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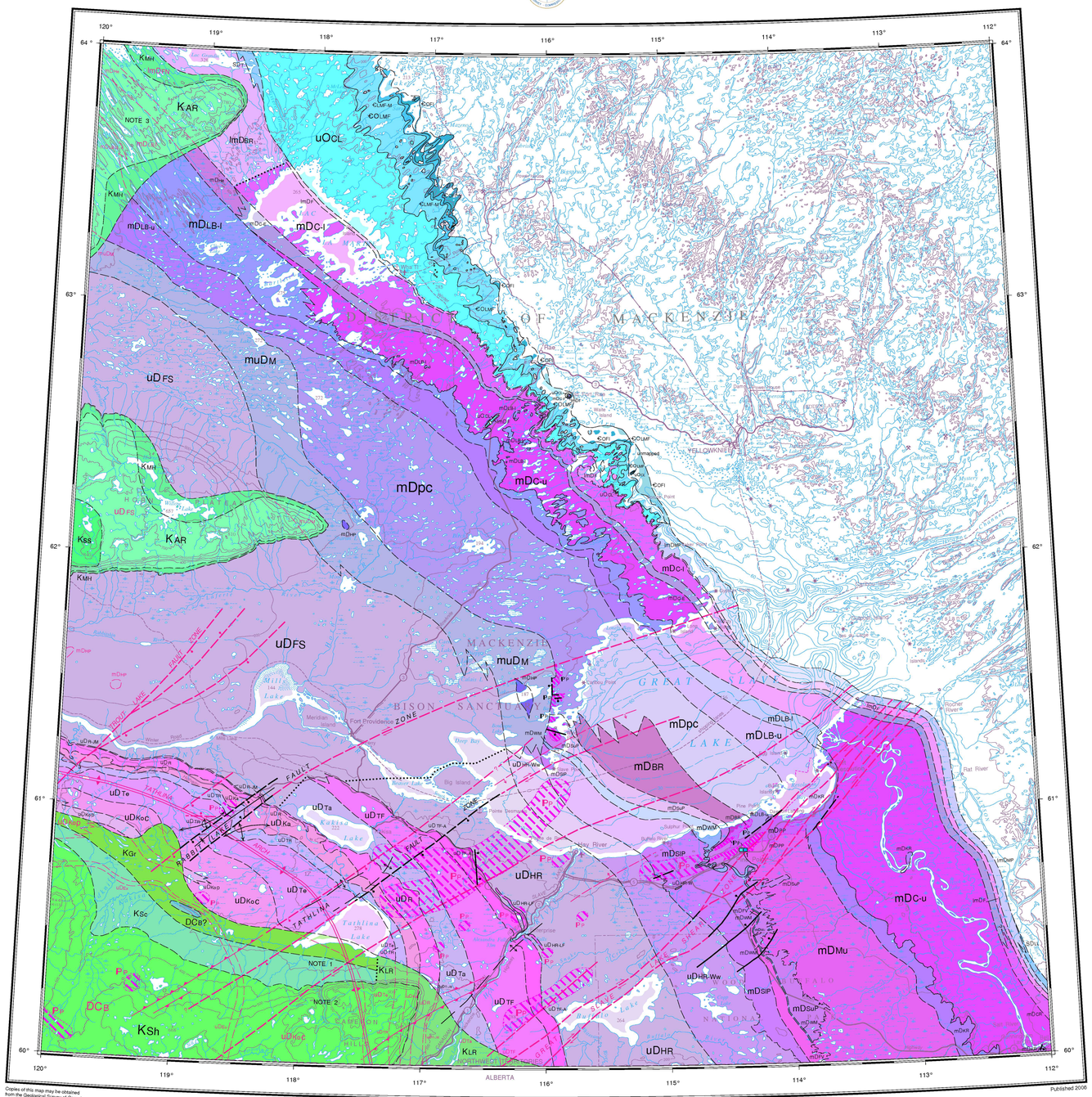

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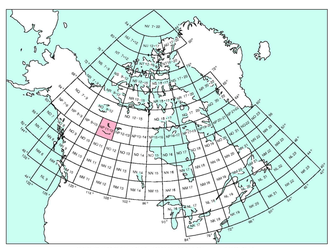

