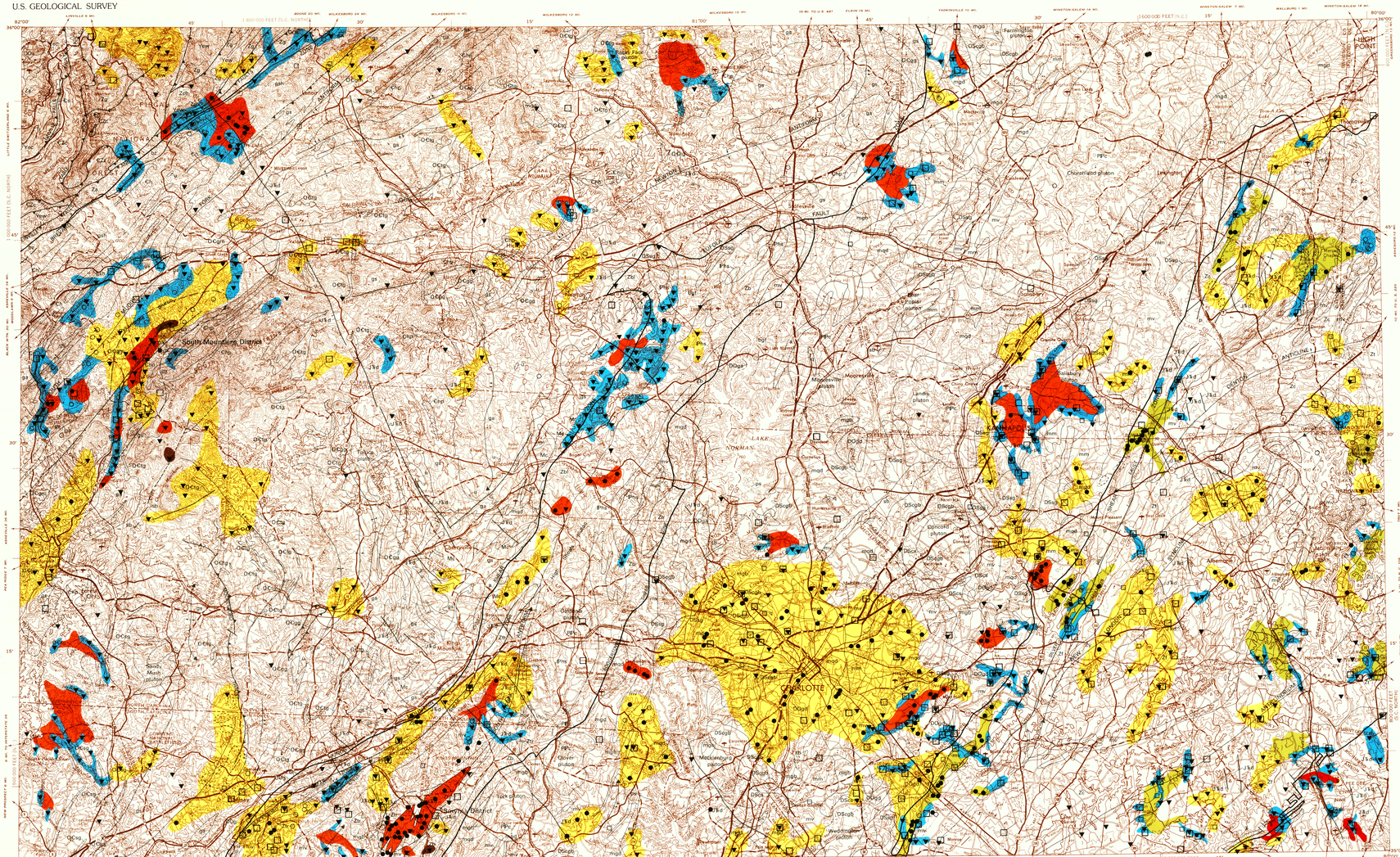


Base from U.S. Geological Survey, 1953
Photorevised 1974

100,000-foot grids based on North Carolina coordinate system and South Carolina coordinate system, north zone

