Geology and Bauxite Deposits of the Rock Run and Goshen Valley Areas Northeast Alabama

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By PRESTON E. CLOUD, Jr.

BAUXITE DEPOSITS OF THE SOUTHEASTERN UNITED STATES

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Distribution, occurrence, and reserves of bauxite and its geologic environment

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GEOLOGY AND BAUXITE DEPOSITS OF THE ROCK RUN AND GOSHEN VALLEY AREAS, NORTHERN ALABAMA

By Preston E. Cloud, Jr.

ABSTRACT

The contiguous Rock Run and Goshen Valley areas occupy about 58 square miles, extending southwestward from the Alabama-Georgia State line for about 18 miles along the regional strike. The areas are in Cherokee County, Ala., in the southern part of the Valley and Ridge physiographic province. The region is deeply weathered and is blanketed by gravel and slope wash.

The principal stratigraphic units mapped are formations in the Knox Group of Late Cambrian and Early Ordovician age. They are flanked to the north and west by older rocks of Late to Early Cambrian ages and to the southeast by patches of younger rocks ranging in age from Middle Ordovician to Mississippian. At the southeast edge of the combined areas, rocks of Early Cambrian age are repeated.

Structurally, the Rock Run and Goshen Valley areas are part of the complex Coosa thrust sheet, which extends from northeast to southwest, parallel to the regional strike. The direction of relative apparent overthrust was to the northwest. The southwest end of the principal thrust in these areas is marked by the scarps of Weisner and Pine Mountains, underlain by the resistant Weisner Quartzite of Early Cambrian age. Northeastward, the fault is in the more readily weathered strata of the Rome Formation and Shady Dolomite which produce less prominent topography. At the southeast margin of the mapped areas the Indian Mountain thrust sheet overrides the Coosa sheet to repeat the Weisner Quartzite in scarps of Indian and Vineyard Mountains. The regional dip is to the southeast; it is interrupted by numerous low folds, particularly in the south-central part of the thrust sheet. Complexities are introduced by high-angle faulting, in part younger than the Coosa thrust. The most conspicuous of the high-angle faults is the Providence Church fault which truncates and scallops the trace of the Coosa thrust at the north edge of the mapped areas.

All deposits of bauxite and kaolin in the Rock Run and Goshen Valley areas are underlain by carbonate rocks of the Knox Group. In the Goshen Valley area, deposits occur principally near the base of the Copper Ridge Dolomite and in the Longview Limestone. In the Rock Run area, most deposits are along or just north of the Indian Mountain thrust fault in the Longview and Newala Limestones, but some are scattered throughout the belt underlain by the Knox Group to the north. Bauxite and kaolin in the Goshen Valley area occur at altitudes ranging from 680 to 860 feet and averaging 760 feet, and in the Rock Run area ranging from 780 to 1,080 feet and averaging about 960 feet.

The bauxite and kaolin are considered to be remnants of formerly extensive deposits of probable early Tertiary age (Paleocene and Eocene), preserved in ancient sinkholes. The Tertiary(?) deposits also include unconsolidated sandy clay, sand, and gravel. All occur in small pockets surrounded by residuum derived from the enclosing carbonate rocks.

Bauxite and kaolin deposits are discontinuous and of varied size because of their origin and subsequent erosion. In the Goshen Valley area new deposits may be expected to average less than 7,000 long tons of commercial-grade bauxite, and a deposit of 15,000 tons would be large. In the Rock Run area, deposits range from about 10,000 to 20,000 long tons.

In the Rock Run and Goshen Valley areas, 32 sites were tested in a drilling program conducted jointly by the U.S. Bureau of Mines and the U.S. Geological Survey. Bauxite or kaolin was found in 9 sites, 8 of which are in the Rock Run area.

Reserves of bauxite and kaolin revealed by drilling are estimated at about 1,376,000 long tons. Of this total, about 28,000 long tons is grades A and B; 183,000 long tons is grade C; 413,000 long tons is grade D; and 752,000 long tons is kaolin (grade D′), of which part is on old mine dumps. Additional reserves of bauxite and kaolin of similar grades are undoubtedly present in these two areas, but, inasmuch as the most favorable sites were drilled during the exploration program, the tonnage is probably small.

INTRODUCTION

The Rock Run and Goshen Valley areas are a part of the Northeast Alabama bauxite district which extends through parts of Cherokee, Calhoun, St. Clair, DeKalb, and Talladega Counties. The district is entirely in the Valley and Ridge physiographic province. The locations of areas in the district are shown on figure 1.

The Rock Run and Goshen Valley areas are in southern Cherokee County, contiguous along the regional strike. The Rock Run area, extending from the Alabama-Georgia State line southwestward, covers about 35 square miles, principally in T. 11 S., R. 11 E., but partly in adjoining townships. The Goshen Valley area covers about 23 square miles, almost entirely in T. 12 S., Rs. 9 and 10 E.

An exploration program was jointly conducted by the U.S. Geological Survey and the U.S. Bureau of Mines in 1942 and 1943. Drilling was done by the Pennsylvania Drilling Co. with a Star churn drill and three Longyear rotary drills under the supervision of Mr. Don M. Coulter, project engineer for the Bureau of Mines. A Bureau of Mines field crew drilled a few holes with a hand auger, dug two shafts to obtain large samples of bauxite for experimental purposes, sampled seven old shafts, and trench-sampled several old mine walls.

All chemical analyses were made by the Bureau of Mines laboratory at Tuscaloosa, Ala. (Coulter, 1948), and all data on grade and

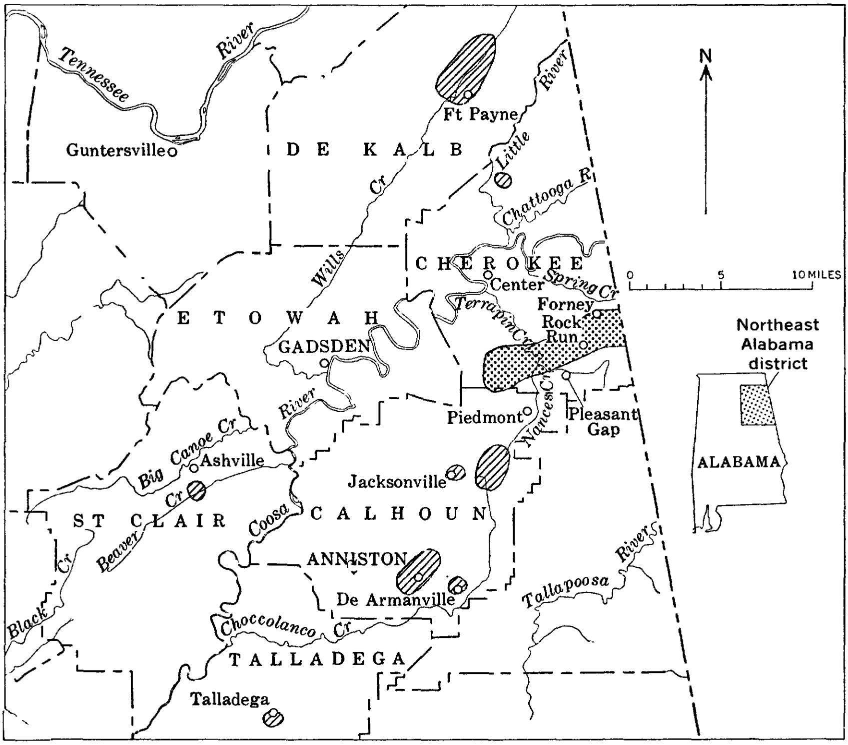

FIGURE 1.—Rock Run and Goshen Valley areas (stippled) and other areas (diagonal lines) in the Northeast Alabama bauxite district.

chemical analyses given in this report are based on those assays, unless otherwise noted.

The Geological Survey conducted the surface exploration and geologic mapping which preceded and accompanied all drilling, and made specific recommendations for drilling. During the drilling it functioned in an advisory capacity to the Bureau of Mines in recommending locations of holes, determining bottoms of holes, and logging drill core in an effort to obtain closer geologic control on the drilling.

GEOLOGIC AND TOPOGRAPHIC SETTING

The Rock Run-Goshen Valley area is dominated by an arc of carbonate rocks, convex to the northwest, that consists primarily of the Knox Group of Cambrian and Ordovician age (pl. 1). Older resistant rocks of Early Cambrian age occur in the eastern and western extremities, forming Weisner and Pine Mountains in the west and Indian and Vineyard Mountains in the east. Younger rocks consist of minor amounts of Middle Ordovician to Mississippian shale, sandstone, and limestone. The strike of the beds swings from approximately north-northeast in the western part of the arc to east-northeast in the east half, with a faulted wedge between. The regional dip is to the southeast.

PRODUCTION

Production from the Rock Run and Goshen Valley areas has not been recorded separately from that of the entire Northeast Alabama district. Production for the district is more than 300,000 long tons of bauxite. From 1891, when mining began, to 1923, all production from Alabama was from the Northeast Alabama district; after 1927, all was from the Eufaula district in the Coastal Plain, except for a very small tonnage during 1941 and 1942 from the Ashville area.

Nearly 95 percent of the 300,000 tons total production is estimated to have come from the Rock Run area, and most of this from the group of mines near the Indian Mountain thrust fault. In the Goshen Valley area, only the Dupont mine produced more than a few tens or hundreds of tons.

POTENTIAL AND RESERVES

The size of a single ore body in any part of the Northeast Alabama district is likely to be small. New ore bodies in the Rock Run area may be expected to average less than 10,000 tons of bauxite, and a 20,000-ton body would be large. Deposits in the Goshen Valley area may be expected to be smaller still. They would probably average about 7,000 tons, and a deposit of 15,000 tons would be large. However, more than one deposit might be found at a favorable locality.

It is expected that new bauxite deposits found in the Goshen Valley area will tend to be smaller, lying nearer the surface than those in the Rock Run area. Geologically recent degradation in Goshen Valley has been greater than that in Rock Run, an observation leading to the expectation that deposits found will be only the roots of formerly more extensive bodies.

J. C. Dunlap and R. L. Heller (written commun., 1943) concluded that there was at least 113,000 long tons of measured plus indicated kaolin and low-grade bauxite on the old mine dumps of the Rock Run area. This reserve was estimated to be mainly kaolin, and, where bauxite is present, it is ordinarily too mixed with the kaolin to make selective recovery feasible.

An estimate of reserves of bauxite and kaolin discovered by drilling is shown in table 1. Estimates of inferred bauxite by grade, are as follows: Grade B, no more than 1 percent of the total; grade B plus C, about 10 percent; grade D, about 30 percent; and grade D′, or kaolin, the rest. Most of the high-grade bauxite is classed as measured or indicated reserves because of the drilling methods used, but even so the amount of high-grade low-silica bauxite in the Appalachian region of Alabama is very small.

Additional reserves of bauxite and kaolin in the Rock Run and Goshen Valley areas are undoubtedly small. The most favorable sites were drilled, and where bauxite or kaolin was found, it was at least partly delimited. Total reserves of bauxite and kaolin in the two districts probably approximate a million and a half long tons, of which about 55 percent is kaolin and less than 15 percent is grades A through C bauxite.

TABLE 1.—*Bauxite and kaolin reserves, in long tons (wet), delimited by drilling in the Rock Run and Goshen Valley areas*

[Grade is based on the Thoenen-Burchard classification. See table 3]

	Grade				Total
	B	C	D	D′ (Kaolin)	
Measured	11,000	89,000	125,000	380,000	605,000
Indicated	15,000	72,000	213,000	118,000	418,000
Inferred	2,000	22,000	75,000	141,000	240,000
Mine dumps				113,000	113,000
Total	28,000	183,000	413,000	752,000	1,376,000

PREVIOUS WORK

The first description of bauxite deposits in Alabama was given by McCalley (1892, p. 20–32) soon after their discovery. Between 1892 and 1902, papers by McCalley (1897) and Hayes (1895a and b, 1902) gave a general view of the geology and bauxite deposits of northeastern Alabama. The work by McCalley was largely confined to Alabama, whereas that by Hayes was primarily in northwestern Georgia but extended into Alabama. Later, Butts (1926) in his monographic study of the Paleozoic strata of Alabama modified parts of the stratigraphic units used by earlier writers. The geologic map of Alabama, compiled by Butts, was published in 1926 (in Adams and others). More recently the bauxite deposits of the State have been described by Jones (1940).

The theory of the formation of bauxite in sinkholes was first put forth by Adams (1923). The idea was later elaborated by Bridge (1950) in a study of bauxite deposits of the entire southeastern region, and tied in to the known age of bauxite in the coastal plain. A somewhat similar geologic situation of kaolin and diaspore in karst depressions in Missouri has been described by McQueen (1943).

ACKNOWLEDGMENTS

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The Geological Survey's field party, under the immediate direction of Josiah Bridge, consisted of W. B. Baldwin, N. M. Denson, J. C. Dunlap, R. L. Heller, H. A. Tourtelot, K. M. Waagé, F. M. Samford, Helmuth Wedow, and the writer.

GEOLOGY

Stratigraphic units in the Rock Run and Goshen Valley areas are summarized in plate 2. The brief description includes the bedrock and the residuum which was the principal means of delineating the underlying units. Except for a local streambank outcrop, or one artificially exposed, only those strata which are resistant to humid temperate weathering appear at the surface. Even these commonly do not crop out and, where they do, are apt to show such heterogeneous attitudes as to furnish little useful structural information. Only the lower phyllitic shale-arenite facies of the Conasauga Limestone north and west of the Coosa thrust crops out characteristically, and it has been crumpled into northwardly overturned minor isoclinal folds whose remnants have a consistent apparent dip to the south-southeast that has nothing to do with its actual regional dip.

STRATIGRAPHY

LOWER CAMBRIAN

WEISNER QUARTZITE

The Weisner Quartzite in the area mapped (pl. 1) ranges from friable sandstone to quartzite; it is white, buff, or pink, and fine to coarse grained. The beds are a few inches to several feet thick. Some beds of conglomerate and some fairly thick argillaceous zones are also included in the formation. The total thickness of the formation is unknown because of faulting, but it is probably on the order of a few thousand feet. No shelly fossils were seen, but the vertical thinly cylindrical burrows known as *Scolithus* are common. These have not been seen in the Frog Mountain Sandstone, which in some respects resembles the Weisner, and in the absence of other fossils, their presence has been used to differentiate these two formations.

Resistant rocks of the Weisner Quartzite underlie the highest topographic features: Weisner Mountain and Pine Mountain on the west, and Indian Mountain and Vineyard Mountain on the east.

SHADY DOLOMITE

The Shady Dolomite appears to be absent in the Rock Run area, but was mapped in the Goshen Valley area on the basis of characteristic residuum—drusy ferruginous jasperoid, in part coarsely vesicular and sandy, and black hackly fracturing chert or black-banded chert nodules. Unweathered dolomite was not observed, and no fossils were found. The zone mapped as Shady has a maximum width of outcrop of 750 feet, from the Weisner Quartzite which underlies it at the west to the fault which truncates it on the east. Assuming an average dip of 30° the thickness would be about 370 feet, plus whatever was cut off by faulting. Topographically the Shady Dolomite commonly occupies a gentle slope.

ROME FORMATION

The Rome Formation in the Rock Run and Goshen Valley areas is interbedded sandstone, siltstone, and shale. The coarser grained beds are commonly purplish red to buff, and the shales are pale yellow or pale green. The formation is thin bedded throughout, ranging from laminae to beds a few inches thick. No fossils were found. In most places the Rome forms narrow strike ridges which are conspicuous where adjacent to lowlands formed on the Shady Dolomite. The full thickness of the formation is not exposed in the mapped area.

MIDDLE AND UPPER CAMBRIAN

CONASAUGA LIMESTONE

Rocks assigned to the Conasauga Limestone in this area actually include very little limestone. The formation so designated has been divided into four facies. Two of these facies occur only on the north and west sides of the Coosa thrust fault; and the other two occur in the area mapped, only in the overthrust plate. North and west of the Coosa thrust the lower part of the Conasauga is a thin-bedded shale-arenite facies in which green phyllitic shale is interbedded with crinkled and fractured quartzite and sandstone. The upper part of the formation in this part of the area consists primarily of a gray and olive-drab shale facies together with some dark-colored argillaceous limestone. South and east of the Coosa thrust the lower facies consists largely of olive-drab shale interbedded with gray limestone and dolomitic limestone, and the upper facies is a dark-gray dolomitic limestone, oolitic and silty in most places.

All four facies of the Conasauga are best exposed in the northeastern part of the mapped area where the two lower facies crop out on opposite sides of the Providence Church fault and are flanked to the south and to the north by the two upper facies (section *A–A′*, pl. 1).

Distinctive trilobites of Middle and Late Cambrian age occur in the limestone and shale. The commonest are those of the *Aphelaspis* zone of Dresbach age.

The great lithic difference in approximately correlative parts of the formation suggests that the original sediments were not deposited close together. This supports the structural interpretation of plate 1, which calls for the Conasauga beds south and east of the Coosa thrust fault to have been moved northwestward to their present position as part of the Coosa thrust block. The resultant shortening of several miles in a northwest-southeast direction would explain the coincidence of the contrasting facies.

UPPER CAMBRIAN AND LOWER ORDOVICIAN

KNOX GROUP

The Knox Group includes the Copper Ridge Dolomite of Late Cambrian age and the Chepultepec Dolomite, Longview Limestone, and Newala Limestone of Early Ordovician age. The term is used in this report to include all conspicuously cherty carbonate rocks of early Paleozoic age not otherwise differentiated.

Previous estimates of the thickness of the Knox Group in this area have been based on the assumption of steep dips. Mapping indicates that dips in the Rock Run area probably average about 5° to 10°. On the basis of such dips and an average breadth of outcrop of 8,000 to 12,000 feet, the thickness is estimated to range from 700 to 2,100 feet. Averaging these figures gives a very rough estimate of 1,400 feet for the thickness of the Knox in the Rock Run area. In the Goshen Valley area the thickness is estimated on the basis of an average dip of 25°, to be between 2,000 and 3,000 feet.

The characteristics of the residuum, by means of which the various divisions of the Knox Group are recognized in the Goshen Valley and Rock Run areas, are described in ascending order.

PIPE CHERT OR GYMNOSOLEN CHERT OF THE BASAL COPPER RIDGE DOLOMITE

One of the most useful and most easily recognized stratigraphic units in the mapped area is a stromatolitic chert in which digitate algal growths of the gymnosolen type are extremely abundant. In vertical section this chert looks as though it were made up of a maze of pipelike structures, and in cross section the tops of the "pipes" show up as subcircular concentric markings. The float consists of large or small blocky masses showing generally well defined "pipes." The chert is dark gray and white, commonly dark gray predominating; it may resemble an ordinary mottled chert. Nowhere was this chert seen in place, but it is well displayed in large float blocks 1.15 miles due south of Forney, west of Alabama Highway 73, NE¼ sec. 22, T. 11 S., R. 11 E. At this place the color is unusually light, but the pipe structure is clearly shown; and beds of sand and fine breccia fill the interspaces between the stromatolitic fingers. Such a biostromal zone should not be expected to hold a fixed stratigraphic level, a uniform thickness, or even to be continuous along the strike. Despite these disadvantages, the pipe chert is an extremely useful stratigraphic and structural datum. In the Rock Run area it ranges in thickness from 80 to 180 feet. In the Goshen Valley area it is probably 170 to 200 feet thick, but it is locally much thinner and disappears abruptly along the strike. The pipe chert is referred to the Copper Ridge Dolomite on the basis of stratigraphic position, making it an easily recognizable base for that formation. Topographically, it forms scarps.

COPPER RIDGE DOLOMITE PROPER

The Copper Ridge Dolomite above the pipe chert yields a great variety of sandy, chalcedonic, porcellaneous, chalky, spongy, or waxy chert. It is mostly light gray to white, but some is dark gray, black, or pink. Dolomoldic chert, and cavernous, porous, or spongy chert of types often considered to be characteristic of the overlying Chepultepec Dolomite are common throughout the Copper Ridge as well as the Chepultepec and the Longview Limestone above it. A recurrent type of chert in the Copper Ridge contains layers of lenticular to subangular cavities resembling the impressions of pebbles. Iron-oxide-cemented chert breccias occur sporadically. Cherty stromatolites of the cryptozoon and archaesolen type have been found at a few places but are uncommon. If any generalization may be made, it is that the cherts immediately above the pipe chert are apt to be gritty, hard, tough, and compact and to occur in large blocky masses.

The harder, tougher varieties of chert tend to persist as blocky masses, whereas the more brittle types are apt to occur as blocky masses on the scarp slopes but break up into numerous small chips on the dip slopes. In general, and with no apparent stratigraphic implication, scarp slopes show accumulations of blocky masses of chert of all varieties, but most dip slopes are covered with loam in which the chert is in small chips and apparently of small amount. The loamy soils of the dip slopes range from henna through yellowish orange to dull brown. In places the change in color is very patchy, and it is most likely related to varying activity of oxidation and reduction.

