DESCRIPTION OF MAP UNITS

STRATIFIED ROCKS

Keweenawan Supergroup (Middle Proterozoic)

Jacobsville Sandstone--Red to brown conglomerate with sandstone interbeds. Mostly lithic arenite. Conglomerate clasts are mostly iron-formation and vein quartz. Conglomerates are massive to crudely bedded. Sandstone is generally well-bedded, in part, crossbedded

Bayfield Group

Chequamegon Sandstone--Red, brown, and white feldspathic sandstone, generally thick-bedded and commonly crossbedded. Rare interbeds of red shale and conglomerate

Devils Island Sandstone--White to tan quartz arenite, generally thin-bedded. Crossbeddng and ripple marks are common

Orienta Sandstone--Red, brown, and white feldspathic sandstone, crossbedded in part. Rare interbeds of red shale and conglomerate

Bayfield Group, undivided--Unit shown on cross sections where formational units cannot be projected with confidence

Oronto Group

Freda Sandstone--Red, brown, and tan sandstone with minor shale and conglomerate beds. Mostly fine- to medium-grained feldspathic and lithic arenite, commonly micaceous. Well bedded and commonly crossbedded

Conglomeratic facies of Freda Sandstone--Interbedded red and brown conglomerate and sandstone. Conglomerate beds are massive, immature, and poorly sorted units with clasts of volcanic and intrusive rocks. Clasts vary from well rounded to subangular and consist mostly of mafic and felsic volcanic rocks in roughly equal proportion. Sandstone interbeds are typical of the Freda Sandstone

Nonesuch Formation--Siltstone, shale, sandstone, mostly gray to black, some red units. In Michigan basal beds are locally mineralized with chalcocite. Becomes interbedded with red sandstone and conglomerate near its pinch-out near Mellen, Wis.

Copper Harbor Conglomerate--Red to brown conglomerate, sandstone, and siltstone. Conglomerates are generally massive to crudely bedded and contain rounded clasts of mostly felsic volcanic rocks as much as 50 cm in diameter. Sandstones are mostly lithic arenites, commonly trough crossbedded with dominantly volcanic grains. Conglomerates are mostly near the base and

finer grained rocks are higher in section. Contains some interbedded basalt flows near base in Michigan

Nonesuch Formation and Copper Harbor Conglomerate, undivided-Unit shown on cross sections where formations cannot be confidently distinguished

Bergland Group

Porcupine Volcanics

Rhyolite--Massive, purplish rhyolite containing small quartz and plagioclase phenocrysts. Outcrops are present only at Copper Peak and Chippewa Falls on the Black River in Michigan

Andesite and basalt--Mostly gray, grayish red, or purple andesite flows. Average flow thickness about 8 m. Aphanitic to sparsely porphyritic with plagioclase phenocrysts. Flows are pahoehoe or autobrecciated and commonly sparsely vesicular. Vesicles filled with chlorite, epidote, quartz, and calcite

Portage Lake Volcanics--Basalt and minor andesite. Medium- to dark-gray and gray-green. Average flow thickness 11 to 13 m. Flow tops are commonly grayish-red to grayish-red-purple and fragmental to vesicular. Numerous conglomerate and sandstone beds between flows are composed of volcanic fragments. Pebbles and cobbles are mostly well-rounded clasts of rhyolite and lesser basalt

Chengwatana Volcanics--Basalt at western edge of map area. Known from extensive exposures to west but not exposed in map area

Volcanic rocks, undivided--Includes enclaves of highly metamorphosed basalt within Mellen Intrusive Complex and volcanic units at depth in cross sections where formational contacts cannot be projected with confidence

Powder Mill Group

Kallander Creek Volcanics

Andesite and basalt--Lava flows mostly of andesite, but includes basalt and felsite. Purple, brown, or reddish colors predominate. Flows range from 9 to 60 m thick, and most have autobrecciated and vesicular tops. A few flows are glomeroporphyritic or have abundant platy porphyroblasts of pink plagioclase as much as 4 cm in diameter