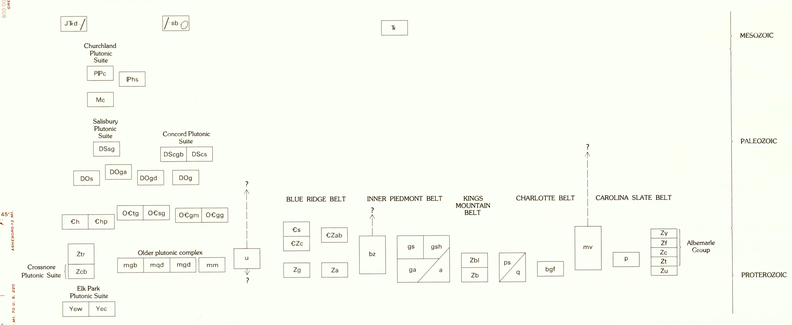
LOCATION DIAGRAM

INTERIOR—GEOLOGICAL SURVEY, RESTON, VA.—1986—G84083

Geologic base modified from Goldsmith and others, in press
Mineral-resource potential by J. E. Gair and J. P. D'Agostino, 1982
Data provided by J. W. Whitlow and others, in press and D'Agostino and Rowe, in press

Note: The following correlation, description, and geologic symbols are for the Geologic map shown in gray.

CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

This map is generalized from Goldsmith and others (in press) in order to make an appropriate base for mineral-resource assessment as part of a project in the Conterminous United States Mineral Assessment Program. Most of the plutonic rock units and all localities of ultramafic rock are shown. Minor stratiform rock units and subdivisions of major stratiform rock units have not been shown.

Sedimentary and volcanic rocks and their metamorphic equivalents

- ₮s — Sandstone, siltstone, and conglomerate
- Ꞓs — Shady Dolomite (Early Cambrian)
- ꞒZc — Chilhowee Group (Early Cambrian to Late Proterozoic)—Quartzite, arkosic quartzite, and phyllite
- ꞒZab — Alligator Back Formation (Early Paleozoic and/or Late Proterozoic)—Laminated quartzofeldspathic gneiss, mica schist, and amphibolite
- bz — Rocks of the Brevard zone—Variably sheared biotite gneiss, mica schist, quartzite, metavolcanic rocks, phyllite, and marble. Includes rocks of several formations
- gsh — Muscovite schist, layered biotite gneiss, and subordinate quartzite and amphibolite; contains narrow zones of Henderson Gneiss
- gs — Biotite gneiss, biotite-muscovite schist, sillimanite mica schist, and subordinate layers of calc-silicate rock, quartzite, metaconglomerate, and many small masses of granite and pegmatite
- bgf — Fine-grained biotite gneiss—Strongly foliated but commonly massive rock of granitic to tonalitic composition. Minor amphibolite and muscovite schist. Probably metamorphosed intermediate volcanic rock
- ga — Biotite gneiss, amphibolite and hornblende gneiss; minor sillimanite and mica schist, and many small masses of granite and granite gneiss locally forming migmatite
- a — Amphibolite
- ps — Phyllite and mica schist; minor quartzite
- q — Quartzite; subordinate mica schist and phyllite. Probably includes both metamorphosed sandstones and metamorphosed hydrothermally leached and silicified rock
- mv — Metavolcanic rocks, undivided—Includes mafic, intermediate, and felsic volcanic rocks and Flat Swamp Member of the Ꞓd Formation and metavolcanic rocks of the Battleground Formation.
- Ꞓg — Grandfather Mountain Formation (Late Proterozoic)—Arkose, siltstone, phyllite, conglomerate and felsic volcanic rocks
- Ꞓa — Ashe Formation (Late Proterozoic)—Muscovite-biotite gneiss, commonly sillimanite mica schist, and amphibolite
- Ꞓy — Yadkin Formation (Late Proterozoic)—Graywacke
- Ꞓf — Floyd Church Formation (Late Proterozoic)—Siltstone and argillite
- Ꞓc — Ꞓd Formation (Late Proterozoic)—Mudstone member
- Ꞓt — Tillery Formation (Late Proterozoic)—Laminated siltstone and mudstone
- Ꞓu — Uwharrie Formation (Late Proterozoic)—Felsic volcanic rocks
- ꞓp — Phyllite (Late Proterozoic)—Probably equivalent to Tillery Formation (Ꞓt) and Ꞓd Formation (Ꞓc)
- Ꞓbl — Blackburg Formation (Late Proterozoic)—Sericite phyllite or schist and subordinate beds of marble, micaceous quartzite, and amphibolite
- Ꞓb — Battleground Formation (Late Proterozoic)—Quartz-sericite schist and phyllite, and subordinate beds of quartz-pebble conglomerate, quartzite, kyanite or sillimanite quartzite, and manganiferous schist. Metavolcanic rocks of the Battleground Formation are included in mv

