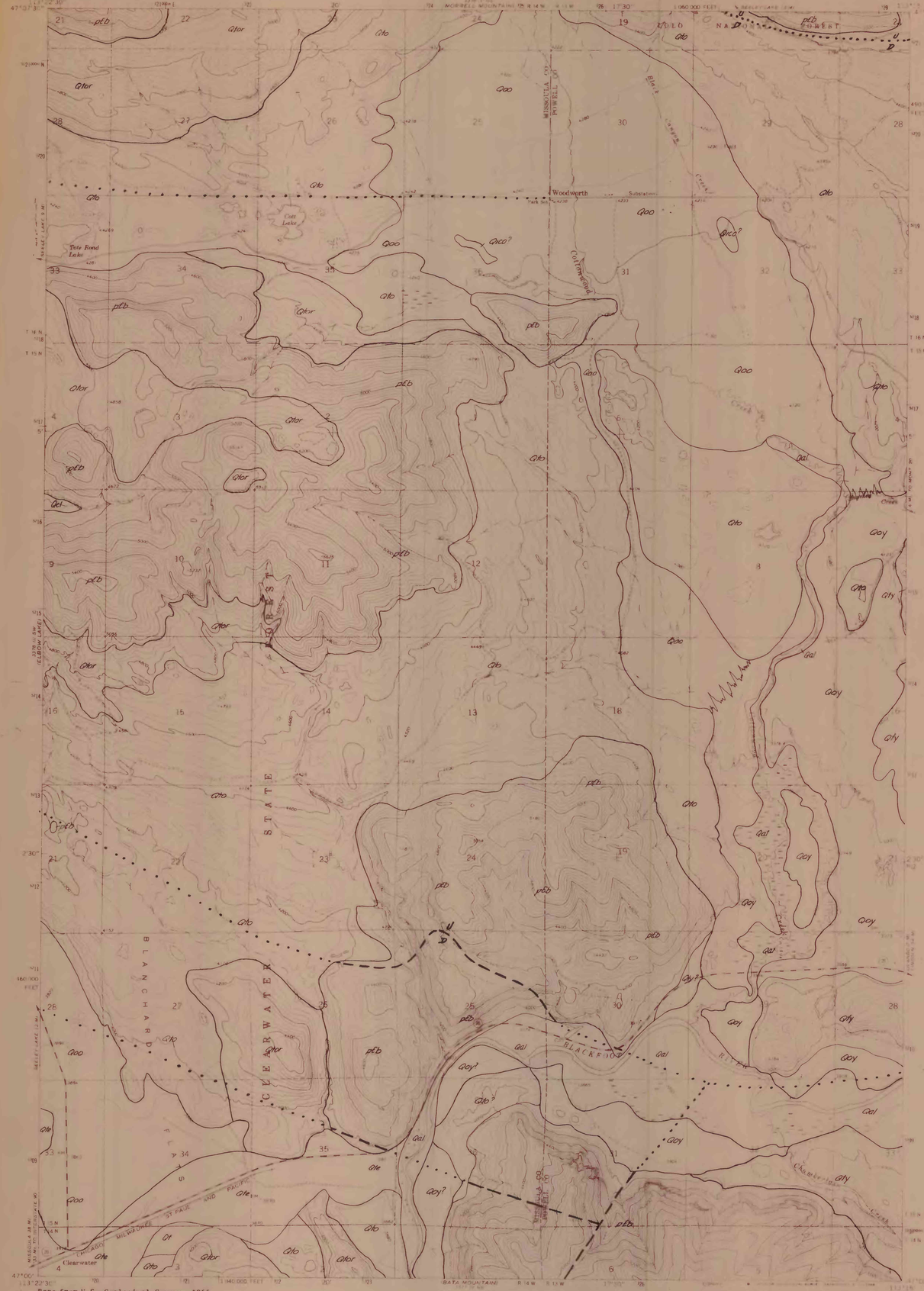
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

OPEN-FILE REPORT
77-203
WOODWORTH QUAD., MONT.



Base from U.S. Geological Survey, 1965.

U.S. Geological Survey
OPEN FILE REPORT
This map is preliminary and has not been edited or reviewed for conformity with Geological Survey standards or nomenclature.

Geology by Irving J. Witkind, 1975. Traces of faults from unpublished maps by M. R. Mudge, U.S. Geological Survey.

