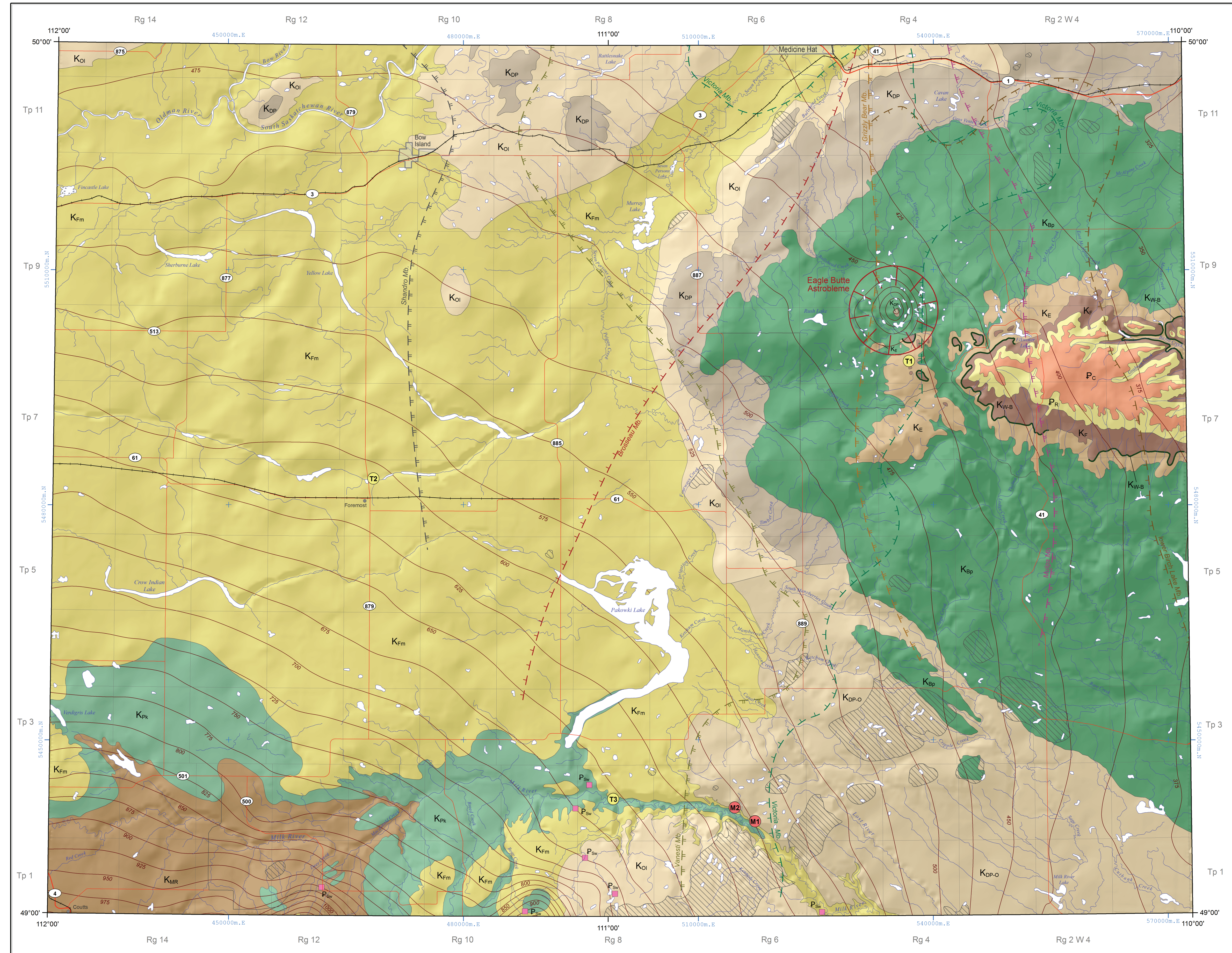
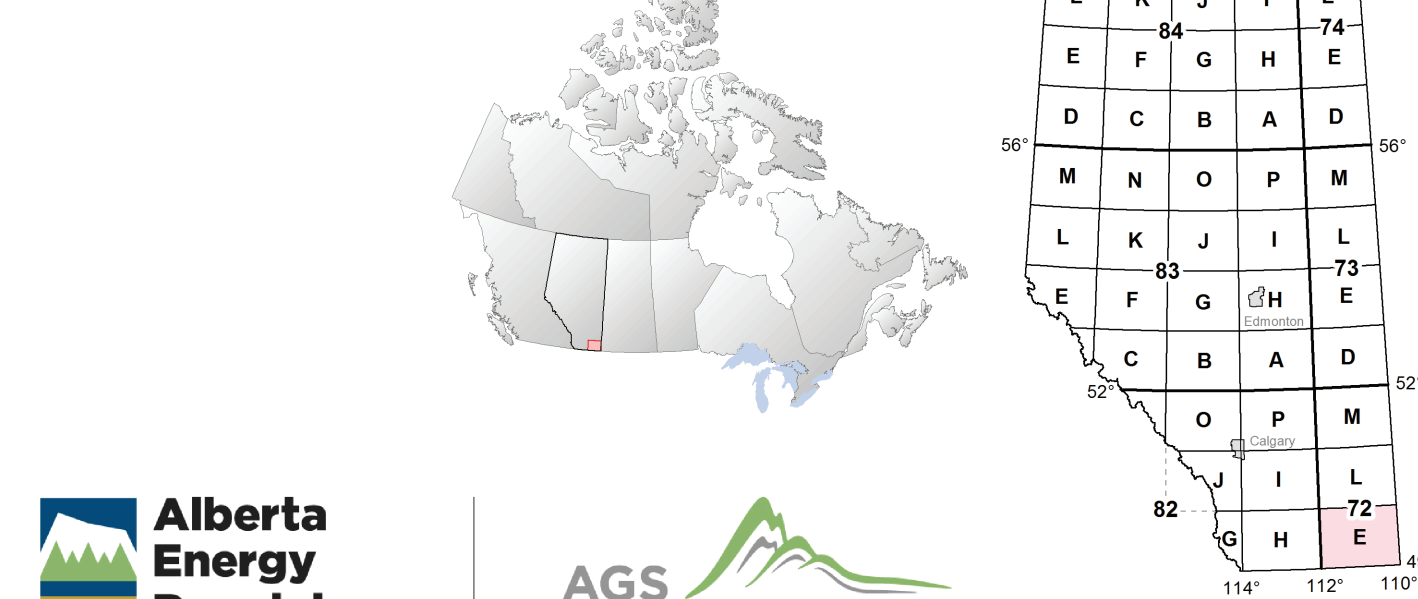