Intrusive and altered rocks

- JꞒd — Diabase (Jurassic and Triassic?)
- sb — Silicified breccia zones
- ꝑPc — Churchland Plutonic Suite (Permian and Pennsylvanian)—Predominantly porphyritic granite containing microcline phenocrysts
- ꝑhs — High Shoals Granite (Pennsylvanian)—Porphyritic gneissic granite
- Mc — Cherryville Granite (Mississippian)—Biotite-muscovite granite; some associated pegmatites contain spodumene
- DSag — Salisbury Plutonic Suite (Devonian and Silurian)—Leucocratic granite
- DScgb — Concord Plutonic Suite (Devonian and Silurian)—Gabbro, norite, gabbro-norite, and hornblende gabbro
- DScs — Syenite of Concord Plutonic Suite
- DOga — Alaskite; granite, fine-grained
- DOgd — Granodiorite, non- to weakly foliated
- DOg — Gneissic metagranite—Medium- to coarse-grained gneissic biotite granite
- DOs — Spruce Pine Alaskite (Early Devonian to Late Ordovician)—Biotite-muscovite granite and granodiorite; associated pegmatites are a source for feldspar and muscovite
- ꞒOctg — Toluca Granite (Early Ordovician and Cambrian)—Medium-grained gneissic to non-gneissic granite and granodiorite; garnet and monazite common accessories
- ꞒOcsg — Grauite of Sandy Mush—Porphyritic gneissic granite probably genetically related to the Toluca Granite
- ꞒOcgm — Migmatitic granitoid gneiss and quartz-diorite gneiss containing inclusions and screens of biotite gneiss amphibolite and metagabbro, and masses of gneissic and non-gneissic granite to quartz diorite similar to the Toluca Granite
- ꞒOcgg — Granitoid gneiss—Layered gneissic biotite granite to hornblende-biotite quartz diorite
- Ꞓh — Henderson Gneiss (Cambrian)—Inequigranular, granitic to granodioritic biotite gneiss. Typically contains lenticoid microcline megacrysts and microcline-plagioclase aggregates parallel to foliation
- Ꞓhp — Garnetiferous phase of Henderson Gneiss—Granitic to granodioritic biotite gneiss containing tabular to lenticoid feldspar megacrysts in garnetiferous matrix
- Ztr — Metamorphosed trondhjemite and biotite tonalite (Late Proterozoic)
- mgb — Metamorphosed gabbro, diorite, and diabase
- mqd — Metamorphosed quartz diorite, diorite, and tonalite; locally porphyritic
- mgd — Metamorphosed granodiorite; locally porphyritic
- mm — Mafic and ultramafic complex—Metamorphosed gabbroic and ultramafic intrusives, hypabyssal and probably extrusive basalts
- u — Ultramafic rocks, variably altered to soapstone and serpentinite
- Zcb — Brown Mountain Granite (Late Proterozoic)—Medium- to coarse-grained leucocratic granite, locally blastomylonitic
- Yew — Wilson Creek Gneiss and Blowing Rock Gneiss (Middle Proterozoic)—Equigranular granite to diorite gneiss; coarse-grained granite augen gneiss
- Yec — Cranberry Gneiss (Middle Proterozoic)—Equigranular granite and layered granite, granodiorite, and biotite gneiss

