Geologic Map of the Devils Fence 7.5' Quadrangle
West-central Montana

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Introduction

The Devils Fence 7.5’ quadrangle, located in the southwest part of the Townsend 30’ x 60’ quadrangle in west-central Montana, lies on the south flank of the Devils Fence anticlinorium within the eastern part of the Montana fold and thrust belt. This very large, north-northeast-trending structure extends for some 25 miles northward from the Boulder River Valley to its surface terminous against the Elkhorn Mountains Volcanics. The volcanics also bound the structure on the east, while the Boulder River Valley forms the southern and southwestern flanks. Westward from the anticline, rocks of the Mississippian section extend into additional fold structures. Proterozoic metasedimentary rocks of the Belt Supergroup form the core of the anticline with a well-exposed Paleozoic and Mesozoic section forming the eroded flanks of the structure.

Devils Fence anticlinorium is a classic structure that has been a focus for numerous geologic investigations, from facies and basin analysis to petroleum exploration. Additionally, the area offers wide opportunity for other kinds of study including volcanic terranes, Tertiary basin-fill deposits, and modern erosional and depositional processes. The present mapping program, conducted by geology faculty and students from the University of Wisconsin/Eau Claire under the U.S. Geological Survey’s EDMAP program, is providing an integrated set of 1:24,000-scale geologic maps of the area (fig. 1).

