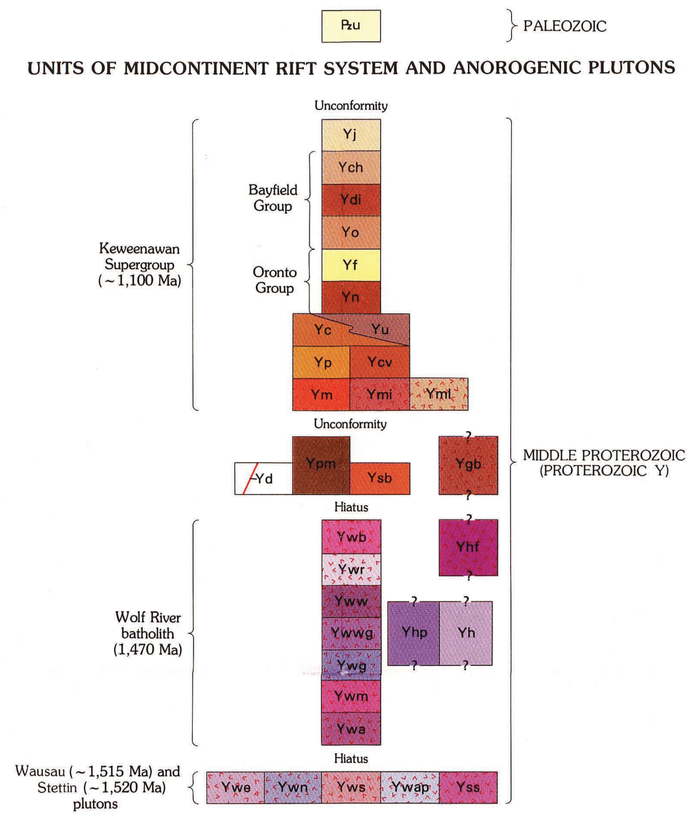
SEDIMENTARY ROCKS OF PALEOZOIC AGE

UNITS OF MIDCONTINENT RIFT SYSTEM AND ANOROGENIC PLUTONS



Ru **Paleozoic rocks, undivided**—Dominantly quartzose and glauconitic sandstone and siltstone with lesser amounts of carbonate rocks

SEDIMENTARY AND IGNEOUS ROCKS OF MIDDLE PROTEROZOIC (PROTEROZOIC Y) AGE

Keweenawan Supergroup (~1,100 Ma) rocks of Midcontinent rift system

Yj **Jacobsville Sandstone**—Red, brown, and white quartzose sandstone, and minor siltstone, shale, and conglomerate

Bayfield Group

Ych **Chequamegon Sandstone**—Poorly sorted arkosic sandstone

Ydi **Devils Island Sandstone**—Well-sorted quartzose sandstone

Yo **Orienta Sandstone**—Poorly sorted arkosic sandstone

Oronto Group

Yf **Freda Sandstone**—Mainly reddish-brown, medium- to fine-grained lithic arkosic sandstone, siltstone, and micaceous silty shale

Yn **Nonesuch Shale**—Gray, green, and brown lithic siltstone, shale, and sandstone. Copper sulfides and native copper occur locally near base

Yc **Copper Harbor Conglomerate**—Red lithic conglomerate and sandstone; mafic to felsic volcanic flows similar to those of the unnamed formation (unit Yu) are interlayered with the sedimentary rocks

Yu **Unnamed formation**—Generally dark-gray basalt, andesite, and felsite flows and subordinate interflow sedimentary rocks

Yp **Portage Lake Volcanics**—Lava flows, mostly basalt, and minor interflow sedimentary rocks. Native copper common in amygdaloidal flow tops and conglomerate beds on Keweenaw Peninsula

Ycv **Chengwatana Volcanic Group**—Gray basalt flows, interflow breccia, tuff, and minor sedimentary rocks

Mellen Intrusive Complex

Ym **Granite (~1,000 Ma)**

Yms **Layered mafic rocks**

Yml **Layered mafic rocks at Mineral Lake**

Yd **Diabase dikes**—Reversely polarized dikes

Ypm **Powder Mill Group, undivided**—Consists of, from youngest to oldest, Kallander Creek Formation, unnamed diorite, and Siemens Creek Formation (Hubbard, 1975). Mapped in area west of Bessemer, Mich. Poorly exposed in area west of Mellen, Wisc.

