GOLD DEPOSITS OF ALABAMA

And Occurrences of Copper, Pyrite, Arsenic and Tin

GEOLOGICAL SURVEY OF ALABAMA *BULLETIN 40*

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BULLETIN 40

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By George I. Adams

UNIVERSITY, ALABAMA

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LETTER OF TRANSMITTAL

University, Alabama,
September 1, 1930

HON. BIBB GRAVES,
Governor of Alabama,
Montgomery, Alabama.

Sir: I have the honor to transmit herewith the manuscript of a report entitled, "Gold Deposits of Alabama and Occurrences of Copper, Pyrite, Arsenic and Tin", by George I. Adams, Staff Geologist, with the request that it be printed as Bulletin 40, of the Geological Survey of Alabama.

Very respectfully,
WALTER B. JONES,
State Geologist.

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INTRODUCTION

Gold is said to have been found in Alabama in 1830. Accordingly this report appears on the centennial of the discovery.

The production of gold was an important factor in the early history of Alabama, although the total amount of gold recovered was not great as compared with the yield of other gold fields.[1] The search for gold stimulated the settlement of the portion of the State in which the crystalline rocks occur and placer gold supplied ready money at a time when there were few marketable products. Gold mining was a source of comparative wealth to some of the inhabitants and washing gold was a gainful occupation when there was no other work to be done and practically no other way of employing negro labor so that it could earn its daily support.

In addition to the placer deposits, there were many small mines which yielded free gold near the surface and could be worked cheaply with primitive equipment. The later working of these deposits at depth was generally less successful. As the zone of unoxidized ores was approached, technical difficulties of recovering the gold arose and most of the mines which were at first profitable ceased operations. Some which had ore reserves from which only a moderate recovery was possible were forced to close when they felt the effects of changing economic conditions and the increased wage scale. Finally the World War caused the total suspension of gold mining by cutting off the supplies of mercury and cyanide, increasing wages, and calling labor to other pursuits.

It is possible that there may be a revival of gold mining at some of the more important localities in Alabama, but the present economic conditions are unfavorable since the price of fine gold is fixed at $20.67 per ounce and the purchasing power of the dollar is low. The tenor of the Alabama ores in the more successful mines has been shown to average from about $4.00 to $8.00 with some occasional shoots carrying higher values. It should be borne in mind, however, that the recovery on large tonnages has not reached $4.00 as may be seen by the study of the statistics of production given in another part of this report. In order to operate with the narrow margin of profit which these conditions indicate, production should be undertaken only after developmental work has demonstrated a sufficient body of ore and technical investigations have shown a

[1]The official statistics report the value of the gold produced in Alabama during the period 1830 to 1928 as $766,746. (Mineral Resources of the U. S. 1928, Part I, p. 24.) No doubt the actual production was larger.

feasible method of recovering the gold. The difficulties which were encountered in the recovery of the gold from ores containing arsenopyrite or were incident to the presence of graphite in the rock have been obviated, so that there is now a better chance of successful operations at certain of the mines.

HISTORICAL SKETCH OF GOLD MINING IN ALABAMA

It is generally agreed by historians that the Indians, and the Spanish explorers, did not find gold in Alabama. The approximate date of the discovery of gold in the State was given by Phillips (p. 10)[1] as 1830, but he cited no authority for the statement. The date is reasonable, since gold was found in Georgia in 1829, and knowledge of this discovery stimulated the search for gold in Alabama.

The discovery in Alabama was probably made by intruders on the lands belonging to the Creek Indians (Fig. 1), who held the area of the crystalline rocks, which includes the gold deposits. About the time of the discovery there was some agitation for the removal of the Indians. Possibly the knowledge that gold had been found was a factor which prompted the negotiation of the treaty by the national government for the lands of the Creeks. The treaty was signed in 1832, but before the removal of the Indians was effected the State legislature formed the lands into counties and settlers flocked in.

The date of the great gold excitement in Alabama has been given as 1835, but Smith, in writing of Arbacoochee, which was one of the early districts, stated (1, p. 44) that the greater part of the placer work was done there soon after the great excitement in 1836. Tuomey said that Arbacoochee once gave employment to 600 men. According to Phillips, it had a contributory population of 5,000 inhabitants in 1845. It is still spoken of as having once been the largest town in Alabama.

The discovery at Goldville, according to Tuomey, was made in 1842. Phillips reported that there were said to have been fourteen stores at Goldville between 1840 and 1850, and that the population of the locality was at least 3,000. It is now a cross roads without a store.

When the California gold rush began in 1849, most of the Alabama miners left the State, but mining continued in a small way. Prospecting in Alabama revived as the result of the search for copper by Cornish miners, who began to drift into the State in 1853-1854 from the Ducktown copper

[1]The authors to whom references are made in this form will be found listed under the heading, "Previous Official Reports," which follows.

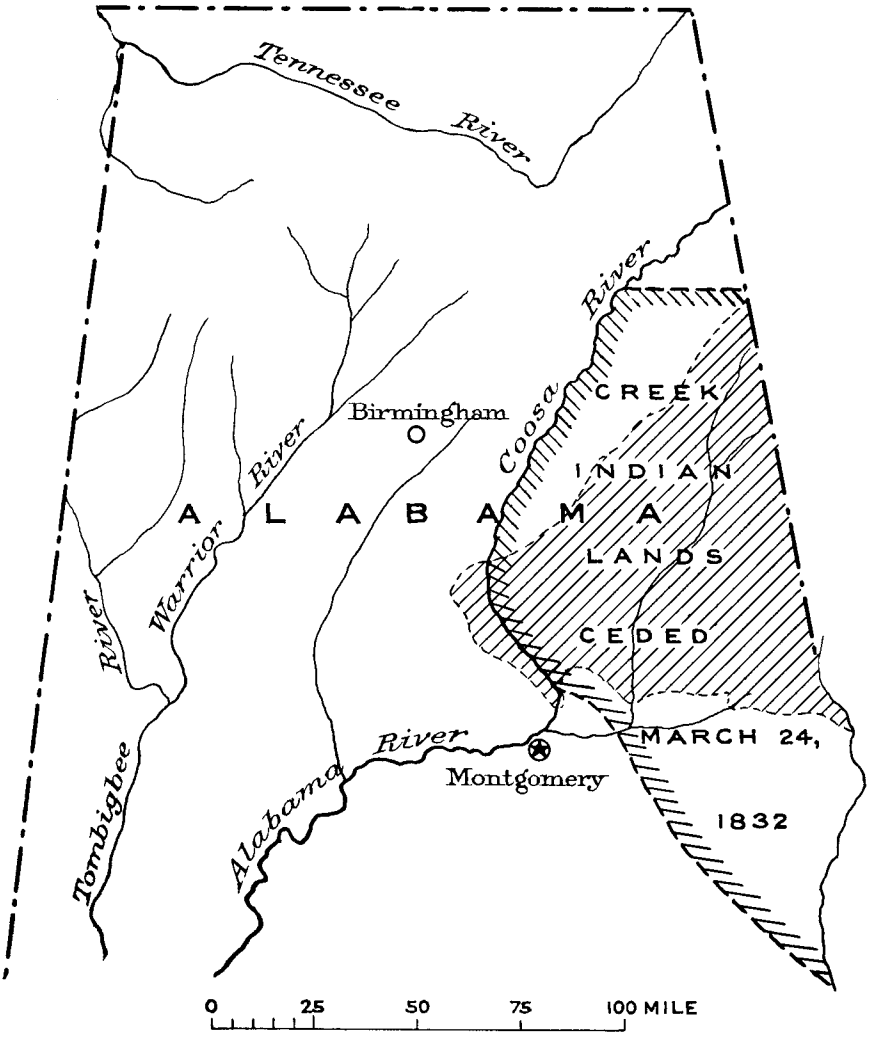
Tennessee River
Coosa River
CREEK
INDIAN
LANDS
CEDED
Birmingham
Warrior River
Tombigbee River
Alabama River
Montgomery
MARCH 24,
1832
0
25
50
75
100 MILE

FIG. 1

mines in Tennessee. The work of these prospectors was usually characterized by the sinking of shafts which were one fathom square. If nothing favorable was found when a depth of ten fathoms was reached, sinking was stopped. The Cornish miners prospected principally iron gossans which were the result of the weathering of pyrite and, according to their experience in Tennessee, were considered to be surface indications of copper. While they did much useless work looking for copper between 1859 and 1861, some of them found gold deposits. These miners went back to Europe in order to escape the draft when the Civil War began in 1861.

During the copper excitement in Alabama following the discovery of the Wood's Copper Mine in 1874, a few additional gold discoveries were made. There was a revival of gold mining in the eighties. Shafts were sunk on some of the well known gold veins, machinery was brought in for equipping mills, and systematic mining was attempted, but the gold below the level of weathering was found impractical of recovery by amalgamation. Cyaniding was introduced in Alabama in 1903 at the Hog Mountain mine, the only place in the State where it was used extensively, and production in 1904 showed a sudden increase.

In 1905 a small dredge was built on the Clear Creek placer ground in the Arbacoochee district. After the dredge was abandoned the engines which operated it were used to pump water for hydraulicking at Arbacoochee.

There were some mines in operation at various times up to 1916 when gold mining was abandoned on account of new economic condition brought about by the World War. At that time amalgamation was being used at the Gold Log mine in the Riddle's Mill district, and the ores at Hog Mountain were being treated by the cyaniding process.

PREVIOUS OFFICIAL REPORTS ON THE GOLD DEPOSITS

The first official report in which there are references to the gold mines of Alabama is the "Second Biennial Report on the Geology of Alabama by M. Tuomey, Geologist to the State," presented in 1855 but not published until 1858. Tuomey went into the field in the spring of 1854, and his first object was to examine the "mines of silver and copper of unparalleled richness" concerning which there were "glowing accounts in the public print." He stated that he spent the summer attempting to repress speculation and prevent in so far as possible the consequences of the wild excitement which seemed to have seized the public mind. His report contains brief descriptions of the gold deposits at Silver Hill, Goldville, Pine-

tuckey, Chulafinnee, Arbacoochee and Stewart's, which are of interest because they show the status of gold mining at that date.

In the "Report of Progress for 1875, by Eugene A. Smith, State Geologist," published in 1875, there is a review of work done the previous summer in the Archean and Metamorphic region of the state and brief descriptions or references to the Rippatoe gold placer, Riddle's Mill gold mine, Arbacoochee district, Pinetuckey, the Harall gold mine, and the Silver Hill gold mine. Smith stated that gold mining in Alabama with rude appliances had probably seen its best days. A mill at Arbacoochee, another at Pinetuckey and a third at Chulafinnee were the only ones that came under his notice. Surface deposits were being worked occasionally.

Following a revival of interest in gold mining, 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" was published in 1892 as Bulletin 3 of the Geological Survey of Alabama. This report was the result of one month of field work done in 1891.

Supplementing the report by Phillips, there is a preliminary report on the "Upper Gold Belt of Alabama, in the Counties of Cleburne, Randolph, Clay, Talladega, Elmore, Coosa and Tallapoosa, by Wm. M. Brewer," which was published in 1896 as Bulletin No. 5, Part 1, of the Geological Survey of Alabama. The field work for this report was done during the summers of 1893-4, but part of the field was revisited later.

The reports on the lower and upper divisions of the gold field listed practically all the gold mines and prospects up to 1895, and have been of great service to the State. A deficiency of the reports was the absence of maps showing the relations of the deposits to the formations, but this was unavoidable, since the geology of the crystalline area was very imperfectly known and could not be mapped at that time.

Part 2, of Bulletin No. 5, contains "A General Account of the Character, Distribution and Structure of the Crystalline Rocks of Alabama and the Mode of Occurrence of the Gold Ores," by Eugene A. Smith, State Geologist, and was particularly valuable because it served to interpret the report by Brewer, who wrote as a practical miner rather than as a trained geologist. Dr. Smith's account is accompanied by three short petrographic reports, namely: "Notes on the Microscopic Characters of the Alabama Crystalline or Metamorphic Rocks by G. W. Hawes," in which twenty-five thin sections sent by Dr. Smith in 1875 are described; "Notes on the Microscopic Character of Certain Rocks from Northeast Alabama by J. Morgan Clements," in which thirty-four specimens collected by him during ten days in 1892 or supplied by Dr. Smith are described; "Preliminary

Petrographic Notes on Some Metamorphic Rocks from Eastern Alabama, by Alfred A. Brooks," which described some twenty specimens collected by Dr. Smith in 1895.

Since the special reports on the gold deposits there has appeared County Report No. 1, entitled "Geology and Mineral Resources of Clay County, with Special References to the Graphite Industry," by W. F. Prouty, Geological Survey of Alabama, published in 1923, and based on work done in the summers of 1916-1919, inclusive. In addition to general geological information, of interest because of its bearing on the problem of the gold deposits, this report contains a brief description of the Alabama Gold and Mica Company mine which had been recently opened and was soon afterwards abandoned.

The geologic map of the State accompanying Special Report No. 14 on the Geology of Alabama, published in 1926, gives a general idea of the distribution and structure of the crystalline rocks, but the mapping of the rocks in the gold belt was necessarily imperfect, because not enough field work could be done to allow of a satisfactory interpretation and amplification of the material which was available for publication.

PRESENT REPORT

The purpose of this report is to supply information which may be used in answering inquiries in regard to deposits in the gold belt. Former reports on this field have been out of print for many years, and, moreover, there have been some new developments since they were published and the geologic formations have received additional study.

The writer's acquaintance with the gold belt began in the summer of 1921 when he spent a month making a reconnaisance map of Coosa County and some of the territory on its borders. In 1924 he spent about one month on a general reconnaisance for the purpose of completing in a general way the boundaries of the divisions of the crystallines for the geologic map of the State, which was published in 1926.

The present report is based on two months of field work done in the summer of 1929. All of the old mines and practically all of the prospects were visited.[1] At many localities little could be learned, because the pits had been abandoned many years and large trees and the luxuriant growth

[1]The locations, by section and quarter section of some of the mines as given in this report are probably in error, since the land lines were difficult to determine, and it was found necessary to depend on the information supplied by local residents who frequently were not certain as to the descriptions of the land.

of summer vegetation covered the dump piles. No mines were in operation.

The surface geology was studied and the general features of the deposits were determined in so far as the time would permit. Some corrections and additions were made in the geologic mapping of the area, and specimens were collected for petrographic study. A few days in the summer of 1930 were devoted to checking the field work and making corrections in the locations of deposits which seemed questionable.

The descriptions of the mines and prospects which are embodied in this report are taken largely from the previous reports and the articles which have appeared in the scientific journals. They have been edited as little as possible to make them consistent with the present requirements. The information has been verified in so far as conditions would permit.

The writer wishes to thank all those who assisted him in the field, and helped him in finding localities.

GENERAL GEOLOGY OF THE GOLD BELT

The crystalline rocks of Alabama in which the gold deposits are found lie in belts or zones between the area mapped as Archean on the southeast and the unaltered Paleozoics on the northwest (Fig. 2). The crystallines are overlapped to the southwest by the Upper Cretaceous sediments. The belts of metamorphosed sedimentaries of the gold field extend northeastward, with some irregularities, nearly to the Alabama-Georgia line. Magmatic influences, to which the metallization of the crystallines is related, can be recognized in all sections of the belts where the gold deposits occur.

The structural relations of the formations are complex because of folding, thrust faulting and intrusion. The mapping is somewhat generalized and the age determinations are tentative and must remain so until detailed field work has been done. It is believed, however, that the general geology is sufficiently well known to form a basis for the discussion of the gold deposits. Some modifications and additions to the mapping shown on the recently published state geologic map have been made during the progress of field work for this report. The following description of the formations is for the most part in accord with the text accompanying the new geologic map of the State.[1] The area of the crystallines mapped as Archean will not be discussed here, since there are no gold deposits in it.

[1]Special Report 14, Geology of Alabama, by George I. Adams, Charles Butts, L. W. Stephenson and Wythe Cooke. Explanatory text to accompany the Geologic Map of the State, Alabama Geological Survey, 1926.

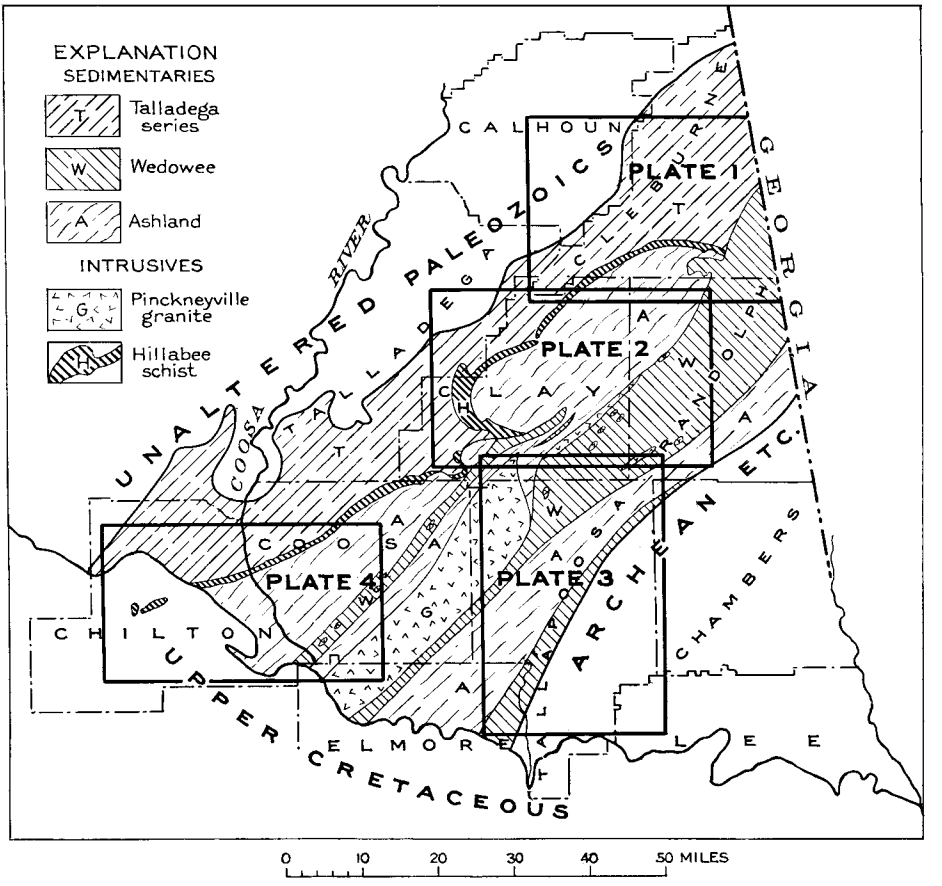
EXPLANATION
SEDIMENTARIES
T Talladega series
W Wedowee
A Ashland
INTRUSIVES
G Pinckneyville granite
H Hillabee schist
UNALTERED PALEOZOICS
PLATE 1
PLATE 2
PLATE 3
PLATE 4
CALHOUN
CLAY
CHILTON
COOSA
TALLADEGA
RIVER
ALABAMA
GEORGIA
ETC.
ARCHEAN
CHAMBERS
UPPER CRETACEOUS
0 10 20 30 40 50 MILES

FIG. 2

Ashland Mica Schist.—This formation is composed of metamorphosed sediments that have been locally invaded by igneous rocks. The altered sedimentaries, which contain no distinctively calcareous beds, are dominantly of two types: garnetiferous, biotite schist and siliceous, more or less graphitic, muscovite schist. The graphitic schists occur in variable bands, alternating with non-graphitic schists and strips of hornblende schists. They have been penetrated in places by basic and acid intrusives. The basic intrusives are believed to be the older since they have the general structure of the schists, while the acid intrusives which occur as granite areas, dikes and pegmatitic bodies are apparently younger.

The dip of the schists is generally southeastward, but there are reversals. The schists are repeated by folding and thrust faulting. The graphite in the schists is crystalline and has evidently been derived from original carbonaceous matter. The geographic distribution of the graphitic phase which is found principally in the western belt is apparently related to lateral variations in the character of the sediments. The siliceous schists which contain quartz schists and rocks suggestive of quartzite, resist erosion, and, in the western belt particularly, have given rise to ridges which by their trends imply repetition by folding and extensive overthrusting to the northwest. No estimate of the thickness of the Ashland mica schists has been made, but the opinion is ventured that it is much more than 10,000 feet. The age was placed tentatively by the writer as Algonkian,[1] but no definite proof of this age can be deduced. They may be of Paleozoic age, at least in large part, and accordingly the equivalent of the lower part of the Talladega series hereafter described.

Wedowee Formation.—This formation consists of phyllites, slates, quarzites and schists. It is characterized in many places by the occurrence of amorphous graphite, which renders the rocks black or grayish black. The graphite also occurs in impure beds. The rocks were deposited as sediments of different sorts, a part of which were carbonaceous and locally highly charged with such material. It is believed that the lower part of the formation is characterized by the occurrence of quartzites, particularly in the southeastern belt, which in one section is known as the Devil's Back Bone. The formation in Alabama contains no distinctively calcareous beds. The Wedowee was probably deposited on the sediments which in their altered condition are known as the Ashland mica schists, since they are in places infolded, or by thrust faulted are imbricated with these schists. The deposition of the Wedowee occurred

[1]Special Report 14, Geological Survey of Alabama, p. 32.

before the late intense folding of the Ashland. The limits of the Wedowee where not clearly marked by faults has necessarily been generalized in the areas in which the graphitic character is subordinate. The border of the area of the Wedowee near the State line has been modified on the map accompanying this report because of observations made since the State map was published. The Wedowee formation has been less altered than the Ashland, which has been subjected to the conditions of the deeper zone of metamorphism.

The Wedowee does not contain the basic intrusives which are found in the Ashland, or at least these intrusives are generally absent. This may be due to the present geographic relations of the Wedowee, since the Wedowee may have been removed where the Ashland contains the intrusives.

The thickness of the Wedowee is difficult to estimate. It may comprise more than 10,000 feet of sediments. The black graphitic phase reaches more than 2,000 feet in places. Since the sediments differ in character and thickness in the different areas, the formation is difficult to map.

The age of the Wedowee is tentatively placed from the Carboniferous downward into the Cambrian, but the lower limit is indefinite. The Carboniferous age of the upper part is supported by its similarity to the Carboniferous portion of the Talladega, the age of which has been determined by fossils.[1] The Wedowee, together with the Ashland, may possibly be the equivalent of the Talladega, which will now be described.

Talladega Series.—This series of more or less metamorphosed sediments, which possibly aggregates 30,000 feet, consists of slates and sericitic phyllites in which are interbedded at certain localities and horizons, conglomerates, sandstones, limestones, marble, dolomite, chert, graphitic phyllite and quartz schists which have been mapped as members by Butts,[2] who has given a detailed description of the series under the name "Talladega slate."[3]

For the purposes of this report a detailed description of the series is not required. Attention is called to the fact that the series forms the northwestern belt of the crystallines and that there are no intrusive rocks in the area.

Hillabee Chlorite Schist.—This chlorite schist is interpreted as a sill of altered igneous rock, which was intruded along, and apparently lubri-

[1]Special Report 14, Alabama Geological Survey, pp. 217-219.
[2]Special Report 14, Alabama Geological Survey, pp. 49-61.
[3]The name "Talladega Series" is preferred by the Alabama Geological Survey, as was noted by Butts, loc. cit. p. 49.

cated, one of the great thrust faults of the region. It extends, with some short interruptions, for about 100 miles and lies between the Ashland mica schist and the Talladega series. Coarse-grained specimens from its most expanded and massive area show the structure and minerals of an igneous rock that probably was a diorite. In its narrower positions it is schistose.

