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# Mississippi State Geological Survey

E. N. LOWE, Director

Report of the  
State Geologist  
on the

## Iron Ores of Marshall and Benton Counties,

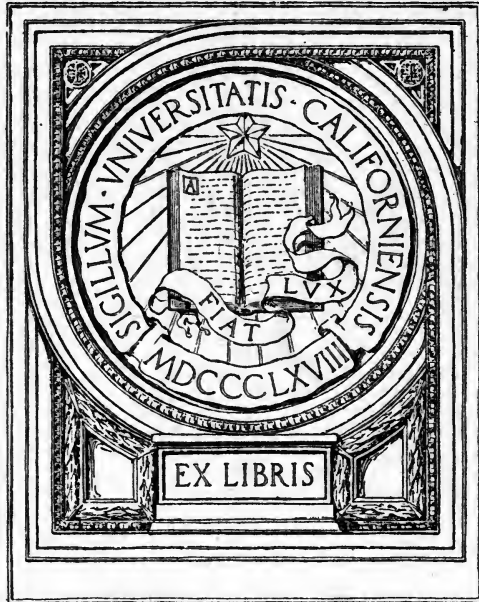
Made to the Geological Commission

May 1, 1912.



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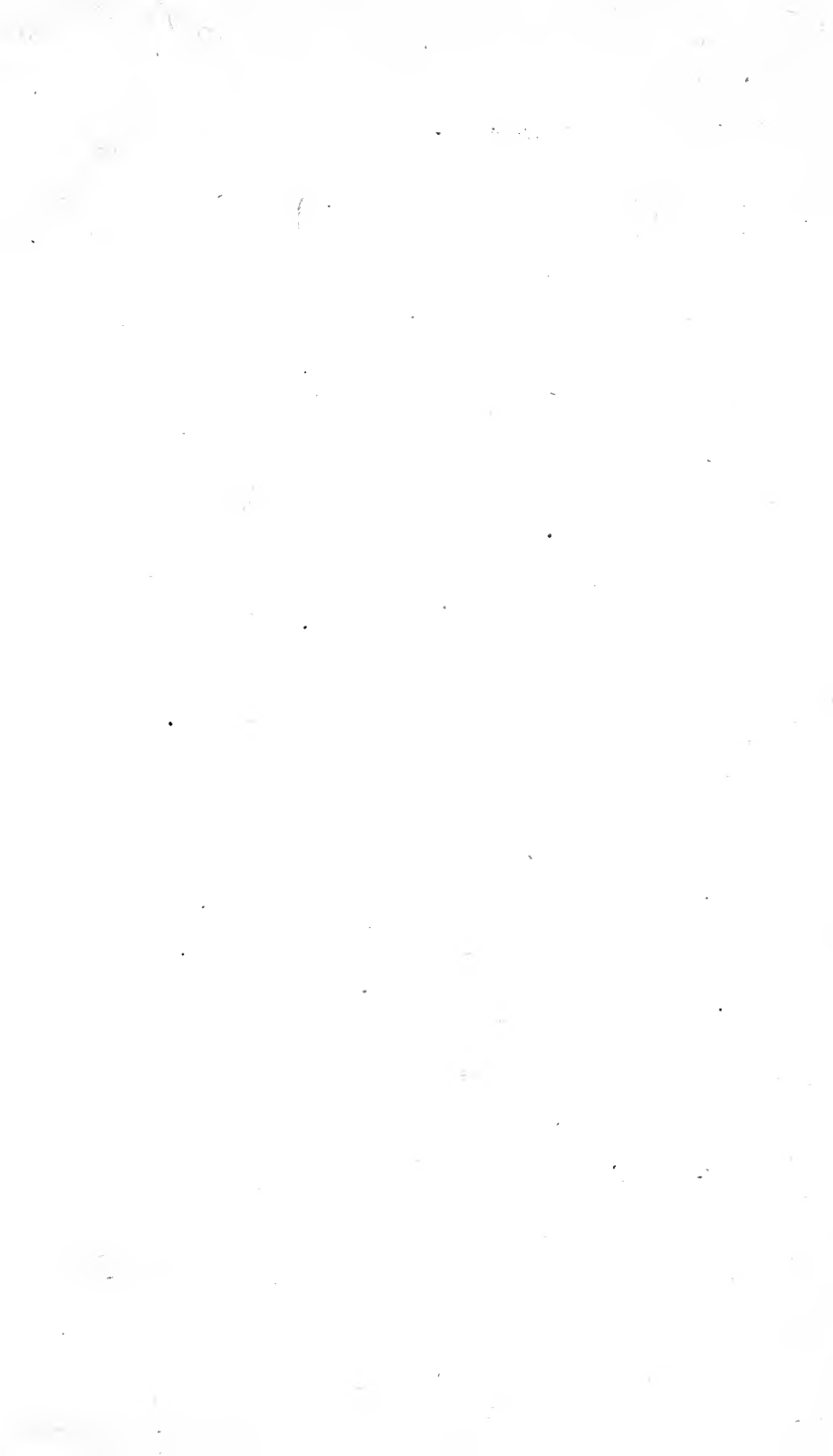
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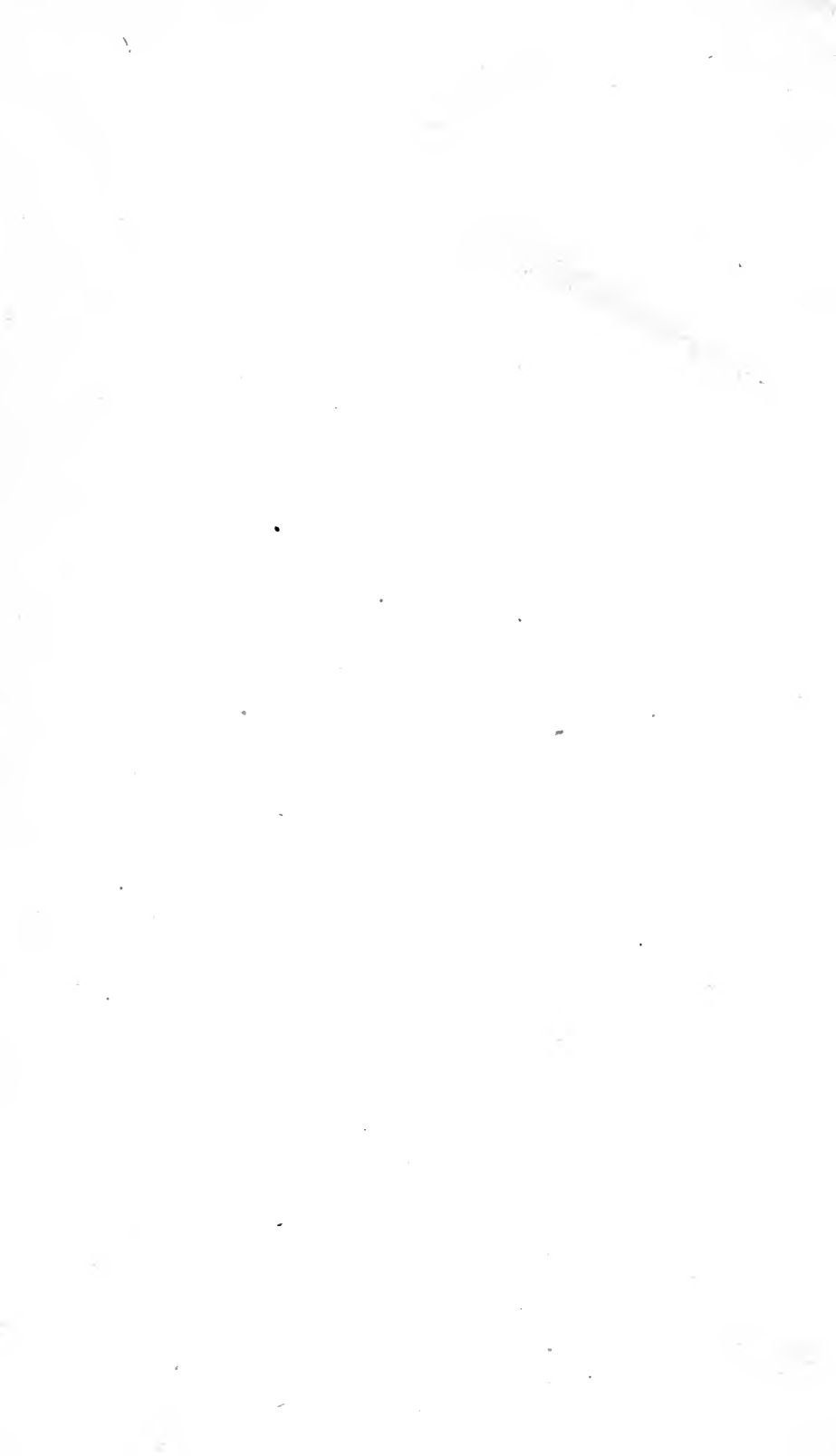


