Gold Occurrences Near Jefferson, South Carolina

GEOLOGICAL SURVEY BULLETIN 1334

Gold Occurrences Near Jefferson, South Carolina

By JAMES P. MINARD

GEOLOGICAL SURVEY BULLETIN 1334

A discussion of gold occurrences, sample analyses, and possible economic potential of Coastal Plain sediments and buried Piedmont rocks

UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON : 1971

UNITED STATES DEPARTMENT OF THE INTERIOR

ROGERS C. B. MORTON, *Secretary*

GEOLOGICAL SURVEY

William T. Pecora, *Director*

Library of Congress catalog—card No. 73–610409

For sale by the Superintendent of Documents, U.S. Government Printing Office
Washington, D.C. 20402 - Price 60 cents (paper cover)

CONTENTS

ILLUSTRATIONS

TABLES

GOLD OCCURRENCES NEAR JEFFERSON, SOUTH CAROLINA

By JAMES P. MINARD

ABSTRACT

Gold, possibly in economically significant amounts, is present in the Jefferson area, South Carolina. It occurs in slate belt rocks of Paleozoic age, in Coastal Plain sediments of Cretaceous age, and in alluvial deposits of Quaternary age. The Jefferson area is near the inner edge of the Coastal Plain province and includes the Brewer gold mine, which was intermittently active until 1935 and had a total gold production of about $450,000. Slate belt rocks underlie the entire area and crop out mainly in valley slopes and upper drainageways; auriferous Coastal Plain sediments underlie a small upland; and Quaternary alluvium is in and along streams draining the upland and adjacent areas. Gold in the bedrock at the Brewer mine occurs chiefly in vein lodes in siliceous volcanic and metavolcanic rocks of Paleozoic age. Gold in Coastal Plain sediments is mainly in placer deposits in the lower gravel layers. Gold in Quaternary alluvial deposits is in placers in present stream channels and in flood-plain and abandoned-channel deposits. A lode deposit of gold may exist in the rocks beneath the Coastal Plain sediments.

INTRODUCTION

The purpose of this report is to outline the gold potential in the Jefferson area, Chesterfield County, S.C. (fig. 1), which includes the area of the Brewer gold mine. Gold is present in the volcanic rocks of Paleozoic age, in the overlying Coastal Plain sediments of Cretaceous age, and in the alluvial deposits of Quaternary age. Described briefly is the geology of an area of about 25 square miles which spans the boundary between the Coastal Plain and Piedmont provinces (pl. 1). Also presented are laboratory analyses and panning results of many samples of the various rocks and sediments (see tables 1–3).

The work is part of a broader field reconnaissance study of the distribution of gold in the Atlantic Coastal Plain physiographic province and was sponsored by the Heavy Metals Program of the U.S. Geological Survey during 1966, 1967, and 1968.

In 1966 gold in the amount of 1.20 ppm (parts per million) was detected in a sample from the basal Coastal Plain gravel one-half mile south of Jefferson (outcrop sample 1, table 2). Additional sampling of outcrops and panning of stream gravels during the fall of 1967 indi-

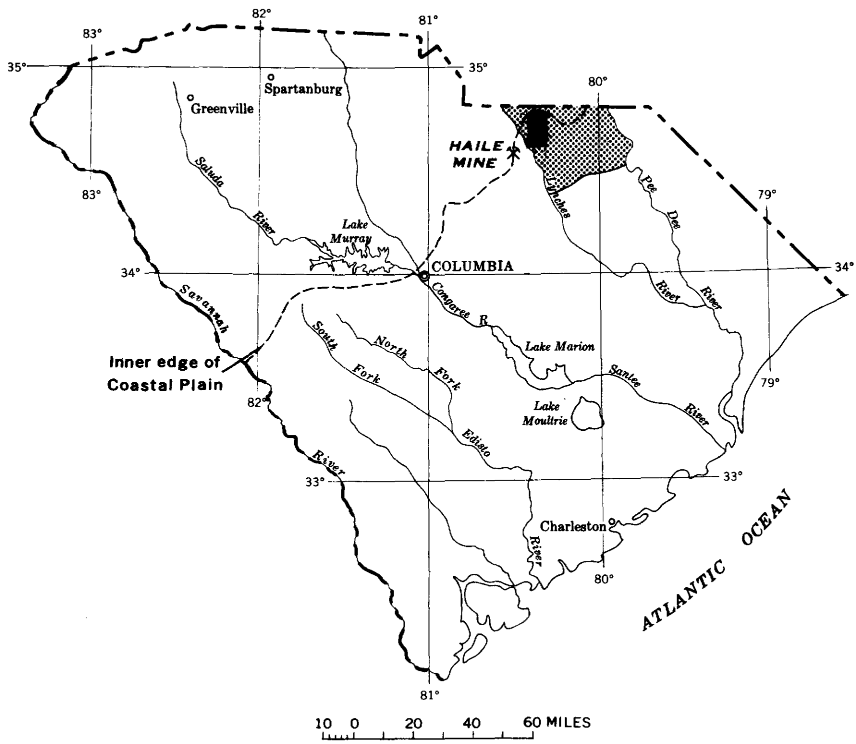

FIGURE 1.—Index map of South Carolina, showing area of Chesterfield County (stippled). Black area is area of this report and of plate 1.

cated that gold was not only in the older rocks in several places beneath the Coastal Plain sediments, but was also present in the Coastal Plain sediments and Quaternary alluvium. During March and May 1968, in order to determine the geologic association and extent of the gold, the author bored auger holes through the Coastal Plain sediments, collected additional outcrop samples, and panned more stream sediments.

All samples were analyzed by atomic absorption techniques in mobile laboratories near the site or in the Denver laboratory of the U.S. Geological Survey. Analysts were G. W. Dounay, T. G. Ging, T. A. Roemer, J. G. Friskin, and A. J. Toevs.

PHYSIOGRAPHY

The Jefferson area lies across the boundary between the Coastal Plain and Piedmont physiographic provinces. Coastal Plain sediments generally underlie low uplands between altitudes of 350 and 650 feet. These uplands slope gently toward the southeast, a general characteristic of the Coastal Plain surface.

The region is well dissected by small streams; throughout most of their length the streams have eroded through the Coastal Plain sediments into the underlying bedrock formations, leaving areas of the Coastal Plain sediments as isolated upland remnants. Only the small upper reaches of the streams flow on Coastal Plain sediments. The land surface of the Piedmont is more rolling and has steeper slopes than those of the Coastal Plain. Piedmont landforms range from gently sloping areas underlain by saprolite to steep valley walls and bald knobs of bedrock rising conspicuously above the surrounding land surface.

