

NEOGLACIATION

GLACIAL DEPOSIT

tt Till of Temple Lake Stage—A single moraine in a cirque on Big Game Ridge. Intersected by local erratics of fresh pale-gray rubble 20 feet high; locally supports sparse grass and trees; consists of blocks and slabs of sandstone in a sandy silt matrix.

ALLUVIAL DEPOSITS

fa Fine-grained humic alluvium—Silt, sand, and clay underlying marshy or seasonally wet upland depressions and stream-flood plains. Humic content is result of seasonal accumulation and burial of local vegetable debris.

sg Stream gravel—Pebbles and cobbles in a medium- to coarse-sand matrix; underlies beds of larger streams and forms adjacent terraces up to 30 feet above streams. Deposits include minor sand and silt lenses and are well sorted and well bedded; stones are well rounded. Along Snake River 4- to 10-inch cobbles are common.

fg Fan gravel—Small alluvial fans of sand, gravel, and silt; mostly in southwestern part of quadrangle.

COLLUVIAL DEPOSITS

ta Talus deposit—Rubble of angular rock fragments or quartzite cobbles with a silty matrix at depth; 5 to 50 feet thick. Lies below cliffs of quartzite conglomerate, sandstone, and rhyolite. Deposits form smooth steep slopes; most are unstable and barren; many are forming at present.

ad Avalanche debris—Mixture of boulder- to pebble-sized angular rock fragments or quartzite cobbles in sandy to silty matrix at foot of talus slopes in cirques on Pinon Peak and Mount Hancock. Poorly sorted to nonsorted.

sd Solifluction deposit—Light-brown stony sandy silt; unsorted; derived from Pinedale Till and landslide debris. Forms lobate fans and sheets on lower slopes and valley floors. Fronts of lobes 2 to 15 feet high. Most deposits seasonally active.

PINEDALE GLACIATION

GLACIAL DEPOSITS

ptu Till—Subround fragments, mainly andesite and quartzite cobbles, in a sandy clay-silt matrix; forms small moraine mound more than 50 feet high north of Pinon Peak. Soil on deposit is 1.5 feet thick and has well-developed B horizon.

pt Till—Gray-brown to gray stony sandy clayey silt; unsorted, moderately compact; stones subangular to rounded. In eastern part of quadrangle, till is bouldery and derived primarily from conglomerate and sandstone of the Absaroka volcanic field and from young basalt flows; in southern part, till is sandy and stones are mainly quartzite cobbles derived from Cretaceous and Tertiary conglomerate; in north half, till is clayey and contains slabs and blocks of sandstone and fragments of shale. Till mantles valley slopes and uplands; thickest (10 to 20 feet) on lower slopes. Drumlinoid forms are common near Fox Park and also at the confluence of Heart and Snake Rivers. In south-central part of quadrangle thick till forms lateral moraines which descend toward Pacific Creek divide of the quadrangle.

pr Glacial rubble—Thin (less than 5 feet) rubby veneer on glaciated uplands, mainly along Chickens and Chicken Ridge. Mostly locally derived, but contains a few erratics of volcanic rocks. Veneer is partly glacial origin and partly the product of postglacial weathering of underlying bedrock. Solifluction and frost action are still affecting the deposits.

LACUSTRINE DEPOSIT

ppl Proglacial lake sand (In stratigraphic section 2 only)—Gray, sandy silt and sand, thin-bedded to massive, well-sorted.

FLUVIATILE DEPOSIT

dp Proglacial gravel (In stratigraphic section 2 only)—Gray, sandy, pebble to cobble gravel, subrounded, mainly of andesite; poorly sorted, crudely bedded; 4 feet thick.

ICE-CONTACT DEPOSITS

pksg Kame deposits—Gray moderately well sorted gravel and sand with minor silty interbeds; irregularly bedded; abrupt vertical changes in grain size. Deposits underlie irregular terraces, many with ice-contact frontal slopes, along Snake River and Passage Creek. Forms mounds mantled with limestone blocks in Fox Park; outwash fans and related terraces in southwestern corner of quadrangle. Deposits 30 to 200 feet thick.

