

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Text to accompany:

Bedrock geologic map of the Pine Mountain-
Oil Mountain area, Natrona County, Wyoming

By

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This report is preliminary and has not
been reviewed for conformity with U.S.
Geological Survey editorial standards
or stratigraphic nomenclature.

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(in pocket)

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Introduction

The Square Top Butte, Reid Canyon, Poison Spider and Oil Mountain quadrangles were mapped as part of the U.S. Geological Survey's program to classify Federal lands as to their mineral resource potential. Future development in the area will include continued exploration for oil and gas.

The Cretaceous Lance Formation contains several beds of coal which crop out, but the beds are thin and steeply dipping, making a commercial mining operation highly improbable. Some parts of the mapped area are currently being studied to determine if there is any potential for uranium.

General Geology

The Poison Spider area lies along the west side of a broad structural uplift, commonly called the Powder River lineament or the Casper arch, that separates the Powder River basin on the east from the Wind River basin on the west. The folds within the area trend about N. 45° W. and parallel the northeastern side of the Wind River basin. The major anticlinal folds are asymmetrical, having their steeper flanks on the southwest (Rich, 1962). The smaller, Iron Creek and Oil Mountain, anticlines locally reverse the dominant regional dip, however, and have steeper dips on their northeastern flanks.

Iron Creek anticline, located in the southeastern corner of the mapped area (cross section D-D'), is an asymmetrical, breached, faulted, doubly plunging fold about 2 mi (3.2 km) long and 3/4 mi (1.2 km) wide near its northern end. The surface exposure of the structure forms a valley surrounded by prominent hogbacks of the Upper Cretaceous Frontier Formation. Dips along the structure range from 10° to 60°, and are steepest along the east limb.

Oil Mountain, Poison Spider, South Casper Creek and Pine Mountain oil fields are all aligned along a northwest-trending structure called the Pine Mountain-Oil Mountain lineament, which is subdivided into the Oil Mountain anticline, minor (unnamed) anticlines between Poison Spider Creek and the South Fork of Casper Creek, and Pine dome (Hares, 1916). Beasley (1954) refers to the large domal structure at the northern end of the trend as Pine Mountain anticline, and the U.S. Geological Survey topographic map lists the same feature as Pine Mountain. Lawson (1954) has apparently named two of Hares' "minor anticlines" as South Casper Creek anticline, marked by the South Casper Creek oil field, and Poison Spider anticline, marked by the Poison Spider oil field. The third minor anticline of Hares' is very small, less than 1 mi (1.6 km) long, and contains the northern end of the South Casper Creek oil field. All three of these minor anticlines are structurally linked, and probably should be considered as one unit.

Oil Mountain, at the southeastern end of the larger trend, is elongate, tightly folded, and deeply breached. The Upper Jurassic Morrison Formation is exposed in the crest of the fold. On the eastern side the basal conglomerate of the Lower Cretaceous Cloverly Formation and resistant lower sandstone units of the Upper Cretaceous Frontier Formation are steeply dipping to slightly overturned to the east.

The central part of the trend contains the three minor anticlines. They are separated from one another by transverse sags developed on the main structure (Hares, 1916). The surface formation throughout this central part is the Upper Cretaceous Frontier Formation. There is one small exposure of Lower Cretaceous Mowry Shale along the crest of the South Casper Creek anticline.

At the northern end of the trend Pine Mountain is the dominant topographic feature in the area. It is a broad, deeply breached dome which has the Upper Jurassic Sundance Formation exposed in two areas on the crest. West of Pine Mountain the prominent hogback formed by the Teapot Sandstone Member of the Upper Cretaceous Mesaverde Formation is steeply dipping to slightly overturned to the west.

The western flanks of Pine Mountain, Oil Mountain, and Iron Creek anticline are marked by northwest-trending reverse faults, dipping eastward, which follow the general alignment of the entire structure. At many localities, particularly along the western side of the structure, there are small, transverse, normal faults cutting across the dominant northwest trend.

It is proposed that a buried, imbricate, high-angle reverse-fault zone parallels the entire length of the Pine Mountain-Oil Mountain structure along its west side. The scanty data available from the Gulf Oil (British American Producing) Company's #1 J.B. Eccles well (SE1/4 SE1/4 sec. 31, T. 35 N., R. 84 W.), drilled on the western edge of the proposed zone, indicate the top of the Upper Cretaceous Lance Formation is at a depth of 10,500 ft (3,170 m). Less than 1 mi (1.6 km) east the Lance Formation crops out. Little evidence of faulting is apparent because younger, early Tertiary, sediments unconformably cover all the older strata.

