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GEOCHEMICAL RECONNAISSANCE OF THE CARROLL COUNTY GOLD BELT AND SOUTHWESTERN PART OF THE DAHLONEGA GOLD BELT, WESTERN GEORGIA

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SUMMARY

The gold deposits in the Carroll County gold belt and the southwestern part of the Dahlonega gold belt are in interlayered metasedimentary and metavolcanic rocks of Late Proterozoic to early Paleozoic age. These rocks are in several thrust sheets that form the southwest continuation of the Blue Ridge thrust stack. The rocks are now mostly mica gneiss and schist, graphitic schist and phyllite, quartzite, amphibolite, and granite gneiss. A sample suite of 788 rock and saprolite samples was collected; the suite represents most of the rock types exposed in the southwest extension of the Dahlonega gold belt in Cherokee, Cobb, Bartow, Paulding, and Haralson Counties, Ga., and in the Carroll County gold belt in Carroll and Douglas Counties, Ga. The samples were analyzed semiquantitatively for 30 elements and quantitatively for gold, copper, lead, and zinc; some samples were also analyzed quantitatively for arsenic, mercury, and molybdenum. Whole-rock analyses were made on 27 samples of relatively fresh mafic rock.

More than two-thirds of the samples are saprolite derived from mica schist and gneiss, graphitic schist, amphibolite, and quartzite, or vein quartz in saprolite. The samples were collected from roadcuts, surface and underground mine workings, and mine dumps. Of the samples collected, 78 percent of those from old mine areas and 13 percent of those from roadcuts contain gold at or above a limit of determination of 0.02 parts per million (ppm). Of those samples that contain detectable gold, 36 percent of the mine samples and 92 percent of the roadcut samples have less than 0.2 ppm gold. Gold is present in detectable amounts in some samples from all the major rock types that were sampled. Gold does not correlate consistently with the other elements in the data set. The few positive correlation coefficients greater than 0.50 are restricted to the smaller subsets of a few samples.

Most of the old mine areas contain small resources of gold in saprolite and probably larger amounts of lower grade material in unweathered rock. The mineralized zones are generally about 5 to 100 ft wide, but may be as much as 250 ft wide. Many deposits are only 100 to 800 ft long, but a few mineralized zones are longer; one is as much as 0.75 mi long.

INTRODUCTION

The Dahlonega gold belt is a narrow, northeast-trending area of scattered gold mines and prospects that extends across Georgia from Haralson County at the Alabama State line to Rabun County at the North Carolina State line (fig. 1). More than two-thirds of these mines and prospects are concentrated in the northeastern part of the belt, roughly centered around Dahlonega in Lumpkin County and Helen in White County (Lesure, 1992); the southwestern part of the belt from Cherokee County to Haralson County contains about 90 mines and prospects, mostly in Cherokee County. The Dahlonega gold belt splits in southwestern Cherokee County; the north fork continues southwestward with only a short break for 45 mi into Haralson County, and the south fork trends south and then southwest 17 mi across Cobb County and into the east half of Paulding County (fig. 2).

The Carroll County gold belt is an area about 10 mi long and 4 mi wide that trends east-northeast in northeastern Carroll County and adjacent Douglas County, and is centered around the town of Villa Rica. An area about 8 mi wide that contains no mines or prospects separates the Carroll County gold belt from the south end of the Dahlonega gold belt (fig. 2).

The rocks in the study area are predominantly interlayered quartz-mica gneiss and schist, graphitic schist and phyllite, quartzite, and amphibolite; magnetite quartzite, calc-silicate granofels, gneissic granite, and various small masses of altered ultramafic rocks are present locally. The ore deposits have been studied by Becker (1895), Yeates and others (1896), Jones (1909), and Pardee and Park (1948). The geology has been mapped by Higgins (1968), Hurst and Crawford (1970), Crawford and Medlin (1974), McConnell and Abrams (1984), German (1988), and Higgins and others (1988). Becker (1895), Pardee and Park (1948), German (1988), and Higgins and others (1988) give extensive lists of references to previous work in the area.

The data presented in this report summarize the analyses of 788 samples of rock and saprolite from the Carroll County gold belt and the southwestern part of the Dahlonega gold belt and vicinity in west-central Georgia (fig. 2). These samples were collected in March–April and October–November 1967 and April 1968 in a reconnaissance study as part of the U.S. Geological Survey (USGS) Heavy Metals Program. Some preliminary results were reported earlier (Lesure, 1969a, b). A separate report described the results of similar sampling in the northeastern part of the Dahlonega gold belt (Lesure, 1992).

Most of the samples are chip composites of representative material taken across bedding or layering over a measured thickness from roadcuts or mine workings. A few are composite samples of rock from mine dumps. The samples are representative of the major rock types—mica gneiss and schist, graphitic schist and phyllite, quartzite, amphibolite, and vein quartz—exposed in the area sampled. Samples of vein quartz generally include some enclosing country rock. Most of the samples are of weathered rock or saprolite. The freshest samples are generally from underground mine workings or mine dumps. The sample localities are shown on figures 3 through 14, and sample descriptions are given in a separate report (Lesure and others, 1992).

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ANALYTICAL METHODS

Rock and saprolite samples were crushed to approximately 0.25-in. (6-mm) particle size and were pulverized to minus 140-mesh (0.004 in. or 0.105 mm) in a vertical grinder having ceramic plates. Most of the samples were analyzed semiquantitatively for 30 elements by means of a six-step, D.C. (direct-current) arc, optical emission spectrographic method (Grimes and Marranzino, 1968) in USGS laboratories, Denver, Colo., by K.J. Curry, D.J. Grimes, J.M. Motooka, G.W. Sears, and K.C. Watts. The semiquantitative spectrographic values are reported as six steps per order of magnitude (1, 0.7, 0.5, 0.3, 0.2, 0.15, or multiples of ten of these numbers) and are approximate midpoints of geometric brackets whose boundaries are 1.2, 0.83, 0.56, 0.38, 0.26, 0.18, 0.12, etc. The expected precision is within one adjoining reporting interval on each side of the reported value 83 percent of the time and within two adjoining intervals 96 percent of the time (Motooka and Grimes, 1976).

The visual lower limits of determination for the 30 elements that were determined spectrographically are as follows: For those given in weight percent:

Calcium	0.05	Magnesium	0.02
Iron	.05	Titanium	.002

For those given in parts per million:

Antimony	100	Copper	5	Silver	0.5
Arsenic	200	Gold	10	Strontium	100
Barium	10	Lanthanum	20	Tin	10
Beryllium	1	Lead	10	Tungsten	50
Bismuth	10	Manganese	10	Vanadium	10
Boron	10	Molybdenum	5	Yttrium	10
Cadmium	20	Nickel	5	Zinc	200
Chromium	5	Niobium	10	Zirconium	10
Cobalt	5	Scandium	5		

The samples were analyzed for gold in the USGS laboratories, Denver, Colo., by W.L. Campbell, S.I. Hoffman, E.E. Martinez, R.L. Miller, A.L. Otsuka, M.S. Rickard, T.A. Roemer, and R.B. Tripp using an atomic-absorption technique described by Thompson and others (1968).

About half of the samples were analyzed for copper, lead, and zinc by atomic-absorption techniques (Ward and others, 1969) by Skyline Labs, Inc., Wheat Ridge, Colo., under contract to the USGS. The rest of the samples were analyzed for the same elements using similar analytical methods by J.B. Cathrall, Luther Dickson, S.L. Noble, and R.B. Tripp in USGS laboratories, Denver, Colo.; W.W. James and S.L. Noble analyzed these samples for mercury using instrumental methods. Some of the samples were also analyzed for arsenic by colorimetric methods in the USGS laboratories, Denver, Colo., by J.G. Frisken, C.O. Hershey, A.L. Meier, S.G. Meyers, E.K. Ragsdale, and J.G. Viets. About half of the samples were also analyzed for molybdenum by thiocyanate methods by Skyline Labs, Inc., Wheat Ridge, Colo., under contract to the USGS. The complete analytical results, including whole-rock analyses for 27 mafic rocks, are given in Lesure and others (1992). Gold-bearing samples are listed in tables 1 through 6.

GEOLOGY

The geology of the southwestern part of the Dahlonega gold belt has been mapped by McConnell and Abrams (1984) and German (1988). These maps differ in interpretation from each other and also from the regional map of Higgins and others (1988). For the purposes of this report, the map units have been generalized into lithologic groups without any implication to stratigraphic sequence or correlation. The interested reader is referred to the more complete geologic reports just listed for further details. The lithologic groupings will be mentioned here only briefly and in general terms where they are related to the geochemical samples.

