

## Black Hills of South Dakota

### Introduction

The Black Hills are a small, isolated mountain range rising from the Great Plains of North America in western South Dakota and extending into Wyoming. Set off from the main body of the Rocky Mountains, the region is something of a geological anomaly—accurately described as an "island of trees in a sea of grass". The Black Hills are home to the tallest peaks of continental North America east of the Rockies, including the highest peak in the Black Hills, Harney Peak at 7,244 feet above sea level. The name "Black Hills" is a translation of the Lakota *Pahá Sápa*. The hills were so-called because of their dark appearance from a distance, as they were covered in trees.

### Formation, Geology, Topography<sup>1</sup>

The formation process that led to the Black Hills began in the Precambrian period, when metamorphic rocks formed at the bottom of a shallow sea 1.6-2.5 billion years ago (before there was any life on earth). At that time, the area that is now western South Dakota was near the edge of the sea, and since there was no plant life to hold the sediment together, erosion operated much faster than it does on earth today. As the sand and clay eroded into the sea and piled up, its own weight formed it into sandstone and shale several miles thick. When sedimentary shale is subject to heat and pressure, it forms schist—one of the predominant forms of rock in the central part of the Black Hills today.

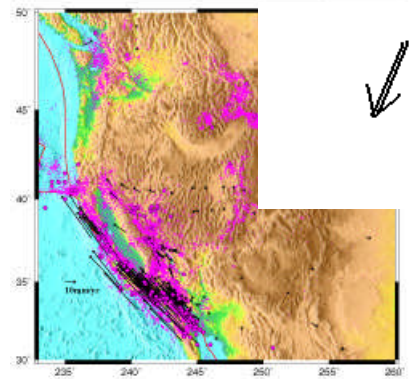
Next, about 1.6 billion years ago, a mass of molten granite rose within the earth and cooled before it reached the surface. Some of it cooled quickly with fine grains (including a large block at the top of Mount Rushmore—an excellent carving medium for the figures of U.S. presidents) and slow-cooling coarse-grained pegmatite. This granite (along with the schist) is the other predominant type of rock in the central Black Hills.

The flanks of the Black Hills are covered with rocks that formed between 100 and 500 million years ago. They have been completely eroded away from the area of the Memorial, but are visible along any of the roads leading to or from the central Black Hills. Most of these rocks are limestone, deposited in shallow seas as millions of sea organisms died and fell to the bottom of the sea, where they were buried and converted into organic sedimentary rock. These formations include the rocks of Wind Cave National Park and Jewel Cave National Monument. During the next several million years, other sedimentary rocks were deposited over the limestone. The next layer above the limestone is red shale, with a layer of slightly harder sandstone on top.

The next important step--the one that formed the Black Hills themselves--occurred starting about 70 million years ago, when the area around the Black Hills started to uplift, as part of the Trans-Hudson Orogeny (mountain-building) that is still going on today to form the central Rocky Mountains. As the Black Hills began to rise--eventually to a maximum height of 15,000 feet above sea level--the softer sedimentary rocks in layers above the crystalline (granite and schist) core began to crack and erode away, leaving the granite/schist core exposed in the central Black Hills. From above, the Black Hills look like a target, with an oval dome and rings of different rock types dipping away from the center.



As a result of this weathering and erosion, the highest areas in the Black Hills are in the central area (blue and gray on the accompanying geology map from 1879), surrounded by a sloping limestone plateau, which in turn is ringed by the lowest (softest, most eroded) red shale "racetrack" (shown in red), which is then ringed by the slightly harder sandstone hogback (shown in green).