Ysb **Siemens Creek Formation**—Dark-gray basalt and minor porphyritic andesite. Generally strongly magnetic with reversed remanent magnetism. Underlain by a thin unit of quartzose sandstone (Bessemer Quartzite)

Ygb **Gabbroic rocks of uncertain affinity**

Anorogenic plutonic rocks

Wolf River batholith (1,470 Ma)—Rocks of the batholith, which occupies an area of about 9,000 km², are characterized by dominant alkali feldspar being more abundant than plagioclase, rapakivi mantling of alkali feldspar, and coarse-grained, hypidiomorphic, inequigranular to porphyritic textures in the several, discrete plutons (Anderson and Cullers, 1978; Anderson, 1980, in press). Age recalculated from Van Schmus and others (1975)

Ywb **Belongia Granite**—Red to pink granite consisting of both a coarse-grained and a fine-grained facies. Probably an epizonal intrusion

Ywr **Red River Granite**—Contains alkali feldspar phenocrysts (0.5–2 cm), subordinate plagioclase and quartz, and rare clusters of biotite with or without hornblende

Yww **Wiborgite porphyry**—Granite porphyry containing 45–70 percent phenocrysts of mantled alkali feldspar and less abundant, zoned plagioclase, quartz, biotite, and hornblende. Occurs mainly as massive dikes

Ywwg **Waupaca Granite**—Rapakivi granite (wiborgite) containing 70–80 percent coarse (1.5–5 cm) ovoid alkali feldspars mantled by plagioclase, coarse anhedral quartz, and interstitial hornblende and biotite

Ywg **Wolf River Granite**—Red, coarse-grained rapakivi granite consisting of large (1–3 cm) ovoid alkali feldspar sporadically mantled by plagioclase, interstitial plagioclase, quartz, biotite, hornblende, and ilmenite

Ywm **Peshtigo Mangerite**—Brown to dark-gray, coarse-grained (0.3–1.5 cm) inequigranular monzonite containing subhedral, zoned plagioclase, alkali feldspar, mafic silicates (fayalite, hypersthene, ferroaugite-hedenbergite, hornblende, and biotite), and interstitial quartz

Ywa **Anorthosite**—Gray, coarse-grained (1–20 cm) plagioclase-rich (An_{45-55}) rock containing interstitial orthopyroxene, clinopyroxene, Fe-Ti oxides, and apatite

Yhf **High Falls Granite**—Gray to pink, equigranular to porphyritic granite to granodiorite containing microcline microperthite, concentrically zoned plagioclase, quartz, biotite, and hornblende

Hager Formation—Quartz porphyry and rhyolite members

Yhp **Quartz porphyry member**—Contains 30–45 percent resorbed quartz phenocrysts (3–4 mm) and less abundant alkali feldspar and plagioclase phenocrysts (4–5 mm) in a fine-grained matrix of quartz, two feldspars, biotite, and hornblende

Yh **Rhyolite member**—Gray to reddish-gray, slightly foliated, porphyritic rhyolite containing aligned phenocrysts of alkali feldspar and lesser amounts of plagioclase in a fine-grained matrix of feldspar, quartz, biotite, and sparse quartz

Wausau pluton (~1,515 Ma)—An elliptical, concentrically zoned, composite body containing flow-oriented metasedimentary xenoliths. Age relationships among units are poorly constrained

Ywa **Granite near Big Eau Pleine Reservoir**—Pink to red, medium- to fine-grained granite containing miarolitic cavities

Ywn **Granite near Nine Mile Swamp**—Orange to pink, coarse-grained massive granite composed of alkali feldspar sporadically mantled by plagioclase, quartz, and biotite; contains miarolitic cavities

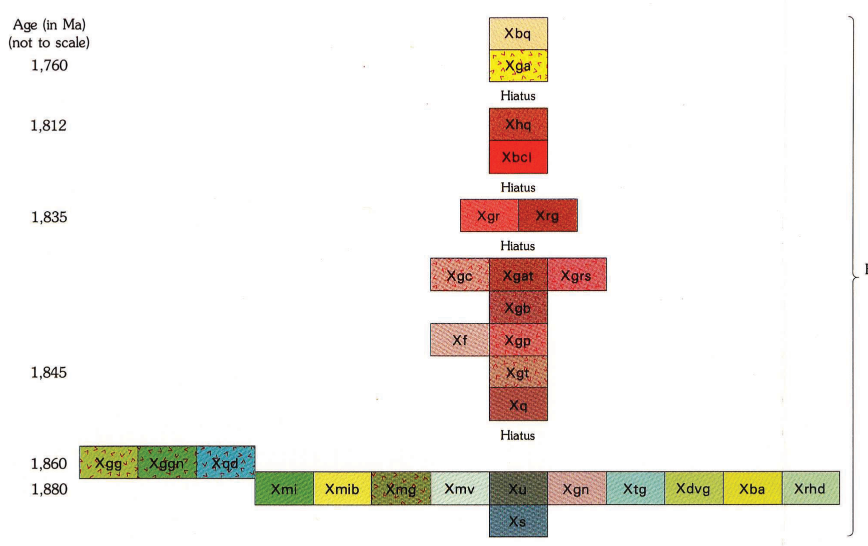
Ysq **Quartz syenite**—Contains flow-oriented xenoliths of biotite schist and sillimanite-bearing quartzite