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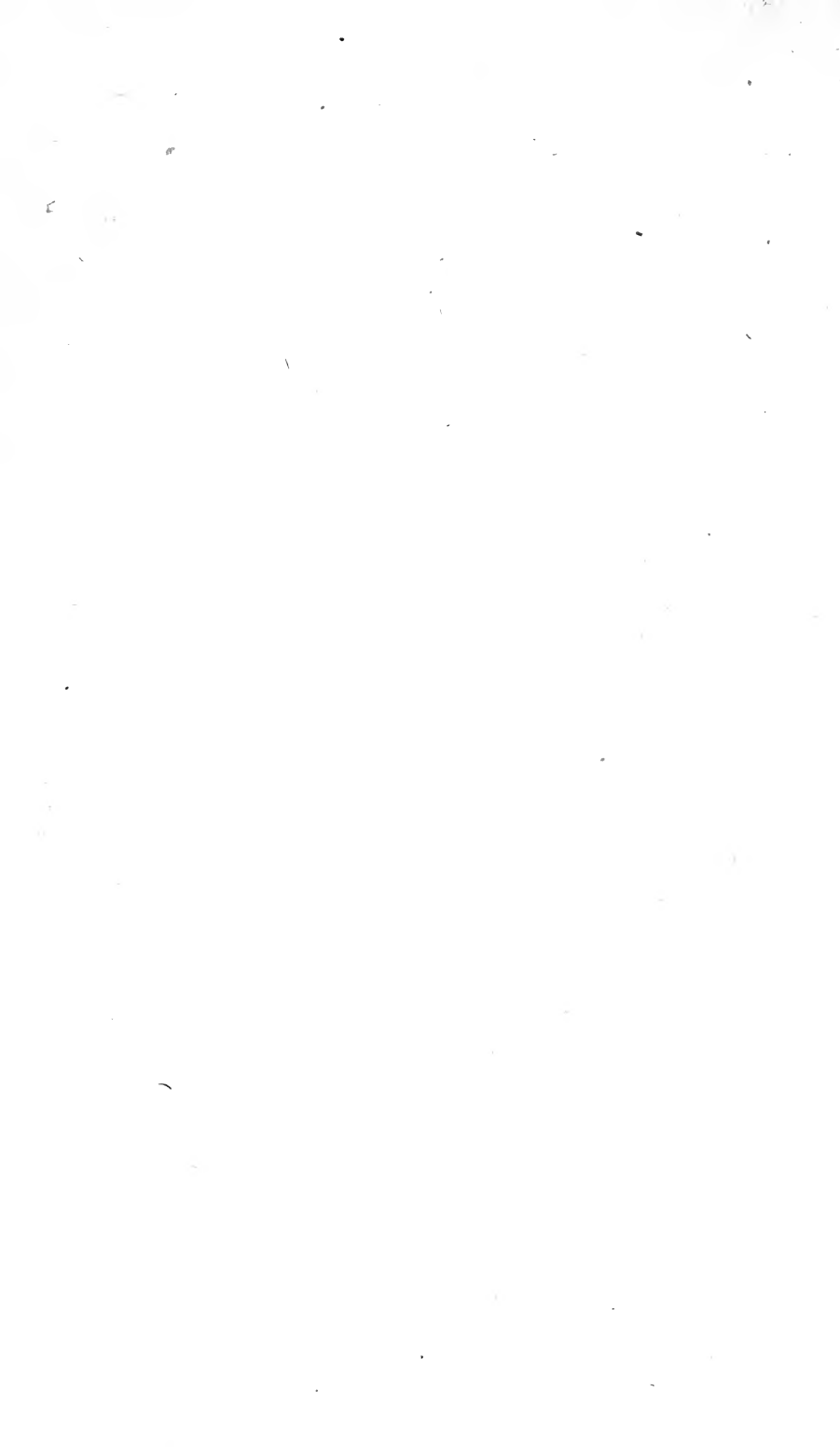














