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Michael Allaby

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Igneous rock

Igneous rock, or "fire rock", comes from cooling magma. As the molten rock cools, tiny crystals grow, then get bigger. The more time igneous rock has to cool, the bigger the crystals become. Some are even bigger than a car. However, lava that erupts onto Earth's surface and cools quickly has tiny crystals that can be seen only with a microscope. Igneous rock can be tough, and it is often used for buildings and roads.



Gabbro
Gabbro is found on the Moon as well as Earth.



Pumice
This light, porous rock is used for cleaning, polishing and scouring.

Andesite
This rock is named after the Andes mountain range.





Obsidian
Glassy and brittle, obsidian breaks into pieces with razor-sharp edges.

Banded obsidian
Obsidian may be banded if the thick lava flows a bit before cooling.



Ignimbrite





Kimberlite
Kimberlite erupts from deep in Earth's mantle and sometimes brings diamond crystals with it.



Rhyolite
Made of the same materials as granite, rhyolite has smaller crystals because the lava cooled quickly.



Vesicular basalt
This common fine-grained grey rock is cooled lava. Sometimes it is full of gas bubbles.



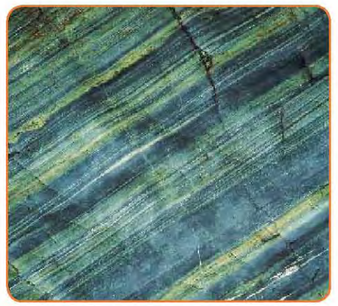
Volcanic tuff
Tuff is made from volcanic ash that has solidified and compressed.



Obsidian lava
Obsidian lava is high in silica. This makes it flow slowly like thick soup.



Pegmatite Pegmatite cools very slowly and so can have large crystals of minerals and gems.



Serpentine Serpentine is a green rock that has been squeezed up along the edges of colliding continents.



Gabbro
This dark-coloured rock is made of coarse crystals.



Granite
Granite is made of large crystals that cooled slowly from magma below Earth's surface.



Andesite
Andesite is formed from thick, soup-like lava that erupted from volcanoes on the edges of tectonic plates.

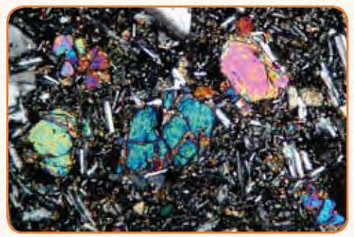


Granite
Pretty pink feldspar crystals make this granite look different from white granite.



Pallasite meteorite
Rich in nickel and iron, this meteorite came from the core of an exploded planet.

LOOKING INSIDE



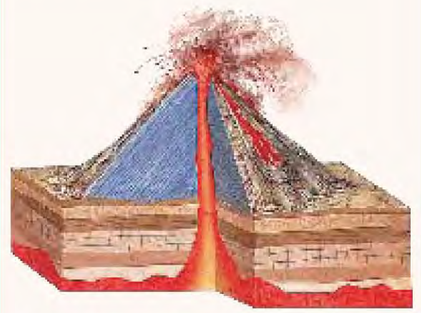
Basalt When sliced and backlit, basalt shows both short and long crystals surrounded by fine-grained minerals.



Gabbro This has the same composition as basalt, but with much bigger crystals because it cooled slowly underground.

VOLCANIC PLUGS

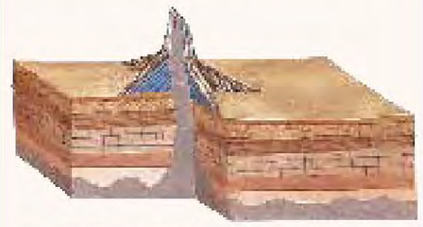
Plugs and dikes are columns of igneous rock that were once part of a volcano. Molten rock that cools in an old volcano's vent is much harder than the soft ash of the volcano's cone. As the ash erodes away, the volcano's insides are exposed.



Eruption Magma rises to the surface and erupts through the active volcano's main vent to build a steep-sided cone of ash layers and lava.



Extinction The volcano eventually becomes extinct, and magma cools inside the vent, hardening from the top down into solid igneous rock.