PRELIMINARY MAP SHOWING SURFICIAL DEPOSITS IN THE WOODWORTH QUADRANGLE, MISSOULA AND POWELL COUNTIES, MONTANA

By
Irving J. Witkind
1977

Introduction

Personnel of the U.S. Geological Survey, in conjunction with Mark Weber, Geologic Consultant to Missoula and Powell Counties, are studying the earth and water resources of an area that extends from the Big Fork quadrangle on the north to the Avon quadrangle on the south. This map represents one product of that study, and is for the use of environmental and land-use planners. Additional maps south of Highway 200 have been prepared by Weber.

The areal distribution of all geologic units, except alluvium, was determined in the field. The distribution of the alluvium was plotted in the office from aerial photographs.

Surficial deposits

Most of the surficial deposits in the northern part of the Big Fork-Avon area were formed in the latter stages of the last ice age--the Pinedale glaciation of the Pleistocene--during the advance and waste of several large glaciers. These deposits mantle the lower flanks of the mountains and form the valley floors; they have been dissected and eroded somewhat by modern streams, but most still appear much as when they were formed.

For ease of discussion and to avoid the complexities of glacial nomenclature these deposits have been grouped into two categories, older and younger. The "older" deposits were likely formed either during early or middle Pinedale time, and the "younger" deposits during the late Pinedale. It is possible that in some localities deposits of more than one ice advance have been included in one or the other category.

Deposits of the older ice are identified on the map by the letter "o" added to the symbol, thus "Qto," is, "till of the older ice."

Deposits of the younger ice are identified on the map by the letter "y" added to the symbol, thus "Qoy," is, "outwash of the younger ice."

Locally, along the length of the Swan Valley, deposits of former small tributary glaciers extend into the main valley. These deposits have been mapped separately and are identified by appropriate symbols, thus "Qth," is, "till of the Holland Lake ice."

CORRELATION OF MAP UNITS

Qcl, Qal, Qf	Holocene	QUATERNARY
Qtc	Holocene and Pleistocene	
UNCONFORMITY?		
Qoy, Qty	Pleistocene	
UNCONFORMITY		
Qlco, Qoo, Qto, Qtor		
UNCONFORMITY		
pCb	PRECAMBRIAN	

DESCRIPTION OF MAP UNITS

Qal ALLUVIUM(HOLOCENE)--Stream-deposited unconsolidated silt, sand, and gravel. Commonly forms the floor of the major stream valleys, as well as of the now-abandoned meltwater channels of former glaciers. Locally includes small deposits of colluvium and other mass-wasting debris. Overlies and normally masks outwash sand and gravel deposited by meltwaters of the wasting glaciers

Qf ALLUVIAL FAN (HOLOCENE)--Small, gently sloping, even-surfaced deposit of moderately well sorted silt, sand, and gravel

Qcl COLLUVIUM (HOLOCENE AND PLEISTOCENE)--Small, hummocky deposit of unsorted debris that has slid down valley sides and now partly fills valley

Qtc TERRACE DEPOSITS (HOLOCENE AND PLEISTOCENE)--Unconsolidated, well sorted silt, sand, and gravel flooring a broad, even-surfaced swale now followed by Highway 200 and the railroad. Clasts range in shape from subangular to well rounded with most being well rounded; in size, range extends from 5 mm to about 30 cm (1/4-12 in.), most are about 4 cm (1 1/2 in.) across. Many cobbles and boulders; boulders are subangular to subrounded and are 0.5-1 m (2-3 ft) across. Large, angular glacial erratics 2.5-3 m (8-10 ft) on a side are scattered irregularly across the surface; these may have been ice-rafted to their present positions. In general, tan quartzite and green argillite clasts dominate; purple clasts are less common. Dark-blue limestone fragments and pebbles are conspicuous. How these terrace deposits formed is uncertain. They may represent outwash deposited by the glacial Blackfoot River when it was emptying into the former Glacial Lake Missoula, or they may have been formed when the Blackfoot River was dammed downstream, possibly by ice, and forced into this westward path. Once the obstruction was removed, the river abandoned this new course and reoccupied its former valley

PINEDALE GLACIATION (PLEISTOCENE)

Qoy Outwash deposited by younger ice--Even-surfaced, gently sloping deposit of unconsolidated well bedded and moderately well sorted silt, sand, gravel, and cobbles. Locally concealed beneath a 5 to 15 cm (2-6 in.) veneer of alluvium. Clasts range in shape from subrounded to well rounded; most are rounded. In general, about 65 percent of unit is composed of clasts that range in size from about 5 mm to about 76 mm (1/4-3 in.); about 30 percent consists of a fine to coarse sand with included small pebbles as much as 5 mm; and the remaining 5 percent is fine silt and clay. Tan quartzite and sandstone clasts predominate; other prominent types include green, gray, and purple argillite.

