



GEOLOGY OF WYOMING

BIGHORN MOUNTAIN BYWAYS PART II



Buffalo Tongue Slide on US 14
Photo by Mark Fisher

Wow Factor *(4 out of 5 stars):*

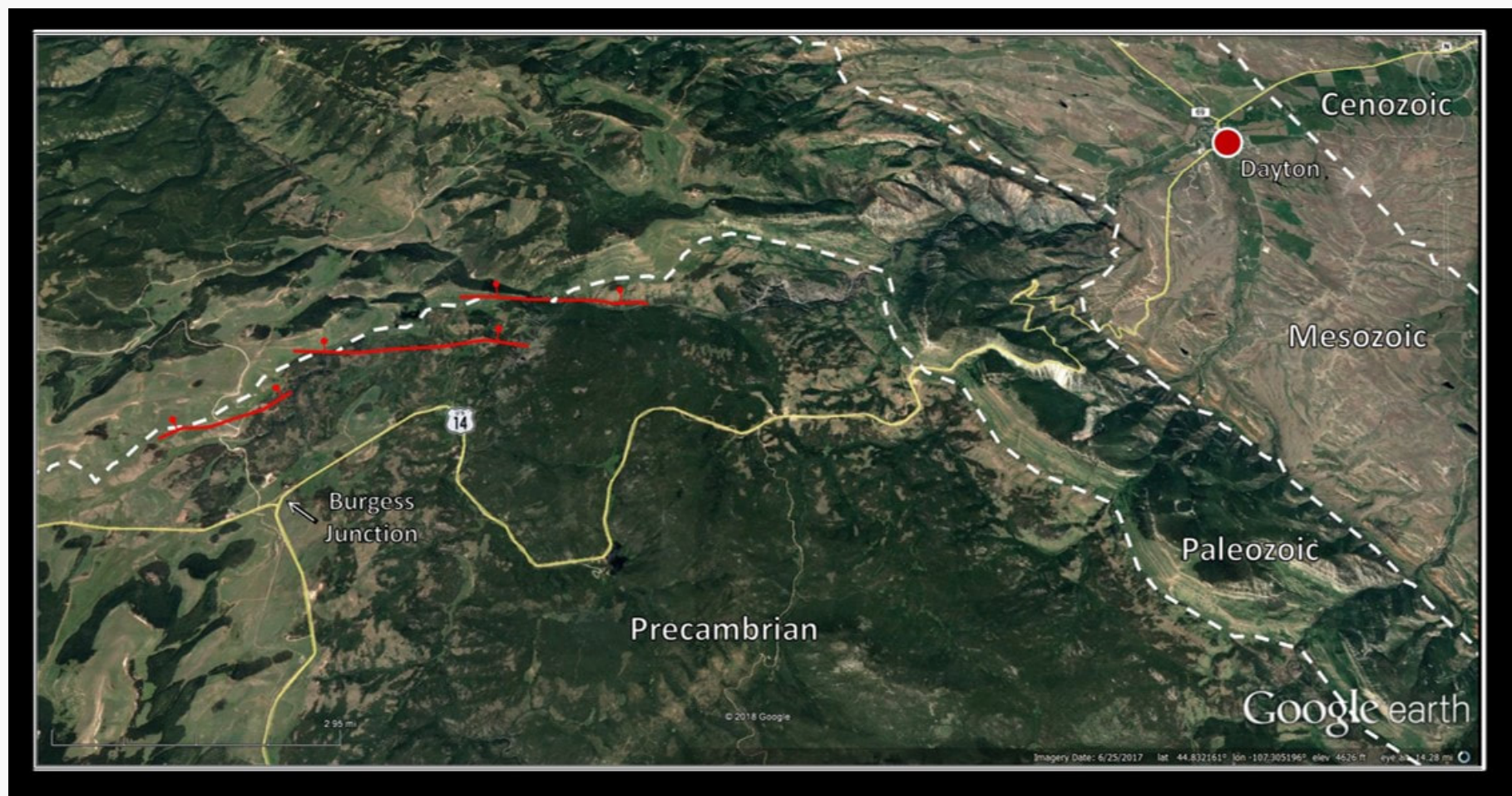


Geologist Factor *(4 out of 5 stars):*



Attraction:

U.S. Highway 14 from Burgess Junction to Dayton travels from the crest of the range down the east flank of the Bighorn Mountains. Scenic drive, hike to Black Mountain Lookout Tower and Tongue River Canyon, remnants of the tie flume, "leopard rock" collecting and views of Fallen City slide.



North aerial view of Bighorn Mountain Byways, Part II from Burgess Junction to Dayton, Wyoming. Ages of rock exposed on the surface are labelled and separated by white dashed lines. Red lines are faults with barbells on downthrown side.

Image; Google Earth, Data: Love, J.D., Christiansen, A.C., and Earle, J.L., 1978, [Preliminary geologic map of the Sheridan 1 degree x 2 degree quadrangle](#), northern Wyoming: U.S. Geological Survey, Open-File Report OF-78-456, scale 1:250,000.

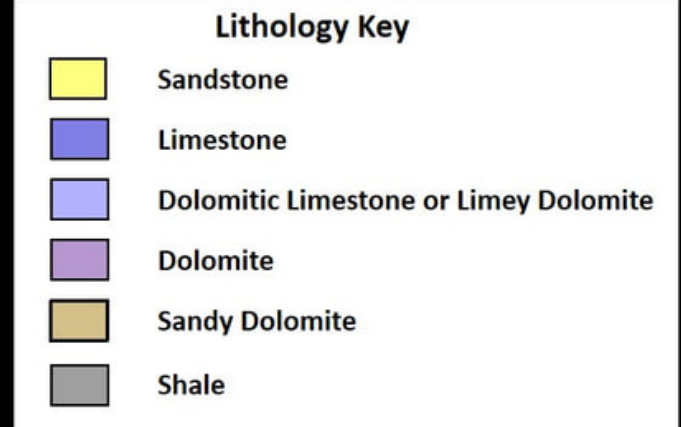
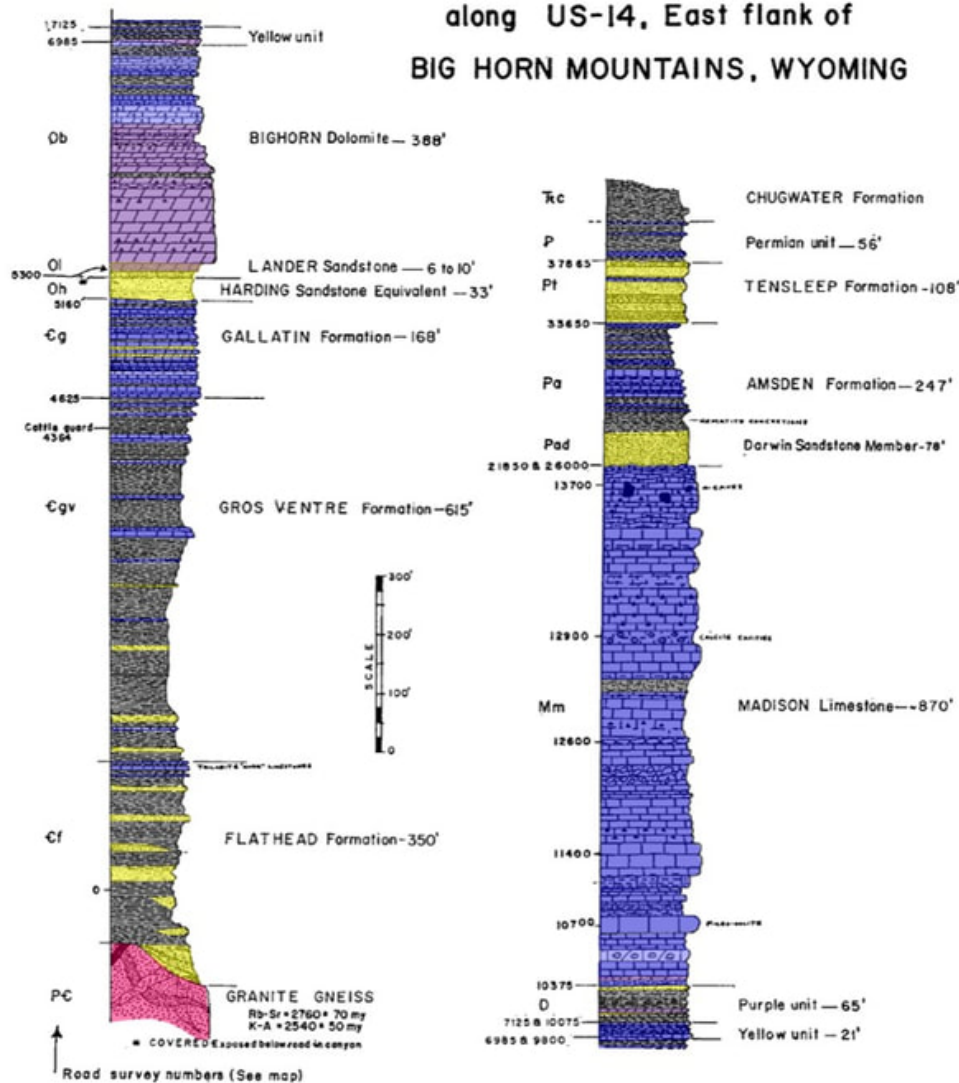
Road Log Bighorn Mountain Byways Part II