Just above the pipe chert (20 to 40 ft. above it at the only place where fossils were collected from bedrock) is a zone characterized by the distinctive bellerophontacean gastropod *Cloudia buttsi* Knight. It occurs in four or five different kinds of chert, but the most common is ash gray, gritty, hard, tough, and irregularly cavernous. Although scarce, this fossil can often be found when a persistent search is made. The hyperstrophic (pseudosinistral), naticiform, onychochilid gastropod *Scaevogyra* has been found at two places near the top of the formation.

In the Goshen Valley area the Copper Ridge proper is probably 400 to 700 feet thick. Topographically, it occurs at the crests and on the back slopes of the more prominent ridges in the Goshen Valley area, and forms moderately high rounded hills with no particular pattern in the Rock Run area.

CHEPULTEPEC DOLOMITE

On weathered outcrops the Chepultepec Dolomite is represented by nondescript chert in a clayey loam residuum similar to that of the Copper Ridge Dolomite. At or near the base of the formation, blocks of sandstone are common. They weather free from a thin zone of sandstone beds or lenses, or possibly from a single bed of sandstone. This sand zone is a good marker for the lower boundary for the formation because the stratigraphically lowest fossils of Chepultepec age are found just above it at many places. The sandstone is not everywhere present, and the zone is probably nowhere more than 2 or 3 feet thick, but it is persistent enough to be useful in mapping the Copper Ridge-Chepultepec boundary. A zone near the middle of the Chepultepec Dolomite also yields sandstone blocks to the float. It is not as persistent as the lower sandstone, but is locally more conspicuous; it may not occupy a uniform stratigraphic position.

From inferred dip and breadth of outcrop, the Chepultepec is estimated to be about 700 of 1,200 feet thick. It occupies hills and slopes comparable to, but generally lower than, those underlain by the Copper Ridge Dolomite.

Distinctive fossils are widely distributed both vertically and laterally within the Chepultepec. They occur in about five different kinds of chert, but most abundantly in a spongy aggregate of chalky sandy chert and crystalline silica. The commonest and most characteristic fossil is the small orthoconic nautiloid *Ectenoceras chepultepecense* Ulrich, Foerste, and Miller, which is about the diameter of a lead pencil and which has a marginal siphuncle. Other fossils are more scarce and probably mark more limited vertical zones.

Except for the fossils, there is no conspicuous and consistent difference between the types of chert in the Chepultepec and those in the Copper Ridge Dolomite above the pipe chert. However, tough ash-gray chert such as that in which the Cloudias of the Copper Ridge commonly occur is not found in the Chepultepec, and cavernous dolomoldic and drusy cherts are more common in the Chepultepec. If the drusy chert is of Chepultepec age, persistent search invariably reveals some fossils.

The only considerable thickness of the Knox Group exposed anywhere in the area mapped is a section of Chepultepec Dolomite about 400 feet thick. This is in the Goshen Valley area and occurs along a big bend in the road from McFrey Crossroads to Old Coloma, opposite a big slough of Terrapin Creek in the SE¼SE¼ sec. 5, and the adjacent part of sec. 8, T. 12 S., R. 10 E. Actual outcrops here total nearly 300 feet of light-gray, mostly fine grained, sparkling, chert-bearing dolomite and a little limestone. Dips are southwest.

A second good exposure of the Chepultepec is at the east side of a sinkhole in the southeast corner of the SE¼NW¼ sec. 28, T. 11 S., R. 11 E., where about 40 feet of strata near the middle of the formation crop out. Here, the rock is mostly a light-buff-gray to light-brownish- or slate-gray fine- to medium-grained chert-bearing dolomite. It includes a 14-inch bed of white fine-grained sandstone and an 18-inch and a 30-inch bed of pure brownish- to slate-gray sublithographic limestone, in part oolitic and in part a breccia. The strike ranges from east to west to N. 50° E., and the dip is 15° to 20° S.

LONGVIEW AND NEWALA LIMESTONES

The Longview and Newala Limestones were mapped as a single unit because of the difficulty of locating a contact between them at most places. Both of these formations consist largely of limestone, although some dolomite was observed. Thin sandstone beds appear to be fairly common, especially in the lower part of the Longview.

The Longview Limestone is characterized by the gastropod *Lecanospira* which occurs typically in or stratigraphically near slabby to blocky hard, brittle light- to medium-gray chert which has bedding surfaces featured by ramifying rounded welts, giving it a "ropy" appearance suggestive of pahoehoe lava. Chert of this type is not known except from the Longview.

The Newala Limestone is characterized by a well-defined fauna principally consisting of high-spired gastropods and the operculums of the gastropod *Ceratopea.* The chert in which these fossils have been found is somewhat variable, but is most typically a thinly banded (bands 1 in. to a few inches thick) chalky chert, characterized by abundant dolomolds lined with orange films. Bluish-gray locally fossiliferous limestone with crinkly argillaceous layers is also characteristic of the Newala.

The weathered surface of the Longview and Newala Limestones is blanketed by a deep henna-colored clay loam with small amounts of a variety of chert float, pellets of iron oxide, and small sandy pebbles. The cherts are characteristically very brittle although tough nondescript cherts like those of the lower part of the Knox and cavernous cherts like those of the Chepultepec Dolomite are locally abundant, especially in the lower part of the Longview-Newala interval. Banded chert concretions ranging from the size of a fist to that of a small pumpkin are locally abundant; "molded forms" resembling the well-known concretionary clay "menchen" are fairly common; smooth undulating surfaces with hard sandy nubbinlike projections are a local peculiarity; and chert that breaks with a crude rhombohedral fracture is a characteristic type. The typical cherts are commonly black or white with few of the intermediate gray shades that are prevalent in chert of the lower part of the Knox Group. On freshly broken surfaces, the "molded forms" and banded cobbles of chert particularly have a glassy black appearance. Where these are abundant, the ground is ordinarily covered with numerous small chips of shiny obsidianlike chert.

The characteristic terrane is one of gentle hills and lowlands. Commonly, the gentle slopes are deeply gullied.

The thickness of the Longview and Newala Limestones is estimated to be about 800 feet. The Longview Limestone comprises 200 to 400 feet of this thickness, and the Newala Limestone accounts for the remainder.

Beds of Longview or Newala age are exposed at two localities in the Rock Run area. One is near the center of the NW¼NE¼ sec. 33, T. 11 S., R. 11 E., where medium-grained light-gray dolomite crops out, and the other is in a quarry near the northwest corner of sec. 5, T. 12 S., R. 11 E., where pure pearl-gray to dark-gray and white limestones and fine-grained calcareous sandstones are exposed.

MIDDLE ORDOVICIAN

ATHENS SHALE

The Athens Shale is a black fissile shale which contains the graptolites *Glossograptus*, *Diplograptus*, and *Dicranograptus*. These fossils are characteristic of the Normanskill Shale. The formation weathers from various shades of gray and yellowish gray to a cream-colored or buff clay, and in some places it is very similar to parts of the weathered Conasauga Limestone or the Floyd Shale. On the Alabama State map (Adams and others, 1926), the Athens of this report is shown as Conasauga Shale. The formation occupies a fairly broad area in the south-central part of the geologic map (pl. 1), but originally it apparently extended over a much larger area and was eroded away before deposition of sandstones of Devonian or Mississippian ages. Information on which to base an estimate of thickness is not available. Topographically, the Athens Shale occupies an almost featureless lowland.

MIDDLE OR LOWER DEVONIAN

FROG MOUNTAIN SANDSTONE

Frog Mountain Sandstone consists principally of sandstone and quartzite, but siltstone, mudstone, and shale are present. The sandstone and quartzite beds are commonly fine to medium grained but are locally coarse grained, light gray on relatively fresh surfaces and buff or pale yellow on weathered surfaces, and commonly contain tiny white sericitic inclusions. They resemble sandstone beds in the Weisner Quartzite; but in the Frog Mountain, fossils ordinarily can be found, and locally corals and brachiopods are fairly abundant. *Scolithus*, which is abundant in some beds of the Weisner, was not found in the Frog Mountain. The most distinctive rock type in the Frog Mountain Sandstone is a ferruginous siltstone bed which has dark-red and green bands of varying thickness. Most of the mudstone and shale beds are dark gray and of limited extent.

The various patches of the Frog Mountain Sandstone are badly fractured by faulting, have no consistent attitude, and crop out so poorly that lithologic sequence cannot be determined. Attitudes are commonly in marked discordance with those of adjoining older rocks, probably because of subsidence accompanying solution of the underlying carbonate rocks across whose slightly beveled edges the Frog Mountain strata were deposited. The thickness of the formation is probably on the order of 500 feet at Frog Mountain in the south-central part of the area mapped.

Topographically, the Frog Mountain Sandstone ordinarily underlies hills and ridges of moderate altitude, but at the east foot of Wolf

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Den Mountain, secs. 29 and 32, T. 11 S., R. 11 E., friable sandstone of this formation occupies the foot of a hill slope and a valley bottom below dolomites of the Knox Group.

Concentrations of iron oxide and, rarely, manganese oxide are found along the margins of the sandstone where it is faulted against carbonate rocks of early Paleozoic age.

MISSISSIPPIAN OR DEVONIAN

An unnamed sandstone of Mississippian or Devonian age occurs southwest of the Frog Mountain Sandstone. The sandstone is characteristically blue gray, medium grained, and quartzitic in most places, but it also occurs as a buff friable fine-to medium-grained sandstone. On the surface it breaks into irregular pieces bounded by joint faces. Cup corals and brachiopods have been collected from two places, but they are fragmentary and poorly preserved, and cannot be dated definitely. The stratigraphic position suggests equivalence to the Frog Mountain Sandstone of Devonian age; but, southwest of the area mapped, the sandstone lies both above and below a crinoidal chert, a fact suggesting a Mississippian age. Locally the unnamed sandstone appears to rest on the uppermost beds of the Knox Group just as the Frog Mountain Sandstone does. At places its upper beds are truncated by undifferentiated rocks of known Mississippian age. Possibly the sandstone was deposited contemporaneously with the Frog Mountain sediments and subsequently reworked by the invading Mississippian sea, so that it could be partly Devonian and partly Mississippian in age, and an unconformity representing most of Middle and Late Devonian time might be within it, and possibly partly coincident with its upper surface.

The sandstone dips steeply in many places, at marked variance with the underlying beds of the Knox Group. This difference in attitude is primarily the result of slumping due to solution of underlying carbonate rocks and secondarily to local faulting. The thickness of the sandstone is irregular, ranging from a thin edge to about 500 feet. Topographically, it makes narrow steep ridges and prominent small hills.

MISSISSIPPIAN, UNDIFFERENTIATED

Undifferentiated rocks of Mississippian age underlie several small areas in secs. 8, 9, 17, 18, and 19, T. 12 S., R. 10 E. in the south-central part of the area mapped. They consist of two dissimilar facies: (1) crinoidal chert with beds of sandstone, siltstone, and silty shale which may be equivalent to the Fort Payne Chert and (2) dark micaceous shale and shaly siltstone with beds and lenses of crinoidal limestone and chert which may be equivalent to the Floyd Shale.

The crinoidal chert facies consist mainly of white, gray, or buff, finely vesicular to compact chert which is almost quartzitic in appearance. Impressions of pelmatozoan columnals are characteristic. Sandstone, siltstone, and silty shale are minor constituents locally. The residuum, like that on the upper part of the Conasauga Dolomite and on the Longview and Newala Limestones, is a henna-colored clay with local accumulations of low-grade ferruginous and manganiferous pellets. Topographically, the crinoidal chert occupies the lower dip slopes of ridges, but it may also form independent hills and ridges. The thickness ranges from a thin edge to possibly 300 feet.

The micaceous shale and siltstone facies seems to overlie the crinoidal chert beds, but this is not certain. The shale and siltstone has been mapped largely in secs. 8 and 17, T. 12 S., R. 10 E. Fenestellid bryozoa are locally abundant. The shale and siltstone weather to variegated clays. Topographically, the facies generally occurs in valley bottoms. The thickness is unknown.

TERTIARY(?)

Tertiary(?) beds of probable Midway (Paleocene) or Wilcox (Eocene) age consist of unconsolidated clay, bauxite, sand, and gravel in thin patches overlying or enclosed in residuum from Paleozoic carbonate rocks. Two varieties of the Tertiary(?) beds were mapped: (1) light-colored interbedded gravel and sand which, in places, have a low dip; and (2) variegated clay, with bauxite, silt, sand, and small amounts of gravel. Bauxite and kaolin in the Rock Run and Goshen Valley areas commonly occur in the variegated clays as the central core of the deposit or are heterogenously mixed with blocks of clay and sand lentils.

The variegated clay generally occurs as irregularly cone shaped or lenticular bodies enveloped by residuum from weathering of the underlying carbonate rocks. Most of the carbonate rocks are sufficiently impure that the characteristically dark to brightly multicolored silty residuum resulting from their weathering is clearly distinguishable from the enfolded white to pastel-colored sand, gritty clay, kaolin and bauxite.

Well-preserved, identifiable fossils have not been found in the Tertiary(?) deposits mapped, although lignite has been found in koalin at a few localities (for example, site RR 4). The Tertiary(?) deposits, however, are similar in lithology and position to clay in the Anniston and Fort Payne areas in northeastern Alabama and the Booger Hollow bauxite mine in northwestern Georgia, where plants of probable Paleocene or Eocene age have been found in kaolin (Cloud and Brown, 1944). A discussion of the paleoflora is given in Cloud (1966).

The Tertiary(?) beds are probably only the remnants of once fairly extensive deposits. In the Rock Run and Goshen Valley areas and elsewhere in the Appalachian region of Alabama, Georgia, Tennessee, and Virginia, the clay and other sediments appear to have been preserved from erosion by early deposition in sinkholes, primarily in carbonate rocks of the Knox Group.

STRUCTURE

Structurally, the Rock Run and Goshen Valley areas are interpreted as being a part of a complex thrust sheet in which the main movement was to the northwest. The sheet is elongate northeast, parallel to the strike. Although there is considerable minor folding, especially in the Goshen Valley area, the rocks generally dip to the southeast. In the Rock Run area, dips of about 15° are common and a few of 10° and 20° were noted, but the areal pattern suggests a probable regional dip of about 10°. The dip in the Goshen Valley area is less regular, but in many places is about 25° SE.

The thrust sheet is bounded on the north and west by the Coosa thrust fault and in part by the Providence Church fault, a later high-angle normal fault that probably dips to the south. At the southeast side of the Rock Run area, Indian and Vineyard Mountains mark the face of a second overriding thrust sheet that moved northwestward on the Indian Mountain thrust fault.

Subsidiary strike faults and dip faults are present throughout the area mapped, but most are in the western part. Most of the high-angle strike faults are interpreted as reverse faults. Some of the dip faults, however, probably represent strike-slip movements, either alone or in combination with dip slip.

TACONIC(?) DISTURBANCE

Post-Middle Ordovician to pre-Middle Devonian folding, possibly representing the Taconic disturbance, is inferred from the fact that an unconformity of considerable magnitude appears to exist below the Frog Mountain Sandstone. The Frog Mountain overlaps beds of the Chepultepec, Longview, Newala, and Athens Formations of Early and Middle Ordovician age. Most outcrops of the sandstone are along or near the axis of a shallow syncline where they appear to overlap the upturned edges of previously folded beds. Therefore, some deformation and erosion must have occurred following deposition of the Athens Shale of Middle Ordovician age and before deposition of the Frog Mountain Sandstone of Middle or Early Devonian age.

INDIAN MOUNTAIN THRUST

The Indian Mountain thrust fault, named here for Indian Mountain at the southeastern edge of the geologic map, has a distinctly sinuous trace that implies a nearly flat thrust sheet. The angle shown in the structure sections (pl. 1), however, is entirely hypothetical; and the fault surface may undulate or dip more steeply than indicated.

The fault system shown along the northwest side of Indian Mountain on the geologic map of the Rome quadrangle, Georgia-Alabama (Hayes, 1902), and on the Alabama State geologic map (Adams and others, 1926) is represented as two intersecting or tangential faults instead of the single fault mapped in the present study. That "fault system" was referred to by McCalley (1897, p. 33) as the Terrapin fault, from Terrapin Mountain to the south; but the name was not used in the discussion of Paleozoic strata by Butts (1926), and it is not used in this report.

COOSA THRUST

Segments of the Coosa thrust fault appear discontinuously along the northern part of the mapped area from the Georgia line to Terrapin Creek. Southwestward from Terrapin Creek it has been traced almost continuously to Alabama Highway 74. The fault was first mapped by Hayes (1894 and 1902) as a major structural feature extending from Rome, Ga., to the south side of Weisner Mountain, Ala., with but two breaks—one a few miles southwest of Rome and the other at the Georgia-Alabama State line. He called it the Coosa thrust fault and postulated that movement to the northwest on the fault was probably about 10 to 15 miles (Hayes, 1894, p. 478). However, Hayes, mapping on a regional scale, did not recognize that the trace of the Coosa had been modified, and in places obliterated, by later faulting. Subsequent regional maps of Alabama by McCalley (1897) and Butts (Adams and others, 1926) generally followed earlier mapping by Hayes.

The effect of the Coosa thrust on the shale-arenite facies of the Conasauga Limestone, which in most places lies beneath the fault plane, has been profound. Intense crumpling, with overturning of the axial planes of minor folds to the north, crinkling and fracturing of the arenites, and a varying degree of phyllitization of the shales are characteristic of this unit and emphasize by metamorphism the variant characters of an already distinct sequence of beds.

The surface of the Coosa thrust fault extends downward from the Rome Formation in the eastern part of the Rock Run area into the Shady Dolomite on the west margin of the Rock Run area and continues in the Shady as far west as Weisner Mountain, where it cuts down into the Weisner Quartizite. On the geologic map (pl. 1), Weisner and Pine Mountains are shown as lobes of the Coosa thrust. Evidence indicating that Weisner and Pine Mountains might be klippen of the Indian Mountain thrust was sought, but none was found. The beds on Weisner Mountain are not overturned, as indicated by the fact that crossbedding and graded bedding at several places on both sides of the crest show the east side to be up. On Pine Mountain, evidence was not clear as to which side was up.

The Coosa thrust is, at least in part, an extremely low-angle fault. The trace of this thrust along the north side of Pine Mountain, and therefore nearly at right angles to its regional strike, diminishes very little in altitude over a distance of three-quarters of a mile. Little Ball Mountain, a half-mile northwest of the spearhead of Pine Mountain and at a lower altitude than the projected trace of the Coosa thrust, is capped by Weisner Quartzite and surrounded by shale of the Conasauga. It is probable that Ball Mountain and one of two of the prominent small hills immediately west of the south end of Weisner Mountain are klippen. At one exposure immediately east of Terrapin Creek, the Coosa thrust has an apparent dip of about 20° S., probably the maximum dip for the fault plane.

PROVIDENCE CHURCH FAULT

The Providence Church fault is well exposed only at the northeast edge of the mapped area on a small tributary to Lumpkin Mill Creek about 600 feet north of U.S. Highway 411 at Providence Church. The presence of the fault, however, is clearly established, on the basis of stratigraphic inconsistencies, from the Georgia line to about 2 miles southwest of Old Coloma, and its position is commonly demonstrable within narrow limits. The fault is named here for the exposure at Providence Church. A fault segment that runs north and south from Gnatville and east of Weisner Mountain (pl. 1) in rough coincidence with the projection of the general trend of the Providence Church fault is not considered by the author to be connected with that fault.

The dip of the Providence Church fault is steeply to the south, as indicated by its relation to topography. The fault normally occupies a strike valley; but where it intersects a hill on the north side of the valley, the fault trace cuts across the topography and rises on the slope with slight convexity toward the north. No outliers of the rocks or residuum characteristically found south of this fault were found anywhere northward from it. Therefore, the Providence Church fault cannot be inclined either at a low angle or to the north, and the fact that this fault truncates lobes of the low-angle Coosa thrust indicates that it represents a later movement.