ALLUVIAL DEPOSITS

pg Gravel—Gray sandy gravel forming terraces (pg, psg) more than 30 feet, and alluvial fans (pgf) more than 15 feet, above present drainage. Along Snake River, Mink Creek, and Coulter Creek, forms well-rounded cobble gravel (pg, psg) deposited as outwash during late middle Pinedale time. Fan gravel (pgf) forms small fans of local origin.

COLLUVIAL DEPOSITS

ptu Talus deposit—Similar to Neoglacial talus (ta), but inactive and forested or grass-covered. Occurs beneath cliffs along canyons of Snake and Heart Rivers. Forms stable mantle of quartzite cobbles and subangular andesite volcanic debris on steep slopes and in cirques on Pinon Peak.

ptf Talus flow deposit—Coarse rubble below cliffs; similar to talus, but occurs on moderate slopes (15° to 20°) and has transverse flow ridges and troughs that are mostly arcuate downslope. Locally forested, but commonly barren except for lichen; in terrestrial areas are open to depth of 1-2 feet. South of Wolverine Creek, deposits overlie landslide debris along base of landslide scarp, and consist of blocks of Yellowstone Tuff from cliff above. In northern part of Two Ocean Plateau deposits consist of slabs and blocks of basalt.

pcu Colluvium—Stable sandstone rubble and quartzite cobbles in a silty to sandy matrix beyond the limit of glaciation in Pinedale time along south edge of quadrangle. Three to five feet thick. Poorly developed zonal soil. Vegetation-covered.

DESCRIPTION OF UNITS

prf Frost rubble—Angular, blocky to slabby rubble; 3-5 feet thick; Pleistocene Yellowstone Tuff fragments on summit of Mount Hancock. Interstices void. Local erratics of fresh pale-gray basalt, derived from region of Passage Creek to northeast, show that rubble was formed after summit was exposed during wasting of Pinedale ice cap.

ls Landslide deposit—Rock-fragment rubble in a silt-clay matrix forming thick lobate masses with flow ridges and undrained depressions. Commonly derived from benthonic shale of Cretaceous to Paleocene age. Only well-defined deposits mapped, but slumping is widespread in areas underlain by shale. The rock debris, other than shale, in and on the deposits is derived from rock units overlying the shale or from till that mantled the slope before failure. Most slides seem inactive, but parts of many continue to move at least seasonally.

BULL LAKE GLACIATION

GLACIAL DEPOSITS

bt Till—Gray to brown, locally pink (stratigraphic sections 5 and 6), stony sandy silt; unsorted, moderately compact. Occurs on upland areas beyond upper limit of glaciation in Pinedale time in southern part of quadrangle, and in stratigraphic sections 2, 3, 5, 6, and 8. Stones primarily quartzite cobbles and quartzite chips broken from Pinon Conglomerate and related conglomerates, but include erratics of Precambrian rock on ridge northeast of Bobcat Ridge and in Pinon Peak area. Till forms well-defined broad moraines on ridge northeast of Bobcat Ridge and in Pinon Peak area that bear a moderately developed soil 2 to 3 feet thick. Till underlies pink lake silt of Bull Lake age at stratigraphic section 3.

br Glacial rubble—Thin (0 to 5 feet) mantle of rubble and fine-grained colluvium in areas covered by Bull Lake glaciers. Contains scattered erratics of basalt and andesite. Occurs on upland areas above Pinedale glacial limit. Bedrock locally shows signs of glacial scour and melt-water channeling. Deposits and underlying rock commonly gullied. Veneer is partly glacial in origin and partly weathered from underlying rock.

