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OPEN-FILE REPORT
78-173
CRATER LAKE QUAD., MONT.

Base from U.S. Geological Survey, 1964

Geology mapped in 1976. Faults from Johns (1970), and unpub. mapping by J. E. Harrison, U.S. Geological Survey

PRELIMINARY MAP SHOWING SURFICIAL DEPOSITS IN THE WEST HALF OF THE CRATER LAKE QUADRANGLE, LAKE AND FLATHEAD COUNTIES, MONTANA

By
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CORRELATION OF MAP UNITS

Qf	Qaf	Qcl				Holocene — QUATERNARY
Qdr	Qic	Qk	Qo	Qtv	Qtf	Pleistocene — QUATERNARY
Qkfn	Qon	Qtvn	Qtfn			Pleistocene — QUATERNARY

UNCONFORMITY

pЄb	PRECAMBRIAN

Introduction

U.S. Geological Survey personnel, in conjunction with Mark Weber, Geologic Consultant to Missoula and Powell Counties, are studying the water and earth resources of an area that extends from the Big Fork quadrangle on the north to the Avon quadrangle on the south (see index map). This map is a product of that study, and is intended for use by environmental and land-use planners. Maps of quadrangles, or parts of quadrangles, south of Highway 200, have been prepared by Weber.

The distribution of the alluvium was plotted in the office from aerial photographs. All other geologic units were mapped in the field.

Surficial deposits

Surficial deposits in the northern part of the Big Fork-Avon area were formed primarily during the latter stages of the latest ice age--the Pinedale Glaciation of the Pleistocene. Glacial deposits mantle the lower flanks of the mountains and form the valley floors; they have been dissected somewhat by streams, but most still appear much as when they were formed.

It seems likely that deposits of at least two glaciers cover this quadrangle. One glacier advanced from the north and overrode the low north end of the Mission Range (directly west of this quadrangle). This glacier probably reached as far south as the north end of Swan Lake; its deposits mantle the north end of the Mission Range, the rolling plain north and east of the Missions, and the foothills of the Swan Range. These deposits are shown on the map by the letter "n" added to the symbol, thus, "Qon - Outwash of the northern glacier." Another younger glacier moved north down the Swan River valley and came to a halt near the north end of Swan Lake. Some of its terminal deposits (Qtv) are exposed in the southwest corner of this quadrangle.

In some localities deposits of both glaciers may have been inadvertently grouped and mapped as the deposits of one or the other glacier.

DESCRIPTION OF MAP UNITS

Qf — ALLUVIAL FAN (HOLOCENE)--Light-brown to brown, low, broad, fan-shaped, gently sloping deposit of partly consolidated, moderately sorted silt, sand, and gravel at mouth of Wolf Creek valley. Locally laps onto small mounds of sand and gravel (kame field of the northern glacier)

Qaf — COALESCED ALLUVIAL FANS (HOLOCENE)--Broad, irregular-shaped, gently sloping, even-surfaced deposit consisting of several coalesced cone-shaped alluvial fans. Consists of poorly sorted angular to subrounded fragments of argillite, siltite, and limestone derived from bedrock exposed in mountains to the east. Clasts increase in size toward mountains, and range in size from silt to boulders as much as 30 cm (12 in.) across

Qcl — COLLUVIUM (HOLOCENE)--Irregular-shaped, gently sloping deposit of partly consolidated, unsorted debris that forms a mantle of uneven thickness across bedrock

MELTWATER DEPOSIT OF PINEDALE GLACIATION (PLEISTOCENE)

Qdr — Drift--Composed of unconsolidated, moderately well sorted silt, sand, and gravel; broad, even to gently undulatory surface broken here and there by small till mounds and undrained depressions. These mounds protrude through the sand and gravel cap and rise some 2-6 m (6-20 ft) above the surrounding surface. Angular to subangular boulders 0.5-1.5 m (2-5 ft) in diameter are scattered across the till mounds. Elsewhere the even surface of the sand and gravel deposit is interrupted by small rounded kettles 3-4.5 m (10-15 ft) deep. Sand and gravel deposit is light brown, and consists of subrounded to well-rounded clasts. In general, about 67 percent of unit is composed of clasts that range in size from about 5 mm to about 76 mm (1/4-3 in.) in diameter; about 31 percent consists of a fine to coarse sand with included small pebbles as much as 5 mm in diameter; and the remaining 2 percent is silt. Green, gray, and purple argillite clasts dominate deposit; tan quartzite and sandstone clasts are minor constituents. A few very large angular glacial erratics are scattered across the surface of the sand and gravel cap.