To determine whether the fault is normal or reverse, three lines of evidence may be considered: (1) drag, (2) dip of the Coosa thrust and its relation to the Indian Mountain thrust, and (3) facies changes in the Conasauga Limestone. These are discussed in order:

1. For 800 feet west and about 3,000 feet east of Providence Church, limestone and dolomitic limestone of the the Conasauga Limestone commonly crop out along the fault; these outcrops extend 300 to 600 feet south of the fault. Immediately at the fault the limestone dips steeply to the south (60° to 80°), but 600 feet farther south the dip averages perhaps 20° S. The regional dip, on the basis of areal pattern, is about 10° S. This suggests drag produced by relative downward movement of rocks south of the fault, in other words a normal fault, if one assumes a southward dip.
2. The dip of the Coosa fault is gentle where measured. If the south side of the Providence Church fault were differentially raised, as in interpretation 2, section *A–A′*, plate 1, the plane of the Coosa thrust would be raised above the present surface an estimated 500 feet at the fault. To the southeast, then, the plane of the Coosa thrust should again intersect the ground surface. The altitude of 500 feet would hardly be enough for the thrust to clear the tops of ridges to the south unless the thrust surface was almost flat and locally warped upward. No evidence, moreover, was found to indicate that the surface of the Coosa thrust passed above the Indian Mountain thrust; so, presumably the Coosa thrust could be either below the Indian Mountain thrust or the two could be coincident. Geologic mapping reveals no place between the traces of these two faults where the Coosa thrust intersects the ground surface. If these faults are part of the same surface of dislocation, probably some outliers would have been left in the area between the Providence Church fault and the Indian Mountain thrust, but none are known. Negative evidence, therefore, indicates that the south side of the Providence Church fault was not raised, but lowered.
3. North of the Providence Church fault and the Coosa thrust, the facies of the Conasauga Limestone are strikingly different from the facies of this formation just south of these faults. These facies differences indicate that rocks of the Conasauga on opposite sides of the faults could not have been deposited in closely contiguous depositional environments. Rather they suggest that shortening along the Coosa thrust, first suggested by Hayes (1894, p. 477–478), downward movement of the overthrust block along the Providence Church fault, and subsequent erosion were the mechanisms whereby these unlike facies

were brought side by side. Were the Providence Church fault a reverse fault as shown in interpretation 2 (section *A–A′*, pl. 1), this would eliminate the shortening effect caused by the Coosa thrust, so that the facies of the Conasauga Limestone on the south side of the faults would be similar to equivalent facies on the north side.

All three of the foregoing lines of evidence point to the Providence Church fault as being a normal fault—interpretation 1 of section *A–A′* in plate 1. This is contrary to the longstanding tradition whereby strike faults of any continuity in the Appalachian region are likely to be interpreted as reverse faults, whether high angle or low angle.

STRUCTURAL ANOMALIES AT GNATVILLE

On the heavily alluviated southeast slope of Weisner Mountain, several spurs and knolls are capped by patches of chert characteristic of residuum from the lower part of the Copper Ridge Dolomite. At intervals in the topographically lower places between these isolated patches, the alluvial blanket sags into sinklike depressions suggesting that carbonate rocks also occur close below. On the basis of projection from known outcrops, a large part of this probable carbonate rock may be regarded as Conasauga Limestone; but at one locality (near the center of the NE¼ sec. 10, T. 12 S., R. 9 E.), decalcified shaly carbonate rocks are found which resemble the residual products of the Shady Dolomite more closely than they do those of the Conasauga. The Shady Dolomite is present three-quarters of a mile to the south in the same valley, and it also extends discontinuously from that locality for at least 2,000 feet in a north-northwesterly direction (pl. 1). Thus the Copper Ridge Dolomite could be interpreted as resting directly on the Shady in this part of the southeast slope.

The anomalies and complicated outcrop pattern can be explained in many ways, three of which are discussed as follows:

1. *Hypothesis of a Gnatville fault.*—The presence of isolated hill-capping patches of Copper Ridge on the east slope of Weisner Mountain suggests a once-continuous layer. Such a layer would require a sheet of Copper Ridge and possibly upper Conasauga rocks to have been thrust westward over the Shady Dolomite and Rome Formation as a thin thrust plate or flaplike structure in which the heave decreases and the angle of inclination increases north and south from the center of maximum forward movement at the south end of Weisner Mountain. To satisfy the outcrop pattern, in the area of least dip the thrust plate would have been warped upward to expose underlying Shady Dolomite in a fenster (interpretation 1, section *E–E′*, pl. 1). The hypothetical fault there presented, as section, *G–G′*, is named the Gnatville fault.

Such a fault satisfies the observed areal relations but raises mechanical difficulties. The Gnatville(?) fault would be about 6 miles long and have a northwestward horizontal displacement of a little more than 2 miles at the line of section *E–E′*. To the south, a decrease in displacement may be borne by probable tear faults which abut the trace of a probable extension of the Gnatville(?) fault at distances of 1¼ and 1½ miles south of the church at Gnatville, evidence suggesting the possibility of abruptly diminishing heave to the south.

2. *Fenster hypothesis.*—The stratigraphic inconsistency of Copper Ridge Dolomite adjacent to the Weisner Quartzite on the east slope of Weisner Mountain also can be explained by postulating that the Copper Ridge Dolomite occurs as a fenster or fensters under the sole of the Coosa thrust, and that the Shady is present from Gnatville to the NE¼ sec. 10 as part of the Coosa thrust plate on the east side of the window. Relatively minor warping of the Coosa thrust (section *E–E′*, interpretation 2, pl. 1), and subsequent erosion, would expose the underlying Copper Ridge beds. The outcrop of the southeast side of the Coosa thrust would be both the faultline shown on the map on the southeast side of Weisner Mountain, and the one about one-quarter mile west of Gnatville and extending roughly north to south. It would be necessary to interpret the fault immediately east and south of Gnatville as a high-angle normal fault rather than a reverse fault as in interpretation 1. Movement along the fault would die out to the north. Rocks below the thrust would have to have been warped or faulted in such a manner that all the Conasauga Formation above the basal shale-arenite facies, which crops out in the SE cor. sec. 9 and SW cor. sec. 10, T. 12 S., R. 9 E., would be crowded together within a horizontal distance of 1,000 feet, extending northeastward to where the Copper Ridge caps a small hill. This would imply a fairly steep dip and is in accordance with vertical dip measured in the shale-arenite facies at the sole of the thrust.

3. *Hypothesis of high-angle faulting.*—A pattern of high-angle faults also can be used to explain the relations observed (interpretation 3, section *E–E′*, pl. 1). At least two normal strike faults are required, and it would be convenient to consider Weisner Mountain as a klippe over the edge of one of these and over the trace of the Coosa thrust. In addition, a short fault would have to extend just south of and parallel to section *E–E′*, approximately in the position of part of the hypothetical fault shown on the map, to bring the Shady Dolomite on the south

up about 2,500 feet against the Copper Ridge cherts to the north; however, the fault could not extend as far as the ridges east of Gnatville capped by the Copper Ridge Dolomite. In such a reconstruction the decalcified carbonate rocks near the center of the NE¼ sec. 10, T. 12 S., R. 9 E., would have to be interpreted as Conasauga rather than the Shady, which, they more nearly resemble.

BAUXITE AND KAOLIN

GEOLOGIC ENVIRONMENT AND ORIGIN

In the Rock Run area occurrences of bauxite fall readily into two groups—those which lie near the Indian Mountain thrust and those which are scattered farther to the north and west. The deposits of the latter group range in altitude from 780 feet (Woodward Hollow prospect 2) to 1,080 feet above sea level (Lumpkin prospect), and they are restricted to strata of the Knox Group, particularly the Chepultepec Dolomite. The bauxite deposits along or near the margin of the Indian Mountain thrust fault are underlain by the Longview and Newala Limestones and lie between altitudes of 900 to 1,000 feet. A surficial cover of unsorted coarse-grained sandstone and quartzite gravel from 1 to 12 feet thick is general. The cover is being eroded and reveals an undulating upper surface of a zone of greatly decomposed brightly mottled and variegated clay, silty clay, silt, and sand residuum in which the bauxite and kaolin deposits seem to lie.

In the Goshen Valley area the 13 scattered bauxite deposits observed are grouped as follows: Six are a short distance stratigraphically above the basal sandstone of the Chepultepec Dolomite; one is in the sandy middle part of the Chepultepec; three are near the base of the Longview Limestone; and three are near the base of the Copper Ridge Dolomite. Their altitudes range from about 680 to about 860 feet, and average 760 feet above sea level.

The bauxite deposits in the Rock Run and Goshen Valley areas are restricted to the outcrop belt of carbonate rocks of the Knox Group, and within this belt appear to occupy zones whose characteristics would favor accelerated ground-water movement or differential solubility. The most important of these zones lies just north of, and roughly parallel to, the Indian Mountain thrust fault. It probably marks the contact of the Weisner Quartzite which overrode the Longview and Newala Limestones during the early Eocene. The greater purity and solubility of these limestones as compared with other carbonate rocks in the region also leads, on weathering, to the formation of larger solution cavities. Other zones where bauxite deposits occur show an apparent affinity for sandstone beds in the carbonate rocks. They are stratigraphically near the basal and medial sandstone beds of the Chepultepec Dolomite, along the sand beds marking the Chepultepec-Longview boundary, and in the lower part of the Copper Ridge Dolomite. Many present-day sinkholes and most of the bauxite deposits occur near one of these zones. The stratigraphic position and possible structural control of known occurrences of bauxite are summarized in table 2. Any structural or

TABLE 2.—*Geologic relations of known occurrences of bauxite in the Rock Run and Goshen Valley areas, Alabama*

Mine or prospect	Stratigraphic position							Structural control		
	Lower part of Copper Ridge Dolomite	Basal sandstone Chepultepec Dolomite		Near sandstone beds in middle of Chepultepec Dolomite	Chepultepec-Longview boundary		Longview and Newala Limestones	Indian Mountain thrust	Other known faults	No fault known nearby
		Above	Below		Above	Below				
Bogan				×						×
Bust-up							×	×		
Carr (drill site RR 5)						×			?	
Cunliff	×								×	
Drill site RR 1							×	?		
2					×		×	?		
4							×	×		
6							×	×		
7							×	×		
Dupont		×							×	
Estes (drill site RR 8)			×							×
Gaines Hill							×	×		
Garvin		×							?	
Hite			×							×
Indian Dykes							×	×		
Johnson (drill site GV 1)					×					×
Klondike			×							×
Lee 1		×								×
2		×								×
Lewis	×								×	
Little Washer							×	×		
Lumpkin	×									×
Mahan-Lumpkin	×									×
Monahan							×	×		
Mundy				×						×
New Dyke							×	×		
New Stewart		×								×
Old Dyke							×	×		
Old Stewart		×								×
Pine Cut							×	×		
Pittman (drill site RR 3)							×	×		
Red Cut							×	×		
Rumsey					×					×
Stubbs Hill					×					×
Tierce							×	×		
Tomahawk							×	×		
Wallace					×				×	
Warwhoop							×	×		
Washer							×	×		
Wilson			×							×
Wright	×									×
Woodward Hollow 1		×							×	
Woodward Hollow 2		×							?	

stratigraphic condition that accelerated ground-water movement and solution was probably important in localizing the sinkholes or karst depressions in which the bauxite accumulated. Shatter zones or joints may have played a part in such localization.

RESIDUAL CLAY

Residual clay is typically very gritty to silty; it ranges in color from brown to henna (terra rossa) to mustard yellow and is commonly splotched with disseminated oxides of manganese and iron; it is finely laminated owing to the repetition of thin zones of variable siltiness in the carbonate rock; and it commonly contains angular inclusions of chert or a drusy, vesicular siliceous aggregate resembling jasperoid. Residual clay derived from relatively pure limestone, such as the Longview or Newala, is locally more difficult to distinguish from the transported kaolinitic clay, but lenses and bands of silty clay can usually be found with a little searching.

TRANSPORTED CLAY

Clay of inferred early Tertiary age immediately surrounds the bauxite. It ranges from pure, unctuous, grit-scarce white to pastel-variegated kaolin to silty, sandy, or lignitic clays. The colors of variegated clay are in streaks, blotches, laminae, or bands. The bands resemble bedding but do not everywhere coincide with lithic changes and may be in part due to water-table fluctuation or diffusion. This type of clay is thought to be transported and not residual for three reasons: (1) deposits in some areas include early Tertiary or possibly latest Cretaceous plant fossils, lignitic clays, and lignite, (2) chert is rare, and the clays are almost free of grit, and (3) the clay bodies tend to be pod shaped and to have discordant relations with enclosing residual clays and carbonate rocks.

At some places primary structures of these clays suggest original deposition in steep-sided surficial depressions or solution structures, but at other places it appears that shallow depressions have sagged or collapsed beneath the enclosed clays. Evidence of collapse or subsidence into underlying carbonate rocks after accumulation of the original bauxite and clay deposit is visible, for example, in the southeast wall of the old Tierce mine, in an especially well developed clay breccia at site RR 5, and in blocks of lignite embedded in white clay at the south edge of the ore body at site RR 1. It is not known, however, whether subsidence in these places enlarged an antecedent depression so as to bring about further foundering of material already in it, or whether the contained clays are part of an originally extensive sheet that was trapped and preserved as a result of foundering. The description of site RR 4 discusses evidence that indicates this particular site to have been one of virtually concomitant solution and fill to a depth in excess of 400 feet below the present rock surface.

BAUXITE

The bauxite is characteristically pisolitic; it ranges from hard to soft and from white through various shades of yellow and pink to red. Pebble- to cobble-size pisolites occur in great variety. They vary from single concretionary structures to compound ones in which some pisolites are enclosed in a rind. The centers of pisolites are hollow, vesicular, or filled with fine powder. Pisolites in some places are crowded together with little matrix, or, at the other extreme, a few pisolites, either large or small, occur in a nonpisolitic clay matrix. The commonest type of bauxite consists of boulder- to pebble-sized chunks, or dornicks, of pisolitic bauxite in a wide range of shapes scattered through a matrix of bauxitic clay.

Nonpisolitic bauxite, however, is not a rarity in the areas discussed. Its appearance is almost identical with the associated kaolin except that the texture is commonly less dense, and it feels somewhat gritty, not sticky, when rubbed between the fingers.

Grade of bauxite cannot be estimated from its physical appearance with a high degree of accuracy. Chemical, X-ray, or differential thermal analyses are necessary. Pisolitic structures, so characteristic of bauxite, are also present in minor degree in kaolin associated with bauxite in these areas; and, on the other hand, high-grade bauxite in some deposits has the appearance of massive kaolin.

In the Appalachian region, and in the Rock Run and Goshen Valley areas in particular, data obtained from drilling show that most, if not all, deposits represent accumulations of bauxite and kaolin that were washed into depressions which may have been deep to shallow sinkholes, or that fell into a subjacent cavity. The original weathering surface, with bauxite forming in place, apparently was not preserved in the region, and the characteristic weathering products, plus some plant fossils in a few places, were preserved only where protected from erosion by deposition in a sinkhole.

CLASSIFICATION OF BAUXITE

In this report the Thoenen-Burchard classification of bauxite (Thoenen and Burchard, 1941, p. 38) used, with the emendation that the grade D ore of their classification has been divided into two parts. As changed, grade D includes only that part of the original grade D in which the percent of alumina is greater than the percent of silica and which, therefore, contains some gibbsite. It is commonly referred to as bauxitic clay. Material called grade D-prime (D′) here refers only to that part of the original grade in which the percentage of alumina is less than the percent of silica, or in other words, to kaolin. Grades A, B, and C have not been changed. The modified classification is given in table 3.

TABLE 3.—*Modified Thoenen-Burchard classification of grades of bauxite*

[All values in percent]

Grade	Alumina	Silica
A	+55	<7
B	50–55	<15
C	45–50	<30
D	30–45	Less than percentage of alumina
D′	30–45	More than percentage of alumina

When samples fall between two grades, for example, 56 percent alumina and 9 percent silica, or 51 percent alumina and 19 percent silica, such samples are put in the lower grade; these two samples would be classed as grades B and C, respectively.

DRILLING PROGRAM

A cooperative program of exploration and drilling was conducted in the Northeast Alabama district by the U.S. Bureau of Mines and the U.S. Geological Survey in 1942 and 1943. Three Longyear rotary drills and one Star churn drill were used on the project. In addition, several holes were put down with a hand auger. Between October 28, 1942, and May 29, 1943, 184 holes were drilled in the Rock Run area and 20 holes were drilled in the Goshen Valley area.

In the Rock Run and Goshen Valley areas 32 sites were tested by drilling, and bauxite or kaolin was found in 9 of them. The locations of holes in the barren sites are shown on plate 1. The nine productive sites are described in the following section. The pattern and spacing of holes drilled was varied according to the individual site, with a view to locating and blocking out ore bodies and exploring for extensions with minimum drilling.

All chemical analyses of samples taken in drilling were made at the U.S. Bureau of Mines laboratory in Tuscaloosa, Ala. Unless otherwise indicated, chemical analyses quoted were made at this laboratory. A brief report by the project engineer (Coulter, 1948) includes all chemical analyses made during the joint exploration program.

DRILL SITES

The nine sites drilled in the Rock Run and Goshen Valley areas where bauxite or kaolin was found are described. Sites RR 1 through RR 8 are in Rock Run; site GV 1 is in Goshen Valley.

SITE RR 1

The deposit at site RR 1 is almost entirely within the southern part of the SW¼NW¼SE¼ sec. 26, T. 11 S., R. 11 E. (pl. 3), underlying a small wooded spur. The top of the deposit is at an altitude of 998 feet; the bottom, at about 827 feet.

The bauxite and kaolin deposit (loc. 21, pl. 1) is about a quarter of a mile north of the trace of the Indian Mountain thrust. The deposit is surrounded by alluvium, but data from drilling indicate that it probably occupies a depression in the Longview or Newala Limestone. The deposit is about 500 feet west of the Old Dyke bauxite mine (loc. 18), and close to the Old Dyke brown iron ore pit.

A few test pits and opencuts, a short drift, two trenches, and one shaft had been dug in early exploration for iron ore and bauxite. The shaft (renumbered Pi–4), near the center of the deposit, penetrated 15 feet of pisolitic bauxite and bauxitic clay which average grade C. At the north side of the deposit, the drift extends about 7 feet south from the south end of an old cut for iron ore, and 3 to 4 feet of crudely pistolitic bauxitic clay are exposed in the walls. White gritty clay, in which are embedded blocks of lignite, is exposed near trench 2, in the former west end of the Old Dyke cut in brown ore.

The bauxite and kaolin body is irregularly oval in outline and somewhat cone shaped in profile. It is about 400 feet long and is 310 feet wide at the widest place. The thickest part of the deposit is off center, toward the northwest end near holes Pi–28 and Pi–114 and shaft Pi–4. At hole Pi–28, bauxite and kaolin, combined, were 81 feet thick and extended to a total depth of 116 feet.

Bauxite and bauxitic clay occur as several small lenses within the kaolin body. Their extent is shown in the sections and topographic map of plate 3. The greatest thickness of bauxite is in the thickest part of the combined bauxite and kaolin body. The highest grade of bauxite lens is 32 feet thick in hole Pi–28. Two intervals, from a depth of 35 to 40 feet and from 45 to 55 feet, averaged grade A bauxite. The bauxite between these two intervals was somewhat more siliceous, but it averaged grade B. Unfortunately, the body of high-grade ore does not extend over a wide enough distance to have been picked up in adjacent drill holes. Chemical analyses of samples of bauxite and kaolin from drill hole Pi–28 are as follows:

Chemical analyses of samples of bauxite and kaolin, drill hole Pi–28

Interval, in feet	Analyses, in percent (Coulter, 1948, p. 8)				
	Al_2O_3	SiO_2	Fe_2O_3	TiO_2	Ignition loss
35–40	57.9	7.0	1.6	2.7	29.8
40–45	52.1	15.5	3.7	2.5	25.6
45–50	57.5	4.7	3.4	2.7	30.3
50–55	55.7	6.2	6.4	2.9	28.6
55–58	42.9	23.6	10.9	2.0	19.5
58–62	47.1	20.1	8.0	2.6	21.8
62–67	41.3	23.9	12.1	2.0	18.8
67–72	36.2	36.0	10.9	1.4	14.3
72–77	36.2	41.9	6.5	1.6	13.5
77–82	37.0	42.8	4.5	1.7	13.7
82–87	35.1	39.6	9.4	1.6	13.5
87–90	30.6	34.3	19.9	1.4	13.1
90–95	36.5	41.0	6.8	1.5	13.9
95–101	35.4	37.5	11.3	1.6	13.9
101–105	36.2	42.2	6.5	1.4	13.5
105–110	32.5	39.1	13.9	1.6	12.5
110–116	35.5	41.9	8.1	1.7	13.2

A relatively thin lens of grade C bauxite, apparently separate from other lenses, was penetrated by the old shaft, Pi–4. The upper 10 feet averaged 48 percent alumina but contained 14 to 21 percent silica and 4 to 5 percent iron oxide. The lower 5 feet contained 44.5 percent alumina, 28.7 percent silica, and 4.0 percent iron oxide.

Considerable lignite was found at the northwest and southeast extremities of the deposit. At the southeast end two large blocks of lignite are exposed in the streambank near trench 2. The sharp contacts between lignite and surrounding white kaolin indicate post-depositional slumping. Much coal-black lignitic clay and small amounts of lignite were penetrated in holes Pi–12, –13, –30, and –31, suggesting that the lignite and perhaps the original depression, once extended farther west and north.

