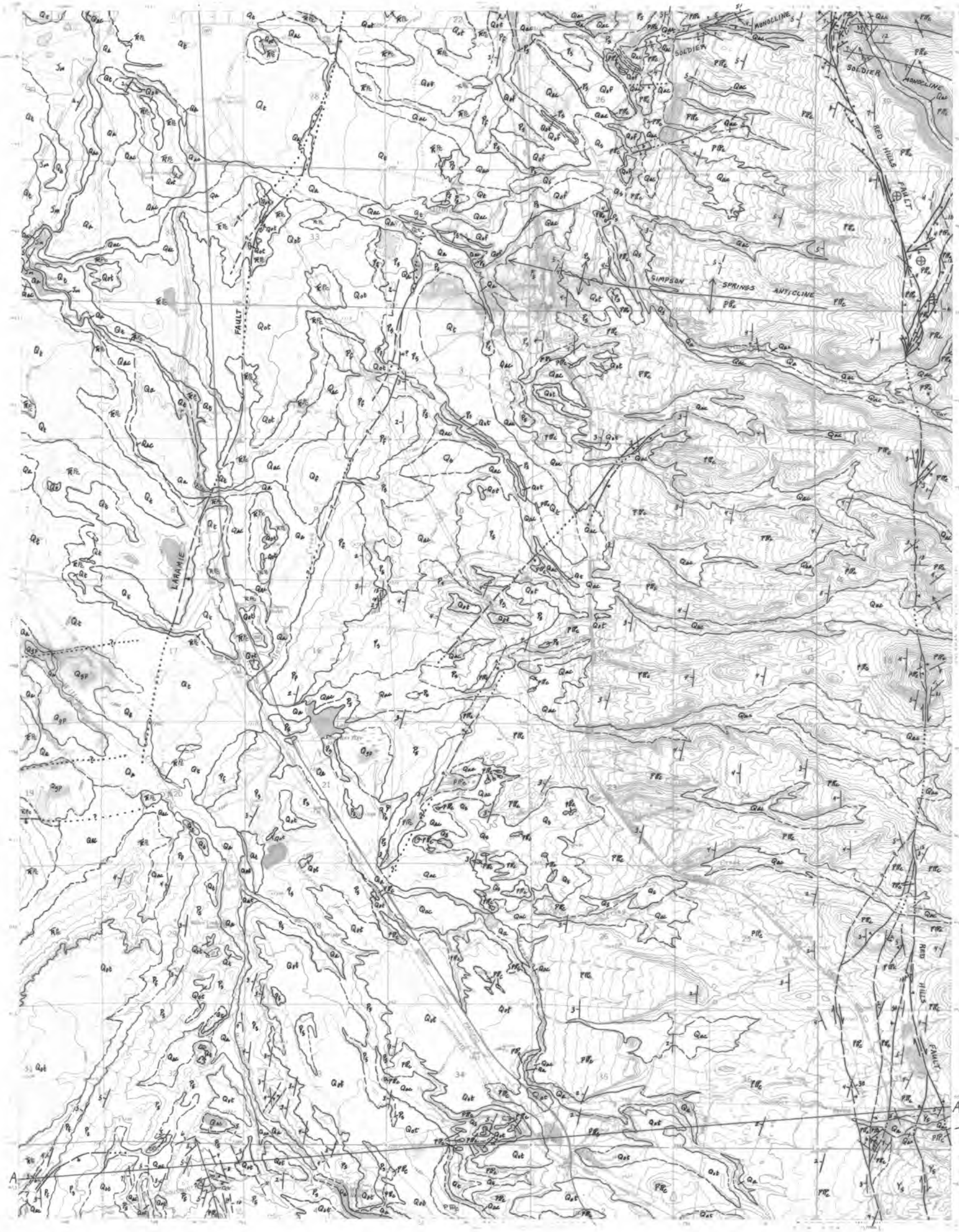
WYOMING STATE GEOLOGICAL SURVEY
Gary B. Glass, State Geologist

PRELIMINARY GEOLOGIC MAP 95-2
Red Buttes Quadrangle
Albany County, Wyoming



EXPLANATION

SEDIMENTARY AND PRECAMBRIAN ROCKS AND SURFICIAL DEPOSITS

Qa **Alluvial deposits**
Unconsolidated and poorly consolidated clay, silt, sand, and gravel, mainly in floodplains and lowest stream terraces. Thickness 0 to 20 feet.

