WYOMING STATE GEOLOGICAL SURVEY
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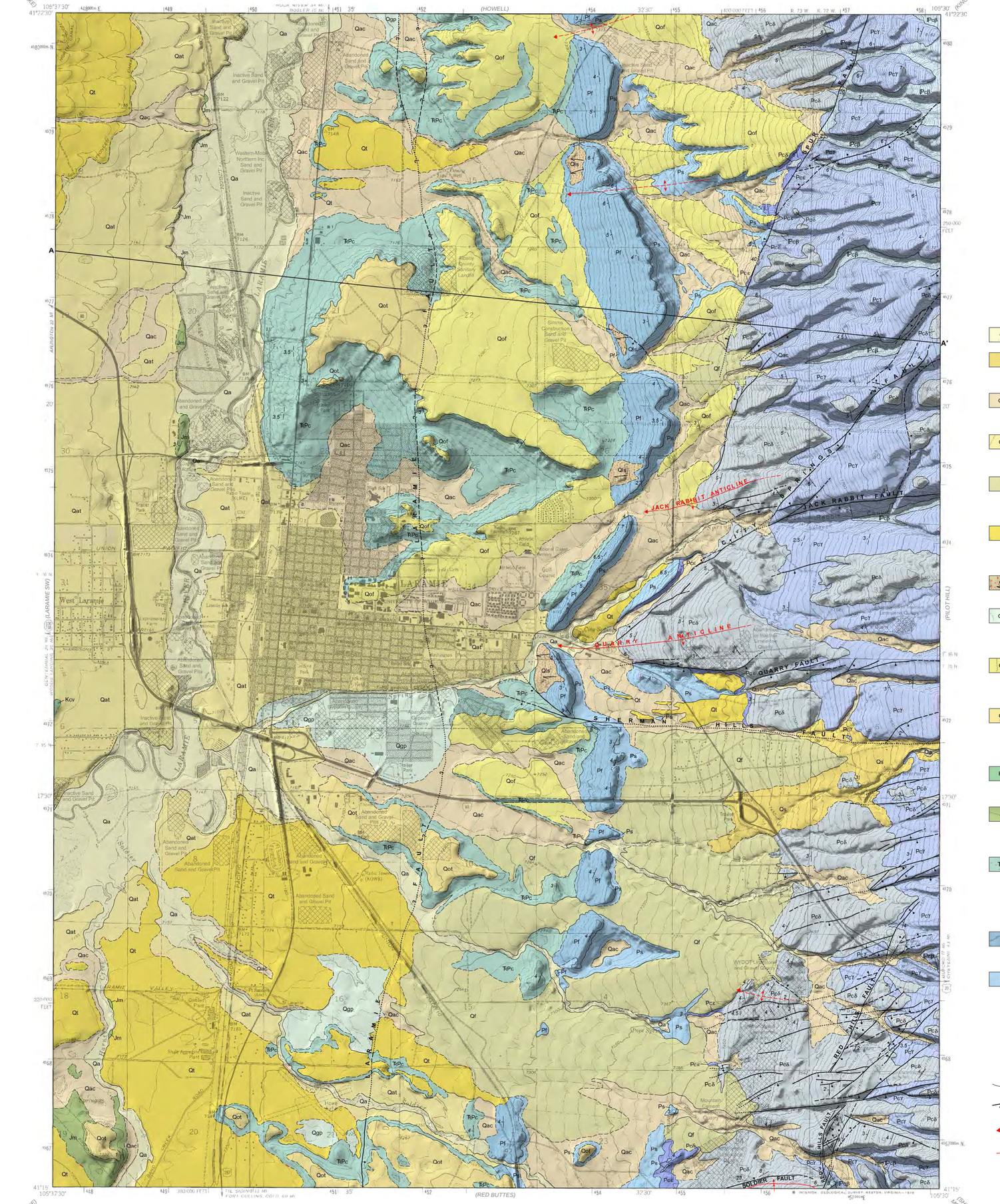
Laramie, Wyoming

Geology - Interpreting the past to provide for the future

Prepared in cooperation with the U.S. GEOLOGICAL SURVEY

MAP SERIES 50
Revised Laramie 1:24,000 - scale Geologic Map
Version 1.0 June 2009

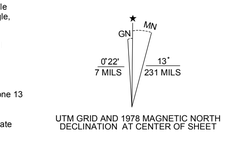


Base map from U.S. Geological Survey 1:24,000-scale topographic map of the Laramie, Wyoming Quadrangle, 1963, photorevised 1978.