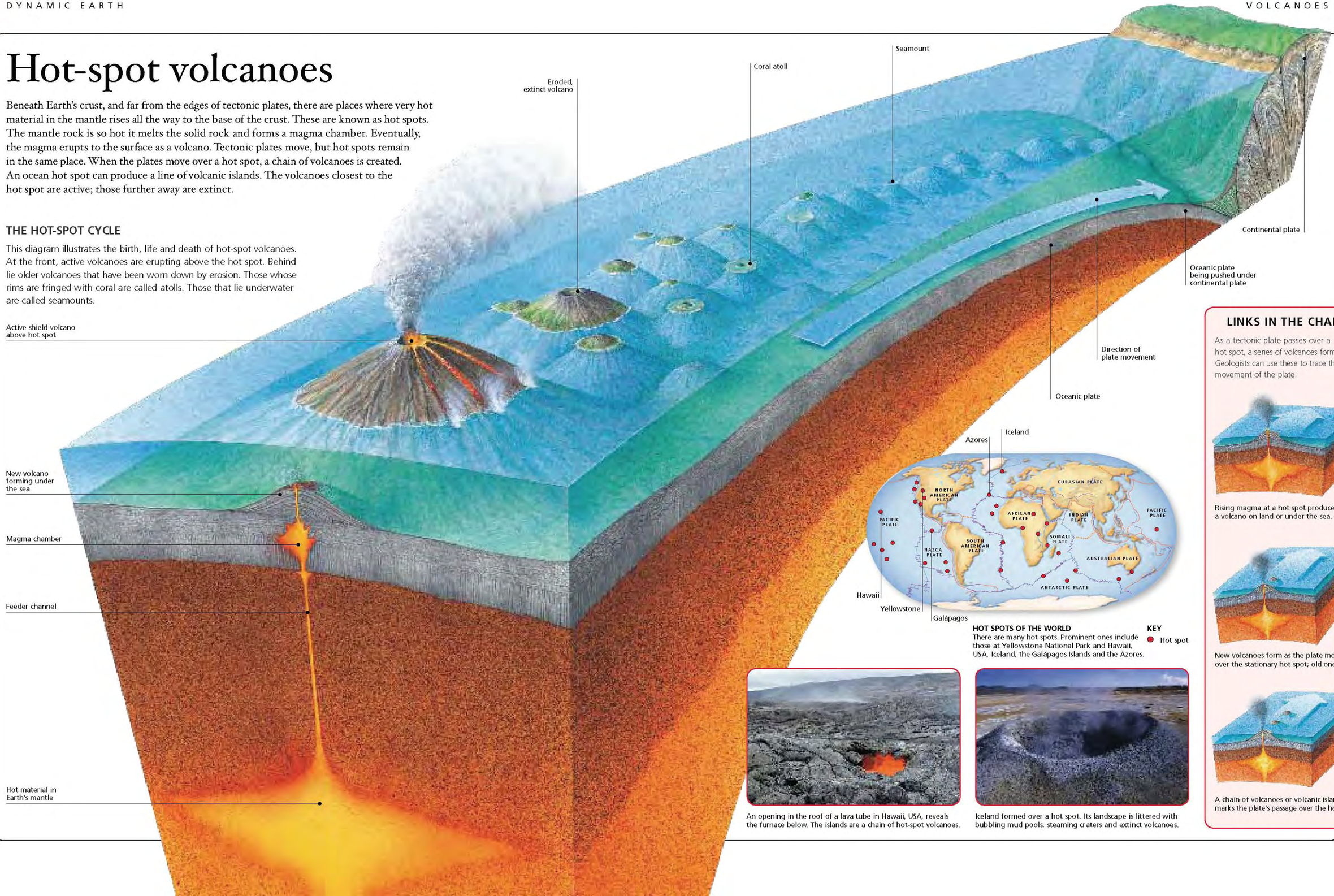
Erosion Rainfall erodes the extinct volcano's sides. The runoff carries away soft ash from the cone and uncovers hard lava formations, called plugs and dikes.

Hot-spot volcanoes

Beneath Earth's crust, and far from the edges of tectonic plates, there are places where very hot material in the mantle rises all the way to the base of the crust. These are known as hot spots. The mantle rock is so hot it melts the solid rock and forms a magma chamber. Eventually, the magma erupts to the surface as a volcano. Tectonic plates move, but hot spots remain in the same place. When the plates move over a hot spot, a chain of volcanoes is created. An ocean hot spot can produce a line of volcanic islands. The volcanoes closest to the hot spot are active; those further away are extinct.

THE HOT-SPOT CYCLE

This diagram illustrates the birth, life and death of hot-spot volcanoes. At the front, active volcanoes are erupting above the hot spot. Behind lie older volcanoes that have been worn down by erosion. Those whose rims are fringed with coral are called atolls. Those that lie underwater are called seamounts.



