UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

PROFESSIONAL PAPER 729–F
PLATE 1

EXPLANATION

Glacier surface above and below inferred equilibrium-line altitude (ELA)

11.5

Contours on surface of ice, in thousands of feet—Solid where surface of ice is defined on nearby nunataks or valley walls; long dashed where approximately located or where altitude of contour is only several hundred feet above freshly glaciated uplands; short dashed where deduced from flow pattern and where altitude of contour is well above the high glaciated uplands. Contours are perpendicular to full-glacial flow features. See chart for conversion to meters

2200

Direction of flow and glacier thickness in feet based on ice-surface contours—See chart for conversion to meters

Direction of glacier flow—Solid arrow, observed in field and on aerial photographs; broken arrow, observed only on aerial photographs. Indicated by glacial streaming, molding, or scouring features. Where full-glacial and deglacial flow directions differed, only full-glacial flow features are shown

Glacial striation—Arrows indicate direction of ice movement

Glacial outwash channels

Ice divide—Arrows indicate flow away from divide

Approximate line of transport of glacial erratics

I II III IV V

Subdivisions of the northern Yellowstone glacier based on icecap source areas—I, Gallatin Range icecap; II, plateau icecap between the Washburn and Gallatin Ranges; III, plateau icecap flowing across Washburn Range-Specimen Ridge area; IV, Beartooth uplift icecap; V, upper Lamar icecap

Present main drainage divides

E G M C G

Lines of profile sections (pl. 4)

Most of the glacial ice in northern Yellowstone was part of the northern Yellowstone glacier, defined as the outlet glacier in the Yellowstone valley and the ice that fed it. The source area of the northern Yellowstone glacier was from four interconnected icecaps; ice from these sources is delimited by roman numerals I to V. This ice converged towards Gardiner, Montana, where it formed the 55-km long outlet glacier. The northern Yellowstone glacier headed along an ice-divide whose shape was rectangular in plan view excepting a missing section occupied by the outlet glacier at the position of the northwest corner of this rectangle. This ice divide did not correspond precisely with the present drainage divides, but was offset by as much as several kilometers. Glacial scour features along the present drainage divides indicate that sizable glaciers flowed across these divides from the Yellowstone River drainage. For example, ice flowed west across the drainage divide of the southern Gallatin Range, where it joined glaciers from local cirques and flowed to terminal moraines in the valleys of the Gallatin River and Grayling Creek

Conversion of feet to meters
1 ft = 0.3048 m

feet	meters	feet	meters
100	30	5,000	1,524
200	61	6,000	1,829
300	91	7,000	2,134
400	122	8,000	2,438
500	152	9,000	2,743
600	183	10,000	3,048
700	213	11,000	3,353
800	244	12,000	3,658
900	274		

Eightmile terminal moraines

Study area boundary

Extent of Pinedale glaciation not mapped in this area

Gallatin River lobe

Maple Creek-Cougar Creek lobe

Madison lobe

Park boundary

MONTANA
WYOMING

Base from AMS, Ashton, Idaho, Mont., Wyo., 1955; Billings, Mont., Wyo., 1954; Bozeman, Mont., Wyo., 1958; Cody, Wyo., 1955

SCALE 1:250 000

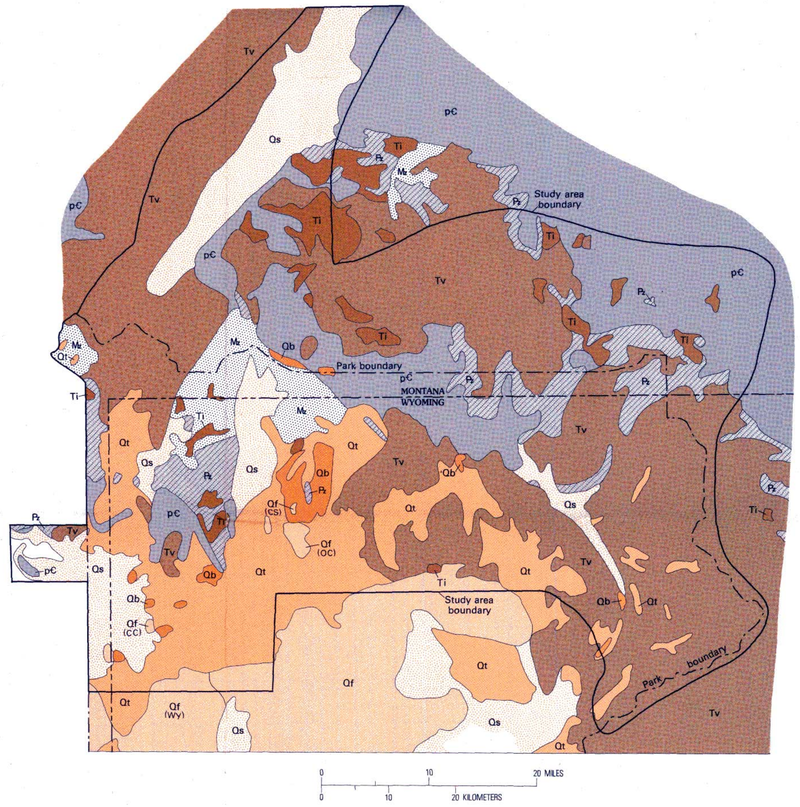
5 0 5 10 15 MILES

5 0 5 10 15 KILOMETERS

CONTOUR INTERVAL 200 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
1979 MAGNETIC DECLINATION AT SOUTH EDGE VARIES FROM 16°15' TO 15°30' EAST

A—PINEDALE FULL-GLACIAL ICEMASS

Glacial geology based on fieldwork between 1965–1974, mostly shown on Pierce (1973a, b, and 1974a, b). Madison Canyon area based on Waldrop and Pierce (1975), and glacial geology along east park boundary south of Frost Pass modified from Richmond and Waldrop (1972). Limit of Pinedale glaciers from Corwin Springs north along the Yellowstone valley modified from Weed (1893), Horberg (1940), Montagne (1968, 1970, written commun., 1972), and my own field observations. Limit of Pinedale glaciers and direction of scour features near drainage divide of Beartooth uplift based on reconnaissance field studies and on more than 450 areas of glacial scour noted on aerial photographs



EXPLANATION

- Qs — Thick Quaternary surficial deposits
- Qb — Quaternary basalt
- Qf — Quaternary rhyolite flows—CC, Cougar Creek flow; CS, Crystal Springs flow; OC, Obsidian Cliff flow; WY, West Yellowstone flow
- Qt — Quaternary rhyolite tuff
- Tv — Tertiary Absaroka Volcanic Supergroup (andesitic)
- Ti — Tertiary intrusive rocks
- Mz — Mesozoic shale and sandstone
- Pz — Paleozoic limestone, shale, and sandstone
- pC — Precambrian granitic rocks and schist

The Quaternary tuff and Tertiary volcanic rocks that underlie most of the area do not record or preserve evidence of glaciation very well. This accounts for the lack of recognition of widespread glaciation in previous studies. Sketch map generalized after U.S. Geol. Survey (1972b) and a compilation by Ross, Andrews, and Witkind (1955).

B—MAJOR BEDROCK TYPES

INDEX MAP SHOWING LOCATION OF STUDY AREA

PINEDALE FULL-GLACIAL ICEMASS AND MAJOR BEDROCK TYPES IN THE NORTHERN YELLOWSTONE NATIONAL PARK AREA, WYOMING AND MONTANA

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