Streams are bordered by flood plains of alluvium of varying widths and thicknesses. Some flood plains are narrow and covered by a thin mantle of alluvium through which bedrock protrudes, whereas others, particularly along Fork Creek, are fairly wide and flat, and alluvium is sufficiently thick to cover the bedrock.

GEOLOGY

PALEOZOIC ROCKS

The oldest rocks in the area are part of the Carolina slate belt series (Overstreet and Bell, 1965a, p. 18–32). Rock types include argillite, rhyolite tuff, rhyolite porphyry, silicified tuff, sericite and muscovite schist, breccias, volcanic flow rocks, hornblende gneiss, amphibolite, graywacke, diabase, and granite. In the Jefferson area, these rocks are mapped as three units; argillite, granite, and intermixed rocks. The argillite and intermixed rocks are low-rank metamorphic rocks of Ordovician to Mississippian age; the granite which intrudes them may be as young as Permian (Overstreet and Bell, 1965a, p. 111). The rocks are in various stages of weathering, ranging from fresh and hard, through saprolites in which the original rock can still be recognized, to nearly unidentifiable saprolite clay.

Argillite

Argillite underlies valley bottoms and fairly gentle slopes and benches in the southern part of the area shown on plate 1. This rock is largely greenish- and brownish-gray fine-grained laminated tuffaceous argillite. As shown by Overstreet and Bell (1965b), the unit includes other types of rocks such as breccias and agglomerates and is similar to the rocks mapped in North Carolina as the Tillery Formation (Conley and Bain, 1965, p. 126). In the Jefferson area, the unit mapped as argillite is largely restricted to laminated argillite; the other types of rocks are included in the intermixed rock unit.

Much of the argillite is fissile, splitting readily into thin wavy plates.

Laminae range in thickness from 0.5 mm (millimeter) to 0.5 cm (centimeter). Minute platelets of mica are abundant and have a strong preferred orientation. Because of the fine laminations, the rock is often referred to as "varved." Foliation surfaces are wavy and minutely irregular, and lateral crinkling of laminae and minute offsets or faults are evident. Many outcrops are littered by papery plates of weathered rock. Fresh rock is greenish gray; weathered rock is shades of brown, dull red, and dull yellow.

Intermixed Rocks

The intermixed rocks include all those mapped between the argillite to the south and the granite to the north. Inliers of the unit are within the granite at two locations in the northwestern part of the area (pl. 1). The unit includes rhyolite tuff, rhyolite porphyry, silicified tuff and breccia, diabase, hornblende gneiss, amphibolite, muscovite schist, sericite schist, and saprolitic tuff.

Rhyolite tuff crops out in the roadcut along Route 39 just east of the location for stream sample 41 (table 1). Tough yellow-brown to pale-orange-pink rhyolite porphyry crops out in and along Fork Creek just north of Route 43 at the location for stream sample 23 (table 1) and along Nugget Creek at the location for stream sample 51 (table 1), between Routes 39 and 40. The rock contains abundant pink feldspar crystals, bipyramidal quartz crystals, and some small pyrite cubes. Silicified tuff crops out in and along Fork Creek, about 50 yards upstream from the location for stream sample 20 and along Nugget Creek at the location for stream sample 52 (table 1). The rock is gray, tough, and fine to coarse grained; the fine-grained varieties contain considerable pyrite.

Coarse-grained dark-gray to greenish-gray and light-gray amphibolitic saprolite crops out in Nugget Creek at the locations for outcrop samples 3, 4, and 10 (table 2), both east and west of Route 40. In the upper tributary to Fork Creek, northeast of White Plains Church at the location for stream sample 2, is an outcrop of a similar rock, gneissic amphibolite, both unweathered and saprolitized.

Mica schist crops out in the roadcut near the top of the hill along Route 40, south of the location of outcrop sample 12 (table 2). The rock is schistose, saprolitized, and cut by quartz veins; angular fragments of quartz litter the surface of the rock. Mica schist also crops out in cuts along the west side of Route 151, just east of the location for stream sample 8 (table 1). The rock is partly sheared and saprolitic, cut by quartz veins and pods, and contains much muscovite and sericite in books as much as 1 inch across.

Amorphous siltstones and claystones, which may be weathered tuffs, crop out in cuts along Route 39 west of Nugget Creek.

The intermixed rocks underlie valley bottoms and slopes intermediate in steepness between the fairly gentle slopes on the argillite and the steep ones on the granite.

Granite

Light-gray coarse-grained massive biotite granite, containing a few small lenses of fine-grained granite, crops out in the northern half of the area. Most outcrops of hard unweathered granite are along streams and low fairly steep slopes; the rock underlying upper land surfaces is largely saprolite. In appearance, granite saprolite looks much the same as the hard unweathered granite, but it can be easily excavated by hand shovel. Pink to light-gray potassic feldspar crystals and plates of biotite are clearly identifiable even though the rock is decomposed in place. The saprolitized rock generally is pale red to grayish pink compared with the light gray of the relatively unweathered granite.

Although not common, hard granite does crop out on the upper land surfaces. In the west-central part of the area shown on plate 1, just west of the location for outcrop sample 13 (table 2), granite forms prominent massive rounded knobs rising as much as 30 feet above the hilltops and upper slopes. The ground surface surrounding these outcrops is covered by light-gray sand and resembles a surface on the Coastal Plain material. When one examines the sand grains closely, however, they are seen to be angular fragments of quartz and feldspar derived from the disintegrating bedrock.

From auger holes and roadcuts it was determined that the granite is locally saprolitized to depths of at least 40 feet. Except at and near the surface, in the zone of eluviation, the saprolite is clayey and maintains steep slopes in cut exposures. With the exception of some inliers of older rocks, the granite underlies most of the northern half of the area shown on plate 1. It apparently postdates the argillite and intermixed rocks and may be of Permian age (Overstreet and Bell, 1965a, p. 111).

TUSCALOOSA FORMATION (CRETACEOUS)

Coastal Plain sediments of Late Cretaceous age in this area are called the Tuscaloosa Formation (Wilmarth, 1938, p. 2200) and are considered by Cooke (1936, p. 19) to be equivalent to the Raritan Formation of the middle Atlantic Coastal Plain, although some of the lower deposits may be of Early Cretaceous age. Swift and Heron (1969) reviewed the stratigraphy of the Carolina Cretaceous and redefined the upper part of the Tuscaloosa as the Middendorf Formation and the lower part as the Cape Fear Formation.

