# GEOLOGICAL SURVEY

OF

# ALABAMA.

EUGENE ALLEN SMITH, PH. D., STATE GEOLOGIST.

## BULLETIN NO. 3.

A PRELIMINARY REPORT ON A PART OF

# THE LOWER GOLD BELT OF ALABAMA,

*in the Counties of Chilton, Coosa and Tallapoosa.*

BY

WILLIAM B. PHILLIPS, PH. D.

Prof. of Chemistry and Metallurgy, University of Alabama

and

CHEMIST TO THE SURVEY.

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UNIVERSITY OF ALABAMA,
February 20th, 1892.

DR. EUGENE A. SMITH,

*State Geologist:*

DEAR SIR:—I beg herewith to submit a Preliminary Report on a part of the Lower Alabama Gold Field in the counties of Chilton, Coosa and Tallapoosa, prepared during the summer of 1891.

Very respectfully,

WILLIAM B. PHILLIPS.

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# PREFACE.

Specific interest in the Lower Appalachian Gold Field dates from June, 1540, when, according to Pickett's History of Alabama, Vol. I, pp. 10 to 15, Villabos and Silvera, two cavaliers from De Soto's army, (then encamped at Chiaha, the site of Rome, Georgia,) went with an Indian guide in search of gold. "About this time a principal Indian from Costa, a town below, informed De Soto that in the mountains to the north, at a place called Chisca, were mines of copper, and of a yellow metal, still finer and softer. Having seen, upon the Savannah, copper hatchets supposed to be mixed with gold, his attention was deeply aroused upon the subject. Villabos and Silvera, two fearless soldiers, volunteered to explore that region. Furnished with guides by the chief of Chiaha they departed upon their perilous journey." . . . . . They seem to have been gone some time for they returned in July. "Three days after this, Villabos and Silvera returned from Chisca. They passed into the mountains, found no gold, but a country abounding with lofty hills and stupendous rocks. Dispirited, they returned to a poor town, where the inhabitants gave them a buffalo robe, which they supposed once covered a tremendous animal, partaking of the qualities of the ox and the sheep. According to Garcelasso, the mines which they reached were of a highly colored copper, and were doubtless situated in the territory of the county of DeKalb."

This is the earliest prospecting trip for gold into the Appalachian Mountains of which I can find mention, and, like a great many subsequent trips of the same nature, resulted in the finding of "a country abounding with lofty hills and stupendous rock," but devoid of gold.

De Soto, while wandering in a somewhat aimless manner about the States of Georgia, Alabama and Mississippi, dining (when he could) on dogs which were said to be as toothsome as a fat wether, had his ears open for any report of gold or silver. He does not appear to have found any gold and all the silver obtained was secured *vi et armis* from the hapless Indians. Pickett says (ut supra, p. 91)

"The Creeks wore many ornaments of silver. Crescents or gorgets, very massive, suspended around the neck by ribbons, reposed upon the breast, while the arms, fingers, hats, and even sometimes the necks, had silver bands around them." This was in 1777, and it is not stated whether or no they had such ornaments in 1540. It is not likely that such was the case. I have in my possession now a silver crescent and a pair of silver bracelets obtained from some Indian graves in Coosa county, but they are evidently of foreign origin, probably English.

Of the thousand and one rumors of Indian silver mines along the Appalachian Range, from Winchester to Wetumpka, it is not likely that a single one is true. I have visited many localities from which the Indians were said to have extracted silver and have assayed samples of the so-called ore without finding more than the merest trace of gold or silver. What the pre-historic inhabitants might have done is irrelevant to the question; they did mine mica in North Carolina and Alabama and they did mine and treat copper ores. And the Indian, such as roamed these forests 150 years ago, mined and sold kaolin, exporting it from Jamestown. But I have found no evidence that the Indian of 1540 or of any other date, mined and treated either gold or silver ores. Nuggets of gold, picked up in some branch, are no proof of the mining of ore or the treatment of it when mined. De Soto's "copper hatchets, supposed to be mixed with gold" are illustrations of a great many other suppositions, equally baseless concerning the occurrence and distribution of the precious metals.

I have been unable to ascertain when gold was first discovered in Alabama, probably the year 1830 will approximate the true date. At any rate we know that shortly afterwards the placer or gravel washings became the seats of an active industry in the counties of Cleburne, Talladega, Randolph, Tallapoosa, Coosa, Chilton and, perhaps, also in Clay. But of the yield of gold there is no record, or indeed of anything in connection with the matter, except that at such and such localities large numbers of men were engaged in the work and that at certain places it was said to be profitable.

No report on the subject has ever been issued by the State and, with the exception of the scattered remarks in Tuomey's Report of 1858, no notice has been taken of what I sincerely believe could be developed into one of the most successful enterprises in the State-gold mining. The present Geological Survey has acted wisely in de-

voting its attention mainly to coal and iron, for, with the meagre support afforded to it, little could be done by distributing the money over the entire State.

It is too small a piece of butter to be spread over a great deal of bread. The last Legislature, however, added to the means at the disposal of the survey and the first thought of the Director was towards the metamorphic region of the eastern part of the State, comprised within the limits already given and including about 3500 square miles.*

For convenience of reference it was decided to divide the gold fields into an Upper and Lower Field by a line running due east and west along the northern boundary of Chilton, Coosa, Tallapoosa and Chambers. To that part of the Field lying south of this line the name "Lower Alabama Gold Belt" was given, and it thus comprises the counties of Coosa, Tallapoosa and Chambers and part of Chilton and contains about 1700 square miles. To that part of the Field lying north of this line the name "Upper Alabama Gold Belt" was given. It thus comprises the counties of Cleburne, Clay and Randolph and part of Talladega, and contains about 1800 square miles. It was further decided to spend three months in each Belt. The work on the Lower Belt was progressing very well when I received word that my wife was very ill at home. This necessitated my presence there and I suspended the examination about the middle of August, 1891, after one months work, and was unable to resume it during the remainder of the year. This report is therefore incomplete even as regards the Lower Belt and is to be considered merely as a preliminary report. It was thought best to publish it in its present shape instead of waiting another year for its completion and to incorporate some additional information concerning this Belt with the report on the Upper Belt, to be published in 1893, if not sooner.

Some photographs of very interesting localities in Chilton and Coosa counties were taken, but, most unfortunately, the box containing the plates was broken in transit and the plates were lost. They represented views at the Rippatoe Mine, Alum Bluff and the neighborhood of Higgins Ferry across the Coosa River.

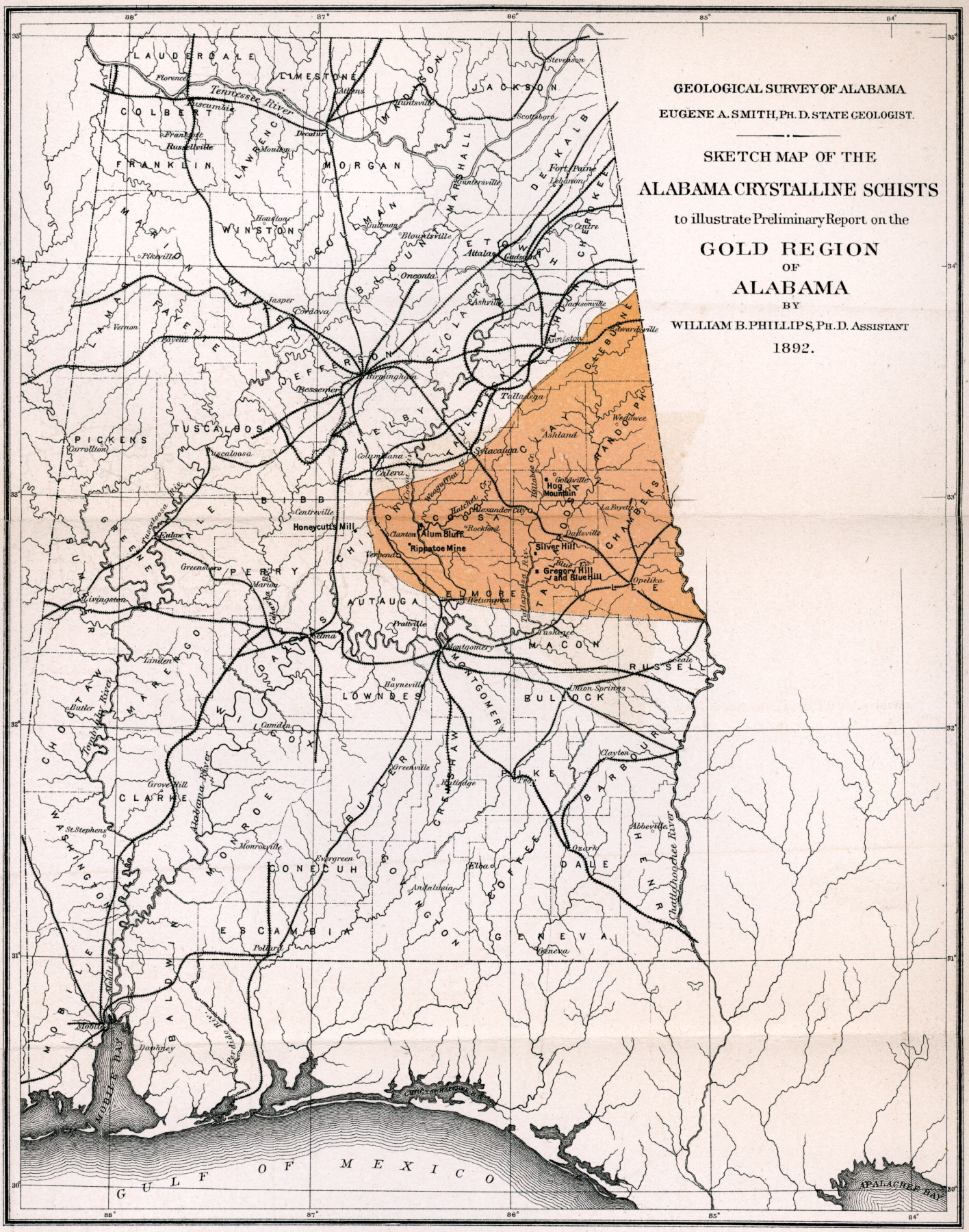
It is hoped to embellish the next report with numerous photographs of the principal gold bearing localities of both belts, and especially of Hog Mt, the Ulrich and Jones Pits, Silver Hill, Gregory

*The total area of the crystalline rocks is 4425 sq. miles. E. A. Smith, Agric. Rep. 1881-2.

Hill, Blue Hill, the Devil's Backbone and other places belonging to the Lower Belt.

I desire to express my thanks to Prof. John M. Francis, of the University of Alabama, for much valuable assistance in the assaying of the samples; to Mr. E. E. Newton, a recent graduate of the Scientific Department of the University for aid in the field as volunteer assistant; to Major Jno. L. Harrell for the pleasure and profit of his company through many parts of Chilton county; and to Col. B. L. Dean for many kindnesses in Tallapoosa county.

WILLIAM B. PHILLIPS.


GEOLOGICAL SURVEY OF ALABAMA
EUGENE A. SMITH, PH. D. STATE GEOLOGIST.
SKETCH MAP OF THE
ALABAMA CRYSTALLINE SCHISTS
to illustrate Preliminary Report on the
GOLD REGION
OF
ALABAMA
BY
WILLIAM B. PHILLIPS, PH. D. ASSISTANT
1892.
Hog Mountain
Goldville
Alum Bluff
Rippatoe Mine
Silver Hill
Gregory Hill and Blue Hill
Honeycutts Mill
GULF OF MEXICO
APALACHEE BAY
MOBILE BAY
Scale
25 0 25 50 75 100 MILES.

## THE GOLD FIELDS OF ALABAMA.

### *General Description.*

The Gold Fields of Alabama extend in part or wholly over the counties of Cleburne, Talladega, Randolph, Clay, Tallapoosa, Chambers, Coosa, Elmore and Chilton. The occurrence of the Gold is therefore confined to that portion of the State in which extensive areas of the crystalline rocks appear. It is not the purpose of this report to consider whether these rocks belong to the Archæan or to the Lower Silurian, whether they are orignal primitive rocks or the products of a more or less complete metamorphism. Probably the western edge of the Field is of Silurian Age, but it seems to me that the inner portion and especially the Eastern part are of older date. One might go so far as to say that if the rocks in the central and western part of North Carolina, and in the Northwestern parts of South Carolina and Georgia are of Archæan Age, then these rocks are, for there is the closest relationship between them, both from a stratigraphic and petrographic point of view. The Gold bearing rocks of Alabama are of the same age as the gold bearing rocks of North Carolina, South Carolina and Georgia, whatever this may be. The occurrence of large deposits of graphite might lead one to classify them as of a period when there was at least plant life on the earth, but, on the contrary the entire absence of fossils and other evidences of life, if we except graphite, would incline one to project their age beyond that of the Silurian. A long and careful examination of the district with especial reference to the stratigraphical relations of these rocks towards the Silurian rocks of the western edge and towards each other would have to precede a positive opinion.

The productive portion of the field is comprised within the following limits: From Calera, on the Louisville and Nashville Railway, thirty miles south of Birmingham, draw a line in a north easterly direction to Tallapoosa, Georgia, on the Georgia Pacific Railway. From the same point draw a line in a south easterly direction to Columbus, Georgia. We have thus, roughly speaking, an equilateral triangle of ninety miles on the side and the area will be about 3,500 square miles. I have used the expression "productive area" to imply that portion of the State in which gold mining has at some time or other been carried on with success. It is not to be taken as meaning that gold mining is now prosecuted within this area on an extensive scale, for such is not the case.

Within this area of 3,500 square miles the metamorphic and primitive rocks find their greatest development and form the south western termination of the great Alleghany Range, or, as it should perhaps be termed, the Appalachian Range.

The country rocks are for the most part crystalline schists and slates, talcose, micaceous, and graphitic, deeply buried on the south western edge beneath the clays of the Tuscaloosa Formation (Cretaceous) but outcropping with ever increasing boldness towards the east until in Coosa county, and farther east they appear with a very coarse granite in considerable hills and bluffs. The first appearance of the granite is in Coosa county near the town of Rockford; from this point to the east it occurs with marked frequency interstratified with graphitic schists and slates and imparting to the landscape quite a bold and rugged appearance.

## CHILTON COUNTY.

### HONEYCUTT'S MILL.

The most westerly exposure of the crystalline schists which I was able to observe is near Honeycutt's Mill in the western part of Chilton county, Sec. 17, T. 22, R. 13, E, 13 miles from Clanton, on Mulberry creek. At this place the creek has cut its way down through the overlying clays of the Tuscaloosa Formation and the underlying rock is well exposed. It is a greenish and bluish green slate, in places quite hard and crystalline. It strikes in a general north east course (N. 75E. near the mill) and dips 15 to 20 degrees south east. The bed of the creek is 125 feet below the general level of the country. In places the slate is soft and rotten, breaks down readily and gives a stiff reddish soil.* It frequently carries small veins of quartz, from one-half an inch to eight inches in thickness running parallel to the slate. It would appear that many of these quartz seams formerly carried pyrite, for there are evident traces of this mineral still to be found, with now and then a fairly good piece but partially decomposed. As a rule, however, the pyrite has disappeared, the quartz is cellular and, for the most part, barren, showing neither gold nor pyrite. It is noticeable that wherever the slate carries quartz it is harder and more crystalline than when the quartz is absent.

Placer mining has been carried on along this creek in a very small way for the last fifty years, beginning about two miles below the mill and extending about eight miles up the creek.

Along the little branches that make into the creek I panned thirty pans, finding gold in twenty-five and failing

*Limonite (brown iron ore) occurs on the waters of Mulberry creek above Honeycutt's, in considerable masses.

to find it in five. The gold is held in a mottled red and white clay, sandy and carrying angular fragments of quartz. This clay is underlaid by a stiff white clay devoid of gold. It is exposed in the bottom of the branches and is overlaid by from 4 to 6 feet of soil and reddish clay, free of gold. In every pan there was left at the last a heavy black sand, sprinkled with minute fragments of garnets and clear quartz. The thickness of the gold bearing stratum is from one to two feet.

The origin of the gold here is to be sought in the thin seams of quartz (formerly pyritous) between the layers of slate. The gold content of the pyritous quartz has been distributed in the clays resulting from the decomposition of the slates.

I remark here

1. No gold has been found in the soft slates which are free of gravel.

2. The quartz seams themselves show free gold in the pan now and then.

3. The clays resulting from the decomposition of the slates are of two sorts, a soft smooth clay with no gravel and no gold, and a sandy, gravelly clay with many angular pieces of quartz and half decomposed pyrite, carrying free gold.

4. The unfailing association of the gold with black iron sand and quartz, with occasional fragments of pyrite, points to the pyritous quartz seams as the origin of the gold.

Although gold is to be found in nearly every little branch running into Mulberry Creek, in the vicinity of Honeycutt's mill, yet I do not think that it occurs in sufficient quantities to warrant any further investigation. The gravel in which it is found is not continuous nor is it rich enough at any place that was examined for it, to be considered more than an interesting distribution of the metal. This is the most western point at which gold has been found in situ, and its association with quartz and pyrite is but another proof of the close companionship of these minerals in the Southern gold fields.

Between Honeycutt's Mill and Clanton I observed no exposure of the underlying rocks; they are doubtless overlaid by the Tuscaloosa clays which extend in an unbroken sheet across the State from Tuscaloosa to the south-east, obscuring the crystalline rocks entirely except where some stream has cut its way through.

On the west side of the Louisville and Nashville Railway the crystalline rocks are but seldom seen, as I went carefully over that part of Chilton County almost to the Autauga line without seeing any sign of them at all. None of the wells dug in that part of the county have penetrated to the old rocks, although some of them have been sunk through forty and fifty feet of soil and clay. The Tuscaloosa clays must be more than one hundred feet in thickness in this part of the State, in certain localities doubtless nearer two hundred feet than one hundred. No gold is to be found in that part of Chilton County below Clanton and on the west of the L. & N. R'y, which demands a more detailed examination. Near Verbena, a station on the Railway below Clanton, some prospecting for gold was carried on many years ago, but no evidence could be found that it was profitable or even encouraging. Some isolated placer washings may still be heard of but I do not think that we need pause to consider them. This part of the county is not to be regarded as a gold district, for, it is not until we reach the old Rippatoe Mines near the Coosa River that we come upon any sound basis for even a preliminary testing.

