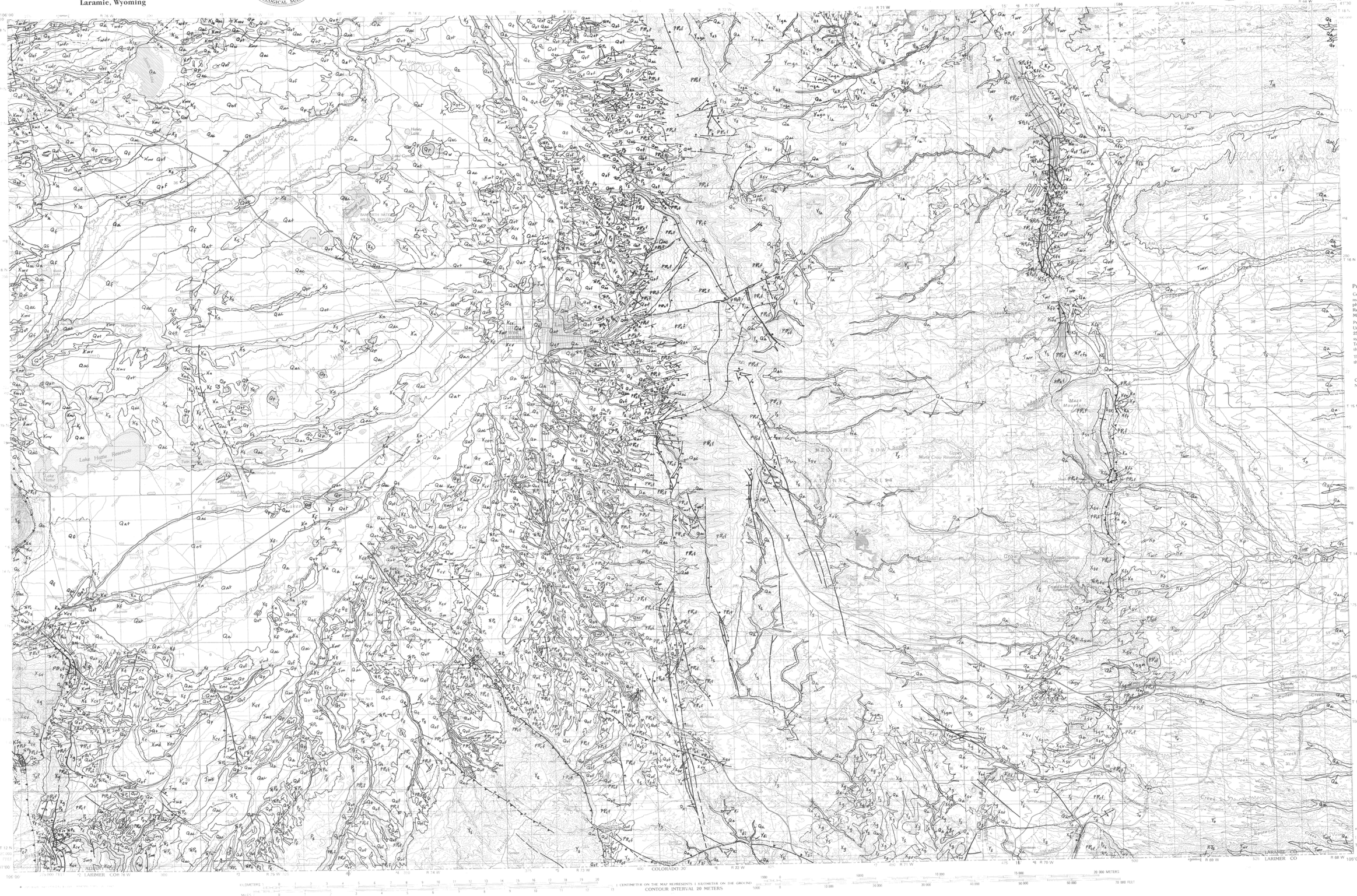
WYOMING STATE GEOLOGICAL SURVEY
Lance Cook, State Geologist
Laramie, Wyoming

PRELIMINARY MAP SERIES 99-1
Laramie 1:100,000-Scale Geologic Map

PGM 99-1



PRELIMINARY GEOLOGIC MAP OF THE LARAMIE 30' x 60' QUADRANGLE, ALBANY AND LARAMIE COUNTIES, SOUTHEASTERN WYOMING

Mapped and compiled by

Alan J. Ver Ploeg and Cynthia S. Boyd

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Pamphlet to accompany
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Laramie, Wyoming
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DESCRIPTION OF MAP UNITS

HOLOCENE AND PLEISTOCENE SURFICIAL DEPOSITS

Qa **ALLUVIAL DEPOSITS (HOLOCENE)**--Unconsolidated and poorly consolidated clay, silt, sand, and gravel, mainly in floodplains and lowest stream terraces. Thickness approximately 0 to 50 feet.

