Geologic and Structure Contour Map of the Fort Peck Lake East 30' x 60' Quadrangle Eastern Montana

By

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GEOLOGIC SUMMARY

The Fort Peck Lake East quadrangle is located in east-central Montana (Figure 1) in an area of rolling plains and dissected benches. It includes parts of Valley, McCone, and Garfield Counties. The area is generally gently rolling and sparsely vegetated where underlain by the Bearpaw Shale, but timbered in upland areas on the divides where the more resistant Tongue River and Tullock Members of the Fort Union Formation crop out. The predominant feature of the region is Fort Peck Reservoir that lies in the valley of the Missouri River across the central part of the quadrangle. Gravel-covered benches obscure the bedrock in some areas, and formation contacts along both shores of the reservoir are obscured by slope wash and landslides.

Structure

Structure contours on the top of the Judith River Formation indicate a very gentle regional dip to the southeast with a gradient of about four meters per kilometer (0.2 degrees), becoming slightly steeper at the southeast corner of the map area. At the surface, incipient mass wasting has locally produced low-angle dips toward the reservoir as the shorelines of the reservoir are approached. Small-scale anticlinal and synclinal folds also cause local modifications of the regional dip. A few small-scale, variably oriented faults offset beds from 20 to 100 feet in the southeastern part of the quadrangle south of the reservoir. Several northeast-trending faults that cross the southeastern corner of the map area may be associated with the Weldon fault located southeast of the map area.

Stratigraphy

The stratigraphic section (Figure 2) is dominated by Upper Cretaceous sedimentary rocks, but the Tertiary Fort Union Formation crops out at the tops of divides along the eastern and southern edges of the quadrangle. Along the shores of Fort Peck Reservoir, extensive landslide complexes have formed due to saturation of the incompetent shales of the Bearpaw Formation. The shales currently lie either under water or slightly above the water level of the reservoir. Where the saturated shales have given way, the overlying beds have moved down slope in either rotational or translation slides.

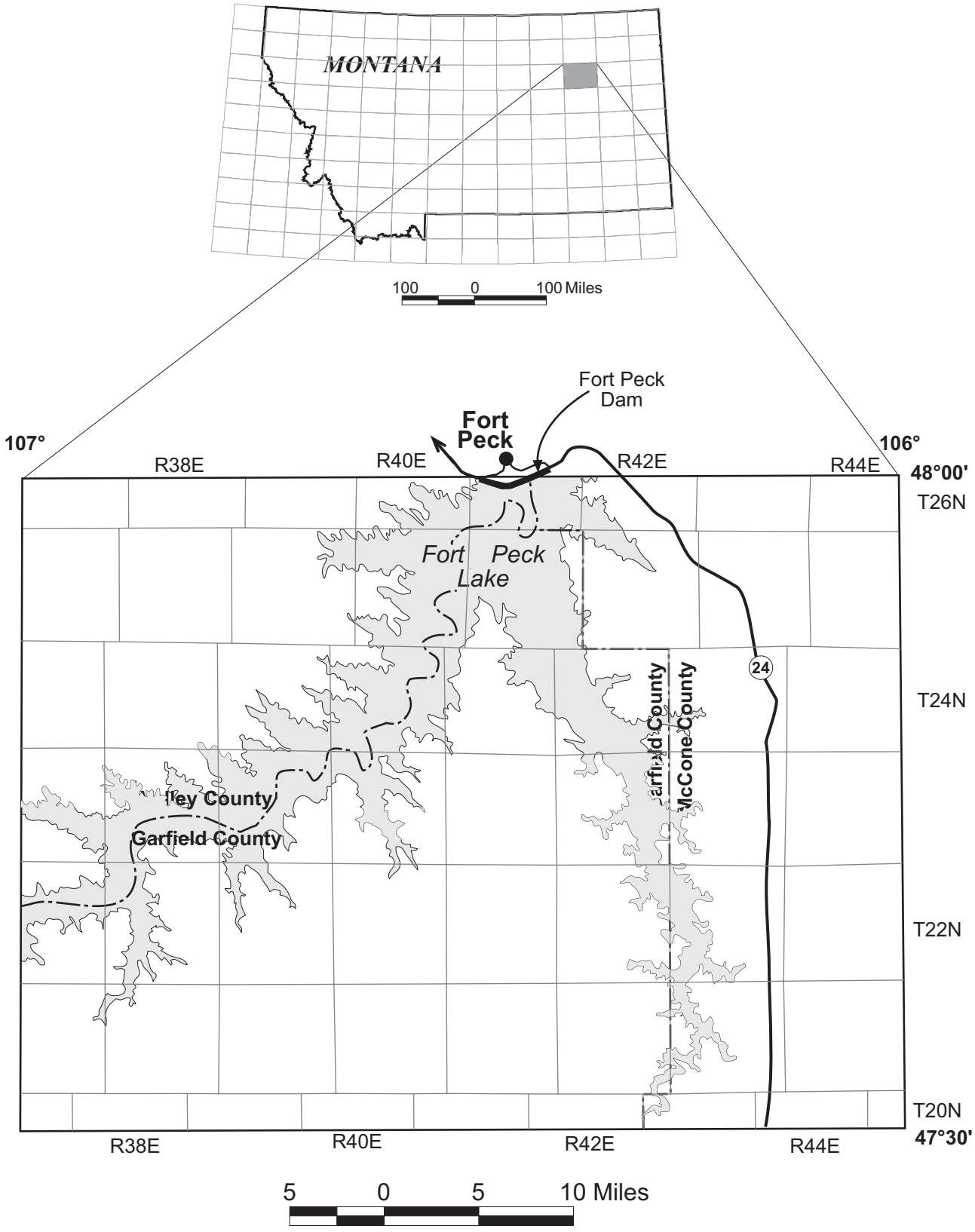
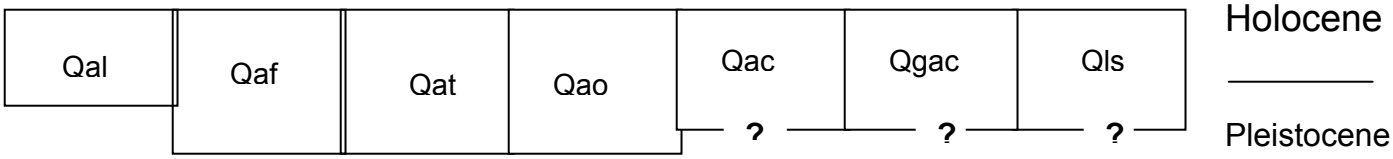