There are two small inliers of the formation in the Upper Cretaceous (Tuscaloosa formation) to the southwest of the main body of the crystallines, and in line with the strike of the Hillabee sill, where it disappears under the overlapping Upper Cretaceous. Possibly it extends for a considerable distance further to the southwest under cover of these later sediments. At its northeastern extremity it is cut off by a thrust fault and has not been found beyond the fault.[1]

At many places the Hillabee contains metallized quartz veins which carry varying amounts of the metallic minerals found associated in the gold deposits. The metallization was subsequent to the development of the schistose structure, since the veins cut across the planes of schistosity and have the characteristics of stringer veins. Gold mines and prospects have been opened in the Hillabee and important gold placer deposits were developed from it by weathering in place and by transportation. In the Pyriton districts pyrite deposits in it have been mined.

The relations of the Ashland and the Carboniferous part of the Talladega along the fault plane on which the Hillabee was intruded, imply a post-Carboniferous age for this metamorphosed basic rock.

Pinckneyville Granite.—This granite has been commonly called a biotite granite,[2] but it varies considerably in the amount of contained biotite. The borders of the larger masses, the smaller intrusives and the sheets and dikes are commonly gneissic. The principal area lies in the southern part of the belt of crystallines. In the central section the granite was intruded as thick sheets between the Ashland and Wedowee along a thrust fault and along parallel faults in the Wedowee. It also occurs in the so-called flat-rock areas in the Wedowee, in which the form of the bodies shows the influence of the schistosity of the containing rocks on the mode of intrusion. There are small areas of the granite in the Ash-

[1]It will be noted that the inliers are additions to the previous mapping of the Hillabee. The mapping of the northeastern end of the sill has been modified and the illogical zigzag course shown on the geological map of the State revised. Also the break in the mapping of the Hillabee in the southwestern part of Coosa County has been closed. The previous mapping at this locality seemingly conformed to a discrepancy in the topographic sheets.

[2]Petrographic studies which are in progress show that, more strictly speaking, it is a quartz-mica diorite.

land, most of them having the form of dikes or relatively thin sheets parallel with the schistosity. They are not shown on the map.

Presumably all of these areas of the granite were derived from the same regional magma. The age of the Pinckneyville granite has generally been considered as post-Carboniferous.

SOUTHERN PART OF CLEBURNE COUNTY AND NORTHERN BORDER OF RANDOLPH COUNTY

The northeastern portion of the Alabama gold belt is shown in Plate 1. On this map in the southern portion of Cleburne County are the well known Arbacoochee and Chulafinnee districts and the scattered mining localities to the south and east of the Arbacoochee district. In the northern border of Randolph County, somewhat isolated, are the Pinetuckey mine and the Gold Ridge mine.

The Arbacoochee district is of interest, because it contained the richest placer ground in the State, and is the only district in Alabama where hydraulicking and dredging were attempted. Chulafinnee was one of the early placer localities. The Pinetuckey mine is noted for rich ore specimens and its interesting history. An early settlement with race track nearby, both now abandoned, gave the name to the mine. The Wood's copper mine, from which most of the copper ore produced in Alabama was taken, is of interest in connection with the question of the metallization of the region. There are some prospects on barite veins in the southern border of Cleburne County. These are the only known occurrences of this mineral in the crystallines in Alabama.

Geology.—The geologic formations included an area of the Ashland mica schist, and to the northwest of it is the Talladega series. The Hillabee schist lying between these two bodies is a basic sill introduced along a low-angle fault plane, which was opened by a thrust from the southeast. The thrusting movement was of great importance since the Hillabee sill extends for about 100 miles to the southwest, to and under the Upper Cretaceous overlap, which limits the exposure of the crystallines in that direction. An earlier thrusting movement was responsible for the low-angle fault along which the Talladega series over-rode the unaltered Paleozoics to the northwest.

Within the Ashland mica schists, particularly near the northwestern border of the belt, there are dikes and areas of basic intrusives (not shown on the map) to which the Hillabee sill may be genetically related.

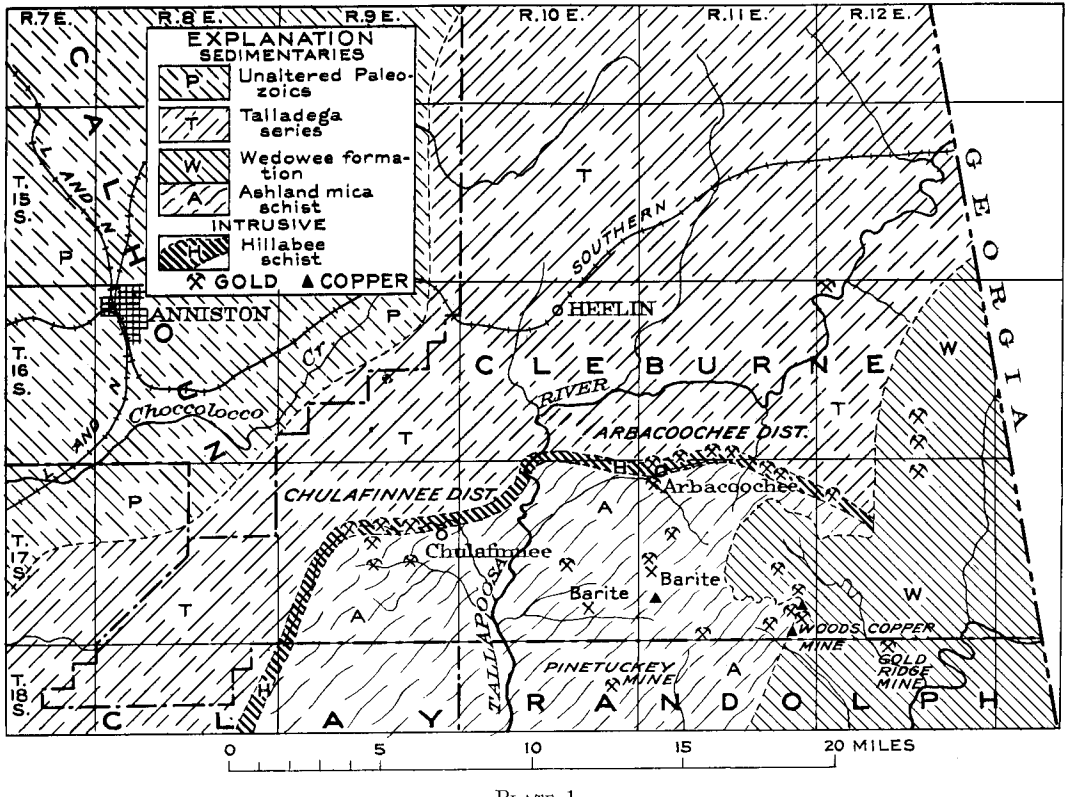
R.7 E.
R.8 E.
R.9 E.
R.10 E.
R.11 E.
R.12 E.
EXPLANATION
SEDIMENTARIES
P Unaltered Paleozoics
T Talladega series
W Wedowee formation
A Ashland mica schist
INTRUSIVE
Hillabee schist
GOLD
COPPER
T. 15 S.
T. 16 S.
T. 17 S.
T. 18 S.
CALHOUN
CLEBURNE
CLAY
RANDOLPH
GEORGIA
ANNISTON
HEFLIN
Choccolocco
SOUTHERN
RIVER
ARBACOOCHEE DIST.
CHULAFINNEE DIST.
Arbacoochee
Chulafinnee
Barite
Barite
WOODS COPPER MINE
GOLD RIDGE MINE
PINETUCKEY MINE
TALLAPOOSA
0 5 10 15 20 MILES

PLATE 1

These basic intrusives have not been found in the belt of the Talladega series and appear to be absent from the Wedowee areas.

It will be seen by reference to the accompanying map that at the western border of the northern part of the Wedowee there is a fault along which the formation has over-ridden the Talladega series and the Hillabee sill. This thrust movement was accordingly later than that which was accompanied by the introduction of the basic Hillabee. Farther south along this fault, or others parallel to it, the Wedowee was thrust over the Ashland mica schist. To the south, beyond the limit of this map (see Pl. 2) the movement was accompanied by the intrusion of extensive masses of granite which arose along thrust planes so that it is interpolated between the Ashland and Wedowee. The granite is also intruded in both of these belts. In the Ashland the granite occurs only in dikes, but in the Wedowee there are several areas which are shown on the map. At the Pinetuckey mine (Pl. 1) the granite is encountered in the Ashland, but is not extensive enough to be shown on the map.

Metallization.—The writer believes that there was but one general period of metallization in the gold belt of Alabama and that it followed the intrusion of the granite. The solutions which formed the veins and brought in the metallic elements presumably arose from the residual derivatives of the regional granitic magma. In the northeastern division of the gold belt, here under discussion, the solutions invaded the Ashland, Wedowee and the Hillabee along fissures which cut the rocks at low angles to the planes of schistosity. The solutions also permeated the country rock adjacent to the fissures. The gold deposited in the quartz veins is accompanied by sulphides, pyrite usually being predominant. In Cleburne County, at the Wood's copper mine and other copper prospects, bodies of pyrrhotite and pyrite with copper sulphides were formed, with gold as a minor constituent. These copper deposits are discussed in another section of this report.

By reference to the map (Pl. 1) it will be seen from the location of the mines that gold-bearing veins in the Hillabee are found in the Arbacoochee and Chulafinnee districts. South of these districts the veins are in the Ashland. There are also veins in the Wedowee. No important metallization has been found in the Talladega in this section of the gold belt.

ARBACOOCHEE DISTRICT

Arbacoochee Placer; Secs. 5 and 6, T. 17 S., R. 11 E.—The first official report in regard to this place was by Tuomey. He stated (p. 70)

that the placer, which is the most extraordinary in the State, extends over an area of six hundred acres on the top and sides of a low hill (Gold Hill) and that at one time it gave employment to 600 men, but no work of consequence had been done for nearly three years; that is, since 1851, or shortly after the California gold rush. One or two persons had resumed work, not in the gravel beds, but on the top of the hill. After the soil was worked over, the sub-soil which had not been disturbed, as was shown by quartz veins intersecting it, was found to be auriferous. The gold was obtained by washing the ground in shallow trenches, dug 12 feet apart and 30 feet in length, into which water was admitted from a small canal. A few ounces of quicksilver were thrown into the trenches and the gold, freed from the loose auriferous earth was taken up by the quicksilver. After awhile the water was shut off and the amalgam was taken out. About 40 cubic feet of the subsoil was said to have yielded $25.00.

Smith wrote (1 p. 44) that the greater part of the work at Arbacoochee was done about 1836, soon after the great excitement. When he visited the place in 1874, two men were at work washing ore down ditches, the gold being caught in pot holes and panned out, and Hilton and Son had an eight-stamp mill located in Sec. 33, T. 16 S., R. 11 E., for milling the decomposed quartz and also the surface loam and slate.

Smith stated that the valley is drained by Dying Creek. It will be found, however, that on the county map there is a stream called Dyen Creek and a tributary of it, called Mud Creek, passes Arbacoochee. Clear Creek joins Mud Creek from the south, and near the juncture there is some auriferous ground on Clear Creek. Phillips reported (p. 36) that the town of Arbacoochee, which at the time he wrote (1891) contained less than 300 people, was said to have had some 5,000 inhabitants in 1845. The writer found one small two-story brick building there and only a few houses nearby. Mr. Jack Talley sluices gold on his place and recovers what he needs for his expenses.

Clear Creek Placer; Sec. 7, T. 17 S., R. 11 E.—McCaskey (1 p. 45) says that placer mining on Clear Creek has long been famous in Alabama and undoubtedly yielded from $50,000 to $60,000 in gold from small workings alone. In 1905 the Clear Creek Mining Company built a small bucket dredge, with a daily capacity of 600 cubic yards, for the purpose of working the gravels on a larger scale than had been done, but operations were not entirely successful and the plant was closed down. Possibly tree stumps interfered with the dredge to some extent, or local strata of white clay balled up some of the gold; certainly it was found that some of the

gold was not free, but in comparatively fresh broken vein matter, and it was thought that the tailing dumps could be worked at a profit by crushing and amalgamation. Facilities for this process were therefore added to complete an extensive plant.

At the end of 1907 the Gold Ridge Mining Company was completing preparations to sluice the gravel by the use of giants and to elevate it to a series of sluice boxes and riffles, 120 feet in length. The enterprise was not profitable.

Anna Howe, Anna Howe Extension and Crutchfield; Sec. 34, *T.* 16 *S., R.* 11 *E.*—The Anne Howe was one of the first gold-bearing quartz discoveries in the Arbacoochee district. The other properties in the same sections have been regarded as extensions of it. These localities show abandoned pits ten or fifteen feet deep at intervals for nearly half a mile along a course slightly north of east. It was reported to Brewer (p. 93) that $2,500 worth of gold was taken from these workings which showed a vein from four inches to one foot in thickness and dipping almost flat to the southeast. An assay from the Anna Howe gave $12.40 in gold, according to Brewer.

The Anna Howe was sold to the Anna Howe Gold Mining Company. They erected a Huntington Mill complete with a Frue Vanner concentrating table. An incline on the dip of the vein was carried for 100 feet and encountered solid Hillabee schist carrying unaltered pyrite in large cubes and forming a large percentage of the schist. The vein was said to have pinched out and was abandoned.

At about the same time that the Anna Howe was sold, the Anna Howe Extension and Crutchfield were purchased by a company which began operations principally on the Crutchfield. They erected no plant. Their work stopped about the time that the Anna Howe was abandoned. Later a lessee, in 1877, pumped out an old shaft and sunk it to a depth of 60 feet, but stopped on account of water. The lessee then opened an old tunnel and succeeded in saving $175 in gold from ten tons of ore.

Valdor Property; Sec. 3, *T.* 17 *S., R.* 11 *E.*—Brewer says (p. 93) that on this land a shaft 10 feet deep showed a bedded vein from four inches to one foot in thickness and dipping, almost flat, to the south. An assay gave $5.17 a ton in gold. He also says (p. 96) that there was an opening in Sec. 5, T. 17 S., R. 11 E., and that the Reeves shaft in Sec. 6, T. 17 S., R. 11 E., contained ore which assayed $2.40 a ton and $2.36 a ton in gold.

Hicks-Wise Mine; Sec. 2, T. 17 S., R. 11 E.—According to Brewer (p. 77) this mine in the summer of 1893 had reached the greatest depth and disclosed a more extensive ore body than any other gold mine in Alabama. A shaft had been sunk 110 feet, or 27 feet below the water level. About 3,000 tons of ore had been milled from levels run at 20, 40 and 85 feet below the surface. It was claimed that the ore yielded $2.00 per ton in gold by amalgamation. The ore was not fully free milling since it carried sulphides below the water level and, moreover, graphite interfered with amalgamation. Two assays of samples taken from the mine by Brewer ran $3.14 and $4.30 in gold, with no silver. The strike of the ore body was reported as N. E., with an almost vertical dip to the S. E. At the 85-foot level the ore body had been drifted on for 200 feet but not cross cut. Its extreme thickness was not determined, but a cave-in which occurred near the surface showed 25 feet of "ore," but whether this was the maximum could not be determined.

Lee Mine; Sec. 2, T. 17 S., R. 11 E.—This property, according to Brewer (p. 78), was purchased by a company in the spring of 1894 and extensive prospecting was begun. The strike of the formation and the ore body is N. W. and the dip 45° to the S. W. Brewer stated that the characteristics of a bedded vein between slate walls were exhibited at this mine better than any other he had seen in the state. The thickness of the ore in a drift 40 feet from the outcrop varied from four to five feet. A cross-cut from the south intersected the shaft at its bottom. A drift 121 feet long was run from the bottom of the shaft in the ore. From the level of the drift an incline was sunk 20 feet, showing the ore body to be five feet six inches thick at the bottom. The ore was treated by three arrastras and a Blake crusher. The superintendent claimed the ore milled $5.00 a ton in gold. A sample taken by Brewer at a depth of 15 feet, where the vein was 2 feet 6 inches thick, assayed $12.61 in gold, with no silver.

Crumpton property; Sec. 7, T. 17 S., R. 12 E.—Brewer (p. 80) reported that the outcrop on this property had not been sufficiently prospected to tell much about it but it panned quite well.

CHULAFINNEE DISTRICT

Chulafinnee placer; Secs. 14, 15, 16, T. 17 S., R. 9 E.—According to Brewer (p. 85) the placer mining near Chulafinnee was done principally along Chulafinnee Creek in the sections above mentioned. The gravels were under five or six feet of soil and paid but an average of 75 cents per day per man by sluicing.

Carr Creek placer; Sec. 23, *T.* 17 *S., R.* 9 *E.*—Tuomey mentioned (p. 69) a deposit of gravel and clay having an area of 240 acres at this place, where a single hand with a rocker was at work. Placer gold was also found in sections 23 and 24.

Rev. Mr. King's property; E½ of NW¼; Sec. 22, *T.* 17 *S., R.* 9 *E.*—A stamp mill was reported by Tuomey (p. 51) as being operated at this locality, which is three miles west of the village of Chulafinnee. The gold was found chiefly in decomposed quartz taken from a shaft. The writer found that new openings had been made at this locality in February, 1930, and a two-stamp steam plant was being operated in an experimental way.

King Mine; Sec. 16, *T.* 17 *S., R.* 9 *E.*—A stamp mill was operated on this property near Chulafinnee in the "seventies," according to Brewer (p. 85). An assay reported by him gave $1.03 in gold per ton. The pit, which covered 2,500 square feet, indicated that the country rock (schist) was milled with the quartz veins.

Striplin property; Sec. 22, *T.* 17 *S., R.* 9 *E.*—Shallow openings showed stringers of quartz in schist. The prospects, according to Brewer (p. 86), panned quite well and the quartz assayed $3.31 in gold per ton.

Higginbottom property.—This property joins the Striplin property on the northeast. It showed, according to Brewer (p. 87) thin quartz veins in decomposed schist that panned rich at the surface.

SOUTH OF ARBACOOCHEE IN CLEBURNE COUNTY

Golden Eagle or Prince Mine; Sec. 17, *T.* 17 *S., R.* 11 *E.*—This mine, according to Brewer (p. 66), was first worked as the Prince mine. Two shallow inclined shafts and 100 feet of tunneling were dug in 1893. In 1894 work was resumed and richer ore was found that assayed as high as $58.00 in gold per ton. A stamp mill was erected. The ore that was free milling was treated. Below a depth of 30 feet the ore carried sulphides, and the appearance indicated arsenopyrite. The shaft reached a depth of 75 feet. Brewer stated that there is intrusive granite exposed at this mine.

Crown Point property; Sec. 19, *T.* 17 *S., R.* 11 *E.*—According to Brewer (p. 72) a five-stamp mill was operated on this property in 1893. No systematic mining was done. The values saved did not yield a profit with the limited equipment. An assay showed $3.23 in gold per ton.

Eckles property; Sec. 23, T. 17 S., R. 10 E.—Brewer relates (p. 65) that an old miner named Eckles, after he had done some prospecting, purchased in the spring of 1893, for $125.00, a forty-acre tract that had previously been offered for a Texas pony worth about $40.00 and that the next summer the property was bonded for $30,000. Brewer found that the opening on the property consisted of a cross-cut 8 feet deep and nearly 50 feet long and a shaft some 65 feet deep below the floor of the cross-cut. Thin quartz veins in decomposed schists striking north of east and carrying some graphite were exposed in the openings. In 1894 the shaft was deepened to nearly 100 feet. A sample from this property assayed $8.58 in gold per ton.

Moss-back property; Sec. 35, T. 17 S., R. 11 E.—Brewer reports (p. 73) that this was one of the gold discoveries made in the "seventies" during the copper excitement. Two inclines were sunk on the lead. The Houston shaft yielded, by mill run, $4.00 to $4.50 in gold per ton from an ore body 18 inches thick. The Company shaft, 30 feet deep in ore 8 feet thick, was lower grade. The country rock is a decomposed schist, somewhat graphitic.

Lucky Joe; Sec. 25, T. 17 S., R. 11 E.—This property, according to Brewer (p. 74), was first developed to a notable extent in 1893 and a ten-stamp Frazer and Chalmers mill was erected. The first clean-up was not satisfactory. Other mill runs, after further prospecting, demonstrated that $2.27 a ton in gold could be saved by amalgamation. In 1894 Brewer found that 300 feet of drifting and cross-cutting showed the line of strike to be a few degrees west of north and the pay ore in "chimneys" dipping 30 degrees to the east. A few weeks later work was suspended.

Pritchet property; Sec. 36, T. 17 S., R. 11 E.—An incline 15 feet deep was sunk as a prospect at this locality. According to Brewer (p. 74) an average sample across seven feet of the body panned $3.00 a ton in gold.

Ayers prospect; SW¼ of SW¼, Sec. 33, T. 17 S., R. 11 E.—This property was developed by J. D. Ayers, but no mining was carried on, although good values in gold were found in some of the pits. The prospects lie just east of the Blake graveyard.

NORTHERN BORDER OF RANDOLPH COUNTY

Pinetucky Gold Mine; Sec. 12, T. 18 S., R. 10 E.—Tuomey stated (p. 67) that Pinetucky is among the old gold localities of the State and

that the surface as well as the veins had been worked extensively. A new company was just beginning operations at the time of his visit, and it was impossible to examine the old workings.

According to Smith (p. 54) gold was first found at Pinetucky in 1845, and, for several years following the discovery, mining was prosecuted with energy so that most of the surface deposits were worked and a good part of the area tunneled under. The gold was found in thin veins of quartz in garnet bearing mica schist. The proprietor, ex-Gov. W. H. Smith, had sunk two shafts to a depth of 69 feet on the vein. The mill of ten stamps was driven by steam power. The mine was drained by a pump and the water from it was used in the mill. The gold in part was mixed with pyrite. Convict labor was used. The average for the quartz, according to ex-Gov. Smith, was $11.00 to $17.00 per ton.

Pinetucky is one of the earliest discoveries in Alabama, according to Brewer (p. 50), who placed it contemporary with the Arbacoochee discoveries. It was called by him "a rich specimen mine" and he wrote that he saw many specimens of ore showing free gold in great splotches and that in about two tons of ore mined nearly every piece was a fine cabinet specimen. Mill runs yielded $40.00 per ton in free gold, but were limited to less than four tons to the run.

Brewer stated that the strike of the vein is N. 30° E., and the dip is 10° or 12° to the S. E. The old pits extend for about a mile and a half. The veins averaged about ten inches in the workings at sixty feet from the surface. They are lenticular and the pay ore was found in shoots or chimneys. The quartz is hard and bluish. The free milling or oxidized ore was mined out when the pits were sunk in the early days.

The workings seen by Brewer in 1894 consisted of a vertical shaft 55 feet deep and a drift on that level about 200 feet in length. Above this the ore was mined out. An incline some ten feet in length had been sunk from the bottom of the shaft along the dip of the vein and this represented the increase in depth for the previous twenty years. A ten-stamp Frazer and Chalmers Mill had been erected on the property some five or six years previously.