About one-half a mile north from Verbena, at the old Floyd Mill, there is a fine out crop of micaceous hornblende schist, tough and well crystallized. It strikes N. 50° E. and dips 15 degrees S. E. It is found also on the west side of the L. and N. R'y one mile S. W. of Verbena and there disappears beneath the clays.

### WILLIAM HOWARD'S.

In the S. W. ¼ of Sec. 29, T. 21, R. 16 E., Chilton County, at Wm. Howard's, there is a good exposure of quartz interstratified with clay slate. It is of the sugary variety, very

white and granular. A sample taken from a vein of eight inches thickness at Howard's gate gave in gold $6.20. A vein of similar appearance, however, at Tom Howard's in Sec. 29, T. 21, R. 16 E., gave only $2.06 per ton.

### ROCKY CREEK.

On Rocky Creek, in Sec. 30, T. 21, R. 16 E., Chilton county, two miles east of Verbena, extensive washings for gold have been carried on in the gravel. Heavy ledges of a dark, fine grained hornblende schist, carrying biotite, cross the creek, bearing N. 15° E. and dipping 20 degrees to the S. E. These schists enclose bands of quartz, in places somewhat pyritous, which are rarely of greater thickness than a few inches. In the immediate vicinity of the quartz seams the schists are harder and more crystalline. The gold gravel underlies the soil at depths varying from 3 to 6 feet and extends on both sides of the creek for about one hundred yards. It is rarely more than twelve inches in thickness and is composed of rounded peices of reddish quartz from one-half inch diameter to six inches. The pay gravel lies on a greenish clay slate. Rocky Creek runs in a general N. E. course and the quartz seems bear in the same direction. The shifting of the creek bed from side to side has doubtless distributed the gold gravel over the area mentioned.

William Howard, an experienced gravel washer of the vicinity, told me that in about ten weeks he himself had obtained $200 worth of gold along Rocky Creek; in one day securing $19. The only apparatus used was the pick and pan. This was twenty years ago. Per contra, he says that a few years ago a stray miner worked there two months and got only $60.

Rocky Creek would not afford sufficient water for extensive operations, and, besides the pay gravel appears to have been pretty well worked over. A considerable amount of work has been done along the Creek from first to last, but none within the last twenty years. Most of the work was

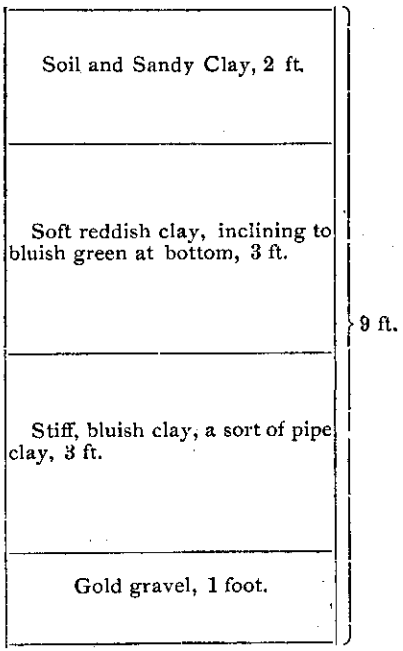
done before 1860, when through this part of the State there was much interest shown in gold mines and especially in placer mines. I saw no evidence of the existence of a workable seam of quartz on Rocky Creek near the old workings. At Howard's there is a better prospect for quartz mining than on Rocky Creek, for the existence of gold bearing sugary quartz at Wm. Howard's is an encouraging sign. It does not seem to me that Rocky Creek will afford pay gravel in sufficient amount and of sufficient richness to warrant any extensive investigations. Doubtless a considerable amount of gold was obtained along the creek fifty years ago with the simple appliances then in use, such as the pan, cradle, and Long Tom. The best of it has, however, been thoroughly worked so that it is now difficult to find a place from which good panning can be had.

### THE RIPPATOE MINE.

This famous property is situated in Sec. 17, T. 21, R. 16 E., Chilton County. It was extensively worked prior to 1860, work having been begun here as early as 1835 and continued with but little interruption for twenty-five years. By far the greater amount of placer mining carried on west of the Coosa River has been done at this place.

The gravel lies on both sides of Blue Creek and is of the same nature as the Rocky Creek gravel. For a mile up the creek from Jas. Mims's, on both sides, there are innumerable old pits, trenches and ditches. These are now so fallen in that I had to sink two new pits in order to examine the gravel at all. Following is a vertieal section of a pit in the bottom of which we came upon a layer of auriferous gravel, very poor but of the same character as the richer gravel, as I was informed by Wm. Howard:

*Vertical Section to Gravel, Rippatoe Mines.*




The gravel is imbedded in a reddish clay, at times somewhat indurated, but generally of a loosely compacted nature, yielding readily to the pick and shovel. From Wm. Howard and others who worked at these diggings I ascertained that the gravel was generally not less than six feet beneath the surface, varying from this depth to eight and even nine feet. As the deposit neared the adjacent hills the gold became scarcer and the gravel thinner and at greater depth.

A great deal of the gold obtained was found in the run of the creek, caught against upturned edges of the slate. Several pieces of gold valued at $1, $5, one valued at $20 and one at $70 were found at these diggings. It is impossible at this time to give any reliable estimate of the amount of gold obtained at the Rippatoe. An approximate statement could be given if it were known what the average yield of gold per bushel of gravel was, for it could be calculated how much gravel was removed. But there are no

statistics and no reliable sources of information. The property was not worked by a regularly organized company, the different gangs of men were associated together for the more economical treatment of the gravel, they kept no permanent accounts, disbanding when they pleased and each going its own way without regard to the others. From first to last, however, there must have been a large amount of gold removed. The extent of the old workings proves that, for in those days when the miners did not find pay gravel they quit and went to some other place. It was not the custom to spend either time or money in prospecting on such an elaborate scale. There was enough water in the creek for their purposes, although not enough for a large business, and they kept at work in a small way for many years, accomplishing in the twenty-five years an astonishing amount. When the California gold fever came upon the country most of these miners were attacked by it and started for that Eldorado forthwith, and there has been no gold washing in this vicinity worthy of mention since 1855.

Only one placer mining company is now at work in the State, the Arbacoochee, in Cleburne Co. I have not visited the place, but understand that of late a better gravel has been found and that the operators are hopeful of good profits. Cleburne County belongs to the Upper Gold Belt and I have not yet visited that part of the State, and can not therefore speak of my own personal observation. But so far as concerns the old placer mines of the Lower Belt, lower Chilton, Coosa and Tallapoosa Counties, I do not think that any revival of the industry is likely to take place. The best gravel has been worked over as with a comb and nothing remains now that would attract capital, for it requires a large amount of money to operate such washings on a profitable scale.

At the Rippatoe the gold was derived from the small quartz veins lying between and in micaceous hornblende schists and clay slates. The creek has cut its way down through the schists and slates, undermining the quartz seams and distributing the resulting gravel along its course. The average width of the valley along which the gravel is found

is less than two hundred yards, in linear extent three quarters of a mile. The relation of the gold gravel to the country rocks appears to be as follows:

The schists themselves are pyritous and also enclose small seams of pyritous quartz. They lie to the Eastward of the clay slates. The slates are softer and more easily broken down by atmospheric agencies and by running water. The schists, overlying the slates, are in this way undermined and finally give down more or less, and allow their quartz seams to be distributed as gravel along the bed of the creek. This result is accelerated by the occurrence of thin seams of pyrite between the quartz and the schists. In places the schists are so impregnated with pyrite that it can be seen plainly with the naked eye. In other places they present the appearance of a true gossan. On panning there is always left in the pan a mixture of black iron sand with small fragments of clear quartz, garnets and pyrite more or less decomposed.

The tendency of the clay slates in this part of the county to present the appearance of a gossan is shown on quite a large scale on the road from Verbena to Higgins' Ferry about one and one-quarter miles from the Rippatoe Mines. At this place a large seam of brown iron ore crosses the road and can be traced for several miles in a N. E. and S. W. direction. Some samples of the ore are very good and the outcrop is bold. There may be enough of this ore above water level to justify a development shaft or drift; it would appear that is is derived from the infiltration of ferruginous waters obtaining their iron from the oxidation of pyrite. I observed numerous cavities of pyrite crystals in the accompanying quartz. Several years ago the Sloss Iron and Steel Co. of Birmingham opened a deposit of this ore lying four miles north of this place, but abandoned the undertaking after going to considerable expense in the construction of a branch road from the L. and N. Ry. It may be, however, that the lower part of the deposit near Rippatoe is of better quality and in greater quantity.

On the land of James Mims in Sec. 16 is to be seen the same kind of gravel accompanied by the same ferruginous slates as appear on the Rippatoe property. Here also the gold gravel has been thoroughly worked over, and although a considerable amount of gold was obtained prior to 1860, nothing of consequence has been done since. I sampled a small seam of sugary quartz on the Rippatoe place near Tiernan's house below James Mims' and found it to contain, in gold, $2.06 per ton. The gravel washings at the Rippatoe have been practically exhausted, but it is probable that by careful investigation workable quartz could be found. The owners of the land should have it examined with this purpose, and I would recommend that they examine especially the western part of the property towards the upper waters of Blue Creek, for as one approaches the Coosa River the schists become much coarser and the dip rises. I observed neither gneiss nor granite on the west side of Coosa River in this part of Chilton County, but it is quite noticeable that the granitic and gneissic soils begin to appear in Sec. 15, T. 22, R. 16 E. In this section also on the land of Jackson Mims numerous pieces of magnetic iron ore have been picked up on the surface. Mr. Mims has prospected for the vein with drift and shaft, but has not yet come upon it. The magnetite is associated with a coarse hornblende schist carrying mica and garnets. No gold has been found in connection with it, nor in fact has gold been found on Blue Creek below the Rippatoe place.

Between the Rippatoe and Higgins' Ferry, about one half mile from the ferry gate, there crosses the road a seam of iron ore partly limonitic and partly of higher oxidation. It appears to have been derived from the oxidation of pyrite and the infiltration of iron-holding waters. The remains of pyrite crystals are to be seen in the associated quartz. The seam can be traced for a quarter of a mile, but does not show any reliable indication of increased richness. A similar ore is to be found in Coosa County also as in Sec. 31, T. 23, R. 20 E. and in Sec. 1, T. 22, R. 19, and in Sec. 6, T. 23, R. 19, where it is partly converted into magnetite.

It is not likely that extensive deposits of good ore will be found where the evidences of the recent oxidation of pyrite are so numerous and so unmistakable. The limonites of S. E. Chilton and the middle and Southern Coosa are comparatively of recent origin. The rocks in which they occur are clay slates and micaceous graphitic schists more or less impregnated with pyrite. The rocks themselves may be, and doubtless are, of the Archaean Age, but the iron ore is of far more recent production, resulting, as it has, from the atmospheric decomposition of pre-existing beds and stringers of sulphuret of iron. Where the original amount of pyrite was very great or where local causes have led to a concentration of the iron these secondary ores are of value, but I can not speak hopefully of these ores. They do not seem to me to exist in sufficient quantity for commercial purposes.

## COOSA COUNTY.

### ALUM BLUFF.

The name Alum Bluff is given to a bold mass of micaceous schist and quartz rising to the height of 250 feet above Hatchet Creek, near its mouth, in Sec. 35, T. 22, R. 16 E., Coosa county. The schists are in places impregnated with the sulphates of iron and aluminum arising from the action of the sulphuric acid derived from the oxidation of pyrite. The so-called Alum forms a white incrustation on the surface of the bluff, and after a long drouth can be scraped up by the handful. It occurs most plentifully near the top of the bluff opposite a large pine tree standing some 200 feet above the creek. At this place there appears a heavy seam of bluish crystalline quartz carrying decomposed pyrite. It is eight feet in width, strikes N. 30 deg. E. and dips also with the schist S. E. 40 degrees. A sample gave to Lagerfelt and Mills, Birmingham, Gold 0.60 ounce per ton, silver, trace and was therefore worth $15.40 per ton. A sample of the walling next the quartz gave in gold, 0.35 ounce and silver 0.10 ounce per ton and was therefore worth $7.33 per ton.

The quartz is somewhat cellular and the sulphurets for the most part pretty well decomposed. This is probably a true vein and is well worth further examination. I did not observe it elsewhere in the immediate vicinity, as it lies in such a position as to be easily covered by the decomposing schists. The seam could be easily mined, as it stands well above Hatchet Creek and the upper two hundred feet of workings would be self draining. I was unable to ascertain the owner of the property, although I made diligent inquiry of well informed persons.

GOLD MINE RIDGE.

Secs. 1 and 2, T. 21, R. 16 E., Coosa Co.

Van Zandt and Smith prospected for copper and gold on this ridge in 1855, and Col. George and Jas. L. Tait for copper and graphite in 1872 and 1873.

The ore is quartz held in a micaceous schist and carries graphite and pyrite. I secured a sample from a four foot seam and it gave to Lagerfelt and Mills, gold 0.15 ounce and silver 0.25 ounce per ton and was therefore worth $3.35 per ton. A considerable amount of work has been done here, but all of the old pits, trenches, &c., have fallen in and nothing can be seen of the seam underground. I saw no evidences of the existence of copper in paying quantities, and the ore is too poor in gold to work for this metal under present conditions.

FLINT HILL.

Sec. 17, T. 22, R. 16 E., Coosa Co.

Heavy seams of crystalline quartz occur here in talcose schist. Of four samples taken only one showed more than a trace of gold and this one contained $4.13 per ton.

Flint Hill is about two miles above Wm. Hardy's Mill on Weoguffka Creek. At the foot of the hill coming towards Hardy's Mill there is found a heavy ledge of talco-micaceous schist carrying graphite and pyrite. These two minerals are so closely associated in the same rock as to give it a very odd appearance. Upon fire assay, however, I found no more than a trace of gold and silver.

In this part of the county many people have sought for a valuable silver mine said to have been worked by the Indians, but concealed by them, so that no one can find it. According to current opinion, the mine is extremely rich, having furnished the Indians with untold wealth for generations. When they left the county, some sixty years ago, they sealed up the entrance to the mine with heavy rocks and then obliterated all traces of the approaches to it. This was very unkind, for they had no reasonable expectation of returning to Coosa County, and could just as well as not

have told where the mine was and how they obtained the ore. I am inclined to think that if the Indians mined silver in this part of Coosa County they had first to convey the ore there from some other locality, an operation by no means unheard of, it is true, but in this case hard to believe.

I have to thank Mr. R. C. Hardy, Dollar P. O., for many courtesies, especially in pointing out to me one of the late Wm. Gessner's Tin Mines. This is situated in the S. W. Sec. 24, T. 22, R. 16 E. Some excavations have been made here, and Mr. Hardy informed me that from the ore obtained Gessner got 3.50 per cent of tin. Mr. Hardy said that he was with Mr. Gessner when he took the samples and he gave me a piece of the ore from which it is said 3.50 per cent of tin was obtained.

The ore is a close grained, much distorted quartz veinlets bound in hydro-mica talcoid schist. No extensive investigation has been made at this place.

During my stay in this part of Coosa County I was the recipient of many kindnesses from Mr. Frank Higgins, who owns the Higgins Ferry and a great deal of the best land along the river contiguous to the Ferry. I desire to express here my obligations to him and the various members of his family. It is always a pleasure to meet wide awake, intelligent men who are interested in the development of the country.

The photograps taken in Chilton County and in this part of Coosa County were unfortunately lost in shipment to Tuscaloosa, so that no views can be given of the Rippatoe or the Alum Bluff.

## ROCKFORD.

Between Higgins' Ferry and Rockford, the county seat of Coosa County, one sees the same schists and slates as occur on the west stde of Coosa River, but the dip is steeper and the texture coarser. About two and a half miles from Rockford there are found for the first time ledges of a very coarse, friable graphite, having the same course as the country rock and approximately the same dip. They alternate

with the schists and slates and extend to the south western part of Coosa County, where they cross the river and are found at and near Wetumpka, assuming here, as also toward the north east part of the county, a closer grain and firmer texture. At Goodwater, a station on the Columbus and Western Railway, in the north east part of the county, the granite becomes much harder and is suitable for building purposes. Lying in immediate proximity to the granite towards the east there occur ledges of a coarse graphitic schists carrying thin seams of quartz and pyrite, and conforming in dip and strike to the contiguous rocks. At times these quartz seams become quite large, as in the W. ½ S. W. ¼ Sec. 14, T. 22, R. 18, one and a half miles west of Rockford, where one of ten feet in width may be seen between two ledges of granite. This quartz carries tourmaline and tantalite, considerable fragments of this latter mineral having been found on the surface of the ground during the last ten years. A piece weighing 16 ounces, now in the Geological Museum at the University of Alabama, was obtained here besides many smaller pieces. It occurs in scattered fragments and occasionally imbedded in quartz.

(For Prof. Tuomey's description of the metamorphic rocks and the granite of Coosa County, see Appendix C.)

In immediate association with a ledge of coarse granite, a quarter of a mile north east of the tantalite locality, I picked up from the surface of the ground nearly two pounds of Cassiterite, the oxide of tin, some of the crystals measuring half an inch across the face and exhibiting an excellent crystallization. Dr. Eugene A. Smith, State Geologist, was the first to examine this locality for tin, which he did in or about 1880. In 1884 Hon. John S. Bentley, Probate Judge in Coosa County for 18 years, sent a box of minerals from Coosa County to the elder Dr. Chas. Shepard, in which were some crystals he thought were cassiterite. In his reply Dr. Shepard told him to look out for tin. In the American Journal of Science for 1884 will be found a brief mention of the matter. Here, however, it rested. No one had examined the place critically, and it seems to have been forgotten that tin

had been found there. The honor of the discovery belongs to Dr. Smith. The only share I have in the matter is the further identification of the crystals as cassiterite and the securing of the largest quantity of tin ore as yet obtained in this State, about two pounds of pure crystals. I say pure crystals, for I sent a sample to A. R. Ledoux & Co., 9 Cliff St., N. Y., for analysis, while I was still in the field, and received a report from the firm that the crystals contained 78.19 per cent. of tin, theory requiring 78.68 per cent.

Investigations are now being conducted in this locality, and it is hoped that before long some interesting results will be reached. My attention was drawn to the matter first by Judge Bentley, whom I visited at his house near Rockford, Aug. 4th, 1891, and again on Aug. 13th and 14th. He told me of the occurrence of tin ore on his land and I examined the place August 5th, and again on the 14th with his son, William H. Bentley, the Judge at that time being unable to walk, having been stricken with paralysis in 1887. For more than twenty years he had been a most indefatigable investigator of the mineral wealth of the county, and indeed while I was there, although he could not take a single step nor help himself into and out of his chair, he had his servant to place him in his buggy and went with me over a considerable part of the district.

