

Porcupine Mountains Wilderness State Park, Michigan

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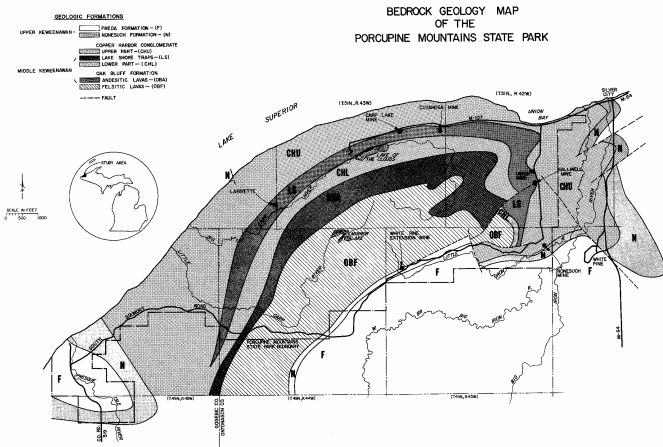


Figure 1. Location and bedrock geology of the Porcupine Mountains area. Abbreviations are explained in the text.

LOCATION

The Porcupine Mountains State Park is located in the northwestern part of Michigan's northern peninsula. The park occupies all of T.50N.,R.45W.; T.51N.,R.43W.; T.51N.,R.44W.; and portions of T.49N.,R.45W.; T.50N.,R.43W.; T.50N.,R.44W.; and T.51N.,R.42W. in Ontonagon and Geogebic Counties (Fig. 1). The area of the park is covered by the Carp River and Tiebel Creek 7½ by 15-minute Quadrangles and the Aldrige Creek, Bergland NE, Government Peak, and White Pine 7½-minute Quadrangles. The principal entrance to the park is via Michigan 107 west of Silver City. Silver City is located 13 mi (21 km) west of Ontonagon on Michigan 64 and 18 mi (29 km) north of Bergland on Michigan 64. Alternate access is provided by County Road 519 16 mi (26 km) north of Wakefield. County Road 519 intersects the park's South Boundary Road which extends north and east to Michigan 107. A visitors' center is located south of the intersection of Michigan 107 and the South Boundary Road. For park visitors, it is extremely advisable not to feed the bears. Further information about Porcupine Mountains State Park may be obtained from Park Manager, Porcupine Mountains State Park, 599 M-107, Ontonagon, Michigan 49953.

SIGNIFICANCE

The Porcupine Mountains Wilderness State Park contains one of the few remaining wilderness areas in the midwest. Also known as the Porkies, it was named by the Chippewa Indians who noted the domal area's resemblance to a crouching porcupine. The Porcupines

is the largest of Michigan's state parks, comprising more than 58,000 acres. It contains some 30,000 acres of uncut timber, the largest stand of virgin wilderness/northern hardwood forest east of the Mississippi River. The park contains four secluded lakes and miles of wild rivers and streams. More than 85 mi (137 km) of foot trails are maintained by the Michigan Department of Natural Resources. The Porkies have some of the highest elevations in the midwest. Summit Peak, in Sec. 11, T.50N., R.44W., is 1,946 ft. (593 m) above sea level. Summit Peak road and trails leading to the peak are located on the Tiebel Creek Quadrangle.