INDEX TO INTERNATIONAL MAP OF THE WORLD
1:1 000 000 SCALE SHEETS

THE NATIONAL EARTH SCIENCE SERIES
GEOLOGICAL ATLAS
GENERAL CO-ORDINATOR: A.V. OKULITCH

MAP NP-11/12-G

PHANEROZOIC BEDROCK GEOLOGY

SLAVE RIVER

DISTRICT OF MACKENZIE

NORTHWEST TERRITORIES

Scale 1:1 000 000

Kilometres 25 0 25 50 75 Kilometres

Lambert Conformal Conic Projection
Standard Parallels 60° 40' N and 63° 20' N

Base map at the same scale, published by Surveys and Mapping Branch in 1975. Bathymetry from Canadian Hydrographic Service charts 6310 and 6370. Not to be used for navigation. Minor revisions from Map MCR 25, scale 1:2 000 000, published by the National Atlas Information Service in 1992.

Elevations in metres above sea level
Depths in metres below mean lake level (1356 m asl)

Copies of the topographical edition of this map may be obtained from the Canada Map Office, Natural Resources Canada, Ottawa, Ontario, K1A 0E8

This 1:1 000 000 scale map is part of the Geological Atlas of Canada and is plotted on the International Map of the World (IMW) base. Bedrock geology is one parameter being published in the National Earth Science Series

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5281
GEOLOGICAL SURVEY OF CANADA
COMMISSION GÉOLOGIQUE DU CANADA
2006

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Canada

LEGEND

MESOZOIC
CRETACEOUS
LOWER CRETACEOUS
ALBIAN AND CENOMANIAN

FORT ST. JOHN GROUP (KGr , KLR, KSc , KSh)

KSh *SHAFTESBURY FORMATION:* shale and siltstone, dark, siliceric; marine, basin

ALBIAN

KSc *SCATTER FORMATION:* shale, siltstone, grey, with sideritic concretions; minor sandstone; marine

KGr *GARBUTT FORMATION:* siltstone and shale, grey; marine

FORT ST. JOHN AND/OR MANNVILLE GROUP

KLR *LOON RIVER FORMATION:* shale, and siltstone, dark grey, with sideritic concretions; minor sandstone; marine

KSS *Rabbitskin sandstone:* sandstone, fine to coarse-grained; shale, carbonaceous; equivalent to Arctic Red or Mahony Lake formations; marine and continental

LOWER AND MIDDLE ALBIAN

KAR *ARCTIC RED FORMATION:* shale, brownish-grey, with thin radioactive shale zones; marine, shelf

UPPER APTIAN AND LOWER ALBIAN

KMH *MARTIN HOUSE FORMATION:* basal sandstone, medium grained to pebbly, crossbedded; interbedded sandstone, siltstone, shale; marine

PALEOZOIC AND(?) MESOZOIC
DEVONIAN TO(?) CRETACEOUS
LATE DEVONIAN TO(?) EARLY CRETACEOUS

PP *PRESQU'ILE dolostone:* dolostone, coarsely crystalline, white, diagenetic; local, karst-associated and stratiform Pb-Zn mineralization; within Givetian strata;
P?P beneath Slave Point Formation; extent constrained by locally sparse well data

PALEOZOIC
DEVONIAN AND CARBONIFEROUS
UPPER DEVONIAN AND CARBONIFEROUS
FAMENNIAN AND TOURNAISIAN

DCB *BANFF FORMATION:* siltstone, with silty limestone interbeds; lesser dolostone, shale, siltstone, sandstone and limestone; cherty, argillaceous and sandy; shale at base; marine, basin to peritidal

DCB sub-Cretaceous

DEVONIAN
UPPER DEVONIAN
FAMENNIAN

sub-Cretaceous: uDEx *EXSHAW FORMATION:* shale, black; marine, basinal, anoxic

WABAMUN GROUP (uDTe to uDKwp)

uDKwp *KOTCHO FORMATION,* shale facies: shale, marly, locally calcareous, grey-green; marine, outer shelf
uDKwp sub-Cretaceous

uDKoc *KOTCHO FORMATION,* limestone facies: limestone, slightly silty, micritic, grey-brown, locally pelletoidal; marine, inner shelf
uDKoc sub-Cretaceous

uDTe *TETCHO FORMATION:* limestone, slightly silty, micritic, brown, massive, pelletoidal, locally bioclastic; minor dolostone, finely crystalline, interbedded with limestone at base; marine, inner shelf
uDTe sub-Cretaceous