Judge Bentley was a remarkable man; always alive to the best interests of the county, popular with all classes of citizens. His untimely death, which occurred in January, 1892, removed from Coosa County one of the best of men as also one of closest observers of natural phenomena I have ever had the privilege of knowing. I can not allow this opportunity to pass without expressing sincere regret that he was taken away at this time, although such a digression may appear out of place in a report of this nature. The State can ill afford to lose such men.

In the same section with the tantalite and cassiterrite i. e. Sec. 14, T. 22, R. 18, on Judge Bentley's land, is found an outcrop of brown iron ore. It shows three feet of fair ore in a trench across the strike, but does not appear ex-

tensive enough to warrant hopes of a workable deposit. It seems to be merely a gossan, as the inclosing slates are in many places impregnated with pyrite in various stages of decomposition.

In the bed of the Gin-house branch, as also in the Carroll and Pole branches, contiguous to this locality, gold has been obtained by washing. The gold is derived from the quartz seams held in the slates and is now associated with the gravel resulting from the breaking down and distribution of the quartz. I do not think that the gravel is worthy of any extensive examination, although it may be that some of the quartz seams carry enough gold to warrant investigation.

Almost within the limits of the town of Rockford is an old pit sunk forty or fifty years since for gold. The ore is quartz, walled in slate, strike N. 3° E., dip S. E. 40, width of seam 6 feet. A sample taken from the old dump gave on fire assay:

No. 1311. {Gold.....6–10 oz. / Silver.....2–10 oz.} Value per ton, $12 40.

It was worked several years ago by Mr. Lewis Parsons, of Birmingham, with but little success so far as could be learned. When first opened the ore was roughly crushed and washed at a small stream near by with some profit. It is often the case that such seams near the surface, where atmospheric agencies have been at work for ages, will yield enough gold by the simplest processes to pay for the labor and give more or less of a profit besides. But as the ore becomes harder, and more especially when sulphurets begin to appear, as is almost universally the case, the crude methods of fifty years since will not suffice. This is the main reason why so many abandoned pits, shafts, &c., are to be seen in all parts of the gold belt.

Near Hissop postoffice, on the land of F. M. Darsey, I observed a close grained granite in association with a highly metamorphosed clay slate, in Sec. 14, T. 22, R. 19, Coosa County. Mr. Darsey afterwards sent me a sample of cellular quartz from near this place but it contained only $2.06 in gold per ton.*

*Fair crystals of Beryl are found near Hissop.

On the land of E. M. Thomas (Hissop P. O.) in Sec. 11, T. 22, R. 19, is a heavy ledge of a highly graphitic schist inclosed between walls of coarse granite. Mr. Thomas informed me that a few years ago he roasted and smelted some of this schist in a black-smith's forge and obtained from one pound of the rock 35 cents worth of silver. This silver he had made into a collar button and, as proof that the rock contained silver and that he had extracted it, he exhibited the button. I took samples of the schist from the same spot which was said to have yielded the silver but on fire assay it failed to show more than the merest trace of gold, with no silver. As the schist is pyritous the gold may be contained in the pyrite, but certainly it is difficult to believe that from this rock any one had obtained silver on the scale of $700 per ton. From near the same locality I took a sample of bluish-green mud which Mr. Thomas also assured me contained silver, as he had himself run it out. On fire assay it gave the merest trace of metal.

On the land of Harris McKinney, in Sec. 6, T. 23, R. 19, and also in Sec. 1, T. 22, R. 19, Coosa County, there is said to occur a seam of magnetite. I examined the same seam in Sec. 31, T. 23, R. 19, at Mr. McKinney's house, where small peices of a slightly magnetic brown ore are found on the surface, but I am not of the opinion that magnetite in any quantity will be found in the vicinity. The ore is derived from the oxidation of local seams of pyrite in the schists and slates and even now pyrite may be observed in immediate proximity to the ore. I obtained at Mr. McKinney's house a peice of sugary quartz representing a seam said to be on his land. On assay, however, it gave:

No. 1309. {Gold.....2-10 oz. / Silver.....trace.} Value per ton,.$4 13.

The road from Rockford to Kellyton runs for 14 miles in a course a little N. of E. Many ledges of coarse granite are crossed, alternating with bands of slate and graphitic schist carrying in places evident signs of pyrite. This mineral seems to have been pretty well distributed in these slates and schists, almost any peice of rock which has not suffered

atmospheric decomposition will exhibit small crystals of pyrite. In certain localities where the pyrite was to some extent concentrated and where it has been decomposed there will be found fair indications of brown ore. I have seen seams of three feet and more in thickness and apparently indicative of a workable deposit. While pyritous quartz and even pyritous slates do, in some places, suffer so great a decomposition as to allow of the utilization of the residual oxide of iron, yet I do not think that the seams of brown ore in this part of Coosa County will be found to be of this kind. The same opinion has already been expressed as to the brown ore of south-east Chilton, for while the amount of visible ore there is far greater than in any part of Coosa County visited, still it has been derived from the enclosing slates in the same manner and is, in my opinion merely the residue of probably much more extensive seams now removed by erosion. I would not be understood as saying that ores derived from the enclosing rocks are, per se, and for this very reason unreliable. The elaborate and most conclusive researches of Sandberger, von Cotta and others have long since established that many of the most valuable ores are thus derived, notably the ores of the precious metals. But there are ores and ores, conditions of enclosure favorable to richness and conditions unfavorable, and it seems to me that in the case of all the brown ores mentioned in this report, we have the latter set of conditions. I am aware that this view of some of these brown ores is not held by some men whose opinions are worthy of consideration, but an acquantance with the brown ores of this State, North Carolina and Kentucky warrants me in taking the position occupied.

It was hoped that during the progress of the survey some indications of the existence of workable iron ore would be found in this part of Coosa County; that is, from the Coosa River through Rockford to the line of the Columbus and Western Railway; but none were found, although to the eastward of Rockford three lines of investigation were carried on. One from Rockford to Kellyton along the mail

route, one from Rockford to Alexander City by the lower road, and one to the south east part of the county in the vicinity of Equality P. O. and beyond into Elmore County four miles. This last named examination was conducted by Mr. E. E. Newton, a recent graduate of the University of Alabama, who was with me as a volunteer assistant. Not only were no iron ores of any importance found, but with the exception of the Alum Bluff and the Rockford Mine, the quartz examined yielded mere traces of gold and silver.* In my opinion, the more northern portions of Coosa County will probably be much more productive of gold ores than the middle and southern portions. (See appendix C.) It was my intention to return through this part of the county later in the summer and to remain there for some time, but the serious illness of a member of my family compelled me to abandon the survey before this could be done.

That portion of Chilton County lying north of Clanton and east of the Louisville and Nashville Railway, was also to have been examined later in the summer, but for the same reason had to be left to some future survey. This report is to be taken as a reconnoissance of the Lower Gold Fields, to mark out those portions of the Field that are worthy of a more extended examination, so that in the future the energies of the Corps should be spent upon ores that can be worked at a profit. That such do exist in this

*No. 1,325. Reddish crystalline quartz, showing free Sulphur from land of Mrs. Nancy Bryant, Sec. 29, T. 21, R. 20, Coosa County.
Gold.....} Traces.
Silver.....}

No. 1326. Sugary quartz, Equality P. O., Sec. 31, T. 21, R. 20, Coosa County.
Gold.....} Traces.
Silver.....}

No. 1327. Sugary quartz, Sec. 18, T. 22, R. 17, Coosa County.
Gold—1-10 oz. per ton.
Silver—trace. Value per ton, $2 06.

No. 1328. Sugary quartz, Sec. 28, T. 25, R. 20, Coosa County.
Gold.....} Traces.
Silver.....}

Nos. 1,321 to 1,324, inclusive, are assays of reddish crystalline quartz, from the land of J. W. Willingham, in Sec. 10, T. 20, R. 4, Elmore County, but only one showed more than traces of gold and silver, and that one contained 1·10 oz. of gold per ton ; value per ton $2.06.

Field is to my mind beyond question, and I think I know something of the conditions of gold mining along the Appalachian Range. It is my deliberate opinion that Alabama offers great inducements to the gold miner, and that capital judiciously invested and economically administered in the extraction of the precious metals would, in this State, find ample returns.

## TALLAPOOSA COUNTY.

I propose now to discuss that part of the Lower Gold Field which seems to me to offer these inducements and to hold out these promises of profitable investment.

I refer to Tallapoosa County, long known, with Cleburne County, as the scene of the greatest development in gold mining to be met with in the State, a place famous among the placer miners and quartz crushers of fifty years ago, and which has yielded a large part of the gold credited to the Southern States between the years 1830–1850.

In the adventures of Captain Simon Suggs, written to describe the truly remarkable experiences of this truly remarkable person, Johnston Hooper incidentally mentions a circumstance which bears upon the history of the gold fever in this part of Alabama. The Captain had bargained for a certain piece of land belonging to a Creek widow. When the time for payment drew near he found himself without the necessary funds to complete the trade, a condition of affairs by no means uncommon with him. Other speculators desired the same piece of land, and offered the widow much more than the Captain had agreed to pay, but she steadfastly refused to deal with any one but with her friend, Captain Suggs. She was beset on every side, but nothing could be done. It was known to the others that the Captain had no funds, and they supposed that in the end he would be forced to say so, when they expected to come in for something good. The Captain disappeared from the Post for several days, and no one knew what had become of him, although he intimated that he was going to borrow some money from a friend. Finally when the widow seemed upon the point of concluding that he had left the country and was about to sell the land to some one else, he rode up, dismounted and

joined the crowd with an enormous pair of saddle-bags on his arm, heavily laden. The speculators at once concluded that he had "struck it rich," as the saying was and is to this day; there was no telling, gold was plentiful then and many good nuggets had been found, and many a fifty pounds of ore that would pay for the land many times over. They at once came to terms and bought from him the coveted quarter section for two and a half times what he had agreed to pay for it. When the bargain had been firmly arranged and the money paid, he quietly threw out from the saddle-bags a lot of worthless rocks picked up along the road. All this happened in what was then Tallapoosa County about the year 1835, and illustrates in a striking manner the rage for speculation. The throwing open of much valuable land for settlement, consequent upon the removal of the Creek Nation, was responsible for much of it, but the genuine gold fever is to be credited with the greater part.

It is most unfortunate that no reliable statistics of the number of miners, or the yield of gold or the cost of the operations are now to be had, but from the trustworthy tradition and from what I have myself seen over a large part of the district in question, there can be no doubt of the activity that prevailed at that time among the gold miners in Alabama. It is said that in the adjoining county of Cleburne the town of Arbacoochee, now containing less than three hundred people, had in 1845 some five thousand inhabitants. From 1830 to 1850 the prospector was a familiar figure along the roads and among the hills of Tallapoosa.

### GOLDVILLE BELT.

From Hillabee Bridge, six miles east of Alexander City, to and beyond Goldville for a distance of 14 miles, an almost unbroken line of pits, trenches and shafts bear witness to-day of the great amount of work done prior to 1855. A mere enumeration of some of these old workings, which may be seen and in part explored, even now will show to what extent these operations were conducted. Thus, from a point

half a mile above the bridge to the Birdsong Pits beyond Goldville, we have

| | Section, | Township, | Range. |
|---|---|---|---|
| Ulrich Pits | 8 | 23 | 22 |
| Mahan Pits | 4 | 23 | 22 |
| Croft Pits | 34 | 24 | 22 |
| Stone Pits | 34 | 24 | 22 |
| Ealy Pits | 26 | 24 | 22 |
| Log Pits (Tog Pits is incorrect.) | 24 | 24 | 22 |
| Houston Pits | 18 | 24 | 23 |
| Goldville | 8 | 24 | 23 |
| Germany Pits | 8 | 24 | 23 |
| Jones Pits | 5 | 24 | 23 |
| Birdsong Pits | 4 | 24 | 23 |

These by no means exhaust the list; there are others which in their day were quite as well known and quite as productive, but whose exact location is now unknown.

It will be seen by consulting any map of Tallapoosa County, or the new State map, that these old workings follow each other in the order given from south west to north east. They do not appear upon either map, but by laying a straight edge along the map from Alexander City to Goldville, they will occur in almost a right line, the Ulrich Pits being the most southwesterly and the Birdsong the most northeasterly. Of the history of these mines little or nothing is known. The only mention of any of them which I have been able to find is a brief note by Oscar M. Lieber, in the Second Report on the Geological Exploration of the State of Alabama by M. Tuomey, published in 1858.

This Report was posthumous, and was edited by J. W. Mallett, now the distinguished Professor of Chemistry in the University of Virginia. He says in his Preface that the Report was drawn up by Prof. Tuomey in November, 1855, and was presented to the State Legislature at its Session of 1855–56. The information it contains is therefore such as was available prior to 1855, although the Report was not printed until 1858. On page 64 of this Report Prof. Tuomey says of Goldville: "The gold mine of this place was discov-

ered in 1842, and was worked to water level. The most noted portion of the mine was known as the tog pit." (There must be an error here, for Col. B. L. Dean, of Alexander City, who has known that district very well for thirty-five years, informed me that the name of 'tog pits' was entirely unknown there. Prof. Tuomey evidently referred to the Log Pits, which, however, are three miles south west of Goldville. W. B. P.) Prof. Tuomey continues: "the richest part of the vein in this pit (what he calls the tog pit) was from 4 inches to 2 feet thick. It was quartz in talcose slate, and yielded 2½dwts. to the bushel of ore. The gold was worth 90 cents to the dwt. Almost $30,000 worth of gold was extracted from this pit, and from this the proprietors received in addition $80.00 in silver. The history of this mine is like that of all Southern gold mines—the total want of any practical system of operations." This mine, Mr. Lieber reports, has been recently re-opened. "A vein has been discovered which, from its curious contortion, is called the snake vein. In the south side of the shaft it is poor, but in the northern side it yields on an average one dollar per bushel. The ore is a friable, porous, ferruginous quartz. The country is talcose slate, decomposed as far as yet reached. Numerous other veins appear on the same property, and properly managed success may be anticipated. The minerals found here, besides gold, are magnetic iron sand, native sulphur, garnets and mica." Thus far Prof. Tuomey.

As to the Ulrich Pits, it may be said that some forty or fifty years ago a German named Ulrich had a vineyard here and opened the gold pits. He mined and crushed in a crude way a considerable amount of the ore and is said to have made a good deal of money. The ore is a free milling sugary, and crystalline quartz, stained with oxide of iron, and held in a tough micaceous slate, strike North 30 deg. East, dip 40 deg. S. E. There are visible six seams of quartz, the largest six feet in width and the smallest three feet. They are separated by bands of slate, and the entire six seams are compriced within a distance of three hundred feet. They

outcrop on a hill above Hillabee Creek, at elevations above the creek of fifty to one hundred and fifty feet. The 530 foot line of altitude runs at the base of the hill at the creek. The pits are now fallen in, as well as the drifts, but the nearest pit to the creek is distant three hundred feet. There is always a bountiful supply of good water in the creek and it never rises to the first opening. All of the work done was on the north side of the creek, for, although the creek cuts all of the seams, nothing has been done on the south side. Mr. Ulrich seems to have cut into the ore while excavating a wine cellar. The deepest pit was sunk fifty feet and is now fallen in and inaccessible in the lower levels. Several drifts were started in to cut the ore at depth and it was found to be of good quality. While a considerable amount of ore was taken out, from first to last, the main body was hardly touched, and there still remains a large amount of free milling quartz within one thousand feet of the creek. From several old dumps I secured samples of the ore which gave by fire assay from $2.06 to $8.46 per ton. (See table of assays along Goldville Belt, pp. 45 and 46).

One of the quartz seams on the Ulrich place crosses the Hillabee Bridge road about three miles from Alexander City, on what is known as the Duncan Place, one mile south west of the Ulrich Pits. Here it is 2½ feet thick, held in the same slate. A sample gave, by fire assay,

Gold .....2 10 oz. per ton.
Silver.....trace. } Value per ton $4.13.

From this point this seam of quartz and others in close proximity extended in a north east direction for twelve miles to and beyond the Birdsong Pits. I have closely observed the character of the quartz over this distance and it differs but little from that at the Ulrich Pits. Scores of old pits, trenches and shafts are found. I do not think that any half mile between Duncan's and Birdsong's will fail to show evidences of former operations; some of them, for that day and time, quite extensive.

Over this entire distance of twelve miles the quartz seams are bold and strong, preserving the same general character-

istics, and showing a remarkable continuity of walling, strike and dip. In places, as for instance at the Jones Pits, where the greater part of the old time work was done, they thicken up to thirty feet. Nothing of any moment has been done at any of the Pits for more than thirty years. Between 1835 and 1860, it is said that several thousand miners were at work along this range, but in 1850 they began to drift towards California, and this migration, with the disturbing effects of the civil war, put an end to the operations. A large amount was certainly taken out and treated, but with what results as to profits can not now be known. The country was then very thinly settled and all the supplies had to be hauled for 50, 60 and even 70 miles over roads that, for the most part, were simply execrable.

No records were kept of the amount of ore treated or the yield, and it would now be a hopeless task to endeavor to ascertain the out-put of gold or the cost of production. From a careful examination of the localities, the nature of the ore and the conditions under which the work must have gone on, it is, I think, evident that the operations must have been, in places, very profitable.

No organized capital was employed and there were no mills worthy of the name. But little was known of the art of mining, and still less of the art of milling, the most important consideration in the successful management of all gold ores, and there must have been a large loss of gold. Yet the work went on for years, some of it costly work. The only explosive they had was black powder; all of the drilling was done by hand and a great deal of the crushing also. But they kept at it, and the engineer who examines the district to-day can see for himself that an astonishing amount of ore was raised and treated. The old openings are now abandoned, large trees are growing in the pits and trenches and the shafts, some of them more than fifty feet deep, are gradually filling up with leaves, rotten timbers and debris from the walls. Gold mining in the Goldville District is unkempt, ragged and down at the heels.

At Goldville itself, between 1840 and 1850, there are said

to have been fourteen large stores with a contributory population of at least 3,000. Now one looks in vain for the tenth part of this population, and the stores have been converted into dwellings and barns.

It must, however, be distinctly stated that the mining operations conducted forty and fifty years ago along this belt merely scratched the great deposits of free milling quartz that characterize it.