Overburden consists of yellow to reddish-brown sandy, clayey soil. Bauxite crops out at the surface only in the vicinity of the shaft. Elsewhere, overburden is variable in thickness, being a maximum of about 15 feet over kaolin. The overburden over bauxite consists of both kaolin and soil, ranges from 0 to 55 feet, and averages 35 feet.

If accurately delimiting the bauxite at this site were desired, at least six holes in the vicinity of holes Pi–28 and Pi–114, as shown on the isopach map (pl. 3), should be drilled to an average depth of 100 feet.

SITE RR 2

Site RR 2 is in the central part of E½NW¼SE¼ sec. 26, T. 11 S., R. 11 E., on the west side, almost at the top, of a small wooded hill. The altitude at the top of the deposit is 1,042 feet; at the bottom, 945 feet.

Although site RR 2 (loc. 20, pl. 1) is slightly more than a quarter of a mile north of the inferred trace of the Indian Mountain thrust fault, sandstone breccia on the hilltop above and south of the deposit is probably residual from the former northerly extension of the upper thrust plate. The type of adjacent residual materials and the shape of the deposit suggest that it occupies an ancient solution depression in gently inclined strata of the Longview Limestone. Gritty, silty, or sandy brown clay, residual from the limestone, underlies the kaolin at most places and probably defines the bottom of the original sinkhole. A discontinuous bed of friable sandstone, in most places about 6 feet thick but ranging from 4 to 28 feet, underlies the gritty residual clay. The sandstone is separated by another interval of residual clay and silt from a second, more indurated, sandstone below. Each sandstone presumably represents several thin sand layers compacted together by removal of intervening carbonates. The discontinuity and variable thickness of the upper sandstone layer suggest slumping toward drainage centers of the ancient sink.

Two small open pits (Nos. 138–A and 138–B) had been dug into the north and central parts of the deposit (pl. 4), and a total of about 2,000 tons of material had been removed from them. According to local reports, about 700 tons of bauxite was shipped to a brick plant at Rome, Ga., between 1914 and 1918. In addition, two 15-foot shafts were sunk. One of these (renumbered shaft Pi–2) is in the bottom of pit 138–B, and the other (shaft Pi–3) is about 20 feet north of pit 138–A. Pisolitic bauxite or smooth, grit-free kaolin is exposed in both shafts from top to bottom.

Four holes were said to have been drilled by the American Cyanamid and Chemical Co. in the autumn of 1935, probably at the corners of pit 138–B, but no samples were taken.

The bauxite and kaolin deposit is approximately oval in plan view, elongate north to south, and irregularly planoconvex in profile (pl. 4). Data from drilling indicate that it is more than 450 feet long and about 250 feet wide. It attains a maximum thickness of about 90 feet near hole Pi–23.

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The sinkhole appears to have had two focal points of solution. The principal one is in the vicinity of hole Pi–23, in the northwest part of the deposit, where the upper sandstone is missing. A secondary focus of slump appears to be in the vicinity of hole Pi–15, in the southwest part of the deposit, where the upper sandstone is deeper, thicker, and separated from the lower sandstone by a thinner zone of silt than elsewhere. Both apparent focuses of solution lie west of the centerline of the deposit; at this side the structure generally appears to be steeper, becoming gradually shallower to the east. Residual clay crops out at the surface, and dolomite was penetrated at a depth of 26 feet in hole Pi–16 on the southwest side of the deposit (section *A–A′*, pl. 4); probable residual clay is also close to the surface in hole Pi–26, near its northwest margin (section *B–B′*, pl. 4); and outcrops of siliceous druse occur immediately west of a line connecting holes Pi–16 and Pi–26.

The bauxite at site RR 2 forms an irregular double lens exposed at the surface and underlain and partly surrounded by kaolin. Most of the bauxite is grade C which encloses three separate lenses of grades A and B bauxite. One of these lenses is exposed in trenches 2 and 3 in pit 138–A; a second lens was penetrated at a depth of 10 to 15 feet in hole Pi–17, and the third at a depth of 60 to 65 feet in hole Pi–15. Grade D bauxite is minor in amount at this deposit, and occurrs mainly below the grade C bauxite but also as thin lenses within it.

Most of the bauxite at site RR 2 is nonpisolitic, and a fragmental texture, particularly one in which fragments of bauxitic clay are found in bauxite is common. The nonpisolitic bauxite has a granular texture and grades into hard pisolitic bauxite or, through nonpisolitic earthy-textured bauxite clay, into plastic kaolin which includes scattered granules or patches of bauxite.

Kaolin occurs mainly below the bauxite and extends a short distance laterally beyond it. The kaolin is pink to white, plastic to semiplastic, and grit free, and most of it has a fragmental texture. It rests sharply on brown gritty residual clay in most places, but on the east side it rests directly on the upper sandstone bed at holes Pi–20 and Pi–21.

Chemical analyses of bauxite and kaolin from hole Pi–23, and a lithologic log of the hole below the analysed section follow:

Chemical analyses of samples of bauxite and kaolin, drill hole Pi–23

Interval, in feet	Analyses, in percent (Coulter, 1948, p. 10)				
	Al_2O_3	SiO_2	Fe_2O_3	TiO_2	Ignition loss
0–5	45.8	25.8	3.0	3.0	21.9
5–10	49.3	21.3	1.8	3.9	23.0
10–15	47.5	26.4	1.5	3.5	21.2
15–20	44.5	31.9	1.8	3.1	18.5
20–25	41.5	38.1	1.6	2.5	16.1
25–30	38.3	43.7	2.0	1.8	13.9
30–48 [1]	----	----	----	----	----
48–53	47.0	29.4	1.2	2.6	19.8
53–58	39.2	44.0	.8	1.3	14.3
58–63	38.1	42.6	2.2	1.8	14.4
63–68	38.2	44.4	1.5	1.0	14.1
68–71	38.0	43.6	.8	3.1	14.5
71–73	38.3	44.3	.7	1.9	14.4
73–74.5	38.1	44.7	.5	1.4	14.4
74.5–77.5	38.3	45.1	1.1	1.5	14.0
77.5–87	38.4	45.1	.7	1.8	13.8

Interval, in feet	Description
87–90	Clay, white, with some pink bands and streaks.
90–91	Clay, brown, gritty.
91–93	Sand, yellow-brown.
93–99	Clay, tan, variegated; sandy streaks.
99–109	Sand and sandstone.
109–115	Clay, sandy, tan, variegated.

[1] Not analysed; variegated kaolin.

SITE RR 3

Site RR 3 is in the NW cor. NE¼ sec. 35 and the adjoining part of sec. 26, T. 11 S., R. 11 E (loc. 23. pl. 1). The site is on the northeast side of a wooded knoll, in a nearly flat brushy hollow. The altitude at the top of the deposit is 986 feet; at the bottom, 895 feet (pl. 5).

The deposit at RR 3 is approximately 350 feet north of the inferred trace of the Indian Mountain thrust fault but is somewhat isolated from other bauxite deposits, and is 750 to 1,000 feet south of the cluster of old mines centering around the Dyke mines. The deposit occupies a depression in carbonate rocks of the Longview or Newala Limestone. The presence of a discontinuous thin sandy clay bed containing pebbles of quartzite and sandstone lying just below the deposits of Tertiary(?) age suggests that the sinkhole probably was in existence before deposition of the bauxite and kaolin.

The site, locally referred to as the Pitman prospect, is peppered with 30 test pits ranging from 2 to 15 feet in depth. Pisolitic bauxite or kaolin is exposed in four of the pits. A long trench cuts across the northeast part of the deposit, but it is not deep enough to reach the bauxite and kaolin body (pl. 5).

The bauxite and kaolin deposit indicated by drilling is small. It is elliptical in outline and somewhat cone shaped in profile, the apex pointing down. It is about 180 feet long, 100 feet wide, and nearly 80 feet thick at hole Pi–117, the thickest known part. The deposit thins abruptly in all directions from this hole, but the solution depression which the deposit occupies extends an undetermined distance to the west as indicated in section *B–B′* (pl. 5) and in the log of hole Pi–122 which penetrated sandy brown, gray, and white clays, and some lignite near the bottom, from a depth of 16 to 51 feet. These sandy clays appear to occupy a part of the west side of the depression below the kaolin, although they are undoubtedly of the same probable early Tertiary age.

Bauxite at site RR 3 occurs as three small lenses. The highest grade material found is at a depth of 25 to 28 feet in hole Pi–117. The bauxite averages grade C, but is very nearly grade B bauxite. The lens was not picked up in adjacent holes, but a 5-foot bed of low-grade bauxitic clay underlying it probably extends to hole Pi–124. A second lens of grade C bauxite occurs at a depth of 38 to 44 feet in hole Pi–117 and at a depth of 40 to 45 feet in hole Pi–124, below the bauxitic clay. In each hole the bauxite is underlain by bauxitic clay that contains 7 to 24 percent iron oxide. This high-iron zone possibly represents a bauxite bed which originally was relatively more porous than the rest of the bauxite or kaolin; or, alternatively, it may indicate that this bed was once close to the surface, and that later was lowered by further deepening of the sinkhole. The third lens of bauxite is at a depth of 64 to 83 feet in hole Pi–117. It averages grade D and was not picked up in adjacent holes.

Kaolin at site RR 3 encloses all three bauxite lenses, but it does not extend a great distance laterally beyond them. The areal extent of the combined bauxite and kaolin body is indicated on the isopach map (pl. 5).

The bauxite is principally nonpisolitic with a small amount of hard pisolitic and fragmental bauxite. Most is light tan to buff and has red to brown stains and streaks.

The suggested locations of nine holes required to fully delimit this ore body are shown on the isopach map (pl. 5). Holes should penetrate to depths exceeding the estimated thickness of the deposit by 30 to 40 feet. The hole west of the deposit should be drilled to definite residuum to eliminate the possibility of an extension of the deposit to the west.

SITE RR 4

Site RR 4 is immediately north of the midpoint on the line between secs. 34 and 35, partly in the SE¼NE¼ sec. 34 and partly in the SW¼NW¼ sec. 35, T. 11 S., R. 11 E. (pl. 6). It is in the bottom and along both sides of a broad gentle wooded hollow. The altitude at the top of the deposit is 940 feet; at the bottom, 540 feet.

The bauxite and kaolin deposit at site RR 4 (loc. 26, pl. 1) is 200 to 300 feet north of the inferred trace of the Indian Mountain thrust fault, in an area underlain by the Longview or Newala Limestone. The deposit fills a deep sinkhole which, as outlined by drilling, is steep sided on the south and southwest sides, but appears to slope more gently in other directions. The deposit is one of several in a small group which includes the Monahan, Big Washer, and Red Washer mines of which the first two are shown on plate 6. The center of greatest concentration of deposits in the Rock Run area is nearly a mile northeast of the center of this small group, and southeast of the group, along the strike, no other bauxite or kaolin deposits are known, although two small deposits of clay and silt of Tertiary age occur about 2 miles to the southeast in sec. 4, T. 12 S., R. 11 E. The absence of surface indications of bauxite deposits in this 2-mile stretch does not preclude their existence, but makes prospecting through the alluvial cover difficult.

Three shallow trenches and 20 tests pits had been dug at the site (pl. 6). None are more than 10 feet deep. Bauxite or kaolin was found about the edges of seven of the pits and one trench, but all merely exposed reworked kaolin and bauxite which fill a hollow in the central part of the body. On the west side of the Big Washer mine, 25 additional shallow test pits and trenches were dug in the general area shown on the topographic map (pl. 6). Pisolitic ferruginous or bauxitic material was found on the dumps of nine of these openings. Southwest of the deposit at site RR 4 and south of the Monahan mine, about 15 additional pits have been dug. Neither bauxite nor kaolin was found on the dumps, but the pits are shallow.

The combined bauxite and kaolin body is roughly triangular in plan view and irregularly cone shaped in cross section, the apex pointing down. The deposit is nearly 400 feet long on each of the three sides, and is 404 feet deep at hole Pi–62, the deepest point. At the north end the shape of the deposit and the extent and depth of the sinkhole are inferred to be approximately as shown in section *B–B′*, plate 6; but additional drill holes are needed to accurately delimit the body, particularly the northern part.

This remarkable deposit is extremely complex. Grade of ore varies within a few feet vertically, and cores from adjacent holes are dissimilar in lithology and sequence. Corrlations of bauxite by grade from hole to hole, as shown in sections *A–A′* and *B–B′*, are generalizations; bauxite of any grade probably does not extend in unbroken lenses or beds as shown. Grade of bauxite ranges repeatedly, for example, from grade C to grade D three or four times within 20 feet of vertical distance. This evidence suggests repeated erosion of bauxite and kaolin from higher parts of the body and redeposition as thin beds in lower areas.

Most of the bauxite and kaolin are clearly transported sediments. Fragmental textures occur in many places, and lignite and lignitic clay are interbedded with the bauxite and kaolin. Lignite is particularly common in the northern part of the deposit. The probable correlations shown in the sections suggest that the bauxite and kaolin were deposited in a sinkhole concurrently with its subsidence, which was greatest in the vicinity of hole Pi–62 and whose effects decrease upward from the deepest and earliest to the shallowest and latest of the filling deposits.

A high-iron content is characteristic of most of the deposit. It ranges from about 8 to 29 Fe_2O_3. Two major exceptions are: (1) the bauxite averaging grade B, which occurs comparatively high on the southeast side of the deposit at hole Pi–63, contains 2.2 to 4.6 percent Fe_2O_3; and (2) the kaolin in the northern part of the deposit, interbedded with carbonaceous clays and lignite, contains 0.8 to 8.7 percent . Inasmuch as this kaolin appears to grade laterally into bauxitic clay, it possibly was impoverished in iron and enriched in silica by humic acid waters at the time the lignite was accumulating. Likewise, the high-grade low-iron bauxite at hole Pi–63, overlain and underlain by high-iron bauxite, probably is due to secondary enrichment of iron.

Most of the high-grade bauxite is in the south and southeast part of the deposit, penetrated by holes Pi–62, Pi–63, and Pi–66 (section *A–A′*, pl. 6). Bauxite of grade A was found in hole Pi–63 at a depth of 116 to 123 feet. The only other grade A bauxite known is a thin bed at a depth of 93 to 95 feet in hole Pi–61 in the north part of the deposit. Grade B bauxite was found in holes Pi–62, Pi–66, and in Pi–63 above and below the grade A bauxite. Drill hole Pi–63 penetrated the greatest thickness of commercial bauxite. Chemical analyses of material from this hole from a depth of 35 to 160 feet follow:

Chemical analyses of samples, drill hole Pi–63

Interval, in feet	Analyses, in percent (Coulter, 1948, p. 14)				
	Al_2O_3	SiO_2	Fe_2O_3	TiO_2	Ignition loss
35–39	35.9	40.2	8.6	2.2	13.0
39–43 [1]					
43–49	32.4	39.2	12.2	2.3	13.3
49–54	35.6	30.1	15.0	2.4	15.9
54–57	44.6	9.1	18.6	2.2	24.7
57–59	47.3	4.9	16.5	2.5	27.6
59–66	45.1	9.2	17.9	2.0	24.8
66–75	39.7	19.2	17.9	2.0	20.3
75–81	37.2	28.1	14.3	2.2	17.6
81–86	46.6	32.4	8.1	2.2	19.8
86-89	41.2	23.2	8.5	2.6	23.7
89–97	55.9	7.2	3.4	3.2	29.0
97–104	53.2	9.4	4.6	3.7	27.5
104–110	55.7	9.2	2.2	3.9	28.5
110–114	50.0	20.5	3.6	2.6	23.5
114–116	53.2	15.3	2.8	2.6	26.0
116–123	55.2	6.9	4.3	3.9	29.9
123–129	54.9	11.7	2.5	3.5	27.5
129–139	50.8	18.5	2.6	2.8	24.7
139-145	41.3	28.8	9.2	2.8	18.1
145–151	38.2	35.7	8.8	1.8	15.6
151–155	35.9	35.2	11.6	2.0	15.1
155-160	32.7	33.8	18.1	1.4	13.8

[1] Not analyzed.

Most of the bauxite at RR 4 is nonpisolitic and fragmental. Where pisolites are present they are small and occur scattered through a matrix of nonpisolitic bauxite, and rarely account for a maximum of 25 percent of the sample. Fragmental textures are common in the bauxite and the kaolin and include small fragments of granular to compact nonpisolitic bauxite, grain to granule-size pisolites, fragments of white or ferruginous kaolin, and limonite grains. The proportion of the constituents determines grade, for the matrix ranges from kaolin to bauxite. Color of bauxite and kaolin ranges from white, buff, or mottled pink to red.

The major tonnage of material at site RR 4, as elsewhere in the area, is grade D (bauxitic clay) and D′ (kaolin). These overlie and underlie the higher grades of bauxite and, in places, are interbedded with them. The average analysis of the whole deposit is about 42 percent alumina and 24 percent silica.

Overburden ranges from about 3 feet in hole Pi–66 to 97 feet in hole Pi–62. The upper 3 to 10 feet of overburden consists of loam, sand, and some gravel. Below this is a variable thickness of heterogeneously mixed silty or lignitic clay, silt, sand, and some fragmental bauxite. Sand and silt predominate on the south side of the deposit, toward Indian Mountain; but variegated clays, lignitic clay and lignite are common to the north. These differences, and the intermediate nature of the overburden near the middle of the body are consistent with its inferred origin as a sinkhole filling.

In terms of tonnage and grade, site RR 4 is the most important site drilled in the joint project. In order to block out the deposit fully and work out its internal complexities, a total of 4,000 to 5,000 feet of additional drilling is needed. Recommended hole locations are shown on the isopach and topographic maps on plate 6. All holes drilled should be bottomed in residual clay.

The deposit at site RR 4 is on a direct line with the Big Washer mine 800 feet to the east and the Monahan mine 700 feet to the west, and it is possible that bauxite at this site extends eastward to, or toward, the Big Washer mine, and that additional bauxite may underlie the hollow south of the Monahan mine. The suggested hole locations indicated on the topographic map (pl. 6) would test these possibilities.

SITE RR 5

Site RR 5 (pl. 7) is in the N½NE¼NW¼ sec. 25, T. 11 S., R. 11 E., on the southeast slope of a wooded spurlike prolongation of a small hill. The altitude at the top of the deposit is 928 feet; at the bottom, 772 feet.

The bauxite and kaolin body at site RR 5 occupies a sinklike depression in carbonate rocks of the upper part of the Chepultepec Dolomite, stratigraphically not far below the sand at the Chepultepec-Longview boundary. The deposit (loc. 8, pl. 1) is more than half a mile north of the inferred trace of the Indian Mountain thrust fault, somewhat isolated from other known occurrences of bauxite or kaolin.

Site RR 5 is adjacent to the north side of the Carr, or White, bauxite mine, and a considerable amount of exploration was done in the past to delimit the ore body. The locations of 24 old test pits and shafts are shown on the topographic map, plate 7. Bauxite or kaolin can be seen in dumps around nine of the pits and in the walls of three shafts; but most of the material penetrated by the test pits is reworked, as few pits were deep enough to penetrate the deposit. The holes drilled by the American Cyanamid and Chemical Corp. bear the prefix AC (pl. 7), logs of the holes used through the courtesy of the company. Twelve holes were drilled by the U.S. Bureau of Mines.

The bauxite and kaolin body is more or less oval in outline and thickly and irregularly lenticular in profile. It is about 380 feet long and 260 feet wide, and attains a maximum thickness at hole Pi-421 where it extends from the surface to a depth of 142 feet. The results of drilling indicate that the body is a much thickened continuation of the deposit at the Carr mine (section *A–A′*, pl. 7), but no high-grade bauxite comparable to that mined from the Carr pit is at site RR 5.

The highest grade bauxite drilled is a 5-foot lens of grade C at a depth of 115 to 120 feet in hole Pi–421, but it did not extend to adjacent holes. The bauxite in the interval averaged 45.1 percent alumina, 25.5 percent silica, 5.1 percent iron oxides, 2.6 percent titania, and 20.4 percent loss on ignition (Coulter, 1948, p. 18). It was underlain by 10 feet of bauxitic clay averaging about 43 percent alumina and 25 percent silica. The remainder of the hole, from a depth of 1 to 142 feet, is in kaolin. In the upper one-third of the hole the kaolin is pisolitic; elsewhere it is massive or somewhat bedded except for scattered lenses that have a fragmental structure.

A peculiar feature of the deposit is a variegated bauxitic clay and kaolin breccia, thick and well displayed in cores from holes Pi–416 and Pi–417, close to the Carr mine, and thin in holes Pi–418, Pi–419, Pi–420, and Pi–421. The extremely angular unoriented mosaics in sections of core through the breccia show little or no compaction or rounding. The fabric may have been produced by the slumping together of a body into a subjacent cavity, or it may represent a pseudofragmental structure due to silication of bauxite to form kaolin or low-grade bauxite. The second alternative is supported by the rather high and variable titania content in bauxitic clay and kaolin from some of the holes. The following analyses of samples from the upper part of drill hole Pi–417 at the southwest side of the deposit are an example.