NTS 72E
BEDROCK GEOLOGY



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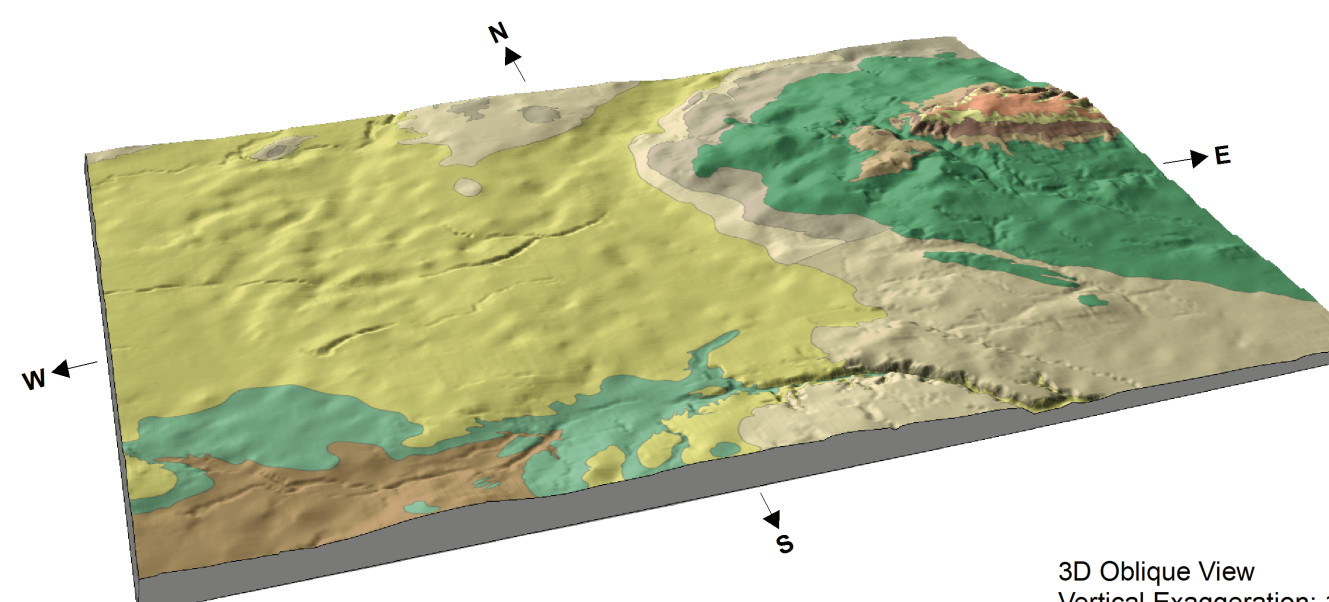
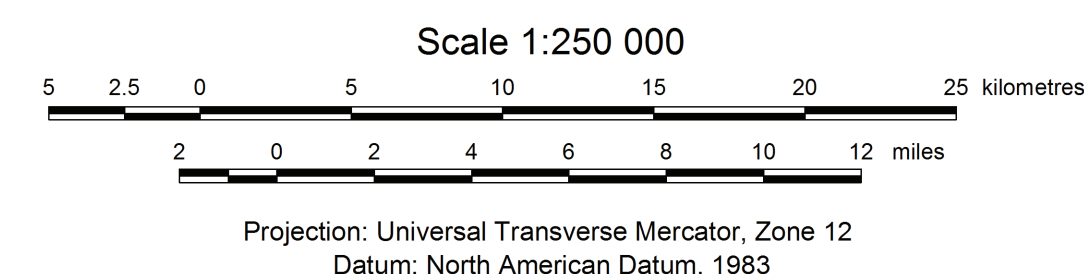
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Map 568

