

HEY, I CAN SEE MYSELF IN THIS PLATE!

OUR NEXT ADVENTURE IS ABOUT PLATES - NOT PLATES WE EAT OFF OF, BUT PLATES FOUND IN THE EARTH!

DO YOU REMEMBER STUDYING THE CRUST AND MANTLE OF THE EARTH? TOGETHER THEY MAKE UP THE **LITHOSPHERE**, WHICH IS BROKEN INTO LARGE PIECES CALLED **PLATES** THAT CONSTANTLY MOVE. THE PLATES CARRY THE OCEANS AND CONTINENTS.



HOW DO PLATES MOVE?

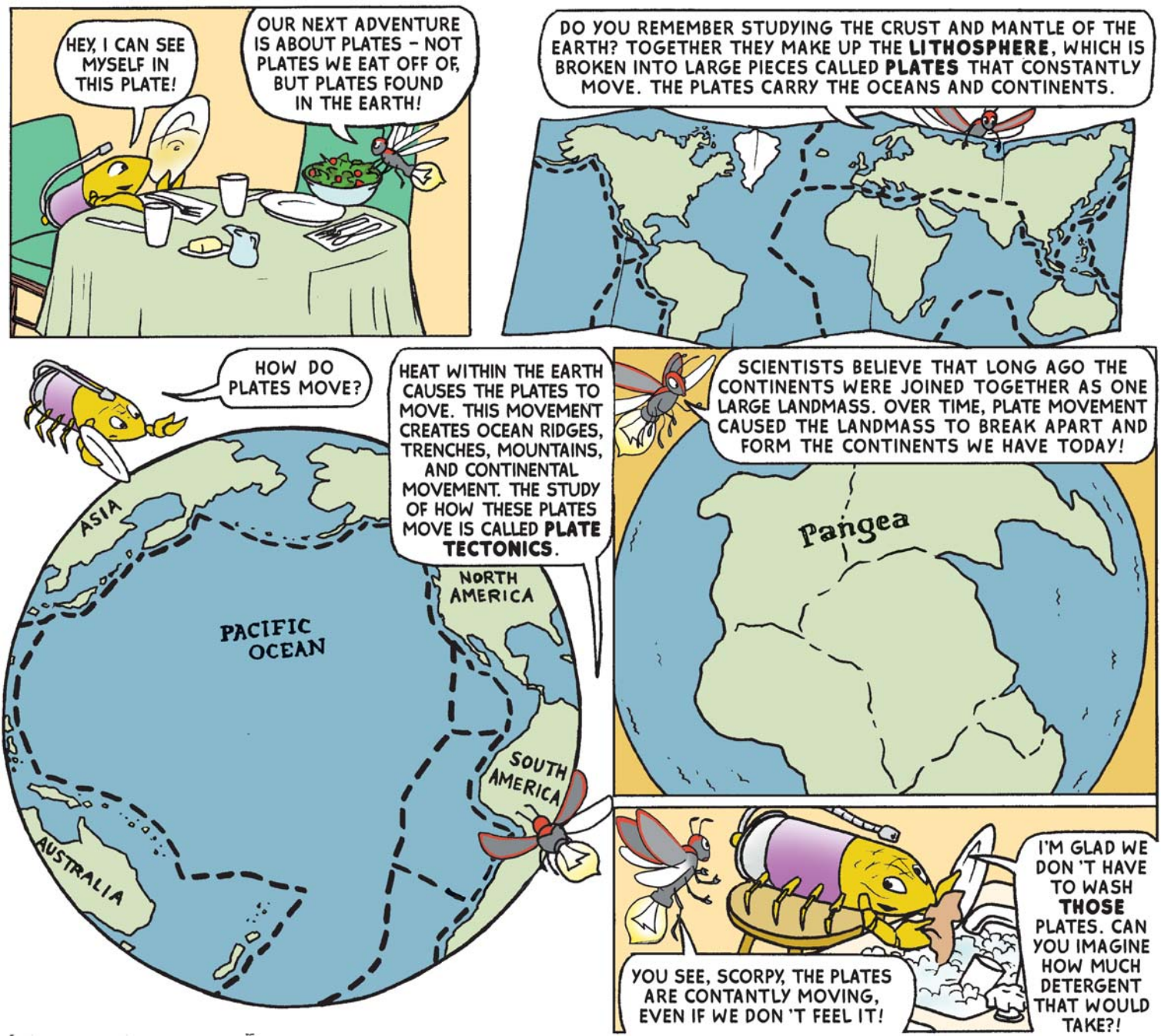
HEAT WITHIN THE EARTH CAUSES THE PLATES TO MOVE. THIS MOVEMENT CREATES OCEAN RIDGES, TRENCHES, MOUNTAINS, AND CONTINENTAL MOVEMENT. THE STUDY OF HOW THESE PLATES MOVE IS CALLED **PLATE TECTONICS**.

