



Natural Resources  
Canada

Ressources naturelles  
Canada

## CANADIAN GEOSCIENCE MAP 144

GEOLOGY

# LA BICHE RIVER

Yukon–Northwest Territories



Map Information  
Document



Canadian  
Geoscience Maps

2014

Canada

## **PUBLICATION**

### **Map Number**

Natural Resources Canada, Geological Survey of Canada  
Canadian Geoscience Map 144

### **Title**

Geology, La Biche River, Yukon–Northwest Territories

### **Scale**

1 :250 000

### **Catalogue Information**

Catalogue No. M183-1/144-2013E-PDF  
ISBN 978-1-100-22360-5  
doi:10.4095/294606

### **Copyright**

© Her Majesty the Queen in Right of Canada, as represented  
by the Minister of Natural Resources Canada, 2014

### **Recommended Citation**

Fallas, K.M., Lane, L.S., and Pigage, L.C., 2014. Geology, La Biche River, Yukon–Northwest Territories; Geological Survey of Canada, Canadian Geoscience Map 144, scale 1:250 000. doi:10.4095/294606

### **Cover Illustration**

View looking northeast across La Biche syncline and Kotaneelee anticline at Kotaneelee Gap toward the Liard Range, Northwest Territories. Vegetation and relief is typical of eastern La Biche River map area. Photograph by I.R. Smith. 2013-307

## **ABSTRACT**

The La Biche River map area (NTS 95-C), Yukon and Northwest Territories occupies the Liard Plateau and the southern termination of the Franklin Mountains. It is situated between the northern Rocky Mountains to the south and the Mackenzie Mountains to the north. The area is thickly vegetated and varies from hilly in the western portion to mountainous in the east. Bedrock exposures are sparse and concentrated along streams, with a few open ridge tops in the west half and with better exposure along open ridge tops of the Beavercrow, La Biche, Kotaneelee, and Liard ranges of the east half. The area is underlain by Proterozoic to Late Cretaceous sedimentary strata, along with Neoproterozoic and Eocene intrusions. Folds and faults preserved in the area were generated during two deformational events, a Neoproterozoic event and a Late Cretaceous to Eocene Laramide deformation. Within the Kotaneelee gas field, gas has

been produced from a Devonian carbonate reservoir beneath the Mount Martin anticline.

## **RÉSUMÉ**

La région cartographique de La Biche (SNRC 95-C), au Yukon et dans les Territoires du Nord-Ouest, occupe le plateau de Liard et l'extrémité sud des monts Franklin. Elle est située entre la partie nord des montagnes Rocheuses au sud et les monts Mackenzie au nord. La région présente une végétation dense et sa topographie varie de vallonneuse à l'ouest à montagneuse à l'est. Les affleurements rocheux sont rares et se concentrent le long des ruisseaux, avec quelques sommets de crêtes dénudés dans la moitié ouest et de meilleures zones d'affleurements le long des sommets de crêtes dénudés des chaînons Beavercrow, La Biche, Kotaneelee et Liard dans la moitié est. Le sous-sol de la région est occupé par des roches sédimentaires s'échelonnant du Protérozoïque au Crétacé tardif, que recoupent des intrusions du Néoprotérozoïque et de l'Éocène. La région présente des plis et des failles hérités de deux épisodes de déformation, l'un remontant au Néoprotérozoïque et l'autre associé à la déformation du Laramide du Crétacé tardif à l'Éocène. Dans le champ de gaz de Kotaneelee, du gaz a été produit depuis des réservoirs carbonatés du Dévonien situés dans les profondeurs de l'anticlinal de Mount Martin.

## **ABOUT THE MAP**

### **General Information**

Authors: K.M. Fallas, L.S. Lane, and L.C. Pigage

Geological compilation by K.M. Fallas, L.S. Lane, and L.C. Pigage, 2007–2013

Geological field observations by M.P. Cecile, L.D. Currie, C.A. Evenchick, K.M. Fallas, G.F. Hynes, L.S. Lane, R.B. MacNaughton, and I.R. Smith of the Geological Survey of Canada, 1996–2002; G. Abbott, T.L. Allen, and L.C. Pigage of the Yukon Geological Survey, 2000–2002; and A.K. Khudoley of St. Petersburg State University, 2001–2002

Historical geological observations by W.B. Brady, 1959, P. Burt, 1983, R.J.W. Douglas, 1957, J.C. Harrison, 1978, R.P. Hill, 1978, T.E. Kubli, 1996, M.R. McDonough, 1995, R. Parrish, 1982, and J.C. Sproule, 1958

Stratigraphic sections measured by E.W. Bamber, A. Couch, P. Harker, E.D. Kindle, D.A. Leckie, R.B. MacNaughton, D.W. Morrow, B.C. Richards, and D.F. Stott of the Geological Survey of Canada, 1943–2002; MSc student J.H. Frank of the University of Alberta, 1999; and PhD student D.M.S. Jowett of Carleton University, 2000–2001

Geomatics by K.M. Fallas, S.D. Orzeck, and R. Chan

Cartography by S.D. Orzeck

Scientific editing by A.J. Weatherston

Joint initiative of the Geological Survey of Canada and the Yukon Geological Survey, conducted under the auspices of the Central Foreland NATMAP Project.

Map projection Universal Transverse Mercator, zone 10.  
North American Datum 1983

Base map at the scale of 1:250 000 from Natural Resources Canada, with modifications.

Elevations in metres above mean sea level.

Magnetic declination 2014, 20°50'E, decreasing 23' annually.  
Readings vary from 21°10'E in the NW corner to 20°28'E in the SE corner of the map.

The Geological Survey of Canada welcomes corrections or additional information from users.

Data may include additional observations not portrayed on this map.

See documentation accompanying the data.

Additional references are included in the map info document.

This publication is available for free download through  
GEOSCAN (<http://geoscan.nrcan.gc.ca/>).