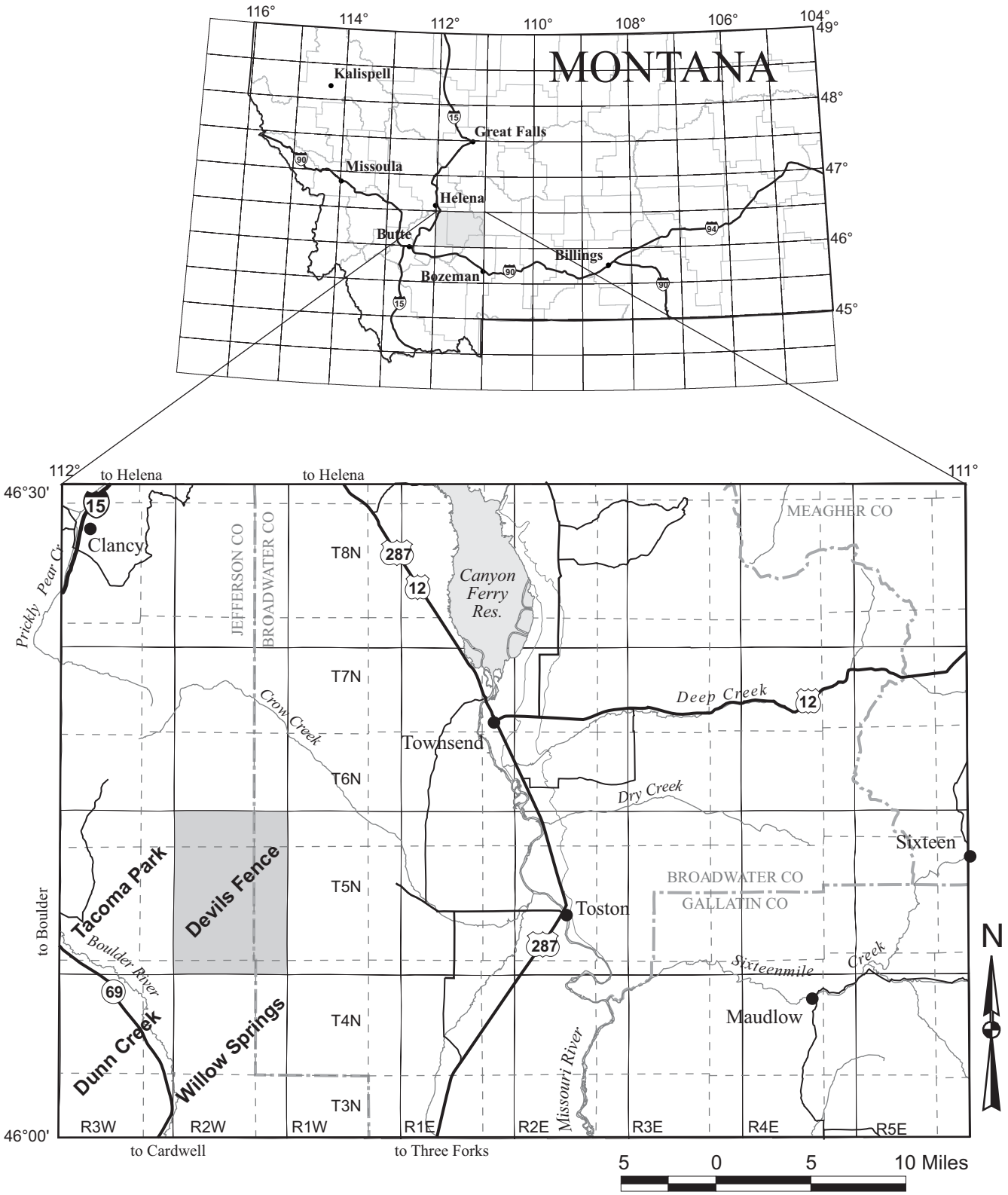


Figure 1. Location of Devils Fence 7.5' quadrangle in southwest corner of the Townsend 30' x 60' quadrangle, west-central Montana. Additional named 7.5' quadrangles indicate where adjacent EDMAP geologic mapping by University of Wisconsin—Eau Claire is complete or in progress.