Phyllite, Slate, and Metasandstone

Low- to middle-grade metamorphic rocks, mostly phyllite, slate, and metasandstone (unit p, figs. 3–6) are found west of a major thrust fault that forms the west border of the southwestern part of the Dahlonega gold belt. Southwest of Bartow County, these low-grade rocks are part of the Talledaga Group of Alabama (German, 1988); northeast of Bartow County similar, but higher grade metasedimentary rocks are correlated with rocks of the Ocoee Supergroup in the Great Smoky thrust sheet (Crawford and Cressler, 1982; McConnell and Costello, 1982). Only 3 samples out of 51 collected from these rocks (A14, DL5, and DL6, fig. 6 and table 4) contain traces of gold, ranging from 0.03 to 0.06 ppm Au.

Graphitic or Carbonaceous Schist and Phyllite

None of the 59 samples of graphitic schist, vein quartz, or related rocks collected from unit c on figure 6 contain gold. To the north in Cherokee County, areas of graphitic schist (unit c, figs. 3 and 4) include some garnet-mica schist that may or may not be graphitic. The Cherokee mine shown as being in unit c is in mostly nongraphitic schist (fig. 4). Only 3 samples of graphitic schist (SC28, SC34, and SC42, fig. 4 and table 2) out of 15 samples collected from unit c in Cherokee County contain traces of gold; all contain 0.02 ppm Au. Graphitic schist in the Brevard fault zone is host for gold deposits in the Blue Hill and Gregory Hill mines, Tallapoosa County, Ala. (Lesure, in press).

Biotite, Schist, and Gneiss

Areas shown as biotite schist and gneiss (unit b, figs. 3–8) also include varying amounts of interlayered hornblende gneiss, amphibolite, and quartzite. Locally, small bodies of talc or chlorite-anthophyllite schist or thin layers of magnetite quartzite are found. This combination of rock types is host for most of the gold deposits in the areas sampled, especially in the deposits in the southwestern part of the Dahlonega gold belt. From more than 230 samples of various rock types in unit b, 20 of the outcrop and 47 of the mine samples contain gold, ranging from 0.02 to 15 ppm Au.

Amphibolite

Areas shown as unit a (figs. 3–8 and 12) are underlain by amphibolite, hornblende gneiss, chlorite or chlorite-anthophyllite schist, and minor amounts of interlayered mica schist or gneiss. Thin layers of magnetite-rich quartzite are found locally. Only 4 samples out of 35 collected from unit a contain gold, ranging from 0.02 to 0.3 ppm Au (T14, T15, T17, fig. 3 and table 1; ST5, fig. 5 and table 3).

Mafic Gneiss and Schist

Areas underlain by mostly mafic gneiss and schist but also containing large amounts of interlayered felsic rocks are shown as unit m (figs. 5, 6, and 8). In some areas, unit m grades into unit a as the mafic components increase. Only one sample (ST27, fig. 5 and table 3) out of 14 collected from this unit contains gold.

Felsic Gneiss and Schist

Several large areas in Carroll, Heard, and Douglas Counties are underlain by mostly felsic gneiss and schist that contains only small amounts of mafic schist, if any (unit f, fig. 6). None of the 38 samples collected in unit f contain gold.

Garnet-Muscovite-Quartz Schist

A large area in Carroll and Heard Counties and some smaller areas in Douglas and Paulding Counties are underlain by garnet-muscovite-quartz schist, kyanite-quartz granofels, muscovite quartzite, and kyanite-muscovite-quartz schist (unit g, fig. 6). Only 2 samples (CA20 and DL8, fig. 6 and table 4) out of 32 samples collected from unit g contain traces of gold; both samples contain 0.02 ppm Au.

Quartzite

Several small areas of quartzite (unit q, fig. 6) or quartzite interlayered with muscovite-quartz schist (unit qg, fig. 12) are present in northeastern Carroll County and adjacent Douglas County. Most of the samples from these units are from the Pine Mountain mine, Douglas County. Other quartzite samples are from several areas in Cobb and Cherokee Counties (figs. 7, 8, and 10). Most of the samples from the Pine Mountain mine (table 6) and many from the Cobb County area (table 5) contain some gold.

Granite Gneiss and Felsic Orthogneiss

Several small- to medium-sized masses of granite, granite gneiss, and felsic orthogneiss (unit o, figs. 4–6 and 12) are shown by McConnell and Abrams (1984) and German (1988). Of the 30 samples collected from unit o, six contain gold ranging from 0.02 to 0.6 ppm Au (figs. 4, 6, and 12; tables 2, 4, and 6). Most of the gold mines in the Carroll County belt are within the area shown as unit o and are centered around Villa Rica, Carroll County (German, 1988, p. 23).

Ultramafic Rocks

Small masses of metamorphosed ultramafic rock (unit u, figs. 5 and 6), now largely chlorite-anthophyllite schist or soapstone, are common in units a, m, and b. Several small bodies shown separately near Villa Rica (fig. 6) include both mafic and ultramafic components. Two samples from unit u (DL23 and V19, fig. 6 and table 4) contain 0.02 ppm Au.

Rocks of the Brevard Fault Zone

Sheared mica schist, quartzite, carbonaceous phyllite, and other rock types in the Brevard fault zone are shown as unit z (fig. 6). None of the samples collected from unit z in Georgia contain detectable gold at a detection limit of 0.02 ppm Au.

SAMPLING IN MINE AREAS

One or more samples were collected at 17 gold mines or prospects, four pyrite mines, and one copper prospect, which are discussed from north to south. Other sample localities, which are scattered mostly along roads throughout the study area, provide a broader coverage of the gold-belt rocks and some coverage of rocks in adjacent thrust sheets.

Creighton Mine

The Creighton or Franklin mine, one of the largest and most successfully operated underground gold mines in the Dahlonega gold belt, is on the south bank of the Etowah River in northeastern Cherokee County (fig. 3) (Yeates and others, 1896, p. 175–182; Jones, 1909, p. 159–166; Pardee and Park, 1948, p. 129; Cook, 1978, p.15–21). The extensive surface workings extend along the northeast strike of the country rocks about 0.75 mi (Pardee and Park, 1948, p. 129). When the mine was visited in 1967, all workings were caved or flooded. Two samples (T22–T23, fig. 3 and table 1) collected from the dump of shaft 3 1/2 (as labeled by Cook, 1978, fig. 2) contain gold, but only one sample (T32, fig. 3 and table 1) out of three collected from the open cut around shaft 3 (Cook, 1978, fig. 2) contains gold.

Standard and Swift Mines

The Standard and Swift mines are adjacent properties about 1 mi west of the Creighton mine in Cherokee County (fig. 3). The mines produced pyrite for acid early in the 20th century (Shearer and Hull, 1918, p. 164–179). Three samples of pyrite and pyritic schist from the dump of the Standard mine (T13–T15, fig. 3) and one sample of mica-schist saprolite from a caving shaft (T17, fig. 3) south of the dump area were collected; three of the four samples (T14, T15, and T17, table 1) contain traces of gold, ranging from 0.02 to 0.03 ppm Au.

Rudicil Mine(?)

The Rudicil mine(?) is in Cherokee County about 8 mi southwest of the Creighton mine (fig. 3). The property was first worked as a placer mine along a small creek, but later about five shallow shafts were dug 10 to 20 ft deep to explore for the source of the placer gold. The one sample of vein quartz (BI2, fig. 3) collected from the dump near several small pits, which may be the shallow shafts, contains no gold at a limit of detection of 0.02 ppm Au.

Sixes Mine

The Sixes mine, 3 mi west-northwest of Holly Springs, was worked extensively as a placer deposit along Sixes Creek (fig. 4) (Yeates and others, 1896, p. 199–202; Jones, 1909, p. 153; German, 1988, pl. 2). Several shafts, 40 to 150 ft deep, were dug on the hillside west of the placer workings (Jones, 1909, p. 153). Only one sample (SC49, fig. 4 and table 2) out of the four samples (SC47–SC50) collected from the dump in the area of these shafts contains gold (0.02 ppm Au).

301 Mine

The 301 (also known as Culp, Doctor's, Farrar, or Kolb) mine is 1 mi west of Holly Springs, Cherokee County (figs. 4 and 9). The mine was worked some during the 1930's (Pardee and Park, 1948, p. 130). Only one sample (SC20, fig. 9 and table 2) out of four collected around the old workings (fig. 9) contains gold (0.98 ppm Au). Five samples collected along the road just southwest of the mine and 1,100 ft along the strike of the ore zone do not contain detectable gold (fig. 9).

Cherokee Mine

The Cherokee mine is on a low ridge above the Little River part of the Allatoona Reservoir in Cherokee County (figs. 4 and 10), about 3 mi southwest of Holly Springs. The mine was worked as early as 1854 (Yeates, 1896, p. 197–198), and part of the workings were cleaned out and sampled in 1932–33 (Pardee and Park, 1948, p. 128). Gold, ranging from 0.02 to 524 ppm Au, is present in 15 out of the 26 samples collected from the Cherokee mine area (fig. 10 and table 2). The country rock consists of interlayered mica schist and amphibolite, both of which contain gold. Ten samples of mica-garnet schist that has minor seams of quartz contain gold ranging from 0.02 to 6.8 ppm Au; two amphibolite samples contain 0.08 and 0.18 ppm Au; and three vein quartz samples contain 0.03, 0.05, and 524 ppm Au (table 2). The vein-quartz sample containing 524 ppm Au is white vein quartz that contains calcite and pyrite and was collected from the dump.