Bedrock Geology of the Foremost Area (NTS 72E)

Geology by: P.M. Glombick



3D Oblique View
Vertical Exaggeration: 10x

SYMBOL LEGEND

- Type section
- Measured section
- Eagle Butte astrobleme (scaled)
- Area of glacial thrusting that may involve bedrock (from Shetsen, 1990, 2007)
- Top of First White Specks Member (Niobrara Formation) structure contour in metres above sea level

Subsurface extents of stratigraphic units in plan view (listed in ascending stratigraphic order from left; ticks show direction of thickening)

- Sandstone units: Brosseau Mb., Victoria Mb., lower Birch Lake Mb.
- Shale units: Shandro Mb., Vanesti Mb., Grizzly Bear Mb., Mulga Mb.

PALEOGENE

OLIGOCENE

P_c Cypress Hills Formation: gravel and sand, locally cemented to conglomerate; mainly quartzite and sandstone clasts with minor chert and quartz component (fluvial).

LOWER TO MIDDLE PALEOGENE

P_r Ravensrag Formation: grey to buff mudstone and siltstone with minor fine-grained sandstone; minor thin coal layers (nonmarine).

UPPER CRETACEOUS

UPPER MAASTRICHTIAN

K_f Frenchman Formation: olive-grey to yellow-grey mudstone and siltstone with minor fine-grained sandstone (nonmarine).

LOWER TO UPPER MAASTRICHTIAN

K_{wb} Battle and Whitemud formations (undifferentiated): pale grey to white-weathering, kaolinitic sandstone, silty mudstone, and mudstone with minor coal and carbonaceous shale (Whitemud Formation); dark grey to purplish-black, silty mudstone with thin, pale grey, siliceous beds in upper part (Battle Formation); discontinuous due to erosion (nonmarine).

LOWER MAASTRICHTIAN

K_e Eastend Formation: yellow to buff, greenish and brownish, fine-grained, cross-stratified sandstone with thin interbeds of grey and greenish-grey mudstone; minor lignitic coal (nearshore marine and coastal plain).

UPPER CAMPANIAN TO LOWER MAASTRICHTIAN

K_{bp} Bearpaw Formation: dark grey, blocky-weathering shale and silty shale; greenish (glauconitic) and grey, muddy sandstone; thin concretionary siltstone and bentonite layers; concretions locally yield ammonites (marine to marginal marine).