Base hillshade derived from USDA/NRCS – National Cartography & Geospatial Center 10-meter Digital Elevation Model (DEM), 2000; azimuth 125°, sun angle 45°, vertical exaggeration 2

Projection: Universal Transverse Mercator (UTM), zone 13
North American Datum of 1927 (NAD 27)
1,000-meter grid ticks: UTM, zone 13
10,000-foot grid ticks: Wyoming State Plane Coordinate System, east zone

A digital version of this map is also available on CD-ROM.



UTM GRID AND 1978 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24,000

1 0.5 0 1 Miles
2,000 1,000 0 2,000 4,000 6,000 Feet
1 0.5 0 1 Kilometers

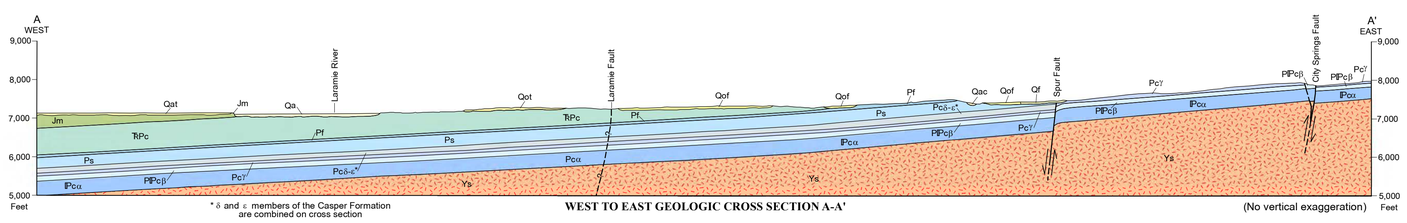
CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

WYOMING QUADRANGLE LOCATION

Geology mapped in 1993; revised and published in digital format in 1998; members of the Casper Formation were mapped indepentantly using Lundy's (1978) classification scheme (Figure 1) and map as a guide in 2008-09.

Digital cartography by Phyllis A. Ranz, Thomas E. Ver Ploeg, J. Fred McLaughlin, and Robin W. Lyons

Prepared in cooperation with and research supported by the U.S. Geological Survey, National Cooperative Mapping Program, under STATEMAP Award No. 1434-94-A-1262 and Cooperative Agreement 08HQAG0083. The views and conclusions contained in this document are those of the authors and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the U.S. Government.



* δ and ε members of the Casper Formation are combined on cross section

WEST TO EAST GEOLOGIC CROSS SECTION A-A'

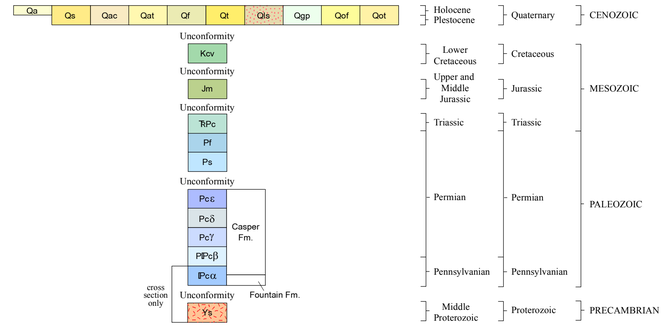
(No vertical exaggeration)

REVISED GEOLOGIC MAP OF THE LARAMIE QUADRANGLE, ALBANY COUNTY, WYOMING

by
Alan J. Ver Ploeg
2009

EXPLANATION

CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

Quaternary surficial deposits

Qa **Alluvial deposits (Holocene)**—Unconsolidated and poorly consolidated clay, silt, sand, and gravel, mainly in flood plains and lowest stream terraces. Thickness approximately 0 to 25 feet (0 to 7.6 m)

Qs **Windblown sand deposits (Holocene/Pleistocene)**—Active and stabilized dunes, made up of very fine-to fine-grained sand. Although numerous unmapped small-scale examples occur within the map area, the only mapped example occurs in the south portion of the Sherman Hills development east of Laramie. Thickness approximately 0 to 15 feet (0 to 4.6 m)

Qac **Mixed alluvium and colluvium (Holocene/Pleistocene)**—Sand, silt, clay, and gravel deposited mainly along intermittent streams; includes slope wash and smaller alluvial fan deposits that coalesce with alluvium. Locally, includes unmapped gypsite deposits in the north Laramie area near the high school and junior high school. Thickness approximately 0 to 20 feet (0 to 6 m)

Qat **Mixed alluvium and terrace deposits (Holocene/Pleistocene)**—Unconsolidated and poorly consolidated clay, silt, sand, and gravel, representing a transition zone between alluvium and terrace deposits, mainly adjacent to the Laramie River. Thickness approximately 0 to 30 feet (0 to 9 m)