Figure 1. Location of Fort Peck Lake East 30'x60' quadrangle, Eastern Montana.

Correlation Chart of Map Units
Fort Peck Lake East 30' x 60' Quadrangle

Quaternary



Quaternary and Tertiary

QTgr

Tertiary

Unconformity

Tftr

Tfle

Tft

Upper Cretaceous

Khc

Kfh

Kb

Kir

Not exposed at surface; top = structure contour datum

Figure 2. Correlation chart of map units.

DESCRIPTION OF MAP UNITS

Quaternary

Qal **Alluvium (Holocene)—**Light-brown, reddish-brown, yellowish-brown, grayish-brown, brown, olive-gray, and light-gray gravel, sand, silt, and clay deposited in modern stream and river channels and on flood plains. Clasts are well sorted to poorly sorted. Deposits are poorly to well stratified. Thickness varies from a few inches to more than 30 feet.

Qaf **Alluvial fan deposit (Holocene)—**Tan to gray and grayish-brown gravel, sand, silt and clay deposits located at the mouths of streams. A fan-shaped deposit is characteristic, and deposits may be moderately well stratified. Thickness may vary from a few inches at the leading edge of the fan to several tens of feet near the mouth of the stream.

Qat **Alluvial terrace deposit (Holocene and Pleistocene)—**Light-brown, grayish-brown, and light-gray, gravel, sand, and silt in terrace remnants at more than one elevation along all streams emptying into Fort Peck Reservoir. Clasts are generally well sorted, and most are well rounded indicating reworking of older glacial and terrace deposits. Clasts are brown, reddish, or yellowish quartzite. Bedding is not usually evident. Thickness of deposits ranges from 6 to 25 ft.

Qao **Alluvium, older (Holocene and Pleistocene)—**Light-colored gray and yellowish-gray, unsorted sand, silt, and clay accumulated by slope wash from higher elevations and by glacial-outwash stream flow associated with the continental ice sheet lying just to the north. Often occurs as extensive deposits along most major stream channels throughout the area. Thickness varies from 3 to 20 ft.

Qac **Alluvial-colluvial deposit (Quaternary)—**Brown, yellowish-brown, grayish-brown and light- to dark-gray sand, silt, and clay deposits derived from slope wash and fluvial deposition. Commonly located in older abandoned fluvial or glacial-outwash channels that may be located at the heads of, or between and connecting to older streams; deposits also occur in broad, generally flat-lying, linear deposits along presently underfit stream channels. Thicknesses vary from a few inches to10 feet.

