UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Geologic Map of the Opheim 1°X30' Quadrangle, Valley and Daniels Counties, Montana

By

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DESCRIPTION OF MAP UNITS

Qp **Pond deposits (Holocene)**--Dark-gray plastic clay, silt, and sandy clay. Size distribution: 50 percent clay, 40 percent silt, and 8 percent sand. Thickness is as much as 4 m (13 ft)

Qe **Eolium (Holocene)**--Light- to dark-brown, medium- to fine-grained, windblown silt and sand. Consists of 5 percent clay, 7 percent silt, and 88 percent sand. Thickness is as much as 6 m (20 ft)

Qal **Alluvium (Holocene)**--Light-yellowish-gray to medium-brown clay, silt, sand, and fine gravel; vertical and horizontal variations in composition and in bedding. Upper part finer grained than lower part. Thickness is as much as 6 m (20 ft)

Qls **Landslide deposits (Holocene)**--Large slump blocks of various formations. Thickness is as much as 20 m (66 ft)

Qac **Alluvial-Colluvial deposits (Holocene)**--Slopewash and creep deposits along valley walls. Composition and color reflect that of parent material. Deposits are gently sloping, poorly sorted, and poorly stratified. Composed of silty clays, sandy silt, pebbly clays, pebbly silts, gravelly clays, and gravels. Size distribution varies but averages 43 percent clay, 42 percent silt, and 15 percent sand. Includes alluvial fans. Thickness is as much as 6 m (20 ft)

Qat **Alluvial terrace deposits (Holocene)**--Well to poorly sorted and stratified deposits of silt, sand, and gravel. Most are light brown. Thickness is as much as 10 m (33 ft) but is generally only 3 or 4 m (10-13 ft)

Qo **Outwash deposits (Pleistocene)**--Poorly to well-sorted sandy gravel interbedded with clay, silt, and well-sorted sand. Contain numerous glacial erratics. Diameter of rounded clasts in gravel is as much as 10 cm (4 in.) but averages 1.5 cm (0.43 in.). Composition varies but averages 6 percent silt, 44 percent sand, 10 percent granules, and 40 percent pebbles. Lithology is approximately 5 percent quartzite, 25 percent limestone and dolomite, and 9 percent granite. Thickness is as much as 5 m (16 ft); most deposits are only 6-15 m (20-50 ft)

Qic **Ice-contact stratified deposits (Pleistocene)**--Coarse, poorly stratified sand and gravel. Includes kames (conical hills) and eskers (long narrow sinuous ridges). Thickness is as much as 6 m (20 ft) but is generally about 3 m (10 ft)

Qt **Till (Pleistocene)**--Yellowish-brown (oxidized) to bluish-gray (unoxidized) unstratified, unsorted, unconsolidated to moderately consolidated heterogeneous mixture of 25-30 percent clay, 25-40 percent silt, 25-40 percent sand, 1-3 percent granules, 1-2 percent pebbles, cobbles, and boulders. Boulders (less than 1 percent) are as much as 2 m (6.6 ft) in diameter. Thickness averages 5 m (16 ft) but may be as much as 20 m (66 ft). Includes till of Wisconsinan and Illinoian age

Qw **Wiota gravels (Pleistocene)**--Reddish-brown coarse quartzite gravel, sand, and silt. Contains sparse scattered erratic stones from Canada (granite, gneiss, schist, limestone, dolomite). Size distribution: 5 percent silt, 15 percent sand, 5 percent granules, 70 percent pebbles. Thickness is 7.5 m (25 ft). Horizontal and vertical facies changes occur within short distances

To **Ogallala Formation equivalent (Miocene)**--Pale-tan or pale-grayish-orange silt and sand; contains several horizons of white caliche (paleosols). It was the "marl member" of Flaxville Formation (Collier and Thom, 1918, p. 182). Thickness is approximately 10 m (33 ft)

Tf **Flaxville Formation (Upper Pliocene)**--Light-reddish-brown clay, silt, sand, quartzite gravel, and volcanic ash. Locally cemented by calcium carbonate to sandstone and conglomerate. Average diameter of pebbles is 4 cm (1.6 in.). Contains boulders as much as 30 cm (11 in.) in diameter. Size distribution: 2 percent silt, 36 percent sand, 4 percent granules, 58 percent pebbles. Lithology: 90 percent brown and red quartzite; remainder chalcedony and fragments from the Ft. Union Formation. Locally contains large lenses of volcanic ash as much as 6 m (20 ft) thick (Collier and Thom, 1918). Thickness is as much as 25 m (82 ft) but averages 10 m (33 ft) in Opheim area