Ywap **Aplite**—Pale-orange to pink, fine-grained porphyritic aplite

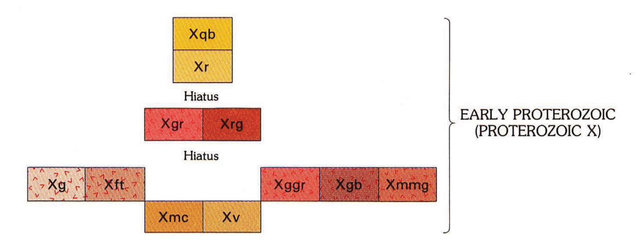
Yss **Stettin pluton (~1,520 Ma)**—Pyroxene syenite, amphibole syenite, tabular syenite, and nepheline syenite. Age approximately 1,520 Ma (Sood and others, 1980)

UNITS OF WISCONSIN MAGMATIC TERRANES (SOUTH OF NIAGARA FAULT)

PEMBINE-WAUSAU TERRANE



MARSHFIELD TERRANE



METAMORPHIC AND IGNEOUS ROCKS OF EARLY PROTEROZOIC (PROTEROZOIC X) AGE

Xbq **Barron Quartzite**—Pink to maroon to light-gray, medium-grained, moderately sorted quartzite. Red argillite (pipestone) interbedded locally. At least 213 m thick

Xga **Granitic rocks of 1,760-Ma age group**—In northern Wisconsin, granite to granodiorite of varied texture. In southern Wisconsin (not mapped separately), red to pink alkali-feldspar granophyric granite associated with rhyolites of both peraluminous and metaluminous affinities (unit Xr of Marshfield terrane)

Xhq **Hines Quartz Diorite (1,812.7 ± 3.6 Ma)**—Dark-gray, massive, medium-grained, intrusive rock. Confined to Mountain shear zone, Oconto County

Xbcl **Baldwin Conglomerate**—Metamorphosed conglomerate on north side of Mountain shear zone. Contains clasts of metavolcanic rocks, quartzite, gneiss, and schist in a matrix of quartz, feldspar, biotite, amphibole, and muscovite

Xgr **Alkali feldspar granite of 1,835-Ma age group**—Red to pink, medium-grained leucocratic alkali feldspar granite; contains miarolitic cavities; biotite is altered to opaque oxide minerals; contains fluorite locally. Called red granite previously (Sims, 1990). Exposed in both Pembine-Wausau and Marshfield terranes

Xrg **Rhyolite at and near Cary Mound and near Brokaw (~1,835 Ma)**—Flow-banded rhyolite, welded tuff, volcanic conglomerate, and volcanogenic sedimentary rocks. Exposed in both Pembine-Wausau and Marshfield terranes

Xgo **Granite near Cherokee (1,853 ± 21 Ma)**—Pink, coarse-grained granite consisting of microcline microperthite and oligoclase phenocrysts in a fine-grained matrix of quartz, potassium feldspar, and oligoclase. Hornblende and (or) biotite occur in clots

Xgar **Athelstane Quartz Monzonite (1,835 ± 15 Ma)**—Pink, coarse-grained granite to granodiorite containing nearly equal amounts of microcline microperthite, plagioclase, and quartz and 5–10 percent biotite and (or) hornblende. Mafic minerals are interstitial and give a clotty appearance

Xgrs **Spikehorn Creek and Bush Lake Granites, undivided (1,835 ± 6 Ma)**—Gray to pinkish-gray, fine- to medium-grained, massive granite containing scattered phenocrysts of potassium feldspar. Exposed in northeastern Wisconsin

Xgb **Gabbro**—Massive to layered intrusive gabbroic rocks; weakly metamorphosed and deformed. Exposed in both Pembine-Wausau and Marshfield terranes

Xf **Felsic metavolcanic rocks of 1,835- to 1,845-Ma age group**—Rhyolite to dacite and, locally, andesite tuff, breccia, and minor sedimentary rocks, including conglomerate. Exposed in central Wisconsin

Xgp **Porphyritic granite**—Granite containing plagioclase, microcline, and quartz phenocrysts in a fine-grained granophyric matrix. Probably subvolcanic intrusions related to volcanic rocks of 1,835- to 1,845-Ma age group

Xgt **Granodiorite-tonalite**—Gray, medium-grained intrusive rocks, including intrusion breccias. Exposed in central Wisconsin. Zircon ages range from 1,837 to 1,847 Ma

