Geologic Map of the Montana Part of the Dubois 30' x 60' Quadrangle, Southwest Montana

by

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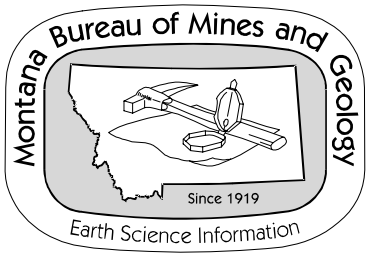


Revised
2/06 Minor changes of units, text and map
2/07 Minor text revisions

This report has been reviewed for conformity with Montana Bureau of Mines and Geology's technical and editorial standards, and has been approved by the U.S. Geological Survey for publication by MBMG.

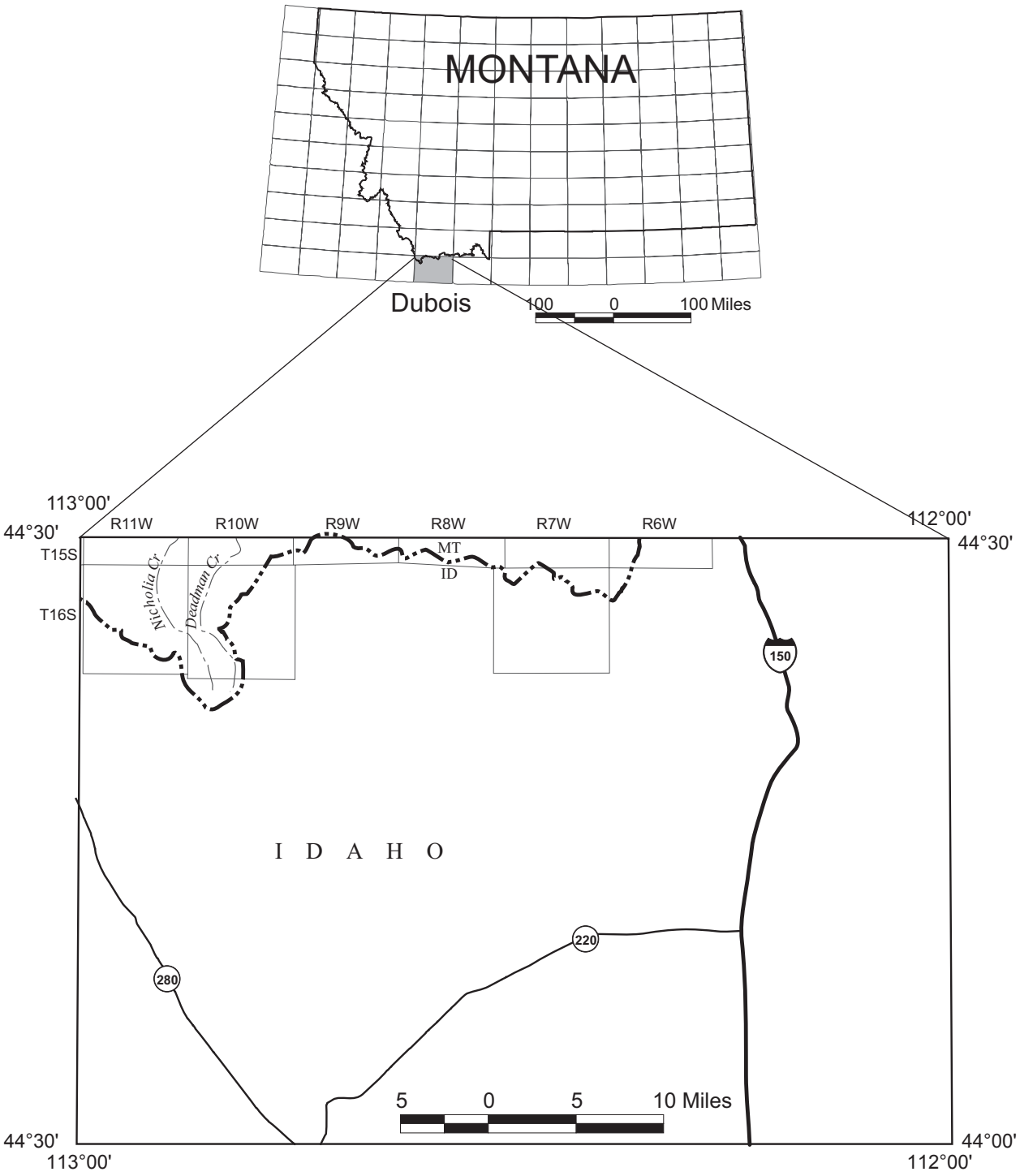
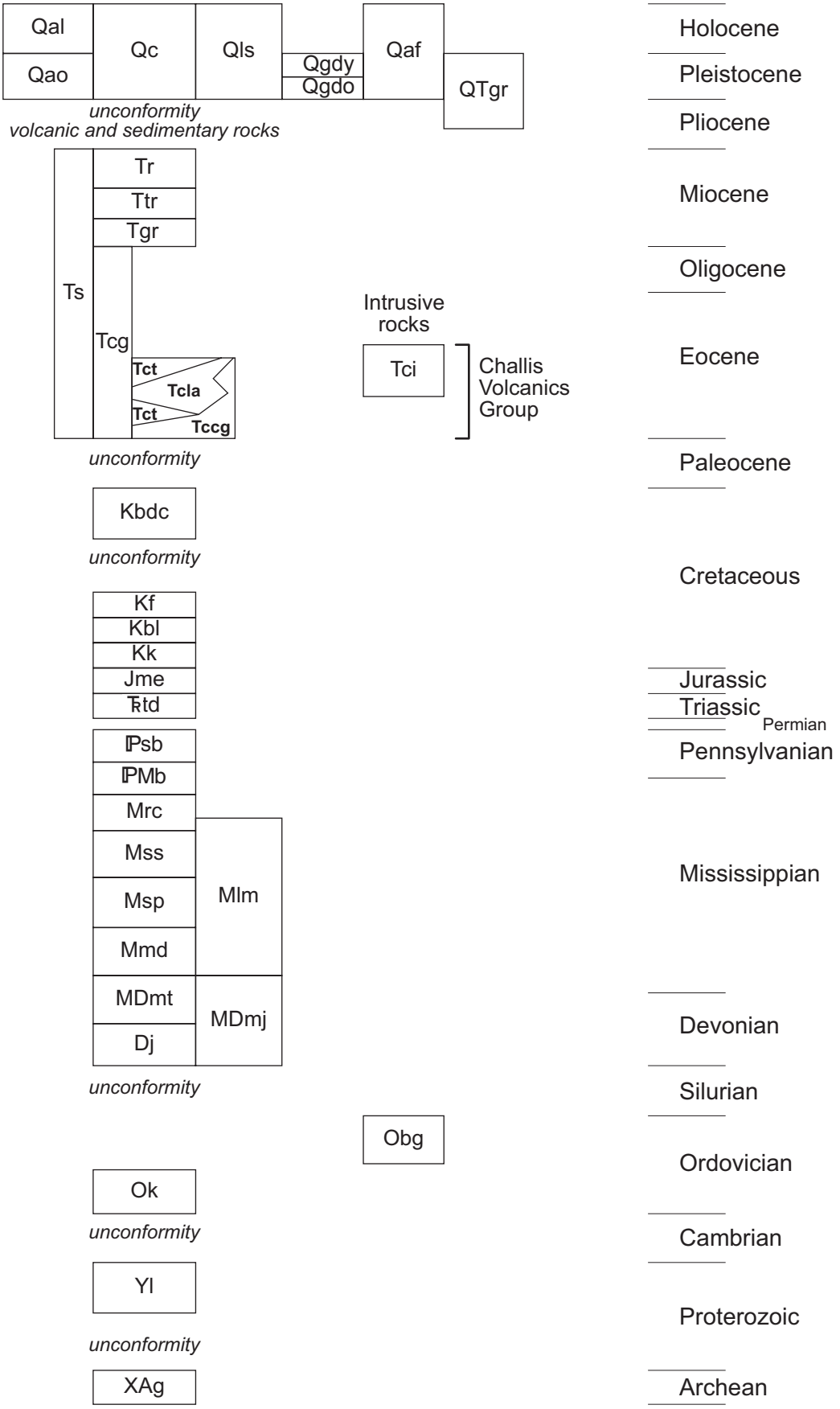


Figure 1. Location of Dubois 30' x 60' quadrangle. The Montana portion is along the northern quadrangle boundary.

