

Waterfall

A **waterfall** is a place where water flows over a vertical drop or a series of steep drops in the course of a stream or river. Waterfalls also occur where meltwater drops over the edge of a tabular iceberg or ice shelf.



Angel Falls in Venezuela is the world's tallest waterfall at 979 m (3,212 ft).

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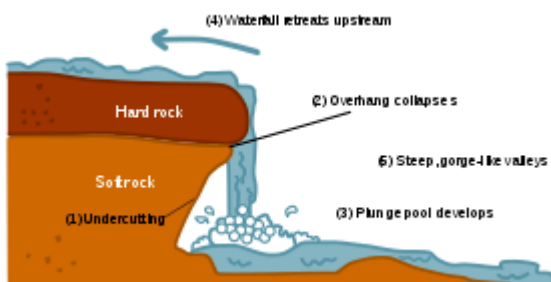
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Formation



Formation of a waterfall

Waterfalls are commonly formed in the upper course of a river in steep mountains.^[1] Because of their landscape position, many waterfalls occur over bedrock fed by little contributing area, so may be ephemeral and flow only during rainstorms or significant snowmelt. The further downstream, the more perennial a waterfall can be. Waterfalls can have a wide range of widths and depths, and this diversity is part of what makes them such a charismatic and interesting natural phenomenon. Research into the diversity of natural waterfalls systematics has been carried out in recent years.^{[2][3]}

When the river courses over resistant bedrock, erosion happens slowly and is dominated by impacts of water-borne sediment on the rock, while downstream the erosion occurs more rapidly.^{[1][5]} As the watercourse increases its velocity at the edge of the waterfall, it may pluck material from the riverbed, if the bed is fractured or otherwise more erodable. Hydraulic jets and hydraulic jumps at the toe of a falls can generate large forces to erode the bed^[6], especially when forces are amplified by water-borne sediment. Horseshoe-shaped falls focus the erosion to a central point, also enhancing riverbed change below a waterfalls^[7]. A process known as "potholing" involves local erosion of a potentially deep hole in bedrock due to turbulent whirlpools spinning stones around on the bed, drilling it out. Sand and stones carried by the watercourse therefore increase erosion capacity.^[1] This causes the waterfall to carve deeper into the bed and to recede upstream. Often over time, the waterfall will recede back to form a canyon or gorge downstream as it recedes upstream, and it will carve deeper into the ridge above it.^[8] The rate of retreat for a waterfall can be as high as one-and-a-half metres per year^[1]

Often, the rock stratum just below the more resistant shelf will be of a softer type, meaning that undercutting due to splashback will occur here to form a shallow cave-like formation known as rock shelter under and behind the waterfall. Eventually the outcropping more resistant cap rock will collapse under pressure to add blocks of rock to the base of the waterfall. These blocks of rock are then broken down into smaller boulders by attrition as they collide with each other, and they also erode the base of the waterfall by abrasion, creating a deep plunge pool in the gorge downstream.

Streams can become wider and shallower just above waterfalls due to flowing over the rock shelf, and there is usually a deep area just below the waterfall because of the kinetic energy of the water hitting the bottom. However, a study of waterfalls systematics reported that waterfalls can be wider or narrower above or below a falls, so almost anything is possible given the right geological and hydrological setting.^[3] Waterfalls normally form in a rocky area due to erosion. After a long period of being fully formed, the water falling off the ledge will retreat, causing a horizontal pit parallel to the waterfall wall. Eventually, as the pit grows deeper, the waterfall collapses to be replaced by a steeply sloping stretch of river bed.^[1] In addition to gradual processes such as erosion, earth movement caused by earthquakes or landslides or volcanoes can cause a differential in land heights which interfere with the natural course of a water flow and result in waterfalls.

A river sometimes flows over a large step in the rocks that may have been formed by a fault line. Waterfalls can occur along the edge of a glacial trough, where a stream or river flowing into a glacier continues to flow into a valley after the glacier has receded or melted. The large waterfalls in Yosemite Valley are examples of this phenomenon, which is referred to as a hanging valley. Another reason hanging valleys may form is where two rivers join and one is flowing faster than the other.^[4] Waterfalls can be grouped into ten broad classes based on the average volume of water present on the fall (which depends on both the waterfall's average flow and its height) using a logarithmic scale. Class 10 waterfalls include Niagara Falls, Paulo Afonso Falls and Khone Falls.