1. See the accompanying map for more information about the geological history and formation of the Black Hills.

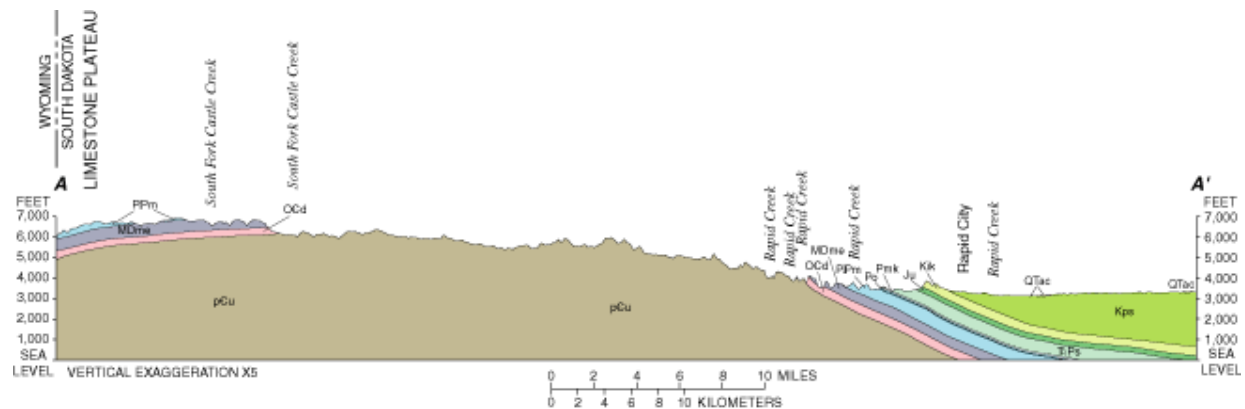
Today, the roads that lead to the central area of the Black Hills (including Mount Rushmore and Harney Peak), traverse the sandstone hogback, cross the low red shale racetrack that rings the limestone plateau, which gives way to the highest (most weather-resistant) granite and schist peaks.

As you can see in the geological map to the right (from the USGS), the material that eroded away the 15,000-foot tall peaks 70 million years ago, leaving today's peaks with a top elevation of about 7,000 feet, washed away to the southeast and formed the Badlands.



## History

Native Americans have a long history in the Black Hills. American Indians have inhabited the area since at least 7000 BC. The Arikara arrived by 1500 AD, followed by the Cheyenne, Crow, Kiowa and Pawnee. The Lakota arrived from Minnesota in the eighteenth century and drove out the other tribes. They claimed the land, which they called *HeSapa* (Black Mountains).

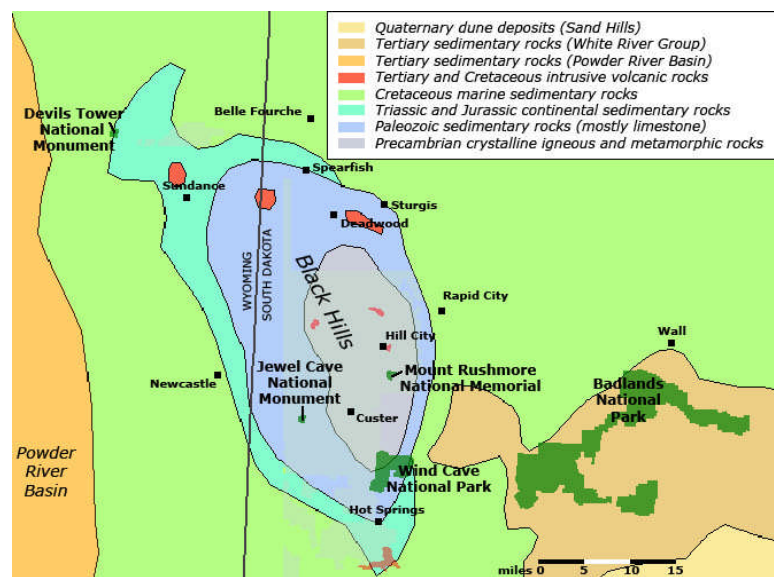


Geologic cross section A-A' (modified from Strobel and others, 1999). Location of section is shown in figure 4. Abbreviations for stratigraphic intervals are explained in figure 3.