Above water level, i. e., at depts varying from 10 to 40 feet, these seams furnished a material much more friable and easily crushed than was found at greater depths. The gold was coarser, and the absence of any considerable amount of sulphurets allowed free malgamation. At few places along the belt, for a distance of 10 miles, did these old miners, so far as could be ascertained, penetrate to the the lower limit of the decomposed sulphuret. At one place only did I observe the presence of undecomposed and decomposing sulphuret, viz: at the Jones pits, in Sec. 5, T. 24, R. 23, near the north east extremity of the Goldville Belt. Here the undecomposed sulphuret of iron, with arsenopyrite, began to come in at the the bottom of a shaft 60 feet deep. It is held in a hard, bluish quartz showing also free gold. A sample, which showed no free gold, gave by fire assay,

Gold.....2 7-10 oz. per ton.)
Silver.....1-10 " " " } Value per ton $55.90.

(See also page 48.)

It is highly probable, and, in the light of universal experience in the South Atlantic Gold Fields, even certain, that the free milling ores, that is, such ores as readily yield their gold to mercury, begin to carry sulphurets below water level. As these come in the free gold goes out, and when a typical sulphuret ore is found, it contains about one third of its total gold in such a condition as that quicksilver will attack it. The other two-thirds can not be extracted with quicksilver at all unless the ore is thoroughly roasted, and even then incompletely. Forty years ago such an ore was almost worthless in a district affording no smelting ores. To be available

at all it had to contain sufficient free gold, easily taken up by quicksilver, to pay for the mining and treatment of the whole amount of ore and leave something over for profit.

Gold exists in quartz seams in at least two conditions. First, as free gold, more or less fine and intimately mixed with the quartz. Second, combined, or mixed, with a mineral consisting of iron and sulphur, or iron, copper and sulphur, known as Pyrite, or Chalcopyrite. Generally the mineral occurring with the gold is pyrite, or, as it is briefly termed, sulphuret, meaning a compound of iron and sulphur. This sometimes contains copper, but in the Southern States rarely beyond two per cent. When this sulphuret is exposed to the atmosphere it begins to decompose, the product being oxide of iron, a reddish or reddish-brown substance, wnich remains, and sulphate of iron (copperas) which, being soluble in water, is washed away.

All the quartz seams of the Goldville Belt seem at one time to have carried sulphuret disseminated through the quartz. The sulphuret has been decomposed down to water level, so that now these seams show above this point a friable quartz penetrated in every direction with thin veinlets of oxide of iron, the remains of the original sulphuret. In many cases the gold carried by the sulphuret is now concentrated along these "iron stains," and on breaking the quartz and rubbing off the stains and panning them, the gold may be panned out, proving that it is now free gold. In the upper portions of these seams all of the gold is now free and is easily taken up by quicksilver. The old time miners, lacking the means for treating the undecomposed sulphuret, ceased their operations when it appeared in any consiberable amount. They mined thus only the upper portions of the seams, from which the gold could be obtained with comparative ease.

Where the decomposition has been going on for ages, as is the case in the Southern Gold Fields, and when the original sulphuret was rich and plentiful, it often happens that the residual oxide of iron forms veins of several inches in thickness and carries m' ch gold. In the Rudisill Mine, near

Charlotte, N. C., there was a vein of this oxide of iron, along with other ores, about four inches thick that went down to a depth of 300 feet, and carried in places nearly $500 worth of gold per ton. At the Boilston Mine, in Henderson County, N. C., I have also observed these veins of iron oxide, one of them carrying $112 per ton. Such veins readily yield their gold to quicksilver, and constitute the best grade of ore in many localities.

One can now appreciate why these old miners made so many pits, trenches and shallow shafts; they were searching for ore that was easy to crush and easy to amalgamate. When they came upon the underlying undecomposed ore, harder and impregnated with sulphuret, they moved on to another place and repeated their operations. But after all, they left an incalculable amount of free milling ore, as the seams of which I speak are continuous for at least 15 miles, and probably extend for 30 miles. Even should this not be the case, assuming that the greater part of the free milling ore had been removed, an assumption by no means to be allowed, we now possess means for the economical treatment of the undecomposed sulphuret, which for ease, rapidity and thoroughness, leave but little to be desired. I refer to the Chlorination of Gold Ores, a full description of which will be found sn Appendix A. The sulphurets, the great Bug-a-boo of Southern gold miners, no longer vex us; they can be and they are treated for their gold contents with the most gratifying success. Apart from the sulphurets, however, and leaving them to be treated when they appear, it is my deliberate opinion that between Hillabee Bridge and the Birdsong Pits there is enough free milling gold ore to maintain a dozen stamp mills of 200 tons per day capacity at work profitably for twenty-five years. I have been over nearly all of the district twice and do not hesitate to say what seems to me to be the truth. The statement may and doubtless will be received by some with the customary smile of incredulity, the almost invariable accompaniment of assertions regarding the profitable treatment of Southern gold ores. The same smile did duty when the first assertions as

to the Southern iron ores were made, when the Florida Phosphates were discovered and when coke making was begun in Alabama, and is still in good working order. It is as old as human nature and will outlive the last man.

In my examination of the Goldville Belt, extending from Hillabee Creek in a general north east direction to the Birdsong Pits, a distance of about 14 miles, I was particularly fortunate in having as my companion and guide Col. B. L. Dean, of Alexander City. He has been a resident of this part of Tallapoosa County for 36 years and has devoted more intelligent attention to the mineral wealth of the county than any one I know of. He is especially well acquainted with the region east of the Columbus and Western Railway and north of the Tallapoosa River. At my request he wrote a brief account of the Goldville Belt and I reproduce it here in his own words:

"The first work in this part of Tallapoosa County was done between 1840 and 1850 by Edward Birdsong, who has been dead for thirty odd years. He owned and mined part of S. W. ¼ and N. W. ¼ of Section 4, T. 24, R. 23. His widow, a resident of Columbus, Ga., was living in 1889. She could give more information about the mining interest in those days than any one I know. She said to me once that she was the cause of her husband's stopping work; the country was full of miners and she could not afford to raise her children where the Sabbath was a day of hunting and gambling. Her husband's work was carried on with negroes. In illustration of the gold fever she said that her negro cook, after attending to all of her duties at the house, would take her pan and wash out 75 cents worth of gold in a day, crushing the ore in a little hand mortar.

"Towards the south west we come next to the Jones Pit, in Sec. 5, T. 24, R. 23. On this property a great deal of work has been done with wooden stamps and the Arastra. There was also at one time a steam engine at the mine. Reports as to the yield of gold vary. The veins are from ten to twenty feet in width. (I have heard old miners say that in places the Jones Pits were very rich, W. B. P.)

"Next towards the south west we come to the Germany Pits, in the N. W. and S. W., Sec. 8, same township and range. It is said that Mr. Germany made money here. In this Section is located the town of Goldville, one of the oldest places in the county.

"Next in order are the Houston Pits, where much work has been done, but I know very little about them.

"The Log Pits are next, where also much work has been done.

"Next are the Ealy Pits in the S. W. ¼ of Sec. 26, T. 24, R. 22. A great deal of work was done here by Mr. A. Ealy and the Hon. Daniel Crawford, Ex-State Treasurer. Col. Crawford had great faith in this part of the county and was always on hand when any work was going on. I asked him once how he worked the Ealy Pits. He said that he made the machinery himself; four iron-shod wooden stamps run by water power at Jarvis' Mill. He hauled the ore two miles, crushed it with the wooden stamps and then "rocked" it in a rocker. I inquired what was the best run he had ever made in one day, and my recollection is that he said it was $73 or $75. After the death of Mr. Ealy, work was suspended, probably in 1845 or 1846, and has not been resumed since. I met a man once, named Collins, living in the northern part of the county, who had worked at the Ealy Pits and he told me that Ealy and Crawford got out some ore that ran $41 to the bushel. (Taking the bushel at 100 pounds, this ore was worth $820 per ton; pretty good stuff for those days. W. B. P.)

"Of the Stone and the Croft Pits, which come next, I know but little. A good deal of work was done from first to last, but nothing of record.

"The Mahan Pits, which come next, seem to be in the slate and a little off the main line of the quartz. Heavy sulphurets begin to show at the Mahan Pits, but the ore carries also free gold, as I have panned it out. Some of the ore was sent north several years ago by a Mr. Linds, and it assayed $22 per ton.

"Lastly, we come to the Ulrich Pits on the east bank of

Hillabee Creek. A great deal of work has been done here also, and much money spent to no purpose in shafts and drifts. The quartz is walled in slate dipping in some places nearly vertically, but as a general thing not above 45 degs. Dr. Ulrich sunk several costly shafts, hunting for copper, but as they were put down on the west side of the veins while they dip towards the east, the deeper he went the the farther he was from the ore. He finally discovered gold instead of copper, and erected a mill furnished with wooden stamps, taking the water for his power from Hillabee Creek. He worked in this way until the war, making his gold into bars and buying cattle with it, so I am informed by old citizens. Ulrich's operations were conducted without the least regard to economical mining, and with no thought for the future. The showing of ore at these pits and at the Jones Pits is greater than at any intermediate locality, and at these two places water is much more abundant and accessible than anywhere along the belt. Col. A. H. Moore had some of the Ulrich ore assayed in North Carolina, and told me that it ran $21 per ton

"On the west side of Hillabee Creek these seams continue in a south west direction, crossing the road from Alexander City to Hillabee Bridge on the the Duncan Place. This belt seems to be bounded on the east by a large slate dyke from 200 to 400 yards distant from the quartz seams. It crosses the Columbus and Western Railway in Coleman's Cut. This ends what I have to say about the Goldville Belt.

"About two and a half miles west of the Log Pits we find a great mass of ore in the Hog Mountain. There are millions of tons of quartz in the Hog Mountain, all of it carrying gold. I saw assays of ore taken from 16 different places and they showed the ore to be worth from $4 to $16 per ton. (Other assays of Hog. Mt. ore will be found under the appropriate heading, W. B. P.)

"From Hog Mt. we come south, in the same section to where William Conant worked in 1844 and 1845. It is said that he made money, using the crudest appliances and hauling the ore two miles with oxen.

"In Section 5 we find gold in the slates and heavy sulphurets in the shoals of Enittachopka Creek, the sands all along the creek for miles will pan gold.

"In all these places the quartz seams appear to go in parallel bands six or seven in a group and from thirty to forty feet apart. The same is true of Hog Mt."

This concludes Col. Dean's interesting and valuable letter. If there were others in the country who took the same intelligent means of informing themselves as to what has been done and what still remains to be done to develop legitimate gold mining the task of the prospector would be easier. He has faith in the future of Tallapoosa county as a gold producer and whether his hopes are fulfilled during his lifetime or not he may, perhaps, from another sphere be able to look down upon a score of mills, pounding away and proving the reality of what he labored so long to establish, the profit in quartz mining along the Goldville and Hog Mt. Belts.

Following is a list of the assays made on small samples taken along the Goldville Belt from Hillabee Bridge to the Jones Pits. It is not claimed for these assays that they represent in every particular the value of the ores, still they will show their general character. To sample these seams correctly would cost a good deal of money and the Survey has no means at its disposal for such an undertaking. The owners of the property should take the matter in hand, employ a competent engineer and furnish him with the means for opening the old pits or sinking new ones, so that average samples could be secured.

Assays along the Goldville Belt from the Duncan place, on the Hillabee Bridge road about 3 miles from Alexander City to the Jones Pits. Fourteen assays were made along this line, viz: one from Duncan's, five from the Ulrich Pits, two from the Ealy Pits, five from the Jones Pits, and one from what is known as the Chisolm Place, in Sec. 9, T. 23, R. 22. The value of the ore varies from $2 to $55.90 per ton.

No. 1282. Duncan Place, sugary quartz 2½ ft. width, sample from seam in road,

Gold.....2–10 ozs. per ton.
Silver.....trace. } Value per ton, $4.13.

No. 1283. Ulrich Pits, old dump, reddish sugary quartz:

Gold.....1–10 oz. per ton.
Silver.....trace. } Value per ton, $2.06.

No. 1284. Ulrich Pits, old dump, reddish sugary quartz.

Gold.....4–10 oz. per ton.
Silver.....1–10 oz. per ton. } Value per ton, $8.36.

No. 1285. Ulrich Pits, old dump, reddish sugary quartz:

Gold.....1–10 oz. per ton.
Silver.....trace. } Value per ton, $2.06.

No. 1286. Ulrich Pits, old dump, reddish sugary quartz:

Gold.....1–10 oz. per ton.
Silver.....trace. } Value per ton, $2.06.

No. 1287. Ulrich Pits, old dump, reddish sugary quartz:

Gold.....4–10 oz. per ton.
Silver.....2–10 oz. per ton. } Value per ton, $8.46.

No. 1288. Ealy Pits, yellowish sugary quartz:

Gold.....1–10 oz. per ton.
Silver.....trace. } Value per ton, $2.06.

No. 1289. Ealy Pits, yellowish sugary quartz:

Gold.....1–10 oz. per ton.
Silver.....trace. } Value per ton, $2.06.

No. 1290. Jones Pits, yellowish crystalline quartz, old dump:

Gold.....1–10 oz. per ton.
Silver.....trace. } Value per ton, $2.06.

No. 1291. Jones Pits, old dump, reddish crystalline quartz:

Gold..
Silver. } traces.

No. 1292. Jones Pits, old dump, white crystalline and bluish quartz, with pyrite, and Arsenopyrite i. e. pyrite containing arsenic:

Gold.....2 7–10 oz. per ton.
Silver.....1–10 oz. per ton. } Value per ton, $55.90.

No. 1293. Jones Pits, old dump, white crystalline quartz:

Gold.....1–10 oz. per ton.
Silver.....trace. } Value per ton, $2.06.

No. 1294. Jones Pits, old dump, white crystalline and bluish quartz with pyrite and arsenopyrite.

Gold.....9–10 oz. per ton.
Silver.....3–10 oz. per ton. } Value per ton, $18.90.

No. 1299. Chisolm Place, out crop of whitish sandy quartz, 6 ft. wide.

Gold.....1–10 oz. per ton.
Silver.....trace. } Value per ton, $2.06.

## HOG MOUNTAIN.

Copy of a letter received from Col. Jas. P. Dawson, Turner Building, St. Louis, September 18th, 1891:

ST. LOUIS, MO., Jan. 22d, 1889.

Elias S. Pepper, Esq.,
3rd National Bank, City:

Dear Sir—The sample of ore from.....marked....., submitted to us for examination, contains

Gold.....2.65 ozs. per ton.
Silver.....0.10 " "

Respectfully,

St. Louis Sampling and Testing Works,
WILLIAM B. POTTER, Mgr.
"S."

According to this assay the ore is worth $54.87 per ton. The letter was marked in pencil "Jones Vein."

In regard to the foregoing analyses I can only reiterate what has been already more than hinted at, that if the owners of gold properties desire assays which shall correctly represent the character and value of the ore, they should employ a competent and reliable mining engineer to make a detailed report. Samples taken at random may be correctly assayed and yet reveal but an indication.

Four miles almost due west from Goldville, two miles east of Hillabee Creek, and the same distance south from the Tallapoosa, Clay, line in Secs. 10 and 15, T. 24, R. 22, in Tallapoosa County, is the famous Hog Mountain. It derives its name from its peculiar shape when viewed from a distance. It attains an elevation of about 1,000 feet above tide and about five hundred feet above the surrounding country. It is composed in great part of quartz seams separated by bands of clay slate, highly metamorphosed in many places. A ledge of coarse granite appears among the slates of the hanging wall, i. e., the south wall, for the seems here are orientated contrary to the general run of the quartz in this part of the county. They bear almost due east and west, and, with the slates, appear to have been twisted around, the normal course being towards the north east. On the west

side of the mountain there are enormous outcrops of quartz seams and massive boulders of quartz. One of the seams, known as the Blue Seam, shows 35 feet in width where it is uncovered. This seam was worked to a limited extent several years ago, and some good ore was taken out.* It bears east and west and dips to the south 30 degrees.

There is now a ten stamp mill, California pattern, with engine and boiler on the property, but no work has been done for several years. From the appearance of the more recent openings I think that perhaps 500 tons of ore were mined and milled, but I have as yet been unable to ascertain with what success. The ore is a sandy, friable quartz near the surface, but soon begins to harden, and at a depth of 15 or 20 feet is quite hard. At a depth of 20 feet in the Blue Seam sulphurets begin to come in and carry gold, as will appear from the assay.

The Tallapoosa Mining Company, of St. Louis, is now preparing to begin the work at the Hog Mt. on an extensive scale, so it is said. With a modern mill crushing from 200 to 300 tons per day, there is no reason why the Hog Mt. should not enter the list of profitable mines. There are millions of tons of workable ore in this hill. The main draw-back to any considerable operations here is the scarcity of water; there is no sufficient supply nearer than Hillabee Creek, 1½–2 miles. For this reason, and on account of the character of the ore, any company wishing to work on a large scarle would have to expend a great deal of money. The difficulties to be met and overcome, however, are no greater than have been successfully encountered elsewhere.

Through the kindness of Col. Jas. P. Dawson, Turner Building, St. Lonis, I can present some additional information concerning the ore from Hog Mt.

*About one mile from the Hog Mt. towards Cowpens Tourmaline is abundant.

"Alexander City, Ala., May, 1889, pannings made on Hog Mt. by Wm. H. Cornell:

| Veins. | No. of pans. | Showed gold. |
|---|---|---|
| 1x2 | 11 | 7 |
| 2x3 | 9 | 6 |
| 3x4 | 20 | 13 |
| 4x5 | 10 | 8 |
| 5x6 | 12 | 7 |
| 6x7 | 8 | 4 |
| 7x8 | 5 | 5 |
| 8x9 | 6 | 4 |
| 9x10 | 4 | 2 |
| | 85 | 56 |

These pannings were all taken from the surface, and as near in diagonal as possible. The show was from three to thirty particles to the pan. From 3x5 the best."

Another letter from Col. Dawson enclosing two from Mr. Jewett, Assayer in charge, United States Assay Office, St. Louis, was received at the same time. From the assertions of Mr. Jewett in regard to some ore which Col. Dawson informs me was from Hog Mt., I find that it was worth $8.26 in gold and 36 cents in silver per ton.

Copy of a letter from the St. Louis Sampling and Testing Works:

"January 11th, 1889.

T. Wright, Esq., 3d and Olive Sts., City:

Dear Sir—We herewith enclose certificate of assay. The concentrates weighed 1.870 grams, 28.85 grains. If obtained from two ounces avoirdupois this would be a concentration of over 30 to 1. Unless the assay of the original is known, it would be impossible to say what loss attended the process.