Classes of other well-known waterfalls include Victoria Falls and Kaieteur Falls (Class 9); Rhine Falls and Gullfoss (Class 8); Angel Falls and Dettifoss (Class 7); Yosemite Falls, Lower Yellowstone Falls and Umphang Thee Lor Sue Waterfall (Class 6); Sutherland Falls (Class 5).^[9]

Researchers

Alexander von Humboldt (1820s) "Father of Modern Geography" Humboldt was mostly marking waterfalls on maps for river navigation purposes.

Oscar von Engeln (1930s) Published "Geomorphology: systematic and regional", this book had a whole chapter devoted to waterfalls and is one of the earliest examples of published works on waterfalls.

R. W. Young (1980s) Wrote "Waterfalls: form and process" this work made waterfalls a much more serious topic for research for modern Geoscientists.^[10]

Types

- **Ledge waterfall** Water descends vertically over a vertical cliff, maintaining partial contact with the bedrock.^[11]
 - **Block/Sheet** Water descends from a relatively wide stream or river.^{[5][11]}
 - **Classical:** Ledge waterfalls where fall height is nearly equal to stream width, forming a vertical square shape.^[5]
 - **Curtain:** Ledge waterfalls which descend over a height larger than the width of falling water stream.^[5]
- **Plunge:** Fast moving water descends vertically losing complete contact with the bedrock surface.^[11] The contact is typically lost due to horizontal thrust of the water before it falls. It always starts from a narrow stream.



Aerial view of Victoria Falls on the Zambezi River in southern Africa. The cloud formed by the mist is called **cataractagenitus**^[4]



An example of an **ephemeral** waterfall. This one, when flowing, feeds into the Chagrin River (Ohio).

- **Punchbowl:** Water descends in a constricted form and then spreads out in a wider pool.^[11]
- **Horsetail:** Descending water maintains contact with bedrock most of the time.^[11]
 - **Slide:** Water glides down maintaining continuous contact.^[11]
 - **Ribbon:** Water descends over a long narrow strip.^[11]
 - **Chute:** A large quantity of water forced through a narrow vertical passage.^[11]
 - **Fan:** Water spreads horizontally as it descends while remaining in contact with bedrock.^[11]
- **Cascade:** Water descends a series of rock steps.^{[5][11]}
- **Tiered/Multi-step/Staircase** A series of waterfalls one after another of roughly the same size each with its own sunken plunge pool.^[11]
- **Cataract** A large, powerful waterfall.^[11]
- **Segmented:** Distinctly separate flows of water form as it descends.^[11]
- **Catadupa:** A cataract or waterfall, originally those of the Nile. The term **catadupae** refers to people inhabiting near such cataracts; there are suppositions that these people are deaf due to the constant din.^[12]
- **Frozen:** Any waterfall which has some element of ice or snow.^[11]
- **Moulin:** A moulin is a waterfall in a glacier

Some waterfalls are also distinct in that they do not flow continuously. **Ephemeral** waterfalls only flow after a rain or a significant snowmelt.^{[13][14][15]}

Examples

Significant waterfalls,^[16] listed alphabetically:

- Angel Falls in Venezuela is the world's tallest above-water waterfall at 979 metres (3,212 ft).
- Aysgarth Falls in the Yorkshire Dales, England – which provided inspiration for Ruskin, Turner and Wordsworth.
- Ban Gioc–Detian Falls a transnational waterfall on the border between China and Vietnam.
- Bridalveil Fall in Yosemite Valley is 189 metres (620 ft) high with a sheer drop.
- Cumberland Falls in Kentucky is one of several falls in the world at which a moonbow is visible.
- Dettifoss in northeast Iceland is the largest waterfall in Europe in terms of volume discharge, having an average water flow of 200 m³/s. The falls are 100 metres (330 ft) wide and have a drop of 44 metres (144 ft) down to the Jökulsárgljúfur canyon.
- Eas a' Chual Aluinn in Scotland, at 200 metres (660 ft), the highest waterfall in the United Kingdom
- Falls of Lora, also in Scotland, is an unusual rapids in the sea that is created when the waters iboch Etive pour out through the narrow mouth of the loch over a rocky shelf.^[17]
- Gocta, the sixteenth-tallest in the world at 771 metres (2,530 ft), is located in the province of Achachapoyas, Peru.
- Huangguoshu Waterfall in Anshun, Guizhou, China, is the largest waterfall in East Asia.
- Iguazu Falls is an extensive series of waterfalls along a 2.7-kilometre (1.7 mi) stretch of escarpment on the Argentina–Brazil border.
- James Bruce Falls the tallest waterfall in North America at 840 metres (2,760 ft), is located in the Princess Louisa Marine Provincial Park British Columbia, Canada.
- Jiao Lung Waterfall in Alishan, Chiayi, Taiwan, is the tallest waterfall in East Asia at 600 metres (2,000 ft).
- Jog Falls in Karnataka, India is the second-highest plunge waterfall in India.
- Kaieteur Falls (Potaro River in central Guyana), located in the Kaieteur National Park, is 226 metres (741 ft).
- Niagara Falls are the widest, most powerful falls in North America.
- Nohkalikai Falls is India's tallest plunge waterfall, located in Meghalaya state, India.