# Mississippi State Geological Survey

E. N. LOWE, Director

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## Iron Ores of Marshall and Benton Counties,

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# Examination of Iron Ore Deposits in Marshall and Benton Counties.

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In addition to the prescribed lines of work just reported upon, I beg to report that the Survey has recently been investigating the Iron ore deposits of the Potts Camp region that point to a discovery, which in my opinion, is of no little economic importance to the State. It has long been known that scattered deposits of brown oxide ore, or limonite, occur in various parts of the State, especially in the northern counties. Nearly three years ago I collected samples of these ores from several points, notably, Grenada, Duck Hill, Pine Valley in Yalobusha County, Lafayette County 8 miles southeast of Oxford, Ackerman in Choctaw County, and from Enterprise in Clarke County, all of which were exhibited at the Capitol in Jackson, where they are now to be seen in the State collection. We had hoped to have these analyzed at the time, but shortage of our funds prevented, and they have not yet been analyzed. At two points, Ackerman and southeast of Oxford in Lafayette County, I have noted the fact that large masses of the oxidized ore on being broken open showed the interior to be light gray in color, indicating the presence of iron carbonate. The presence of carbonate was surprising because having heretofore escaped notice, but as the quantity of the material was not apparently great at either place, little attention was paid to the discovery and no analyses were made. In both cases the carbonate ore was associated with lignitic clays and lignites.

During the summer of 1911, having from time to time

heard reports of iron at Potts Camp in the southeastern part of Marshall County, I stopped between trains and examined the deposits somewhat hurriedly. The area gone over was perhaps as much as 75 to 100 acres, and considerable quantities of brown oxide of iron were seen scattered over the hill slope. It was not considered of enough importance to investigate further, being very similar to deposits found elsewhere in the State, though the ore appeared of good quality. Recently, however, reports of carbonate iron ore found at that point together with some analyses of those ores submitted to me for my opinion, and which showed the ore to be carbonate ore high in iron, determined me to re-examine the area. I was also instructed by the Governor to go over the ground in more detail and to make a report on the deposits observed. I accordingly did so in April of this year, and have the honor to report as follows:

## Potts Camp District

AREA and TOPOGRAPHY.—The area of ore-bearing territory, so far as at present determined, embraces a region approximately seven miles in extent east to west and about the same north and south, with Winborn situated nearly in the center. It is extremely probable that the deposits in southern Lafayette, in Yallobusha, and in Grenada Counties, and perhaps that also in Choctaw, were at one time continuous with but have been separated by erosion, from the Potts Camp area.

The whole region was originally part of a high plateau of north-central Mississippi, which has been cut by erosion into hills and ridges with intervening valleys. As a result the surface of the region is rough, the ridges and hills parting

the stream courses being 75 to 100 feet above the drainage, and having rather steep slopes. The uplands of the region are too rough and the soil too sterile to offer encouragement to farming; so that, while some of the more promising parts are open to agriculture, by far the greater part is still in timber, such as pine, oak of several species, hickory, and dogwood, though most of the merchantable timber has been cut off.

Two streams of considerable size flow through the area taking almost parallel courses from northeast to southwest. The larger of the two is Tippah River flowing two miles west of Potts Camp, the smaller, Ocklinita Creek east and southeast of Hickory Flat. These streams have alluvial flats from half a mile to a mile wide. Numerous streams descend from the uplands to the valleys, cutting deep ravines in the ridges that make the drainage divides. Since, as will appear later, the observable ore beds are in the uplands, the numerous gorges and ravines have carved out and carried away much of the ore-bearing formations.

