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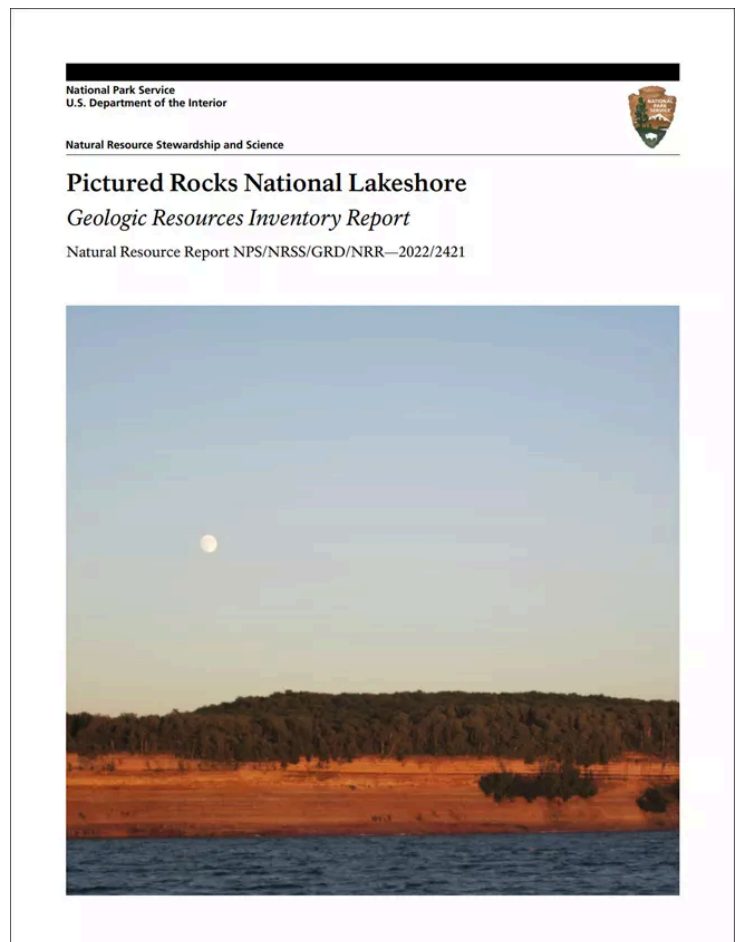
NPS Geodiversity Atlas—Pinnacles National Monument, California

Pinnacles National Park (<https://www.nps.gov/pinn/>)

Geodiversity refers to the full variety of natural geologic (rocks, minerals, sediments, fossils, landforms, and physical processes) and soil resources and processes that occur in the park. A product of the [Geologic Resources Inventory](https://www.nps.gov/subjects/geology/gri.htm) (<https://www.nps.gov/subjects/geology/gri.htm>), the NPS Geodiversity Atlas delivers information in support of education, [Geoconservation](https://www.nps.gov/subjects/geology/park-geology.htm) (<https://www.nps.gov/subjects/geology/park-geology.htm>), and integrated management of living (biotic) and non-living (abiotic) components of the ecosystem.

Introduction

Pinnacles National Park (PINN) is located in the southern Gabilan Range, about 64 km (40 mi) inland from the Pacific Ocean and about 129 km (80 mi) south of the San Francisco Bay Area in Monterey and San Benito Counties, California. Originally proclaimed as a national monument on January 16, 1908, it was re-designated as a national park on January 10, 2013 (National Park Service 2016). PINN encompasses approximately 10,799 hectares (26,686 acres) and protects valuable geologic resources that include spire-like rock formations standing 152–366 m (500–1,200 ft) high, an extensive assemblage of rare talus caves, and a variety of volcanic features associated with the Neenach Volcanic Field (National Park Service 2015b). Volcanic rocks of the Neenach Volcanic Field are believed to have formed ~23 Ma near present-day Lancaster, California, and have been transported to their current location some 315 km (196 mi) northwest by the extensive San Andreas fault system (Turner et al. 1970; Matthews 1973b; Sims 1993). Over the course of millions of years, the forces of wind and water have slowly sculpted the volcanic rocks to form a unique landscape of deep narrow gorges, caves, colonnades, and monoliths.



[.https://irma.nps.gov/DataStore/DownloadFile/677577](https://irma.nps.gov/DataStore/DownloadFile/677577)

In-depth geologic information is contained in the baseline inventory products of the Geologic Resources Inventory, see table below.