Early European-American settlers found *Paha Sapa* (Black Hills or Bluff), easier to pronounce, as the term was less guttural. The mountains commonly became known as the Black Hills. After conquering the Cheyenne in 1776, the Lakota took over the territory of the Black Hills, which became central to their culture. When European Americans discovered gold there in 1874, as a result of George Armstrong Custer's Black Hills Expedition, erstwhile miners swept into the area in a gold rush.

The US government re-assigned the Lakota, against their wishes, to other reservations in western South Dakota. Unlike the rest of the Dakotas, the Black Hills were settled by European

Americans primarily from population centers to the west and south of the region, as miners flocked there from earlier gold boom locations in Colorado and Montana.



After the public discovery of gold in the 1870s, European Americans increasingly encroached on Lakota territory. The conflict over control of the region sparked the Black Hills War, the last major Indian War on the Great Plains. The 1868 Treaty of Fort Laramie had previously confirmed the Lakota's (Teton Sioux) ownership of the mountain range. Both the Sioux and Cheyenne claimed rights to the land, saying that in their culture, it was considered the *axis mundi*, or sacred center of the world.

Following the defeat of the Lakota and their Cheyenne and Arapaho allies in 1876, the United States took control of the region in violation of the Treaty of Fort Laramie. The Lakota never accepted the validity of the US appropriation. They continue to try to reclaim the property.

On July 23, 1980, in *United States v. Sioux Nation of Indians*, the Supreme Court of the United States ruled that the Black Hills were illegally taken and that remuneration of the initial offering price plus interest — nearly \$106 million — be paid. The Lakota refused the settlement, as they wanted the Black Hills returned to them. The money remains in an interest-bearing account, which now amounts to over \$757 million, but the Lakota still refuse to take the money. They believe that accepting the settlement would validate the US theft of their most sacred land.

### Black Hills Gold Rush



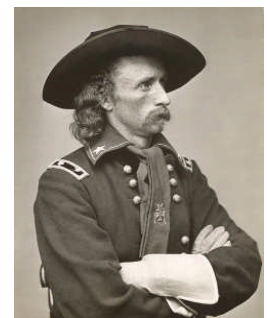
Although rumors of gold in the Black Hills had circulated for decades, it was not until 1874 that Brevet Major General George Armstrong Custer of the 7th US Cavalry led an expedition into the Black Hills in 1874 and discovered gold in French Creek. An official announcement of gold was made by the newspaper reporters accompanying the expedition. The following year, the Newton-Jenney Party conducted the first detailed survey of the Black Hills. The surveyor for the party, Dr. Valentine McGillycuddy, was the first European American to ascend to the top of Harney Peak.

Prospectors found gold in 1874 near present-day Custer, South Dakota, but the deposit turned out to be small. The large placer gold deposits of Deadwood Gulch were discovered in November 1875, and in 1876, thousands of gold-seekers flocked to the new town of Deadwood, although it was still within Indian land.

During the 1875–1878 gold rush, thousands of miners went to the Black Hills; in 1880, the area was the most densely populated part of Dakota Territory. There were three large towns in the Northern Hills: Deadwood, Central City, and Lead. Around these were groups of smaller gold camps, towns, and villages. Hill City and Custer City sprang up in the Southern Hills. Railroads were quickly constructed to the previously remote area. From 1880 on, the gold mines yielded about \$4,000,000 annually, and the silver mines about \$3,000,000 annually.

The Black Hills Gold Rush began in 1874. The first arrivals were a force of one thousand men led by George Armstrong Custer to investigate reports that the area contained gold, even though the land was owned by the Sioux. They found small amounts of gold in present day Custer, South Dakota, and looked for better paying locations. They moved north, establishing the towns of Hill City, Sheridan, and Pactola. At each spot they found flakes of gold, but not the bonanza they sought. Things changed when the miners stumbled across Deadwood and Whitewood Creeks in the northern Black Hills. For the initial discoverers, each spade of earth revealed a veritable fortune in gold.