**GEOLOGY.**—The whole of this region is early Tertiary in age, belonging to the Wilcox Formation of the Eocene Tertiary. Hickory Flat lies at the eastern edge of the field and just two miles west of the western edge of the Midway or basal Tertiary.

The Wilcox in its upper part consists of 200 or 300 feet of chocolate-colored clay; the middle portion is largely coarse sands of reddish and yellowish tints as they appear at the surface, becoming dark grayish or greenish beneath the surface on account of the protoxide condition of the contained iron; these sands are intercalated with beds of lignitic clays and lignite; toward the base the Wilcox shows greenish and dark gray sands and sandy clays with beds of iron carbonate

and of lignite and gray or lignitic clays. The iron carbonate beds usually underly the sandy clay beds and are underlaid by the same, or more frequently by the lignitic clays. In the cut at Ackerman an 8 inch bed of iron carbonate partly oxidized by exposure lies between beds of lignitic clays with thin seams of lignite. At the base of the cut large masses of kidney ore lie within the sandy clay both above and below which are lignite beds.

ORE BODIES.—The region as a whole presents or s of two kinds, brown oxide ores at the surface, and iron carbonate or spathic ores beneath the surface, both in the form of distinct beds and of large kidney or concretionary masses. These are exposed in sections at various places. In discussing the occurrence of the ores, I will speak of three areas in the region studied; viz, the Potts Camp area, the Winborn area, and the Hickory Flat area, each being separated from the others apparently by erosion.

POTTS CAMP AREA.—A range of hills or ridges lying on the west side of the Tippah River valley and north of the Frisco R. R., and having a northeast and southwest trend shows large quantities of brown oxide ore lying upon the surface. A tipple was constructed at the rail road and 25 car loads of ore is reported to have been shipped during last year by the Allen Bros. of Birmingham, Alabama, from the point of the hills nearest the railroad, on what is known as the Reid property. The ore was collected and hauled to the tipple in farm wagons by green hands, and I am informed by Mr. Allen that there is ready demand for all that can be shipped to the furnaces in Birmingham. Examination of the Reid property revealed beside the loose ore lying thickly over the surface, a distinct ledge of the oxide ore 14 inches thick underlying the tops of the ridges, with only a cover-

ing of 2 to 4 feet of loose earth. The ore is of good quality as shown by the accompanying analysis made at the State University of materials collected by myself.

Oxide ore from Reid property, Potts Camp.

Chemical Analysis.

Fe .....	..53.64
Al .....	1.45
Mn .....	8.00
S .....	0.53
P .....	0.075
CO <sub>2</sub> .....	0.87
Si O <sub>2</sub> .....	5.34
O & H <sub>2</sub> O....	20.91
Insol .....	9.18

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W. L. PERDUE, Analyst.

A ledge of two feet of carbonate ore is also reported to outcrop on this property farther to the northwest, but I failed to find it, though farther north on the Gurley place such ore was found.

Adjoining the Reid property on the north is the Gurley property of several hundred acres, partly lying in the valley of Tippah River, but largely also back upon the hills. All over the hill slopes from the Reid property to Mr. Gurley's residence, about a mile, the brown oxide ore lies thickly strewn in masses from the size of a walnut to boulders weighing a thousand pounds, the greater part of which looks to be equally good with that shown in the above analysis. In fact it is derived from the same bed, the outcropping of which on top of the ridges can be seen. The ore lying upon these slopes not only thickly covers the surface, but the

pick strikes it almost everywhere beneath the surface, where it seems to be disseminated through the soil, though I doubt if it extends more than a foot or two beneath the surface.

All this loose ore seems to represent remnants of a ledge that once lay just beneath the surface of the original plateau, but which erosion has let down and scattered over the slopes of the remaining higher lands.

One mile north of Gurley's residence on the little creek upon which his sawmill is located I found outcrops of two ledges of carbonate ore of excellent quality, as shown by the accompanying analysis, made at the University, the materials being collected by myself from this locality.

Carbonate Ore from Gurley's place, Potts Camp.  
Chemical Analysis.

Fe .....	45.32	About 67.0	Calcined.
Al .....	1.22		
Mn .....	3.90		
S .....	0.01		
P .....	0.045		
C O <sub>2</sub> .....	33.06		
Si O <sub>2</sub> .....	3.65		
O & H <sub>2</sub> O ....	11.56	in carbonate and hydrated oxides	
Insol .....	1.24		

W. L. PERDUE, Analyst.

The smaller ledge from which the above sample was taken, is about 8 inches thick, and outcrops on the east side of the stream about 8 or 10 feet beneath the surface. The bed dips at a low angle to the south and perhaps east. Talus material prevented my seeing the base of the slope but about 100 yards farther up the stream, another ledge of the same ore



outcrops at a lower level, dipping slightly toward the south and undoubtedly underlying the other at slight depth. This last ledge lies only 2 to 4 feet beneath the surface, the overlying material being soft earth, perhaps alluvial constituting a flat several acres in extent on the north side of the stream. The ledge is 20 inches thick of solid ore. It would appear to underly all this territory, but covered more or less deeply beneath the hills. Other and thicker outcrops along this stream have been recently reported, though these I have no knowledge of.

