MARGINAL NOTES

BEDROCK TOPOGRAPHY

... Paleozoic section (Winnipeg and Red River formations) as a prominent, buried escarpment, up to 40 m high, within Lake Winnipeg. This escarpment represents the Precambrian-Paleozoic boundary (G. Matile, pers. comm., 2002; see cross-section B-B').

The 'Bedrock Topography' inset map shows an irregular surface characterized by erosional lows more than 50 m in depth. These lows may be the result of karst topography (i.e., sinkholes), channel erosion or structural faulting. Some of these deeply incised topographic lows in the Paleozoic bedrock have been infilled by Cretaceous outliers. These outliers occur throughout the area of the map sheet; eighteen are known to exist. At one time, the area may have been covered by Mesozoic sediments that were subsequently eroded.

The 'Bedrock Topography' inset map reflects regional trends in the rock surface and does not necessarily account for local fluctuations. In areas with Paleozoic bedrock, local fluctuations commonly occur as karst depressions, resulting in anomalous depth to bedrock values. Alternatively, in areas underlain by Precambrian bedrock, east and north of Lake Winnipeg, local relief on the bedrock surface can be as much as 20 m and the depressions are commonly filled with Quaternary sediments (see cross-section B-B').

PRECAMBRIAN UNCONFORMITY

The Precambrian strata are unconformably overlain by basal Paleozoic sandstone of the Middle Ordovician Winnipeg Formation. The Precambrian surface is interpreted to have been peneplaned, but numerous irregularities are present in this area (see 'Precambrian Topography' inset map; Bezys and McCabe, 1996).

In the William Lake area, mineral-exploration drilling by Falconbridge Ltd. encountered topographic highs over the Precambrian surface as great as 35 m, between holes less than 1 km apart. Their drilling targeted the Precambrian along the SBZ, and such extreme variations on top of the Precambrian suggest the existence of faulting or tectonic reactivation of faults affecting the Paleozoic strata (Bezys, 1996a).

Near Bracken Lake (Twp. 54, Rge. 16, W 1st Mer.), Falconbridge Ltd. drillhole BL-94-77 indicated a Precambrian structural low of approximately 145 m below the normal structural elevations. This low consisted of 85 m of possible Cambrian Deadwood Formation, which overlies weathered Precambrian granitic fault breccia. Since the Deadwood Formation is present only in southwestern Manitoba, the Bracken Lake low may be a graben structure that sheltered the strata from erosion.

The Norris Lake anomaly is a Precambrian structural high located in 19-51-15-W1, 8 km south of Norris Lake. This 61 m high was encountered in drillhole MXD-72-1 by Amax Exploration Ltd. Two metres of extensive brecciation and carbonate-quartz-pyrite veinlets were intersected between the overlying Paleozoic sediments and the Precambrian (B. Bannatyne, internal government document, 1981).

The Denby structure is situated in 46-16-W1, south of the village of Easterville. The Precambrian surface is 107 m above the normal structural elevations and coincides with the outline of a strong aeromagnetic high. The Cominco Denby number 2 drillhole, drilled in 1971, intersected 91.4 m of red, blue and grey clay containing a thick layer of uniformly sorted, fine-grained sand with abundant marcasite nodules. Between 91.4 and 114.0 m, a sequence of sand-clay-limestone was encountered. Paleozoic dolomite was present between 114.0 and 130.1 m, and Precambrian serpentine was intersected at 130.1 m. Winnipeg Formation was absent in this hole. These data are interpreted to indicate that 80 to 105 m of local, post-Ordovician, probably pre-Mesozoic structural uplift occurred (McCabe, 1978).

Thirteen kilometres northwest of the Denby structure is Cominco's drillhole RP-96-21, which intersected Cretaceous accretionary lapilli in a pre-Mesozoic channel (Bezys et al., 1996). Micropaleontology data from the sedimentary rocks indicate they are of Mesozoic age (A.R. Sweet, internal government report, 4-ARS-1997). The lapilli occur at the base of a channel cut into the Paleozoic and infilled with strata of Mesozoic age. The Mesozoic infill consists of light brown and tan to white (some red), very fine grained, consolidated and unconsolidated sand, silt and clay. Interbedded with these sediment types are minor amounts of black shale and sand. The interval 133.1 to 136.6 m contains a light brownish tan lapilli tuff with small accretionary lapilli, 0.1 to 2 cm in size. Thin sections indicate that the lapilli beds are composed of fresh, intermediate volcanic and pyroclastic rocks. Accretionary lapilli usually fall within a few kilometres of the eruptive vent and are rare at distances greater than 20 km (Bezys et al., 1996). There are no known eruptive volcanoes in the vicinity of Denbeigh PointEasterville. The Paleozoic strata adjacent to this erosional channel do not appear to be otherwise disturbed.

