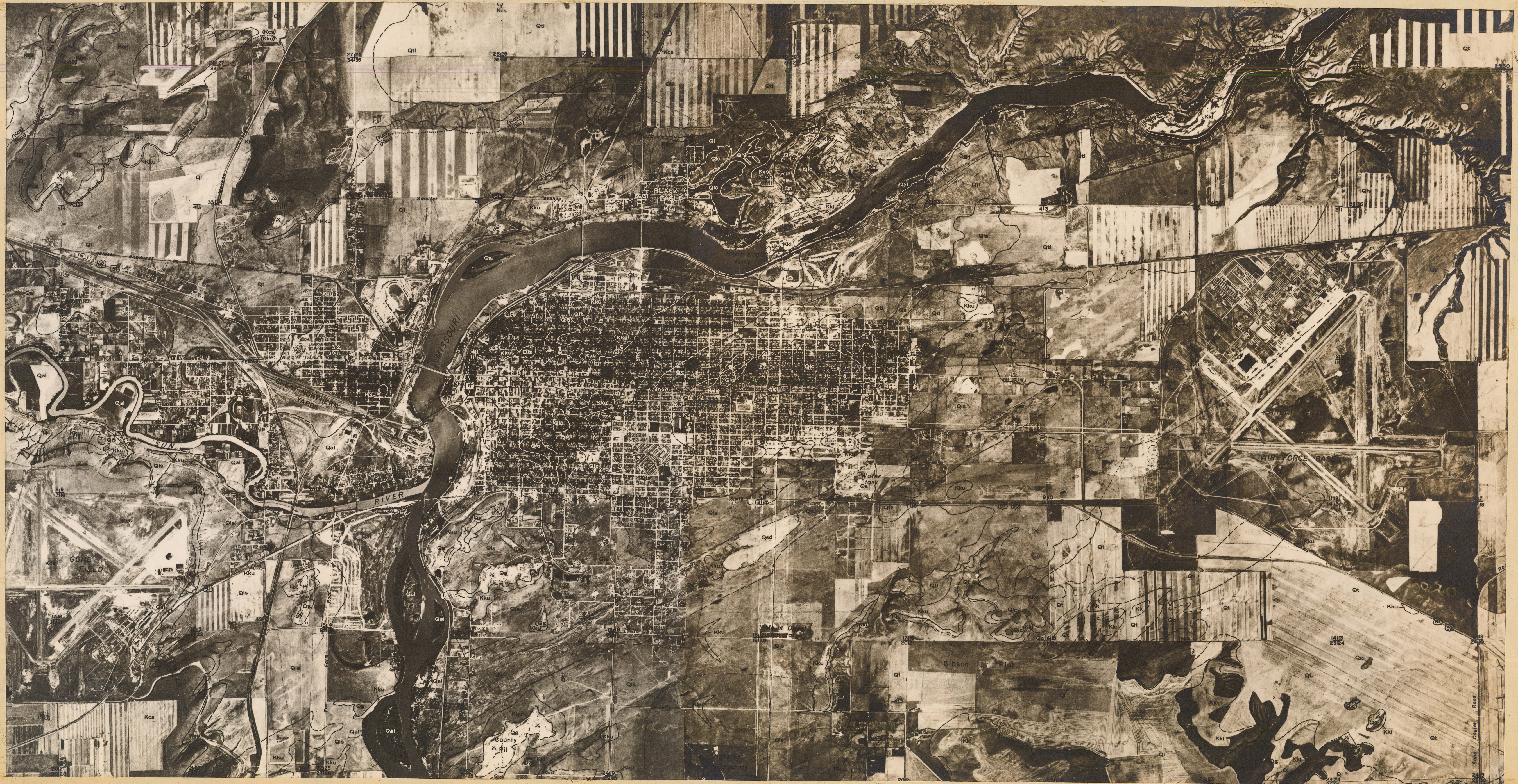
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

Prepared as a part of the Department of the Interior's program for the development of the Missouri River Basin

Missouri River Basin
mapping and mineral resource investigations
Great Falls, Montana



Photomosaic base map prepared from aerial photographs flown in 1950 for the Production Marketing Administration, U. S. Department of Agriculture. Prints rectified and adjusted to scale.