Very respectfully,

St. Louis Sampling and Testing Works,

Wm. B. Potter, M'g'r."

S.

This letter is marked, in pencil, "Hog Mt." The certificate referred to was as follows, as per copy:

"St. Louis, Mo., Jan. 12th, 1889.

T. Wright, Esq.,
3d and Olive Sts., City:

Dear Sir—The sample of Pulp from.....marked "Concentrates," submitted to us for examination contains

Gold.....4.37 ozs. per ton.
Silver.....2.92 " " "

Respectfully,
St. Louis Sampling and Testing Works,
Wm. B. Potter, M'g'r. J."

Taking the total value of these concentrates at $93.24 per ton and the degree of concentration as 30 to 1, the value of the untreated ore would be $3.10 per ton.

Copy of a certificate of assay of what Col. Dawson wrote was "a number of pieces picked up at random on the mountain and assayed together."

"St. Louis, Mo., April 22d, 1889.

T. Wright, Esq.,
3d and Olive streets, City:

Dear Sir—The sample of ore from....., marked....., submitted to us for examination, contains

Gold.....0.3 ozs. per ton.
Silver.....0.1 " " "

Respectfully,
St. Louis Sampling and Testing Works.
William B. Potter, Manager."

Taking these figures, the value of the ore per ton was $6.20.

Copy of another letter received from Col. Dawson:

"St. Louis, Mo., Oct. 2d, 1889.

T. Wright, Esq.,

3d and Olive streets, City:

Dear Sir—We have treated the barrel of ore you sent us as follows: The ore was crushed in a three stamp gold battery, with inside and outside amalgamated plates, using a 40 mesh screen, and the tailings were run over an Evans concentrating table with the following results:

Net weight of ore.....502 lbs.
Containing gold..... 1.90 ozs. per ton.
" silver.....0.1 " " "

The amount remaining in the mortar after the run was 219 lbs., assaying 1.90 ozs. gold per ton, thus giving 283 lbs. as the net weight of ore treated. The tailings from the plates contained, Gold.....0.50 ozs. per ton, showing a saving of 73.7 per cent of the Gold.

The tailings, after passing over the Evans Table, gave the following results:

Headings.....11 lbs., containing
Gold .....1.60 ozs. per ton.
Silver.....0.10 " " "
Middlings.....48 lbs., containing
Gold.....0.35 ozs. per ton.

The Headings contain 3 per cent of the Gold in the original ore, but it will be noticed that their grade is a little lower than the original ore.

The above results would indicate that your ore is fairly free milling. With a larger amount of ore, sufficient to make several runs under varying conditions, it is possible that somewhat better results might be obtained.

Respectfully,

St. Louis Sampling and Testing Works,
William P. Potter, Manager.
J."

According to this assay the ore was worth as follows:

Gold .....$39.27
Silver ..... .10

$39.37 per ton.

The following letter, also from Col. Dawson, is very important, showing as it does that at one time much more information concerning the Hog Mt. ores was available than is now the case.

"St. Louis, Sept. 8, 1891.

James P. Dawson, Esq.,
President Tallapoosa Mining Co.,
City:

Dear Sir—Replying to your inquiry concerning assay work done by my direction on Hog Mountain ore, I have searched all through my papers for the records but could not find them, and I do not know what I did with them. I had very many assays made, perhaps sixty or seventy, of the ore taken from different parts of that property, and of course can not remember them. I do remember that they ran as low as $2 and as high as $31, and I believe that they averaged $7.50, and I believe that they represented perhaps the true character of the property more closely than any other investigation ever made. I regret very much that I do not have the records, since I would be glad to give them to you.

Yours truly,

A. F. HOFFER.

The assays I speak of were made in '86 and '87."

I made four assays of ore taken at random from some old dumps on the Hog Mt. They ran from $6.20 to $58.67 per ton, the average being $24.53. They are as follows:

No. 1,295. Hog Mt., old dump, yellowish sugary quartz.
Gold.....2 8-10 ozs. per ton.
Silver....8-10 " " " } Value per ton, $58.67.

No. 1,296. Hog Mt., old dump, whitish sugary quartz.
Gold.....3-10 oz. per ton.
Silver.....trace per ton. } Value per ton, $6.20.

No. 1,297. Hog Mt., old dump, yellowish sugary quartz.
Gold.....1 1-10.
Silver.....trace. } Value per ton, $22.73.

No. 1,298. Hog Mt., blue seam, bluish crystalline quartz, with a little pyrite.
Gold.....5-10 ozs. per ton.
Silver.....2-10 " " " } Value per ton, $10.53.

RESUME ON THE GOLDVILLE AND HOG MT. BELT.

1. No work of any consequence has been done for thirty years.

2. No reliable records are to hand relating to the work done prior to 1860.

3. Except at the Ulrich, Jones and Hog Mt. mines no good exposures of the veins are to be seen now. The old workings are fallen in and access to the seams is not to be had except at some expense, and the Survey has no means at its disposal for this purpose.

4. The assays of the samples taken show that the ores vary in value from $2 per ton to $58.67.

5. A large amount of work has been done by the old miners, and by reliable tradition some of it was very profitable.

6. The Ulrich and Jones Pits are well supplied with running water sufficient for extensive operations. The Hog Mt. is from one and a half to two miles from Hillabee Creek, the nearest available water supply.

7. An abundance of good timber of all kinds is within easy reach of all the Pits and of Hog Mt.

8. Profitable gold mining could be carried on in this part of the county.

THE SILVER HILL BELT.

Silver Hill is in Secs. 16 and 17, T. 20, R. 22, Tallapoosa County, and is about 13 miles S. W. of Dadeville. Mining was carried on here probably as far back as 1835, but there are no records of what was done or of anything in connection with the work. There are abundant evidences that a great deal was done from first to last, for the old works are quite extensive, more so than at any locality in the County. A description of Silver Hill is contained in the Report of Prof. Tuomey, previously referred to as having been published in 1858. As he or Mr. Lieber, or both, visited the place before the shafts, drifts, &c., had fallen in as badly as

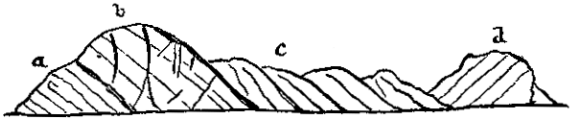
they have now and as the description is well worth reproducing it is here given in full, taken from pages 47 to 50 of that Report.

Prof. Tuomey says:

"The talcose slates of Silver Hill are seen outcropping near Ufola, and the gold mine occupies the crest and flank of the hill which extends to the stream on which the mill is situated.

"The auriferous slates are enclosed between beds of hornblende. The following section will show the position of the mine:

*Fig. 1.*




*Section of Silver Hill. (after Tuomey.)*

*a.* Hornblende slate.
*b.* Auriferous talcose slate, with veins of quartz.
*c.* Dark colored talcose slates.
*d.* Hornblende slates.

"This section is best seen at the base of the hill near the mill. Both *a.* and *b.* are quite hard, when placed beyond the influence of atmospheric agencies.

"About ten years ago this mine was in its most prosperous condition. About 150 feet of the principal vein was found out-cropping on the crest of the hill. It was 2 feet thick, but about 12 feet below the surface it became thinner and richer, at a depth of 15 feet it became poorer. It again thickened to 4 or 5 feet, and continued to improve in productiveness until it was abandoned.

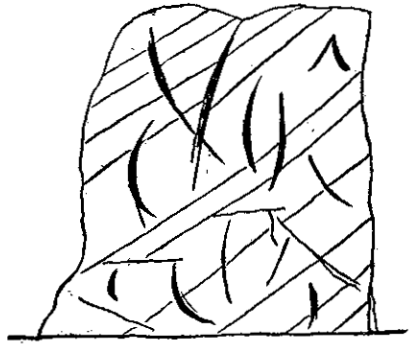
"The vein, which was quartz, was worked to a depth of 80 feet in the centre, where it was richest. The ore was there worth $4.85 per bushel (about $96 per ton W. B. P.) The course of the vein was a little North of East. The usual

mode of letting out the mine in small parcels was adopted here, and with the same results as elsewhere—the total ruin of the works. The vein is situated in Section 16, Township 20, Range 22. (The range is 21, W. B. P.)

"It has been recently re-opened with some prospect of success. An adit has been driven a little above the natural drainage of the Creek, with a view of striking the vein below the old works. Whilst this heavy work is going on, the proprietors are working some ore from the top of the hill. The ore is hauled by oxen about 250 yards to the mill, where I found 6 stamps, and a badly constructed Burke Rocker, in operation. The ore thus treated yielded only 12½ cents per bushel. (Say $2.50 per ton, W. B. P.)

"The principal vein was not exposed at the time of my visit, but some of the auriferous portions of the country, which were worked, presented the appearance shown in the cut, Fig. 2:

*Fig. 2.*



*Quartz veins, Silver Hill. (after Tuomey.)*

"The dark lines represent broken quartzose veins containing gold. On the branch, into which the drainage and surface water flows, signs of old works occur in the gravel deposited in its bed. Mr. Lieber, who examined this place more recently, reports as follows:

'The Silver Hill Mines, which were formerly abandoned on account of difficulties among the members of the company, are now worked by a Georgia company, with a prospect of success.

'The country is a talcose slate, one of the beds of which is of that peculiar black kind resembling black lead. Another talcose bed, in which quartz appears in irregular masses, is the one which is worked, the slate being also auriferous. This bed strikes North 70° East, and dips 15° to 35°. A quartz vein, leading from this, and striking North, is about 12 feet thick, including the selvages and the workable slate. The main body is 8 feet thick. Deeper down, the quartz will consolidate, in all probability, into a regular vein. Garnets and peroxide of iron occur, but all mixed confusedly with the slate. The black and grey slates are not auriferous, whilst the red, and portions of the white slates, are.

'The present company have driven two good adits, one of which is 400 feet in length, which, by draining a large amount of untouched ore, will enable them to win the contents of the mine for a long time, without any additional expense of consequence for drainage. The gold is said to be worth 95 cents per dwt.'

"On the opposite side of the branch, an immense series of quartz beds comes to the surface, which beds are more or less auriferous, and have even been worked, but with great difficulty, owing to the distance from water. They occupy the crest of a hill of considerable elevation, towards Blue Creek, forming an interesting feature of the landscape. (This ridge is known locally as The Devil's Back-bone, and extends for several miles in a North Easterly direction, W. B. P.)

"On the tributaries of the Creek, a great amount of gravel has been washed, in years past, for gold, and with much success, but these works have been abandoned years since."

Thus far Prof. Tuomey.

I can only confirm what is here stated as to Silver Hill, the work has been carried on in a haphazard way by first one set of miners and then by another. I could not get into the lower works but from what appears on the surface there is sufficient evidence of the wasteful and unscientific methods which were pursued. That there is good ore still at Silver Hill the following assays will show. The samples were taken at random from some old dumps:

No. 1276. Bluish crystalline quarts, carrying pyrite.
Gold.....4 9-10 ozs. per ton.
Silver.....3 7-10 ozs. per ton.
Value per ton $104.98.

No. 1277. Yellowish suary quartz.
Gold .... 4-10 ozs. per ton.
Silver.....3-10 ozs per ton.
Value per ton $8.56.

No. 1278. Light yellow sugary quartz, gave traces of gold and silver.

No. 1276 represents the ore which is found in the bottom of an 80 ft. shaft, so I was informed by Mr. Isham Worsham, who worked at Silver Hill many years ago. Of course it can not be said that all the ore is of this quality, I am even disposed to think that but little of it is so good. Mr. Worsham described the vein as being about five feet in width and as carrying a good deal of sulphuret. The shaft was entirely filled with water at the time of my visit in August, 1891. I have some interesting letters concerning Silver Hill from Major C. H. Parmalee, Ass't. Treas. of the White Breast Fuel Co., 18 Broadway, N. Y. As they contain some valuable information regarding the value of the ore, I reproduce them here, omitting such parts as are of a purely personal nature.

*Copy.*

WHITE BREAST FUEL CO.,
18 BROADWAY, N. Y.,
Sep't 1st, 1891.

*Mr. W. B. Phillips, Univ. Ala.*

DEAR SIR: Your very kind favor of the 27th Aug. received, also the report of the Thies Process of treating low grade gold ores, for which I thank you very much.

"Before the War," Prof. Emmons, State Geologist of

N. C., made an examination for me of the Silver Hill property. I will hunt it up and send it to you. Mr. R. C. Hills, the Geologist of our Coal Companies, also made a partial examination of Silver Hill and Gregory Hill. I think I have his letter and the results of some assays he made, which I will also send you. (Neither of these reports has come to hand, W. B. P., Feb. 15th, 1892.) Many years ago I had some assays made of Silver Hill ores but can only say that the lowest was $15.00 per ton and highest $500. Some Cincinnati parties a few years ago had assays made of Silver Hill sulphuret ores, and told me that the average was $30.00. I worked from the North end of Gregory Hill (two miles N. E. of Silver Hill, W. B. P.) ten years ago about 1200 tons of the ore, without any selection. It averaged $1.75 per ton. My screens were very coarse, and we knew but little about the business. ..... I think that Gregory Hill would average, without selection, $2.00 per ton and at a cost of 50 cents per ton: ample water can be obtained for 20 stamps, say 60 tons per day. I think it would be safe to call the Silver Hill refactory ores $25.00. I once got $14.00 free gold per ton from 8 tons of refuse Silver Hill ore. It was hauled from the surface yard at Silver Hill to the 5 stamp Battery I had near Gregory Hill. Same screens were used. The ore was partially decomposed by weather exposure, say for twenty years. .....

Yours, C. H. P."

In this letter Major Parmelee also says in regard to Hog Mt.: "A Mr. Phillips, a mining engineer, examined Hog Mt. for Burke of New Orleans. He said to me it was a very valuable property because of the cheapness with which it could be worked. His test of the ore ranged from $6.00 to $16.00 per ton."

*Copy.*

"NEW YORK CLUB,
5TH AVE. AND 35TH ST.,
Oct. 2nd, 1891.

*Mr. W. B. Phillips, Univ. Ala.*

..... You are probably not aware that there is

a shaft sunk about 90 feet down square on to the sulphuret vein—at least 30 feet or more below any of the old works ..... It was in this shaft that Prof. Emmons examined the vein. It has been sunk about 20 feet deeper since that time. The old workings will not interfere with this shaft in any way. There is also another shaft on the same vein about 150 feet west of this (what I call No. 1 shaft) that can be cleaned out. The ore from these shafts will assay from $15.00 to $50.00. The vein so far as stripped averaged from 18 to 24 inches. This is very, very hard and so are the walls. .....

I am very truly yours,

C. H. PARMELEE."

At Dent Hill, half a mile north-east of Silver Hill, some work has been done on a curious mixture of talcose schist and quartz, but I was unable to find more than $2.06 per ton of gold in the sample taken. At this point begins the Devil's Back-bone, previously spoken of, and continues for several miles in a northeasterly direction. It is a very bold out crop of a sandy, friable quartz, almost like a sandstone, varying in width from six to fifty feet, and carrying some gold. From Silver Hill to a point opposite the Gregory Hill in Sec. 33, T. 21, R. 22, I took 8 samples but found no more than $2.06 of gold per ton in any on them. All showed this amount of metal. Seven of the samples were taken between Dent Hill and Farrar's Mill along the out-crop, the other one from a point on the ridge directly opposite Gregory Hill, where the wagon road crosses the vein. This tremendous out-crop of quartz is one of the prominent features of the landscape, as already remarked by Prof. Tuomey, and is remarkably uniform for miles. I was along it for about five miles and observed that at no place did it appear to show any deviation from its typical character. It is in most places stained of a light yellowish color, and, on crushing and panning leaves traces of undecomposed pyrite and black iron sand. It has occurred to me that the presence of gold in the highly graphitic schists of Gregory Hill and Blue Hill may be due to leaching from this enormous

mass of quartz, the strike and dip of the two being nearly the same. These schists are in places very rich in free gold but do not yet evince the presence of pyrite; the gold is coarse and free. A fuller description of Gregory Hill and Blue Hill will enable one to see the force of this suggestion. The entire locality is brim full of interest to the geologist and to the practical miner, to the first on account of the association of gold with schists heavily charged with graphite, and to the latter on account of the ease with which mining can be carried on here.

### GREGORY HILL: BLUE HILL.

Location, Sec. 33, T. 21, R. 22, Tallapoosa County. The ore here is a mass of highly graphitic schist holding numerous small seams of quartz. It is readily mined and easily crushed or stamped. I took two samples of twenty-five pounds each, from the top of the hill, mixed them well and the sample then gave

Gold.....3-10 oz. per ton
Silver.....1-10 oz. per ton } Value per ton, $6.30.

A good deal of work has been done here at one time or another. Major Parmelee has a fifteen stamp mill at work and as the ore is readily treated the stamps weigh 450 pounds each. There is not sufficient water for more than twenty stamps within a mile of the mill. I do not know what the ore yields in the mill. It seems to me that Rolls would do better work on this class of ore than stamps. There is sufficient ore in sight to warrant much more extensive works and I belive that with good management a handsome profit could be secured.

The same ore shows also a Blue Hill in the same Section. A sample taken from the mass gave

Gold.....4-10 oz. per ton
Silver.....2-10 oz. per ton } Value per ton, $8.46.

I panned several pans from Gregory Hill and from Blue Hill and each one gave coarse gold. At Gregory Hill it is almost impossible to take a pan from any place on the top

of the hill, where the ore has been mined, without getting free gold, the surface earth yields good panning and when one takes the ore itself extraordinary results are obtained. I have never seen better panning anwhere than from this locality. I do not think that the operations at present conducted there are based on sound principles of mining or of milling. From the methods used there must be a considerable loss which could be avoided by a better system.

I was much pleased with the ore at Gregory Hill; while it may not run over $6.00 per ton yet it can be mined and milled at a slight expense. The chief item will be the water. There may be enough for fifteen or twenty stamps during a favorable season, but during "a dry spell" the supply becomes scarce and uncertain. But little work has been done at Blue Hill yet the general character of the ore is the same as at Gregory Hill. The neighboring ravines have been prospected and some of them washed for gold during wet weather, and I was informed by Mr. Isham Worsham, an old miner of these parts, that he had often gotten good results from the gravel. Gravel washing, however, owing to the scarcity of water, is not to be considered either at Gregory Hill or at Blue Hill, unless indeed the waters of Blue Creek be called into use by means of powerful pumping machinery. This is a bold stream of water and could be tapped at a distance of about one mile. For twenty or thirty feet in depth the ore at Gregory Hill could be easily disintegrated by the hydraulic process, and if it should be proved by experience that stamps do not suit the ore I know of nothing better than the treatment referred to.