The Cretaceous Coastal Plain sediments in the Jefferson area are unconsolidated light-gray, yellow-brown, and reddish-brown clay, silt, sand, and gravel; sand predominates, especially in the upper part of the formation. Clay, yellow to reddish brown, is chiefly kaolinite. Sand, mostly quartz, is locally arkosic, particularly where it is adjacent to or overlaps granite. Gravel is generally more abundant at the base and in the lower part of the unit; some layers of gravel above the lower beds are exposed in roadcuts as at the location for outcrop sample 2 (table 2 and pl. 1). The gravel is chiefly pebble size, but some cobbles are present. The base of the formation is irregular and unconformably overlies all the older rock types in the area. Some deposits of sand and gravel are in filled channels cut into the older rocks. The upper sandy deposits cover most of the upland along Route 151 from Jefferson north for about 4 miles; the sand is generally leached to light gray at the surface.

Compact arkosic sand is well exposed in a cut on Route 40 at the location for outcrop sample 13 (table 2 and pl. 1). Cross stratification is well defined in this outcrop, as in other exposures. The formation is generally distinctively bedded, and gravel is chiefly in distinct layers and lenses from several inches to several feet thick.

Most of the formation in this area probably is fluviatile in origin and was deposited in stream channels and on flood plains. The fossils found elsewhere in the formation are plant remains of terrestrial origin. The irregular channeled base, horizontal and cross stratification, lenticular shapes of gravel beds, abundance of sand, and apparent fluviatile origin favor correlation of these sediments with the Middendorf (upper Tuscaloosa) of Swift and Heron (1969, p. 208, 213–215), for which they suggest a fluvial origin, more than with the Cape Fear Formation (lower Tuscaloosa), for which they seem to favor an origin other than fluvial (p. 212). It is difficult specifically to identify the Coastal Plain sediments in the Jefferson area with one of the divisions of Swift and Heron (1969), only on the basis of criteria of that report. Therefore, the Coastal Plain sediments in this area are still called the Tuscaloosa Formation.

QUATERNARY DEPOSITS

The streams are bordered by Quaternary deposits, largely sand and gravel. Because most of these deposits are thin and somewhat discontinuous along many of the streams, they are shown on the map (pl. 1) only along part of Fork Creek where they form a flood plain as much as one-quarter mile wide and thick enough to cover bedrock completely.

GOLD RESOURCES

Gold is present in most of the rocks of the area. It is probably more abundant in the silicified tuffs and breccias, Coastal Plain sediments, and Quaternary deposits than in the other rocks. This distribution is corroborated by the evidence of past mining in these rocks and sediments and by the results of this study. Gold is concentrated in the Brewer mine area and farther north in the Jefferson-Pageland upland area.

In the present study, gold was detected in the highest values (0.02 to 12 ppm) in unweathered silicified tuff (table 2) and in silicified tuff saprolite (table 3), in amounts ranging from 0.02 to 2.20 ppm in Coastal Plain sediments (tables 2 and 3), and in amounts to 0.70 ppm in stream sediment samples (table 2).

There seems to be slightly less gold in the amphibolitic rocks than in the tuff and Coastal Plain sediments. Gold was detected in these rocks in amounts of 0.02 to 0.04 ppm (table 2). Gold was detected in argillite in an amount of 0.02 ppm in one outcrop sample (table 2). Gold was not detected in two outcrop samples of granite from within the mapped area, but samples of granite saprolite from auger holes contained gold in amounts of 0.02 ppm (table 3).

Of 11 samples of granite and granite saprolite, two contained gold; nine of 35 samples of intermixed rocks and saprolite from intermixed rocks contained gold; of 16 samples of argillite, one contained gold; 13 of 100 samples of Coastal Plain sand and gravel contained gold; and 92 of 110 samples of stream sediments contained gold.

In addition, 72 samples were collected from one roadcut in an attempt to determine the precise stratigraphic position and lateral distribution of the gold. Each sample was continuous for a horizontal distance of 10 feet. The cut, at location for field sample 1 (table 2), is 200 feet long and 4 to 8 feet deep and is along the west side of Route 151, one-half mile south of Jefferson. Fifteen samples were collected and analyzed from the upper 1-foot thickness of argillite exposed in the base of the cut; there was no gold in any of these samples. Of 19 samples collected and analyzed from the basal 1 foot of the gravelly Coastal Plain sediments, gold, in the amount of 0.06 ppm, was detected in two. This is the same horizon from which outcrop sample 1, containing 1.20 ppm gold, was collected. Gold was not detected in any of 19 samples from the Coastal Plain sediments 2 feet above the base, nor in any of the 19 more from the top 1 foot of the cut. The gold was in the basal gravelly sand of the Coastal Plain sediments and was probably transported into this area, because none was detected in the underlying argillite bedrock.

A. R. Kinkel, Jr., U.S. Geological Survey, collected 243 additional samples in 1967 from near the Brewer mine; his analytical results are given in the next section of this report.

BREWER MINE AREA

The Brewer mine area includes the Tanyard placer, the Hartman, Topaz, and Brewer pits, and the other workings in the immediate vicinity (Pardee and Park, 1948, pls. 30, 31; pl. 1, this report).

About $450,000 in gold was recovered at the Brewer mine from 1828 to the mid-1890's and during brief periods to 1935 (Pardee and Park, 1948, p. 106). The Brewer deposit consists of gold-bearing silicified tuff, saprolite, and Coastal Plain sediments, the last largely derived from the weathered tuff. The first discoveries were placer deposits in the small outlier of Coastal Plain sediments covering the bedrock surface west and south of the lode pit. The Coastal Plain sediments in this outlier ranged in thickness from a thin veneer to possibly 10 feet. In the early years of the operation as many as 200 people were working the deposit, mining both the placer and top few feet of the underlying saprolite. Mining subsequently progressed down into weathered tuff and into the lode deposits.

The ore was washed in rockers; later, Chilean arrastres (primitive stone grinding mills) were used. There was little activity from the late 1850's until after 1880, when much of the placer was reworked by hydraulic methods, using water pumped from Little Fork Creek. A five-stamp mill built in 1886 near the creek was expanded to 40 stamps by 1889, and in 1892 a chlorination plant was added. Shortly after 1892 the operation closed, partly as a result of legal issues over tailing damage. Since then, operation has been minimal and brief.

Production from the placer contributed most of the gold recovered from the total mining operation. Placer production has been estimated at $300,000 and lode production at $150,000 (Pardee and Park, 1948, p. 106). About two-thirds of the placer area was called the Tanyard placer. Other placer areas included patches of Coastal Plain sediment around the outcrop of the lode and strips from these patches down natural drainageways. The total placer area mined was about 185,000 square yards (38 acres). In addition to the placer mines, the Brewer deposit included two large pits in the lode, the Brewer and Hartman, and many small surface openings in bedrock along a belt trending northwestward on the ridge between Little Fork Creek and Lynches River (Pardee and Park, 1948, pls. 30, 31, 32).

