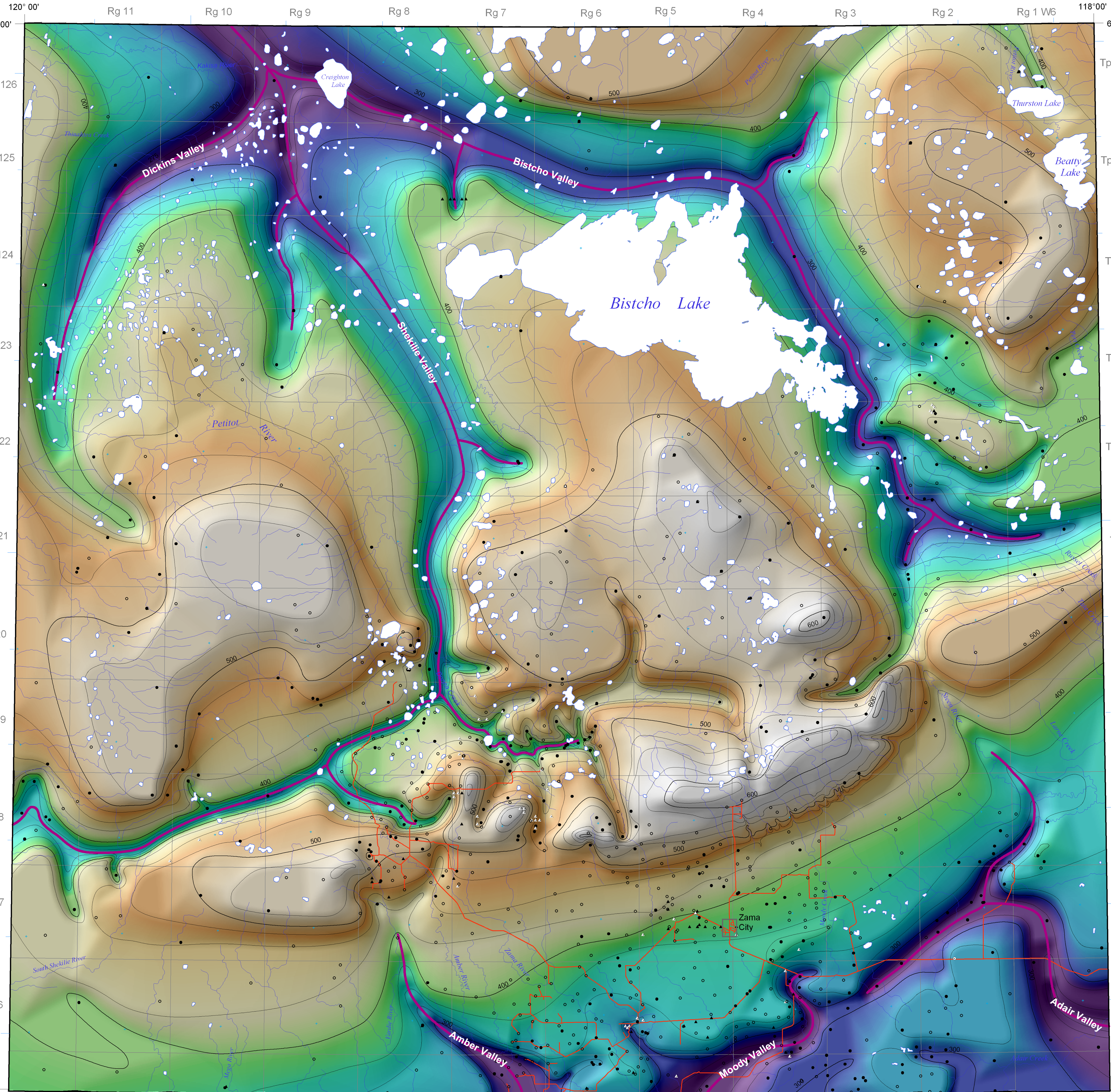
NTS 84M
BEDROCK TOPOGRAPHY



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. The drift typically displays a lower gamma and a higher resistivity response than the subcropping bedrock, which is dominantly Cretaceous marine shale. Other sources of data were drill cuttings and water well lithologs. Surficial geology maps provided information on bedrock outcrops and till veneers over shallow bedrock (Kowalchuk et al., 2006; Paulen et al., 2006a, 2006b; Plouffe et al., 2006; Smith et al., 2007). Data were used from 849 oil and gas wells, 132 water wells and 13 bedrock outcrop locations.