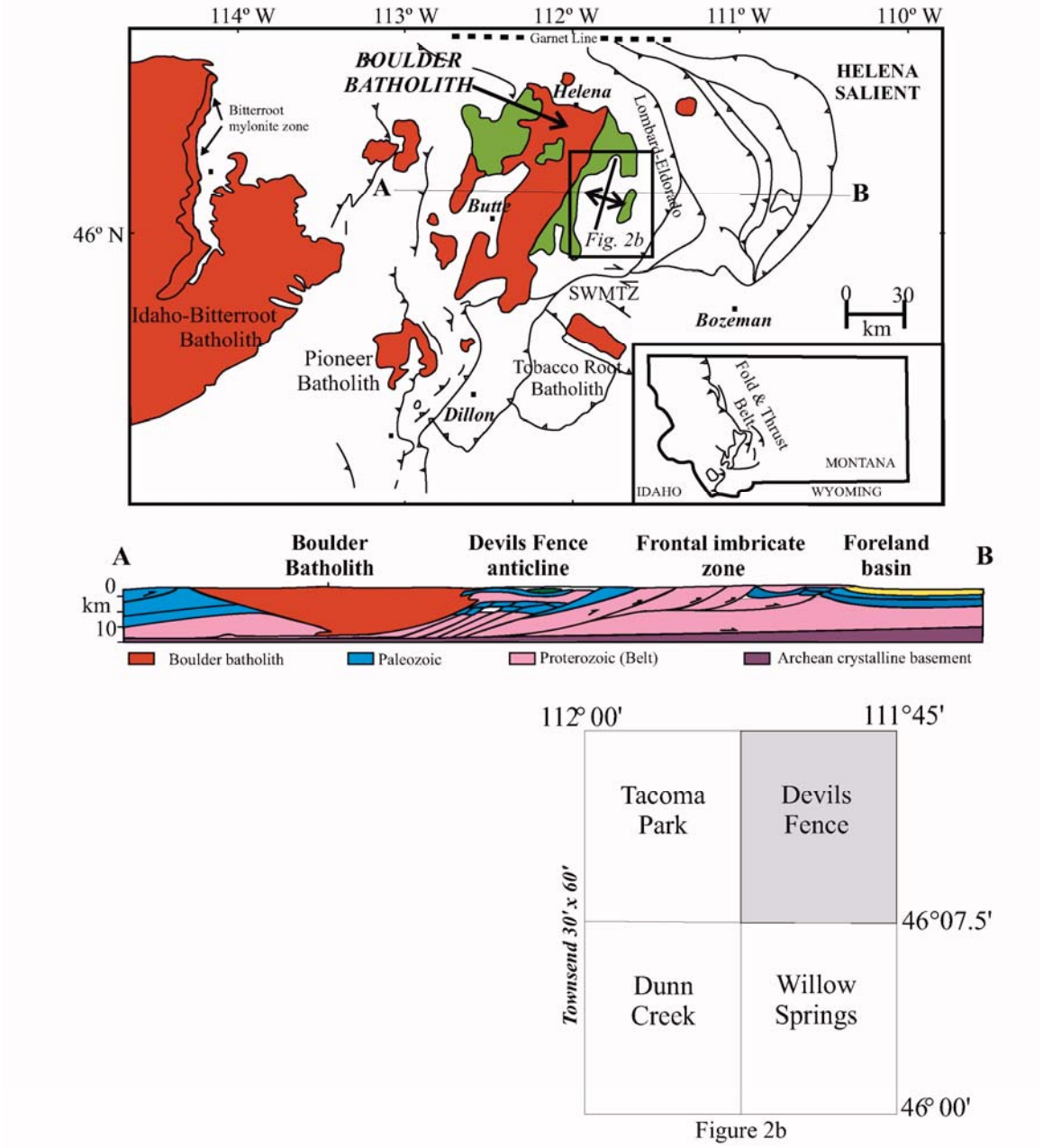
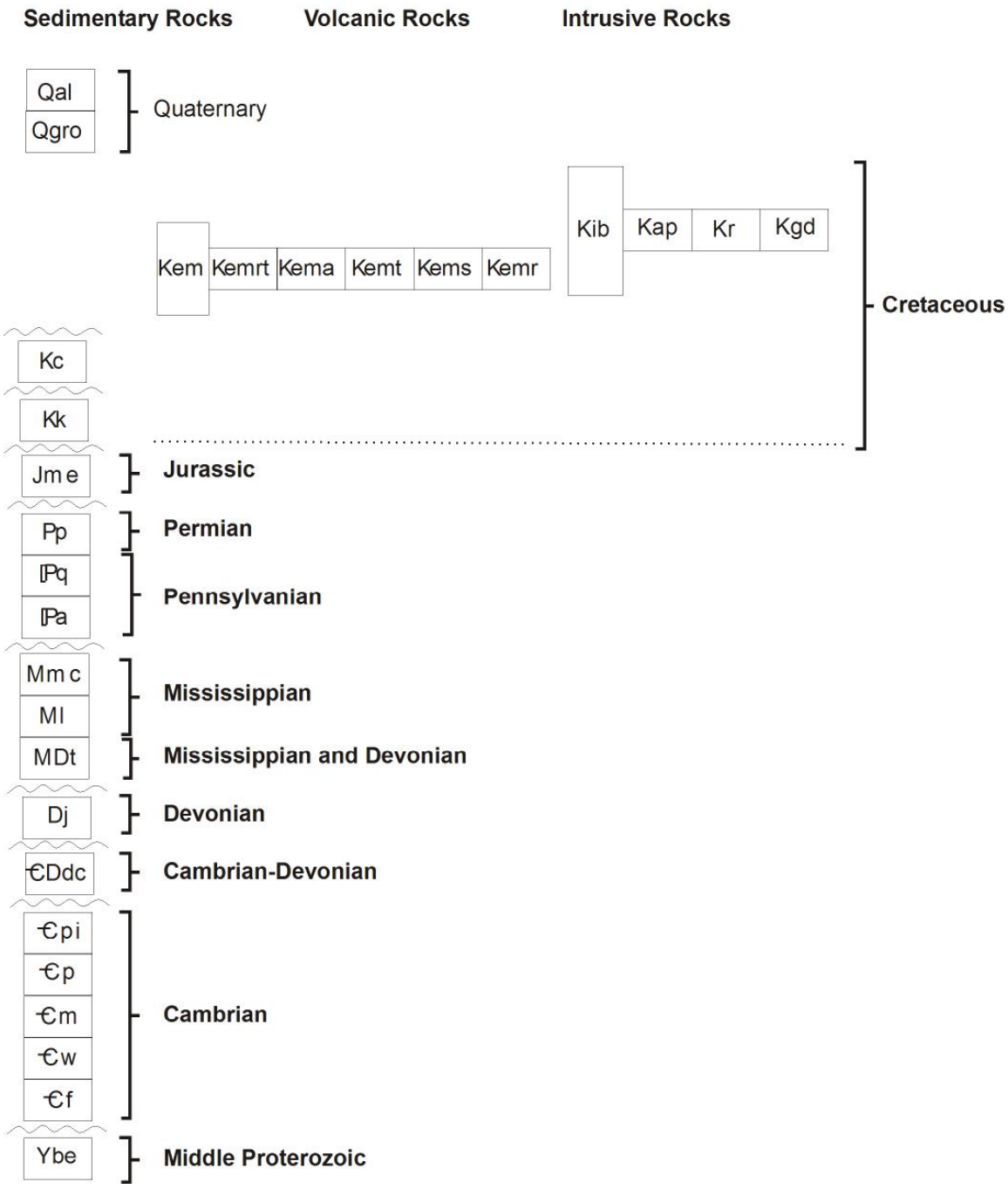