Lode Rock

The Brewer lode is in gray hard cherty siliceous (quartz-sericite) schistose rock, mostly breccia and all probably derived from bedded volcanic rocks. The lode is 200 to 300 feet wide and about 1,000 feet long; the long axis trends northeast. The deepest workings, the Brewer pit, are 140 feet deep. The upper 40 to 60 feet of rock is weathered to varying degrees, and some is loose fine white quartz sand. Weathering extends to a depth of at least 140 feet in a shattered zone in the southwest part of the Brewer pit.

Pyrite is abundant in the unweathered rock, mostly as disseminated grains, and constitutes from several percent to nearly half of large masses of rock in the lower part of the Brewer pit. Other minerals of the lode include bismuth, cassiterite, topaz, gold, and several copper minerals. Parts of the lode rock are almost entirely topaz (Fries, 1942). The gold-bearing rocks of the lode consist of irregular lenslike bodies 10 to 30 feet wide, closely grouped in the pit area, and oriented northwestward. The better grade of ore assayed $5 to $7 per ton; the average was $3.

Samples 6 and 7 (table 2), collected by the author from the unweathered pyrite-rich zones in the bottom of the Brewer pit, yielded gold values of 12.0 and 0.04 ppm; the richest value was from the north side of the pit. A. R. Kinkel, Jr., U.S. Geological Survey (written commun., May 27, 1968), sampled the hard rock in the Brewer, Topaz, and Hartman pits (pl. 1) and obtained the following analytical results:

Pit	Field No.	Lab. No.	Au (ppm)
Brewer	K 289	ABP 310	4.50
Topaz	K 356	ABX 023	3.90
Do	K 1458	ABX 972	.56
Hartman	K 358	ABX 025	.64
Do	K 359	ABX 026	1.90
Do	K 361	ABX 028	.22

Kinkel collected 243 samples along Route 110 between Route 265 and Route 39 (pl. 1) to learn if the mineralized zone extended southwest from the Brewer mine toward the Haile mine (fig. 1). These samples were almost continuous along all roadcuts. Twenty of the samples contained gold in amounts of 0.02 to 0.20 ppm. The apparent lack of rich mineralization in an arc of nearly 180° to the west of the mine led Kinkel to speculate that "The Brewer Mine may be at a volcanic center. The presence of fairly coarse pyroclastic and coarse tuff, shatter brecciation of diatreme type, very strong silicification in a limited area, and the presence of an unusually large amount of fluorine in topaz, suggest that the mine might be in an explosion vent," (written commun., May 27, 1968).

Coastal Plain Sediments

Most of the area of Coastal Plain sediments at the Brewer mine was worked and reworked during early mining operations. Not only the fluvial and possibly marine (Pardee and Park, 1948, p. 111) placers in the Coastal Plain sands and gravels were worked but also the residual placers in the easily excavated underlying saprolite. The several acres of unworked Coastal Plain sediments (south of the Hartman pit and east of the Tanyard placer (pl. 1)), from a few feet to 10 feet thick (including the underlying weathered sandy saprolite), may be worth investigating further. If the value of 2.20 ppm obtained from sample 8 (table 2) is representative of several feet of the sand, the deposit may be economically significant, at least in connection with mining the lode.

Beneath the Coastal Plain sediments at the Brewer mine is weathered siliceous bedrock ranging from a veneer to several feet thick. Unless one examines it closely, this material looks nearly identical to the overlying Coastal Plain sand. The weathered siliceous rock is a white- to yellow-brown and reddish-brown fine-grained quartz sand that probably blanketed nearly all the bedrock over the Tanyard placer. Near the middle of the placer area is much vein quartz, most of it in windrows, apparently placed aside during mining operations. The large volume of excavated material, both Coastal Plain sediments and underlying sandy saprolite, represents a prodigious effort because most of the digging was done by hand. Hydraulic methods were used later, largely to rework previously excavated material.

An interesting aspect of the placer mining is the local abundance of rounded pebbles of ironstone which are unlike the iron-oxide coated quartz pebbles near the bedrock pits. The presence of these ironstone pebbles on the surface where no Coastal Plain sediments now exist appears to indicate former wider distribution of such deposits, later eroded, leaving as lag deposits the ironstone pebbles. On this premise, one may think that the gold in the saprolite sand beneath the pebbles is in placers deposited by stream or wave action. Upon close examination of the pebbles, however, the author concludes that they are merely oxidized rounded residual fragments of pyritic, siliceous bedrock, and their presence by themselves does not indicate that Coastal Plain sediments once blanketed this area.

Other gold recovery operations in the mineralized area were scattered and small. Panning and sluicing or rocker recovery methods may have been used along most of the streams, at least along those near the Brewer mine. During this study, however, large areas, apparently untouched by early mining activity, were found to be gold-bearing. On the south flood plain of Nugget Creek, the only stream along which remains of early workings are readily visible, and then only between Routes 39 and 40, are small diggings a few feet across, ditches 2 to 3 feet wide and 10 to 30 feet long, and small piles of tailings dug from material in pockets and weathered joint fillings in the bedrock. A local farmer, Mr. Ingrahm, said that tenant farmers mined gold along the creek between Routes 39 and 40 over an 8- to 10-year period during the 1930's. He said (oral commun., March 19, 1968) that they used a shaker (half barrel with cleats) and mercury.

Although the author walked along several other streams in the area and panned along much of their lengths, he saw no tangible evidence of mining activity like that along Nugget Creek. This is surprising because gold is readily recoverable in small amounts along the streams, particularly along Fork Creek which has a broad flood plain containing a considerable volume of alluvium. Also, the largest particles of gold (coarse to very coarse) recovered by the author were from Nugget Creek east of Route 40 where the flood plain shows no evidence of former mining activity. There are old ditches in a regular pattern, but they appear to be part of a drainage system used when the land was formerly tilled.

JEFFERSON-PAGELAND UPLAND AREA

The Jefferson-Pageland upland area includes the remnant upland of Coastal Plain which is the fairly flat-topped north-south drainage divide between Fork Creek on the east and Little Fork Creek on the west. It also includes the flat area of Coastal Plain near White Plains Church and the flanking stream valleys, slopes, and hills of argillite, intermixed rocks, and granite (pl. 1).

Argillite

Only one sample (sample 5, table 2) of 16 collected in the argillite rocks in the mapped area (pl. 1) contained gold. Gold was detected, however, in many places in stream sediments lying on the argillite. Most of this gold was finer grained than that recovered from stream sediments on the intermixed rocks. This distribution may indicate finer gold in the host rocks, or the fact that, because of the smaller particle size, the gold could be transported farther and was derived from other rocks upstream from the argillite. Gold values from the argillite are not very large, and further investigation of this rock unit does not seem as promising as investigating the intermixed rocks.