FRASNIAN AND FAMENNIAN

uDTR *TROUT RIVER FORMATION:* limestone, partly sandy; marine, shallow shelf
uDTR sub-Cretaceous

FRASNIAN

GRUMBLER GROUP (uDTF-A to uDKa)

uDKa *KAKISA FORMATION:* limestone, quartzose, silty and dolomitic, grey, bioclastic lenses; marine, shallow shelf
uDKa sub-Cretaceous

uDR *REDKNIFE FORMATION:* shale, calcareous and silty, greenish-grey and maroon; minor interbeds of limestone, argillaceous and sandy, thin-bedded, and sandstone, calcareous; marine, shelf
uDR sub-Cretaceous

uDR-JM *REDKNIFE FORMATION, Jean Marie Member:* limestone, argillaceous, silty and dolomitic, bioclastic; marine, shallow shelf

uDTa *TATHLINA FORMATION:* siltstone, calcareous, greenish-grey; shale, silty and sandy; minor limestone, silty, bioclastic; marine, shelf
uDTa sub-Cretaceous

uDTF *TWIN FALLS FORMATION:* limestone, bioclastic; siltstone, calcareous; sandstone and shale, all interbedded; marine, platform
uDTF sub-Cretaceous

uDTF-A *TWIN FALLS FORMATION, Alexandra Member:* limestone, aphanitic, bioclastic and reefy beds at base; shale; marine, platform

uDHR *HAY RIVER FORMATION:* shale, greenish-grey, fissile; lesser limestone, argillaceous and fossiliferous; marine, shelf and slope

uDHR-LF *HAY RIVER FORMATION, Louise Falls Member:* limestone, bioclastic and reefy beds; marine, platform

uDHR-Ww *HAY RIVER FORMATION, Waterways member:* shale, green and grey, fissile; limestone, argillaceous, silty, thin-bedded, locally fossiliferous; marine, shelf

MIDDLE AND LATE DEVONIAN
GIVETIAN AND FRASNIAN

muDM *HORN RIVER GROUP, MUSKWA (SPENCE RIVER) FORMATION:* shale, bituminous, black; local interbeds of limestone, bituminous, shaly; marine, slope and basin
muDM sub-Cretaceous

MIDDLE DEVONIAN
GIVETIAN

mDSiP *SLAVE POINT FORMATION,* Limestone member: limestone, partly dolomitic and anhydritic, aphanitic, micritic and micro-fragmental; fossiliferous; minor interbeds of mudstone, dark, fossiliferous, and limestone, argillaceous; semirestricted marine platform; basal Sleen member: limestone, pyritic, argillaceous; brackish, nearshore

mDFv *FORT VERMILION FORMATION:* interbedded anhydrite, cryptocrystalline, brownish-grey; limestone, greyish-brown, aphanitic; limestone, dark greenish-grey, argillaceous and pyritic; dolostone, pale greyish-brown; minor gypsum; brackish to hypersaline, nearshore

mDWM *WATT MOUNTAIN FORMATION:* shale, silty, pyritic, calcareous, dolomitic, green; sandstone, arkosic or quartzose; limestone, argillaceous, nodular, micro-fragmental, fossiliferous; local basal rubble and breccia; fresh to brackish, nearshore, lagoonal; lacustrine

ELK POINT GROUP
UPPER ELK POINT SUBGROUP (mDLB-u to mDSuP)

mDSuP *SULPHUR POINT FORMATION:* limestone, in part argillaceous, aphanitic to fine-grained, brown, biostromal; local dolostone, coarsely crystalline, white and shale partings, green; marine, lagoonal and reefal to subaerial (equivalent to Muskeg Formation, Blaiche Member)

mDBR *BUFFALO RIVER shale:* shale, pyritic, calcareous, grey to green, fissile; basal limestone, micritic, light grey-brown, bioturbated; thin interbeds of limestone, argillaceous, fine-grained, grey and brown, thin and nodular bedded, sparsely fossiliferous; marine, slope

mDpc *Bituminous shale and limestone beds:* lower marlstone, bituminous, dark, fossiliferous; interbedded with limestone, dark brown, nodular and thin-bedded, fossiliferous; upper limestone, very fine-grained, dark brown and grey, thin-bedded, petroliferous, fossiliferous; lesser shale, bituminous, black; marine, slope

mDMu *MUSKEG FORMATION:* anhydrite and gypsum, white to grey; lesser dolostone, limestone, shale; minor halite; marine, restricted, hypersaline, lagoon (formerly Nyarling Formation)

