

Encyclopedic Entry

fold mountain

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Fold mountains are created where two or more of Earth's **tectonic plates** are pushed together. At these colliding, compressing boundaries, rocks and debris are **warped** and folded into rocky outcrops, **hills**, mountains, and entire **mountain ranges**.

Fold mountains are created through a process called **orogeny**. An **orogenic event** takes millions of years to create a fold mountain, but you can **mimic** it in seconds. Cover a table with a tablecloth, or place a rug flat on the floor. Now push the edge of the tablecloth or rug—wrinkles will develop and fold on top of each other.

The vocabulary of fold mountains owes something to this simple tablecloth experiment. Some of the key structures in fold mountains are nappes. **Nappes** are common, dramatic folded rocks or rock formations. “Nappe” is French for “tablecloth” and the formations were named after the tabletop experiment.

The huge difference between the rock folds and cloth folds is that in the tabletop experiment, the table itself does not fold. In the creation of fold mountains, Earth's **crust** itself is warped into folded forms.

Fold mountains are often associated with **continental crust**. They are created at convergent plate boundaries, sometimes called continental collision zones or compression zones. Convergent plate boundaries are sites of **collisions**, where tectonic plates crash into each other. **Compression** describes a set of **stresses** directed at one point in a rock or rock formation.

At a compression zone, tectonic activity forces crustal compression at the leading edge of the crust formation. For this reason, most fold mountains are found on the edge or former edge of continental plate boundaries. Rocks on the edge of continental crust are often weaker and less stable than rocks found in the continental interior. This makes them more **susceptible** to folding and warping. Most fold mountains are composed of **sedimentary rock** and **metamorphic rock** formed under high pressure and relatively low temperatures. Many fold mountains are also formed where an underlying layer of **ductile** minerals, such as salt, is present.

Young and Old, High and Low

Fold mountains are the most common type of mountain in the world. The **rugged**, soaring heights of the Himalayas, Andes, and Alps are all active fold mountains.

The Himalayas stretch through the **borders** of China, Bhutan, Nepal, India, and Pakistan. The crust beneath the Himalaya, the most towering mountain range on Earth, is still the process of being compressed. Here, the Indian plate is colliding northward with the Eurasian plate. The sedimentary rocks of the Himalayas include shale and limestone. Metamorphic rocks of the region include schist and gneiss. **Dikes** of igneous rock also intrude throughout the rock formations of the Himalayas.

The Andes are the world's longest mountain chain. They stretch along the entire west coast of South America, from Colombia in the north and through Ecuador, Peru, Bolivia, Chile, and Argentina to the south. Here, the **dense oceanic crust** of the Nazca and Antarctic plates is **subducting** beneath the less-dense continental crust of the South American plate. The Andes are mostly being folded and uplifted from the thicker, less-dense rocks of the South American plate. The sedimentary and metamorphic rocks of the Andes are dotted by active and dormant **volcanoes**.

The Alps roughly mark the top of the “boot” of the Italian Peninsula. The Alps stretch across Italy, Slovenia, Austria, Germany, Switzerland, Lichtenstein, Monaco, and France. Here, the tiny Adriatic plate is colliding with the much larger Eurasian plate to the north. The J-shaped Adriatic plate is a **remnant** of the African plate to the south, and today it carries the eastern Italian Peninsula as well as the entire Adriatic Sea. **Alpine geology** includes sedimentary and metamorphic rock, as well as **igneous rocks** that once were part of the ocean floor and were later uplifted in the process of folding.

Not all fold mountains are soaring peaks. The Appalachians, stretching along North America’s east coast, are generally low-lying, gentle **slopes**. Millions of years ago, the Appalachians were taller than the Himalayas! Millions of years of **erosion**, however, have taken their toll. Today, some of the highest peaks of the Appalachians are less than a third of the height of Everest.

The crust that is now the Appalachians began folding 480 million years ago, when the North American and African continental plates collided. Plate tectonics created this ancient mountain range, then called the Central Pangean Mountains . . . and plate tectonics tore it apart. As tectonic activity ripped apart the ancient **supercontinent Pangea**, the African, Eurasian, and North American plates drifted apart.