Boone dome is a separate structure northwest of Pine Mountain and west of the imbricate fault zone. Only the extreme southeastern nose of this fold, which plunges southeast, extends into the northwestern corner of the mapped area. A small exposure of the Upper Cretaceous Mesaverde Formation is present along the crest.

Oil and Gas

As of July 1, 1975, more than 300 wells had been drilled for oil and gas in the mapped area. Many records of the early wells are incomplete or nonexistent. Numerous wells have been worked over and/or changed operators one or more times, until it is very difficult to determine their exact histories. Several are less than 1,000 ft (302 m) deep and are little more than stratigraphic tests. The deepened Union 8 O. T. Reilly well (SE1/4SE1/4 sec. 11, T. 33 N., R. 84 W., T.D. 17,945 ft; or 5,473 m) reached the Madison Limestone (Mississippian) on the west side of the imbricate fault zone. In contrast, the Ted Price and Associates T-6 well (SE1/4NW1/4 sec. 12, T. 33 N., R. 83 W., T.D. 3,703 ft; 1,129 m), east of the zone and on the crest of the Poison Spider anticline, drilled Precambrian basement rocks at 3,665 ft (1,106 m). The two major producing horizons in the area are the Upper Jurassic Sundance Formation and the Pennsylvanian Tensleep Formation.

Gas was first discovered in the area in 1914, in what was later named the Pine Mountain oil field. The earliest known occurrence of oil dates back to the 1840's. During that time oil was collected from a surface seep near the north end of Oil Mountain (sec. 28, T. 33 N., R. 82 W.), and sold to pioneers passing through the area along the Oregon and Mormon Trails (Hares, 1916). It was used to lubricate the axles of the wagons. The first oil field discovered was in 1919, on South Casper Creek anticline. All the fields in the area (table 2) are still active. No production has been reported from the Blue Canyon and Smith Canyon subsidiary areas of the Pine Mountain field.

Coal

The earliest study of the coal deposits was made by Woodward and Winchester (1912). They established coal mining districts, two of which are partially within the mapped area. They stated the coal beds occur in the shale member of the Mesaverde Formation, but this study shows the coal to be in the Lance Formation.

The Powder River district extends southward into T. 35 N., Rs. 84 and 85 W., from the northwest. Woodruff and Winchester (1912) believed the beds extended southeast beyond the limits of the outcrops, but pointed out that positive information could not be obtained because the beds were concealed by the Wind River Formation (Tertiary).

The Efell district trends northwestward from sec. 8, T. 32 N., R. 82 W., to sec. 6, T. 33 N., R. 83 W. Two small drifts are located in sec. 8, T. 33 N., R. 83 W. The larger of the two was called the Efell mine, which worked the thickest bed and the one which was traced for the greatest distance by Woodruff and Winchester (1912). According to their report, in 1909 the mine consisted of one entry driven from the side of a small coulee along the strike of the steeply dipping bed for about 200 ft (61.0 m). It was operated periodically during the winter months to supply the Efell ranch which, at the time of the report, was the only permanently inhabited place in the district. They also estimated approximately 200 tons (180 t) of coal had been mined. The other drift in sec. 8 and the one in sec. 26 were mainly prospect holes; no production was reported for either one.

Within the part of the Powder River district included in the mapped area, thickness of the coal beds range from 1 ft 9 in. to 5 ft 9 in. (0.53 to 1.7 m), and those in the Efell district range from less than 1 ft to 6 ft 10 in. (0.3 to 2.1 m) (Woodruff and Winchester, 1912).

Uranium

In recent years there has been some exploration for uranium deposits. To date, no prospects have been developed.

Stratigraphy

The stratigraphic units used in mapping the Poison Spider area are shown in the generalized columnar section accompanying the map. The formation names are consistent to those generally used in this part of Wyoming. Problems of stratigraphic nomenclature and age are not treated in this study. One of the controversies encountered was concerned with the correct term for the major producing formation in the area. To the southeast, on Casper Mountain, the unit occupying the equivalent stratigraphic position as the major producing formation is called the Casper Formation. Laraway's intent was to extend this name into the Poison Spider area. Study of the literature on the Wind River Basin and the restriction on the use of the term, Casper Formation, has precluded its use, and Tensleep Sandstone appears to be the correct term.