## **Map Viewing Files**

The published map is distributed as a Portable Document File (PDF), and may contain a subset of the overall geological data for legibility reasons at the publication scale.

The spatial geological data is provided in two file formats, SHP and XML, that may be imported into Geographic Information System (GIS) software for the purposes of viewing, querying, and analysis.

## **ABOUT THE GEOLOGY**

### **Descriptive Notes**

The geology of the La Biche River map area was previously published by Douglas (1976). Additional stratigraphic and structural observations since then have allowed for a refinement of Douglas' interpretation, presented here. Revisions to map units and stratigraphic relationships in the area have been derived from various sources (Fig. 1). Terminology for igneous rocks is derived from Rowins and Francis (1995), Harrison (1981), and Pigage (2009). Stratigraphic terms for the upper part of the sedimentary succession are taken from Stott (1982) and Leckie et al. (1991) for Cretaceous units; Gibson (1975) and MacNaughton (2002) for Triassic units; Harker (1963), Bamber et al.

(1968), and Richards (1989) for Late Devonian, Carboniferous, and Permian units. Early Permian carbonate, herein assigned to the informal Tika formation, had been correlated with the Kindle Formation of northeast British Columbia (Henderson, 1989), but Chung (1993) demonstrated that the Kindle Formation is Late Mississippian to Early Pennsylvanian, overlapping with the Mattson Formation, so the term 'Kindle Formation' is not used here.

Within lower Paleozoic strata, the La Biche River map area straddles the boundaries between the MacDonald carbonate platform to the south, the Mackenzie carbonate platform to the north and east, and the Selwyn shale basin in the northwest (Fig. 2). The resulting map-unit terminology is drawn from each of these geological regions as follows: Taylor and Mackenzie (1970), Norford et al. (1966), and Morrow (1978) describe units from the MacDonald platform; Morrow and Cook (1987), Morrow (1982), and Ludvigsen (1979) describe units from the Mackenzie platform; and Gabrielse et al. (1973), Cecile and Norford (1979), and Pyle and Barnes (2000) describe shale-dominated units of the Selwyn basin. Pigage (2009) summarizes the relationships between these units within the western La Biche River area and discusses locally defined Neoproterozoic and Cambrian units (see Fig. 2).

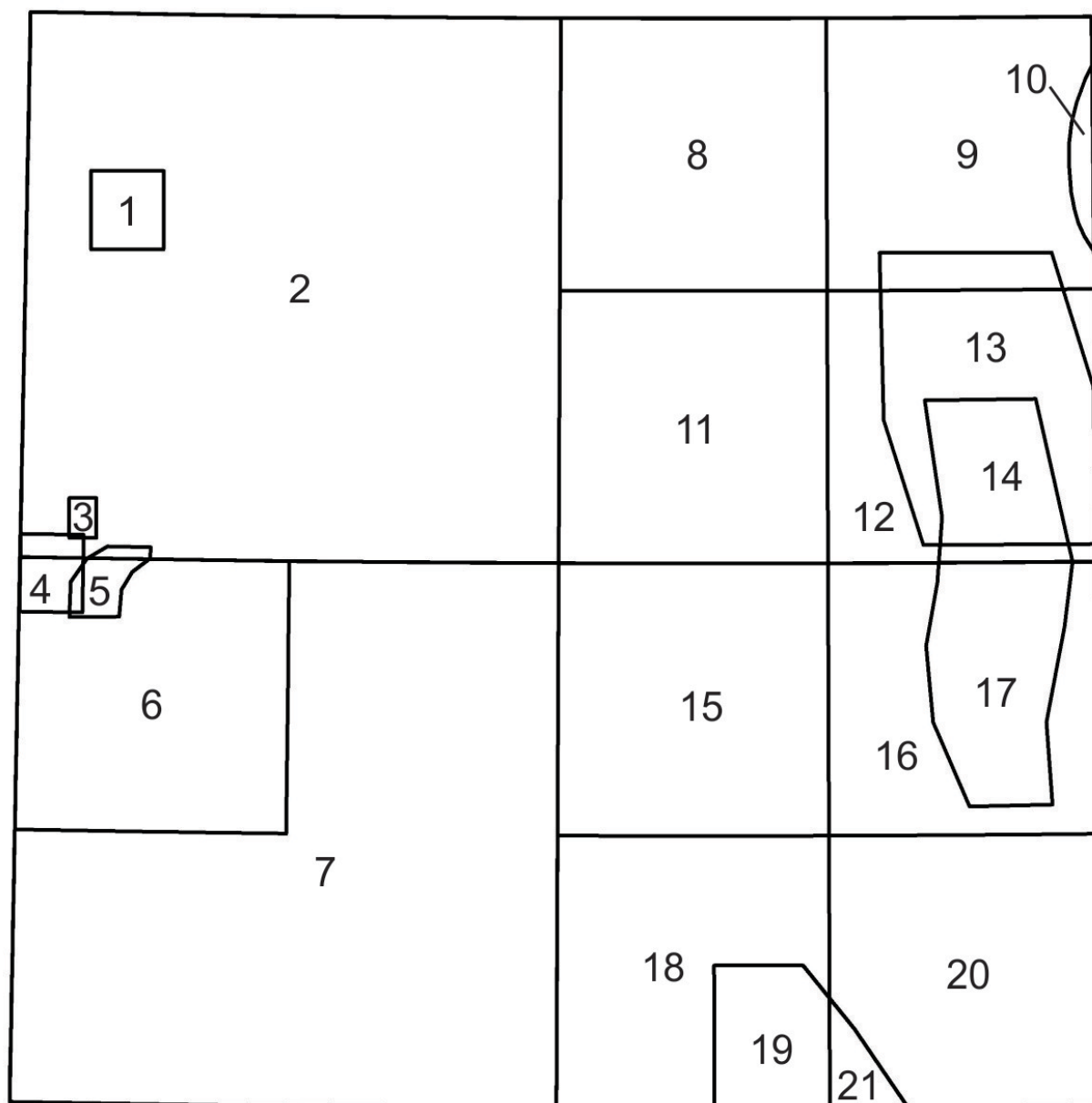
The following discussion outlines stratigraphic features that influenced the organization of map units across the La Biche River area. Lepine and Sully formations are combined where the intervening Sikanni is not well developed; the combined interval includes Sikanni-equivalent strata. Chinkeh and Garbutt formations are combined where the Chinkeh becomes too thin to map separately. Although the Chinkeh Formation was not observed in the western part of the La Biche area, it may be present at the base of the Garbutt Formation. A pre-Cretaceous southern tilt to the region is recorded by erosionally thinned Permian and Triassic strata beneath the Cretaceous strata in the north. Exposures of Triassic strata are generally few and incomplete, but a coarsening-upward trend within the combined Grayling and Toad unit was observed. The shale-dominated base can be assigned to the Grayling Formation, and the sandier upper portion probably belongs in the Toad Formation. Permian units, Tika formation and Fantasque Formation, are combined because they are too thin to map separately on steep fold limbs; both become increasingly shaly and recessive westward and may be indistinguishable from each other and the base of the Triassic Grayling and Toad unit. Poor exposure combined with possible facies variations is the reason for combining some or all of the members of the Mattson Formation in the western portion of the map area. Thinning of the Golata Formation in the northeast corner of the map required inclusion of the Golata with the underlying Flett Formation. Though not shown separately, the Dunedin Formation east-southeast of Larsen Lake has locally developed Manetoe facies dolomitization. Along the western edge of the map area, where quality of exposure and biostratigraphic control are poor, the Ordovician to Devonian carbonate unit may correlate with the Beaverfoot, Nonda, Muncho-McConnell, and Stone formations of the MacDonald platform to the south. The Ordovician to Silurian carbonate unit attempts to separate Beaverfoot and Nonda formation equivalents from Siluro-Devonian Muncho-McConnell and Stone formations. To the north, facies in this interval change to Road River Group of the Selwyn Basin and Headless Formation of the Mackenzie Platform. Coarse siliciclastic units in the western part of the map area, Crow Formation and the Ordovician sandstone unit, are preserved around a paleotopographic