By 1876, miners had claimed all the land around the creeks. Although all the land was claimed thousands more flocked in, hoping to find a missed spot. The gold the miners found was placer gold, loose gold pieces that were mixed in with the rocks and dirt around streams.



Most good prospectors knew that this placer gold was eroded from hard rock deposits. So while many still flocked to Deadwood, others looked for the hard rocks deposits that were the source of the placer gold. On April 9, 1876 Fred and Moses Manuel, Hank Harney and Alex Engh discovered a gold outcropping near Lead, South Dakota; they claimed their find and named it the



Homestake. They had located the area from which the placer gold in Deadwood Creek had eroded. It was here that men would produce ten percent of the world's gold supply over the next one hundred and twenty five years. Many more prospectors hoped to find another "Homestake" so they continued to look, but the Homestake mine was unique.

The workers crushed the rock to release the gold, concentrated the gold by gravity methods, and then exposed the concentrate to mercury that would amalgamate with the gold. Miners call this kind of gold ore free milling. Gold existed elsewhere in the Black Hills, but it was not in the free milling state. In these conditions, gold was chemically bound to the rock, and very difficult to remove. It was called refractory gold ore. For many years, the Homestake operated as the only major gold mine in the Black Hills. Chlorization and smelting were seen as two methods that could remove gold from the refractory ore in the 1890's. More rock mining regions opened up around Lead and Deadwood because of this discovery.

During the gold rush, "Treasure Coaches" transporting large quantities of the precious metal worth up to \$300,000 on each haul to Cheyenne, Wyoming became a favorite target for road agents. The last recorded hold-up occurred around 3:00 p.m. on September 26, 1878, at the Canyon Springs station, about 35 miles south of Deadwood. The robbers bound and gagged the stableman and lined the stable wall with their guns through cracks between the logs. As the coach approached the station, the desperadoes opened fire. One guard was killed, and two guards were wounded. The chief guard took cover behind a large pine tree, exchanged a few shots with the bandits, and got them to agree to let him go if he would leave the coach with them. After he left, the outlaws tied the driver to one of the coach's wheels, opened the safe with a sledge hammer and chisels, divided the loot, and rode off in different directions. Aroused citizens in the area organized manhunts, and the stage company offered a \$2,500 reward. Several suspects were lynched, others were convicted at trial on various counts, and more than half of the gold was eventually recovered.



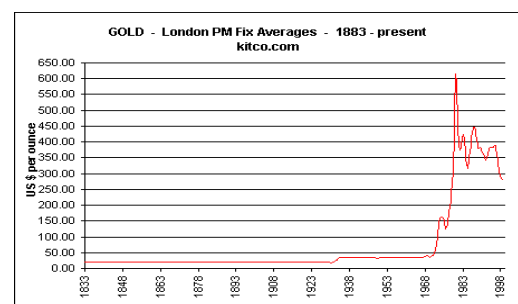
The government fixed the price of gold at \$20.67 per ounce in the 19th century. Many gold mines closed down in the early 20th century because the price of labor and supplies escalated, while the price of gold remained fixed. Only the Homestake could endure it. During the great depression, President Franklin Delano Roosevelt raised the price of gold to \$35 per ounce to help the country's finances. While the country remained in depression the gold industry boomed. At the start of World War II, the government classified gold mining as a non-essential industry, and ordered all gold mines closed. Again only the Homestake could survive.



After President Richard Nixon freed gold from government control the price floated and topped \$800 an ounce in the early 1980s. A new gold rush swept the Black Hills area. All but one gold mine has closed. They either closed down because they ran out of gold ore, or the lower price of gold prevented profits. Even the Homestake gave way to diminishing returns and stopped operations in 2001. Only the Wharf mine near Terry Peak remains in business.