P_{sw} Sweetgrass Hills intrusions

CAMPANIAN

BELLY RIVER GROUP

K_{cp} Dinosaur Park Formation: pale grey, very fine to medium-grained, bentonitic to carbonaceous sandstone interbedded with grey to brownish-grey siltstone, carbonaceous siltstone to mudstone, and coal; disconformity at base; coal restricted to upper part (fluvial and estuarine, uppermost part marginal marine).

K_{oi} Oldman Formation: fine to coarse-grained, light grey to yellow weathering sandstone; locally cross-bedded, fining upwards and lenticular; grey, muddy siltstone; grey to greenish grey-weathering mudstone commonly with carbonaceous fragments; dark grey to brown carbonaceous mudstone; concretionary siltstone layers; locally divisible into lower sandstone-dominated unit and upper siltstone unit (nonmarine).

K_{cp-o} Undifferentiated Oldman and Dinosaur Park formations.

K_{fm} Foremost Formation: pale grey to pale brown sandstone; grey to greenish-grey siltstone; dark grey carbonaceous mudstone; coal; concretionary siltstone layers; coal seams near the top of the formation (marginal marine to nonmarine).

K_{ps} Pakowki Formation: dark grey mudstone and silty mudstone; minor sandstone; thin pebble conglomerate locally present at base (marine).

SANTONIAN TO CAMPANIAN

K_{mr} Milk River Formation: interbedded mudstone and sandstone with some siltstone (Telegraph Creek Member; marine offshore to shoreface) overlain by thick-bedded, massive to cross-stratified sandstone (Veggie Member; marine shoreface) overlain by sandstone, local carbonaceous mudstone, siltstone, and minor coal (Deachrose Coulee Member; nonmarine fluvial).

BASEMAP LEGEND

- City or town
- Village
- Railway
- Road (major highway)
- Road (minor)
- Township / Range road
- Water body (lake or major river)
- Stream
- UTM, Zone 12 grid