Figure 2b

Figure 2. Schematic map and cross section of pertinent geologic features in the northern Rocky Mountains (modified from Lageson and others, 2001). Note location of study area within Helena Salient of the Montana fold and thrust belt. Figure 2b shows Tacoma Park quadrangle in relation to other quadrangle maps in progress.



Correlation chart of map units in Devils Fence 7.5’ quadrangle.

Description of Map Units
Devils Fence 7.5' Quadrangle

Cenozoic

Qal **Quaternary alluvium (Holocene):** Light-gray to light-brown, moderately to well sorted, crudely stratified boulder, cobble, pebble, sand, silt, and clay. Heterolithic clasts include Paleozoic carbonate and siliciclastic rocks, plutonic and volcanic rocks. Unit restricted to modern stream drainages. Thickness varies; generally <35 ft (~10 m)

Mesozoic

Cretaceous Intrusive Rocks

Kgd **Granodiorite**: Coarse-grained, biotitic (Sagebrush Creek stock)

Kap **Andesite porphyry**: Dark-green to dark-gray, aphanitic to plagioclase-phyric; commonly localized in thin-bedded, fine-grained Proterozoic and Lower Paleozoic sedimentary units

Cretaceous Sedimentary Rocks

Kk **Kootenai Formation**: Light-gray to brown, medium-bedded, moderately sorted, chert-lithic arenite; commonly displays large, low-angle cross stratification. Thickness 150-350 ft (~50-100 m).

Jurassic sedimentary rocks

Jme **Morrison Formation and Ellis Group, undivided:** Recessive succession characterized by a lower portion of thin-bedded, calcite-cemented, lithic arenite, sandy siltstone, siltstone, and shale yielding orange, red, tan, and dark-gray, sandy siltstone regolith and an upper portion of thin- to medium-bedded, orange to red quartz arenite, thin-bedded siltstone, shale, and sandy micrite. Thickness 125-225 ft (~40-70 m).

Paleozoic

Permian sedimentary rocks

Pp **Phosphoria Formation:** Thin unit containing black to dark-gray bedded chert, cherty limestone, siltstone and gray to black, locally oolitic phosphatic shale. Locally contains a lenticular basal conglomerate. Thickness 0-20 ft (~0-5m).

Pennsylvanian sedimentary rocks

lPq **Quadrant Formation:** Cliff-forming unit of buff-yellow and pink, medium-thick bedded, silica-cemented, cross-stratified, quartz arenite. Locally contains chert

nodules and thin calcareous silt laminations. Contains basal unit of dolomitic, cross-stratified quartz arenite to sandy dolomite. Thickness 150-350 ft (~50-100 m).

lPa **Amsden Formation:** Recessive unit of light-gray to tan, thinly laminated, thin-bedded quartz arenite, siltstone, shale, and silty micrite that produces distinctive reddish-brown regolith. Thickness 100-165 ft (~30-50 m)).