Other localities in Tallapoosa County have been the seat of old mining operations, or, rather of gold washing, as for instance the Long Branch about one mile south of Silver Hill, where a great deal of work has been done, with good results. The Owl Hollow, in the same vicinity, is also another famous place for gold gravel. The Long Branch is, next to Silver Hill, the most famous place in this part of the county, as tradition informs us that it yielded much gold

forty and fifty years ago. I was unfortunately prevented from visiting it, nor did I see the Owl Hollow. I am informed by old miners that the cream of the gravel in both places has long since been removed.

At the Bonner–Terrell Mine, about ten miles north-east of Dadeville, some work has been done, but I could not visit it and hence have no assays of the ore and know nothing about it except that it is said some of the ore was very good.

Near Perry's old mill on the Tallapoosa River, not far from Dudleyville, according to Tuomey, is the Morgan Mine. He says (Report of 1858, p. 64): "This is situated on a branch very near the river. It is a deposit mine, composed of a thick bed of coarse gravel. Some veins in the neighboring rocks appear to be auriferous. The mine was just opened at the time of my visit and was attracting much attention."

The south-western corner of Tallapoosa County below the Long Branch, is the southern limit of the gold region of the State. It is said that a little placer mining has been carried on in the north-western part of Elmore where it adjoins Tallapoosa County, but I have been unable to find any reliable evidence that it was more than a mere prospecting.

Chambers County, also, belongs to the Lower Gold Belt, but so far as is known no gold mining has been attempted within its borders. Heavy quartz seams are found in the county as far south as LaFayette, but they have not been examined. It is very likely that the northern portion of the county is penetrated by some of the seams belonging to the Goldville Belt. Investigations on this point will be undertaken during the summer of 1892 and the results will appear in the next report. Two complete sections across the gold fields will also be incorporated in the Report on the Upper Gold Belt as it was thought best to defer this until the lines could be run to the Alabama–Georgia boundary.

It is likely that the outlook in the Upper Belt is better than in the Lower Belt, particularly in the vicinity of Arbacoochee, where placer mining has been carried on for fifty years, and Bell's Mills, Idaho, Extension Mine, Pinetucky

(where a ten-stamp mill is now at work), and other localities in Cleburne, Randolph, Talladega and Clay Counties. The survey to be undertaken this summer (1892) will cover these localities.

# APPENDIX A.

[TRANSACTIONS OF THE AMERICAN INSTITUTE OF MINING ENGINEERS.]

N. Y. MEETING, Sept., 1890.

## THE THIES PROCESS OF TREATING LOW-GRADE AURIFEROUS SULPHIDES AT THE HAILE GOLD MINE, LANCASTER COUNTY, SOUTH CAROLINA.

BY A. THIES, CONCORD, N. C., AND WM. B. PHILLIPS, UNIVERSITY OF ALABAMA, TUSKALOOSA, ALA.

1. *Introductory Remarks.*—The Haile Gold Mine is in Lancaster county, South Carolina, 3½ miles east of Kershaw station on the Charleston, Cincinnati and Chicago Railway. It was first opened about the year 1832, and since that time has passed through various fortunes. Many different operations have been practiced here for extracting gold: panning, grinding in Chilian mills or arrastras, stamping, the Designolle process, dry crushing, and finally the Thies process of barrel-chlorination, which has now been in successful use for 2½ years, and by which 36,000 tons of ore have been treated profitably.

The Thies process is in brief the treatment of dead-roasted auriferous concentrates (pyrite, sometimes also chalcopyrite, as at the Phœnix mine, Cabarrus Co., N. C.), with nascent chlorine, without artificial pressure or exhaust, in lead-lined iron cylinders; the throwing of the mass on a sand filter; and the quick filtration and precipitation of the gold chloride with fresh and active ferrous sulphate. The gold is precipitated as metallic gold of a reddish-brown color which, after being allowed to settle completely, is collected, washed, dryed and melted with soda and borax in graphite pots and cast into bars.

The efficiency and economy of the process are such that, in working on a large scale, crude ore of the assay-value of $4 per ton, carrying about one-third of its gold free and two-thirds in sulphurets, can be profitably treated. At the Haile mine 36,000 tons of such ore have been successfully treated, and it is now mined and treated at the rate of 80 tons per day of 24 hours.

It should be observed at the outset that the chlorination system here used is not patented. Any one is free to employ it; and therefore what is said of it in the present paper is without any bias of commercial interest. It is the second attempt to introduce into the southern gold-fields, on a large scale, the chlorination of roasted ore in place of amalgamation, and as an adjunct to amalgamation before roasting.

The uniform and most gratifying success attending the use of this process for several years at the Phœnix mine, Cabarrus Co., N. C., (see TRANS. xvii., 313) induced the owners of the Haile property to introduce it at these mines under the personal supervision of Mr. A. Thies. Mr. Thies' improvements on the old Mears chlorination process have been fully set forth in the paper above referred to. Without severing his connection with the Phœnix Co., he took charge of the Haile mine in January, 1888, where he operated 20 stamps from that time to January last, and since the latter date, has added 40 stamps, making a present total of 60 in operation.

By this process of chlorination there have been treated since 1880 at the Phœnix mine 5,000 tons of concentrates, and at the Haile, since May, 1888, the date of the beginning of the work here, 2353 tons.

This statement is sufficient evidence that the process is conducted upon a commercial scale, and has long since passed the experimental stage. There is now no more reason to doubt its success as applied to low-grade auriferous sulphides than to doubt the success of the Thomas process in the manufacture of steel. Nor is it too much to claim for it that it stands metallurgically towards the other and older processes for the extraction of gold as the Thomas process

stands towards the other and older processes for the manufacture of steel. Both these processes were successfully applied about the same time. They are vital improvements upon the ideas of previous unsuccessful applications; and they deal with materials that hitherto had baffled all attempts at utilization, the one with high-phosphorus iron-ores, and the other with low-grade sulphuret gold-ores.

In order to realize the especial significance of the Theis process to the metallurgy of gold, it is only necessary to recall the history of southern gold mines for the past fifty years. It is a history of disappointed hopes. The capital invested in such mines has been, to say the least, extremely unproductive. Even during the last six or eight years, when any one who chose might have ascertained for himself the true method of treating these ores, the old state of affairs has continued, and the old story has repeated itself.

The elements combined in this successful solution of the problem are concentration, roasting and chlorination. They go hand in hand; each is incomplete without the others. But what distinguishes this process from all others is the method of applying the chlorine to the roasted ore, of which we shall speak later.

Since a complete account of the process requires some notice of the conditions under which it is employed at the Haile mine, this paper will briefly describe the geological occurrence of the ore; the operation of mining and transportation to the mills; and the milling and concentrating; after which an account will be given of the roasting and chlorination, including the delivery of the gold-solution to the precipitating-vats, and finally, the precipitation, collection and smelting of the gold.

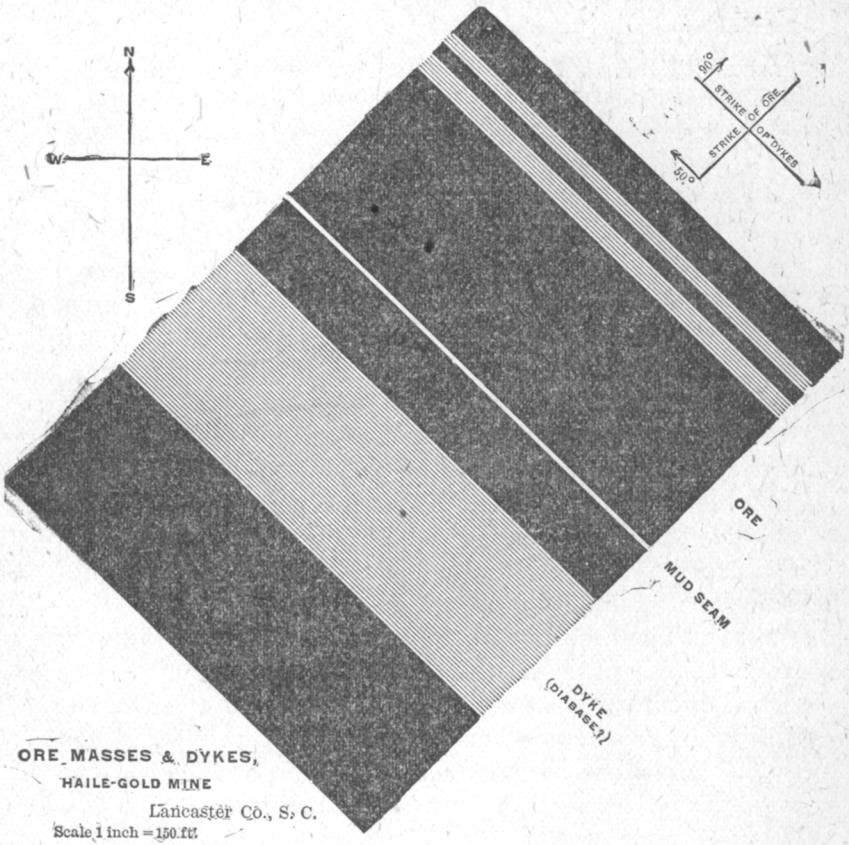
2. *Geological Occurrence of the Ore.*—For a more detailed description of the geological conditions, the paper of Messrs. Thies and Mezger, which is presented simultaneously with this, may be consulted, and reference may be conveniently made to the geological sketch-map by Mr. Mezger, which accompanies that paper. It is not intended here either to controvert or fully to adopt the conclusions there set forth, the simple reason being that the two papers have been

prepared independently, and there has been no subsequent consultation of all the writers concerned.

The ore at the Haile mines is a mixture of pyrite and stratified talcose slate. The strike of the strata varies from N. 52° E. to N. 73° E., and the dip (nortwesterly) from 45° to 75°. The foot-wall is soft talcose slate, colored yellowish, brownish and red by iron-salts, and showing cross-joints. The hanging-wall is (often if not always) greenstone. From the foot-wall towards the hanging wall there is a well-marked increase in the hardness of the ore; bands of siliceous matter appear, and veinlets and veins of almost pure pyrite, from the thickness of $\frac{1}{4}$ inch to $1\frac{1}{2}$ foot. These streaks of pyrite cut across the slates in all directions and are also at times parallel to them. Now and then masses of considerable hardness are also found near the foot-wall, but whether they occur here or in the vicinity of the hanging-walls, they are evidently derived from the talcose slates. It is believed that whatever be the earthy material mixed with the slates in the ore-bearing mass, it has been derived from the slates themselves. Even the very siliceous material found near the hanging-wall and bearing no close resemblance to the slates either in color, hardness or stratification, was doubtless derived from them.

Several dikes, seemingly of diabase, cross the slates at irregular intervals. On the accompanying diagram they are shown as cutting the slates at right angles to their strike. This is not quite true; but the variations are slight. Between these dikes lie the immense deposits of talcose slates, impregnated with gold-bearing pyrite and with more or less free gold. The free gold is generally fine. Wherever the slates are rich enough in free gold and in pyrite, they are mined. The richer streaks are of various widths, from 2 feet to 30 feet, and are of the same general character as the main body of the slates. In immediate proximity to the dikes, as well as to the hanging-walls, the slates are, as a rule (with some exceptions) richer than elsewhere.

As to the correlation between the dikes and the ore-masses, little will be said here. That the dikes do influence the richness of the ore favorably seems to be beyond ques-




tion, but it is not so easy to say why. Nor can we speak positively as to the nature of the dikes themselves. They stand nearly vertical; they cut the strike of the slates nearly at right angles; they exercise a favorable effect upon the richness of the ore; but whether they are strictly diabase or not, and whether they are of plutonic origin or not, will not be discussed here.

3. *The Mining and Transportation to the Mills.*—In such thick masses of ore, choice must be made between taking out all the ore (sustaining the walls with timbers) and taking such ore as can be extracted, using as little timber as possible, and leaving pillars. The first plan is not to be thought of here, on account of the varying value of the ore, the enormous amount of timber required and the expense connected with keeping it in sound condition. The other plan was therefore adopted and has worked satisfactorily. The levels are driven from 60 to 70 feet apart and connected at different points by winzes which serve during stoping as ore-shoots. Between these winzes main pillars are left, while the ore is stoped on each side of the pillars from hanging to foot, leaving sufficient solid ore against the hanging-wall to insure safety.

Of the mines partly opened and worked in earlier years, the Bequelin (formerly known as the Blauvelt) is now in active operation. The main shaft has reached a depth of 194 feet on the dip of the ore, of which 15 feet are used for a sump. The levels are driven east and west from the shaft at intervals of 60 feet, and the ore is trammed from chutes at the 180 foot level to the main station to be hoisted by double skips to the surface. From 80 to 100 tons are hoisted in 24 hours.

The system of mining would require for its full discussion a separate paper. It may be characterized here as the pillar system (Pfeilerbau) generally employed when excessive timbering is to be avoided.

The drilling is done by double-hand, single hand and machine-drills. For this latter purpose there are 4 Ingersoll-Sargeant Drills of $3\frac{1}{8}$-inch cylinder, now used entirely for development-work.

The plant at the Bequelin shaft consists of 2 boilers, of 90 and 35 horse-power respectively, which, under full headway, carry from 75 to 80 lbs. steam pressure, consume about 6 cords of pine wood in 24 hours (at a cost of $1.40 per cord, delivered), and furnish steam to one 20x30 Ingersoll air-compressor, one 40 horse-power Dickson reversible link-

motion hoisting-engine, one 20 horse-power crusher-engine for a 20x10 Blake crusher, and one No. 9 Davidson mining pump, of 200 gallons per minute capacity. The ore is hoisted in skips which discharge automatically upon two grizzlies and thence to the crusher. One man can load 60 tons per ten hours on the skips, which hold 1500 lbs. each.

The grizzlies have each a square surface of 32 feet, and the bars are set 1½ inches apart for the "shaft-smalls," while the coarser ore goes directly to the 20x10 crusher. The grizzlies and crusher discharge into an ore-bin, holding 30 tons. From this bin the ore is hauled by a narrow-gauge locomotive ¾ mile to the mill; a trainload being 7 cars carrying 3 tons each. An engine-driver and two boys look after the loading of the ore from the bin on to the cars, the transportation to the mill and the discharging into the mill-bins. They also keep the track in repair.

4. *Milling and Concentrating.*—There are at present 40 stamps working; 20 more are up, but not quite ready to begin dropping. The average amount of ore crushed per stamp per 24 hours during the last 4 months is 2.01 tons. The stamps weigh 750 lbs. each, and drop 5¼ inches 84 times per minute. The screens are 36-mesh, of brass wire. Formerly 40-mesh slotted Russian sheet-screens were used, but these were discarded in favor of the wire-screens, the latter not only possessing greater durability, but giving a far more uniform pulp for concentration. The average life of the wire-screen has been 6 weeks, while slot-screens often had to be thrown out in 14 days. The average amount of water used per stamp is 3½ gallons per minute, and the average consumption of quicksilver per ton of ore is 0.35 ounces. The average wear and tear of shoes and dies per ton of ore stamped is 1.3 pound.

The area of inside-plates per battery of 5 stamps is 1.75 square feet, and of outside-plates 32 square feet, with a 2-inch inclination to the foot. There are 3 boilers of 50 horse-power each and one Harris-Corliss engine of 150 horse-power. The 40 stamps are run with a steam-pressure of 50 pounds.

The mill is of the back-to-back type, 30 stamps on east and 30 stamps on west side. Each double battery has its own cam-shaft, which is driven by belt from a pulley on the shaft common to all the stamps on the same side. The east battery-shaft and the west battery shaft are driven by steel bevel-gearing from the main shaft.

The railway-cars are bottom-dumpers, and discharge their ore on the iron-plated comb, dividing the east-side bin from the west-side bin. These bins hold 150 tons each, and discharge their ore into Hendy self-feeders. The angle of inclination of the bin-bottom towards the self-feeders is 60°. The battery-tailings are conveyed to the concentrator through open launders 8x10 inches, with cross riffles, one inch high, every 8 to 10 inches. Total length of launders, 78 feet; inclination, ½ inch per foot. The launders discharge into a box from which runs a series of small launders at right angles to the main launder, to each concentrator. There are 16 Embrey end shake concentrators, 8 to each 20 stamps. The distribution table for the battery-tailings is provided with an amalgamated copper plate for saving any free gold, amalgam or free quicksilver which may escape from the outside battery-plates. The belts are set with 2⅝ inch inclination and travel 5 feet per minute. The number of strokes is 192 per minute. The yield in concentrates per ton of ore stamped averages 9 per cent., *i. e.*, for each 11 1-9 tons stamped, there is a yield of 1 ton of concentrates. The loss in sulphurets is about 10 per cent.

The fire-assay value of the ore delivered to the stamp is $4.50 per ton. The mint returns of bullion give $3.90 per ton of ore treated, of which $1.45 is to be credited to the stamps, *i. e.*, to free gold, and $2.45 to sulphurets. Taking the value of the ore at $4.50, and the actual yield in bullion at $3.90, we have an indicated loss of 60 cents per ton, or 13⅓ per cent. Taking the yield in free gold at $1.45 per ton from an ore worth $4 50 per ton (or approximately 32 per cent.), we have 68 per cent. to be sent into the concentrates. But the total yield in free gold and in gold from the sul-

phurets is $3.90 per ton, so that the ratio of the free gold saved to the total amount saved is approximately 38 per cent., and of the combined gold 62 per cent. An ore of this kind therefore carries about one-third of its gold free and about two thirds combined.

We have used the term combined gold to express the condition of the gold that is not free. Whether the gold that is not free is chemically or mechanically diffused in the sulphurets, or both, is not known. Much has been written upon this subject; but as yet we are not warranted in adhering positively to either view. One thing appears certain, viz.: that, no matter what may be the state of the gold in such material, it must be thoroughly roasted before it can be profitably extracted. From the 80 tons of ore stamped per 24 hours, there are obtained 7½ tons of concentrates, which gives as the yield of each concentrator, a little less than one-half ton. The concentrates are piled in a shed and thence conveyed by rail to the furnaces, a distance of 1200 feet. The average assay-value of the raw concentrates has been, for the last 12 months, $30 per ton. This corresponds closely to the estimated value. Assays vary from $25 to $35 per ton of 2000 pounds. The percentage of sulphur in the raw concentrates varies from 40 to 45 per cent. In roasting, this is brought down to from 0.25 to 0.40 per cent. and the value of the material per ton is increased by one-third, *i. e.*, a raw concentrate of $30, becomes a roasted material of $40 per ton.