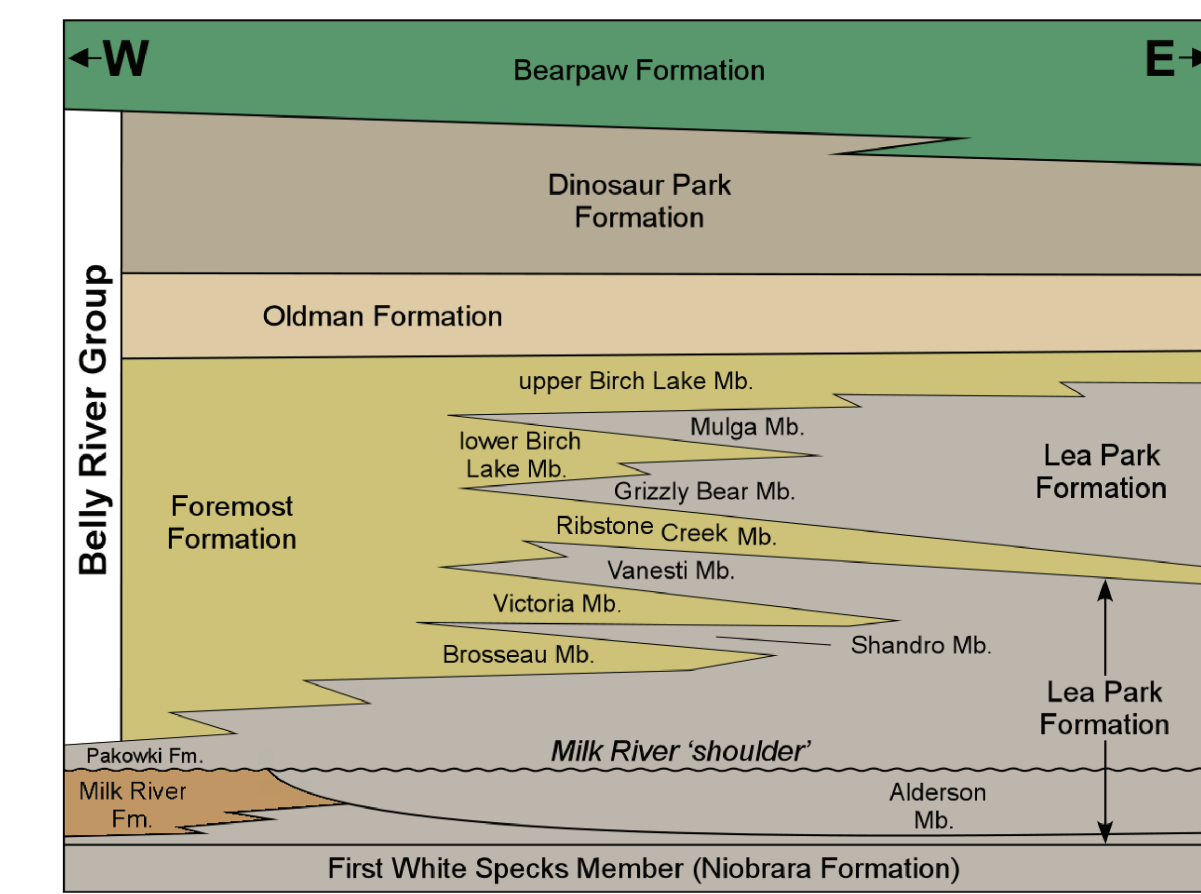


Figure 1. Schematic, east-west-trending stratigraphic cross-section showing the relationship between lithostratigraphic units in eastern Alberta (modified from Naus, 1945; Shaw and Harding, 1949; Nichols and Wyman, 1969).

Description of Type and Measured Sections Located within NTS 72E Foremost Map Sheet

- Unit: Foremost and Oldman formations**
Top Easting: 517 247 m
Top Northing: 5 438 538 m
Base Easting: 517 128 m
Base Northing: 5 439 223 m
Reference: Hathway et al., 2011
Section: S02-T02-R06-W4
- Unit: Battle Formation**
Type: outcrop
Easting: 537 131 m Northing: 5 498 503 m
Reference: Irish, 1970
Notes: S09-T08-R04-W4 in quarry
- Unit: Pakowki Formation**
Type: outcrop
Reference: Dowling, 1917
Notes: exact location uncertain
- Unit: Foremost Formation**
Type: outcrop
Easting: 468 486 m Northing: 5 483 263 m
Reference: Dowling, 1917
Notes: exact location uncertain

Coordinates in UTM Zone 12, NAD83.

Background

Exposed bedrock in the area is composed dominantly of Upper Cretaceous to Paleogene clastic sedimentary rocks. The Eastend, Whitemud, Battle, Frenchman, Ravensrag, and Cypress Hills formations are restricted to the Cypress Hills, a topographically high region located along the eastern margin of the map sheet. The Belly River Group is comprised of the Foremost, Oldman, and Dinosaur Park formations. South of Twp. 5, the Dinosaur Park and Oldman formations cannot be differentiated based on downhole geophysical well logs. Within the lower Belly River Group, there is a complex transition between nonmarine to marginal marine clastic rocks of the Foremost Formation in the west, and marine mudstone and siltstone of the Lea Park Formation in the east. In the transitional zone, sandstone-dominated regressive members of the Belly River Group (Brosseau, Victoria, Ribstone Creek, upper and lower Birch Lake members) interfinger with mudstone-dominated units of the Lea Park Formation (Shandro, Vanesti, Grizzly Bear, and Mulga members, Figure 1). The maximum westward extent of each of the members of the Lea Park Formation is shown on the map in plan view, as is the easternmost extent of the sand-dominated members of the Belly River Group.

The structure in the map area is dominated by the extension of the Kevin-Sunburst dome into south-eastern Alberta from northern Montana. Structure contours are shown for the top of the First White Specks Member of the Niobrara Formation. A broad structural arch, known as the Bow Island Arch, extends north-northeastward from the northern flank of the dome into east-central Alberta (Lorenz, 1982). This arch separates the Alberta Basin in the west from the Williston Basin in the east.

Approach

Selected bedrock units (Dinosaur Park, Oldman, Foremost, and Pakowki formations) were mapped in the subsurface using downhole geophysical well logs (Figure 2; Glombick, 2010a, b, 2011a, b, 2013a, b, c, d). Additional data points were obtained from measured outcrop sections (Hathway et al., 2011), previously published maps (Furnival, 1946; Russell, 1940a, b; Irish, 1968; Campbell, 1974), and air photo interpretation. Elevation data for outcrop locations were obtained using topographic contour data. Subsurface data were modelled using ArcGIS Geostatistical Analyst to create structure surfaces for the top of each stratigraphic unit. The intersection of each surface with a model of bedrock topography (Figure 3; Atkinson and Lyster, 2010) provided the preliminary map trace for each unit. Structure surfaces were also intersected with a digital elevation model (DEM, United States Geological Survey, 2004) for comparison. Map traces were modified to honour the control data as best as possible. As the regional structure of the area is gentle, map patterns are controlled to a large degree by topography on the bedrock surface. Other contacts (Cypress Hills, Ravensrag, Frenchman, Whitemud/Battle, Eastend, and Milk River formations) were modified from Prior et al. (2013) and Irish (1968).