high centered on the Pool Creek syenite. In the case of the Crow Formation, it is distinct from the laterally equivalent regional unit, Rabbitkettle Formation.

Laramide deformation in the La Biche River map area is recorded as abundant folds with associated faulting; and structural style varies across the area largely as a function of the mechanical properties of the rock types at surface. In the northwest, where shale-dominated lower Paleozoic units are abundant, folds are common with subordinate faulting in the carbonate units. To the southwest, faulting is more common due to the prevalence of more resistant units of lower Paleozoic carbonate and sandstone, yet topographic relief is subdued in the west. Through the south-central and eastern portions of the map area, a regular pattern of long-wavelength (10–20 km) folding dominates, with minor faulting associated with upper Paleozoic and Mesozoic siliciclastic strata. Anticlines in this region are detached within the Besa River Formation and outlined by resistant units of the Mattson Formation, forming high ridges above the treeline, whereas valleys are underlain by recessive Triassic and Cretaceous strata. The sinuosity of the Kotaneelee and La Biche ranges is a function of en échelon linking of multiple anticlinal culminations (e.g. Mount Martin and Kotaneelee anticlines). Trends of individual structures vary from northeast to northwest, in contrast to the consistent northwest trend of structures in the northern Rocky Mountains and Foothills to the south (Taylor and Stott, 1973, for example). Major features identified by Douglas (1976) are recognizable in this compilation, although higher resolution mapping, particularly in the west, has modified some structures in detail and refined the stratigraphic units. In particular, new observations do not support the previous interpretation of a significant northeast-trending fault bisecting the northwest portion of the map area – the Beaver Fault of Douglas (1976; see *also* Morrow and Miles, 2000). Misalignment or termination of structures north and south of the Beaver River near Gold Pay Creek are the basis for the inferred Gold Pay structure. The northwest trend is constrained by the surface structures and may reflect trends of postulated reactivated faults originating at deeper structural levels in Proterozoic or Lower Paleozoic strata. A similar origin may explain other northwest-trending structures in the map area (Toobally-Crow Fault, Caribou Thrust, and Jedhi Deh Thrust). An older deformation and intrusive event involving Proterozoic strata is recorded near the western edge of the map, represented by east-west-trending folds involving only Proterozoic strata and the ~650 Ma Pool Creek syenite. Eocene intrusions in the western portion of the map area appear to be post-tectonic.

Historical petroleum exploration in the area has concentrated on Devonian carbonate targets on anticlinal structures in the subsurface. The Kotaneelee gas field, on the east flank of Mount Martin has produced from one such target. More recent exploration, focused in the Liard Basin to the south, has targeted Devonian and Triassic organic-rich shale units exposed in this map area. Mineral showings exposed in the western portion of the map area are dominantly lead, zinc, and barium deposits concentrated in Silurian and Devonian carbonate and shale, or associated with intrusive bodies.

More detailed information regarding field observations, structural measurements, measured sections, fossil localities, radiometric ages, wells, mineral localities, and original sources can be found in the accompanying digital GIS files.



**Figure 1.** Key to source references for material used in this compilation. See accompanying cgm\_0144\_info.pdf document for itemized list and full references.

## Key to Source References, 95C

In addition to the 1:250 000 compilation of La Biche River by Douglas (1976), the following sources were used in the compilation of this map. Numbers match those in Figure 1.