After Brewer had made his examination, the Pinetucky company in 1895 executed a lease for five years to the Fair Mining and Milling Company of Chicago, who proceeded to prospect the deposit. A thorough sampling of the mine prior to prospecting with a diamond drill showed an average yield of $38.00 per ton, according to information given to Brewer. From 25 to 75 per cent of the ore was free milling, and concentrating gave one ton of concentrates from 216 tons of ore.

Three diamond drill holes were sunk by the lessees. One hole in the bottom of the shaft at the mill house went to a depth of 205 feet without cutting any ore body, but at a depth of 55 feet showed granite alternating with mica schist. A second hole seventy feet to the west passed through mica schist for 60 feet, then granite was encountered, and below this conditions were the same as in the first hole to a depth of 130 feet. A third hole 80 feet east of the old working shaft struck granite at 47 feet, after passing through mica schist, and encountered ore 12 inches thick. The next four feet was gouge. Below that there was garnetiferous mica schist and then granite.

McCaskey,[1] when he visited the Pinetucky mine in 1907, found that a twenty-stamp mill had been erected several years previously in order to treat the ore by the milling-amalgamation process, but owing to difficulties in obtaining a high extraction by this method and uncertainty as to the best future procedure the mines and plant had been closed for some years and the mine had become flooded. He reported that the vein on which most of the modern work had been done is from 6 inches to 3 feet thick and lenticular in type. On this vein three shafts and two winzes had been sunk and from 500 to 600 feet of drifts and stopes had been worked. The strike of the vein was given as N. 10° E. to N. 30° E., and the dips about 50° S. 80° E. to S. 60° E. The vein matter proper is hard bluish quartz with a sheeted or banded structure and contains both free gold and auriferous sulphides. Films of muscovite are developed between bands of quartz, and garnets are found with the quartz.

Gold Ridge property; Sec. 4, *T.* 17 *S., R.* 12 *E.*—On this property Brewer (p. 71) found a shallow-inclined shaft. The strike of the formations was reported as N. E., and the dip about 45° to the S. E. Samples taken by Brewer from the dump showed $4.00 to $5.00 per ton in free gold and an assay gave $4.82 per ton.

McCaskey,[2] who visited this mine in 1907, recorded the following observations: "The country rock is, for the greater part at least, made up of argillaceous slates and schists, striking N. 10° E. to N. 40° E., and with planes of schistosity dipping from 30° to 45° E. to S. 60° E. Certain of the clay slates and quartz schists appear to be of sedimentary origin and the enclosing rocks of the quartz veins belong mainly to this class of rocks. The origin of the foot wall of the Eckert vein, however, which is a highly garnetiferous mica schist, and that of a quartz magnetite schist found in association with another vein a mile to the south, is of considerable doubt.

[1]H. D. McCaskey, Bull. No. 340, U. S. Geol. Survey, 1908, p. 46.
[2]Ibid., p. 42.

The garnets of the Eckert foot wall are much decomposed, but are shown to be of the iron alumina variety. Many of them are dodecahedra from 2 to 3 inches in diameter. The matrix of the schist is highly micaceous. The quartz-magnetite schist is made up almost entirely of these two minerals, as shown by a microscopic examination, with light colored micas here and there along the planes of schistosity. Many of the magnetite crystals are one-tenth inch in average diameter.

"Two veins are exposed by numerous pits, trenches and cross-cuts. The Black vein, stained with manganeses, shows 10 feet of dark quartz at the best exposures. The Eckert vein is from 6 to 36 inches thick. On this vein an inclined shaft had been sunk for about 100 feet and drifts turned off on the 50-foot level to the north and south for about 250 feet. The vein pinches and swells and thick portions of it in cross section in weathered exposures show reentrant angles simulating grooving. One "pipe," with its long axis lying in the line of strike, showed an oval cross section with corrugated border, and having no connection with portions either above or below.

"The ore is free-milling above the water level and sulphides of iron have been encountered only to a slight extent in the veins. A steam twenty-stamp mill began operations on these ores towards the last part of 1907. In the Mineral Resources of the U. S. for 1908 it is stated that a small quantity of gold was produced that year from the Gold Ridge mine and towards the end of the year the cyanide process was decided upon."

The writer learned that operations were discontinued shortly after McCaskey's' visit.

EAST OF ARBACOOCHEE IN CLEBURNE COUNTY

Middlebrook property; Sec. 3, *T.* 17 *S., R.* 12 *E.*—At this locality from an inclined shaft 20 feet deep Brewer (p. 80) panned not less than $5.00 in gold per ton.

Sutherland property; Sec. 34, *T.* 16 *S., R.* 12 *E.*—Brewer (p. 80) described the prospecting on this property as quite extensive. One inclined shaft at an angle of 45° reached a depth of 30 feet and encountered a fault. There were two other inclines, one 25 feet deep and the other 15 feet deep. A temporary wooden stamp mill with iron shoes on 4 by 4 timbers was being operated.

Bennefield property; Sec. 27, *T.* 16 *S., R.* 12 *E.*—The ore on this property was exposed by open cuts. Brewer stated (p. 81) that the ore was low grade, according to what he panned.

NORTHEAST OF ARBACOOCHEE

Marion White property; Sec. 6, T. 16 S., R. 12 E.—Brewer wrote that there was considerable excitement about this property in 1893, because some rich specimens of ore in which gold was visible were said to have been found there as float. Prospecting developed a thin lenticular vein in slates which panned gold. An assay yielded $2.27 per ton. This locality is in the Talladega series. There appears to be no important mineralization in the Talladega in the northeastern part of the gold belt of Alabama.

SOUTHEASTERN TALLADEGA COUNTY, CLAY COUNTY AND THE WESTERN BORDER OF RANDOLPH COUNTY

This portion of the Alabama gold belt lies to the southwest of the area already described. By reference to the map (Pl. 2), it will be seen that the mines are grouped in three rather well-defined districts. The Riddle's Mill district lies in the southeastern part of Talladega County and is of special interest, because it is the most important locality where gold mining has been carried on in the Talladega series. The Idaho district is in the western part of Clay County in the Ashland schists and lies to the southwest of the pyrite mines in the Hillabee schist. The Cragford district, which lies in the western border of Randolph County and the eastern border of Clay County, is in the Wedowee formation and is characterized by the occurrence of a notable amount of arsenopyrite in some of the prospects. At one time it was thought that the district might supply arsenic ore.

Geology.—The geologic formations in this section of the gold belt afford evidence of extensive low-angle thrust faulting. The Talladega series was thrust over on the unaltered Paleozoics along the fault line which marks the contact between them. The Ashland mica schist (see Pl. 2) over-rode the Talladega series, probably for several miles at the time of the intrusion of the Hillabee schist, which is a basic sill that may have lubricated the plane along which the movement occurred.

Basic intrusives, which occur as dikes in the Ashland schists in the Idaho district and as more important bodies to the northeast, may possibly be related to the Hillabee. These basics appear to have no genetic relation to the gold deposits. The only deposits thus far found in them are minor amounts of magnetic iron ore and some occurrences of manganese which are unimportant. There was a subsequent period of thrusting during

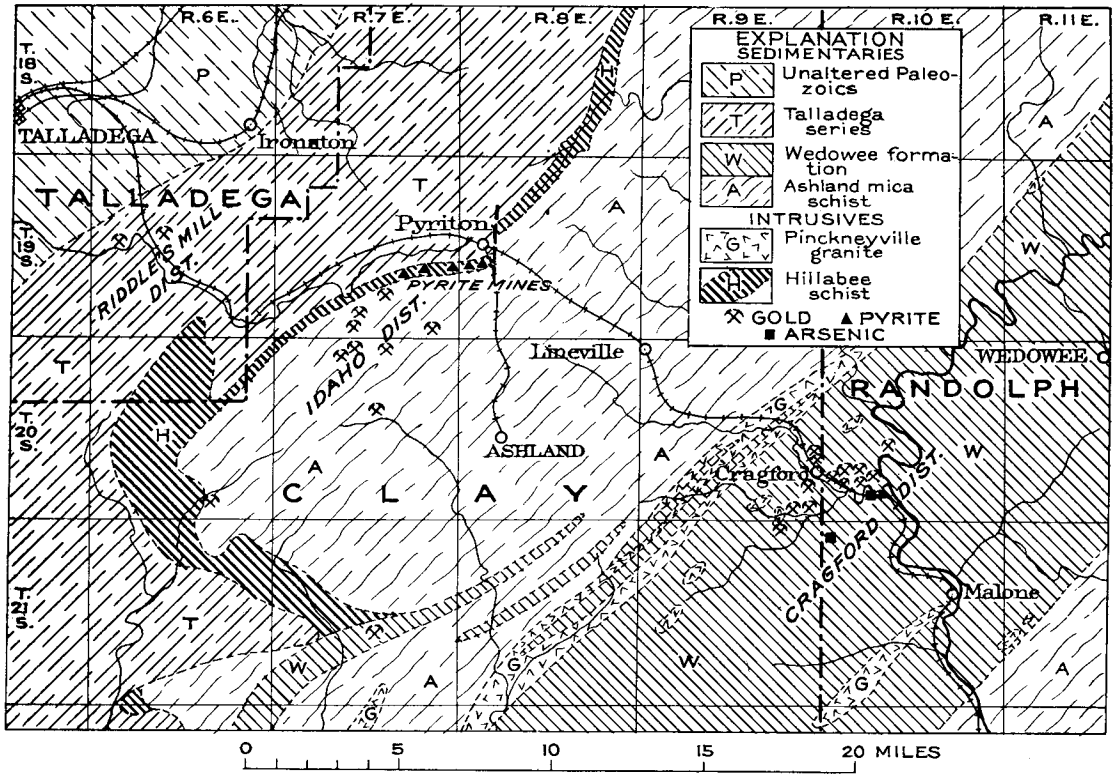
R.6E.
R.7E.
R.8E.
R.9E.
R.10E.
R.11E.
T. 18 S.
T. 19 S.
T. 20 S.
T. 21 S.
TALLADEGA
Ironaton
TALLADEGA
Pyriton
RIDDLES MILL DIST.
PYRITE MINES
IDAHO DIST.
Lineville
ASHLAND
CLAY
RANDOLPH
WEDOWEE
Cragford
CRAGFORD DIST.
Malone
EXPLANATION
SEDIMENTARIES
P Unaltered Paleozoics
T Talladega series
W Wedowee formation
A Ashland mica schist
INTRUSIVES
G Pinckneyville granite
H Hillabee schist
GOLD
PYRITE
ARSENIC
0
5
10
15
20 MILES

PLATE 2

which the Pinckneyville granite was intruded between the Ashland and the Wedowee and also in the Wedowee and in the Ashland. The map shows a portion of an area of granite which cuts the Ashland. This area of granite further southwest forms a belt from 6 to 8 miles wide (see Pl. 3) and extends for 40 miles to the southwest to where it is covered by the Upper Cretaceous overlap. The thrusting which accompanied the intrusion of the granite probably caused the faulting of the Hillabee near Pyriton. It has been explained that the movement cut off the Hillabee sill at its eastern end, as shown in Pl. 1. Dikes of granite too small to be shown on the map are found within the area of the Ashland.

Metallization.—The gold-bearing veins which are believed to have originated after the intrusion of the Pinckneyville granite were probably derived from solutions which came from the regional abyssal granite magma. The pyrite deposits in the Hillabee near Pyriton represent a second phase of the metallization, and the arsenic ores in the Cragford district which contain some sphalerite and galena represent a third phase. The copper deposits at the Wood's mine have already been mentioned. That the metalliferous deposits are later than the intrusion of the granite is shown by the occurrence of gold-bearing veins in the granite at Hog Mountain, which is shown in Pl. 3, and will be described in connection with the discussion of the next section of the gold belt. It is not improbable that a granite mass lies under the Cragford district at a considerable depth. Possibly this is the case in other districts where no granite is at the surface.

The pyrite deposits near Pyriton, which carry a small percentage of copper sulphides, will be discussed in another portion of this report. The arsenic ores of the Cragford district will also be given separate consideration.

RIDDLE'S MILL DISTRICT

Riddle's Mine; Sec. 16, *T.* 19 *S., R.* 6 *E.*—This mine was worked with some success, according to Smith (1 p. 4), but at the time he visited the locality (1874) it was idle. He stated (2 p. 131) that the quartz showed gold plainly to the eye and that the numerous assays of samples from various depths as well as the testimony of those who had worked the mine showed that the mining could be carried on with profit.

Brewer reported (p. 98) that mining had reached a depth of not over 100 feet by an incline on the dip of the formation. The quartz was found to be in lenses or kidneys rarely exceeding four inches in thickness. The

value of the quartz by assay tests varied from $20.00 to $150.00 per ton in gold. The quartz at depth carried pyrite. Brewer was informed that at one time mining was carried on for six months, but was stopped because gold could not be saved by amalgamation. Several local miners leased the property and sometimes made good wages by crushing the ore and panning it. In 1894 Mr. Walter Riddle, one of the owners, milled the ore mined by lessees, using light stamps, and met with some success. An assay reported by Brewer gave $35.97 in gold and 83 cents in silver per ton.

Woodward tract; Sec. 16, *T.* 19 *S., R.* 6 *E.*—The lead from the Riddle's mine according to Brewer (p. 99) extends to this tract, which is also in the same section as the Riddle's property. Some prospecting was done there, and an assay reported by Brewer gave $145.83 in gold and $1.58 in silver per ton.

Story, Warwick and Cogburn or Gold Log Mine; SW¼ of SW¼ of Sec. 20, *T.* 19 *S., R.* 6 *E.*—According to Smith (2, p. 128), this mine was owned in 1875 by Senator A. Cummins, who had a crushing mill on Talladega Creek in Sec. 20, near the mine. The quartz vein varies in thickness and lies in partially decomposed slates. This mine is on the same lead as Riddle's' mine, according to Brewer (p. 99), and the character of ore is the same. An incline had been dug some 60 feet on the dip when he visited the property.

Spencer,[1] who visited the district in 1889, said that the Story mine had yielded $100,000 worth of gold, one company having made a profit of $16,000, but that it and other mines nearby had not been worked since 1887. He mentioned the Robb mine nearby in Sec. 19, at which, with pan and mortar, men had made $2.50 to $50.00 a day.

The writer was told by Mr. Grant Lowe that this property was later called the Warwick and Cogburn mine and was afterward known as the Gold Log. Mr. Lowe worked this mine in 1914-1917. It was then equipped with a compressor, crusher and stamps, which were run by water-power at a dam on Talladega Creek. A width of from 4 to 8 feet of quartz and schist was mined and milled. The vein strikes N. E. and dips S. E. An incline shaft was sunk and workings were carried to 500 feet on the dip. The mine closed when mercury was no longer obtainable on account of the World War. There was also a simultaneous increase in the cost of labor. Without the intervention of these factors the mine would presumably have continued in operation.

[1]J. W. Spencer, Economic Geologic Survey in Georgia and Alabama along the Macon and Birmingham Railway, 1889, p. 58.

In 1916 Bastin made an inspection of the Story mine, which was then called the Gold Log mine. The following information is taken verbatim from his report:[1]

"The mine is in Talladega County, Ala., about 7½ miles south of Talladega, on the east side of the valley of Talladega Creek. It is operated by the Gold Log Mining Co., E. A. Thomas, president and manager. According to Mr. Thomas, the mine was formerly known as the Story mine and had been operated intermittently for perhaps 70 years before it was taken over by the present owners in June, 1915.

"The wall rock of the vein is a gray, very fine-grained schist of slightly greenish cast, which strikes N. 60°-65° E., and dips 35°40° S. E. This schist is very finely foliated, and here and there its folia show prominent wavy cross-folding. At some places there are two sets of wavy cross-folds, an early and a later set, which run nearly at right angles to each other, the earlier much smaller than the later. The microscope shows that this schist is composed of quartz, sericite, calcite (possibly introduced during mineralization), chlorite and scattered irregular grains of magnetite, the minerals being here named in the order of their abundance. The flakes of sericite lie in subparallel positions. They are not evenly distributed, but are aggregated into narrow bands, which are composed almost entirely of that mineral. It is these bands that give the rock its finely foliated structure. The other minerals are usually irregular in outline and show little tendency to elongation parallel to the foliation.

"The vein has been exploited by a drift tunnel about 250 feet long, from which an incline follows the vein for about 320 feet. Most of the mining in recent years has been done below the tunnel, the greater part of the vein above the tunnel having been stoped out many years ago. The stopes range in width from 5 to 8 feet, the average being about 6 feet.

"The ore consists of (1) irregularly interlocking white to light-gray quartz, white to pale-pink calcite, and very minor amounts of sulphides and free gold, and (2) schist partly replaced by some or all of these minerals. The principal sulphide noted was chalcopyrite, much of which shows peacock tarnishes. Enargite (?) was also noted, and magnetite was seen in one specimen. Free gold occurs locally in irregular masses in the quartz. The ore is usually massive and compact, showing no crustification or crusy cavities. It generally forms bands or lenses parallel with the folia of the schist. The contacts between ore and schist are as a rule extremely sharp, in places cutting across the folia of the schist, and sharp fragments

[1]Bastin, Edson S., The Gold Log Mine, Talladega County, Alabama. Bull. 640, Pl. I, U. S. Govt. Survey, pp. 159-161.

of schist are here and there inclosed by ore. Elsewhere there are transitions, parallel to the trend of the folia of the schist, from typical sericite schist wall rock to a grayer rock less finely schistose, and from this rock to a typical assemblage or ore minerals. The microscope shows that the transition rock differs from the typical wall rock only in its larger content of quartz and calcite and in that the sericite bands are narrower and more widely spaced. It is believed to have been formed by the partial replacement of the sericite schist wall rock by calcite and quartz. Locally this replacement preceded the development of the lens-shaped bodies of massive ore, for in some places these cut sharply across the folia of the gray, partly altered schist. Abundant grains of pyrite, most of them less than 1 millimeter in diameter, were noted in some of the schist close to and in sharp contact with the massive ore, but pyrite is entirely absent from other schist similarly situated and was not noted in the gray, partly replaced schist that forms a transition product between ore and unaltered wall rock. As a rule, pyritization of the wall rock is local and inconspicuous.

"In general, the relations of ore to wall rock appear to indicate a certain amount of replacement of the sericite schists by ore-forming solutions penetrating along the folia of the schist in the early stages of the mineralization, followed by an actual prying apart and in places disruption of the folia in the later stages. Whether this disruption was a result of injection of the ore-bearing solutions under pressure or of the forces of crystal growth is uncertain.

"The richer parts of the ore are typified by an exposure at the bottom of the incline, where a number of subparallel lenses of quartz, calcite and metallic minerals together constitute about two-thirds of the 5-foot face. The individual lenses, which range from a few inches to a foot in width, are separated by sericite schist and by quartzose and calcite schist formed by the partial replacement of the sericite schist. It is characteristic of the deposit that comparatively wide bodies of ore may decrease greatly in width or pinch out completely in very short distances parallel to the trend of the vein. For example, 6 feet along the strike of the vein from the 5-foot exposure just described, which was about two-thirds ore, practically all the vein quartz had pinched out, the entire face being sericite schist.

"A mill at the mine is operated by water power obtained by damming Talladega Creek. The mill equipment consists of a jaw crusher, ten 750-pound stamps (2 batteries) dropping 75 to 80 times a minute, two 6-foot amalgamation plates, and tables covered with blankets. The capacity of the mill is about 25 tons in 24 hours. The value of the precious metals recovered is reported to average about $4.00 to the ton of ore treated. Con-

centration is not attempted. The bullion recovered from the amalgam is shipped directly to the mint. The mint returns from 32 lots of bullion show that the ratio of gold to silver in the bullion ranges from 6 to 1 to 60 to 1; in most shipments the gold is in excess of 10 gold to 1 silver."

IDAHO DISTRICT

Idaho or Franklin Pits; Sec. 3, T. 20 S., R. 7 E.—The workings at this place were described by Brewer (p. 58) as open cuts, some of them 50 or 60 feet deep. They extended 104 yards along the hillside and exposed graphitic and garnet schists with quartz stringers. The formations had been quarried and milled in a ten-stamp mill which had been idle since 1889. Panning showed values of $2.00 per ton in free gold. Brewer commented on the great quantity of garnet in the schists in the vicinity and on the presence of wad and limonite in the pits.

Laurel pits; Sec. 4, T. 20 S., R. 7 E.—Shallow pits showing decomposed ground that panned gold were reported by Brewer (p. 62) at this place. He stated that a miner made fair wages sluicing the ground during the summer of 1893.

Chinca-Pina; Sec. 33, T. 19 S., R. 7 E.—The workings which Brewer saw on the Chinca-Pina property consisted of an open cut, an inclined pit or shallow shaft and several shallow holes in which the surface formation panned gold. The strike is N. E. and the dip about 30° S. E.

Hobbs pit; Sec. 3, T. 20 S., R. 7 E.—The workings here, according to Brewer (p. 63), were shallow pits and were promising prospects.

California property; Sec. 15, T. 20 S., R. 7 E.—Brewer reported (p. 63) that a ten-stamp mill had been operated on this property several years before his visit. The workings were caved in. Ore found in the mill yielded gold by panning.

Horn's Peak; Sec. 4, T. 20 S., R. 7 E.—Considerable work had been done at this place before Brewer visited it. He stated (p. 63) that some ore had been treated in a five-stamp mill near by with a saving of $2.00 in gold per ton by amalgamation.

Alabama Gold and Mica Co.; SE¼ of the SW¼ of Sec. 36, T. 19 S., R. 7 E.—According to Prouty (p. 84), this was the only gold mine operating in Clay County in 1919. The thickness of the quartz vein was about 10 inches. The schists below the vein carried more gold and for a greater distance than those above it. The vein strikes N. E. and dips 50° to 60°

S. E. Stringers of granite occur in the garnetiferous mica schist, and garnets occur in the quartz. A five-stamp mill and a 50 H. P. engine were installed. Water was brought by gravity to the mill. The gold was saved by amalgamation.

Haraldson Mine; NW of NE of Sec. 33, T. 19 S., R. 7 E.—The location of this property is shown on the map of Clay County by Prouty. He made no comment. Evidently it was an old mine.

Eley mine; NW¼ of SE¼ of Sec 27, T. 19 S., R. 7 E.—This location is shown on the geological map of Clay County by Prouty. Work was done on the property in 1899 and some machinery installed.

(The following mines are not strictly in the Idaho district.)

Harall Gold Mine; Sec. 34, T. 20 S., R. 6 E.—This location is about seven miles southwest of the Idaho district proper and was shown on the map as the Harold gold mine by Prouty. Smith (1, p. 72) stated that this mine (which he called the Haral) was said to be rich, but nothing had been done there for some time. Spencer, whose report was made in 1889, said that the mine owned by Mr. Harallson had only recently been reopened with the use of stamps and that the ore contained $3.00 or $4.00 per ton in gold. He mentioned the Shinker mine, "a mile or two away," as being in operation.

Prospect Tunnel; SW¼, Sec. 23, T. 21 S., R. 7 E.—This old tunnel is on the property of W. T. Harwell, and, according to reliable information, was made long ago by Cornish miners who were searching for copper. In 1930 a prospector reported rich gold assays from the tunnel. The opening was advanced about ten feet, but no vein was found which warranted working. There is no copper in the formation at this place.

CRAGFORD DISTRICT

This was called the Goldberg district by Brewer from the name of an old post office. The name here used is taken from the town Cragford, on the A., B. & C. Railway.

