



The Palisades at Sheep Creek Canyon Geological Area—A Geosite in the Uinta Mountains, Daggett County, Utah

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M. Milligan, R.F. Biek, P. Inkenbrandt, and P. Nielsen, editors



Cover Image: Panoramic view of the Palisades as seen from the Sheep Creek Canyon Geological Area overlook.



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Utah Geosites showcases some of Utah's spectacular geology, both little-known localities and sites seen by visitors to Utah's many national and state parks and monuments. The geosites reflect the interests of the many volunteers who wrote to share some of their favorite geologic sites. The list is eclectic and far from complete, and we hope that additional geosites will be added in the coming years. The Utah Geological Survey also maintains a list of geosites <https://geology.utah.gov/apps/geosights/index.htm>.

We thank the many authors for their geosite contributions, Utah Geological Association members who make annual UGA publications possible, and the American Association of Petroleum Geologists—Rocky Mountain Section Foundation for a generous grant for desktop publishing of these geosite papers.

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PRESIDENTS MESSAGE

I have had the pleasure of working with many different geologists from all around the world. As I have traveled around Utah for work and pleasure, many times I have observed vehicles parked alongside the road with many people climbing around an outcrop or walking up a trail in a canyon. Whether these people are from Utah or from another state or country, they all are quick to mention to me how wonderful our geology is here in Utah.

Utah is at the junction of several different geological provinces. We have the Basin and Range to the west and the Central Utah Hingeline and Thrust Belt down the middle. The Uinta Mountains have outcrops of some of the oldest sedimentary rock in Utah. Utah also has its share of young cinder cones and basaltic lava flows, and ancient laccoliths, stratovolcanoes, and plutonic rocks. The general public comes to Utah to experience our wonderful scenic geology throughout our state and national parks. Driving between our national and state parks is a breathtaking experience.

The “Utah Geosites” has been a great undertaking by many people. I wanted to involve as many people as we could in preparing this guidebook. We have had great response from authors that visit or work here in the state. Several authors have more than one site that they consider unique and want to share with the rest of us. I wanted to make the guidebook usable by geologists wanting to see outcrops and to the informed general public. The articles are well written and the editorial work on this guidebook has been top quality.

I would like to personally thank Mark Milligan, Bob Biek, and Paul Inkenbrandt for their editorial work on this guidebook. This guidebook could not have happened without their support. I would like to thank Jenny Erickson for doing the great desktop publishing and the many authors and reviewers that helped prepare the articles. Your work has been outstanding and will certainly showcase the many great places and geology of Utah. Last, but not least, Thank you to the American Association of Petroleum Geologists, Rocky Mountain Section Foundation for their financial support for this publication.

Guidebook 48 will hopefully be a dynamic document with the potential to add additional “geosites” in the future. I hope more authors will volunteer articles on their favorite sites. I would like to fill the map with locations so that a person or family looking at the map or articles will see a great location to read about and visit. Enjoy Guidebook 48 and enjoy the geology of Utah.

Peter J. Nielsen
2019 UGA President

ABSTRACT

The Palisades is an impressive ridge within the Sheep Creek Canyon Geological Area—an area nestled on the north flank of the eastern Uinta Mountains not far from Flaming Gorge National Recreation Area. Sheep Creek cuts through the Palisades, as well as the heart of the geological area, to reveal about 800 million years of geology, from ancient environments to the rise and ultimate erosion of the Uinta Mountains. The oldest rocks exposed at the Palisades comprise the upper part of the Neoproterozoic (about 770 million years ago) Uinta Mountain Group, which have been thrust upon the Mississippian (about 350 million years ago) Deseret Limestone (equivalent to the upper Madison Limestone). That thrust fault and others exposed along the north and south sides of the Palisades are part of the Uinta thrust fault zone, which is responsible for intense folding of both formations. Although the uplift of the Uinta Mountains and related deformation along the Uinta fault zone set the stage for development of the Palisades, it was erosion that revealed and shaped this spectacular feature.

INTRODUCTION

The Palisades is an impressive natural rampart of contorted and contrasting reddish- and grayish-colored rocks through which Sheep Creek has cut a narrow gash. Rising at least 1200 feet (370

m) above the creek bottom, the Palisades reveal an important part of the geologic history of the Uinta Mountains, from ancient landscapes to the upheaval that formed the mountain range. Arguably, it is the showcase geologic feature within the Sheep Creek Canyon Geological Area. The Palisades location coordinates are: N 40° 54' 24.07" latitude, W 109° 47' 49.45" longitude, WGS84; 40.906686°, -109.797070°.

