

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 State 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.

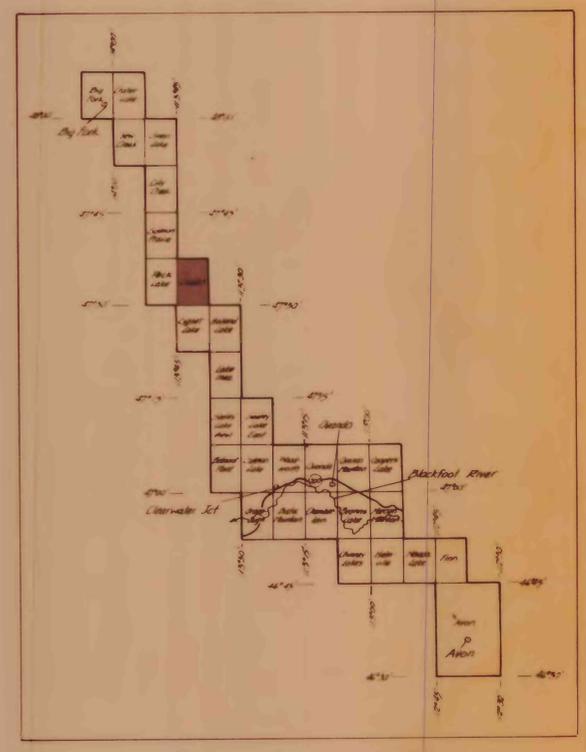
Surficial deposits

Surficial deposits in the northern part of the Big Fork-Avon area were formed primarily during the latter part 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. In some localities deposits of more than one ice advance may have been included in one or the other category.

Deposits of former tributary glaciers locally extend into the Swan Valley. These deposits are mapped separately and are identified by appropriate symbols; thus "Qch" is "till deposited by ice from the Holland Creek Valley."

- DESCRIPTION OF MAP UNITS**
- Qal ALLUVIUM (HOLOCENE)--Stream-deposited unconsolidated silt, sand, and gravel. Forms the floor of Swan River and the lower reaches of Glacier Creek. Locally includes small deposits of colluvium and other mass-wasting debris. Commonly, overlies outwash sand and gravel deposited by meltwater of wasting ice.
- Qch MELT-WATER DEPOSITS OF PINEDALE GLACIATION (PLEISTOCENE)
Outwash--Patches of light-brown to brown, unconsolidated, moderately well sorted silt, sand, and gravel, flooring Glacier Creek Valley, and some 3-18 m (10-60 ft) above the alluvium of the Swan River. Locally veneered by very fine grained sand 5-15 cm (2-6 in.) thick. Clasts range in shape from subangular to subrounded; most are subrounded. In general, about 70 percent of unit is composed of clasts that range from about 5 mm to about 76 mm (1/4-3 in.) in diameter; about 24 percent is a fine to coarse sand with included small pebbles as much as 5 mm; and the remaining 6 percent is silt. Green, gray, and purple argillite clasts strongly dominate deposit; tan quartzite and sandstone clasts are minor constituents. Well-rounded cobbles are common. A few subangular to subrounded boulders, 30-36 cm (12-14 in.) in diameter, are scattered throughout the deposit. Patches along Swan River are relicts of a once-continuous outwash deposit formed by north-flowing meltwater of wasting ice which occupied Swan Valley.
- Till (Swan Valley facies)--Characterized by a striking knob-and-kettle topography. Brown to reddish brown, very coarse; consists of a heterogeneous mixture of unconsolidated gravel, cobbles, and boulders in a matrix of medium to coarse sand. Clasts range from angular to well rounded; most are rounded. In general, about 62 percent of unit is composed of clasts that range from about 5 mm to about 76 mm (1/4-3 in.) in diameter; about 25 percent is a fine to coarse sand with included small pebbles as much as 5 mm; and the remaining 13 percent is silt. Contains 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. Green, gray, and purple argillite clasts dominate; tan quartzite and sandstone clasts are minor components. Many angular to subangular boulders 2.4-3 m (8-10 ft) across are scattered through the till and on the surface. Southeast of Condon small, oval mounds composed of unconsolidated, poorly sorted sand and gravel may have been formed by meltwater of the wasting ice.
- This till was deposited chiefly by ice that flowed northward from Lindbergh Lake Valley (south west of this quadrangle) into the Swan Valley. Smaller glaciers emerging from valleys, chiefly along the east flank of the Mission Range (west of this quadrangle), flowed into and added to the bulk of this ice.
- Till of Holland Creek Valley--A small patch of moraine deposited by the Holland Creek Valley ice is exposed in the southeast corner of the quadrangle. Where well exposed south of this quadrangle, the moraine, in most places, is characterized by knob-and-kettle topography. Locally the hummocky aspect changes to a gently rolling terrain.
- The 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 sandy. This till lacks the cobbles and boulders which are abundant in other tills in this quadrangle. Clasts range from angular to subrounded. Sizes range from about 5 mm to 20 cm (1/4-8 in.) in diameter; dominant sizes range from about 13 mm to 5 cm (1/2-2 in.) in diameter. Green, gray, and purple argillite clasts dominate; tan quartzite and sandstone clasts are minor constituents. Sparse angular to subangular boulders about 0.6-1.5 m (2-5 ft) across are scattered through the till and on the surface.

