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GEOLOGICAL SURVEY OF CANADA | COMMISSION GÉOLOGIQUE DU CANADA

DESCRIPTIVE NOTES

The Gods Lake map area, of approximately 176 000 km^2 in northwestern Ontario and north-eastern Manitoba, includes parts of the Precambrian Superior Province and Trans-Hudson Orogen of the Canadian Shield and part of the Phanerozoic Hudson Bay Basin. The Canadian Shield is the peneplained Severn Upland with low relief, heavy drift cover and sporadic bedrock exposure. The Hudson Bay Basin, part of the Hudson Bay Lowlands, is a flat plain largely covered by bogs and swamps, poorly drained by river systems incised into thick Pleistocene glaciogenic deposits.

The Archean Superior Province in the Gods Lake map area includes parts of the Berens River, Sachigo, and Pikwitonei subprovinces and is bounded to the north by Proterozoic rocks of the Trans-Hudson Orogen. The poorly exposed Superior - Trans-Hudson boundary is a zone several kilometres wide of Archean rocks that have been orogenically reworked during the Proterozoic.

The Berens River Subprovince is mainly massive and foliated to gneissic plutonic rocks of intrusive origin with only minor remnant supracrustal, greenstone belt sequences. The plutonic rocks are generally divisible into early sodic suites, mainly pre- to synkinematic, metamorphosed gneissic and foliated tonalite, and younger more massive, syn- to post-kinematic potassic suites, commonly granodiorite, granite, monzonite and syenite. U-Pb zircon ages, mainly on the younger plutonic suites, range from 2768 to 2696 Ma; in southern Berens River Subprovince, older gneissic plutonic rocks have yielded zircon ages of ca. 3000 Ma. Berens River Subprovince is traversed by several northwest-trending dextral shear zones and faults; one, the Favourable Lake Fault, is chosen as the boundary between the Berens River and Sachigo subprovinces.

Sachigo Subprovince comprises numerous narrow, sinuous, partly interconnected remnant greenstone belts surrounded and intruded by voluminous granitoid rocks. The northwest and east - west trending greenstone belt successions are commonly cyclical and typically comprise lower, pillowed tholeiitic mafic volcanics and upper, diverse calc-alkalic and tholeiitic mafic - felsic sequences with clastic and chemical sediments. Several belts, notably the North Spirit Lake and Opapimiskan Lake belts, have relatively mature sedimentary rocks, including quartz arenite, quartz pebble conglomerate, and stromatolitic marble. The volcanic sequences have zircon ages of 2720 to 2760 Ma and 2850 to 3050 Ma. Komatiitic volcanics are present in several belts, as are shoshonitic and alkalic volcanics with fluviatile clastic sediments, late sequences that unconformably overlie older volcanics and synvolcanic plutons. Several of these younger sequences, for example the Oxford Lake and Island Lake groups, have U-Pb zircon ages of ca. 2705 Ma. Plutonic rocks of Sachigo Subprovince are generally similar to those of Berens River Subprovince, including older, gneissic and foliated sodic suites and younger, massive, potassic suites. Locally, as along the Berens River - Sachigo boundary, there are bodies of peraluminous, mineralogically complex granite and pegmatite. Early tonalitic gneisses have U-Pb zircon ages of 3000 to 2880 Ma. Younger quartz diorite, tonalite, and granodiorite plutons, some of which are synvolcanic, others syn- to late-kinematic with respect to major deformation, range in age from 2783 Ma to 2729 Ma. Late, post-kinematic plutons are 2715 Ma to 2650 Ma. The ages of the plutonic and volcanic rocks bracket the age of the last major deformation and metamorphism in this part of the Superior Province between 2729 Ma and 2700 Ma.

Deformation was polyphase with early ductile folding producing upright, plunging isoclines in the supracrustal rocks and dome and basin structures in the gneissic domains. Later, increasingly brittle deformation resulted in formation of northwest-trending dextral and minor northeast-trending sinistral faults and shear zones. Deformation was accompanied by intermediate-pressure, Barrovian-type greenschist to amphibolite facies regional metamorphism. Static, low pressure, Abukuma-type metamorphic aureoles surround some granitic intrusions.

