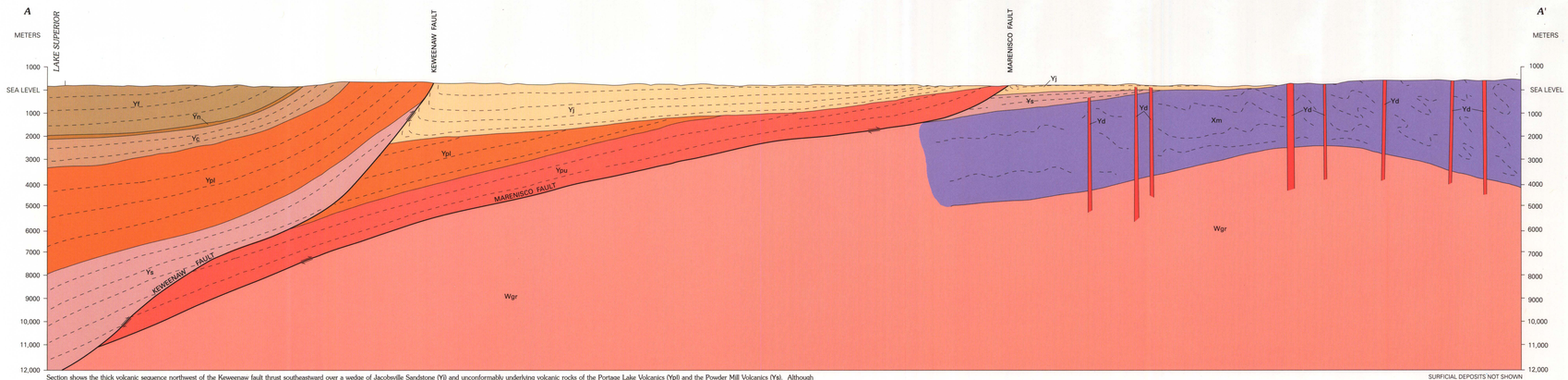
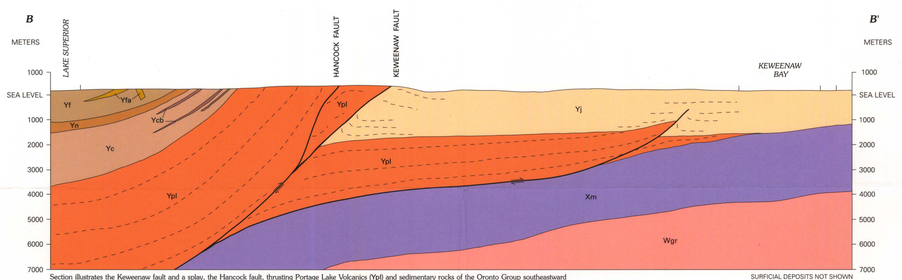
U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

GEOLOGIC INVESTIGATIONS SERIES
MAP I-2696
Explanatory pamphlet accompanies map



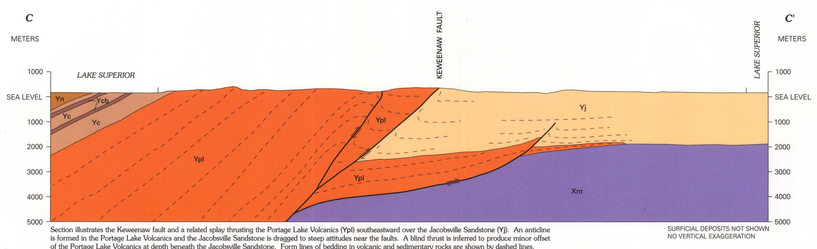
Section shows the thick volcanic sequence northwest of the Keweenaw fault thrust southeastward over a wedge of Jacobsville Sandstone (Yj) and unconformably underlying volcanic rocks of the Portage Lake Volcanics (Ypl) and the Powder Mill Volcanics (Ys). Although absolute displacement of the Keweenaw fault is poorly constrained, the geometry shown in the section is compatible with about 8 km of thrust motion on the plane of the fault. The Marenisco fault, a major thrust to the west, becomes less prominent in the map area and appears to have only a kilometer or two of displacement. In this section it has thrust Powder Mill volcanic rocks to the surface through the veneer of overlying Jacobsville Sandstone. In the southeast, diabase dikes, probable feeder dikes for an initially more extensive Siemens Creek Volcanic unit (Ya), cut Archean and Early Proterozoic rocks as well as volcanic rocks of the Keweenaw Supergroup, but are truncated along the pre-Jacobsville unconformity. Form lines of bedding in volcanic and sedimentary rocks are shown by dashed lines.