Geologic Setting

Situated along the San Andreas Fault, the geology of Pinnacles National Park has been heavily influenced by transform plate motion and contains rocks that have been transported hundreds of kilometers or miles from where they were formed. The geology of PINN can be subdivided into three main groups of rocks: (1) Cretaceous-age intrusive rocks; (2) volcanic rocks of the Oligocene–Miocene Pinnacles Volcanics; and (3) Neogene and younger rocks of the Monterey Formation, Pancho Rico Formation, and Paso Robles Formation. Older Cretaceous units are mapped along the western boundary and southeastern portion of PINN and include quartz monzonite of Bickmore Canyon and quartz diorite–granodiorite of Johnson Canyon. The Pinnacles Volcanics consist of rhyolite, dacite, andesite, agglomerate, breccia, and pumice lapilli–tuff that underlie the central core of the park between the Pinnacles Fault to the west and Chalone Creek Fault to the east. The Pinnacles Volcanics are correlative

with the Neenach Volcanics, two igneous units that are now separated 315 km (196 mi) along strike of the San Andreas Fault (Turner et al. 1970; Sims 1993). Over the course of geologic time, the San Andreas Fault has split and slowly offset the Neenach Volcanic Field, leaving petrologically similar lithologies on either side of the transform boundary. Rocks of the Miocene Monterey Formation and Pliocene Pancho Rico Formation are located east of the Chalone Creek Fault in northeastern PINN. The youngest bedrock is represented by the Pliocene–Pleistocene Paso Robles Formation along the southwestern margin of the park.



A view from the High Peaks Trail.

Regional Geology

Pinnacles National Monument is a part of the [Pacific Border Physiographic Province](https://www.nps.gov/articles/pacificborderprovince.htm) (<https://www.nps.gov/articles/pacificborderprovince.htm>) and shares its geologic history and some characteristic geologic formations with a region that extends well beyond park boundaries.

Maps and Reports

Geologic Resources Inventory

The [Geologic Resources Inventory](https://www.nps.gov/subjects/geology/gri.htm) (<https://www.nps.gov/subjects/geology/gri.htm>) produces digital geologic maps and reports for more than 270 [natural resource parks](https://www.nps.gov/orgs/1386/index.htm) (<https://www.nps.gov/orgs/1386/index.htm>). The products listed below are currently available for this park, check back often for updates as many maps, reports, and posters are still in progress.

Scoping summaries are records of scoping meetings where NPS staff and local geologists determined the park's geologic mapping plan and what content should be included in the report.

Digital geologic maps include files for viewing in GIS software, a guide to using the data, and a document with ancillary map information. Newer products also include data viewable in Google Earth and online map services.

Reports use the maps to discuss the park's setting and significance, notable geologic features and processes, geologic resource management issues, and geologic history.

Posters are a static view of the GIS data in PDF format. Newer posters include aerial imagery or shaded relief and other park information. They are also included with the reports.

Projects list basic information about the program and all products available for a park.

2022 [Digital Geologic-GIS Map of Pinnacles National Park and Vicinity, California \(NPS, GRD, GRI, PINN, PINN digital map\) adapted from a California Geological Survey Regional Geologic Maps by Wagner, Greene, Saucedo, and Pridmore \(2002\) and Rosenberg and Wills \(2016\)](#)
(<https://irma.nps.gov/DataStore/Reference/Profile/2165382>).

2022 [Digital Geologic-GIS Map of the Pinnacles Volcanic Formation, California \(NPS, GRD, GRI, PINN, PIVF digital map\) adapted from a University of California at Santa Cruz Ph.D. Dissertation map by Matthews \(1973\)](#)
(<https://irma.nps.gov/DataStore/Reference/Profile/2165380>).

2022 [Pinnacles National Park: Geologic resources inventory report](#)
(<https://irma.nps.gov/DataStore/Reference/Profile/2294842>).

2010 [Geologic Resources Inventory Project for Pinnacles](#)
(<https://irma.nps.gov/DataStore/Reference/Profile/2171413>).

2008 [Geologic Resource Evaluation Scoping Summary: Pinnacles National Monument, California](#)

Source: [NPS DataStore Saved Search 3146](#) (<https://irma.nps.gov/DataStore/SavedSearch/Profile/3146>).

To search for additional information, visit the [NPS DataStore](#) (<https://irma.nps.gov/DataStore/>).

Soil Resources inventory

A [NPS Soil Resources Inventory](#) (<https://www.nps.gov/subjects/geology/sri.htm>) project has been completed for Pinnacles National Monument and can be found on the NPS Data Store.

2013 [National Park Service - SRI - Soil Survey Geographic \(SSURGO\) for Pinnacles National Monument, CA](#)
(<https://irma.nps.gov/DataStore/Reference/Profile/1048955>).

Source: [NPS DataStore Saved Search 3097](https://irma.nps.gov/DataStore/SavedSearch/Profile/3097) (<https://irma.nps.gov/DataStore/SavedSearch/Profile/3097>).