Among the many attractions the park has to offer are old copper mines. The major mines are located on Figure 1. The geology of the mines has been poorly recorded. Apparently, the LaFayette, Carp Lake, Cuyohoga, Union, and Halliwell mines were explored along the upper part of the Lake Shore Traps and the base of the upper part of the Copper Harbor Conglomerate (Fig. 1). The Nonesuch and White Pine Extension properties were in the Nonesuch Shale. Most of the copper produced in the Porcupine Mountain area, as elsewhere in Michigan's copper range, was in its elemental state and referred to as native copper, although most of the copper from the Nonesuch Shale is from the sulphide chalcocite. At least 53 mining permits were granted in this area. Prospectors were in the Porcupine Mountains as early as 1844, and in 1845 there were two active mining operations, the LaFayette and Union mines. Of those mines located on Figure 1, only two within the park recorded production; the Carp Lake produced 15 tons, and the Nonesuch 180 tons. In the extreme western part of the park, the Nonesuch Shale of the Presque Isle syncline has been explored and reported to contain 95,254,400 tons of ore with an average grade of 1.27 percent copper (Wilband, 1978). A detailed description of the history of early mining in this area is presented by Jamison (1950). The premier mining operation within the Porcupine Mountain area is at White Pine about 2 mi (3 km) east of the park boundary (Fig. 1). The White Pine mine was first opened in 1881, produced 2,104 tons of copper in 1916, and closed in 1921. A new venture began construction in 1951 and from 1954 through 1986 produced 1,451,186 tons of refined copper. The ore-bearing horizon at White Pine, the Nonesuch Shale, contains small amounts of liquid hydrocarbons, commonly referred to as Precambrian oil and, in recent years, has excited some segments of the petroleum industry. This occurrence had previously been reported in a Michigan Geological Survey publication as small quantities of bituminous oil in the Nonesuch beds and as the first sign of life in the Precambrian (Rominger, 1894). The hydrocarbon seeps at White Pine have been investigated by the Geophysical Laboratory, Carnegie Institution of Washington (Hoering and Ableson, 1964). They reported that the petroleum, benzene extract, and kerogen are typical petroleum fluids with a rather high proportion of paraffin hydrocarbons. It was further concluded that the evidence indicates that this formation

contains the products of organisms that lived a billion years ago and that it represents the remains of life dating back one-fourth of geologic time (Hoerin, 1965, 1967, 1976). Radiometric age dating of calcites filling late faults which contain petroleum inclusions indicates an age of $1,047 \pm 35$ Ma, which establishes a minimum age for White Pine oil (Kelly and Nishioka, 1985). The Nonesuch Shale within the park boundary has a strike length of approximately 8 mi (13 km) and probably contains hydrocarbons.

DESCRIPTION

The Porcupine Mountains anticline is a large fold on the southern flank of a very large structural syncline referred to as the mid-continent gravity high or rift. Gravity and magnetic surveys trace this feature from eastern Lake Superior west and south to central Kansas. A smaller gravity high extends from eastern Lake Superior to the south through the southern peninsula of Michigan. The Porcupines result from a large domal warp on a rather normal synclinal limb and represent the largest known structural flexure in the exposed Lake Superior syncline. The structural amplitude between the crest of the Porcupine Mountain anticline and the trough of the Iron River syncline to the east is at least 8,000 ft (2,440 m) and may be more than 11,000 ft (3,350 m) (Hubbard, 1975).

Rock formations of the Porcupine Mountains area include one of igneous origin and three sedimentary formations with a combined thickness of about 8,000 ft (2,240 m). They are Middle Proterozoic in age, dated about 1 Ga. Formation descriptions are principally from Hubbard (1975).

The oldest rock unit, the Oak Bluff Formation (formerly Unnamed Formation), has been separated into a series of andesite flows (OBA, Fig. 1) and one or more felsic flows (OBF). The Oak Bluff contains some interflow sediments, principally sandy conglomerate usually containing pebbles and cobbles less than 4 in (10 cm) in diameter, but some boulders as much as 3 ft (1 m) in diameter occur. Most andesite flows are porphyritic and contain oligoclase, pyroxene, and 10 to 30 percent opaque minerals consisting of hematite, magnetite, and ilmenite. Flow tops generally contain sparse vesicles filled with chlorite, epidote, quartz, and calcite. In this area the andesite flows are about 2,000 ft (610 m) thick. The felsite flow or flows form the core of the Porcupine Mountains. This rock contains very sparse quartz phenocrysts in a devitrified cryptocrystalline matrix. It is about 500 ft (155 m) thick.

