The Kettle Rapids map area (NTS 54D) is underlain by the Precambrian Shield and the Paleozoic Hudson Bay Basin in the northeast. The Precambrian Shield consists of the Proterozoic Churchill Structural Province, the Churchill - Superior Boundary Zone, including the dominantly Archean Split Lake block and the northwestern termination of the Proterozoic Fox River belt. Granulites of the Superior Province (Pikwitonei domain) are interpreted to occur (but are not exposed) in the extreme southwest corner of the map area.

Churchill - Superior Boundary Zone

The Churchill - Superior Boundary Zone comprises the Split Lake block, the western termination of the Proterozoic Fox River supracrustal belt and cataclastic zones at the southern and northern margins of the Split Lake block.

The Split Lake block is composed predominantly of Archean gneisses and intrusive rocks representing retrograded and deformed granulite grade assemblages, enclaves of granulites and late Archean granitic rocks.

Inclusions of felsic granulite (O) and hypersthene-bearing amphibolite (Ah), in the southern half of the Split Lake block, are interpreted to be equivalent to units mapped in the adjacent Pikwitonei domain to the south. Retrograde granulites include amphibolite and metagabbro (A), diopside-bearing massive and layered amphibolite (Ah), garnetiferous amphibolite (Ag), anorthosite (I) and tonalite (T). These rocks are intruded and migmatized by late Archean granite to granodiorite (G, Gh), and the Gull Lake granite (GLG), which has a Rb-Sr whole rock isochron age of 2600 ± 75 Ma (Clark et al., 1974). This granite-granodiorite forms the neosome in hornblende and hornblende-biotite lit par lit gneisses (Nn), which represent the dominant rock type in the western segment of the Split Lake block (NTS 64A). The youngest rock recognized in the Split Lake block is the Fox Lake granite (FG), which postdates the 1884 ± 2 Ma Molson dykes (Machado et al., 1986).

Proterozoic migmatites (N) composed of reworked Archean migmatites and gneisses form two linear belts that parallel the major cataclastic zones across Gull Rapids and the south shore of Split Lake extending up the Aiken River.

The western end of the Proterozoic Fox River belt is concealed beneath the drift covered south central portion of the map area. The boundaries of the belt and subdivision of supracrustal rocks and ultramafic intrusive rocks are based on geophysical interpretation and limited drill core.

Metasedimentary rocks of the lower sedimentary formation (LS) include siltstone, marble and iron formation (LSi). Metabasalts and gabbro of the lower volcanic formation (LV), along the northern margin, are in contact with Kisseynew gneisses. Several ultramafic intrusions (LU) occur in metasedimentary rocks that are intercalated with metabasalt.

A small outlier of thin-bedded greywacke and siltstone outcrops at the east end of Gull Rapids. These metasediments are unlike Burntwood greywacke gneisses to the east and are interpreted to represent a fault bounded block of Fox River belt metasedimentary rocks within the Churchill - Superior bound-

The Assean Lake cataclastic zone extends from NTS 64A into NTS 54D. It follows the 60° trend of the Assean River and is interpreted to continue along the northern margin of the Split Lake block to the Gull Rapids cataclastic zone, at the Nelson River, in the centre of NTS 54D. All rocks in this zone show ubiquitous, but variable degrees of brittle deformation and minor recrystallization at greenschist metamorphic grade. This cataclastic zone contains rocks from different domains. At the western margin of NTS 54D, along the Assean River, recognizable Kisseynew domain rocks (sMS, BW), supracrustal rocks (oV) related to Thompson belt Ospwagan Group and Split Lake block units (N, FG,) occur between faults on the north side of a major mylonite zone. The fault zone at Gull Rapids contains Proterozoic migmatites (N) and granite (Ge) of the Split Lake block, Ospwagan Group supracrustal rocks (oV) and much less metamorphosed thin-bedded greywacke and siltstone interpreted as lower sedimentary formation (LS) of the Fox River belt.

