DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

OPEN-FILE REPORT
77-202
SEELEY LAKE EAST QUAD., MONT.

Base from the 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.

SCALE 1:24000
CONTOUR INTERVAL 40 FEET
DOTTED LINES REPRESENT 20-FOOT CONTOURS
DATUM IS MEAN SEA LEVEL
UTM GRID AND 1965 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

MONTANA
QUADRANGLE LOCATION

Geology by Irving J. Witkind, 1975. Traces of faults from unpublished maps by J. E. Harrison (west of highway 209), and M. R. Mudge (east of highway), both of the U.S. Geological Survey.

PRELIMINARY MAP SHOWING SURFICIAL DEPOSITS IN THE SEELEY LAKE EAST 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

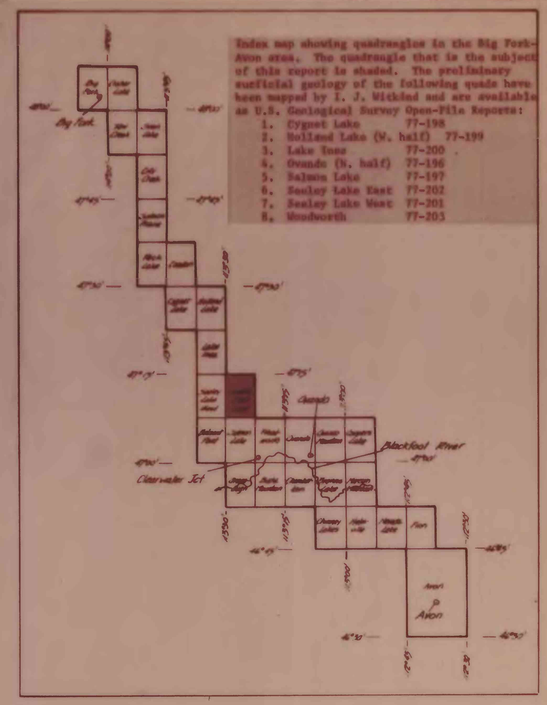
Most of the surficial deposits in the northern part of the Big Fork-Avon area were formed in the latter stages of the last ice age--the Pinedale glaciation of the Pleistocene--during the advance and waste of several large glaciers. These deposits mantle the lower flanks of the mountains and form the 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

Qal, Qf, Qofo	Holocene	QUATERNARY
Qlco, Qkto, Qoo, Qko, Qto, Qtor	Pleistocene	QUATERNARY
UNCONFORMITY		
pCb		PRECAMBRIAN

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 glaciers

Qf ALLUVIAL FAN (HOLOCENE)--Low, broad, cone-shaped, gently sloping, light-brown to brown deposit of unconsolidated to semiconsolidated moderately sorted silt, sand, and gravel formed at valley mouth. Locally contains thin sheets of gravel

PINEDALE GLACIATION (PLEISTOCENE)

Qofo Outwash fan deposited by older ice--Narrow, fan-shaped deposit of unconsolidated, moderately well sorted silt, sand, and gravel. Clasts range in shape from subangular to well rounded; most are well rounded. Sizes range from 0.5 to 25 cm (1/8-10 in.); dominant sizes range from 1 to 9 cm (1/2-3 1/2 in.). Tan quartzite and sandstone clasts predominate; other prominent types include green, gray, and purple argillite. A few small rounded boulders 0.3-0.6 m (1-2 ft) in diameter are scattered through the deposit. Formed by meltwaters that flowed in the former outwash channel now occupied by Trail Creek

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

Qkto Kame terrace deposited by older ice--Elongate, narrow, irregular to even surfaced, terrace-like deposit of light-brown to brown unconsolidated silt, sand, and gravel. Moderately well sorted. Clasts range in shape from subrounded to well rounded; most are well 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 silt. Few rounded boulders scattered through deposit. Tan quartzite and sandstone clasts predominate; other types include green, gray, and purple argillite. Many interlayered lenses and pockets of unconsolidated light-brown sand, some as much as 30 m (100 ft) long and 6 m (20 ft) thick. Sand lenses are composed of about 85 percent fine to coarse sand, and about 15 percent silt. Formed by meltwaters between the edge of an ice mass and the adjacent valley wall

