



Fact Sheet Compiled in 2023

Geologic Resources Inventory Fact Sheet

The Geologic Resources Inventory provides geologic map data, a written report, a map poster, and pertinent information to support resource management and science-informed decision making. The report was completed in 2009; the map and poster were updated in 2020 and 2023, respectively. The report is still relevant to the newer, more detailed map.

Scan QR code for
access to the full
report, map poster,
and GIS data



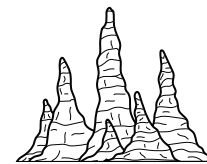
<https://irma.nps.gov/DataStore/SavedSearch/Profile/2908>

Jewel Cave is...

- A spectacular void known for its length, complexity, levels, and speleothems (cave formations/secondary deposits of minerals).
- The fifth longest cave in the world. As of 16 January 2023, 346.09 km (217.32 mi) of cave passages had been discovered, mapped, and surveyed.
- Filled with abundant “jewels” (calcite crystals).
- The deepest cave in the Black Hills. Jewel Cave is 253.6 m (832.1 ft) below the surface at its deepest point.
- The first cave to be designated as a national monument (established 7 February 1908).
- Mostly in the Mississippian Pahasapa Limestone—regionally known as the Madison Limestone—though partly in the overlying basal sandstone of the Pennsylvanian Minnelusa Formation.



Calcite spar.
NPS photo by
Marc Ohms.



Geologic History

The geology in and around Jewel Cave National Monument spans about 350 million years. Primary development (dissolution) of Jewel Cave began about 58 million years ago. Pages 11–12 and 29–30.

Although speleologists are still investigating the main cause of cave genesis, the overall geologic history of the monument is as follows:

- 350 million years ago: The Pahasapa Limestone is deposited in a shallow sea. During high rates of evaporation and poor circulation, a zone of gypsum and anhydrite (evaporite minerals) forms as part of the limestone.
- 330 million years ago: Dissolution of gypsum and anhydrite creates voids into which overlying rock collapses, creating a brecciated (composed of rock fragments) zone; calcite replaces gypsum in this zone.
- 320 million–300 million years ago: Lowering of sea level exposes the limestone at the surface.
- 300 million–65 million years ago: The Pahasapa Limestone is deeply buried by sediments, starting with the overlying Minnelusa Formation. Calcite lines preexisting voids (not filled with sediment) in the limestone.
- 80 million–50 million years ago: The modern Rocky Mountains rise during the Laramide Orogeny, ending marine conditions.
- 58 million–54 million years ago: Uplift of the Black Hills takes place as part of the Laramide Orogeny. Thermally rising groundwater moves through the bedrock. Primary cave development takes place under phreatic (saturated) conditions. At the surface, canyons are forming in the Pahasapa Limestone.
- 2.5 million years ago: Calcite “jewels” (spar) line the cave. Notable layers of subaqueous manganese also form.
- 500,000–300,000 years ago: Drainage of Jewel Cave takes place. Formation of a wide variety of speleothems, including fragile gypsum forms and flowstone, begins.



Speleothems in Jewel Cave Pages 11–12

- Balloons (round, thin-walled, filled with gas)
- Boxwork (fins and plates protrude in relief; resembles a cluster of post-office boxes)
- Conulites (cup-shaped)
- Coralloides (knobby, nodular, or coral-like)
- Draperies or cave bacon (thin, translucent with parallel color banding)
- Fibrous speleothems (e.g., beards, cotton, hairs, and needles)
- Flowers (grow from a base with “petals” radiating outward)
- Frostwork (needlelike crystals)
- Helictites (twisted and wormlike)
- Pearls (polished and spheroidal; form in cave pools)
- Rafts (thin, planar slabs that float in cave pools)
- Scintillates (similar to helictites but encrusted with crystals)
- Vents and rims (openings with projecting rims of calcite)
- Spar (faceted calcite crystals)
- Stalactites (form on the ceiling as water drips)
- Stalagmites (form on the floor as water drips)

Geologic Resource Management Issues

Airflow

Airflow has been the most valuable tool for discovering new passages in Jewel Cave. The addition and modification of cave openings change airflow, which alters temperature and relative humidity, and, in turn, affects speleothem growth. *Page 5.*

Cave Protection

Trail development and associated visitor use adversely affect the cave environment. Algae grow around the lights that line developed cave passages, and lint and other particulates are brought in by thousands of visitors annually. These degrade the cave’s appearance, provide a food source for opportunistic organisms, and dissolve cave surfaces. *Page 6.*

Hydrology

“Open communication” between the surface and subsurface via groundwater contributes to Jewel Cave’s vulnerability. Studies using dye traces show direct surface–cave conduits and a residence time of as much as three years. *Pages 6–7.*

Land Use and Surface Development

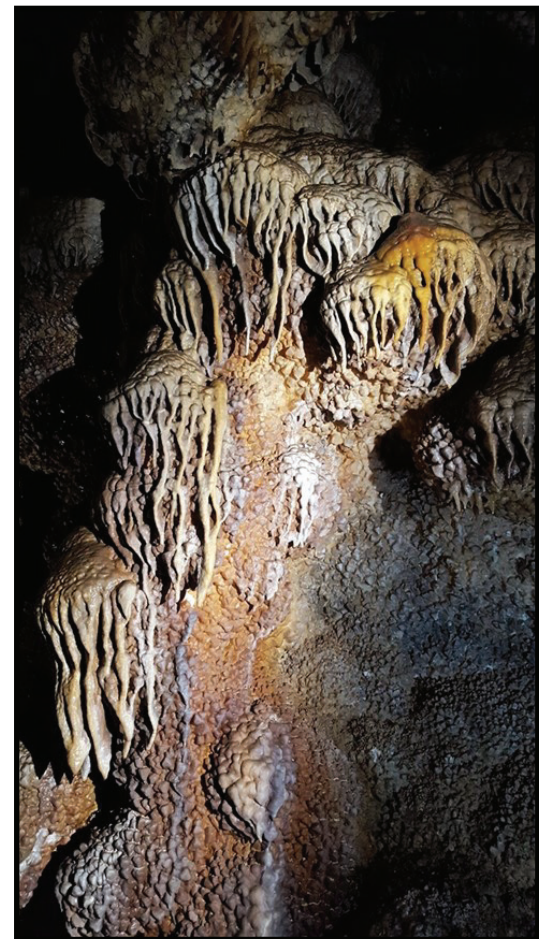
More than 40% of the known cave exists outside the boundaries of the monument; knowing where the cave is in relation to surface features is imperative for continued cave protection. Within the monument, roads, a paved parking lot, buildings, water and sewer systems, underground fuel-storage tanks, sod, and timber harvest all contribute to modifications in the cave system, including drainage, infiltration patterns, and exposure to pollutants. *Page 7.*

Radon

Caves are “traps” for the radioactive gas radon. Human exposure to radon results in an increased risk of developing lung cancer. At the current levels of use, however, the exposure to radon is minor for visitors, as well as for interpreters who regularly lead cave tours and resource managers who spend extended periods underground. *Pages 8–9.*

Geologic Hazards

Two areas in the monument have been investigated for rockfall—the landing at the bottom of the elevator shaft in the Target Room and the historic entrance. One area has been investigated for landslides—the uphill side of Highway 16 in Hell Canyon. Failure is not considered imminent at any of these locations. *Pages 9–10.*



Speleothems. NPS photo by B. Block.