This road log is a sequel to [Bighorn Mountain Byways Part I](#). It is edited and compiled from the

Wyoming Geological Association Guidebook of 1990 and a paper by Koucky and Cygan (1963) in the Wyoming Geological Association 18th Annual Field Conference Guidebook, pages 17-25. Interval and cumulative mileages are reported west to east (blue) and east to west (brown) to allow travel in either direction.

| Mileage | | | | Description |
|-----------------|------------|-----------|------------|--|
| W/E | | E/W | | L = Left; R = Right |
| Increment | Cumulative | Increment | Cumulative | Blue = West to East route; Brown = East to West |
| U.S. Highway 14 | | | | |
| 0 | 0 | 0.3 | 24.9 | Burgess Junction (8,040' elevation). U.S. 14 lies on Precambrian basement for the next 13 miles. The exposed Precambrian rocks in the core of the Bighorn Mountains cover approximately 1,100 square miles. Age dating of whole-rock samples of granite and gneiss show an isochron age of 2.85 billion years. This was a period of metamorphism of pre-existing sedimentary and igneous rocks (alteration of units that become greenstone belts). |

GENERALIZED PALEOZOIC SECTION along US-14, East flank of BIG HORN MOUNTAINS, WYOMING



Paleozoic stratigraphic column for US 14 and east flank of Bighorn Mountains.

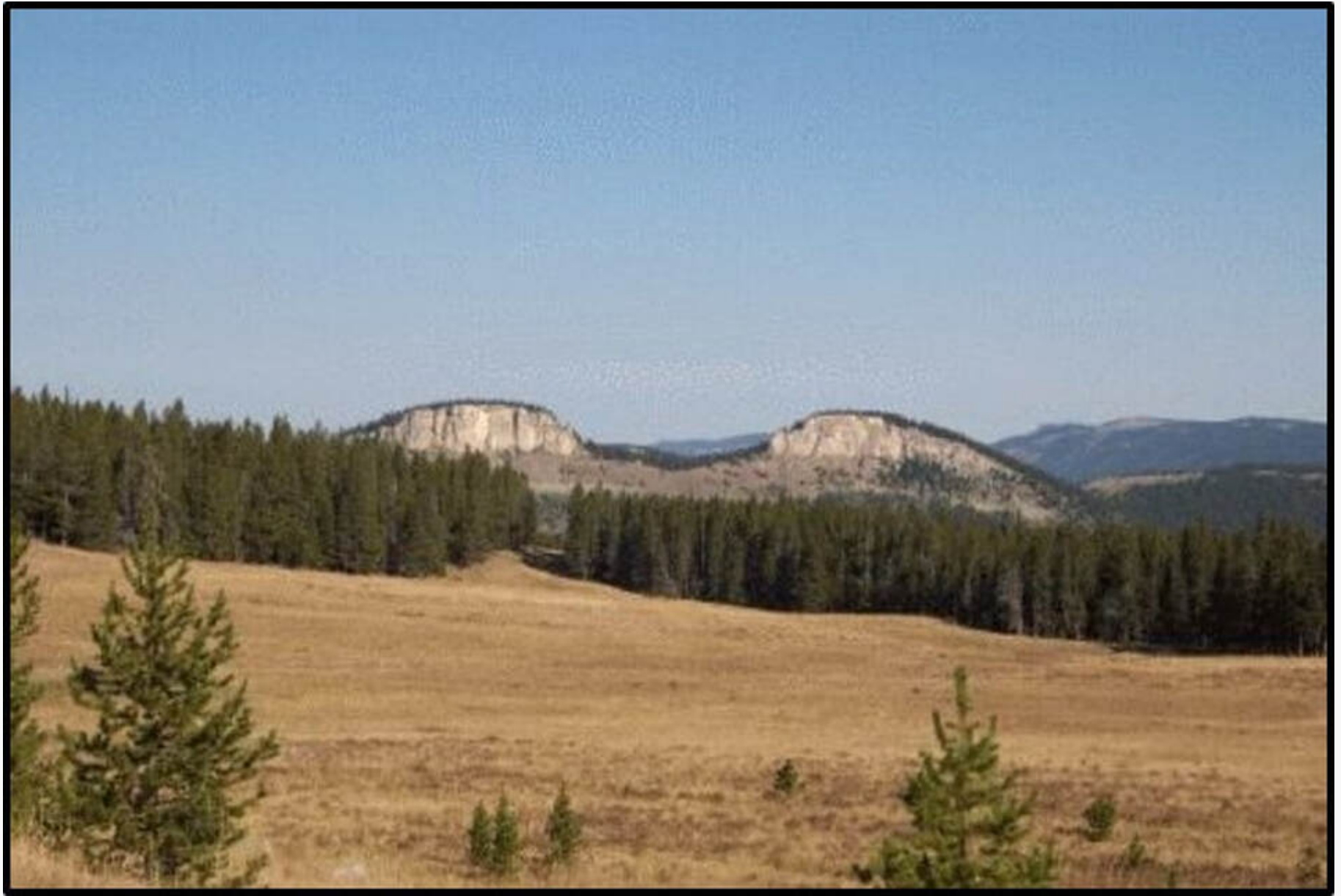
Image: After Koucky, F.L. and Cygan, N.E., 1963, *Paleozoic Rocks Exposed Along U.S. Highway 14 on the East Flank of the Big Horn Mountains, Wyoming*: Wyoming Geological Association 18th Annual Field Conference Guidebook, Fig. 1, p. 18.

| | | | | |
|-----|-----|-----|------|---|
| 0.3 | 0.3 | 1.3 | 24.6 | Burgess RV Dump Station to north (L/R) |
| 1.3 | 1.6 | 1.6 | 23.3 | Burgess Junction Visitor Center to north (L/R). Twin Buttes on skyline with Ordovician Bighorn Dolomite capping the buttes. |



Burgess Junction Visitor's Center

Image: Mark Fisher



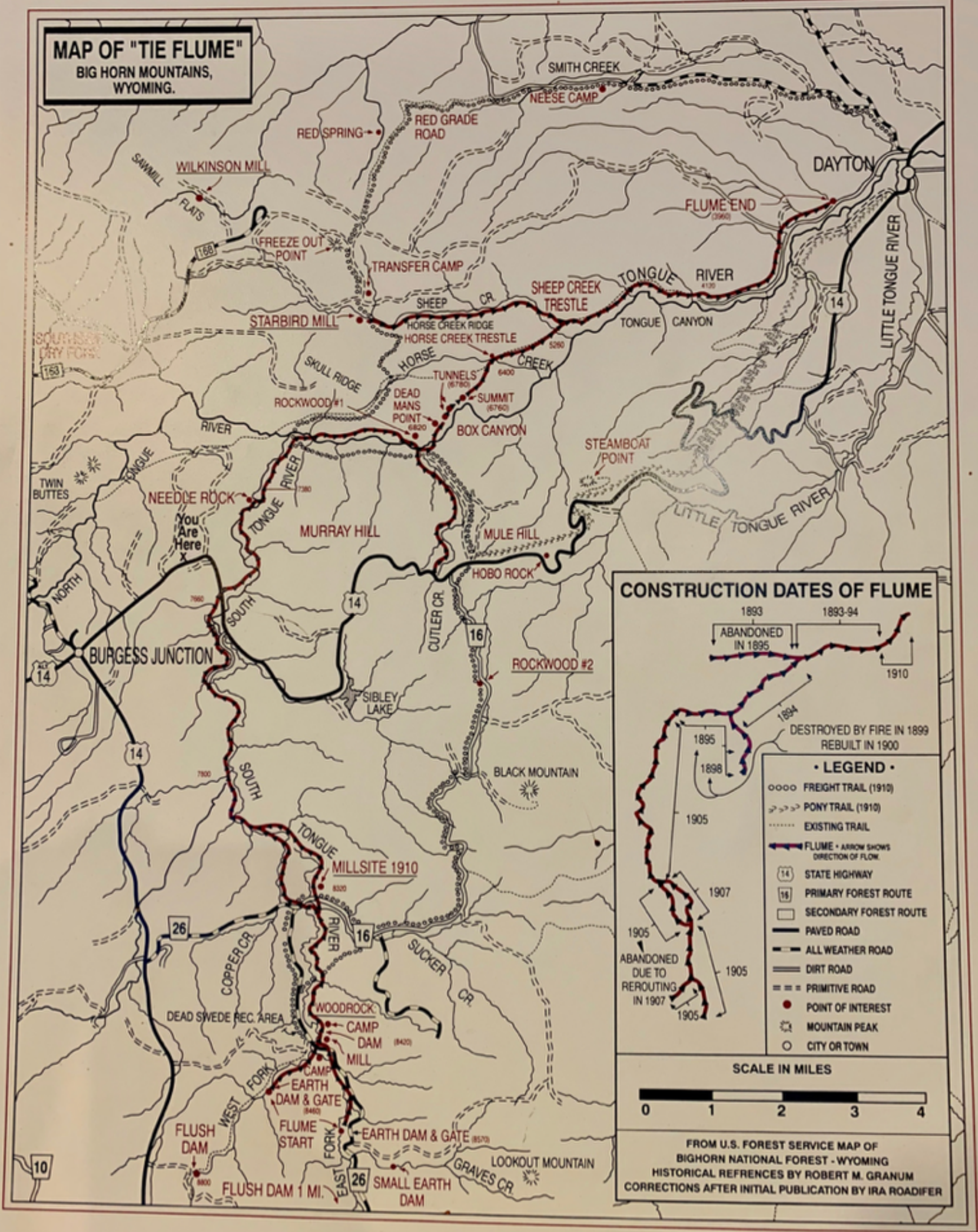
Twin Buttes landmark from Burgess Junction Visitor Center.