Intermixed Rocks

Gold was detected in seven samples of a total of 33 from the intermixed rocks; four of these (samples 3, 4, 10, and 12, table 2) were outcrop samples and three (holes 2 and 5, table 3) were saprolitic material from auger hole cuttings. Outcrop samples 3, 4, and 10 were collected from exposures of coarse-grained saprolitic amphibolite along Nugget Creek. Outcrop sample 12 was collected from a roadcut exposure of weathered rhyolite tuff.

The auger-cuttings samples, containing as much as 0.04 ppm gold, were from hole 2 from depths of 35–39 and 39–43 feet, and from hole 5 from 40–41 feet (table 3). Each sample was a saprolite clay overlain by 35 to 40 feet of Coastal Plain sediments. The gold may have been contamination by Coastal Plain sediments as the cuttings were withdrawn from the holes. However, because gold occurred in the same type of bedrock in outcrop (sample 12, table 2), the gold probably was in place in the saprolite.

Nugget Creek, which drains the area of the intermixed rocks, yielded more coarse gold than any other stream, and it was worked by prospectors for at least 8 to 10 years during the 1930's. The nearby Brewer mine in the same belt of rocks adds to the economic potential of these rocks. Peter Popenoe and C. L. Tippens, U.S. Geological Survey, ran ground electromagnetic surveys across part of this belt of rocks along the road east of Route 151 (along which auger holes 1–6 are located) and along the next road to the east (pl. 1). These surveys detected two strong anomalies: the first, 100 feet wide between auger holes 3 and 4, and the second, 150 feet wide along the next road to the east on a line between auger holes 3 and 4 extended northeast to the location of stream sample 21 (pl. 1). These two anomalies may be a single continuous anomaly and may indicate a massive sulfide deposit in bedrock at a depth of possibly 35 to 40 feet beneath the Coastal Plain sediments (Peter Popenoe, oral commun., Feb. 4, 1970).

A straight line extended southwest from the two electromagnetic anomalies passes through the known mineralized zone at the Brewer mine. The Nugget Creek northeast-trending gold-bearing zone is north of this line and warrants further investigation. Possibly the area north of the Brewer mine and southwest of the Nugget Creek zone should also be investigated, both at the surface and at depth. The possibility of a mineralized zone in the rocks beneath the Coastal Plain sediments northeast of the Brewer mine reminds one of the Iola and Uwarra mines near Candor, N.C. (Pardee and Park, 1948, p. 82–83), where the lode was not discovered until 1901, primarily because it was mostly beneath a cover of Coastal Plain sediments. This lode produced a million dollars worth of gold in the first 15 years of operation of the mines.

Granite

Gold was not present in any sample from granite outcrops within the mapped area (pl. 1). Although gold was in auger cuttings from two samples of granite saprolite, contamination was possible from the overlying Coastal Plain sediments through which the samples passed on retrieval. At many locations gold was recovered from stream sediments on granite bedrock. There too the gold may be derived from the overlying Coastal Plain sediments. However, only 11 samples were collected of the granite, both fresh and saprolitic. A more thorough sampling seems warranted. Gold was found in minute amounts in three granite samples collected from a long deep roadcut along Route 601 on the west side of Lynches River, 6¾ miles west of the mapped area (Z. S. Altschuler, U.S. Geol. Survey, written commun., Apr. 4, 1968). Gold values determined were 1.8, 1.9, and 2.4 parts per billion.

Coastal Plain Sediments

Gold is present in the Coastal Plain sediments which form the upland from the south edge of Jefferson north to Pageland. Gold was detected in 11 samples of 98 collected from this area. A sample of basal Coastal Plain gravelly sand south of Jefferson contained 1.20 ppm gold (sample 1, table 2 and pl. 1). Several other samples of basal Coastal Plain sediments near here yielded minor amounts of gold. Gold also was detected in small amounts in a sample from an outcrop of basal Coastal Plain gravel along Route 151 north of Route 109 (sample 2, table 2 and pl. 1). Small amounts of gold were recovered from cuttings of Coastal Plain sand and gravel from auger holes 1, 8, 9, 12, and 13 (table 3 and pl. 1).

The author first detected gold in panned concentrates from Fork Creek south of Jefferson. In an attempt to determine the source of the gold, stream-bottom and bank sediments were panned, working upstream. In the first attempts, sediments from many locations only a short distance apart were panned. Later, because this obviously was too time consuming, sediments were panned at wider intervals. This partly explains the close spacing of sample locations along Fork Creek south of Jefferson and along Gold Dust Branch north of Route 109, and the more widely spaced intervals elsewhere. The close intervals along Nugget Creek, however, are partly because larger gold particles were recovered and because it was believed that they had not traveled very far; closely spaced stations were selected in an attempt to locate the source.

After the source of some of the gold was traced into the base of the Coastal Plain sediments in the upper reaches of Gold Dust Branch (pl. 1), holes were bored in these sediments in an attempt to learn how widespread gold occurrences were. When gold was detected in stream sediments in the upper part of Fork Creek northeast of White Plains Church, auger holes were drilled into the Coastal Plain sediments circling the drainage basin. Eight of these 15 auger holes contained gold (see pl. 1 and table 3).

Possibly gold is present in amounts up to 1 ppm in the lower part of the unconsolidated Coastal Plain sediments over an area of several square miles in the Jefferson-Pageland upland. The Coastal Plain cover ranges in thickness from a thin veneer to about 40 feet. In order to recover gold, the land would have to be literally turned over, the gold extracted, and an attempt made to restore the land to its former use, agriculture. In the process, silting of the streams undoubtedly would be a problem.

Quaternary Deposits

Quaternary deposits contain gold in the Jefferson-Pageland upland area but are much smaller in total volume than the Coastal Plain sediments. Most of the streams are bordered by narrow flood plains underlain by thin alluvial deposits. The flood plain along Fork Creek, south of Route 43, is fairly broad (pl. 1) and is underlain by alluvial deposits as much as 10 feet thick, a considerable volume of alluvium. Traces of gold are nearly everywhere in bedload sediments of the present stream channel (table 1) and were also detected in bank samples. Therefore, a fairly large volume of auriferous alluvial sediments, some of possible economic importance, may be present on relatively unused land.

SOURCES OF GOLD

COASTAL PLAIN SEDIMENTS

The Brewer mine is the nearest known source for the gold in the Coastal Plain sediments of the area. Two smaller gold mines, the Leach and the Kirkley, are 2.0 miles N. 54° W. and 2.3 miles S. 10° E. of Jefferson, respectively (Pardee and Park, 1948, p. 105). Gold in the base of the Coastal Plain sediments at the Brewer mine likely was not transported far; probably it was derived from the underlying weathered lode rock and possibly from a short distance north of the mine. The gold may have been concentrated by flowing water in a stream and (or) by winnowing action of waves along a shoreline.

