GEOLOGIC MAP OF THE

LONESOME LAKE 30' x 60' QUADRANGLE

NORTH-CENTRAL MONTANA

by

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INTRODUCTION AND DISCUSSION

The Lonesome Lake 30' X 60' Quadrangle lies within the area that was covered by Pleistocene continental glaciers. Thus, glacial deposits cover much of the bedrock in the area. Glacial deposits are depicted by a stippled pattern, and buried bedrock units are identified by letter symbols in parentheses (see Map Symbols, p.8). The bedrock geology depicted here is based on limited exposure and on oil and gas drill-hole data. Because of the lack of sufficient data, buried contacts beneath glacial deposits are approximate and appear rather stylized.

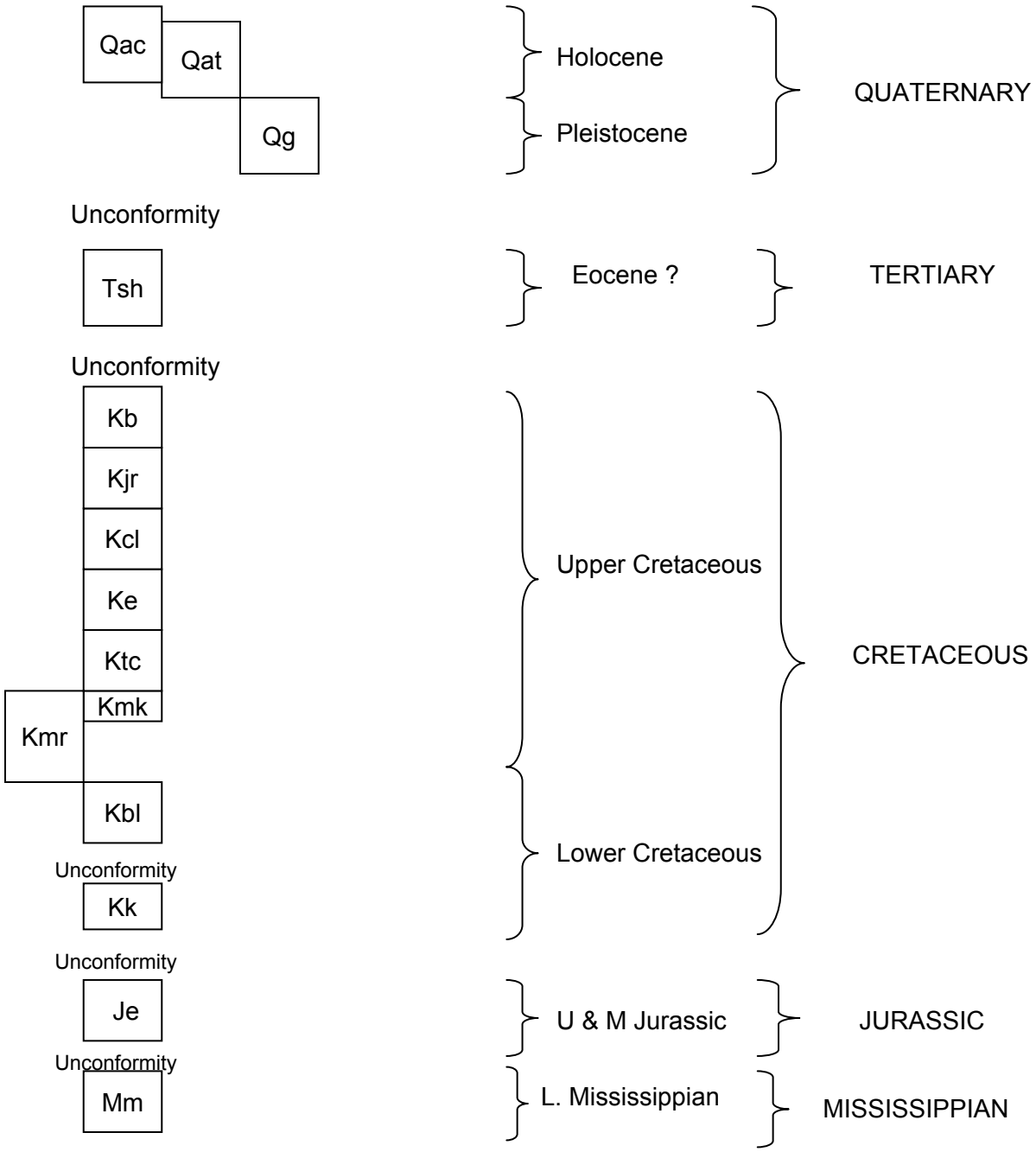
The northeast-trending Great Falls Tectonic Zone is a broad zone that passes beneath most of the area of this quadrangle (Lopez, 1995; O'Neill and Lopez, 1985). Its effect on bedrock geology in this area could not be determined because of the limited amount of bedrock exposure and detailed subsurface mapping is beyond the scope of this report. In the areas covered by glacial deposits, the bedrock structure must be much more complicated than shown on this map, as is the case in the nearby Sweet Grass Hills (Lopez, 1995). Limited available gravity and aeromagnetic data, as well as unpublished proprietary data, show the structure in the area is dominated by a northeast-striking basement faults that are part of the Great Falls Tectonic Zone and that are known to affect the Paleozoic and Mesozoic rocks in the area (Lopez, 1995; O'Neill and Lopez, 1985).

