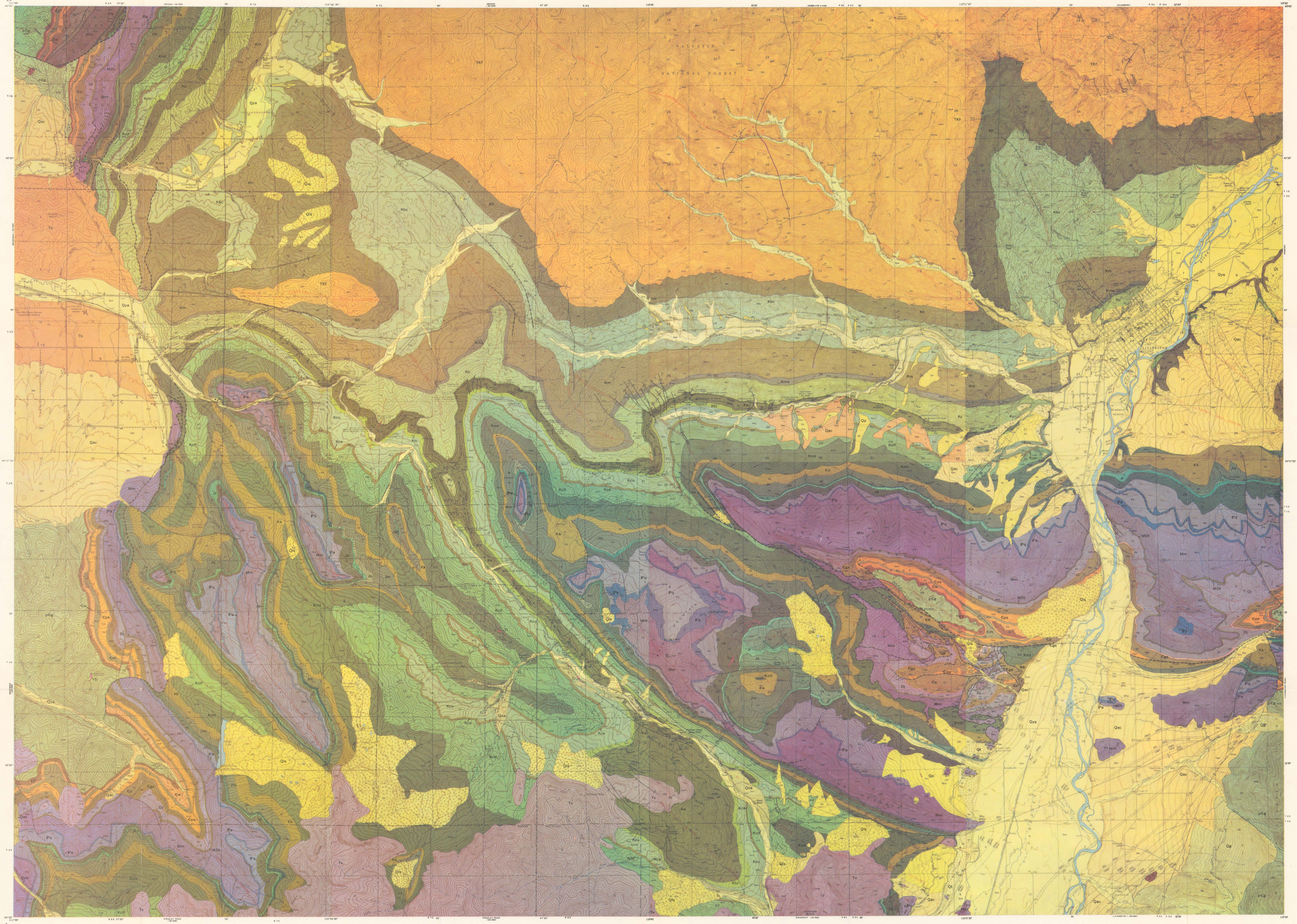
UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

PROFESSIONAL PAPER 526–C
PLATE 1



Base from U.S. Geological Survey; 1951
Map color separated and printed by U.S. Army Topographic Command with electronic scanning equipment from U.S.G.S. maps published at 1:24,000 scale. See index for reference to individual maps.

GEOLOGIC MAP OF THE AREA WEST OF LIVINGSTON, GALLATIN, AND PARK COUNTIES, MONTANA

SCALE 1:62 500

1 ½ 0 1 2 3 4 5 MILES

1 .5 0 1 2 3 4 5 KILOMETERS

CONTOUR INTERVALS 20, 40, AND 80 FEET
DATUM IS MEAN SEA LEVEL

Geology from A. E. Roberts (1964a–e, g, h) and modified from A. E. Roberts (1964 f)
See references in text

EXPLANATION

QUATERNARY — Pleistocene and Holocene

Qya — Younger alluvium
Unconsolidated interbedded clay, silt, sand, and gravel along stream channels and on flood plains

Qac — Alluvium and colluvium
Slope-wash and alluvial fan deposits of mixed silt, sand, pebbles, cobbles, and boulders

