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AN OCCURRENCE OF BROWN IRON ORE IN THE GUNTERSVILLE AREA, MARSHALL COUNTY, ALABAMA

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In the course of geologic investigations in the Guntersville area, Marshall County, Alabama, the writer examined numerous properties reputed to contain valuable deposits of iron ore. A majority of these properties are located on the outcrop belt of the Red Mountain formation, and were thought to contain seams of red ore. Several tracts, closely grouped in a section known as Polecat Hollow, were alleged to contain workable deposits of brown iron ore. It is with the latter tracts that this paper deals.

Although the hydrous oxides of iron are to be found on every property within the lower 1.5 mile section of Polecat Hollow, the writer's field studies disclosed no deposits which are workable under present conditions. Nevertheless, some of the properties have been exploited in the past for iron ore and ocher. One very brief mining operation ceased about 1900 and another was discontinued in 1915. The present paper has been prepared with a three-fold objective in mind: (1) to record the occurrence of brown iron ore minerals in the Guntersville area; (2) to present a brief account of the geology of this occurrence; and (3) to summarize the history of such mining efforts as have been made.

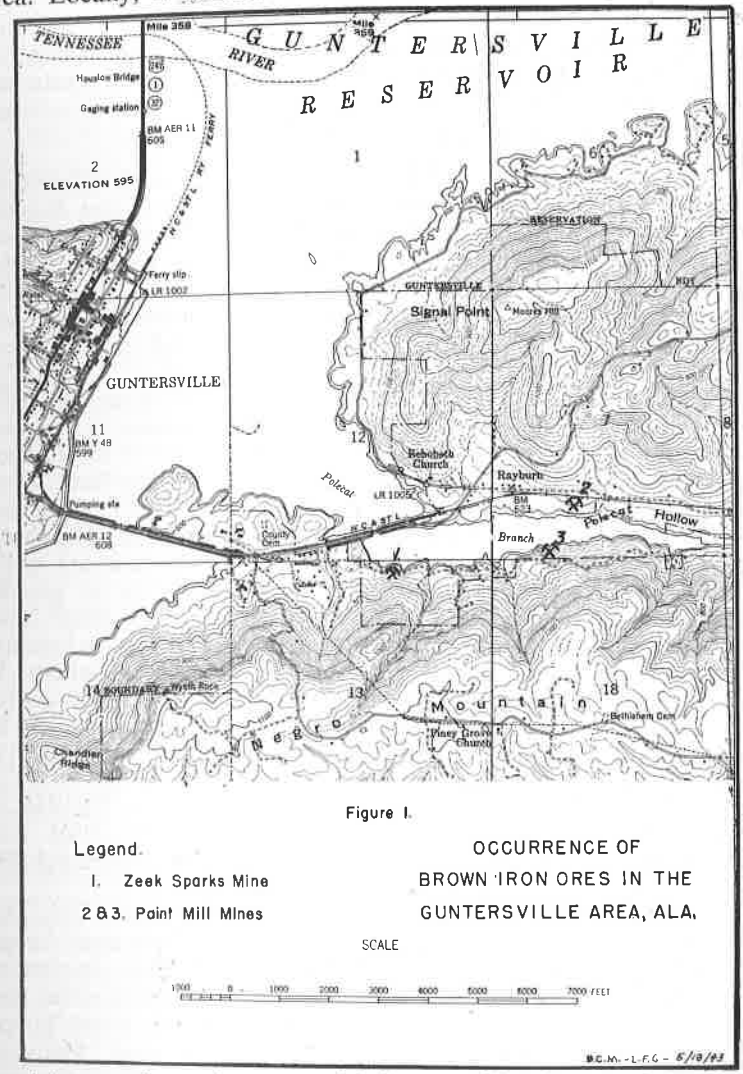
GEOLOGY OF THE AREA

Location of the area. Polecat Hollow, the east-west trending valley of Polecat Branch, is due east of Guntersville (Fig. 1). The Guntersville to Albertsville branch of the Nashville, Chattanooga, and St. Louis Railway extends up Polecat Branch and Rayburn Station is within the Hollow. Formerly, Polecat Branch followed a westerly course down its valley and joined Big Spring Creek 0.7 miles east of Guntersville. The valleys of both streams are now flooded up to elevation 595 feet above the datum plane by the waters of the Guntersville Reservoir.