Above the Oak Bluff lies the Copper Harbor Conglomerate (CH) composed predominantly of sandstone and siltstone with subordinate beds of conglomerate. The composition includes rock fragments, quartz, feldspar, and small amounts of epidote, amphibole, and chlorite. Rock fragments are predominantly intermediate and felsic volcanic rocks, but also include metamorphic rocks. Most of the

conglomerate beds are less than 5 ft (1.5 m), although some are as thick as 25 ft (8 m). The pebbles and cobbles are generally less than 3 in (8 cm) but may be as large as 9 in (23 cm). The maximum thickness of the Copper Harbor Conglomerate in the Porcupine Mountains area is about 5,000 ft (1,525 m).

At least six lava flows are interbedded with the Copper Harbor Conglomerate. They have been named the Lake Shore Traps (LS) and form a prominent linear escarpment from which a large area of the park and Lake Superior may be viewed (Fig. 2). The flows range in thickness from 15 to 70 ft (4 to 21 m). The rocks are fine-grained and generally porphyritic; vesicles are filled with chlorite, quartz, and epidote. Petrographically they resemble flows of the Oak Bluff Formation.

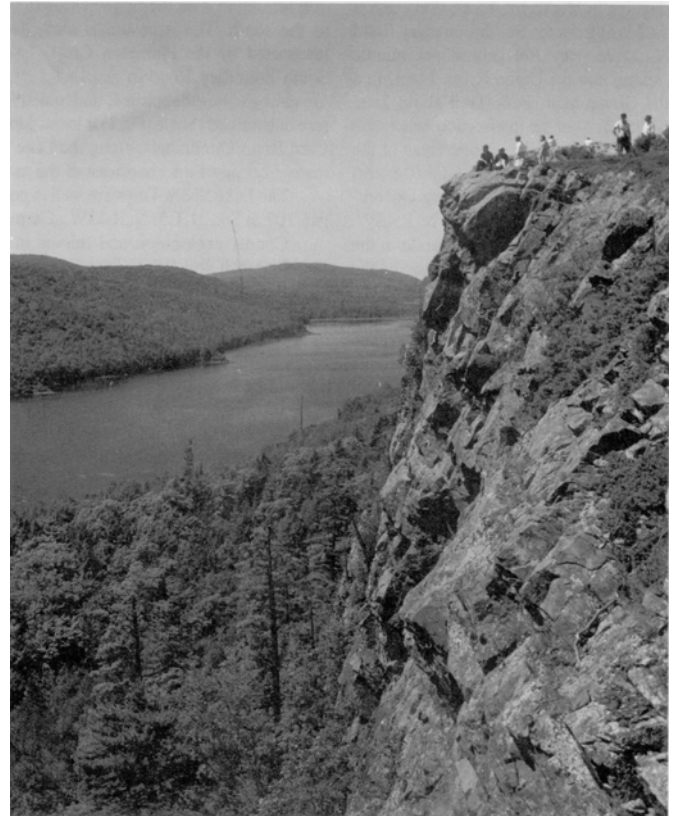


Figure 2. View of Lake of the Clouds (Fig. 1) from the escarpment of the Oak Bluff Formation.

Above the Copper Harbor Conglomerate is the Nonesuch Formation (N). Most of the Nonesuch is a thinly laminated silt-stone and very fine to fine-grained sandstone. The basal part is a shale mineralized with chalcocite and with some native copper. The siltstone and sandstone is composed principally of fragments of pre-Keweenaw rocks including schists; mafic, intermediate, and felsic volcanic rocks; and quartz and feldspar. Opaque grains are abundant. Within the Porcupine Mountains area, the Nonesuch Formation is about 600 ft (185 m) thick.

The youngest rocks exposed in the Porcupine Mountains area make up the Freda Formation (F). The Freda is a cross-bedded, moderately well sorted sandstone and coarse siltstone derived from a terrain of metamorphic

and plutonic rocks, lower Keweenaw volcanic rocks, and iron-formation. A layer of sandy conglomerate to conglomeratic sandstone 12 to 67 ft (4 to 20 m) thick occurs about 500 ft (150 m) above the base. Along the Montreal River, which separates Michigan from Wisconsin, the Freda Formation is about 12,000 ft (3,660 m) thick.