Qf **Alluvial fan deposits (Holocene/Pleistocene)**—Poorly sorted clay, silt, and gravel; crudely bedded to non-bedded. Appear to be active, receiving sediments from intermittent streams flowing off the Laramie Mountains. May have some debris flow component. Grade into terrace deposits toward west, approaching the Laramie River. Locally, grade into alluvium and colluvium. Thickness 0 to 25 feet (0 to 7.6 m)

Qt **Terrace deposits (Holocene/Pleistocene)**—Beds of coarse sand and gravel with occasional boulders and lenses of silt and clay. Includes fragments of weathered granite and limestone cobbles, predominance varies depending on feeding stream source. Occur along present drainages, a few feet (0.6 m) to over 35 feet (11 m) above modern floodplains. Thickness approximately 0 to 10 feet (0 to 3 m)

Qls **Landslide deposits (Holocene/Pleistocene)**—Blocks of bedrock or loose slope debris; arrows on the map point in the inferred direction of movement. Occur in the Forelle Limestone, detaching at the contact with the underlying Satanka Shale

Qgp **Gypsite deposits (Holocene/Pleistocene)**—Unconsolidated clay-sized gypsum interbedded with red clay, sand, gravel, and limestone cobbles. Located in stream valleys immediately west of the Laramie Fault, probably related to erosion of gypsum beds of the lower Chugwater Formation and upper Satanka Shale which were brought to the surface or near surface by the Laramie Fault and associated springs. Thickness approximately 0 to 20 feet (0 to 6 m)

Qof **Older alluvial fan deposits (Holocene/Pleistocene)**—Poorly sorted clay, silt, sand, and gravel; crudely bedded to non-bedded with some debris flow component. Limestone cobbles are common. Currently inactive and dissected, often occurring as erosional remnants. Grade into older terrace deposits toward the west, in the northern part of the map area. Thickness 0 to 10 feet (0 to 3 m)

Qot **Older terrace deposits (Holocene/Pleistocene)**—Beds of coarse sand and gravel with occasional boulders and lenses of silt and clay. Limestone cobbles are common. Often occur as erosional remnants ranging from 20 to 100 feet above present stream flood plains. Some remnants may actually be older alluvial fan remnants. Thickness 0 to 10 feet (0 to 3 m)

Mesozoic and Paleozoic sedimentary rocks

Kcv **Cloverly Formation (Lower Cretaceous)**—Basal tan to white coarse-grained sandstone and chert-pebble conglomerate, locally cross-bedded and overlain by variegated buff and purple claystones interbedded with thin black shale beds, and an upper gray to buff to brown, fine- to coarse-grained sandstone, cross-bedded in lower part. Thickness 100 to 120 feet (30 to 37 m)

Jm **Morrison Formation (Upper and Middle Jurassic)**—Pale-green, olive-green, blue-green to maroon, and chalky white variegated calcareous and bentonitic claystones interbedded with thin drab limestones and buff, non-resistant sandstones. Limestone locally contains orange to brown chert inclusions. A thin section of Sundance Formation may exist in the area, but due to few and poor exposures, it is mapped with the Morrison. Thickness 300 to 375 feet (91 to 114 m)

TRPc **Chugwater Formation (Triassic and Permian)**—Red shale and siltstone with interbedded red to salmon to buff, fine-grained sandstone. Lower part of section contains red shale interbedded with thin to thick gypsum beds and banded, wavy, gypsiferous thin limestone sometimes mistaken for part of the Forelle Limestone. This part of the Chugwater along with the underlying Forelle Limestone and Satanka Shale would be mapped as Goose Egg Formation west of the Laramie Basin. Locally, some possible thin erosional outliers of Jelm Formation sandstone may occur, but due to their lack of persistence, they are mapped with the Chugwater. Thickness 650 to 800 feet (200 to 240 m)

Pf **Forelle Limestone (Permian)**—Gray to purple, thin bedded, sparsely fossiliferous limestone locally interbedded with red siltstone and thin gypsum laminations. Wavy outcrops resembling algal structures common. Landslides are common on Forelle dip slopes with the unit detaching from the underlying Satanka Shale. Thickness 10 to 30 feet (3 to 9 m)

Ps **Satanka Shale (Permian)**—Red siltstone and shale (often banded with white and ocher zones), soft sandstone, thin limestone beds, and local gypsum beds, especially near the top. Buff to orange to red, fine-grained sandstone with ripple marks common near base of unit. Gypsum beds in the Satanka are currently being mined in the Red Buttes area to the south of this map. Thickness 250 to 300 feet (76 to 91 m)