Rhyolite--Two thick rhyolite units occur near the top of the formation. The uppermost flow is a massive, pink, quartz- and plagioclase-phyric rhyolite, generally devoid of internal texture. The stratigraphically lower unit is distinctly flow-banded, pink, quartz-phyric rhyolite

Siemens Creek Volcanics--Basalt and andesite, olive-gray to dark-greenish-gray. Commonly strongly chloritized. Generally fine-grained and massive, but more felsic flows have plagioclase phenocrysts. Flows generally 3 to 14 m thick. Basal flows are thicker (35-50 m) than higher flows and generally pillowed. Flow tops are pahoehoe and sparsely vesicular. Vesicles are filled with chlorite, epidote, quartz, and calcite. In western half of map area flows are strongly metamorphosed to hornblende and pyroxene hornfels in which granoblastic texture obliterates original igneous textures. Where most strongly metamorphosed, segregations and veinlets of granophyric granite are abundant

Bessemer Quartzite (Middle Proterozoic)--Quartzite, gray to red. Mostly fine- to medium-grained, and well-bedded quartz arenite. Near base is mostly conglomerate composed of clasts of Early Proterozoic metasedimentary rocks

Marquette Range Supergroup (Early Proterozoic)

Baraga Group

Tyler Formation --Quartz-rich graywacke and argillite. Gray, greenish-gray, and brown. Thin- to thick-bedded, commonly graded-bedded. Ripple marks and cross laminations also common. Ferruginous black chert, black pyritic slate, and feruginous conglomerate near base

Menominee Group

Ironwood Iron-Formation--Strongly ferruginous unit consisting of interbeds of two lithologies: (1) thick- and commonly irregularly bedded, white, gray, and red chert, commonly granular or oolitic. Ferruginous layers consist of hematite, magnetite, and lesser iron carbonate and iron silicate minerals, (2) thinly and regularly bedded, gray-green, cherty carbonate-silicate-magnetite iron-formation. Metamorphism is progressively more intense from east to west. West of Upson, Wis., originally carbonate-bearing units are generally converted to iron-silicate and magnetite beds. East of Upson, the iron-formation contains masses of earthy limonite and hematite previously mined as iron ore

Iron-formation--Unit defined and traced by exploration drilling and prominent aeromagnetic anomaly. Exposures are lacking. Upper part mostly irregularly bedded magnetite and hematite beds interlayered with dark-gray to black chert. Lower part is even-bedded carbonate and silicate iron-formation

Volcanic rocks--Unexposed unit known from exploration drilling to be chloritic schist, probably mafic volcanic or volcanogenic sedimentary rocks

Palms Formation--Gray, gray-green, and reddish-brown argillite, siltstone, quartzite, and conglomerate. Locally has thin basal conglomerate containing clasts of Archean and older Early Proterozoic strata. Remainder of the unit is a generally coarsening-upward sequence of thin-bedded siltstone to fine sandstone near base and massive to crossbedded, white to pink quartzite

near top. Locally includes dolomite and chert breccia of underlying Bad River Dolomite where that unit is too thin to show separately

Chocolay Group--

Bad River Dolomite--Dolomite and dolomitic marble. Tan to white. Generally thick bedded, commonly with lenses or thin beds of chert. Most primary textures obliterated by metamorphism but domal structures preserved in cherty layers are probably algal mounds. Coarse rosettes of tremolite are common along cherty beds. In central part of map area, unit is mostly breccia of chert fragments in a cherty or sandy matrix or monolithic conglomerate with subrounded pebbles of chert

Volcanic rocks, undivided (Late Archean)--Metamorphosed basalt and andesite flows, dacitic and rhyolitic pyroclastic rocks, and volcanogenic sedimentary rocks