Assuming the surface bed of oxidized ore to have been originally carbonate, which is almost a certainty, we have in this area at least three ledges, and it is not improbable that others may exist. As a matter of fact, one of the engineers employed by the Birmingham company made a drilling in the edge of the Tippah valley on Gurley's land and claims to have passed through a six foot bed of material at a depth of about 30 feet, which analysis is reported to have shown to be carbonate ore. However, as I saw neither the analysis nor the material I cannot of myself vouch for these statements. Further, two and a half miles up the Tippah River from Gurley's residence a ledge of the carbonate ore is reported to extend across the river at an old mill site, but the water was too high at the time of my visit to see any evidence of it. Not far from the same locality, on the west side of the river, Gurley reported the same material as being struck in a well. I have not been able to get any of the material from the well for analysis, and therefore cannot vouch for the character of the deposit. Two beds are reported to have been struck within 30 feet of the surface, each about 2 feet in thickness. Mr. W. S. Allen of Birmingham, informs me that he obtained specimens of the material from the well, which he had analyzed and proved to be carbonate of iron.

It would seem from these facts that deposits of the carbonate ore underly this region in at least three—perhaps more—beds, which the evidence indicates to be of workable thickness, a great deal of which can be mined by stripping at slight cost. In order to make a certainty what the facts in hand appear to make probable, it will be necessary to make numerous drillings throughout the area with a core drill. The examination of the cores brought up will determine the presence or absence of the ore beds, number, thickness and depth beneath the surface of the beds, and by analysis of the cores the quality of the ore.

WINBORN AREA.—One half mile south of Winborn, on the place of I. N. Bready, in Section 26, T 5, R 1, W, a hill examined three hundred yards northwest of the Bready residence, shows three ledges outcropping, the lowest a thin ledge of 6 to 8 inches thickness 25 feet below the top of the ridge. The other two ledges outcrop at levels of approximately 18 and 8 feet below the crest of the ridge, each about one foot in thickness.

The ore at surface is oxidized, but where freshly exposed, as seen in one or two places where Mr. Bready had been quarrying the material for chimneys and foundations, the material showed a thin shell of oxide externally, but a fraction of an inch thick, beneath which it revealed the gray appearance of the carbonate. These ledges outcrop at frequent intervals along the hillsides, and seem continuous beneath the hill.

The ores here are more siliceous than elsewhere observed and as before stated, has been quarried by Mr. Bready for chimneys and foundations. Some of the material observed in the chimneys of the Bready residence is very dark, almost black, though Mr. Bready states that at the time of quarrying it looked almost white. A sample of the oxidized ore tak

en from the ledge 18 feet below the top of the hill shows the following results on analysis:

Oxide Ore from hill northwest of Bready's residence, at Winborn.

Chemical Analysis.

Fe .....	43.48
Al .....	1.48
Mn .....	9.04
S .....	0.37
P .....	0.074
C O <sub>2</sub> .....	0.11
Si O <sub>2</sub> .....	19.69
O & H <sub>2</sub> O ....	15.40
Insol .....	10.45

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W. L. PERDUE, Analyst.

A sample taken from the uppermost ledge outcropping on the hill 300 yards northwest of the residence of I. N. Bready, Winborn, shows the following analysis:

Carbonate Ore from Bready's place.

Chemical Analysis.

Fe .....	40.03	About 47.0 Calcined.
Al .....	0.65	
Mn .....	3.02	
S .....	1.81	
P .....	0.11	
C O <sub>2</sub> .....	15.92	
Si O <sub>2</sub> .....	14.27	
O & H <sub>2</sub> O ....	16.51	
Insol .....	13.69	

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W. L. PERDUE, Analyst.

On the Bready property the hills or ridges have a general direction of northwest to southeast. To the southeast of Bready's residence little ore is seen for a distance of two or three hundred yards, but a good deal of ferruginous sand stone. In fact, in this area all the formations are more sandy than in the Potts Camp area. Even the dark gray clays underlying the ore beds are more sandy than elsewhere observed

About 500 yards southeast of Bready's residence on the same ridge is an outcropping of good-looking oxidized ore, which has the appearance of being the exposed edge of a workable ledge 12 to 15 inches thick lying 1 to 3 feet beneath the surface, the overburden being all loose material. The ledge appears on the opposite side of the hill, appearing to cap an area of five or six acres, perhaps as much as 15 acres though evidence is not conclusive for the larger estimate. Drillings would easily establish the presence or absence of the ledge. A sample taken shows the following analysis:

Oxide Ore from Bready place.

Chemical Analysis.

Fe .....	39.32
Al .....	9.78
Mn .....	12.30
S. ....	3.72
P .....	0.02
C O .....	0.015
Si O <sub>2</sub> .....	4.36
O & H <sub>2</sub> O ....	19.88
Insol .....	7.46

W. L. PERDUE, Analyst.

Another sample from the same outcrop gave the following analysis:

Oxide Ore from Bready place.

Chemical Analysis.

Fe .....	54.60
Al .....	1.07
Mn .....	3.22
S .....	0.23
P .....	0.04
C O .....	0.87
Si O .....	17.26
O & H <sub>2</sub> O ....	17.81
Insol .....	4.82

W. L. PERDUE, Analyst.

Good surface oxide ore in considerable quantity occurs on the hill slope just beyond the Bready land to the south and east, on the Byrd Maimon property, but no ledges were seen except possibly at one place about 150 yards from the division fence. The conditions are so analogous to those seen a few hundred yards away on the Bready land that the presence of the surface oxidized ledge may be reasonably inferred.