Rocks of the Pikwitonei Subprovince, a poorly-exposed east-west belt of high grade gneisses along the northern margin of the Superior Province, are bounded on the north by gneisses of the Superior-Churchill boundary zones, the retrograded equivalents of the Pikwitonei gneisses that have been tectonically reworked during Proterozoic orogenic events. The Pikwitonei rocks are mainly granulite facies, migmatitic enderbitic gneisses derived mainly from tonalitic intrusions with remnants of supracrustal rocks, chiefly amphibolite, metasediments such as iron formation, and layered mafic - ultramafic - anorthositic complexes. These rocks have been deformed and metamorphosed under granulite facies conditions at temperatures of about 800°C and pressures of 7 to 8 Kb. U-Pb ages of metamorphic zircon from outside the map area indicate that metamorphism occurred at 2744 - 2738 Ma and again at 2686 - 2637 Ma. Uplift of the Pikwitonei granulites to form an oblique, northward and westward deepening crustal cross-section may be related to Early Proterozoic plate-style collisional events involving the Superior Archean craton and elements of the Proterozoic Trans-Hudson Orogen. These events culminated after emplacement of the Molson dyke swarm some 1884 Ma ago.

Rocks of the Trans-Hudson Orogen in the northern part of the map area include Early Proterozoic (Aphebian) strata of the Fox River belt and high-grade metasediments that are possibly equivalent to the Kisseynew metasedimentary gneisses of west-central Manitoba. The rocks of the Fox River belt, the Fox River Group, form an east-west trending, north-dipping sequence of low-grade, little deformed Early Proterozoic (Aphebian) sediments and mafic - ultramafic volcanics with several differentiated mafic - ultramafic intrusions, the largest being the Fox River sill with a zircon age of 1884 ± 2 Ma. The contact between the Fox River Group and deformed retrograde gneisses of the Superior - Trans-Hudson boundary zone is probably tectonic. Early Proterozoic (Aphebian) carbonatite - alkalic complexes and northeast-trending, mafic - ultramafic dykes of the 1884 Ma Molson swarm cut the rocks of the Superior Province. Northwest trending mafic dykes of the Mackenzie swarm, with an age of 1270 ± 5 Ma, cut rocks of the Superior and Trans-Hudson terranes.

The Hudson Bay Basin of the Hudson Platform contains Ordovician and Silurian carbonates and minor clastics up to 500 m thick in the Gods Lake area. From their erosional edge bordering Severn Arch, they dip northeastward into the basin where they are overlain by younger Silurian, Devonian and Cretaceous strata reaching a total thickness of over 2200 m.

The oldest strata, the Late Ordovician (Edenian) Bad Cache Rapids Group, consist largely of limestone of subtidal origin. This contains a thin (< 1 m) layer of sandstone, shale and conglomerate at its base, representing the initial deposits of the Paleozoic sea as it slowly encroached upon the irregular surface of the Canadian Shield.

Conformably succeeding the Bad Cache Rapids Group with gradational contact is black, shaley petroliferous limestone of the Boas River Formation. Of probable subtidal origin, the beds were apparently deposited under similar anaerobic conditions as equivalent Maysvillian strata that are preserved in widely separated segments of the St. Lawrence Platform, far to the southeast.

Succeeding the Boas River Formation with gradational contact is the Late Ordovician Maysvillian (?) to Richmondian limestone and interbedded dolostone and minor shale of the Churchill River Group. As in preceding units, the beds accummulated in broad open platform marine conditions that prevailed across a wide segment of the Canadian craton, extending from the Williston Basin in the south to the Arctic Platform in the north.