The U.S. Forest Service designated nearly 3600 acres (1460 hectares) of land as the Sheep Creek Canyon Geological Area on May 13, 1962, to preserve the spectacular geology of the canyon for future generations (Schell, 1969). This remarkable area is located on the north flank of the Uinta Mountains in west Daggett County, Utah, and is part of the Sheep Creek drainage west of and discharging into Flaming Gorge Reservoir (figure 1). The elevation within the Sheep Creek Canyon Geological Area drops from about 9000 feet (2700 m) along a ridge in the southwest part of the geological area to 6400 feet (1950 m) in the northeast part of the area where Sheep Creek enters the broader, alluviated valley in the lower part of Sheep Creek Canyon. The peaks in the eastern Uintas are generally below 10,000 feet (3000 m) in elevation, 3000 to 4000 feet (900–1200 m) lower than the high peaks of the west part of the range, due to extensional faulting that occurred during the past 25 million years (Sprinkel, 2014), but are still impressive. One

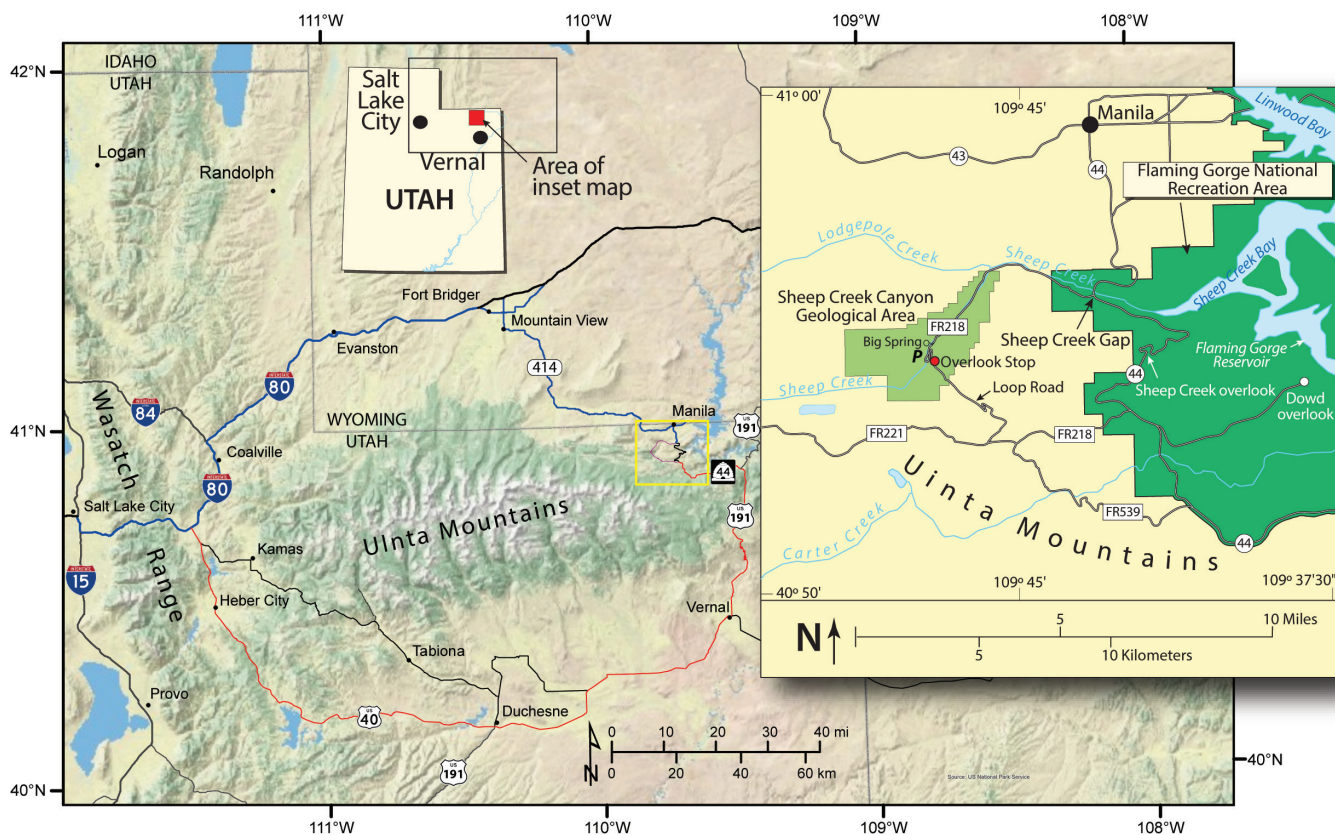


Figure 1. Color-relief map of northeast Utah and southwest Wyoming showing the two routes to the Palisades geosite within the Sheep Creek Canyon Geological Area. The shortest route from Salt Lake City, Utah, in blue, is by traveling through southwest Wyoming. The longer route, in red, is by traveling through northeast Utah. The inset map shows the location of the Sheep Creek Canyon Geological Area and main roads. The P on the inset map shows the approximate center of the Palisades.

paved road, with small sections being graded gravel, goes through the geological area to form a loop that connects Utah State Road 44 (SR 44) near Dowd Spring on the south with Sheep Creek Gap on the north.

When and by whom the name “Palisades” was first applied to this impressive feature is unclear. However, the name “Palisades” was used in a 1969 publication by Schell (1969), but it is not recognized by the United States Board of Geographic Names. However, Palisades Campground, located near the foot of the Palisades, is formally recognized by the Board of Geographic Names and is on the 1963 version of the Jessen Butte 7.5’ quadrangle topographic map. Palisades Campground was later renamed Palisades Memorial Park in honor of the seven lives that were lost in a flash flood (debris flow) that swept through the campground on the night of Wednesday, June 9, 1965 (Dietrich, 1979; Sprinkel and others, 2010). The name “Palisades Memorial Park” is shown on the 1996 version of the Jessen Butte quadrangle and is also recognized by the Board of Geographic Names. The southeast-trending ridgeline south of Sheep Creek is formally named Windy Ridge—that name is shown on the 1963 and subsequent versions of the Jessen Butte quadrangle and is recognized by the Board of Geographic Names.