5. *Roasting and Chlorinating.*—The roasting-plant consists of one pan revolving furnace (of the type described in the paper by one of the writers previously referred to, *Trans.* xvii., 313), two double-hearth reverberatories, each of 400 square feet roasting-surface, and one American Spence furnace.

The capacity of the pan-furnace for twenty-four hours is 2½ tons of roasted ore (equal to 3⅓ tons of raw concentrates) and that of each reverberatory furnace 2 tons of roasted ore (equal to 2⅔ tons of raw concentrates). The yield of roasted ore per day of twenty-four hours is 6½ tons from one pan

and two reverberatories. The consumption of wood is one-half cord for each furnace per ton of roasted ore. Each furnace is attended by four men for twenty-four hours, who do all the work of charging, firing and rabbling, and also deliver the roasted ore on the cooling floor. They are paid $1.00 per day of twelve hours. The wood used is pine and costs $1.40 per cord delivered. Mr. Spilsbury, in a paper read before the Institute in 1883, (*Trans.* xii., 103) puts the roasting-capacity of the reverberatory furnace at 6 to 10 tons per day of twenty-four hours. This is not practicable when the product is to be so roasted as to be suitable for chlorination. No such feat has been accomplished in *that kind* of roasting by any furnace, modern or ancient, automatic or otherwise. It should be added that the roasting to which Mr. Spilsbury refers was followed by amalgamation.

In November, 1889, an American Spence furnace was built, but the expectations entertained concerning its operation were not realized, and the furnace, after many unsatisfactory attempts, has been idle since. The difficulties encountered were: 1st, the matting of the iron rakes whereby they were prevented from swinging on their axis; and 2d, the banking of the ore on both ends of the shelves.

The first difficulty, viz., the clogging of the rakes by the fine ore, was in part overcome by providing the rake with a sheet-iron hood. But although this gave some help, it did not altogether remove the trouble. The swinging of the rakes on their axis is a *sine qua non* of their efficiency, and just in the measure in which this is prevented, in the same measure is the roasting hindered. If the rakes cannot swing they cannot rabble the ore, and without this no thorough roasting is possible. This trouble is intimately connected with the second difficulty, viz, the banking of the ore at the ends of the shelves.

Under the present construction of the furnace the difference between the length of the roads which move the rakes is 6 inches, so that when the ore drops from a shelf to the one underneath, the rake on the lower shelf is 6 inches in advance of the rake on the upper. This distance is not sufficient to prevent the fine, red-hot ores from falling upon the

lower rake as they are discharged from the upper shelf. These ores move very easily—they may almost be said to flow; and they begin to fall through the opening when the rake is 12 to 14 inches from it. In this way the ore falls in front and on top of the lower rake, and is pushed by it towards the end of the shelf. In its back-stroke, the rake, being clogged by the fine ore falling on it, cannot take with it all of the ore that it pushed forward. Some is left, and the pile grows larger and larger, until finally the entire end of the shelf is full of ore. The alternate pushing and pulling of the clogged rakes causes a banking of the ore at both ends of the shelves. After several weeks of continual trouble and worry it was finally decided to discontinue the attempt to utilize this furnace for chlorination-roasting.

The principle on which the Spence furnace works is correct in every detail, and it is undoubtedly the proper furnace for roasting coarse ores for smelting purposes where a complete elimination of the sulphur is not wanted. A chlorination-roast, however, must be a uniform dead-roast, and no furnace which will not deliver material in that condition can be used.

From the furnaces the ore goes to the cooling floor where it is allowed to cool; then it is dampened with water and elevated to the chlorination-floor.

The chlorination-plant consists of two chlorinators, eight filters, two storage-tanks for the filtered solutions, thirteen precipitating tanks, two settling-tanks for precipitates, a storage-tank for sulphuric acid, and a tank for preparing the ferrous sulphate (copperas).

As regards the chlorination, no better description of what is now done at the Haile can be written than is contained in a letter from Mr. Thies to Mr. C. N. Aaron, published in the Eighth Annual Report the State Mineralogist of California, 1888, pp. 844–846.

Mr. Thies says:

PHŒNIX MINES, OCTOBER 15, 1888.

C. N. AARON, ESQ., SAN FRANCISCO, CAL.

*Dear Sir:* In my former letter I promised to write an article on the "Hydrometallurgy" of gold, but seeing, through the pressure of business, that it will be impossible for me to do justice to the subject to get it ready for print by the 1st of November, I will here give you a brief description of the barrel-chlorination as in practice at the Phœnix mines, North Carolina, and the Haile gold-mine, South Carolina.

The success of barrel-chlorination I attribute to the generation of chlorine in the ore-pulp, to attrition and to quick filtering. The original Mears process was based upon the presence of chlorine, either generated outside and forced by a pump into a lead-lined cylinder through a hollow trunnion or generated by the use of chloride of lime and sulphuric acid in such quantities as would create a pressure of from 30 to 40 pounds per inch. To ascertain the pressure, a lead-lined gas-pipe in the form of a goose-neck (and called so), passed through the hollow trunnion, was securely fastened, provided with a stuffing-box and connected with a pressure-gauge. In using chloride of lime, the inner lead-lining of the cylinder was provided with a sulphuric acid chamber capable of holding 100 pounds of acid. While, indeed, the result in working well-roasted ores was satisfactory, the annoyance through leakage; the continual wearing out of goose-neck; the collapsing of the inner lead-lining by a too strong exhausting of the gas; by being too often deceived as to the presence of chlorine, when pressure but no chlorine was present, causing rehandling of the ore, made the process an expensive and unsatisfactory one.

In this annoying way I worked for nearly two years, testing meanwhile the effect of a highly saturated chlorine-water under attrition without pressure, and when, after repeated tests, I found my results equally as good without pressure as with the highest pressure (and better when I divided the requisite amount of chlorine and sulphuric acid, so as to have the nascent gas during the time of working), I remodelled the chlorinator by closing up the hollow trunnion and removing the goose-neck and acid-chamber and substituted a lead valve, connected with the inner lead-lining in such a way that the presence of free chlorine can be ascertained at any moment, and no charge subject to chlorination need be thrown on the filter without full knowledge of the work being complete.

The cast or sheet-iron cylinder (chlorinator) is 42 inches in diameter by 60 inches long. The heads are cast and securely bolted to end-flanges and provided with tight and loose pulleys. The bung for the introduction of the roasted ore and chemicals, 6 inches in diameter, is provided with a lead-lined cover, which, before rotation, must be closed hermetically.

The interior of the cylinder is lined with sheet-lead of 10 to 12 pounds per square foot. The capacity of the chlorinator is from 1 to 1¼ tons of roasted ore. Before introducing the ore, the chlorinator is charged with

from 100 to 125 gallons of water, or, I might say, with enough water to make an easy-flowing pulp. This done, the roasted ore is introduced, half the requisite quantity of sulphuric acid is then poured in, and lastly, half the required chloride of lime. when the bung-hole is closed and the chlorinator is set in motion at the rate of fifteen revolutions per minute.

For Phœnix ores I used 40 pounds of chloride of lime and 50 pounds of commercial sulphuric acid per ton of roasted ore; but I charge 20 pounds of chloride of lime and 24 pounds of acid first, rotate for three or four hours, open the bung and charge the other half, having found better results in dividing the chemicals. Rotate for two or three hours longer, and if, by the aid of the lead valve, free chlorine is found present the cover is removed from the bung-hole and the chlorinated ore is thrown on a shallow filter, 6 by 8 feet, provided with a 5-inch filter-bed, over which the pulp spreads to a thickness of about 4 inches.

The filter. before the ore-pulp is thrown on it, is first flooded with clear water from below, and when the water stands over the filter the discharge-hole is opened, so that the water acts as a cushion against the ore-pulp, prevents the packing of the filter-bed and admits of a free filtering.

When the chlorinator has been emptied on the filter the cork is removed and the solution allowed to pass into a stock-tank below. As soon as the first solution has passed through, so that the ore-surface is exposed, from 3 to 4 inches of water is added over the whole surface; and when this is filtered through and the ore-surface exposed again the whole space above the ore, about 11 inches in depth, is filled, which, by practice on Phœnix ore, has proved sufficient to remove all the chloride of gold; but should there be still a reaction with ferrous sulphate more water must be added.

The filters are lead-lined, 18 inches deep, and have a fall of 1 inch towards the outflow. The bottom is first covered with perforated glazed tiles or clays or mineraline, which is impervious to the action of acids and chlorine. On this rests the gravel filter-bed, which is topped off with ordinary clean river-sand. To prevent the filter from getting an uneven surface, longitudinal 1¼ inch wooden slats, 8 or 10 inches apart, keep it in place.

The filtering should be accomplished as quickly as possible, but, as this depends generally on the fineness of the ore treated, no rule can be established. As long as the solution shows the presence of chlorine when the last wash-water has passed through the filter, there is no danger of not having clean tailings. The solutions accumulating in stock-tank are let off into smaller tanks for precipitation with ferrous sulphate, which should always be regenerated, if not active, so as to destroy any ferric sulphate. Care should be taken by examining, after twenty-four hours. to ascertain if all the gold had been precipitated, as losses have occurred by a partial precipitation. The tanks for precipitation should not be too deep; a convenient size is 6 to 8 feet in diameter and 3 feet high, holding the solutions from about 3 tons of roasted ore. A sufficient number should be on hand to allow the precipitate at least three days to settle. After three days settling in shallow vats, the supernatant liquor can be drawn off and fresh solutions added for precipitation.

At the Phœnix, the liquor is passed over metallic iron, and the copper is recovered as cement. From the precipitating-tanks the precipitate is finally collected, washed as clean as possible to remove the iron-salts, dried and melted.

The amount of chloride of lime and acid used at the Phœnix I have stated as 40 and 50 pounds respectively, which is due to the presence of an appreciable amount of chalcopyrite. An excess of acid should always be used so as to convert all the lime into a sulphate to remain in the filter. The solution should be slightly acid. If neutral, soluble chloride of lime will cause a bulky precipitate with ferrous sulphate. At the Haile mine, where I have to deal with a pure "iron sulphuret," I use at present but 10 pounds of chloride of lime to 15 pounds of acid, and treat 4 tons of roasted ore in two chlorinators during ten hours, and I have not failed to extract 94 per cent of the assay-value.

The Haile mine ores, which have been so long the bugbear for economic treatment, and on which so many experiments have failed, are offering no obstacles to the barrel-chlorination, and are cheaper and easier to chlorinate than the Phœnix ores.

As the success of chlorination, by whatever process, depends on a thorough roast, assuming that we have clean concentrates, it is of the utmost importance that the roaster should have some guide to go by, and to this end, I let him test every charge before drawing by a bright-filed iron-rod. A small portion of the roasted ore is boiled in water and stirred with the bright iron. The least trace of sulphates will stain the iron,—a sign for the workmen that the roasting is not completed.

At the Phœnix, I use a revolving pan furnace of 12 feet diameter, with a short reverberatory attached. From two working doors the roaster can rabble the ore. When a charge is finished, the ore is discharged through the hollow axis on which the pan revolves into an outer circle below, and is then removed by scrapers attached to the bottom of the pan into a car, and delivered to the cooling-floor, from which it is elevated into the chlorination house. Such a pan furnace roasts 1 ton of raw ore in twelve hours, with a consumption of three-eights of a cord of wood and 90 cents for labor. The power necessary to drive the pan is a small item, and will not exceed 25 cents per ton of raw ore.

At the Haile mine, a double reverberatory furnace furnished 2 tons of ore every twenty-four hours, with an average consumption of 1 cord of wood at $1.25 per cord and four laborers. The cost per ton of roasted ore amounts to $2.62½.

The cost of chlorination by the barrel process depends chiefly on the number of tons chlorinated per day. Two men can easily chlorinate 4 tons in ten hours, elevate the ore and clean out the filters, of which I have four to each chlorinator; and having arranged on this basis the work at the Haile mine, the cost for chlorinating 4 tons daily is as follows:

| | |
|---|---|
| 40 pounds of chloride of lime at 3 cents | $1.20 |
| 60 pounds of sulphuric acid at 2 cents | 1.20 |
| 2 barrels at 90 cents | 1.80 |
| 1 chlorinator man | 2.00 |
| Motive power | .50 |
| Total | $6.70 |

or $1.67½ per ton.

Add to this 12½ cents for sulphuric acid for making sulphate of iron, and 20 cents for repairs and wear, which is more than liberal, and we have the sum of $2 per ton for chlorination, or $4.62½ for roasting and chlorinating 1 ton of roasted ore, representing 1½ tons of raw iron pyrites. Inside of seven hours from the time the ore is in the chlorinator, the solutions are ready for precipitation and the tailings are clean.

The wear on the inner lead-lining of the chlorinators is imperceptible,—a chlorinator in use at the Phœnix for over five years does not show any wear on the lead.

That the barrel chlorination has advantage over the Plattner process can not be gainsaid, and its successful working here and at the Bunker Hill, Amador county, California, where it surpassed the Plattner in results, will undoubtedly lead to its adoption in regions where the auriferous sulphurets are an important factor in the production of gold.

Hoping that these notes will aid you in your work, and ready to give any desired information,

I remain very truly yours,

A. THIES.

This description is as true of the Haile to-day as it was two years ago. The amount of chemicals varies between 10 and 15 pounds for chloride of lime and 15 and 20 pounds for sulphuric acid. The assay-value of the tailings from the chlorinator, which are removed from the filter-bed and thrown over the dump, is, on an average, $2 per ton.

6. *Precipitation, Collection and Smelting of the Gold.* The ferrous sulphate employed as a precipitant should be used fresh, and to this end it is made up fresh for each day's run. It is easily prepared from one day to another.

As already observed, care must be taken to see that the precipitation is complete by testing the solutions about twenty-four hours after precipitation. Generally, the total absence of chlorine and a sweetish odor are fair indications of a complete precipitation after a thorough stirring with ferrous sulphate.

At the end of a month's work, or whenever it is deemed necessary, the completely-settled precipitate is taken up

from the precipitating-vats into small lead-lined tanks 2 feet by 4 feet in size and 2 feet deep, in which it is allowed to settle again for twenty-four hours. The supernatant liquor is then syphoned out, and the precipitate is washed with boiling water until freed from most of the iron salts. It is then collected on filters, dried and melted in Dixon crucibles with borax and soda, and shipped to the United States Assay Office at Charlotte, N. C. Its fineness varies between 975 and 985.

The successful treatment of 2,353 tons of concentrates from the Haile mine by this process is all the more gratifying because of the failure of all other processes here to work at a profit.

It is commended to those who have to deal with large quantities of low-grade sulphurets in the belief that it will solve their difficulties, and enable them to work such ores profitably. For simplicity, cheapness and adaptability to such ores, it cannot be too highly praised.

(At this time, February, 1892, there are 60 stamps running at the Haile, and the process, under the skillful management of Mr. Thies, continues to justify the expectations based upon it. I can heartily commend it to all who have low grade sulphuret ores to treat. W. B. P.)

# APPENDIX B.

METAMORPHIC ROCKS OF COOSA, TUOMEY'S REPORT OF 1858, pp. 43 TO 47.

It was stated in a previous report that the metamorphic rocks terminated at Wetumpka. Beds of gneiss, passing into mica slate, occur here in great force. The edges of the strata rise up boldly from the bed of the river, but are covered by drift from the banks. The rock is coarse, splits with ease, but the bedding planes are uneven. The strike is north-east and south-west, and the dip 75° north-west.

Turning east above the Penitentiary, and passing over the undulating surface of the drift, to where the road crosses Coon Creek, below the ford, a ledge of rock is seen, which resembles that of Wetumpka, excepting that it is rendered porphyritic by flattened crystals of pink feldspar, that lie between the laminae of mica. Although coarse, this rock is strong, and the contrast between the color of the feldspar and the black mica gives it an agreeable appearance. The crystals of feldspar are compressed, and interlaced by the mica; the rock may be called a porphyritic gneiss. At this locality another bed of white gneiss occurs. It resembles very much the rock at Tallassee, both in color and compactness, and it would make an excellent building material. Although no quarry is opened, the rock may be examined at the ford. With the exception of the denuded beds of streams, the rest of the country is composed of drift, covered with one unbroken pine barren, to the Tallapoosa.

Above the falls of Tallassee, the river is wide, and divided by little islands, into numerous channels which unite near the barrier of gneiss, which crosses the stream in a direction nearly East and West. The pent up water has forced a

passage through this natural dam, and foaming amongst the vast masses of rock, sends its spray to the winds. The gneiss is fine grained, and compact, but not thick bedded. Immediately at the falls the strata are worn into pot-holes, some of which are eight feet in diameter. The water, often pouring into these finds an outlet between the strata, which in time are completely under-mined, and in this way most of the huge masses lying around have been broken off from their original beds. The entire fall, at the Factory at the foot of the falls, is sixty feet. In summer, when the banks are fringed with green and beautiful shrubs, this place presents a scene of picturesque wildness, that will repay the labor of a visit. On the right, the valley is quite narrow, and a well located road, exposes on its side the beds of drift which rise to a height of 200 feet above the river.

It would be difficult to conceive of a more favorable locality for manufactories, on a large scale, than this. The whole of the river is precipitated, through a narrow gorge, over a fall of 60 feet, and in a distance of 8 miles the river falls 800 feet.

The Factory recently erected here, at a cost of $30,000, presents a fine example of the adaptation of the rock of the falls to building purposes.

On the side of a little stream, called Slone's Mill Creek, which empties into the river below the falls, the gneiss becomes slaty, and excellent flagging stones could be quarried. Although such materials are found elsewhere in the State, I know of no locality so favorable as this.

The first falls on the river occur two miles South of Tallassee, at the site of the old Indian village of Tuckabatcha. (Pickett's History of Alabama, Vol. I, page 124, gives Took-au-batche-tal-lau-hasse as the name of a town among the Upper Creeks in 1778, W. B. P.)

The river, after following the metamorphic rocks till they are covered to a great depth by the drift, turns directly West to join the Coosa, four or five miles below Wetumpka.

Section from Tallassee, on the bed of the river, to Tuckabatcha:

*Fig. 3.*


*Section from Tallassee to Tuckabatcha. (after Tuomey.)*

*a.* Beds of gneiss, forming the Tallassee Falls, strike East and West dip towards the North 40°.