Image: <http://www2.onu.edu/~d-sawyers/BighornsWebsite/Part1.html>

| | | | | |
|-----|-----|-----|------|---|
| 1.6 | 3.2 | 0.1 | 21.7 | Arrowhead Lodge to west (R/L). Approximate location of tie flume along the South Tongue River built in 1905 to move railroad ties cut in the mountains to Ranchester. |
| 0.1 | 3.3 | 1.1 | 21.6 | Bridge over South Tongue River and Pine Island Group Area to west (R/L) |
| 1.1 | 4.4 | 1.2 | 20.5 | Camp Bethel to east (L/R). Christian summer camp and retreat center. |
| 1.2 | 5.6 | 0.3 | 19.3 | Sibley Lake Campground and Recreation Area to south (R/L). |
| 0.3 | 5.9 | 0.2 | 19.0 | Sibley Lake to south (R/L). Artificial water body, Prune Creek impounded by dam along northwestern margin. |

MAP OF "TIE FLUME"

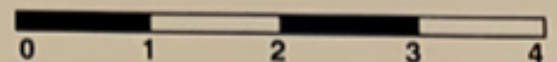
BIG HORN MOUNTAINS,
WYOMING.



CONSTRUCTION DATES OF FLUME



SCALE IN MILES



FROM U.S. FOREST SERVICE MAP OF
BIG HORN NATIONAL FOREST - WYOMING
HISTORICAL REFERENCES BY ROBERT M. GRANUM
CORRECTIONS AFTER INITIAL PUBLICATION BY IRA ROADIFER

tie flumes in the Bighorn Mountains at <https://www.wyohistory.org/encyclopedia/tongue-river-tie-flume>

Image: Map at Forest Service Burgess Junction Visitor Center



Sibley Lake, Wyoming at 7,900-foot elevation. The area offers fishing, hiking, picnicking and campground opportunities. Sibley Lake is named for Lieutenant Frederick W. Sibley who led a calvary scouting party of 30 men in 1876 to the Tongue River. His party was discovered by a large group of Sioux and Cheyenne warriors. The soldiers escaped into the Big Horn Mountains where they fought, abandoned their horses and evaded Indians over several days. They walked over thirty miles back to their main camp with no casualties. For an engrossing read about the Sibley retreat, see this short [story](#).

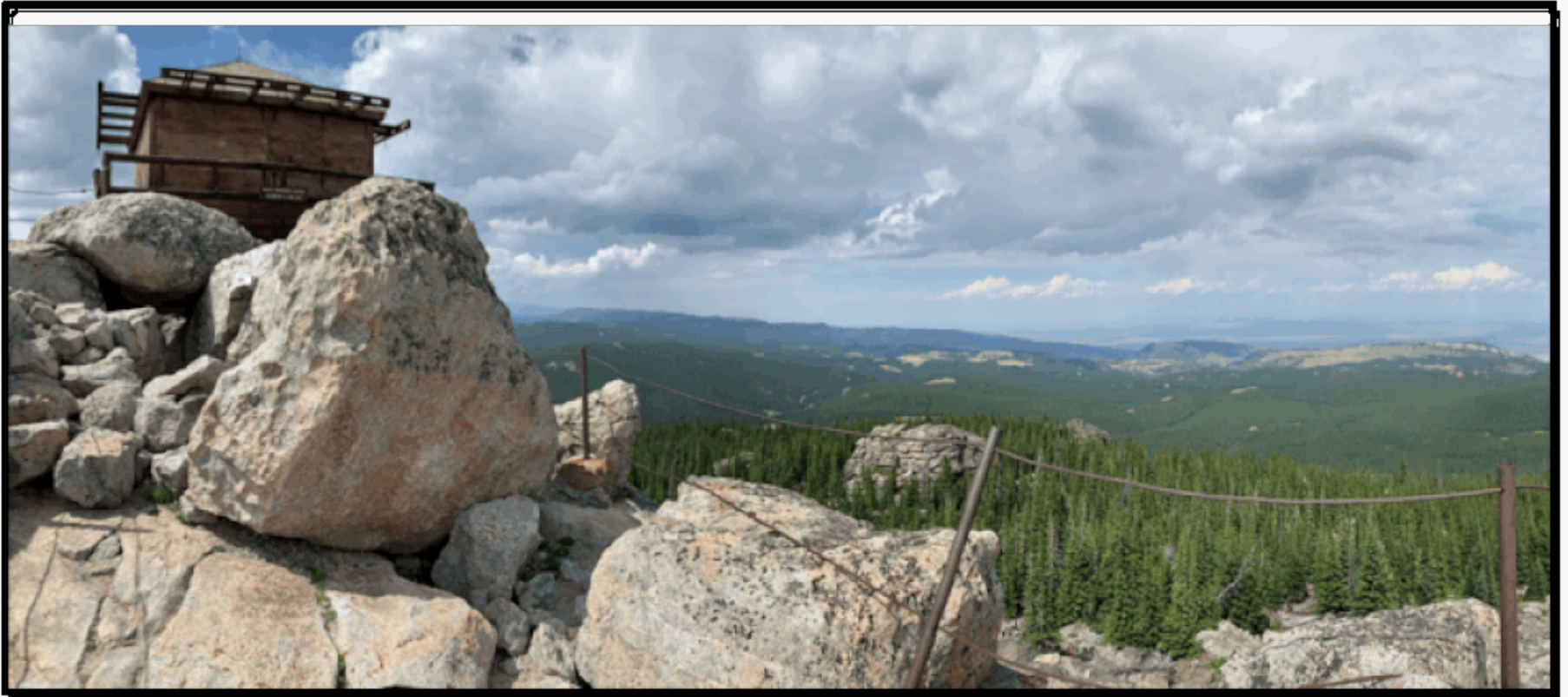
Image: USDA Forest Service,
2018, https://www.fs.usda.gov/Internet/FSE_MEDIA/stelprd3809914.jpg.



Precambrian basement granite spire. Note the horizontal joints in the outcrop.

Image: Mark Fisher

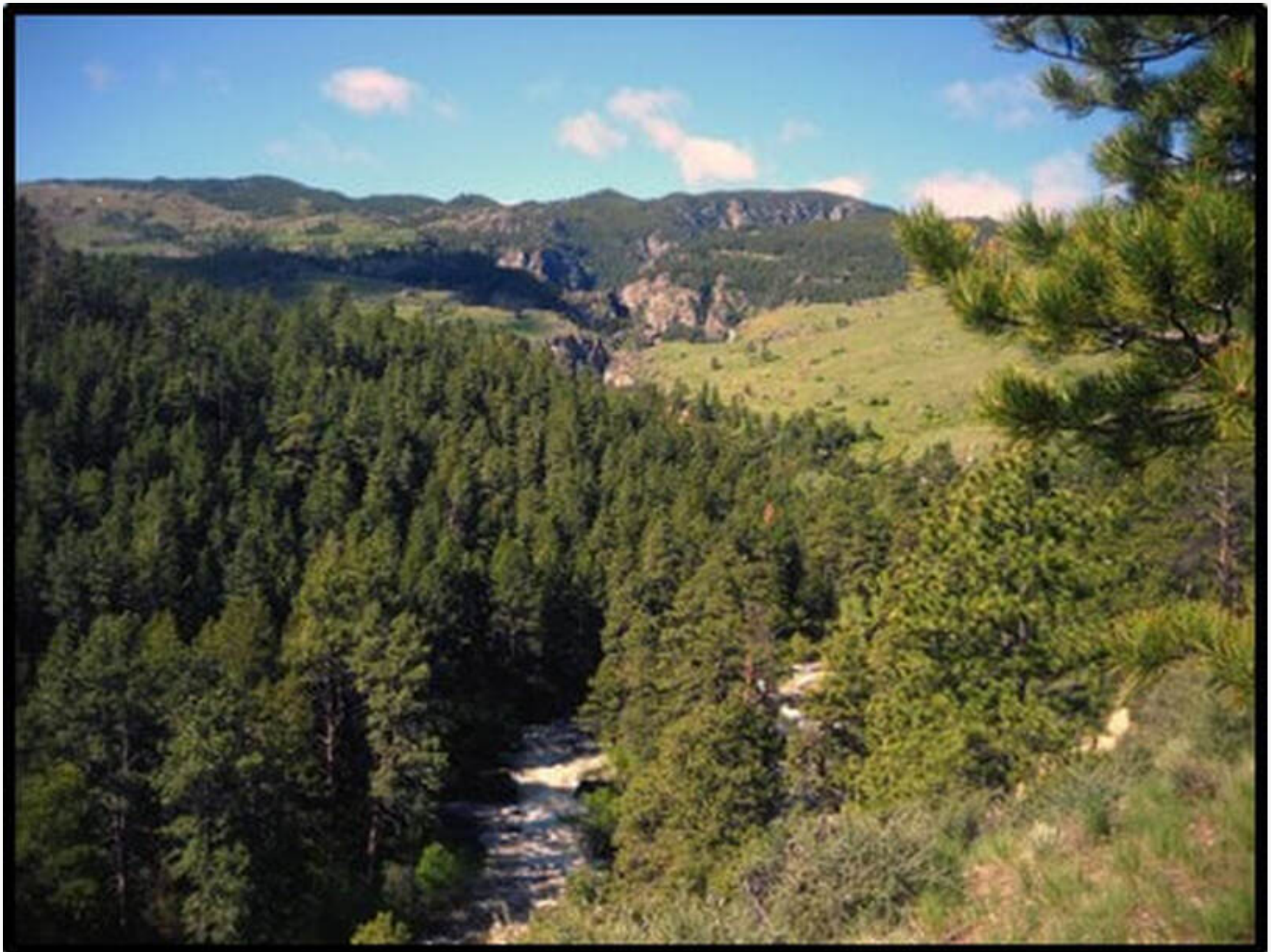
| | | | | |
|-----|-----|-----|------|--|
| 0.9 | 7.0 | 2.5 | 17.9 | Cutler Nordic Ski Trails to west of highway (L/R) |
| | | | | Black Mountain Road (FS 16) to south of highway (R/L) leads to Black Mountain Lookout Tower. Drive 3.5 miles south on FS 16, turn left onto FS 222 (4WD high clearance road), drive or hike 0.85 mile to trailhead, hike 1.1 miles to lookout tower. Stunning views from top! (detailed description in Things To Do) |
| 2.5 | 9.5 | 0.4 | 15.4 | |