HOW TO GET THERE

From Salt Lake City, Utah, the Palisades (within the Sheep Creek Canyon Geological Area) can be reached by traveling east on Interstate 80 (I-80) through southwest Wyoming to Manila, Utah, and then south on SR 44. This route is about 190 miles (306 km), or about three hours, from Salt Lake City. The Palisades can also be reached from Salt Lake City by traveling east to Vernal, Utah, on I-80 and U.S. Highway 40 (U.S. 40), north on U.S. 191 along the Flaming Gorge-Uintas National Scenic Byway, and then west on SR 44. This route is about 230 miles (370 km) and will take about 4.5 hours.

Driving the shorter route to the Palisades from Salt Lake City (figure 1)—travel east on I-80 to Fort Bridger, Wyoming (exit 34), then to Mountain View, Wyoming, on Wyoming State Road 414, and finally to Manila, Utah. Note that Wyoming 414 changes to Utah SR 43 at the state line. From Manila, travel south on SR 44 for about 6 miles (10 km) through Sheep Creek Gap and turn west (right) onto paved U.S. Forest Road 218; small section of this road is graded gravel. A sign in Sheep Creek Gap alerts drivers of this intersection. The Palisades is about another 6 miles (10 km) on U.S. Forest Road 218. A good overview of the Palisades is at the Sheep Creek Canyon Geological Area overlook that is past Palisades Memorial Park and at the top of the switchbacks.

Driving the longer route to the Palisades from Salt Lake City (figure 1)—travel east on I-80 to the U.S. 40 exit at Park City, Utah, and travel U.S. 40 east to Vernal, Utah. From Vernal, travel north

about 35 miles (56 km) on U.S. 191 to the intersection with SR 44. Continue straight ahead on SR 44 for about 15 miles (24 km) to the intersection of the Spirit Lake-Browne Lake road (U.S. Forest Road 218). Continue about 7.5 miles (12 km) on U.S. Forest Road 218 to the Sheep Creek Canyon Geological Area overlook.

GEOLOGY OF THE SHEEP CREEK CANYON GEOLOGICAL AREA

Sheep Creek Canyon Geological Area is on the north flank of the eastern Uinta Mountains (figure 1). About 800 million years of geologic history are showcased within the geological area, from the deposition of lower Neoproterozoic sedimentary rocks about 770 to 750 million years ago (Dehler and others, 2007; Rybczynski, 2009; Sprinkel, 2016) to the classic faults and folds of the Laramide orogeny that uplifted the Uinta Mountains about 70 to 34 million years ago (Hansen, 1965; Sprinkel, 2010, 2018a). Ten bedrock formations having a total thickness of about 6600 feet (2000 m) (figure 2) are exposed in northwest-trending bands that dip north-eastward; the oldest rocks are exposed in the south part of the geological area and the bands young to the north (figure 3).

The oldest rocks in Sheep Creek Canyon compose the lower Neoproterozoic formation of Hades Pass of the Uinta Mountain Group. Regionally, this formation is overlain by the Red Pine Shale of the Uinta Mountain Group, which is exposed about 4 miles (6 km) to the west of the Sheep Creek Canyon Geological Area. At the Palisades, however, the Red Pine Shale is faulted out by a fault within the Uinta fault zone, which is described in detail below. The rocks of the Uinta Mountain Group were deposited by marine and non-marine processes from about 770 to 750 million years ago in a faulted basin (Dehler and others, 2005; Dehler and others, 2007; Rybczynski, 2009; Sprinkel, 2010). The basin that accumulated the thick sediments of the Uinta Mountain Group was inverted by uplift before the end of the late Neoproterozoic causing subtle folding, tilting, and erosion of the Neoproterozoic section (Stone, 1993; Sprinkel, 2014, 2018a). The uplift and subsequent erosion formed an irregular topographic surface that affected deposition and distribution of Cambrian Tintic Quartzite and equivalent Lodore Sandstone. Afterwards, the Late Cambrian to Devonian was a prolonged period—about 140 million years—of interspersed deposition and erosion. Erosion prevailed—any sediments deposited during this time were later eroded. It was not until the Mississippian, a quiet time during which much of the western United States was covered by a warm epicontinental sea (Blakey and Ranney, 2008), that sediments were laid down on the unconformable surface and preserved. Marine conditions dominated the rest of the Paleozoic, with a hiatus during Late Pennsylvanian to Early Permian time during which the eolian Weber Sandstone was deposited (figure 2). The youngest formation in the Sheep Creek Canyon Geological Area is the Lower Triassic Dinwoody Formation.