Chemical analyses of samples, drill hole Pi–417

Interval, in feet	Analyses, in percent (Coulter, 1948, p. 17)				
	Al_2O_3	SiO_2	Fe_2O_3	TiO_2	Ignition loss
5–10	39.9	44.5	0.5	1.8	14.0
10–12	42.8	36.8	.8	2.8	16.8
12–15	38.2	43.6	1.1	2.6	14.0
15–20	44.6	34.2	.4	2.6	18.2
20–25	42.8	38.4	.3	2.2	16.5
25–30	45.8	32.3	.5	2.6	18.9
30–35	45.6	33.9	.5	2.2	18.3
35–40	35.3	40.2	7.8	2.8	14.0

Locations of such holes as would be necessary fully to block out this deposit are shown on plate 7. They should be drilled to bottom in residual clay of the Chepultepec Dolomite. The depth will be approximately 10 feet plus the thickness of the deposit at that locality, as indicated on the isopach map.

SITE RR 6

Site RR 6 is just south of the midlength of the north boundary of the NE¼SW¼ sec. 25, T. 11 S., R. 11 E. (pl. 8) on a southeast-facing slope above a broad hollow. It is along both sides of an old road near a strip of woods that separates two open fields. The altitude at the top of the deposit is 978 feet; at the bottom, 948 feet.

Site RR 6 (loc 9, pl. 1) is about 350 feet north of the inferred trace of the Indian Mountain thrust fault. Residual materials of the Longview or Newala Limestone are exposed at the surface immediately west of the prospect, but alluvium of Quaternary age obscures geologic relations elsewhere, and much of the bauxite, kaolin, and associated materials appear to be reworked, at least in part.

Two shallow test pits had been dug at this site. Low-grade bauxite is exposed in the walls of the pit nearest the road. Bauxite also occurs in the debris about the edges of the other pit, but evidence from drilling and a careful inspection of the pit makes doubtful the occurrence of bauxite in place at this pit.

The deposit at site RR 6 is extremely small. The radius of the circle taken to represent the deposit's probable areal extent (pl. 8) is derived by taking the distance from hole Pi–36 to the northern edge of the test pit, which lies about 18 feet north of Pi–36, where bauxite is exposed in place. The highest grade material penetrated by hole Pi–36 is nonsandy fragmental kaolin from a depth of 9 to 24 feet. Sandy, somewhat fragmental kaolin overlies and underlies it from a depth of 2 to 40 feet. The remainder of the hole, to a total depth of 87 feet, and other holes at the site penetrated sandy clay, banded in places, and sand.

SITE RR 7

Site RR 7 is near the SE. cor. SW¼NW¼ sec. 25 and extends into the SE¼NW¼ sec. 25, T. 11 S., R. 11 E. (pl. 8) just west of the crest of a wooded spur. The altitude at the top of the deposit is 1,031 feet; at the bottom, 988 feet.

The deposit (loc. 10, pl. 1) is about 750 feet north of the inferred trace of the Indian Mountain thrust fault, and is probably underlain by the Longview or Newala Limestone. The deposit is about 300 feet northeast of the abandoned Warwhoop mine.

An old prospect pit about 70 feet long, 50 feet wide, and 3 to 10 feet deep had been dug at the site (pl. 8). The pit is entered on the southwest side by a shallow cut about 80 feet long and 15 feet wide. Hard pisolitic bauxite occurs in a pile on the northwest side of the cut. Two shallow test pits had been dug in the bottom of the larger pit but were filled in when visited in 1943.

The deposit is extremely small. Its areal dimensions appear to be roughly delimited by the old pit (pl. 8). Silt and siliceous druse in the southeast and northeast walls of the pit indicate that the deposit extended no farther in these directions, and the peripheral drill holes —Pi–308, –310, –311, and –312—penetrated only silt and silty clay residual from the carbonate rocks. Hole Pi–309, northwest of the pit (and about 50 ft northwest of Pi–307) penetrated transported kaolin and sandy clay which are probably within, but near the margin of, the original sinkhole; however, the ore body probably does not extend in that direction a significant distance beyond the edge of the pit. This deposit is not connected with the one at the old Warwhoop mine.

Drill hole Pi–307 penetrated 43 feet of bauxite and kaolin to give the probable maximum thickness of the deposit. The highest grade material penetrated was grade C at a depth of 5 to 12 feet. It is overlain by 5 feet of grade D bauxite and underlain by 31 feet of kaolin. Most of the bauxite is nonpisolitic or contains only scattered pisolites. The underlying kaolin is smooth textured in the upper part but contains scattered pisolites below a depth of about 30 feet. The sharp increase in titania content at this depth suggests that the kaolin here was formed from bauxite by addition of silica. Chemical analyses of core from hole Pi–307 follow:

Chemical analyses of core samples, drill hole Pi–307

Interval, in feet	Analyses, in percent (Coulter, 1948, p. 19)				
	Al_2O_3	SiO_2	Fe_2O_3	TiO_2	Ignition loss
0–5	41.9	31.5	3.9	2.6	19.2
5–10	47.9	24.2	2.3	2.9	22.4
10–12	47.2	25.8	2.4	2.8	21.7
12–14	37.8	43.5	3.6	1.8	13.6
14–17	38.0	43.4	3.0	2.4	13.6
17–22	37.7	44.3	2.9	1.8	13.4
22–27	34.2	44.0	6.1	1.8	11.6
27–31	37.0	44.6	3.2	1.8	12.9
31–35	36.3	42.8	3.6	3.0	13.7
35–39	37.7	43.2	3.0	2.6	13.7
39–43	36.7	43.3	3.2	2.4	13.8

The very small deposit could be further blocked out by seven holes averaging 10 feet in depth and spaced on 15-foot centers around the periphery of the large pit, if this becomes desirable.

SITE RR 8

Site RR 8 is in the SW¼SW¼NE¼ sec. 24, T. 11 S., R. 11 E., at the foot of the northwest side of a steep wooded hill and across a broad hollow. The altitude at the top of the deposit is 918 feet; at the bottom, 878 feet.

The deposit (loc. 3, pl. 1) is in an area underlain by the upper part of the Copper Ridge Dolomite close to its contact with the Chepultepec Dolomite. The deposit is roughly a mile north of the Indian Mountain thrust fault in an area of scattered, rather than closely clustered deposits. The nearest known bauxite is at the Bogan mine about half a mile to the south.

Two large open pits, three shallow test pits, and a shaft had been dug at this site known as the Estes prospect (pl. 8). The northern open pit is about 70 feet long, 25 feet wide, and 20 feet deep. Ferruginous pisolitic bauxite and kaolin are exposed across the east end of the pit and for about 20 feet to the west along the south side, but some of this material clearly occurs as reworked boulders in a lower grade matrix. Neither bauxite nor kaolin was exposed in 1943 in the walls of the smaller pit which is about 30 feet long and 18 feet wide. A caved pit, 70 feet S. 40° W. of the opening of the large pit and about 7 feet deep in 1943, is probably the shaft described by Jones (1940, p. 35). He states that it was about 6 feet square and 30 feet deep, and was reported to have been in ferruginous bauxite from top to bottom. Jones (1940, p. 35) includes an analysis of a boulder of hard ore which contained 53.8 percent alumina, 9.5 percent silica, 6.0 percent iron oxide, 4.0 percent titania, and 26.7 percent loss on ignition. Bauxite is also exposed in a test pit between the two open pits, and kaolin was seen in the walls of a shallow pit about 40 feet north of the large open pit (pl. 8).

Whether bauxite was mined and shipped from this prospect is not known; but if so, it could not have been more than a few hundred tons.

The deposit at site RR 8 is disappointing in both size and grade compared with the size and grade suggested by previous information. The deposit indicated by drilling is probably about 150 feet long, 75 feet wide, and less than 30 feet thick (pl. 8). The deposit does not appear to be directly connected with the bauxite and kaolin exposed in exploratory pits up the hill from it. However, all the bauxite and kaolin at site RR 8 may represent either: (1) the roots of a single large body which occupied a sinklike depression and subsequently was largely removed by erosion, or (2) a landslide or colluvial accumulation from a deposit once lying topographically above it. No sure evidence of a higher deposit was found, but such a deposit might be inferred from the interbedding of silty clay and chert with bauxite and kaolin, and the occurrence of bauxite mainly as bounders in kaolin or sandy clay.

Chemical analyses made of 2- to 5-foot intervals of drill core indicated that the highest grade material found was kaolin, but separate analyses were not made of possible bauxite boulders. Hole Pi-412, except for a 3-foot interval of sandy kaolin, penetrated kaolin containing 37 to 38 percent alumina and 43 to 46 percent silica from a depth of 10 to 30 feet. Slightly lower grade kaolin occurs at a depth of 30 to 35 feet. Some of the kaolin has an appearance of nonpisolitic bauxite, but if it once was bauxite, silication has changed nearly all to kaolin. In hole Pi–410 kaolin occurs from a depth of 5 to 15 feet; this is underlain by 5 feet of clay and chert which in turn is underlain by 17 feet of clay containing a single patch of ferruginous pisolitic bauxite at a depth of 35 feet. Kaolin was found also in hole Pi–411 at a depth of 12 to 17 feet. It is overlain and underlain by cherty clay.

SITE GV 1

Site GV 1, the Johnson prospect, is in the central part of the W½ NW¼ sec. 7, T. 12 S., R. 10 E. (pl. 9), at the head, and on the slope at the east side, of a small sparsely wooded hollow. The altitude at the top of the deposit is 718 feet; at the bottom, 674 feet.

Site GV 1 (loc. 35, pl. 1) is underlain by the lower part of the Longview Limestone close to its contact with the underlying Chepultepec Dolomite. Two large faults intersect about a quarter of a mile northeast of the site, but faults were not mapped in the immediate vicinity.

Eight holes were drilled on this site, about 1936 by the American Cyanamid and Chemical Corp., according to Mr. W. P. Cowan of Piedmont, Ala. The locations of five of the holes were still visible in 1943, but no information about them was available. In October 1942 the firm of Dempsey and Cowan stripped a small area to bauxite and dug a large test pit 5 feet deep into bauxite. They discontinued operations because of failure to locate a satisfactory market outlet for the ore.

The two bodies partly delimited by drilling are small. The larger of the two is approximately 150 feet long, 80 feet wide, and 40 feet thick. The smaller deposit, about 100 feet to the south-southwest, is approximately 140 feet long, 60 feet wide, and 15 feet thick (pl. 9). Because of their closeness and their present topographic position in an eroding stream valley, the two bodies may represent the two deepest parts of what was originally a single large deposit.

The larger deposit consists of a lens of grade C bauxite overlying the north end of a kaolin body. Bauxite was penetrated by one hole, Pi–439, and is exposed in the large pit, but the lens does not extend to adjacent holes. The transition between bauxite and kaolin is sharp, and, in general, little bauxitic clay was observed anywhere at the site. The probable extent of the lens and the shape of the deposit (sections *A–A′* and *B–B′*, pl. 9) lead to the inference that the lens of bauxite was deposited in a kaolin-filled sinkhole during a period when the north end of it was abruptly deepened. A lens of silty kaolin penetrated near the bottom of hole Pi–439 may also represent an earlier period of deepening and rapid deposition into a shallow depression.

The small deposit consists of kaolin, but no bauxite. The kaolin is somewhat bauxitic in appearance at the top and is silty at the bottom. The top of this deposit is below the altitude of bauxite in the larger deposit.

Bauxite is predominantly nonpisolitic at site GV 1, and kaolin is commonly massive. However, boulders, or dornicks, of hard pisolitic bauxite are exposed in a matrix of nonpisolitic bauxite in the walls of the pit, and the lower part of the lens at hole Pi–439 contains rare crude pisolites. Both the bauxite and kaolin exhibit minor fragmental structures throughout, but they are most common in kaolin. Chemical analyses of core samples from hole Pi–439 follow:

Chemical analyses of core samples, drill hole Pi–439

Interval, in feet	Analyses, in percent (Coulter, 1948, p. 26)				
	Al_2O_3	SiO_2	Fe_2O_3	TiO_2	Ignition loss
5–10	46.6	24.8	3.1	2.4	22.7
10–15	50.5	20.3	1.6	2.9	24.0
15–20	39.3	42.3	1.3	2.6	14.7
20–27	38.2	44.9	1.4	1.5	13.9
27–33	38.7	44.8	.9	1.7	14.0
33–38	39.0	44.9	.8	1.4	14.0
38–40	38.2	45.3	1.2	1.6	14.1
40–45	31.1	46.3	5.8	2.1	14.4
45–50	34.8	41.9	4.5	2.7	15.3
50–54 [1]	------	------	------	------	------
54–58	32.8	48.9	2.6	1.6	13.1

[1] Sandy clay; not analyzed.

Iron content is fairly low in the larger body, ranging from less than 1 to 6 percent, except in the lower part of the south end where it ranges from about 15 to 18 percent from a depth of 27 to 40 feet in hole Pi–243, and in parts of hole Pi–437 where it becomes as high as 12 percent. The iron content of core from hole Pi–202 in the smaller body, the only material analyzed from the body, is 7 to 10 percent.

Overburden consists of unconsolidated sandy clay alluvium containing some gravel and chert. It ranges from a few feet to about 20 feet in thickness.

The locations of holes necessary to fully block out the larger deposit at site GV 1 are shown on the isopach map (pl. 9). If additional drilling becomes desirable to block out the smaller deposit, holes may be located approximately along the inferred edges of the body as shown on the topographic map, and one hole should be drilled in the center of the body. Inasmuch as both deposits are small and are not connected, no great tonnage of either bauxite or kaolin can be expected at site GV 1.

RESULTS OF DRILLING

Drilling in the Rock Run area was sufficient to test the best probabilities and to eliminate from consideration most of the wildcat sites not drilled.

The ore body at site RR 4 was the most promising found. It contains a large part of the total reserve tonnage and most of the grade B and C bauxite that was found as a result of the 1942–43 exploration in the district. A site in the Rock Run area which might warrant testing is the Woodward Hollow prospect 1 (loc. 29, pl. 1). The best likelihood of finding new commercial ore, however, is in the area underlain by Longview and Newala Limestones northwest of the Indian Mountain thrust fault where bauxite has not as yet been found—namely, the belt southwestward along the thrust fault from Murnaghan mine (loc. 27, pl. 1). Electrical resistivity, magnetic, or gravity surveys of this area might indicate specific drilling targets.

Only 1 of 13 possible sites in the Goshen Valley area was drilled, but this (site GV 1, or the Johnson prospect) was one for which probabilities were considered good. However, the results were disappointing, and other deposits in the area are likely to be even smaller. If the Wright prospect (loc. 43, pl. 1) and the Stewart prospects (locs. 32 and 33, pl. 1) were drilled with similar results, it would be fair to conclude that erosion since formation of the bauxite has left only the lowest parts of ore bodies in this area.

BAUXITE MINES AND PROSPECTS IN THE ROCK RUN AREA

Asbury prospect 1

See drill site RR 6, page N37.

Asbury prospect 2

See drill site RR 7, page N38.

Big Washer mine

See drill site RR 4, page N32.

Bogan mine

Location: About the middle of SW¼NE¼SE¼SW¼ sec. 24, T. 11 S., R. 11 E. (pl. 1, loc. 7). About 600 feet north of a county road.

Altitude: Top of cut, 935 feet; bottom, 915 feet above sea level.

Topographic position: South-facing slope of a 1,000-foot spur. The mine is cut in northwest side of a small nose on this spur.

Stratigraphic position: Chepultepec Dolomite.

Development: Abandoned, dry. The pit is about 120 feet long, 60 feet wide, and 25 feet deep, elongate west-northwest. Ironcemented chert breccia, but no bauxite is exposed in test tips north and east of the mine; only cherty debris with some sandstone is exposed in those to the west and south. Apparently most of the material taken out of the mine went on the dump.

Physical and chemical composition: Pisolitic bauxite, bauxitic clay, and kaolin. Bauxite of great variety; a small amount looks highly ferruginous, some is hard, and some is soft white bauxite. Jones (1940, p. 34) gives an analysis as follows: 11.5 percent SiO_2, 57.9 percent Al_2O_3, 0.8 percent Fe_2O_3, 1.5 percent TiO_2, and 28.3 percent loss on ignition.

Nature of walls: Bauxitic and kaolinitic material exposed in entire worked face. Most of the bauxite is probably at the east end in cavernous and siliceous masses. The main body is composed of a few boulders of bauxite in a mass of bauxitic clay and kaolin.

Possible extensions: East and south, as seen in the mine face. Only small amounts of bauxite are in large amounts of bauxitic clay and kaolin.

Overburden: About 5 to 12 feet of chert float in a sandy, loamy matrix at the top of the pit.

Bust-up, or Burst-up, mine

Location: SE¼NW¼SE¼SE¼ sec. 26, T. 11 S., R. 11 E. (pl. 1, loc. 15).

Altitude: Top of cut, 1,015 feet; water level, 990 feet above sea level.

Topographic position: At the head of a broad, flat reentrant on the north slope of Indian Mountain.

Stratigraphic position: Upper part of the Knox Group, in the Longview or Newala Limestone.

Structure: Along the trace of the Indian Mountain thrust fault.

Development: Abandoned, water filled. The pit is about 300 feet in diameter. Jones (1940, p. 45) states that it was 110 feet deep and that he was informed that 14,000 tons of ore was mined.

Physical and chemical composition: Mostly hard white to red bauxite with small closely crowded pisolites. Jones (1940, p. 47) gives seven analyses which range from 2.0 to 44.9 percent SiO_2, 37.6 to 63.5 percent Al_2O_3, 0.7 to 8.3 percent Fe_2O_3, 1.6 to 3.7 percent TiO_2, and 14.0 to 29.1 percent loss on ignition.

Nature of walls: A little white and red bauxite in northeast wall, and white bauxite in southeast wall. The exposed part of east wall consists mainly of gravel, sand, and clay, in part nearly horizontal. Elsewhere walls are of slumped gravel and clay.

Possible extensions: West, southwest, or northwest. The Weisner Quartzite is to be expected to the east and southeast. Mr. B. S.

Whisenand of Gnatville, Ala., who was working in the Bust-up mine when it closed, told the author (oral commun., May 2, 1942) that the pit was then about 75 feet deep with a wall of bauxite 40 high at the east side, and that mining was abandoned only because of caving. It is possible that the ore extends to the east under the Weisner, but exploration would be very difficult; recovery would require draining the old pit and using underground mining methods because of the difficulty of stripping the cover of Weisner.

According to Jones (1940, p. 45), "when the operations closed, there was still in the pit a wall of ore 40 feet high and 80 feet wide and test with a tunnel 36 feet deep. It was estimated that there were 10,000 tons in that wall alone."

Overburden: Gravel, sand, clay. Thickness unknown but probably considerable.

Carr or White mine

Location: Near the center of the NW¼NE¼NW¼ sec. 25, T. 11 S., R. 11 E. (pl. 1, loc. 8).

Altitude: Top of cut, 950 feet; bottom, 920 feet above sea level.

Topographic position: Northeast slope of a low hill.

Stratigraphic position: Near the top of the Chepultepec Dolomite.

Structure: About half a mile north of the trace of the Indian Mountain thrust.

Surface indications: Bauxite float, and outcrops east and northeast of mine.

Development: Abandoned, dry. The pit is almost 300 feet long and about 100 feet wide at the widest parts; it averages about 20 feet deep and opens to the east. However, Jones (1940, p. 34) states that little ore was shipped.

There are a number of pits and shafts in the vicinity of the mine, particularly to the north (see pl. 7). The area north of the mine was explored by the U.S. Bureau of Mines and the U.S. Geological Survey as drill site RR 5.

Physical and chemical composition: Hard white bauxite consisting of small closely packed pisolites; coarsely pisolitic compound bauxite; and earthy bauxite. Jones (1940, p. 34) gives three analyses which range from 28.2 to 44.5 percent SiO_2, 37.5 to 46.0 percent Al_2O_3, 0.5 to 1.0 percent Fe_2O_3, 2.0 to 2.2 percent TiO_2, and 15.3 to 22.8 percent loss on ignition.

Nature of walls: Mostly slumped and debris covered. Bauxitic clay is in the lower part of the west wall, and some large chunks of limonitic sandstone breccia and sandstone can be seen near the top.

Possible extensions: See discussion of drill site RR 5, page N36.

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Overburden: Debris of some sandstone and much chert. It is probably thick to the west but fairly thin to the northeast, southwest, and east.

Dyke mines

See New Dyke, Old Dyke, and Indian Dyke mines.

Estes prospect

See drill site RR 8, page N39.