The well data are unevenly distributed throughout the map area, making the bedrock surface difficult to identify where data are sparse. In many of the wells where 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, shallow wells that did not intersect bedrock provide minimum drift thickness values. The bedrock topography contours were initially generated from well data of the bedrock surface picks using a computer-contouring program, followed by subsequent modifications to better reflect the geological model. Figure 1 illustrates a typical response on petrophysical logs of the drift and the top of bedrock pick at a depth of 338 metres from an oil and gas well located in Legal Subdivision 10, Section 22, Township 123, Range 2 west of the 6th Meridian (10-22-123-2W6).

Discussion

The physiographic regions of the Bistcho Lake map area are defined by Pettapiece (1986) and shown on the surface relief map in Figure 2. In the south, the Hay River Plain is part of the more extensive Fort Nelson Lowland. In the north and central areas, Bootis Hill, Elsa Hill, Cameron Hills and the Bistcho Plain are physiographic subdivisions of the entire Cameron Hills Uplands. The lowest elevation in the map area is found in the Hay River Plain, which is characterized by broad low-relief topography that gently rises in elevation from about 350 metres above sea level at the Hay River to 450 metres at the base of the Cameron Hills Uplands. Greater topographic relief is present within the Cameron Hills Uplands where elevations range from 450 metres to almost 800 metres in Bootis, Elsa and Cameron hills. The entire map area is blanketed by boreal forest and extensive bogs and fens. Surface drainage flows primarily in two directions from a divide along the south edge of the uplands. South of this divide, drainage flows toward the Hay River, whereas in most of the uplands flow is primarily westward into British Columbia through Bistcho Lake and the Petitot River. The bedrock is mantled by drift comprised of recent, glacial and preglacial unconsolidated sediments. The exceptions are a few bedrock outcrops located along the south flank of the uplands. Bootis, Elsa and Cameron hills generally reflect highs in the bedrock surface, but in places are underlain by thick drift. Earlier work by Borneuf and Pretula (1980) reported thick drift from isolated wells and Pawlowicz and Fenton (1995a, 1995b) compiled regional maps of bedrock topography and drift thickness for Alberta. Deeply buried valleys with thick drift were reported in the Zama Lake area to the south by Pawlowicz et al. (2005a, 2005b). Over 300 metres of drift was identified in several wells throughout the Bistcho Lake map area, both within major buried valleys and beneath parts of the uplands (Figure 3; Pawlowicz et al., 2007). The geology of the bedrock underlying the drift consists of Cretaceous Shaftesbury Formation and Loon River Formation (Fort St. John Group) marine shales (Green et al., 1970; Hamilton et al., 1999). The Base of Fish Scale bed (BFSC) was identified from well logs above 450 m in elevation in Bootis, Elsa and Cameron Hills, and it served as an important stratigraphic marker for determining the presence of bedrock at this approximate elevation. Bedrock outcrops and thin drift veneers were found along the south flank of the Cameron Hills Upland between 400 and 600 m in elevation during surficial mapping by Paulen et al. (2006a) and Smith et al. (2007).

The bedrock topography map shows contours of the elevation of the bedrock surface above sea level, ranging from a low of 215 metres in the southeast corner to greater than 640 metres in Elsa Hill. In general, the major topographic relief in uplands is controlled by the bedrock topography. The surface of the bedrock in the low-lying areas between the hills and in the Hay River Plain is incised by paleovalleys completely in-filled with glacial and possibly preglacial sediments. The contoured south flank of the uplands and linear flutes at surface are evidence of erosion and modification by glacial ice (Figure 2; Paulen et al., 2006a; Smith et al., 2007). Major buried valleys are identified on the map by their thalweg names. Data from the Bistcho map area, and adjacent areas of British Columbia and Northwest Territories, indicate the gradients of the Shekilie and Bistcho valleys trend northwestward, and likely flowed toward the Mackenzie River valley in the north. The elevation of the lowest part of the Bistcho Valley was determined from well data to be 234 metres above sea level at the northern end of the major paleovalley that exits the map area to the north. The trend of the Dickins Valley northward from Bootis Hill is based on sparse data, and may have a western tributary that flowed from British Columbia. South of the Cameron Hills Uplands, the gradients of Amber and Moody paleovalleys indicate that flow was toward the south, likely connecting with the Zama Paleovalley in the adjacent map area to the south (Pawlowicz et al., 2005a). The Adair Valley forms part of what was previously interpreted as the Steen Paleovalley by Pawlowicz and Fenton (1995a) and trends southeastward through the Hay River Plain. The bedrock elevation in the Adair Valley is 215 metres above sea level at its lowest point and is the lowest bedrock elevation in the entire map area.