Qat **MIXED ALLUVIUM AND TERRACE DEPOSITS (HOLOCENE)**--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.

Qp **PLAYA LAKE DEPOSITS (HOLOCENE)**--Clay to silt-sizes stratified lake bed deposits.

Qw **WIND-BLOWN DEPOSITS (HOLOCENE)**--Clay to silt-sized lake bed deposits occurring in dunes on the northeast or east (downwind) side of lakes and playa lakes. Also active and stabilized sand dunes east and south of Laramie, ocurring in and sourced by Casper Formation sandstones. Thickness 0 to 50 feet.

Qc **COLLUVIUM (HOLOCENE/PLEISTOCENE)**--Unconsolidated masses of rock fragments and soil material on relatively steep slopes with thickest accumulations at the bases of slopes.

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. Thickness approximately 0 to 50 feet.

Qf **ALLUVIAL FAN DEPOSITS (HOLOCENE/PLEISTOCENE)**--Poorly sorted clay, silt, and gravel; crudely bedded to nonbedded. Appear to be active, receiving sediments from intermittent streams flowing off of the Laramie and Medicine Bow Mountains. May have some debris flow component. Grade into terrace deposits near the Laramie River. Locally, grade into alluvium and colluvium. Thickness approximately 0 to 25 feet.

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 source of feeding stream. Occur along present drainages, a few feet to over 40 feet above modern flood plains. Thickness approximately 0 to 10 feet.

Qls **LANDSLIDE DEPOSITS (HOLOCENE/PLEISTOCENE)**--Blocks of bedrock or loose slope debris; arrows point in the inferred direction of movement. Many 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. Many are located in stream valleys immediately west of the Laramie Fault, probably related to erosion of gypsum beds of the lower Chugwater Formation which were brought to the surface or near surface by the Laramie Fault. These deposits were mined for cement plaster in the Laramie area near the turn of the century. Similar deposits occur in the southern and southeastern part of the Laramie Basin, also associated with faulting in the Chugwater Formation. Thickness 0 to 10 feet.

Qof **OLDER ALLUVIAL FAN DEPOSITS (HOLOCENE/PLEISTOCENE)**--Poorly sorted clay, silt, sand and gravel; crudely bedded to nonbedded with some debris flow component. Limestone cobbles are common. Includes boulders and cobbles of quartzite and other Precambrian material on west side of map area. Currently inactive and dissected, often occurring as erosional remnants. Grade into older terrace deposits toward the Laramie River. Thickness 0 to 10 feet.

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 in those occurring on the east side of the Laramie Basin, while Precambrian rocks predominate in those occurring on the west side of the basin. Often occur as erosional remnants ranging from 20 to 300 feet above present stream floodplains. Some remnants may actually be older alluvial fan remnants. Thickness 0 to 10 feet.

QTw **WIND-BLOWN DEPOSITS (LOWER PLEISTOCENE/PLIOCENE?)**--Stabilized, eroded sand dune remnants perched on the sides of gulches located near the upper reaches of Gilmore Gulch, southeast of Laramie. These perched dune remnants, capped by cobble-sized lag gravels, occur in and are sourced by Casper Formation sandstones. Thickness 0 to 100 feet.

UNCONFORMITY

TERTIARY SEDIMENTARY DEPOSITS

To **OGALLALA FORMATION (MIOCENE)**--Light-colored, sometimes tuffaceous, unconsolidated to well cemented heterogeneous deposits of silt, sand and gravel containing some cobbles and boulders, particularly near the Laramie Mountains. Thickness 0 to 330 feet. Only present in the Denver Basin.