Xq **Quartzite**—Maroon but locally white, gray, and red quartzite (quartz arenite) with a basal quartzose conglomerate. At Flambeau Ridge (Chippewa County) consists of conglomerate. Distinguished from other quartzite units in being strongly deformed and metamorphosed. Includes Flambeau, Rib Mountain, McCaslin, and Thunder Mountain Quartzites of local usage

Xgg **Granite-tonalite**—Gray to pinkish-gray, medium-grained, generally equigranular granite to tonalite and granitoid gneiss; locally includes diorite. Intrudes older metavolcanic rocks. Zircon ages range from 1,852 ± 15 to 1,862 ± 5 Ma

Xggn **Granite gneiss**—Medium-grained granodiorite gneiss in northwestern Marathon County

Xqd **Quartz diorite**—Includes Marinette Quartz Diorite of Dunbar dome (Sims and others, 1985a) and nearby Twelve Foot Falls Quartz Diorite

Volcanic and sedimentary rocks of 1,860- to 1,880-Ma age group—Succession of basalt, andesite, and rhyolite and less abundant sedimentary rocks that composes the major part of the Pembine-Wausau terrane. Metamorphosed to greenschist and amphibolite facies. Available U-Pb zircon ages range from about 1,860 to 1,880 Ma, but some rocks included in succession could be younger

Xmi **Mafic metavolcanic rocks**—Dominantly tholeiitic basalt and basaltic andesite flows and tuffs; associated with sheeted dikes, massive and layered metagabbro, and ultramafic rocks. In northeastern Wisconsin, rocks have been named Quinnesec Formation

Xmib **Bimodal mafic and felsic metavolcanic rocks**—High-aluminum basalt to low-silica andesite pillowed flows and interlayered dacite to rhyolite tuffs and porphyries in Monico and Mountain areas, northeastern Wisconsin. A rhyolite porphyry at Jennings (Oneida County) has an age of 1,869 ± 6 Ma. Rocks are host to massive sulfide deposits (Crandon and Pelican River)

Xmg **Metagabbro**—Mafic to ultramafic bodies defined and delineated principally by positive magnetic and gravity anomalies; includes diorite bodies. Comagmatic with unit Xmi

Xmv **Mafic to felsic metavolcanic rocks**—Volcanic rocks in areas of sparse geologic data and nondefinitive magnetic and gravity data

Xu **Ultramafic rocks**—Serpentine-, talc-, and actinolite-bearing schist

Xgn **Gneiss and amphibolite**—Interlayered quartzofeldspathic gneiss and amphibolite between Athens shear zone and Owen fault, central Wisconsin

Xtg **Felsic volcanic and volcanogenic rocks**—Tuff, argillite, graywacke, and minor volcanic rocks of lower greenschist facies in southern Rusk County. Could be younger in age than adjacent metavolcanic rocks

Xdvg **Dacite and volcanogenic graywacke**—Includes andesite tuff. Occurs in northeastern Wisconsin. Dacite has age of 1,866 ± 39 Ma

Xba **Basaltic and andesitic breccia**—Exposed in northeastern Wisconsin

Xrhd **Rhyolite to dacite**—Massive to flow-banded rocks of greenschist metamorphic grade in northeastern Wisconsin; virtually undeformed

Xs **Metasedimentary rocks**—Interlayered quartz-rich schist, impure quartzite, impure marble, calc-silicate rocks, and biotite schist. Lithologically resembles metasedimentary rocks of the Chocolay Group of the Marquette Range Supergroup

METAMORPHIC AND IGNEOUS ROCKS OF EARLY PROTEROZOIC (PROTEROZOIC X) AGE

Xqb **Quartzite and breccia**—Red, micaceous quartzite and silicified breccia. Age uncertain; in part could be older than rhyolite (unit Xr). In Baraboo Range, quartzite is associated with slate, dolomite, and ferruginous slate. Includes Baraboo and Waterloo Quartzites

Xr **Rhyolite**—Ash-flow tuffs and interbedded volcaniclastic sedimentary rocks and cogenetic granite (unit Xga) exposed as inliers in southern Wisconsin. In central Wisconsin, pink, flow-banded rhyolite and chert-cemented breccia inferred to be 1,760 Ma

Xgr **Alkali feldspar granite of 1,835-Ma age group**—Red to pink, medium-grained leucocratic alkali feldspar granite; contains miarolitic cavities; biotite is altered to opaque oxide minerals; contains fluorite locally. Called red granite previously (Sims, 1990). Exposed in both Pembine-Wausau and Marshfield terranes

Xrg **Rhyolite at and near Cary Mound and near Brokaw (~1,835 Ma)**—Flow-banded rhyolite, welded tuff, volcanic conglomerate, and volcanogenic sedimentary rocks. Exposed in both Pembine-Wausau and Marshfield terranes

Xg **Granitic rocks, undivided**—Gray, weakly foliated to massive granite in poorly exposed areas

Xft **Foliated tonalite**—Medium-gray, mottled, medium-grained, equigranular tonalite and granodiorite. Intrudes rocks of Milladore Volcanic Complex

Xggr **Gneissic granite (1,871 ± 5 Ma)**—Pale-red, medium- to fine-grained, leucocratic, mylonite gneiss exposed near Neillsville, Wisc.