The Appalachians are just one remnant of the Central Pangean Mountains. The Appalachians stretch from the province of Newfoundland, in southeastern Canada, through the southern state of Alabama in the U.S. They are related to the gentle fold mountains of the Scottish Highlands (Eurasia) and the Little Atlas Mountains, Morocco (Africa)—their orogenic sisters from the Central Pangean Mountains.

Types of Folds

Fold mountains are defined by **complex, vital** geologic forms known as folds. There are many, many different types of folds. **Geologists** primarily **categorize** folds by their shape—do they have sharp turns or gentle curves? Are the folds **convex** or **concave**?

A fold mountain usually displays more than one type of fold. Anticlines and synclines are the most common up-and-down folds that result from compression. An **anticline** has a n-shape, with the oldest rocks in the center of the fold. A **syncline** is a U-shape, with the youngest rocks in the center of the fold.

Domes and basins are often considered types of folds. A **dome** is a series of **symmetrical** anticlines, roughly shaped like half a **sphere**. Like an anticline, the oldest rocks in a dome are found in the center. A **basin** is a depression, or dip, in the Earth’s surface. Like a syncline, a basin has its youngest rocks in its center.

Other types of fold include:

- **monoclines**. A monocline is a type of fold in which all rock layers **incline**, or dip, in the same direction.
- **chevron**. A chevron is a sharp, straight fold where rock layers look like zig-zags.
- **slump**. A **slump fold** is a result of slope failure (a type of **mass wasting** or **landslide**). The slope failure happened when **sediments** were soft, before they became a single mass of rock. As the **sediments** lithified, they became a slump.
- **ptygmatic**. **Ptygmatic folds** are a type of slump fold created where the folding material is much more **viscous** than the material surrounding it. Many ptygmatic folds are created as metamorphic rock melts and intrudes into another rock layer, forming a dike.
- **disharmonic**. **Disharmonic folds** describe rock formations in which different rock layers have different fold shapes.

VOCABULARY

Term	Part of Speech	Definition
ancient	<i>adjective</i>	very old.
anticline	<i>noun</i>	layers of rock that have folded into a hill or crest.
basin	<i>noun</i>	a dip or depression in the surface of the land or ocean floor.
border	<i>noun</i>	natural or artificial line separating two pieces of land.

categorize	<i>verb</i>	to arrange by specific type or characteristic.
chevron	<i>noun</i>	zig-zag or V-shaped pattern.
collision	<i>noun</i>	crash.
complex	<i>adjective</i>	complicated.
compress	<i>verb</i>	to press together in a smaller space.
concave	<i>adjective</i>	curving inward.
continent	<i>noun</i>	one of the seven main land masses on Earth.
continental crust	<i>noun</i>	thick layer of Earth that sits beneath continents.
convergent plate boundary	<i>noun</i>	area where two or more tectonic plates bump into each other. Also called a collision zone.
convex	<i>adjective</i>	curving outward.
crust	<i>noun</i>	rocky outermost layer of Earth or other planet.
dense	<i>adjective</i>	having parts or molecules that are packed closely together.
dike	<i>noun</i>	a barrier, usually a natural or artificial wall used to regulate water levels.
disharmonic fold	<i>noun</i>	rock formation in which different rock layers have different fold shapes.
dome	<i>noun</i>	shape that is half of a sphere.
ductile	<i>adjective</i>	capable of withstanding a certain amount of force by changing form before fracturing or breaking.
erosion	<i>noun</i>	act in which earth is worn away, often by water, wind, or ice.
fold mountain	<i>noun</i>	areas of the Earth's crust that have been bent and forced up by movement of tectonic plates.
geologist	<i>noun</i>	person who studies the physical formations of the Earth.
geology	<i>noun</i>	study of the physical history of the Earth, its composition, its structure, and the processes that form and change it.
hill	<i>noun</i>	land that rises above its surroundings and has a rounded summit, usually less than 300 meters (1,000 feet).
igneous rock	<i>noun</i>	rock formed by the cooling of magma or lava.
incline	<i>noun</i>	slant, slope, or dip.
intrude	<i>verb</i>	to thrust or bring into.
landslide	<i>noun</i>	the fall of rocks, soil, and other materials from a mountain, hill, or slope.
lithify	<i>verb</i>	to change into stone or rock.
mass wasting	<i>noun</i>	downward movement of rock, soil, and other material.
metamorphic rock	<i>noun</i>	rock that has transformed its chemical qualities from igneous or sedimentary.
mimic	<i>verb</i>	to copy another organism's appearance or behavior.