Gaines Hill mine

Location: Center of the SE¼NE¼SE¼ sec. 26, T. 11 S., R. 11 E. (pl. 1, loc. 12).

Altitude: Top of the cut, 1,045 feet; bottom, 1,025 feet above sea level.

Topographic position: At the head of a hollow on the north slope of Indian Mountain.

Stratigraphic position: Upper part of the Knox Group, in the Longview or Newala Limestone.

Structure: Near the trace of the Indian Mountain thrust.

Development: Abandoned, dry. The opening in 1943 was about 210 feet long, 170 feet wide, and 30 feet deep. About 370 feet north of the mine a heap of about 600 tons of bauxite either was piled for shipment and never moved, or was discarded as slightly inferior in grade.

Physical and chemical composition: Hard white buckshot ore and impure "pebble" ore in the walls. A sample collected by the author contained 33.6 percent SiO_2, 45.0 percent Al_2O_3, 0.2 percent Fe_2O_3, 2.3 percent TiO_2, and 18.6 percent loss on ignition.

Nature of walls: White bauxite in the southeast, east, and northwest walls. White and red clays in the west and southwest walls.

Possible extensions: To the east and north, and below the bottom of the pit. Some bauxite is in the south wall, but it probably terminates against the Weisner Quartzite to the south.

Overburden: Clay and boulder float about 10 feet thick to northwest and west, little or none to east and south.

Hite mine

Location: In the northwest corner of the SE¼NW¼SW¼ sec. 23, T. 11 S., R. 11 E. (pl. 1, loc. 6).

Altitude: Top of the cut, 915 feet; top of bauxite, 895 feet; bottom of pit, 850 feet above sea level.

Topographic position: On the steep south (scarp) side of a west-draining hollow.

Stratigraphic position: In the Knox Group, possibly the Copper Ridge Dolomite.

Structure: May be near a high-angle fault.

Development: Abandoned, dry. Many test shafts have been put down in the vicinity. Only chert and limonite-cemented chert breccia is exposed in pits south and west of the mine. Soft bauxite is exposed in pits to the north. The mine in 1943 was about 150 feet in diameter and 45 feet deep. A considerable tonnage of bauxite had been mined and shipped.

Physical and chemical composition: Soft pisolitic or mottled bauxite visible in the walls. Pisolites are of varying sizes and generally not closely crowded. Bauxite is cream colored with salmon-colored pisolites, creamy white and almost nonpisolitic, pink with brick-red pisolites, and red with dark-red pisolites. Some hard ferruginous bauxite is on the dumps. Jones (1940, p. 38) gives two analyses as follows: 31.4 and 30.1 percent SiO_2, 36.6 and 45.6 percent Al_2O_3, 14.2 and 0.3 percent Fe_2O_3, 2.6 and 2.2 percent TiO_2, and 15.2 and 21.8 percent loss on ignition.

Nature of walls: Badly slumped. Where exposed, soft bauxite is visible at the base. It is overlain by compact silty and sandy material, with some clayey layers which trend east and dip south; chert cobbles, some sandstone pebbles, and manganiferous patches can be seen in places close to the top (about 15 ft thick in the east wall).

Possible extensions: Particularly to the east-northeast and west-southwest.

Overburden: About 3 to 20 feet of sandy clay, thickening to the east and capped by 2 to 10 feet of chert float.

Indian Dyke mine

Location: Midlength of the east side of the SW¼SE¼ sec. 26, T. 11 S., R. 11 E. (pl. 1, loc. 16).

Altitude: Top of the cut, 985 feet; water level, 980 feet above sea level.

Topographic position: On a flat, sloping gently northwest from Indian Mountain.

Stratigraphic position: Upper part of the Knox Group in the Longview or Newala Limestone.

Structure: The Indian Mountain thrust fault is not far to the south.

Development: Abandoned, filled to brim with water; surrounded by test pits. The mine is about 250 feet long and 100 feet wide, elongate northeast to southwest. According to Jones (1940, p. 50) it was "perhaps 30 feet deep."

Physical and chemical composition: Hard, brittle boulders of bauxite with a waxy luster and pink, red, and white pisolites in a buff-colored matrix common on dumps. Jones (1940, p. 50) gives an analysis of "average soft" bauxite showing 5.7 percent SiO_2, 60.0 percent Al_2O_3, and 2.7 percent Fe_2O_3.

Possible extensions: Any direction.

Overburden: Sandstone gravel.

Klondike mine

Location: In the southwest corner of the NW¼SE¼ sec. 23, T. 11 S., R. 11 E. (pl. 1, loc. 5).

Altitude: Top of the cut, 900 feet; water level and the top of the only bauxite seen in place, 860 feet above sea level.

Topographic position: In the bottom of a broad hollow on the scarp side of a hill south of the stream.

Stratigraphic position: In the Knox Group, probably in the Copper Ridge Dolomite.

Structure: Possibly along or near a high-angle fault.

Development: Abandoned, water filled. No bauxite is in shallow test holes on hills to the northwest and southeast. The mine is about 300 feet long in a north-south direction and 200 feet wide. Jones (1940, p. 35) states that the pit was about 100 feet deep and that in 23 years of sporadic production many thousands of tons of bauxite were produced.

Physical and chemical composition: Hard cream-colored bauxite with scattered pisolites varying in size. A sample collected by the author was analysed by the U.S. Bureau of Mines (written commun., 1943) as follows: 43.9 percent SiO_2, 38.8 percent Al_2O_3, 0.4 percent Fe_2O_3, 2.5 percent TiO_2, and 14.5 percent loss on ignition.

Nature of walls: Walls of cherty debris packed in white, purple, and variegated silts, in part clayey, where not covered by slump. The only bauxite visible in 1942 was a mass about 12 feet long and 3 feet wide at water level about 10 feet from the west side of the pit. Some white, pink, and mottled kaolin is exposed near water level in the northeast wall. Near top are moderately compact clayey silt and sand masses with a breccia pattern in varied colors. A surface wash of chert float covers the rim. A large mass of chert is at the middle of the east wall.

Possible extensions: Southwest or northeast most favored by topography. It is locally reported that mining was stopped when the property line to the south was reached.

Overburden: Chert float, 2 to 12 feet thick; sands and silts, 10 to 40 feet thick.

Little Washer mine

See Red Washer mine.

Lumpkin prospect

Location: About center of the NW¼SE¼ sec. 14, T. 11 S., R. 11 E. (pl. 1, loc. 1), and extending west along the midline of the "forty" almost to the west margin.

Altitude: Highest bauxite at 1,080 feet; lowest at 980 feet above sea level.

Topographic position: Hill slopes just north and west of the top of a hill, 1,094 feet above sea level.

Stratigraphic position: In the Knox Group near the base of Copper Ridge Dolomite.

Surface indications: Float in valleys draining to the west and north.

Development: About 30 test pits, bauxite visible in 9 of them. The deepest test pit is 150 feet N. 60° E. from the summit of a hill at an altitude of 1,060 feet, and is locally reported to have been 35 feet deep and to have exposed pisolitic bauxite to the bottom. In 1942 the pit was only 8 feet deep and no bauxite could be seen. One hole was drilled at this prospect during the U.S. Bureau of Mines-U.S. Geological Survey joint exploration project (pl. 1, loc. 1). No bauxite or kaolin was found.

Physical and chemical composition: Mainly boulders of siliceous and ferruginous pisolitic bauxite. Most of the bauxite seen was in the debris thrown out of test holes. A boulder about 3 feet in diameter is exposed in the wall of the deepest pit. Three analyses by the U.S. Bureau of Mines (written commun., July 7, 1942) show a range from 42.2 to 47.3 percent SiO_2, 33.8 to 35.4 percent Al_2O_3, 2.0 to 6.5 percent Fe_2O_3, 1.4 to 2.9 percent TiO_2, and 12.8 to 14.0 percent loss on ignition.

Possible extensions: In the heads of hollows to the north, west, and south.

Overburden: Chert float of unknown thickness.

Mahan-Lumpkin prospect

Location: Mostly in the NW¼SW¼SE¼ sec. 14, T. 11 S., R. 11 E.; in part also in NE¼SW¼SE¼ and the southwest corner of the NW¼SE¼ sec. 14, T. 11 S., R. 11 E. (pl. 1, loc. 2).

Altitude: Highest bauxite at an altitude of 1,010 feet; lowest at 970 feet above sea level.

Topographic position: In a saddle between the heads of two deep hollows.

Stratigraphic position: At the base of the Copper Ridge Dolomite.

Surface indications: Float in the ravine west of the prospect. Small bits of bauxite float occur at the surface in the vicinity of the test pits.

Development: About a dozen test pits. Reworked bauxite is present in six of these. Six holes were drilled at this prospect during the U.S. Bureau of Mines-U.S. Geological Survey joint exploration project. The locations of the holes are shown on plate 1, locality 2. None of the holes penetrated a true bauxite or kaolin deposit, but the westernmost hole (Pi–431) penetrated two lenses of colluvial bauxite between a depth of 9 and 15 feet. The lenses are about 8 and 10 inches thick, respectively. They are overlain, underlain, and interbedded with cherty silty clay.

Physical and chemical composition: Pistolitic, with pisolites mostly large. Bauxite is siliceous but most is not very ferruginous. A sample collected by the author was analyzed by the U.S. Bureau of Mines (written commun., 1943) as follows: 44.4 percent SiO_2, 39.2 percent Al_2O_3, 0.8 percent Fe_2O_3, 1.7 percent TiO_2, and 14.1 percent loss on ignition.

Possible extensions: In hollows to the southeast and northwest.

Overburden: Chert float of unknown thickness.

Monahan, Murnaghan, or Pittsburg mine

Location: In the center of the south edge of the SE¼NE¼ sec. 34, T. 11 S., R. 11 E. (pl. 1, loc. 27).

Altitude: Top of pit, 920 feet; water level, 900 feet above sea level.

Topographic position: In a shallow depression on the gentle northwest slope at the foot of Indian Mountain.

Stratigraphic position: Upper part of the Knox Group in the Longview or Newala Limestone.

Structure: The Indian Mountain thrust fault is a short distance south of the mine.

Development: Abandoned, water filled. The mine is about 350 feet long by 280 feet wide and according to Jones (1940, p. 56) was 110 feet deep. A number of test pits have been dug about the mine, but most of them did not penetrate bauxite.

Physical and chemical composition: Pisolitic bauxite in considerable variety present on the dumps. The only bauxitic material seen in place is soft bauxitic clay at the water's edge in the west wall. Jones (1940, p. 56) gives the analysis of a blue chalky variety of ore from this pit as follows: 3.6 percent SiO_2, 61.1 percent Al_2O_3, 0.6 percent Fe_2O_3, and 2.8 percent TiO_2.

Nature of walls: Poorly sorted angular gravel, sand, and red and white mottled sandy clay in exposed parts of the walls. In the west wall a little soft bauxitic clay is visible at the water's edge.

Possible extensions: West, north, possibly east and south. Parts of the whole shallow depression in which the opening lies (700 ft to the west and 500 ft to the north) might be underlain by bauxite.

About 200 feet southeast of the southwest corner of the mine, hard bauxite with red pisolites is piled up beside a test pit. Other shallow test pits east, west, and south of this one and between it and the mine are in gravel and mottled red and white sandy clays, but not bauxite. Most of the test pits along the south edge of the mine and up a little gully running southeast from the southwest corner of the principal opening.

White pisolitic bauxite has been piled up about one water-filled test pit 500 feet east of the northeast corner of the Murnaghan mine in the hollow next east from it; other test pits in that vicinity also are in bauxite.

Bauxite is in float about 1,600 feet north and 200 feet west from the mine; but, of about a dozen shallow test pits in this area, none exposes anything other than sandstone gravel.

Overburden: About 3 feet of angular gravel and 12 feet of sand and sandy clay to water level on southeast side.

New Dyke mine

Location: Near the center of the W½SW¼SE¼ sec. 26, T. 11 S., R. 11 E. (pl. 1, loc. 22).

Altitude: Top of the pit, 960 feet; water level, 955 feet above sea level.

Topographic position: On a flat sloping gently northwestward from Indian Mountain.

Stratigraphic position: In the Longview or Newala Limestone in the upper part of the Knox Group.

Structure: Not far north of the Indian Mountain thrust fault.

Development: Abandoned, filled to brim with water. The open pit is about 275 feet long, elongate to the northeast, 90 feet wide at the northeast end, and 200 feet wide at the southwest end. Jones (1940, p. 52) states that it was about 90 feet deep when abandoned.

Physical and chemical composition: Pisolitic, porous to compact, hard, buff to pink bauxite on the dumps. Jones (1940, p. 52) gives two analyses as follows: 1.9 and 6.5 percent SiO_2, 62.7 and 52.6 percent Al_2O_3, 0.7 and 10.4 percent Fe_2O_3, 2.0 and 3.7 percent TiO_2, and 32.7 and 26.8 percent loss on ignition.

Nature of walls: Only very low gravel and clay banks visible.

Possible extensions: Any direction. Parts of the entire flat in which the opening lies might contain bauxite.

Overburden: Sandstone gravel and clay of unknown thickness.

Old Dyke mine

Location: In the center of the SE¼ sec. 26, T. 11 S., R. 11 E. (pl. 1, loc. 18).

Altitude: Top of the cut, 1,005 feet; water level, 980 feet above sea level.

Topographic position: On the south slope of a low hill.

Stratigraphic position: In the Longview or Newala Limestone.

Structure: The mine lies at the north edge of the Indian Mountain thrust fault.

Development: Abandoned, filled with water. This deposit was mined for limonitic iron ore prior to the discovery, probably in 1889 or shortly thereafter, that the underlying "iron ore blossom" was bauxite. This locality is one of the two considered to be the site of the first discovery of bauxite in Alabama. According to McCalley (1897, p. 776) the limonite pit was 600 feet long, 225 feet wide, and 30 to 75 feet deep. It was subsequently deepened to about 110 feet (Jones, 1940, p. 110) in mining the bauxite, and when seen by the author in 1942, appeared to be about 330 feet long and 250 feet wide. The north side of the mine is indicated on the map of drill site RR 1 (pl. 3).

Physical and chemical composition: Pisolitic bauxite, with pisolites small and closely packed, or compound. The bauxite is in part spongy and in part ferruginous. Jones (1940, p. 50) gives three analyses which range from 5.3 to 14.6 percent SiO_2, 40.1 to 55.6 percent Al_2O_3, 0.3 to 32.2 percent Fe_2O_3, 1.3 to 2.8 percent TiO_2, and 21.1 to 27.3 percent loss on ignition.

Nature of walls: Slumped clays and miscellaneous ferruginous and sandy rubble in most places. Limonite and highly ferruginous bauxite crop out in the northwest wall. Finely pisolitic and complex boulders of bauxite are imbedded in red and white mottled clay in parts of the north and northeast walls.

Possible extensions: Extensions may exist to the east or south. Mottled clays similar to those in the walls of the pit also occur in a streambed to the west. The area north of the mine was explored during the U.S. Bureau of Mines-U.S. Geological Survey joint project as drill site RR 1 (p. N27 and pl. 3), and a bauxite and kaolin deposit was discovered.

Overburden: Gravel, limonite, and clay to a thickness of perhaps 40 feet or more.

Pine Cut mine

Locality: Just east of the center of the SE¼ sec. 26, T. 11 S., R. 11 E. (pl. 1, loc. 17), about 80 feet east of the Old Dyke mine.

Altitude: Top of deposit, 1,010 feet; bottom, 990 feet above sea level.

Topographic position: On a bench on the south side of a low hill.

Stratigraphic position: Longview or Newala Limestone.

Structure: Near the trace of the Indian Mountain thrust fault.

Development: Abandoned; water filled in winter, dry in summer. The pit is about 90 feet in diameter and 20 feet deep. Jones (1940, p. 51) states that "about 100 tons of good bauxite were raised" here.

Physical and chemical composition: Hard light-buff pistolitic boulders of bauxite and bauxitic clay. Jones (1940, p. 51) gives 2 analyses as follows: 3.5 and 2.8 percent SiO_2, 62.6 and 61.7 percent Al_2O_3, 0.9 and 1.4 percent Fe_2O_3, 2.2 and 4.0 percent TiO_2, and 30.8 and 30.1 percent loss on ignition.

Nature of walls: Mostly slumped clays with overwash of gravelly debris. Light-colored bauxite and kaolin are exposed in the north and northeast walls; one bauxite boulder 2 feet in diameter is visible.

Possible extensions: Mainly to the southeast. About 50 feet south-southeast of the mine two holes were drilled within 10 feet of one another. It is locally reported that both holes, drilled independently by private companies, penetrated 40 to 80 feet of bauxite at a depth of 180 feet. The deposit may also extend east, west, and below the open pit.

Overburden: Clay, gravel, and limonite to the north. Thickness is unknown.

Pittman prospect

See drill site RR 3, page N31.

Pittsburg mine

See Murnaghan mine.

Red Cut prospect

Location: SW¼SW¼NE¼SE¼ sec. 26, T. 11 S., R. 11 E. (pl. 1, loc. 19). Small cut about 80 feet northeast of northeast edge of Old Dyke mine.

Altitude: 1,020 feet above sea level.

Topographic position: South side of a low hill.

Stratigraphic position: Longview or Newala Limestone.

Structure: Near the trace of the Indian Mountain thrust fault.

Development: Abandoned, dry. Jones (1940, p. 51) states that "it is doubtful if more than 50 tons of good bauxite were ever shipped from this place."

Physical composition: Highly ferruginous red pisolitic bauxite or iron ore.

Overburden: Limonitic, thickens to the north.

Red Shaft prospect

Location: Near the midlength of the north edge of the SE¼SW¼ NW¼ sec. 35, T. 11 S., R. 11 E. About 70 feet S. 70° E. from the east end of the Red Washer mine. Shown on plate 1 with Red Washer mine, locality 24.

Altitude: Top of deposit 960 feet; bottom, 950 feet above sea level.

Topographic position: At the foot of the northwest slope of Indian Mountain.

Stratigraphic position: Longview or Newala Limestone.

Structure: Just north of the trace of the Indian Mountain thrust fault.

Development: Abandoned pit about 30 feet in diameter but shallow; dry.

Physical composition: Ferruginous and siliceous bauxite.

Nature of walls: Slumped ferruginous clay.

Red Washer, or Little Washer, mine

Location: Near the midlength of the north edge of the SE¼SW¼ NW¼ sec. 35, T. 11 S., R. 11 E. (pl. 1, loc. 24).

Altitude: Top of deposit, 960 feet; water level, 940 feet above sea level.

Topographic position: At the foot of the northwest slope of Indian Mountain.

Stratigraphic position: Longview or Newala Limestone.

Structure: Just north of the trace of the Indian Mountain thrust fault.

Development: Abandoned, water in bottom. The pit is about 75 feet long, 40 feet wide, and 30 feet deep, with a little water in the bottom.

Physical and chemical composition: Ferruginous boulder and pebble ore with red pisolites. Two analyses, by the U.S. Bureau of Mines (written commun., 1942), of samples collected by the author follow: 2.0 and 2.5 percent SiO_2, 50.0 and 42.7 percent Al_2O_3, 17.0 and 28.5 percent Fe_2O_3, 4.2 and 2.7 percent TiO_2 and 25.2 and 22.0 percent loss on ignition.

Shape of ore body: Probably linear in shape with a northeasterly trend and a very steep dip to the north.

Nature of walls: Slumped and covered with slope wash except on northeast side and parts of north and west sides. The northeast wall, about 40 feet long, is fairly well exposed its entire length. A succession of four bauxite and kaolin beds are exposed. They dip steeply to the north. From south to north these beds are: (1) kaolin with near vertical red and white banding, (2) brick-red oolitic and pisolitic bauxitic clay, (3) boulders of hard red and white pisolitic bauxite imbedded in a softer red pisolitic bauxitic clay, and (4) pebble-sized red compound pisolites in a mottled red and buff bauxitic clay, giving the appearance of a gravelly clay. The boulders in bed 3 are crudely alined east to west and dip steeply north. Only bed 3 is exposed in the west wall and in places in the north wall.

Possible extensions: Most promising to the northeast and west. Low-grade pisolitic bauxite, bed 4, probably extends to the north. The topography to the south is favorable, but the apparent attitude of the ore body is opposed to a southern extension. Two holes were drilled northeast of the mine during the joint U.S. Bureau of Mines-U.S. Geological Survey program (pl. 1, loc. 24), but neither hole penetrated bauxite or kaolin.

Overburden: Five feet or more of sandstone gravel.

Stubbs Hill mine

Location: SE¼NE¼SE¼SW¼ sec. 28, T. 11 S., R. 11 E. (pl. 1, loc. 28).

Altitude: Top of the deposit, 975 feet; bottom, 950 feet above sea level.

Topographic position: At the break in the gentle northwest slope of a hill which rises to 1,057 feet.