Xgb **Gabbro**—Massive to layered intrusive gabbroic rocks. Exposed in both Pembine-Wausau and Marshfield terranes

Xmmg **Metagabbro**—Mafic to ultramafic bodies defined and delineated principally by positive magnetic and gravity anomalies

Xmc **Milladore Volcanic Complex (~1,860 ± 7 Ma)**—Succession of poorly exposed interlayered metavolcanic and metasedimentary rocks. Lithic units described in Sims (1990)

Xv **Volcanic rocks, undivided**—Mafic to felsic flows, pyroclastic rocks, impure quartzite, and conglomerate in Eau Claire River, Eau Claire and northern Clark Counties. Rhyolite has zircon ages of 1,858 ± 5 Ma. Possibly correlative with Milladore Volcanic Complex

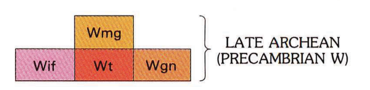
MARSHFIELD TERRANE

METAMORPHIC AND IGNEOUS ROCKS OF EARLY PROTEROZOIC (PROTEROZOIC X) AND ARCHEAN (PRECAMBRIAN A) AGE

XAf **Fault rocks**—Mylonitic rocks of uncertain lithology in Eau Pleine shear zone

XAgt **Gneiss and intrusive tonalite**—Abundant intrusive bodies of Early Proterozoic tonalite ranging in age from 1,840 to 1,890 Ma and Archean basement gneiss. Both the tonalite and gneiss are metamorphosed to amphibolite grade (Maass, 1983)

MARSHFIELD TERRANE



METAMORPHIC AND IGNEOUS ROCKS OF LATE ARCHEAN (PRECAMBRIAN W) AGE

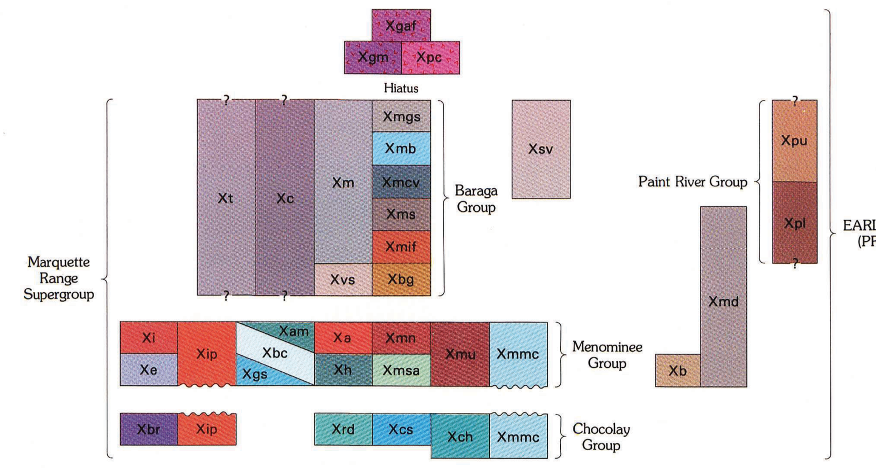
Wmg **Layered metagabbro**—Interlayered gabbro, mafic accumulates, gabbroic anorthosite, and anorthosite (Cummings, 1984) in Eau Claire River (T. 27 N., R. 8 W.). Age uncertain, but interpreted as Archean (Sims, 1990)

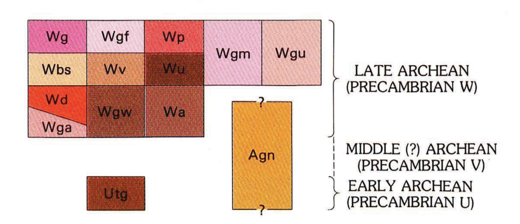
Wif **Banded iron-formation and associated volcanogenic rocks**—Magnetite-quartz iron-formation and associated talc schist in aluminous quartzofeldspathic schist (unit Wt)

Wt **Tuff-breccia schist and minor iron-formation**—Pink and gray, layered quartzofeldspathic schist of intermediate volcanic composition and associated thin iron-formation. Felsic gneiss at Arbutus Dam on Black River at Hatfield has U-Pb zircon age of ~2,800 Ma (Sims and others, 1989)