EXPLANATION OF MAP SYMBOLS

- Contact
- High angle fault, dashed where inferred
- Reverse fault, teeth on upthrown plate, dashed where inferred
- Reverse fault, overturned
- Thrust fault, teeth on overriding plate, dashed where inferred
- Anticline or antiform, showing direction of plunge
- Syncline or synform, showing direction of plunge
- Overturned anticline, or antiform showing direction of dip of limbs
- Overturned syncline or synform, showing direction of dip of limbs

REFERENCES CITED

D'Agostino, J. P., and Rowe, W. D., Jr., in press, Mineral occurrences in the Charlotte 1° x 2° quadrangle, North Carolina and South Carolina: U.S. Geological Survey Miscellaneous Field Studies, Map MF–1793.

Gair, J. E., ed., in press, Mineral resources of the Charlotte 1° x 2° quadrangle, North Carolina and South Carolina: U.S. Geological Survey Professional Paper

Gair, J. E., Goldsmith, Richard, Daniels, D. L., Griffitts, W. R., DeYoung, J. H., Jr., and Lee, M. P., in press, The Conterminous United States Mineral Assessment Program—Background information to accompany folio of geologic, geophysical, geochemical, mineral occurrence, mineral resource potential, and mineral production maps of the Charlotte 1° x 2° quadrangle, North Carolina and South Carolina: U.S. Geological Survey Circular 944

Goldsmith, Richard, Milton, D. J., and Horton, J. W., Jr., in press, Geologic Map of the Charlotte 1° x 2° quadrangle, North Carolina and South Carolina: U.S. Geological Survey Miscellaneous Investigations Series, Map I–1251–E.

Griffitts, W. R., Duttweiler, K. A., Whitlow, J. W., Siems, D. F., and Hoffman, J. D., 1984, Distribution of molybdenum in heavy-mineral- concentrate samples from the Charlotte 1° x 2° quadrangle, North Carolina and South Carolina: U.S. Geological Survey Open-File report, OF 84–843–J.

Griffitts, W. R., Whitlow, J. W., Duttweiler, K. A., Siems, D. F., and Botinelly, Theodore, in press, Distribution of copper in heavy-mineral-concentrate samples from the Charlotte 1° x 2° quadrangle, North Carolina and South Carolina: U.S. Geological Survey Open File Report 84–843–B.

Griffitts, W. R., Whitlow, J. W., Duttweiler, K. A., Siems, Wilch, L. O., in press, Distribution of antimony, arsenic, bismuth, and cadmium, in heavy-mineral-concentrate samples from the Charlotte 1° x 2° quadrangle, North Carolina and South Carolina: U.S. Geological Survey Open File Report 84–843–O

Griffitts, W. R., Whitlow, J. W., Siems, D. F., Duttweiler, K. A., and Hoffman, J. D., 1984, Distribution of cobalt in heavy-mineral-concentrate samples from the Charlotte 1° x 2° quadrangle, North Carolina and South Carolina: U.S. Geological Survey Open-File report 84–843–L.

Whitlow, J. W., Duttweiler, K. A., Griffitts, W. R., and Siems, D. F., in press, Distribution of gold in heavy-mineral-concentrate samples from the Charlotte 1° x 2° quadrangle, North Carolina and South Carolina: U.S. Geological Survey Open-File report 84–843–E.