19½°
TRUE NORTH
MAGNETIC NORTH
APPROXIMATE MEAN DECLINATION, 1954

PRELIMINARY GEOLOGIC MAP
CITY OF GREAT FALLS AND VICINITY, MONTANA

by R. W. Lemke and E. K. Maughan

Scale approximately 1:20,000

½ 0 ½ 1 1½ MILES

Geology mapped 1950-1954

Montana (Great Falls area). Geol. 1:20,000. 1954. cop. 2

This report and/or map is preliminary and has not been edited or reviewed for conformity with Geological Survey standards or nomenclature.

EXPLANATION

QUATERNARY

Recent

Qal
River valley alluvium

Silt intermixed with considerable clay, and sand, and locally fine to coarse gravel; light greyish brown. Deposited fluvially on floors of Missouri and Sun River valleys.

Qsd
Active dune sand

Arcuate dunes of fine to medium-grained sand; height about 15 feet.

Qsl
Landslide deposits

Slump block type of slides; in a few small places includes debris slides and mud flows. Slide material consists mostly of wind- and lake-deposited sand and bedrock rubble. Sliding is accelerated by removal of basal supporting material on steep debris covered slopes underlain by shale equivalent to the Skull Creek formation.

Qc
Colluvium and alluvium

Silt, clay and minor amounts of sand and gravel, originating chiefly as soil creep, slope wash, tributary stream deposits, and intermixed windblown deposits. Ranges in thickness from thin veneer to more than 30 feet. Not mapped in many small areas, and generally not mapped where less than three feet thick.

Qs
Semi-active dune sand

Thin blanket of wind blown sand generally less than 10 feet thick modified on the surface into linear semi-active dunes 3 to 5 feet high. Mapped in most places where more than two feet thick. Gradational contact with Qls.

af
Artificial fill

Chiefly glacial lake clay, sand and some sandstone rubble largely derived from excavations; also bricks, cinders, and other man-made refuse. Occupies areas in the city that were low, poorly drained and swampy. As much as 10 feet thick. Highway and railroad fills not included.

Pleistocene

Qgy
Younger gravel

Gravel and sand; mostly medium to coarse grained poorly sorted quartzites, argillites, locally derived sandstones, and a few granitic rocks. Deposit forms terrace remnants in Missouri River trench. As much as 40 feet thick, but generally 15 to 25 feet thick.

Wisconsin stage

Ql
Deposits of glacial Lake Great Falls (undivided)

Clay (Qlc) thinly overlain by silt and sand (Qls). Thickness might be as much as 250 feet in Sun River valley, along Missouri River valley above Sun River, and in Gibson Flat. Upper part locally modified by Recent aeolian action and contact is gradational with Qs.

Qls
Silt and sand of glacial Lake Great Falls

Silt and fine sand, light tan to grey; generally only a few feet thick, but, locally, as much as 20 feet. Deposited in glacial lake, but also includes a thin deposit of loess that extends beyond the shoreline of the lake. Contact with underlying lake clay is gradational. Low bearing strength when saturated. Fossil snails locally abundant.

Qlc
Clay of glacial Lake Great Falls

Very plastic clay; indistinctly to well-banded with alternating dark and light brown laminae. Generally moderately well compacted; high moisture content, high shear and shrinkage ratios.

Qtl
Till with admixed lake clays

Till consisting chiefly of reworked glacial lake clay and locally grading downward into undisturbed glacial lake clay. In some places it is homogeneous, poorly bedded to non-bedded, medium brown clayey silt with many thin veins of white gypsum. Locally, includes till of the same character as that mapped as Qt. Thickness ranges from a few feet to 100 feet; thickens eastward and grades imperceptibly into Qt.