LACUSTRINE DEPOSIT

bl Lake silt (In stratigraphic sections 3, 4, 7, and 9 only)—Clayey to sandy silt, pinkish, laminated, compact, locally waxy; some fine gravel and fine sand lenses; at stratigraphic section 3, color may be derived from nearby Mesozoic rocks; beds dip 25°-30° W. along fault and overlie compact pink Bull Lake Till. At stratigraphic section 4, beds broken by overriding ice dip 10° W.

FLUVIATILE DEPOSIT

bg Gravel (In stratigraphic section 1 only)—Grayish-brown sand and pebble to cobble gravel, poorly sorted, unstratified, compact; platy parting. Occurs in terrace overlain by 10-15 feet of Pinedale Till (pt). May be an ice-contact deposit.

COLLUVIAL DEPOSIT

brf Frost rubble—Blocky to slabby rubble above upper limit of glaciation in Bull Lake time on Big Game Ridge. Composed of large sandstone blocks in a sandy matrix. Though formed in Bull Lake time, it was probably reactivated in Pinedale time; now stable.

PRE-BULL LAKE GLACIATION

GLACIAL DEPOSIT

pbt Till—Stony clayey sandy silt; unsorted; compact. Oxidized reddish brown to depth of 15 feet. Occurs as patches of formless till on Pinon Peak and on ridge northeast of Bobcat Ridge. Contains unweathered stratified quartzite cobbles and fresh to partly weathered granite, gneiss, schist, and amphibolite. Most limestone fragments completely leached but some are only deeply etched; broken quartzite cobbles commonly litter the surface. Thickness 10 to 30 feet. Overlies conglomerate of quartzite cobbles.

BEDROCK

R Paleozoic and Mesozoic carbonate rocks, shale, and sandstone are locally exposed along streams and lower slopes in Fox Park-Mink Creek area. Cretaceous shale and sandstone underlie much of south half of quadrangle from Chicken Ridge and Big Game Ridge to lower slopes of Bobcat Ridge-Pinon Peak-Gravel Peak divide. Cretaceous and Tertiary quartzite-cobble conglomerate and interbedded sandstone and shale underlie the area south of this divide. Tertiary volcanic conglomerate, sandstone, and ash mudstone of the Absaroka volcanic field underlie the Two Ocean Plateau along east boundary of quadrangle. Pleistocene Yellowstone Tuff underlies area east and west of Heart River, south of Wolverine Creek, the basin of Chipmunk Creek, and the top of Mount Hancock. A dense gray basalt of Pleistocene age underlies the upland north of Fox Park.

STRATIGRAPHIC SECTIONS

Units shown in descending order; numbers represent thickness, in feet. * Soil of the Bull Lake/Pinedale interval

- 12 pt / 30 bgs
- 15 pt/18 ppt/4 psg/20 bt
- 2 sg/4 bl/3 brf
- 20 pt/5 bl
- 14 pt/20 pt/3 bt
- 10 pt/20 pt/4 sb*/15 bt
- 6 pt/4 bl
- 5 pt/8 bt
- 6 pt/3 bl

INTRODUCTION

The Mount Hancock quadrangle covers an area in south-central Yellowstone National Park and the adjacent Teton National Forest to the south. In the northeast part of the quadrangle the Continental Divide separates drainage which flows into the South Arm of Yellowstone Lake only 2 miles to the north, from that of westward-flowing tributaries of the Snake River. Another important divide, extending west across the southern part of the quadrangle, separates the Snake River and Pacific Creek drainages. The area is characterized by broad high uplands separated by deep valleys. To the east lies the Two Ocean Plateau, ranging in altitude from 8,500 to 9,400 feet to the north and northwest. Chickens and Big Game River rise to altitudes above 9,000 feet and are more than 2,000 feet above the Snake River. In the center, at an altitude of 10,214 feet, is Mount Hancock, the highest point in the quadrangle.