EXPLANATION

Selected areas of resource potential for different types of gold deposits

[Areas considered to have potential for this type of deposit, judged by relatively unambiguous data]

Area of placer-gold resource potential—Occurs in all belts. Shown by clusters of data sites representing former gold-placer mines and pan-concentrate samples that contain visible and spectrographically detected gold. Some gold-bearing concentrate samples located near one another are not considered to represent areas of resource potential because they are not in interconnected stream systems and thus do not indicate a sufficient extent of gold-bearing stream sediment to constitute a resource potential. Valley bottoms from which only one gold-bearing concentrate sample has been collected, downstream from an area of lode-gold resource potential, are accorded resource potential between the sample site and the head of the valley

Area of Carolina slate belt lode-gold resource potential—Represented by stratabound gold deposits and associated gold-quartz veins in volcanic-sedimentary rocks. Deposits probably mainly or entirely syngenetic. Shown in the Carolina slate belt by 1) clusters of data sites representing former lode-gold mines and 2) common-headwater areas of selected streams that had placer-gold mines along them or yielded gold-bearing concentrate samples during the CUSMAP survey

Area of gold-quartz vein (lode) resource potential west of the Carolina slate belt—Represented mainly or entirely by deposits in cross-cutting veins in the Charlotte, Kings Mountain, Inner Piedmont, and Blue Ridge belts. Deposits mainly or entirely epigenetic. Shown west of the Carolina slate belt by 1) clusters of data sites representing former lode-gold mines and nearby gold-bearing concentrate samples collected during the CUSMAP survey, and 2) common-headwater areas of selected streams that had placer-gold mines along them or yielded gold-bearing concentrate samples during the CUSMAP survey

Area of gold resource potential in (Triassic) Wadesboro basin—Represented by gold-bearing Triassic conglomerate that probably formed as channel gravels. Shown in Wadesboro basin by gold-bearing pan-concentrate samples derived from samples of Triassic conglomerate and from sediments in streams draining the conglomerate

Area of gold resource potential in saprolite—Represented by flat-lying siliceous zones in saprolite characterized by vuggy quartz. Shown in South Mountains area, N. C., and adjacent to the Smyrna district, S. C., by gold-bearing pan-concentrate samples derived from the siliceous material in the saprolite and from sediment in roadside ditches downslope from exposures of the siliceous material

Area of gold resource potential in colluvium—Represented by gold-bearing pebbly zones within thick lenses of colluvium. Shown in South Mountains area, N. C., and adjacent to the Smyrna district, S. C., by gold-bearing pan-concentrate samples derived from pebbly colluvium and from sediment in roadside ditches downslope from exposures of the colluvium

Area of resource potential without designation of type of gold deposit

Area considered to have potential for gold deposits; deposit type not indicated because area characterized by mixtures of data representing different deposit types and by ambiguous data about deposit type. Potential of area is largely or entirely for lode and placer gold resources

Boundary of major lithotectonic belt (from Goldsmith and others, in press)

Boundary of gold-producing district or area

Data used for identifying areas of gold resource potential

- Abandoned lode mine (high to low potential); symbol may overlap that of nearby lode mine or symbol for other type of data
- Abandoned placer mine (high to low potential)
- Particulate gold visible in pan concentrate from recent stream sediments or roadside-ditch sediment, or from pulverized rock, saprolite, or colluvium (high potential)
- Gold >20 ppm in pan concentrate from recent stream sediments. Detected by semi-quantitative spectrographic analysis (medium to low potential)
- Gold detected in pan concentrate from recent stream sediments, but <20 ppm detected by semi-quantitative spectrographic analysis (low potential)
- Area of abandoned lode-gold prospects and no known production (low potential)

INTRODUCTION

The mineral resources of the Charlotte 1° X 2° quadrangle, North Carolina and South Carolina, were assessed between 1978 and 1982 under the Conterminous United States Mineral Assessment Program (CUSMAP). The mineral-resource assessments were made on the basis of geologic and geophysical investigations, the presence of existing or abandoned mines, mapped mineral occurrences, and, where appropriate, on hexavalent occurrences seen in pan concentrates or detected by geochemical analysis of pan concentrates. The data sources and resource assessments for all commodities studied are listed in a U.S. Geological Survey Circular (Gair and others, in press).