### Mt Rushmore

Mount Rushmore National Memorial is a monumental granite sculpture by Gutzon Borglum (1867–1941), located within the United States Presidential Memorial that represents the first 150 years of the history of the United States with 60-foot sculptures of the heads of former United States



presidents (left to right): George Washington (1732–1799), Thomas Jefferson (1743–1826), Theodore Roosevelt (1858–1919), and Abraham Lincoln (1809–1865).

Originally known to the Lakota Sioux as *Six Grandfathers*, the mountain was renamed after Charles E. Rushmore, a prominent New York lawyer, during an expedition in 1885. At first, the project of carving Rushmore was undertaken to increase tourism in the Black Hills region of South Dakota. After long negotiations involving a Congressional delegation and President Calvin Coolidge, the project received Congressional approval. The carving started in 1927, and ended in 1941 with some injuries and no fatalities.

The carving of Mount Rushmore involved the use of dynamite, followed by the process of "honeycombing". About two million tons of rock were blasted off the mountainside.

As *Six Grandfathers*, the mountain was part of the route that Lakota leader Black Elk took in a spiritual journey that culminated at Harney Peak. Following a series of military campaigns from 1876 to 1877, the United States asserted control over the area, a claim that is still disputed on the basis of the 1868 Treaty of Fort Laramie. Among white American settlers, the peak was known variously as Cougar Mountain, Sugarloaf Mountain, Slaughterhouse Mountain, and Keystone Cliffs. It was named Mount Rushmore during a prospecting expedition by Rushmore, David Swanzy (whose wife Carrie was the sister of author Laura Ingalls Wilder), and Bill Challis.

Historian Doane Robinson conceived the idea for Mount Rushmore in 1923 to promote tourism in South Dakota. In 1924, Robinson persuaded sculptor Gutzon Borglum to travel to the Black Hills region to ensure that the carving could be accomplished. Borglum had been involved in sculpting the Confederate Memorial Carving, a massive bas-relief memorial to Confederate leaders on Stone Mountain in Georgia, but was in disagreement with the officials there.

The original plan was to perform the carvings in granite pillars known as the Needles. However, Borglum realized that the eroded Needles were too thin to support sculpting. He chose Mount Rushmore, a grander location, partly because it faced southeast and enjoyed maximum exposure to the sun. Borglum said upon seeing Mount Rushmore, "America will march along that skyline." Congress authorized the Mount Rushmore National Memorial Commission on March 3, 1925. President Coolidge insisted that along with Washington, two Republicans and one Democrat be portrayed.

### Construction of Mount Rushmore

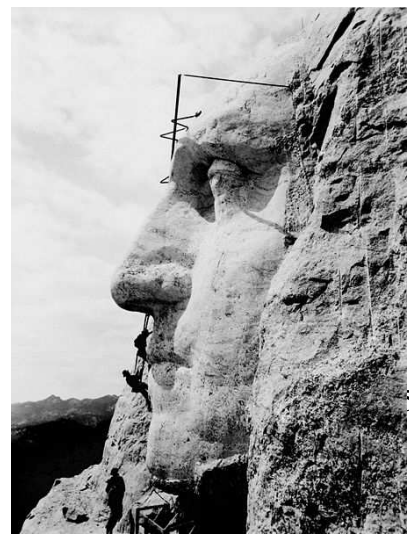
Between October 4, 1927, and October 31, 1941, Gutzon Borglum and 400 workers sculpted the colossal 60-foot (18 m) carvings of U.S. presidents George Washington, Thomas Jefferson, Theodore Roosevelt, and Abraham Lincoln to represent the first 150 years of American history. These presidents were selected by Borglum because of their role in preserving the Republic and expanding its territory.

The image of Thomas Jefferson was originally intended to appear in the area at Washington's right, but after the work there was begun, the rock was found to be unsuitable, so the work on the Jefferson figure was dynamited, and a new figure was sculpted to Washington's left.