Gold in the Coastal Plain sediments of the Jefferson-Pageland upland area probably was also derived from the underlying saprolite and bedrock, or from a short distance upslope to the north. This interpretation is partly based on the fact that the economic concentration of gold in the Tanyard placer at the Brewer mine was on and near the lode. At the Haile mine, about 10 miles southwest near Kershaw (fig. 1), the Coastal Plain sediments directly over the lode contain appreciable amounts of gold, as yet unmined. The author sampled the basal 5 feet of the 10- to 15-foot-thick mantle of Coastal Plain sediments in the southeast part of the Haile mine. Thirty-three of 42 samples, collected from a horizontal distance of 300 feet, contained gold to 2.20 ppm and averaged 0.50 ppm (50 cents per ton). All 42 samples averaged 0.40 ppm gold.

Some fine gold particles may have traveled some distance, but the coarser particles probably were not transported very far. A stream having a fairly steep gradient and a large volume of water probably would be required to transport the coarse particles of gold any distance. That such a stream did not exist here is indicated by the fact that the Coastal Plain sediments are primarily sand, with gravel (most within pebble-size range) layers only near the base of the section.

Gold in the Coastal Plain sediments may have been concentrated several times by different processes. In several places in the region where gold in low values is present in the bedrock, it is or was present in higher values in the saprolite than in the underlying bedrock. These enriched saprolites may be considered residual placers, formed largely by lag concentration as enclosing bedrock was saprolitized and the fine rock particles washed away by rainfall. If an enrichment zone existed in the saprolite, then a second concentration as a fluvial or marine placer may have occurred as the weathered surface was eroded and was redeposited as Coastal Plain sediments. Subsequent flash floods or wave action reworking this material deposited as bars, fans, or deltas, may have constituted a third concentration process.

Placers of economic significance may therefore have formed in the base of the Coastal Plain sediments in this area where the bedrock contains gold. It was pointed out that rich lodes may be present in the rocks underlying the Coastal Plain sediments. If both Coastal Plain sediments and underlying bedrock are considered, the economic potential of the area should be investigated further.

QUATERNARY DEPOSITS

Gold in the Quaternary deposits is the result of one or more stages of reworking and concentrating. It may be derived directly from bedrock and deposited in the stream gravels and flood-plain deposits, thus undergoing only one stage of concentration before deposition as a Holocene placer. Repeated reworking, however, may have concentrated the gold as enclosing sand, silt, and clay were washed away. Higher values may therefore be present in the Quaternary deposits than in the Coastal Plain sediments because the younger deposits may have undergone more reworking. The wide flood plains along Fork Creek and Little Fork Creek from southwest to east of Jefferson may contain placers of significant value.

CONCLUSIONS

Gold is present in the Coastal Plain sediments (Tuscaloosa Formation) and Quaternary alluvium in the Jefferson area, South Carolina, in amounts as much as 1.20 ppm ($1.20 per ton). Gold-bearing Coastal Plain sediments cover an area of about 25 square miles and are from several feet to 40 feet thick. The gold in these sediments seems to be in the basal few feet and in sparse layers of gravel above.

These sediments appear to be fluviatile in origin but may include some beach deposits. Gold may have undergone several concentration processes, and placers of potential economic value may be present in the Coastal Plain sediments and in the wider flood-plain alluvial deposits bordering the present streams.

Factors diminishing the potential value of the deposits include present land use as residential and productive farmland, probable silting of creeks during gold-recovery processes, and the necessity and expense of restoring the land to its pre-gold-recovery state.

This study indicates that gold in amounts of economic importance may be present in underlying bedrock lodes as yet undiscovered under the thick cover of Coastal Plain sediments. The intermixed group of rocks seem to be the most promising of the bedrock formations for further investigation. Gold is present in these rocks in several places in amounts up to at least 12 ppm, both where the rocks are exposed and where they are beneath the Coastal Plain sediments.

The possibility of lode gold in the area north of Jefferson is suggested by: (1) the coarse gold in Nugget Creek, (2) the electromagnetic anomalies, and (3) the gold-bearing saprolite recovered from auger hole 2 (table 3). Closely spaced drilling is recommended in the vicinities of auger holes 1 to 6, 8 and 9, 12 to 15, and across the electromagnetic anomalies, through Coastal Plain sediments and into the underlying bedrock. Further sampling of the bedrock along Nugget Creek is recommended, as well as more thorough sampling of the granite, particularly in the vicinity of White Plains Church and in the upper reaches of Gold Dust Branch, even if drilling through the Coastal Plain sediments is necessary.

If results of exploratory drilling show that gold in economically important amounts is present in bedrock beneath Coastal Plain sediments, then underground mining methods might possibly be used, causing minimal surface damage and disfiguration.

REFERENCES CITED

Cooke, C. W., 1936, Geology of the Coastal Plain of South Carolina: U.S. Geol. Survey Bull. 867, 196 p.

Conley, J. F., and Bain, G. L., 1965, Geology of the Carolina slate belt west of the Deep River-Wadesboro Triassic basin, North Carolina: Southeastern Geology, v. 6, no. 3, p. 117–138.

Fries, Carl, Jr., 1942, Topaz deposits near the Brewer mine, Chesterfield County, South Carolina: U.S. Geol. Survey Bull. 936-C, p. 59–78.

Overstreet, W. C., and Bell, Henry, 3d, 1965a, The crystalline rocks of South Carolina: U.S. Geol. Survey Bull. 1183, 126 p.

——— 1965b, Geologic map of the crystalline rocks of South Carolina: U.S. Geol. Survey Misc. Geol. Inv. Map I-413, scale 1:250,000.

Pardee, J. T., and Park, C. F., Jr., 1948, Gold deposits of the southern Piedmont: U.S. Geol. Survey Prof. Paper 213, 156 p.

Swift, D. J. P., and Heron, S. D., Jr., 1969, Stratigraphy of the Carolina Cretaceous: Southeastern Geology, v. 10, no. 4, p. 201–245.

Wilmarth, M. G., 1938, Lexicon of geologic names of the United States (including Alaska): U.S. Geol. Survey Bull. 896, Part 2, M-Z, p. 1245–2396.