Tfu **Fort Union Formation (Paleocene)**--Yellowish-brown interbedded sand, sandstone, siltstone, silt, clay, clayey shale, lignite, and claystone. Measured sections in northeastern Montana indicate 50-52 percent sand and sandstone, 35-48 percent shale and clay, and 4-8 percent lignite and carbonaceous shale. In northeast corner of Opheim area thickness is as much as 100 m (338 ft)

Khc **Hell Creek Formation (Late Cretaceous)**--Brown, gray, and violet claystone and shale, siltstone and silty fine- to medium-grained sandstone. Beds of bentonite and lenticular carbonaceous and lignitic shales in upper part of formation. Soft and hard, brown, medium-grained salt-and-pepper sandstone and ferruginous conglomerate in basal unit which is 20-30 m (66-100 ft) thick. Total thickness is 51-83 m (170-270 ft). Size distribution: 30 percent clay, 3 percent silt, 4 percent shale, and 61 percent sand and sandstone. Basal contact with Fox Hills Formation is unconformable

Kfh **Fox Hills Formation (Late Cretaceous)**--Lower part is transitional between the underlying Bearpaw Shale and the sandy part of the formation, and is composed of yellowish-gray to dusky-yellow or dark-yellowish-orange fine-grained sandstone and thin-bedded shale and siltstone. Transition zone is composed of 96 percent clay and silt and 4 percent sand. Thickness is 10-12 m (35-40 ft). Upper part of the formation is 44-52 percent clay and silt and 48-56 percent sand. Thickness of upper part varies from 0 to 32 m (0 to 46 ft)(Jensen and Varnes, 1964). Lower contact gradational with Bearpaw Shale; upper contact is unconformable

Kb **Bearpaw Shale (Late Cretaceous)**--Fossiliferous, semiconsolidated, olive-gray, fissile marine shale containing numerous bentonite beds and concretionary zones. Thickness ranges from 330 to 360 m (1,082 to 1,180 ft), but averages 345 m (1,132 ft)

Kjr **Judith River Formation (Late Cretaceous)**--Medium- to dark-gray, brown, and greenish shale and sandstone; bentonitic shale and beds of bentonite are abundant. Shale is thinly interbedded with silt and sandstone. Composed of 26 percent shale, 73 percent sandstone, and 1 percent lignite. Carbonaceous shale grades laterally into lignite. Sandstones are fine to medium grained, well indurated, gray to greenish gray and weather buff to brown. Glauconitic sandstones in the basal part. Thickness is approximately 99-106 m (325-290 ft)[1]

Kc **Claggett Shale (Late Cretaceous)**--Soft dark-gray shale and bentonite. Thickness is approximately 64-77 m (220-250 ft)

 **CONTACT**--Dashed where approximately located

W **WATER**

REFERENCES CITED

Collier, A.J., 1924, The Scobey lignite field, Valley, Daniels, and Sheridan Counties, Montana: U.S. Geological Survey Bulletin 751-E, 73 p.

Collier, A.J., and Thom, W.T., Jr., 1918, The Flaxville gravel and its relation to other terrace gravels of the northern Great Plains: U.S. Geological Survey Professional Paper 108-J, p. 179-184.

McLean, J.R., 1971, Stratigraphy of the Upper Cretaceous Judith River Formation in the Canadian Great Plains: Saskatchewan Research Council Report No. 11.