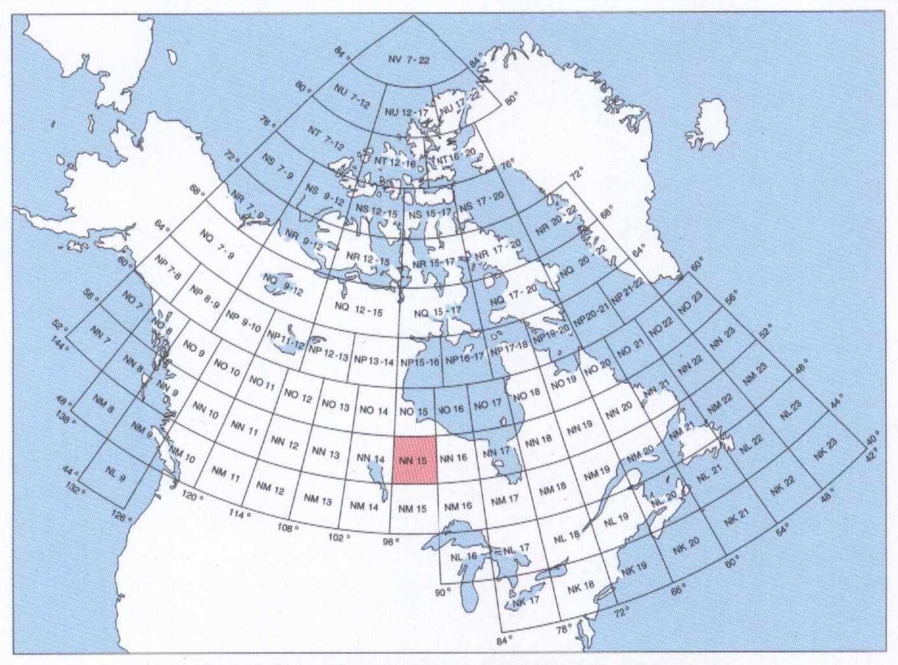
Completing the Ordovician succession are the laminated dolostone and minor evaporite of the Red Head Rapids Formation of probable Richmondian to Gamachian age. Interbeds of gypsum, anhydrite and halite, most common in its upper part, point to deposition in a restricted marine environment that temporarily prevailed as the Ordovician Sea regressed from the central segment of the craton.

Early Silurian Llandovery limestone and interbedded dolostone of the Severn River Formation succeed Ordovician strata with disconformable contact. The renewed transgression provided open platformal marine subtidal and periodic tidal flat environments that prevailed to the end of the Early Silurian. The Severn River Formation is in turn conformably overlain by dolostone and cherty dolostone of the Ekwan River Formation. These give place vertically and in part laterally to reef platformal dolostone with massive biostromes and bioherms of the Attawapiskat Formation. The latter facies formed a broad barrier reef complex completely encircling the Hudson Bay Basin, a phenomenon that continued up to at least latest Llandovery time.

Following the Ekwan River / Attawapiskat depositional cycle, uplift of the Severn and Cape Henrietta Maria arches segmented the Hudson Platform into the Hudson Bay and Moose River basins. Certain segments of the Hudson Platform were uplifted to such elevations that they remained emergent until late Middle Devonian (Givetian) time.

Vein deposits of gold, copper, lead, and zinc are present in the Archean rocks of Sachigo Subprovince. Chromite and platinum group elements occur in the Protérozoic Fox River sill. Porphyry-style Cu - Mo mineralization is present in the Favourable Lake area and there are occurrences of rare-element and uranium-bearing pegmatites in Berens River and Sachigo subprovinces.

Paleozoic strata may contain oil and gas in deep segments of the Hudson Bay Basin. Basal sandstone of the Bad Cache Rapids Group and the Attawapiskat reefs have reservoir potential and Boas River petroliferous limestones have good hydrocarbon source rock potential. Some carbonate units, notably the reef facies, could contain suitable host-rocks for lead and zinc.