SCIENTISTS BELIEVE THAT LONG AGO THE CONTINENTS WERE JOINED TOGETHER AS ONE LARGE LANDMASS. OVER TIME, PLATE MOVEMENT CAUSED THE LANDMASS TO BREAK APART AND FORM THE CONTINENTS WE HAVE TODAY!

Pangea

I'M GLAD WE DON'T HAVE TO WASH **THOSE** PLATES. CAN YOU IMAGINE HOW MUCH DETERGENT THAT WOULD TAKE?!

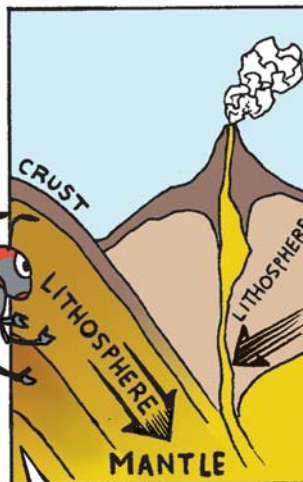
YOU SEE, SCORPY, THE PLATES ARE CONTANTLY MOVING, EVEN IF WE DON'T FEEL IT!



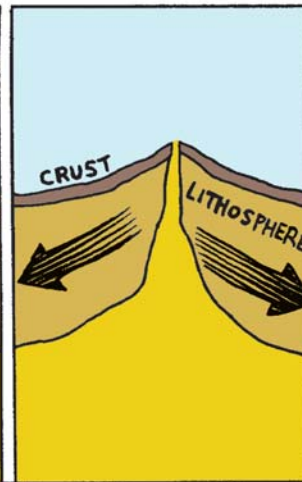
HEY, LIGHTNING, STOP MOVING THE TABLE. YOU'RE MESSING UP MY DRAWING!

I WANT YOU TO SEE WHAT AN EARTHQUAKE IS LIKE! EARTHQUAKES OCCUR WHEN EARTH'S SURFACE SUDDENLY SHAKES BECAUSE THE MOVEMENT OF THE PLATES EXCEEDS THE STRENGTH OF THE CRUST. PLATE MOVEMENT IS CAUSED BY ENERGY STORED WITHIN THE EARTH THAT IS RELEASED.

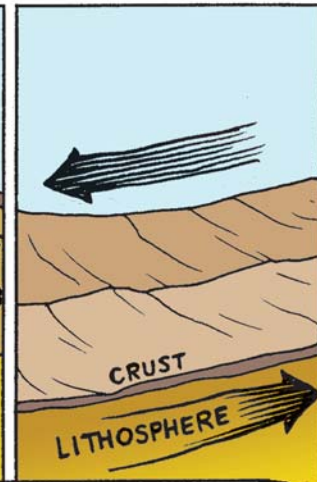
CONVERGENT



DIVERGENT



TRANSFORM



EARTHQUAKES HAPPEN AT PLATE BOUNDARIES, WHICH ARE CALLED **FAULTS** OR **CRACKS**. PLATES MOVE TOGETHER, APART, OR SLIP PAST EACH OTHER HORIZONTALLY. THE GREATER THE STRESS AND ENERGY, THE STRONGER THE EARTHQUAKE.

WOW, LOOK HOW THE EARTH IS BROKEN HERE!!

TODAY WE ARE MUCH BETTER EDUCATED ABOUT THE CAUSES OF EARTHQUAKES THANKS TO SEISMOLOGISTS. MANY PLACES AROUND THE WORLD NOW HAVE EARTHQUAKE DRILLS. BUILDINGS IN CALIFORNIA ARE DESIGNED TO WITHSTAND EARTHQUAKES. THIS PREPARATION CAN PREVENT GREATER LOSS OF LIFE AND DAMAGE.

EARTHQUAKES CAN CAUSE MILLIONS OF DOLLARS IN DAMAGE AND MANY DEATHS WHEN THEY OCCUR. ALTHOUGH WE CAN'T PREVENT THEM, WE CAN TAKE PRECAUTIONS BEFORE THEY STRIKE!