Manning placer; Sec. 25 and 36, T. 20 S., R. 9 E.—According to Brewer (p. 32), the old placer diggings in these sections along the branches emptying into Crooked Creek are landmarks of work done in 1830-1840. There are thin quartz veins on the property. Two samples taken from Sec. 36 assayed $23.03 and $10.42 in gold per ton.

Goldberg Mining Co.; SW¼ of Sec. 30, T. 20 S., R. 10 E.—The workings on this property as described by Brewer (p. 34) consisted of an open cut and, at another place, an inclined shaft following the dip of the formations. Assays of three samples taken by Brewer gave $5.14, $3.14 and $2.56 in gold per ton. The character of the ore is indicated by the presence of some arsenic and traces of antimony and copper. Brewer also reported some veins 6 to 15 inches in thickness cutting across the strike of the formations on a ridge to the north of the property.

Dawkins property; SE¼ of Sec. 2, T. 21 S., R. 9 E.—The openings in this locality lie between the forks of White Oak and Wesobulga Creeks. According to Brewer (p. 27), they were made prior to 1860. A stamp mill was operated there and the gold was saved by amalgamation.

Farrar property; NW¼ of SW¼ of Sec. 36, T. 20 S., R. 9 E.—On this land Brewer (p. 31) found a deep shaft, a cross-cut tunnel, and evidence of considerable work which had been done prior to 1860.

Bradford Ridge; NW¼ of SE¼ of Sec. 30, T. 20 S., R. 10 E.—The most extensive prospecting in the district which Brewer saw was on this land. He mentioned (p. 38) an open cut with a breast of 22 feet, a tunnel 100 feet long, a 50-foot shaft and other openings. A ten-stamp mill was run on this property for some time. All operations were abandoned soon after Brewer's visit. He reported seven assays from samples which he took gave the following values in gold per ton: $7.23, $7.75, $5.15, $5.70, $5.44, $3.99 and $3.99. The ore carried arsenopyrite where it was not weathered. These workings have also been called the Weaver mines. A partially dismantled mill stands on this property. It was equipped with a Huntington mill, Bartlett concentrator, Crawford extractor, jaw crushers, etc. The refractory nature of the ore below the zone of weathering made treatment in the mill unprofitable.

W. D. Mitchell's Pine Hill prospect; SE¼ of NE¼ of Sec. 30, T. 20 S., R. 10 E.—According to Brewer (p. 42), the work done here in 1896 consisted of an inclined shaft about 80 feet deep and some pits along the strike. A drift 100 feet long was run from the shaft at 40 feet below the surface. Cross-cuts showed an "ore body" with an extreme thickness of 14 feet and an average thickness of 6 feet so far as exposed. Some samples were quite rich, but a fair average for the ore showed it to be not over $5.00.

Teakle property; NW¼ of Sec. 29, T. 20 S., R. 10 E.—A deep shaft known as the Orum Pit had been sunk before Brewer's first visit to this

property. On a second visit in 1894 he saw a pit which had just been dug and which exposed a vein considered by him to be a continuation of the Orum vein 600 feet distant. An arastra was being worked on the property, but it soon shut down.

Morris property; Sec. 21, *T.* 20 *S., R.* 10 *E.*—On this property, according to Brewer (p. 45), a shaft 18 feet deep exposed the ore for 14 feet and was still in ore. Brewer also stated that the formation can be traced to the Tallapoosa River about a quarter of a mile to the northeast, where there are shoals.

Grissel property; Sec. 24, *T.* 20 *S., R.* 9 *E.*—A vein of hard quartz was prospected to a depth of 30 feet on this land. Near the surface, according to Brewer (p. 47), some rich specimens containing free gold were taken from the vein where it was only six inches thick. As sinking continued, the values were less, and some of the quartz carried no gold.

Other properties in this district mentioned by Brewer are *Wild Cat Hollow* (p. 44), Sec. 29, T. 20 S., R. 10 E.; the *Bradford fraction* (p. 33) in Sec. 30 adjacent and the *H. S. Bradley land* (p. 46) in Sec. 30, T. 19 S. R. 9 E.

Brewer says some prospecting was done in Randolph County around Wedowee and along the Little Tallapoosa, but he gave no localities. He mentions a prospect near Omaha in Sec. 32, T. 19, R. 13 E., which did not give encouraging results. There was a mine on Wedowee Creek, northwest of Wedowee. These localities lie outside of the Cragford district and are not shown on the map.

TALLAPOOSA COUNTY

This county (see Pl. 3) includes four gold districts, namely: Devil's Back Bone, Eagle Creek, Goldville and Hog Mountain. The Goldville district, which is about 14 miles long, was a scene of great activity in the early days and is said to have had a population of 3,000. The mines in the Devil's Back Bone and the Eagle Creek districts, which occur at varying intervals along a narrow belt of slates, have been less important. Hog Mountain is unique for Alabama in that the veins are in granite. It was at this place that cyaniding was introduced in the State for the recovery of gold.

Geology.—The rocks in the southeastern part of Tallapoosa County (see Pl. 3) have been classed as Archean, with younger intrusives and

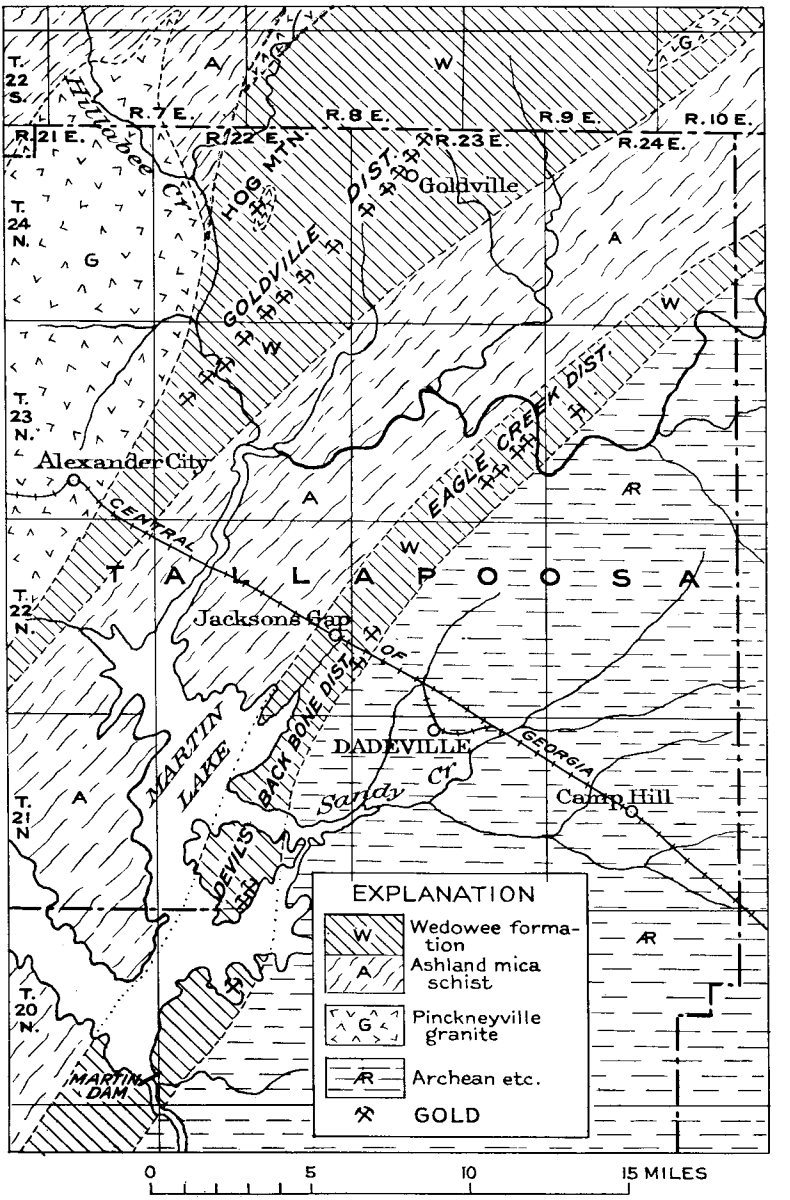
T. 22 S.
T. 24 N.
T. 23 N.
T. 22 N.
T. 21 N.
T. 20 N.
R. 7 E.
R. 21 E.
R. 22 E.
R. 8 E.
R. 23 E.
R. 9 E.
R. 24 E.
R. 10 E.
Hillabee Cr.
HOG MTN.
GOLDVILLE DIST.
Goldville
GOLDVILLE DIST.
EAGLE CREEK DIST.
Alexander City
CENTRAL
TALLAPOOSA
Jacksons Gap
BACK BONE DIST.
MARTIN LAKE
DADEVILLE
GEORGIA
Sandy Cr.
Camp Hill
DEVILS
MARTIN DAM
EXPLANATION
W Wedowee formation
A Ashland mica schist
G Pinckneyville granite
AR Archean etc.
GOLD
0
5
10
15 MILES

PLATE 3

infolded metamorphics. No gold deposits were known in the part of the State in which these rocks occur.

The metamorphosed sedimentaries which compose the Ashland and Wedowee have been subjected to thrusting from the southeast and the planes of schistosity dip towards the southeast. There has been close-folding and faulting repetition of these rocks. The belts of these formations are presumably limited by faults. The Ashland mica schist, adjacent to the southeastern belt of the Wedowee, contains intrusions of biotite augen gneiss, which are not shown on the map. This augen gneiss does not seem to be related in any way to the gold-bearing veins of the district. In discussing the sections of the gold belt to the northeast of Tallapoosa County, it has been explained that there were two periods of thrust-faulting and that in the later period the Pinckneyville granite was intruded between the Wedowee and the Ashland. This relationship is shown to the north of Hog Mountain (see Pl. 3). The broad area of granite in the western portion of the map is a portion of a mass which extends 45 miles to the southwest, where it is overlapped by the Upper Cretaceous, which limits the crystallines in that direction. The granite was also intruded in the Ashland and the Wedowee.

Metallization.—In Hog Mountain, which is a granite mass intruded in the Wedowee, the gold-bearing veins occupy fissures which appear to have been formed by the shrinkage of the granite on cooling. The veins were probably formed by the rising of solutions which were differentiated from the regional magma at abyssmal depths. If this interpretation is correct the veins in Hog Mountain are the key to the question of the age of the metallization. The granite is considered to be post-Carboniferous, and the veins were formed very shortly after the intrusion of the granite. It is reasonable to suppose that the regional magma was also responsible for the veins of the Goldville district, which is in the area of the Wedowee nearby. Since there are granite intrusions at many places in the gold belt and pegmatite dikes, which are presumably related to deep-lying masses of granite, are also widely distributed in the belt, it seems reasonable to conclude that there was but one period of metallization which shows some variations with locality and the depth to which erosion has exposed the veins.

In Tallapoosa County the gold is commonly associated with pyrite, excepting at Hog Mountain, where pyrrhotite is present. In other localities already discussed the metallization introduced, arsenic and minor amounts of zinc and lead. In discussing the next section of the gold belt it will be shown that there is an occurrence of tin related to the granite.

DEVIL'S BACKBONE DISTRICT

It will be seen by reference to the map (Pl. 3) that this district lies in a belt of the Wedowee formation. The southern end of the belt lies in Elmore County, west of the Tallapoosa River. East of the river the belt runs in a northeast direction with a slightly compound curve and, crossing the river again in the northeastern part of Tallapoosa County, continues into Chamber County. Martin Lake, formed by the back-water of the Tallapoosa River above Martin dam, now floods a considerable portion of the belt in the southern part of Tallapoosa County.

The rocks which compose the belt are principally slates, phyllites, quartzites and schists. They are largely of sedimentary origin, judging from the distribution of the quartzites and the bands of graphitic slates and phyllites. The beds have been closely folded and faulted so that for the most part they dip at steep angles toward the southeast. The strike is with the trend of the belt of the formations. In the middle section of the belt some heavy beds of quartzites are conspicuously exposed in a ridge, known as the Devil's Back Bone. On the ridge south of Jackson's Gap there is a profusion of large pieces of quartz which have been derived from the breaking down of heavy barren veins. Graphitic beds and quartzites are important in the middle section of the belt, but in the northern and southern portions schists dominate.

The veins which are auriferous are stringer-veins dipping approximately with the slates and schists. Veinlets, some of which are paper thin, lie along the planes of schistosity of the graphitic slates and the schists. The principal veins are variable in thickness and lenticular in form. The veins and veinlets have a net-like relationship within the slates and schists. At and near the surface there is free gold, but in the unweathered portions the gold is associated with pyrite.

Placer deposits.—The auriferous gravels along the streams which cross the Devil's Back Bone were largely worked out, and now most of them are flooded by Martin Lake. They were not of great importance. Phillips reported (p. 63) Long Branch and Owl Hollow in the central portion. Tuomey noted the Morgan mine on a branch which enters the Tallapoosa in the northern section of the ridge. Brewer mentions (p. 8) Channahatches, Peru Branch and (p. 7) Kielijah (Kowaliga) Creek in the southern part in Elmore County. In the early days all of these localities yielded some gold, most of which was recovered by pick and pan.

Silver Hill mine; Sec. 16 *and Sec.* 17, *T.* 20 *N., R.* 22 *E.*—In the early days gravel was washed on the branches in this locality, and Phillips stated

(p. 55) that mining was carried on there as far back as 1835. Tuomey reported (p. 47) that about 1845 the mine was in its most prosperous condition. The principal vein, which has a course a little north of east, was about two feet thick at the surface, but was thinner and richer at 12 feet in depth. At 15 feet it became poorer and then thickened to 4 or 5 feet. The workings extended 80 feet in depth in the center of the tract where the vein was richest. The ore there was reported to be worth $4.85 per bushel (this would be about $96.00 per ton, taking the bushel at 100 pounds). Tuomey stated that, while an adit was being driven, ore from the top of the hill was hauled 250 yards to the mill, where there were six stamps and a badly constructed Burke Rocker. This ore yielded 12½ cents per bushel ($3.50 per ton). He also reported that his assistant, Mr. Lieber, who visited the mine later, found a Georgia company working the mine with a prospect of success. The slates in which the quartz vein occurs were being worked. The company had driven two adits, one of them 400 feet long. Quartz beds on the opposite (south) side of the branch were also being worked. Tuomey gave a sketch section showing talcose slates with quartz veins and dark colored talcose slates lying between hornblende slates and a second sketch indicating quartz stringers in talcose slates.

Phillips, who visited the mine in 1891, stated (p. 59) that he could only confirm the report by Tuomey. He could not get into the workings, but found evidence of haphazard work. A letter from Major C. H. Parmalee, quoted by Phillips, states that it would be safe to say that the Silver Hill refractory ores would yield $25.00 per ton. In another letter the information is given that Prof. Emmons, State Geologist of North Carolina, made an examination of the unweathered vein at a depth of 90 feet "before the war," but this report was not received by Phillips. Major Parmalee also stated that the ore from the two shafts assayed from $15.00 to $50.00, and that the vein averages 18 to 24 inches. The values given in these letters probably represented "samples" rather than systematic sampling.

The writer had occasion to examine the property in 1924. The indications were that only the weathered portion of the vein was worked to any great extent and that the slates with the quartz stringers were milled extensively. The workings were not accessible since the property had long been idle. No provision for treating the refractory ores had ever been made, in so far as could be learned, and the yield obtained by amalgamation evidently was not profitable. The property is now partly flooded by Martin Lake.

Dent Hill prospect.—This property is situated half a mile northeast of Silver Hill. Phillips reported that it exhibited a mixture of schist and quartz in which he was unable to find more than $2.06 in gold per ton.

Gregory Hill Mine; Sec. 33, T. 21 N., R. 22 E.—Phillips states (p. 62) that the ore at this locality is a mass of graphitic schist holding numerous small seams of quartz. Panning gave coarse gold. Two samples of twenty-five pounds each when mixed and assayed yielded gold 3/10 oz., and silver 1/10 oz., or a value of $6.30 per ton. Major Parmalee was running a fifteen-stamp mill, the stamps weighing 450 pounds each. Brewer (p. 9) found that the hillside was being quarried, because it was impossible to separate the slate and the quartz in mining. The saving was $2.00 per ton. He expressed the opinion that twice the amount could be saved by a process that would eliminate the graphite before attempting to amalgamate.

Blue Hill property; Sec. 33, T. 21 N., R. 22 E.—This is a continuation of the northeast of the Gregory Hill property. Phillips (p. 62) found the value per ton of the one sample taken was $8.40. Only a little work had been done. Brewer (p. 9) took a sample from the Nichols opening at Blue Hill which assayed $8.66 per ton.

The writer examined these properties in 1924 and came to the opinion that the gold values in the loose surface material had been concentrated by weathering. The free gold from surface pits gave the values which were saved in the mill. A sample of the graphitic slate, which once contained paper thin veinlets of quartz and still showed very thin seams of quartz, was taken from a pillar which was left in a shallow incline and this gave $3.30. The lower portion of this property, and especially Gregory Hill, is now flooded by Martin Lake.

Bonner-Terrell property; Sec. 19, T. 22 N., R. 23 E.—According to Brewer (p. 10) a stamp mill had been run on this property, but had been moved away. The workings had caved in and he was unable to determine the extent or value of the ore. At the Preacher Gunn property in Sec. 30 some prospecting was done.

Holly prospect; Sec. 10, T. 21 N., R. 22 E.—This locality lies to the left of the old Dadeville-Young's Ferry road. Considerable work was done about 1911, but evidently it was not profitable. The venture is now referred to as a "wildcat."

EAGLE CREEK DISTRICT

Jennings property; SW¼ of Sec. 26, T. 23 N., R. 23 E.—This is the southwestern property in the portion of the Devil's Back Bone, which was called the Eagle Creek district by Brewer. Brewer (p. 12) found only shallow pits on this land. The decomposed quartz veins were six to eight inches thick and panned $3.00 to $4.00 per ton.

Tapley property; SE¼ of Sec. 26, T. 23 N., R. 23 E.—This was regarded by Brewer (p. 12) as a continuation of the Jennings property. Ore had been mined to a depth of 50 feet. The ore on the dump showed sulphides. The openings were numerous, but the timbering in them had rotted and they were inaccessible. Some of the ore was reported to have been treated in the Hammock mill on the property by that name.

Hammock property; SW¼ of Sec. 24, T. 23 N., R. 23 E.—According to Brewer (p. 13) this place had been mined about 1881. A stamp mill known as the Hammock mill was operated on a creek which flowed through the property. Ore from the mine dump assayed $7.50 per ton. It was hard quartz with sulphides. It was claimed that mining and milling were suspended because the ore could not be treated by amalgamation.

Greer property; SE¼ of Sec. 24, T. 23 N., R. 23 E.—The quartz lead on the Hammock land was reported by Brewer (p. 13) as traceable to these pits. The strike of the vein is N. E., and the dip S. E. 45°. Ore taken from these pits was treated in the Hammock mill.

Johnson property, W½ of SW¼, Sec. 17, T. 23 N., R. 24 E.—Old workings, consisting of tunnels and shallow-inclined shafts, are stated by Brewer (p. 14) to have been dug in 1840-1845. The outcrop of the quartz veins apparently extends a mile and a half. A sample of the ore yielded $3.43 per ton and panning showed the values ran quite evenly. The same lead, apparently, was traced to the Griffin property in Sec. 19, where, however, no work had been done.

GOLDVILLE DISTRICT

This district (see Pl. 3) lies in a broad belt of the Wedowee formation. The rocks in the zone, which constitutes the district, are graphitic slates, mica schists and garnetiferous schist. The strike of the formations is N. 30° E., and the dip is about 40° to the southeast. The district extends from the vicinity of the bridge over Hillabee Creek northeast of Alexander City for a distance of about fourteen miles in a northeasterly

direction to and a little beyond the cross-roads which marks the site where once was Goldville.

Auriferous veins are numerous in the district, and, although some of them are important and locally rich, they are stringer veins and the graphitic slates and schists carry many veinlets so that values are distributed in a zone. There were no very important areas of placer ground in this district but free gold, concentrated at the surface by weathering, made it possible to work profitably with pick and pan at some places.

According to Tuomey (p. 64) gold was discovered near Goldville in 1842 and was worked to the water level. A line of trenches, pits and shafts indicates the great amount of work done, most of which was performed prior to 1855. It is said that the district at one time had a population of about 3,000 and there were fourteen stores in Goldville. Phillips enumerates the following pits:

Birdsong Pits; SW¼ and NW¼ of Sec. 4, *T.* 24 *N., R.* 23 *E.*—In a letter from Col. B. L. Dean, of Alexander City, quoted by Phillips (p. 44), it is stated that the first work in the Goldville district was done on this land owned by Mr. Edward Birdsong, who between 1840 and 1850 carried on the mining with negro labor.

Jones Pits; Sec. 5, *T.* 24 *N., R.* 23 *E.*—On this property a great deal of work was done with wooden stamps and arastras. There was at one time a steam engine at the mine. Five samples were taken by Phillips: two assayed $2.06, one showed a trace, one showing pyrite and arsenopyrite gave $55.90, another similar $18.90.

Germany Pits; Sec. 8, *T.* 24 *N. R.* 23 *E.*—In this section Goldville was located, one of the oldest places in the county. The letter quoted by Phillips (p. 45) says that Mr. Germany made money working his pits.

Goldville Pits; Sec. 8, *T.* 24 *N., R.* 23 *E.*—Aside from the location no record has been found concerning this pit.

Houston Pits; Sec. 18, *T.* 24 *N., R.* 23 *E.*—Much work was done here, but nothing has been reported about the property.

Log Pits; Sec. 24, *T.* 24 *N., R.* 23 *E.*—According to Tuomey (p. 64) the richest part of the vein in this pit was from 2 inches to 4 feet thick and yielded 2½ dwts. to the bushel ($45.00 per ton). Almost $30,000.00 worth of gold was extracted from this pit and the proprietors received in addition $80.00 for silver. The mine had been recently re-

opened and a new vein discovered which yielded on the average $1.00 per bushel ($20.00 per ton).

Early Pits; SW¼ of Sec. 26, T. 24 N., R. 22 E.—From a letter quoted by Phillips (p. 45) it is learned that the ore from these pits was hauled two miles to water power, was crushed by four wooden stamps shod with iron and then washed in a rocker. The best run was said to have been $73.00 or $75.00. Work was suspended in 1845 or 1846. Two samples taken by Phillips each gave $2.06 per ton in gold.

Stone Pits; Sec. 34, T. 24 N., R. 22 E.—Concerning this pit, nothing besides the location has been reported, and it would be difficult to obtain information now that it has been abandoned for many years.

Croft Pits; Sec. 34, T. 24 N., R. 22 E.—This pit, like the Stone pit, has no record. Only the old workings give evidence of the work done.

Mahan Pits; Sec. 4, T. 23 N., R. 22 E.—Heavy sulphides were found in these pits, according to a letter quoted by Phillips (p. 45), and an assay of some ore sent away gave $22.00 per ton.

Ulrich Pits, Dutch Bend or Romanoff mine; Sec. 8, T. 23 N., R. 22 E.—These pits are on the east bank of Hillabee Creek. A large amount of work was done sinking shafts in search of copper. Phillips said (p. 39) that while digging a wine cellar gold was discovered. The strike of the slates on this property is N. 30° E., and the dip 40° S. E. There are six veins of quartz, the largest six feet and the smallest three feet in width. They are separated by bands of slate, and all are composed within a belt 300 feet wide. According to a letter quoted by Phillips (p. 46) a stamp mill was constructed which used water power from the creek. Some ore assayed in North Carolina is said to have given $21.00 per ton. Of the five samples taken by Phillips, three gave $2.06, one gave $8.36 and the other $8.46.

