EXPLANATION
GEOLOGIC MAP OF NORTH AMERICA

SEDIMENTARY ROCKS

Seafloor units are indicated by asterisks (*) in the explanation. Asterisks are not used in labels on the map.
For seafloor outcrops a query (?) before the label indicates uncertainty about age; a query (?) after the label indicates uncertainty about composition, or whether the rock is in situ.

Selected lithologies are indicated by suffixes as follows:
cs, conglomerate and sandstone (Early Proterozoic)
qz, quartzite (Early Proterozoic)
ds, carbonate (W. Canada)
e, evaporite (W. Canada)

Selected depositional environments and tectonic settings where known are indicated by patterns:
Continental deposits
Offshelf deposits
Melange (including diamictite and tillite)

VOLCANIC ROCKS

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Lithologies are indicated by suffixes as follows:
v, undivided volcanic rocks
vb, bimodal rocks
vf, felsic and intermediate rocks
vi, intermediate rocks
vim, intermediate and mafic rocks
vm, mafic rocks
vma, alkaline mafic and intermediate rocks
vmb, alkaline mafic rocks
vmk, alkaline mafic rocks
vk, alkaline rocks
vks, komatiite and basalt
vs, sedimentary and volcanic rocks
vsm, undivided sedimentary and mafic volcanic rocks
vsmi, interlayered sedimentary and volcanic rocks
vsmk, interlayered sedimentary and alkaline volcanic rocks
vsk, interlayered sedimentary and alkaline volcanic rocks

SPECIAL SEAFLOOR UNITS

Mafic volcanics at recent or active spreading centers
Quaternary
Pliocene and Quaternary
Neogene and Quaternary
Pliocene
Neogene
Strongly condensed sedimentary sections with numerous outcrops of volcanic oceanic crust and pre-Quaternary sedimentary rocks
Tertiary and Quaternary
Eastern Pacific
Cretaceous-Quaternary
Eastern Pacific

PLUTONIC ROCKS

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Lithologies are indicated by suffixes as follows:
g, granite
gi, undivided granitic rocks
gim, felsic and intermediate plutons in the Superior province
i, syenitic granite
im, intermediate rocks
l, leucocratic granite
l, felsic
fm, felsic and mafic rocks
fi, felsic and intermediate rocks
m, undivided mafic rocks
ma, gabbro-anorthosite
mi, gabbro-monzonite
mg, alkaline diorite gabbro and syenite
mu, mafic and ultramafic rocks
s, undivided granites
s, charnockite
d, diabase

METAMORPHIC ROCKS AND UNDIVIDED CRYSTALLINE ROCKS

Seafloor units are indicated by asterisks (*) in the explanation. Asterisks are not used in labels on the map.
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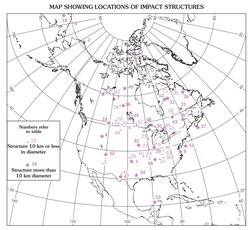
Age symbols generally indicate protolith ages. Lithologies of gneissic rocks are indicated by patterns and by suffixes as follows:
a, undivided metamorphic rocks
ag, orthogneiss and paragneiss
gn, gneissic rocks
mm, mafic gneiss
gn, orthogneiss
sg, undivided granites
sm, sedimentary and volcanic gneiss
ts, impact breccia
sm, psammite
sp, pelite
sch, schist
ms, metasedimentary rocks
ss, sandstone gneiss
ls, marble, tectonic gneiss
sn, paragneiss

Metamorphic rocks are indicated by overprints:
Granulite facies metamorphism (Phanerozoic only in the Canadian Shield)
Rocks metamorphosed during the Phanerozoic. In most areas includes rocks of amphibolite-grade or higher. In young metamorphic belts also includes rocks of blueschist or higher grade
Proterozoic-Paleozoic (granite and gneiss SW of Porcupine Bank, eastern north Atlantic)

IMPACT STRUCTURES
(Modified from Planetary and Space Science Center, University of New Brunswick, 2003)