EIFELIAN AND GIVETIAN

mDHP *HORN PLATEAU reefs:* limestone, light coloured, coarse grained, fossiliferous; marine, reef core, flat and flank
mDHP subsurface; beneath Muskwa Formation

mDPP *PINE POINT dolostone:* dolostone, finely crystalline, brown, diagenetic; upper bed of dolostone, fine-grained, fossiliferous; marine, reef barrier

mDXR *KEG RIVER FORMATION:* lower dolostone, calcareous, fine-grained, light brown; upper dolostone and limestone, in part argillaceous, aphanitic, light brown, thick-bedded to massive, aphanitic, vuggy, reefoid; minor dolostone, gypsiferous; marine, platform (formerly Little Buffalo Formation; includes Chinchaga Formation, Dolostone and Hay Camp members of Norris and Uyeno, 1998)

uDFS *FORT SIMPSON FORMATION:* shale, dark grey and green, fissile; claystone, calcareous, silty, grey; limestone, argillaceous; minor sandstone, thin bedded; marine, turbiditic
uDFS sub-Cretaceous

PALEOZOIC
DEVONIAN
MIDDLE DEVONIAN
EIFELIAN

mDLBu *LONELY BAY FORMATION,* Limestone member: limestone, brown, fossiliferous; minor dolostone; marine, shallow shelf
mDLBu sub-Cretaceous

mDLBl *LONELY BAY FORMATION,* Dolostone member: dolostone, finely crystalline, light, thin-bedded, fossiliferous; marine, peritidal
mDLBl sub-Cretaceous

CHINCHAGA FORMATION (mDCu, mDCE and mDCw)

mDCu *Upper member:* interbedded anhydrite-mudstone, grey, thin-bedded and dolomite-mudstone, anhydritic, brown, thin-bedded; marine and hypersaline, shallow and intertidal

mDCE *Ebbutt Member:* shale, dolomitic, green; basal interbeds of siltstone, dolomitic, argillaceous, grey; upper interbeds of dolostone and anhydrite, pale; brackish, lagoonal, lacustrine

mDHe *HEADLESS FORMATION:* interbedded limestone, grey and brown, and mudstone, calcareous, grey; basal interbedded shale and limestone, argillaceous, grey and green, minor conglomerate; marine, subtidal
mDHe sub-Cretaceous

mDCl *Lower member:* anhydrite-mudstone, grey; local shale, green and dolomite-mudstone, pale; marine, nearshore, peritidal, lagoonal

mDCR *CONTACT RAPIDS FORMATION:* dolostone and sandstone, argillaceous, red and grey; continental, lacustrine and marine, peritidal

LOWER AND(?) MIDDLE DEVONIAN
ZLICHOVIAN (EMSIAN), DALEJAN AND(?) EIFELIAN

mDBR *BEAR ROCK FORMATION:* dolostone, in part anhydritic, crypto- to finely crystalline; anhydrite, dolomitic, microcrystalline, grey; anhydrite, fine to coarsely crystalline, white, nodular-bedded; carbonate-evaporite breccia; equivalent to Fort Norman Formation; marine to hypersaline, restricted, tidal to subtidal, sabkha
mDFn sub-Cretaceous

mDF *FITZGERALD FORMATION:* dolostones, argillaceous, anhydritic and peloidal, grey and brown; dolostone and limestone, conglomeratic, brown, fossiliferous; marine, restricted to hypersaline, lagoonal (also called Fitzgerald member, Mirage Point Formation and equivalent to Ernestina Lake Formation in the subsurface)

mDMP *MIRAGE POINT FORMATION:* dolostone, interbedded sandy and argillaceous, red; shale, dolomitic, red and green; lesser gypsum, anhydrite; subsurface halite; marine, restricted; hypersaline, lagoonal and continental; lacustrine

SILURIAN (?) AND DEVONIAN
UPPER SILURIAN (?) AND LOWER AND(?) MIDDLE DEVONIAN
LUDFORDIAN (?) TO LOCHKOVIAN (OR?) EIFELIAN