Staubbach Falls, a 297-metre (974 ft) waterfall in Switzerland



Aerial view of Iguazu Falls on the Iguazu River between Brazil and Argentina

- Pissing Mare Falls at 350 metres (1,150 ft), is one of the tallest waterfalls in eastern North America.
- Ramnefjellsfossen in Stryn, Nesdalen, Norway is the world's third-tallest waterfall at 808 metres (2,651 ft).
- Reichenbach Falls in Switzerland, a sequence of two waterfalls totaling 120 metres (390 ft) in height, were the site of the disappearance and purported death of fictional detective Sherlock Holmes in the story "The Final Problem".
- Rhine Falls near Schaffhausen, Switzerland, are among the largest in Europe, at 150 metres (490 ft) wide.
- Ribbon Fall, a seasonal waterfall in Yosemite National Park, is the highest single-drop fall in North America, at 1,612 feet (491 m).
- Shir-Abad Waterfall is located near Khan Bebin in Golestan Province, Iran.
- Shoshone Falls in Idaho has been termed the "Niagara of the West".
- St. Clair's Falls, Sri Lanka's widest waterfall, is 265 feet (81 m) tall.
- Takakkaw Falls, 384 metres (1,260 ft) high, are in Yoho National Park in Canada.
- Tequendama Falls is a 132-metre (433 ft) waterfall on the Bogotá River, about 30 kilometres (19 mi) southwest of Bogotá in Colombia.
- Tugela Falls is the world's second-tallest at 947 metres (3,107 ft) in KwaZulu-Natal province, Republic of South Africa.
- Venta Rapid in Latvia, said to be Europe's widest waterfall, is more than 800 feet (240 m) wide but only about 6 feet (1.8 m) high.
- Victoria Falls, on the Zambezi river along the border between Zimbabwe and Zambia, is among the largest waterfalls in the world. During periods of high flow, it creates an unbroken sheet of water more than a mile wide.
- Virginia Falls (Northwest Territories) on South Nahanni River, Northwest Territories, Canada, is the world's 14th-largest waterfall located in Nahanni National Park Reserve a UNESCO World Heritage Site
- Waihilau Falls, at 792 metres (2,598 ft), is located in the Waimanu Valley, Hawaii, United States.
- Yosemite Falls, 739 metres (2,425 ft), located in Yosemite National Park, United States.
- Yumbilla Falls is the world's fifth-tallest waterfall and located in Peru.



Aerial view of Niagara Falls in the state of New York, U.S., and province of Ontario, Canada



Aerial view of Rhine Falls in Switzerland

Image gallery



Huangguoshu Waterfall in Guizhou province, China, is a *block*-type waterfall and a *cataract*.



Song Khon Waterfall in Loei Province, Thailand is an example of a *cascade* waterfall.



In Pamukkale, Turkey is an example of *travertine terraces* built by flowing water.



First fall of Elephant Falls in Shillong, India, is an example of a *horsetail-punchbowl* waterfall.