TABLE 1.—*Data on panned stream-sediment samples*

[Only the fraction passing the 0.185-inch opening sieve was panned. A 15-inch gold pan was used; sample size was about three-fourths contents of a pan]

Sample No. (pl. 1)	Field No.	Location (pl. 1)	Description of sample site	Number of gold particles in each pan; silt to very coarse sand size
1	259D	Upper part Fork Creek northeast of White Plains Church.	Sand and gravel riffle at the head of a shallow pool.	2
2	259	----do----------------	Sand and gravel scraped from joints in hornblende gneiss bedrock.	1
3	259C	----do----------------	Sand and gravel riffle near the head of a shallow pool.	2
4	259B	----do----------------	----do----------------------	2
5	259A	----do----------------	Sand and gravel riffle----------	2
6	235B	----do----------------	----do----------------------	1
7	235C	----do----------------	----do----------------------	0
8	235A	----do----------------	----do----------------------	0
9	239B	East side Route 151 first creek north of Gold Dust Branch.	----do----------------------	4
10	239A	West side Route 151 upper part Gold Dust Branch.	Sand bar in bottom of pool------	4
11	232I	Gold Dust Branch of Fork Creek, east of Route 151.	Small gravel riffle; stream is about 4 ft wide.	18
12	232H	----do----------------	----do----------------------	3
13	232G	----do----------------	----do----------------------	4
14	232F1	----do----------------	Gravel riffle at head of pool; 10-ft-high granite outcrop 20 ft from southwest bank.	52
14	232F2	----do----------------	Sand and gravel near the foot of the same pool as 232F1.	18
14	232F3	----do----------------	Gravel bar at the foot of the same pool as 232F2.	42
14	232F4	----do----------------	Gravel riffle below the same pool as 232F3.	7
15	232E	----do----------------	Sand and gravel bar in a pool beneath overhanging granite ledge.	0
16	232D1	----do----------------	Gravel-paved foot of a pool below a 2-ft-high waterfall over ledges of granite.	10
16	232D2	----do----------------	Gravel riffle below 232D1------	3
17	232C	----do----------------	Gravel bar in creek in a cut through a granite ridge.	0
18	232B1	----do----------------	Gravel bottom in a pool below a low falls over a granite ledge.	2
18	232B2	----do----------------	Gravel bottom in a pool 50 ft downstream from 232B1.	1
19	232A	Fork Creek just downstream from route 109.	Coarse sand bar in a pool by several large granite boulders.	2
20	234A	Fork Creek downstream from Route 109.	Sand bar in a pool about 50 yards downstream from an old earth and rock dam.	0
21	234B1	----do----------------	Coarse gravel bar in the middle of the creek.	6
21	234B2	----do----------------	----do----------------------	13
21	234B3	----do----------------	----do----------------------	5
22	234D1	Fork Creek upstream from Route 43.	Gravel riffle------------------	2
22	234D2	----do----------------	----do----------------------	5
23	234C1	Fork Creek just upstream from Route 43.	Bottom gravel in a pool below low falls over ledges of rhyolite porphyry.	3
23	234C2	----do----------------	----do----------------------	4
23	234C3	----do----------------	----do----------------------	3
24	260C	East branch of Fork Creek between Routes 43 and 265.	Sand and gravel bar in a pool---	1
25	260B1	----do----------------	Sand and gravel bar composed mainly of quartz gravel.	3
25	260B2	----do----------------	----do----------------------	4
25	260B3	----do----------------	----do----------------------	3
26	260A1	----do----------------	Sand and gravel riffle---------	12
26	260A2	----do----------------	----do----------------------	10 (some medium-coarse)

TABLE 1.—*Data on panned stream-sediment samples*—Continued

Sample No. (pl. 1)	Field No.	Location (pl. 1)	Description of sample site	Number of gold particles in each pan; silt to very coarse sand size
27	217-1	Fork Creek just upstream from Route 265.	Gravel riffle	21
27	217-2	do	do	24
27	217-3	do	do	28
27	217-4	do	do	17
27	217-5	do	do	17
27	217-6	do	do	13
28	216H1	Fork Creek between Routes 265 and 151.	do	12
28	216H2	do	do	10
29	216G	do	Gravel bar	3
30	216F	do	Fine gravel on bottom of pool	0
31	216E1	do	Gravel riffle	2
31	216E2	do	do	2
32	216D1	do	do	2
32	216D2	do	do	24
33	216C1	do	do	5
33	216C2	do	do	5
34	216B1	do	do	2
34	216B2	do	do	2
35	216A1	do	do	10
35	216A2	do	do	15
35	216A3	do	do	22
36	216	Fork Creek just east of Route 151.	do	10
37	215-1	do	do	10
37	215-2	do	do	2
37	215-3	do	do	8
37	215-4	do	do	20
37	215-5	do	do	12
38	214-1	do	do	4
38	214-2	do	do	10
38	214-3	do	do	6
38	214-4	do	Gravel riffle	1
38	214-5	do	do	20
38	214-6	do	do	18
39	244C	Little Fork Creek north of Route 39.	do	0
40	244A	do	do	1
41	244B	do	do	2
42	245A	Branch of Little Fork Creek just east of Route 40.	do	3
43	254D	Upper part of Nugget Creek east of Route 40.	Gravel bar in a narrow channel	0
44	254C	do	Gravel bar below a 4-ft-thick quartz vein in mudstone saprolite.	0
45	254B	do	Fine bottom gravel	0
46	254A	do	Bottom gravel on quartz-veined saprolitic tuff.	0
47	248	Nugget Creek east of Route 40.	Gravel riffle on mudstone saprolite cut by a quartz vein.	2
48	254-1	do	Sand and gravel in joints of saprolitic amphibolite.	6 (1 coarse grain)
48	254-2	do	do	0
48	254-3	do	do	1
49	253-1	do	Pothole in saprolitic amphibolite.	25
49	253-2	do	do	30 (1 very coarse grain)
49	253-3	do	do	1
50	246-1	do	Pockets in bedrock joints just above 6-inch-high falls over saprolitic amphibolite.	3
50	246-2	do	do	5 (1 very coarse grain)
50	246-3	do	do	1
50	246-4	do	do	1
50	246-5	do	do	2 (Coarse to very coarse grains)
50	246-6	do	do	1
50	246-7	do	do	2

TABLE 1.—*Data on panned stream-sediment samples*—Continued

Sample No. (pl. 1)	Field No.	Location (pl. 1)	Description of sample site	Number of gold particles in each pan; silt to very coarse sand size
50	246-8	----do----------------	Sand and gravel from joints in saprolitic amphibolite just below 6-inch-high falls.	16 (4 coarse, 1 very coarse grain)
50	246-9	----do----------------	----do----------------------	12 (6 medium, 2 coarse to very coarse grains)
50	246-10	----do----------------	----do----------------------	2 (1 coarse, 1 very coarse grain)
50	246-11	----do----------------	----do----------------------	0
50	246-12	----do----------------	----do----------------------	0
50	246-13	----do----------------	----do----------------------	8 (1 coarse grain)
51	243A	Nugget Creek between Routes 39 & 40.	Bottom gravel just below ledges of rhyolite porphyry.	4
52	242B1	----do----------------	Gravel from bottom of pool at a bend below an outcrop of vitreous tuff.	2
52	242B2	----do----------------	----do----------------------	5
53	242A1	----do----------------	Pockets of gravel in weathered grooves in foliated bedrock just below old mortared dam remnant.	7
53	242A2	----do----------------	----do----------------------	3
54	252A	Little Fork Creek just north of Route 265 (below Brewer mine)	Gravel riffle------------------	2