Later workings at this locality were called the Dutch Bend or Romanoff mine. The equipment included a 20-stamp mill and cyanide plant. There was some production in 1906.

Chisolm property; Sec. 9, T. 23 N., R. 22 E.—A sample taken from a six-foot vein at this place by Phillips assayed $2.06.

Duncan property; Three Miles from Alexander City on the Hillabee Bridge Road.—A sample taken by Phillips from a quartz vein 2½ feet wide gave $4.13.

Numerous pits besides these mentioned above were sunk, worked and abandoned in the early period. An important later attempt to mine in this district was at the Tallapoosa mine.

Tallapoosa Mine; SW¼ of SW¼, Sec. 26, T. 24 N., R. 22 E.— This mine was opened in the Goldville belt near the Early pits. McCaskey found in 1907 that the workings consisted of an inclined shaft 185 feet deep from which drifts were run on the vein. The surface ore had been largely stoped out to the water level at a vertical depth of about 40 feet. The vein which had been developed was from 6 inches to 4 feet thick. The walls were dark slates. The strike was N. 23° E. to N. 35° E., and the dip 45° to the southeast. The vein was somewhat banded in structure, consisting of alternations of white and blue quartz, with white and brown mica developed along the parting planes. Pipe-like masses of quartz were also seen. The vein swelled and pinched, parted and reunited and here and there crossed the planes of schistosity at slight angles.

The ore was free milling to the water level, and in part so, even below the water level where iron sulphide was present. The average value of the ore was reported to be about $16.00 per ton. The proceeds of treatment had been amalgamation, stamp milling, fine crushing and cyaniding. A modern plant was constructed, which ran only a short time before closing down pending the company's reorganization.

The writer discussed the Goldville district with Mr. Grant Lowe, who has had experience in several gold mines in Alabama, including the Tallapoosa mine. He was living a short distance west of the Goldville crossroads and was prospecting in the district on some lands which he had recently purchased, because he regarded the gold veins on them as valuable. From his conversation, it appeared that from $4.00 to $8.00 ore with occasional richer spots is about the general tenor of the best parts of the district.

HOG MOUNTAIN DISTRICT

The occurrence of gold in Hog Mountain has usually been discussed in connection with the Goldville district. The locality, however, is about three miles west of Goldville (see Pl. 3), and since most of the veins are in granite (see Fig. 3) it merits a separate discussion. The mountain reaches an elevation of a little over 1,000 feet and stands about 500 feet above Hillabee Creek. The granite which forms the core of the mountain has been intruded in the Wedowee formation, and the mass dips with the schistosity of the enclosing rocks. It has been shown by workings that the

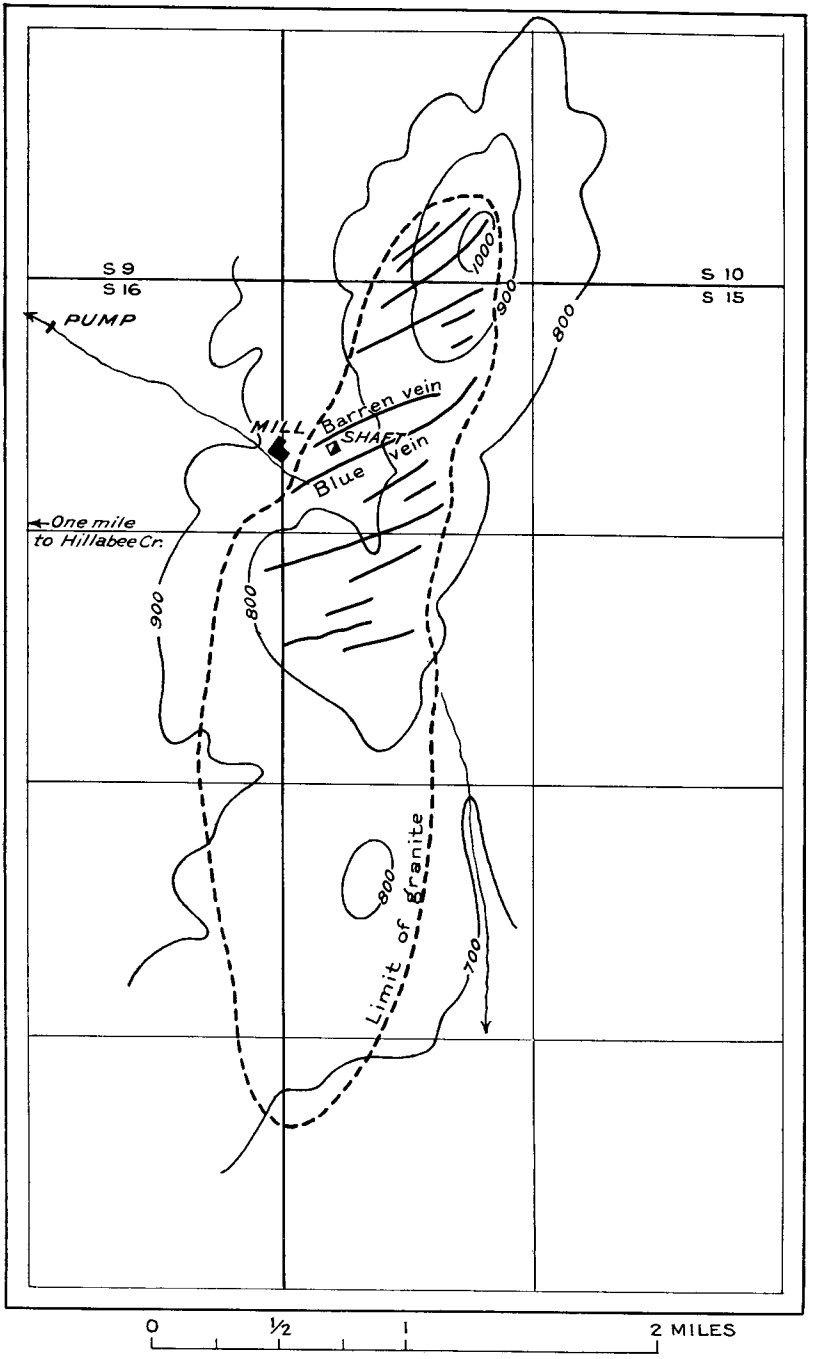
S 9
S 16
S 10
S 15
PUMP
MILL
SHAFT
Barren vein
Blue vein
One mile to Hillabee Cr.
1000
900
800
900
800
800
700
Limit of granite
0
½
1
2 MILES

FIG. 3

Wedowee slates extend under the granite for some distance on the western side of the mountain and that the granite extends under the Wedowee on the eastern side. Some prospecting has been done along the strike to the south of the granite, but no important veins have been found outside of the granite.

Hog Mountain or Hillabee mines; Secs. 10 *and* 15, *T.* 24 *N., R.* 22 *E.* —This mine has also been referred to as the Hogback mine. A letter quoted by Phillips (p. 46) states that at the south end of Hog Mountain ore was mined in 1844 and 1845 and that money was made, using the crudest appliances and hauling the ore to the creek with oxen.

Spencer stated that he visited the mine (1889) and that it had been worked during that year. There was an opening to the depth of 20 to 30 feet on a vein 4 to 10 feet wide and the vein had also been worked by an addit. There were two batteries of modern stamps on the property.

When Phillips visited the mines at Hog Mountain in 1891, there was a ten-stamp mill, California pattern, with engine and boiler on the property, but no work had been done for several years. He estimated that 500 tons of ore had been mined and milled. The ore near the surface was friable. The ore at a depth of twenty feet in the Blue Vein was quite hard and carried pyrite. Assays from samples which Phillips took at random from the old dump gave $58.67, $6.20 and $22.73, and one from the bluish quartz with a little pyrite, taken from the Blue Vein, gave $10.53. Letters which Phillips quoted (pp. 51-54) supply the following information: One assay gave $8.26 in gold and 36 cents in silver per ton. A barrel or ore sent to the St. Louis Testing Works for treatment gave $39.27 in gold and 10 cents in silver per ton. Many assays made in 1886 and 1887 gave from $2.00 to $31.00 per ton and averaged $7.50 per ton, and this was spoken of as representing the true character of the ore better than any other investigation which had been made.

In 1890 Hog Mountain was taken over by the Hillabee Gold Mining Company, of which T. H. Aldrich was president and T. H. Aldrich, Jr., manager. Soon after, a cyanide plant with six tanks was installed, designed to treat 75 tons of ore per day. Air drills were employed in mining and a Blake crusher and rolls were used for crushing the ore. In 1893 a 200 H. P. hydroelectric plant was constructed on Enantichopko Creek, a mile and half from the mine. Work was started on the Blue Vein and the Barren Vein. A shaft was sunk between these two to a depth of 110 feet and with a 15-foot sump. Cross-cuts from the shaft were run to the veins and ore, principally from the oxidized part of the veins, was mined

and treated. Various experiments were conducted in the treatment of the ore,[1] including heating in a revolving kiln which had the effect of causing the quartz to shatter, due to the expansion of the included gas bubbles. A large amount of work was done in prospecting the other veins in the granite. It was found that there are many small veins in the granite connecting the larger veins and that the granite in places carries from 60 cents to $1.25 in gold. Mr. T. H. Aldrich, Sr., told the writer that the oxidized ore assayed on the average $5.00 per ton in gold. The sulphide ore assayed from $6.50 to $9.00 per ton, but there was richer ore at the zone of gradation from oxidized ore to sulphide ore and in the shoots. The gold recovered by the company totaled $250,000.00.

McCaskey[2] reported that the fissure veins in the granite are apparently confined to that body and decrease in width on approaching the slates and pinch out at the contact or before reaching it. He found some pyrrhotite and traces of chalcopyrite in the ore and that the gangue quartz was of at least two generations. The older or "blue" quartz, somewhat glassy and smoky, evidently suffered strain and fracture before the introduction of the light colored quartz, which is free from inclusions, and does not have undulatory extinction. Near the walls of the veins foils of muscovite and veinlets of tourmaline occur in the quartz. The veins dip northwest at steep inclinations, and the ore shoots pitch north somewhat flatter than the veins.

The mine was closed in 1916 when, on account of the World War, cyanide could not be obtained and labor was drawn away into military service or employment at greatly increased wages. The mine might readily have continued in operation but for these reasons, since the supply of ore is large and the veins appear to be sufficiently well-defined in the granite to allow of systematic work.

CHILTON AND COOSA COUNTIES

The southwestern section of the gold belt of Alabama (see Pl. 4) includes portions of Chilton and Coosa Counties. By reference to the map it will be seen that the area of the crystallines is limited to the southwest by the overlap of the Upper Cretaceous (Tuscaloosa formation). There are two inliers, however, within the area of the Upper Cretaceous. The mines in this portion of the belt are not grouped in well-defined districts, and none of them have been very important, excepting, perhaps, the placers, which were worked in the early days.

[1]Aldrich, T. H., Jr., Trans. A. I. M. E., Vol. 39, 1909, pp. 578-583.
[2]H. D. McCaskey, Bull. 340, U. S. Geol. Survey 1908, p. 39.

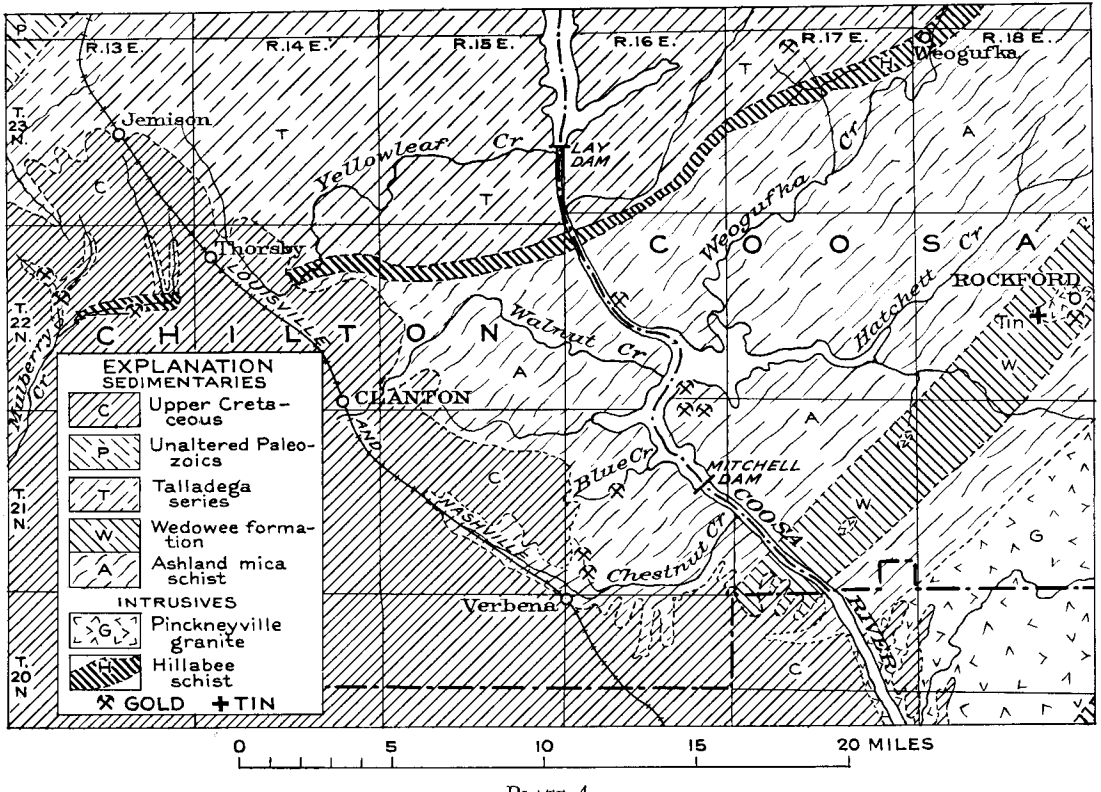
R.13 E.
R.14 E.
R.15 E.
R.16 E.
R.17 E.
R.18 E.
T. 23 N.
T. 22 N.
T. 21 N.
T. 20 N.
Jemison
Yellowleaf Cr
LAY DAM
Weogufka
Weogufka Cr
COOSA
ROCKFORD
Thorsby
OLD TOWN
CHILTON
Walnut Cr
Hatchet Cr
Tin
Mulberry Fork
CLANTON
BEELAND
Blue Cr
MITCHELL DAM
NASHVILLE
Chestnut Cr
COOSA RIVER
Verbena
EXPLANATION
SEDIMENTARIES
C Upper Cretaceous
P Unaltered Paleozoics
T Talladega series
W Wedowee formation
A Ashland mica schist
INTRUSIVES
G Pinckneyville granite
H Hillabee schist
GOLD
TIN
0
5
10
15
20 MILES

PLATE 4

Geology.—In this section of the gold belt there were probably two periods of thrust-faulting, although the evidence is less clear than it is to the northeast. In the first the Ashland mica schist belt was thrust over the Talladega on a fault plane along which the Hillabee sill was intruded and the Talladega was likewise thrust over the unaltered Paleozoics, which are shown in the extreme northwestern part of the map (Pl. 4). The intrusion of Pinckneyville granite presumably occasioned the second thrusting, but there are no low-angle faults, which are clearly referable to this event. It is interesting to note that there are small areas of the granite in the belt of the Wedowee formation to the west of the extensive granite area, a portion of which is shown in the southeast corner of the map. The gold localities occur in the Ashland, Wedowee, Talladega and the Hillabee and on the border of the area of granite at Rockford so that all the relationship of the gold deposits which were found to the northeast are repeated here, excepting that no gold veins have been prospected in the granite. The occurrence of tin (cassiterite) in the granite at Rockford is of special interest.

Metallization.—One period of metallization following the intrusion of the granite is adequate to account for the gold-bearing quartz veins of this section of the belt just as has been proposed for the sections to the northeast. No intrusions of granite have been found in the broad belt of the Ashland, but there are some pegmatites in it not far from the Hillabee sill, and it is reasonable to suppose that where there are pegmatites and quartz veins there is a deep-seated regional granite which furnished the magmatic extract which on ascending formed them. The occurrence of tin in granite is a usual type of metallization. Unfortunately the occurrence of tin is not important, excepting scientifically. There is considerable arsenopyrite and some copper sulphides in certain of the prospects, but the usual sulphide accompanying the gold is pyrite.

CHILTON COUNTY

Rippatoe placer; Sec. 17, T. 21 N., R. 16 E.—This locality is on Blue Creek, which is a short tributary of the Coosa River in the southeastern part of Chilton County. According to Phillips (p. 19) this was a famous property. Work began there in 1835 and was carried on irregularly for twenty-five years until the best gravels were worked over and the area nearly exhausted. Most of the miners left for the California gold rush and no gold washing of importance has been done since 1855. The valley has a width of not over two hundred yards and the lineal extent of

the workings is about one mile. The gravels were usually encountered at depths of from six to nine feet. Gold is reported to have been found in the creek bed under the edges of the slates. The locality is said to have yielded nuggets valued at $1.00 to $5.00. One worth $20.00 and another worth $70.00 are credited to the place. According to Phillips, the gold and gravel was derived by weathering and erosion from small quartz veins enclosed in pyritiferous slates and schists. He reported, as did also Smith (1, p. 29), that similar gravel on adjoining land in section 16 had been thoroughly worked over prior to 1860. A sample from a quartz vein which Phillips took in this section yielded $2.06 per ton in gold.

Rocky Creek placer; Sec. 30, T. 21 N., R. 16 E.—On Rocky Creek, two miles northeast of Verbena in the southeastern part of Chilton County, placer mining was carried on in the early days. Phillips (p. 18) reports that an experienced gravel washer obtained $200.00 worth of gold in ten weeks, and in one day secured $19.00 using a pick and pan. He also stated (p. 17) that a sample taken from a vein eight inches thick in the SW¼ of Sec. 29, T. 21 N., R. 16 E., which is near the Rocky Creek placer, yielded only $2.06 per ton in gold. The value in the veins are apparently variable and low. The placer gold is of local origin from quartz veins which are usually only a few inches thick, and the placer ground has been quite thoroughly worked over.

Mulberry Creek placer; Sec. 17, T. 22 N., R. 13 E.—Phillips (p. 15) reported that the most westerly exposure of the crystalline schists which he observed was near Honeycutts Mill in the section noted above. This old mill site is 13 miles west of Clanton in Chilton County on a branch of Mulberry Creek. The creek there has cut down through the Tuscaloosa (Upper Cretaceous) formation, and the underlying rock which is exposed is a bluish green schist, in places quite hard and crystalline. It strikes in a general east course, N. 75° E. near the mill, and dips 15° to 20° S. E. It frequently carries small veins of quartz from one-half of an inch to eight inches thick, running parallel to the schistosity.

The writer identified this exposure as the Hillabee schist and mapped it, and another larger area, and also the accompanying Talladega schists, as an inliers in the Tuscaloosa formation as shown on the accompanying map (Pl. 4). This is a correction which should be noted on the geologic map of the State.

Phillips stated that the gravels of this branch of Mulberry Creek had been worked for gold from a point about two miles below the mill for some distance up the stream and that small tributaries have some gold along them.

The Franklin, or Jemison mine; NW¼ of the SW¼ of Sec. 8, *T.* 22 *N., R.* 13 *E.*—These pits, which are not very extensive, are on a small tributary of Mulberry Creek and in the Talladega formation. The writer found the remains of a ten-stamp mill near them. Evidently not much work was done at this locality. The quartz found at the pits and at the mill showed cavities from which pyrite had weathered out. Evidently the ore which was milled carried free gold and apparently some gold was found in the schists since the mineralization is diffused by stringer leads. The Mineral Resources of the U. S. for 1923 states that work was done at the Jemison mine that year.

B. T. Childers prospect; NW¼ of the SE¼ of Sec. 15, *T.* 22 *N., R.* 13 *E.*—On the south bank of the creek at this locality on the land of B. T. Childers, a new prospect had been opened a short time before the writer visited the place in 1929. It is in the typical Hillabee schist. The mineralized veins are approximately parallel to the schistosity, and there is pyrite in the schist. The quartz veins are rather bluish and carry pyrite with a little arsenopyrite and chalcopyrite. On exposure, the ore develops a bluish or greenish coating, which gives a misleading impression as to the copper content. The ore minerals look interesting, but a selected sample showed only a trace of copper, a little arsenic, and gold values which are too low to warrant the working of the deposit. The veins are irregular, seldom more than a few inches in thickness, and so distributed in the Hillabee schist that they cannot be mined systematically.

COOSA COUNTY

Hatchett Creek placer.—The following information is taken from Tuomey (p. 76), who quotes from a report to him by his assistant, Mr. Lieber: Work at the Miller Mines was begun in 1840, but work was carried on only when there was no other employment. As many as fifty hands worked there in 1843. Six or eight hands during the summer of 1847 averaged from 75 cents to $1.00 per day. This was perhaps the last systematic work done there.

Weogufka Creek placer.—Concerning this deposit there is the information in the report by Tuomey (p. 76) and his assistant, Mr. Lieber, that the gravels pan from four to twenty particles of saveable gold. If the report is correctly interpreted, this was on the lands of Thomas and Samuel Lambert.

Rockford Placer.—Tuomey states (p. 74) that an auriferous deposit of gravel and clay near Rockford was once washed. Brewer (p. 30)

states that gold has been obtained by washing in the bed of Gin-house Branch, as also in Carroll and Pole Branches.

Alum Bluff locality; Sec. 35, *T.* 22 *N., R.* 16 *E.*—Phillips reported (p. 25) that on an elevation near the mouth of Hatchett Creek an eight-foot vein of quartz carrying decomposed pyrite was found, striking N. 30° E. and dipping S. E. 40° with the enclosing schists. A sample gave $15.40 per ton in gold and a sample of the wall rock gave $7.30. The schists are impregnated with sulphates of iron and alum rising from the action of sulphuric acid derived from the decomposition of pyrite.

Gold Ridge Mine; Sec. 1 *and Sec.* 2, *T.* 21 *N., R.* 16 *E.*—This ridge, according to Phillips (p. 26), was prospected for copper and gold in 1855 and for copper and graphite in 1872-3. A considerable amount of work was done. A sample from a four-foot vein gave $3.35 per ton in gold.

Flint Hill locality; Sec. 17, *T.* 22 *N., R.* 16 *E.*—Of four samples taken by Phillips (p. 26) from a heavy quartz vein, only one showed more than a trace of gold and it assayed $4.13 per ton in gold.

Rockford Mine.—In the southeastern limit of the town of Rockford there was an old pit sunk some time between 1840 and 1850. According to Brewer (p. 30) the quartz vein is six feet thick and is in slate. The strike of the vein is N. 3° E., and the dip is S. E. 40°. It was worked with some profit near the surface. An assay gave 6/10 oz. of gold and 3/10 oz. of silver per ton, or a value of $12.40 per ton.