Black Mountain Lookout Tower. Tower was constructed in 1930's as a fire observation post for the Bighorn National Forest.

Image: Mark Fisher

| | | | | |
|-----|------|-----|------|---|
| 0.4 | 9.9 | 1.9 | 15.0 | Forest Service Road 185 to north of highway (L/R) that is almost opposite to the brake check pullout, leads to dike of Leopard Rock (detailed description in Things To Do) |
| 1.9 | 11.8 | 0.6 | 13.1 | Precambrian outcrops on both sides of highway. |
| 0.6 | 12.4 | 0.1 | 12.5 | Steamboat Point overview turnout. Parking area is approximate Precambrian/Cambrian contact with Precambrian outcrops on hill to southwest and Cambrian outcrops on hill to northeast. Box Canyon of the Tongue River can be seen to the northwest (L/R) of Steamboat Point. |



Box Canyon of Tongue River.

Image: Hobart, R., 2017;<https://www.hikingproject.com/photo/7029670/the-trail-follows-the-tongue-river-along-a-box-canyon>.

0.1

12.5

0.8

12.4

Highway passing over approximate Precambrian/Cambrian contact. Paleozoic rocks dip northeastward on the Precambrian surface. View of Steamboat Point to north of highway (L/R). Ordovician Bighorn Dolomite overlies Cambrian units. Flatiron developed in lower part of formation which dips 25° northeast. Hendrick Ridge on the horizon to the southeast of highway (R/L). Ordovician Bighorn dolomite caps the ridgeline overlying Cambrian rocks. Blocks of Bighorn Dolomite litter the grass-covered slope of Cambrian rocks.



Steamboat Point. Note horizontal and vertical joints in the outcrop. Cgv is Cambrian Gros Ventre Formation, mostly shale; Cg is Cambrian Gallatin Formation, mostly thin limestones; and Ob is Ordovician Bighorn Dolomite

Image: Roth, M., 2012; <https://www.mountainproject.com/photo/107616464>.

0.8 13.3 0.4 11.6

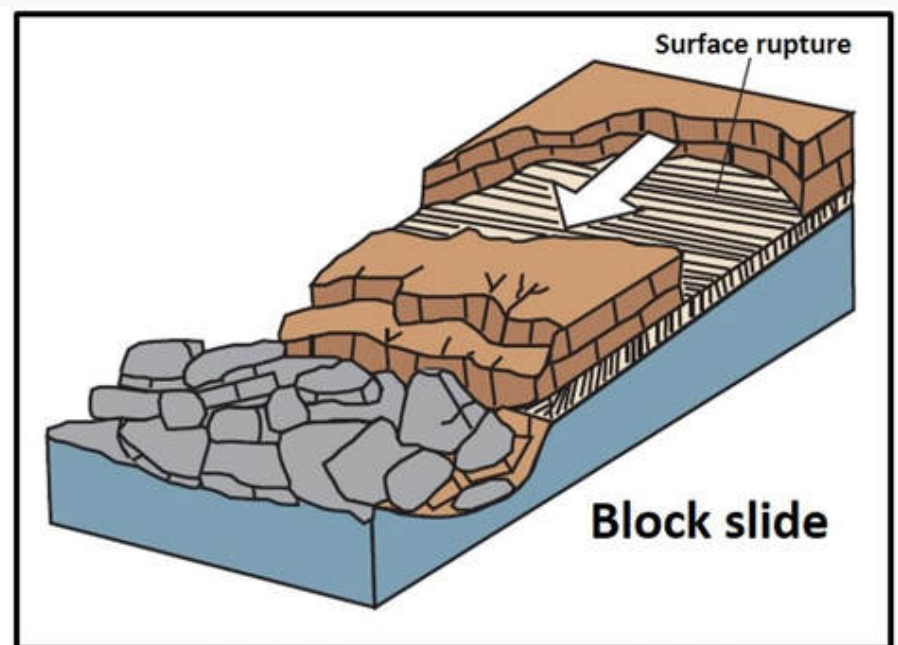
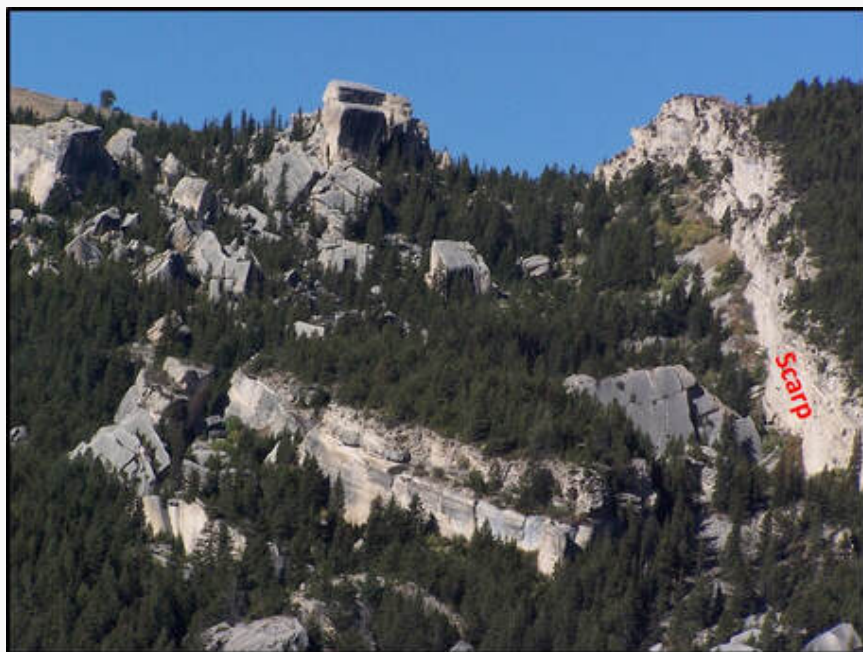
Highway crossing approximate Cambrian/Ordovician contact.

0.4 13.7 0.5 11.2

Highway crossing approximate Ordovician/Devonian contact. Devonian Darby outcrop to north of highway (L/R).