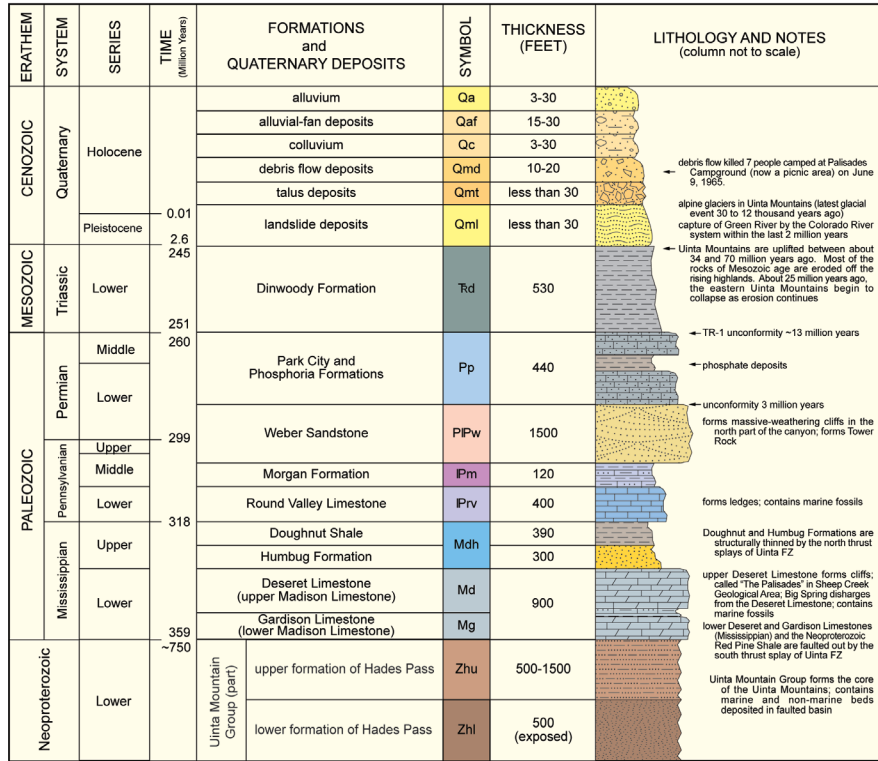


Figure 2. Stratigraphic column of bedrock formations and surficial map units shown in figure 3. The Palisades is a ridge of nearly vertical beds of the Mississippian Deseret Limestone (upper Madison Limestone). The underlying Mississippian Gardison Limestone and Neoproterozoic Red Pine Shale are faulted out at the Palisades by the south splay of the Uinta fault zone (FZ).