The Split Lake - Aiken River cataclastic zone, marks the south boundary of the Split Lake block. It extends from the Assean Lake fault zone on the Burntwood River (NTS 64A), west of Split Lake, outheastward across the southwest margin of the map area. This cataclastic zone is similar in character to the Assean Lake cataclastic zone. Reworked Archean migmatites (N) with variable cataclastic deformation predominate. Extensive steeply dipping mylonites (M) form a linear eastsoutheast fault zone.

Churchill Province

The Kisseynew domain is a metasedimentary gneiss belt that flanks the Leaf Rapids domain on the south and is truncated by the Churchill - Superior boundary zone in the southwest. It is composed of paragneiss, amphibolite and migmatite derived from Lower Proterozoic sedimentary and subordinate volcanic strata. This belt has undergone upper amphibolite facies metamorphism and polyphase deformation. The supracrustal succession consists of three divisions:

from graphitic greywacke-mudstone turbidites (Gilbert et al., 1980); Ag) derived from mafic volcanic rocks and clastic to chemical sedimentary rocks; and

(1) the lowest division (Burntwood River Metamorphic Suite) (BW) is composed of

(3) the upper division (Sickle Metamorphic Suite) conformably overlies the middle division. A relatively consistent stratigraphic succession in this suite is defined by a) hornblende-bearing quartzofeldspathic gneiss (sMWh), b) feldspathic metagreywacke (sMWb), c) sillimanite-bearing meta-arkose (SMSs), and d) garnet-cordierite-sillimanite-magnetite-bearing metagreywacke. Metaconglomerate (SMC) is typically associated with the hornblende-bearing quartzofeldspathic gneiss and/or feldspathic metagreywacke. In areas of poor outcrop or highly migmatized zones, nondivided Sickle Metamorphic Suite rocks (sмS) are composed of quartz-feldspar-rich gneiss ± hornblende, or ± sillimanite derived from lithic sandstone, calcareous sandstone and arkose.

NOTE: In the region from Long Spruce Dam upstream to Gull Rapids and all of Stephens Lake, Manitoba Hydro projects have significantly raised water levels. The geology shown on the map is taken from pre-flood mapping programs reported in the Lower Nelson River Project (Corkery, 1985). However, only few outcrops are still exposed.

The Leaf Rapids domain, north of the Kisseynew domain, is predominantly an intrusive terrane that contains the 1876 +8/-7 Ma old Rusty Lake metavolcanic belt (Baldwin et al., 1987) in NTS 64B to the west. The eastern part of the domain, in the extensive drift covered Limestone River area, is dominated by widely separated clustered outcrops of intrusive rocks in which supracrustal rocks of uncertain age occur as rafts and narrow belts. The intrusive rocks are grouped into two associations:

and/or Rusty Lake metavolcanic rocks, include hornblende and hornblende-biotite orthogneiss (Nh) and granodiorite to tonalite gneiss (Gi). These are generally highly foliated gneisses with abundant rafts of Campbell - Waskaiowaka sedimentary paragneiss (cwS) and rare amphibolites (A); and b) Intrusive rocks associated with the 1855 Ma (average age) Chipewyan batholith (Van Schmus and Schledewitz, 1986). These include porphyritic pink granite-quartz monzonite (Gp), mag-

a) Older intrusive rocks, associated with Campbell - Waskaiowaka metasedimentary rocks

netite-clot pink pegmatite and schlieric granite (Gm), and leucogranite (Gl). Included within this association are intrusive rocks of similar age ranging in composition from tonalite to Within the granitic rocks are screens of supracrustal rocks interpreted to be Wasekwan Group amphibolite (A) and Campbell - Waskaiowaka metasedimentary rocks. These include: arkosic gneiss

matites. The metasedimentary gneisses may be Sickle equivalents. A northeast-trending strong geophysical anomaly that parallels the Little Churchill River in the northwest corner of the map sheet is interpreted to be an extension of the Owl River shear zone (NTS

The Chipewyan domain batholithic complex, underlying the predominantly drift covered northwest margin of the map area in the Recluse Lake area, comprises three major components: 1) porphyritic pink granite-quartz monzonite (cGp);

2) seriate to porphyritic granite with pegmatite and aplite (cGr); and

3) magnetiferous syenogranite; hornblende-pyroxene bearing (cZp). Van Schmus and Schledewitz (1986), report a mean age of 1855 \pm 10 Ma for granitic rocks of the chipewyan complex in the Big Sand Lake area. To the west of Recluse Lake, on the Gauer River NTS 64B), a U-Pb zircon age from porphyritic granite (BLGp) in the Baldock batholith (NTS 64A) provided a preliminary age of 1855 \pm 30 Ma (Van Schmus, unpublished data).