Correlation of map units
Dubois 30' x 60' quadrangle, Montana part



DESCRIPTION OF MAP UNITS

Montana part of Dubois 30' x 60' Quadrangle

Quaternary

Qal ALLUVIUM (HOLOCENE)—Unconsolidated, poorly sorted deposit of clay, silt, sand, and gravel deposited by modern streams.

Qc COLLUVIUM (HOLOCENE AND PLEISTOCENE)—Unconsolidated slope wash, talus, and rock falls; locally includes alluvium.

Qls LANDSLIDE DEPOSIT (HOLOCENE AND PLEISTOCENE)—Unconsolidated deposits of locally derived, chiefly angular, poorly sorted debris.

Qaf ALLUVIAL FAN DEPOSIT (HOLOCENE and PLEISTOCENE)—Chiefly fan-shaped deposits of unconsolidated clay, silt, sand, and gravel; locally dissected.

Qao OLDER ALLUVIUM (PLEISTOCENE)—Chiefly unconsolidated, locally dissected deposits of clay, silt, sand, and gravel.

Qgdy GLACIAL DRIFT, YOUNGER, UNDIVIDED (PLEISTOCENE)—Loosely consolidated to unconsolidated drift of unsorted pebble- to boulder-size clasts in a matrix of silt, sand, and clay; probable Pinedale age; mapped in Nicholia and Bear Creek drainages (Scott, 1982).

Qgdo GLACIAL DRIFT, OLDER, UNDIVIDED (PLEISTOCENE)—Unconsolidated, poorly sorted, pebble- to boulder-size clasts; probable Bull Lake age; mapped in south Nicholia Basin.

Quaternary and Tertiary

QTgr GRAVEL (HOLOCENE THROUGH PLIOCENE)—Unconsolidated to poorly consolidated gravels on Continental Divide near Bannack Pass. Younger than, and possibly reworked from, QTg (gravel, sand, and silt of Quaternary and possible late Pliocene age) of Skipp and others (1979)

Tertiary

Tr RHYOLITE (MIOCENE)—Welded ash-flow tuffs of Blacktail Creek Tuff of Heise Volcanic Group (Skipp, 1984; Pierce and Morgan, 1992).

Ttr TRAVERTINE (MIOCENE)—Fresh-water limestone, light gray and white, vuggy, thick-bedded; locally quarried for decorative stone.

Tgr GRAVEL, MUDSTONE, AND TUFF (MIOCENE?)—Unconsolidated to poorly consolidated gravel, gray mudstone, and minor air-fall tuff; locally present beneath travertine.

Ts SEDIMENTARY ROCKS, UNDIVIDED (EOCENE TO MIOCENE?)—Sandstone, mudstone, limestone and conglomerate, locally well bedded in Nicholia and Medicine Lodge Creek basins. Gradational with underlying conglomerate.

Tcg CONGLOMERATE (OLIGOCENE? AND EOCENE)—Chiefly greenish-gray mudflow breccias and water-laid pebble to boulder conglomerates composed of volcanic detritus interbedded with light-gray air-fall tuffs and minor latite flow breccias west of Nicholia Creek. Well-rounded pebble to cobble conglomerate composed of volcanic and subordinate sedimentary clasts east of Nicholia Creek; subordinate sandstone.

Challis Volcanics Group (Eocene)

Tct TUFF OF CHALLIS VOLCANICS GROUP—Yellowish-gray to light-greenish-gray, biotitic rhyolitic air-fall tuff locally present at top of Challis Volcanic Group. K/Ar age of 47 Ma reported on biotite 1 mile south of Bannack Pass (Skipp, 1984). An $^{40}Ar/^{39}Ar$ age of 47.56± 0.27 Ma single-crystal age determined on sanidine from N/2, NW/4 sec. 31, T. 15 S., R.10 W. by S.U. Janecke and W. McIntosh (unpublished data). Includes tuffs beneath lava flows at west edge of quadrangle; correlation of unit to east and west of Nicholia Creek is uncertain. Tuffs northeast of Bannack Pass are distinctive quartz-sanidine-bearing tuffs that have been dated at about 46 Ma to the north (M'Gonigle and Dalrymple, 1996; Janecke and others, 1999).

Tcla LATITE LAVA FLOWS AND TUFFS OF CHALLIS VOLCANIC GROUP— Chiefly gray and dark-greenish-gray latite lava flows and local tuffs, and minor interbedded volcanic conglomerate.