See also

- List of waterfalls
- List of waterfalls by height
- List of waterfalls by flow rate
- List of waterfalls by type
- Cave waterfall
- Panhole

- Stream pool
- Tributary
- Water feature
- Artificial waterfall

References

1. Carreck, Rosalind, ed. (1982). *The Family Encyclopedia of Natural History* The Hamlyn Publishing Group. pp. 246–248. ISBN 0711202257.
2. "Dr. Gregory B. Pasternack - Watershed Hydrology Geomorphology and Ecohydraulics :: Waterfalls" (<http://pasternack.ucdavis.edu/research/projects/waterfalls/>) *pasternack.ucdavis.edu* Retrieved 11 June 2017.
3. Wyrick, Joshua R.; Pasternack, Gregory B. (1 September 2008). "Modeling energy dissipation and hydraulic jump regime responses to channel nonuniformity at river steps" (<http://onlinelibrarywiley.com/doi/10.1029/2007JF000873/abstract>). *Journal of Geophysical Research: Earth Surface* **113** (F3): F03003. doi:10.1029/2007jf000873 (<https://doi.org/10.1029%2F2007jf000873>) ISSN 2156-2202 (<https://www.worldcat.org/issn/2156-2202>)
4. Sutherland, Scott (23 March 2017). "Cloud Atlas leaps into 21st century with 12 new cloud types" (<https://www.theweathernetwork.com/news/articles/cloud-atlas-leaps-into-21st-century-with-12-new-cloud-types/80685/>) *The Weather Network*. Pelmorex Media Retrieved 24 March 2017.
5. "Adventure" (<http://geographyhowstuffworks.com/terms-and-associations/waterfall.htm/printable>) 16 June 2008 Retrieved 10 November 2016.
6. Pasternack, Gregory B.; Ellis, Christopher R.; Marr, Jeffrey D. (1 July 2007). "Jet and hydraulic jump near-bed stresses below a horseshoe waterfall" (<http://onlinelibrarywiley.com/doi/10.1029/2006WR005774/abstract>) *Water Resources Research* **43** (7): W07449. doi:10.1029/2006wr005774 (<https://doi.org/10.1029%2F2006wr005774>) ISSN 1944-7973 (<https://www.worldcat.org/issn/1944-7973>)
7. "Dr. Gregory B. Pasternack - Watershed Hydrology Geomorphology and Ecohydraulics :: Horseshoe Falls" (<http://pasternack.ucdavis.edu/research/projects/waterfalls/horseshoe-falls/>) *pasternack.ucdavis.edu* Retrieved 11 June 2017.
8. "Observe river erosion creating waterfalls and chasms" (http://www.classzone.com/books/earth_science/terc/content/visualizations/es1305/es1305page01.cfm?chapter_no=visualization) Retrieved 10 November 2016.
9. Richard H. Beisel Jr, *International Waterfall Classification System*, Outskirts Press, 2006 ISBN 1-59800-340-2
10. Hudson, B. J. (2013) Waterfalls, science and aesthetics
11. "Worldwaterfalls.com" (http://worldwaterfalls.com/waterfall_types.php) Retrieved 10 November 2016.
12.  This article incorporates text from a publication now in the public domain Chambers, Ephraim ed. (1728). "Catadupa" (<http://digicoll.librarywisc.edu/cgi-bin/HistSciTech/HistSciTech-idx?type=turn&entity=HistSciTech.Cyclopaedia01.p0323&id=HistSciTech.Cyclopaedia01&isize=M&q1=Catadupa>) *Cyclopædia, or an Universal Dictionary of Arts and Sciences* (first ed.). James and John Knapton, et al. p. 169.
13. <https://www.terrageria.com> (<https://www.terrageria.com/parks/np-image.maca39887.html>) Ephemeral waterfall seen from inside cave. Mammoth Cave National Park.
14. <https://www.kidsdiscover.com> (<https://www.kidsdiscover.com/quick-reads/horsetail-falls-one-yosemites-ephemeral-waterfalls/>) About Horsetail Falls, One of Yosemite's Ephemeral Waterfalls.
15. <https://www.wncwaterfalls.com> (https://www.wncwaterfalls.info/waterfall/94/Brd_Rock_Falls) Bird Rock Falls.
16. "World Waterfall Database - The webs most authoritative source about Waterfalls" (<http://www.world-waterfalls.com/>) Retrieved 10 November 2016.
17. "Falls of Lora Information" (http://www.fallsoflora.info/about_the_falls_of_lora.htm) The Falls of Lora. Retrieved 18 September 2011.

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