Glade Mine

The Glade mine is 3.5 mi north of Acworth in Bartow County (fig. 4). The mine consists of numerous shallow workings in an area about 1,500 ft long and 500 ft wide on several land lots (Yeates and others, 1896, p. 220–221; Jones, 1909, p. 146). None of the four samples collected in the western workings (AC9–AC12, fig. 4) contain gold.

Georgiana Mine(?)

The Georgiana mine(?) is in Cherokee County, 3.3 mi north-northeast of Acworth (fig. 4). The workings consist of several caved shafts and slumped open cuts along a low ridge just east of the Bartow-Cherokee County line. None of the three samples collected from the dump or in the wall of one shaft (AC13–AC15, fig. 4) contain gold at a detection limit of 0.02 ppm Au.

Bell-Star Mine

The Bell-Star mine is in southwestern Cherokee County, 6.5 mi northeast of Acworth (fig 4). Both gold-bearing quartz veins and massive sulfide deposits have been worked on this property (Shearer and Hull, 1918, p. 146–153). The one sample, chlorite-garnet schist, collected from the dump of the sulfide workings contains no gold (K7, fig. 4).

Dunaway Mine

The Dunaway mine is on the east side of Georgia Highway 61, 1.7 mi northeast of Burnt Hickory Ridge, Paulding County (fig. 5). Several shafts and adits have been dug on the property to explore the area (Yeates and others, 1896, p. 232; Jones, 1909, p. 143–144): The exploration followed the contact between mica schist and amphibolite (Jones, 1909, p. 144). Only one of the two samples (ST14, fig. 5 and table 3) of mica-schist saprolite that were collected at the Dunaway mine contains gold (0.1 ppm Au).

Merritt Mine

The Merritt mine is 0.4 mi along strike to the southwest of the Dunaway mine (fig. 5) (German 1988, p. 43). The large open cut was badly caved in 1967. Sample ST12, light-brown saprolite developed from mica schist, contains 0.05 ppm Au (table 3). A sample of a thin quartz stringer in the saprolite (ST13, fig. 5) contains no gold at a detection limit of 0.02 ppm Au.

Copper Prospect(?)

The Cooper prospect(?), an adit driven 75 ft or more into the hillside just above creek level, is about 1 mile northwest of Burnt Hickory Ridge, Paulding County (fig. 5). A sample of amphibolite containing mostly iron sulfides, taken near the mouth of the adit, contains a trace of gold (0.02 ppm Au) and 1,000 ppm Cu (ST5, fig. 5 and table 3).

Russell Mine

The Russell mine (also known as Sheffield or Heidt mine) is 0.3 mi northwest of Burnt Hickory Ridge, Paulding County (fig. 5). The mine was worked as early as 1845 (Yeates and others, 1896, p. 229–230). All six of the samples collected from the old workings (ST6–ST11, fig. 5 and table 3) contain gold ranging from 0.02 to 9.34 ppm Au. Sample ST8 (9.34 ppm Au) and sample ST11 (3.95 ppm Au) are light-brown saprolite developed from mica schist that contains thin stringers of quartz, 0.5 to 2 in. thick.

Yorkville Mine

The Yorkville mine is 1.8 mi southeast of the town of Yorkville, Paulding County (figs. 6 and 11). Gold was discovered in a small stream near the mine in 1855, and underground mining was begun in 1868 (Yeates and others, 1896, p. 235–236). Three out of five samples of mica schist, which contains minor amounts of thin quartz seams, contain gold, ranging in content from 0.02 to 0.22 ppm Au (DLY1, DLY4, and DLY6, fig. 10 and table 4). Two of three samples of vein quartz collected (DLY3 and DLY5, fig. 10 and table 4) contain gold (0.54 and 0.13 ppm Au, respectively).

Baxter Prospect

The Baxter prospect is about 8 mi southwest of Dallas, Paulding County (fig. 6). The workings consist of an old shaft, about 40 ft deep, and two trenches, one about 90 ft long and the other about 30 ft long. None of the four samples collected in the larger trench contain gold at a detection limit of 0.02 ppm Au (DL11–DL14, fig. 6).

Hicks Prospect

The Hicks (or B.T. McGarity?) prospect is in Paulding County, 3.5 mi southwest of Yorkville (fig. 6). The workings consist of a shallow cut about 50 ft long and 10 to 30 ft wide that is dug into weathered garnet-mica schist that contains numerous thin seams and veins of quartz. Of the five samples collected (BU24–BU28), one sample of schist (BU26) and one of vein quartz (BU27) contain traces of gold (0.02 and 0.04 ppm Au, respectively, table 4); a composite sample of small limonite cubes after pyrite, collected on the surface near the open cut, contains 3.8 ppm Au.

Villa Rica Mine

The Villa Rica pyrite mine is just east of Georgia Highway 61 in Douglas County about 2.7 mi northeast of Villa Rica (fig. 6). The area was first prospected for copper before the Civil War and was mined for pyrite from 1890 to 1917 (Shearer and Hull, 1918, p. 91–98). A sample of massive pyrite from the dump (DL29, table 4) contains 0.2 ppm Au, which is normal for massive sulfide deposits in the southern Appalachian Mountains.

Southern Klondike Mine(?)

Some old caved workings in mafic schist interlayered with granite gneiss, 0.15 mi north of the city limits of Villa Rica, Carroll

County, may be part of the Southern Klondike mine (fig. 6) (Jones, 1909, p. 133–134). A sample of vein quartz containing limonite after pyrite and calcite (DL25, table 4), which was collected from a 4-ft-thick quartz vein near the road between the workings, contains 0.6 ppm Au.

Pine Mountain Mine

The Pine Mountain mine is in Douglas County 2.5 mi northeast of Villa Rica (figs. 6 and 12). The mine has been worked extensively in the past, but not much is known about its history (Yeates and others, 1896, p. 237–238; Jones, 1909, p. 134–135). The geology has been described briefly by Abrams and McConnell (1984). The extensive workings (fig. 12) are in deeply weathered rock that consists of interlayered muscovite quartzite, muscovite-quartz schist, chlorite-anthophyllite schist, and gneissic granite. The muscovite quartzite and muscovite-quartz schist are locally pyritic. The rocks have been tightly folded; axes of small folds plunge gently to the northeast or southwest (fig. 12).

All the exposed rock types are represented in the 116 samples collected in and around the mine workings (fig. 12), and the 109 samples containing gold are listed in table 6. Complete analyses and sample descriptions are given in Lesure and others (1992). The weighted average gold content of the 45 samples of quartzite is 1.26 ppm Au; of the 28 samples of quartzite and thinly interlayered muscovite schist, 1.28 ppm Au; of the 25 samples of muscovite schist, 1.18 ppm Au; of the 10 samples of granite, 0.38 ppm Au; and of the 5 samples of mafic rock, 0.06 ppm Au.

The sampling outlines two mineralized zones: the southern and larger mine area is over 800 ft long and 100 to 250 ft wide, and the northern zone is about 700 ft long and 50 to 100 ft wide. The southern zone has been mined to depths of 10 to 40 ft; the northern zone to depths of 10 to 15 ft. Using these measurements, and assuming a tonnage factor of 15 ft^3/short ton and an average grade of 1 ppm Au or 0.03 troy oz/ton, the inferred gold resources to depths of 40 ft in the southern zone and 20 ft in the northern zone are about 10,000 to 15,000 troy oz of gold.

Royal-Vindicator Mine

The Royal-Vindicator mine (also known as Hollins or Camille mine) is 2.5 mi south of Tallapoosa, Haralson County (figs. 6 and 13). The mine was worked as early as the 1830's and intermittently as late as 1917 (Yeates and others, 1896, p. 250–252; Jones, 1909, p. 140–141; Paris, 1990). More recent exploration done in 1979 and 1988 is described by Paris (1990) and German (1990).

In 1967 the mine workings consisted of a large caving open cut, 700 ft long and 50 to 200 ft wide, partly filled with water (fig. 13). Additional prospect pits extend for 300 ft west of the cut. A caved shaft south of the cut is reported to be 155 ft deep (Paris, 1990, p. 51). Bedrock is mostly saprolite developed from quartz-mica schist, quartzofeldspathic gneiss, and some mafic schist. Quartz stringers are common in all rock types.

All but three of the 20 samples collected in and near the workings contain gold, ranging from 0.02 to 15 ppm Au (fig. 13 and table 4). Recent exploration has outlined 350,000 tons of mineralized rock containing about 50,000 oz gold (Paris, 1990).