PLEISTOCENE GLACIATIONS

Great icecaps covered most of Yellowstone Park during at least three Pleistocene glaciations: pre-Bull Lake (oldest), Bull Lake, and Pinedale (youngest). The pre-Bull Lake icecap probably covered most, if not all, of the quadrangle, for its deposits are found on nearly all of the highest summits. The Bull Lake icecap was somewhat less extensive; the Pinedale icecap was like the Bull Lake, but 200 to 300 feet thinner in this quadrangle.

PRE-BULL LAKE GLACIATION

Deposits of a pre-Bull Lake glaciation occur in the southern part of the quadrangle on Pinon Peak, between 9,550 and 9,700 feet altitude, and on the ridge northeast of Bobcat Ridge, between 9,000 and 9,500 feet. These deposits lie about 100 feet above the upper limit of Bull Lake Till or moraines, but lack any semblance of glacial form. The till contains erratics of Precambrian gneiss, granite, amphibolite, and schist, and Paleozoic limestone and sandstone. Several glacially striated quartzite cobbles were found on Pinon Peak. The source of the Precambrian rocks is not known. They may be derived either from a nearby Tertiary conglomerate or from the basal unit of the Absaroka volcanic field or they may have been transported by glaciers from outcrops of these rocks in the headwaters of Buffalo Fork to the southeast. The till is deeply weathered. Northeast of Bobcat Ridge it is oxidized reddish brown to a depth of 15 feet, and limestone and sandstone cobbles in the weathered zone are decayed and soft. On Pinon Peak the weathered zone seems to have been stripped by erosion, for solution-etched cobbles of siliceous limestone normally found at the base of the soil occur at its surface. Extensive stream erosion, which cut valleys as much as 200 feet deep, took place between deposition of the pre-Bull Lake Till and the subsequent Bull Lake Glaciation.

BULL LAKE GLACIATION

Deposits of the Bull Lake Glaciation, like those of pre-Bull Lake age, are known only from the southern part of the quadrangle. They occur on Big Game Ridge, and on the ridges north and south of Pinon Peak. They also occur on the flanks of Bobcat Ridge, Gravel Peak, the ridge northeast of Bobcat Ridge, and on the east flank of Bobcat Ridge itself. In most places the deposits are only a veneer of glacial rubble (br), but on the flanks of Pinon Peak, in the area of Gravel Peak, and on the ridge northeast of Bobcat Ridge there are deposits of Bull Lake Till (bt) that form distinct broad mature moraine ridges. An outwash channel cut by Bull Lake melt waters in the till is preserved south of Gravel Peak. The till contains erratics of Precambrian granite and gneiss, of Tertiary andesite and basalt from the Absaroka volcanic area to the north, of Paleozoic limestone from the north, and of quartzite cobbles from nearby outcrops of Tertiary conglomerate. The Precambrian rocks may be derived either from pre-Bull Lake till, from the local Tertiary conglomerate, or from rocks near the base of the Absaroka volcanic field. Bull Lake Till commonly extends to higher elevations than moraines of the Pinedale Glaciation. In Fox Park, Bull Lake Till and overlying lake beds form the cores of drumlins mantled with Pinedale Till. The Bull Lake deposits are exposed in outcrops of the Snake River (stratigraphic sections 4 and 5). At stratigraphic section 6, Pinedale Till overlies the Bull Lake Till, and on the ridge northeast of Bobcat Ridge sections 3-8, the till and lake beds are reddish and are considered to be of Bull Lake age because of their position locally beneath Pinedale Till.

Areas not glaciated since Bull Lake time are more extensively modified by colluvial processes, especially solifluction, and are locally more deeply gullied than those glaciated in Pinedale time. This difference in weathering and erosion is especially noticeable on the flanks of Bobcat Ridge, Gravel Peak, and the ridge north of Gravel Peak.