SURFICIAL DEPOSITS NOT SHOWN
NO VERTICAL EXAGGERATION



Section illustrates the Keweenaw fault and a splay, the Hancock fault, thrusting Portage Lake Volcanics (Ypl) and sedimentary rocks of the Oronto Group southeastward over the Jacobsville Sandstone (Yj). Compressive deformation has formed an anticline in the Portage Lake Volcanics near the Keweenaw fault. The Jacobsville Sandstone is dragged to near vertical and locally has an overturned attitude near the fault. A thrust with small displacement, possibly an extension of the Marenisco fault, is inferred to cut Portage Lake Volcanics at depth beneath the Jacobsville Sandstone. Form lines of bedding in volcanic and sedimentary rocks are shown by dashed lines.

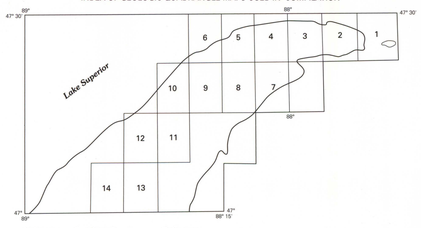
SURFICIAL DEPOSITS NOT SHOWN
NO VERTICAL EXAGGERATION



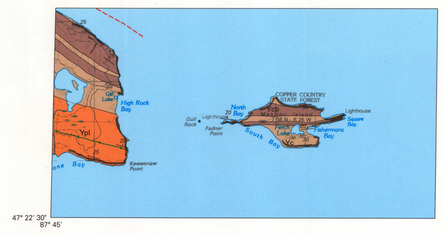
Section illustrates the Keweenaw fault and a related splay thrusting the Portage Lake Volcanics (Ypl) southeastward over the Jacobsville Sandstone (Yj). An anticline is formed in the Portage Lake Volcanics and the Jacobsville Sandstone is dragged to steep attitudes near the faults. A blind thrust is inferred to produce minor offset of the Portage Lake Volcanics at depth beneath the Jacobsville Sandstone. Form lines of bedding in volcanic and sedimentary rocks are shown by dashed lines.