Tectonic Synopsis

The rocks in NTS 54D have been affected by deformation and metamorphism of the Trans-Hudson orogen. This orogen is an early Proterozoic collisional belt with remnants of early Proterozoic oceanic and island arc rocks between Archean cratons comprising the Superior Province and the Hearn/Nain (Northwest Churchill) Province (Hoffman, 1988). Assuming a northwest dipping subduction polarity, the following tectonic elements are represented in the Kettle Rapids area (NTS 54D):

 Foreland Zone comprises the Churchill Superior boundary zone. Thrusting of the Reindeer zone (see below) onto the Superior craton is interpreted to be the cause of the highly tectonized nature • Internal Reindeer Zone is made up of juvenile Proterozoic island arc successions (volcanic, volcaniclastic and plutonic rocks, and younger molasse type sedimentary rocks) of the Leaf Rapids

domain and supracrustals (volcanogenic sediments) of the Kisseynew domain. Internal structures and tectonic relationships between the domains is poorly understood; Chipewvan Batholith is an Andean type large batholithic complex with subduction related and arc magmatic chemical characteristics. It extends along the southeastern edge of the hinterland not exposed in the area of NTS 54D;

Spilt Lake block is interpreted to represent a portion of the Archean craton that was dislocated by a late Archean tectono-metamorphic event and probably further modified during terminal Hudsonian

Fox River belt sequence is interpreted to represent an intracratonic basin deposited on Superior Province gneisses at the margin of the craton. The supracrustal rocks were subsequently thrust to the south onto the Superior craton (Scoates, 1981). Kisseynew gneisses to the north in turn have been thrust 80 km or more over the lower metamorphic grade Fox River belt (Weber, 1991).

PALEOZOIC

The Hudson Bay Basin in Manitoba comprises a sequence of Ordovician, Silurian and Devonian rocks; they consist largely of limestone and dolomitic limestone with minor shale, siltstone and sandstone and represent mostly shallow, open platform, marine to restricted marine environ deposition with minor continental influence (Cumming, 1971). In NTS 54D, outcrops of Ordovician strata are present along the banks of the Nelson River and were first reported by Bell (1879) and Savage and Van Tuyl (1919). These rocks were later studied in detail by Nelson (1964) who formalized much of the Ordovician stratigraphic nomenclature for the Hudson Bay Basin. Further investigations were carried out under Operation Winisk (Sanford et al., 1968; Norford, 1971 and Cumming,

HUDSON BAY BASIN

In the early 1960s, mineral exploration drilling by Kennco in the northeast corner of NTS 54D provided some insight into the subsurface stratigraphy and confirmed the exsistence of paleo-erosion channels that had been indicated by earlier EM surveys (McCabe, 1990, personal communication). These features may represent either Mesozoic or Pleistocene glacial erosional events that cut through the complete Paleozoic sequence and into the Precambrian. Further drilling by Manitoba Hydro along the Nelson River has provided additional stratigraphic information (Bezys, 1990). Since completion of the Limestone Generating Station, outcrops of Ordovician rock upstream from the dam (Cumming, 1971) are now flooded. Ordovican rocks are still exposed downstream of the dam.

ORDOVICIAN

Rapids domain.

BAD CACHE RAPIDS GROUP The Bad Cache Rapids Group (Nelson, 1964) nonconformably overlies peneplaned Precambrian rocks. The group is divided into the Portage Chute and Surprise Creek formations (in ascending stratigraphic sequence).