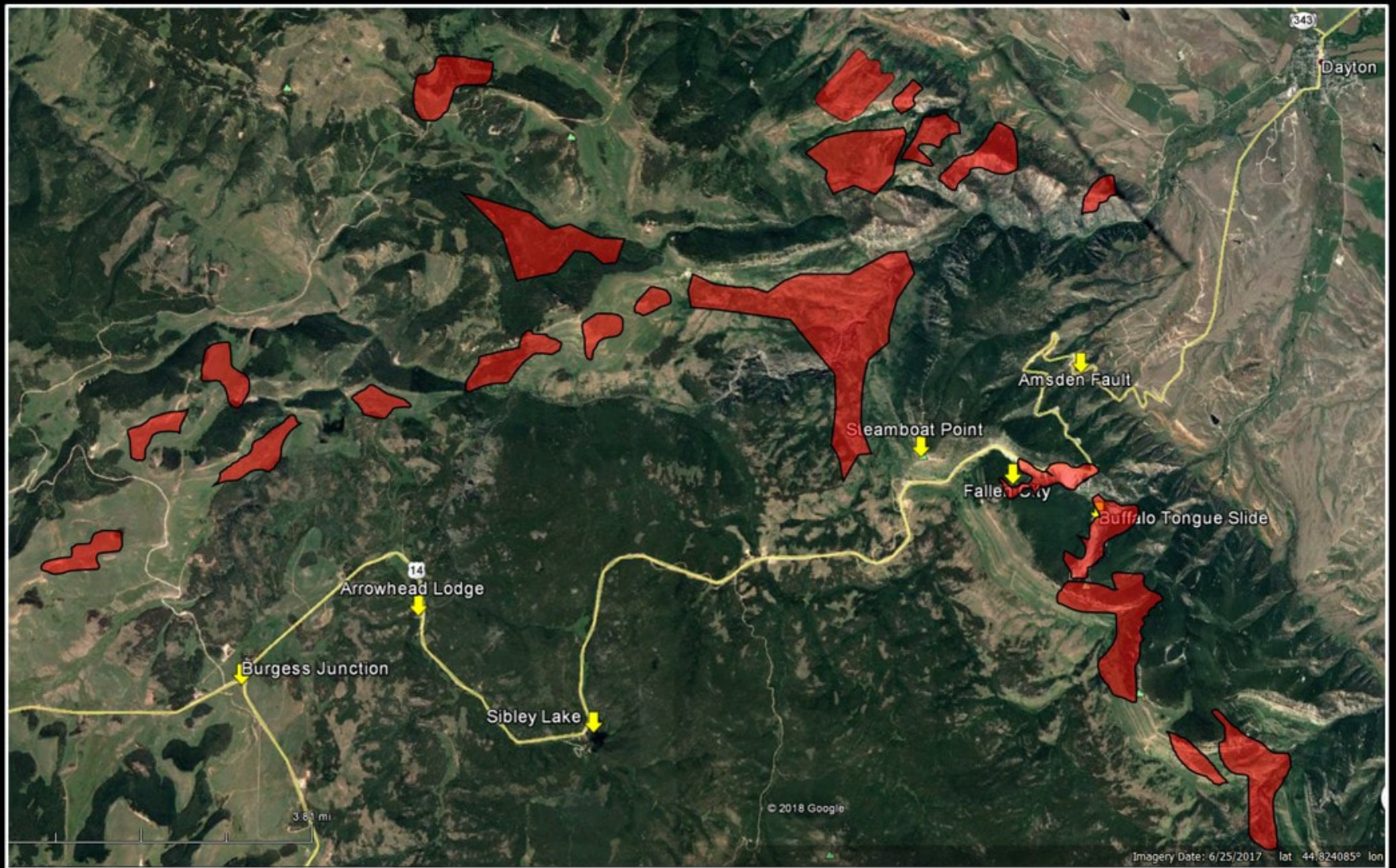
0.5 14.2 0.1 10.7

Second Fallen City turn out. Fallen City landslide complex with blocks of Bighorn Dolomite (based on Preliminary Geologic Map of Sheridan, 1978, by Love, Christiansen and Earle, USGS). Landslides are common in this area. The rocks were jointed and fractured with the folding during the Laramide uplift of the Bighorn Mountains. The fractures are conduits for water to move through the rocks. Winter freeze expands the water as ice forms and over time the fractures increase in size. All the landslides occurred over the last two million years and the majority happened during the Holocene (less than 11,650 years ago). Note sign pointing out Darby Formation on left side of road.



Fallen City block slide. Note scarp wall on right side of image. Blocks are Ordovician Bighorn Dolomite based on mapping by Love, J.D., Christiansen, A.C., and Earle, J.L., 1978, **Preliminary geologic map of the Sheridan 1 degree x 2 degree quadrangle**, northern Wyoming: U.S. Geological Survey, Open File Report OF-78-456, scale 1:250,000.

Image: Left: <https://www.flickr.com/photos/63339942@N00/242153020>; Right: U.S. Geological Survey, 2004, *Landslide Types and Processes; Fact Sheet 2004-3072*; <https://pubs.usgs.gov/fs/2004/3072/images/Fig3grouping-2LG.jpg>.

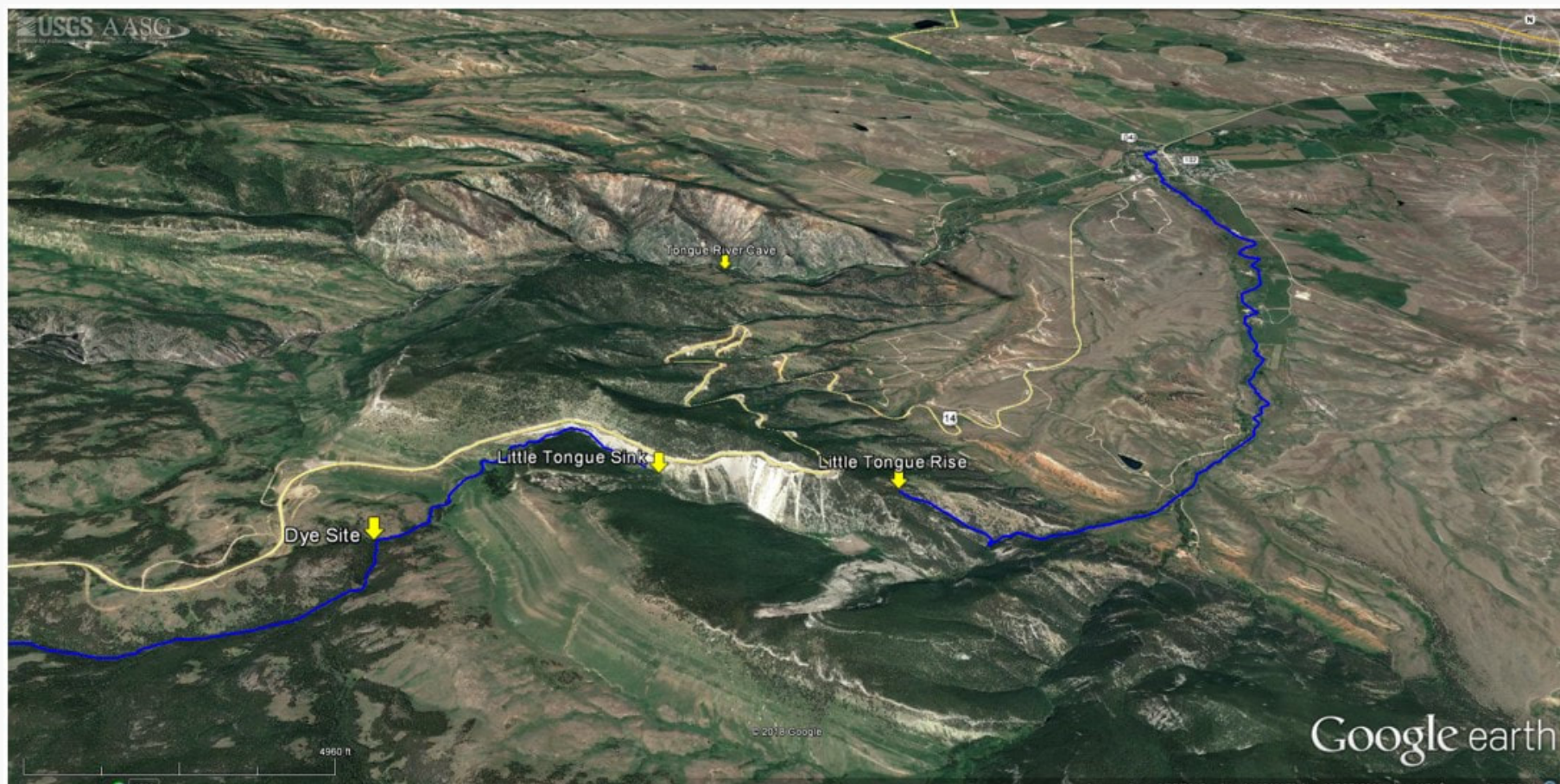


Landslides near U.S. Highway 14, Bighorn Byways.

Image: After Case, J.C., Piwoschuk, K.L., and Murray, W.B., 1984, *Preliminary map of landslides on the Sheridan 1° x 2° topographic map*: Geological Survey of Wyoming [Wyoming State Geological Survey] Open File Report 84-10, scale 1:250,000.

0.1 14.3 0.1 10.6

Third Fallen City turn out. The sinks of the Little Tongue River is about 0.1 mile south in the canyon (R/L). The river disappears into the Ordovician Bighorn Dolomite at an elevation of 6,516 feet and reemerges about 1 mile east at an elevation of 5,835 feet. A tracer dye test in 1974 showed that some of the flow is connected to the stream in Tongue River cave (4,880 foot elevation) in tongue River Canyon, 2.63 mile to the north. The outcrop area of the Bighorn Dolomite and the Madison Limestone along the eastern flank of the Bighorn Mountains is part of the recharge area for the two major aquifers underlying the Great Plains region: the Cambrian-Ordovician aquifer and the Madison aquifer.



North aerial view of Little Tongue River rise, sink, dye test site and Tongue River Cave.