Bonner Mine

The Bonner mine is in southern Carroll County, 2.5 mi north of Roopville (figs. 6 and 14). Gold was discovered here in the 1840's; the early work was placer mining along the small creeks (Yeates and others, 1896, p. 245–248; Jones, 1909, p. 129–130). Surface mining, begun after the Civil War, resulted in a large open cut now badly caved (fig. 14). Bedrock is mostly mica-garnet schist saprolite containing numerous thin quartz stringers. All seven of the samples collected at the mine in 1967 contain gold ranging from 0.02 to 0.17 ppm Au (AB1–AB7, fig. 14 and table 4).

DISCUSSION OF SAMPLE DATA AND CONCLUSIONS

Table 7 shows a summary of the analytical data for gold in the various rock types from outcrops and mines. Gold is present in detectable amounts in some samples from all major rock types that were sampled. Outcrop samples are those taken at least 500 ft from a known mine area; they have a lower average gold content and a lower frequency for detectable gold than the mine samples. Fewer outcrop and mine samples of vein quartz contain detectable gold than samples of most other rock types. In general, however, 13 percent of any rock type collected in outcrop and 78 percent of any rock type collected from a mine area contain detectable gold at a limit of detection of 0.02 ppm. Similar calculations for the northeastern half of the Dahlonega belt show that 24 percent of outcrop samples and 67 percent of mine samples are gold-bearing (Lesure, 1992).

Gold does not correlate consistently with the other elements in the data set (table 8). The few positive correlation coefficients greater than 0.50 are generally restricted to the smaller data sets. The distribution of the higher negative correlation coefficients also appears to be random. Similar results were found for samples from the northeastern half of the Dahlonega gold belt (Lesure, 1992).

Although all of the rock types in the area sampled contain some gold, the ore-grade material in the Dahlonega gold belt and probably some of the deposits in the Carroll County belt are generally restricted to minor shear zones that are nearly parallel to the regional foliation. These structures produced conditions favorable for the deposition of thin seams, lenses, and veins of quartz or zones of silicification in the country rock, called stringer leads by Becker (1895, p. 281–284). The veins and sheeted zones contain mostly quartz and lesser amounts of calcite or dolomite, pyrite, pyrrhotite, muscovite, biotite, hornblende, garnet, and chlorite. Within these veins, gold is found as native metal or possibly as a telluride (Paris, 1990, p. 67). Most of the mineralized zones are narrow, generally only 5 ft to as much as 100 ft wide, and are discontinuous along strike. Most of the old mine areas contain small resources of gold in saprolite and probably larger amounts of lower grade material in unweathered rock.

Of the mines sampled, the Pine Mountain mine appears to have the greatest potential for additional gold. This mine is distinctive in that it contains few quartz veins. The quartzite, muscovite- quartzite, and quartz-muscovite schist that contain most of the gold at the Pine Mountain mine may have been a volcanic sinter(?) or siliceous alteration assemblage within a volcanic pile (Abrams and McConnell, 1984, p. 1537).

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TABLES 1–8

Table 1.—Selected elements in gold-bearing samples (≥0.02 parts per million) from parts of the Ball Ground East, Ball Ground West, Birmingham, and Canton 7.5-minute quadrangles, Cherokee County, Ga. (see fig. 3 for sample locations)

[All analyses were made in USGS laboratories, Washington, D.C., or Denver, Colo. Symbols: S, semiquantitative spectrographic analyses; AA, atomic-absorption analyses; N, looked for but not detected at limit of detection (see text); <, less than value shown. Complete analyses and sample descriptions given in Lesure and others (1992)]

Sample No.[1,2]	Element, in parts per million							
	Ag (S)	Ba (S)	Co (S)	Cu (S)	Pb (S)	Au (AA)	Zn (AA)	Cu (AA)
BI1	N	700	30	70	30	0.02	96	40
T01	N	300	15	30	15	.02	95	90
T14	N	70	N	20	70	.03	45	24
T15	10.0	30	70	30	300	.03	210	110
T17	N	200	N	200	30	.02	120	310
T18	N	300	15	20	30	.03	95	80
T20	N	70	10	30	30	.90	<25	25
T21	N	700	10	70	70	.02	130	50
T22	N	500	10	70	30	.73	80	50
T23	N	300	5	70	50	.04	<25	80
T25	N	70	100	150	500	.04	40	50
T26	N	700	15	20	30	.04	40	15
T32	N	100	5	150	10	.05	<25	120
T34	N	700	15	50	15	.02	80	25

[1]Ciphers preceding numerals added to maintain numerical order in computer processing.

[2]Rock type:

BI1	Mica-schist saprolite
T01	Mica-garnet schist
T14	Pyritic quartzite
T15	Massive pyrite
T17	Mica-schist saprolite
T18	Mica-garnet schist
T20	Vein quartz
T21	Mica-garnet schist saprolite
T22	Quartz-mica schist
T23	Vein quartz
T25	Mafic-schist saprolite
T26	Mica-schist saprolite
T32	Vein quartz
T34	Mica-schist saprolite.

Table 2.—Selected elements in gold-bearing samples (≥0.02 parts per million) from parts of the Acworth, Allatoona Dam, Kennesaw, and South Canton 7.5-minute quadrangles, Bartow, Cherokee, Cobb, and Paulding Counties, Ga. (see figs. 4, 9, and 10 for sample locations)

[All analyses were made in USGS laboratories, Washington, D.C., or Denver, Colo. Symbols: S, semiquantitative spectrographic analyses; AA, atomic-absorption analyses; N, looked for but not detected at limit of detection (see text); <, less than value shown. Complete analyses and sample descriptions given in Lesure and others (1992)]

Sample No.[1,2]	Element, in parts per million							
	Ag (S)	Ba (S)	Co (S)	Cu (S)	Pb (S)	Au (AA)	Zn (AA)	Cu (AA)
AC07	N	500	15	7	10	0.03	65	31
AC18	N	15	30	70	N	.10	25	160
SC20	N	200	30	10	<10	.98	<25	<10
SC28	N	700	N	30	15	.02	<25	16
SC34	N	3,000	3	50	150	.02	<25	50
SC42	N	700	7	20	70	.02	30	15
SC49	N	100	N	50	20	.02	25	25
SCC03	N	150	70	70	N	.03	<25	65
SCC04	N	150	30	150	15	.33	350	190
SCC05	N	100	50	15	20	524.00	35	90
SCC06	1.5	200	20	70	N	.18	<25	120
SCC07	N	300	50	20	N	.07	25	65
SCC08	N	300	20	20	N	.05	40	30
SCC10	N	700	50	150	10	.07	30	110
SCC11	N	300	30	30	10	.02	85	65
SCC14	N	300	70	100	N	.57	50	120
SCC15	N	700	70	150	10	6.80	30	90
SCC21	N	700	30	70	15	.04	50	80
SCC22	N	150	20	10	N	.18	25	65
SCC23	N	500	70	150	10	.49	45	160
SCC24	N	500	15	20	10	.02	<25	18
SCC26	N	70	20	20	15	.08	<25	19

[1]Ciphers preceding numerals added to maintain numerical order in computer processing.

[2]Rock type:

AC07	Granitic-gneiss saprolite
AC18	Mafic schist
SC20	Mica-schist saprolite
SC28	Graphitic mica-garnet schist saprolite
SC34	Graphitic mica schist
SC42	Graphitic quartz-mica-garnet schist saprolite
SC49	Pyritic quartz vein
SCC03	Vein quartz
SCC04	Quartz-biotite-garnet schist
SCC05	Pyritic vein quartz
SCC06	Amphibolite
SCC07	Mica-schist saprolite
SCC08	Vein quartz
SCC10	Mica-schist saprolite
SCC11	Do.
SCC14	Do.
SCC15	Do.
SCC21	Do.
SCC22	Do.
SCC23	Do.
SCC24	Do.
SCC26	Mafic-schist saprolite.

Table 3.—Selected elements in gold-bearing samples (≥0.02 parts per million) from parts of the Burnt Hickory Ridge and Taylorsville 7.5-minute quadrangles, Paulding Counties, Ga. (see fig. 5 for sample locations)

[All analyses were made in USGS laboratories, Washington, D.C., or Denver, Colo. Symbols: S, semiquantitative spectrographic analyses; AA, atomic-absorption analyses; N, looked for but not detected at limit of detection (see text); <, less than value shown. Complete analyses and sample descriptions given in Lesure and others (1992)]

Sample No.[1,2]	Element, in parts per million							
	Ag (S)	Ba (S)	Co (S)	Cu (S)	Pb (S)	Au (AA)	Zn (AA)	Cu (AA)
ST01	N	700	10	15	10	0.17	70	80
ST05	<0.5	N	50	1,000	30	.02	70	2,000
ST06	N	700	50	20	20	.17	50	65
ST07	N	70	100	30	N	.09	25	130
ST08	N	300	70	150	N	9.34	35	230
ST09	N	70	100	20	N	.08	25	90
ST10	N	500	10	30	15	.02	25	19
ST11	N	300	50	100	N	3.95	25	160
ST12	N	300	10	30	10	.05	50	130
ST14	N	300	15	20	10	.10	45	50
ST27	N	70	10	15	<10	.02	9	14

[1]Ciphers preceding numerals added to maintain numerical order in computer processing.