Qac **Mixed alluvium and colluvium**
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 20 feet.

Qat **Mixed alluvium and terrace deposits**
Unconsolidated and poorly consolidated clay, silt, sand, and gravel, representing a transition zone between alluvium and terrace deposits; small occurrence along Willow Creek, in the southern part of the map. Thickness approximately 0 to 15 feet.

Qs **Windblown sand deposits**
Active and stabilized dunes, made up of very fine-to fine-grained sand. Although numerous unmapped small-scale examples occur within the map area, mapped examples occur at the mouth of Gilmore Gulch and southeast of Red Buttes in the Red Buttes housing developement. Thickness approximately 0 to 15 feet.

Qf **Alluvial fan deposits**
Poorly sorted clay, silt, and gravel; crudely bedded to nonbedded. Appear to be active receiving sediments from intermittent stream. May have some debris flow component. Only occurrence is on a relatively small scale northeast of Red Buttes. Thickness 0 to 30 feet.

Qt **Terrace deposits**
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 to over 15 feet above modern flood plains. Thickness approximately 0 to 10 feet.

Qgp **Gypsite deposits**
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 Formation which were brought to the surface or near surface by the Laramie Fault. Thickness approximately 0 to 20 feet.

Qof **Older alluvial fan deposits**
Poorly sorted clay, silt, sand and gravel; crudely bedded to nonbedded 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 20 feet.

Qot **Older terrace deposits**
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 40 feet above present stream floodplains. Some remnants may actually be older alluvial fan remnants. Thickness 0 to 10 feet.

UNCONFORMITY

Twr? **White River Formation? (Oligocene)**
Mostly unconsolidated, light gray sand and silt interbedded with lenses of gravel and cobbles composed of limestone and sandstone eroded from outcrops of Casper Formation, as well as, igneous and metamorphic cobbles from the Precambrian outcrops to the east. Outcrops occur in Gilmore Gulch on the east edge of the map. Additional work is required to definitively establish the age of these deposits. Thickness 0 to nearly 100 feet.

UNCONFORMITY

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 and questionable indentification, it is mapped with the Morrison. Thickness 300 to 400 feet.

UNCONFORMITY

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 and banded wavy gypsiferous thin limestone and associated solution breccia, 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. Locally, some possible Jelm Formation sandstone erosional outliers may occur, but due to their lack of persistence and questionable indentification, they are mapped with the Chugwater. One example of possible Jelm Formation occurs east of Harney Creek in Sec 29, T.15N., R.73W. 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 and associated solution breccia. Wavy outcrops resembling algal structures common. 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 south of Red Buttes. Thickness 140 to 200 feet.

UNCONFORMITY

PPc **Casper Formation (Permian and Pennsylvanian)**
Buff to reddish, calcareous to quartzitic, fine- to coarse-grained, well cemented subarkosic sandstone interbedded with thin 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. The limestone beds are quite thin and less numerous than in the Laramie area and are for the most part absent in the southern part of the map area. The Casper Formation serves as the prime aquifer in the map area. Intertongues with underlying Fountain Formation, which is up to 400 feet thick in the map area and includes primarily maroon arkosic cross-bedded fine to coarse sandstone and conglomerate interbedded locally with shales and thin limestones. They are mapped together due to the transitional nature of the contact between the Casper and the Fountain. Thickness 600 to 800 feet.

UNCONFORMITY

Ys **Sherman Granite (Middle Proterozoic)**
Coarsely crystalline pink granite ranging in age from 1,414 to 1,435 Ma. Crops out in the southeast corner of the map area.

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.