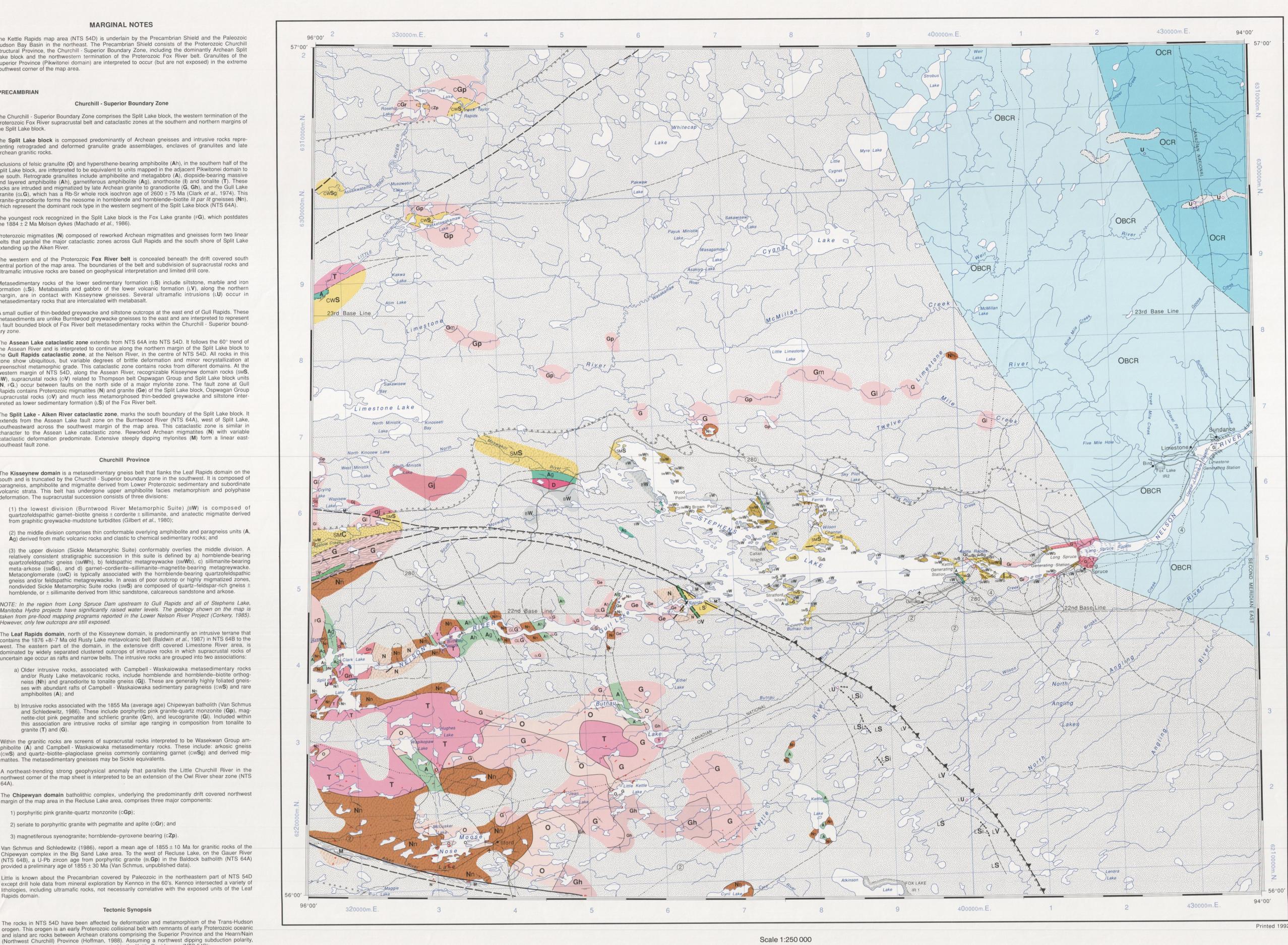
An informal lower member consists of a 1 to 2.5m basal calcareous quartz sandstone in NTS 54D. Minor argillaceous, green-grey siltstone beds occur with some burrow mottling and pyrite mineralization. This unit can be tentatively correlated with the Winnipeg Formation in the Williston Basin (southern Manitoba). The lower member is overlain conformably and transitionally by a ca. 25m microcrystalline, nodular, bioclastic limestone that locally is dolomitic. It is correlatable with the lower Red River Formation of the Williston Basin. Excellent outcrops of the Portage Chute Formation are present on the north and south shores of the Nelson River, downstream from the Limestone Generating Station.