Stratigraphic position: Longview or Newala Limestone.

Structure: About a quarter of a mile northwest of a fault bringing Frog Mountain Sandstone of Devonian age against the Knox Group.

Surface indications: Much iron oxide.

Development: Abandoned; water in bottom during winter, dry in summer. The pit is about 100 feet long, 70 feet wide, and 25 feet deep. Most of the bauxite mined appears to have gone onto the dumps.

Physical and chemical composition: Scattered cobbles of white, pink, or red pisolitic bauxite in ferruginous silty clay and clayey silt. Most of the light-colored bauxite is high in silica. According to Jones (1940, p. 57) three analyses range from 3.5 to 28.1 percent SiO_2, 48.3 to 62.2 percent Al_2O_3, 1.0 to 1.8 percent Fe_2O_3, 2.0 to 2.5 percent TiO_2, and 20.4 to 31.2 percent loss on ignition; an analysis of loose pisolites or "pebbles" of bauxite shows 44.3 percent Fe_2O_3.

Nature of walls: Bauxitic clay exposed in all the walls, but particularly ferruginous on the northwest side. Cobbles of bauxite are scattered through the bauxitic clay.

Possible extensions: Test pits about 50 feet to the east and 20 feet to the north and south expose ferruginous bauxite similar to that in the principal opening. A heap of perhaps half a ton of white clayey bauxite with purple streaks lies about 30 feet east of the mine in a small iron ore pit. The Stubbs Hill mine is completely surrounded by test pits and larger openings in which are exposed considerable iron but very little bauxite.

Overburden: Chert and sandstone float of negligible thickness.

Taylor mine

See Washer mine.

Tierce mine

Location: At the middle of the north edge of the SE¼SE¼ sec. 26, T. 11 S., R. 11 E. (pl. 1, loc. 14).

Altitude: Top of the pit, 1,020 feet; water level, 995 feet above sea level.

Topographic position: At the head of a broad hollow.

Stratigraphic position: Longview or Newala Limestone.

Structure: Near the Indian Mountain thrust fault.

Development: Abandoned, water filled. The mine is about 280 feet long (east to west), 200 feet wide, and 25 feet deep to water level.

Physical and chemical composition: Pink pisolitic bauxite and light-colored bauxitic clay. An analysis by the U.S. Bureau of Mines (written commun., 1942) of a sample collected by the author follows: 14.2 percent SiO_2, 54.0 percent Al_2O_3, 1.1 percent Fe_2O_3, 3.2 percent TiO_2, and 26.1 percent loss on ignition.

Nature of walls: Bauxite is visible in the northeast, southeast, and southwest corners; brown ore and ocher occur at the top of the north bank, with mottled clay below; elsewhere the banks are slumped clay and quartzitic gravel.

Possible extensions: Between this mine and the Gaines Hill mine to the northeast, the Bust-up mine to the southwest, and the Pine Cut and Old Dyke mines to the west.

Overburden: Limonite and clay to the north; clay elsewhere except to the southeast, where the Weisner Quartzite is to be expected. The thickness of overburden is uncertain but is probably considerable.

Tomahawk mine

Location: About the midlength of the line between the southeast and southwest quarters of the NE¼SE¼ sec. 26, T. 11 S., R. 11 E. (pl. 1, loc. 13). The mine is about 150 feet north of the Tierce mine and 100 feet west of the Gaines Hill mine.

Altitude: Top of the pit, 1,035 feet; bottom, 1,025 feet above sea level.

Topographic position: On the southeast slope of a low hill.

Stratigraphic position: Probably in the upper part of the Knox Group.

Structure: Near the trace of the Indian Mountain thrust fault.

Development: Abandoned; a small pool of water in the east end in winter; dry in summer. The mine is about 300 feet long from northeast to southwest, and ranges from 20 to 100 feet wide. It averages about 10 feet in depth. About 1,500 tons of soft bauxite was mined and shipped from here (Jones, 1940, p. 45).

Physical and chemical composition: Relatively high grade; light colored. Jones (1940, p. 45) gives analyses of "average" ore and "average pink soft" ore as follows (in that order): 23.3 and 2.9 percent SiO_2, 51.1 and 61.2 percent Al_2O_3, 0.7 and 0.5 percent Fe_2O_3, 1.4 and 3.6 percent TiO_2, and 23.8 and 31.8 percent loss on ignition.

Nature of walls: Variegated clays with a little iron ore at the northeast end.

Possible extensions: Below the present pit. This deposit is probably nearly mined out.

Overburden: Variegated clays of unknown thickness.

Warwhoop mine

Location: In the NE¼NE¼NW¼SW¼ sec. 25, T. 11 S., R. 11 E. (pl. 1, loc. 11).

Altitude: Top of the deposit, 1,005 feet; water level, 990 feet above sea level.

Topographic position: At the head of a hollow.

Stratigraphic position: Longview or Newala Limestone.

Structure: Near the trace of the Indian Mountain thrust fault.

Development: Abandoned, partly filled with water. About a dozen test pits were dug west, southwest, and northeast of the mine, and there are two trenches to the northwest and southwest. The mine is about 230 feet long (north to south) and 180 feet wide. According to Jones (1940, p. 40) it was about 40 feet deep.

Physical and chemical composition: Light-colored pisolitic bauxite and bauxite clay. The ore mined was reported to be highly variable.

Nature of walls: Mostly slumped clay banks. A little bauxite and bauxite clay is in the east wall, and white bauxite is exposed in the west wall.

Possible extensions: North, west, or below the pit. Hayes (1895, p. 584) writes "the ore extends at least 40 feet below the lowest part of the pit." Jones (1940, p. 40) states that there was "a lead of good ore on the west bank when work stopped." The test pits and trenches in the vicinity of this mine are mostly barren, or water-filled.

Overburden: Gravel and clay of unknown thickness.

Washer, Big Washer, or Taylor mine

Location: About the midlength of the west margin of the SE¼SW¼NW¼ sec. 35, T. 11 S., R. 11 E. (pl. 1, loc. 25).

Altitude: Top of the pit, 1,000 feet; top of ore, 955 feet; bottom of pit, 920 feet above sea level.

Topographic position: At the foot of the north slope of Indian Mountain.

Stratigraphic position: Longview or Newala Limestone.

Structure: Just north of the trace of the Indian Mountain thrust fault.

Surface indications: Abundant bauxite float and an outcrop on a low hill to the west.

Development: Abandoned; a pool of water at the northwest corner in winter; dry in summer. Many test pits were dug in the vicinity. The mine is about 250 feet in diameter and a maximum of 80 feet deep on the south side.

Physical and chemical composition: Two types present. White to buff bauxite with small or large compound pisolites can be seen in the east and northeast walls. Boulders of pisolitic bauxite and loose pisolites imbedded in a matrix of ferruginous bauxitic clay is exposed in the northwest wall and in test pits to the west. An analysis of low-grade bauxite by the U.S. Bureau of Mines (written commun., 1942) is as follows: 25.5 percent SiO_2, 29.8 percent Al_2O_3, 28.1 percent Fe_2O_3, 1.8 percent TiO_2, and 14.3 percent loss on ignition.

Nature of walls: Bauxite in the east and northeast walls, and in one place in the north wall. Red clayey bauxite in the northwest wall. The rest are slumped clay except in the highest part of the south wall where weakly bonded sands occur.

Possible extensions: East, west, or north. Of 20 test pits and 5 trenches dug in the low hill west of the main opening, pisolites of bauxite in a matrix of softer ferruginous and clayey bauxite are exposed in 5 test pits and 4 trenches. Bauxite may be there in an area of at least 1,500 square feet and to a depth probably in excess of 20 feet.

Overburden: About 5 to 30 feet of quartzite gravel and clay.

White mine

See Carr Mine.

Wilson mine

Location: In the middle of the N½NE¼NW¼SE¼ sec. 23, T. 11 S., R. 11 E. (pl. 1, loc. 4).

Altitude: Top of the cut, 960 feet; water level, 935 feet above sea level.

Topographic position: On the east slope of a gentle nose trending south from Poplar Ridge.

Stratigraphic position: In the Knox Group, probably in the Copper Ridge Dolomite.

Structure: Possibly along or near a high-angle fault.

Development: Abandoned, water in the bottom. The pit is about 150 feet in diameter and 25 feet deep to water level. Judging by the size of the dumps, a large proportion of the material mined must have been waste.

Physical and chemical composition: Cream-colored bauxite with large compound pisolite and buff-colored bauxite with few pisolites. Bauxite and kaolin occur on the north and south sides of the pit in large masses which look as if they had once been continuous across the pit in beds with a northeasterly trend. Jones (1940, p. 35) gives four analyses which range from 3.2 to 25.6 percent SiO_2, 46.4 to 62.2 percent Al_2O_3, 0.3 to 5.8 percent Fe_2O_3, 2.2 to 3.4 percent TiO_2, and 24.4 to 32.0 percent loss on ignition.

Nature of walls: Slumped on east wall and parts of others. Variegated silty clays and clayey silts characterize the west wall. Cream-colored to white bauxitic and kaolinitic clay is in the north and south walls. Some massive bauxite, enclosing boulders of bauxite with large compound pisolites, can be seen in northeast corner.

Possible extensions: North, up the hollow. Test pits in the vicinity of this mine did not penetrate bauxite.

Overburden: Cherty slope wash, about 5 to 20 feet thick, over clays of unknown thickness.

Wood property

Location: In the SE¼NW¼ sec. 5, T. 12 S., R. 11 E.; not shown on pl. 1.

Altitude: 720 feet above sea level.

Topographic position: In a broad, flat valley floor.

Stratigraphic position: Longview or Newala Limestone.

Surface indications: Scattered small bits of bauxite float. Two pieces about the size of a walnut were found in an hour's search.

Development: A single test pit was sunk about 150 feet east of the center of the SE¼NW¼ sec. 5, T. 12 S., R. 11 E. By 1942 the pit was so filled that it was only about 2 feet deep. Mrs. Arthur Wood (oral commun., 1942) said that it was dug by her husband in 1919 and that he found a number of pebbles of bauxite. The largest she recalls having seen was about the size of a baseball. No bauxite was exposed in the walls when examined by the author.

Physical composition: Of the two small pisolitic pebbles found, one is ferruginous and the other looks siliceous. No chemical analyses were made.

Overburden: Sandy loam and gravel.

Remarks: The bauxite probably is only float from occurrences well up the drainage, for an altitude of 720 feet is well below that of any known bauxite in the Rock Run area.

Woodward Hollow prospect 1

Location: At the midlength of the west edge of the SW¼NW¼ NW¼ sec. 31, T. 11 S., R. 11 E. and the midlength of the east edge of the SE¼NE¼NE¼ sec. 36, T. 11 S., R. 10 E. (pl. 1, loc. 29).

Altitude: Top of deposit, 830 feet; bottom, 810 feet above sea level.

Topographic position: On the southeast slope of a hill which rises from near the valley bottom to an altitude of 1,088 feet.

Stratigraphic position: In the Knox Group, probably in the Copper Ridge Dolomite.

Structure: Possibly along or near a high-angle fault.

Development: Two small open pits, a trench, and two shallow test pits. The prospect is abandoned. It is doubtful if any ore was ever shipped from this place, though a ton or more of the best ore has been piled up at the south edge of the central pit. One open pit is about 25 feet in diameter and 15 feet deep. The open pit to the northeast is 70 feet long by 40 feet wide and 15 feet deep.

Physical composition: Buff to orange with pisolites of irrregular size and shape but mostly large. This bauxite occurs as scattered boulders in bauxitic clay and is in part intimately associated with iron which appears to have filled cracks and seams in the clay.

Nature of the walls: Variable, as follows: No bauxite and little clay are in the northeast open pit; the trench to the west is barren; boulders of pisolitic bauxite in clay are in the south and southeast walls of the central open pit, but only limonite and clay are exposed in the north wall.

Possible extensions: West into the hillside, up a small hollow to the north, or possibly northeast or southwest in the bottom of Woodward Hollow.

Overburden: A few feet of loamy cherty slope wash overlyling variegated clays.

Remarks: Possibly this is the bauxite deposit noted by McCalley (1897, p. 776) as occurring in the SE¼SW¼ sec. 30, T. 11 S., R. 11 E. No bauxite was seen in the quarter section noted by McCalley.

Woodward Hollow prospect 2

Location: Near the center of the W½NE¼SE¼NE¼ sec. 36, T. 11 S., R. 10 E. (pl. 1, loc. 30).

Altitude: 780 feet above sea level.

Topographic position: Almost at the bottom of Woodward Hollow on a gently sloping nose on the west side.

Stratigraphic position: In the Knox Group, probably in the Copper Ridge Dolomite.

Development: A number of test pits; no mining. Boulders of highly ferruginous bauxitic material lie about the edges of a single shallow test pit. Only limonitic iron and clay is exposed in three fair-sized abandoned pits at intervals of 70 to 100 feet to the northwest. The 8 or 10 test pits to the southwest are barren of bauxite.

Physical Composition: Very ferruginous.

Possible extensions: The heads of the hollows to the northwest or southwest and the hill slope west of the test pit.

Overburden: Loamy soil with chert at the surface and variegated silty clays below.

BAUXITE MINES AND PROSPECTS IN THE GOSHEN VALLEY AREA

Cowan prospect

See Lewis prospect.

Cunliff prospect

Location: N½SW¼SW¼NW¼ sec. 10, T. 12 S., R. 9 E. (pl. 1, loc. 42).

Altitude: About 850 feet above sea level.

Topographic position: On top of a small knoll on a low spur extending southeastward from the southeast end of Weisner Mountain.

Stratigraphic position: In the Copper Ridge Dolomite, probably lower part, inasmuch as "pipe chert" is fairly common in the float.

Structure: Just east of a strike fault. A zone of springs along this fault indicates active ground-water movement here.

Surface indications: Bauxite abundant as surface float.

Development: Auger holes and test pits. W. P. Cowan (oral commun., 1942) relates that he put down 12 auger holes to an average depth of about 20 feet in the small area covered by bauxite float. Small bits of bauxite were recovered in samples from several of the holes; all other holes were barren. He also dug five shallow test pits most of which were barren. Around the deepest of these, about 7 feet deep in 1942, were scattered bits of bauxite in a chert gravel. Sticky white clay, but no bauxite, is exposed in a ditch at the site of a former millrace on the north side of the knoll on which the bauxite float occurs.

Physical and chemical composition: Scattered small pebbles of cream-colored to buff pisolitic bauxite in cherty sandy slope wash. An analysis by the U.S. Bureau of Mines (written commun., 1942) of a sample taken from the wall of the deepest test pit follows: 56.4 percent Al_2O_3, 11.7 percent SiO_2, 0.9 percent Fe_2O_3, and 3.0 percent TiO_2.

Possible extensions: Northwestward up the slope. The bauxite seen at this prospect was all transported but probably not far, and if the ore body from which the bauxite was derived has not been entirely eroded away, it lies nearby.

Overburden: An indeterminable thickness of silty clay with a thin gravel bed near the surface.

Remarks: This prospect takes its name from the fact that it is on land known locally as the "Cunliff Place."

The occurrence of bauxite here has been known to local residents for a number of years, but no published reference to it has been found.

Dupont, or Snyder, mine

Location: Just north of center of S½NE¼NW¼ sec. 7, T. 12 S., R. 10 E. (pl. 1, loc. 34).

Altitude: About 700 feet above sea level.

Topographic position: At the bottom and near the mouth of a broad south-southeastward-trending hollow where it intersects an east-southeastward-trending hollow to form an irregular basin between low hills.

Stratigraphic position: Probably near the basal sandstone of the Chepultepec Dolomite. If the probable position of the basal sandstone of the Chepultepec is projected under the alluvium-filled hollow in which the ore body lies, it falls 80 to 200 feet below the surface at the Dupont mine.

Structure: A few hundred feet northeast of the intersection of a strike fault with a dip fault.

Development: Abandoned, water-filled. A number of shallow test pits have been dug in the vicinity of the principal opening, but bauxite was seen only in those immediately northeast of the mine. The mine is about 120 feet in diameter, with a roughly triangular extension to the northeast about 25 feet on a side. It was about 40 feet deep.

Physical and chemical composition: Pink to red and buff pisolitic masses of bauxite in bauxitic clay. Jones (1940, p. 58) gives two analyses as follows: 50.6 and 61.3 percent Al_2O_3, 6.6 and 1.9 percent

SiO_2, 14.3 and 1.4 percent Fe_2O_3, 3.0 and 2.4 percent TiO_2, and 25.5 and 33.0 percent loss on ignition.

Nature of the walls: Above water in the mine, pink bauxite in parts of northwest, southeast, and south walls; chert gravel on south and southwest sides. It is locally reported that bauxite was exposed in the bottom and west wall of the mine when operations stopped about 1906.

Overburden: Cherty alluvium and silty, sandy clay. Some of the bauxite is only a few feet from the surface.

Remarks: Possibly this is the deposit referred to by McCalley (1897, p. 772–773) in the E½NW¼ sec. 7, T. 12 S., R. 9 E. If R. 9 E. was a typographical error for R. 10 E., McCalley's location and description fit the Dupont mine fairly well, for massive boulders and outcrops of limonite-cemented chert breccia do occur about 400 feet to the southeast.

Garvin prospect

Location: Near center of S½SW¼SE¼ sec. 33, T. 11 S., R. 10 E. (pl. 1, loc. 31). On the right (west) bank of Terrapin Creek just south of a big hairpin bend.

Altitude: The highest bauxite seen was in a test pit a little above 700 feet, but bauxite has been thrown out from test pits at altitudes down to 650 feet or less and float occurs down to stream level at 610 feet above sea level.

Topographic position: East side of Catlet Mountain on the gently sloping surface and steep east-facing slope of a lunate reentrant which overlooks Terrapin Creek and which may be part of an old stream terrace.

Stratigraphic position: Chepultepec Dolomite.

Structure: Possibly just southeast of a slightly oblique strike fault.

Surface indications: Bauxite float. Cream-colored plastic in part cherty clay occurs at two places on the road along the west bank of Terrapin Creek.

Development: A number of shallow test pits. Boulderlike masses of bauxite can be seen about the edges of five or six of them.

Physical and chemical composition: Hard pisolitic buff to pink boulderlike masses. Pisolites are irregular in shape and small to large. Jones (1940, p. 32) gives two analyses as follows: 39.4 and 51.0 percent Al_2O_3, 42.7 and and 14.9 percent SiO_2, 1.7 and 5.1 percent Fe_2O_3, 2.8 and 2.4 percent TiO_2, and 13.4 and 26.6 percent loss on ignition.

Overburden: Cherty loamy slope wash and silty clay of unknown but probably not very great thickness.

Remarks: Relatively inaccessible to a drill rig because of the steep banks leading up to it. A private road leads to the base of the steep bank, but for the last 500 feet or so the road is frequently flooded by high water of Terrapin Creek.

Johnson prospect

See drill site GV 1, page N41.

Lee prospect 1

Location: Near midlength of east edge of SE¼NW¼SW¼ sec. 14, T. 12 S., R. 9 E. (pl. 1, loc. 38).

Altitude: About 850 feet above sea level.

Topographic position: On a southeastward-trending spur, just north from the axis of a northeast-trending saddle between two knolls.

Stratigraphic position: Lower part of the Chepultepec Dolomite, about 150 feet above the basal sandstone.

Structure: No faults discernible in vicinity.

Surface indications: Bauxite float.

Development: Test pits and trenches. Two trenches (one about 35 by 20 ft across and 10 ft deep and the other about 20 by 8 ft across and 8 ft deep) lie immediately north of a private road, and two test pits (each about 8 ft across and 8 and 4 ft deep, respectively) just north of them. Cream-colored to light-buff pisolitic bauxite is exposed at the west end of the larger trench. Minor amounts of pink clay in silty cherty clay are exposed in the other trench and in the pits.

Physical and chemical composition: Mostly cream colored to buff and vesicular, with scattered irregular pisolites. Some of the bauxite is reddish and looks ferruginous. Jones (1940, p. 61) gives the following analysis for "hard, white" ore from this prospect: 56.4 percent Al_2O_3, 15.5 percent SiO_2, 0.3 percent Fe_2O_3, 1.6 percent TiO_2, and 26.2 percent loss on ignition.

Overburden: Cherty slope wash about 2 feet thick.

Lee prospect 2

Location: About 150 to 200 feet west of center SW¼ sec. 14, T. 12 S., R. 9 E. (pl. 1, loc. 39), and approximately 350 feet S. 15° W. from Lee prospect 1.

Altitude: About 840 feet above sea level.

Topographic position: On a southeastward trending spur, just south from the axis of a northeast-southwest trending saddle between two knolls.

Stratigraphic position: Same as Lee prospect 1.

Structure: Same as Lee prospect 1.

Surface indications: Small amounts of bauxite float.

