DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

OPEN-FILE REPORT
77-199
HOLLAND LAKE 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Traces of faults from unpublished maps by M. R. Mudge, U.S. Geological Survey.

SCALE 1:24 000

CONTOUR INTERVAL 40 FEET
DATUM IS MEAN SEA LEVEL

QUADRANGLE LOCATION

PRELIMINARY MAP SHOWING SURFICIAL DEPOSITS IN THE WEST HALF OF THE HOLLAND LAKE QUADRANGLE, MISSOULA COUNTY, 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.

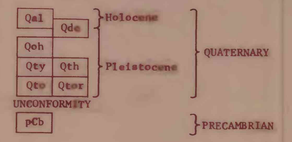
For ease of discussion and to avoid the complexities of glacial nomenclature these deposits have been grouped into two categories, older and younger. The "older" deposits were likely formed either during early or middle Pinedale time, and the "younger" deposits during the late Pinedale. It is possible 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



DESCRIPTION OF MAP UNITS

Qal ALLUVIUM (HOLOCENE)--Stream deposited, unconsolidated silt, sand, and gravel. Commonly forms the floor of 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 glacier

Qde DELTA (HOLOCENE AND PLEISTOCENE)--Low, broad, fan-shaped deposit of unconsolidated light-brown to brown silt, sand, and gravel deposited at the mouth of Holland Creek where it empties into Holland Lake

PINEDALE GLACIATION (PLEISTOCENE)

Qoh Outwash deposited by Holland Lake ice--Even-surfaced deposit of unconsolidated, moderately well sorted silt, sand, and gravel flooring ice-marginal and outwash channels of the Holland Lake glacier. In many places covered by a thin layer of alluvium. Clasts range in shape from angular to well rounded; most are rounded. In general, about 64 percent of unit is composed of clasts that range in size from about 5 mm to about 76 mm (1/4-3 in.); about 33 percent consists of a fine to coarse sand with included small pebbles as much as 5 mm; and the remaining 3 percent is silt. Includes many well rounded cobbles, 8-20 cm (3-8 in.) in diameter, and a few subrounded to rounded boulders 25-46 cm (10-18 in.). Clasts of green, gray, and purple argillite dominate; tan quartzite and sandstone clasts are minor components

Qty Till deposited by younger ice--Brown to reddish brown, very coarse; consists of a heterogeneous mixture of unconsolidated gravel, cobbles, and boulders in a medium to coarse sand matrix. Clasts range in shape from angular to well rounded; most are rounded. In general, about 62 percent of unit is composed of clasts that range in size from about 5 mm to about 76 mm (1/4-3 in.); about 25 percent consists of a fine to coarse sand with included small pebbles as much as 5 mm; and the remaining 13 percent is silt. Includes many well rounded cobbles, 8-20 cm (3-8 in.) in diameter, and many subrounded to rounded boulders 0.3-1 m (1-3 ft) across. Clasts of green, gray, and purple argillite dominate; tan quartzite and sandstone clasts are minor components

Qth Till deposited by Holland Lake ice--Gently rolling moraine that locally gives way to a hummocky surface marked by knob-and-kettle topography. Till has a distinctive reddish-brown cast. Consists of a heterogeneous mixture of gravel, cobbles, and boulders in a silty to clayey matrix which locally becomes somewhat sandy. A striking characteristic is the paucity of cobbles and boulders which are so abundant in most of the other tills in the area. Clasts range in shape from angular to rounded; most are subrounded. Sizes range from about 5 mm to 20 cm (1/4-8 in.); dominant sizes range from about 13 mm to 5 cm (1/2-2 in.). Clasts of green, gray, and purple argillite predominate; tan quartzite and sandstone clasts are minor constitutents. Sparse angular to subangular boulders about 0.6 m (2 ft) across are scattered through the till and on the surface, as are a few large glacial erratics about 1.5 m (5 ft) across

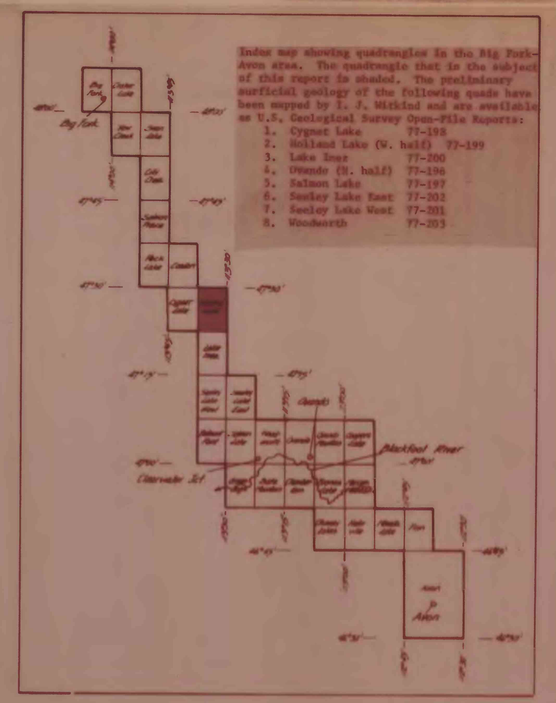
Qto Till deposited by older ice--Hummocky moraine characterized by a modified knob-and-kettle topography. Till is light brown to reddish brown, and consists of a heterogeneous mixture of gravel, cobbles, and boulders in a sandy matrix which locally is somewhat clayey. Clasts range in shape from angular to well rounded; most are subangular. Most clasts range from 13 mm to 6 cm (1/2-2 1/2 in.) across. Till is strongly dominated by tan to reddish-brown quartzite and sandstone clasts; other prominent types include green, gray, and purple argillite. Fragments of gray diorite of all sizes are widespread. In general, larger material is composed of quartzite and sandstone; smaller fragments are of argillite. Boulders about 1/2 m (2 ft) across are common. Only a few large glacial erratics, 1.5 m (5 ft) across, were noted

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 Empire (argillite and siltite), Helena (dolomite), Snowslip (argillite and sandstone), and Shepard (argillite and dolomite) Formations. These are bright units in varying shades of red, maroon, green, tan, and gray

———— CONTACT--Approximately located or inferred. Queried where uncertain. In many places, somewhat concealed by debris or dense foliage

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



Index map showing quadrangles in the Big Fork-Avon area. The quadrangle that is the subject of this report is shaded. The preliminary surficial geology of the following quads have been mapped by I. J. Witkind and are available as U.S. Geological Survey Open-File Reports:

1. Cygnet Lake 77-198
2. Holland Lake (W. half) 77-199
3. Lake Inez 77-200
4. Ovando (N. half) 77-196
5. Salmon Lake 77-197
6. Seeley Lake East 77-202
7. Seeley Lake West 77-201
8. Woodworth 77-203