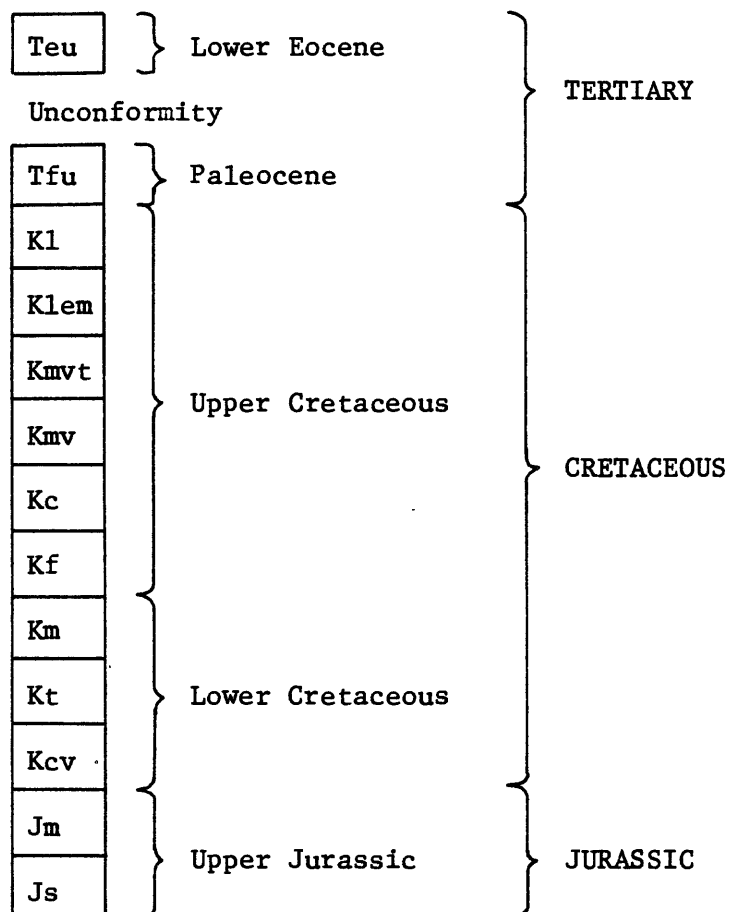
The measured, exposed sequence (some 14,000 ft; 4,267 m thick) ranges in age from the Jurassic Sundance Formation through the Tertiary Fort Union Formation. Later Tertiary units in the area, which were not measured or studied in detail by Cserna in the first stages of mapping are designated Eocene rocks, undivided. Well data indicate at least 2,300 ft (701 m) of Paleozoic and Mesozoic sediments underlie the area.

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CORRELATION OF MAP UNITS

(Surficial units not mapped)



LIST OF MAP UNITS

Teu	EOCENE UNITS, UNDIVIDED
Tfu	FORT UNION FORMATION
K1	LANCE FORMATION
Klem	LEWIS SHALE AND MEETEETSE FORMATION, UNDIVIDED
	MESAVERDE FORMATION
Kmv	Teapot Sandstone Member
Kmv	Mesaverde Formation, Undivided
Kc	CODY SHALE
Kf	FRONTIER FORMATION

Km	MOWRY SHALE
Kt	THERMOPOLIS SHALE
Kcv	CLOVERLY FORMATION
Jm	MORRISON FORMATION
Js	SUNDANCE FORMATION

———— CONTACT---Long dashed where approximately located; short dashed where inferred

FAULTS---Long dashed where approximately located; short dashed where inferred

$\frac{U}{D}$ — — — Normal---U, upthrown side; D, downthrown side

—— α — — — Reverse---R, upthrown side. On contoured horizon (top of

—— α — — — Tensleep Formation) if shown in red

STRIKE AND DIP OF BEDS

\swarrow 45 Inclined

\searrow 86 Overturned

\downarrow Vertical

—— 2500 ——— STRUCTURE CONTOURS---Drawn on top of Tensleep Formation. Long dashed where approximately located; short dashed where inferred. Interval = 500 ft (152 m), with 250 ft (76.2 m) supplemental contours. Datum is mean sea level