Mississippian sedimentary rocks

Madison Group

Mmc **Mission Canyon Formation:** Thick to massively bedded, medium- to dark-gray, fossiliferous (rugose corals, sponges, and bioclastic hash) wackestone, packstone and locally rudstone. Displays characteristic scalloped surface and locally abundant thin, dark-gray chert nodules. Coarsely crystalline in part. Massive character commonly makes determination of bedding orientation difficult. Thickness 575-825 ft (~175-250 m).

Ml **Lodgepole Formation:** Characteristically very well bedded, thin- to medium-bedded micrite to packstone with tan silty interbeds. Displays abundant sedimentary structures including scour marks, graded bedding, parallel laminations, cross lamination, and ripple marks. Forms blocky outcrops. Becomes thicker-bedded and increasingly fossiliferous (crinoids, brachiopods, rugose corals, bioclastic hash) toward gradational contact with overlying strata. Thickness 500-650 ft (~150-200 m).

Mississippian-Devonian sedimentary rocks

MDt **Three Forks Formation**: Recessive unit of gray to green, thin-bedded, calcareous, micaceous shale, siltstone, silty micrite, and lesser fine-grained quartz arenite. Subdivided into three members consisting of a middle resistant, platy, thinly laminated siltstone, a silty micrite and a fine-grained sandstone overlain and underlain by recessive siltstone and shale units. Characterized by reddish-orange to green, platy regolith. Thickness 165-250 ft (~50-75 m).

Dj **Jefferson Formation:** Dark-gray to blue-gray, medium- to thick-bedded, locally massive, intercalated dolomite (duotone) and subordinate limestone. Consists of a resistant basal medium-bedded, dark-gray, fossiliferous (crinoids, brachiopods, corals) sandy dolomitic wackestone with strong fetid odor overlain by a recessive, black, calcareous shale. Upper section is a cliff-forming, slightly fetid, locally fossiliferous, sandy dolomitic wackestone with thin sandstone laminations. Unit is distinctly sucrosic and weathers to a light-gray scalloped surface. Thickness 500-650 ft (~150-200 m).

Cambrian sedimentary rocks

€dc **Dry Creek Formation: O**range, red, brown, and yellow, thin-bedded, thinly laminated siltstone and shale with subordinate very fine grained quartz arenite. Contains abundant parallel laminae, cross laminae, and climbing-ripple laminae.

Weathers recessively and forms valleys and saddles characterized by reddish, platy regolith. Thickness 60-150 ft (20-50 m).

€pi **Pilgrim Formation:** Lower portion characterized by a gray to light gray thin convolute bedded, mottled micrite interbedded with orange weathering fine grained quartz arenite. Grades into a dark gray, medium- to thin-bedded, bioturbated dolo-wackestone overlain by a resistant, fetid, heavily bioturbated dolomitic wackestone. Thickness ~500 ft (~150m).

€p **Park Formation**: Recessive unit of green-gray, thinly laminated, locally calcareous micaceous shale that produces distinct green regolith. Thickness ~150-165 ft. (50 m).

€m **Meagher Formation:** Medium gray, fossiliferous wackestone to micrite containing very thin wavy sandy interbeds that grade into a thinly bedded, light-tan to dark-gray, locally mottled, sandy micrite to packstone. Upper portion is light-gray to gray, thin- to medium-bedded, locally cross-stratified oolitic packstone. Thickness 120-140 ft (~40 m).

€w **Wolsey Formation:** Recessive unit of tan, parallel-laminated, thinly bedded micaceous sandy shale/siltstone to very fine quartz arenite. Characterized by tan, micaceous regolith. Thickness 200-220 ft (~65 m).

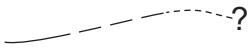
€f **Flathead Formation:** Cliff-forming, light tan to pink, poorly to moderately sorted, medium- to thick-bedded, parallel and cross-stratified, siliciously cemented subfeldspathic arenite to quartz pebble conglomerate that fines upward into thin- to medium-bedded, trough to planar cross-stratified quartz arenite. Thickness 50-100 ft (~15-30m).

Proterozoic sedimentary rocks

Ybe **Middle Proterozoic Belt Supergroup**: Characterized by red, green, and tan, thin bedded siltstone and shale interbedded with tan, fine- to medium-grained, thin to medium bedded, quartz arenite to micaceous sub-feldspathic arenite and green-gray, fine-grained calcareous arenite. Thickness >5,000? ft (>1,500? m).