SURFICIAL DEPOSITS NOT SHOWN
NO VERTICAL EXAGGERATION

INDEX OF GEOLOGIC QUADRANGLE MAPS USED IN COMPILATION

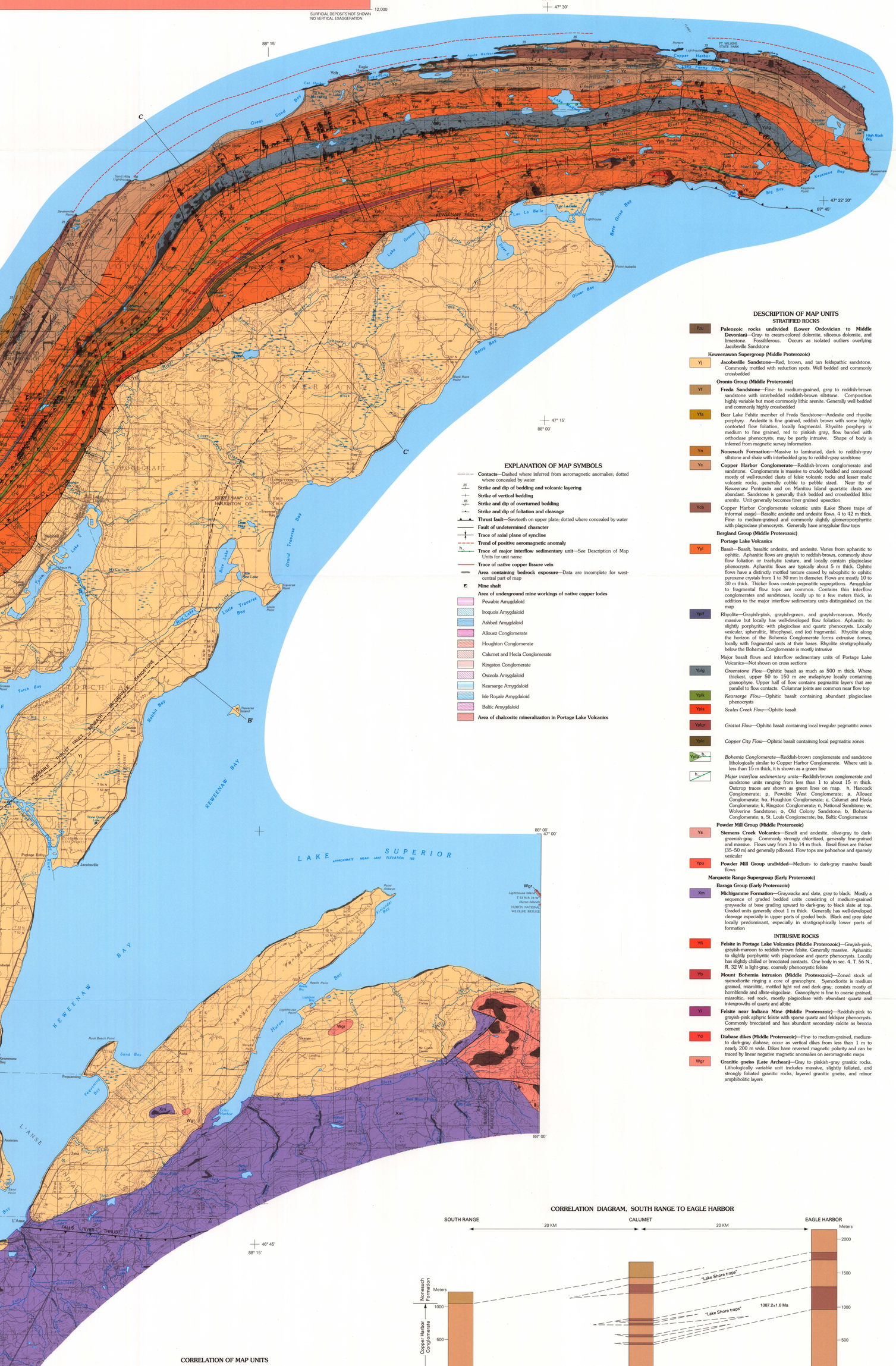


Index no.	Quadrangle	Reference
1	Manitou Island	Cornwall and White, 1955
2	Fort Wilkins	Cornwall, 1955
3	Lake Medora	Cornwall, 1954b
4	Delaware	Cornwall, 1954a
5	Eagle Harbor	Cornwall and Wright, 1954
6	Phoenix	Cornwall, 1954c
7	Deer Lake	Cornwall, 1954a
8	Bruneau Creek	Wright and Cornwall, 1954
9	Mohawk	Davidson and others, 1955
10	Ahmeek	White and others, 1953
11	Laurium	Cornwall and Wright, 1956b
12	Hancock	Cornwall and Wright, 1956a
13	Chassell	White,1956
14	South Range	White and Wright, 1956



47° 22' 30'
87° 45'

88° 00'
47° 30'



88° 30'
47° 15'
88° 00'
47° 00'
46° 45'
88° 15'
46° 30'
89° 00'