TABLE 2.—*Data on outcrop samples*

Sample No. (pl. 1)	Field No.	Location (pl. 1)	Description of sample	Amount of gold
1	105	Roadcut west side Route 151 south of Jefferson.	Basal, gravelly, clayey Coastal Plain sand.	1.20 ppm
2	239	Roadcut east side Route 151 north of Route 109.	Coarse pebble layer in the Coastal Plain sand.	3 flakes in 1,000-gram sample.
3	247	Nugget Creek east of Route 40.	Coarse-grained amphibolitic saprolite in creek bed.	.02 ppm
4	253	----do----------------	----do----------------------	.02 ppm
5	260	East branch Fork Creek 2 miles northeast of Jefferson.	Yellow-brown to pink-purple laminated argillite saprolite.	.02 ppm
6	261	Brewer mine, bottom Brewer pit, north side.	Pyritic silicified tuff-----------	12.0 ppm
7	318	Brewer mine, bottom Brewer pit, south side.	----do----------------------	.04 ppm
8	316	Brewer mine, northeast part of Tanyard pit.	Coarse Coastal Plain sand 3 ft from the base.	2.20 ppm
9	317	----do----------------	From the basal 1 foot of coarse Coastal Plain sand.	.06 ppm
10	303	Nugget Creek west of Route 40.	Coarse-grained saprolitic amphibolite in creek bed.	.04 ppm
11	216	Fork Creek east of Route 151 south of Jefferson.	Stream-bottom sand and gravel-	.70 ppm
12	297	Roadcut east side Route 40 south of Nugget Creek.	Weathered tuff----------------	1 flake in 100-gram sample.
13	300	Roadcut west side Route 40, 2½ miles northwest of Jefferson.	Cross-stratified arkosic, pebbly coarse Coastal Plain sand.	Do.

TABLE 3.—*Data on cuttings from auger holes*

Hole No. (pl. 1)	Field No.	Location (pl. 1)	Depth (in feet) from surface	Description of sample	Amount of gold
1	262	Spur road along east side Route 151 north of Jefferson.	25	Yellowish-gray, pebbly, clayey Coastal Plain sand.	0.04 ppm
1	263	----do----------------	30	----do--------------------	-----------
2	264	----do----------------	30	Yellow-brown coarse clayey Coastal Plain sand.	-----------
2	265	----do----------------	35–39	Yellow-brown clayey saprolite---	.02 ppm
2	266	----do----------------	39–43	Yellow-brown to grayish-blue clayey saprolite.	.04 ppm
2	267	----do----------------	43–48	Blue-gray saprolite-----------	-----------
2	268	----do----------------	48–51	----do--------------------	-----------
3	269	----do----------------	20–25	Fine-pebbly coarse Coastal Plain sand.	-----------
3	270	----do----------------	28–30	----do--------------------	-----------
3	271	----do----------------	30–35	Yellow-brown saprolite---------	-----------
3	272	----do----------------	35–41	Yellow-brown to purple saprolite	-----------
4	273	----do----------------	10	Coastal Plain coarse sand and fine gravel.	-----------
5	274	----do----------------	20	Coarse Coastal Plain sand-------	-----------
5	275	----do----------------	30–35	Pebbly coarse Coastal Plain sand	-----------
5	276	----do----------------	38	----do--------------------	-----------
5	277	----do----------------	40–41	Greenish-gray saprolite clay-----	1 flake in 100-gram sample
6	278	----do----------------	15–20	Yellow-brown Coastal Plain sand	-----------
6	279	----do----------------	35–38	Clayey, pebbly coarse Coastal Plain sand on yellow-brown saprolite.	-----------
6	280	----do----------------	38–41	Green-gray saprolite-----------	-----------
7	281	West side Route 151 south of Route 109.	20	Coarse Coastal Plain sand-------	-----------
7	282	----do----------------	30	----do--------------------	-----------
7	283	----do----------------	35	----do--------------------	-----------
7	284	----do----------------	40–43	Dusky-red granite saprolite-----	-----------
7	285	----do----------------	45–50	----do--------------------	-----------
8	286	East side Route 151 north of Route 109.	15–18	Clayey coarse light-gray Coastal Plain sand.	-----------
8	287	----do----------------	25	Clayey coarse fine pebbly Coastal Plain sand.	1 flake in 100-gram sample.
8	288	----do----------------	30	----do--------------------	-----------
9	289	----do----------------	1–4	Gravel layer in Coastal Plain sand.	3 flakes in 1,000-gram panned sample.
9	290	----do----------------	20	Clayey coarse angular quartz sand with much feldspar. Derived from granite saprolite.	-----------
9	291	----do----------------	30	----do--------------------	2 flakes in 100-gram sample.
9	292	----do----------------	35–40	----do--------------------	Do.
10	293	West side Route 151 south of 2nd creek north of Route 109.	0–3	Pebbly Coastal Plain sand------	-----------
10	294	----do----------------	3–6	Light-gray to pink granite saprolite.	-----------
11	304	South side of road east of White Plains Church.	0–5	Coarse Coastal Plain sand-------	-----------
11	305	----do----------------	5–11	Light-gray to dusky-red saprolite clay.	-----------
12	306	Just north of White Plains Church.	5–10	Coarse Coastal Plain sand-------	.02 ppm
12	307	----do----------------	10–16	Coarse Coastal Plain sand on granite saprolite.	-----------
13	308	West side of road north of White Plains Church.	6–8	Pebbly coarse Coastal Plain sand	.02 ppm
13	309	----do----------------	8–12	Pebbly coarse Coastal Plain sand on granite saprolite.	.02 ppm
14	310	----do----------------	8–12	Yellow-brown clayey coarse Coastal Plain sand.	-----------
14	311	----do----------------	12–18	Pebbly coarse Coastal Plain sand	-----------
14	312	----do----------------	18–22	White fine to medium sand from weathered granite.	-----------
15	313	North side of road 1.2 miles northeast of White Plains Church.	1	Ironstone------------------	-----------
15	314	----do----------------	8–10	Intermixed Coastal Plain sand and granite saprolite.	-----------
15	315	----do----------------	14–15	Sandy granite saprolite---------	.02 ppm

U. S. GOVERNMENT PRINTING OFFICE : 1971 O - 417-131