Locally, as near the mouth of Shanley Creek, cobbles and boulders form low, elongate mounds that are oriented more or less parallel to the outwash channel

Qty Till deposited by younger ice--Several small exposures of this till, in the form of a hummocky moraine, are along the east edge of the quadrangle. In the adjacent Ovando quadrangle to the east, the surface of this till sheet is characterized by a striking knob-and-kettle topography, and by many scattered kettle lakes and swamps. Consists of a heterogeneous mixture of gravel, cobbles, and boulders in a light-brown to dark-brown silty to sandy matrix. Locally the matrix is somewhat clayey. Clasts range from angular to rounded; most are subangular. Sizes range from 0.5 to 30 cm (1/8-12 in.). Only a few angular boulders, 0.6-1 m (2-3 ft) across were noted. A few large glacial erratics, about 1.5-2.5 m (5-8 ft) on a side, are scattered irregularly across surface. Tan quartzite and sandstone predominate; other prominent types include green, gray, and purple argillite. In places, till appears very much like an unsorted sand and gravel deposit. In these localities the fine-grained materials are lacking implying that water has percolated through the till

Qoo Outwash deposited by older ice--Even-surfaced, gently sloping, extensive deposits of unconsolidated, well bedded, and well sorted silt, sand, and gravel. Deposits along the north and east edges of the quadrangle were formed by meltwaters which flowed southeastward through the narrow canyon now occupied by the Cottonwood Lakes and Cottonwood Creek (in Morrell Mountain quadrangle to the north). Clasts in these deposits range in shape from subangular to well rounded; most are subrounded. Size range is from 0.3 to 25 cm (1/8-10 in.); dominant sizes are from 1 to 8 cm (1/2-3 in.). Tan quartzite and sandstone clasts predominate; other prominent types include green, gray, and purple argillite. Cobbles are common, but no boulders were noted.

Deposits in the southwest corner of the quadrangle are part of a long, narrow, pitted outwash plain formed by south-flowing meltwaters derived from the waste of a trunk glacier which occupied much of Clearwater Valley. In general, about 75 percent of unit is composed of clasts that range in size from about 5 mm to about 76 mm (1/4-3 in); about 15 percent consists of a fine to coarse sand with included small pebbles as much as 5 mm; and the remaining 10 percent is fine silt and clay. Well rounded cobbles are widespread. Tan quartzite and sandstone clasts predominate; other prominent types include green, gray, and purple argillite

Qlco Ice-contact deposit of older ice--Small, oval-shaped deposit of silt, sand, and gravel. Clasts range from subrounded to well rounded; most are well rounded. Tan quartzite and sandstone clasts predominate; other prominent types include green, gray, and purple argillite. Formed in contact with wasting ice

Qto Till deposited by older ice--In northern part of quadrangle marked by a fresh well-defined knob-and-kettle topography. Consists of an unsorted mixture of gravel, cobbles, and boulders in a brown to reddish-brown very sandy matrix. Clasts range in shape from subangular to well rounded; most are rounded. Sizes range from 0.5 to 35 cm (2/8-14 in.); most are in the range 1 to 5 cm (1/2-2 in.). Tan quartzite and sandstone clasts predominate; other prominent types include green, gray, and purple argillite. A few boulders, 0.5-1 m (2-3 ft) across, are scattered through till. No large glacial erratics were noted.

Till in southern part of quadrangle also appears as a hummocky moraine, but here many of the kettles have been breached. Till is much like that to the north with the prominent exception that purple argillite clasts predominate; other prominent types include green and gray argillite, and tan quartzite and sandstone. Many large glacial erratics 3-4.5 m (10-15 ft) across are scattered across surface. Drumlin pattern suggests that ice from the west flowed southeastward across Clearwater Valley and covered virtually all of the quadrangle

Qtor Rubble from till deposited by older ice--Thin, discontinuous veneer and rubble derived from widespread erosion of till of the older ice leaving bedrock widely exposed; few scattered erratics. Elsewhere the till forms small patches of irregular shape and thickness. In general, the upper contact marks the highest limit of the till patches

pCb OLDER BEDROCK OF BELT SUPERGROUP, UNDIVIDED (PRECAMBRIAN)--Consists of various units of the Belt Supergroup, chiefly the Snowslip (argillite and sandstone), Shepard (argillite and dolomite), and Mount Shields (argillite and sandstone) Formations. These are bright units in varying shades of red, maroon, green, tan, and gray

——— CONTACT--Approximately located or inferred. In many places somewhat concealed beneath overlying surficial deposits or dense foliage

U
D ····· FAULT--Dashed where approximately located or inferred; dotted where concealed. U, upthrown side; D, downthrown side