② ——— LOCATION OF MEASURED STRATIGRAPHIC SECTION---Data used in compiling generalized columnar section where circled; measured section number is identified as to formation

⌘ ABANDONED COAL MINE

DRILL HOLES--Numbers refer to Table 1

● ¹⁷	Oil well
☀	Gas well
✱	Oil and gas well
☛	Oil well, with show of gas
●	Oil well, shut-in
☀	Gas well, shut-in
✱	Oil well, abandoned
☀	Gas well, abandoned
✱	Gas well, with show of oil, abandoned
⊙	Dry hole
✱	Dry hole, with show of oil and gas
⊙	Dry hole, with show of oil
✱ ^W ✱ ^W	Wells converted to water input
☛ ^G	Converted gas input well
☛ ^G	Drilled gas input well
●	Oil seep
○ ^W	Water well
● ^W	Water well, with show of oil

^{D5194}
x MESOZOIC FOSSIL LOCALITY--U. S. Geological Survey collection
number (Denver catalogue)

LITHOLOGIC DESCRIPTION

(Surficial deposits not mapped)

EOCENE UNITS, UNDIVIDED (Teu)--Continental sandstone, shale, and siltstone units, poorly consolidated to consolidated

FORT UNION FORMATION (Tfu)--Interbedded light- to dark-gray shale, brown to dusky-red sandstone, grayish-red to tan conglomerate, and silty carbonaceous shale units. Lower contact gradational; picked as base of lowest, dusky-red, ferruginous sandstone

LANCE FORMATION (K1)--Interbedded sandstone and shale units, mostly fine- to medium-grained. Fossil floral and faunal remains in localized areas. Some beds contain abundant ferromagnesian minerals. Sandstone units generally friable and porous, fine- to medium-grained, sub-angular to subround; locally calcareous, hard, and crossbedded. Lower part of unit contains thin beds of carbonaceous shale and coal

LEWIS SHALE and MEETEETSE FORMATION, UNDIVIDED (Klem)--Interbedded shale and sandstone. Shale predominates and ranges from light- to dark-gray. Bedding massive to blocky. Local carbonaceous and coaly zones, with a zone containing Gryphea near the base. Sandstone units are brown or gray, very soft and friable. Entire unit very poorly exposed

MESAVERDE FORMATION

Teapot Sandstone Member (Kmv_t)--At top of formation. White to light-gray, very fine grained to fine-grained, friable, well sorted, porous. Sand grains sub-angular to subround. Shows excellent delta and torrential crossbedding. Weathers to a grayish-white ridge and weathered surfaces show iron-cemented, cup-shaped, hollow concretions. Unit dips steeply and forms prominent northwest-trending hogback across entire area

Mesaverde Formation, Undivided (Kmv)--Interbedded sandstone and shale.

Sandstone units are grayish-white to tan, fine- to medium-grained, well sorted, friable, porous, locally crossbedded. Sand grains are sub-angular to subround, cement is generally calcareous. Weathering is frequently slabby or blocky. Shale units are soft and silty.

Colors range from dove- to dark-gray, or light- to dark-brown.

Carbonaceous material common. Parkman Sandstone Member and Fales Member are identified in oil and gas wells in the area (see Table 1)

CODY SHALE (Kc)--Shale in varying shades and tints of gray; silty, calcareous, concretionary, and fossiliferous. Weathers blocky to splintery. Very minor sandstone, silty and thin-bedded; salt and pepper appearance, grains mostly subround

FRONTIER FORMATION (Kf)--Interbedded sandstone and shale; sandstone units are various shades of brown, generally thin-bedded, well sorted, and fine-grained. Locally asphalt-stained or grayish-white due to leaching by oil. Minor constituents include chert pebbles and ferromagnesian minerals. Ridge- and ledge-forming, locally crossbedded, concretionary, and calcareous. Shale units are gray, dark-gray to black, soft, blocky, calcareous, silty; contain thin bentonite and carbonaceous beds; minor concretionary limestone and siltstone

MOWRY SHALE (Km)--Shale, dark-gray to black, soft, fissile. Grades into hard, siliceous, ridge-forming unit. Minor constituents are bentonite and chert. Contains abundant fish scales, weathers to characteristic silvery-gray