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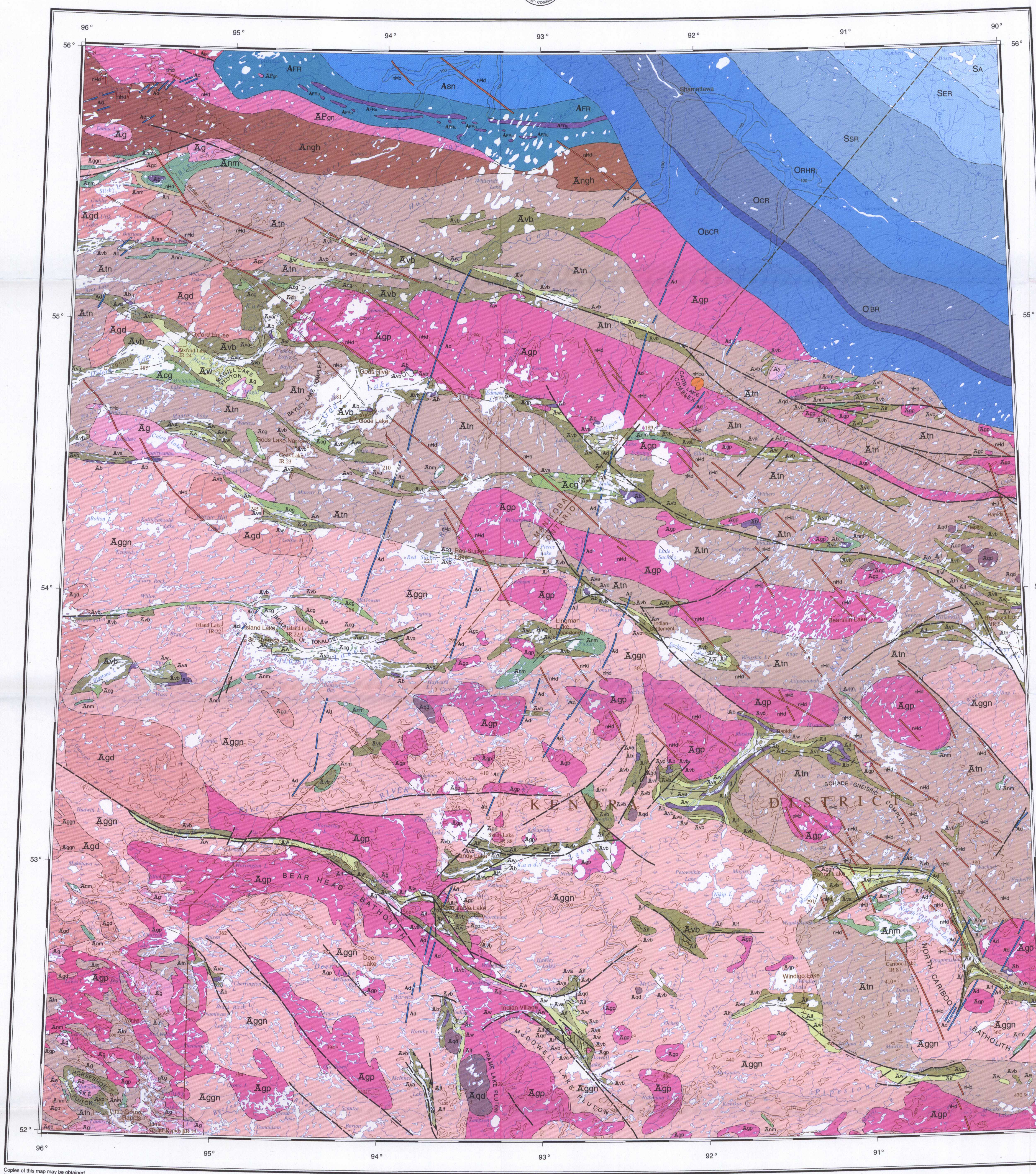
1:1 000 000 SCALE SHEETS



Copies of this map may be obtained
from the Geological Survey of Canada:
601 Booth Street, Ottawa, Ontario K1A 0E8
3303-33rd Street N.W., Calgary, Alberta T2L 2A7
100 West Pender Street, Vancouver, B.C. V6B 1R8