Tccg CONGLOMERATE AND SANDSTONE OF CHALLIS VOLCANIC GROUP— Chiefly greenish-gray volcanic conglomerate containing petrified wood in upper part. Basal beds contain non-volcanic detritus derived from Paleozoic sedimentary and igneous rocks including Ordovician Kinnikinic Quartzite and Beaverhead Mountains pluton, and some Middle Proterozoic sandstone. Locally contains vuggy, slightly cherty limestone beds associated with rare mudstone and sandstone.

Tci INTRUSIVE ROCKS OF CHALLIS VOLCANIC GROUP—Dark-gray to olive-gray, altered latitic intrusive rocks in plugs and sills.

Cretaceous

Kbdc DIVIDE CREEK CONGLOMERATE OF BEAVERHEAD GROUP (UPPER CRETACEOUS)—Interbedded limestone and quartzite conglomerates. Limestone conglomerates composed chiefly of detritus derived from Triassic and Jurassic rocks deposited in an alluvial fan environment. Quartzite conglomerates composed chiefly of detritus derived from north-central Idaho Proterozoic sources deposited in a braided stream environment (Ryder and Scholten, 1973; Dougherty, 1997; Skipp, 1984).

Kf FRONTIER FORMATION (UPPER CRETACEOUS)—Greenish-gray siltstone and mudstone, interbedded with brown-weathering salt-and-pepper sandstone. Upper part contains green porcellanite, fine-grained biotitic sandstone, and local limestone and quartzite conglomerate beds (Dyman and others, 1997; Dyman, Haley, and Perry, 1995).

Kbl BLACKLEAF FORMATION (UPPER AND LOWER CRETACEOUS)— Volcaniclastic mudstone, bentonite, porcellanite, and siltstone (pastel beds) in upper part. Ledge-forming quartz and chert sandstone and minor mudstone in lower part (Dyman and Nichols, 1988; Skipp, 1984).

Kk KOOTENAI FORMATION (LOWER CRETACEOUS)—Mollusk-bearing fresh-water limestone in upper part; sandstone and mudstone, locally red, in middle part; and ledge-forming conglomerate and conglomeratic sandstone at base (Skipp, 1984).

Jurassic

Jme MORRISON FORMATION AND ELLIS GROUP, UNDIVIDED (UPPER AND MIDDLE JURASSIC)—Poorly exposed upper interval of gray and grayish-green, calcareous mudstone and argillaceous limestone containing a ledge-forming oolitic limestone near the base. Lower part is reddish-brown mudstone, siltstone, and sandstone (Skipp, 1984; Skipp and others, 1979).

Triassic

Trtd THAYNES, WOODSIDE, AND DINWOODY FORMATIONS, UNDIVIDED (TRIASSIC)—Light-gray to brownish-gray, interbedded limestone, silty limestone, and calcareous siltstone in upper part; recessive red mudstone in middle part; and chocolate-brown, thin-bedded limestone and silty limestone in lower part (Skipp, 1984).

Pennsylvanian

IPsb BLOOM MEMBER, INFORMAL, OF SNAKY CANYON FORMATION (PENNSYLVANIAN)—Medium-gray limestone, fossiliferous, containing stromatolite mounds, yellowish-brown chert, and thin sandstone interbeds (Skipp, 1984).

Pennsylvanian and Mississippian

IPMb BLUEBIRD MOUNTAIN FORMATION (PENNSYLVANIAN AND MISSISSIPPIAN)—Light- to medium-gray, very fine grained sandstone; forms ledges (Skipp, 1984).

Mississippian

Mrc RAILROAD CANYON FORMATION (UPPER MISSISSIPPIAN)—Medium-gray and grayish-black, phosphatic mudstone, limestone, limestone conglomerate, and medium-gray sandstone (Skipp, 1984).

Mss SURRETT CANYON AND SOUTH CREEK FORMATIONS UNDIVIDED (UPPER AND LOWER MISSISSIPPIAN)— Medium-gray, thin- to thick-bedded limestone, chiefly forms slopes (Skipp, 1984)

Msp SCOTT PEAK FORMATION (UPPER MISSISSIPPIAN)—Medium-gray, thick-bedded, cliff-forming, sandy limestone (Skipp, 1984).