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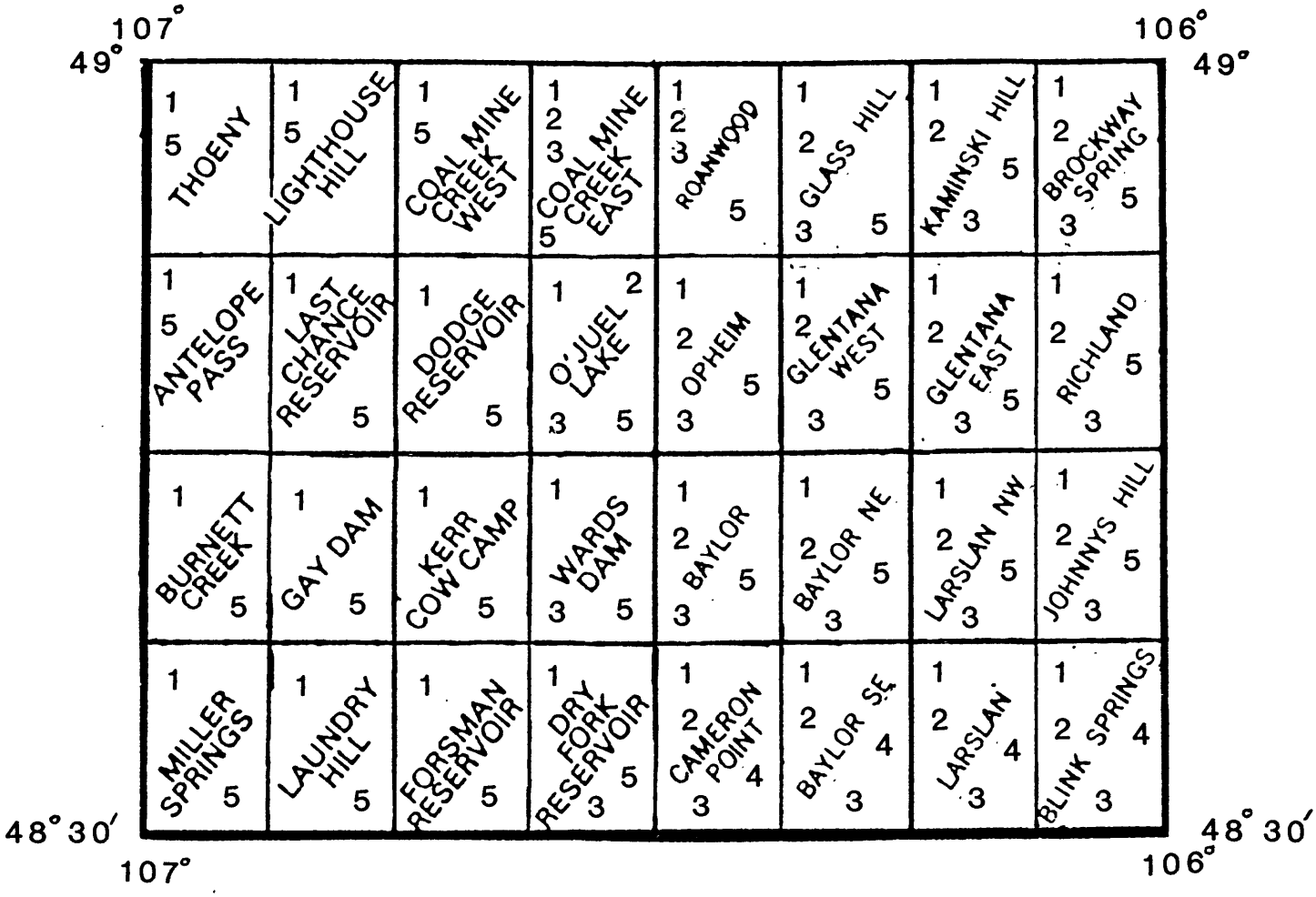
[1]Thicknesses of Judith River Formation and Claggett Shale were taken from McLean (1971) cross section D-D'.

SOURCES OF INFORMATION

1. Collier, A.J., 1919, Geology of northeastern Montana: U.S. Geological Survey Professional Paper 129, p. 17-39.
2. Collier, A.J., 1924, The Scobey lignite field, Valley, Daniels, and Sheridan Counties, Montana: U.S. Geological Survey Bulletin 751-E, p. 157-230.
3. Collier, A.J., and Thom, W.T., Jr., 1918, The Flaxville gravel and its relation to other terrace gravels of the northern Great Plains: U.S. Geological Survey Professional Paper 108-J, p. 179-184.
4. Colton, R.B., 1964, Geologic map of the south half of the Baylor, Larslan, West Fork, Police Creek, Kahle, and Lundville Quadrangles, Valley, Roosevelt, and Daniels Counties, Montana: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-361.
5. Colton, R.B., Whitaker, S.T., and Ehler, W.C., unpublished geologic mapping.