The sand and gravel lapping onto the till mounds represent debris deposited by glacial meltwaters of the Swan River glacier. The boulders, which are scattered across the sand and gravel cap, were ice-rafted to their present position. During the melt of the glacier, small ice floes containing these boulders floated downstream on the glacial meltwaters. As the floes melted the encased boulders were freed and dropped. The end result is an irregular scattering of boulders across the outwash sand and gravel

Qic — Ice-contact deposit--Light-brown; moderately well sorted, and well-bedded deposit of unconsolidated silt, sand, and gravel plastered onto an elongate, oval till ridge. Clasts range in shape from subangular to subrounded; most are subrounded. In general, about 30 percent of unit is composed of clasts that range in size from about 5 mm to about 76 mm (1/4-3 in.) in diameter; about 59 percent consists of a fine to coarse sand with included small pebbles as much as 5 mm in diameter; and the remaining 11 percent is silt. A few cobbles are scattered through the deposit. Green, gray, and purple argillite clasts dominate deposit. Deposit was probably formed by north-flowing meltwaters confined between the bulk of the Swan River glacier (which then filled the depression now occupied by Swan Lake) and the till that formed the northeast valley wall

Qk — Kame deposit--Moderately to poorly sorted silt, sand, and gravel forming small, ellipsoidal, low hillock. Few well-rounded cobbles are scattered through unit. Probably formed by a glacial stream that flowed down into a depression in a stagnant ice mass

Qo — Outwash--Even-surfaced deposit, flanking Swan River, of unconsolidated, moderately well sorted silt, sand, gravel, and cobbles. Locally covered by a layer, 5-60 cm (2-24 in.) thick, of very fine grained sand. Clasts range in shape from subangular to subrounded; most are subrounded. In general, about 67 percent of unit is composed of clasts that range in size from about 5 mm to about 76 mm (1/4-3 in.) in diameter; about 31 percent consists of a fine to coarse sand with included small pebbles as much as 3 mm in diameter; and the remaining 2 percent is silt. Green, gray, and purple argillite clasts dominate deposit; tan dolomite and bluish-gray limestone are minor constituents. This outwash was deposited by glacial meltwaters of the north-flowing Swan River glacier

Qon — Outwash of the northern glacier--Light-brown, unconsolidated, well-bedded and well-sorted silt, sand, and gravel which form a broad, unusually even surfaced deposit. Includes a few interspersed cobbles 15-20 cm (6-8 in.) in diameter. Clasts range in shape from subrounded to well rounded; most are rounded. In general, about 37 percent of unit is composed of clasts that range in size from about 5 mm to about 76 mm (1/4-3 in.) in diameter; about 56 percent consists of a fine to coarse sand with included small pebbles as much as 3 mm in diameter; and the remaining 7 percent is silt. Green, gray, and purple argillite clasts dominate deposit; tan dolomite, bluish-gray limestone, and gray diorite are minor constituents. This deposit differs from outwash deposited by the north-flowing Swan River glacier in that it contains well-rounded clasts of black basalt marked with small clusters of white minerals. These clasts are derived from the erosion of the Precambrian Purcell Lava, a volcanic rock exposed north of this area. These black basalt clasts are characteristic of debris deposited by or derived from the south-flowing glacier which once occupied Kalispell Valley; they have not been found in deposits of the north-flowing Swan River glacier. This outwash was probably deposited by glacial meltwaters of the south-flowing glacier

Qkfn — Kame field deposits--Light-gray to gray, unconsolidated, moderately well sorted silt, sand, gravel, cobbles, and boulders forming many small, steep-sided, rounded knolls or kames each about 30 m (100 ft) high. Clasts range in shape from angular to well rounded; most are subrounded. In general, about 72 percent of unit composed of clasts that range in size from about 5 mm to about 76 mm (1/4-3 in.) in diameter; about 25 percent consists of a fine to coarse sand with included small pebbles as much as 5 mm in diameter; and the remaining 3 percent is silt. Lenses of dark-brown to dark-gray fine to coarse sand are common; locally these grade laterally into pods of sand and gravel. A few large boulders 2.5-3 m (8-10 ft) in diameter are scattered through the kame field. Green, gray, and purple argillite clasts dominate deposit; bluish-gray limestone is a minor constituent

TILL OF PINEDALE GLACIATION (PLEISTOCENE)

