

## Encyclopedic Entry

### rift valley

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A **rift valley** is a lowland region that forms where Earth's tectonic plates move apart, or **rift**. Rift valleys are found both on land and at the bottom of the ocean, where they are created by the process of **seafloor spreading**. Rift valleys differ from **river valleys** and **glacial valleys** in that they are created by tectonic activity and not the process of **erosion**.

**Tectonic plates** are huge, rocky slabs of Earth's **lithosphere**—its **crust** and upper **mantle**. Tectonic plates are constantly in motion—shifting against each other in **fault** zones, falling beneath one another in a process called **subduction**, crashing against one another at convergent plate boundaries, and tearing apart from each other at divergent plate boundaries.

Many rift valleys are part of “**triple junctions**,” a type of **divergent boundary** where three tectonic plates meet at about 120° angles. Two arms of the triple junction can split to form an entire ocean. The third, “failed rift” or **aulacogen**, may become a rift valley. The Atlantic Ocean, for instance, is a result of a triple junction that started in what is now the Gulf of Guinea on the west coast of Africa. Two arms of a triple junction on the **supercontinent Pangaea** “opened” the ocean, while the aulacogen formed the rift valley known as the Benue Trough through what is now southern Nigeria.

Rift valleys can also form at transform faults, where tectonic plates are grinding past each other. The Salton Trough, which stretches through the states of California (United States) and Baja California (Mexico), is a rift valley created in part by the San Andreas Fault. The San Andreas is a **transform fault** that marks the roughly northward movement of the Pacific plate and the roughly southern movement of the North American plate.

### Mid-Ocean Ridges

Many of Earth's deepest rift valleys are found underwater, dividing long mountain ranges called **mid-ocean ridges**. As tectonic plates move away from one another at mid-ocean ridges, **molten** rock from the mantle may **well up** and harden as it contacts the **frigid** sea, forming new **oceanic crust** at the bottom of the rift valley.

In the northern Mid-Atlantic Ridge, the North American plate and the Eurasian plate are splitting apart at a rate of about 2.5 centimeters (1 inch) per year. Over millions of years, the Mid-Atlantic Ridge has formed rift valleys as wide as 15 kilometers (9 miles).

In the Pacific Ocean, the East Pacific Rise has created rift valleys where the Pacific plate is separating from the North American plate, Cocos plate, Nazca plate, and Antarctic plate. Like many underwater rift valleys, the East Pacific Rise is dotted with **hydrothermal** vents. **Geologic** activity beneath the underwater rift valley creates these vents, which spew superheated water and **vent fluids** into the ocean.

### Continental Rift Valleys

Very few active rift valleys are found on continental lithosphere. The East African Rift, the Baikal Rift Valley, the West Antarctic Rift, and the Rio Grande Rift are Earth's major active continental rift valleys. The East African Rift is part of the “Great Rift Valley” system discussed below.

The Baikal Rift Valley (sometimes called the Baikal Rift Zone) cuts through 2,000 kilometers (1,200 miles) of [Siberia](#), in eastern Russia. The Baikal Rift Valley is formed by a divergent plate boundary, where the Amur plate is slowly tearing itself away from the Eurasian plate, and has been doing so for about 25 million years. The Amur plate is moving eastward at a rate of about 4 to 5 millimeters (.16 to .2 inch) a year.

The West Antarctic Rift is a series of smaller rifts that roughly separate the two regions of Earth's southernmost [continent](#), West Antarctica and East Antarctica. The West Antarctic Rift is one of the most difficult rift valleys to study, because it lies beneath the [massive Antarctic Ice Sheet](#), which can be more than 2 kilometers (1.2 miles) thick.

The Rio Grande Rift is a series of rift valleys along faults in the Southwestern United States. The Rio Grande Rift separates the Colorado [Plateau](#), which is generally moving in a clockwise direction, from the older part ([craton](#)) of the North American plate. The Rio Grande Rift stretches from central Colorado to the Mexican state of Chihuahua.

## Great Rift Valley

The most well-known rift valley on Earth is probably the so-called "[Great Rift Valley System](#)" which stretches from the [Middle East](#) in the north to Madagascar in the south. The area is geologically active, and features [volcanoes](#), [hot springs](#), [geysers](#), and frequent [earthquakes](#).

Today, however, the Great Rift Valley exists as a cultural concept, not a scientific one. All of the rift valleys in the "system" are connected, but not part of a single unit.