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Recommended Reference Format

Glombick, P.M. (2014). Bedrock geology of the Foremost area, Alberta (NTS 72E). Alberta Energy Regulator, AER/AGS Map 568, scale 1:250 000.

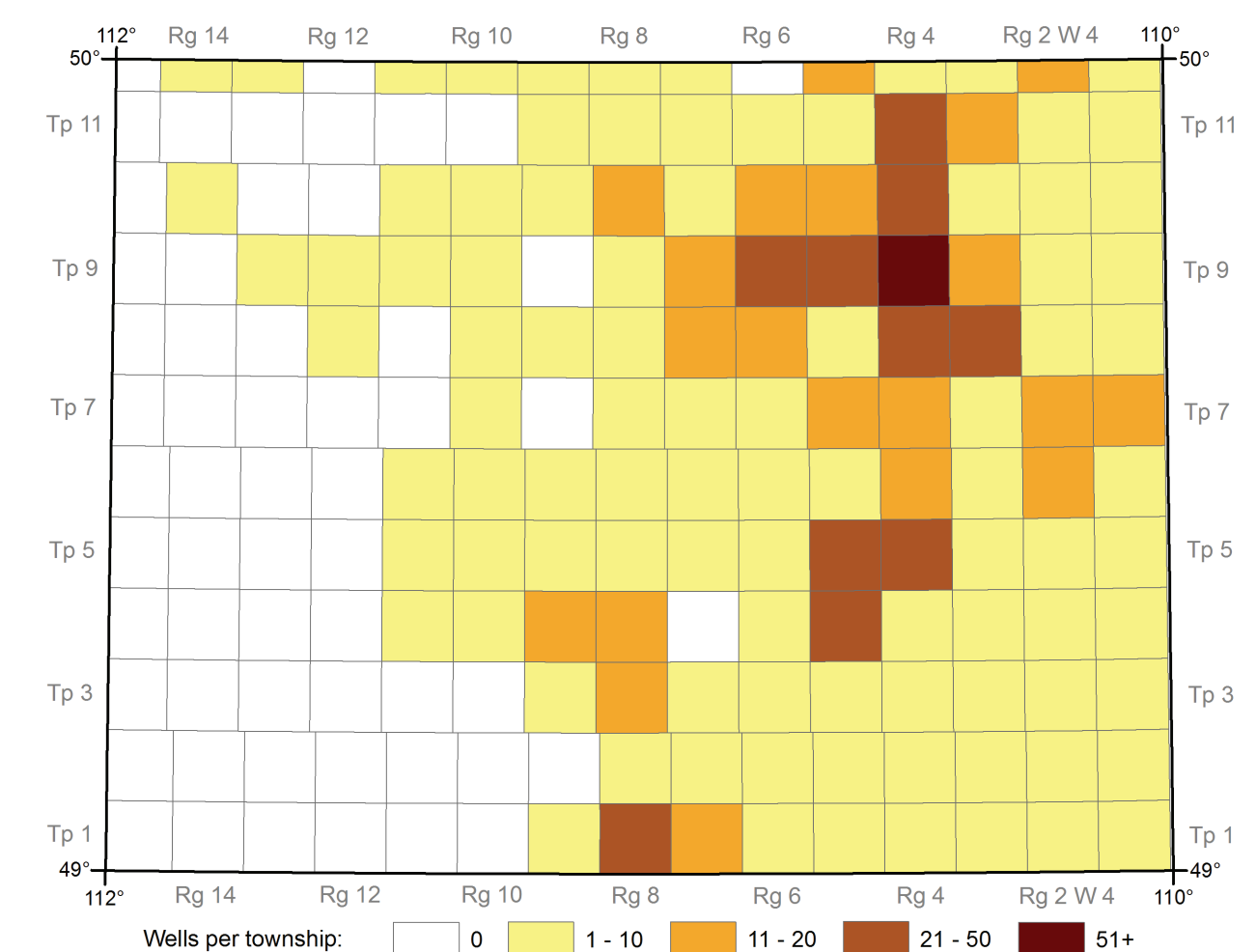


Figure 2. Map showing subsurface well data distribution used in this study.