Stewart or Parsons Mine; Sec. 4, *T.* 23 *N., R.* 17 *E.*—According to Tuomey (p. 73) the auriferous part of the ridge in this locality is about 200 feet wide and was first worked by open cuts; but the ridge was perforated by shafts, at intervals, for a distance of one-half mile. The mine was equipped with stamps, but work had long since been abandoned. Masses of bronze-colored pyrite occur in the refuse. The workings lie about one mile northeast of the locality known as Goldbranch.

STATISTICS OF GOLD PRODUCTION IN ALABAMA

There does not appear to be a record of the first gold production in Alabama, but the date of discovery is usually given as 1830. The amount of gold which was produced from the time of the early excitement until the miners were drawn away to California in the gold rush of '49 was probably something more than $350,000, but the details of the production of this first important period are lacking.

From the time of the California rush until the Civil War, the production of gold in Alabama continued in a small way, and after the Civil War the industry moved very slowly until the period of prospecting for copper, which led to the discovery of the Wood's Copper Mine in 1874, stimulated interest in the gold deposits. The richest placer deposits and the free gold in the surface portions of the vein deposits had been largely worked out, and consequently production was hindered by the difficulties incident to the recovery of gold by amalgamation from the ores of the deeper zone which contained sulphides.

During the years 1880 to 1903 for which statistics are available, the annual production of gold ranged from $1,000 to $6,000, but in 1904 there was a sudden increase to $29,288. This was largely due to the introduction of cyaniding at the Hog Mountain mine which, up to the time it closed because of the World War, produced about $250,000 in gold. The second important period of gold mining in Alabama was practically co-extensive with the activities of this mine, and others which also used cyaniding. During this period the total production was about $300,000 in gold.

The following table shows the official estimate of the total gold production of Alabama for the years 1830 to 1879, inclusive, as $365,300, and gives the annual production from that time forward to 1917 as reported in the Mineral Resources of the United States published by the U. S. Geological Survey. Since 1917 the gold production has amounted to only a few hundred dollars. The Mineral Resources of the United States for 1928, published by the Bureau of Mines, gives the total production of Alabama from 1830 to 1928 as $766,746.

VALUE OF GOLD PRODUCED IN ALABAMA

1830 to 1879	$365,300
1880	1,000
1881	1,000
1882	3,500
1883	6,000
1884	5,000
1885	6,000
1886	4,000
1887	2,000
1888	5,600
1889	2,639

1890	2,170
1891	2,245
1892	2,419
1893	6,369
1894	4,092
1895	4,635
1896	6,495
1897	8,455
1898	6,578
1899	4,766
1900	2,618
1901	3,773
1902	2,938
1903	4,894
1904	29,288
1905	41,530
1906	24,921
1907	25,982
1908	41,208
1909	29,239
1910	33,533
1911	18,916
1912	16,724
1913	11,094
1914	11,970
1915	5,243
1916	8,650

Beginning with the year 1904, the reports on the mining industry in the "Mineral Resources of the United States" give more details concerning the individual states. The following information concerning Alabama, extracted from the reports, is presented here because of the historical interest. More particularly it shows the tenor of the gold ores which were mined the period when deeper mining was carried on. It should be borne in mind that there are no silver mines in Alabama, and that the statements concerning the silver production refer to silver recovered in refining the gold which was sold to the mint.

1904.—Alabama is credited with a production of 1,417 ounces of gold, valued at $29,288, and 200 ounces of silver. This was presumably largely from the Hog Mountain mine.

1905.—The production of gold in Alabama was 2,009 ounces, valued at $41,530. The silver production was 336 ounces. One placer and two deep mines were in operation. The placer yielded 50 ounces of gold. Dry or siliceous ores from the deep mines yielded 1,959 ounces of gold. The average value of gold and silver per ton of ore from the deep mines was $2.46.

During the year the Clear Creek Gold Mining Company experimented with a small dredge, but their operations were discontinued. At Hog Mountain the Hillabee Gold Mining Company continued its successful career. The ore was treated in a 75-ton dry crushing plant, and this was followed by cyanide treatment. The Tallapoosa Mining Company became a producer.

1906.—The gold production in Alabama from dry or siliceous ores was 1,205.51 ounces, valued at $24,921. The silver production was 124 ounces. There was but a small production at the Dutch Bend mine in Tallapoosa, owing to suspension of operations in the middle of the year. The mine was equipped with a 20-stamp mill and a cyanide plant. The Tallapoosa mine reported no output, but a 55-stamp mill with 1,050-pound stamps and a 20-ton cyanide plant were in course of erection on the property. The Hog Mountain mine in Tallapoosa County was the principal producer.

1907.—The production of gold in Alabama for 1907 is given as 1,256.88 ounces, valued at $25,982. The silver production was 439 ounces. The sources of the gold were. placer, 2.03 ounces; dry or siliceous ores, 1,232.35 ounces; copper ores, 22.50 ounces. The sources of the silver were: dry or siliceous ores, 189 ounces; copper ores, 250 ounces. Some gold and silver were recovered at acid works by the treatment of the cupriferous pyrite ore from Pyriton. The principal output was from the Hog Mountain mine. The Tallapoosa mine was also producing.

1908.—The production of gold in Alabama for 1908 was 1,993.44 ounces, valued at $41,208. The silver production was 282 ounces. There were 3 placer mines and 2 deep mines in operation. The placers produced 45.72 ounces of gold and the dry or siliceous ores yielded 1,947.12 ounces. The dry ores mined totaled 11,174 tons, with an average value of $3.616 per ton. The Hog Mountain mines of the Hillabee Mining Company furnished the greater part of the gold production. There was a small production from the placers at Arbacoochee and Clear Creek. The Gold Ridge Mining Company produced some gold from the operation of their 20-stamp amalgamation mill.

1909.—The production of gold in Alabama for 1909 was 1,414.44 ounces, valued at $29,239. The silver production was 212 ounces. There were several small placer mines and 2 deep mines in operation. The dry or siliceous ores treated totaled 9,886 tons and showed an average recovery of $2.96 per ton. The production was almost wholly from the Hog Mountain mine, but a small production was reported from the Warwick mine near Talladega.

1910.—The production of gold in Alabama for 1910 was 1,622.16 ounces, valued at $33,533. The silver production was 268 ounces. There were 3 placers and 3 deep mines in operation. The placers yielded 17.27 ounces of gold. The dry or siliceous ores yielded 1,604.89 ounces of gold. The total of these ores mined was 9.763 tons, with an average yield of $3.41. The placer gold from Mud Creek and Clear Creek in Cleburne County was valued at $357. The production from siliceous ores was almost wholly from the Hog Mountain mine in Tallapoosa County. There was a nominal output from the Gold Ridge mine and a small yield from the Story prospect in Talladega County.

1911.—The production of gold in Alabama for 1911 was 9155.06 ounces, valued at $18,916. The silver production was 171 ounces. There were 2 deep mines which produced 6,360 tons of dry or siliceous ore, which gave an average recovery of $2.99. The output was mainly from the Hog Mountain mines. A small tonnage was treated at the Story prospect in a 5-stamp mill. Small trial shipments were made from the Holly prospect near Dadeville in Tallapoosa County.

1912.—The production of gold in Alabama for 1912 was 809.02 ounces, valued at $16,724. The production of silver was 168 ounces. The gold and silver production was from 5,693 tons of dry or siliceous ores, which gave an average recovery of $2.96. The output was chiefly from the Hog Mountain or Hillabee mines. A small tonnage was treated at the Story mine, and the Tallapoosa mine was operated for a short time.

1913.—The production for Alabama for 1913 was 536.67 ounces of gold, valued at $11,094. The silver production was 117 ounces. The tonnage of siliceous ores treated was 4,068, with an average recovery of $2.74 per ton. The Hog Mountain mine was operated a part of the year on a lease for experimental purposes, and the remainder of the time by the Hog Mountain Gold Mining Company. A small tonnage was treated at the Story mine.

1914.—The production of gold in Alabama for 1914 was valued at $11,970. The silver production was 199 ounces. This was mainly from 5,079 tons of siliceous ore, with an average recoverable value in gold and

silver of $2.28 per ton. The only placer gold reported was a small quantity obtianed by the Clear Creek Gold Mining Company from placers in Cleburne County. The placers were worked experimentally by means of a small dredge from May to December, when the plant was dismantled. At the Story mine, near Waldo in Talladega County, the Gold Log Mining Company treated a considerable quantity of ore in a 10-ton, 5-stamp mill by amalgamation. The mine and mill were operated intermittently during the year and considerable development was accomplished. At the Hog Mountain mine in Tallapoosa County an increased tonnage was treated in a 100-ton cyanidation and blanket concentrator plant after crushing in rolls and tube mill. Concentrates contained about 6.2 per cent of bismuth, but this was not paid for by the purchaser. The greater part of the ore was unoxidized, but a portion was from the oxidized zone, which extends from 40 to 60 feet from the surface. The quartz veins are in granite, and a little pyrrhotite is reported present. The quantity of gold recovered by cyanidation was slightly in excess of that derived from concentrates, and most of the small yield of silver was derived from concentrates shipped.

1915.—The production of gold in Alabama for 1915 was 253.62 ounces, valued at $5,243. The production of silver was 12 ounces.

1916.—In 1916 there were produced in Alabama 418.44 ounces of gold, valued at $8,650, and 53 ounces of silver. There were 11,063 tons of ore treated by amalgamation at two deep mines in operation, the greater part being from Tallapoosa County. There were 3 placer mines in operation.

Since 1916 there has been no important production.

COPPER

The search for copper in Alabama and the early successful mining of it in one locality is of considerable interest. The copper excitement led to a second period of exploration of the crystalline area for metallic deposits and a revival of gold mining.

There is little probability that important new copper deposits will be found, or that the mines which were worked will be reopened. The origin of the copper ore, however, is none the less interesting and is part of the general subject of the metallization of the crystalline belt in which there has been mining and prospecting since the first settlement of the area.

Occurrences of Copper Minerals.—At many of the gold mines and in the pyrite deposits sulphides of copper and alteration products from these sulphides occur in minor quantities. These attracted attention and excited the hope that copper deposits might be found. Prospecting for copper was also stimulated by the working of the Ducktown copper mines in Tennessee.

At Wood's copper mine there was found under the gossan a rich zone of secondary chalcocite. It was this ore which was marketed when the mine was first worked. It is referred to in the various quoted descriptions which follow, as "black earthy sulphuretted ore," "black oxide," and "black copper or oxide of copper." The reader should be careful to note that these terms are applied to the black or sooty chalcocite which resulted from the weathering of copper sulphides near the surface, the transfer of the copper downward in solution as sulphate, and the redeposition of the copper as a sulphide below the water level. Under the zone of the secondary chalcocite thus formed the ore consisted of unaltered sulphides which carried low copper values. Apparently it was impossible to work the unaltered primary ore at a profit, and this led to the abandonment of the mine. At the Wood's copper mine the amount of pyrrhotite appears exceptional. At Smith's copper mine, pyrite with some pyrrhotite is accompanied by some copper sulphides, but not enough copper was found to render the deposit profitable. These two localities, which are in the southern part of Cleburne County, are spoken of as being on the same lead. Their relations to the geological formations and the structure are shown on the map (Pl. 1) accompanying the discussion of the gold deposits in the first part of this bulletin. It appears from an examination of the surface geology and what can be seen around the old shafts, as well as from the descriptions of the mines which are available, that the copper deposits

are simply a special phase of the metallization of the belt of crystallines which gave rise to deposits of the other metallic elements.

First Wood's copper prospect; Sec. 31, *T.* 17 *S., R.* 11 *E.*—In the spring of 1854 Tuomey saw the first shaft sunk in Alabama for copper. It was the property of R. T. Wood and Co., and was described as the Wood's Copper Mine, but it should not be confused with the Wood's Copper Mine described below. Tuomey stated (2, p. 68) that copper in the form of carbonate was discovered in a branch near the mine. A trench was cut parallel with the stream and showed disseminated sulphides with some malachite. A vein of red oxide of iron was cut, but water caused the abandonment of the place. A trial shaft was sunk which likewise found disseminated copper, but no lode, and so the shaft was abandoned. No considerable portion of the bed was workable, although rich specimens were found.

Tuomey in the introduction of his report speaks of a wild excitement which seemed to have seized the public and of his efforts to restrain speculation. Evidently there were miners from Ducktown, Tenn., who were prospecting gossans. In a chapter on economic materials, Tuomey discussed the usual occurrences of copper, including the Ducktown deposits, and noted (p. 114) all of the then known minor occurrences of copper minerals in Alabama. He stated that, although no true lode was found by Mr. Wood, it appeared that the indications were sufficient to warrant a careful exploration at some expense.

The strike of the rocks at this locality was said to be nearly east and west and, although the slates were contorted, the dip was given as 35°, direction not stated. The following section was described.

a. Mica slate, filled with garnets, and presenting on the weathered surface rough, warty protuberances. The stratum is seventy feet thick.
b. Hornblende slate, containing a little copper.
c. A bed of quartz, 15 feet thick.
d. A dark colored mica slate, approaching to gneiss, six feet.
e. Copper-bearing slate, twenty feet thick.
f. Talcose rock.
g. Hornblende slate.

Stringfellow prospect; Sec. 19, *T.* 20 *S., R.* 7 *E.*—Concerning this locality, Tuomey (2, p. 72) made the comment that it is, perhaps, one of the most interesting points yet (1855) explored for copper in the State, more especially as it presents nearly the same association of minerals as

that found in Ducktown. He also stated (2, p. 113) that a shaft was sunk in a position to cut the lode eight or ten fathoms below the surface. Where it was struck the lode consisted of pyrite with a little chalcopyrite, with some showings of copper sulphate. He recommended that the superintendent should seek the black ore between the gossan and the pyriteferous bed. A thin seam was found containing only a small percentage of copper.

Smith (1, p. 73) stated that the lease expired without further development work. He recorded the strike as northeast and southwest, with a slight dip to the southeast, and described the lode as being between thick beds of slaty, arenaceous rock, with disseminated graphite. Northwest of the shaft the succession of rocks is, first, hornblendic gneiss, and next schist filled with garnets. Towards the southeast the graphitic schist continues to the foot of the hill.

Prouty in his report on Clay County, in which this prospect is located, makes no direct mention of the Stringfellow Mine. Evidently the prospect was abandoned. Under the discussion of pyrite some references are made to prospects in this general locality, but none of them contain important amounts of copper mineral.

Other prospects in iron gossans.—Some years before the Wood's copper mine described below was discovered (1874), and also at that time irisdescent iron oxide occurring at several widely separated localities excited the hope that copper could be found by prospecting.

Specimens of the iridescent iron oxide obtained by Dr. Smith and preserved in the collections of the State Geological Survey are interesting because of their beautiful play of colors. Smith states (1, p. 81) that at the mouth of Hatchett Creek in Sec. 2, T. 21 N., R. 16 E., the red, blue and green colors, which were due to a thin film which showed no reaction for copper, had excited prospectors to do some work. Work was also done for copper at the mouth of Chestnut Creek in Sec. 32, T. 21 N., R. 16 E. Another locality noted (1, p. 32) is Sec. 1, T. 22 N., R. 15 E. Smith also recorded (1, p. 79) that extensive beds of ferruginous tuffa or gossan showing iridescent films were prospected in Sec. 9, T. 24 N., R. 19 E., on Weoguffka Creek. An analysis showed .61% of sulphur which suggested the origin of the gossan from pyrite. He also noted (1, p. 71) that a shaft sunk in gossan in Sec. 3, T. 21 S., R. 6 E., encountered cupriferous pyrite in quartz, but only in small amounts.

Wood's Copper or Stone Hill Copper Mining Company mine; Sec. 35, T. 17 S., R. 11 E.—The first discovery of paying copper ore, accord-

ing to Smith (1, p. 46), was made in 1874, some twenty-five years after the first excitement which occurred when the Ducktown mines were opened. The property known as the Wood's Copper Mine has had an interesting history. The description of this mine as given by Smith (1, pp. 46-47) is as follows:

"At Wood's mines the country rock is a hornblendic gneiss, thick-bedded, and approaching syenite. The strata strike nearly due north and south, and dip east 40°45°. The surface indications here is the "gossan," a light, porous, brown oxide of iron, which is associated with a micaceous schist, highly colored with iron. The vein, if it be a vein, is a bedded lode lying between strata of the micaceous schist, which near the line of contact with the ore proper is more or less impregnated with the copper, and when thrown out soon becomes covered with efflorescences of the sulphates of iron and copper. The gossan overlies the ore, and a mundic, chiefly iron pyrites, lies below. This massive pyrites is the limit of all the excavations made here thus far. The ore itself is principally a black earthy sulphuretted ore, usually called "black oxide," with some pyrites, or copper pyrites. Occasionally masses of cuprite, or the red oxide, have been found, and rarely the native copper. A few very handsome specimens of malachite and azurite have been excavated; but all these ores, except the black ore and the yellow sulphuret, are comparatively rare. The shafts, five or six in number, at the time of my visit, are about twenty-five feet deep, and are sunk upon the lode at the distance of twenty feet from each other. The first shaft was sunk near the foot of the hill, the others higher up, but the average depth is the same in all—that is, the copper is found at the same depth below the surface of the ground, so far as it has been explored. The ore is hoisted by means of ordinary windlasses and buckets thrown upon a platform near the mouth of the shaft, where the best only is put up in sacks for shipment. The sacks of ore are hauled to Carrollton, in Georgia, about forty miles distant, and thence shipped to the market in Baltimore. The expenses of mining, carting and freight are about $35.00 to $40.00 per ton of 2,500 pounds. At Baltimore the ore brings, on an average, $60.00 per ton. Mr. Wood has been shipping his ore since May 1st, with a short interruption, and has sold during these four months about 300 tons at the price mentioned.

"There is of course much waste, since the lower grade ores are thrown aside as unprofitable, but it is the intention of the proprietor to erect works by which these poorer ores may be concentrated at the mine and thus fitted for shipment. Mr. Richard J. Wood, the owner of the mines,

has spent much time in the search for a paying ore of copper, and his success at last has certainly been well deserved."

In his second report Dr. Smith (2, pp. 184-188) gave an account of the operations at the mine since his first visit. The following quotations include what is pertinent to this report:

"Mr. Wood has erected one calciner, with a capacity of 6,000 lbs. of ore in 24 hours; one reverberatory, with a capacity of 1,200 lbs. of calcined ore in 24 hours. These two furnaces are calculated only to make a matte of 35 per cent. There is also a crushing mill of four stamps, with an engine of 30 horse power.

"It is in contemplation soon to put up two blast furnaces and a refiner, and to produce ingot copper on the spot.

"The amount of ore now lying in piles about the mouths of the shafts, and of the refuse from the ores shipped last year, is estimated to be about 800 tons. All this will do for smelting, and will probably average 8 to 10 per cent.

"Up to date (October 15, 1875) Mr. Wood has raised and shipped about 1,500 tons of ore averaging 15 per cent of copper, for which he has received $3.75 per unit of the percentage.

"All the wild rumors about the large amounts of silver contained in the ores are reduced to the simple fact that with the ores are found occasionally masses of rock impregnated to some extent with sphalerite or zinc blende, which shows a trace of lead and silver when carefully tested. The amount of sphalerite is extremely small, and the silver or lead in it a minimum.

"As was stated in my previous report, the vein is a bedded lode, with the richer black sulphurette ores (which are commonly called black oxide) lying between the 'gossan' above and the 'mundic' or solid pyrites below. As yet, only about 150 yards of the vein have been mined, and only the richer ores have been raised, except where the yellow sulphuret has been mined for smelting within the past few months. There has been no exploration of the vein by which either the thickness of the mass of cupriferous pyrites under the black ore or its depth is ascertained. It has been cut to a depth of twenty feet and a width of ten feet through the solid mass without reaching the limit of the vein in any direction, so that the probable amount of these pyrites, which averages about 9 per cent of copper, is very large. As far as the vein has been worked the higher grade ores have been taken out, but the great waste thus incurred has induced Mr. Wood to provide for the working up of all his material at the mine."

This property was examined by R. P. Rothwell and his report was published in pamphlet form, a copy of which is on file in the Engineering Societies Library in New York. Rothwell's description of the mine was also published in the Engineering and Mining Journal.[1]

The following quotations and illustrations, taken from the journal, contain the information which is of interest in this connection:

"The property of the 'Stone Hill Copper Mining Company' consists of about 294 acres of land, situated in Section 35, Township 17, Range 11 East, in Cleburne County, Alabama, on which are found two large deposits of copper ore, one of which only has been proved to any extent. The copper deposit consists of an immense bed of sulphuret ore, intercalated in a micaceous schist of Laurentian or Taconic (Emmons) Age. Near the surface the ores have been altered by atmospheric agencies and converted into limonite iron ore, which forms the 'iron cap' or gossan outcrop of the deposit. In a zone below this limonite, the copper, originally contained in the ore now converted into gossan, appears to have been collected by a leaching process. This concentrated ore, known as 'black oxide,' is a sulphuret containing over 30 per cent of copper. It forms a zone of variable thickness (seldom more than six or eight feet), which seems to follow, in a somewhat irregular manner, but always at a comparatively small depth, the contour of the surface. From its richness and the ease with which it is mined, when found in quantity this black ore has always been highly esteemed, and, indeed, has always formed the sole object of the pioneer mining in each of the copper mining districts where it occurs.

"The Stone Hill deposit is in its character and surroundings similar to the well known and often-described 'veins' of Ducktown, Tenn., Ore Knob, N. C., Carroll County, Va., and those so extensively worked in Vermont. The explorations of Stone Hill consist of an adit run in about 400 feet on the 'vein,' a slope down about 50 feet below this adit level, a few smaller exploration headings, and a number of trial shafts at intervals along the outcrop of the bed.

"The ore occurs in a bed which has been traced on its outcrop across a hill to about 150 feet in height above the lowest point upon the property, as shown on the accompanying map. The length of the bed thus proven is about 1,200 feet to the south of the entrance to the adit; and, no doubt, it will be found to extend in the opposite direction where the nature of the surface makes it impossible to trace it without shafting. The strike of the copper-bearing rock is N. 16° E., and it dips to the east at an angle of

[1]The Stone Hill Copper Mine and Works, Cleburne County, Ala. Eng. and Mining Journal, Aug. 4, 1877, pp. 86-88.