The Surprise Creek Formation conformably overlies the Portage Chute Formation and consists of a ca. 15m microcrystalline, slightly bioclastic, cherty calcitic dolomite to dolomitic limestone. Locally it is slightly argillaceous. It is correlated with the upper Red River Formation (Fort Garry Member) in southern Manitoba. No outcrops occur in NTS 54D and its presence is inferred from outcrops and subsurface studies to the east of the map area.

CHURCHILL RIVER GROUP The Bad Cache Rapids Group is disconformably overlain by the Churchill River Group, which was divided into two formations (Caution Creek and Chasm Creek, in ascending stratigraphic sequence) by Nelson (1964). The Caution Creek Formation is a microcrystalline, sublithographic, slightly argillaceous, calcitic dolomite. It ranges in thickness from ca. 5-10m in NTS 54D and is correlated with the Gunn and lower Penitentiary members of the Stony Mountain Formation of the Williston Basin (Nelson and Johnson, 1966).

The presence of the Surprise Creek Formation is inferred from outcrop and subsurface data in NTS 54C, whereas the Caution Creek Formation is inferred from subsurface correlations only. The Chasm

Creek Formation is not discussed in detail because it is not present in NTS 54D.



Churchill River Group: Caution Creek Formation: microcrystalline, sublithographic, slightly argilla-Bad Cache Rapids Group: Portage Chute Formation*: basal calcareous quartz sandstone (~ 1 2.5m) overlain by microcrystalline, nodular, bioclastic limestone, slightly dolomitic in places (± 25 m) Surprise Creek Formation: microcrystalline, slightly bioclastic, cherty calcitic dolomite to dolomitic limestone, slightly argillaceous; minor anhydrite and halite casts (± 15m) * Formations described in ascending stratigraphic PRECAMBRIAN CHURCHILL - SUPERIOR CHURCHILL PROVINCE **BOUNDARY ZONE** KISSEYNEW DOMAIN LEAF RAPIDS DOMAIN CHIPEWYAN DOMAIN Proterozoic M Layered mylonite Mylonite, protolith unknown Cataclastic Rocks Cataclastic granite to tonalitic gneiss, derived from all granitic and felsic gneisses below Chipewyan Batholithic Complex Leucocratic granite, with biotite and garnet (Fox Lake granite) Homogeneous grey granite; GI - Leucogranite, cGp - Porphyritic pink granite-quartz monzonite Seriate pink granite, locally porphyritic; with locally with abundant rafts of amphibolite/ cGp cGr - seriate to porphyritic pink granite with pegmatite and aplite gabbro/metabasalt; Gp - porphyritic pink pegmatite and aplite granite-quartz monzonite; Gm - magnetite clot, pink pegmatite and schlieric granite; T Tonalite to granite c**Zp** Syenogranite Tonalite to granite Granodiorite to granite gneiss, commonly seriate, with dioritic schollen and skialiths Hornblende and hornblende-biotite gneiss of unknown affinity G Granodiorite-granite Diorite, metagabbro Sickle Metamorphic Suite Campbell - Waskaiowaka Sediments Campbell - Waskaiowaka Sediments Sickle Metamorphic Suite (undivided); smS Arkosic gneiss; cwSg - quartz-biotite-plagioclase cwS Arkosic gneiss (of uncertain affinity) (patterned) arkosic metatexite gneiss, commonly containing garnet Gabbro or diabase dyke (Molson swarm) Metagreywacke, garnet-cordierite-sillimanitemagnetite bearing (Odei River equivalent?) Ultramafic rocks intersected by drilling (Lower SMSs Meta-arkose, sillimanite-bearing gneiss differentiated mafic-ultramafic intrusion) Lower volcanic formation; basalt and komatiitic Quartzose, conglomeratic paragneiss sMWb - feldspathic greywacke-psammitic gneiss; LS - Lower sedimentary formation; siltstone, argillite, biotite-magnetite gneiss; smWh - hornblendebearing quartzofeldspathic gneiss, greywackelimestone, sandstone derived; sMW - (patterned) migmatite, greywackederived; smWh - (patterned) migmatite LSi - hematite/magnetite iron formation **Burntwood River Metamorphic Suite** Amphibolite; Ag - garnet amphibolite and associated Ospwagan Group Amphibolite garnet-biotite gneiss Compositionally layered amphibolite derived from basalts and mafic to felsic volcanogenic sediments Greywacke gneiss, garnet-biotite bearing; locally with staurolite; BW - (patterned) migmatite Ultramafic rocks intersected by drilling Proterozoic and/or Archean U • Ultramafic rocks Migmatite complex; well foliated and discontinuously layered gneiss, comprising reworked Archean migmatites and intrusive rocks Granodioritic gneiss; highly foliated and thinly laminated gneiss derived from Nn below Archean G - granite, granodiorite, containing nebulitic zones