Symbols Used on Map and Cross Section
Devils Fence 7.5' Quadrangle

Map Symbols



Contact: solid where known; dashed where approximate; dotted where assumed; queried where uncertain.

Normal fault: solid where known; dashed where approximate; dotted where assumed; queried where uncertain; ball and bar on downthrown side.

Thrust fault: solid where known; dashed where approximate; dotted where assumed; queried where uncertain; teeth on up thrown side.

Strike-slip fault: solid where known; dashed where approximate; dotted where assumed; queried where uncertain.

Anticline: solid where known; dashed where approximate.

Syncline: solid where known; dashed where approximate.

Strike and dip of bedding

Breccia zone

Cross Section Symbols

Fault: showing relative vertical displacement

Strike-slip fault movement indicators showing movement into and out of fault plane of cross section (tail and tip of arrow, respectively)

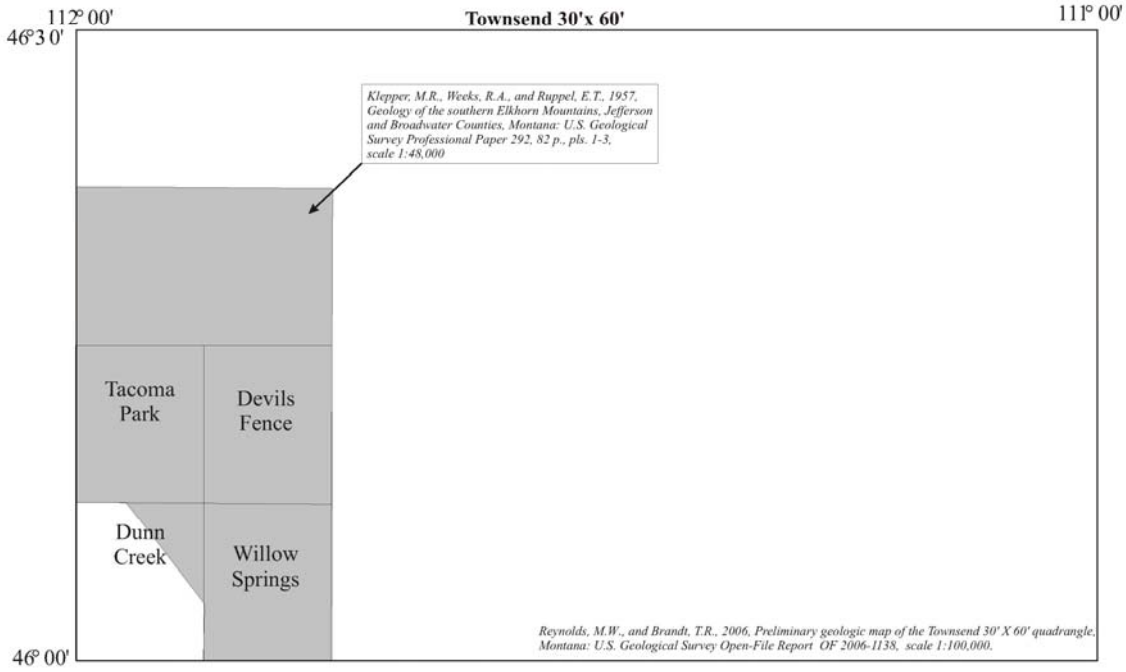


Figure 3. Geologic source maps used in this report. Shaded area is Klepper and others, 1957. Tacoma Park, Dunn Creek, and Willow Springs 7.5' quadrangles maps are in progress by University of Wisconsin, Eau Claire.

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Map Symbols

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32 **Strike and dip of bedding**

Breccia zone

Cross Section Symbols

Fault: showing relative vertical displacement

Strike-slip fault movement indicators showing movement into and out of fault plane of cross section (tail and tip of arrow, respectively)

For a more detailed description of the map units and symbols, please refer to the text accompanying this map.