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OPHEIM 30′ X 60′ QUADRANGLE, MONTANA

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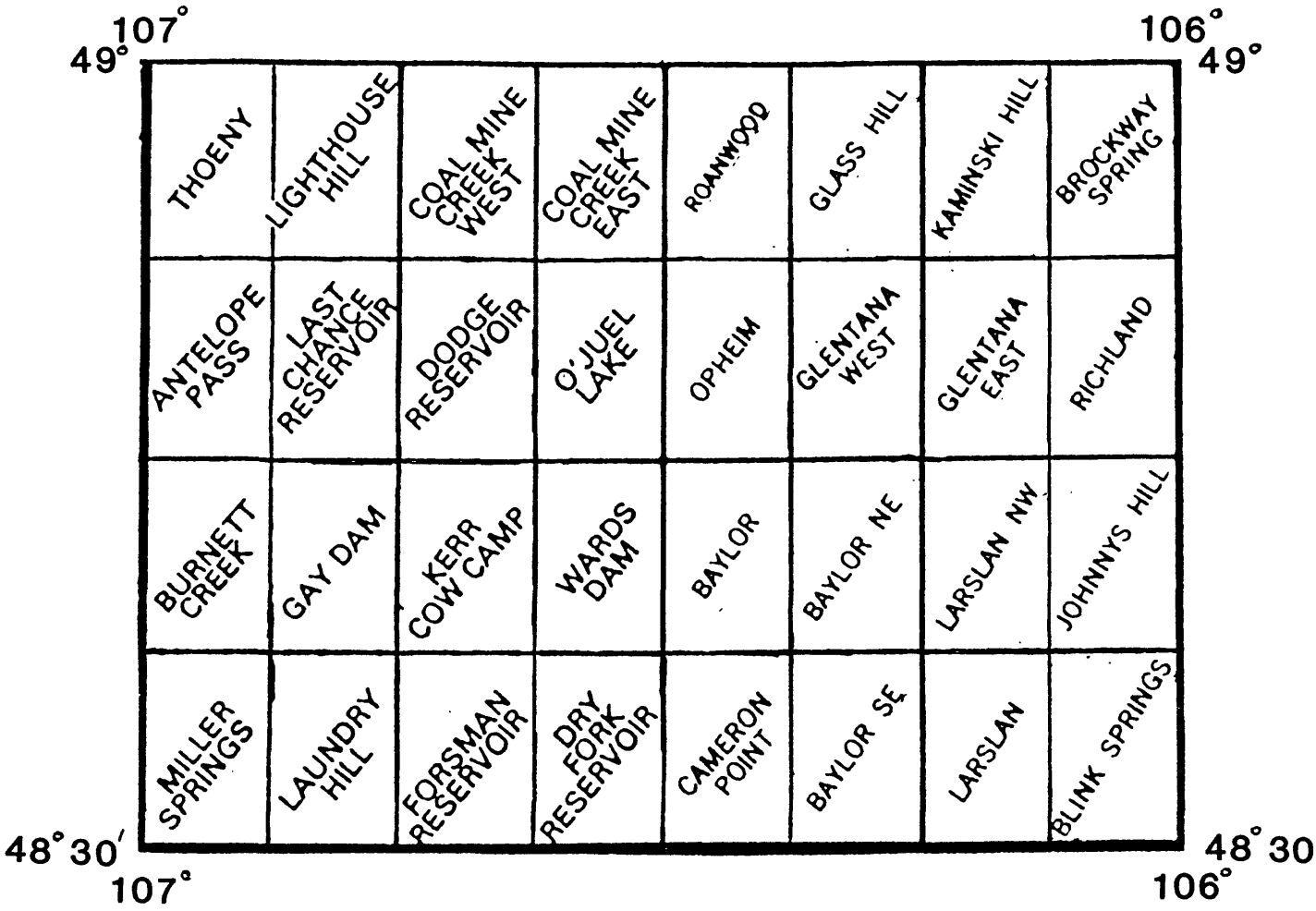