- 1 Cathro (1983a), Fallas et al. (2005)
- 2 Fallas et al. (2005)
- 3 Fallas et al. (2005), Harrison (1981)
- 4 Brady (1959), Cathro (1983b), Fallas et al. (2004), Pigage (2008)
- 5 Brady (1959), Burt (1983), Fallas et al. (2004), Pigage (2008)
- 6 Brady (1959), Fallas et al. (2004), Pigage (2008)
- 7 Brady (1959), Fallas et al. (2004)
- 8 Fallas (2003b)
- 9 Fallas et al. (2003)
- 10 Fallas et al. (2003), Hill (1978)
- 11 Khudoley (2003c)
- 12 Currie et al. (1999a), Lane and Fallas (2003b)
- 13 Currie et al. (1999a), Lane and Fallas (2003b), McDonough (1995)
- 14 Currie et al. (1999a), Lane and Fallas (2003b), Kubli (1996), McDonough (1995)
- 15 Brady (1959), Khudoley and Fallas (2006)
- 16 Brady (1959), Currie et al. (1999b), Fallas and Lane (2006)
- 17 Brady (1959), Currie et al. (1999b), Kubli (1996), Fallas and Lane (2006)
- 18 Brady (1959), Fallas and Evenchick (2006)
- 19 Brady (1959), Fallas and Evenchick (2006), Kindle (1944)
- 20 Brady (1959), Fallas (2006), Sproule (1958)
- 21 Brady (1959), Fallas (2006), Kindle (1944)





## Acknowledgments

The following acknowledgments address work done by the Geological Survey of Canada and the Yukon Geological Survey based out of Fort Liard, Northwest Territories in 1997, 2000, 2001, and 2002 as part of the Central Foreland NATMAP project.

The authors would like to thank the following GSC and YGS field assistants for their hard work: F. Anderson, R. Aquilini, J. Barclay, C. Bass, G. Carrelli, A. Couch, M. Crockett, A. Daigle, M. Ebner, L. Evans, R. Fraser, D. Hodder, K. Kennedy, R. Kennedy, A. McNeill, K. McWilliam, N. Utting, and A. Yanko.

The authors would also like to thank the following residents of Fort Liard for their assistance in the field: A. Bertrand, D. Kotchea, J. Harris, M. McQuaid, M. Bertrand, and J. Bertrand.

The following petroleum exploration companies kindly contributed geological expertise in the field as well as assistants: Crestar Energy, Conoco Canada, Gulf Canada Resources, PetroCanada, and Nexen.

Expertise on aspects of the economic potential of the area was provided by R. Freeman of the Yukon Oil and Gas Branch and A. Fonseca of the Yukon Geological Survey.

Logistical support and accommodations in Fort Liard were provided by Liard Valley Motel, Riverside Inn, Flett Mountain Camp Services Ltd., with camp management by J. O'Rourke.

Helicopter and fixed-wing support was provided by Talon Helicopters, Wildcat Helicopters, Mustang Helicopters, Deh Cho Helicopters, and South Nahanni Airways.

The authors wish to thank M. Cecile and L. Currie for critical review of the map.

## References

Allen, T.L., Pigage, L.C., and MacNaughton, R.B., 2001. Preliminary geology of the Pool Creek map area (95C/5), southeastern Yukon; *in*: Yukon Exploration and Geology 2000, D.S. Emond and L.H. Weston (eds.), Exploration and Geological Services Division, Yukon, Indian and Northern Affairs Canada, p.53–72.

Bamber, E.W., Taylor, G.C., and Procter, R.M., 1968. Carboniferous and Permian stratigraphy of northeastern British Columbia; Geological Survey of Canada, Paper 68-15, 25 p.

Brady, W.B., 1959. The Geology of the Liard River Area, Northwest Territories, Yukon Territory and British Columbia; National Energy Board Report, 28-1-5-4, 99 pages + insert map and sections.

Burt, P., 1983. Geological, geochemical and geophysical report of work performed during June and July of 1983 on the BEAV 1 to 180 claims; Assessment Report 091486; Energy, Mines and Resources, Yukon Government.

Cathro, R.J., 1983a. Report on geological and geochemical surveys conducted July 6 – August 15, 1982, MARS 1-49 claims – YA68539-YA68587; Assessment Report 091458; Energy, Mines and Resources, Yukon Government.

Cathro, R.J., 1983b. Report on geological and geochemical surveys conducted July 12 – August 17, 1982, TRANZ 1-4 claims, YA68631-JA68644; Assessment Report 091459; Energy, Mines and Resources, Yukon Government.

Cecile, M.P. and Norford, B.S., 1979. Basin to platform transition, Paleozoic strata of Ware and Trutch map areas, northeastern British Columbia; in Current Research, Part A; Geological Survey of Canada, Paper 79-1A, p. 219–226.

Chung, P., 1993. Conodont biostratigraphy of the Carboniferous to Permian Kindle, Fantasque, an unnamed and Belloy Formations, Western Canada; M.Sc. thesis, University of Calgary, Calgary, Alberta, 189 p.

Couch, A.G., 2003. Eolian dunes in the Upper Member of the Mattson Formation, southwest Northwest Territories; B.Sc. thesis, University of Calgary, Calgary, Alberta, 67p.

Currie, L.D., Kubli, T.E., and McDonough, M.R., 1999a. Preliminary Geology, Chinkeh Creek (95C/09), Yukon Territory, and Northwest Territories; Geological Survey of Canada, Open File 3843; scale 1:50 000. doi:10.4095/211233

Currie, L.D., Kubli, T.E., and McDonough, M.R., 1999b. Preliminary Geology, Babiche Mountain (95C/08), Yukon Territory, and Northwest Territories; Geological Survey of Canada, Open File 3844; scale 1:50 000. doi:10.4095/211234

Currie, L.D., Kubli, T.E., McDonough, M.R., and Hodder, D.N., 1998. Geology of the Babiche Mountain and Chinkeh Creek map areas, southeastern Yukon Territory and southwestern Northwest Territories; *in* Cordillera and Pacific Margin / Interior Plains and Arctic Canada; Geological Survey of Canada, Current Research, no.1998-A/B, p. 39–48.