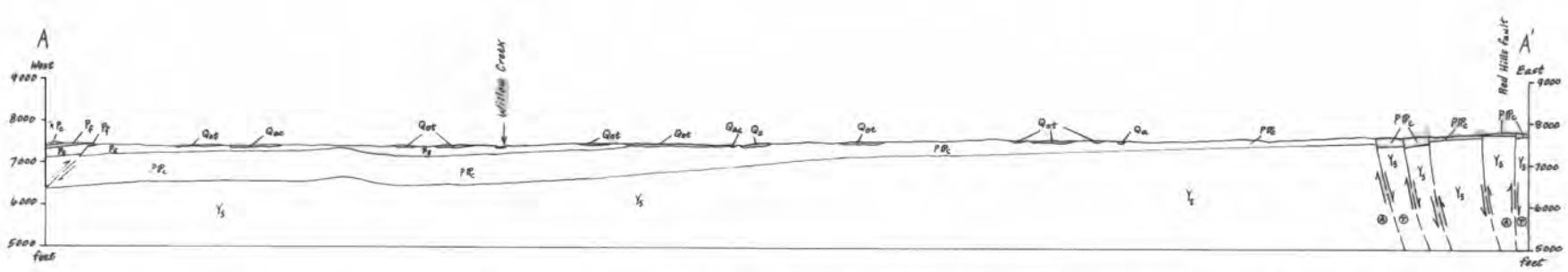
Monocline
Trace of axial plane as determined by field measurements and by photo interpretation. Dashed where approximately located. Short arrow denotes steeper dipping limb.

Strike and dip of beds, showing angle of dip

Horizontal beds

Strike and dip measurements from Lundy (1978) and Nicoll (1963)

Cross section location



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PRELIMINARY GEOLOGIC MAP OF THE RED BUTTES QUADRANGLE, ALBANY COUNTY, WYOMING

by
Alan J. Ver Ploeg
1995

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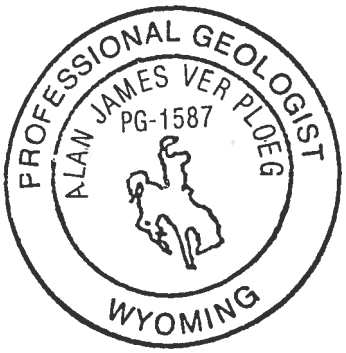

Alan J. Ver Ploeg
7/10/96

PRELIMINARY GEOLOGIC MAP
95-2

Laramie, Wyoming
1995

Overview of the Preliminary Geologic Map of the Red Buttes Quadrangle, Albany County, Wyoming

Introduction

The Preliminary Geologic Map of the Red Buttes Quadrangle represents the second in a series of 1:24,000-scale geologic maps developed to aid citizens, county and city planners, and local industry in incorporating basic geologic information into their planning and development efforts. This project emphasizes creating geologic maps at a detailed scale of the more populated areas within the State of Wyoming. The map provides information relating to mineral resources, groundwater resources, potential geologic hazards within the map area, and structural geology as it may relate to development and planning within the mapped area.

Mineral Resources

Mineral development within the Red Buttes Quadrangle centers primarily around sand and gravel production, limestone production, and gypsum production. Sand and gravel mining is typically associated with the Quaternary units mapped on the quadrangle, including but not restricted to mixed alluvial and colluvial deposits, terrace deposits, and older terrace and alluvial fan deposits. Recently active operations occurred in older terrace deposits near U.S. Highway 287 on the southern portion of the map.

Limestone production is restricted to the limestone units in the Casper Formation which crop out on the east side of the mapped area, on the flanks of the Laramie Mountains. The limestone is mined for concrete production needs, road gravel, and other types of construction aggregate. Historically, quarries have existed in numerous locations along the Laramie Mountains. Recently active quarries have existed southeast of Laramie, on Soldier monocline, and near U.S. Highway 287 on the south end of the map.

Near the turn of the of the century, gypsum was mined from the gypsum beds in the Satanka Shale, immediately west of U.S. Highway 287 near Red Buttes. The gypsum was used in plaster production. A currently active gypsum mining operation exists immediately north of the historical mine workings. The gypsum beds mined here are also from the Satanka Shale, ranging from 15-20 feet in thickness. The gypsum mined is used as a retardant additive for cement.

Groundwater Resources

The Casper Formation is the principal aquifer supplying water for private and/or domestic needs within the quadrangle. The formation consists of alternating sandstone and limestone, with the permeable sandstone serving as the aquifer and the limestones, unless highly fractured, serving as impermeable confining units. The Casper produces excellent water with low dissolved solids and excellent flows. The important recharge area for the Casper Formation is in the

eastern part of the quadrangle on the flanks of the Laramie Mountains. Other local aquifers of lesser importance include thin basal sands in the Satanka Shale, fractured limestone in the Forelle Limestone, and sands in the upper Chugwater Formation. These aquifers produce poor quality water, high in total dissolved solids with very limited flow potential. Wells producing from these aquifers are used primarily for livestock watering. In addition, a well in the northwest corner of the map reportedly produces potable water from a sandstone of possible Jurassic age.