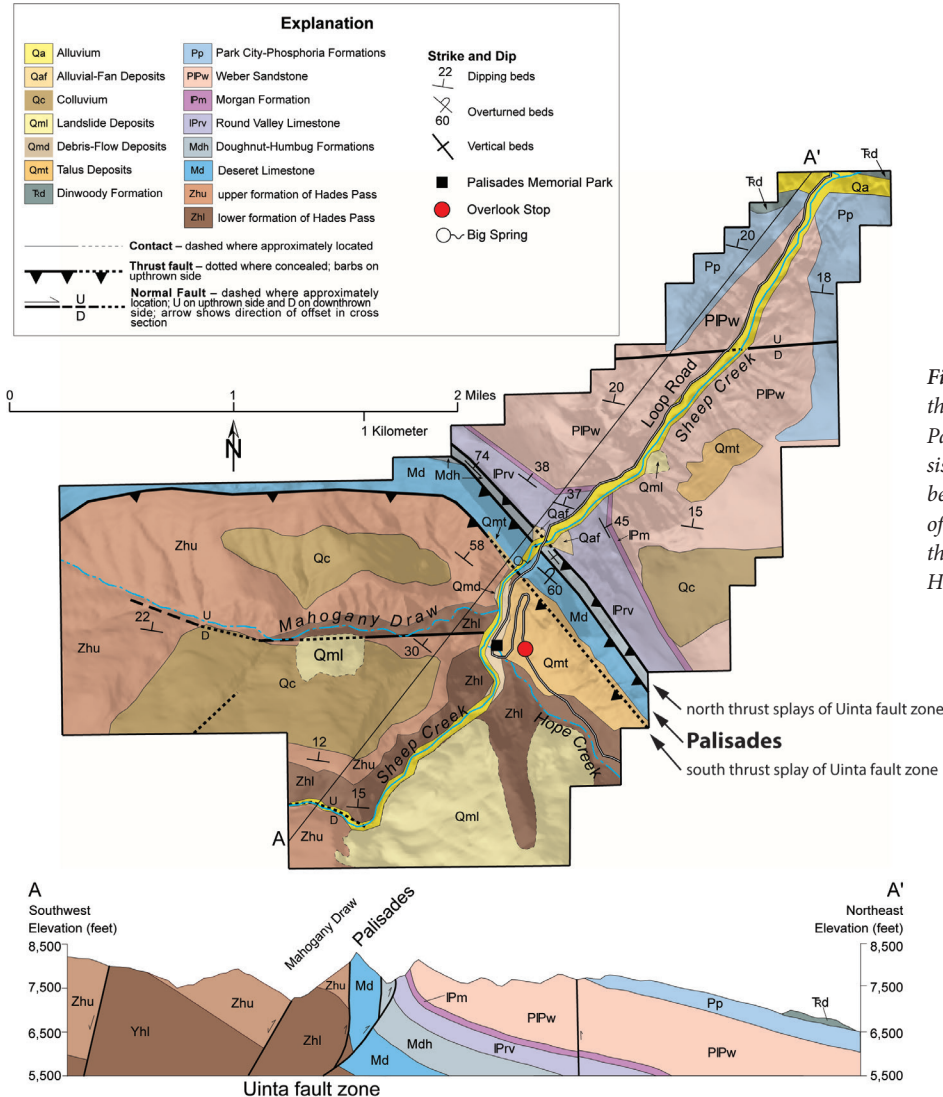


Figure 3. Geologic map and cross section of the Sheep Creek Canyon Geological Area. The Palisades is a structurally thinned sliver of Mississippian Deseret Limestone that is sandwiched between splays of the Uinta fault zone. A set of faults that are part of the hanging wall of the Uinta fault zone displaces the formation of Hades Pass down to the south.

The Uinta Mountains rose along several segmented fault zones along the north and south flanks of the range during latest Cretaceous to early Tertiary time (70 to 34 Ma). Precambrian, Paleozoic, and Mesozoic rocks were uplifted, tilted steeply northward, folded into monoclines, and faulted (Hansen, 1965; Stone, 1993; Sprinkel, 2010; Sprinkel and others, 2010). About 18,000 to 25,000 feet (5500–7600 m) of rock was eroded from the rising highlands, eventually exposing the Precambrian core of the Uinta Mountains. The landscape and drainage system of the eastern Uinta Mountains, which includes Sheep Creek Canyon, continued to change as the Gilbert Peak erosion surface formed early in the Oligocene during a time of relatively regional stability and planation (Hansen, 1986). The erosion surface and the generally coextensive Oligocene Bishop Conglomerate was later faulted and tilted during Miocene extension, beginning as early as about 25 million years ago (Aslan and others, 2017). This extensional faulting resulted in the structural collapse of the eastern Uinta Mountains that caused the reorganization of streams and rivers (Hansen, 1986; Aslan and others, 2017). Renewed uplift of the Colorado Plateau during Basin and Range extension that began about 20 million years ago, and continues today, rejuvenated the upper Colorado River Basin and caused deep canyon cutting and active headward erosion of many creek and rivers in the Uinta Mountains.

GEOLOGIC DESCRIPTION OF THE PALISADES

The ridge of brownish-gray rocks that form the Palisades consists of Mississippian-age limestone and dolomite beds called the Madison Limestone, with only the upper part of the formation

present because of faulting (Schell, 1969; Sprinkel, 2006; Sprinkel and others, in revision). About 4 miles (6 km) west of the Palisades at Sheep Creek, Schell (1969) indicated that the Madison is thicker and can be subdivided into a lower, thin-bedded unit of mostly limestone and an upper, thick-bedded to massive brecciated limestone and dolomite with brownish-gray chert. Caves and sinkholes are common karst features in the upper Madison caused by the dissolution of the limestone and dolomite beds that result in a complex groundwater network. Water from Big Spring gushes from caves located near the base of the Palisades into Sheep Creek (see discussion of Big Spring near the end of this article).

Continuing stratigraphic work and geologic mapping in the Uinta Mountains indicate that the lower Madison correlates to the Gardison Limestone and the upper Madison correlates to the Deseret Limestone of the Wasatch Range to the west on the basis of similar lithologies and stratigraphy (Sprinkel and others, in revision). The identification of the basal Delle Phosphatic Member of the Deseret Limestone of Sandberg and Gutschick (1984) is key to this correlation. A slope-forming interval that is the Delle Phosphatic Member can be traced from the west part of the Uintas (Sprinkel, 2018b) into the central part of the range (Kinney, 1955; Poduska, 2015); however, this unit thins and becomes predominantly a slope-forming, thin-bedded cherty limestone and dolomite without phosphatic shale. I have chosen to use the terms Gardison and Deseret interchangeably for the Madison Limestone in this article.