MAP SYMBOLS

Formation contact—Dashed where approximately located

Fault—Dashed where approximately located, dotted where concealed. Bar and ball on downthrown block; arrows indicate relative direction of oblique-slip movement

Anticline—Trace of axial plane and direction of plunge determined by field dip measurements and by photo interpretation, dashed where approximately located

Monocline—Trace of axial plane as determined by field measurements and by photo interpretation; dashed where approximately located; short arrow denotes steeper dipping limb

Strike and dip of beds—showing angle of dip

Strike and dip measurements from Lundy (1978)

Cross section location—Line of section. Ys, Sherman Granite (Middle Proterozoic), is shown on the cross section only as it does not crop out in map area

Surface mines and quarries—Outline of quarry or pit where bedrock has been disturbed, removed, or reclaimed as of June 1998. Solid boundary indicates active operation, dashed line indicates inactive or abandoned operation. Includes company name (for active operations) and commodity mined

REFERENCES

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Darton, N.H., and Siebenthal, C.E., 1909, Geology and mineral resources of the Laramie Basin, Wyoming: U.S. Geological Survey Bulletin 364, 81 p.

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Zielinski, R.A., Peterman, Z.E., Stuckless, J.S., Rosholt, J.N., and Nkomo, I.T., 1981, The chemical and isotopic record of rock-water interaction in the Sherman Granite, Wyoming and Colorado: Contributions to Mineralogy and Petrology, v. 78, p. 209-291.

Casper and Fountain formations, undivided (Permian and Pennsylvanian)—Combined unit not mapped on this quadrangle; see detailed descriptions below. Buff to reddish, calcareous to quartzitic, very fine- to coarse-grained, well-cemented subarkosic sandstone interbedded with buff to purplish-gray limestone and dolomite beds, usually micritic and locally fossiliferous. Sandstone often exhibits large-scale festoon cross-bedding, increasing toward the south. As many as 10 distinct limestone or dolomite beds, which are locally quarried for cement or gravel uses, have been identified in the Casper in the Laramie area (Benniran, 1970). The Casper Formation serves as the prime aquifer for the city of Laramie. Thickness 600 to 700 feet (180 to 210 m) (Benniran, 1970, and Kirn, 1972)

Casper/Fountain subdivisions—Benniran (1970) subdivided the formation into separate informal members based on 10 distinct limestone units (limestone 10 is the highest stratigraphically and the youngest, limestone 1 is the lowest stratigraphically and the oldest) that are separated by sandstones (**Figure 1**). The sandstone units act as local aquifers. Lundy (1978) combined the limestone units into five informal members (epsilon, delta, gamma, beta, and alpha) based upon local, confined aquifer packages (**Figure 1**)

PCε **Epsilon member (Permian)**—The youngest Casper Formation member; capped by limestone 10 (occurs south of the mapped area) and a sandstone unit that grades into the overlying Satanka Shale. Consists of red to pink, medium- to fine-grained sandstone, mostly covered in the Laramie area. Overall thickness of this member 22 to 30 feet (6.7 to 9.1 m)

PCδ **Delta member (Permian)**—Includes limestones 9 and 8 and two separate sandstone units. Limestone 9 is an 8- to 10-foot (2.4- to 3.0-m)-thick, white-gray to pink, massive, fractured limestone that caps the member. A reddish-brown to buff, thinly laminated, thick sandstone separates the two limestones of the delta member. Limestone 8 is a pink to light-gray, massive, fractured 12-foot (3.7-m)-thick limestone that crops out mostly at the base of the Laramie Mountains. A light-tan to red, calcareous, cross-laminated, porous sandstone 40 to 55 feet (12 to 17 m) thick lies beneath limestone 8. Overall thickness of delta member is 80 to 112 feet (24.4 to 34.1 m)

PCγ **Gamma member (Permian)**—Includes limestones 7 and 6 and two separate sandstone units. Limestone 7 is an extensive unit, 17 to 18 feet (5.2 to 5.5 m) thick, that forms prominent ridges and the main dip slope of the western Laramie Mountains, as well as caps the gamma member. It has a tan to buff, dolomitic base overlain by a sandy grayish limestone. Limestone 6 is a dense, fossiliferous limestone, 6 to 8 feet (1.8 to 2.4 m) thick, that is only present in the northern part of the Pilot Hill map area. A pink to red, fine- to medium-grained, friable, calcareous sandstone, 50 to 60 feet (15 to 18 m) thick, extends from the base of limestone 7 to the top of limestone 5 except where it is divided by limestone 6. Overall thickness of gamma member 73 to 86 feet (22 to 26 m)