SDLL *LA LOCHE FORMATION:* sandstone, arkosic and dolomitic, conglomeratic, red and grey; interbeds of shale, sandy; continental, fluvial to marine, nearshore (includes 'Basal Red Beds' unit)

SDT *TSETSO FORMATION:* dolostone, finely crystalline, grey; sandstone, dolomitic, fine- to medium-grained; dolostone, argillaceous, grey; shale, brown; minor anhydrite; marine, nearshore

ORDOVICIAN
UPPER ORDOVICIAN
RICHMONDIAN

uOCL *CHEDABUCTO LAKE FORMATION:* dolostone, fine-grained, brown, thick-bedded to massive, in part vuggy; dolostone, cherty, and sandy; shale, grey; marine, platform (equivalent to 'Mount Kindle Formation')

CAMBRIAN AND ORDOVICIAN
MIDDLE CAMBRIAN TO MIDDLE ORDOVICIAN

COLMF *LA MARTRE FALLS FORMATION:* shale, ferruginous, green and red, fissile; dolostone, argillaceous and silty, grey; salt crystal casts; minor sandstone, fine-grained, grey; marine, platform, in part restricted (equivalent to Mount Cap, Saline River and lowermost Mount Kindle formations)

CAMBRIAN
MIDDLE CAMBRIAN

COLMF-M *LA MARTRE FALLS FORMATION, Mazenod Member:* dolostone, grey and brown, nodular-bedded; sandstone, quartzose; basal conglomerate, polymictic; continental, lacustrine and marine, peritidal

LOWER AND(?) MIDDLE CAMBRIAN

COFI *OLD FORT ISLAND FORMATION:* sandstone, quartzose, fine- to coarse-grained, grey and white, thick- to thin-bedded, some crossbedded; some thin beds of siltstone, greenish-grey and dusky red; minor laminae of shale, green and sandstone, argillaceous, olive green; continental, lacustrine to marine, shallow

Geological contact; stratigraphic conformable, stratigraphic unconformable, intrusive (approximate, assumed)
Line of nomenclature change
Facies change (approximate, assumed)
Diagenetic front (approximate, assumed)
Fault, displacement unknown (approximate, assumed)
Normal fault, solid circle on hanging wall (approximate, assumed)
Strike-slip fault, dextral, sinistral, arrows indicate relative movement (approximate, assumed)
Anticline (approximate, assumed)
Syncline (approximate, assumed)
Direction of plunge of folds (approximate, assumed)
Subsurface geological contact; stratigraphic, conformable, stratigraphic unconformable, intrusive (assumed)
Subsurface diagenetic front (assumed)
Subsurface fault, displacement unknown (assumed)
Subsurface normal fault, solid circle on hanging wall (assumed)
Subsurface thrust fault, teeth on hanging wall (assumed)
Subsurface strike-slip fault, dextral, sinistral, arrows indicate relative movement (assumed)
Subsurface arch, anticlinorium, uplift (assumed)
Subsurface monocline (assumed)

MINERAL OCCURENCES

MAP NO.	PROPERTY	COMMODITIES	DEPOSIT TYPE	MAP UNIT	STATUS
1	Pine Point	Pb, Zn	stratified sedimentary	PP / mDSuP	reserves; past production

DEPOSIT TYPE

Stratified sedimentary

METALS / MINERALS

Lead
Zinc

DEPOSIT SIZE - TONNES OF CONTAINED METAL / MINERAL

(Size reduced on map for clarity)

Cu, Ni, Cr, Pb, Zn $> 10^7$

DEPOSIT STATUS

The commodity is no longer produced although there are known reserves, reserves, past production

FAULT NOMENCLATURE

The terms Hay River Fault or Fault Zone are not used in this compilation because they have been applied by various authors since 1959 to four discrete zones of deformation between Tathlina and Buffalo lakes. Not any of the recent applications follow the original definition and only one un-named zone actually lies along the Hay River. The terms have been obscured by mis-application and misunderstanding and are best abandoned unless formally redefined in the wake of further study.

NOTE 1

Division of the Fort St. John Group in this region is based upon regional paleogeographical reconstructions and extensions of contacts mapped in adjacent areas and is conjectural. The location of the nomenclature change approximates the change from strata with Cordilleran provenance to deposits of the marine basin, which are derived from the craton, highlands to the south and the Cordillera.