The northern part of the system is the Jordan Rift Valley. The Jordan Rift Valley stretches from the Golan Heights, near Israel's [border](#) with Syria and Lebanon, to the Dead Sea, to the Gulf of Aqaba—an [inlet](#) of the Red Sea that separates the Sinai [Peninsula](#) from the Arabian Peninsula.

Associated with the Jordan Rift Valley to the south is the Red Sea Rift. Millions of years ago, the Arabian Peninsula was connected to Africa. Seafloor spreading caused the Arabian and African plates to rift apart. The Indian Ocean flooded the rift valley between the continents, creating the Red Sea. Today, Africa and Asia are connected by the triangle of the Sinai Peninsula. Eventually, the Red Sea Rift will separate Africa and Asia entirely and connect the Mediterranean and Red Seas.

### *East African Rift*

South of the Red Sea Rift lies the massive, [complex](#) East African Rift. Throughout the East African Rift, the continent of Africa is splitting in two. The African plate, sometimes called the Nubian plate, carries most of the continent, while the smaller Somali plate carries [Horn of Africa](#).

The two major rift valley systems of the East African Rift are the Gregory Rift and the Western Rift. These rift valleys are dotted by volcanoes: Erta Ale, Ethiopia; Mount Kenya, Kenya (an [extinct stratovolcano](#)); Ol Doinyo Lengai, Tanzania; Mount Kilimanjaro, Tanzania (a [dormant stratovolcano](#)); and Mount Nyiragongo, Democratic Republic of Congo.

The Gregory Rift stretches from the Red Sea and the Arabian Sea to as far south as Mount Kilimanjaro. One of the most important features of the Gregory Rift is the Afar Triple Junction, found where the Horn of Africa straddles the Red Sea and the Gulf of Aden in the Arabian Sea. At the Afar Triple Junction, the Arabian plate, Nubian plate and Somali plate are all tearing away from each other.

Two arms of the Afar Triple Junction continue to widen in the process of seafloor spreading—the arm extending into the Red Sea and the arm extending into the Gulf of Aden. As these rifts continue, the narrow [valley](#) created by the Gregory Rift (the arm of the Afar Triple Junction located above [sea level](#)) may sink low enough that the Arabian Sea will flood it. Separated from Africa by this new [strait](#), Horn of Africa (sitting on the Somali plate) would become a [continental island](#), like Madagascar or New Zealand.

The Western Rift, also called the Albertine Rift, includes many of the [African Great Lakes](#). The Western Rift is one of the most biodiverse regions in Africa, featuring a narrow [corridor](#) of highland [forests](#), snow-capped mountains, [savannas](#), and chains of [lakes](#) and [wetlands](#).

## Rift Lakes

**Rift lakes**, formed as **freshwater** floods rift valleys, often mark rift valley systems. More than a billion years ago, for instance, the North American plate began a rifting process. A triple junction formed in the middle of the young continent, and deep rift valley developed. Freshwater drained and collected in this rift valley, creating a lake. After millions of years, however, the rift failed. The continent remained intact and the rift's arms failed to open up a new ocean. Today, the remains of that **ancient** rift lake, Lake Superior, rest atop one of the oldest and deepest rift valleys in the world.

Lake Baikal, the rift lake over the Baikal Rift Valley in Siberia, is the deepest and oldest freshwater lake in the world. The deepest parts of Lake Baikal are 1,642 meters (5,387 feet), and are getting deeper every year. In addition, over the past 25 million years, layers of soft **sediment** have **accumulated** on the **lakebed**. The actual floor of the rift valley is more than 5 kilometers (3 miles) deep. Lake Baikal also has the largest **volume** of liquid freshwater in the world—a staggering 23,615 cubic kilometers (5,700 cubic miles).

The Dead Sea is a rift lake in the Jordan Rift Valley. Although the Dead Sea is not the world's deepest lake, the deep Jordan Rift makes it the lowest land **elevation** on Earth. The surface of the Dead Sea is 429 meters (1,407 feet) below sea level, and the lake's depth is another 304 meters (997 feet). Unlike Lake Baikal, however, the Dead Sea is not a true rift lake as it was not formed entirely by the rift beneath it. The so-called Dead Sea Transform is a geologically complex area, where tectonic plates interact in many ways.

The most famous rift lakes in the world may be the series of narrow, deep rift valleys in the East African Rift known simply as the Rift Valley lakes. The Rift Valley lakes, stretching from Ethiopia to Malawi, are sites of amazing **biodiversity**. They include freshwater lakes, similar to Lake Baikal, as well as saltwater **"soda lakes"** similar to the Dead Sea.