GOOD IDEA - I'LL MAKE AN EMERGENCY KIT FOR OUR HOUSE!

IT'S NOT REALLY BROKEN. THIS IS THE FAMOUS **SAN ANDREAS FAULT** IN CALIFORNIA, LOCATED AT A PLATE BOUNDARY. HERE THE GROUND IS ACTUALLY SEPARATED ALONG THE FAULT. GROUND SEPARATION LIKE THIS IS RARE.

WOW - THAT IS ONE BIG MOUNTAIN!

THAT'S NOT JUST ANY OLD MOUNTAIN, SCORPY. THAT'S A **VOLCANO**, FORMED BY THE ACCUMULATION OF MOLTEN ROCK THAT HAS BLASTED THROUGH AN OPENING IN THE EARTH'S CRUST.

MOST VOLCANOES HAVE STEEP SIDES CAUSED BY THE BUILDUP FROM THESE ERUPTIONS. THE VOLCANOES ABOVE SEA LEVEL ARE THE BEST KNOWN, BUT MOST OF THE WORLD'S VOLCANOES ARE BELOW THE OCEAN'S SURFACE.

RRRRRR

HOW DOES MAGMA GET OUT FROM INSIDE THE VOLCANO?

DRUMMBLE

THE MAGMA ERUPTS THROUGH ONE OR MORE OPENINGS. THESE OPENINGS ARE CALLED "VOLCANIC VENTS." VERY HOT TEMPERATURES AND HIGH PRESSURE FROM WITHIN THE EARTH CAN CAUSE MAGMA TO BLAST THROUGH THE VENT. THIS RESULTS IN A VOLCANIC ERUPTION.

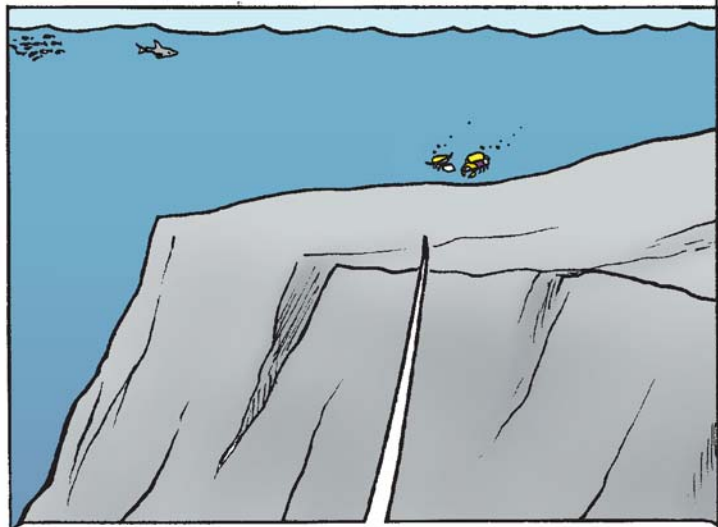
ACTIVE VOLCANOES ARE VERY DANGEROUS. THE ASH AND LAVA FLOW CAN BE DEADLY TO ALL IN ITS PATH. BUT VOLCANIC ERUPTIONS CAN ALSO BE HELPFUL, GENERATING RICH, FERTILE SOIL.

WELL, I KNOW I WOULD NEVER WANT TO MAKE A VOLCANO MAD. I WOULD HATE TO MAKE ONE BLOW ITS TOP!

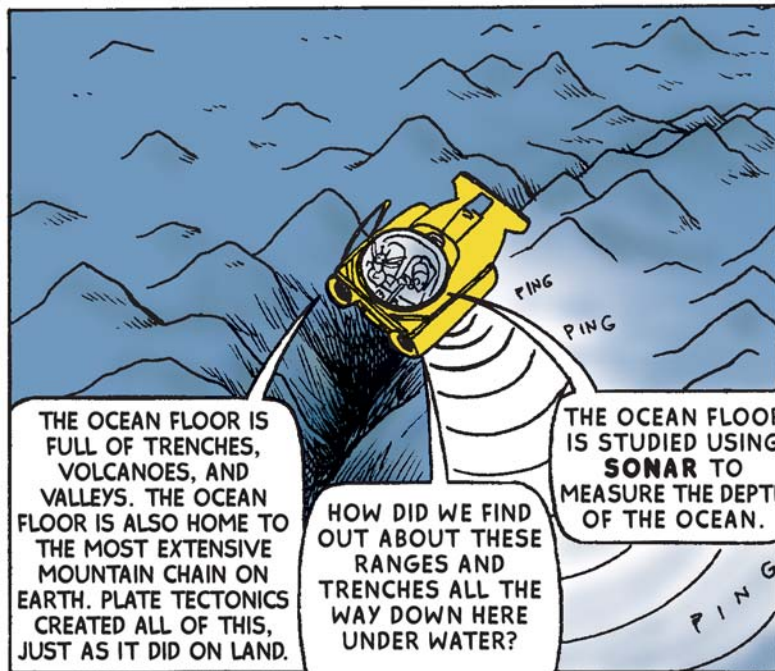
NOW THIS IS MORE LIKE IT! AFTER ALL THOSE VOLCANOES, IT'S GREAT TO BE NEAR THE OCEAN, WHERE IT'S FLAT.