PIPCβ **Beta member (Permian and Pennsylvanian)**—Includes limestones 5 and 4 and two separate sandstone units. Limestone 5 is a finely crystalline, purple to pink, dense, highly fractured limestone, 8 to 12 feet (2.4 to 3.7 m) thick, that weathers to dark gray and caps this member. A light-brown to tan-red, calcareous, fine-grained, friable, 25- to 30-foot (7.6- to 9.1-m)-thick sandstone separates limestones 5 and 4. Limestone 4 has a buff to tan dolomitic base that grades upward into light-gray to purple, dense, ridge-forming limestone, 18 to 26 feet (5.5 to 7.9 m) thick. Below limestone 4, a thick [90 feet (30 m)], red to buff, moderately resistive, extremely calcareous, thick, moderately sorted sandstone layer forms the base of the beta member. North of Rogers Canyon (on adjacent quadrangles) entire member is Permian in age. Overall thickness of this member 141 to 158 feet (43.0 to 48.2 m)

IPCα **Alpha member (Pennsylvanian)**—Shown on cross section only; does no crop out in the Laramie 1:24,000 quadrangle, but the member is mapped in the Pilot Hill quadrangle to the east. The oldest member of the Casper Formation includes limestones 3, 2, and 1 and three separate sandstone units, the lowest of which grades into the underlying Fountain Formation, which which forms the base of this member. Limestone 3 at the top of the Alpha member is one of the more prominent limestones in this section of the Casper Formation. The base of the 29- to 40-foot (8.8- to 12-m)-thick limestone 3 is light-tan to brown sandy dolomite, fining upwards into a purple-pink carbonate that weathers gray and forms ridges. A light-brown to reddish-brown, poorly sorted, fine-grained sandstone unit, 75 to 80 feet (23 to 24 m) thick, separates limestone 3 from limestone 2. Limestone 2 is a thin [8 to 12 feet (2.4 to 3.7 m)], pink to purple, sandy unit that is mostly covered in the map area. A pink to brown, calcareous, cross-laminated, medium-sorted, fine-grained sandstone, 65 to 80 feet (20 to 24 m) thick, separates limestones 2 and 1. Limestone 1 is a purple to pink, massive, fossiliferous, sandy unit, 9 to 13 feet (2.7 to 4.0 m) thick. The unit below limestone 1 is a tan, pink, and red, cross-bedded, medium-grained sandstone that interfingers with thin [up to 1 inch (3 cm)] thick, sandy limestones. The basal sandstone unit, 80 to 150 feet (24 to 46 m) thick, is slightly arkosic; more so as it grades into the Fountain Formation. Overall thickness of the Alpha member 266 to 375 feet (81.1 to 114 m)

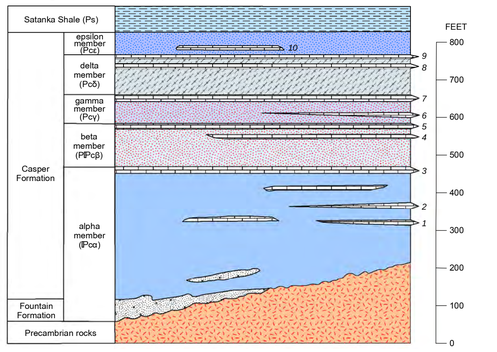
Fountain Formation (Pennsylvanian)--Coarse-grained pink to red to purple sandstone and arkose, with some conglomerates, siltstones and shales. Interfingers with and underlies Casper Formation, thinning to the north and pinching out near Rogers Canyon northeast of the Laramie quadrangle. For mapping purposes, the Fountain Formation was included with the alpha member, which is entirely in the subsurface on the quadrangle. The Fountain Formation lies unconformably on top of Precambrian basement rock. Possibly deposited by an alluvial plain or a series of coalescing fans at the base of the Ancestral Rockies. Approximately 30 feet (9 m) thick at Pilot Hill (Benniran, 1970)

Middle Proterozoic granitic and metamorphic rocks

Ys **Sherman Granite**—Shown on cross section only. Where it crops out east of the map area, it is medium- to coarse-grained, pink to orange, biotite hornblende granite, syenogranite, quartz monzonite, and granodiorite. The Sherman Granite has been dated at 1,430 ±20 Ma (Mega-annum or million years before present) by a Rb-Sr whole rock isochron (Zielinski and others, 1981)

FIGURE 1

Schematic relationship between Lundy's (1978) informal members of the Casper Formation and the Casper limestones (1-10) as defined by Benniran (1970) in the vicinity of Laramie, Wyoming. Map area falls within diagram, but not all units crop out in the map area.



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