

ECONOMIC GEOLOGY: NEW JERSEY HIGHLANDS

General Introduction and Road Log

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The New Jersey Highlands province comprises the centermost portion of northern New Jersey, extending 96 Km northeasterly across the state and ranging in width from 16 to 40 Km. It is flanked on the northern side by the Valley and Ridge province and on the southern side by the Triassic Lowlands of the Piedmont province. The province, which is part of the Reading Prong of the New Jersey Highlands is essentially a belt of Precambrian crystalline rocks with certain narrow belts of folded and in-faulted Paleozoic sedimentary rocks. The three articles that follow this general introduction contain specific information on these rock types and their relationships.

The Precambrian rocks of the New Jersey Highlands have been hosts to several commercial mineral deposits. Historically, the magnetite iron ore deposits are of unique importance. These deposits have been mined since at least as early as 1710 (Buddington, 1957), perhaps the oldest iron mining in the United States. Geologic and other information concerning the major magnetite deposits of the Highlands was first outlined by Bayley (1910). For several years during the third quarter of the nineteenth century, New Jersey was the biggest producer of iron ore in the United States. Of the 136 mines active in 1880, none are operating today. However, some of the now abandoned mines are still accessible. During this field trip, John Puffer will lead us through two such mines: the Andover-Sulphur Hill Iron Mines (STOP 2) and the Edison Magnetite Deposits (STOP 3).

Interest in the mineralization of the Franklin area has been worldwide and has continued, unabated, for more than a century. In certain rare cases, a significant accumulation of a wide variety of elements is possible in certain areas of the earth's crust, resulting in the formation of a large number of minerals, some of which are unique or exclusive to the area. Kostov (1968) lists only four such localities in the world, with the Franklin area being one of them. The Franklin deposits are enriched mainly in manganese, iron, and zinc, but the combina-

tion of the silicate-oxide ore minerals with numerous associated gangue minerals is unique and generally unknown elsewhere. Kushner (1970) compiled an abbreviated manual of Franklin minerals and listed about 200 species. Some of these minerals (e.g., franklinite, zincite, etc.) are either unique to Franklin or are rarely found elsewhere. Today, except for the mining operations at Sterling Hill and at the Farber White Limestone Quarry on Cork Hill Road, all of the mining activities at Franklin have ceased. Bob Metsger, who has been the chief geologist at the Sterling Hill Mine for several years, will lead us through the mine area and describe the occurrence and origin of this classic deposit (STOP 4). Mineral collecting will be available at the mine dump. However, those who are interested may also visit the Trotter and Buckwheat dumps for additional mineral collecting upon payment of a small fee.

The search for uranium in the 1950's is responsible for the greatest metal hunt in the history of the world. The New Jersey Highlands province was included in this hunt, and in 1955 a series of geiger counter hot spots were discovered along the perimeter of a large pegmatite near Cranberry Lake by Mr. Edward Koral and the New Jersey Geological Survey. In 1959 the Byram Exploration Minerals Company put down a vertical shaft on one of the hot spots and named the deposit the Bemco Mine. Throughout the summer of 1959 some uranium was recovered and shipped out (about 95 tons of ore), but the rare earth values of the ore were overlooked at the time. The Bemco Mine, also known as the Charlotte Mine, is located on land now designated as Green Acres and is, of course, inactive. The ore represents a highly unusual mineral assemblage of metamict minerals (e.g. fergusonite, uranotorite, zircon), and is of interest as a good example of hydrothermal mineralization relating to the intrusion of a pegmatite into the metamorphic host rocks. Diamond drill cores studied by Williams (1967) define the ore zone up to a depth of 30 meters. On STOP 1 of the trip, this writer will point out the relationships between the ore and the associated rock units and discuss the origin of the deposit.

As shown in Fig. 1 and in the Road Log that follows, the trip will consist of four main stops:

STOP 1: Bemco Mine, Cranberry Lake area, led by A. H. Vassiliou

STOP 2: Andover-Sulphur Hill Iron Mines, led by J.H. Puffer

STOP 3: Edison Magnetite Deposit, led by J.H. Puffer

STOP 4: The Sterling Hill Mine, Ogdensburg, led by R. Metsger.

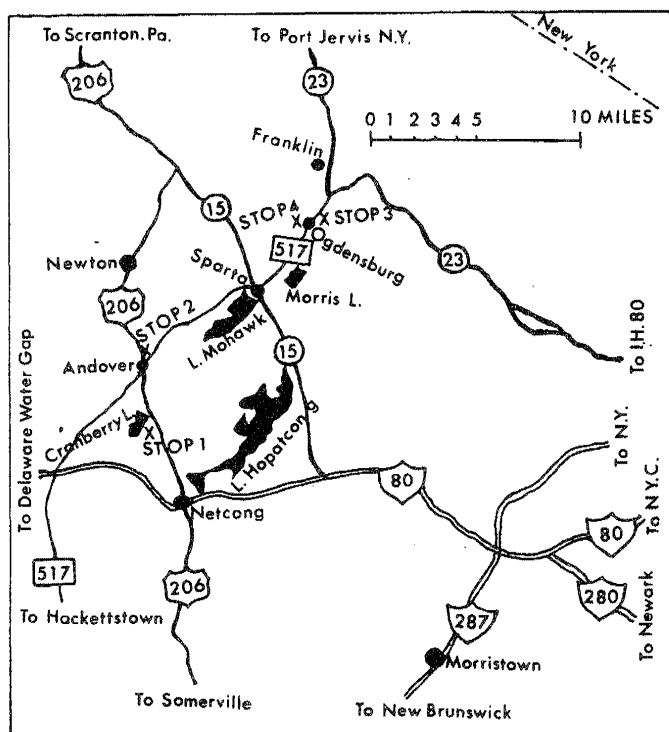


Fig. 1 Map showing location of field stops.