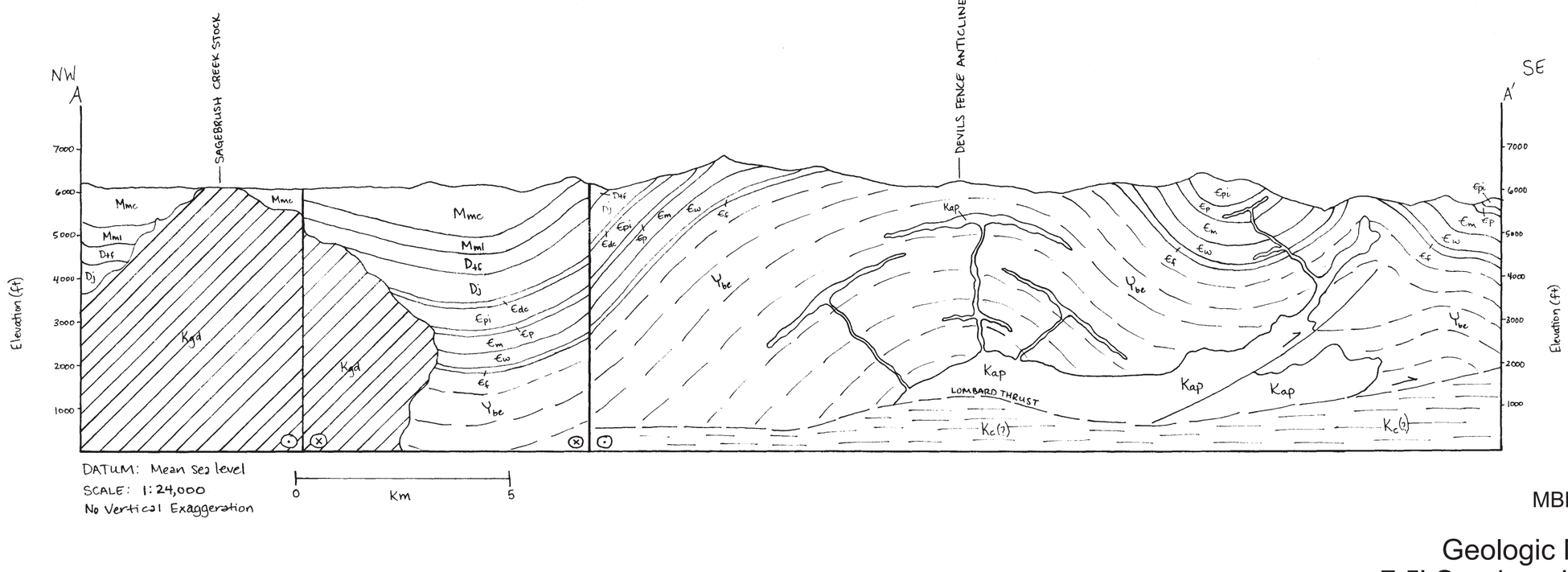
PRODUCED BY THE UNITED STATES GEOLOGICAL SURVEY
CONTROL BY . . . . . USGS, NOS/NOAA, BONNEVILLE POWER ADMIN.
COMPILED FROM AERIAL PHOTOGRAPHS TAKEN 1980
FIELD CHECKED . . . . . 1982 MAP EDITED 1986
PROJECTION . . . . . LAMBERT CONFORMAL CONIC
GRID: 1000-METER UNIVERSAL TRANSVERSE MERCATOR . . . . . ZONE 12
10,000-FOOT STATE GRID TICKS . . . . . MONTANA, SOUTH ZONE
UTM GRID DECLINATION . . . . . 0°35′ WEST
1986 MAGNETIC NORTH DECLINATION . . . . . 16°30′ EAST
VERTICAL DATUM . . . . . NATIONAL GEODETIC VERTICAL DATUM OF 1929
HORIZONTAL DATUM . . . . . 1927 NORTH AMERICAN DATUM

NORTH

SCALE 1:24 000
MILES 1 0 1
FEET 1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10 000
KILOMETERS 1 5 0 1 2
METERS 1000 0 1000 2000
CONTOUR INTERVAL 40 FEET

MONTANA
QUADRANGLE LOCATION

DEVILS FENCE, MONTANA



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