*b.* Flagging stones finely exposed on Slone's Mill Creek: course of the joints which intersect the quarry, North 20° West.

*c.* Mica slates.

*d.* Thick strata of slates with bosses of feldspathic and coarse crystalline granite protruded through them. Rounded masses of quartz are found embedded in the slates, and when the latter are worn away, they rest on the surface like large boulders.

*e.* Micaceous and talcose slates, containing lentiform nodules of graphite between the slates, which abound in garnets. The graphite, when divested of the slates, is very pure, but unfortunately the pieces in which it may be procured are not very large. The strata extend across the bed of the river, and as the banks are covered with alluvium can only be seen at low water. The locality requires a more thorough examination than I could give it at the time of my visit.

*f.* Beds of drift.

North of the falls the rocks become talcose, and on a little stream, called Coon Creek, beds of hornblende and soapstone occur. In a hollow, near the creek, a bed of soapstone of great thickness is found. This seems to have been well known to the Indians, who resorted to the spot for the purpose of manufacturing culinary utensils. Excavations, of considerable extent, were made on the best portions of

the rock, and the sides of the excavations are curiously pitted where the vessels have been cut out. It appears to have been their practice, to inscribe on the rock the circumference of the pot or bowl to be cut out, and then excavate around it until a sufficient depth was attained, after which the mass was split off and finished. Occasionally, when failure in splitting off the mass ensued, pieces remain attached to the rock. Everywhere the impression of the bottom of the vessel is left on the face of the quarry.

The rock is calcareous, effervescing with acid. Crystals of pyrites are abundant, but no other minerals, excepting actinolite and talc, are found here.

These Indian excavations have deceived many inexperienced persons, who supposed that they were made for the precious metals. The soapstone of this locality extends across the county to Chambers, and at intervals throughout this extent it is perforated by such excavations. This is the locality which excited so much interest at the Tallapoosa Silver Mine.

*Figure 4.*


*Section on Coon Creek (after Tuomey.)*

*a.* Gneissoid rock extending to the mouth of the Creek.
*b.* Sienitic gneiss, with flat crystals of hornblende.
*c.* Hornblende slate.
*d.* Soapstone, 100 feet thick, out-cropping on Penn's land.
*e.* Hornblende.

The strike on the rocks in this section is South, South-west, and North, North-east, dip of the bed at *a.* South, South east, and of the gneiss at *a.* North, North-west.

From this point to Silver Hill hornblende slates are every where displayed, with the exception of the occasional occurrence of beds of gneiss, as may be seen on the Sougahatchee, where the rock passes into talcose slates. The course of the rocks here is North-east and South west, dip 40 degrees

North-west. The country is composed of rounded hills, covered with a warm, brown soil, common to hornblende rocks. Such soils suffer from excessive drouth, but for the production of grain they are amongst the very best.

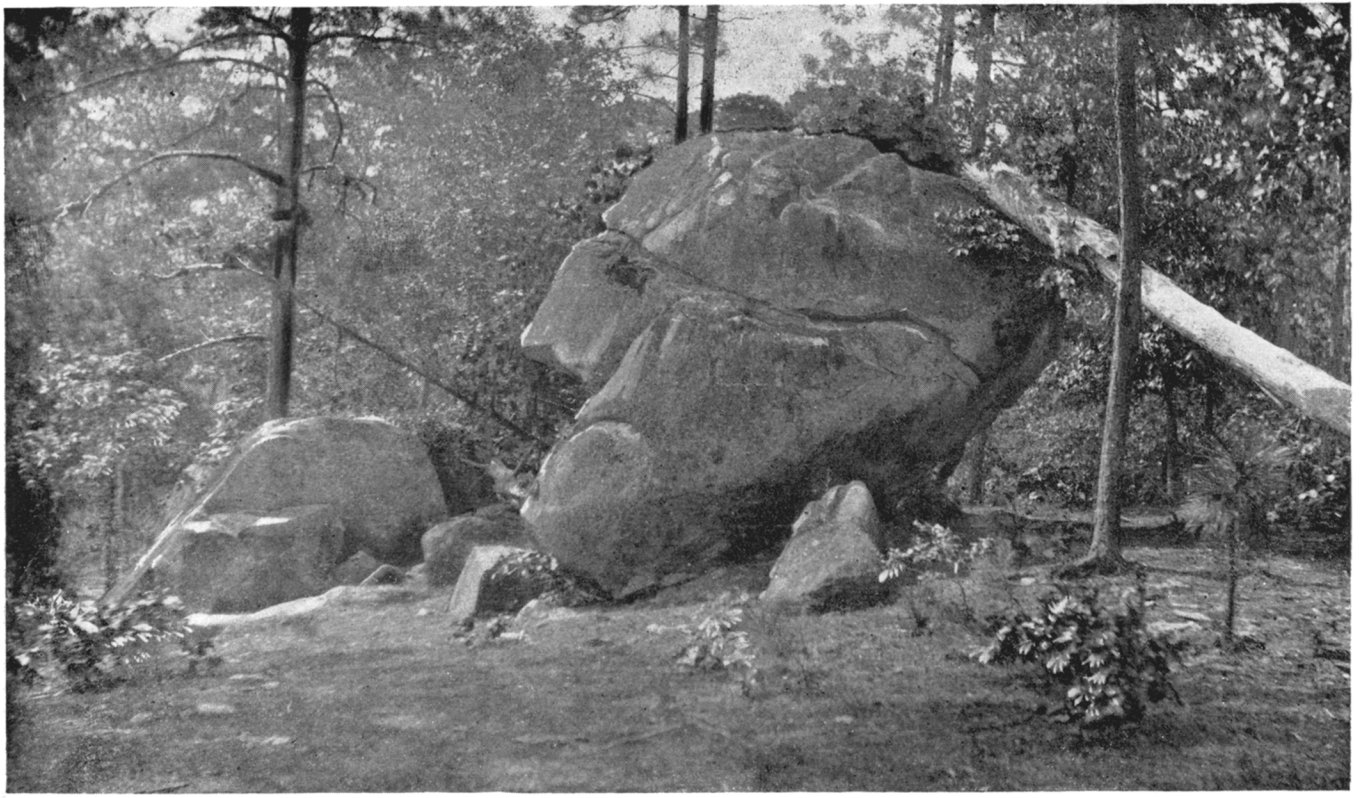
GRANITE OF COOSA AND TALLAPOOSA (pages 77 and 78).

Around Rockford large weathered masses of a whitish gneissoid granite are found on the surface. Sometimes immense fragments are undermined and broken off by their own weight. (Three photographs of such masses are shown herewith, taken by myself during the summer of 1891. W. B. P.)

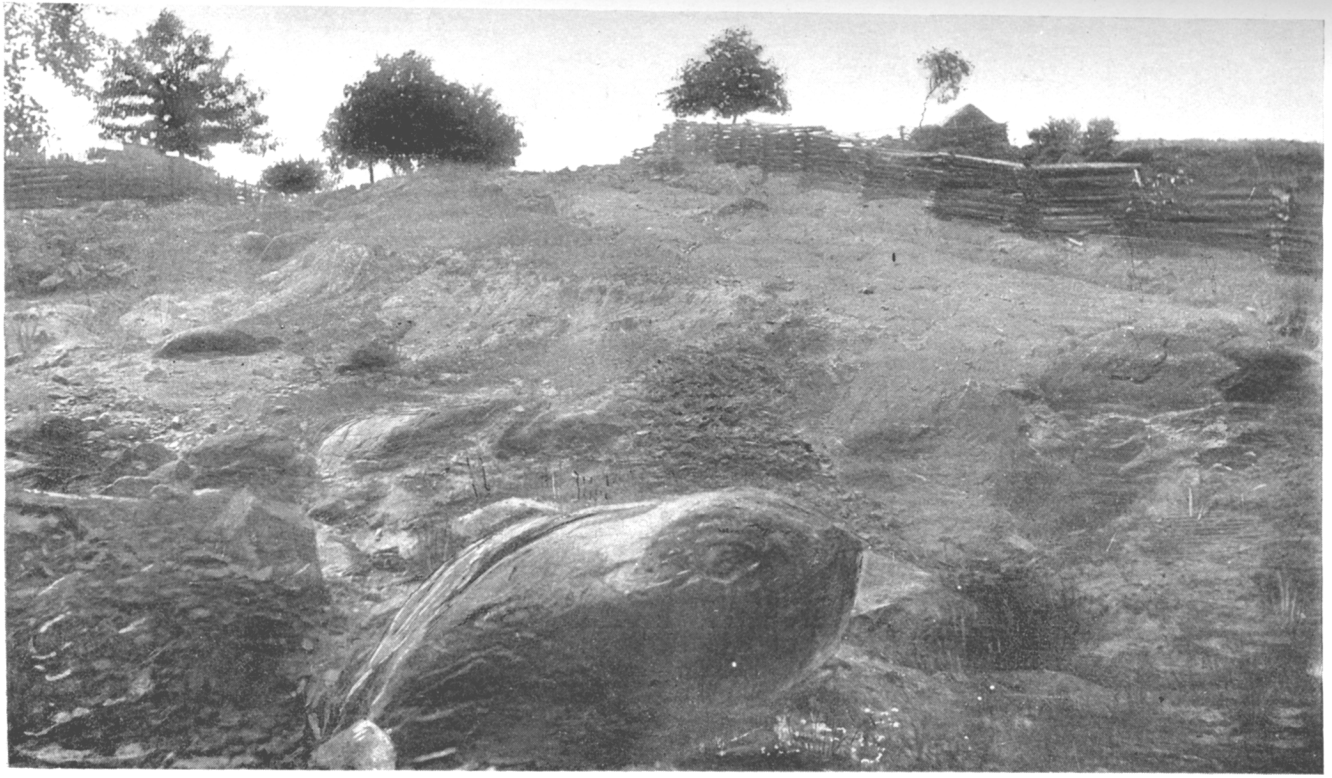
On the way to Bradford I saw another trial shaft, sunk, I believe, in search of silver. There was really no reason to expect any profitable result from exploration here. The shaft was sunk on a bed of coarse slate abounding in rough garnets. It is true, that mica slate containing garnets is a promising metalliferous rock; still we must have some positive evidence of the existence of some valuable metal in the rock before we commence expensive operations. The rock in question contained the merest trace of copper, not more than one might expect to find in any of the rocks of this region.

At Bradford, gneiss is finely exposed at the Factory, where it is cut up into prisms by joints running North 20 degrees East, across the stream; the fall here is thirty-five feet. A mile further up it becomes more granitic, and rises above the surface, in the manner of the masses at Rockford. On the surface it is weathered, sometimes inclined to disintegration, and where it is feldspathic produces a fine porcelain clay; this clay I found excited interest at some of the mines. At Mr. S. S. Graham's the rock is hard, very white, and clings to the hammer. It would be difficult to find a more beautiful building material. It belongs to the great gnessoid granitic belt that extends along the northern portion of the Southern States.

It is seen again at Blake's Ferry on the Tallapoosa. In hand specimens, and even the largest masses exposed, it presents no appearance of stratification; it is, notwithstand-



GRANITE BOULDERS OF DISINTEGRATION. ROCKFORD, COOSA CO.



GRANITE BOULDERS OF DISINTEGRATION, ROCKFORD, COOSA CO.

GRANITE BOULDERS OF DISINTEGRATION. ROCKFORD, COOSA CO.

ing, interstratified with mica slates, has the same strike and dip, and must therefore be called gneissoid granite. The plank road, to a distance below Powelton, passes over the disintegrated edges of the gneissoid rocks, with only here and there a bed of hornblende. The grey soils of this region owe their excellence, for the production of cotton, to the underlying rock. The physical features of the country are also favorable; the surface is undulating, but not broken. On Chenahatchee a very peculiar gneissoid granite occurs, in which the mica is not regularly distributed through the rocks, but occurs in small patches, contrasting curiously with the white feldspar of the rock.

# APPENDIX C.

[From Tuomey's Report of 1858, pages 73 to 77.]

## Stewart's Gold Mine.

This old mine is in Sec. 4, T. 23, R. 17, Coosa County. The auriferous portion of the ridge is about 200 feet wide, and was at first worked in open cut; but the ridge is perforated by shafts, at intervals, for a distance of one half mile. This mine was worked for some time with stamps, but has long since been abandoned. Masses of bronze colored pyrite are scattered among the refuse; they seem to be portions of a vein cut in the mine, and are more or less auriferous.

The Weoguffka Mountains are composed of talcose slates, which are finely presented at the point where the Weoguffka Creek crosses the Rockford road. About thirty-three miles above Wetumpka the ridges assume a greater elevation, and from their tops the broken character of the country can be seen. The country is covered with a magnificent forest of long leaf pine, which, when seen from above, presents a peculiarly rich and luxuriant appearance. The talcose slates are succeeded by mica slates, which continue till they pass into the gnessoid rocks, near Rockford. On the way to Rockford I examined a curious locality, where immense masses of ferruginous matter occurred on the surface, and excited hopes that they would turn out to be copper gossan; and a shaft was sunk under the supposition that the gossan would be cut at the proper depth below the surface. But, unfortunately, these masses were formed in the same manner

as the ferruginous tuxa (tufa?) of Randolph, and did not exend below the surface at all.

Near Rockford, on the land of C. W. Chancellor, there occurs an auriferous deposit of gravel and clay, a portion of which was once worked. Of the gold mines of Coosa Mr. Lieber speaks as follows:

"The old mine near Mr. Griffin's in Coosa occurs in Sec. 4 T. 23, R. 27 E. The works having fallen in nothing is now to be seen. It produced well at one time, and an engine was mounted on the spot, but want of skill, together with mismanagement, prevented success. The auriferous gravel deposits of Alabama present some very peculiar and interesting features. It would be difficult to circumscribe them with regard to their geographical occurrence, since gold is found, in greater or less quantity, in almost all the gravels and sands of the creeks and branches of the metamorphic region, extending even as far South as the Tallapoosa, twenty miles east of Wetumpka, where traces of gold exist. The deposits of the Weoguffka and Hatchet Creeks, in Coosa County, demand, perhaps, the greatest attention. On Messrs. Thomas and Samuel Lambert's place, in Coosa, some of these beds occur, and a fine opportunity is afforded for observing them. The 'packed gravel,' as it is locally termed, immediately underlies the soil and débris of the surrounding rock, and is usually about a foot or eighteen inches in depth. The beds contain a large amount of clay, so that their unctuous touch serves to distinguish them with the hand even under water, from the dry débris which overlies them. The quartz of the gravel is throughout of orange color, of a kind I have not seen in any other auriferous region. It belongs to that compact granular quartz, commonly called 'sugar quartz,' and is probably identical with that which, in Australia, has received improperly the name of 'cairngorm." It is worthy of remark, that I have but in one solitary instance found this peculiar quartz in place, though making its discovery a matter of careful attention. This was at Mr. Richmond Noel's, in Randolph County,

Secs. 4, 5, 8 and 9, T. 22, R. 10 E. The bed is here two feet thick, and holds a position between a bed of gneissoid eurite, containing, however, a little white mica, and a body of gneissoid granite, which is the same as that at Hunter's. It crops out in the bed of a branch, whose gravel has been found to be auriferous. The quartz, when newly broken, resembles lumps of good brown sugar. The color is pale lemon within, and orange without. Occasionally pieces are seen which pass from a blood red to a deep claret color, and on the fresh break exhibit correspondingly redder tints than the other.

"To return to the gravel deposits of the Weoguffka: the largest quartz boulder observed contained about four cubic feet. All these, from the smallest to the largest, are much rolled, although the larger ones are not so much rounded and still roughly indicate the original forms of the broken pieces. In these gravel beds we rarely meet with pieces of the slates, gneiss, &c., which are found so abundantly in the dry and not gold bearing beds covering them, and where no powerful action has tended to round the constituent pieces of rock. I am inclined to believe that Zereuner errs in enumerating gneiss as one of the rocks found in the auriferous gravel of Alabama. The specimen had probably fallen in from the upper beds. Occasionally the deposits widen to 150 or even 300 feet, but always depend upon the width of the little valleys. Owing to these depositions the surface of the ground in the valleys is singularly level, and has afforded space for the accumulation of very good soil. Branches are found in some, but not all, of these valleys. The gravel pans from four to twenty particles of saveable gold of a fine color, and there is scarcely a doubt, but that, if suitable locations were selected and proper contrivances chosen for extracting the gold, very profitable operations would be the result, especially when we bear in mind the greasy nature of the gravels, in consequence of which only the very coarsest particles of the metal are saved in panning. The utmost attention should be paid to this fact also in the treatment on a large scale. The Hatchet Creek deposits

include what is termed the Miller Gold Mine in Sec. 1, T. 24, R. 20 E., and another close to it in Sec. 11, of the same Township and Range. The former, or old Miller Mine, usually paid about $1.75 per hand, the latter only $1.00. The former was last worked in 1847, by T. Phillips, of Nixburg, with six or eight hands, and averaged, during the summer, from 75c. to $1.00 per hand per diem. The ground worked is extensive, and we find upon it both gravel beds and decomposed talcose and micaceous slates with interspersed masses of itacolumitic quartz. Both were worked, and the operations were all exposed to day, so that now all is in confusion and decay. As many as fifty hands were engaged here, at the same time, in the summer of 1843. The operations were commenced in 1840, but frequent interruptions took place, and indeed these mines were only resorted to when no other employment presented itself. The gold was of a very superior quality and better than that at the old mine, which was formerly worked near the Weoguffka. This spot, if properly managed, might yet be made very productive, and indeed the old gravels might again be worked over to advantage; as a proof of which it may be proper to state that, in the summer of 1854, a man engaged in this operation quite alone, and made over $1.00 a day, by the roughest treatment. Ill health prevented his continuing. Messrs. McElrath Bros., of Cherokee County, now own two-thirds of this mine. The whole valley seems to be auriferous, for a Mr. Ford, an old resident of the neighborhood, now of Texas, sank many pits about, and found only one in which he was unable to obtain gold. It has been already stated that it is impossible to point out all the occurrences of deposit gold in Alabama, and it is almost as difficult to ascertain all the localities at which it might be profitably worked, especially as it may require a long time before a really efficient treatment can replace the present barbarous processes. Future discoveries, too, will probably develop far more than it is possible to show at present."

The country around Weoguffka and Hatchet Creeks is

doubtless the most broken portion of the State occupied by the metamorphic rocks, yet in the valleys the soil is good and productive.

# INDEX.