EXPLANATION OF MAP SYMBOLS

- **Contacts**—Dashed where inferred from aeromagnetic anomalies; dotted where concealed by water
- **Strike and dip of bedding and volcanic layering**
- **Strike of vertical bedding**
- **Strike and dip of overturned bedding**
- **Strike and dip of foliation and cleavage**
- **Thrust fault**—Sawteeth on upper plate; dotted where concealed by water
- **Fault of undetermined character**
- **Trace of axial plane of syncline**
- **Trend of positive aeromagnetic anomaly**
- **Trace of major interflow sedimentary unit**—See Description of Map Units for unit name
- **Trace of native copper fissure vein**
- **Area containing bedrock exposure**—Data are incomplete for west-central part of map
- **Mine shaft**
- **Area of underground mine workings of native copper lodes**
  - Pewabic Amygdaloid
  - Iroquois Amygdaloid
  - Ashbed Amygdaloid
  - Allouez Conglomerate
  - Houghton Conglomerate
  - Calumet and Hecla Conglomerate
  - Kingston Conglomerate
  - Osceola Amygdaloid
  - Kearsarge Amygdaloid
  - Isle Royale Amygdaloid
  - Baltic Amygdaloid
- **Area of chalcocite mineralization in Portage Lake Volcanics**

DESCRIPTION OF MAP UNITS

STRATIFIED ROCKS

Pzu **Paleozoic rocks undivided (Lower Ordovician to Middle Devonian)**—Gray- to cream-colored dolomite, siliceous dolomite, and limestone. Fossiliferous. Occurs as isolated outliers overlying Jacobsville Sandstone

Keweenawan Supergroup (Middle Proterozoic)

Yj **Jacobsville Sandstone**—Red, brown, and tan feldspathic sandstone. Commonly mottled with reduction spots. Well bedded and commonly crossbedded

Oronto Group (Middle Proterozoic)

Yf **Freda Sandstone**—Fine- to medium-grained, gray to reddish-brown sandstone with interbedded reddish-brown siltstone. Composition highly variable but most commonly lithic arenite. Generally well bedded and commonly highly crossbedded

Yfa Bear Lake Felsite member of Freda Sandstone—Andesite and rhyolite porphyry. Andesite is fine grained, reddish brown with some highly contorted flow foliation, locally fragmental. Rhyolite porphyry is medium to fine grained, red to pinkish gray, flow banded with orthoclase phenocrysts; may be partly intrusive. Shape of body is inferred from magnetic survey information

Yn **Nonesuch Formation**—Massive to laminated, dark to reddish-gray siltstone and shale with interbedded gray to reddish-gray sandstone

Yc **Copper Harbor Conglomerate**—Reddish-brown conglomerate and sandstone. Conglomerate is massive to crudely bedded and composed mostly of well-rounded clasts of felsic volcanic rocks and lesser mafic volcanic rocks, generally cobble to pebble sized. Near tip of Keweenaw Peninsula and on Manitou Island quartzite clasts are abundant. Sandstone is generally thick bedded and crossbedded lithic arenite. Unit generally becomes finer grained upsection

Ycb Copper Harbor Conglomerate volcanic units (Lake Shore traps of informal usage)—Basaltic andesite and andesite flows, 4 to 42 m thick. Fine- to medium-grained and commonly slightly glomeroporphyritic with plagioclase phenocrysts. Generally have amygdular flow tops

Bergland Group (Middle Proterozoic)

Portage Lake Volcanics

Ypl **Basalt**—Basalt, basaltic andesite, and andesite. Varies from aphanitic to ophitic. Aphanitic flows are grayish to reddish-brown, commonly show flow foliation or trachytic texture, and locally contain plagioclase phenocrysts. Aphanitic flows are typically about 5 m thick. Ophitic flows have a distinctly mottled texture caused by subophitic to ophitic pyroxene crystals from 1 to 30 mm in diameter. Flows are mostly 10 to 30 m thick. Thicker flows contain pegmatitic segregations. Amygdular to fragmental flow tops are common. Contains thin interflow conglomerates and sandstones, locally up to a few meters thick, in addition to the major interflow sedimentary units distinguished on the map

Ypf Rhyolite—Grayish-pink, grayish-green, and grayish-maroon. Mostly massive but locally has well-developed flow foliation. Aphanitic to slightly porphyritic with plagioclase and quartz phenocrysts. Locally vesicular, spherulitic, lithophysal, and (or) fragmental. Rhyolite along the horizon of the Bohemia Conglomerate forms extrusive domes, locally with fragmental units at their bases. Rhyolite stratigraphically below the Bohemia Conglomerate is mostly intrusive

Major basalt flows and interflow sedimentary units of Portage Lake Volcanics—Not shown on cross sections