Douglas, R.J.W., 1976. Geology, La Biche River, Yukon Territory-District of Mackenzie; Geological Survey of Canada, Map 1380A, scale 1:250 000. doi:10.4095/109155

Douglas, R.J.W. and Norris, D.K., 1959. Fort Liard and La Biche map Areas, Northwest Territories and Yukon, 095B and 095C; Geological Survey of Canada, Paper 59-6.

Douglas, R.J.W. and Norris, D.K., 1977. Geology, Virginia Falls, District of Mackenzie; Geological Survey of Canada, Map 1378A, scale 1:250 000. doi:10.4095/109052

Fallas, K.M., 2001. GIS Dataset: Preliminary Geology of Mount Martin (95C/01), Yukon Territory, British Columbia and Northwest Territories; Geological Survey of Canada, Open File 4015. doi:10.4095/212646

Fallas, K.M., 2002. Preliminary Geology - Mount Martin (95C/01), Yukon Territory, British Columbia and Northwest Territories; Geological Survey of Canada, Open File 3402; scale 1:50 000. doi:10.4095/213527

Fallas, K.M., 2003a. Geology of Dendale Lake (95C/15), Yukon Territory and Northwest Territories; Geological Survey of Canada, Open File 1460, scale 1:50 000. doi:10.4095/213860

Fallas, K.M., 2003b. A GIS dataset of geological features for the Dendale Lake (95C/15) map area, Yukon Territory and Northwest Territories; Geological Survey of Canada, Open File 1750. doi:10.4095/214446

Fallas, K.M., 2006. Geology, Mount Martin, Yukon Territory-Northwest Territories-British Columbia; Geological Survey of Canada, Map 2087A, scale 1:50 000. doi:10.4095/222639

Fallas, K.M. and Evenchick, C.A., 2002a. Preliminary Geology of Mount Merrill (95C/02), Yukon Territory and British Columbia; Geological Survey of Canada, Open File 4264; scale 1:50 000. doi:10.4095/213390

Fallas, K.M. and Evenchick, C.A., 2002b. A GIS dataset of geological features for the Mount Merrill map area (95C/2), Yukon Territory and British Columbia; Geological Survey of Canada, Open File 4359; scale 1:50 000. doi:10.4095/213613

Fallas, K.M. and Evenchick, C.A., 2006. Geology, Mount Merrill, Yukon Territory-British Columbia; Geological Survey of Canada, Map 2091A, scale 1:50 000. doi:10.4095/222767

Fallas, K.M. and Lane, L.S., 2001. Geology of the Mount Martin, Fisherman Lake, and Mount Flett map areas, Yukon and Northwest Territories: Central Foreland NATMAP Project; Geological Survey of Canada, Current Research 2001-A5, 7 p. doi:10.4095/211990

Fallas, K.M. and Lane, L.S., 2003a. Geology, Babiche Mountain (95C/8), Yukon Territory and Northwest Territories; Geological Survey of Canada, Open File 1563, scale 1:50 000. doi:10.4095/214149

Fallas, K.M. and Lane, L.S., 2003b. A GIS dataset of geological features for the Babiche Mountain (95C/8) map area, Yukon Territory and Northwest Territories; Geological Survey of Canada, Open File 1747. doi:10.4095/214402

Fallas, K.M. and Lane, L.S., 2006. Geology, Babiche Mountain, Yukon Territory-Northwest Territories; Geological Survey of Canada, Map 2088A, scale 1:50,000. doi:10.4095/222240

Fallas, K.M., Hynes, G.F., and Lane, L.S., 2003. A GIS dataset of geological features for the Etanda Lakes map area (95C/16), Northwest Territories and Yukon Territory; Geological Survey of Canada, Open File 1802. doi:10.4095/214835

Fallas, K.M., Pigage, L.C. and Lane, L.S., 2005. Geology, La Biche River northwest (95C/NW), Yukon and Northwest Territories; Geological Survey of Canada, Open File 5018, scale 1:100 000. doi:10.4095/221511

Fallas, K.M., Pigage, L.C., and MacNaughton, R.B., 2004. Geology, La Biche River southwest (95C/SW), Yukon Territory and British Columbia; Geological Survey of Canada, Open File 4664, scale 1:100 000, 2 sheets. doi:10.4095/216140

Frank, J.H., 2002. Sedimentology, ichnology and stratigraphy of the lowermost Cretaceous, Liard Basin, Canada. M.Sc. thesis, Department of Earth and Atmospheric Sciences, University of Alberta, Edmonton Alberta, Canada, 181 p.

Fraser, R.C., 2002. Controls on changes in trend, vergence and structural style in the La Biche Range, southern Franklin Mountains, Northwest and Yukon Territories; M.Sc. thesis, University of Calgary, Calgary Alberta, 109 p.

Gabrielse, H. and Blusson, S.L., 1969. Geology of Coal River map area, Yukon Territory-District of Mackenzie; Geological Survey of Canada, Paper 68-38, 22 p., 1 map in pocket, scale 1:253 440.

Gabrielse, H., Blusson, S.L., and Roddick, J.A., 1973. Geology of the Flat River, Glacier Lake and Wrigley Lake map-areas, District of Mackenzie and Yukon Territory; Geological Survey of Canada, Memoir 366 (Parts I and II), 421 p. doi:10.4095/100705

Gibson, D.W., 1975. Triassic rocks of the Rocky Mountain Foothills and Front Ranges of northeastern British Columbia and west-central Alberta; Geological Survey of Canada, Bulletin 247, 61 p. doi:10.4095/103976

Harker, P., 1961. Summary account of Carboniferous and Permian formations, southwestern District of Mackenzie; Geological Survey of Canada, Paper 61-1, 9 p.

