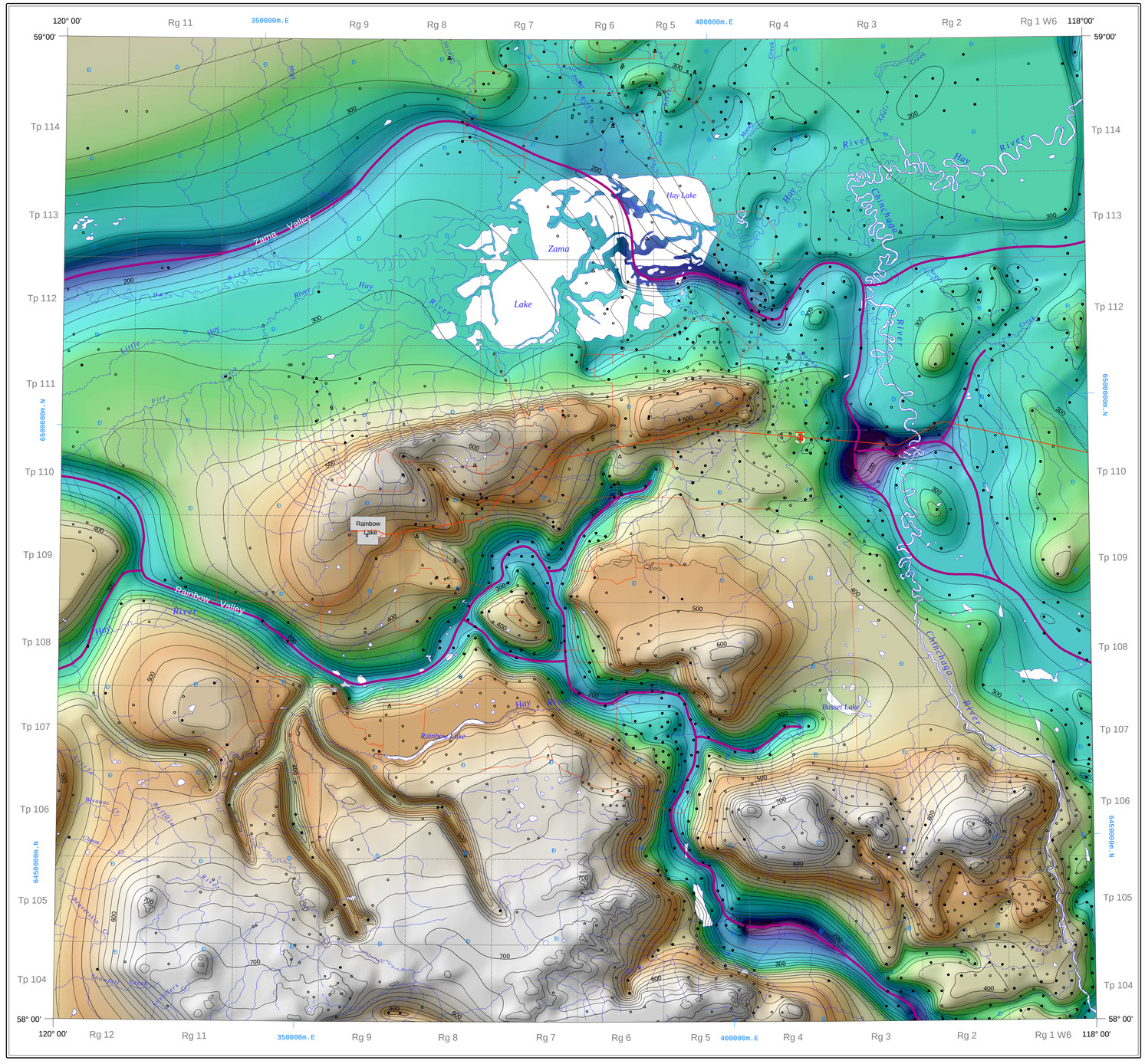
NTS 84L
BEDROCK TOPOGRAPHY



Published 2005

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Map 328

Bedrock Topography of Zama Lake Area, Alberta (NTS 84L)