[2]Rock type:

ST01	Muscovite-schist saprolite
ST05	Pyritic mafic schist
ST06	Muscovite-schist saprolite
ST07	Vein quartz
ST08	Mica-schist saprolite
ST09	Magnetite quartzite
ST10	Muscovite-schist saprolite
ST11	Do.
ST12	Mica-schist saprolite
ST14	Do.
ST27	Vein quartz.

Table 4.—Selected elements in gold-bearing samples (≥0.02 parts per million) from parts of the Anniston, Atlanta, Griffin, and La Grange 30 × 60-minute quadrangles, Georgia and Alabama (see figs. 6, 11, 13, and 14 for sample locations)

[All analyses were made in USGS laboratories, Washington, D.C., or Denver, Colo. Symbols: S, semiquantitative spectrographic analyses; AA, atomic-absorption analyses; N, looked for but not detected at limit of detection (see text); <, less than value shown. Complete analyses and sample descriptions given in Lesure and others (1992)]

Sample No.[1,2]	Element, in parts per million							
	Ag (S)	Ba (S)	Co (S)	Cu (S)	Pb (S)	Au (AA)	Zn (AA)	Cu (AA)
A01	<0.5	300	7	15	<10	0.10	60	20
A02	<.5	300	20	15	15	.04	50	40
A14	<.5	300	<5	15	10	.06	40	10
A28	<.5	500	50	100	30	.02	25	80
A29	<.5	150	50	100	30	.02	75	60
AB1	<.5	300	30	100	100	.14	25	90
AB2	<.5	300	<5	100	30	.17	25	60
AB3	<.5	300	20	100	70	.09	25	70
AB4	<.5	150	10	100	<10	.02	<25	30
AB5	<.5	150	20	100	30	.09	<25	50
AB6	<.5	700	70	70	150	.03	<25	40
AB7	<.5	700	150	100	200	.10	100	80
AH01	<.5	500	7	15	<10	2.00	50	20
AH02	1.5	100	15	15	<10	15.00	45	50
AH03	<.5	150	10	10	10	.20	40	15
AH04	<.5	700	20	10	<10	.20	70	30
AH05	<.5	500	30	20	10	.40	40	20
AH06	<.5	300	5	20	<10	.40	65	20
AH07	1.5	70	<5	20	10	2.50	90	15
AH08	<.5	300	15	30	10	.04	55	15
AH09	<.5	70	30	15	15	.02	205	50
AH10	<.5	150	15	20	10	.20	62	20
AH11	<.5	150	70	50	15	.20	40	20
AH12	<.5	30	30	15	20	.08	60	10
AH13	<.5	300	10	15	15	.10	60	40
AH14	<.5	150	5	15	15	.20	50	20
AH15	<.5	700	5	15	15	.50	55	40
AH16	<.5	200	<5	15	50	1.30	40	20
BU20	<.5	30	70	500	<10	.02	25	70
BU21	<.5	700	100	20	70	.05	25	50
BU23	N	50	70	70	N	.07	25	50
BU26	N	700	30	100	200	.02	400	70
BU27	N	700	10	20	15	.04	41	28
BU28	N	50	70	100	50	3.80	95	40
CA020	<.5	700	10	70	10	.02	25	60
DL01	<.5	70	30	50	<10	.03	25	20
DL03	<.5	100	5	30	<10	.06	25	30
DL04	<.5	7	30	200	<10	.02	150	30
DL05	<.5	700	30	70	10	.03	150	20
DL06	<.5	700	<5	30	10	.03	75	30
DL08	<.5	500	50	50	<10	.02	25	20
DL10	N	150	10	10	30	.02	<25	<10
DL23	N	15	150	50	10	.02	13	26
DL25	N	100	N	30	<10	.60	<5	<5
DL27	N	<20	150	5	<10	.02	7	<5
DL29	15.0	200	150	700	1,500	.20	14,000	600
DLY1	<.5	500	30	100	<10	.05	<25	60
DLY3	<.5	300	10	10	<10	.54	225	40

Table 4.—Continued

Sample No.[1,2]	Element, in parts per million							
	Ag (S)	Ba (S)	Co (S)	Cu (S)	Pb (S)	Au (AA)	Zn (AA)	Cu (AA)
DLY4	<0.5	700	20	150	<10	0.22	75	50
DLY5	<.5	150	30	15	<10	.13	<25	30
DLY6	<.5	150	70	100	15	.02	25	120
TA45	N	300	<5	7	N	.08	7	<5
TA47	N	100	20	150	N	.20	20	65
TA48	N	N	30	1,000	<10	.50	310	960
TA49	N	100	5	7	N	.04	27	<5
TA53	N	150	7	30	<10	.10	11	8
VO1	<.5	300	5	7	<10	.02	150	80
V19	N	500	10	50	10	.02	35	<5
V26	N	1,000	70	150	30	.02	15	48

[1]Ciphers preceding numerals added to maintain numerical order in computer processing.

[2]Rock type:

A01	Mica-schist saprolite
A02	Do.
A14	Do.
A28	Mica-garnet schist saprolite
A29	Do.
AB1	Do.
AB2	Do.
AB3	Do.
AB4	Vein quartz
AB5	Mica-garnet schist saprolite
AB6	Do.
AB7	Do.
AH01	Mica-schist saprolite
AH02	Vein quartz
AH03	Mica-gneiss saprolite
AH04	Mica-schist saprolite
AH05	Do.
AH06	Quartz-mica schist
AH07	Vein quartz
AH08	Quartz-mica schist saprolite
AH09	Mafic-schist saprolite
AH10	Mica-schist saprolite
AH11	Mica-gneiss saprolite
AH12	Chlorite-epidote schist
AH13	Mica-schist saprolite
AH14	Do.
AH15	Do.
AH16	Do.
BU20	Mafic-schist saprolite
BU21	Mica-schist saprolite

Rock type—Continued:

BU23	Magnetite quartzite saprolite
BU26	Quartz-mica-garnet schist
BU27	Vein quartz
BU28	Limonite after pyrite cubes
CA020	Mica-gneiss and mica-schist saprolite
DL01	Mafic-schist saprolite
DL03	Granite saprolite
DL04	Amphibolite
DL05	Mica-schist saprolite
DL06	Do.
DL08	Do.
DL10	Augen-gneiss saprolite
DL23	Soapstone
DL25	Vein quartz
DL27	Mafic-schist saprolite
DL29	Massive pyrite
DLY1	Mica-schist saprolite
DLY3	Vein quartz
DLY4	Quartz-mica schist
DLY5	Vein quartz
DLY6	Quartz-mica schist
TA45	Quartzite and mica-schist saprolite
TA47	Mafic-schist saprolite
TA48	Mica-schist saprolite
TA49	Do.
TA53	Do.
V01	Granite
V19	Granitic gneiss
V26	Quartz-mica-magnetite schist saprolite.

Table 5.—Selected elements in gold-bearing samples (≥0.02 parts per million) from part of the Mountain Park 7.5-minute quadrangle, Cherokee and Cobb Counties, Ga., and part of the Atlanta 30 × 60-minute quadrangle, Georgia (see figs. 7 and 8 for sample locations)

[All analyses were made in USGS laboratories, Washington, D.C., or Denver, Colo. Symbols: S, semiquantitative spectrographic analyses; AA, atomic-absorption analyses; N, looked for but not detected at limit of detection (see text); <, less than value shown. Complete analyses and sample descriptions given in Lesure and others (1992)]

Sample No.[1,2]	Element, in parts per million							
	Ag (S)	Ba (S)	Co (S)	Cu (S)	Pb (S)	Au (AA)	Zn (AA)	Cu (AA)
MA01	<0.5	70	15	50	20	0.06	60	135
MA02	<.5	50	20	70	15	.04	35	10
MA03	<.5	30	<5	30	<10	.06	30	32
MA04	<.5	150	15	50	50	.04	40	45
MA05	<.5	70	<5	15	<10	.02	45	12
MA06	<.5	70	<5	70	<10	.02	45	20
MA09	<.5	70	<5	15	<10	.02	40	18
MA14	<.5	200	10	70	10	.02	65	50
MA15	<.5	300	10	20	10	.06	60	30
MA17	<.5	30	<5	15	<10	.04	40	18
MA18	<.5	70	<5	50	20	.04	25	12
MA20	<.5	150	<5	15	<10	.02	30	10
MA21	<.5	50	<5	15	<10	.04	45	<10
MA22	<.5	70	5	15	<10	.02	50	10
MA23	<.5	70	<5	20	<10	.06	35	15
MA24	<.5	150	<5	10	<10	.06	75	22
MA25	<.5	70	20	30	<10	.08	72	60
MP01	<.5	500	<5	150	70	.20	45	265
MP02	<.5	70	<5	70	20	.08	40	90
MP03	<.5	700	<5	100	100	.04	40	150
MP05	<.5	50	<5	15	<10	.04	45	10
MP06	<.5	50	<5	10	10	.06	40	<10
MP07	<.5	1,500	<5	30	20	.20	40	100
MP08	<.5	70	<5	15	<10	.04	35	15
MP09	<.5	70	<5	15	<10	.06	30	<10
MP10	<.5	70	<5	10	<10	.04	65	30
MP11	<.5	70	<5	7	<10	.04	48	40
MP12	<.5	30	<5	15	<10	.04	25	15
MP13	<.5	200	50	70	<10	.04	32	80
MP15	<.5	150	7	15	<10	.02	50	50
MP16	<.5	150	30	20	<10	.20	135	140
MP17	<.5	300	20	20	20	.08	40	15

[1]Ciphers preceding numerals added to maintain numerical order in computer processing.