PINEDALE GLACIATION

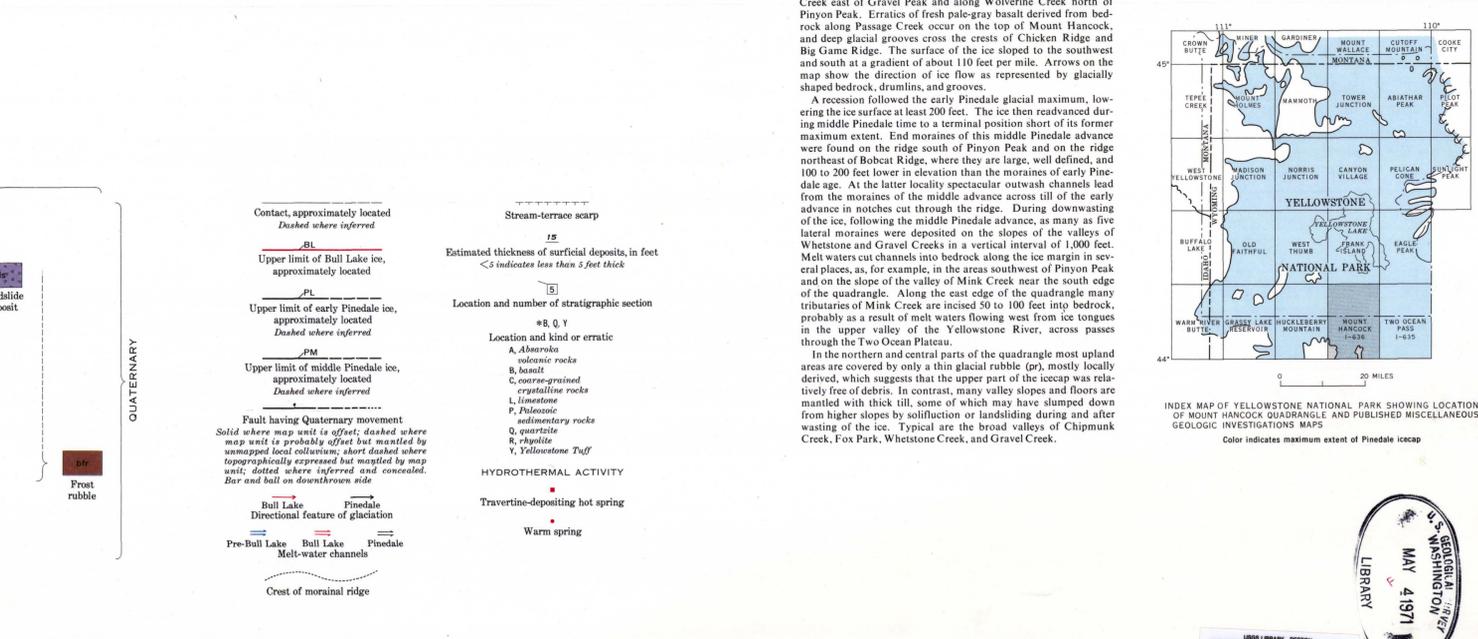
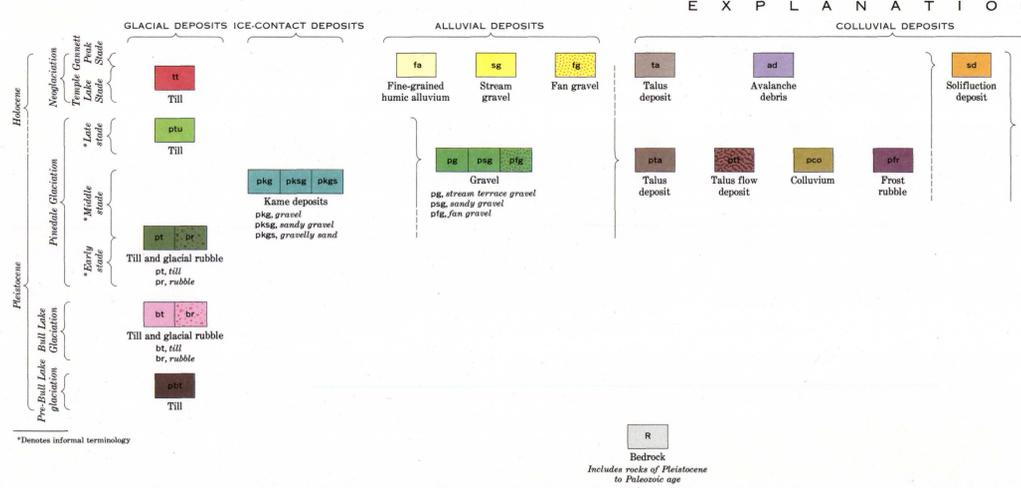
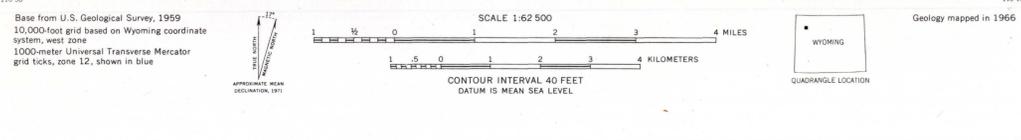
During the Pinedale Glaciation ice covered all the quadrangle except the upland in the southwest corner and the summit areas of Pinon Peak, Gravel Peak, and the unnamed upland north of Gravel Peak. Undoubtedly snow accumulated and glaciers developed in the local cirques, such as those on the northeast side of Big Game Ridge and on many of the uplands, but deposits of local glaciation are lacking. The direction of glacial molding of the topography shows that ice invaded the quadrangle from an icecap in the Yellowstone Lake Basin to the east and northeast. A pass through the Continental Divide (altitude 7,950 feet), at the head of Outlet Creek in the Frank Island quadrangle to the north, was probably the course of the earliest overflow of ice into the westerly drainage of the Heart and Snake Rivers. At about the same time Two Ocean Pass (altitude 8,050 feet), in the Two Ocean Pass quadrangle to the east, was the path of the earliest overflow of ice into the southerly drainage of Pacific Creek. The intervening area of the Continental Divide was ultimately overwhelmed by ice, but the direction of flow continued to be diverted east and south by the high mass of Big Game Ridge. The valley of Wolverine Creek contains little evidence of ice-scour or molding of the topography, although it was probably backfilled by ice flowing down the Snake River and across a pass (altitude 8,920 feet) from the valley of Mink Creek.