THAT'S NOT EXACTLY RIGHT, SCORPY. THE OCEANS OF THE WORLD ARE NOT FLAT ON THE BOTTOM! LOOK HOW THE OCEANS ARE SHAPED AT VARIOUS LEVELS.



GOING DOWN FROM THE SHORELINE OF THE CONTINENT, WE SEE THE SUBMERGED PART OF THE CONTINENTAL MASS. THIS IS THE **CONTINENTAL SHELF**. IT GIVES WAY ABRUPTLY TO A STEEPER ZONE - THE **CONTINENTAL SLOPE**.

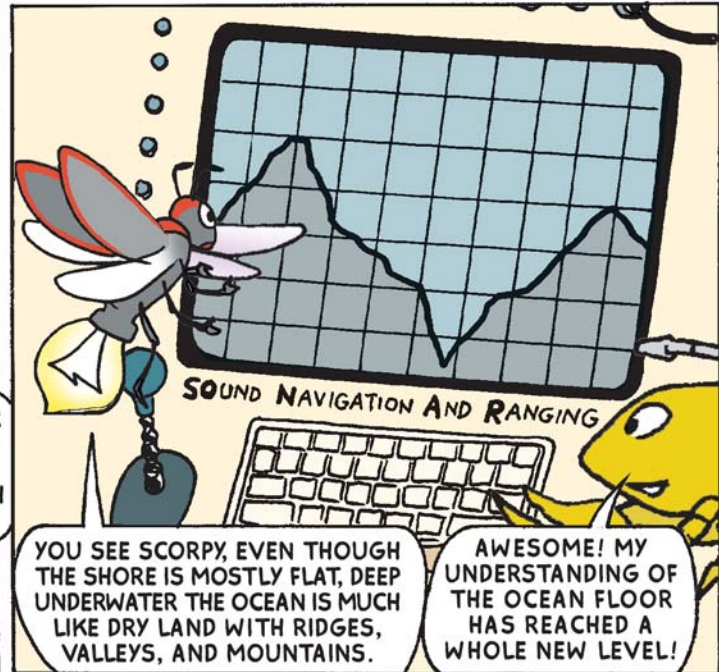


THE OCEAN FLOOR IS FULL OF TRENCHES, VOLCANOES, AND VALLEYS. THE OCEAN FLOOR IS ALSO HOME TO THE MOST EXTENSIVE MOUNTAIN CHAIN ON EARTH. PLATE TECTONICS CREATED ALL OF THIS, JUST AS IT DID ON LAND.

HOW DID WE FIND OUT ABOUT THESE RANGES AND TRENCHES ALL THE WAY DOWN HERE UNDER WATER?

THE OCEAN FLOOR IS STUDIED USING **SONAR** TO MEASURE THE DEPTH OF THE OCEAN.