Wgn **Gneiss, migmatite, and amphibolite (~2,800 Ma)**—Quartzofeldspathic gneiss and less abundant amphibolite and migmatite. Includes granitoid rocks. Granitic gneiss at Port Edwards, Wisc., on Wisconsin River has a U-Pb zircon age of 2,870 ± 13 Ma, and gneiss at Jim Falls in Chippewa River valley has a U-Pb zircon age of 2,522 ± 22 Ma (Sims and others, 1989)

UNITS OF CONTINENTAL MARGIN ASSEMBLAGE (NORTH OF NIAGARA FAULT)





METAMORPHIC AND IGNEOUS ROCKS OF EARLY PROTEROZOIC (PROTEROZOIC X) AGE

Xgaf **Alkali-feldspar granite (1,733 ± 25 Ma)**—Red, fine- to medium-grained, massive to lineated (primary) alkali-feldspar granite compositionally similar to rare-metal-rich granites. Age determined by Rb-Sr method (Schulz and others, 1988)

Xgm **Granitic rocks**—Gray to pinkish-gray, mottled, medium-grained syenite, granite, and granodiorite. Moderately strong propylitic alteration and weak cataclasis. Forms small bodies south of Crystal Falls, Mich. (James and others, 1968). A body near Tobin Location has a U-Pb concordia intercept age of 1,840 ± 5 Ma (Z.E. Peterman, written commun., 1988). Includes porphyritic red granite that intrudes Late Archean Dickinson Group—Red mylonitic gneissic granite (~1,970 Ma)

Xpc **Peavy Pond Complex**—Chiefly hornblende metagabbro, but includes metanorite, metatonalite, granodiorite, and granite (Bayley, 1959)

Marquette Range Supergroup—Metasedimentary and less abundant bimodal metavolcanic rocks (Cannon and Gair, 1970). Underlain by Archean basement, except perhaps locally. Rocks of the Marquette Range Supergroup (Cannon and Gair, 1970) have been assigned previously to four groups: from youngest to oldest, Paint River, Baraga, Menominee, and Chocolay Groups (James, 1958). Recent recognition that the Badwater Greenstone (unit Xb) probably is correlative with the Hemlock Formation (unit Xh) (see correlation of map units above) requires some modification of the established stratigraphy. Accordingly, the Paint River Group (units Xpu and Xpl) is tentatively considered approximately correlative with the Michigamme Formation of the Baraga Group. A carbonate-apatite bed in iron-formation (unit Xmif) at the base of the Michigamme, exposed in Huron River, has virtually concordant U-Pb ages of about 1,930 Ma (R.E. Zartman, written commun., 1988); a biotite schist (metagraywacke; unit Xsv) in northwestern Wisconsin, which is probably correlative with the upper part of the Michigamme Formation (possibly a foredeep deposit, Barovich and others, 1989), has a U-Pb concordia intercept age of 1,852 ± 6 Ma (Sims and others, 1985b). The younger age probably represents the approximate upper limit of the time of sedimentation; sedimentation probably began substantially before 1,930 Ma

Baraga Group

Xt **Tyler Formation**—Light- to dark-gray, feldspathic, fine-grained sandstone, argillaceous siltstone, and argillite. Near base, ferruginous argillite contains beds of cherty sideritic and pyritic iron-formation

Xc **Copps Formation**—Fine- to medium-grained graywacke and less abundant gray to black slate. This basal conglomerate west of Lake Gogebic contains clasts of underlying Archean rocks in a quartzitic and argillaceous matrix

Xm **Michigamme Formation, undivided**—Thick and stratigraphically varied formation of sedimentary and less abundant volcanic rocks. Mapped undivided in poorly exposed areas

Xmgs **Metamorphosed graywacke**—Predominant rock of Michigamme Formation. Calcareous concretions common. Metamorphosed from chlorite to sillimanite grade (Cannon, 1986)

Xmb **Mafic to intermediate flows and pyroclastic rocks**—Poorly exposed

Xmbv **Clarksburg Volcanics Member (Cannon and Gair, 1970)**—Mostly mafic to intermediate pyroclastic rocks in Marquette trough, between Marquette Bay and Champion

Xme **Gray to black slate**—Strongly cleaved. Represents lower stratigraphic part of formation

Xmif **Banded cherty and slaty iron-formation**

Xvs **Volcanic-sedimentary unit**—Interlayered fine- to medium-grained metasedimentary rocks and metavolcanic rocks in poorly exposed areas in southern Baraga County, Mich.

