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Surficial Deposits of the Bridger Wilderness, Wyoming

by

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Introduction

The Bridger Wilderness in the Wind River Range in northwestern Wyoming includes the high peaks and most of the uplands southwest of the Continental Divide that drain into the Green River. A small area at the south end of the range drains into the Sweetwater River. Altitudes in the Wilderness range from 8,000 to 13,800 feet.

The Bridger Wilderness is underlain chiefly by Precambrian granitic and associated crystalline rocks (see Worl and others, this volume). Only the northwestern end of the area is underlain by Paleozoic and Mesozoic rocks--sandstone, limestone, dolomite, and shale. The bedrock is cut by a large number of predominantly northwest-trending high angle faults which, in the Precambrian rocks, become shear zones that have greatly influenced the direction and extent of subsequent stream and glacial erosion.

Almost all of the Wilderness area was covered by an icecap several times during the Pleistocene, and glacial erosion is chiefly responsible for its present scenic grandeur.

Terrain types

The landscape of the western slope of the Wind River Range is divisible into seven terrain types in which the surficial deposits differ significantly in character and extent. All but one occur within the Bridger Wilderness.

1. Unglaciated mountain front
2. Unglaciated high divides
3. Glaciated high uplands
4. Cirques and upper canyons
5. Western plateau and upland valleys
6. Large canyons of major drainage ways
7. Piedmont end moraine belts

Unglaciated mountain front

The southwestern and southern front and adjacent upland of the Wind River range is thickly mantled with gruss. The gruss consists of sand and pebble-size aggregates of quartz, feldspar, and mica. Locally, the material contains angular to subround fragments of partially weathered crystalline rock. Irregularly weathered bedrock tors, commonly mantled with residual joint-block core boulders, project through the gruss along ridge crests and summit areas. This terrain represents the remnant of a deeply weathered regolith that mantled the entire range throughout Tertiary time. The regolith was removed by the glaciers throughout most of their extent and has been extensively reworked by mass wasting beyond the glacial limit at the margin of the range both in and adjacent to the Wilderness.

Unglaciated high divides

The unglaciated high divides along the crest of the range are mantled chiefly by sandy block rubble. In a few areas, large joint-block core boulders and gruss testify to the former presence of the Tertiary regolith, but that ancient mantle has been almost wholly stripped by periglacial processes that were extensively active in these areas during the Pleistocene and still are active locally today.

Flat to gentle uplands are typically covered with sandy blocky felsenmeer, including extensive areas of sorted polygons, sorted stripes, and broad solifluction lobes or terraces. In some areas, the mantle is chiefly sand and is characterized by non-sorted polygons and non-sorted stripes. Drainage ways have closely fitted, evenly surfaced block pavements along them in places.

Moderate to steep slopes are chiefly mantled with subangular to subround blocky solifluction debris. Block garlands and small block streams are present on some moderate slopes. Boulder lag deposits are common where snowmelt streams descend the slopes.

Most of the high upland deposits are stable and support a lichen or tundra vegetation, the latter where fine-grained material is at the surface. However, deposits downslope from snowbanks that last throughout all or most of the summer tend to remain saturated throughout the meltwater season, and commonly exhibit evidence of activity in the form of freshly scarred boulders, displaced sediment, or disrupted vegetation, that indicate upheaval, collapse, churning or downslope movement.

Glaciated high uplands

The glaciated high uplands are above treeline, and chiefly between altitudes of 10,500 and 11,500 feet. Slopes range from gentle to steep; cliffs are present in places. This terrain is underlain mostly by barren glaciated bedrock that locally is striated, grooved, and polished. Glacial boulders, ranging from less than a foot to more than 30 feet in long dimension, are scattered over the rock surface. Thin stony sandy till partly fills the many small depressions. In places, lee slopes are mantled with thin patches of eolian silt. The terrain includes numerous lakes, both large and small, which in many places contain subaquaeous marginal benches of sandy, blocky solifluction debris that has flowed into the lakes from adjacent slopes. Active or stable sorted polygons are present on many of the benches. Where stable, the polygons are mantled with silt similar in all respects to that on lee slopes. Small deltas commonly are present where streams enter the lakes.

Alluvial deposits are chiefly sandy to bouldery and are characterized in places by evenly-surfaced block pavements. Pebbles and cobbles in intermittent meltwater channels on gentle slopes commonly have a brownish rind as much as 1/8 inch thick. Boulder-lag deposits are abundant along the channels on moderate to steep till-covered slopes.

Small deposits of talus occur at the base of cliffs, and banks of boulders and till, collapsed from higher positions during deglaciation, occur at the base of many steep slopes.

Cirques and upper canyons

Cirques and the upper parts of canyons heading in the vicinity of the Continental Divide are cliffed. Glaciated rock surfaces characterize most of the valley floors. The base of the cliffs are bordered by extensive rock-fall debris, including talus, talus flows, and protalus ramparts. Alpine mudflow channels are common on talus deposits. Locally, solifluction rock glaciers, rock slides, and rock-fall avalanche deposits are present along the margins of the canyons.

