most volcanos on the Earth can be found along the coasts of the Pacific Ocean, along the subduction areas of the Pacific Plate. If we look at them on a globe, the volcanos are like perls on a chain. This chain is called the Ring of Fire. Indonesia is located on this Ring of Fire, and there are 129 active volcanos, more than in any other country in the world! Some are very popular too, like Merapi or Krakatau.

With their fertile soils, volcanic ashes form the livelihood for millions of people, but at the same time, volcanos can cause fear, sicknees and death, when they erupt. Eruption means that the crater spits out ash, lava or gas because of the high pressure inside the earth.

Fortunately, scientists can predict these out-breaks quite well. Still, though, in February 2014, seventeen people died after the eruption of Mount Sinabung in Northen Sumatra.

Observing volcanos can help to predict an eruption and protect people.

Safety Message

The Indonesian government, through the Geological Agency in Bandung, runs. What they call a monitoring system to observe the most dangerous volcanos and to start safety precautions if a volcano is becoming too dangerous.

It is the government's responsibility to inform us, warn us and if necessary, to lead us to safer places and shelters. But it is our duty to follow the instructions.

What is the nearest volcano from your home town? How might it impact your home? Can you protect your house against some of these impacts? Do you know about the different precautions?

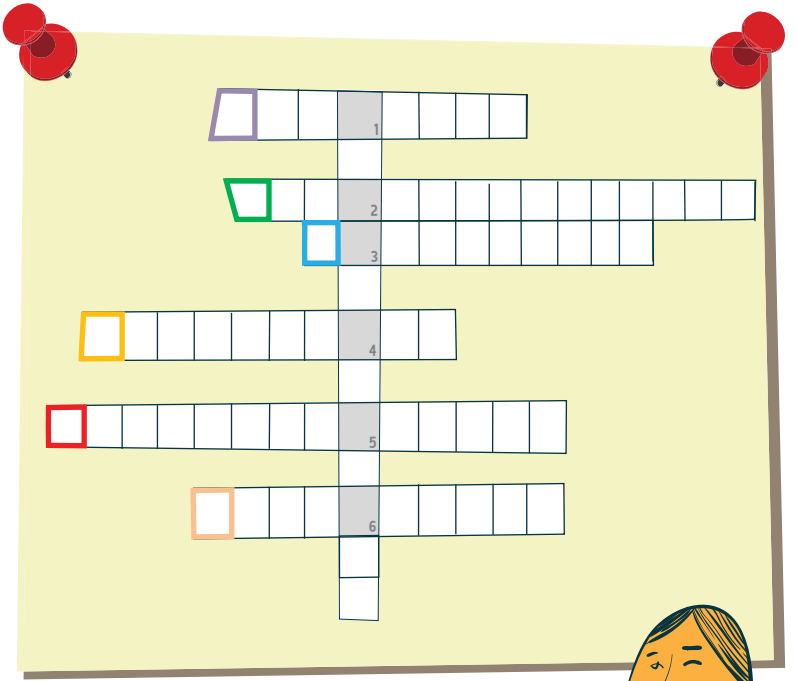
Think about it and discuss it in your class!

DID YOU PAY ATTENTION ?

To your right there are colored squares with questions. Enter your answer in the line with the corresponding colour or letter per square, from left to right. Transfer the letters from the grey fields into the grey squares in the result fields below, keeping the same number sequence. If you answered all questions correctly, they help you to answer teh final question :
What is the name of the biggest tectonic plate?

In order to complete the result, just fill in the missing letters by what you have learnt.

- How do you call it if a volcano spits out material due to higher activity?
- What is the name of a tectonic plate in Indonesia?
- How do you call the road which takes you fastest to a safe place?
- How is the process called, when a heavier plate moves under a lighter plate
- How are the pieces called that build up the earth's surface?
- The coastline of the Pacific Ocean on which volcanos appear like pearls on a chain is also called...



THE BIGGEST TECTONIC PLATE IS CALLED :

1		2	3		4		5		6		

You are now an expert in Indonesia's Tectonic Secret !

This document is produced under the auspices of the German-Indonesian Technical Cooperation on 'Mitigation of Georisks' between the Geological Agency of Indonesia under the Ministry for Energy and Mineral Resources (KESDM) and the German Federal Institute for Geosciences and Natural Resources (BGR), financed by the Federal Ministry for Economic Cooperation and Development (BMZ), Germany.

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