In 1933, the National Park Service took Mount Rushmore under its jurisdiction. Engineer Julian Spotts helped with the project by improving its infrastructure. For example, he had the tram upgraded so that it could reach the top of Mount Rushmore for the ease of workers. By July 4, 1934, Washington's face had been completed and was dedicated. The face of Thomas Jefferson was dedicated in 1936, and the face of Abraham Lincoln was dedicated on September 17, 1937.

In 1937, a bill was introduced in Congress to add the head of civil-rights leader Susan B. Anthony, but a rider was passed on an appropriations bill requiring that federal funds be used to finish only those heads that had

already been started at that time. In 1939, the face of Theodore Roosevelt was dedicated.



The Sculptor's Studio—a display of unique plaster models and tools related to the sculpting—was built in 1939 under the direction of Borglum. Borglum died from an embolism in March 1941. His son, Lincoln Borglum, continued the project. Originally, it was planned that the figures would be carved from head to waist, but insufficient funding forced the carving to end. Borglum had also planned a massive panel in the shape of the Louisiana Purchase commemorating in eight-foot-tall gilded letters the Declaration of Independence, U.S. Constitution, Louisiana Purchase, and seven other territorial acquisitions from Alaska to Texas to the Panama Canal Zone.

A model at the site depicting Mount Rushmore's intended final design. Insufficient funding forced the carving to end in October 1941. The entire project cost US\$989,992.32. Notably for a project of such size, no workers died during the carving.

On October 15, 1966, Mount Rushmore was listed on the National Register of Historic Places. An essay from Nebraska student William Andrew Burkett, selected as the winner for the college-age group in 1934, was placed on the Entablature on a bronze plate in 1973. In 1991, President George H. W. Bush officially dedicated Mount Rushmore.

In a canyon behind the carved faces is a chamber, cut only 70 feet into the rock, containing a vault with sixteen porcelain enamel panels. The panels include the text of the Declaration of Independence and the Constitution, biographies of the four presidents and Borglum, and the history of the U.S. The chamber was created as the entranceway to a planned "Hall of Records"; the vault was installed in 1998.

Ten years of redevelopment work culminated with the completion of extensive visitor facilities and sidewalks in 1998, such as a Visitor Center, the Lincoln Borglum Museum, and the Presidential Trail. Maintenance of the memorial annually requires mountain climbers to monitor and seal cracks. The memorial is not cleaned to remove lichens. It has been cleaned only once. On July 8, 2005, Kärcher GmbH, a German manufacturer of cleaning machines, conducted a free cleanup operation; the washing used pressurized water at over 200 °F.

### Hill City, SD

Hill City is known as the "Heart of the Hills" because of its close proximity to both the geographical center of the Black Hills, and the local tourist destinations.

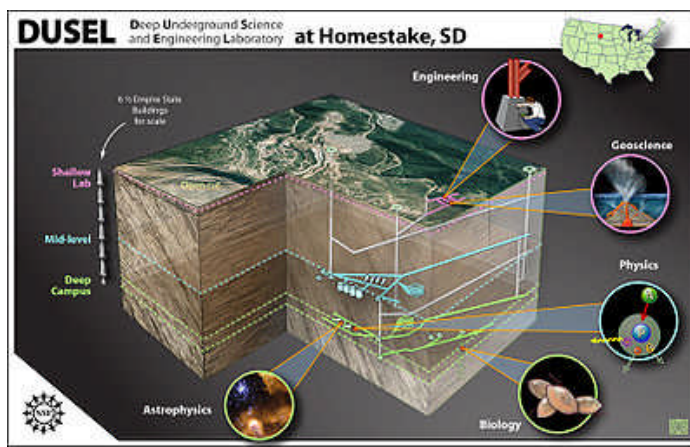
The city has its roots in the Black Hills mining rush of the late 1800s. Tin mining was dominant in the 1880s and led to an influx of capital and people into the area. As the mining industry subsequently waned, tourism and timber became increasingly important to the area. With the establishment of Mount Rushmore in the 1940s, Custer State Park, and the Sturgis Motorcycle Rally, the Black Hills became known as a tourist destination which Hill City benefited from. In recent years the city has diversified to become a center for the arts in the area featuring several art studios and festivals.