LEGEND

Paleozoic

Ordovician

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< 1:50 000

≥ 1:50 000 < 1:100 000

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(RESIDUAL TOTAL FIELD) +200 +175 +150 +125 +100 +75 +50 +25 0 -25 -50 -75 -100 -125 -150 -175 -200 -225 GAMMAS

MAJOR DOMAINS

KISSEYNEW DOMAIN

LEAF RAPIDS DOMAIN

Split Lake Block

96° PIKWITONEI DOMAIN

MAGNETIC ANOMALY MAP

1. The map units within each domain are in approximate

2. Legend boxes to the right of the column (Churchill - Superior

Boundary Zone) indicate interpreted units in areas of overburden.

Boundary Zone may not correlate with adjacent domains.

nronological order. However, some units in the Churchill - Superior

Foliation and parallel primary layering (60°-79°, 80°-90°) Foliation (± parallel layering), metamorphic layering (dip unknown, 0°-29°, 30°-59°, 60°-79°, 80°-90°) Thrust fault Area of little or no outcrop Paleozoic outcrop Precambrian outcrop exposed at low water levels

SYMBOLS

Geological boundary (approximate, inferred from aeromagnetic and electromagnetic

True North 2°38′ E Approximate mean declination (1992) for centre of map Decreasing 8.0' annually

Synoptic geology by M.T. Corkery, W.D. McRitchie, R.K. Bezys and C.R. McGregor Compilation by D. Lindal Cartography by T. Franceschet

Manitoba Energy and Mines, 1992; Bedrock Geology Compilation

Suggested reference to this publication:

Map Series, Kettle Rapids, NTS 54D, 1: 250 000.

INDEX MAP AND MAJOR TECTONIC DIVISIONS 98° 94° 90° PHANEROZOIC Hudson Bay Basin

of highly assimilated older gneiss; GLG - Gull Lake

granite; Ge - massive to foliated grey granite, as dykes, sills and irregular bodies; Gh - granite with rafts and partially assimilated inclusions of O

Hornblende and hornblende-biotite gneiss, comprising mobilized and injected layered gneiss

10% to 75% tonalite to granodiorite lits

containing up to 25% inclusions of A below

Felsic granulite, opdalite

granofels

BEDROCK GEOLOGY COMPILATION MAP SERIES

KETTLE RAPIDS

NTS 54D

and agmatites derived from T and A (below), with

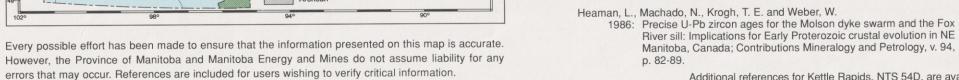
Tonalite-granodiorite with hornblende clots,

Amphibolite and metagabbro; Ag - garnet

amphibolite and garnet-diopside-hornblende-

plagioclase granofels; Ah - amphibolite and

hornblende-diopside-plagioclase ± hypersthene



LITHOLOGIES

Sedimentary rocks

Granitoid gneisses and granulites

Sedimentary gneiss and granitoids

ultrama(ics; granulites

Early Proterozoic

Metavolcanics, metasediments and granitoids

Granitoids, metasediments, metavolcanics and

Granitoids

Granulites

PRINCIPAL GEOLOGICAL DOMAINS

NEJANILINI

CHIPEWYAN

SOUTHERNMOHAND

102° 98° 94° 90° 86°

HUDSON