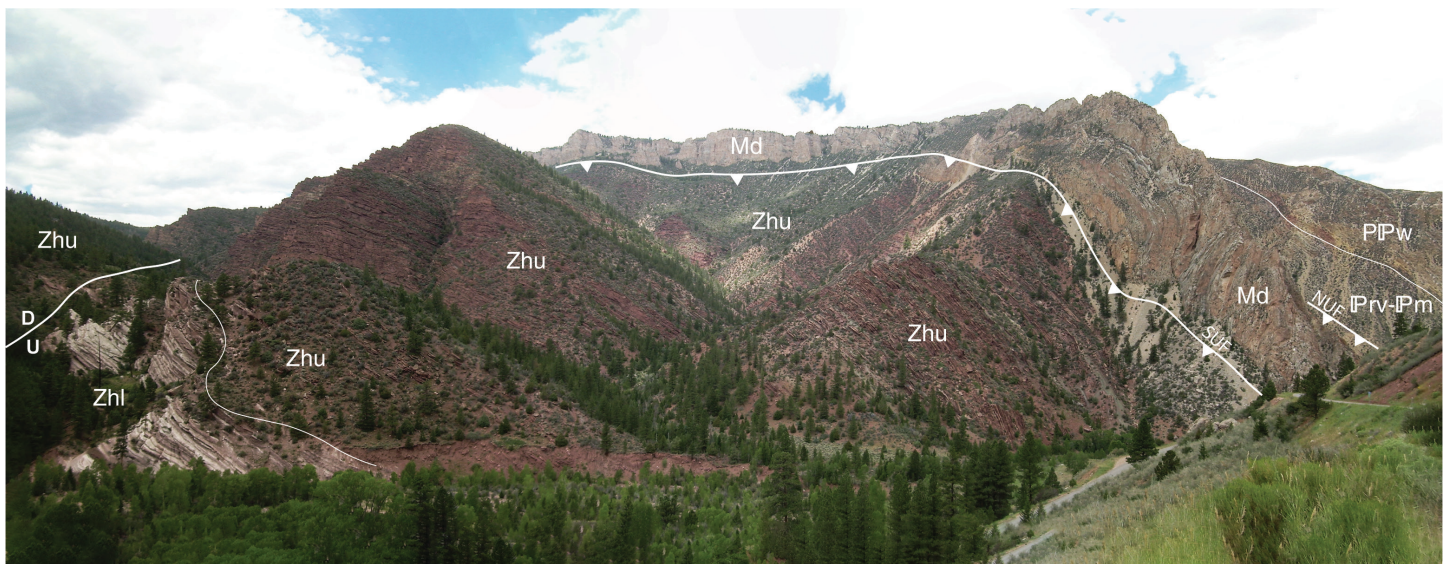


Figure 4. Panoramic view of the Palisades as seen from the Sheep Creek Canyon Geological Area overlook. View is to the northwest. The Palisades is an impressive natural rampart of contorted and contrasting reddish- and grayish-colored rocks through which Sheep Creek has cut a narrow gash. Rising at least 1200 feet (366 m) above the creek bottom, the Palisades reveal an important part of the geologic history of the Uinta Mountains, from ancient landscapes to the upheaval that formed the mountain range. Lines labeled SUF (south thrust splay of Uinta fault zone) and NUF (north thrust splay of Uinta fault zone) are thrust faults with the barbs on the upthrown side. The thick line labeled D (down) and U (up) along the left edge of view is a fault that generally parallels Mahogany Creek. The zone of light-colored rocks at the top of the lower formation of Hades Pass is likely the result of “bleaching” by post-depositional fluids. Zhl – lower formation of Hades Pass, Zhu – upper formation of Hades Pass, Md – Deseret Limestone, IPrv-IPm – Round Valley Limestone and Morgan Formation, PIPw – Weber Sandstone.

The Deseret Limestone forms the Palisades in the Sheep Creek Canyon Geological Area (figure 4). As elsewhere in the Uinta Mountains and the Wasatch Range, the Deseret commonly displays karst features and springs similar to those found at the Palisades. The Deseret bedding attitudes in the Palisades are upright, steeply dipping to the north, to locally vertical and overturned with steep dips to the south (figure 3).

The reddish-colored rocks juxtaposed against the Deseret Limestone on the south side of the Palisades are the lower Neoproterozoic formation of Hades Pass of the Uinta Mountain Group (figure 3). The formation of Hades Pass in this area is informally subdivided into lower and upper parts. The lower Hades Pass is mostly reddish-brown, medium- to coarse-grained, quartz sandstone with lesser amounts of feldspathic sandstone, and typically forms cliffs. The unit also includes some interbeds of reddish-brown siltstone and greenish-gray shale. Sedimentary features preserved in the sandstone beds indicate a fluvial origin (Dehler and others, 2005; Kingsbury-Stewart and others, 2013). An interval of light-colored sandstone beds is conspicuously exposed along Mahogany Draw (figure 4), which may be related to reducing fluids (“bleaching”) associated with the west-trending fault that generally parallels Mahogany Draw (figure 3). However, this interval of light-colored sandstone beds is also found near the top of the lower Hades Pass on the downthrown block above the west-trending segment of Sheep Creek south of Mahogany Draw, which can be traced westward. Thus, the “bleached” interval may be related to Laramide or older post-deposition fluid flow that is unrelated to faulting. The upper Hades Pass is lithologically similar to the lower Hades Pass with reddish-brown quartz and feldspathic sandstone, reddish-brown siltstone, and greenish-gray shale, except (1) the percentage of feldspathic sandstone beds increases relative to quartz sandstone, (2) the amount of interbedded fine-grained beds (siltstone and shale) also increases, and (3) it is thinner bedded forming ledges instead of cliffs.

Structurally, outcrops of the formation of Hades Pass are on the hanging wall (upper plate) of the south thrust splay of the Uinta fault zone, and is up relative to the Deseret Limestone (figure 3). The formation of Hades Pass is also displaced down-to-the-south by faults along Mahogany Draw and the west-trending segment of Sheep Creek. Beds of the formation of Hades Pass dip north 12° to 15° at the south end of the geological area but increase in dip to 58° northeast approaching the Palisades (figure 3), and ultimately become nearly vertical to locally overturned (figure 5).