Xbg **Goodrich Quartzite**—Thick- to thin-bedded, white, gray, and tan quartzite and arkosic quartzite with thin argillaceous interbeds. Ferruginous conglomerate common at base

Xsv **Biotite schist**—Metamorphosed graywacke in poorly exposed areas in northwestern Wisconsin. Sample at one locality (near Blockhouse Lake, 10 km northeast of Park Falls, T. 40 N., R. 1 E.) has a U-Pb zircon age of 1,852 ± 6 Ma (Sims and others, 1985b)

Paint River Group

Xpu **Upper part**—Dominantly Fortune Lakes Slate, but includes other rocks in poorly exposed areas. Correlated with upper part of Baraga Group

Xpl **Lower part**—Includes Stambaugh Formation, Hiawatha Graywacke, Riverton Iron-formation, and Dunn Creek Slate (James and others, 1968). Correlated with lower part of Baraga Group

Xmd **Metadiabase**—Variably metamorphosed dikes, sills, and subconcordant sheets of diabasic rocks. Probably coeval (in part) with volcanic rocks of Hemlock Formation (unit Xh)

Menominee Group

Xi **Ironwood Iron-formation**—Interbedded cherty and slaty iron-formation. Locally, secondary enrichment has formed "soft ore" bodies. In eastern part of Gogebic Range, Ironwood Iron-formation is intercalated with pyroclastic rocks of Emperor Volcanic Complex, and in eastern half of T. 47 N., R. 43 W. (where mapped within unit Xip) consists entirely of black slate

Xe **Emperor Volcanic Complex**—Metamorphosed intermediate to mafic pyroclastic and flow rocks in easternmost part of Gogebic Range

Xip **Ironwood Iron-formation of Menominee Group and Palms Formation of Chocolay Group**—Mapped where units are too thin to show separately on map (Gogebic Range). Palms Formation includes Bad River Dolomite and Sunday Quartzite of Chocolay Group

Xsm **Unexposed magnetic unit**—Surrounds gneiss domes in Gogebic County, Mich., and Vilas County, Wisc., and occurs in north-central Dickinson County. Probably correlative with part of Blair Creek Formation (Sims and others, 1984)

Xbc **Blair Creek Formation**—Dominantly dark-gray, massive, porphyritic tholeiitic basalt. Includes a basal conglomerate and a lean iron-formation in middle of formation

Xgs **Biotite gneiss and schist**—Interlayered massive biotite-quartz-feldspar gneiss and fine-grained biotite schist in Watersmeet dome. Probably correlative with part of Blair Creek Formation (unit Xbc)

Xs **Amasa Formation**—Includes Fence River Formation of older reports. Variably metamorphosed slaty iron-formation, cherty iron-formation, and ferruginous slate

Xh **Hemlock Formation**—Predominantly mafic to intermediate volcanic flows and pyroclastic rocks with interlayered slate and tuff beds

Xmn **Negaunee Iron-formation**—Highly metamorphosed banded iron-formation. Principal iron-formation in Marquette trough and nearby areas. Includes abundant metadiabase sills

Xsmj **Composite unit of Siamo Slate and Ajibik Quartzite**—Siamo Slate is laminated green siltstone and argillite. Ajibik Quartzite is white, buff, and pink orthoquartzite and less abundant sericite quartzite

Xmu **Menominee Group, undivided**—Includes Negaunee Iron-formation, Siamo Slate, and Ajibik Quartzite in areas where units are too thin to map individually

Xmmc **Menominee and Chocolay Groups, undivided**—Mapped where units are too thin to show separately on map

Xb **Badwater Greenstone**—Dark-greenish-gray, pillowed to massive tholeiitic basalt and pyroclastic rocks. Correlated with Hemlock Formation on basis of geology and similarity in chemical composition

Chocolay Group

Xbr **Bad River Dolomite**—Gray to buff dolomite and cherty dolomite

Xrd **Randville Dolomite**—Dolomite, siliceous dolomite, arkose, and slate

Xcs **Saunders Formation**—Mainly silica rock (probably silicified dolomite) ranging from massive, nearly structureless, white to gray cherty rock to angular breccia; includes dolomite and slate. Probably correlative with Randville Dolomite (unit Xrd)

Xch **Chocolay Group, undivided**—In Dickinson County, Mich., includes Randville Dolomite, Sturgeon Quartzite, and Fern Creek Formation. In Marquette range, between Marquette Bay and Champion, includes Wewe Slate, Kona Dolomite, Mesnard Quartzite, and Enchantment Lake Formation

METAMORPHIC AND IGNEOUS ROCKS OF ARCHEAN AGE

Wg **Granitic rocks (Late Archean)**—Massive to weakly foliated, medium- to coarse-grained tonalite and granodiorite in northern complex of Marquette district

Wgf **Foliated granitic rocks (Late Archean)**—Medium- to coarse-grained tonalite and granodiorite in northern complex of Marquette district; prominent secondary foliation