This map shows the variation in bedrock topography at 1:250 000 scale and these complement those presented in the regional bedrock topography of Alberta (Fenton et al., 1994; Pawlowicz and Fenton, 1995a). 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. Stratified sediments in drift overlying the buried valleys are potentially favourable locations for groundwater aquifers and shallow gas. Accumulations of shallow gas within drift, which are known to occur in the Zama Paleovalley to the south in Township 110, Range 3 west of the 6th Meridian (Pawlowicz et al., 2004; Alberta Energy and Utilities Board, 2006a) may also be present in the Bistcho Lake map area. This may be due in part to adequate seals formed from thick clay-rich tills and glaciolacustrine sediments that trap any upward migrating gas. Artesian conditions encountered during drilling have been documented in the area (Alberta Energy and Utilities Board, 2006b; Alberta Environment, 2006) and are likely the result of over-pressured aquifers in buried valleys beneath confining clay-rich beds.

FEATURES LEGEND

Data sources

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

Bedrock elevation (masl)

625 m
425
225 m

BASEMAP LEGEND

- Road - gravel
- Township/range
- River
- Lake
- Town
- UTM, Zone 11 Grid (400000m.E)

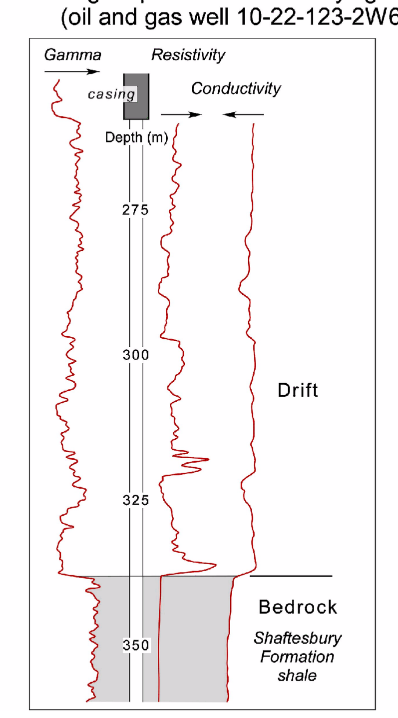


Figure 1. Log response of drift overlying shale (oil and gas well 10-22-123-2W6)