ROAD LOG

Mileage

- 0 Leave Rutgers-Newark, parking lot 500 next to Boyden Hall, turning right on Warren Street. Go for one block to traffic light.
- 0.1 Turn right on High Street. Go for about two blocks to first traffic light.
- 0.2 Turn left, but bearing to the right of the island, onto Sussex Street. Continue on Sussex which becomes Nesbitt Street after the first traffic light. Go to end of Nesbitt, about one block (T intersection).

- 0.8 Turn left to face traffic light and entrance to I 280 West. Stay on 280 West for about 15 miles. See Manspeizer (this field book) for description of columnar structures in basalt along I 280.
- 15.6 Exit for I 80 West. Stay on 80W for about 19 miles.
- 34.4 Exit for Rt. 206 North.
- 38.2 Left on South Shore Road, bearing left at intersection.
- 38.4 Left on to first dirt road. Continue on dirt road (old railroad line).
- 39.2 **STOP 1** (about one hour). At this point the dirt road has small parking area on the right whose path or trail (uphill) leads to the BEMCO MINE. Go 420 feet along the trail: "sulfide quarry" to the right, downhill. + 840 feet to "red flag" — turn right down the hill to lower trail (about 50 feet). + 350 feet, turn left for mine area. + 145 feet, to old shaft.

See attached article on the deposit by A.H. Vassiliou.

LEAVE FIRST STOP, go back to intersection with Rt. 206, continue on Rt. 206 North.

- 43.6 Right on Rt. 669 (Limecrest Road). Exxon at right corner.

- 44.5 **STOP 2** (about one hour). Park off road and follow path or trail (right side of road) to ANDOVER-SULPHUR HILL IRON MINES. See attached article by J.H. Puffer.

You will be asked to sign a waiver before entering the mine property, and are requested to wear a hard hat and safety glasses. Follow the path from the mine gate to an open clearing. The Andover Mine workings including adit portals and an open pit are found along a cliff located south of the central clearing. Highly altered diabase dikes are intruded along the cliff. The diabase is black to dark green, highly chloritized, fine grained rock that has been sheared and mylonitized. The magnetite ore is disseminated in a light gray Quartz-Oligoclase Gneiss. Dark green pyroxene-feldspar gneiss is exposed above the cliff east of the mine. The pyroxene-feldspar gneiss is green (highly epidotized) fine grained, migmatitic, locally calcareous rock. The pyroxene component is diopside. A light buff microcline granite gneiss is exposed along the road just west of the mine.

The Sulphur Hill open pit is located about 400 feet north of the central clearing. The pits are dangerous and are closed to visitors. Most of the rocks found in dumps at the north and eastern edges of the clearing are from the Sulphur Hill Mine. The rock is a magnetite and sulphide rich garnet skarn. Amphibolite is exposed south of the Sulphur Hill Mine. It is recognized by its black hornblende content, and is coarser grained than the pyroxene-feldspar gneiss.

LEAVE STOP 2, go back to intersection of Rt. 206 and turn left at intersection to get onto Rt. 206 South.

- 45.2 Left (at light) on 517 North. Stay on 517 for about 12 miles.

- 56.8 Right on road (no name shown) across from Danforth's Trailer and Vespa dealership (shortly after school on left).

- 59.3 **STOP 3** (about 30 minutes). Park off road (clear area on right). Climb up bank, cross fence, to the EDISON MINE magnetite deposit. See attached article by J.H. Puffer.

Buses will turn around. At the southern end of the open pit (The Old Ogden Mine) there are good exposures of a biotite, sillimanite and magnetite rich phase of a metasedimentary Quartz-Potassium Feldspar Gneiss. Sulfides including pyrite, chalcopyrite, and molybdenite are disseminated throughout the rock but are found concentrated near the south-east corner of the pit. Acid solutions leached through the sulfides have accelerated the alteration of the rock to a sericite rich saprolite. Please exercise extreme caution when approaching the open pit, and be on the alert for poison ivy.

LEAVE THIRD STOP, go back to Rt. 517, make a left at intersection on to 517 South.

- 59.4 Right on Passaic Ave. (just before school).
- 60.0 Left on Plant Street to the New Jersey Zinc Co. mine buildings.

STOP 4 — The Sterling Hill Mine (Ogdensburg). Here we shall have lunch, go on a mine tour, and then do some mineral collecting at the dump. See attached article on the deposit by R. Metsger.

Stop duration, two to three (or more?) hours.

REFERENCES CITED

- Bayley, W.S., 1910, Iron mines and mining in New Jersey: Geol. Survey of New Jersey, v. VII.
- Buddington, A.F., 1957, Magnetite iron ore deposits of the New Jersey Highlands in Dorf, E., ed., Guidebook for Field Trips, Atlantic City Meeting, Geol. Soc. Am., p. 77-86.
- Kostov, Ivan, 1968, Mineralogy: Oliver and Boyd, London, p. 79.
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- Williams, R.L., 1967, Reconnaissance of Yttrium and rare-earth resources in northern New Jersey: U.S. Bureau of Mines Report of Investigations 6885, p. 9-15.



TROWBRIDGE MOUNTAIN AND WATNONG PLAINS, FROM SUGAR LOAF HILL, MORRIS CO.

TROW BRIDGE MOUNTAIN AND WATNONG PLAINS,
from Sugar Loaf Hill, Morris Co.
H. Carmiencke Del. 1856
From N.J.G.S. 2nd Annual 1856