



Rockfall

What is a rockfall?

Rockfalls are a natural and dynamic geologic process. Due to its steep, glacier-carved cliffs, Yosemite Valley experiences many rockfalls each year. Historical records indicate that at least 600 rockfalls have occurred in the park over the last 150 years. Massive piles of “talus” or rock debris at the base of Yosemite Valley’s cliffs are reminders of these dramatic events. Natural processes like rockfall help to create the beautiful and changing scenery in Yosemite National Park, but they also present potential hazards.

What causes rockfall?

A number of geologic processes set the stage for rockfall. Glaciation, weathering, and bedrock fractures all play a role in causing rockfall. Tectonic and erosional stresses cause granite rock to fracture. Rockfalls later occur along these fractures. Fractures that develop parallel to the surface are called **sheet joints**. Sheet joints create large slabs of rock that ultimately fall away in a process known as **exfoliation**. In Yosemite Valley, Royal Arches and the face of Half Dome are landforms that have resulted from this process. Over long time periods, **water** flowing through fractures weathers the bedrock, loosening bonds that hold rocks in place. This is called **weathering**.

Triggering mechanisms like water, ice, earthquakes, and vegetation are the final forces that cause unstable rocks to fall. If **water** enters fractures in the bedrock, it lubricates surfaces and can build up pressure behind unstable rocks. Water also may seep into fractures in the rock and freeze, causing the fractures in the rock to expand. This process is called “**frost wedging**” or “**freeze-thaw**” and can incrementally lever loose rocks away from cliff faces. Ground shaking during **earthquakes** can also trigger rockfalls. Additionally, a variety of **vegetation**—most notably firs, pines, and canyon live oaks—grow into the sheer rock faces where their roots expand and pry apart joints in the granite. There is still uncertainty about exactly what triggers rockfall; historical records indicate that more than half of all documented rockfalls were not associated with a recognizable trigger.

Most rockfalls in Yosemite occur in the winter and early spring during periods of intense rainfall, snow melt, and/or subfreezing temperatures, but large rockfalls have also occurred during periods of warm, stable weather. Predicting actual rockfall events is not yet possible, but understanding the forces that trigger rockfalls is an important step toward this goal.



July 27, 2006 Half Dome Rockfall

Photo: Amanda Nolan

How does the park address rockfall?



Computer modeling shows promise in simulating future rockfall behavior

The National Park Service is responding to rockfall in a variety of ways. Park scientists, in collaboration with the U.S. Geological Survey and academic researchers, are actively studying rockfall through the use of new technology such as high resolution digital photography and laser mapping of cliffs. These tools offer vast improvement in resolution from previously available data, allowing geologists to accurately map rockfall zones and to study rockfall source areas. The park is also actively investigating possible methods for monitoring rockfall activity. Additionally, new computer modeling technology shows some promise in simulating future rockfall behavior. Park planning incorporates potential rockfall hazards, and rangers have developed emergency plans for rockfall events. Park managers may also close trails and post warning signs in particularly hazardous areas.

What can I do about rockfall?

- **Understand this dynamic natural process.** Rockfall is the most powerful geologic agent acting today in Yosemite. The dramatic cliffs of Yosemite are constantly being shaped by this potent natural force.
- **Be aware of your surroundings.** Remember that Yosemite is a wild place. Rockfall hazard zones occur throughout the park near any cliff faces. Be aware that rockfalls are inherently unpredictable and may happen at any time. Pay attention to warning signs, stay off of closed trails, and, if unsure, keep away from the cliffs.
- **Inform park managers if you witness a rockfall.** If you witness or hear a rockfall of any size, please report it by calling (209) 379-1420. This information is useful for assessing rockfall hazards and adds to the growing knowledge base of rockfall activity in the park.

Public Participation

Public participation is essential for the success of this and all other park projects. Here are some ways to stay involved in the park:

- **Attend a National Park Service public open house** to talk with project specialists and obtain more information on this topic. Visit the park's planning website (listed below) for upcoming dates.
- **Add your name to the park's planning list** and receive the *Planning Update* newsletter as well as other planning-related notices. You can also submit your email address to receive the park's periodic electronic newsletter.
- **Additionally, you can submit comments with your thoughts about this topic or any other project in the park by any of the following means:**
 - Mail:** Superintendent
P.O. Box 577
Yosemite, CA 95389
 - Phone:** 209/379-1365; **Fax:** 209/379-1294
 - E-mail:** Yose_Planning@nps.gov
- **Visit online:** www.nps.gov/yose/parkmgmt/planning.htm to find out about plans and projects or www.nps.gov/yose/naturescience/index.htm to find out about science & nature in Yosemite National Park.