### Newcastle, WY

The shortgrass prairie of the High Plains and the Black Hills meet at Newcastle, WY. From here you can lunch on the Canyon Springs Prairie near Custer's 1874 Black Hills route, drive the Cheyenne - Deadwood Stage Trail, or tour the shortgrass prairie's open and unending spaciousness - its sagebrush, ranches, tumbleweeds, antelope, prairie dogs, birds and more - echoing the past under unbelievably clear blue skies.

### Lead, SD (pronounced "lead")

The city was officially founded in July 10, 1876, after the discovery of gold. It is the site of the Homestake Mine, the largest, deepest (8240 feet) and most productive gold mine in the Western Hemisphere before closing in January 2002.



By 1910 Lead had a population of 8,382, making it the second largest town in South Dakota. Lead was originally founded as a company town by the Homestake Mining Company, which ran the nearby Homestake Mine. Phoebe Hearst, wife of one of the principals, was instrumental in making Lead more livable. She



established the Hearst Free Public Library in town, and in 1900 the Hearst Free Kindergarten. She donated regularly to Lead's churches, and provided college scholarships to the children of mine and mill workers.

Lead and the Homestake Mine have been selected as the site of the Deep Underground Science and Engineering Laboratory (DUSEL), a proposed NSF facility for low-background experiments on neutrinos, dark matter, and other nuclear physics topics, as well as biology and mine engineering studies.

In 1974, most of Lead was added to the National Register of Historic Places under the name of the "Lead Historic District." Over four hundred buildings and 580 acres were included in the historic district, which has boundaries roughly equivalent to the city limits.

Two prominent man-made features of Lead's geography are the giant open cut, which was used for surface gold mining by the Homestake Mine, and the resulting ridge nearby built with the non-producing material from the cut.

### **Rapid City, SD**

Rapid City is the second-largest city in the state of South Dakota, and the county seat of Pennington County. Named after the Rapid Creek on which the city is established, it is set against the eastern slope of the Black Hills mountain range. Rapid City had a population of 59,607 at the 2000 census. Rapid City is known as the "Gateway to the Black Hills" and the "Star of the West". The city is divided by a mountain range that splits the western and eastern parts of the city into two.

Rapid City is located on the eastern edge of the Black Hills, and is split in half by the Dakota Hogback. Rapid City's "Westside" is located in the Red Valley between the foothills of the Black Hills proper and the Dakota Hogback, so named for the red Spearfish formation soils and the way the valley completely circles the Black Hills. Rapid City has grown up into the foothills, with both ridges and valleys developed, especially in the last 20 years, and wildfire is a distinct threat to these residential areas, as shown by the Westberry Trails fire in 1988.

Skyline Drive follows the summits of the Dakota Hogback south from near Rapid Gap (where Rapid Creek cuts through the Hogback) to a large high plateau which forms the current south edge of Rapid City. The Central and Eastern portions of Rapid City lie in the wide valley of Rapid Creek outside the Hogback, which includes a number of mesas rising a hundred feet or more above the floodplain.

Rapid Creek flows through Rapid City, emerging from Dark Canyon above Canyon Lake and flowing in a large arc north of Downtown. Rapid Creek descends to the southeast as the valley widens. The floodplain of Rapid Creek is mostly a series of parks, arboretums, and bike trails, one legacy of the Black Hills Flood of 1972. To the north, a series of ridges separates Rapid Creek from Box Elder Creek, with large older and new residential areas and commercial areas along I-90. To the south, the terrain rises more steeply to the southern widening of the Dakota Hogback into a plateau dividing the Rapid Creek drainage from Spring Creek