Figure 2. Present-day surface topography and physiography

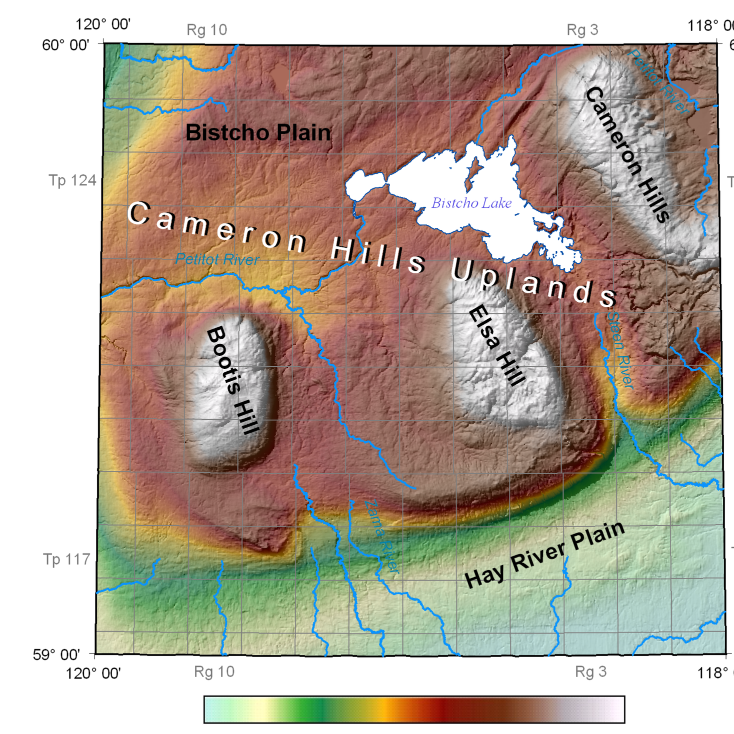
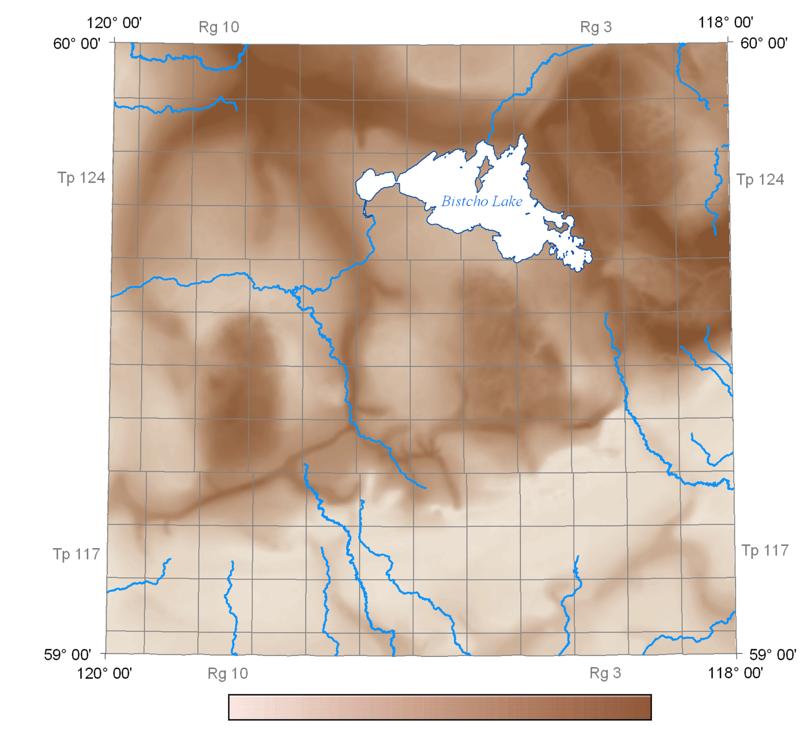


Figure 3. Drift thickness



References

Alberta Energy and Utilities Board (2006a): Shiningbank Energy sweet gas well blowout brought under control; Alberta Energy and Utilities Board, EUB News Release 2006-02-28, 1 p.

Alberta Energy and Utilities Board (2006b): EUB Provincial surveillance and compliance summary 2005; Alberta Energy and Utilities Board, EUB ST99-2006, 92 p.

Alberta Environment (2006): Groundwater information system; Alberta Ministry of Environment, URL <http://www3.gov.ab.ca/env/water/groundwater/index.html>, [December 2006].

Andriashek, L.D. (2003): Quaternary geological setting of the Athabasca oil sands (in situ) area, northeastern Alberta; Alberta Energy and Utilities Board, EUB/AGS Earth Sciences Report 2002-03, 286 p.

Andriashek, L.D. and Fenton, M.M. (1989): Quaternary stratigraphy and surficial geology of the Sand River area, 73L; Alberta Research Council, Alberta Geological Survey, Bulletin 57, 154 p.

Borneuf, D. and Pretula, B. (1980): Hydrogeology of the Zama – Bistcho Lakes area, Alberta; Alberta Research Council, Alberta Geological Survey, Earth Sciences Report 1980-03, 7 p.