[2]Rock type:

MA01	Quartz-mica schist saprolite
MA02	Do.
MA03	Vein quartz
MA04	Quartz-mica schist saprolite
MA05	Quartzite saprolite
MA06	Quartzite
MA09	Do.
MA14	Do.
MA15	Do.
MA17	Do.
MA18	Do.
MA20	Quartz-mica schist saprolite
MA21	Quartzite
MA22	Do.
MA23	Do.
MA24	Do.

Rock type—Continued:

MA25	Mafic-schist saprolite
MP01	Quartzite
MP02	Clay layer in qurtzite
MP03	Quartz-muscovite schist and quartzite saprolite
MP05	Quartzite
MP06	Do.
MP07	Quartz-muscovite-garnet schist
MP08	Quartzite
MP09	Do.
MP10	Do.
MP11	Do.
MP12	Do.
MP13	Do.
MP15	Quartz-feldspar-mica schist saprolite
MP16	Quartzite
MP17	Do.

Table 6.—Selected elements in gold-bearing samples (≥0.02 parts per million) from the Pine Mountain mine, Douglas County, Ga. (see fig. 12 for sample locations)

[All analyses were made in USGS laboratories, Washington, D.C., or Denver, Colo. Symbols: S, semiquantitative spectrographic analyses; AA, atomic-absorption analyses; N, looked for but not detected at limit of detection (see text); <, less than value shown. Complete analyses and sample descriptions given in Lesure and others (1992)]

Sample No.[1,2]	Element, in parts per million							
	Ag (S)	Ba (S)	Co (S)	Cu (S)	Pb (S)	Au (AA)	Zn (AA)	Cu (AA)
DLP001	<0.5	700	<5	5	<10	0.23	<25	40
DLP002	<.5	700	<5	100	<10	.26	<25	10
DLP003	<.5	300	<5	30	<10	.80	<25	80
DLP004	<.5	300	<5	100	<10	3.47	<25	80
DLP005	<.5	100	<5	30	<10	.68	75	<10
DLP006	<.5	300	<5	70	<10	7.16	25	30
DLP007	<.5	700	<5	70	<10	.44	25	70
DLP008	<.5	70	10	20	<10	.54	50	100
DLP009	<.5	300	100	100	30	.71	75	90
DLP010	<.5	500	5	30	<10	3.44	75	80
DLP011	<.5	700	<5	50	<10	1.76	25	160
DLP012	<.5	100	<5	50	<10	3.12	50	40
DLP013	<.5	300	<5	2	<10	.10	<25	40
DLP014	<.5	700	<5	70	<10	1.96	50	80
DLP015	<.5	200	<5	100	<10	1.54	<25	30
DLP016	<.5	500	<5	50	<10	.31	50	30
DLP017	<.5	300	<5	50	<10	.50	100	4,000
DLP018	<.5	200	<5	50	<10	1.27	<25	30
DLP019	<.5	500	<5	50	<10	5.56	<25	20
DLP020	<.5	500	<5	20	<10	2.30	<25	10
DLP021	<.5	700	<5	50	<10	.06	<25	10
DLP023	N	70	200	300	30	.02	120	150
DLP024	N	30	200	700	<10	.30	34	380
DLP026	N	300	N	5	<10	2.00	<5	<5
DLP027	N	150	<5	30	15	.06	5	<5
DLP028	N	100	<5	30	10	3.20	7	8
DLP029	N	300	N	30	<10	.60	<5	<5
DLP030	N	300	N	20	<10	.30	<5	6
DLP031	N	150	<5	2	<10	1.40	<5	<5
DLP032	N	150	N	20	15	.60	9	11
DLP033	N	700	N	30	<10	.20	<5	5
DLP034	N	150	N	2	<10	.06	<5	<5
DLP035	N	300	N	2	<10	.30	<5	<5
DLP036	N	300	N	5	10	2.50	<5	6
DLP037	N	150	N	20	15	.10	6	<5
DLP038	N	700	N	10	<10	.08	<5	6
DLP039	N	300	N	30	<10	.40	15	26
DLP040	N	700	N	70	<10	.30	<5	14
DLP041	N	500	N	30	<10	.20	<5	9
DLP042	N	700	N	30	<10	.20	<5	8
DLP043	N	500	N	15	<10	.60	<5	<5
DLP044	N	700	N	15	<10	2.50	<5	6
DLP045	N	1,000	N	150	<10	.40	<5	57
DLP046	N	700	10	30	<10	.20	<5	5
DLP047	N	700	N	30	<10	.30	<5	6
DLP048	N	300	N	10	<10	1.00	<5	5
DLP049	N	500	N	50	<10	.90	5	20
DLP050	N	150	N	150	10	.80	6	36
DLP051	N	700	N	70	<10	1.10	6	20

Table 6.—Continued

Sample No.[1,2]	Element, in parts per million							
	Ag (S)	Ba (S)	Co (S)	Cu (S)	Pb (S)	Au (AA)	Zn (AA)	Cu (AA)
DLP052	N	200	N	20	<10	0.80	<5	5
DLP053	N	300	N	50	10	.90	9	12
DLP054	N	1,000	N	20	<10	.40	<5	8
DLP055	N	700	N	7	<10	1.20	<5	5
DLP056	N	700	N	20	<10	5.60	<5	7
DLP057	7.0	700	10	20	<10	32.00	5	30
DLP058	N	700	N	30	<10	1.50	10	18
DLP059	N	500	N	15	<10	.60	<5	6
DLP060	N	1,000	N	30	<10	.90	<5	7
DLP061	N	1,500	N	50	<10	.90	7	18
DLP062	N	30	N	30	10	.20	5	12
DLP063	N	700	N	20	<10	2.20	<5	9
DLP064	N	200	N	50	10	1.60	8	11
DLP065	N	300	N	20	<10	.30	<5	<5
DLP066	N	700	N	100	<10	1.90	<5	22
DLP067	N	500	N	10	<10	.30	<5	<5
DLP068	N	700	N	10	<10	.80	<5	<5
DLP069	N	700	N	15	<10	.20	<5	<5
DLP070	N	700	N	10	<10	.30	<5	13
DLP071	N	1,000	N	150	10	.90	6	43
DLP072	N	50	N	50	10	1.60	12	18
DLP073	N	300	N	30	<10	.90	5	17
DLP074	N	700	N	30	<10	1.60	5	12
DLP075	N	300	N	20	<10	1.90	<5	17
DLP076	N	700	N	15	<10	.30	<5	10
DLP077	N	500	N	30	<10	.80	7	30
DLP078	N	700	N	20	<10	.40	<5	7
DLP079	N	300	N	10	<10	6.30	<5	13
DLP080	N	300	N	70	<10	1.40	7	32
DLP081	N	300	N	30	<10	3.00	<5	6
DLP082	N	300	N	15	<10	.20	<5	5
DLP083	N	300	N	30	<10	.10	<5	<5
DLP085	N	300	70	100	<10	.08	10	50
DLP086	N	150	15	30	10	.06	24	11
DLP087	N	700	50	30	10	3.10	<5	7
DLP088	1.5	700	N	30	15	26.00	<5	6
DLP089	N	300	N	15	<10	1.70	<5	<5
DLP090	N	500	N	30	10	.30	<5	<5
DLP093	N	700	N	30	<10	.10	6	45
DLP094	N	500	N	20	<10	.02	<5	5
DLP095	N	1,000	N	30	<10	.02	<5	7
DLP097	N	1,500	<5	30	<10	.08	<5	32
DLP098	N	300	N	100	<10	.10	<5	8
DLP100	N	700	N	30	<10	.08	<5	6
DLP101	N	1,000	<5	30	<10	.08	<5	14
DLP102	<.5	500	N	30	<10	.04	<5	<5
DLP103	.7	1,000	N	30	<10	.04	<5	7
DLP104	<.5	150	N	150	10	2.20	5	65
DLP105	N	700	<5	15	<10	2.20	<5	5
DLP106	N	700	<5	15	<10	4.00	<5	8
DLP107	N	1,000	<5	20	<10	.20	<5	6
DLP108	N	1,000	N	70	<10	.60	<5	53

Table 6.—Continued

Sample No.[1,2]	Element, in parts per million							
	Ag (S)	Ba (S)	Co (S)	Cu (S)	Pb (S)	Au (AA)	Zn (AA)	Cu (AA)
DLP109	N	1,500	N	20	<10	0.20	<5	6
DLP110	0.7	700	N	30	<10	1.60	<5	16
DLP111	N	1,500	<5	20	<10	.10	<5	12
DLP112	N	1,500	<5	70	15	1.40	5	24
DLP113	N	700	<5	30	10	2.00	<5	14
DLP114	N	150	15	30	15	.06	<5	<5
DLP115	N	700	<5	30	10	.08	<5	6
DLP116	N	1,500	<5	30	10	.04	<5	18

[1]Ciphers preceding numerals added to maintain numerical order in computer processing.