Mmd MIDDLE CANYON FORMATION (UPPER AND LOWER MISSISSIPPIAN)—Medium- to dark-gray, thin- to medium-bedded limestone and black ribbon chert (up to 60%) (Skipp, 1984).

Mlm LOMBARD AND KIBBEY FORMATIONS AND MADISON GROUP UNDIVIDED (UPPER AND LOWER MISISSIPPIAN)—Chiefly medium- to dark-gray, medium-bedded limestone and calcareous mudstone and siltstone in upper part; lower part is medium-gray, medium-bedded, fossiliferous, ledge-forming limestone (Lonn and others, 2000).

Mississippian and Devonian

MDmt McGOWAN CREEK AND THREE FORKS FORMATIONS UNDIVIDED (MISSISSIPPIAN AND DEVONIAN)—Chiefly black, shaly mudstone, slltstone, and interbedded limestone and sandstone (Skipp, 1984).

MDmj McGOWAN CREEK, THREE FORKS, AND JEFFERSON FORMATIONS UNDIVIDED (MISSISSIPPIAN AND DEVONIAN)—Chiefly black, shaly mudstone and siltstone, and interbedded limestone and sandstone, and a medium-gray dolomite (Skipp, 1984)

Devonian

Dj JEFFERSON FORMATION (DEVONIAN)—Light- to dark-gray dolomite, dolomitic limestone, limestone, dolomite breccia, and a basal conglomeratic sandstone (Scholten and others, 1955; Skipp, 1984).

Ordovician

Obg GRANITE OF BEAVERHEAD MOUNTAINS PLUTON (FORMERLY BEAVERHEAD PLUTON OF SCHOLTEN AND RAMSPOTT, 1968) (MIDDLE ORDOVICIAN) - See Skipp (1984).

Ok KINNIKINIC FORMATION (MIDDLE ORDOVICIAN)— Light-gray to yellowish-gray orthoquartzite; forms cliffs and ledges (Scholten and others, 1955).

Proterozoic

Yl LEMHI GROUP ROCKS, UNDIVIDED (MIDDLE PROTEROZOIC)—Chiefly pale red feldspathic sandstone that weathers reddish-brown; minor dark-reddish-brown mudstone and grayish-red conglomerate; metamorphosed to lower greenschist facies (Skip, 1984; Skipp and Link, 1992).

Proterozoic(?) and Archean

XAg GRANITIC GNEISS AND SCHIST (EARLY PROTEROZOIC? AND ARCHEAN).

Map Symbols

Bedding

Inclined

Horizontal

Vertical

Overturned

Approximate dip and strike, from photo interpretation

Contact; dashed where approximately located; dotted where gradational

Faults; dashed where approximately located, dotted where concealed

Unknown sense of movement

Thrust or reverse fault; teeth on upthrown side

Normal fault; bar and ball on downthrown side

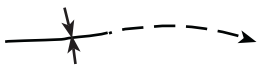
Thrust fault with reactivated normal movement; ball and bar on hanging wall

Detachment fault; dashed where aproximately located, dotted where concealed, hachures on downthrown side

Axial trace of fold, showing plunge; dashed where approximately located

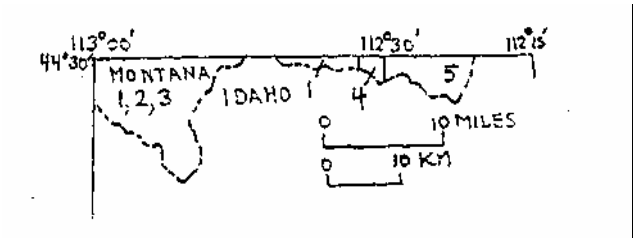
Anticline

Overturned anticline



Syncline

Overturned syncline



1. Skipp (1984) and unpublished field work and photogeology, 1988 and 2000.

2. Janecke and others (2001) and unpublished field work and photogeology by S.U. Janecke, 1999 and 2000.

3. Scholten and Ramspott (1968).

4. Skipp and others (1979), Dougherty (1997), and unpublished field work by S.U. Janecke and Betty Skipp, 2001.

5. Dyman and others (1995), unpublished mapping by J.C. Haley, 1983, and photogeology by S.U. Janecke, 2002.

Figure 3. Index map of geologic mapping in the Dubois 30' x 60' quadrangle (Montana part).

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