HOT SPOTS OF THE WORLD
There are many hot spots. Prominent ones include those at Yellowstone National Park and Hawaii, USA, Iceland, the Galápagos Islands and the Azores.

KEY
- Hot spot

An opening in the roof of a lava tube in Hawaii, USA, reveals the furnace below. The islands are a chain of hot-spot volcanoes.

Iceland formed over a hot spot. Its landscape is littered with bubbling mud pools, steaming craters and extinct volcanoes.

LINKS IN THE CHAIN

As a tectonic plate passes over a hot spot, a series of volcanoes forms. Geologists can use these to trace the movement of the plate.

Rising magma at a hot spot produces a volcano on land or under the sea.

New volcanoes form as the plate moves over the stationary hot spot; old ones die.

A chain of volcanoes or volcanic islands marks the plate's passage over the hot spot.

Tsunamis

A tsunami—is Japanese for "harbour wave"—begins on the ocean floor with an earthquake or a large underwater landslide. The movement of the ocean floor sends shock waves through the water, like ripples on a pond, travelling at 645 kilometres per hour (400 mph) or more, but only about 90 centimetres (3 ft) high. Sailors at sea may not even notice these waves. When the waves enter shallow water, friction with the seabed acts like a brake at the bottom of the waves and slows them to about 50 kilometres per hour (30 mph). The waves that continue to arrive push together, increasing the wave height. More waves follow. Sometimes a tsunami comes ashore as a vertical wall of water that batters and floods the coast and causes enormous damage.

A TSUNAMI STRIKES

A tsunami has nothing to do with the tides, but it is more like a tidal movement than a breaker, hence its old name of `tidal wave`. There are early warning systems to inform people of approaching tsunamis, and there are sometimes natural warning signs. Anyone seeing these signs should move to high ground immediately.



Incoming water advances further up the shore than usual and remains still for several minutes.



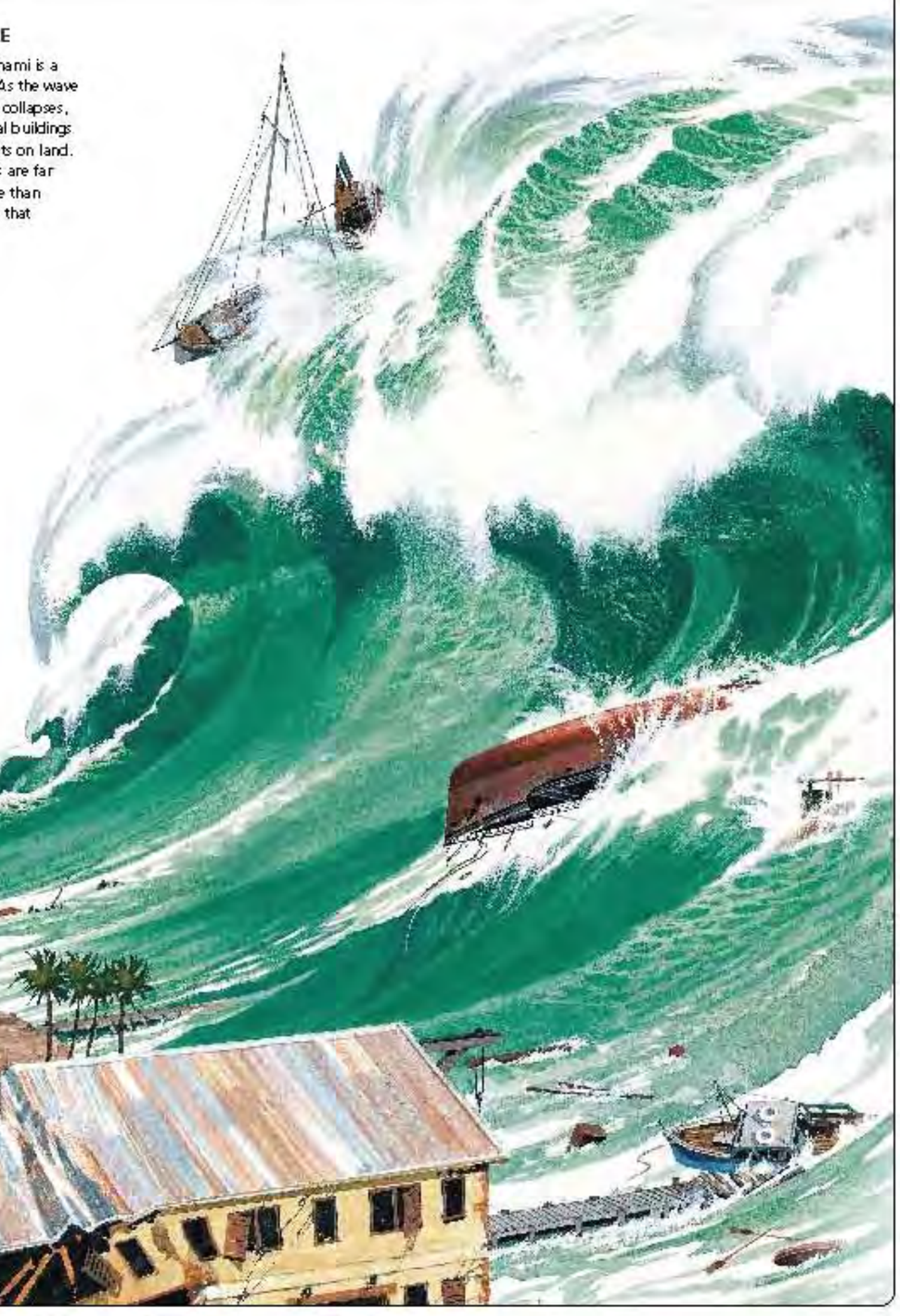
The water retreats away from the coast much further than normal, as if someone had pulled a giant bath plug.