Image: Google Earth



Tongue River Cave. Dye test showed connection with the Little Tongue River sink.

Image: Cave Map: After Hill, C., Sutherland, W., and Tierney, L., 1976, Caves of Wyoming:

| | | | | |
|-----|------|-----|------|--|
| 0.1 | 14.4 | 0.6 | 10.5 | <p>Highway crossing approximate Devonian/Mississippian contact. Mississippian Madison Limestone outcrop to north of highway (L/R). The Highway will travel on the Madison for the next 2 miles.</p> |
| 0.6 | 15.0 | 0.7 | 9.9 | <p>Pull out for Buffalo Tongue Slide (Sand Turn overlook) where carbonates have slid down into the Little Tongue. Horseshoe Mountain above the slide to the southeast is composed of gray limestones of the Madison on top of red & yellow colored beds of the Devonian Darby. The dip slope to the northwest of the slide is mapped as Bighorn Dolomite. All three formations are dipping northeastward. The Little Tongue River rise is 0.3 mile to the east (R/L) of the pull out. East is a view of the Great Plains landscape. Highway heads northward along strike of the Upper Madison.</p> |



Buffalo Tongue Slide.

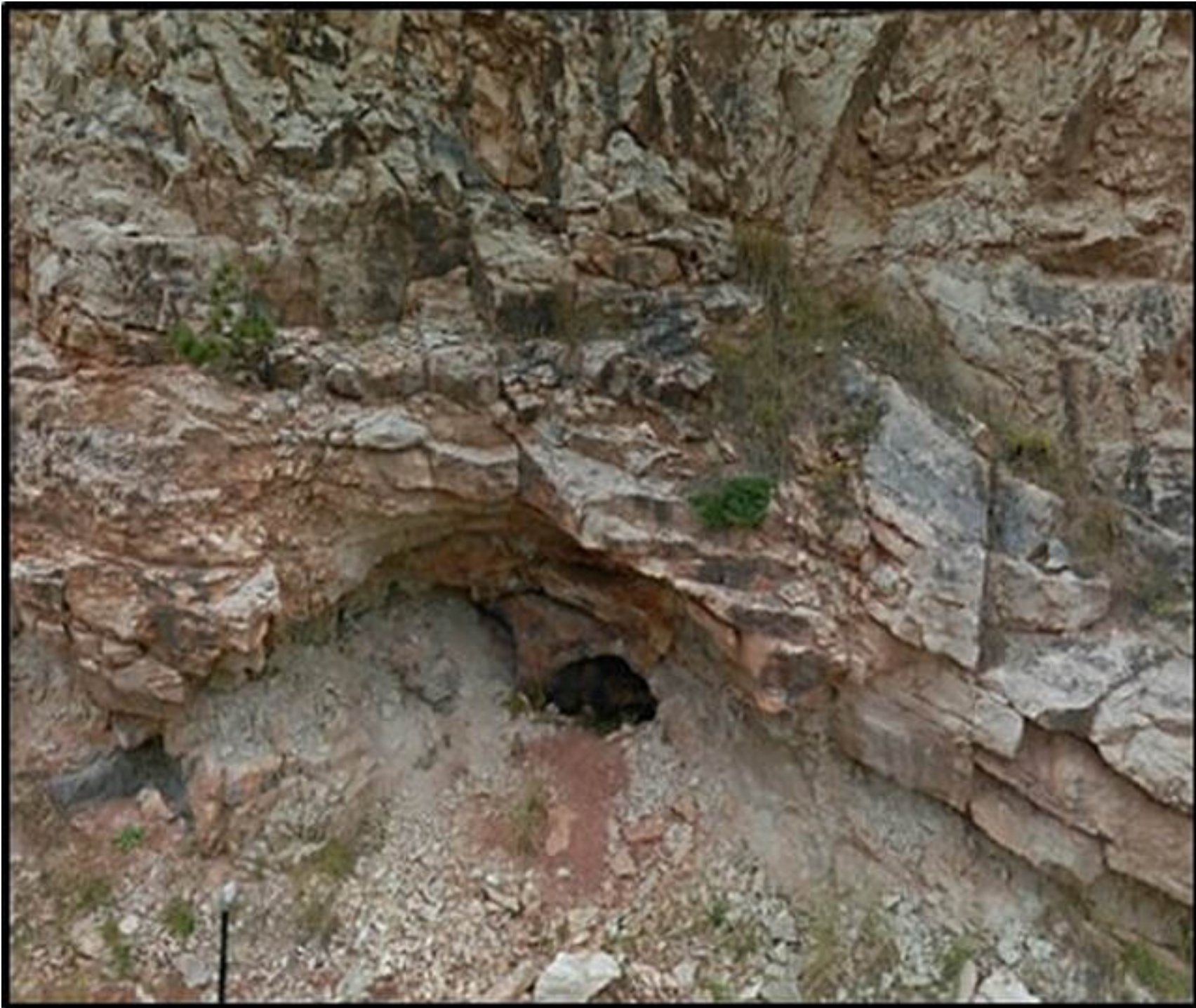
Image: USDA Forest Service; https://www.fs.usda.gov/Internet/FSE_MEDIA/stelprd3841484.jpg.



View east onto the Great Plains prairie land.

Image: Hendrix, J. and Hendrix, M., 2014; <http://travellogs.us/2014%20Logs/Wyoming/WY-13%20Scenic%20US-14/WY-13a%20Big%20Horn%20Mts%20on%20US-14.htm>.

| | | | | |
|-----|------|-----|-----|---|
| 0.7 | 15.7 | 0.8 | 9.2 | <p>Scenic turn out on east (R/L) side of roadway. View here is partially obscure by trees.</p> <p>Small cave exposed in roadcut to west (L/R). The cave walls are encrusted with black-stained calcite speleothems. This is probably a pre-Amsden solution feature. About 75 feet onward is the Madison Amsden contact. The roadcut exposes red shales of the Horseshoe Shale lying on the Madison Limestone.</p> |
| 0.8 | 16.5 | 1.0 | 8.4 | |



Madison cave on roadside of U.S. Highway 14.

Image: Google Earth Street View.

1.0 17.5 1.2 7.4

Hairpin turn scenic overlook. The Wolf Mountains can be seen on the skyline about 25 miles to the north-northeast. The Tongue River Anticline is a west to east plunging fold located along the Tongue River Canyon at the edge of the mountain front. It can be recognized by the bend in the outcrop pattern of the Tensleep Sandstone and the Chugwater Formation red beds (see aerial image below for location of the anticline).

1.2 18.7 0.8 6.2

High-angle reverse fault cutting the Amsden with only minor displacement. The upthrown block is on the west or right. A couple hundred feet further down mountain is the Amsden/Tensleep contact with white to tan Tensleep Sandstone overlying the shales & light colored carbonates of the Ranchester Limestone Member of the Amsden Formation.



Small reverse fault in the Amsden with upthrown side on the right

Image: Mark Fisher

0.8 19.5 0.1 5.4

The Tensleep contact with the basal Permian Goose Egg Formation. Red shales of the Goose Egg unconformably overlie red stained beds of the Tensleep Sandstone in outcrop to the southwest (R/L) of the highway.



Tensleep-Goose Egg contact.

Image: Mark Fisher

0.1 19.6 0.9 5.3

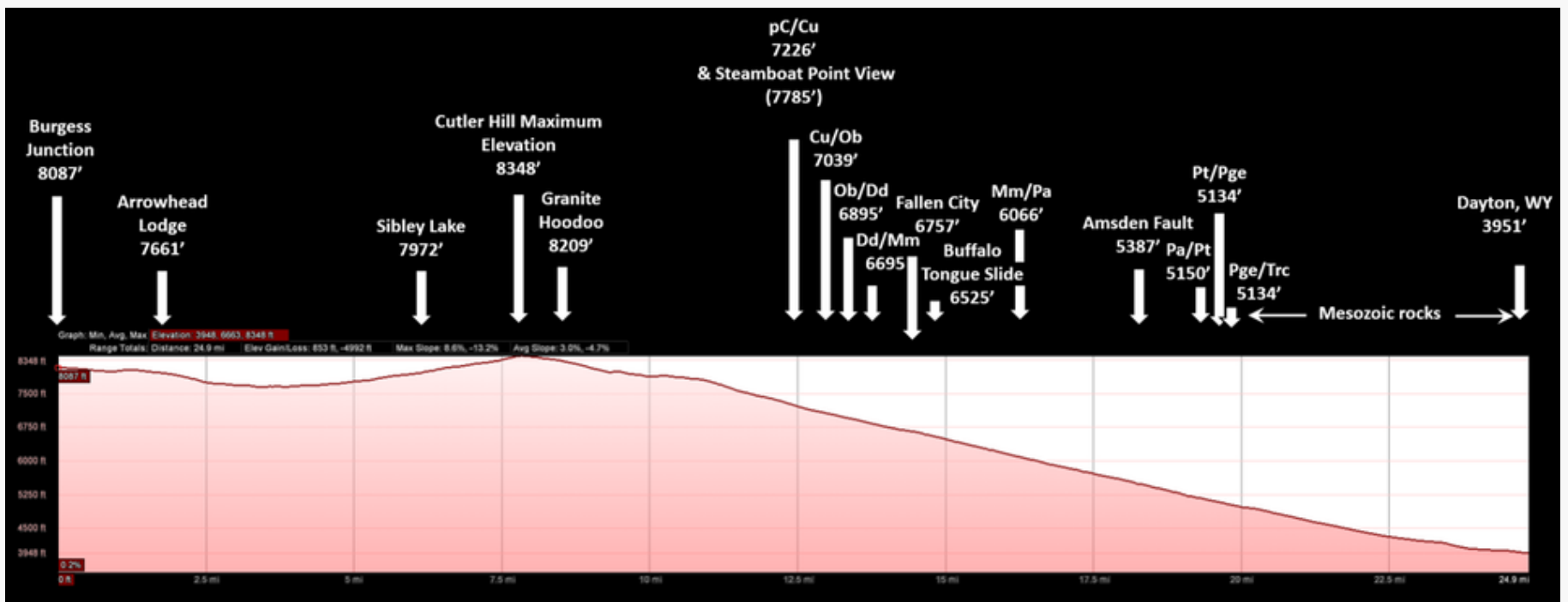
Highway crossing approximate Goose Egg/Chugwater contact. This is the boundary between Paleozoic and Mesozoic strata. The steep Paleozoic section of the east flank has now ended. Now crossing the gently sloping pediment surface of the Mesozoic section.