The formations immediately north of the Palisades represent the normal stratigraphic succession of the overlying Mississippian Humbug Formation to the Pennsylvanian-Permian Weber Sandstone; however, the Humbug and Doughnut Formations and, to some degree, the Round Valley Limestone, are structurally

complicated because of thrust faults in the north part of the Uinta fault zone (figure 6). The Deseret Limestone appears to be faulted against the Humbug Formation, which steeply tilted the beds 74° northeast to vertical and overturned. Another thrust splay is in the Doughnut Formation, but bedding attitudes are uncertain because exposures are poor. All formations are structurally thinned. Bedding is upright and attitudes become gentler northward and away from the Uinta fault zone, ranging from 37° northeast nearest the fault zone to 18° north-northeast near the north boundary of the geological area (figure 3).



Figure 5. The south thrust splay of the Uinta fault zone (barbs on the upthrown side of thrust fault) on the south side of the Palisades placed the upper formation of Hades Pass (Zhu) up against the Deseret Limestone (Md) or upper Madison Limestone. Beds of the formation of Hades Pass and the Deseret Limestone are steeply dipping upright to vertical and overturned. The arrowhead on the white lines (representing strike) indicates the direction of bed tops. View is to the west.

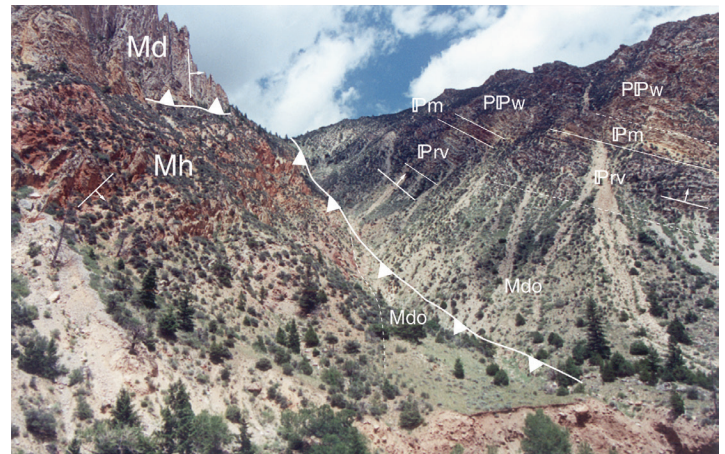


Figure 6. The two thrust splays of the Uinta fault zone (barbs on the upthrown side of thrust fault) on the north side of the Palisades steeply tilts and structurally thins the formations involved in the faulting. Bedding in the footwall is not as steep, becoming gentler away from (to the right) the thrust fault in the drainage (also see the cross section in figure 3). The arrowheads on the white lines (representing strike) indicate the direction of bed tops. Thin solid lines indicate formation contacts; dashed lines indicate where contact is approximately located. View is to the northwest. Md – Deseret Limestone, Mh – Humbug Formation, Mdo – Doughnut Formation, IPrv – Round Valley Limestone, IPm – Morgan Formation, PIPw – Weber Sandstone.

The Uinta fault propagates at depth and resurfaces west of the Sheep Creek Canyon Geological Area where much of the Red Pine Shale is faulted out. Stratigraphic throw on the Uinta fault increases eastward through the geological area. Schell (1969) estimated about 1000 feet (300 m) of stratigraphic throw along the Palisades, but my estimate is about 2600 feet (800 m) because the Red Pine Shale, the Gardison Limestone (lower Madison), and lowermost part of the Deseret Limestone (upper Madison) are faulted out. Stratigraphic throw continues to increase eastward as the Paleoproterozoic Red Creek Quartzite is thrust upon the Paleocene-Eocene Wasatch Formation (Hansen, 1965; Sprinkel, 2006). Hansen (1965) estimated as much as 34,000 feet (10,300 m) of stratigraphic throw along the Uinta fault zone in Flaming Gorge National Recreation Area; however, it may be only about 26,000 to 28,000 feet (8000–8600 m) because the Uinta Mountain Group is likely only 16,000 to 18,000 feet (4900–5500 m) thick (Sprinkel and Waanders, 2005), less than the estimated thickness of 24,000 feet (7300 m) by Hansen (1965).

How and when did the Palisades form?

The Palisades' spectacular scenery results from the combination of movement on the Uinta fault zone and differential erosion of the Deseret Limestone. The deformation along the Uinta fault zone is associated with uplift of the Uinta Mountains, which occurred during a Laramide mountain-building event that began about 70 million years ago and ended about 34 million years ago (Sprinkel, 2018a, 2018b). Upward movement along the south thrust splay of the Uinta fault zone placed the reddish-colored formation of Hades Pass up against the Deseret Limestone and folded rocks on both sides of the fault as reflected in the steeply dipping to overturned beds. Additional upward movement on the two north thrust splays structurally thinned involved formations and increased the dips on the entire hanging wall of the Uinta fault zone. As a result, the faults sandwiched the resistant Deseret Limestone between less-resistant formations.