MAP SHOWING LOCATIONS OF IMPACT STRUCTURES



NO.	NAME	LOCATION	LATITUDE	LONGITUDE	AGE (Ma)	SIZE (km)	EXPOSED
1	Ames	Oklahoma, U.S.A.	36°15'	-98°12'	470±30	16	no
2	Avak	Alaska, U.S.A.	71°15'	-156 38'	?	12	no
3	Barringer	Arizona, U.S.A.	35° 02'	-111°01'	0.049	1.2	yes
4	Beaverhead	Montana, U.S.A.	44°36'	-113°00'	<600	60	no
5	Brent	Ontario, Canada	46°05'	-79°29'	396±20	3.8	yes
6	Calvin	Michigan, USA	41°50'	-85°57'	450±10	8.5	no
7	Carswell	Saskatchewan, Canada	58°27'	-109°30'	115±10	39	yes
8	Chesapeake	Virginia, U.S.A.	37°17'	-76°01'	35.5±0.5	85	no
9	Chesapeake Bay	Virginia, U.S.A.	37°17'	-76°01'	35.5±0.5	85	no
10	Chicxulub	Yucatan, Mexico	21°20'	-89°30'	64.98±0.05	170	no
11	Clearwater East	Quebec, Canada	56°05'	-74°07'	290±20	26	yes
12	Clearwater West	Quebec, Canada	56°13'	-74°30'	290±20	36	yes
13	Couture	Quebec, Canada	60°8'	-73°20'	430±25	8	yes
14	Crooked Creek	Missouri, U.S.A.	37°50'	-91°23'	320±80	5	yes
15	Decaturville	Missouri, U.S.A.	37°54'	-92°43'	<300	6	yes
16	Deep Bay	Saskatchewan, Canada	56°24'	-102°59'	100±50	13	yes
17	Des Plaines	Illinois, U.S.A.	42°2	-87°53'	<280	8	no
18	Eagle Butte	Alberta, Canada	49°42'	-110°35'	<65	10	no
19	Elgygytgyn	Russia	67°30'	172°0'	3.5±0.5	18	yes
20	Elbow	Saskatchewan, Canada	50°59'	-106°42'	395±25	8	no
21	Flynn Creek	Tennessee, U.S.A.	36°17'	-85°40'	360±20	3.55	yes
22	Glasford	Illinois, U.S.A.	40°36'	-89°47'	<430	4	no
23	Glover Bluff	Wisconsin, U.S.A.	43°58'	-89°22'	<500	8	yes
24	Gow	Saskatchewan, Canada	56°27'	-104°29'	<250	5	yes
25	Houghton	Nunavut, Canada	75°22'	-89°41'	23±1	24	yes
26	Howell	Kansas, U.S.A.	37°35'	-98°10'	<0.85	0.015	yes
27	Hollidford	Ontario, Canada	44°28'	-76°38'	550±100	2.25	no
28	Roubaix	Quebec, Canada	50°41'	-73°53'	<300	4	no
29	Kentland	Indiana, U.S.A.	40°45'	-87°24'	<97	13	yes
30	Le Moinene	Quebec, Canada	57°26'	-66°37'	400±50	8	yes
31	Manicouagan	Quebec, Canada	51°22'	-68°42'	214±1	100	yes
32	Manson	Iowa, U.S.A.	42°35'	-94°23'	73.8±0.3	35	no
33	Maple Creek	Saskatchewan, Canada	49°48'	-108°36'	<75	6	no
34	Marquez	Texas, U.S.A.	31°17'	-96°18'	58±2	13	no
35	Middlesboro	Kentucky, U.S.A.	36°37'	-83°44'	<300	6	yes
36	Mistastin	Newfoundland/Labrador, Canada	55°53'	-63°18'	36±4	28	yes
37	Montagnais	Nova Scotia, Canada	43°52'	-64°13'	50.5±0.76	45	yes
38	New Quebec	Quebec, Canada	61°17'	-73°40'	1.4±0.1	3.44	yes
39	Newporte	North Dakota, U.S.A.	48°58'	-101°05'	<500	3.2	no
40	Nicholson	Northwest Territories, Canada	62°40'	-102°41'	<400	12.5	yes
41	Odessa	Texas, U.S.A.	31°46'	-102°29'	<135	0.168	yes
42	Pilot	Northwest Territories, Canada	60°29'	-111°01'	445±2	6	yes
43	Pongo-Ile	Quebec, Canada	49°42'	-74°40'	<365	28	yes
44	Red Wing	North Dakota, U.S.A.	47°36'	-103°32'	200±25	9	no
45	Saint Martin	Manitoba, Canada	51°47'	-98°32'	220±32	40	yes
46	Serpent Mound	Ohio, U.S.A.	39°02'	-83°24'	<320	8	yes
47	Sierra Madera	Texas, U.S.A.	30°36'	-102°55'	<100	13	yes
48	Slate Islands	Ontario, Canada	48°40'	-87°00'	<450	30	yes
49	Steen River	Alberta, Canada	59°30'	-117°38'	95±1	25	no
50	Sudbury	Ontario, Canada	46°36'	-81°11'	1850±3	250	yes
51	Toms Canyon	New Jersey, U.S.A.	39°04'	-72°50'	35.5±5	20	no
52	Upheaval Dome	Utah, U.S.A.	38°26'	-109°54'	<65	10	yes
53	Versailles	Kentucky, U.S.A.	38°02'	-84°43'	<455	1.3	yes
54	Viewfield	Saskatchewan, Canada	49°35'	-103°04'	190±35	2.5	no
55	Wanapitei	Ontario, Canada	46°45'	-80°46'	37.3±1.2	7.5	yes
56	Wells Creek	Tennessee, U.S.A.	36°23'	-87°40'	200±100	12	yes
57	West Hawk	Manitoba, Canada	49°46'	-95°11'	100±50	2.44	yes