Qtv — Valley facies--Light tan to light brown; consists of a heterogeneous mixture of gravel, cobbles, and boulders in a partly consolidated silty to clayey matrix. Clasts range in shape from angular to well rounded; most are rounded. Includes many rounded cobbles 8-20 cm (3-8 in.) in diameter, and many angular to subrounded boulders 0.3-1 m (1-3 ft) across. Many large angular to subangular boulders 2.5-3 m (8-10 ft) across, are scattered through the till and on the surface. Clasts of green, gray, and purple argillite dominate deposit. Confined mainly to the southwest corner of this quadrangle. Characterized by a knob-and-kettle topography marked by many small kettle lakes and swamps. A few alined drumlinoid knobs, west of Swan Lake, suggest general northwest direction of movement of the Swan River trunk glacier which deposited and overrode this till. This till is part of the crescentic-shaped terminal moraine formed at the north end of Swan Lake when the north-flowing Swan River glacier probably reached its farthest northern extent

Qtf — Foothill facies--Light brown to brown; consists of an unsorted mixture of gravel, cobbles, and boulders in a silty to clayey matrix. Clasts range in shape from angular to subrounded; most are subangular. Most clasts range from 0.1 to 6 cm (1/2-2 1/2 in.) across. Boulders 0.5-4.5 m (2-15 ft) across are common. Clasts of green, gray, and purple argillite, of tan dolomite, and of tan quartzite and sandstone appear to be equally profuse. Forms a veneer of variable thickness over bedrock; extensively mantled by colluvium. Source of this till is unknown; likely it was deposited by an older glacier that flowed north in ancestral Swan River valley prior to the advent of the younger glacier responsible for the drift that now mantles most of the valley floor. It may have been deposited, however, by an older glacier that flowed southward up the ancestral Swan River valley

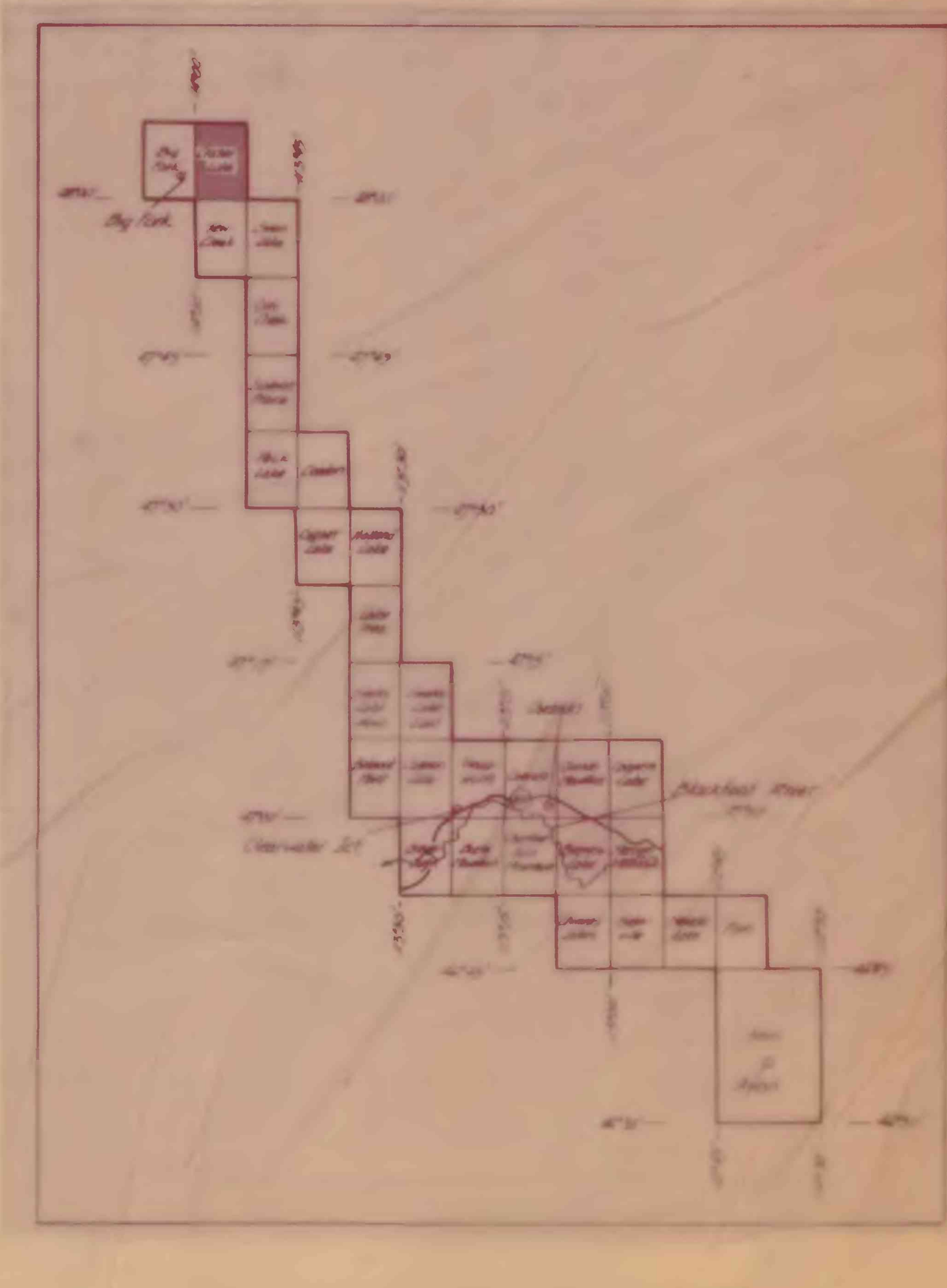
Qtvn — Valley facies of northern glacier--Light brown to brown, locally dark brown. Compact gravelly till that stands at steep angles in roadcuts. Consists of a heterogeneous mixture of gravel, cobbles, and boulders in a silty to clayey matrix. Clasts range in shape from angular to subrounded; most are subangular. Includes many rounded cobbles 8-20 cm (3-8 in.) in diameter, and many angular to subangular boulders 0.3-1 m (1-3 ft) across. Many large angular to subangular boulders 2.4-3 m (8-10 ft) across, are scattered through the till and on the surface. Clasts of purple and green argillite dominate deposit; tan dolomite and black basalt are minor constituents. Hummocky surface characterized by knob-and-kettle topography with many small kettle lakes and swamps