Some north or northwest facing cirques contain moraines and/or glacial rock glaciers, but remarkable few of these deposits are present west of the Continental Divide. Small modern glaciers are similarly distributed. Larger glaciers occur in the higher northern part of the range but, except in the Gannett Peak area, are east of the Continental Divide.

Most axial streams flow on rock surfaces, and alluvium is sparse and thin. The largest deposits are in alluvial fans where tributary streams enter the canyons. Tarns and rock-bound chain lakes are abundant, many with small deltas at their upper ends. Some lakes, such as Seneca Lake, are deep.

The western plateau and upland valleys

The broad western plateau and intruding upland valleys are below treeline, but include a large area of grassland in the southern part of the range. The terrain as a whole is characterized by glaciated rock surfaces and areas of sandy till. Four subcategories of terrain are recognized.

1. Areas that are underlain mostly by glaciated bedrock littered with boulders, but include small patches of thin till.
2. Areas in which till is more abundant than glaciated bedrock, but most of the till is thin.
3. Areas that are underlain chiefly by till, but include some glaciated bedrock. The till in these areas is variably thick or thin.
4. The grassland area in the southern part of the range, including some adjacent forested terrain, that is underlain by thick till and a relatively few rock outcrops. It also is characterized by numerous drumlins oriented predominantly southwest. Some of the drumlins are wholly of till; others, in part of rock. A few, known as rock drumlins, are wholly of rock. Those wholly of till commonly comprise an upper layer of bouldery sandy till and an underlying layer of older compact till on which a weathered zone is locally preserved. In a few, the upper till overlies pale gray sandy gruss, remnant from the ancient Tertiary regolith.

Along the eastern limit of the plateau, where canyons open onto it from sources along the Continental Divide, small end moraines at an altitude of about 10,400 feet mark the outer limits of a secondary readvance of the glaciers following recession from their maximum position on the piedmont during the last major glaciation, discussed below. Similar small end moraines outline a contemporaneous local icecap on the higher part of the plateau in the northern part of the range.

Block fields, block streams, boulder-lag channel deposits and small circular block pits are developed in the till on the floor and slopes of many upland valleys. Boulder pavements are rare, but present along some streams.

Many small lakes contain solifluction benches on which inactive sorted polygons are covered by as much as 20 inches of silt of possible eolian origin. The benches support a sedge vegetation beyond which a lake may be partly or wholly covered by a floating vegetation matte. At lower altitudes many former lake basins are completely filled with sandy silt, locally with peat. Around larger lakes, that have notched perennial outlets, solifluction benches tend to be remnant on adjacent slopes a few meters above present water level.

At the southern end of the range coarse blocky scree extends downslope from the high unglaciated divides to the stony gruss and rock tors along the mountain front.

Large canyons of major drainage ways

The large canyons of major drainage ways are deep U-shaped glacial troughs that extend headward from the front of the range across the western plateau to tributary canyons in the inner part of the range. During at least the last Pleistocene glacial maximum they were the dominant avenues of flow from the ice-cap on the range to the piedmont southwest of the mountain front.

The floor of the canyons are underlain chiefly by sand and gravel; locally by till. Glaciated rock knobs or high rock steps occur where the canyons are crossed by faults. Rock dammed lakes or chains of lakes occur upstream from faults in some canyons, for example, that of Fremont Creek.

Within the plateau, the canyon floors are bordered by talus cones above which glaciated bedrock cliffs rise as much as 2000 feet. Above the cliffs, the glaciated canyon shoulders and adjacent floors of tributary upland valleys are characterized by abundant joint-controlled glaciated bedrock knobs, separated by scanty deposits of thin bouldery sandy till.

The lower parts of the canyons, near the margin of the range are mantled with thick till, and large lateral moraines, commonly representing at least two glaciations, are present along the canyon rims. Much of the area of the lower parts of the canyons is beyond the Wilderness boundary.

Piedmont end moraine belt

The piedmont end moraine belt is at and beyond the front of the range and is entirely outside the Wilderness. It includes the largest and most characteristic deposits of the Pleistocene glaciers.

Almost all of the major canyons in the northern half of the range terminate in large deep glacial lakes on the piedmont. Surrounding each of the lakes is a series of nested bouldery end moraines representing the terminal deposits of successive glacial advances and readvances. End moraines of two major glaciations are present around some lakes, end moraines of only the last glaciation around others. The older glaciation was named Bull Lake, and the younger was named Pinedale by Eliot Blackwelder in 1916. The Bull Lake glaciation is commonly represented by two gently sloping, smooth-crested moraines that outline the maximum limits of two different advances. The Pinedale glaciation is commonly represented by six or seven commonly steeply sloping, sharp-crested, hummocky moraines that outline the maximum limits of three major and four minor readvances of the ice.

In the southern half of the range, glacial lakes are lacking at the mouth of canyons and deposits of only the Pinedale glaciation are present. As in the northern part of the range, these include six or seven end moraines. The overall extent of the ice at the southern end of the range was much less than to the north, and the Pinedale end moraines tend to occur at intervals along the entire length of the canyons rather than nested on the piedmont.