[2]Rock type:

DLP001 Feldspar-quartz-mica schist
DLP002 Do.
DLP003 Mica-schist saprolite
DLP004 Quartzite
DLP005 Do.
DLP006 Do.
DLP007 Mica-schist saprolite
DLP008 Quartzite and mica-schist saprolite
DLP009 Do.
DLP010 Mica-schist saprolite
DLP011 Quartzite saprolite
DLP012 Do.
DLP013 Mica-schist saprolite
DLP014 Do.
DLP015 Granite saprolite
DLP016 Mica-schist saprolite
DLP017 Do.
DLP018 Do.
DLP019 Quartzite saprolite
DLP020 Muscovite quartzite
DLP021 Mica-schist saprolite
DLP023 Mafic-schist saprolite
DLP024 Do.
DLP026 Quartzite saprolite
DLP027 Granite(?) saprolite
DLP028 Mafic-schist saprolite
DLP029 Quartzite saprolite
DLP030 Mica-gneiss and mica-schist saprolite
DLP031 Quartzite saprolite
DLP032 Granite saprolite
DLP033 Quartzite saprolite
DLP034 Do.
DLP035 Do.
DLP036 Do.
DLP037 Granite(?) saprolite
DLP038 Quartzite saprolite
DLP039 Mafic-schist saprolite
DLP040 Mica-schist saprolite
DLP041 Quartzite saprolite
DLP042 Do.
DLP043 Do.
DLP044 Do.
DLP045 Mafic- and mica-schist saprolite
DLP046 Quartzite saprolite
DLP047 Do.
DLP048 Do.
DLP049 Mafic-schist saprolite
DLP050 Do.
DLP051 Mica-schist saprolite
DLP052 Quartzite saprolite
DLP053 Mica-schist saprolite
DLP054 Quartzite and mica-schist saprolite
DLP055 Quartzite saprolite
DLP056 Do.
DLP057 Do.

Rock type—Continued:

DLP058 Mafic-schist saprolite
DLP059 Quartzite and mica-schist saprolite
DLP060 Quartzite saprolite
DLP061 Mica-schist saprolite
DLP062 Mafic-schist saprolite
DLP063 Quartzite saprolite
DLP064 Mafic-schist saprolite
DLP065 Mica-schist saprolite
DLP066 Mafic- and mica-schist saprolite
DLP067 Quartzite saprolite
DLP068 Do.
DLP069 Do.
DLP070 Do.
DLP071 Mica-schist saprolite
DLP072 Mica-schist saprolite
DLP073 Quartzite and mica-schist saprolite
DLP074 Mica-schist saprolite
DLP075 Quartzite and mica-schist saprolite
DLP076 Do.
DLP077 Do.
DLP078 Do.
DLP079 Do.
DLP080 Mafic-schist saprolite
DLP081 Quartzite
DLP082 Do.
DLP083 Quartzite and mica schist
DLP085 Mafic-schist saprolite
DLP086 Mafic-gneiss saprolite
DLP087 Quartzite saprolite
DLP088 Quartzite and mica schist
DLP089 Quartzite
DLP090 Do.
DLP093 Quartzite and mica-schist saprolite
DLP094 Do.
DLP095 Do.
DLP097 Mica-schist saprolite
DLP098 Mica-gneiss saprolite
DLP100 Granitic-gneiss saprolite
DLP101 Mica-schist saprolite
DLP102 Quartzite
DLP103 Quartzite and mica-schist saprolite
DLP104 Limonite-cemented quartzite
DLP105 Quartzite
DLP106 Do.
DLP107 Do.
DLP108 Do.
DLP109 Quartzite and mica-schist saprolite
DLP110 Quartzite saprolite
DLP111 Mica-schist saprolite
DLP112 Mica-gneiss and mica-schist saprolite
DLP113 Quartzite and mica-schist saprolite
DLP114 Granitic-gneiss saprolite
DLP115 Quartzite saprolite
DLP116 Mica-schist and quartzite saprolite.

Table 7.—Distribution of gold in outcrop[1] and mine samples by rock type for southwestern part of the Dahlonega gold belt, Georgia
[ppm, parts per million; —(leader), not calculated]

Rock type	All samples			Outcrop samples					
	Number of samples	Number of samples containing gold	Percent samples containing gold	Number of samples	Number of samples containing gold	Percent samples containing gold	Gold (ppm) Maximum	Gold (ppm) Minimum	Gold (ppm) Median
All	788	249	32	559	71	13	0.9	N	N
Amphibolite	63	20	32	36	7	19	.2	N	<.02
Fresh and weathered	30	4	13	18	2	11	.1	N	<.02
Saprolite	33	16	48	18	5	28	.2	N	N
Ultramafic rock	8	3	38	6	2	33	.02	N	N
Mica gneiss	39	5	13	36	2	5	.03	N	N
Fresh and weathered	15	0	—	15	0	—	—	—	—
Saprolite	24	5	21	21	2	10	.03	N	N
Interlayered gneiss-schist-amphibolite	52	29	56	25	4	16	.2	N	N
Fresh and weathered	9	2	22	7	1	14	.2	N	N
Saprolite	43	27	63	18	3	17	.08	N	N
Mica schist	284	85	30	205	24	12	.5	N	N
Fresh	57	13	23	43	3	7	.2	N	N
Saprolite	227	72	32	162	21	13	.5	N	N
Graphitic schist	60	3	5	60	3	5	.02	N	N
Granite and diorite	29	10	29	20	3	15	.06	N	N
Fresh	7	3	43	5	2	40	.02	N	N
Saprolite	22	7	32	15	1	7	.06	N	N
Vein quartz	150	19	13	124	4	3	.9	N	N
Quartzite	87	68	78	38	20	53	.2	N	<.02
Magnetite quartzite	10	4	40	6	2	33	.07	N	N
Mylonite	2	0	0	2	0	—	—	—	—
Pyrite (massive)	2	2	100	0	0	—	—	—	—
Limonite	2	1	50	1	0	—	—	—	—

[1]Samples collected more than 500 ft from a known mine area.
*Includes 116 samples from the Pine Mountain mine, Douglas County, Ga.

Table 7.—Continued

Outcrop samples—Continued: Gold-bearing samples only (ppm)		Mine samples							
					Gold (ppm)			Gold-bearing samples only (ppm)	
Mean	Std. dev.	Number of samples	Number of samples containing gold	Percent samples containing gold	Maximum	Average	Median	Mean	Std. dev.
0.07	0.122	229*	178	78	524	N	0.2	4.27	39.33
.07	.065	27	13	48	1.6	N	<.02	.55	.70
.06	.057	12	2	17	.18	N	<.02	.1	.11
.074	.074	15	11	73	1.6	N	.08	.63	.73
.02	—	2	1	50	.08	N	—	—	—
.025	.007	3	3	100	.2	.1	.2	1.67	.06
—	—	0	0	—	—	—	—	—	—
.09	.007	3	3	100	.2	.1	.2	1.67	.06
.025	.081	27	25	93	26	N	.4	2.05	5.17
—	—	2	1	50	26	<.02	—	—	—
.05	.03	25	24	96	6.3	N	.4	1.05	1.37
.07	.103	79	61	77	32	N	.1	1.23	4.30
.08	.101	14	10	71	.73	N	.16	.28	.22
.07	.107	65	51	78	32	N	.10	1.42	4.69
.02	—	0	0	—	—	—	—	—	—
.03	.023	9	7	78	1.91	N	.08	.62	.79
.02	—	2	1	50	1.91	<.02	—	—	—
—	—	7	6	86	1.54	N	.08	.41	.59
.25	.430	26	15	58	524	N	.03	36.55	134.91
.05	.039	49	48	98	7.16	N	.71	1.45	1.62
.05	.035	4	2	50	.08	<.02	.02	.06	.04
—	—	0	0	—	—	—	—	—	—
—	—	2	2	100	.2	.03	—	—	—
—	—	1	1	100	3.8	—	—	—	—