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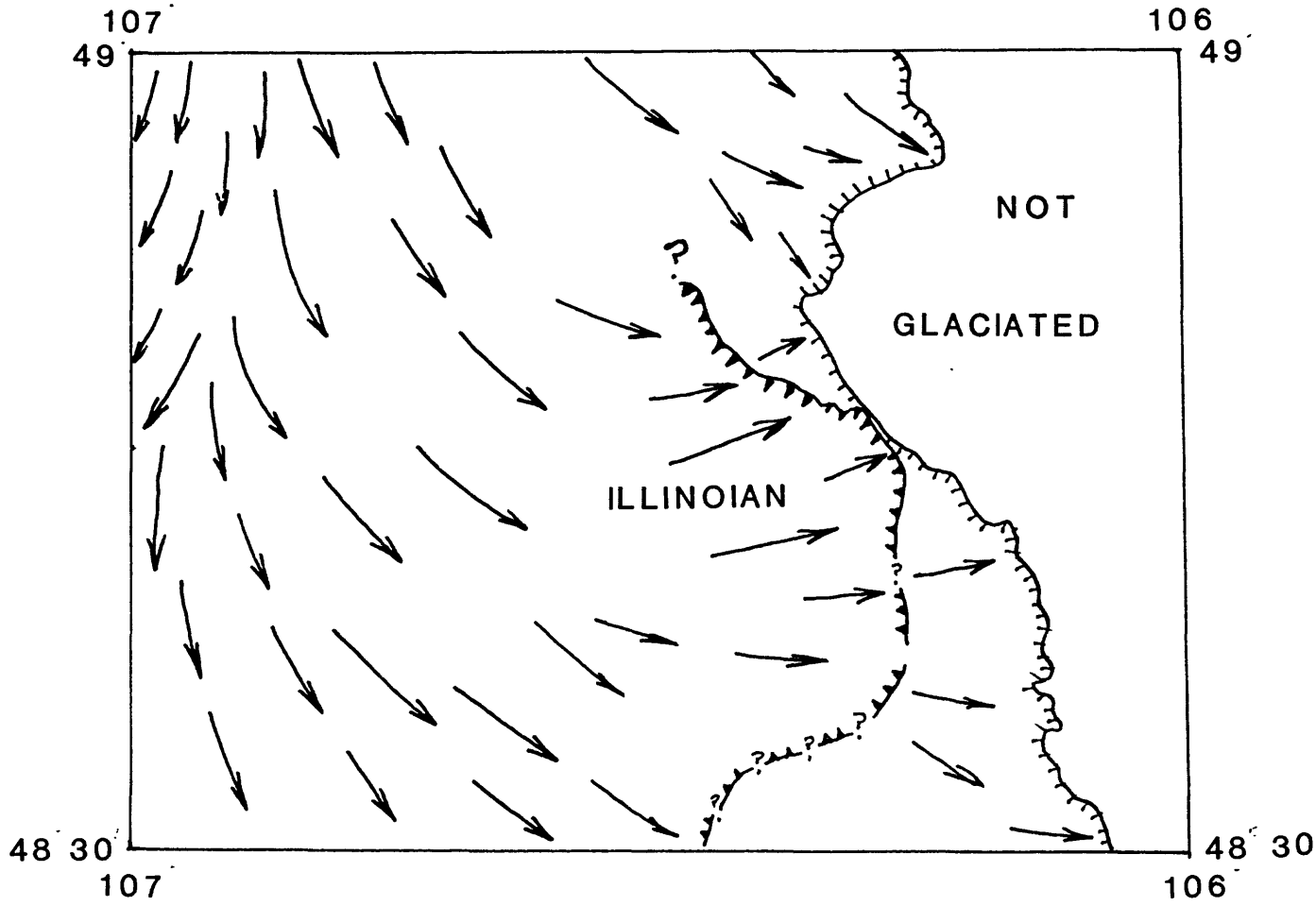

INFERRED DIRECTIONS OF ICE MOVEMENT

IN THE OPHEIM 30'X 60' QUADRANGLE, MONTANA

INFERRED DIRECTION OF ICE MOVEMENT

LIMIT OF GLACIATION

LIMIT OF INFERRED READVANCE DURING ILLINOIAN TIME

CORRELATION OF MAP UNITS