The Ochre Lake structure is an area of disturbance that has affected the Silurian bedrock. A disturbed zone, approximately 100 m wide, contains sideritized carbonate breccia, abundant clay (ochre-like) and siliceous boulders. The East Arm Formation dolomite beds are extremely jointed and discoloured (Bezys, 1996b). All of the above anomalous structures occur within the Paleozoic along strike with the SBZ. Structural cross-section A-A' indicates a relatively flat topped Precambrian surface, with a slight flexure at the extreme western end of the section. Again, this part of the section lies on top of the SBZ. Datum for this cross-section is hung on the 'T-zone' marker bed.

PALEOZOIC

REGIONAL STRUCTURAL GEOLOGY

Regional strike of the sedimentary strata is approximately north-south, with the exception of a slight northwesterly strike adjacent to the north edge of the map sheet. The regional structural dip increases gradually and uniformly from about 1.0 m/km at the western shore of Lake Winnipeg to 1.5 m/km in the western part of the map sheet. Despite the regional structural dip to the west, isopachs of the Winnipeg to Stonewall formations generally trend east (see Winnipeg, Red River, Stony Mountain and Stonewall isopach inset maps), and thicken to the south. This indicates a major change in tectonic framework subsequent to early Paleozoic time. The current north-striking structural trend probably developed during the late Paleozoic to early Mesozoic, due to uplift with associated erosion and eventual exposure of Precambrian bedrock in eastern Manitoba (the Severn Arch). See Bezys and McCabe (1996) for further details.

CAMBRIAN

Deadwood Formation

The Deadwood Formation occurs in this map sheet as outliers in two localities. In both localities, it was intersected in a drillhole below a sequence of Silurian and Ordovician rocks. The Deadwood Formation in these holes consists of a complex sequence of dark grey, micaceous, argillaceous siltstone to sandstone. In places, the unit is crossbedded, with intervals of disrupted laminations. At Bracken Lake, the Falconbridge Ltd. drillhole BL-94-77 encountered 85 m of Deadwood Formation and the Precambrian is structurally low, at 145 m. The other occurrence is at the Denby structure and has not been clearly identified as Deadwood Formation. The presence of this stratum so far removed from the actual Deadwood Formation subcrop indicates that the formation was regionally present in this area but subsequently eroded. It is suggested that the intersected Deadwood Formation represents remnants preserved in a graben-like structure.

ORDOVICIAN

Winnipeg Formation

The Winnipeg Formation in this map sheet consists of interbedded sandstone, siltstone and minor shale. Regionally, the formation thins and becomes increasingly sandy to the north, in comparison to southern map sheets (McCabe, 1978). The sand is poorly consolidated, medium grained, mature, well rounded and quartzose; the shale is commonly light olive-grey and kaolinitic, with variable sand and silt content. The maximum thickness of the Winnipeg Formation in NTS 63G is 27 m (averaging 9 m; see Winnipeg Formation isopach inset map).

Red River Formation

Winnipeg Formation sandstone and shale are overlain conformably and transitionally by mottled dolomitic limestone of the Red River Formation, 11 to 97 m in thickness (averaging 51 m; see Red River Formation isopach inset map). The transition zone consists of a thin sequence of interbedded limestone and shale, termed the 'Hecla Beds' (Porter and Fuller, 1959). The Red River Formation consists of two principal subunits, the lower Red River and upper Red River, which can be distinguished in this map sheet. The lower Red River is approximately equivalent to the Yeoman Formation in Saskatchewan. Lower Red River strata consist of light grey to yellowish and brownish buff, prominently mottled, fossiliferous, commonly cherty dolomite. The unit cannot be subdivided into its constituent members (Dog Head, Cat Head and Selkirk, in ascending stratigraphic sequence) in this map sheet, since they occur in southern Manitoba only. The upper part of this unit, equivalent to the Selkirk 'Tyndall Stone™', is extensively quarried at Garson in southern Manitoba.

The upper Red River strata, consisting of dolomite and argillaceous cherty dolomite, is designated the Fort Garry Member. These beds are approximately equivalent to the Herald Formation in Saskatchewan. Thin argillaceous breccia zones are believed to represent zones where evaporites have been dissolved by subsurface dissolution.