Lake Tanganyika, whose long **shores** are shared by Burundi, Democratic Republic of Congo, Tanzania, and Zambia, is the largest of the Rift Valley lakes. Lake Tanganyika is the world's second-deepest and second-biggest (by volume of freshwater) lake in the world. Only Lake Baikal is deeper and holds more water. Like many freshwater Rift Valley lakes, Lake Tanganyika is home to hundreds of **endemic** species of **cichlid** fish.

Lake Natron, Tanzania, is one of the shallow, **alkali**-rich soda lakes of the East African Rift. Its dazzling red color is not a product of the region's rocky geology, but the **pink** salt-loving **bacteria** that live in the **briny** water.

## VOCABULARY

Term	Part of Speech	Definition
<b>accumulate</b>	<i>verb</i>	to gather or collect.
<b>African Great Lakes</b>	<i>noun</i>	system of lakes in and around the Great Rift Valley: Lake Albert, Lake Edward, Lake Kivu, Lake Malawi, Lake Tanganyika, Lake Turkana, and Lake Victoria. Also called the Rift Valley Lakes and the East African Lakes.
<b>alkali</b>	<i>noun</i>	chemical compound often found as mineral salt in soils and bodies of water.
<b>ancient</b>	<i>adjective</i>	very old.
<b>Antarctic Ice Sheet</b>	<i>noun</i>	thick glacier covering most of Antarctica.
<b>aulacogen</b>	<i>noun</i>	failed or stunted arm of a triple junction in a plate tectonics rift system.
<b>bacteria</b>	<i>plural noun</i>	(singular: bacterium) single-celled organisms found in every ecosystem on Earth.
<b>biodiversity</b>	<i>noun</i>	all the different kinds of living organisms within a given area.
<b>border</b>	<i>noun</i>	natural or artificial line separating two pieces of land.
<b>briny</b>	<i>adjective</i>	salty.
<b>cichlid</b>	<i>noun</i>	spiny-finned freshwater fish.
<b>complex</b>	<i>adjective</i>	complicated.

<b>concept</b>	<i>noun</i>	idea.
<b>continent</b>	<i>noun</i>	one of the seven main land masses on Earth.
<b>continental island</b>	<i>noun</i>	land once connected to a continent but broken off by shifting tectonic plates.
<b>convergent plate boundary</b>	<i>noun</i>	area where two or more tectonic plates bump into each other. Also called a collision zone.
<b>corridor</b>	<i>noun</i>	hallway, or connecting passage of land.
<b>craton</b>	<i>noun</i>	old, stable part of continental crust, made up of shields and platforms.
<b>crust</b>	<i>noun</i>	rocky outermost layer of Earth or other planet.
<b>divergent boundary</b>	<i>noun</i>	area where two or more tectonic plates are moving away from each other. Also called an extensional boundary.
<b>dormant</b>	<i>adjective</i>	state of minimal growth or activity.
<b>earthquake</b>	<i>noun</i>	the sudden shaking of Earth's crust caused by the release of energy along fault lines or from volcanic activity.
<b>elevation</b>	<i>noun</i>	height above or below sea level.
<b>endemic</b>	<i>adjective</i>	native to a specific geographic space.
<b>erosion</b>	<i>noun</i>	act in which earth is worn away, often by water, wind, or ice.
<b>extinct</b>	<i>adjective</i>	no longer existing.
<b>fault</b>	<i>noun</i>	a crack in the Earth's crust where there has been movement.
<b>forest</b>	<i>noun</i>	ecosystem filled with trees and underbrush.
<b>freshwater</b>	<i>noun</i>	water that is not salty.
<b>frigid</b>	<i>adjective</i>	very cold.
<b>geologic</b>	<i>adjective</i>	having to do with the physical formations of the Earth.
<b>geyser</b>	<i>noun</i>	natural hot spring that sometimes erupts with water or steam.
<b>glacial valley</b>	<i>noun</i>	depression in the earth created by a moving glacier.
<b>graben</b>	<i>noun</i>	small rift valley.
<b>Great Rift Valley system</b>	<i>noun</i>	series of faults and other sites of tectonic activity stretching from southwestern Asia to the Horn of Africa.
<b>Horn of Africa</b>	<i>noun</i>	large peninsula in northeast Africa, including the countries of Somalia, Djibouti, Eritrea, and Ethiopia. Also called the Somali Peninsula.
<b>hot spring</b>	<i>noun</i>	small flow of water flowing naturally from an underground water source heated by hot or molten rock.
<b>hydrothermal</b>	<i>adjective</i>	related to hot water, especially water heated by the Earth's internal temperature.
<b>inlet</b>	<i>noun</i>	small indentation in a shoreline.
<b>lake</b>	<i>noun</i>	body of water surrounded by land.
<b>lakebed</b>	<i>noun</i>	bottom of a lake.
<b>lithosphere</b>	<i>noun</i>	outer, solid portion of the Earth. Also called the geosphere.