Qtfn — Foothill facies of northern glacier--Brown to dark brown; very sandy till that is almost free of silt and clay. Consists of an unsorted mixture of gravel, cobbles, and boulders in a coarse sandy matrix. Clasts range in shape from subangular to subrounded; most are subangular. Size range of most clasts is 1-6 cm (1/2-2 1/2 in.). Boulders 0.5-1 m (2-3 ft) in diameter are common; no very large boulders found. Clasts of purple and green argillite, and of bluish-gray limestone dominate deposit. Forms a thin to thick veneer over bedrock; extensively mantled by colluvium. Source of this till is unknown; likely it was deposited by the older glacier that flowed south, filled Kalispell Valley, and overrode the low north end of the Mission Range

pЄb — BEDROCK OF BELT SUPERGROUP, UNDIVIDED (PRECAMBRIAN Y)--Consists of several units of the Belt Supergroup, chiefly the Spokane (argillite and siltite), Empire (argillite and siltite), and Helena (dolomite) Formations. These are bright units in varying shades of red, purple, green, tan, and gray

——— CONTACT--Approximately located or inferred. In many places wholly or partly concealed by debris or dense foliage

• • • • • (U / D) FAULT--Dotted where concealed. U, upthrown side; D, downthrown side



Index map showing quadrangles in the Big Fork-Avon area. The Crater Lake quadrangle is shaded. Preliminary surficial geologic maps of the following quadrangles, by I. J. Witkind, are available as U.S. Geological Survey Open-File Reports from the:

Open-File Services Section,
Branch of Distribution,
Box 25425, Federal Center,
Denver, Colorado 80225

Copies of the maps can be examined at the following offices:

Denver Public Inquiries Office,
U.S. Geological Survey,
1012, Federal Building,
1961 Stout Street,
Denver, Colorado 80202

Salt Lake City Public Inquiries Office,
U.S. Geological Survey,
8015, Federal Office Building,
125 South State Street
Salt Lake City, Utah 84111

Spokane Public Inquiries Office,
U.S. Geological Survey,
678, U.S. Courthouse Building,
West 920 Riverside Avenue,
Spokane, Washington 99201

1.	Big Fork	78-174
2.	Cilly Creek	77-860
3.	Condon (W. half)	77-540
4.	Coopers Lake (S. half)	77-466
5.	Crater Lake (W. half)	78-173
6.	Cygnet Lake	77-198
7.	Holland Lake (W. half)	77-199
8.	Lake Inez	77-200
9.	Ovando	77-196
10.	Ovando Mountain (S. half)	77-465
11.	Peck Lake (E. half)	77-539
12.	Salmon Lake	77-197
13.	Salmon Prairie	77-861
14.	Seeley Lake East	77-202
15.	Seeley Lake West	77-201
16.	Swan Lake (SW quarter)	78-135
17.	Woodworth	77-203
18.	Yew Lake (NE quarter)	78-136

REFERENCE

Johns, W. M., 1970, Geology and mineral deposits of Lincoln and Flathead Counties, Mont.: Montana Bur. Mines and Geology Bull. 79