Stony Mountain Formation

The Red River Formation is overlain sharply, and possibly with slight disconformity, by shaly beds of the Stony Mountain Formation. In NTS 63G, the Stony Mountain Formation ranges in thickness from 11 to 40 m (averaging 29 m; see Stony Mountain Formation isopach inset map). In Manitoba, this formation is subdivided into three members, in ascending stratigraphic order, the Gunn, Penitentiary and Gunton members. In NTS 63G, this subdivision in not present and the entire unit is Gunton-like, specifically a buff, finely crystalline, sparsely fossiliferous, nodular-bedded dolomite. In southern Manitoba, the Gunton Member is extensively used for crushed stone, extracted from quarries in the Stonewall area.

ORDOVICIAN/LOWER SILURIAN

Stonewall Formation

The Williams Member, herein placed as the basal unit of the Stonewall Formation, represents the oldest in a series of so-called 'paratime-stratigraphic' markers: thin sand and/or argillaceous beds that can be traced for many hundreds of kilometres, throughout most of the Williston Basin area. These marker beds provide the primary means for stratigraphic subdivision of Upper Ordovician and Silurian strata, and probably represent deposits related to brief periods of shoaling or even slight uplift and erosion (i.e., nonsequences; Porter and Fuller, 1959).

The lower Stonewall beds, above the Williams Member, consist of approximately 7 m of pale yellowish grey to yellowish brown, faintly mottled, medium- to thin-bedded, finely crystalline dolomite with sparse, poorly preserved fossils. These beds are separated by a sandy argillaceous marker bed, the 'T-zone', from the upper Stonewall Formation (Porter and Fuller, 1959). The upper Stonewall beds consist of approximately 6 m of light brown to grey, laminated to thin-bedded, sparsely fossiliferous microcrystalline dolomite. The formation is capped by a thin, argillaceous marker bed, called the 'Upper Stonewall Member'. In this map area, the Stonewall Formation can reach a thickness of 35 m (averaging 20 m; see Stonewall Formation isopach inset map). The Ordovician-Silurian boundary occurs within the upper part of the Stonewall sequence, associated with the T-zone (Bezys, 1991; Haidl, 1991).

SILURIAN

Interlake Group

The Interlake Group in this map area comprises a 0 to 76 m (averaging 30 m) sequence of dolomite, ranging from variably fossiliferous and stromatolitic to predominantly finely crystalline and dense to sublithographic. The Silurian occurs as exposed bedrock over large expanses of this map sheet and is severely eroded in places. Minor lithological variations, along with the occurrence of several thin, sandy, argillaceous marker beds, are used to subdivide the Interlake Group into the following members (in ascending stratigraphic order): Fisher Branch, Moose Lake, Atikameg, East Arm and Cedar Lake.

MESOZOIC OUTLIERS

Outliers of Mesozoic age are abundant in NTS 63G as channel infill within the Paleozoic bedrock. There are 18 known occurrences in the map area, all but one having been identified in mineral-exploration drillholes; the exception is the outcrop exposure at Ochre Lake. The rocks range from varicoloured shale and siltstone to sandstone, and may contain lignite fragments, bentonite seams and accretionary lapilli (as discussed above). Preliminary micropaleontological work on the sediments indicate a Barremian to Middle Albian age (Cretaceous; A.R. Sweet, internal government report, 4-ARS-1997).

QUATERNARY

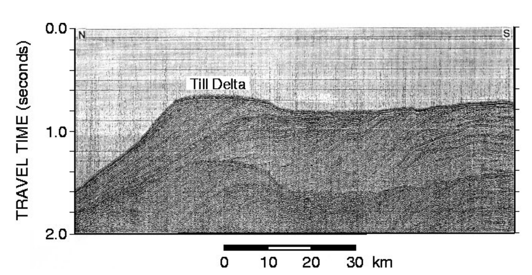
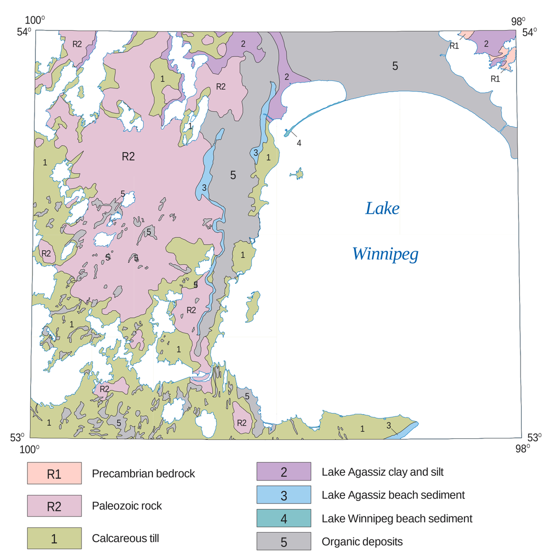


Figure 1: Seismic profile from the bed of the Ross Sea, Antarctica, showing stratigraphic relationships attributed to the formation of a till delta (West Antarctic Ice Sheet Working Group, 1994).