UNCONFORMITY

Twr **WHITE RIVER FORMATION (OLIGOCENE)**--White to pale pink blocky tuffaceous claystone and lenticular arkosic conglomerate in the Laramie Basin. While in the Denver Basin, away from the Laramie Mountains, the formation is orange-gray claystone and siltstone with local and usually thin gray sandstone and conglomerate. Conglomerates and arkoses are particularly abundant near the Laramie Mountains on both sides of the range. Thickness 0 to 500 feet in the Denver Basin, 0 to 100 feet in the Laramie Basin. The Members defined below are only mapped separately in a portion of the Denver Basin and not on this quadrangle.
Upper Conglomerate Member--Gray to brown to red, poorly to well cemented conglomerate and sandstone with Paleozoic and Precambrian clasts, and claystone, siltstone and sandstone matrix material. The member becomes more conglomeratic toward the Laramie Mountains. Thickness 0 to 300 feet.
Brule Member--Pale pink to white argillaceous siltstone with local channel sandstone, limestone, claystone and volcanic ash. Thickness 0 to 450 feet.
Chadron Member--Variegated tuffaceous and bentonitic claystone and siltstone, with channel sandstone and conglomerate. The lower portion contains fluvial deposits. Thickness 0 to 700 feet.

UNCONFORMITY

Twdr **WIND RIVER FORMATION (UPPER EOCENE)**--Variegated claystone, shale and arkosic sandstone with lenticular conglomerate. Upper portion of the formation is a distinctive reddish maroon siltstone and claystone. Only present in the Laramie Basin. Thickness 400+ feet.

UNCONFORMITY

Th **HANNA FORMATION (PALEOCENE)**--Mostly brown to gray coarse-grained arkosic sandstone, with siltstones, dark carbonaceous shale, coal and a basal conglomerate that contains giant quartzite boulders near the Medicine Bow Mountains. Thickness roughly 800 feet. Only present in the Laramie Basin.

UNCONFORMITY

UPPER AND LOWER CRETACEOUS AND JURASSIC DEPOSITS

Kmb **MEDICINE BOW FORMATION (UPPER CRETACEOUS)**--Light colored to gray to brown claystone, sandstone and siltstone with coal and carbonaceous shale beds. Thickness 0 to 400 feet. Only present in the Laramie Basin.

Kfh **FOX HILLS FORMATION (UPPER CRETACEOUS)**--Gray to yellow brown sandstone that is sometimes interbedded with dark shale. The sandstone can be friable, silty or pyrite bearing, and the lower portion can be finer-grained, very limy and green. Thickness 190 to 250 feet. Only mapped separately on the east side of the Laramie Mountains.

Kle **LEWIS SHALE (UPPER CRETACEOUS)**--Gray marine shale and siltstone with gray and brown lenticular sandstone beds; contains many concretions. Only present in the Laramie Basin. Thickness 2200-2600 feet.

Kp **PIERRE SHALE (UPPER CRETACEOUS)**--Dark gray shale with thin to moderately thick, sometimes persistent sandstone beds. Only present in the Denver Basin. Thickness about 5700 feet.

Kmv **MESAVERDE FORMATION (UPPER CRETACEOUS)**--Gray to tan sandstone and interbedded dark gray to black siltstone and sandy shale, with some coal beds and carbonaceous shale in the upper part. Capped by the Pine Ridge sandstone member. Only present in the Laramie Basin. Thickness up to1600 feet.

Ks **STEELE SHALE (UPPER CRETACEOUS)**--Gray marine shale and siltstone, with numerous bentonite beds and thin lenticluar sandstones, and some limestones. Only present in the Laramie Basin. Thickness 2300 to 2700 feet.

Kn **NIOBRARA FORMATION (UPPER CRETACEOUS)**--Black or gray to yellow speckled, calcareous shale, and light-colored limestone and chalk. Thickness roughly 325 to 700 feet. Thickest in the Laramie Basin.

Kft **FRONTIER FORMATION, MOWRY SHALE, MUDDY SANDSTONE AND THERMOPOLIS SHALE UNDIVIDED**

Kf **FRONTIER FORMATION (UPPER CRETACEOUS)**--Dark gray to black shale with interbedded thin, lenticular, tan to gray sandstones and thin bentonite beds. Persistent tan sandstone occurs at top of formation, locally referred to as the "Wall Creek Sandstone". Thickness approximately 550 feet.

Kmt **MOWRY SHALE, MUDDY SANDSTONE AND THERMOPOLIS SHALE UNDIVIDED**

Kmr **MOWRY SHALE (UPPER CRETACEOUS)**--Dark gray to black siliceous shale that weathers silver gray and contains thin bentonite beds and abundant fish scales. Thickness 80 to 150 feet. Thickest in the Laramie Basin

Kmd **MUDDY SANDSTONE (LOWER CRETACEOUS)**--Tan to gray sandstone that is 20 to 100 feet thick. Thinnest in the Laramie Basin. A black shale sequence was mapped with the Muddy Sandstone by Vargas (1974) in the southwest corner of the map, elsewhere on the map this sequence is mapped with the Mowry Shale.