Ramsay Formation (Late Archean)--Felsic schist and pyroclastic rocks. Variably metamorphosed rhyolite and rhyodacite. Original textures are poorly preserved, but fragmental textures in some outcrops indicate unit is at least partly pyroclastic. Where least metamorphosed consists of quartz, plagioclase and K-feldspar with minor biotite, chlorite, epidote, and calcite. Pyrite is locally abundant. Most of unit is more highly metamorphosed and is quartz-feldspar-biotite-garnet schist

INTRUSIVE ROCKS

Mellen Intrusive Complex (Middle Proterozoic)--Intrusive complex consisting of four distinct intrusions, all of nearly the same age. Mineral Lake intrusion and Potato River intrusion are the principal gabbroic units including granophyric phases. Granite, informally called Mellen granite by many previous workers, shows crosscutting relations to Mineral Lake intrusion, but the two have indistinguishable U-Pb ages. Rearing Pond gabbroic intrusion appears to cut Mineral Lake intrusion but contact relations are not well exposed

Granite (Mellen granite of informal usage)--Pink, massive, medium- to coarse-grained granitic rocks. Equigranular to porphyritic. Biotite- and hornblende-bearing in places. Contains border zone rich in country rock xenoliths

Mineral Lake intrusion and Potato River intrusion

Gabbro, anorthositic gabbro, gabbroic anorthosite-Coarse-grained, generally 80 to 90 percent plagioclase (An55 to An60), lesser clinopyroxene, orthopyroxene, and rare olivine. Plagioclase crystals commonly show preferred orientation

Granophyre--Brick-red to pink, fine- to medium-grained granophyre and ferrodiorite. Small phenocrysts of plagioclase in graphic-textured matrix of K-feldspar and quartz. Ferrodiorite is commonly hornblende-bearing

Ferrodiorite--Dark-gray to black. Plagioclase laths up to 1 cm, commonly strongly oriented. Olivine generally abundant and apatite is common accessory. Abundant opaque minerals in places

Olivine-bearing gabbroic rocks--Plagioclase-rich gabbro in which olivine is generally more abundant than pyroxene. Forms basal zone of Mineral Lake and Potato River intrusions

Anorthosite--Medium- to coarse-grained rocks containing more than 85 percent plagioclase. Accessory minerals are clinopyroxene, orthopyroxene, minor hornblende, apatite, and opaque minerals. Mapped as separate unit only in Potato River intrusion

Rearing Pond intrusion

Olivine gabbro, gabbro, quartz gabbro--Mostly medium- to coarse-grained olivine-bearing gabbro in which both olivine and some plagioclase have cumulus textures. Grades to gabbro without olivine and to quartz-bearing gabbro

Serpentinized peridotite--Dark-gray to black. Olivine and lesser magnetite have cumulus textures and are surrounded by anhedral plagioclase and pyroxene. Most olivine grains are largely converted to serpentine

Diabase (Middle Proterozoic)--Medium-grained, massive, black diabase. Occurs as dikes and plugs cutting Tyler Formation. Also cuts older rocks as dikes that are too thin to map or in areas where outcrops are insufficient to trace dikes

Metadiabase (Early Proterozoic)--Metamorphosed diabase and gabbro. Generally massive with well-preserved igneous textures. Most pyroxenes have been converted to actinolite, hornblende, and biotite. Occurs as sills in Early Proterozoic strata and as abundant dikes cutting Archean rocks. The latter are not shown on the map

Puritan Quartz Monzonite and related gneiss (Late Archean)--Medium- to coarse-grained, pink, granitic rocks, commonly with coarse pegmatoidal patches. Massive to weakly foliated and, in part, porphyritic with K-feldspar phenocrysts. Also includes biotite and hornblende gneiss and migmatite probably derived from the adjacent volcanic units

Late Archean rocks, undivided--Unit shown only on cross sections where nature of Archean rocks at depth is not known