SURFICIAL GEOLOGY



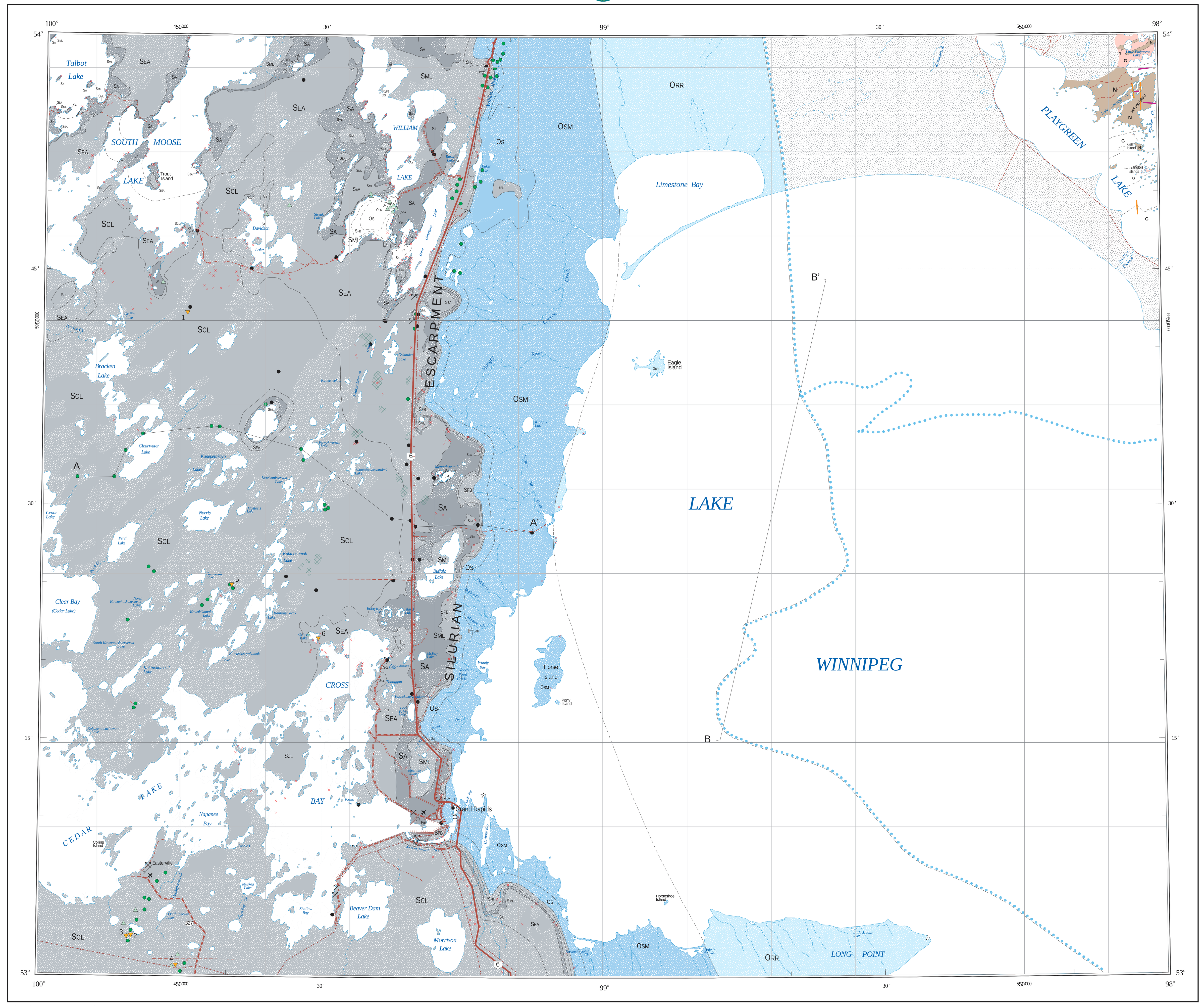
ECONOMIC GEOLOGY

PRECAMBRIAN

Superior Province

Superior Boundary Zone

Trans-Hudson Orogen

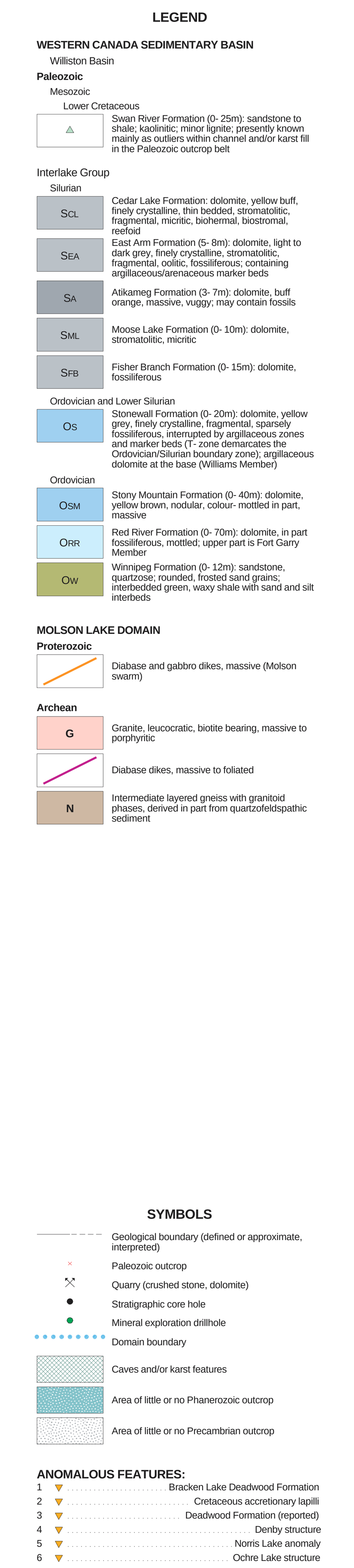


Universal Transverse Mercator Projection
Zone 14 North American Datum 1983

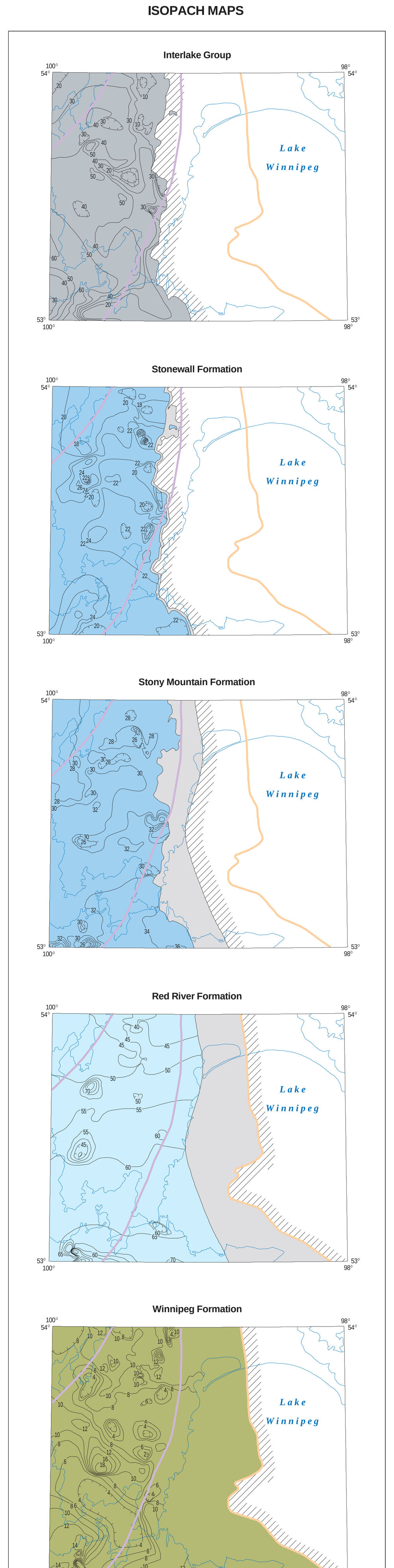