Kt **THERMOPOLIS SHALE (LOWER CRETACEOUS)**--Dark gray to black soft fissile shale that can contain thin partings of bentonite and sandstone. Ironstone concretions appear in the upper portion of the formation. Fossil fish fragments occur locally in the upper thin sandstones. Selenite crystals are common in outcrop. Thickness 60 to 100 feet.

KJs **CLOVERLY, MORRISON AND SUNDANCE FORMATIONS UNDIVIDED**

KJ **CLOVERLY AND MORRISON FORMATIONS UNDIVIDED**

Kcv **CLOVERLY FORMATION (LOWER CRETACEOUS)**--Basal tan to white coarse-grained sandstone and chert pebble conglomerate, locally crossbedded and overlain by varigated buff and purple claystones inter-bedded with thin black shale beds, and an upper gray to buff to brown, fine- to coarse-grained sandstone, crossbedded in lower portion. Thickness 100 to 140 feet.

UNCONFORMITY

Jms **MORRISON AND SUNDANCE FORMATIONS UNDIVIDED**

Jm **MORRISON FORMATION (UPPER 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. Thickness 130 to 300 feet.

SUNDANCE FORMATION (UPPER AND MIDDLE JURASSIC)--Varigated gray sandstone and siltstone, with greenish sandy shale in the lower portion of the section. The formation is variably glauconitic and thins to less than 30 feet on the south flank of the Laramie Basin. It is not mapped separately on this quadrangle. Thickness 25 to 150 feet.

UNCONFORMITY

TRIASSIC, PERMIAN, AND PENNSYLVANIAN SEDIMENTARY DEPOSITS

Trj **JELM FORMATION (UPPER TRIASSIC)**—Yellow to salmon pink massive sandstone, with large-scale crossbedding, interbedded with thin partings red siltstone, claystone, and shale. This unit was mapped separately by Vargas (1974) and is only represented on the southwest corner of the map. Thickness ranges up to 125 feet, thinning rapidly to the east and pinching out on the east side of the Laramie basin.

TrPcfs **CHUGWATER FORMATION, FORELLE LIMESTONE, AND SATANKA SHALE UNDIVIDED**

TrPc **CHUGWATER FORMATION (TRIASSIC AND PERMIAN)**—Red shale and siltstone with interbedded red to salmon to buff, fine-grained sandstone. Lower portion of section contains red shale interbedded with thin to thick gypsum beds, local solution breccia, and banded wavy gypsiferous thin limestone sometimes mistaken for part of the Forelle Limestone. This portion of the Chugwater along with the underlying Forelle Limestone and Santanka Shale would be mapped as Goose Egg Formation west of the Laramie Basin. With the exception of the southwest corner of the map, thin Jelm Formation sandstone erosional outliers that occur are mapped with the Chugwater. Thickness 650 to 800 feet.

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.

Ps **SATANKA SHALE (PERMIAN)**--Red siltstone and shale (often banded with white and ocher color zones), soft sandstone, thin limestones, 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. Thickness 75 to 300 feet.

UNCONFORMITY

PIPcf **CASPER AND FOUNTAIN FORMATIONS UNDIVIDED**

Casper Formation (Permian and Pennsylvanian)--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 different limestone or dolomite beds, which are locally quarried for cement or gravel uses, have been identified in the Laramie area. The Casper Formation serves as the prime aquifer in the Laramie area. Thickness 150-800 feet.

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 the north edge of the map. Thickness 0 to 500 feet.

DEVONIAN DIATREME INTRUSIVES

Dki **DEVONIAN DIATREMES**--Porphyritic, brecciated, kimberlitic intrusive masses and dikes that sometimes contain diamonds. Xenoliths of Silurian and Orodovician limestone and dolomite, Precambrian crystalline rocks, peridotite, and eclogite are present in the diatremes.

MIDDLE PROTEROZOIC ROCKS

Ys **SHERMAN GRANITE (MIDDLE PROTEROZOIC)**--Medium to coarse grained, pink to orange, biotite hornblende granite, syenogranite, quartz monzonite and granodiorite. The Sherman Granite is gradational with or interfingers with the Syenite of the Laramie Mountains. The Sherman Granite has been dated at 1,430 $\pm$20 MA (million years ago) by a Rb-Sr whole rock isochron (Zielinski and others, 1981).