Yplg *Greenstone Flow*—Ophitic basalt as much as 500 m thick. Where thickest, upper 50 to 150 m are melaphyre locally containing granophyre. Upper half of flow contains pegmatitic layers that are parallel to flow contacts. Columnar joints are common near flow top

Yplk *Kearsarge Flow*—Ophitic basalt containing abundant plagioclase phenocrysts

Ypls *Scales Creek Flow*—Ophitic basalt

Yplgr *Gratiot Flow*—Ophitic basalt containing local irregular pegmatitic zones

Yplc *Copper City Flow*—Ophitic basalt containing local pegmatitic zones

Yplb *Bohemia Conglomerate*—Reddish-brown conglomerate and sandstone lithologically similar to Copper Harbor Conglomerate. Where unit is less than 15 m thick, it is shown as a green line

Major interflow sedimentary units—Reddish-brown conglomerate and sandstone units ranging from less than 1 to about 15 m thick. Outcrop traces are shown as green lines on map. h, Hancock Conglomerate; p, Pewabic West Conglomerate; a, Allouez Conglomerate; ho, Houghton Conglomerate; c, Calumet and Hecla Conglomerate; k, Kingston Conglomerate; n, National Sandstone; w, Wolverine Sandstone; o, Old Colony Sandstone; b, Bohemia Conglomerate; s, St. Louis Conglomerate; ba, Baltic Conglomerate

Powder Mill Group (Middle Proterozoic)

Ys **Siemens Creek Volcanics**—Basalt and andesite, olive-gray to dark-greenish-gray. Commonly strongly chloritized, generally fine-grained and massive. Flows vary from 3 to 14 m thick. Basal flows are thicker (35–50 m) and generally pillowed. Flow tops are pahoehoe and sparsely vesicular

Ypu **Powder Mill Group undivided**—Medium- to dark-gray massive basalt flows

Marquette Range Supergroup (Early Proterozoic)

Baraga Group (Early Proterozoic)

Xm **Michigamme Formation**—Graywacke and slate, gray to black. Mostly a sequence of graded bedded units consisting of medium-grained graywacke at base grading upward to dark-gray to black slate at top. Graded units generally about 1 m thick. Generally has well-developed cleavage especially in upper parts of graded beds. Black and gray slate locally predominant, especially in stratigraphically lower parts of formation

INTRUSIVE ROCKS

Yti **Felsite in Portage Lake Volcanics (Middle Proterozoic)**—Grayish-pink, grayish-maroon to reddish-brown felsite. Generally massive. Aphanitic to slightly porphyritic with plagioclase and quartz phenocrysts. Locally has slightly chilled or brecciated contacts. One body in sec. 4, T. 56 N., R. 32 W. is light-gray, coarsely phenocrystic felsite

Yb **Mount Bohemia intrusion (Middle Proterozoic)**—Zoned stock of syenodiorite ringing a core of granophyre. Syenodiorite is medium grained, miarolitic, mottled light red and dark gray; consists mostly of hornblende and albite-oligoclase. Granophyre is fine to coarse grained, miarolitic, red rock, mostly plagioclase with abundant quartz and intergrowths of quartz and albite

Yi **Felsite near Indiana Mine (Middle Proterozoic)**—Reddish-pink to grayish-pink aphyric felsite with sparse quartz and feldspar phenocrysts. Commonly brecciated and has abundant secondary calcite as breccia cement

Yd **Diabase dikes (Middle Proterozoic)**—Fine- to medium-grained, medium- to dark-gray diabase; occur as vertical dikes from less than 1 m to nearly 200 m wide. Dikes have reversed magnetic polarity and can be traced by linear negative magnetic anomalies on aeromagnetic maps

Wgr **Granitic gneiss (Late Archean)**—Gray to pinkish-gray granitic rocks. Lithologically variable unit includes massive, slightly foliated, and strongly foliated granitic rocks, layered granitic gneiss, and minor amphibolitic layers