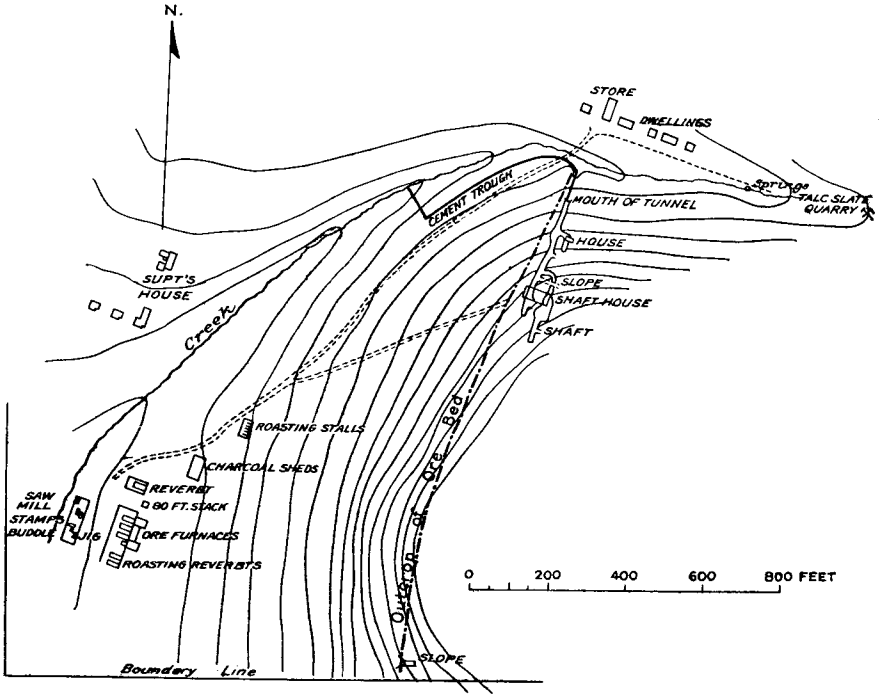
N.
STORE
DWELLINGS
Spring
TALC SLATE QUARRY
CEMENT TROUGH
MOUTH OF TUNNEL
HOUSE
SUPT'S HOUSE
SLOPE
SHAFT-HOUSE
SHAFT
Creek
ROASTING STALLS
CHARCOAL SHEDS
REVERB
90 FT. STACK
SAW MILL
STAMPS
BUDDLE
ORE FURNACES
ROASTING REVERBTS
Outcrop of Ore Bed
0 200 400 600 800 FEET
SLOPE
Boundary Line

FIG. 4

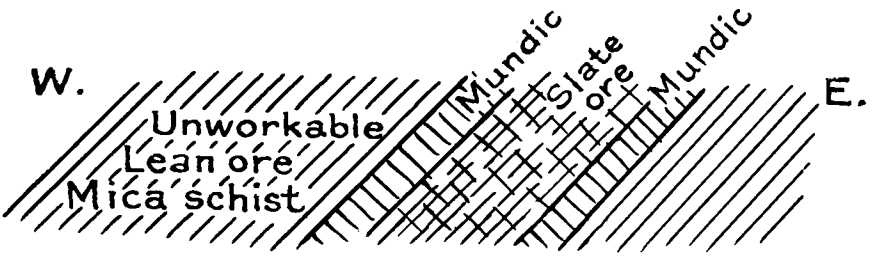
W.
Unworkable
Lean ore
Mica schist
Mundic
Slate
ore
Mundic
E.

FIG. 5

about 45°. Though the ore occurs in well-defined beds, yet the total thickness of the deposit is somewhat indefinite, the richer beds have an aggregate thickness of 25 to 30 feet, but above these occur series of schists similar to the central portion of the great ore mass, though with copper less abundantly disseminated through them; the beds becoming poorer the further they are distant from the central mass, till the thickness of this unworkable portion exceeds in places 50 feet, throughout the whole of which more or less copper pyrites can be seen.

"That portion of the cupriferous deposit which is worked, and is known as the 'vein,' is composed of three main divisions, shown in the accompanying sketch. The upper division is a mundic bed of from 3 to 3½ feet in thickness. The middle division, called among the miners the 'slate vein,' is from 15 to 20 feet in thickness, and is composed of micaceous schist impregnated with copper and iron pyrites, with the beds perfectly defined, and the ore pretty evenly distributed through them. It is noteworthy that the ore always conforms to the bedding of the schist, and, however then these bodies may be, it does not seem to cement them together; or, in other words, whatever changes have occurred in the mineral composition of the beds subsequent to their disposition must have been confined to the gradual replacement of one mineral by another, rather than any sudden injection of the present constituents, between the beds of the pre-existing rocks.

"Under the 'slate vein,' or middle and richest portion of the deposit, is found a bed of mundic varying in thickness from four to five feet.

"The richness of the ore varies irregularly in the bed, some places presenting nearly pure copper pyrites, running up to 30 per cent of copper, while in other portions, especially in the mundic beds, this percentage runs down to 3 or 4 per cent. * * * *

"The average yield of roasting ore was 7.37 per cent. If the picking and dressing were more carefully made, there would be no difficulty in bringing the percentage of the picked and dressed ore to 8 per cent copper.

"We have spoken of this ore body as a bed—not a vein—since its character seems to justify this definition.

"Whatever may have been the origin of this deposit, it was certainly the same as that of the Tennessee, North Carolina, and Vermont deposits, for in all essential characteristics they are almost identical."

From a review of the history of Wood's Copper Mine and an account of its later history by Brewer[1] the following quotations are taken:

"My purpose is to call attention to the conditions which have been ex-

[1]Brewer, Wm. M., Alabama Industrial and Scientific Society, Vol. 7. Pt. 1, 1897, pp. 13-16.

posed at the old Dick Wood's copper mine in the southern edge of Cleburne County, since it has been unwatered and the old workings thoroughly exploited. A brief review of the past history of the property may prove interesting, because it demonstrates the difficulty under which operations were carried on at these mines during their early development. The line dividing Cleburne and Randolph Counties passes through the property, leaving the buildings of the mine itself, in the first named and the old furnace and smelter in the last. The discovery was made about 1870[1] by Dick Woods, who purchased the tract of land on which the gossan outcrop occurred, and commenced mining and hauling the ore to Carrollton, Georgia, whence it was shipped to Baltimore for treatment. During 1874-75-76, I am reliably informed that from 200 to 500 names were carried on the payrolls, and the string of teams engaged in hauling would sometimes extend for nearly a mile along the wagon road. The mine was usually called the 'Wood's Copper Mine,' and the postoffice established for the convenience of the camp, 'Stone Hill,' while the company operating the property was designated as the 'Copper Hill Mining Company.' At about the same time copper ore was discovered on another tract of land about a mile northeasterly from Copper Hill, which was operated by ex-Governor Smith, and was known as the 'Smith Copper Mine.' "

"In 1876 the policy of hauling the ore for shipment was abandoned and the companies operating both these mines erected furnaces for smelting the ore and for refining the matte. The product shipped after this time until operations were abandoned, about 1879, was in the shape of ingots of refined copper. Of course, while the black copper or oxide of copper, with occasional sheets of native copper, was being mined in the shallow workings, the business was quite profitable as long as the policy of shipping the ore in its crude state was carried out, even after payment of the excessive freight charges for wagon haul and railroad to Baltimore. But when the smelting was attempted in the primitive method adopted, and with almost inexperienced metallurgists in charge, it was found that instead of being a more economical policy it was really the opposite. Consequently, when the black copper was mined out, and pyrrhotite, iron pyrites and chalcopyrites or copper pyrites took its place as depth was attained in the mine workings, instead of being able to conduct the operations profitably as in the earlier days, the companies discovered that losses resulted to such an extent that in 1879 the mines were shut down and the properties abandoned. I am informed that during the years the Copper Hill mine was operated the old books show that $1,300,000, in

[1]Dr. Smith gave the date as 1874, which appears to be correct.

round figures, were realized from the sale of ore, matte and ingots of copper. It is claimed also that no attempt was made to save any value from the ore except the copper, although by assaying it was shown to carry also gold and silver.

"From 1879 until the spring of 1896 these properties remained idle, the buildings were allowed to go to ruin, and what machinery was not moved away fell a prey to rust and weather. But during the spring of 1896 some western men leased the Woods mine, organized a new company under the title of "The Copper Hill Mining Company," and commenced work by unwatering the old mine workings preparatory to resuming work, if the ore body proved, on investigation, to be of sufficient extent, and the ore of high enough grade to warrant such action. Recently I visited this property and found that the new management was doing work of such a character as should command the praise of all who are interested in the development of our mineral resources. The old workings, which extended to a depth of about eighty feet with the dip of the ore body, consisted of an incline shaft, drifting and stoping from that level to the surface, about twenty feet of thickness, and for a distance of eighty feet along the line of strike. These workings had been full of water from 1879, and consequently the mere work of unwatering had been quite an undertaking, especially when it is considered that the present management spent its money merely on tradition, and had no means of ascertaining anything about the property, except from the out-cropping, until the work of pumping out the water had been accomplished.

"At the time of my visit their work of continuing to sink the incline shaft to greater depth was being carried on. A shaft house had been erected which was furnished with hoisting and pumping machinery of sufficient capacity to carry on the work of developing the property to at least a depth of 300 feet. The first shaft on the property had been sunk on the ore body with the foot walling of that body for the lower wall of the shaft, the upper wall of the shaft being in ore. When the new work was commenced the ore body was first cross-cut to the hanging wall at the bottom of the shaft on the 80-foot level, and sinking was resumed with the hanging wall of the vein for the upper wall of the shaft. This policy, the management informed me, would be continued until a depth of 200 feet had been reached in the mine, when a cross-cut would be made back to the foot wall, and an up-raise to the old working. * * * *

"The ore body as cross-cut by the present operators is about 24 feet in thickness. The richest ore is found next to the hanging wall and foot wall, while the center of the body of some ten feet in thickness is of a

much leaner character. The superintendent informs me that about ten feet of the ore will average more than 7 per cent in copper, besides an appreciable value in gold and silver, while the entire body would average probably about 3 per cent. Since my visit a quantity of sorted ore has been hauled to the Southern railroad at Heflin, a distance of about twenty miles, and shipped by carload lots to the Buhlbach smelter at Newark, N. J., for treatment."

In September, 1897, after the development by the Copper Hill Mining Company, which is referred to just above in the extract from the article by Brewer, C. L. Constant made a report on the Woods or Stone Hill mine to the Lewisohn Brothers of New York.[1]

The following is extracted from the report:

"The ores are very similar to the Ducktown ores, with the exception that the Stone Hill ores carry notable quantities of silver and a little gold. At the surface I found oxides and carbonate of copper, changing into sulphides as depth is attained. The sulphides consist of chalcopyrite, pyrites and pyrrhotite, somewhat streaked in their occurrence; and it is upon these that the value of the property must be based.

"The equipment comprises a store house 36′ x 55′, substantially built and covered with iron; a boiler and hoisting engine and a steam pump sufficient to carry the shaft to a depth of 300 ft. The water is very acid, but is not greater in quantity than can be handled in two hours per day.

"The development consists of a shift 8′ x 11′ vertical for the first 40 feet, thence dipping east with the ore body to a total depth of about 212 feet. Only the first forty feet are timbered. The ore is hoisted in a bucket at present.

"The shaft passes through the gossan into sulphides to a depth of 113 feet, at which there is a drift running into the old works. This appears to be the lowest point reached by the old managers. At this point the new work was begun, the first thing encountered being some 10 feet of very hard rock which forms a cap over the vein, cross-cutting it. Below this a strong vein of sulphides was found, and the shaft was continued down to about 212 feet, being all the way in ore.

"No drifting was done with the exception of short 10-ft. drifts north and south from the bottom of the shaft.

"A cross-cut was run at the south drift to determine the width of the vein. This is about 30 feet. The hanging wall was not yet reached. Of this 30 feet, about 25 feet are good vein matter, the remaining distance—

[1]The Geological Survey of Alabama is indebted to E. J. McNamara, of 11 Broadway, N. Y., for a copy of this report and the subsequent reports by C. S. Herzig and Charles Mentzel, who represented the Lewisohn interests.

that towards the hanging wall—being mineralized schists, rather than lean as regards copper.

"Piled up in front of the shaft house I found an ore dump which I judge to contain nearly 1,000 tons of ore. My sample assayed:

Copper, wet assay	4.07%
Silver	3.10 ozs. per ton
Gold	0.02 oz. per ton

"As two carloads of selected ore had previously been sorted out and shipped away, I think my sample should certainly not be richer than a fair average of the last 100 ft. of the shaft.

"I took a second sample from the cross-cut from the bottom of the shaft. This sample was drawn from the entire 30 ft. and included the mineralized schist, which in actual mining operations would be set aside for concentration or thrown away entirely. This sample yielded:

Copper, wet assay	2.93%
Silver	2.49 ozs.
Gold	0.01 oz.

"A sample taken from the old slag dumps, not including any of the numerous old furnace bottoms, assayed:

Copper, wet assay	3.71%"

The following is extracted from a report dated October, 1899, by C. S. Herzig, Superintendent:

"When we commenced operations, the bottom of one shaft was about 4 feet in the hanging wall, and in sinking it we changed its direction and soon encountered a smooth wall having a dip of about 70°, and we ceased sinking to drift north and south for purposes of exploration, any such change in the direction of our skidway would certainly handicap our hoisting operations. Up to the time of the change in the dip of the ore in the shaft showed up very well averaging higher than heretofore.

"We have driven the drifts north and south at the 220-foot level and now have a length of about 80 feet exposed from end to end. The ground hereabouts shows considerable geological disturbance and the faces of these drifts do not look well; however, I hope that the next few days' work will show an improvement.

"On the 140-foot level we have about 110 feet from end to end and we have encountered some good ore. The shaft is down some ten or twelve feet below the 220-foot level."

From a report by Chas. Mentzel, E.M., dated 1917, the following information is transcribed:

"A Mr. Detrick operated in 1897. Mr. J. Parke Channing took charge in 1898 and ran for one year. Since 1897 the mine has been abandoned. * * * * On the dump are a few tons of mineral somewhat weathered. The clean fracture shows this to consist of pyrite, marcasite and pyrrhotite in which chalcopyrite is deposited in varying amounts. The copper mineral was very probably deposited after the primary mineralization of the iron sulphides took place. There are also pieces of mineral that are evidently replacement of the original schists, the texture of the latter being preserved, but this metasomatic action is very common in vein deposits and we cannot expect it here to be the principal type of mineralization. Judging from the structure of the country, we may expect the ore bodies to be of lenticular type as is very frequent in sulphide deposits in schists, and maintaining the general strike and dip of the country rock. The remains of a stamp battery and the quartz tailings from this indicates that a part, at least, of the ore is siliceous in character. There is no lime deposit in the immediate vicinity. Lime would be necessary to smelt this type of ore."

Weed[1] published a paper in which he used the description of the Wood's Copper Mine by Brewer and the information given by Rothwell, classifying the deposits as of the Ducktown type. Later Weed[2] discussed the Alabama copper deposits, quoting descriptions of the Stone Hill (Wood's) mine and the Smith Mine. He erroneously gave the date of discovery of the Wood's mine as 1870 and apparently made the mistake of assigning to the Smith mine the production which came from the Wood's mine.

Emmons and Laney[3] have concluded that the Ducktown deposits are the result of the replacement of limestones. At the Wood's Copper Mine no limestones have been found and limestones are not known to occur in the formations of the district. It has been shown[4] that limestone were replaced at the Tallapoosa (Waldrop) pyrite mine

[1]Weed, Walter Harvey, Types of Copper Deposits in the Southern United States, American Institution of Mining Engineers, Vol. 30, 1900, pp. 449-504.
[2]Copper deposits of the Appalachian States, Bull. 455, U. S. G. S., 1911, pp. 157-160.
[3]Prof. Paper 139, U. S. Geol. Survey, 1926, p. 64.
[4]Schearer and Hull, Pyrite Deposits of Georgia, Bull. 33, Geol. Survey of Georgia, 1918, pp. 68-79.

(with copper) in the northeastern part of Haralson County, Ga., about thirty miles northeast and in a formation which the writer believes to be the same as that at Wood's Copper Mine.

Further working of the Wood's Copper Mine might have revealed the presence of limestone, and shown it to be similar to the Tallapoosa mine and the Ducktown deposits.

Smith's Copper Mine; Sec. 25, *T.* 17 *S.,. R.* 11 *E.*—In his first report published in 1875 Dr. Smith, State Geologist, gave (p. 49) the following description of this property:

"One mile and a half, a little east of north of this mine (Wood's Copper Mine), a shaft was sunk before the war by Mr. Hightower; and since the war some work has been done there by Messrs. Wood and W. H. Smith. The ore raised has been chiefly iron pyrites, with a small percentage of copper, in some instances twenty or twenty-five per cent; but the proportion of the latter ore has been small. * * * *

"The rock cut in sinking the shaft is a very tough mica schist, full of imbedded garnets."

In his second report Smith stated (p. 187) that a new shaft had been sunk on this property, machinery set up, and preparations made for systematic work. He makes the comment that in the district many trial shafts had been put down, and that as in Tuomey's time, "practical miners from Ducktown" seemed to be the bane of the country.

In the history of operations at the Wood's Copper Mine, quoted previously in this report from an article by Brewer, a brief reference is made to the Smith Copper Mine, but there is nothing to indicate that it was an important producer. Apparently it was abandoned soon after the installation of the machinery which Dr. Smith reported was to be set up.

PYRITE DEPOSITS

Introduction.—Pyrite is one of the common minerals in the crystalline rocks and attracts attention because of its brass-yellow color. It has been called "fools gold." The composition of pyrite is FeS_2, and on oxidation it commonly yields limonite, which in some localities forms bodies of brown ore of the type known as gossans. Pyrite is the most common metallic mineral accompanying native gold in the mines and prospects of the gold belt. Frequently, however, there is no gold, or only a trace of gold accompanying pyrite.

In the Pyriton district, described below, pyrite has been mined commercially. It was used in the production of sulphuric acid at fertilizer plants. The deposits of the Pyriton district have not been exhausted, but they have ceased to be profitable. At the present time, sulphur produced in Texas and Louisiana supplies, for the most part, the demands of the fertilizer plants which manufacture acid for treating phosphate rock.

Origin of the Pyrite deposits.—In discussing the origin of the gold deposits described in the first part of this bulletin, it was argued that there was only one important period of metallization in the belts of crystallines in which the gold mines occur. The metallization, however, varied from place to place, giving rise to ores and minerals of gold, copper, arsenic and minor amounts of lead and zinc. Pyrite in varying amounts accompanies the deposits in which these metals are found. At some localities pyrite is dominant, although not of economic importance, but in the Pyriton district it occurs in large bodies which have been exploited. In the Pyriton district (Fig. 6), the bodies are massive or accompany quartz veins which cut the planes of schistosity of the Hillabee schist at low angles. The latter mode of occurrence shows that the pyrite was introduced relatively late, and it is believed that its source was the same deep-seated regional magma which caused the metallization of the other types of deposits. In the Pyriton district the presence of minor amounts of copper minerals and low gold values serve to show a genetic relationship with the other mining districts.

PYRITON DISTRICT

In his report on Clay County, Prouty makes the following statement concerning the Pyriton district:*

*Prouty, W. F., Geology and Mineral Resources of Clay County, Geol. Surv. of Ala., 1923, p. 80.

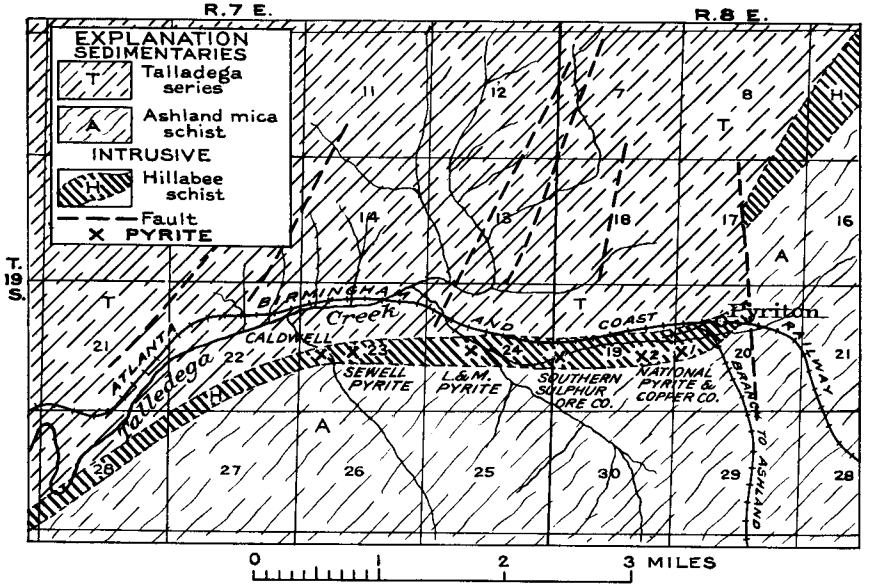
R.7 E.
R.8 E.
EXPLANATION
SEDIMENTARIES
T Talladega series
A Ashland mica schist
INTRUSIVE
H Hillabee schist
Fault
X PYRITE
T. 19 S.
BIRMINGHAM
Creek
CALDWELL
ATLANTA
Talladega
COAST
LAND
Fyriton
R.R.
SEWELL PYRITE
L&M. PYRITE
SOUTHERN SULPHUR ORE CO.
NATIONAL PYRITE & COPPER CO.
BRANCH TO ASHLAND
0 1 2 3 MILES

FIG. 6

"In the stretch of Hillabee running in a general east and west direction between Pyriton and Erin, occurs the best known pyrite deposits in the State. In a distance of a little less than two miles there are the mines of three companies which were active during the war period. These companies are: the National Pyrite and Copper Company; the Southern Sulphur Company; and the L. & M. Mining Association. Besides these mines, which have openings in sections 19 and 20, T. 19 S., R. 8 E., and S. 24, T. 19 S., R. 7 E., there are two well known prospect pits in the SW¼ of S. 23, T. 19 S., R. 7 E., on the Sewell and Caldwell properties. Of the three mines, that of the National Pyrite and Copper Company has been most worked, although some of the best ore bodies have been found in the main opening of the Southern Sulphur Company."

National Pyrite and Copper Co.; NE¼ of SW¼ of Sec. 20 *and NE¼ of SE¼, Sec.* 19, *T.* 19 *S., R.* 8 *E.*—The openings in these localities are known as No. 1 and No. 2, respectively (see Fig. 6), and the name used is that of the company which operated these from 1917-1919. The property has a long and varied history. An entry for copper was driven in the early days, probably in the early fifties, during the copper fever, and later a shaft was sunk by a company working for the Confederate Government during the Civil War.

The property was acquired in 1910 and turned over to the Alabama Pyrites Company, which began work. A report by Joseph Squire* states that a band of orange color on the formation (Hillabee) extending for a mile and a half, indicated the presence of pyrite in sections 19 and 20. The Alabama Pyrites Company owned one and a fourth miles along the vein outcrop and a Mr. Hardy of Tennessee had purchased the other part. The holdings of Mr. Hardy were later developed by the Southern Sulphur Ore Company.

The Alabama Pyrite Company, according to Squire, had a well-timbered slope driven 300 feet on the vein, which dipped about 31 degrees to the south. Eight feet of ore from the workings gave an analysis from 43 to 49 per cent of sulphur. About 10,000 tons of ore were banked at the mouth of the slope.

From a report by R. H. Elliott made in 1902, it appears that ten borings were made from 200 to 400 feet south of the line of outcrop and at intervals along it for 8,000 feet. The average of nine satisfactory holes gave a little under 5.8 feet of solid ore and 7 feet 9 inches of fines. In the slope the ore averaged about 6 feet. The report states that the ore is

*The reports on pyrite deposits referred to in this discussion, unless otherwise expressly stated, are private reports, copies of which are on file in the office of the State Geologist.

in detached bodies and that the company expected to find it so. There was a plant for running ten drills by compressed air. A line had been surveyed for a railway to the property.

From another report by Elliott made in 1904, the following notes concerning sections from which samples were taken by him in the working are transcribed:

"No. 1 entry, east, top hard ore 40 in., soft ore 5 in., hard ore 6 in., fines 2 in., hard ore 8 in. Total 61 in. Top hard ore gave 36.5 per cent sulphur.

"No. 1 entry, west; hard ore 72 in.

"No. 2 entry, west; top hard ore 30 in., soft ore fines 6 in., hard ore 18 in. Samples from hard ores combined, 33 per cent sulphur.