Harker, P., 1963. Carboniferous and Permian rocks, southwestern District of Mackenzie; Geological Survey of Canada, Bulletin 95, 91 p. doi:10.4095/100614

Harrison, J.C., 1981. Petrology of the 'Ting Creek' alkalic intrusion, southeast Yukon; M.Sc. Thesis, University of Toronto, Toronto, Ontario, 299 p.

Henderson, C.M., 1989. Absaroka Sequence - the Lower Absaroka Sequence: Upper Carboniferous and Permian; in Western Canada Sedimentary Basin – a case history, (ed.) B.D. Ricketts; Canadian Society of Petroleum Geologists, Special Publication No. 30, p.203–217.

Hill, R.P., 1978. Fort Liard coal project, Northwest Territories, 1978 field programme report; unpublished mineral claim report for Utah Mines Ltd., National Energy Board File #061857, 54 p. + 2 maps.

Hynes, G.F., Fallas, K.M., and Lane, L.S., 2003. Geology, Etanda Lakes (95C/16), Northwest Territories and Yukon Territory; Geological Survey of Canada, Open File 1676, scale 1:50 000. doi:10.4095/214444

Jowett, D.M.S., 2004. Foraminiferal biostratigraphy and sequence stratigraphy of Lower Cretaceous strata in the Liard basin, British Columbia, Yukon Territory, and Northwest Territories; PhD Thesis, Carleton University, Ottawa, Ontario.

Khudoley, A.K., 2002. Geology, Brown Lake (95C/7), Yukon Territory; Geological Survey of Canada, Open File 4267, scale 1:50 000. doi:10.4095/213305

Khudoley, A.K., 2003a. Geology of Tika Creek (95C/10), Yukon Territory and Northwest Territories; Geological Survey of Canada, Open File 1660; scale 1:50 000. doi:10.4095/214288

Khudoley, A.K., 2003b. A GIS dataset of geological features for the Brown Lake (95C/7) map area, Yukon Territory; Geological Survey of Canada, Open File 1765. doi:10.4095/214482

Khudoley, A.K., 2003c. A GIS dataset of geological features for the Tika Creek (95C/10) map area, Yukon Territory and Northwest Territories; Geological Survey of Canada, Open File 1777. doi:10.4095/214515

Khudoley A. K. and Fallas, K.M., 2006. Geology, Brown Lake, Yukon Territory; Geological Survey of Canada, Map 2083A, scale 1:50 000. doi:10.4095/221951

Kindle, E.D., 1944. Geological reconnaissance along Fort Nelson, Liard, and Beaver Rivers, northeastern British Columbia and southeastern Yukon; Geological Survey of Canada, Paper 44-16, 19p. + 1 map.

Lane, L.S. and Fallas, K.M., 2003a. Geology, Chinkeh Creek (95C/9), Northwest Territories and Yukon Territory; Geological Survey of Canada, Open File 1674. doi:10.4095/214305

Lane, L.S. and Fallas, K.M., 2003b. A GIS dataset of geological features for the Chinkeh Creek map area (95C/9), Northwest Territories and Yukon Territory; Geological Survey of Canada, Open File 1828. doi:10.4095/214836

Leckie, D.A. and Potocki, D., 1998. Sedimentology and petrography of marine shelf sandstones of the Cretaceous Scatter and Garbutt formations, Liard Basin, northern Canada; Bulletin of Canadian Petroleum Geology, v. 46, p. 30–50.

Leckie, D.A., Potocki, D.J., and Visser, K., 1991. The Lower Cretaceous Chinkeh Formation: A frontier-type play in the Liard Basin of Western Canada; American

Association of Petroleum Geologists Bulletin, v. 75, p. 1324–1352.

Lenz, A.C. and Jackson, D.E., 1964. New occurrences of graptolites from the south Nahanni region, Northwest Territories and Yukon; Bulletin of Canadian Petroleum Geology, v. 12, p. 892–900.

Ludvigsen, R., 1979. A trilobite zonation of Middle Ordovician rocks, southwestern District of Mackenzie; Geological Survey of Canada, Bulletin 312, 99 p.

MacNaughton, R.B., 2002. Sedimentology of Triassic siliciclastic strata, Mount Martin and Mount Merrill map areas, Yukon Territory; Geological Survey of Canada, Current Research, 2002-A4, 10 p. doi:10.4095/213070

MacNaughton, R.B. and Pigage, L.C., 2003. Geology, Larsen Lake (95C/4), Yukon Territory and British Columbia; Geological Survey of Canada, Open File 1791, scale 1:50 000. doi:10.4095/224834

Morrow, D.W., 1978. The Dunedin Formation: a transgressive shelf carbonate sequence; Geological Survey of Canada, Paper 76-12, 35 p.

Morrow, D.W., 1982. Correlations between the Sunblood, Esbataottine and Whittaker formations in the Lower Paleozoic sequence of the southern Mackenzie Mountains; in Current Research, Part A; Geological Survey of Canada, Paper 82-1A, p. 95–98.

Morrow, D.W. and Aulstead, K.L., 1995. The Manetoe Dolomite – a Cretaceous-Tertiary or a Paleozoic event? Fluid inclusion and isotopic evidence; Bulletin of Canadian Petroleum Geology, v. 43, p. 267–280.

Morrow, D.W. and Cook, D.G., 1987. The Prairie Creek embayment and Lower Paleozoic strata of the southern Mackenzie Mountains; Geological Survey of Canada, Memoir 412, 195 p. doi:10.4095/122458

Morrow, D.W. and Miles, W.C., 2000. The Beaver River Structure: a cross-strike discontinuity of possible crustal dimensions in the southern Mackenzie Fold Belt, Yukon and Northwest Territories, Canada; Bulletin of Canadian Petroleum Geology, v. 48, p. 19-29.

Norford, B.S., Gabrielse, H., and Taylor, G.C., 1966. Stratigraphy of Silurian carbonate rocks of the Rocky Mountains, northern British Columbia; Canadian Society of Petroleum Geologists, Bulletin of Canadian Petroleum Geology, v. 14, p. 504–519..