Stratigraphy and Structure. The stratigraphy and structure of the area are clearly shown on the Geologic Map of Alabama (1926). The oldest formation exposed in Polecat Hollow is the Bangor limestone (restricted) which forms the floor and the lower slopes of the valley. It consists mainly of about 600 feet of thick-bedded, bluish gray, coarsely crystalline, and oolitic limestones. Bedrock is nearly everywhere concealed by a thick overburden of residuum, alluvium (now under water), or waste from the overlying formations.

The Bangor limestone is overlain by the Pennington shale which consists of about 75 feet of red and gray shale and argillaceous

limestone. This formation is entirely covered by talus and other detritus from the overlying Pottsville sandstone. The Pottsville sandstone forms the Cumberland Plateau, including the mountains north and south of the Hollow, and is the youngest formation in the area. Locally, it consists of some 350 feet of coarse, cross-bedded



sandstone and conglomerate with interstratified layers of dark shale and thin coal seams. Polecat Branch has cut its valley completely through this formation, through the Pennington shale, and well down into the Bangor limestone. Steep bluffs of sandstone occur at the higher elevations overlooking the Hollow.

The dominant structural feature in the Guntersville area as a whole is the Sequatchie anticline, an asymmetrical fold trending about north 45 degrees east. The opposing limbs of this fold exhibit wide variations in the angle of dip, but the dip of the northwest and southeast limbs average 25 degrees and 10 degrees, respectively. A short distance away from the axis of the fold the beds on either limb are essentially horizontal. There is a slight dip to the southeast in the Polecat Hollow section but, for all practical purposes, the strata are nearly horizontal.

Mode of Occurrence of Brown Iron Ore[1]

Varying amounts of the hydrous oxides of iron, known collectively as the "brown iron ores" occur in the residuum over the Bangor limestone throughout its extent in Polecat Hollow; however, below elevation 600 most of the residuum has been cut away by erosion and replaced by alluvium. Nearly all of the material is limonite ($Fe_2O_3.3H_2O$) with associated siliceous and argillaceous impurities. Two types of occurrence may be recognized, although no hard and fast distinction between them can be made.

One type of occurrence, which may be called the disseminated type, is represented by small, somewhat rounded nodular bodies of limonite which occur sparsely distributed through the residuum of the Bangor limestone. These bodies are not spheroidal, nor do they even approach sphericity. In general, they are quite irregular in form but have one or more surfaces somewhat rounded. Sharp angles and sharp edges are entirely lacking and mammillary prominences are quite common. The rounded character of these bodies is a growth phenomenon, and not a result of abrasion. In size, they range from less than an inch to a few inches across. Material of this type exhibits dark brown colors and is very fine-grained and dense throughout. It commonly, but not invariably, contains megascopic grains of quartz sand. Because of its sparse distribution, no attempt has been made to mine the disseminated limonite. The iron and silica content of a typical specimen are as follows:

Iron (Fe)	52.14%
Silica (SiO_2)	8.01

(Analysis by Southern Testing Laboratories, Birmingham, Alabama.)

The other type of occurrence is that of "ore pockets" within the residuum of the Bangor limestone. In occurrences of this type, lumps of limonite are in some places of limited extent thickly distributed through the residuum. Individual lumps range in size from pieces less than an inch on a side up to masses several feet across. These lumps are very sharply angular and extremely irregular in shape. Many of them are spongy, cellular, or septate in structure, although good boxwork structures do not occur. Rounded surfaces, mammillary prominences, botryoidal masses and stalactitic forms are entirely

[1]The term *ore* is used advisedly. Strictly speaking, an ore is a material of sufficient value to be mined at a *profit*.

lacking. Ore of this type is of light brown to dark brown color, although surfaces may contain yellowish or orange ocher. The pocket deposits vary widely in size. Some of the exhausted pockets contained very little ore; others yielded many tons.

Mining

Some properties in Polecat Hollow have not been prospected; others have been prospected extensively. A considerable amount of mining has been done on one property and the attempt was made to develop a mine on a neighboring tract.