Scale 1:250 000

Printed 2002

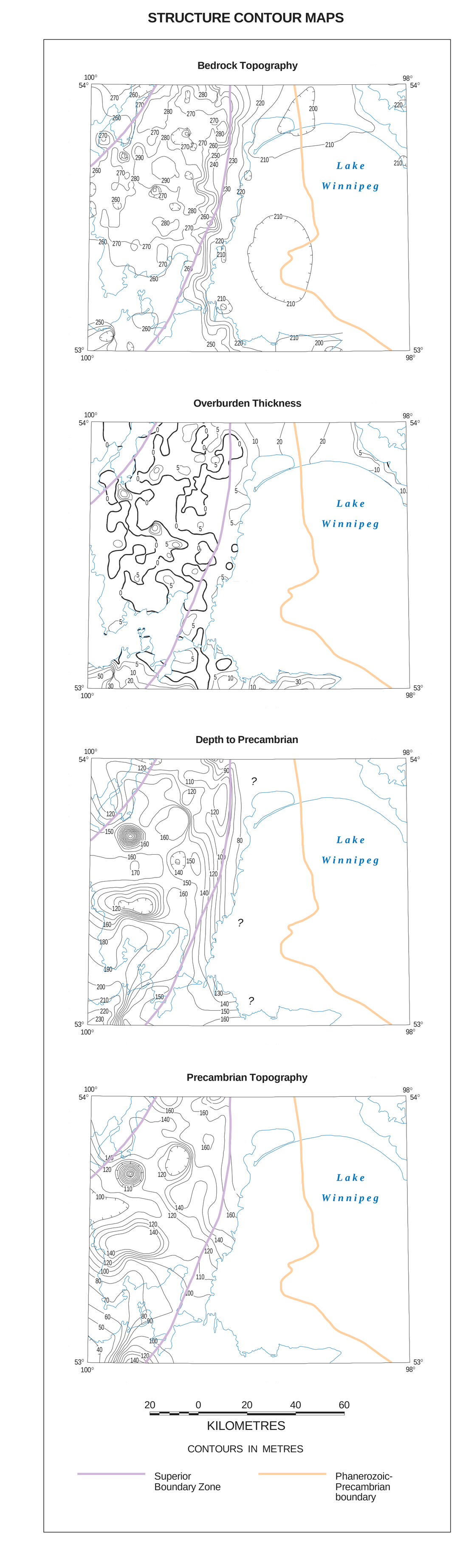
LEGEND



ISOPACH MAPS



STRUCTURE CONTOUR MAPS



Approximate mean declination (2002) for centre of map
Decreasing 7.8' annually

Synoptic geology by R. Bezys, with contributions by C.R. McGregor, G.L.D. Matile, J.D. Bamburak, H.D. Groom and G.R. Keller