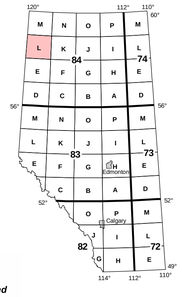
Geology by: J.G. Pawlowicz, A.S. Hickin, T.J. Nicoll, M.M. Fenton, R.C. Paulen, A. Plouffe and I.R. Smith

Scale 1:250 000

0 3.75 7.5 15 22.5 30 kilometres

0 2.5 5 10 15 20 25 miles

Projection: Universal Transverse Mercator, Zone 11
Datum: North American Datum, 1983



Shallow Gas & Diamond Opportunities in Northern Alberta and British Columbia 2003 - 2007

Data

Petrophysical logs from oil and gas wells were the primary source of information used for constructing the bedrock topography. A suite of the common well logs (gamma, resistivity, spontaneous potential, density, neutron, sonic and caliper) were useful in making the pick for top of bedrock; however, the gamma and resistivity logs proved to be the most useful. In this region, the drift typically displays a lower gamma response and higher resistivity response than the underlying bedrock. Other sources of data were drill cuttings, water well lithologs and surficial geological mapping that provided information on bedrock outcrop locations and till veneers over shallow bedrock (Paulen et al., 2005a and 2005b; Plouffe et al., 2004; Smith et al., 2005).

Mapping the bedrock surface was difficult in some areas where data were sparse. In many of the wells, log traces are not available for the upper part of the hole. The depth of surface casing set in bedrock provides a limit on the maximum possible drift thickness. Conversely, water wells and gas wells that did not intersect bedrock provide minimum drift thickness values. The bedrock topography contours were initially generated from bedrock surface picks using a computer-contouring program with subsequent modifications to better reflect the geological model.

Discussion

The Zama Lake map area lies within the Fort Nelson Lowland, Vermilion Lowland and Clear Hills Uplands physiographic regions defined by Pettapiece (1986). These regions are shown on the accompanying digital elevation model (Figure 1). The Hay River Plain and the Zama Lake Plain lie within the Fort Nelson Lowland in the northern and eastern parts of the map area. This lowland is characterized by broad, low-relief areas between 335 and 450 metres above sea level (asl) blanketed by boreal forest and extensive bogs and fens. The southwestern quadrant of the map area forms part of the Clear Hills Uplands that rise to >700 m asl and contains the Rainbow Lake Plain, the Chinchaga Plain and Bassett Hill. Zama Lake and Hay Lake are the dominant features in the north-central part of the lowlands. A prominent ridge, informally named Rainbow Ridge, also referred to as Zama Mountain (Green et al., 1970), lies immediately south of Zama Lake. Present-day rivers include Hay River, which dissects the Rainbow Lake Plain and then flows through Zama Lake before exiting the northeast corner of the map area, and Meander River, which flows northward from the southeast corner. Glacial drift, over 400 m thick in places, covers most of the map area (Figure 2; Pawlowicz et al., 2005).

Bedrock subcrop consists of Upper Cretaceous Dunvegan Formation in the uplands (Green et al., 1970; Hamilton et al., 1999). Cretaceous Shaftesbury Formation shale underlies much of the area with Lower Cretaceous Fort St. John Group shale present where the buried valleys have incised deeply into the bedrock. In the northeastern quadrant, Devonian Wabamun Group limestone underlies the drift locally. Outcrops of Dunvegan Formation sandstone are found above 600 m asl on Bassett Hill and the Chinchaga Plain. Shaftesbury Formation shale outcrops along the Meander River, along former glacial meltwater channels and along the north flank of Rainbow Ridge (Paulen et al., 2005a and 2005b; Pawlowicz et al., 2005; Plouffe et al., 2004; Smith et al., 2005).