A white line on the horizon marks the tsunami wave crest, now approaching very fast.

KILLER WAVE

A towering tsunami is a terrifying sight. As the wave reaches land, it collapses, smacking coastal buildings and hurling boats on land. Often, tsunamis are far more destructive than the earthquakes that caused them.

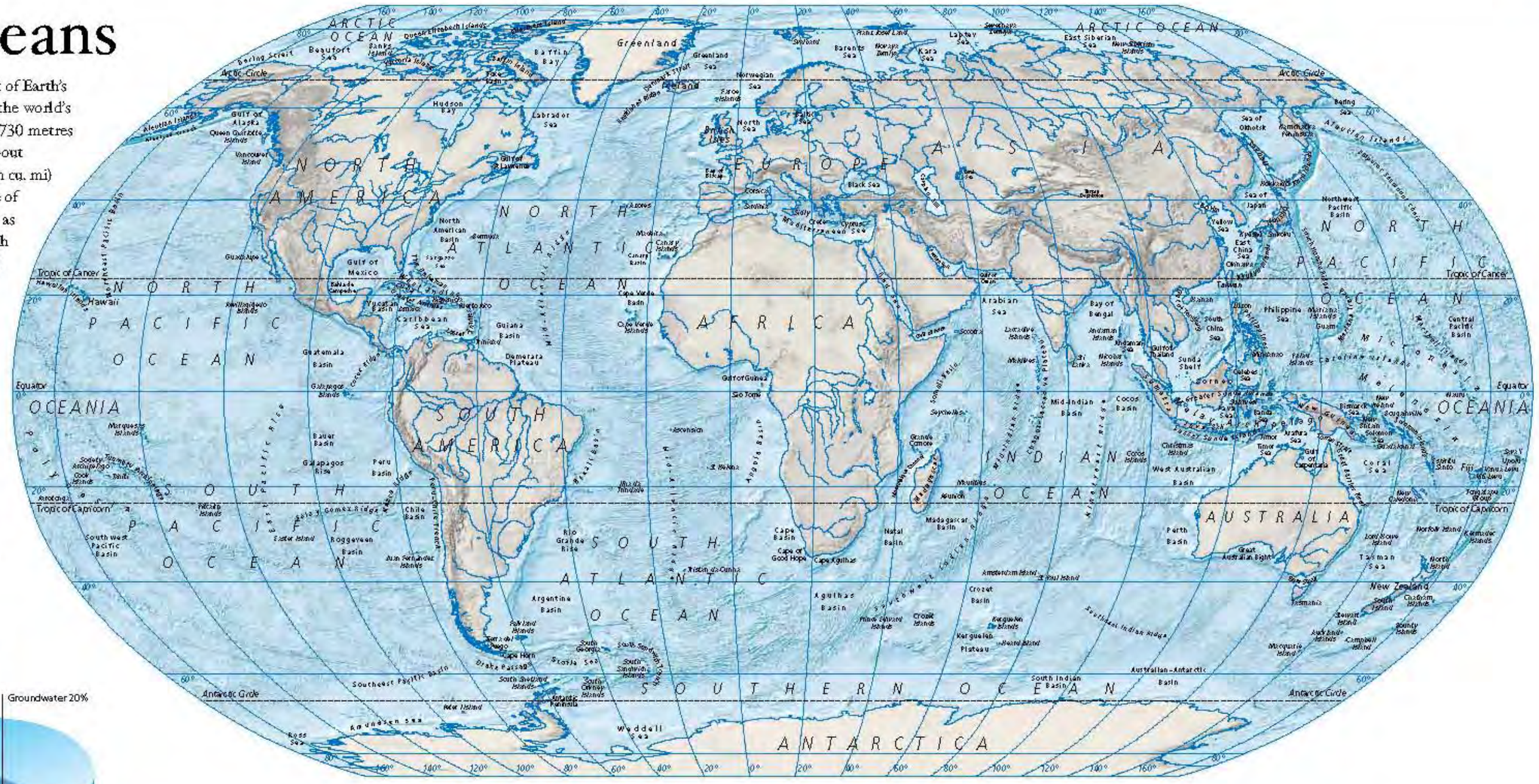




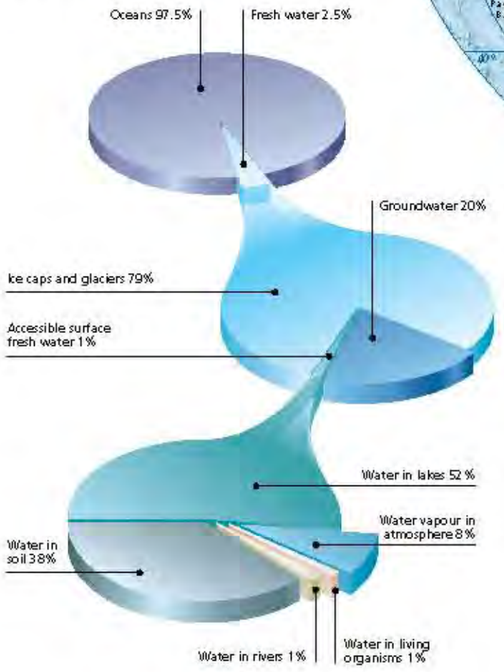
A tsunami that hit Indonesia on December 26, 2004, killed more than 280,000 people. It was caused by a Richter magnitude 9.3 earthquake.

World Oceans

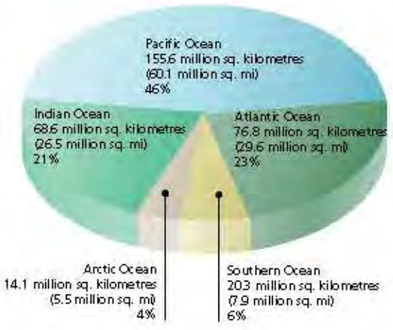
Oceans and seas cover 71 per cent of Earth's surface. The average depth of the world's five oceans is approximately 3,730 metres (12,240 ft), and combined they contain about 1,370 million cubic kilometres (329 million cu. mi) of water. Continents extend for an average of 72 kilometres (45 mi) beyond their coasts as gently sloping continental shelves beneath the water. At the edge of the continental shelves, the water is about 152 metres (500 ft) deep. Beyond that the ocean floor slopes more steeply. The deepest point is at the bottom of the Mariana Trench, about 11 kilometres (6.8 mi) below the surface of the Pacific Ocean.



WATER ON EARTH
Oceans hold 97.5 per cent of Earth's water. Of the remaining 2.5 per cent, 79 per cent is frozen in ice caps and glaciers, 20 per cent is below ground, and only 1 per cent—0.00025 per cent of all the water on Earth—exists as fresh water.



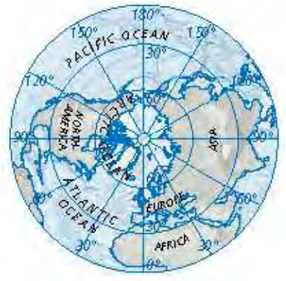
SIZE OF THE OCEANS
The Pacific is by far the largest ocean. It makes up 46 per cent of the world's oceans. The Atlantic and Indian oceans are almost the same size, and the Southern and Arctic oceans are much smaller.



THE HEMISPHERES

Water is not distributed evenly on Earth because tectonic plate movements have carried the continents northward into the Northern Hemisphere. More than two-thirds of Earth's land area is found here, while oceans cover nearly 80 per cent of the Southern Hemisphere. At present the Atlantic Ocean is growing wider and the Pacific Ocean is getting narrower.

NORTHERN HEMISPHERE



SOUTHERN HEMISPHERE