Zeek Sparks Property. The first attempt to mine brown iron ore in the area is reported to have been made some time between 1896 and 1900[2] on a property known as the Zeek Sparks tract. A trench about 30 feet long, 8 feet wide and a few feet deep was opened on a hillside south of Polecat Branch (Fig. 1). According to Ross[2], a hundred cubic yards of material was taken from this mine, but it is obvious from the spoil pile that very little of it was ore. The material was mined for ocher, although it was not used as a pigment in paint. It was mixed with linseed oil and applied as a "primer" to prepare surfaces for painting. It was used also as a "filler" in paint. Operations were soon discontinued, due apparently, to the lack of quantity or quality of the ore, or both.

The following partial analyses afford a fair indication of the quality of the ore:

	I	II	III	IV
Iron (Fe)	32.64	21.8	21.4	1.6
Silica (SiO_2)	36.31			
Insolubles		58.8	57.2	93.5

I. A composite sample of "ore" from the Zeek Sparks mine, collected by the writer. Analysis by the Southern Testing Laboratories.

II and III. Limonite from the Zeek Sparks mine. Collected by Robert M. Ross. Analysis by TVA.

IV. "Ocher" from Zeek Sparks mine. Collected by Robert M. Ross. Analysis by TVA.

Paint Mill Property. A property known as the Paint Mill Tract, located near Rayburn on the north side of the Hollow, was worked first for ocher and later for iron ore. The date of the first prospecting and mining was not ascertained. The gentle slopes of a rounded knoll about a quarter of a mile due east of Rayburn are interrupted by numerous small to sizable open pit workings. Apparently, the property was prospected as it was worked. A small pit was dug and, if ore was encountered, the pit became a "mine" and was expanded laterally and vertically until all of the ore was removed. Pits in which no ore was found were soon abandoned. The deposits appear to be nearly completely exhausted, as there is but little ferruginous material to be seen around the workings. The character of the ore is shown by the following chemical analysis of a composite sample collected by the writer.

Iron (Fe)	45.76%
Silica (SiO_2)	14.79
Phosphorous (P)	0.39
Sulfur (S)	0.04

(Analysis by Southern Testing Laboratories, Birmingham, Alabama)

That portion of the Paint Mill Tract which lies on the south side of Polecat Branch has been prospected by numerous small pits, some of which revealed low grade ferruginous material. A large trench slightly above elevation 600 feet above sea level was worked as a mine but it appears to have yielded little

[2]Ross, Robert M.: Unpublished memorandum dated May 3, 1938.

or no commercial ore. The partial chemical analysis of a composite sample of the ore collected by the writer is as follows:

Iron (Fe)	51.64%
Silica (SiO_2)	7.64

(Analysis by Southern Testing Laboratories, Birmingham, Alabama)

All ore mined on the property was mined by hand labor and washed at the mine. The first ore mined is reported to have been sold as ocher to a paint manufacturer in Guntersville. Mr. Lee Singleton, who resides in Guntersville in the East Lake Community, reported to the writer that he operated a mine on the property for a Guntersville banker in 1915. He stated that he shipped ten carloads of ore to a blast furnace at LaFollette, Tennessee and two carloads to a furnace at Chattanooga. The shipments to the latter furnace were rejected because of the low grade of the ore. As the shipper was required to pay the freight on the rejected ore, the mines were shut down in 1915 after a few months' operation. The washer has been removed from the property, but its location is still marked by a low mound of tailings. The concrete foundation on which the engine was mounted is intact and the stone masonry foundation of the boiler is in ruins.

Other Properties. Although neither mining nor systematic prospecting have been attempted on the other properties in Polecat Hollow, a little limonite is to be found on all of them. None of these properties appear to contain enough limonite to justify prospecting.

Origin of the Limonite

The limonite found in Polecat Hollow was derived from iron sulphide, principally marcasite, which occurs in the Bangor limestone in small disseminated crystals. Under conditions favorable to oxidation and hydration, which are afforded by the processes of weathering in a humid climate, the sulphide was altered to hydrous iron oxide. This material remained essentially in place with other insoluble materials, especially clay and chert, which form the residuum, but the more soluble materials were carried away in solution. The concentration of the hydrous oxide of iron into nodules and other masses took place at the surface and within the residuum as erosion progressed.

Conclusions

The brown iron ore deposits in the Polecat Hollow section, all of which are above elevation 600, are small and most of the material is of low grade. Although ore was mined on one property on a small scale for a short period of time, and an abortive attempt was made to develop a mine on another property, such deposits as remain on the properties investigated are without present commercial value.

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