The valley of Coulter Creek was similarly backfilled by ice from the valley of Wolverine Creek. The valley of Whetstone Creek was first penetrated by ice flowing from the head of the valley of Wolverine Creek across a pass at 8,400 feet altitude.

At the maximum of Pinedale Glaciation, in early Pinedale time, the ice was more than 2,600 feet thick in the valley of the Snake River, north of Mount Hancock, and 2,000 feet thick along Mink Creek east of Gravel Peak, and 1,000 feet thick along the head of Wolverine Creek across a pass at 8,400 feet altitude.

In the northern and central parts of the quadrangle most upland areas are covered by only a thin glacial rubble (gr), mostly locally derived, which suggests that the upper part of the icecap was relatively free of debris. In contrast, many valley slopes and floors are mantled with thick till, some of which may have slumped down from higher slopes by solifluction or landsliding during and after wasting of the ice. Typical are the broad valleys of Chipmunk Creek, Fox Park, Whetstone Creek, and Gravel Creek.

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SURFICIAL GEOLOGIC MAP OF THE MOUNT HANCOCK QUADRANGLE, YELLOWSTONE NATIONAL PARK AND ADJOINING AREA, WYOMING

By
Gerald M. Richmond and Kenneth L. Pierce

Wyoming (Mount Hancock quad.), Surficial. 1:62,500. 1971.

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