No carbonate ore was noted at this end of the property, but at Bready's residence a well 16 feet deep stopped upon a ledge said to be this ore, and the water has a distinct chalybeate flavor. I infer that all the surface oxides here, as at Potts Camp and at Hickory Flat, as will be noticed later, is derived directly by surface exposure resulting in oxidation from the carbonate, and I am of the opinion that exploration with a core drill would probably reveal beds of carbonate beneath these ledges.

Just beyond the north edge of the town of Winborn considerable quantities of what appears to be good grade oxide ore lies loose over the land of W. H. Cruse. Masses lie all over the plowed ground in the field. Two wells on the place encountered the ore beds, according to account of M. Cruse, and had to stop in the ore, being unable to penetrate it. The wells were bored wells 20 to 25 feet deep, and no materials taken from them could be found for identification.

On the J. F. Taylor land adjoining that of the Cruse place, loose oxide ore of good grade occurs scattered rather abundantly over the hill slope. A distinct ledge outcrops around the hills just back of the Cruse place, of good quality and about 10 inches thick. This ledge lies about 7 or 8 feet below the top of the hill, the overburden being all loose earth easily removed by shovels. Another apparent ledge crosses the road 200 yards north of the school house, but of undetermined thickness. All this ore appears to be of good quality brown oxide. No carbonate ore has been seen north of Winborn, but exploration with the drill would probably reveal it, since conditions, so far as these are observable are precisely similar to those on the Bready property and at Potts Camp, where it does occur.

## Hickory Flat Area.

The chain of hills and ridges examined at Winborn on the Bready and Byrd Marmon properties swing around to the south of Hickory Flat. As would be expected, the same set of conditions prevail here as at Winborn. The separation by erosion of the Winborn and Hickory Flat areas is not so well marked as that of the Winborn and Potts Camp areas. On the land of J. H. Morehead 3 miles southwest of Hickory

Flat an outcrop of oxidized ore occurs in which the original carbonate condition of the ore is still observable, showing the ledge to be one of carbonate ore. This ledge in places assumes the character of kidney concretions of large size, but for the most part appears to be a continuous ledge where exposed on the slopes of the hill upon which is located the residence of John May, situated in Section 30, T 5, R 1, E. It is 12 to 14 inches thick, of good looking ore, and passes from the point of the hill where exposed, back under the ridge, an area of about 30 acres, the depth beneath the surface varying from a foot or two to 10 to 15 feet. A well sunk near the house struck the ore at a depth of 10 to 12 feet.

On Section 31 outcrops of 15 inches thickness occur on the south side of a small creek 10 or 12 feet below the surface of the hill on which stands the house of B. Nolen, on land of R. J. Morehead. The ore bed shows all around the point of the hill, but the ore appears highly siliceous. In appearance it is very much the same as that observed on the land of Mr. Bready at Winborn, though no carbonate was observed.

At a well sunk about 3 years ago at a point 200 yards south of the Nolen house a bed of pure carbonate ore was struck at a depth of 15 feet. As stated by Mr. Morehead, the material when freshly brought to the surface was light bluish gray in color, but at the present time it is somewhat oxidized, by exposure. A sample which I picked off the pile at the well gives the following results as analyzed at the State University:

Carbonate Ore from well on Morehead place.

Chemical Analysis.

Fe .....	50.49	66.6	Calcined.
Al .....	3.29		
Mn .....	10.21		
S .....	0.52		
P .....	0.30		
C O .....	25.12		
Si O .....	5.28		
O & H O .....	4.11		
Insol .....	5.06		

W. L. PERDUE, Analyst.

According to Mr. Morehead the well was discontinued because the material was too hard to penetrate with a pick. The thickness of the bed was not determined. About 75 yards west of the first well another was sunk, with the same result. Both these wells were sunk at an elevation several feet lower than the ledge underlying Nolen's house, so that the bed struck in the bottom of the well at a depth of 15 feet, in my opinion, could hardly be the same, since there is no appreciable dip of the former. Besides, the ore seems of much purer quality. It probably corresponds with the bed cut by a ditch one-fourth of a mile west of the first well. The bed here exposed is 20 inches thick on the west side of the ditch next to the hills, where it passes under cover, which at the ditch is 3 or 4 feet, but gets deeper, up to 15 or more feet under the hill. This ledge of ore, which so far as examined was all oxidized, could be traced only for a few yards—8 or 10—and it was impossible to determine whether this was because of slumping from above or because the ledge pinched out. A rather distinct terrace running along the base of the hill possibly marks the covered outcrop of this ledge.



Following the ditch 50 yards up from this point a deep brown sandstone forms a distinct ledge across the ditch. 15 inches thick, which probably is not of economic importance, appearing too siliceous. All along the ditch boulders of both oxide and carbonate ores are thickly strewn upon the bottom, but none that positively could be determined to be in place appeared until at a point about 300 yards up the ditch. Here the current of the water undercut the bank 16 to 18 feet high on the west side, and a recent slump has occurred exposing the whole face of the bluff for a distance of 10 or 12 yards. The material of the upper half of the bluff is dark grayish sandy lignitic clay overlying a stratum composed of a bed of carbonate ore 12 inches thick. This stratum is in part a continuous bed, but for part of the distance is composed of lenticular masses of large size lying closely together. Below this ore stratum the material to the base of the cut is gray massive clay.