To search for additional information, visit the [NPS DataStore](https://irma.nps.gov/DataStore/) (<https://irma.nps.gov/DataStore/>).

Related Links

- [Pinnacles—Geology](https://www.nps.gov/pinn/learn/nature/geology.htm)
(<https://www.nps.gov/pinn/learn/nature/geology.htm>).
- [Pinnacles—Geologic Formations](https://www.nps.gov/pinn/learn/nature/geologic-formations.htm)
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- [NPS—Caves and Karst](https://www.nps.gov/subjects/caves/siteindex.htm) (<https://www.nps.gov/subjects/caves/siteindex.htm>).
- [NPS—Geologic Time](https://www.nps.gov/subjects/geology/geotime.htm) (<https://www.nps.gov/subjects/geology/geotime.htm>).
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- [NPS—Geology](https://www.nps.gov/subjects/geology/index.htm) (<https://www.nps.gov/subjects/geology/index.htm>).
- [California Geological Survey](http://www.conservation.ca.gov/cgs/) (<http://www.conservation.ca.gov/cgs/>).



A talus cave in Bear Gulch.

Related Articles

Pinnacles National Monument

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Cenozoic Era

(<https://www.nps.gov/articles/000/cenozoic-era.htm>)



(<https://www.nps.gov/articles/000/cenozoic-era.htm>)

The Cenozoic Era (66 million years ago [MYA] through today) is the "Age of Mammals." North America's characteristic landscapes began to develop during the

Cenozoic. Birds and mammals rose in prominence after the extinction of giant reptiles. Common Cenozoic fossils include cat-like carnivores and early horses, as well as ice age woolly mammoths.

Locations: Agate Fossil Beds National Monument, Aniakchak National Monument & Preserve, Badlands National Park, Bandelier National Monument, Big Bend National Park, **more »**

Offices: Geologic Resources Division

Pyroclastic Flows and Ignimbrites, and Pyroclastic Surges

(<https://www.nps.gov/articles/000/pyroclastic-flows-and-ignimbrites-and-pyroclastic-surges.htm>)



(<https://www.nps.gov/articles/000/pyroclastic-flows-and-ignimbrites-and-pyroclastic-surges.htm>)

Pyroclastic flows and surges are among the most awesome and most destructive of all volcanic phenomena.

Pyroclastic flow deposits are found in at least 21 units of the National Park System.

Locations: Aniakchak National Monument & Preserve, Bandelier National Monument, Bering Land Bridge National Preserve, Big Bend National Park, Chiricahua National Monument, **more »**

Offices: Geologic Resources Division

Series: Geologic Time—Major Divisions and NPS Fossils

(<https://www.nps.gov/articles/series.htm?id=AEE6BF21-A803-4EDF-3ED76CFD25820BC5>)



(<https://www.nps.gov/articles/series.htm?id=AEE6BF21-A803-4EDF-3ED76CFD25820BC5>)

The National Park System contains a magnificent record of geologic time because rocks from each period of the geologic time scale are

preserved in park landscapes. The geologic time scale is divided into four large periods of time—the Cenozoic Era, Mesozoic Era, Paleozoic Era, and The Precambrian.

Type: Series

Locations: Agate Fossil Beds National Monument, Alibates Flint Quarries National Monument, Aniakchak National Monument & Preserve, Appalachian National Scenic Trail, Arches National Park, **more »**

Volcanic Processes—Lahars

(<https://www.nps.gov/articles/000/volcanic-processes-lahars.htm>)

(<https://www.nps.gov/articles/000/volcanic-processes-lahars.htm>)

Locations: Aniakchak National Monument & Preserve, Big Bend



Lahars are volcanic mudflows and are among the most destructive of volcanic phenomena. Lahars present significant geohazards since they can travel great distances down river valleys and impact population centers away from

the immediate area of a volcano.

National Park, Crater Lake

National Park, Florissant Fossil Beds National Monument, John Day Fossil Beds National Monument, **more »**

Offices: Geologic Resources Division

Pacific Border Province

(<https://www.nps.gov/articles/pacificborderprovince.htm>)



(<https://www.nps.gov/articles/pacificborderprovince.htm>).

The Pacific Border straddles the boundaries between several of Earth's moving plates on the western margin of North America. This region is one of the most geologically

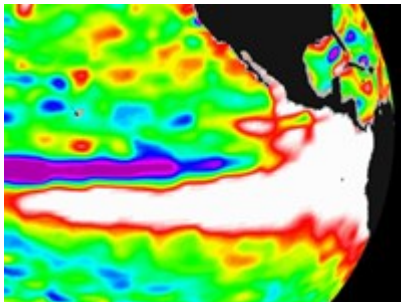
young and tectonically active in North America. The generally rugged, mountainous landscape of this province provides evidence of ongoing mountain-building.