Table 8.—Correlation coefficients between gold and other elements listed by rock type

[Coefficients calculated using USGS STATPAC statistical progam Bastat and ignoring qualifying codes such as N, not detected at limit given; semiquantitative spectrographic methods except where indicated]

Rock type	Number of samples	Elements									
		Fe	Mg	Ca	Ti	Mn	Ag	B	Ba	Be	Co
All types	788	0.07	0.01	0.03	−0.02	0.00	0.02	−0.01	−0.02	−0.02	0.03
Outcrop[3]	559	.07	.00	−.02	−.05	−.01	.13	−.04	−.05	−.04	−.02
Mine	229	.14	.02	.04	.01	.00	.01	−.02	−.05	−.02	.04
Amphibolite											
Fresh and weathered	30	−.05	−.08	−.19	−.02	−.14	.56	−.06	.24	−.07	−.27
Outcrop	18	.00	.03	−.23	−.02	−.04	−.11	−.07	−.15	−.06	−.17
Mine	12	−.21	−.16	−.16	−.02	−.49	.81*	−.06	.41	−.09	−.38
Saprolite	33	−.28	−.07	−.05	−.03	−.40	−.13	−.03	.37	−.13	−.25
Outcrop	18	.59	−.15	−.16	.21	−.11	−.04	.18	−.11	−.13	−.16
Mine	15	−.45	−.11	−.09	.08	−.55	−.18	−.10	.57	.00	−.34
Ultramafic rocks	8	.46	−1.00	.87	.96	.11	.00	.00	.02	.00	−.76
Mica gneiss											
Saprolite	24	.01	−.15	−.14	−.18	.12	−.08	−.17	−.19	.16	.58
Outcrop	21	−.07	.30	−.09	−.10	−.10	−.05	−.12	.02	−.15	.21
Mine	3	.33	.50	.00	−.83	.95	.00	.00	−1.00	1.00	.56
Interlayered gneiss, schist, and amphibolite											
Fresh and weathered	9	−.15	−.22	−.28	−.39	−.41	.86*	−.05	.40	−.18	−.24
Saprolite	43	.22	.56	.45	−.03	.13	.86*	−.16	−.24	.14	−.26
Outcrop	18	.16	−.23	−.12	−.03	−.27	−.08	.21	.07	−.20	−.31
Mine	25	.08	−.08	.00	.29	−.05	−.15	.00	−.30	.00	.00
Mica schist											
Fresh and weathered	57	.16	.06	−.29	.40	.01	−.11	.39	.18	.41	−.22
Outcrop	43	−.10	−.01	.22	−.25	−.17	.92*	−.25	−.09	−.16	−.16
Mine	14	−.26	−.17	.41	−.30	−.26	.68+	−.21	.15	.19	−.44
Saprolite	227	−.08	−.07	.00	−.13	−.04	.90*	−.02	.01	−.05	.01
Outcrop	162	.13	.27	−.02	−.08	−.02	−.02	−.06	−.12	−.05	.00
Mine	65	−.09	−.09	−.01	−.07	−.09	.93+	.00	.06	−.07	−.01
Graphitic schist	60	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Quartzite											
Outcrop	38	.61	.69	.86	.09	.49	.00	−.03	−.09	.17	.08
Mine	49	.08	−.02	.14	−.08	.02	.02	.02	−.10	.00	.00
Magnetite quartzite	10	−.43	−.33	−.19	−.38	−.69	.00	−.21	−.40	−.34	.66
Vein quartz											
Outcrop	124	.00	−.05	−.05	−.03	−.05	.57	−.02	−.04	−.02	−.01
Mine	26	.71	.29	.21	.32	.00	−.07	−.03	−.10	−.05	.15

[1]Analyses by instrumental methods.
[2]Analyses by atomic-absorption methods.
[3]Samples collected more than 500 ft from a known mine area.
*Only one sample contains determinable amount.
+No determinable silver in any sample.

L, detected but not determined at limit given; G, greater than value given. Analyses of gold by atomic-absorption methods; other elements by

Elements																
Cr	Cu	La	Mo	Nb	Ni	Pb	Sc	Sr	V	Y	Zr	Hg[1]	Zn[2]	Cu[2]	Pb[2]	Mo[2]
-0.01	-0.01	-0.02	-0.01	-0.02	-0.01	-0.01	-0.01	-0.01	-0.02	-0.03	-0.04	0.00	0.00	0.01	0.01	-0.01
-.01	.28	-.05	-.04	-.02	-.01	-.02	.00	-.05	.00	-.05	-.05	.10	.14	.38	.05	-.07
-.02	-.03	-.02	-.01	-.01	-.02	-.01	.00	-.02	-.02	-.05	-.06	.01	.00	.00	.00	-.02
-.12	-.08	-.11	-.18	.00	-.17	-.11	-.10	-.02	-.21	-.19	-.14	-.10	-.16	-.02	.14	-.13
-.01	-.09	-.11	-.20	.00	-.04	-.12	-.02	.01	-.22	-.22	-.08	-.13	-.10	.22	.15	-.15
-.41	-.11	-.13	-.18	.00	-.35	-.14	-.17	-.06	-.27	-.16	-.28	-.10	-.31	-.07	.13	-.13
.16	-.07	-.13	.28	-.08	.01	-.09	.18	.16	-.28	-.23	.00	-.14	-.32	-.11	-.40	.22
-.09	.10	-.11	-.01	.00	.09	.01	.05	-.05	-.12	-.23	-.18	.04	-.09	.26	-.02	.00
.12	-.15	-.29	.46	-.18	-.11	-.35	.22	.44	-.20	-.38	.02	-.20	-.39	-.23	-.75	.27
-.82	-.15	.00	-1.00	.00	-.52	1.00	.77	1.00	.23	.34	.98	1.00	.82	-.16	.93	-.71
-.21	.40	-.12	-.28	-.02	-.13	-.15	.06	-.22	-.20	-.24	-.10	-.09	.06	.01	.25	-.16
-.03	-.15	.30	-.27	-.11	.02	-.15	-.05	-.22	-.14	-.12	-.07	-.07	.33	.19	.25	-.24
-1.00	-.90	.00	-1.00	-1.00	-.50	.00	.56	-1.00	-.99	.50	.00	.87	1.00	.91	1.00	-1.00
.12	-.10	-.13	.99*	.00	-.15	-.25	-.31	-.14	-.42	-.16	-.41	-.15	-.54	-.19	-.29	.96
.29	.00	-.17	.22	-.19	.11	-.17	-.23	.11	-.17	-.23	-.25	-.12	-.26	-.12	-.28	.03
-.13	-.03	-.17	.08	-.18	-.19	.14	-.11	.00	-.03	-.21	-.05	-.10	-.22	.12	-.22	.22
.17	-.07	.00	.00	-.15	-.01	.06	-.10	.00	-.08	.00	-.24	.00	-.02	-.08	.08	-.12
-.36	.12	-.22	-.12	-.14	-.34	-.21	-.27	-.12	-.26	-.21	-.35	.28	.05	.44	.05	-.18
.05	-.06	-.10	-.06	.06	-.18	-.09	.08	-.10	.03	-.13	-.34	.15	-.04	.41	.14	-.09
-.36	-.11	.68	-.22	.25	-.40	-.27	-.47	-.33	-.25	.25	-.15	.55	-.22	.38	-.27	-.34
.02	.01	-.07	-.01	-.08	-.04	-.05	-.07	.00	-.05	-.07	-.12	-.02	-.08	.05	-.07	.09
.13	.73	-.08	-.02	-.07	.07	-.05	.04	-.02	.25	-.07	-.12	.05	.37	.81	-.03	-.03
.08	.01	-.08	.16	-.08	-.01	-.08	-.05	.16	.05	-.09	-.22	-.04	-.17	.08	-.19	.30
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.06	-.15	-.09	-.22	.25	.09	-.05	.27	-.31	.21	.48	.01	.01	.69	.46	.26	-.19
.33	.28	.00	.02	.00	-.04	-.06	.03	-.42	-.02	-.41	-.11	.42	.15	.14	.42	-.06
-.34	-.30	-.18	-.55	-.41	-.36	-.17	-.37	-.55	-.27	-.43	-.45	.58	-.19	.16	.35	-.53
-.05	.06	.03	-.07	-.01	-.05	.15	-.16	-.29	-.03	-.01	-.02	.23	.01	.03	.13	-.09
-.11	-.11	-.08	-.07	-.04	-.07	.17	.26	.01	.07	-.18	-.06	-.01	-.05	.17	.11	-.07