MAP SYMBOLS

Volcanic features—Caldera rim dotted where concealed or inferred
Cinder cone or lava dome
Volcano
Caldera

Impact structures—Approximate outlines of larger structures shown to scale; numbers refer to table; symbols without numbers are suspected impact structures; many structures are largely or completely buried beneath younger deposits. Point symbols are omitted where other geologic features clearly indicate location of structure
≥ 10 km diameter
< 10 km diameter

Diapirs—Chiefly salt diapirs in and around the Gulf of Mexico, Scotian margin, and on the Grand Banks; evaporite diapirs in the Canadian Arctic Islands; mud diapirs in the Caribbean and off northern South America; may contain evaporites or serpentinite; off Honduras. Blue lines in areas of abundant diapiric structures show general trends of crest lines of elongate diapirs
Dome >10 km diameter
Dome <10 km diameter
Area of abundant diapiric structures. Lines indicate trends of elongate structure

Small bodies of unusual igneous rocks
Carbonatite
Kimberlite
Alkaline complex
Alaskan type ultramafic body
Diatreme

Contact—Dashed where approximately located, dotted where inferred

Unclassified fault—Dashed where approximately located, dotted where concealed or inferred

Normal fault—Dashed where approximately located, dotted where concealed or inferred; ticks on downthrown block

Thrust fault—Dashed where approximately located; dotted where concealed or inferred; teeth on upper plate

Strike-slip fault—Dashed where approximately located, dotted where concealed or inferred

Shear zone

Growth fault

Limit of Wisconsin glaciation—Shown only east of the Rocky Mountains

Limit of pre-Wisconsin glaciation—Shown only east of the Rocky Mountains

Submarine escarpment

Slump scar or growth fault

Bathymetric contours and contours on base of Greenland Icecap—Contours at -200 or -500 meters and at 1000 meter intervals beginning at -1000 meters. Depression contours shown by ticks

Axis of submarine canyon, sea valley, or channel—Dotted where approximately located