mineral	<i>noun</i>	inorganic material that has a characteristic chemical composition and specific crystal structure.
monocline	<i>noun</i>	step-shaped fold in a rock formation in which all rock layers gently dip in the same direction.
mountain	<i>noun</i>	landmass that forms as tectonic plates interact with each other.
mountain range	<i>noun</i>	series or chain of mountains that are close together.
nappe	<i>noun</i>	large mass or fold of rock that has been thrust from its position by tectonic activity. Also called a thrust sheet.
oceanic crust	<i>noun</i>	thin layer of the Earth that sits beneath ocean basins.
orogenic event	<i>noun</i>	process of a specific mountain range or ranges being formed.
orogeny	<i>noun</i>	the way mountains are formed.
outcropping	<i>noun</i>	layer of rock visible above the surface of the Earth.
Pangea	<i>noun</i>	(300 million years ago) ancient supercontinent that contained all present-day continents and began to break up about 200 million years ago.
peak	<i>noun</i>	the very top.
peninsula	<i>noun</i>	piece of land jutting into a body of water.
province	<i>noun</i>	division of a country larger than a town or county.
ptygmatic fold	<i>noun</i>	rock formation (fold) created where the folding material is much more viscous than the material surrounding it.
remnant	<i>noun</i>	something that is left over.
rock	<i>noun</i>	natural substance composed of solid mineral matter.
rugged	<i>adjective</i>	having an irregular or jagged surface.
salt	<i>noun</i>	(sodium chloride, NaCl) crystalline mineral often used as a seasoning or preservative for food.
sediment	<i>noun</i>	solid material transported and deposited by water, ice, and wind.
sedimentary rock	<i>noun</i>	rock formed from fragments of other rocks or the remains of plants or animals.
slope	<i>noun</i>	slant, either upward or downward, from a straight or flat path.
slump fold	<i>noun</i>	rock formation (fold) formed by the collapse of soft sediments on the edge of a continental boundary.
sphere	<i>noun</i>	round object.
stress	<i>noun</i>	physical or mental factor (or set of factors) that disturbs the body's normal state of functioning or ability.
subduct	<i>verb</i>	to pull downward or beneath something.
supercontinent	<i>noun</i>	ancient, giant landmass that split apart to form all the continents we know today.
susceptible	<i>adjective</i>	able to be influenced to behave a certain way.
symmetrical	<i>adjective</i>	having the same arrangement of parts on either side.
syncline	<i>noun</i>	layers of rock that have folded to create a dip or area between hills.

tectonic plate	<i>noun</i>	large, moveable segment of the Earth's crust.
toll	<i>noun</i>	amount of loss or suffering from an event.
uplift	<i>noun</i>	elevation of the Earth's surface due to tectonic or other natural activity.
viscous	<i>adjective</i>	liquid that is thick and sticky.
vital	<i>adjective</i>	necessary or very important.
volcano	<i>noun</i>	an opening in the Earth's crust, through which lava, ash, and gases erupt, and also the cone built by eruptions.
warp	<i>verb</i>	to bend out of shape.

For Further Exploration

Articles & Profiles

- Mountain Professor: Folded Mountains
- Physical Geography: Crustal Deformation Process—Folding and Faulting
- Geologic Structures: Anticlines and Synclines
- The Geography Site: Fold Mountains



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