The bedrock topography map shows the elevation of the bedrock surface. In general, the bedrock topography controls the surface topography in the map area. Rainbow Ridge, Bassett Hill and the Chinchaga Plain are generally underlain by bedrock highs. Rainbow Ridge and other westerly trending bedrock ridges parallel the regional ice flow (Paulen et al., 2005a and 2005b; Plouffe et al., 2004; Smith et al., 2005) suggesting modification by glacial erosion. Major buried valleys lie within the Fort Nelson Lowland and the Rainbow Lake Plain. The elevation of the bedrock rises to >700 m asl in the uplands, similar to the land surface. The elevations in the lowest parts of the buried valleys differ markedly from the land surface in that they are as low as 25 m asl compared to a minimum ground surface elevation of 335 m asl. Two major northwesterly trending buried valleys that extend into British Columbia are the Rainbow Valley in the south and the Zama Valley in the north. A deeply incised depression located within the Zama Valley in Township 110, Range 3, west of the 6th Meridian has eroded through the entire Cretaceous bedrock sequence, including gas-bearing sandstones of the Bluesky Formation, and into the Devonian Wabamun Group limestone down to an elevation of 25 m asl. Buried valleys are one factor that may contribute to the presence of shallow gas within drift, which is known to occur in the Zama Valley within Township 110, Range 3, west of the 6th Meridian, and elsewhere in the Zama Lake region.

This map shows the regional variations in bedrock topography and these complement those presented in the regional bedrock topography of Alberta (Pawlowicz and Fenton, 1995). A preliminary version of this map was released last year (Pawlowicz et al., 2004). Experience from more detailed investigations elsewhere in Alberta (Andriashek and Fenton, 1989; Andriashek, 2003) have shown that, in addition to the large paleovalleys, narrow buried valleys are to be expected.

FEATURES LEGEND

Data sources

- Petroleum well, bedrock surface picked
- Petroleum well, bedrock surface above logged interval
- Water well, bedock surface picked
- Water well, bedrock surface below bottom of well
- Bedrock valley thalweg
- Bedrock topography elevation above sea level contour interval 25 m

Bedrock elevation (m asl)

775 m
625
425
225
25 m

BASEMAP LEGEND

- City/Town
- Road - gravel
- Road - paved
- Township/range - surveyed
- Township/range - unsurveyed
- UTM, Zone 11 Grid — Đ 450000m.E
- River
- Lake

Figure 1. Present-day surface topography and physiography

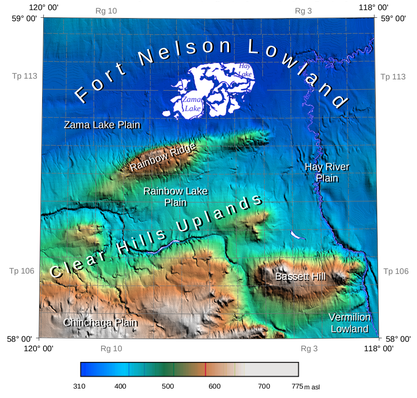
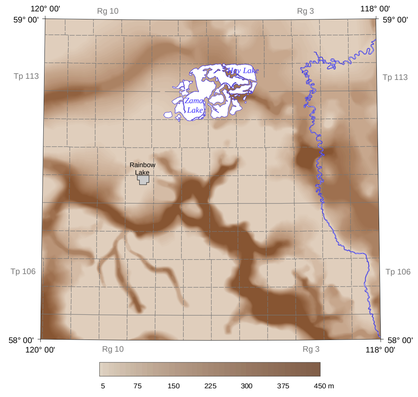


Figure 2. Drift thickness



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Acknowledgements:

The Zama Lake (NTS 84L) bedrock topography and drift thickness maps were completed as an Alberta Geological Survey and Geological Survey of Canada collaborative contribution to Northern Resources Development Project 4450, Shallow Gas and Diamond Opportunities in Northern Alberta and British Columbia 2003-2007, with funding support from the second phase of the Targeted Geoscience Initiative program. Final digital cartography/GIS by M.C. Price, data compilation assisted by T. Berezniuk and editing by G. Hippolt-Squair and G.J. Prior. Digital base map provided by Resource Information Management Branch, Strategic Corporate Services, Alberta Sustainable Development, supplied by Spatial Data Warehouse. Digital elevation model provided by Geomatics Canada, Natural Resources Canada.

Recommended reference format:

Pawlowicz, J.G., Hickin, A.S., Nicoll, T.J., Fenton, M.M., Paulen, R.C., Plouffe, A. and Smith, I.R. (2005): Bedrock topography of Zama Lake area, Alberta (NTS 84L); Alberta Energy and Utilities Board, EUB/AGS Map 328, scale 1:250 000.

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