Qgac **Gravelly sheet-wash alluvium and colluvium (Quaternary**)—Gray, brown, brownish-gray or yellowish-gray, fine to coarse gravel, fine to coarse sand, and silt. Unit located on upland benches in patchy deposits covering bedrock units. Thicknesses vary from 4 to 20 feet.

Qls **Landslide deposits (Quaternary)—**Areas of mass movement of bedrock and surficial deposits. Mechanism of movements include slide and flow. Materials involved usually are incompetent basal shales that have given way due to water saturation allowing all overlying units to move downslope.

Quaternary and Tertiary(?)

QTgr **Gravels—**Gravels of uncertain origin and uncertain age, located in small remnant patches predominantly on east side of reservoir and along ridge top in south-central map area. Clasts are of various silicate rocks; carbonate clasts are absent.

Tertiary

Fort Union Formation (Paleocene)

Tftr **Tongue River Member—**Light-yellowish- to orangish-brown or tan, fine- to medium-grained sandstone and thinner interbeds of light-yellowish- to orangish-brown or tan siltstone and light-tan or gray mudstone and claystone. Claystone is dominantly non-swelling. Contains thick to thin, poorly cemented fluvial sandstone and medium- to moderately large-scale, trough-cross-bedded channel sandstones that locally weather into cavernous cliffs. Unit generally poorly cemented and weathers to badlands topography. Plant and vertebrate fossils occur in some beds. Contains several relatively thin but highly visible coal beds that have locally burned to form clinkered outcrops. Thicknesses exposed in the area are as much as 320 feet.

Tfle **Lebo Member—**Medium- to dark-gray, grayish-brown, and olive-gray sandstone, siltstone, and mudstone that is commonly smectitic and/or carbonaceous, interbedded with gray to dark-gray silty shale, thin yellowish-gray siltstone and sandstone, and very thin lenticular coal beds. Contains small-scale, light-gray, fine- to medium-grained cross-bedded channel sandstones. Smectitic mudstones often exhibit characteristic "popcorn" weathering. Typically forms gently rolling slopes except close to river cuts. Thickness varies from 190 to 300 ft.

Tft **Tullock Member—**Yellowish-gray, fine- to medium-grained, trough-cross-bedded to planar-bedded or massive appearing sandstone. Interbedded with brownish-gray or purplish-gray claystones, dark-gray carbonaceous shale, and thin lenticular coal beds. Sandstone beds are thinner, more tabular and more persistent than those in the underlying Hell Creek Formation. Channel sequences are larger-scale than those found in the Lebo Member, but generally smaller-scale than those of the Tongue River Member. Thickness ranges from approximately 240 to 280 ft.

Upper Cretaceous

Khc **Hell Creek Formation (Upper Cretaceous, Maastrichtian)—**Dominantly gray and grayish-brown sandstone; smectitic, silty shale and mudstone; and a few thin lenticular coal beds or carbonaceous shale. Sandstones are fine- or medium-grained, and calcium carbonate-cemented concretions are typical in the fine-grained sandstones. Generally poorly cemented overall, and may weather to badlands topography. Swelling smectitic clays may locally produce "popcorn" weathering. Numerous bone fragments and plant fossils are present in the formation throughout the area. Contact with the underlying Fox

Hills Formation may be either gradational or erosional, locally. Thickness ranges from 320 to 450 ft.

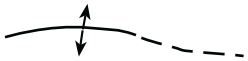
Kfh **Fox Hills Formation—**Thin layers of interbedded tan sand, silt, and clay overlain by well-sorted, very fine- to medium-grained, upward-coarsening, cross-bedded, poorly consolidated sandstone. This upward-coarsening sequence is more clay-rich toward the base. An interbedded transitional sequence is present at the base of the formation throughout most of the area. It consists of thin beds of very fine-grained, tan sand, light-gray to brownish-gray silt, and gray to dark-gray or medium- to dark-brown clay that grades downward into the sandy shales of the upper Bearpaw Formation. Locally, a cross-bedded, fine- to medium-grained, upward-fining channel sandstone that weathers white to light-gray is present at the top of the formation. Thickness ranges from 40 to 180 ft.

Kb **Bearpaw Formation—**Dark-brownish-gray to black, bentonitic mudstone and shale. Locally contains thin stringers of jarosite, and fossiliferous limestone concretions that contain marine ammonites and pelecypods. Lower part of formation not exposed. Exposed thickness is less than 200 ft.

Map Symbols

Contact: dotted where concealed

Fault: dotted where concealed; sense of movement indicated where known; ball and bar on down-thrown side



Anticline: showing trace of axial plane and plunge direction where known; dashed where approximately located

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