Pigage, L.C., 2008. Geological map of the Pool Creek area (NTS 95C/5), southeast Yukon (1:50 000 scale); Yukon Geological Survey, Geoscience Map 2008-1, also Plate 1 in Bulletin 16.

Pigage, L.C., 2009. Bedrock geology of NTS 95C/5 (Pool Creek) and NTS 95D/8 map sheets, southeast Yukon; Yukon Geological Survey, Bulletin 16, 150 p.

Pigage, L.C. and Allen, T.L., 2001. Geological map of Pool Creek (NTS 95C/5), southeastern Yukon, 1:50 000 scale; Exploration and Geological Services Division, Yukon Region, Indian and Northern Affairs Canada, Open File 2001-32.

Pigage, L.C. and Mortensen, J.K., 2004. Superimposed Neoproterozoic and early Tertiary alkaline magmatism in the La Biche River area, southeast Yukon Territory; Bulletin of Canadian Petroleum Geology, v. 52, p. 325–342. doi:10.2113/52.4.325

Pyle, L.J. and Barnes, C.R., 2000. Upper Cambrian to Lower Silurian stratigraphic framework of platform-to-basin facies, northeast British Columbia; Bulletin of Canadian Petroleum Geology, v. 48, p. 123–149.

Richards, B.C., 1989: Uppermost Devonian and lower Carboniferous stratigraphy, sedimentation, and diagenesis, southwestern District of Mackenzie and southeastern Yukon Territory; Geological Survey of Canada Bulletin 390, 135 p. doi:10.4095/127662

Rowins, S.M. and Francis, D.M., 1995. The late Tertiary to Recent Beaver River alkaline complex, southeastern Yukon, Canada; Geological Society of America, 1995 annual meeting, Abstracts with Programs – Geological Society of America, 1995, v. 27, Issue 6, p. 46.

Smith, I.R., 2002. Surficial geology, Mount Merrill, Yukon Territory and British Columbia (95C/02); Geological Survey of Canada, Open File 4324; scale 1:50 000. doi:10.4095/213491

Smith, I.R., 2003a. Surficial geology, Chinkeh Creek, Northwest Territories - Yukon Territory; Geological Survey of Canada, Open File 1615. doi:10.4095/214284

Smith, I.R., 2003b. Surficial geology, Etanda Lakes, Northwest Territories - Yukon Territory; Geological Survey of Canada, Open File 1671, scale 1:50 000. doi:10.4095/214291

Stevens, R.D., Delabio, R.N. and Lachance, G.R., 1982. Age determinations and geological studies, K-Ar isotopic ages. Report 15; Geological Survey of Canada, Paper 81-2, p. 21–23.

Stockmal, G.S., Kubli, T.E., Currie, L.D., and McDonough, M.R., 2002. Map symbology and analysis of box and polyclinal folds, with examples from the Rocky Mountain Foothills of northeastern British Columbia and the Liard Ranges of southeastern Yukon Territory and southwestern Northwest Territories; Canadian Journal of Earth Sciences, v. 39, p. 145–155.

Stott, D.F., 1960. Cretaceous Rocks in the region of Liard and Mackenzie Rivers, Northwest Territories; Geological Survey of Canada Bulletin 63, 36 p.

Stott, D.F., 1982. Lower Cretaceous Fort St. John Group and Upper Cretaceous Dunvegan Formation of the foothills and plains of Alberta, British Columbia, District of



Mackenzie and Yukon Territory; Geological Survey of Canada, Bulletin 328, 124 p.  
doi:10.4095/119100

Taylor, G.C. and Stott, D.F., 1973. Tuchodi Lakes map-area, British Columbia;  
Geological Survey of Canada, Memoir 373, 37 p.

Taylor, G.C. and Mackenzie, W.S., 1970. Devonian stratigraphy of northeastern British  
Columbia; Geological Survey of Canada, Bulletin 186, 62 p.

Yukon Geological Survey, 2013. Yukon MINFILE; retrieved 25 July 2013, from  
<http://data.geology.gov.yk.ca/>

Geological Survey of Canada Paleontological Reports (available from GSC Calgary):

Bamber, E.W., 2002. Report on ten collections of invertebrate fossils from the Trutch,  
Fort Liard and La Biche River map areas, northeastern British Columbia, southwest  
District of Mackenzie and southeastern Yukon, submitted by L.S. Lane. NTS 94G, 95B,  
95C; Geological Survey of Canada, Paleontological Report 2-EWB-2002, 6 p.

Haggart, J.W., 2005. Report on an Early Cretaceous fossil from La Biche River map-  
area (NTS 95C), Yukon Territory, submitted by Karen Fallas, Geological Survey of  
Canada, Calgary, AB (1 Lot); Geological Survey of Canada, Paleontological Report  
JWH-2005-03, 4 p.

MacNaughton, R.B., 2002. Report on one sample from Ordovician strata, Pool Creek  
map area, Yukon Territory, collected by Lee Pigage (Yukon Geology Program) and  
submitted for trace-fossil identification; NTS 95C/5; Geological Survey of Canada,  
Paleontological Report 001-RBM-2002, 3 p.

McCracken, A.D., 2003a. Report on 12 conodont samples from Middle Ordovician and  
Devonian strata from British Columbia collected by A. Khudoley and L. Pigage and  
submitted by L.Lane (GSC-C) NTS 94G/12, 95C/04, 95C/05, 95C/11, 95C/12, 95C/13;  
Geological Survey of Canada, Paleontological Report 6-ADM-2003.

McCracken, A.D., 2003b. Report on conodont sample (Con. No. 1674) from Middle  
Ordovician strata from southeastern Yukon Territory collected by R.B. MacNaughton  
(GSC-C) NTS 95C/05; Geological Survey of Canada, Paleontological Report 7-ADM-  
2003.