Qls — Landslide deposits
Unstratified heterogeneous mixtures of soil mantle and angular rock fragments

Qoa — Older alluvium
Semiconsolidated deposits similar in composition and structure to younger alluvium. Includes low level terrace deposits of tributary streams

Qt — Terrace deposits
Silt, sand, and gravel with some cobbles and boulders of alluvial origin underlying surfaces of terraces 30 to 160 feet above present flood plain of Yellowstone River

Qp — Pediment veneer
Semiconsolidated poorly sorted deposits of silt, sand, pebbles, cobbles, and boulders on pediments

Qg — Glacial deposits
Semiconsolidated till and outwash sand and gravel deposits from mountain glaciers

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TERTIARY

Miocene and Pliocene

Tb — Bozeman Group (upper part)
Poorly stratified variously consolidated tuffaceous siltstone, claystone, sandstone, and conglomerate

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Eocene

Tv — Crandall(?) Conglomerate, and Cathedral Cliffs(?), Golmeyer Creek, and Hyalite Peak Formations, undifferentiated
Andesite and basalt flows, breccias, tuffs, coarse-grained clastic sedimentary rocks, conglomerate, sandstone, and channel-fill deposits of poorly to moderately consolidated gravel with minor lenses of sand; contains fossil spores of Wasatchian provincial age of Wood and others (1941)

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Paleocene

TKf — Fort Union Formation
Conglomerate, sandstone and siltstone; conglomerates contain pre-Cretaceous rocks; contains fossil spores, plants, wood, fresh-water mollusks, and vertebrates

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CRETACEOUS

Upper Cretaceous — Livingston Group

Kh — Hoppers Formation
Andesitic sandstone with interbedded claystone and siltstone; massive crossbedded yellowish-gray sandstone member at base

Kbc — Billman Creek Formation
Olive-gray, brownish-gray, and grayish-red claystone with interbedded sandstone, siltstone, and conglomerate; contains fresh-water mollusks and dinosaur bones

Km, Kms — Miner Creek Formation
Andesitic siltstone and sandstone with beds of tuff and bentonite in lower part; contains fossil spores, plants, wood, and dinosaur bones
Kms, *Sulphur Flats Sandstone Member; prominent massive sandstone; distinct mottled yellowish-gray sandstone at base*

Kc — Cokedale Formation
Andesitic siltstone and sandstone with claystone, tuff, bentonite, and coal; lower part carbonaceous with some thin coal beds; sandstone units locally conglomeratic; contains fossil spores, plants, wood, dinosaur bones, and fresh-water mollusks

Upper Cretaceous

Ke — Eagle Sandstone
Well-bedded sandstone and siltstone with intercalated coal and shale in upper part; massive indurated crossbedded sandstone with intercalated coal, siltstone, and shale in lower part. Coal beds named where identified; otherwise as u, upper coal zone identified locally, and l, lower coal zone identified locally

Ktc — Telegraph Creek Formation
Predominantly siltstone with thin-bedded sandstone; calcareous concretions; mostly concealed

Kcf, Kcu, Kce, Kclf — Cody Shale and Frontier Formation
Medium- to dark-gray and brown shale and glauconitic and calcareous arkosic sandstone containing heavy minerals and chert grains
Kcf, *undivided*
Kcu, *upper shale member of Cody Shale*
Kce, *Eldridge Creek Member of Cody Shale*
Kclf, *lower shale member of Cody Shale, and Frontier Formation*
c, *base of chert-pebble conglomerate*
a, *base of analcite-bearing sandstone*

Lower Cretaceous

Kmt — Mowry and Thermopolis Shales
Dark-brown and dark-gray shale and quartzose sandstone; basal sandstone locally a quartzite

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Kk — Kootenai Formation
Red and green sandstone, mudstone, and fresh-water fossiliferous limestone; massive chert-pebble conglomerate at base

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JURASSIC

Upper Jurassic

Jm — Morrison Formation
Varicolored shale, siltstone, mudstone, limestone, and massive quartzose sandstone; black shale near top

Ellis Group

Js — Swift Formation
Cliff-forming, very calcareous, glauconitic sandstone; abundant fossil trash; chert-pebble conglomerate at base locally

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Jr — Rierdon Formation
Olive-gray shale and bluish-gray limestone in upper part; cliff-forming oölitic limestone beds in lower part

Middle Jurassic

Jp — Piper Formation
Olive-gray shale in upper part; flaggy, very fossiliferous argillaceous limestone beds in middle part; multicolored siltstone in lower part

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PENNSYLVANIAN

IPq — Quadrant Quartzite
Quartzite, well-sorted quartzose sandstone, and dolomite. Includes thin section of quartzose sandstone and bedded chert of the Phosphoria Formation of Permian age in sec. 24, T. 2 S., R. 6 E., secs. 19, 29, 30, and 32, T. 2 S., R. 7 E., and in secs. 2, 3, 4, and 9, T. 4 S., R. 6 E.