Significantly, thrust sheets that have been gravitationally emplaced off of the Bearspaw uplift (Reeves, 1924a, 1924b, 1946) appear in a few places on

this quadrangle. There undoubtedly are many more of these structural features buried beneath glacial deposits. These thrust sheets appear to sole in, and glide on, two horizons about in the middle of the Marias River section (Baker and Johnson, 2000) The thrusts therefore, effect rocks younger than the Marias River Formation. Structure below the thrust sheets is unrelated to, and does not reflect, the thrusted geometry. These thrust features are important structural traps for natural gas in the region surrounding the Bearspaw uplift.

This map is based on, and supersedes an earlier compilation of the geology of the Lonesome Lake Quadrangle, published as Open-File Report MBMG-314 (Lopez and Sholes, 1994)

CORRELATION OF UNITS
LONESOME LAKE 30'X 60' QUADRANGLE



DESCRIPTION OF UNITS
LONESOME LAKE 30'X 60' QUADRANGLE

Qac **Alluvium and colluvium, undivided (Holocene) –** Alluvial deposits in active streams and rivers, consisting mainly of locally derived sand and gravel and reworked material from glacial till. Coarser material, as large as boulder size, can be present close to mountainous areas. Locally includes colluvium, glacial outwash, and glacial lake deposits.

Qat **Alluvial terrace deposits, undivided (Holocene ?) –** Alluvium composed mainly of gravel and sand underlying terraces at varying levels above present-day river elevations. Gravel is rounded, ranges from cobble to pebble size, and is 10 to 20 ft thick.

Qg **Glacial deposits, undivided (Pleistocene) –** Unsorted deposits of clay- to boulder-size material. Clast composition is anomalous relative to local bedrock; predominant lithologies are pink granite, quartz-biotite schist, granite gneiss, and quartzite. Locally, cobbles and boulders of ultramafic rocks have been observed. Areas underlain by these deposits display characteristic hummocky topography. Roger Colton (written communication, 1994), on unpublished mapping of quaternary deposits, divides these deposits in greater detail, but is not included here because of the bedrock emphasis of this map.

Tsh **Shonkinite (Eocene)** – Dark-gray, porphyritic, composed of hornblende, olivine, pyroxene, biotite, and orthoclase. Resistant dikes and sills. Dikes average 4 ft wide; sills 4-20 ft thick (Lindvall, 1956b).

Kb **Bearpaw Shale (Upper Cretaceous)**—Dark-gray shale; upper 100 ft contain brownish sandy beds. Thin bentonite beds throughout formation. Numerous gray and dark-reddish gray calcareous concretions. About 700 ft thick (Lindvall, 1956b).