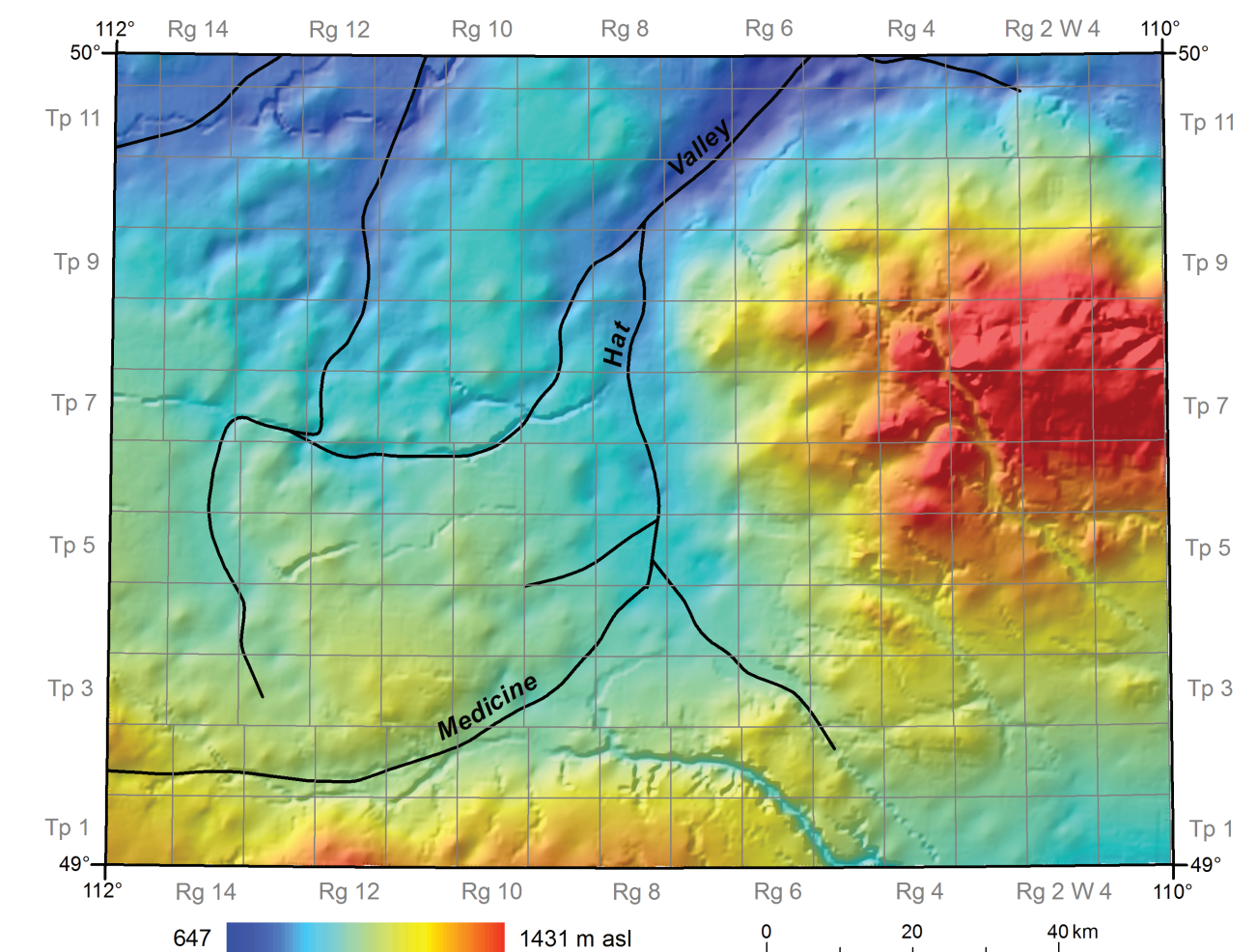


Figure 3. Shaded relief map of bedrock topography from Atkinson and Lyster (2010) showing the location of major preglacial valleys (from Farvolden et al., 1963; Atkinson and Lyster, 2010).

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