THERMOPOLIS SHALE (Kt)--Shale, dark-gray to black, soft, thin-bedded, fissile, non-calcareous. Sandstone, brownish-green, very fine grained thin-bedded, abundant ferromagnesian minerals and animal burrows

CLOVERLY FORMATION (Kcv)--Sandstone and massive basal conglomerate. Sandstone is grayish-white, weathers rusty-brown, fine-grained to very coarse grained, crossbedded, locally conglomeratic. Primarily quartz sand cemented with silica, locally cemented with iron. Forms prominent ledge with conspicuous bedding planes. Oxidized iron forms reddish color-bands along bedding planes upon weathering

MORRISON FORMATION (Jm)--Claystone, variegated green, gray, and maroon, soft, calcareous, silty. Locally contains thin, soft, siltstone beds, limestone in nodular lenses, and thick, soft, friable, cross-bedded sandstone lenses. Grains very fine and well sorted. Lower part of unit is shale, green to gray, soft, silty, calcareous to non-calcareous

SURFACE

SUBSURFACE

SUNDANCE FORMATION (Js)--Interbedded sandstone, shale, and minor limestone. Base not exposed. Limited exposures of basal unit indicate drab- to dove-gray, glauconitic, calcareous, blocky-weathering shale. Sandstone units gray to dark-gray, fine-grained, well sorted, locally calcareous and glauconitic. Locally contain oolites and brachiopods, crossbedded and ripple-marked. Weathers greenish-gray into small blocky fragments with a few thin ledges. Shale units are gray to dark-gray, soft, calcareous, glauconitic, friable. Limestone is fine- to medium-bedded, very fossiliferous; belemnites abundant on surface. Weathers into irregular blocks

CHUGWATER GROUP

JELM FORMATION--Sandstone, brown and pale-orange, interbedded with red shale; medium- to coarse-grained

ALCOVA LIMESTONE--Limestone, pink to light-red

RED PEAK FORMATION--Sandstone, pale-orange to light-gray, very fine grained to medium-grained; and siltstone, brown to red

GOOSE EGG FORMATION--Siltstone and claystone, reddish brown, interbedded with white gypsum and gray to yellowish-brown limestone

TENSLEEP SANDSTONE--Sandstone, gray to orange, very fine grained to medium-grained; and limestone, gray to pink

AMSDEN FORMATION--Claystone, brown to dark-red

MADISON LIMESTONE--Limestone, gray to pink, dolomitic in the lower part

GALLATIN(?) and GROS VENTRE FORMATIONS, UNDIVIDED--Sandstone, white to red, calcareous, abundant glauconite

FLATHEAD SANDSTONE--Sandstone, light-gray to white, fine- to medium-grained, slightly quartzitic, with minor red claystone. The lower part of the units is light-gray to brown sandstone, medium-grained to very coarse grained

GRANITE

Table 2.--Cumulative production of the Oil Mountain-Pine Mountain area as of January 1, 1975.

[Compiled from U.S. Geological Survey and Wyoming State Oil and Gas Commission records. Fields partly or totally within the mapped area are: Boone Dome, Iron Creek, Oil Mountain, Pine Mountain, Pine Mountain-Blue Canyon area, Pine Mountain-Smith Canyon area, Poison Spider, South Casper Creek, and West Poison Spider. ---, no gas produced.]

Field	Year discovered	Number active wells	Barrels of oil	Thousand cubic feet of gas	Producing formation	Remarks
Boone Dome-----	1923	6	403,612	25,617,243	Frontier	Only 1 well in mapped area.
Iron Creek-----	1917	11	148,557	----	Frontier	
Oil Mountain-----	1945	1	72,825	4,865	Tensleep	
Pine Mountain-----	1914	4	53,034	3,088	Tensleep	
Blue Canyon area-----	1955	0	NO PRODUCTION REPORTED			
Smith Canyon area-----	1966	0	NO PRODUCTION REPORTED			
Poison Spider-----	1917	34	3,146,534	65,000	Sundance	
South Casper Creek-----	1919	25	9,296,918	----	Tensleep	Hydrothermal injection project.
West Poison Spider-----	1948	1 6 9	5,731,938	8,007,822	Frontier Cody Mesaverde	
Total		97	18,853,418	33,698,018		