CORRELATION OF MAP UNITS

SCALE 1:100 000

1 0 1 2 3 4 5 6 7 8 MILES

1 0 1 2 3 4 5 6 7 8 9 10 KILOMETERS

CONTOUR INTERVAL 10 METERS

Base from U.S. Geological Survey
Copper Harbor, 1985 (photoinspected 1992); Hancock,1985 (photoinspected 1990); Iron River, 1989; L'Anse, 1991

Digital compilation by Michele E. McRae
Digital cartography by Linda M. Masonic

CORRELATION DIAGRAM, SOUTH RANGE TO EAGLE HARBOR

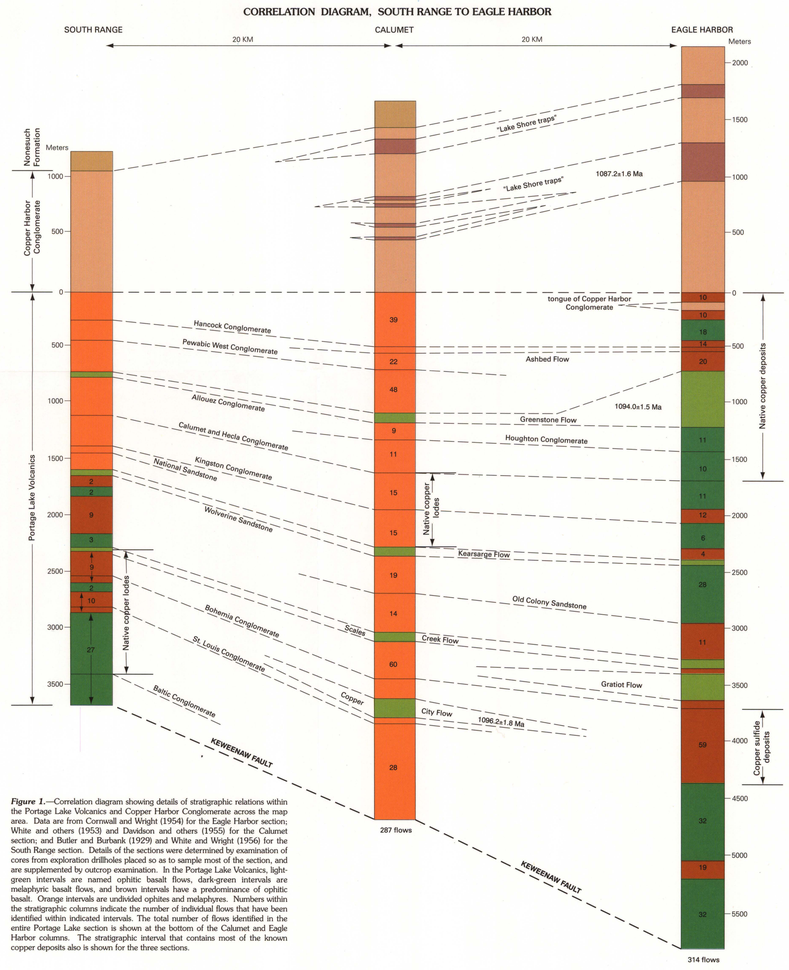


Figure 1.—Correlation diagram showing details of stratigraphic relations within the Portage Lake Volcanics and Copper Harbor Conglomerate across the map area. Data are from Cornwall and Wright (1954) for the Eagle Harbor section; White and others (1953) and Davidson and others (1955) for the Calumet section; and Butler and Burbank (1929) and White and Wright (1956) for the South Range section. Details of the sections were determined by examination of cores from exploration drillholes placed so as to sample most of the section, and are supplemented by outcrop examination. In the Portage Lake Volcanics, light-green intervals are named ophitic basalt flows, dark-green intervals are melaphyric basalt flows, and brown intervals have a predominance of ophitic basalt. Orange intervals are undivided ophites and melaphyres. Numbers within the stratigraphic columns indicate the number of individual flows that have been identified within indicated intervals. The total number of flows identified in the entire Portage Lake section is shown at the bottom of the Calumet and Eagle Harbor columns. The stratigraphic interval that contains most of the known copper deposits also is shown for the three sections.

GEOLOGIC MAP OF THE KEWEENAW PENINSULA AND ADJACENT AREA, MICHIGAN

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2001

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