Locations: Channel Islands National Park, Ebey's Landing National Historical Reserve, Eugene O'Neill National Historic Site, Fort Point National Historic Site, Fort Vancouver National Historic Site, **more »**

Offices: Geologic Resources Division

1997–1998 El Niño / 1998–1999 La Niña

(<https://www.nps.gov/articles/1997-1998-el-nino-1998-1999-la-nina.htm>)



(<https://www.nps.gov/articles/1997-1998-el-nino-1998-1999-la-nina.htm>).

Wind-driven waves and abnormally high sea levels contributed to hundreds of millions of dollars in flood and storm damage in the San

Francisco Bay region, including Point Reyes National Seashore, Golden Gate National Recreation Area, and Pinnacles National Monument. In addition to California, the 1997–1998 El Niño and the following 1998–1999 La Niña severely impacted the Pacific Northwest, including many National Park System units.

Locations: Ebey's Landing National Historical Reserve, Fort Vancouver National Historic Site, Golden Gate National Recreation Area, Lewis and Clark National Historical Park, Mount Rainier National Park, **more »**

Offices: Geologic Resources Division

1982–1983 El Niño

(<https://www.nps.gov/articles/1982-1983-el-nino.htm>)

(<https://www.nps.gov/articles/1982-1983-el-nino.htm>).

As a result of this El Niño, heavy surf and rains severely eroded beaches and fragile sea cliffs in coastal California. National Park System units in California affected by the 1982–1983 El Niño event

Locations: Golden Gate National Recreation Area, Muir Woods National Monument, Pinnacles National Park, Point Reyes National Seashore

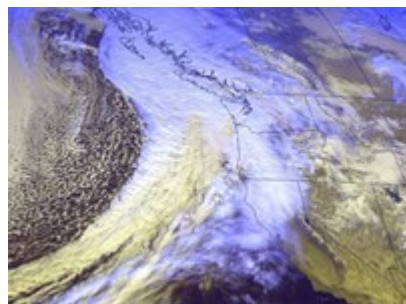


were Point Reyes National Seashore, Golden Gate National Recreation Area, and Pinnacles National Monument.

Offices: Geologic Resources Division

Series: Coastal Geomorphology—Storms of Record

(<https://www.nps.gov/articles/series.htm?id=678B3351-9DED-0F66-2D59B47C7965D0AA>)



(<https://www.nps.gov/articles/series.htm?id=678B3351-9DED-0F66-2D59B47C7965D0AA>)

Storms can bring about significant coastal change as well as substantial economic damage and loss in the human environment. Read about a few

Type: Series

Locations: Ebey's Landing National Historical Reserve, Fort Vancouver National Historic Site, Golden Gate National Recreation Area, Lewis and Clark National Historical Park, Mount Rainier National Park, **more »**

storms of interest that have since made history due to their unique intensity, characteristics, or impacts.

Bats and Bear Gulch Cave

(<https://www.nps.gov/articles/bats-bear-gulch-cave.htm>)



(<https://www.nps.gov/articles/bats-bear-gulch-cave.htm>)

Bear Gulch Cave at Pinnacles National Park is currently home to a large colony of Townsend's big-eared bats. Because the bats are sensitive to human disturbance, park

Locations: Pinnacles National Park

Offices: Inventory and Monitoring Division

management and scientists have developed a plan to allow both people and bats to use the cave. Learn what times of year the cave will likely be open and find answers to bat FAQs.

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National Park Service Geodiversity Atlas

The servicewide [Geodiversity Atlas \(https://www.nps.gov/articles/geodiversity-atlas-map.htm\)](https://www.nps.gov/articles/geodiversity-atlas-map.htm) provides information on [geoheritage \(https://www.nps.gov/subjects/geology/geoheritage-conservation.htm\)](https://www.nps.gov/subjects/geology/geoheritage-conservation.htm) and [geodiversity \(https://www.nps.gov/subjects/geology/geodiversity.htm\)](https://www.nps.gov/subjects/geology/geodiversity.htm) resources and values within the National Park System. This information supports science-based [geoconservation \(https://www.nps.gov/subjects/geology/park-geology.htm\)](https://www.nps.gov/subjects/geology/park-geology.htm) and interpretation in the NPS, as well as STEM education in schools, museums, and field camps. The [NPS Geologic Resources Division \(https://www.nps.gov/orgs/1088/index.htm\)](https://www.nps.gov/orgs/1088/index.htm) and many parks work with National and International geoconservation communities to ensure that NPS abiotic resources are managed using the highest standards and best practices available.

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