Development: Trenches and test pits. The principal excavation is a trench, about 120 feet long, extending northwest, 25 feet across, and 10 feet deep in 1942. The walls are badly slumped. Normal to the trench and at about its midlength is a much shallower and smaller trench. George Estes, a local resident, states (oral commun., 1942) that one carload of ore was shipped from here. Test pits were sunk in the bottom of the main trench and about its margins. Those in the bottom, especially at the northwest end, expose small amounts of bauxite; the others are barren.

Physical and chemical composition: Buff, pink, and chocolate-colored hard pisolitic bauxite with small to large pisolites. An analysis by the U.S. Bureau of Mines (written commun., 1942) of a sample collected by the author follows: 50.2 percent Al_2O_3, 22.6 percent SiO_2, 1.0 percent Fe_2O_3, and 2.0 percent TiO_2.

Overburden: Cherty slope wash, about 10 feet thick.

Lewis prospect

Location: Principally in the SW¼NE¼SE¼NW¼ sec. 13, T. 12 S., R. 9 E. (pl. 1, loc. 36).

Altitude: From about 850 to 870 feet above sea level.

Topographic position: On the south slope of a hill, 1,000+ feet high, at the south end of the long ridge which extends north from Dry Slough opposite Lank Pond Mountain.

Stratigraphic position: Copper Ridge Dolomite.

Structure: Near the probable intersection of a strike fault and a dip fault.

Surface indications: Large boulders of ferruginous pisolitic bauxitic clay.

Development: Test pits. Masses of pisolitic material are around the edges of two test pits, but no bauxite was seen in place. Nearby, and principally uphill from these pits, is a number of prospect pits in which limonite but no bauxite is exposed.

Physical and chemical composition: Pisolitic boulderlike masses. The pisolites are principally brick red, large to small, and either crowded or scattered in the matrix which is cream colored to pink. Some of the limonite also has a pisolitic structure. A sample collected by the author from this prospect contained 26.20 percent Al_2O_3, 48.45 percent SiO_2, 12.62 percent Fe_2O_3, and 1.18 percent TiO_2. Analysis by the U.S. Bureau of Mines (written commun., 1942).

Overburden: Silty clays, limonite, and cherty slope wash.

Remarks: This prospect is probably the one briefly noted by Jones (1940, p. 60) as the Cowan prospect, but it is not known to the local residents by that name. It was first described by McCalley (1897,

p. 772). Like the Garvin prospect, it is relatively inaccessible to a drill rig because of the steep banks leading up to it.

Mundy prospect

Location: NE¼SE¼SW¼NE¼ sec. 26, T. 12 S., R. 9 E. (pl. 1, loc. 41).

Altitude: About 800 feet above sea level.

Topographic position: On the west side of a shallow hollow which drains to the north-northeast between two low hills at the foot of a long, gentle slope trending southeastward from a prominent ridge.

Stratigraphic position: Probably near the middle sandstone zone of Chepultepec Dolomite although considerable chert of Mississippian age occurs in the float near here.

Structure: Several hundred feet south of a dip fault.

Development: Test pits and one shaft. Small pebbles of bauxite are scattered in clay about the edges of three broad shallow test pits dug by T. C. Cowan about 1909. A little pink bauxitic clay and much variegated clay is exposed in two 12-foot pits dug by W. P. Cowan in 1941. These five pits are within an area about 40 feet long and 30 feet wide. About 50 feet S. 20° E. from them, a shaft about 12 feet deep exposes ferruginous sandstone in the walls on the northeast side and white plastic clay on the southwest side. Hard iron ore and ferruginous sandstone, but no clay, can be seen in several pits to the east and south.

Physical composition: Pebbles of pisolitic, cream to buff bauxite, and small amounts of pink bauxitic clay.

Possible extensions: Probably none. All bauxite at this place is probably transported and no real ore body is present.

Overburden: Cherty slope wash and clay of unknown thickness.

Remarks: This prospect was discovered about 1909 by T. C. Cowan who was prospecting for iron ore. No published reference to it has been found.

New Stewart prospect

Location: SW¼NE¼NE¼SE¼ sec. 6, T. 12 S., R. 10 E. (pl. 1, loc. 33).

Altitude: About 700 feet above sea level.

Topographic position: Near the foot of a spur trending southeast from Roberts Mountain.

Stratigraphic position: Not far above the basal sandstone of the Chepultepec Dolomite.

Structure: No structural discordance known nearby.

Development: An abandoned dry prospect pit about 25 feet in diameter and 12 feet deep, with short trenchlike extensions to the northeast and southeast.

Physical and chemical composition: Hard pisolitic boulderlike masses, principally light buff with pastel variegations. Jones (1940, p. 59) gives the following analysis: 59.9 percent Al_2O_3, 4.6 percent SiO_2, 1.7 percent Fe_2O_3, 3.3 percent TiO_2, and 30.5 percent loss on ignition.

Nature of walls: Mostly obscured by slumping. About 5 feet of bauxitic clay is exposed in a small extension of the pit to the northeast, and bauxitic clay crops out in parts of the west wall.

Overburden: Cherty slope wash and silty clays of unknown thickness. Bauxite is at the surface in the pit.

Remarks: It is possible that this prospect represents part of the bauxite referred to by McCalley (1897, p. 773) as occurring in the N½SW¼ sec. 6, T. 12 S., R. 9 E. If McCalley's location was a typographical error for the N½SE¼ sec. 6, T. 12 S., R. 10 E., the Old Stewart prospect (north-northeast of here) would fit his description of "a solid ledge, for 6 to 8 feet across a wash." Unless this is so, there is no mention of the New Stewart prospect in McCalley's paper, yet he probably knew of it inasmuch as the prospect was opened in 1895 according to Jones (1940, p. 58).

Old Stewart prospect

Location: Near center of NE¼NE¼SE¼ sec. 6, T. 12 S., R. 10 E. (pl. 1, loc. 32), about 280 feet north-northeast of the New Stewart prospect.

Altitude: About 680 feet above sea level.

Topographic position: In a wash at the bottom of and near the mouth of a narrow hollow draining southeastward from Roberts Mountain.

Stratigraphic position: Not far above the basal sandstone of Chepultepec Dolomite.

Structure: Same as New Stewart prospect.

Development: An abandoned dry pit about 60 feet long along a wash, 30 feet wide, and 8 feet deep at its deepest point.

Physical and chemical composition: Pinkish to buff, pisolitic, hard to medium soft, fairly massive bauxite. Jones (1940, p. 59) gives analysis of "average soft" ore as follows: 54.8 percent Al_2O_3, 14.9 percent SiO_2, 1.2 percent Fe_2O_3, 1.2 percent TiO_2, and 27.9 percent loss on ignition.

Nature of walls: Obscured by slumping except for west wall, where bauxite is exposed for nearly 30 feet across the wash. At the south end of this wall, bauxite is about 2 feet thick and is underlain by mottled clay; but at midlength of the wall, bauxite is 8 feet thick, extending to the floor of the pit; toward the north end, the bauxite thins only slightly.

Overburden: Cherty slope wash and silty clays of unknown thickness. The bauxite is very close to the surface in the pit.

Remarks: It is possible that this prospect represents part of the bauxite referred to by McCalley (1897, p. 773) as occurring in the N½SW¼ sec. 6, T. 12 S., R. 9 E., and that his location as given was in part a typographical error (see the description of the New Stewart prospect).

Rumsey prospect

Location: Near center of N½SW¼NW¼NE¼ sec. 14, T. 12 S., R. 9 E. (pl. 1, loc. 37).

Altitude: About 780 feet above sea level.

Topographic position: On the south side of a small knoll in the bottom of a broad irregular basin.

Stratigraphic position: Probably in the Longview Limestone.

Structure: No faults known within 1,000 feet.

Development: A single small test pit about 3 feet deep. A large number of small to large pieces of white to pink bauxite embedded in clayey silt can be seen in the pit. Much iron oxide (in part a breccia) occurs at the surface immediately east of the bauxite.

Physical and chemical composition: White to pinkish soft bauxite with scattered pisolites varying in size from small to large. Jones (1940, p. 61) gives an analysis of "hard white" bauxite as follows: 57.4 percent Al_2O_3, 11.9 percent SiO_2, 0.7 percent Fe_2O_3, 3.2 percent TiO_2, and 26.8 percent loss on ignition.

Overburden: Alluvial sand and clayey silt, with some chert and sandstone float. The bauxite is close to the surface.

Snyder mine

See Dupont mine.

Stewart prospects

See Old Stewart prospect and New Stewart prospect.

Terrapin Creek prospect

See Garvin prospect.

Wallace prospect

Location: Northeast corner of the SW¼NE¼ sec. 23, T. 12 S., R. 9 E. (pl. 1, loc. 40), about 200 to 250 feet S. 68° W. from a big lone red-oak tree.

Altitude: About 770 feet above sea level.

Topographic position: On the north side of a low spur extending southeastward into a broad basin. The deposit is 10 or 15 feet above the basin floor.

Stratigraphic position: Probably in the Longview Limestone. Float of Mississippian chert is abundant in the vicinity, but it is probably a gravel which has no stratigraphic significance.

Structure: A probable strike fault lies about 600 feet to the east. No closer structural discontinuity is known. If the bauxitic material at this place is part of an ore body and not merely a gravel, its occurrence may be related to one of the sandstone zones that characterize the Longview-Newala beds.

Surface indications: Cobbles and pebbles of pisolitic bauxite in red to buff clay and silt. The bauxite occurs at three places that define a roughly triangular area with a 40-foot base and 60-foot sides. The bauxite is near the surface in three shallow rill washes and appears to have been recently exposed. The bauxitic float also is limited to the immediate vicinity of these exposures.

Development: None.

Physical and chemical composition: Pebbles and cobbles of pink to cream-colored pisolitic, and in part vesicular, bauxite in an impure gritty clay. Pisolites are small to large, simple to compound, scattered, and irregular in shape. An analysis by the U.S. Bureau of Mines (written commun., 1942) of a composite sample follows: 32.61 percent Al_2O_3, 40.32 percent SiO_2, 12.12 percent Fe_2O_3, and 1.77 percent TiO_2.

Overburden: Silty clay and gravel. The probable thickness is indeterminable, and possibly no true ore body is present.

Remarks: No published reference to the occurrence of bauxitic material at this place has been found. Mr. Jim Pruitt, a local resident who called attention to this prospect, states that it was discovered by him while plowing a few years prior to 1942.

Wright prospect

Location: Near center of the S½NE¼SE¼NW¼ sec. 27, T. 12 S., R. 9 E. (pl. 1, loc. 43).

Altitude: About 800 feet above sea level.

Topographic position: On the west side of a small hollow trending southward on the gentle dip slope of a cuesta-like ridge.

Stratigraphic position: Copper Ridge Dolomite, probably the lower part. "Pipe chert" is fairly common in the float nearby.

Structure: No structural discontinuity known. Evidence indicates that the rocks underlying the bauxite dip gently to the east-southeast in normal sequence.

Surface indications: A little bauxite float.

Development: Test pits and trenches. Three shallow trenches about 25, 50, and 120 feet long have been dug, as well as three shallow test pits. The largest test pit is about 12 by 20 feet across and was

5 feet deep when visited in 1942. Eight large boulderlike masses of bauxite are exposed in the walls of the pit, and a fair quantity of light buff pisolitic bauxite occurs about the edges of it.

Physical and chemical composition: Pisolitic light buff boulders of bauxite. An analysis by the U.S. Bureau of Mines (written commun., 1942) of a typical sample follows: 63.1 percent Al_2O_3, 1.3 percent SiO_2, 0.3 percent Fe_2O_3, 2.8 percent TiO_2, and 31.7 percent loss on ignition.

Overburden: Clay, gravelly and silty near the surface. Its thickness should not exceed a few tens of feet.

Remarks: The Wright prospect is so named because it is on land known to local residents as the "Old Wright Place" from the Wright sawmill which was once located here. The occurrence of bauxite has been known locally for a number of years, but no published reference to it has been found.

REPORTED OCCURRENCES OF BAUXITE NOT VERIFIED IN MAPPING

1. McCalley (1897, p. 772–773) writes as follows: "Bauxite crops out in several places in the E. 1/2 of N. W. 1/4, of S. 7, T. 12, R. 9 E. In one of these places, it shows as a solid patch, 25 to 30 feet in diameter, of boulders. The most of these boulders are of a pinkish clayey looking ore, though some of them are of a good ore. To the south, between 100 and 200 yards, there is a large deposit of limonite in black boulders that, though rocky or cherty, are high in iron."

   The locality, as given above, falls well out on a broad flat, southwest of Weisner Mountain, in an area probably underlain by argillaceous rocks and limestones of the Conasauga Limestone. This is topographically and stratigraphically an unusual place for bauxite to occur. The entire area cited by McCalley was searched for trace of bauxite, but none was found. If, however, the R. 9 E. in McCalley's location is a typographical error for R. 10 E., the location corresponds to that of the Dupont mine cited above.

2. McCalley (1897, p. 773) writes as follows: "Bauxite shows also in a couple of places in the N. 1/2 of S. W. 1/4 of S. 6, T. 12, R. 9 E. In the most north-east of these places, it shows as a solid ledge, for 6 to 8 feet across a wash. It is here a pure white ore that is said to have 63% of alumina * * *"

   This locality, as given, falls in the same broad flat as the one above. It, too, was thoroughly searched for any trace of bauxite, but none was found. However, the description given by

McCalley fits the occurrences known as the Stewart prospects if it be assumed that his location contained two typographical errors and should read the N½SE¼ sec. 6, T. 12 S., R. 10 E. For more detail, see the descriptions of the New and Old Stewart prospects.

3. McCalley (1897, p. 772) writes that "bauxite, of a soft clayey ferruginous variety, makes a small showing in a gully in the S. W. 1/4 of S. E. 1/4 of S. 11, T. 12, R. 9 E."

No bauxite was found in the area cited by McCalley, but it is near the Rumsey prospect.

4. Mr. W. P. Cowan of Piedmont, Ala., relates (oral commun., 1942) that in 1941 he found two small pebbles of bauxite in the SW¼NW¼SE¼SW¼ sec. 24, T. 12 S., R. 9 E., in a field on a hillslope about 300 to 400 feet west of Robert Ray's house.

In the course of three visits to this locality (one with Cowan) the entire cleared hillslope and adjoining woods was searched without finding any bauxite. Mr. Ray remembers Cowan's find but states that during many years of cultivating the field in question he never saw another piece of bauxite on it. This locality is not regarded as favorable for bauxite: first, because cherty clays exposed in a wash nearby suggest that bedrock may be not far below the surface; and second, because neither structure nor stratigraphy is especially favorable to formation of sinks here.

5. It is locally rumored that bauxite was found in an old dry well in the SE¼NW¼SW¼NE¼ sec. 25, T. 12 S., R. 9 E.

Mr. Ollie T. Ray of Piedmont, Ala., remembered such a discovery. He states that he was 10 or 15 years old (he was 46 in 1942) when the well was dug, that it was 30 to 60 feet south of a house (now represented only by a chimney foundation) on a low ridge, and that it was dug to a depth of 40 or 50 feet and abandoned because of caving without striking water. Mr. Ray says that the bauxite was struck about 30 feet below the surface and was about eight feet thick. Although himself unfamiliar with the character of bauxite at the time, he was told by older men that the material was bauxite. He describes it as being hard and resembling a coarse cement mortar, yet easily broken to small pieces with a hammer—an apt description of some types of bauxite.

Mr. Ross Davis, who lived about 2½ miles from the locality, about midway between it and Piedmont, states that he dug the well himself about the year 1900, that it was about 60 feet deep, and that there was no bauxite in it. Moreover, he claims that he dug five wells in the 7 or 8 acres immediately about the old house site, that these wells were all 60 feet or more deep, and that none of them struck anything but chert, cherty clay, and a little iron oxide. Mr. Davis, who was 73 years old in 1942 and the local resident of longest tenure, stated that he had worked in the bauxite mines of the Rock Run area for several years before he dug the well and would surely have known bauxite if he saw it.

6. Mr. W. P. Cowan of Piedmont, Ala., stated that his father, T. C. Cowan, told him that bauxite was struck in an old well perhaps 100 to 150 feet west of the midlength of the line between the SE¼SE¼ sec. 11, T. 12 S., R. 9 E. and the NE¼NE¼ sec. 14, T. 12 S., R. 9 E.

   The well in 1942 was a shallow cone-shaped hole about 10 feet in diameter at the top and 4 feet deep; it was in the woods about 260 feet S. 40° E. from the corner of an old clearing. Mr. Cowan states that the well was dug about 1895 or 1900 to a depth of about 30 feet but does not recall the depth at which the bauxite was supposed to have been struck.

BAUXITE LOCALITY NEAR CLEBURNE COUNTY LINE

Howell prospect

Location: NE¼SE¼NE¼SW¼ and NW¼SW¼NW¼SE¼, sec. 29, T. 12 S., R. 11 E., a few miles south of the Rock Run area.

The locality is about 6 miles N. 60° E. of Piedmont, and is best reached by following Alabama Highway No. 74 about 0.35 mile east-southeast beyond the turnoff to Pleasant Gap (see pl. 1), turning south-southeast on a good private road, and driving southeast (without turning off) to the end of the passable road at a log cabin about 0.6 mile distant. From there walk on up the hollow, take the first south fork of the woods road across a creek, and swing around and up a gentle spur to follow the trail along a low spurlike ridge to the Howell prospect about a mile beyond the log cabin.

Altitude: 1,150 to 1,190 feet above sea level.

Topographic position: On the southeast slope of a small ridge that trends west-northwest from the gap between the most northeasterly peak of Wolf Ridge and the unnamed 1,603-foot hill north of it, where the slope of the small ridge grades into the gentle slope on the west side of the gap.

Stratigraphic position: Probably a shale bed in the Weisner Quartzite. It is a soft yellowish-brown, gray, and greenish-yellow micaceous silty shale (in part finely laminated), and is interbedded with siltstone and thin beds of light-brownish-yellow sandstone. The underlying shale crops out in the gully south of the pisolitic rock, and there in part has weathered to a cream-colored soft plastic gritty clay. Other test pits and shafts in the vicinity expose silty and manganiferous clay.

Structure: Probably 200 to 300 feet above the sole of a major thrust fault. The State geologic map of Alabama indicates a fault striking northwestward through the gap in which the fault lies, and the topography favors such an interpretation.

Surface indications: Float of pisolitic rock.

Development: Three shallow test pits and a trench. The three test pits are about 100 feet south of the woods road and alined roughly east to west. The westernmost pit is about 2 by 3 feet across and 2 feet deep. The middle one is about 5 feet in diameter and 3 feet deep. The easternmost pit is about 6 by 8 feet across and 2½ feet deep. The trench, about 60 feet east-southeast of the third pit, is about 40 feet long and 10 feet wide. Nearer the road manganese and sand are exposed in additional pits. One of these is at the south edge of the road, due north of the bauxite pits. It is about 50 feet long and 25 feet wide. There are four additional small test pits on the north side of the road and one large pit alined roughly east to west. The large pit is about 45 feet long and nearly 25 feet wide. No bauxitic or pisolitic material was seen in the manganese pits.

Physical composition: Irregular and roughly equidimensional cobbles of pisolitic rock or clay-ball conglomerate embedded in silty clay. On freshly broken faces can be seen irregularly subround to round bodies of red very gritty clay in a cream-colored to brownish-pink clay matrix. The round red bodies crumble readily, and most do not show any structure, but a few afford suggestions of a concentric or concretionary structure. The matrix contains scattered round quartz grains, a few flakes of a white mica, and local pockets filled with small to large round quartz grains. One piece had several angular inclusions of shale. No chemical analyses are available.

Subround quartz pebbles of the type widespread in gravel deposits north, west, and south of here occur near the crest of the ridge and at scattered places on both sides of the woods road, and are indicative of once-active transportation. Therefore, the "bauxite" might have been transported and lodged in a pocket formed by erosion of the weakly resistant shale of the Weisner Formation. The nature of the occurrence suggests local movement and mixing of materials.

Nature of the walls: Commonly slumped. Pisolitic rock and purple to buff silty clay are exposed in the debris about the westernmost pit. Digging into clay in the northeast corner of the easternmost pit revealed pieces of pisolitic rock ranging in size from a baseball to a hickory nut embedded in a sticky gritty orange clay. At the trench, shovel work disclosed pebbles and small cobbles of pisolitic rock in a yellow-brown and pink gritty clay at the north end. Only barren silt and clay were found at the south end.

Possible extensions: Probably negligible. The deposit appears to consist of an accumulation of transported materials, some of which were locally derived.

Overburden: None.

Remarks: No economic importance is attached to this prospect, and no further exploration is recommended. The locality is about a half mile from the Cleburne County line and it is probably the "bauxite" which has been reported as occurring in Cleburne County by Burchard (Thoenen and Burchard, 1941, p. 20).

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