Aerial west view of the east flank of the Bighorn Mountains.
Image: Google Earth.

| | | | | |
|-----|------|-----|-----|---|
| 0.9 | 20.5 | 0.6 | 4.4 | Crossing approximate Chugwater/Gypsum Spring contact seen on both sides of the highway. Road is on the south flank of the Tongue River Anticline. For the next 2 miles the rock units strike northeast. This direction is essentially perpendicular to the strike of the Tensleep flatirons along the mountain front. |
| 0.6 | 21.1 | 1.8 | 3.8 | Private road to southeast (R/L) leads to Horseshoe Ranch. |
| 1.8 | 22.9 | 2.0 | 2.0 | For the next two miles into the town of Dayton, the road crosses poorly exposed Cretaceous shales and sandstones. |
| 2.0 | 24.9 | 0 | 0 | Highway crossing approximate Cretaceous Mesaverde/Bearpaw contact. Tongue River High School is to the west (L/R). City limits of Dayton, Wyoming (3,921' elevation). The Cretaceous-Tertiary boundary lies 1,200 feet beyond the city's eastern limit. |

End Of Road Log



Elevation profile of Bighorn Mountain Byways, Part 2 road log.
Image: Google Earth

Things To Do in Bighorn Mountain Byways Part II

Burgess Junction to Dayton is a pretty area with hikes, rock collecting, fishing, **ORV roads**, horseback riding trails, hunting and camping. There are a couple of Forest Service campgrounds, one at **Sibley Lake** and one at **Prune Creek**. The following are suggested activities: collecting leopard rock on FS 185, hike to Black Mountain Lookout Tower and Tongue River Canyon hike.

Leopard Rock on Forest Service Road 185

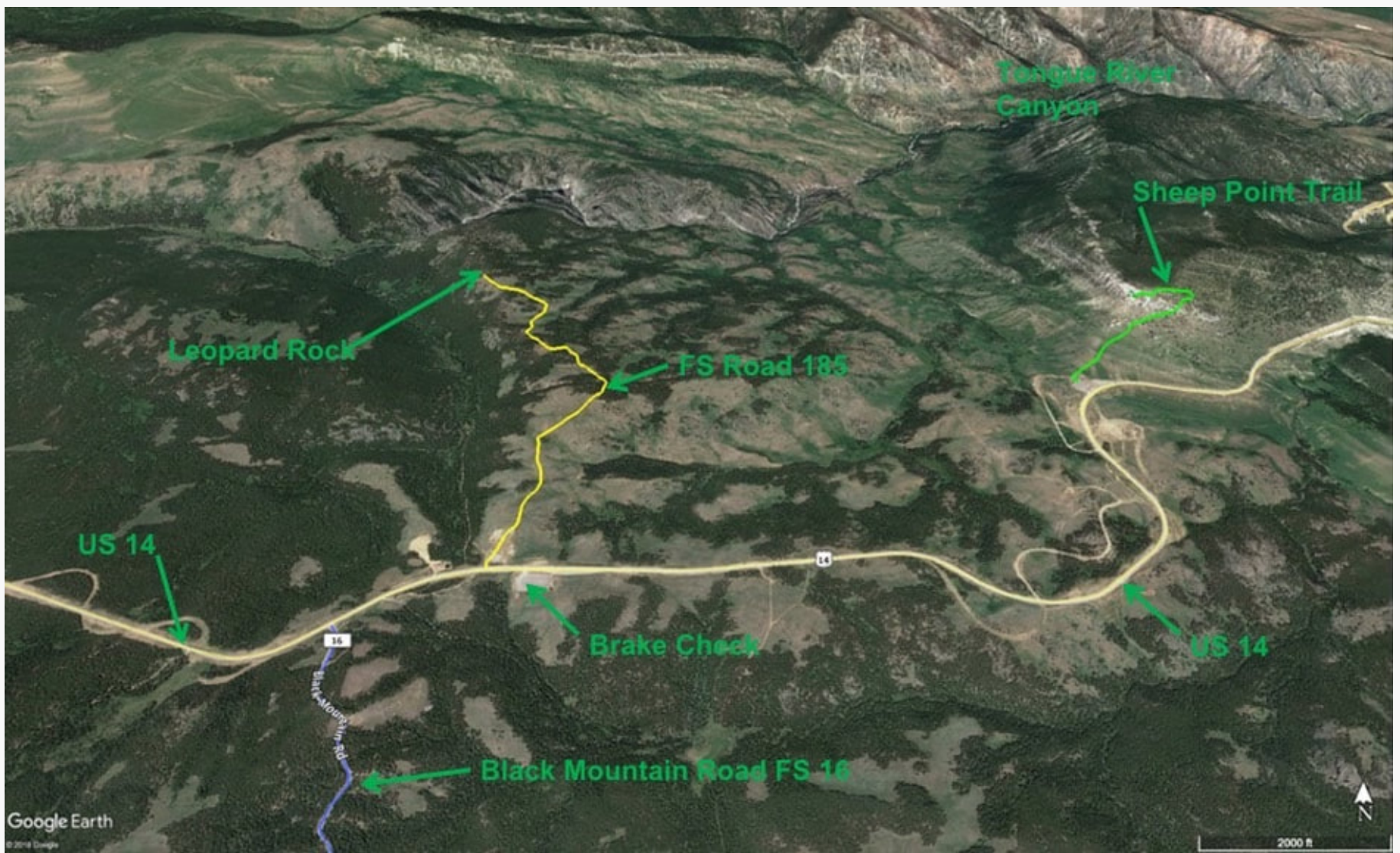
Some of the mafic dikes found in the Bighorn Mountains have a spotted or leopard appearance with large white plagioclase crystals in a dark gray fine-grain groundmass. These plagioclase crystals are concentrated in the central portions of the dikes (Stephen Harlan, **2005 Poster GSA Conference pdf**). An outcrop of this attractive igneous rock can be found at the end of Forest Service Road 185, a high clearance 4WD rough dirt road that turns off US 14 at 9.9 miles from Burgess Junction or 15 miles from Dayton. FS 185 is on the north side of the US 14 almost opposite the brake check pull off. **Directions (see map below):** Take FS 185 north, road immediately splits, take right fork on FS 185 (FS 184 goes left and reaches the Tongue River in a couple of miles), drive open ridge with a few stands of trees, 0.6 miles property boundary of State and Forest Service land, 0.8 miles enter trees and pass through gate at high point on ridge, road immediately splits, take left fork on FS 185, 1.4 miles road takes path around large outcrop of Precambrian then heads back up steeply to ridge, 1.7 miles road ends in a circle. Leopard rock outcrop is about 30 feet beyond end of road on a ridge. Dike trends North 58

degrees East. This dike is Precambrian.