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Digital CAD drafting by T. Franceschet

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GIS Cartography by L. Chackowsky

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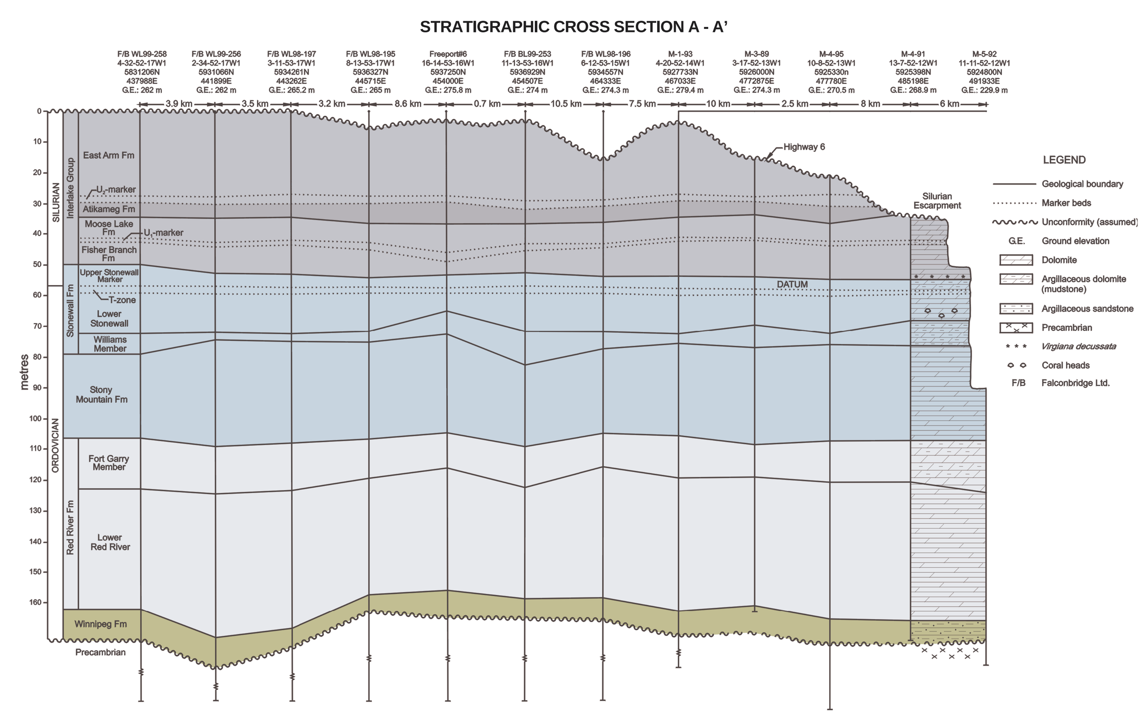
BEDROCK GEOLOGY COMPILATION MAP SERIES