Qoo Outwash deposited by older ice--Outwash that floors Clearwater Valley differs somewhat from that exposed on the upland between Trail and Morrell Creeks. The Clearwater Valley outwash is an even-surfaced, gently sloping, extensive deposit of unconsolidated, well bedded and well sorted silt, sand, gravel, and cobbles. Clasts range in shape from subrounded to well rounded with most being well rounded. In general, about 75 percent of unit is composed of clasts that range in size from about 5 mm (1/4 in.) to about 76 mm (3 in.); about 15 percent consist of a fine to coarse sand with included small pebbles as much as 5 mm; and the remaining 10 percent is silt and clay. Tan quartzite and sandstone clasts predominate; other prominent types include green, gray, and purple argillite. This deposit is part of a long, narrow, pitted outwash plain that was formed by south-flowing meltwaters derived chiefly from the waste of a trunk glacier which occupied Clearwater Valley. Seeley Lake, and undrained depressions in this outwash plain, were formed when buried ice blocks melted and permitted the overlying sand and gravel to collapse into the resulting voids.
The outwash on the upland between Morrell and Trail Creeks appears to rest on till. The outwash is even surfaced, slopes gently southward, and ranges in thickness from 9 to 15 m (35-50 ft). It consists of reddish-brown, crudely bedded, poorly sorted silt, sand, gravel, cobbles, and boulders. Clasts range in shape from subangular to rounded; most are rounded. Size ranges from 0.5 to 25 cm (1/8-10 in.); dominant sizes range from 1 to 9 cm (1/2-3 1/2 in.). In general, clasts of tan quartzite, and green, gray, and purple argillite are about equally distributed through the deposit. Many large rounded boulders 1-2 m (4-6 ft) are scattered irregularly through and across the surface. Deposit appears to have been formed when ice blocked south-flowing meltwaters and diverted them southeastwards across upland to empty into the valley of Trail Creek

Qko Kame deposited by older ice--Elongate, steep-sided hillock composed of unconsolidated, moderately well sorted silt, sand, and gravel. Clasts range in shape from subangular to well rounded; most are well rounded. In general, about 70 percent of the 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 5 percent is silt. Tan quartzite and sandstone predominate; other prominent types include green, gray, and purple argillite. Includes sparse well rounded cobbles, and a few small rounded boulders 0.3-0.6 m (1-2 ft) in diameter. Formed by glacial stream that flowed down into a stagnant ice mass

Qto Till deposited by older ice--Two types of till are exposed: a quartzite-dominated one in Clearwater Valley, and an argillite-dominated one in the broad valley drained by Morrell and Trail Creeks.
The Clearwater Valley till forms a hummocky moraine characterized by a striking knob-and-kettle topography. Elongate drumlins trend about S. 40° E. and are separated by elongate narrow undrained depressions and swamps. Till consists of an unsorted mixture of sand, gravel, cobbles, and boulders in a brown to reddish-brown very sandy matrix. Clasts range in shape from angular to subangular with most being subangular. Till is very coarse; sizes range from small pebbles 0.5 cm (1/8 in.) to small angular boulders about 1 m (3 ft) across. Tan quartzite and sandstone clasts predominate; other types include green, gray, and purple argillite. Many large, angular glacial erratics 2.5-3 m (8-10 ft) across are scattered through till and across surface. This till appears to end along Seeley Creek. General alinement of drumlins suggests that ice flowed southeastward across the western half of the quadrangle.
The till in the broad valley occupied by Morrell and Trail Creeks is also marked by fresh knob-and-kettle topography. This till, although much like the Clearwater Valley till, differs sharply in that it is dominated by clasts of green and purple argillite. Clasts of tan quartzite and sandstone are minor constituents.
The till along the west edge of the quadrangle was deposited by a major trunk glacier which occupied the Clearwater Valley. The till that fills the broad valley drained by Morrell and Trail Creeks was formed by a large southward-moving glacier

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 by debris or dense foliage

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