Wp **Puritan Quartz Monzonite (Late Archean)**—Pink to pinkish-gray, medium- to coarse-grained, equigranular to inequigranular granite to granodiorite in Puritan batholith south of Gogebic Range. Age 2,710 ± 140 Ma (Sims and others, 1977)

Wgm **Gneiss and migmatite (Late Archean)**—Banded gneiss and migmatite; includes interlayered amphibolite in northern complex of Marquette district

Wgu **Granitic rocks, undivided (Late Archean)**—Mapped in northern complex of Marquette district where detailed mapping is lacking

Wbs **Biotite schist (Late Archean)**—Quartz-plagioclase-biotite schist of probable intermediate volcanic protolith in area south of Gogebic Range

Wv **Metabasalt (Late Archean)**—Derived from mafic to intermediate pyroclastic rocks and massive to pillowed lava flows. Unit mapped as Ramsay Formation by Prinz (1981) south of Gogebic Range; mapped as Mona Schist and Kitchi Schist in northern complex of Marquette district

Wu **Ultramafic rocks (Late Archean)**—Includes serpentine bodies at Deer Lake and Presque Isle, northern complex of Marquette district

Wd **Dickinson Group, undivided (Late Archean)**—Metavolcanic and metasedimentary rocks in Dickinson County, Mich. From youngest to oldest, consists of Six Mile Lake Amphibolite, Solberg Schist, and East Branch Arkose

Wgw **Metagraywacke (Late Archean)**—Gray, fine-grained, thin- to thick-bedded, commonly graded graywacke and slate in Marenisco, Mich., area

Wa **Amphibolite (Late Archean)**—Dark-gray, massive to foliated amphibolite and hornblende schist in northern complex of Marquette district

Wga **Gneiss and amphibolite (Late Archean, 2,640–2,750 Ma)**—Interlayered quartzofeldspathic gneiss and amphibolite in Marenisco, Mich., area and northwestern Wisconsin. Protoliths are bimodal intermediate and mafic volcanic rocks (Sims and others, 1984)

Agn **Migmatitic gneiss and amphibolite (Late to Early Archean)**—Varied gneisses of mostly unknown age in cores of gneiss domes and fault-bounded uplifts (Archean gneiss terrane). Except for Watersmeet dome (Late to Early Archean), all dated rocks are Late Archean. Includes granite of Late Archean age that transgresses gneisses and amphibolite

Ug **Tonalitic augen gneiss (Early Archean, 3,562 ± 39 Ma)**—Medium-gray, medium- to coarse-grained layered gneiss containing plagioclase augen in Watersmeet dome; includes an overlying biotite gneiss unit

Contact—Approximately located

High-angle fault—Showing dip where known. Dashed where concealed by sedimentary rocks. Bar and ball on downthrown side where sense of movement known

Transcurrent fault—Showing relative horizontal movement

High-angle reverse fault of Middle Proterozoic (Keweenawan) age—Showing dip where known. Dashed where covered by Paleozoic rocks or by water in Lake Superior; queried where presence uncertain. Hachures on downthrown side. Initiated as normal fault (in part, growth fault) during deposition of volcanic rocks and later reversed

High-angle thrust fault of Early Proterozoic (Penokean) age—Sawteeth on upper plate. Inferred to flatten at depth

Thrust fault of Late Archean age—Sawteeth on upper plate

Fault intruded by narrow dike

Mylonite—Ductile deformation zones

Strike and dip of beds

Inclined

Overturned

Vertical—Stratigraphic top direction not known

Vertical—Showing stratigraphic top direction

Strike and dip of foliation

Inclined

Vertical

Bearing and plunge of lineation—May be combined with bedding and foliation symbols

Bearing and plunge of minor folds

Massive sulfide deposit

Massive sulfide occurrence

Kimberlite occurrence

Trend of magnetic lineament

GLTZ Great Lakes tectonic zone—Exposed in area south of Marquette

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COMMENT ON GEOLOGY

The bedrock in the map area is largely obscured by a thin to moderate thickness of Quaternary glacial deposits. Accordingly, in most parts of the region geologic mapping of the Precambrian rocks has relied extensively on magnetic and gravity anomaly maps and on drill-hole data. Most contacts are covered, and the degree of reliability of the positions of the units shown on the map varies widely.

INTERIOR—GEOLOGICAL SURVEY, RESTON, VA—1992

CONVERSION FACTORS

Multiply	By	To obtain
centimeters (cm)	0.3937	inches (in)
meters (m)	3.281	feet (ft)
kilometers (km)	0.6214	miles (mi)

EXPLANATION FOR
GEOLOGIC MAP OF PRECAMBRIAN ROCKS, SOUTHERN LAKE SUPERIOR REGION, WISCONSIN AND NORTHERN MICHIGAN

Compiled by
P.K. Sims

1992