TYPES OF DATA AND FAVORABLE AREAS

This map shows areas favorable for gold occurrence and resources as indicated by the following criteria: 1) a history of lode or placer gold production represented by sites of mining (D'Agostino and Rowe, in press), 2) presence of particulate gold in unconsolidated stream sediments (as seen in pan concentrates), 3) 20 ppm or more gold in pan concentrates of stream sediments determined by spectrographic analysis of samples, and 4) the presence of prospecting sites (without known gold production). The map contains data points showing the production and sample sites, and a few generalized areas of abandoned gold prospects that have not had any known production. Clustering of sites both for any one type of data and for combinations of data is the basis for outlining areas of potential on the map. The outlining of data clusters is somewhat arbitrary and a matter of judgement, much like the placement of formation contacts between scattered, widely separated outcrops. The areas of potential shown, therefore, represent an interpretation of the data points on the map.

Wherever the data are reasonably definitive, areas of resource potential for specific types of gold deposit such as lode, placer, saprolite, colluvial, and Triassic-conglomerate deposits are shown on the map. However, despite evidence of resource potential from the clustering of data in certain areas, it may not be possible to identify the type of deposit most likely to contain the gold resources because of the nature or distribution of the data. Mixtures of data from different types of deposits within a designated area are principal deterrents to identifying a specific deposit type.

In some areas, even where all or most of the indications of potential are one type of data from placer-like occurrences (pan concentrates of stream sediments) reasonable certainty of the potential for placer gold may not be possible. If the samples are isolated from one another by not being in an interconnected stream system, they then provide no evidence of any extension of the gold-bearing stream sediment along the valley, a necessary condition for resources of placer gold; such clustered pan-concentrate data if adjacent but unconnected streams could as likely signify a potential for lode-gold resources, the source of the stream-sediment gold. Areas of such ambiguous data and of mixed data sources are shown on the map separately (in yellow) from areas of potential that are correlated with specific deposit types.

Areas of potential for placer-gold resources are generally shown on the map where two or more appropriate data points are near one another on the same stream or along a single stream network. The large area showing potential for placer-gold resources in the central part of the quadrangle consists of several such gold-bearing stream systems adjacent to one another. A number of relatively isolated data points shown on the map are not used to designate areas of resource potential because of lack of evidence of any extension of mineralization beyond such sites. Also, a few sites of gold-bearing pan concentrates that are near areas of resource potential, but in streams not connected to streams within the areas of potential are treated in the same way as the more isolated gold-bearing sites and are not included within the areas of potential. An exception to this general practice is made where a gold-bearing pan-concentrate sample is downstream from an area of lode-gold resource potential, so that the stream sediments between the sample site and the evident source area of the gold can reasonably have the potential to contain additional gold.

The level of degree of resource potential has not been established for the different areas because each type of data or the combinations of data used to identify areas of potential may represent wide ranges of potential. Abandoned lode or placer mines, for example, represent a range of high to low resource potential, depending on the extent to which a deposit was exhausted by mining. Locations where visible gold was found during the CUSMAP survey clearly contain recoverable gold and represent high potential. Sites of pan concentrates containing geochemically detected but no visible gold represent medium potential at best because favorable geochemical data may be derived from minor mineralization or economically unusable minerals and so are a less certain indication of resource potential than the actual presence of commodity minerals. Even the seemingly high gold values detected by the spectrographic method (from 20 to about 200 ppm) do not significantly increase the "status" of the favorable geochemical data because such data from the pan concentrates represents generally low-grade material in the bulk sediment prior to panning. The analyzed material has been concentrated 1,800 to 9,000 times by panning and subsequent laboratory treatment; therefore, 20 ppm gold in concentrate is equivalent to a tenor of about .02 to .01 ppm of gold in the bulk sediment. Where detected, trace-element values approach background levels, the slightly favorable geochemical data represent very low potential. Areas of abandoned gold prospects also are accorded low potential. The possible potentials or range of resource potentials represented by the different types of data are shown in the explanation for the map.