PING



SOUND NAVIGATION AND RANGING

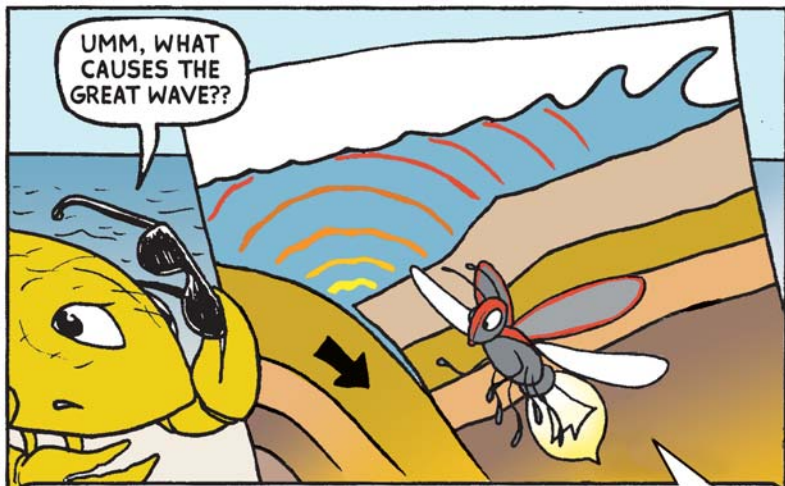
YOU SEE SCORPY, EVEN THOUGH THE SHORE IS MOSTLY FLAT, DEEP UNDERWATER THE OCEAN IS MUCH LIKE DRY LAND WITH RIDGES, VALLEYS, AND MOUNTAINS.

AWESOME! MY UNDERSTANDING OF THE OCEAN FLOOR HAS REACHED A WHOLE NEW LEVEL!



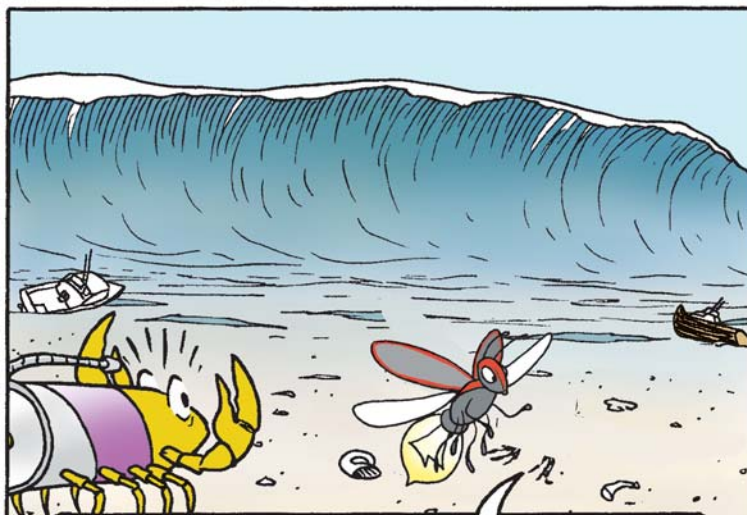
THAT WAS FUN
LOOKING AT THE
OCEAN FLOOR.
NOW BACK TO
THE BEACH!

SOMETIMES, SCORPY, THERE IS AN EARTHQUAKE UNDER THE OCEAN FLOOR THAT CAUSES A TSUNAMI. **TSUNAMI** IS A JAPANESE WORD THAT MEANS "GREAT HARBOR WAVE."



UMM, WHAT
CAUSES THE
GREAT WAVE??

PLATES UNDERWATER GRIND TOGETHER AND GET STUCK, CAUSING PRESSURE TO BUILD. EVENTUALLY THE PLATES SEPARATE WITH A JOLT, AND THIS JOLT CREATES AN EARTHQUAKE THAT CAN LIFT OR DROP THE OCEAN FLOOR, MAKING THE WATER ABOVE MOVE. THIS MOVEMENT TRIGGERS THE TSUNAMI WAVES.



THE TSUNAMI WAVES GET BIGGER AS THEY GO UP THE **CONTINENTAL SLOPE** AND INTO THE SHALLOWER WATER NEAR SHORE. THEY USUALLY SUCK ALL THE WATER AWAY FROM THE BEACH BEFORE THEY ROLL ASHORE. WHEN THEY HIT THEY CAN BE AS TALL AS 100 FEET. THEY CAN POUND THE SHORE EVERY 15 MINUTES FOR TWO HOURS OR MORE.



CRASSHHH

WHEW - THAT
WAS CLOSE!! HOW
CAN WE KNOW
WHEN A TSUNAMI
IS COMING??

THERE ARE SCIENTISTS WHO MONITOR EARTHQUAKE ACTIVITY AROUND THE WORLD. WHEN AN EARTHQUAKE OCCURS UNDERWATER, THEY CAN SEND A QUICK WARNING TO SURROUNDING AREAS THAT CAN ACTIVATE A TSUNAMI WARNING DEVICE. UNFORTUNATELY, MANY AREAS OF THE WORLD ARE TOO POOR TO BUY TSUNAMI ALARMS TO WARN THEIR PEOPLE.