Fenton, M.M., Schreiner, B.T., Nielsen, E. and Pawlowicz, J.G. (1994): Quaternary geology of the Western Plains; in Geological Atlas of the Western Canada Sedimentary Basin, G.D. Mossop and I. Shetson (comp.), Canadian Society of Petroleum Geologists and Alberta Research Council, URL <http://www.ags.gov.ab.ca/publications/ATLAS_WWW/ATLAS.shtml>, [February 2007].

Green, R., Mellon, G.B. and Carrigy, M.A. (1970): Bedrock geology of northern Alberta; Research Council of Alberta, Alberta Geological Survey, Map 24, scale 1:500 000.

Hamilton, W.H, Langenberg, W., Price, M.C. and Chao, D.K. (1999): Geological map of Alberta; Alberta Energy and Utilities Board, EUB/AGS Map 236, scale 1:1 000 000.

Kowalchuk, C., Ward, B.C., Paulen, R.C. and Plouffe, A. (2006): Surficial geology, Moody Creek (NTS 84M/02); Alberta Energy and Utilities Board, EUB/AGS Map 397; Geological Survey of Canada, Open File 5283, scale 1:50 000.

Paulen, R.C., Kowalchuck, C.J., Plouffe, A., Ward, B.C. and Smith, I.R. (2006a): Surficial geology of the Zama City Area (NTS 84M/SE); Alberta Energy and Utilities Board, EUB/AGS Map 361, Geological Survey of Canada, Open File 5184, scale 1:100,000.

Paulen, R.C., Plouffe, A. and Smith, I.R. (2006b): Surficial geology of the Beatty Lake area (NTS 84M/NE); Alberta Energy and Utilities Board, EUB/AGS Map 360, Geological Survey of Canada, Open File 5183, scale 1:100,000.

Pawlowicz, J.G. and Fenton, M.M. (1995a): Bedrock topography of Alberta; Alberta Department of Energy, Alberta Geological Survey, Map 226, scale 1:2 000 000.

Pawlowicz, J.G. and Fenton, M.M. (1995b): Drift thickness of Alberta; Alberta Department of Energy, Alberta Geological Survey, Map 227, scale 1:2 000 000.

Pawlowicz, J.G., Nicoll, T.J. and Sciarra, J.N. (2007): Drift thickness of Bistcho Lake area, Alberta (NTS 84M); Alberta Energy and Utilities Board, EUB/AGS Map 417, scale 1:250 000.

Pawlowicz, J.G., Hickin, A.S., Nicoll, T.J., Fenton, M.M., Paulen, R.C., Plouffe, A. and Smith, I.R. (2004): Shallow gas in drift: northwestern Alberta; Alberta Energy and Utilities Board, EUB/AGS INF 130, 1 p.

Acknowledgements:

The Bistcho Lake (NTS 84M) bedrock topography and drift thickness maps were completed as a 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. M.M. Fenton is thanked for his input on the geological interpretation, final digital cartography/GIS by M.C. Price, editing by A. Beaton and G.J. Prior, and final proofreading by G. Hippolt-Squair. 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., Nicoll, T.J. and Sciarra, J.N. (2007): Bedrock topography of Bistcho Lake area, Alberta (NTS 84M); Alberta Energy and Utilities Board, EUB/AGS Map 416, scale 1:250 000.

Published 2007

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Alberta Geological Survey
Information Centre Office
Telephone: (780) 422-3767
Website: www.ags.gov.ab.ca

Map 416

Bedrock Topography of Bistcho Lake Area, Alberta (NTS 84M)

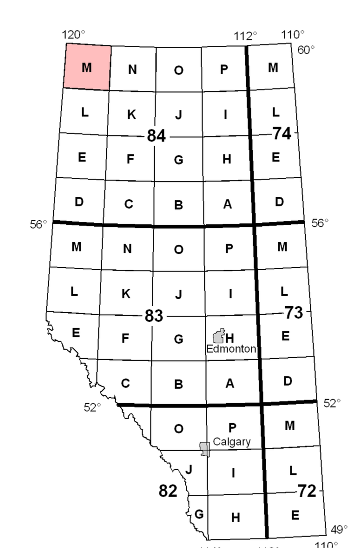
Geology by: J.G. Pawlowicz, T.J. Nicoll and J.N. Sciarra

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

Alberta Energy and Utilities Board

Alberta Geological Survey