Mineral-resource potential depends on the presence of favorable host rock, and the distribution of such rock on a geologic map should be taken into account in outlining areas of potential. Many gold deposits in the region are associated with conformable and cross-cutting quartz veins; therefore quartz veins in general are considered a favorable host rock. Even though many quartz veins are barren, all untested veins have potential for gold. Because of the 1:250,000 mapping scale used to show CUSMAP results, individual quartz veins cannot be indicated on the map, so quartz-vein occurrences have not been used in the map separately (in yellow) from areas of potential that are correlated with specific deposit types.

The areas of resource potential for specific types of deposits shown on the map are for lode deposits of the Carolina slate belt, other lode deposits west of the slate belt, placer deposits throughout the area, and deposits in colluvium, saprolite, and Triassic conglomerate. The areas of potential identified by mixed or ambiguous data and shown without a designation of deposit type undoubtedly are virtually all lode and (or) placer deposits.

The map shows a general northeastward elongation of the areas favorable for gold resources, parallel to the major lithotectonic belts and structural grain of the region, except around Charlotte, N. C. Many of these areas, however, do not seem to be associated with a particular geologic formation or environment. The Carolina slate belt is the only region where there is an obvious association between the underlying geologic formations and gold occurrence. This belt probably represents an ancient volcanic arc.

As noted above, a distinction is made between lode deposits of the Carolina slate belt and those to the west; lodes of the slate belt are probably largely in conformable veins cogenetic with their host rocks whereas lodes to the west are mainly in cross-cutting, epigenetic veins. Some previously mined gold placers, and some gold-bearing pan concentrates collected during CUSMAP, occur in streams that flow from the vicinity of a formerly mined lode deposit. Such lode deposits are probably the source of the gold in the placers and pan-concentrate samples downstream. The common headwater areas of some groups of streams which contain gold-bearing sediments are labeled as areas of potential lode-gold resources although no such gold occurrences are known in the drained region. Such common-headwater areas of groups of streams designated as areas of lode-gold potential are found 1) along the southeast side of the Carolina slate belt, 2) in the Charlotte belt south of Salisbury, N. C., 3) on the boundary of the Charlotte and Inner Piedmont belts east of Statesville, N. C., 4) in the Inner Piedmont belt northwest of Statesville, 5) in the northern part of the Kings Mountain belt, and 6) near the southwest corner of the quadrangle. Whitlow and others (in press), in noting the association of gold with faults or fracture zones, related the gold occurrences east of Statesville to the Eufola fault and those in the northern part of the Kings Mountain belt to the shear zone between the Kings Mountain and the Inner Piedmont belts.

Placer deposits occur throughout the six major lithotectonic belts of the quadrangle. The areas of resource potential for placer gold shown on the map yield pan concentrates of stream sediments that contain gold detected either visibly or by spectrographic analysis, or contain sites of past placer production places. However, sites of past production are not considered indicative of resource potential unless there is evidence that some gold remains in the stream sediments. As noted above, isolated placer-gold sample sites provide no evidence for an extension of gold-bearing alluvium beyond the sites and probably do not represent areas of exploitable gold.