LEGEND

PALEOZOIC
SILURIAN
LOWER SILURIAN

- SA — ATTAWAPISKAT FORMATION
- SER — EKWAN RIVER FORMATION
- SSR — SEVERN RIVER FORMATION

ORDOVICIAN
UPPER ORDOVICIAN

- ORHR — RED HEAD RAPIDS FORMATION
- OCR — CHURCHILL RIVER GROUP
- OBR — BOAS RIVER FORMATION
- OBCR — BAD CACHE RAPIDS GROUP

PHANEROZOIC

HELIKIAN
NEOHELIKIAN

- nHca — *Alkalic rock/carbonatite complexes; syenite, carbonatite*
- nHd — *Mackenzie dykes*

APHEBIAN

- Ad — *Molson dykes*
- Asn — *Paragneiss and migmatite*
- AFRu — FOX RIVER SILL
- AFR — FOX RIVER GROUP
- Agd — *Granite and granodiorite with intrusions of layered migmatitic gneiss, aplite and pegmatite*

PROTEROZOIC

- APgn — *Layered migmatitic gneiss, aplite and pegmatite*

PROTEROZOIC AND ARCHEAN

LATE INTRUSIVE ROCKS

- Ay — *Syenite, nepheline syenite*
- Ag — *Massive and foliated late- to post-tectonic granite and granodiorite; minor syenitic rocks*
- Aqd — *Monzonite, diotite, quartz diorite, granodiorite*
- Agd — *Massive and foliated late- to post-tectonic granodiorite, tonalite and quartz diorite; minor syenitic rocks*
- Agp — *Undivided massive and foliated syn- to post-tectonic felsic plutonic rocks*
- Acg — *Wacke, conglomerate, arkose, mafic and alkalic volcanic rocks*

EARLY INTRUSIVE ROCKS, GNEISS, MIGMATITE

- Atn — *Tonalite and granodiorite, foliated to gneissic, commonly with abundant mafic gneiss and amphibolite enclaves and variable amounts of younger felsic intrusives*
- Aggn — *Undivided felsic and intermediate plutonic rocks, gneiss and migmatite*
- Anm — *Mafic gneiss and amphibolite*
- Angh — *Felsic granulite; minor gabbro, anorthosite, amphibolite and metasediments*
- Ab — *Mafic and ultramafic intrusions*

- Aif — *Iron formation, mainly oxide facies with lesser sulphide and carbonate facies*
- Aw — *Wacke, siltstone, conglomerate, arkose, iron formation*
- An — *Metasedimentary gneiss and migmatite*
- Ava — *Felsic and intermediate metavolcanic rocks; mainly pyroclastics with some flows and intrusions and sedimentary rocks*
- Avb — *Mafic, ultramafic and intermediate volcanic rocks; basalt, komatiite; minor andesite, sedimentary rocks, mafic/ultramafic intrusions*

ARCHEAN

Geological boundary (approximate, assumed)
Fault, displacement unknown (approximate, assumed)
Thrust fault, teeth on hanging wall (approximate, assumed)
Strike-slip fault, dextral, sinistral (approximate, assumed); arrows indicate relative movement
Anticline (approximate, assumed)
Syncline (approximate, assumed)

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

MAP NN-15-G
SHEET 1

BEDROCK GEOLOGY

GODS LAKE

MANITOBA - ONTARIO

Scale 1:1 000 000

Kilometres 25 0 25 50 75 Kilomètres

Lambert Conformal Conic Projection
Standard Parallels 52°40'N and 55°20'N

Base map at the same scale, published by Surveys and Mapping Branch in 1971

Elevation in metres above sea level

Copies of the topographical edition of this map may be obtained from the Canada Map Office, Department of 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

Geological compilation by K.D. Card and B.V. Sanford, 1992

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

Sheet 1 of 4, Map NN-15-G, Bedrock geology

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