Many natural features may be observed in the Porcupine Mountains State Park along roads and trails located on the above cited topographic quadrangle maps. Union Spring, near the center of Sec. 20, T.51N., R.42W., Government Peak Quadrangle, is the second largest natural spring in Michigan. Access is via Union Spring Trail about 2 mi (3.2 km) from the South Boundary Road in Sec.27, T.51N., R.43W. More than 700 gallons per minute (3,182 L) flow from the spring into the Union River. The Union Spring Trail intersects the Government Peak Trail about 2 mi (3.2 km) west of Union Spring. East of the intersection, where the trail crosses Carp River inlet, outcrops of andesitic lavas of the Oak Bluff Formation may be observed. About 0.5 mi (0.8 km) south and 2 mi (3.2 km) west of the intersection, along Government Peak Trail, is Government Peak in Sec.26, T.51N., R.43W. This peak, at 1,850 ft (564 m), is the second highest point in the park. The bedrock of Government Peak is felsitic lavas of the Oak Bluff Formation.

Summit Peak, Sec.11, T.50N., R.44W., Tiebel Creek Quadrangle, at 1,958 ft (597 m) is the highest elevation in the park, and the summit affords an exciting view of the park and of Lake Superior. Summit Peak Road extends 2.5 mi (4 km) north of South Boundary Road from Sec. 13, T.50N., R.44W., and Side Trail continues another 1 mi (1.6 km) to Summit Peak. North of Summit Peak in Sec.2, T.50N., R.44W., Carp River Quadrangle, along the South Mirror Lake Trail is Mirror Lake, the highest lake in the park at an elevation of 1,532 ft (467 m). Felsitic lavas of the Oak Bluff Formation are well exposed on Summit Peak and surrounding Mirror Lake.

An interesting exposure of Copper Harbor Conglomerate was described by Wright (1905, p. 41). It is located at the mouth of the Carp River, Sec.33, T.51N., R.44W., Carp River Quadrangle. In addition to rounded pebbles of felsite, melaphyre, and sandstone, jaspilite iron formation pebbles 1 to 6 in (1 to 15 cm) in diameter form part of the conglomerate. The nearest known iron formation is on the Gogebic iron range nearly 30 mi (48 km) to the south. The exposure is along the Lake Superior Trail intersected by the Pinkerton Creek Trail originating from the South Boundary Road in Sec.14, T.50N., R.45W., Tiebel Creek Quadrangle. For the spirited, undaunted hiker, an unfaulted exposure of Nonesuch Shale (Fig. 1) is located in Sec.26, T.51N., R.44W., Carp River Quadrangle, along the Lake Superior Trail approximately 2.5 mi (4 km) northeast of the mouth of the Carp River.

The Lake Shore Traps are well exposed at the end of Michigan 107 in Sec.21, T.51N., R.43W., Carp River Quadrangle.

Copper exploration and mining in the Nonesuch Shale at the Nonesuch and White Pine Extension mines have been previously mentioned. There are excellent exposures of Nonesuch at and near the mouth of the Presque Isle River in Sec. 19 and 30, T.50N., R.45W., Tiebel Creek Quadrangle. A trail trending north about 0.25 mi (0.4 km) from the termination of County Road 519 leads to a footbridge across the Presque Isle River. Here the Nonesuch, with numerous potholes, may be observed.

South of the Nonesuch Shale in Sec. 30 described above, the Freda Formation is well exposed in and along the Presque Isle River continuing south to the South Boundary Road. Almost continuous outcrops of Freda, Nonesuch, and Copper Harbor are in and along the Presque Isle River in Secs. 4 and 9, T.49N., R.45W.

An interesting observation was made by Wright (1905) while mapping the Porcupine Mountains area. He noted that the kinds of trees over the various formations differ. The felsite is densely covered with hardwood, while hemlock predominates in other parts. The distribution of tree belts is especially noticeable in this district. In certain parts the boundary lines of various tree belts are so sharply defined that they can be mapped accurately.

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