- Qef TILL (foothill facies)--Forms a thin to thick veneer over bedrock; extensively mantled by unmaped colluvium. Light brown to brown; consists of an unsorted mixture of gravel, cobbles, and boulders in a silty to clayey matrix. Clasts range from angular to subrounded; most are subangular. Most clasts range from 0.1-6 cm (1/2-2 1/2 in.) across. Green, gray, and purple argillite, and tan quartzite and sandstone clasts, appear to be equally abundant. Fragments of gray diorite are wide-spread. Boulders 0.3-4.5 m (2-15 ft) across are common.
- Source of this till is unknown. It may represent material deposited during a previous ice advance, or it may have been formed during the waste of the ice that lay in Swan Valley and that deposited the till which now forms the valley floor.
- pCb BEDROCK OF BELT SUPERGROUP, UNDIVIDED (PRECAMBRIAN)--Consists of several units of the Belt Supergroup, chiefly the Spokane (argillite and siltite), Empire (argillite and siltite), Helena (dolomite), and Shepard (argillite and 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.
- D FAULT--dotted where concealed, approximately located or inferred. U, upthrown side; D, downthrown side.



Index map showing quadrangles in the Big Fork-Avon area. The Condon 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 following offices:

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|---------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| Denver Public Inquiries Office
U.S. Geological Survey
1012, Federal Building
1961 Stout Street, Denver, CO 80202 | Salt Lake City Public Inquiries Office
U.S. Geological Survey
8015, Federal Office Building
125 South State Street
Salt Lake City, UT 84111 | Spokane Public Inquiries Office
U.S. Geological Survey
678, U.S. Courthouse Building
West 920 Riverside Avenue
Spokane, WA 99201 |
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- | | |
|---------------------------|--------|
| 1. Condon (W. half) | 77-540 |
| 2. Coopers Lake | 77-466 |
| 3. Cygnet Lake | 77-198 |
| 4. Holland Lake (W. half) | 77-199 |
| 5. Lake Inez | 77-200 |
| 6. Ovando (N. half) | 77-196 |
| 7. Ovando Mountain | 77-465 |
| 8. Peck Lake (E. half) | 77-539 |
| 9. Salmon Lake | 77-197 |
| 10. Seeley Lake East | 77-202 |
| 11. Seeley Lake West | 77-201 |
| 12. Woodworth | 77-203 |

Base from U.S. Geological Survey, 1965

U.S. Geological Survey
OPEN FILE REPORT

This map is preliminary and has not been edited or revised for conformity with Geological Survey standards of nomenclature.

Geology mapped in 1976. Faults from M. R. Mudge, U.S. Geological Survey, unpub. data.

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

By
Irving J. Witkind
1977