"No. 2 entry, east; hard ore 84 inches.

"No. 3 entry, east; top hard ore 40 in., soft ore fines 10 in., hard ore 40 in. Sample from hard ores combined, 39.65 per cent sulphur.

"No. 4 entry, west; top soft fines 18 in., hard ore 24 in., soft ore 24 in., hard ore 30 in. Sample of 24 in. hard ore, 43.68 per cent sulphur. Sample of 30 in. hard ore, 44.68 per cent sulphur.

"No. 4 entry, east; top hard ore 60 in., soft ore 6 in., hard ore about 60 in. Sulphur 41.01 per cent.

"No. 5 entry, west; top hard ore 36 in., soft ore 28 in., hard ore 15 in. Top hard ore gave 44.52 per cent sulphur. Bottom hard ore gave 3.88 per cent copper.

"No. 5 entry, east; top hard ore 60 in., soft ore 10 in., hard ore 24 in.

"An assortment of samples from the bottom of the mine, but taken from the dump pile, showed an average of 7.80 per cent copper. Selected samples gave 14.24 per cent copper."

The comment was made that the ore shows the effect of weathering, but that the high grade sulphur ore had been reached.

A field note on this mine, made Oct. 4, 1904, by Henry McCalley and quoted by Prouty[1] is as follows:

"The ore is said to be 14 feet thick, but only the lower 5 feet is much worked. The drift and slope is on the southeast side of the valley some 120 yards from the southeast side. The dip of the Hillabee is 30-35° S. E. The good ore is separated out by hand-picking from broad belts. The slate is separated by jigging or specific gravity."

In 1905 J. J. Calahan in a report stated that the slope had been sunk 400 feet and that there were six places in the drifts where the ore had been worked, wheelbarrows being used. The roof was good and had not

[1]Opus Cit. p. 82.

been timbered. The ore was not less than 8 feet where worked and in some places was 14 feet. The ore had a tendency to wave. He regarded the equipment of crushers, picking tables and elevators as of no benefit and thought that 60 per cent of the ore could be marketed as lump, leaving 40 per cent for ultimate disposition. He recommended sinking the slope another 300 feet.

In a report by A. B. Rogers (1905) in which the mine was called the Alabama Sulphur Ore and Copper Company, a little additional information is given concerning the ore, and the statement is made that there was a five-story frame mill structure on the hillside with the machinery dismantled. New machinery had been ordered to crush and concentrate 100 tons daily.

From a report by O. F. Pattberg made in 1909, it is learned that the operations previous to 1905 were apparently for the purpose of making a showing which would induce capital to build a railroad. After several engineers had examined the property, a branch line of the L. and N. Ry. from Talladega was constructed to the mine, and a mortgage was given on the property. The first plant mentioned by Rogers was a failure, although jigs were added during the last few months of its operation.

When the A. B. and A. Ry. purchased the branch line railway and paid off the mortgage, thus freeing the property, a second mill was constructed about one-half miles west of the mine dump. The ore was hauled to it in dump cars. The mill equipment consisted of gyratory and jaw type crushers, rolls, troummels, elevators and numerous jigs, the capacity being about 100 tons per 12 hours. The mill, although of poor design, was remodeled and operated. From 100 tons of ore it produced 33 tons of concentrates averaging 44 per cent sulphur.

In the report by Pattberg, attention is called to the fact that one-third of the ore could have been shipped as spalls containing a minimum of 40 per cent sulphur. The inclined shaft was reported to be down 600 feet. There were five left drifts and five right drifts, but mining was done in only a few to meet the demands of the mill, and most of them were not advanced over 250 feet from the slope. Considerable stoping was done. Number 2 slope was started near the second mill and went about 150 feet. All work was suspended about 1909.

The property was operated by the National Pyrites and Copper Company from 1917 to 1919. The equipment which was assembled under stress of war conditions was entirely second-hand and some of the machinery was obsolete design and uneconomical in operation. From March, 1918, to May, 1919, the company shipped 9,040 tons of lump ore and 9,748

tons of concentrates, making a total of 18,788 tons. The average sulphur content of the lump ore was about 39 per cent. The sulphur content of the concentrates varied from 40 to 42 per cent.

The following statement is quoted from Prouty:[1]

"When visited in 1916, the opening of the National Pyrite and Copper Company had been sunk to a depth down the slope of 450 feet. The average dip of the ore body is about 25° to the south, while the trend of the ore body (stope length) is in a general southeast direction. There are two distinct enrichment horizons about 10 to 15 feet apart. The upper one is mined near the mouth of the opening and the other one farther down the slope. The thickness of the mineralized zone usually mined is about 14 feet. This 14 feet may be represented by two or more layers of massive pyrite, with considerable green schist carrying disseminated pyrite, or it may locally be broken up into many smaller stringers and disseminated ore. In this mine there are a number of small faults cutting the rock in a northwest-southeast direction, with small displacements, usually 2 to 3 feet. In one place, the first right hand entry, there is a cross fold that allows both upper and lower ore bodies to appear in the entry."

Southern Sulphur Ore Company; NW¼ of SW¼, Sec. 19, *T.* 19 *S., R.* 8 *E.*—Smith, in his report (1, p. 67), referred to this locality as the Montgomery Copper Mining Company's property and stated that ore was raised from a shaft about half a mile from the roasting and smelting works. This property which was purchased in 1900 by Mr. Hardy of Tennessee and has been referred to as the Carpenter tract, the Williams mine, and the Montgomery Sulphur Company, in certain reports, and was called the Southern Sulphur Co., by Prouty.

A field note by Henry McCalley is as follows: "The slope at this mine extends down some 100 feet in the ore. The workable ore is from 6 to 14 feet thick. The ore has a decided top and bottom. The ore is shipped in lumps, picked and worked by hand. They (Williams mine, Montgomery Sulphur Co.) are now shipping 60 tons per day to a fertilizer plant in Montgomery. There is some copper in the ore after getting to the second cross entry. The copper is said to increase with depth."

In a report by R. H. Elliott made in 1904, it is stated that at the Southern Sulphur Ore Company, owned by the Tennessee Fertilizer Company, of Montgomery, and controlled by Mr. Carpenter, the slope enters good ore, the weathered surface ore having been eroded. The length of the slope is given as 160 feet.

[1]Loc. cit. p. 81.

A section 15 feet down the slope gave, top hard ore 54 in., soft ore 16 in., hard ore 16 in., soft ore 20 in., hard ore 12 in., soft ore 36 in.

No. 2 entry, east, about half way down the slope; top hard ore 4 in., soft ore 4 in., hard ore 36 in., soft ore 6 in., hard ore 36 in., and extending below the floor. Top hard ore gave 44.88 per cent sulphur; middle hard ore, 46.42 per cent sulphur; bottom hard ore, 39.67 per cent sulphur.

Ten feet above the bottom of the slope, 36 inches of hard ore gave 49.99 per cent sulphur.

A report from the office of the Southern Sulphur Ore Company (not dated) states that the mine was operated for about three years, but operations were discontinued on account of excessive freight rates to consuming points. Later the A. B. and A. Ry. gave direct access to the southeast. The plant consisted of boilers, engines, air compressors, drills and crushing machinery. The ore is at an angle of about 35 degrees. One slope was opened to a depth of about 230 feet and another was driven to about 270 feet. The face exposed by the workings showed the breadth of the ore to be between 1,100 and 1,200 feet. The ore body was a series of bands or lenses of more or less pure pyrite, one band above another, and in places 20 feet or more of pyrite was exposed. More than half of the material was suited for lump ore and the balance subject to concentration. A total of 50,713 tons of ore was shipped. Picked lump ore averaged about 42 per cent sulphur. The cinder from the ore contained 1.90 to 2.65 per cent of copper and an appreciable amount of both gold and silver. Thirty-three thousand tons of ore suitable for concentration was on hand.

From a report by A. B. Rogers dated 1905, it is learned that in the Southern Sulphur Ore Company mine, the No. 1 east level, 50 feet below the surface had a length of 275 feet and a breast of 5 feet, mostly solid ore. Level No. 1, west, had a length of 275, showed 68 inches of solid and fine ore. A sample gave 1.97 per cent copper and 44.43 per cent sulphur. Level No. 2 east, 100 feet down and 275 feet long, had a breast of 7 feet 10 in. of mostly solid ore which gave 1.67 per cent copper and 44.65 per cent sulphur. Level No. 2, west, 125 feet down and 260 feet long, showed a breast of 3 feet solid ore and 3 feet of fines. Bottom of the slope, 240 feet from the surface, ore pinched, measures 17 inches mostly solid.

In a report by O. F. Pattberg, dated 1909, the statement is made that the Southern Sulphur Ore Company (Carpenter tract) seems to have done well shipping solid ore, for with the exhaustion of their part of the pyrite vein they endeavored to purchase adjacent land from the Alabama Sulphur Ore and Copper Company (later known as the National Pyrite and Copper Company).

Prouty,[1] who visited the locality in 1916, made the following statements concerning this mine:

"In the mine of the Southern Sulphur Company, about a mile west of the main opening of the National Pyrite and Copper Company, there is a massive bed of pyrite at the mouth of the slope, 12 feet in thickness. The general zone of mineralization that is removed in mining is about 15-16 feet. This zone may be locally in large part massive ore, or it may be largely schist with disseminated crystals between thin sheets of massive ore. In this mine the ore body thins down the dip and to the west, which seems to indicate that the main ore body trends to the east of south from the outcrop in this mine, as well as in the one a mile to the east."

L. and M. Mining Association Mines; NE¼ of SW¼, Sec. 24 T. 19 S., R. 7 E.—Smith stated (1, p. 66) that at this place Col. E. R. Smith made a cut in ferruginous "tuffa" 5 or 6 feet thick and at a depth of 10 feet found pyrite 4 or 5 feet thick, and showing little particles of covellite.

A field note concerning the Watts Ore Co. by Henry McCalley written in 1904, and quoted by Prouty[2] with the explanation that it probably refers to the L. and M. opening, gives the following information: Two slopes were started in the hillside. The workable ore was found to be 4 feet 6 inches to 7 feet in thickness, with slate partings in it. Some of the ledges of pure ore were as much as 18 inches thick. In one of the slopes near the bottom of the ore there was a parting of Hillabee schist perhaps two feet in thickness.

In a report by A. B. Rogers (1905) mention is made of a Mattison and Henderson property, which may be the same as the one here under discussion. The only comment is that the pyrite is not so massive as further to the east.

At the time of Prouty's visit (1916) the openings were full of water. He stated,[3] however, that the openings were 350 feet across the strike from the southern border of the Hillabee and 850 feet from the northern border, and accordingly, like all other openings in the vicinity, about one-third the thickness of the formation below the top.

No record of production from this property has been found.

Sewell pyrite opening; NW¼ of SW¼, Sec. 23, T. 19 S., R. 7 E.—The position of this opening is shown on the map of Clay County by Prouty, but no description of it was given.

[1]Loc. cit. p. 81.
[2]Loc. cit. p. 82.
[3]Loc. cit. p. 81.

Caldwell pyrite opening; NW¼ of SW¼, Sec. 23, T. 19 S., R. 7 E.— The position of this opening is also shown by Prouty, but no description of it was given.

OTHER LOCALITIES IN THE HILLABEE SCHIST

Many prospects in the Hillabee schist show more or less pyrite. Some work was done northeast of Dempsey in sections 13 and 14, T. 18 S., R. 8 E., but no body of ore was discovered. Concerning the McGee prospect in Sec. 3, T. 21 S., R. 6 E., J. W. Spencer[1] commented that it is one of the many openings made in the early fifties for copper. The mineral was mostly pyrite, but with some copper. The sulphides were scattered through quartz 6 or 8 feet thick, but the part rich in pyrite is only about 3 feet thick, and for copper alone it was not worth working. Prouty found the mine abandoned for many years.

There are other localities where pyrite has been found in the Hillabee. They have been mentioned in discussing the gold deposits, but since they are of little importance they are not listed here.

PYRITE PROSPECTS IN THE ASHLAND MICA SCHIST

Spencer mentions a pyrite prospect in Sec. 30, T. 20 S., R. 7 E., and another on the property of Jasper Williams (probably in Sec. 36, T. 20 S., R. 6 E.). Prouty stated that pyrite had not been mined at any locality in Clay County in the Ashland schist.

The pyrite in the copper mines in the southern border of Cleburne County is important, but no one has ever attempted to market it, and it probably is not now of economic value, regardless of the lack of transportation facilities.

PYRITE IN THE TALLADEGA SERIES

The Garrett pyrite prospect, NE¼ of NE¼, Sec. 17, T. 21 S., R. 6 E., noted on the map of Clay County by Prouty, was visited by Dr. E. A. Smith in 1896. His field notes are as follows:

"There are numerous pits along the creek sunk to a bed of pyrite, which seems from gossan to be regularly bedded and dip 75° to 80° to the northeast. Gossan would indicate a mineralized zone of from 20′ to 50′ in thickness. Shaft to east of line of pits in Talladega slate shows many quartz veins.

[1]Spencer, J. W., Economic Geological Survey along the (proposed) Macon and Birmingham Railway, 1889.

"Pyrite showing in dump is unusual in appearance. It is not solid, but made up of numerous botryoidal aggregates of small crystal pipes or stalactites, with radiating fibrous texture just like some forms of limonite. All this is in distinct contrast to the pyrite of the McGhee and other mines on the 'copper lead' Hillabee schist, which consist of good sized cubical crystals, imbedded in quartz matrix, which in places includes the pyrite in quantity. Capt. Lewis states that his pyrite gives 51.50 per cent sulphur."

ARSENIC

Introduction.—In the early period of gold mining in Alabama in the Cragford district (Pl. 2) the workings which entered the unoxidized zone encountered considerable arsenopyrite. When the price of white arsenic (arsenious oxide) went to from three or four cents to ten or fifteen cents per pound because of the demand for it as an insecticide used in spraying cotton in order to detroy the boll weevil, the occurrences of arsenic ores became more important and a new interest was awakened in the Cragford district as a possible field for exploitation. In 1923 some of the old gold mines were reopened to a limited extent and a little prospecting was done at new localities. The writer visited the district then and saw the most promising of the prospects, but not enough work had been done to show the extent of the deposits.

A note published in 1924[1] called attention to the Cragford district as a possible source of arsenic, but gave no detailed information.

G. R. Mansfield of the U. S. Geological Survey visited the district early in 1924. He was given credit for the following information in the "Mineral Resources of the U. S." for that year:[2]

"The veins are lenticular to irregular masses of quartz and pegmatite, which strike about N. 35° E., and dip 35° S. E. The arsenopyrite, accompanied by minor quantities of pyrite, chalcopyrite and galena, occurs in the veins as masses and disseminated grains, but is commonly localized between pure quartz and wall rock. The workings, nearly all shallow pits, were filled with water and afforded little opportunity for inspection. The arsenopyrite that could be seen in place consisted principally of layers from 1 to 3 or 4 inches thick, but more promising material lay on the dumps and gave the impression that the ores were worthy of further exploration as to tonnage and adaptability to concentration. Single ore shoots may be small, but it remains to be seen whether several shoots can be profitably worked to supply a concentrator and roasting plant."

Prospecting for arsenic was not continued in the district and no ore was produced. In 1929 the writer revisited the district and found the pits filled with water and in poor condition for examination. The following notes will give some idea of the character of the work which had been done at some of the well known localities.

Walker prospect; SW¼ of SW¼, Sec. 6, T. 21 S., R. 10 E.—This pit on the Bowen Walker land, close to the Hardy Robinson spring branch,

[1]Clarke, G. H., Eng. and Mining Journal Press, Vol. 117, No. 6, April 19, 1924, p. 654.
[2]Heikes, V. C., and Laughlin, G. F., Arsenic, Mineral Resources of the U. S., Part 1, p. 170.

is near an old tunnel that was opened for gold. Pieces of the ore seen there in 1923 were the richest which the writer observed in the district. They showed the metallization was in lenses in the schist, and some of the specimens of ore were as much as 8 inches thick. Most of the quartz veins, however, carried only a moderate amount of arsenopyrite. The rich ore showed, besides arsenopyrite, some chalcopyrite, galena and a little sphalerite. All the best ore had been carried away before 1929 and only lean ore specimens were obtainable then. Dr. Jones[1] supplies the following information:

"Dr. George M. Hall, of Johns Hopkins University, examined specimens of this ore and reported that they carried arsenopyrite, galena, sphalerite and chalcopyrite, with quartz, feldspar, limonite, siderite, muscovite, biotite, epidote and topaz as accessory minerals. Dr. Hall regards all of the metallic minerals as being the product of one period of mineralization. The arsenopyrite and other sulphides occur as masses and disseminated grains and are usually localized between relatively pure quartz and wall rock. Some of the veins are several inches in thickness and appear to be very promising."

Number Two prospect; NE¼ of NE¼, Sec. 32, *T.* 20 *N., R.* 10 *E.*—This prospect is so named because it is in a small branch which enters Crooked Creek just east of the second railway bridge above the mouth of the creek. It is reported that when the railway was built and the bridge constructed, veins carrying arsenopyrite were discovered. The prospecting which was done at this place consisted of three pits close to the creek. The largest is an open cut made in a low bluff. It shows lenses of quartz in schists dipping 35° to the southeast. The specimens on the dump showed some arsenopyrite and a little chalcopyrite. All of the sulphides were badly weathered and did not indicate rich ore, but probably the best specimens had been carried away.

Benjamin prospect; NE¼, Sec. 25, *T.* 20 *S., R.* 9 *E.*—This prospect is across a small creek east of the railway station at Cragford. It is well above the stream and showed sulphides at a shallow depth, but the quartz veins are rather thin and the ore is rather lean. Arsenopyrite and a little chalcopyrite were seen in the specimens on the dump.

Lashley prospects; NW¼ of NW¼, Sec. 30, *T.* 20 *S., R.* 10 *E.*—These prospects are on what is there spoken of as a "true fissure vein" in garnet schist. Very little of the ore was seen, but it was reported that

[1]W. B. Jones, Index to the Mineral Resources of Alabama, Bull. 28, Geol. Surv. of Ala., 1926, p. 15.

arsenopyrite was encountered in a shaft which was said to be 35 feet deep. The vein strikes about N. 45° W., and is practically vertical. It is accordingly nearly at right angles to the strike of all of the other leads in the district. It has been traced for more than half a mile; at least there are pits along the strike for that distance. The quartz of this vein carries free gold in the weathered zone. The vein is said to cut the Benjamin lead, and one of the pits is thought to be at the intersection of the vein with this lead, but it is shallow, and affords but little information as to the character of the metallization.

It is said that careful sampling of workings in section 30 has shown values ranging from $16.00 to $18.00 in gold.

TIN

Introduction.—Evidently there was some search for tin ore in Alabama in the early days, since there were some accounts of supposed discoveries in the newspapers. Probably the search was stimulated by the discovery of tin deposits in other Appalachian states.

In his first report, Smith (1875, p. 74 and p. 121) states that a specimen of an alloy of tin, lead and bismuth appeared to be the only basis for a supposed discovery in Clay County.

Bentley tin property; SW¼, Sec. 14, T. 22 N., R. 18 E.—The only authentic occurrence of tin ore in Alabama is on this property, about one and a half miles west of Rockford in Coosa County (see Pl. 3). In 1880 Judge John S. Bentley sent a box of minerals to the elder Dr. Charles Shepard, who on examining them found some crystals of cassiterite, and published the following note, entitled "Cassiterite at Coosa, Alabama."[1]

"Among the smaller fragments and grains of tantalite from this interesting locality, I find numerous crystals of cassiterite, the largest of which do not exceed the size of a pea. Some of them are well formed octahedral crystals, showing, however, narrow faces of the primary prism between the pyramids. When heated before the blowpipe on charcoal, along with soda, metallic tin is plentifully afforded. It is at present unknown whether this desirable ore exists in workable quantity."

On August 8, 1880, Dr. Smith, State Geologist, visited Judge Bentley's place near Rockford. His field notes for the day include the following statements:

"This morning after breakfast, rode out to Judge Bentley's, where I picked up a number of pretty fair specimens of tantalite. Rockford is situated upon a belt of granite or granitosed gneiss two miles or more in width. Great masses of this rock as boulders of disintegration lie all over the country. * * * * A quartz vein through this rock bears the tantalite and I had the pleasure of finding a piece imbedded in a fragment of quartz. At Judge Bentley's house have been found crystals of tin stone, and I received from him a crystal which is probably of this ore. The locality is well worth a much more detailed examination, which I hope to give it some of these days."

Phillips in his report on the Lower Gold Belt (p. 28) wrote as follows concerning the locality:

[1]Shepard, Charles Upham, Mineralogic Notes, Amer. Journal of Science, Vol. XX, No. 15, July, 1880, p. 56.

" * * * * at times these quartz seams become quite large as in the W½ of SW¼, Sec. 14, T. 22 N., R. 18 E., one and a half mile west of Rockford, where one 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 of 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.

"In immediate association with a ledge of coarse granite, a quarter of a mile northeast 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."

In an article on tin in the United States, Graton[1] says that at two localities in Alabama, cassiterite has been found. In Coosa County a few pounds were found on the surface in association with a ledge of coarse-grained granite (pegmatite) which cut the schists of the gold belt.

Near Ashland, in Clay County, work was done in the eighties at the Broken Arrow mines. Banks of gneiss are said to alternate with layers of schist, all resting on a feldspathic granite. The cassiterite occurs in the gneiss. A stamp mill was erected, but the venture proved unsuccessful. As will be seen from the following notes on the Broken Arrow locality, no tin was found there.

Broken Arrow Tin Mining fiasco.—The following is an account of this unfortunate expenditure of money and energy. In the Mineral Resources of the U. S. for 1883[1] there is a description of the Broken Arrow mine, two miles from Ashland, Clay County. W. G. Gessner, who was in charge of the operations is cited as furnishing the information. A section of the crystallines is given which listed in the space of 800 feet six nearly vertical belts of stanniferous gneiss. The average content of the ore was stated to average 1½ per cent. Reduction works were built and work was carried on, but up to July 1 the results were not commercially successful.

The same publication the next year[2] redescribed the mine briefly and added the information that a Frue vanner was operated with gratifying results. Ten men were employed in 1884. There had been no commercial production, but a bar of tin was exhibited in New York in 1883.

[1]Graton, L. C., Tin. Bull. 260, U. S. G. S., 1904, p. 164.
[1]Albert Williams, Jr., Min. Res. of U. S., 1883, pp. 434-436.
[2]Blake, W. P., Tin Min. Res. of U. S., 1884, pp. 601-602.

The following year the same publication[3] carries the information that Henry J. Biddle had visited the locality of the Broken Arrow mine and could find no evidences of tin ore and that Prof. Eugene A. Smith, State Geologist of Alabama, stated that the supposed tin ore analyzed by him proved to be mostly menaccanite (ilmenite) and rutile, with no traces of tin. Metallic buttons from the slag of the furnace erected at the mine were found to be chiefly metallic iron with no tin.

Phillips (p. 27) gives the location of "one of the late Wm. Gessner's Tin Mines" as SW¼, Sec. 24 T,. 22 N., R. 16 E. He reported that some excavations had been made there and that the ore is close-grained, much distorted quartz veinlets in schists. Apparently no attention has been given to this place since the first prospecting.

[3]Day, David T., Min. Res. of U. S., 1887, p. 214.