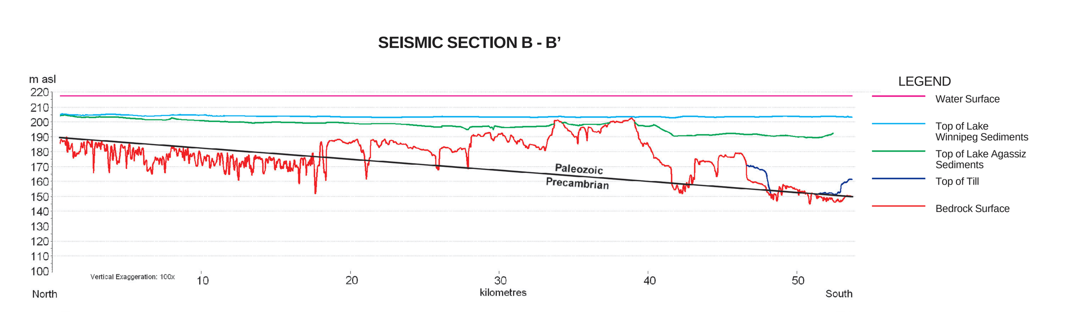
GRAND RAPIDS

NTS 63G

STRATIGRAPHIC CROSS SECTION A - A'



SEISMIC SECTION B - B'



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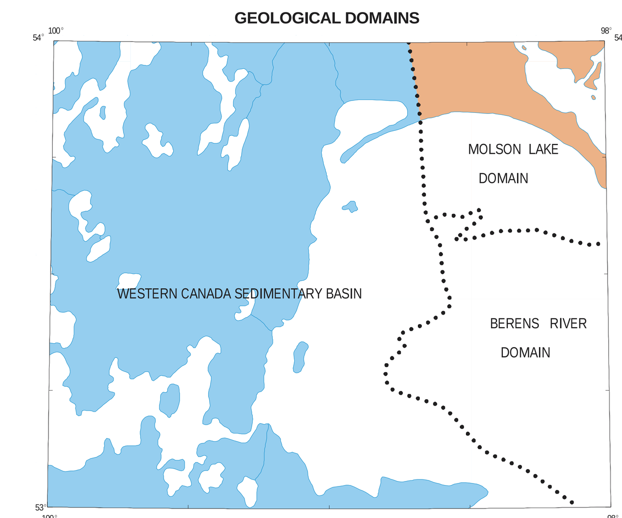

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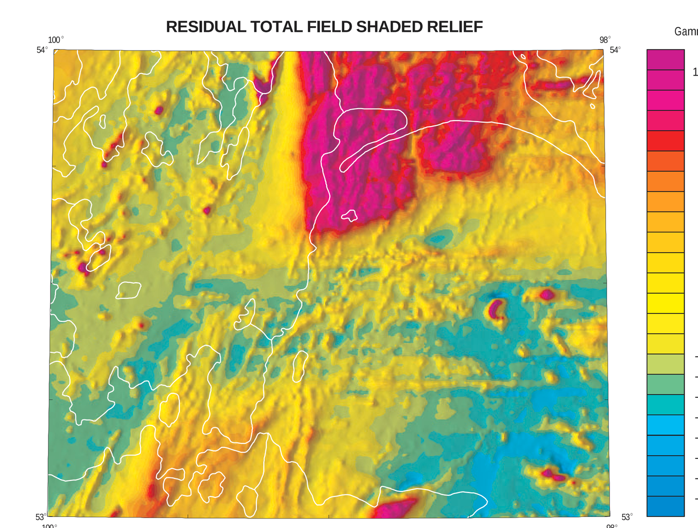