In the ditch below this cut are large masses of excellent carbonate ore, and smaller masses varying in size from that of a walnut to blocks weighing 75 to 150 pounds are scattered rather thickly along the bed of the ditch. All of this material impressed me as having slumped or rolled down from the south bank of the ditch. Here as farther down, something of a shelf or terrace probably marks the position of the ore bed.

Since the outcropping ore beds in this vicinity, so far as observable, have little if any dip, and since the ledge observed at the slope just mentioned is at a level at least 10 or 12 feet above the ledge first described outcropping on this ditch, I am of the opinion that they are not the same, but that the 12 inch ledge overlies the 20 inch ledge, separated by a vertical interval of 10 or 12 feet.

Below is an analysis of ore taken from the 20 inch ledge outcropping on the Morehead ditch:

Chemical Analysis.

Fe .....	56.61
Al .....	13.02
Mn .....	10.89
S .....	1.06
P .....	0.072
C O .....	1.18
Si O .....	10.29
O & H O .....	1.21
Insol .....	5.57

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W. L. PERDUE, Analyst.

At a point in the ditch bed immediately beneath the slope above mentioned a sample of fresh carbonate ore was taken which gives the following analysis:

Carbonate Ore from Morehead's ditch.

Chemical Analysis.

Fe .....	47.12 — 68.0 Calcined.
Al .....	2.02
Mn .....	6.26
S .....	1.14
P .....	0.034
C O .....	29.06
Si O .....	4.80
O & H O .....	9.01
Insol .....	1.08

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W. L. PERDUE, Analyst.

On a little creek that crosses the road about 250 or 300

yards south of the house of B. Nolen, in Section 31, and not more than 100 yards above the road crossing a new slump of earth on the south bank reveals a ledge of carbonate ore 15 inches thick, which passes back beneath the surface of the field lying on that side of the stream. The ore bed lies 2 feet beneath the surface of the field where exposed and cannot be much more than that over the whole field of several acres. Other exposures occur farther up the stream, but the ore seems more siliceous than at the first exposure.

Practically all the hills and ridges in this vicinity, as at Potts Camp, seem to be topped by an oxidized ore of good grade, which lies scattered over the surface, or just beneath the soil in the form of a distinct bed. This is almost surely part of a surface ledge that at one time covered the whole region, but which erosion has cut away in carving out the valleys and hollows, leaving such of the ore as remains in fragmentary beds capping the hills and ridges, or letting it down in loose fragments upon the hill slopes. If this be a correct interpretation of the history of these ore beds, it is quite possible that, owing to their gravity and hence difficulty of removal by water currents at the bottom of the alluvial deposits of the smaller streams of all this region very considerable deposits of this ore may be found, something in the nature of placer deposits in gold regions. However, this can be determined only by exploration beneath the surface. It is possible that the very considerable quantity of drift ore found in the bottom of the Morehead ditch is evidence of this mode of accumulation.

From the foregoing facts it will be evident that, as regards conditions, kinds of ore, modes of occurrence, and related facts, the three areas of Potts Camp, Winborn, and Hickory Flat, are a unit; and that the deeper beds of the

three regions are perhaps continuous from one to the other areas, though the use of the core drill will be necessary to prove continuous beds of ore.

## Possibility of Development

QUALITY OF ORE.—Of nine specimens of ore collected by myself from representative deposits of the three areas five were oxide ores and four carbonate ores, all of which were analyzed at the State University, the analyses being included in the foregoing discussion. Summarizing the result, I find the following:

Five oxide ores give averages as follows:

Metallic Iron	..49.53
Manganese	.... 8.69
Sulphur	..... 1.38
Phos	..... 0.057
Silica	..... 18.88

Four carbonate ores give the following averages after calcination:

Metallic Iron	..62.15
Manganese	.... 5.77
Sulphur	..... 0.87
Phos	..... 0.122
Silica	..... 13.345

An average of all the above nine ores is as follows:

Metallic Iron	..55.14
Manganese	.... 7.43
Sulphur	..... 1.15
Phos	..... 0.086
Silica	..... 16.42

An average of 17 ores tested, including carbonate ores all calcined, gives the following results:

Metallic Iron	..55.07
Manganese	....4.072
Sulphur	..... 1.15
Phosphorus	.. 0.079
Silica	..... 13.12

An average of eight carbonate ores not calcined gives the following:

Metallic Iron	..45.2
Manganese	....1.074
Phosphorus	.. 0.059

On calcination it is probable that these carbonate ores would raise rather than lower the general average iron content, would very materially lower the Manganese content, and would lower somewhat the Phosphorus content. The effect upon the Silica content is not known because no tests for Silica were made in connection with these eight carbonate ores.

It will be seen that these ores average rather high in iron, have sufficient Manganese to add quality to the iron, is not too high in Silica, especially the carbonate ores, and are exceptionally low in Sulphur and Phosphorus. There is no doubt that the iron made from these ores would be of the highest quality of soft malleable iron, and well adapted to the manufacture of the best grades of steel.

QUANTITY OF ORE.—The lowest possible estimate which I have been able to put upon the quantity of ore in sight and certainly available at minimum cost of mining, not to exceed one dollar per ton on board car, is half a million tons. Ore of this kind is selling in Birmingham, Alabama, at \$2.50 per

ton. Allowing a freight rate of fifty cents per ton, a margin of one dollar per ton remains. Assuming that there is no more than there is now in sight, which is an unwarranted assumption, since all indications point to a larger supply beneath the surface, the exploitation of this ore will net \$500,000.00 exclusive of plant necessary to develop, the cost of which would not be great, unless smelting furnaces were erected.