The gold-bearing colluvium, Triassic conglomerate, and a variety of saprolite deposits are newly recognized types of gold deposits in the quadrangle and have not been previously mined. All are low-grade deposits. The gold in the Triassic rocks occurs as disseminated grains in conglomerates that are probably lithified stream-channel gravels. The occurrences in colluvium are in gravelly zones near the bottoms of thick colluvial lenses in the South Mountains area. The newly discovered type of saprolite deposit consists of disseminated gold in horizontal and gently dipping zones of compact to vuggy quartz which are 5 to 40 cm thick and subparallel to the overlying land surface. Also, a previously known and worked type of saprolite deposit occurs in thin, weathered, steeply dipping quartz veins in the South Mountains. All three types of newly recognized deposits were observed only in roadcuts during CUSMAP and are undoubtedly much more extensive than shown on the map.

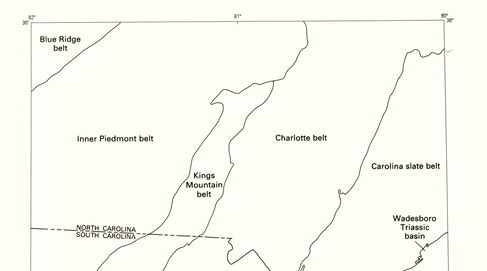
On several of the maps showing the resource potential of other commodities within the Charlotte quadrangle, levels of high, medium, and low potential are defined by the type of available data indicating the presence of resources, and by various combinations of the data. On those maps, the fundamental factors identifying areas of high and medium potential are favorable geologic units combined with favorable mineral-occurrence or geochemical data. However, for gold, the favorable geologic "units" for the different types of deposits consist of the various gold-bearing materials: quartz veins, alluvium, Triassic conglomerate, colluvium, and saprolite. Principally, because of 1) mapping scale (1:250,000), 2) lack of knowledge of the extent of gold-bearing material, and 3) lack of knowledge during mapping that certain materials were gold bearing, the distribution of geologic materials favorable for gold occurrence is not shown on the map. This restricts the possibility of showing areas of high and medium potential for gold resources. However, as noted above, ranges of potential can be inferred at the data points shown, although there is little or no basis for projecting potentials away from data sites, and ranges of potential implicit in individual types of data or in mixtures of data from different sources precludes assigning levels of resource potential in most areas.

ASSOCIATIONS BETWEEN GOLD AND OTHER FEATURES

Whitlow and others (in press) note an association between gold and faults or fracture zones, some of which are identified by linear physiographic features. They found such an association 1) in the Brevard zone which separates the Inner Piedmont and Blue Ridge belts, 2) in the South Mountains, 3) east of Gaffney, S. C., in the Kings Mountain belt, and 4) near the northern end of the Kings Mountain belt. They conclude that the gold of such occurrences may be in small fractures that are probably related to regional-scale faults and fractures.

Associations between gold and other trace elements, particularly copper, molybdenum, cobalt, arsenic, and antimony are discussed in reports by W. R. Griffitts and other workers (see References). These associations have been seen in silt or pan-concentrate samples collected where gold formerly was mined and where gold has been found in stream sediments during CUSMAP. The samples have yielded generally weakly anomalous amounts of one or more of the other trace elements. Therefore, anomalous amounts of these other elements may help to identify areas for gold exploration, particularly if some gold-bearing samples occur in the same areas. However, because these other trace elements are not necessarily associated with gold, they are not used as a basis for designating areas of resource potential for gold.

[1]Visible and spectrographically detected gold from the same sample site are different manifestations of the same gold occurrence and are treated as a single type of data in evaluating resource potential.



Index map showing major lithotectonic belts in the Charlotte 1° x 2° quadrangle (Belts outlined but not labeled on large map)

MINERAL RESOURCE POTENTIAL FOR GOLD IN THE CHARLOTTE 1° x 2° QUADRANGLE, NORTH CAROLINA AND SOUTH CAROLINA

By
Jacob E. Gair and John P. D'Agostino

1986

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