Qt
Till

A highly impervious mixture of clay, silt, and sand with some pebbles and a few cobbles and boulders. Thickness ranges from a few feet to 200 feet; thickens eastward. Locally contains small lenses of banded lake clays which increase in number to the west; gradational contact with Qtl.

? ?

Qg
Older gravel

Cobble gravel, poorly bedded, well-rounded cobbles of quartzite, argillite, and a few of chert, limestone, and sandstone in a silty sand matrix; maximum thickness about 15 feet. Chiefly cobbles 3 to 4 inches in diameter; some boulders are as much as 12 inches. Many flat cobbles lie imbricately. Rocks are coated with caliche, and, locally, are partly cemented.

CRETACEOUS

Lower Cretaceous

Colorado formation

Kcn
Newcastle equivalents

Very dark gray bentonitic shale, numerous thin beds of bentonite, and a few beds of glauconitic sandstone. About 260 feet thick, but only the lower 125 feet are exposed in the northeast corner of the map area. Shale is fissile but is plastic when wet, and weathers to poorly exposed flat slopes. A bed of quartzitic and glauconitic sandstone 15 to 20 feet thick occurs about 100 feet above the base, is medium to coarse-grained, friable; weathers readily; is poorly exposed, and forms semi-rounded hills and benches.

Kcs
Skull Creek equivalents

Sandstone, overlying shale and shaly sandstone; thickness 90 to 100 feet. Upper 40 to 50 feet are buff fine- to medium-grained sandstone, flaggy in upper part, massive and crossbedded in lower part; resistant to weathering and forms prominent bluffs; underlies upland surfaces west of city. Middle 30 feet is glossy black paper shale; hard when dry, but soft and plastic when wet. Lower 20 feet is thin lenticular sandstone and siltstone interbedded with black paper shale, abundant in the upper 10 feet, and sparse in the lower 10 feet. Bedding surfaces of lenses marked by numerous raised casts of worm-like burrows. This lower sandstone thickens to the south and may be equivalent to the Fall River sandstone.

Kootenai formation

Kk
Kootenai formation (undivided)

Lower and upper members (Kkl and Kku); poorly exposed.

Kku
Upper member

Varicolored mudstone and shale, and a few lenticular sandstone beds; total thickness approximately 175 feet. Beds predominately dark red, but commonly variegated with green, purple, and maroon; weather to bare, rounded, deeply rilled hills. Basal bed is light lavender to buff thin-bedded to massive and crossbedded magnetite-bearing sandstone 20 to 30 feet thick. Sandstone is loosely cemented but resistant to weathering, and forms much of the bedrock surface underlying the city of Great Falls.

Kkl
Lower member

Beds of fine-grained sandstone, siltstone, shale, and clay; total thickness approximately 175 feet with a maximum exposure, at Black Eagle Falls, of the upper 125 feet. Beds are 1 to 10 feet thick, are moderately well-bedded, and have gradational lateral changes in facies and color. Most beds are dark red but some are light green, purple, maroon, or light buff to yellow. Sandstones and siltstones are hard, well jointed and blocky, and form prominent cliffs. Shales and clays are weakly consolidated and mostly are somewhat fissile. Locally, intraformational channel sandstones interrupt the uniform bedding; channel sandstones generally are thickly bedded to massive, prominently jointed, light yellowish-grey, and as much as 50 feet thick. In the upper part of the member are thin dark grey limestone beds which weather bright orange; these beds thin westward and are lacking west of Rainbow Falls. Near top of member is a carbonaceous shale bed that contains numerous carbonized plant stems, leaves, and cones.

Contact, dashed where approximately located.

Contact, gradational or inferred.

(Kcs)
(Kku)

Contact concealed by surficial deposits. (Symbols in parentheses indicate bedrock units concerned.)

Gravel pit

Quarry