Norford, B.S., 2001. Report on six collections from the Trutch and La Biche River map  
areas, northern British Columbia and adjacent Yukon Territory submitted by Dr. L.S.  
Lane in 2001 (NTS 94G/04, 95C/05); Geological Survey of Canada, Paleontological  
Report S-3-BSN-2001.

Norford, B.S., 2002. Report on two lots of fossils from the La Biche River map area,  
southern Yukon Territory, Collected by Mr. Lee Pigage and Ms. Tammy Allen in 2001

and submitted by Dr. L.S. Lane in 2001 (NTS95C/5); Geological Survey of Canada, Paleontological Report S-1-BSN-2002.

Norford, B.S., 2005. Report on five samples collected by messrs. Andrei Khudoley and Lee Pigage from the La Biche River map-area, Yukon Territory (NTS 95C/13 & 95C/14) in 2002 and submitted for study in 2005; Geological Survey of Canada, Paleontological Report 02-BSN-2005.

Nowlan, G.S., 2001. Report on one sample from Yukon Territory collected by Larry Lane (GSC Calgary) and submitted for microfossil analysis; NTS 095C/05; Con # 1627; Geological Survey of Canada, Paleontological Report 010-GSN-2001, 2 p.

Nowlan, G.S., 2004. Report on eighteen samples from Cambrian, Ordovician, Silurian and possibly Devonian strata in the southeastern part of Yukon Territory submitted for conodont analysis by Larry Lane, Rob MacNaughton and Karen Fallas (Geological Survey of Canada Calgary) and Lee Pigage and Tammy Allen (Yukon Geological Survey); NTS 095C/05; Geological Survey of Canada, Paleontological Report 002-GSN-2004.

Orchard, M.J., 2004. Report on conodonts and other microfossils. Trutch (94G), Fort Nelson (94J), Fort Liard (95B), and La Biche River (95C), 36 Samples (10 unproductive) collected by L. Lane, L. Pigage, L. Khudoley, and K. Fallas (1997, 1999 - 2002); Geological Survey of Canada, Paleontological Report MJO-2004-5, 16 p.

Utting, J., 1983. Palynological investigation of the Mattson and Kindle formations in subsurface samples of cuttings from the southwest District of Mackenzie, southeastern Yukon Territory, and northeastern British Columbia, submitted by B.C. Richards (NTS 95 B, 95 C, and 94-O); Geological Survey of Canada, Paleontological Report 10-JU-1983.

Utting, J., 2000. Palynological study of 10 samples from the Lower Paleozoic and Proterozoic of Yukon; submitted by T. Allen, Mineral Resource Branch, Whitehorse, Yukon (NTS 95C/5, Pool Creek); Geological Survey of Canada, Paleontological Report 8-JU-00, 5 p.

Utting, J., 2001. Palynological examination of 4 outcrop samples from the Liard area of southeast Yukon and southwest Northwest Territories, submitted by K. Fallas (NTS 95 C/1); Geological Survey of Canada, Paleontological Report 5-JU-2001.

Utting, J., 2004a. Palynological study of 2 outcrop samples from Larsen Lake (La Biche SW) map area, Yukon, submitted by L.S. Lane, GSC (Calgary) (NTS 95C/4); Geological Survey of Canada, Paleontological Report 1-JU-2004.

Utting, J., 2004b. Palynological examination of 3 outcrop samples from the Liard area of southeast Yukon and southwest Northwest Territories submitted by K. Fallas (NTS 95C/08); Geological Survey of Canada, Paleontological Report 06-JU-2004, 4 p.

Utting, J., 2005. Palynological examination of 27 outcrop samples from the Liard area of southeast Yukon and southwest Northwest Territories submitted by L.Lane, GSC (Calgary) (NTS 95B, C, F, G); Geological Survey of Canada, Internal Paleontological Report 02-JU-2005.

White, J.M., 2001. Palynological report on 3 samples of Neocomian, Late Jurassic to Paleogene, and Albian or younger ages, from NTS 95C/01, 07, Yukon, as requested by K. Fallas, GSC, Calgary; Geological Survey of Canada, Paleontological Report 5-JMW-2001, 4 p.

White, J.M., 2005. Palynological report on 13 samples of Mid- and Late Cretaceous age from NTS 94G/16, 95B/01, 04, 05, 95C/03, 06, 08, 10, 106M/13, 107B/02, 04, as requested by L. Lane, Geological Survey of Canada, Calgary; Geological Survey of Canada, Paleontological Report 04-JMW-2005, 8 p.

### **Author Contact**

Questions, suggestions, and comments regarding the geological information contained in the data sets should be addressed to:

K. M. Fallas  
Geological Survey of Canada  
3303 33rd Street N.W.  
Calgary Alberta  
T2L 2A7

### **Coordinate System**

Projection: Universal Transverse Mercator  
Units: metres  
Zone: 10  
Horizontal Datum: NAD83  
Vertical Datum: mean sea level

### **Bounding Coordinates**

Western longitude: 126°00'00" W  
Eastern longitude: 124°00'00" W  
Northern latitude: 61°00'00" N  
Southern latitude: 60°00'00" N

### **Data Model Information**

Surface bedrock data are organized into feature classes and themes consistent with logical groupings of geological features. All field observation point data are related through the Station\_ID property of the Station theme. These feature attribute names and definitions are identical in the shapefiles and the XML files.

Consult PDFs in Data folder for complete description of the feature classes, feature attributes, and attribute domains.

The Bedrock Data Model and the Bedrock Domains documents are intended to describe all bedrock features which may be compiled at the 1:50 000 scale. Therefore, some of the feature classes and feature attributes described in these documents may not be present.

### ***LICENSE AGREEMENT***

View the licence agreement at <http://data.gc.ca/eng/open-government-licence-canada>

### ***ACCORD DE LICENCE***

Voir l'accord de licence à <http://donnees.gc.ca/fra/licence-du-gouvernement-ouvert-canada>