"Leopard Rock" dike at end of Forest Service Road 185

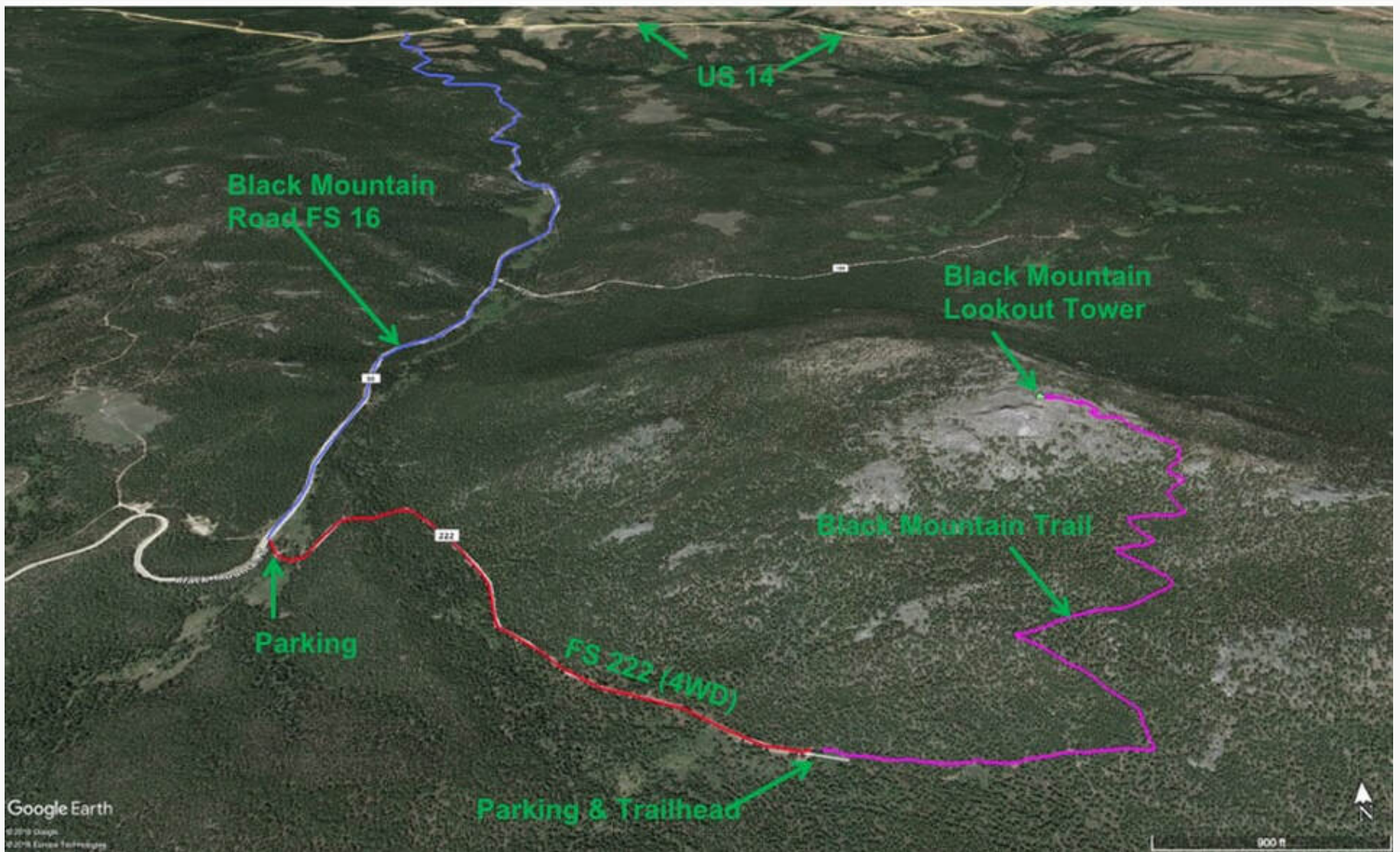
Photo by Mark Fisher



North aerial view of access to Leopard Rock and Sheep Point. Black Mountain Forest Service Road 16 in blue, Forest Service Road 185 in yellow and Sheep Point Trail in green.
Image by Google Earth

Black Mountain Lookout Tower Hike

The hike is through the forest and Precambrian rock the whole way to the Lookout Tower. At the end, you break out of the trees and climb a rock ridge to the Tower with outstanding panoramic views. ATVs and motorcycles are allowed on this trail, although the upper part of the trail seems to rocky and narrow for ATVs. **Directions (see map below):** Turn south on Black Mountain Forest Service Road 16 which is a good gravel road fine for cars, 3.5 miles turn left on Forest Service Road 222 which is a high clearance, 4WD rutted & rocky dirt road, park immediately if you have a passenger car & walk from here, cross stream and take left fork in road, 3.7 miles second stream crossing, 4.4 miles end of road and Black Mountain Trailhead, hike 1.1 miles one way and 800 vertical feet up to Lookout Tower, return the same way. If you walk FS 222, it adds 0.85 miles each way to the hike. Be aware that the Lookout Tower is on a rock ridge surrounded by cliffs.



North aerial view of Black Mountain Lookout Tower hike. Forest Service Road 16 in blue, Forest Service Road 222 in red and Black Mountain Trail in purple.

Image by Google Earth

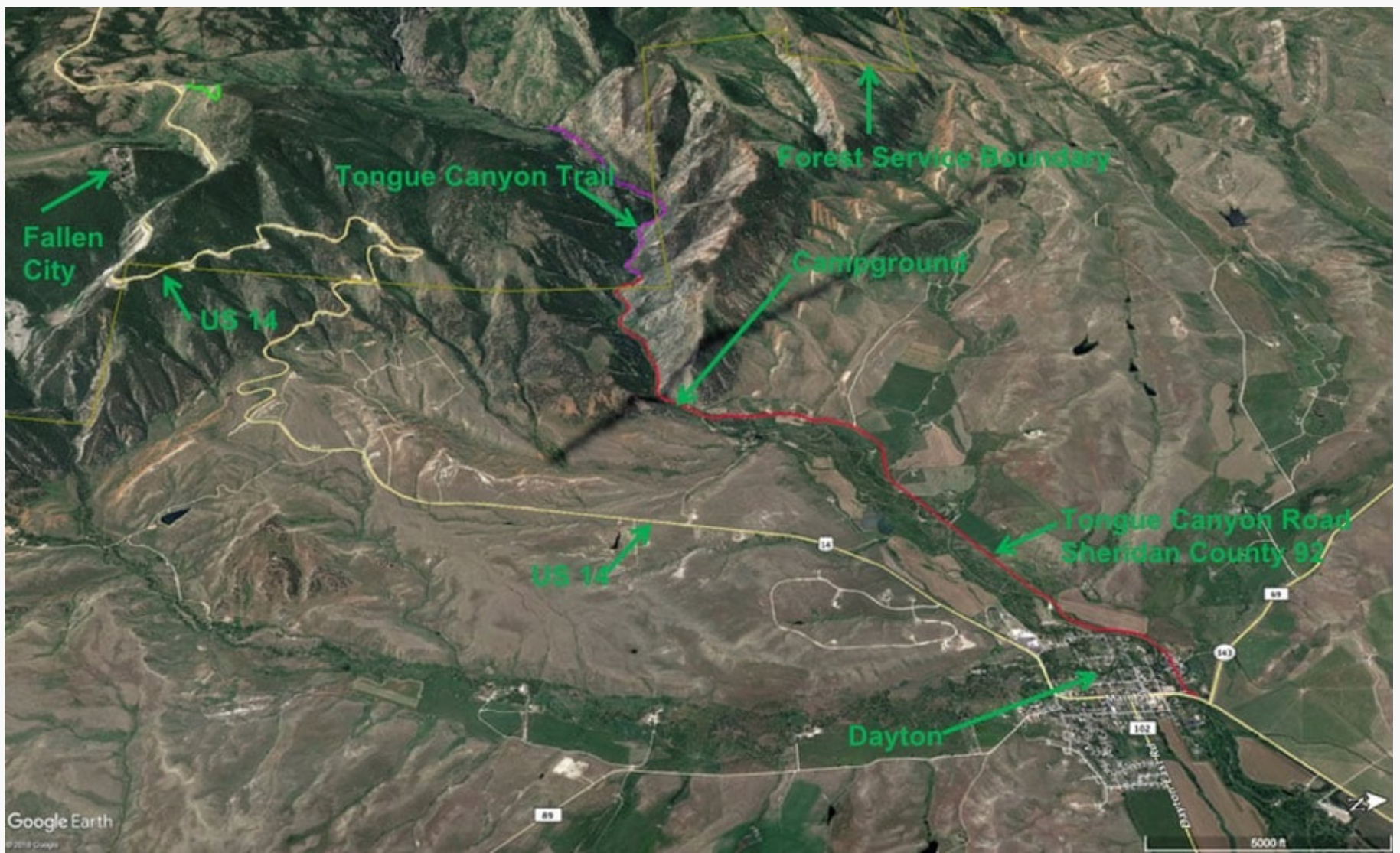
Tongue River Canyon Hike

The trail follows the Tongue River up the canyon for 2.35 miles. At that point the trail climbs out of the canyon and continues on toward Burgess Junction. At just 0.2 miles from the start of the trail, there is a bridge that is a steep side trip to a cave (not the Tongue River Canyon Trail). **Directions (see map below):** From the Mercantile store in downtown Dayton, head toward Ranchester on US 14, 0.2 miles cross bridge over Tongue River and then turn left on Tongue Canyon Road, Sheridan County 92, 0.6 miles end of pavement, 2.6 miles stay left on Tongue Canyon Road at junction with Amsden Road, 3.5 miles campground and public toilet, travel past cliffs of Ordovician Bighorn Dolomite and Mississippian Madison Limestone, 5.1 miles road ends at parking area for Tongue River Canyon Trail, public toilet.



Cliffs of Madison Limestone and Bighorn Dolomite along Tongue Canyon Road

Image by Mark Fisher



West aerial view of Tongue River Canyon Trail. Tongue Canyon Road in red and Tongue River Canyon Trail in purple.
Image by Google Earth



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