NOTE 2

East of 119°W in the Cameron Hills, Cretaceous strata may only occur as scattered remnants beneath thick Quaternary cover. Some Quaternary and Paleozoic strata may have been misidentified as Cretaceous (Dixon, 1999).

NOTE 3

Division of Cretaceous strata in this area is unconstrained by surface or subsurface data and is conjectural.

COMPILER'S NOTE

Published geological maps from the Slave River area are mostly based on reconnaissance mapping done 30 to 45 years ago, and the scattered well core and seismic data available when the maps were compiled (Norris, 1965; Douglas, 1974; Douglas and Norris, 1974; Douglas, et al., 1974) . At least one concurrent, wide-ranging thesis study (Richmond, 1965) was not integrated into these publications, and much subsurface information, particularly around the Pine Point Pb-Zn deposit was unavailable. The very poor outcrop in most parts of the area (except of the Precambrian crystalline rocks), the sometimes conflicting interpretations of well cores and uncertainties about the genesis of the Presqu'ile dolomite, led to a complex and not ways consistent nomenclature for the Cambrian to Devonian strata.

In the past 20 years, availability of considerable subsurface information from the Pine Point deposit (eg. Rhodes, et al., 1984) extensive study of well cores combined with better paleontological control and understanding of facies relationships (eg. Williams, 1977, 1981a, b, c; Halbertsma and Meijer Drees, 1987; Meijer Drees, 1993, Norris and Uyeno, 1998) and modern models of dolomite diagenesis (eg. Morrow, 1998) resolved many of these problems and permited the erection of a regional consistent stratigraphic nomenclature and facies model. This progress left the available maps incomplete and inconsistent with the subsurface data and regional models.

The present 1:1 000 000 scale Phanerozoic bedrock geology map takes as its primary guides the mapping of Douglas, et al. (1974), Richmond (1965) and Meijer Drees, (1975) for the Cambrian and Ordovician strata northwest of Great Slave Lake, and the comprehensive study of Devonian strata by Meijer Drees (1993). The mapping of Rhodes, et al. (1984) is used in the Pine Point mine area. The subsurface stratigraphic model is projected into the plane of the map, allowing for the trends of facies changes and pinch-out and dissolution of strata updip. The pervasive absence of outcrop permits considerable latitude in the portrayal of units and their inter-relationships. Beginning with the published maps, it is possible to apply the newer nomenclature and to add inferred units and sub-units wherever their extent can be deduced from subsurface information. Similarly, it is possible to plausibly extend contacts across the bottom of Great Slave Lake and beneath Cretaceous strata. Finally, using the latest compilations of aeromagnetic data (W. Miles, personal communication, 2002), new compilations of lineaments and basement contour maps from adjacent areas to the south (Pană, et al., 2001), and seismic studies (MacLean and Morrow, 2001; Morrow, et al., 2002) it is possible to portray numerous basement faults. Some of these are known to have become active during the Phanerozoic and are instrumental in controlling platformal facies development and subsequent fluid flows, diagenisis and mineralization.

Significant mineralization occurs at Pine Point, a former producing mine extracting lead and zinc from ore bodies hosted in a middle Givetian carbonate barrier complex. The complex underwent karst formation, diagenesis and mineralization during eight episodes possibly throughout mid-Devonian to Cretaceous time (Krebs and MacQueen, 1984). Diagenesis formed the Presqu'ile dolomite and paleokarst solution channels and chimney-like structures developed at the base of the Presqu'ile. Metals were carried by chloride-rich brines possibly expelled by burial or tectonic over-pressures from the westerly-adjacent deep basin or extracted from subjacent shear zones in crystalline basement, and deposited in cavities in the karst and in porous strata of the lower Pine Point Formation. Production and reserves exceed 85 million tons of 3% Pb and 6.5% Zn. In the subsurface, the Presqu'ile dolomite (Williams, 1982; Meijer Drees, 1993; Janicki, in press) occurs west and southwest of Pine Point but wells are widely spaced in some areas and do not permit complete delineation of the extent of the diagenetic facies throughout the region. Some occurrences appear to be spatially associated with major fault zones or deflections in the basement surface.

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Any revisions or additional geological information known to the user would be welcomed by the Geological Survey of Canada

Map NP-11/12-G, Phanerozoic Bedrock Geology

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