Ysd **SHERMAN GRANITE AND BASALT MIXED**

Ysgm **SHERMAN GRANITE BORDER FACIES**--Medium and fine-grained porphyritic facies of the Sherman Granite. Mapped separately in the southeastern portion of the quadrangle.

Ysi **SHERMAN GRANITE INNER CAP ROCK PHASE**—Pinkish-gray, porphyritic, biotite monzogranite. Foliation defined by oriented, tabular, microcline phenocrysts; biotite-rich streaks; and oriented, tabular inclusions. Mapped in the southern portion of the quadrangle as part of the Virginia Dale ring structure.

Ydi **DIORITE (DIORITIC ROCKS OF THE VIRGINIA DALE RING STRUCTURE)**—Black to gray, medium-grained subophitic, ophitic, or hypidiomorphic-granular; composed of andesine, hornblende, biotite, quartz, and opaque minerals. Mapped in the southern portion of the quadrangle as part of the Virginia Dale ring structure.

Yls **LARAMIE MOUNTAINS HORNBLENDE AND PYROXENE SYENITE (MIDDLE PROTEROZOIC)**--Coarse grained, brown to black hornblende biotite syenite, quartz syenite, and monzonite. These rocks grade by occurrence of pyroxene into coarse grained, light brown to black, hornblende pyroxene syenite; by relative increase of plagioclase into noritic anorthosite; and by relative increase of quartz and microcline into Sherman Granite. The unit includes microcline porphyry syenite, pink leucocratic hornblende syenite dikes and sills which intrude metamorphic country rocks. Zircons from both major phases of the syenite define a single chord

on a U-Pb concordia plot, indicating an age of 1,435±15 MA. This syenite is part of what some geologists call the Laramie Anorthosite Complex.

Yan **LARAMIE MOUNTAINS ANORTHOSITE AND NORITE (MIDDLE PROTEROZOIC)**--White to light bluish gray, medium to coarse grained, generally leucocratic anorthosite that is massive to layered to brecciated. A minor gray mafic anorthosite or norite commonly forms a gradational phase between syenites and the leucocratic anorthosite, or forms less resistant, more mafic layers in layered anorthosite. This unit commonly occurs as sharply bounded angular inclusions in the syenite, but as noted above is gradational into the syenite. This anorthosite is the bulk of what some geologists call the Laramie Anorthosite Complex. On the north end of the Laramie Mountains, this complex has been subdivided into several units listed below, based on unpublished mapping by D.H. Lindsley of the State University of New York at Stony Brook.

Ya **CHUGWATER ANORTHOSITE**

Ya1 **CHUGWATER ANORTHOSITE (An 1)**

Ya2 **CHUGWATER ANORTHOSITE (An 2)**

Ya3 **KING MOUNTAIN ANORTHOSITE (An 3)**

Yuga **UPPER GABBROIC ANORTHOSITE**

Ymga **MIDDLE GABBROIC ANORTHOSITE**

Ylga **LOWER GABBROIC ANORTHOSITE**

EARLY PROTEROZOIC ROCKS

Xg **OLDER PROTEROZOIC GRANITIC ROCKS**--Medium to coarse grained, pink granite. Very similar in composition to the Sherman Granite, although composed of a higher percentage of calcic plagioclase and lower percentage of potassium feldspar. Restricted to small exposures in the Medicine Bow Mountains (southwest corner of map) and Laramie Mountains. Other similar rocks have been dated at about 1740 Ma in the Medicine Bow Mountains and 1700-1750 Ma in the Laramie Mountains (granite of the Duck Creek area).

Xsv **OLDER PROTEROZOIC METASEDIMENTARY AND METAVOLCANIC ROCKS**
Laramie Mountains--Pelitic schist, marble, granite gneiss, layered amphibolite, and felsic gneiss. The Granite Village area in the southeastern Laramie Mountains area is mapped in much greater detail by Houston and Marlatt (1997).
Medicine Bow Mountains (southwest corner of the map)--Granite gneiss, felsic gneiss, amphibolite, hornblende gneiss, and amphibolite.

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. No indication on fault trace indicates undetermined motion.

Thrust fault--Dashed where approximately located, dotted where concealed. Sawteeth on upthrown block.

Anticline--Trace of axial plane and direction of plunge determined by field dip measurements and by photo interpretation. Dashed where approximately located. Short arrow denotes steeper dipping limb.

Monocline--Trace of axial plane determined by field dip measurements and by photo interpretation. Dashed where approximately located. Short arrow denotes steeper dipping limb.

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