Erosion of the stratigraphic section by a network of streams began as the mountain range was uplifted. Erosion continued to remove formations as streams cut deeper into older rocks even after uplift stopped. However, rocks are not removed evenly. Less-resistant rocks tend to erode faster, leaving more-resistant rocks standing relatively higher. The Palisades is an example of differential erosion where the less-resistant formation of Hades Pass on the south and the Humbug-Doughnut Formations on the north eroded more easily than the resistant Deseret Limestone. The steeply dipping beds also played a role in forming a knife-edge ridge of Deseret Limestone. The contorted and contrasting colored beds of the formations in the Palisades area creates an impressive view.

BIG SPRING

As noted previously, Big Spring is located at the base of the Palisades along the Sheep Creek Canyon loop road (figure 1). The spring is part of a karst system developed within the Deseret Limestone (upper Madison Limestone) and is one of many similar springs that occur in the Uinta Mountains. Like other karst springs, the source of the water for Big Spring is snowmelt and rain that feeds streams which disappear underground through fractures and sinkholes at the surface. The groundwater generally flows through a network of solution-enlarged fractures and caves to finally emerge at the surface as springs. Water from Big Spring discharges from Sheep Creek Caves and flows down a small talus slope into Sheep Creek (figure 7). The flow rate of Big Spring is not regularly measured but varies depending on snowmelt and the amount of rain received during precipitation events in the drainage basin during the spring. Mundorff (1971) estimated a flow that ranged from less than 5 cubic feet/second (cfs) to at least 36 cfs (0.14–1.0 cms); that equates to about 2244 to 16,158 gallons/minute.

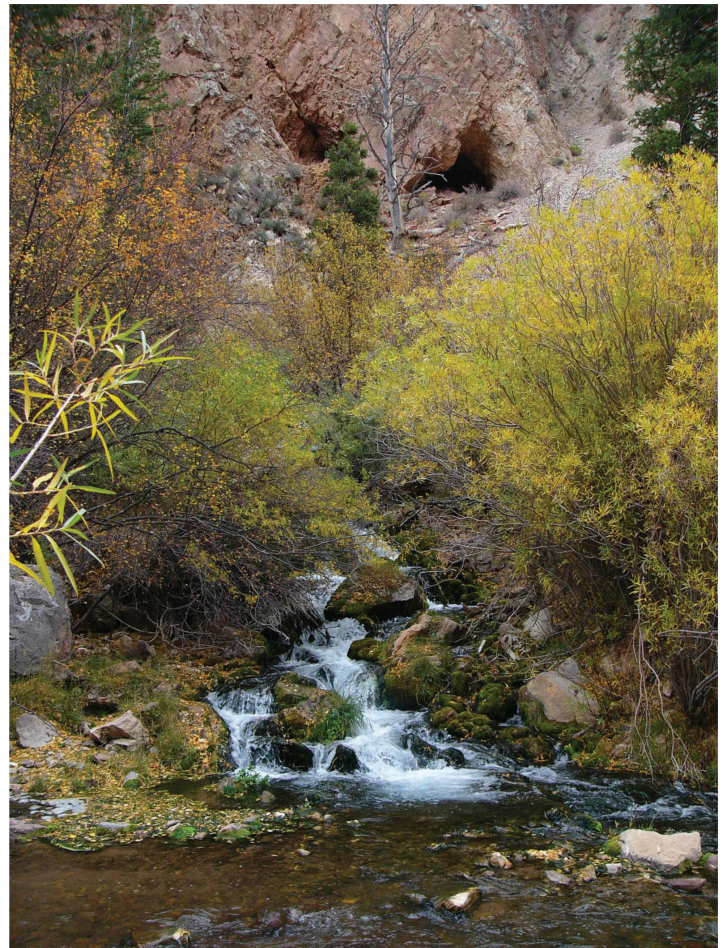


Figure 7. Water from Big Spring (discharge area in the trees at the base of the Palisades) discharges from Sheep Creek Cave, which is in the Deseret Limestone, and flows down a talus slope into Sheep Creek. The cave openings visible in the cliff face likely represent a former springhead (Spangler, 2005). Water from the spring originates, in part, from Lost Creek Sink, more than 14 miles (22.5 km) to the west. View is to the west.

A major source of water for Big Spring is from a sinkhole found at the base of a ridge of Madison Limestone (Deseret Limestone) along Lost Creek about 14 miles (23 km) west of the spring. Dye tracing in 1979 and again in 2001 confirms that one of the sources of water for Big Spring is from Lost Creek, which disappears into Lost Creek sinkhole. This underground system is one of the longest in Utah documented by dye tracing (Spangler, 2005). The Lost Creek sinkhole is at an elevation of about 9100 feet (2800 m) and Big Spring is at an elevation of about 6945 feet (2100 m). Notably, Lost Creek is part of the Burnt Fork drainage and Big Spring is part of the Sheep Creek drainage with a surface hydrologic divide between the two drainages (see figure 3 of Spangler, 2005). The water disappearing into Lost Creek sinkhole flows through a network of fractures and caves within the steeply dipping Deseret Limestone and drops more than 2100 feet (640 m) in elevation before discharging at Big Spring, despite crossing a surface hydrologic divide. Results of the dye-tracing test also indicate that the travel time of water from Lost Creek to the spring is no more than two weeks (Spangler, 2005).

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