Kjr **Judith River Formation (Upper Cretaceous)** – Interbedded deposits of fluvial sandstone, shale, mudstone, siltstone, and coal. Forms rounded light-colored outcrops. Sandstones are lenticular, trough cross-bedded, fine to coarse grained, light gray to yellow-brown, and nearly white to brown weathering. Mudstones are commonly carbonaceous. Fossil plant debris is common. A complete section is not exposed in the area, but the total thickness is reported to be about 750 ft (Erdmann, 1942).

Kcl **Claggett Shale (Upper Cretaceous)** – Brownish gray, silty and sandy shale with thin interbeds of argillaceous and calcareous sandstone. Brown septarian concretions and *Inoceramus* prisms are common. The lower part contains beds of bentonite. The Claggett is typically very poorly exposed. Cobban (1955) reported a thickness of 420 ft at Goosebill Butte, 30 miles south of Chester.

Ke **Eagle Sandstone (Upper Cretaceous)** – Upper part is generally poorly exposed and is characterized by thin sandstone beds interbedded with brown and olive mudstones and less abundant bentonite, bentonitic mudstone, carbonaceous shale, and coal. Fossilized plant debris is common in this part of the section. The lower part is light-brown- to buff-weathering, thick-bedded to massive sandstone that forms rounded rims and bluffs. Sandstones are fine grained, light gray to light brownish gray,

limonite speckled, and well indurated to friable. Ripples, low-angle cross-bedding, and burrowing are common. This lower part of the section is commonly referred to as the Virgelle Member. The Eagle Sandstone is about 350 ft in total thickness in the area.

Ktc **Telegraph Creek Formation (Upper Cretaceous)** – Interbedded medium-brownish gray, sandy shale and brown, fine-grained, thin-bedded, argillaceous sandstone. Proportion of sandstone relative to shale increases upward. Total thickness is about 150 ft.

Kmr **Marias River Formation, undivided (Upper Cretacous) –** used only on cross section.

Kmk **Kevin Member, Marias River Formation (Upper Cretaceous)** – Medium-dark-gray to brownish gray, calcareous, fissile shale. In the subsurface the informal name, First White Specks, is commonly applied because of the characteristic white specks (calcite) visible on shale partings. Thin, light-gray bentonite beds, gray limestone septarian concretions, and *Inoceramus* prisms are common in this member. At the type section on the Kevin-Sunburst Dome, it is 620 ft thick (Cobban and others, 1976).

Kmf **Ferdig Member, Marias River Formation (Upper Cretaceous)** – Dark-gray fissile shale, with scattered laminae and very thin beds of sandstone and siltstone in the lower part. Reddish brown, gray, and brownish gray septarian concretions usually less than 1 ft in diameter are common. At the type section on the Kevin-Sunburst Dome the Ferdig is 224 ft thick (Cobban and others, 1976).

Kbl **Blackleaf Formation (Lower and Upper Cretaceous) –** used only on cross section.

Kk **Kootenai Formation (Lower Cretacous) –** used only on cross Section.

Je **Ellis Group (Upper and Middle Jurassic) –** used only on cross section.

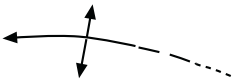
Mm **Madison Group (Upper Mississippian) –** used only on cross section.

Map Symbols

Contact; dotted where concealed.

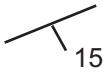
Fault; dotted where concealed; bar and ball on down-thrown side.

Thrust fault; queried where uncertain, dotted where condealed: teeth on upper plate



Anticline; dotted where concealed, arrow denotes direction of plunge.