FUTTING THE ORE UPON THE MARKET.—The furnaces at Birmingham consume 10,000 tons of brown oxide ore per month, which on account of its low phosphorus, is mixed with the red ores of that district to improve the quality of the iron produced. The Potts Camp brown ore will no doubt find a market there, all heretofore shipped to Birmingham, about 1500 tons, having met with ready acceptance, and requests for more having been made.

Since all but the surface ore of the district is carbonate ore, which by all reasonable inferences must form the bulk of the ore of the district, a calcining plant will be necessary when deeper mining begins. Should the underground supply of ore prove great, Memphis would prove a strategic point for the erection of smelting furnaces, the calcining plants being placed probably nearer the mines. The ore district is less than 60 miles from Memphis, which is accessible by water to all parts of the country, both the Mississippi valley and the Atlantic seaboard. On the basis of six mills per ton a mile, a freight rate of the ore to Memphis would be thirty-five cents per ton, to which adding fifteen cents for loading on barges at Memphis, would make the cost f. o. b. Memphis 50 cents.

Low phosphorus ore is at a premium and much in demand in all the great iron and steel plants in the country. The Bethlehem Steel Co., Pennsylvania Steel Co., and Maryland

Steel Co., use these ores in great quantities, the first named, at Bethlehem, Pennsylvania, having recently contracted for about 4 1-2 million tons of Swedish ore. The Potts Camp ore, in its low phosphorus content, approximates the Swedish ore in character, and put on board steamer at Memphis could readily compete with the foreign ore along the Atlantic seaboard. It is probable that the ore shipped from Memphis by water could be put at Atlantic coast points for \$3.25 per ton including mining costs. The ore is worth 8 1-2 cents per unit, and since this ore averages, as noted above 55 per cent of metallic iron, the selling price per ton would be \$4.65, giving a net margin of \$1.40.

It will be seen then that a market for this kind and grade iron ore can be had at the furnaces in Birmingham with a margin of profit, or that, handled by way of Memphis, much wider markets may be reached and still have a good margin of profit.

By the establishment of furnaces at Memphis, the ore could be smelted at that point and the pig iron shipped to the market, instead of the ore. A furnace that would consume 75 tons of ore per day would cost, including coke ovens approximately \$250,000 and, as already estimated, the ore in sight now ought to keep such a furnace running about 19 years.

This ore would perhaps best be reduced by the use of charcoal; the iron so produced would be softer and command a better price. Charcoal can be made at a cost of not more than 6 cents per bushel, the lands furnishing the ore furnishing also abundant material for charcoal. It will take about 125 bushels of charcoal to make one ton of pig iron, costing \$7.50 per ton, but this cost can be reduced by the erection of by-product ovens. Estimating the cost of putting the ore at

the stack at \$2.00 per ton, labor at the kiln \$1.50, and flux 50 cents, the total cost will be \$11.50. Charcoal iron is selling now in Alabama at the furnace for \$22.00 per ton, leaving a margin of \$10.50.

The consumption of charcoal would be so great that it would probably eventually have to be replaced by coke for smelting purposes. Nut and slack coal from the coal mines of Pennsylvania and West Virginia, suitable for making coke, can be put into Memphis by water transportation at a cost of perhaps \$1.25 to \$1.50 per ton. By erecting by-product ovens in connection with the coke ovens, the by-product output may be sold at figures to make the coke to be used for calcining or smelting almost clear of cost, reducing very materially the cost of smelting, and thereby increasing in an equal ratio the margin of profit, at the same time making it possible to handle ores of a lower grade at a profit.

At the present time one company, the Memphis Mining and Manufacturing Co., of Birmingham, Alabama, are operating in the Potts Camp district. They have holdings of several thousand acres of the most promising lands, especially those lying near the Frisco Railroad. So far little development has been done. Twenty-five carloads of oxide ore picked up from the surface is reported to have been shipped out, and sold at Birmingham, all this coming from the Reid property two miles west of Potts Camp, at a point on the Railroad where a tibble has been erected. All the prospecting has been on the surface, with the exception of one or two drillings, which are reported to have struck carbonate ore at depths of 25 to 30 feet.

The best outcrops and surface deposits of ore observed in this region lie within two miles of the railroad, the intervening distance being either level or down grade toward the



railroad, so that spurs could be built at little expense to each of the Potts Camp, Winborn, and Hickory Flat areas. Natural conditions are good for handling the ores cheaply and easily.

It is my opinion that one of the first steps toward the development of this region should be the putting down of numerous drill holes, using the core drill, so as to be able to determine the exact extent, thickness, and character of the deposits beneath the surface. A system of levels or contours established would assist materially in identifying ore beds in the various regions. We do not believe that any costly preparations for developments would be necessary or advisable until this is done, for the reason that the bedding of the Wilcox Formation, in which all this ore occurs, is often discontinuous and uncertain. Further, I believe that the first developments should be made looking to the recovery of the surface ore, since this can be done at comparatively little cost, and that the erection of smelters and other costly plants be deferred until the extent of the deposit be fully proved by the use of the core drill, as heretofore mentioned. By proceeding in this way the marketing of the surface ores can be made to furnish the means for the development of the underground deposits, without a previous investment of large sums on uncertainties. A company working in good faith will find it best to proceed in this way, both for their own protection against possible loss, and for the protection of those who may invest in their enterprise.

Respectfully submitted,

E. N. LOWE,

Jackson, Miss., May 1, 1912.











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