Axis of sediment drift

Isochron in oceanic crust—Solid where basement is exposed, dashed where basement is not exposed, dotted where inferred

Spreading center, overlapping spreading center—Solid where active, dashed where abandoned

Transform fault or non-transform offset of spreading center—Solid where active, dashed where inactive

Shear zone, diffuse

Frontal thrust fault of active accretionary wedge

Fossil subduction zone

Pseudofault in oceanic crust

Special Submarine Features

Polymetallic sulfide deposits
Hydrothermal vent
Gas/oil seep
Gas/fuel seep
Commonly associated with hydrothermal biologic communities

Rock in seafloor sample
Ultramafic
Felsic
Granite

Manganiferous deposits
Undifferentiated
Crusts
Nodules
Blocks, slabs, and pavements
Crusts, blocks, slabs, and pavements
Nodules, blocks, slabs, and pavements
Crusts and nodules
Crusts, nodules, blocks, slabs, and pavements

Phosphate nodules or pavement

DIKES AND SILLS

Suffixes denoting lithology are same as those for volcanic rocks. Dashed lines indicate concealed dikes inferred from aeromagnetic surveys. Letter symbols on the map may include upper case suffixes that identify named dike swarms. Map showing provinces of the Canadian shield referred to in descriptions is shown to the right. 'U' indicates uranium-lead age.

Tertiary dikes
Tmd, Tmdi
Tmdd(), mafic and alkaline dikes, east Greenland (60–16 Ma)
Tmmt, mafic dikes, coastal west Greenland (56 Ma)
Tmmf, mafic dikes, Prince Rupert, British Columbia
Tmmi, intermediate and mafic dikes, Queen Charlotte Islands (50–40 Ma)
Tmdi, felsic and intermediate dikes in Sierra Nevada and San Juan volcanic fields, central Colorado
pgTmi, intermediate and mafic dikes, Absaroka volcanic field, northwest Wyoming, and Crazy Mountains, southcentral Montana

Cretaceous-Tertiary dikes
KTmm(), mafic alkaline dikes, northern Greenland (~65 Ma)

Mid-Cretaceous dikes
mKmi, Sverdrup mafic dikes, Canadian Arctic Islands (100–90 Ma)

Early Cretaceous dikes
Kmd(), diabase and mafic dikes, southwest Greenland (~135 Ma)

Triassic and Jurassic dikes and sills
TJm, mafic dikes and sills, U.S. Appalachian Piedmont and Blue Ridge and Canadian Appalachians (U 200±2 Ma)

Late Proterozoic mafic dikes
Includes:
Zmd, Franklin dikes, southern Greenville province (590±2–1 Ma)
Zmck, Long Range dikes, Newfoundland and northeast Grenville province (615±2 Ma)
Zmct, Thule dikes, northeast Greenland (700–600 Ma)
Zmf, Franklin dikes, northern Canadian shield (U 723 +4/-2 Ma; 716±1 Ma)
Zmh, Hottah dikes, Bear province (U 779±2 Ma)
Zmmkt, MacKenzie Mountains dikes, northeast Canadian Cordillera (U 779±2 Ma)
Zmnt, Muskeg dikes, eastern Canadian Cordillera (U 779±2 Ma)

Middle Proterozoic mafic dikes (1200–1000 Ma)
Includes:
Ymk, Kewenaw dikes, Southern province (U 1100 Ma)
Ymk, Abitibi dikes, southeast Superior province (U 1141±1 Ma)
Ymks, Adlie dikes, southeast of Nain province (1100 Ma)