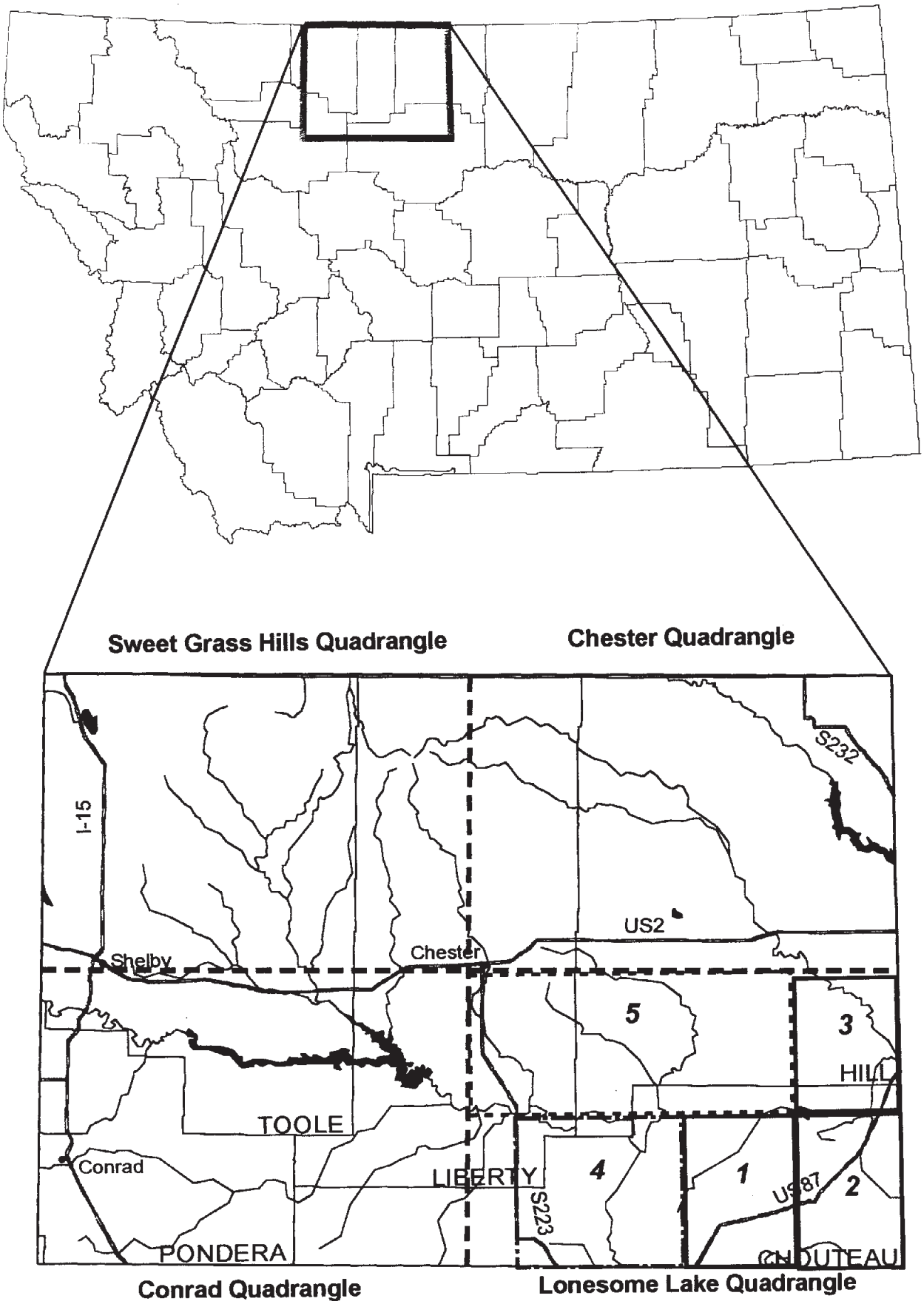
Dikes and sills (red on map)



Strike an dip of bedding

(Kjr)

Unit symbol in parentheses denotes that the unit is concealed by glacial deposits



Index map and sources of geologic mapping for the Lonesome Lane 30’ x 60’ quadrangle.

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(Bold map numbers at end of citations correspond to numbered areas on index map)

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