INDEX MAP AND MAJOR TECTONIC DIVISIONS

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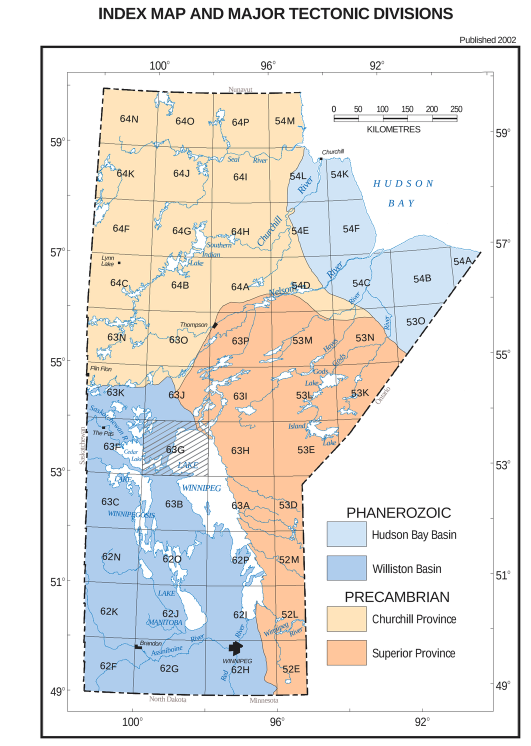
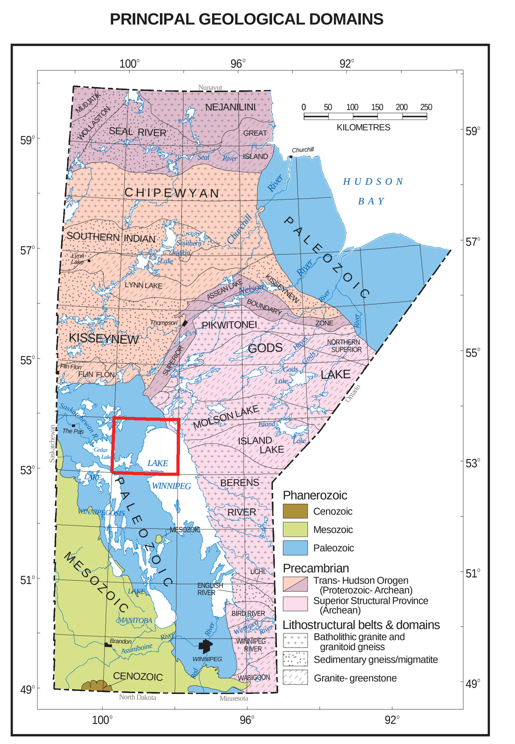
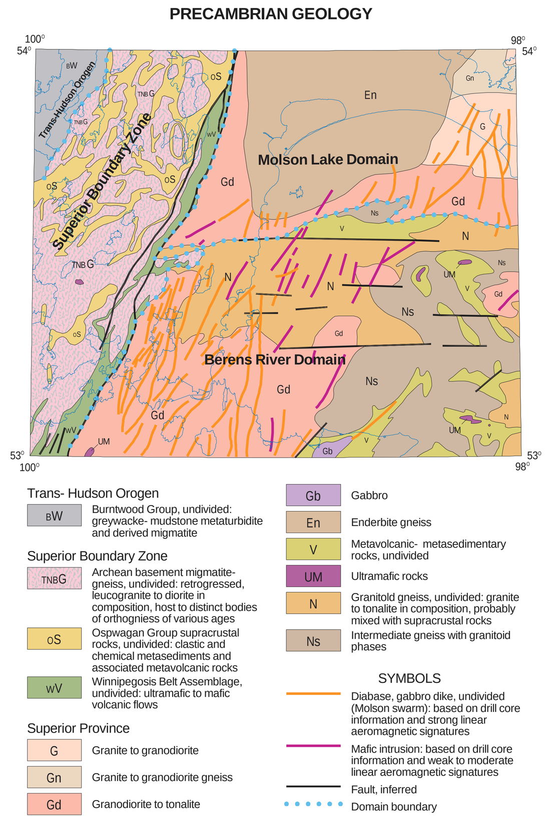


PRINCIPAL GEOLOGICAL DOMAINS



PRECAMBRIAN GEOLOGY



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