Middle Proterozoic mafic dikes and sills (1400–1200 Ma)
Includes:
Ymd, Sudbury dikes, Southern province (U 1235+7/-3 Ma)
Ymtd, Midaymorayi diabase sills, northwest Greenland (~1250 Ma)
Ymtd, Thule dikes, northwest Greenland and northeast Greenland (1250 Ma)
Ymmt, Muzzy dikes, northeast Grenville province (U 1250±2 Ma)
Ymt, MacKenzie dikes, northwest Canadian shield (U 1267±2 Ma)*
Ymmt, Mealy dikes, Labrador and northeast Grenville (1270 Ma)
Ymmt, Schaffenburg dikes, Churchill and Superior provinces (1265–1260 Ma)
Ymmj, Kiromi dikes, southwest Churchill province (1260 Ma)
Ymmt, sills in Belt Supergroup, Montana and Idaho (~1440 Ma)

Early Proterozoic mafic dikes (1800–1600 Ma)
Includes:
Ymmt, Melville Bugt dikes, west Greenland (~1650 Ma)
Ymm, Dease dikes, Bear province (1700 Ma)
Ymcl, Cleaver dikes, Bear province (1780–1680 Ma)

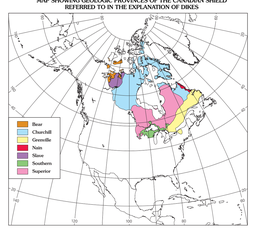
Early Proterozoic mafic dikes (2100–1800 Ma)
Includes:
Ymmt, Thanh Channel dikes, Southern province (1900 Ma)
Ymdt, Sparrow dikes, west Churchill province (U 1837±4 Ma)
Ymdj, Beechey dikes, northeast Slave province (2000 Ma)
Ymmt, Hearne dikes, southeast Slave province (2000 Ma)
Ymcl, Lac de Gras mafic dikes, central Slave province (2030–2023 Ma)
Ymmt, Kaminak dikes, Southern province (2100 Ma)
Ymmt, Fort Francois–Kaministiquia dikes, southeast Superior province (U 2076±4 Ma)
Ymcl, Umvuk dikes, southeast Greenland (~2050 Ma)

Early Proterozoic mafic dikes (2200–1800 Ma)
Includes:
Ymmt, Molson dikes, northwest Superior province (2170–1880 Ma)
Ymmt, Harris dikes, northeast Superior province (2200–1800 Ma)

Early Proterozoic mafic dikes (2500–2100 Ma)
Includes:
Ymmt, Marathon dikes, south Superior province (U 2121+13/-7 Ma)
Ymmt, Biscotasing dikes, southeast Superior province (U 2167±2 Ma)
Ymmt, metadiabase dikes, southeast Greenland (Ikkobisk–2150 Ma)
Ymmt, Ungava dikes, northeast Superior province (U 2190 Ma)*
Ymmt, Dogrib dikes, southeast Slave province (U 2197±2 Ma)*
Ymmt, Talamahi dikes, central Churchill province (2190 Ma)
Ymc, Indin dikes, southeast Slave province (2200 Ma)
Ymmt, Kikiktat dikes, northernmost Superior province (U 2201±1 Ma)
Ymmt, Nauyat dikes, northeast Churchill province (U 2216±2 Ma)*
Ymmt, Senneterre dikes, southeast Superior province (U 2216±4 Ma)*
Ymmt, Malley dikes, southeast Slave province (U 2230 Ma)*
Ymmt, Matachewan dikes, Superior province (U 2473±16 Ma)
Ymmt, Matawishi dikes, east Superior province (2450 Ma)
Ymb, Nipaktok dikes, northern Nain province (2500–2100 Ma)
Ymmt, Matachewan dikes, Superior province (U 2446±2 Ma; U 2473+16/-9 Ma)

Middle Archean mafic dikes
Ymad, Amaruk–Tartaletalik dikes, west Greenland (Ikkobisk–3270 Ma, norite–3510 Ma)
Computed ages shown by dashed lines except for X-mdt Dogrib dikes and X*-mdt Malley dikes in Slave province.

MAP SHOWING GEOLOGIC PROVINCES OF THE CANADIAN SHIELD
REFERRED TO IN THE EXPLANATION OF DIKES



Geological Survey of Canada
Commission géologique du Canada
Woods Hole Oceanographic Institution 1930
The Geological Society of America 1888