IPa — Amsden Formation
Dolomite, calcareous sandstone, and siltstone in upper part; argillaceous limestone in middle part; massive sandstone and red calcareous siltstone and limestone in lower part; mostly concealed

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MISSISSIPPIAN

Upper Mississippian / Lower Mississippian

Mm — Madison Group
Massive cliff-forming gray limestone and dolomite with some red, calcareous siltstone in upper part (Mission Canyon Limestone); well-bedded cliff-forming gray limestone and dolomite in lower part with concentration of chert at base (Lodgepole Limestone)

DEVONIAN

Upper Devonian

MDt — Three Forks Shale
Black shale and olive-gray shale with thin beds of dolomite in upper part; olive-gray and reddish-brown calcareous fossiliferous shale in lower part; mostly concealed

Dj — Jefferson Dolomite
Massive cliff-forming olive-gray fetid dolomite in upper part and brownish-gray limestone and dolomite in lower part. Includes thin section of Maywood Formation at base in secs. 1, 2, 11, 12, and 13, T. 3 S., R. 9 E.

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ORDOVICIAN

Upper Ordovician

Ob — Bighorn Dolomite
Massive, cliff-forming, mottled gray and yellow dolomite

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CAMBRIAN

Upper Cambrian

Ꞓgs — Grove Creek and Snowy Range Formations
Grove Creek Formation is limestone and shale distinguished by rounded limestone pebbles; Snowy Range Formation is green shale and gray limestone that is partly a flat-pebble conglomerate; bed of columnar limestone locally in lower part of Snowy Range Formation; mostly concealed

Ꞓp — Pilgrim Limestone
Massive cliff-forming oölitic mottled magnesian and dolomitic limestone with edgewise limestone-pebble conglomerates; interbedded shale and siltstone; and glauconitic limestone

Middle Cambrian

Ꞓps — Park Shale
Multicolored shale with thin beds of argillaceous limestone, siltstone, and sandstone; mostly concealed

Ꞓm — Meagher Limestone
Thin-bedded silty medium-gray limestone and yellowish-gray dolomite; locally oölitic

Ꞓw — Wolsey Shale
Greenish-gray calcareous shale and mudstone with thin beds of limestone; mostly concealed

Ꞓf — Flathead Quartzite
Gray to red quartzose sandstone and quartzite; conglomeratic in lower part locally

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PRECAMBRIAN

pꞒg — *Gneiss, schist, and granite; pegmatite dikes locally*

IGNEOUS ROCKS

TERTIARY

Ti — Intrusive rocks
Diabase and basalt dikes and sills

Symbols

(Js) (Jr) — Contact
Dashed where approximately located; dotted where concealed. Symbols in parenthesis indicate the concealed bedrock

U D — Fault
Dashed where approximately located; dotted where concealed; queried where doubtful. U, *upthrown side;* D, *downthrown side*

Thrust fault
Sawteeth on upper plate. Dashed where approximately located; dotted where concealed

Overturned thrust fault
Sawteeth in direction of dip; bar on side of tectonically higher plate. Dashed where approximately located; dotted where concealed

Anticline
Showing crestline and direction of plunge of fold. Dashed where approximately located; dotted where concealed

Overturned anticline
Showing trace of axial plane, direction of dip of limbs, and direction of plunge of fold. Dashed where approximately located; dotted where concealed

Syncline
Showing troughline and plunge of fold. Dashed where approximately located; dotted where concealed

Overturned syncline
Showing trace of axial plane and direction of dip of limbs. Dashed where approximately located; dotted where concealed

Calcite vein

Coal bed or coal zone
Dashed where approximately located; dotted where concealed; queried where doubtful

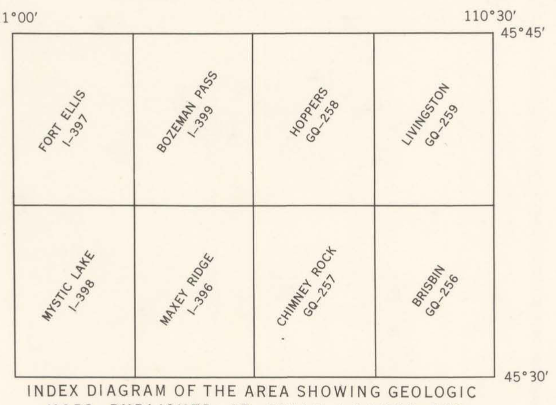
Strike and dip of bedding
Horizontal — Inclined (50) — Overturned (60) — Vertical (90)

Mine or coal prospect
Short bar indicates caved or flooded

Gravel pit
Short bar indicates abandoned

NO 1 STRONG — IPq / 7008
Test well drilled for oil or gas
IPq, Quadrant Quartzite (Pennsylvanian), the oldest formation penetrated; number below the line is the total depth, in feet

MB-5
Shallow drill hole
Coal tests drilled by Maxey Brothers Coal Co.



INDEX DIAGRAM OF THE AREA SHOWING GEOLOGIC MAPS PUBLISHED AT SCALE 1:24,000 FOR MORE DETAILED STUDIES. COPIES OF THESE MAPS MAY BE PURCHASED FROM U.S. GEOLOGICAL SURVEY, WASHINGTON, D. C. 20242.