<b>mantle</b>	<i>noun</i>	middle layer of the Earth, made of mostly solid rock.
<b>massive</b>	<i>adjective</i>	very large or heavy.
<b>Middle East</b>	<i>noun</i>	region of southwest Asia and northeast Africa.
<b>mid-ocean ridge</b>	<i>noun</i>	underwater mountain range.
<b>molten</b>	<i>adjective</i>	solid material turned to liquid by heat.
<b>oceanic crust</b>	<i>noun</i>	thin layer of the Earth that sits beneath ocean basins.
<b>Pangaea</b>	<i>noun</i>	supercontinent of all the Earth's landmass that existed about 250 million years ago.
<b>peninsula</b>	<i>noun</i>	piece of land jutting into a body of water.
<b>plateau</b>	<i>noun</i>	large region that is higher than the surrounding area and relatively flat.
<b>plate tectonics</b>	<i>noun</i>	movement and interaction of the Earth's plates.
<b>rift</b>	<i>noun</i>	break in the Earth's crust created by it spreading or splitting apart.
<b>rift lake</b>	<i>noun</i>	lake formed as a result of plate tectonics separating the Earth's crust and water collecting in the depression.
<b>rift valley</b>	<i>noun</i>	depression in the ground caused by the Earth's crust spreading apart.
<b>river valley</b>	<i>noun</i>	depression in the earth caused by a river eroding the surrounding soil.
<b>savanna</b>	<i>noun</i>	type of tropical grassland with scattered trees.
<b>seafloor spreading</b>	<i>noun</i>	rift in underwater mountain range where new oceanic crust is formed.
<b>sea level</b>	<i>noun</i>	base level for measuring elevations. Sea level is determined by measurements taken over a 19-year cycle.
<b>sediment</b>	<i>noun</i>	solid material transported and deposited by water, ice, and wind.
<b>shore</b>	<i>noun</i>	coast.
<b>Siberia</b>	<i>noun</i>	region of land stretching across Russia from the Ural Mountains to the Pacific Ocean.
<b>soda lake</b>	<i>noun</i>	lake with a high concentration of carbonate salts. Also called an alkaline lake.
<b>staggering</b>	<i>adjective</i>	overwhelming or shocking.
<b>strait</b>	<i>noun</i>	narrow passage of water that connects two larger bodies of water.
<b>stratovolcano</b>	<i>noun</i>	steep volcano made of hardened lava, rock, and ash. Also known as a composite volcano.
<b>subduction</b>	<i>noun</i>	process of one tectonic plate melting or going beneath another.
<b>supercontinent</b>	<i>noun</i>	ancient, giant landmass that split apart to form all the continents we know today.
<b>tectonic activity</b>	<i>noun</i>	movement of tectonic plates resulting in geologic activity such as volcanic eruptions and earthquakes.
<b>tectonic plate</b>	<i>noun</i>	large, moveable segment of the Earth's crust.
<b>transform fault</b>	<i>noun</i>	boundary between two tectonic plates, where the plates are moving horizontally or vertically in opposite directions, not against or away from each other. Also called a conservative plate boundary.

<b>triple junction</b>	<i>noun</i>	region where the boundaries of three tectonic plates meet and interact.
<b>valley</b>	<i>noun</i>	depression in the Earth between hills.
<b>vent fluid</b>	<i>noun</i>	chemicals ejected by hydrothermal vents.
<b>volcano</b>	<i>noun</i>	an opening in the Earth's crust, through which lava, ash, and gases erupt, and also the cone built by eruptions.
<b>volume</b>	<i>noun</i>	space an object occupies.
<b>well up</b>	<i>verb</i>	to swell or build up.
<b>wetland</b>	<i>noun</i>	area of land covered by shallow water or saturated by water.

## For Further Exploration

### Articles & Profiles

- American Association of Petroleum Geologists: Dead Sea Geology Promise Unmet

### Websites

- National Geographic Science: Valleys—Natural Depressions
- National Geographic Science: Plate Tectonics
- USGS: East Africa Volcanoes



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