Potential Geologic Hazards

Potential geologic hazards within the Red Buttes Quadrangle are related to the gypsite and bedded gypsum deposits, windblown deposits, and potential landslides in the Forelle Limestone. The gypsite deposits occur west of the Laramie Fault in the Willow Creek drainage, west of Red Buttes. The deposits occur as a result of lower Chugwater gypsum beds being brought near surface by the Laramie fault, coupled with Quaternary erosion of the beds and concurrent mixing with sediments from the east. Gypsite deposits also exist southeast of Red Buttes where gypsum beds in the Satanka Shale have been eroded by Harney Creek. A significant solution cavity exists near Simpson Springs Creek northwest of the Monolith Ranch where bedded gypsum in the Satanka Shale was subjected to solution activity. The high solubility of the gypsum in these deposits make them quite susceptible to the formation of cavities and local resultant collapse features. High amounts of gypsum in the soil can inhibit plant growth and can react with untreated concrete causing disintegration. The location of these gypsite and bedded gypsum occurrences definitely needs to be considered in any plans for development within affected areas.

Windblown deposits occur locally, on a small-scale, throughout the eastern half of the quadrangle. The occurrence in the Buttes housing development southeast of Laramie is the largest occurrence on the quadrangle. The deposits are made up of sand dunes which are for the most part stabilized by vegetation in the area. Care needs to be taken in development of these types of areas to prevent removal of too much vegetation, thereby destabilizing the sand dunes and initiating migration of the dunes.

Although no landslides have been mapped on the quadrangle in the Forelle Limestone, slides can occur at the contact between the Forelle Limestone and the underlying Satanka Shale, where dip angles exceed 5 degrees. The Forelle could detach given the right combination of conditions including unusually wet weather, a steep dip slope, and, for example, removal of the toe of a slope. Consideration of this potential should be included in planning for development on or near Forelle outcrops with these characteristics.

Debris flow potential exists along the margins of mapped older alluvial fan and alluvial fan deposits. These areas become especially vulnerable during periods of abnormally high precipitation. This potential hazard should be considered in planning for development near these types of deposits.

Structural Geology

Rock units on the Red Buttes Quadrangle have a regional dip to the west off of the Laramie Mountains, of approximately 3-5 degrees, striking nearly north to south. This regional trend is interrupted locally by faulting and folding. Folding is in the form of mostly east-west trending anticlines and monoclines which plunge toward the west. The Simpson Springs anticline and the Soldier monocline, in the northeast portion of the quadrangle, are typical examples of these folds.

Faults are quite common on the quadrangle and appear to have occurred in two episodes. The first episode, which probably occurred concurrent to the formation of the above folds, is represented by the predominantly north to northeast trending faults. Compressional stresses directed in a northeasterly direction probably created these features with the faults exhibiting strike-slip or horizontal motion in a right lateral sense, i.e., the west block of the fault moving toward the northeast relative to the east block, coupled with minor vertical motion. Offset of the Soldier monocline in the northeast portion of the map is compelling evidence for right lateral movement on these types of faults. The Red Hills fault, which occurs on the east side of the map, is an example of this episode of faulting.

A possible second, later episode of faulting is indicated by a few east to west trending faults on the map. These faults may have occurred as a result of relaxation of the earlier compressional stresses, creating the east-west trending normal faults which are for the most part downthrown to the south. These faults commonly occur on the south flanks of east-west trending folds. The east-west trending faults southwest of Red Buttes and the east northeast trending fault south of Soldier monocline are examples.

The Laramie fault trends primarily north-south in the western portion of the map, passing just west of Red Buttes. This fault is not well exposed on the map but appears to be upthrown on the west side based on well data from water wells drilled adjacent to each other on opposing sides of the fault, immediately north of the quadrangle. The location of gypsum beds which led to the gypsite deposits noted on the west side of the fault can be explained by reverse movement on the fault. Although no evidence was noted due to poor exposure, strike-slip motion is also a possibility on the Laramie fault as it is parallel to the Red Hills fault and may have been created by the same north-northeast directed stresses. The occurrence of numerous springs along the Laramie fault and associated faulting to the east has made them a prime target for water well tests, along with the anticlinal folds which occur on the quadrangle, as they project basinward toward the west. The location and character of the structural features on the quadrangle can be instrumental in predicting the occurrence of water resources and potential geologic hazards in the Laramie area.