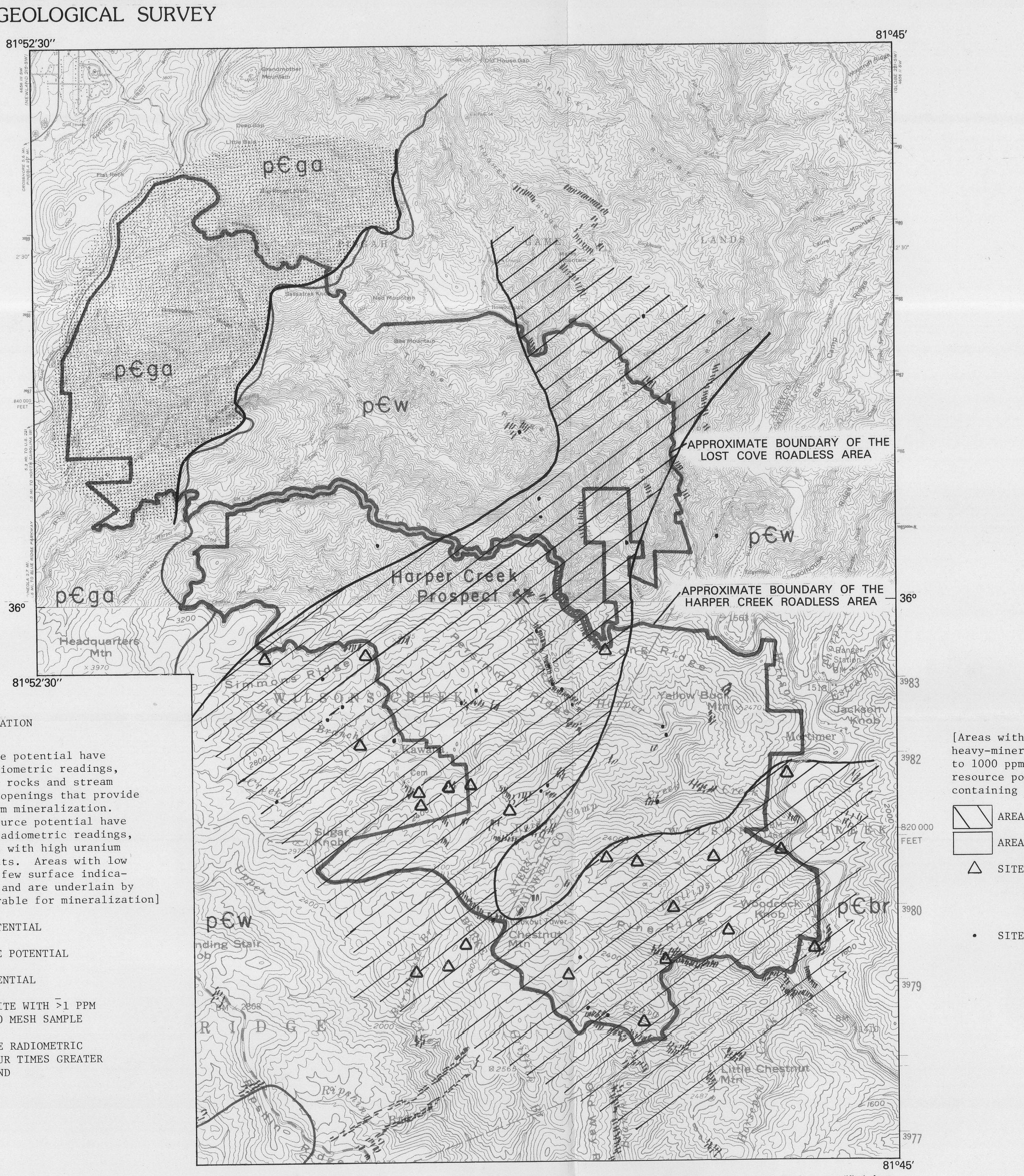


EXPLANATION

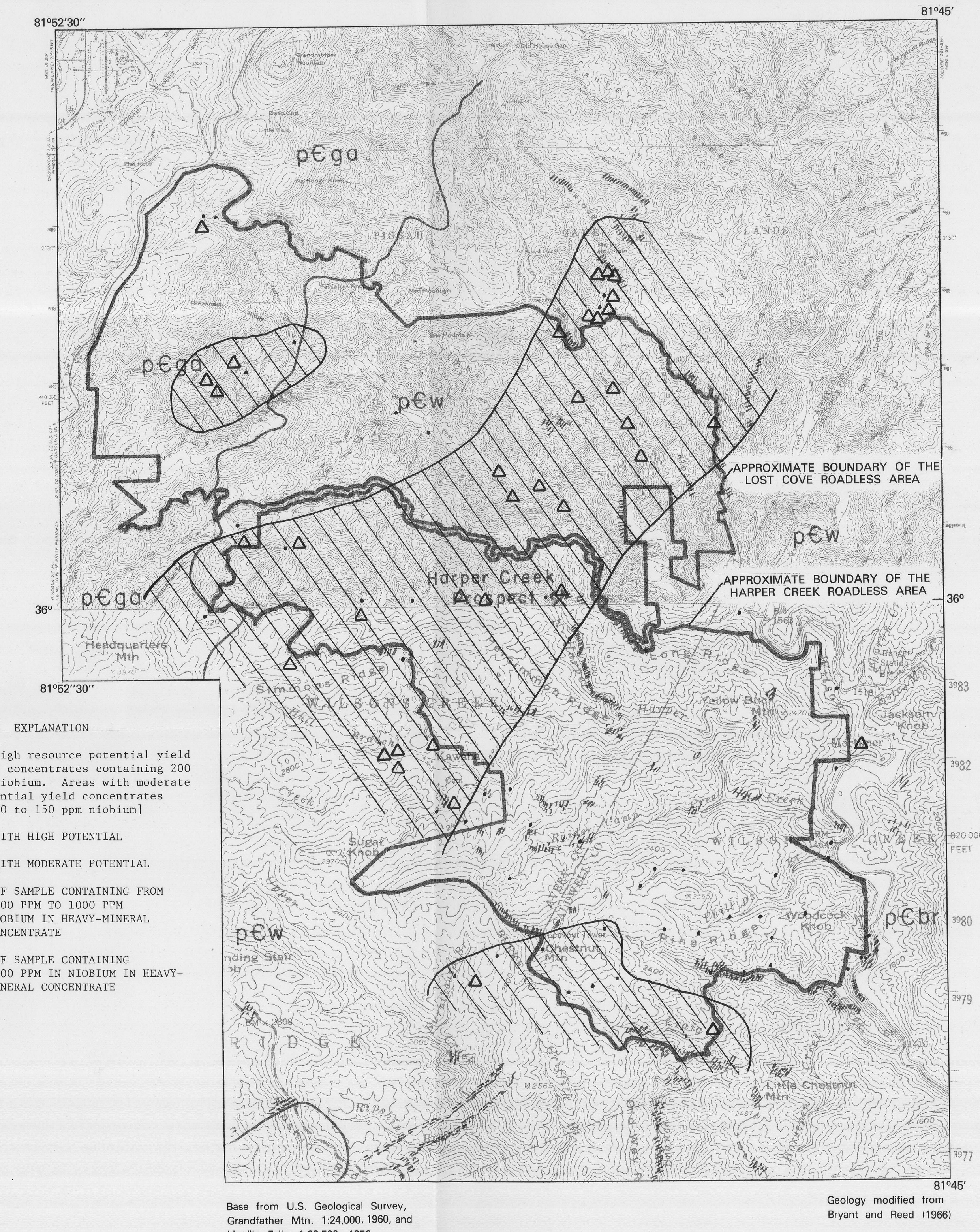
[Areas with high resource potential have many sites with high radiometric readings, high uranium contents in rocks and stream sediments, and prospect openings that provide information about uranium mineralization. Areas with moderate resource potential have fewer places with high radiometric readings, fewer rocks or sediments with high uranium contents, and no prospects. Areas with low resource potential have few surface indications of mineralization and are underlain by rocks that are not favorable for mineralization]

- AREA WITH HIGH POTENTIAL
- AREA WITH MODERATE POTENTIAL
- AREA WITH LOW POTENTIAL
- △ SEDIMENT SAMPLE SITE WITH >1 PPM URANIUM IN -80 MESH SAMPLE
- • SITE WHERE SURFACE RADIOMETRIC READING IS FOUR TIMES GREATER THAN BACKGROUND
- ⚒ URANIUM PROSPECT

Base from U.S. Geological Survey, Grandfather Mtn. 1:24,000, 1960, and Linville Falls, 1:62,500, 1956

Geology modified from Bryant and Reed (1966)

MAP A.–URANIUM RESOURCE POTENTIAL



EXPLANATION

[Areas with high resource potential yield heavy-mineral concentrates containing 200 to 1000 ppm niobium. Areas with moderate resource potential yield concentrates containing 100 to 150 ppm niobium]

- AREA WITH HIGH POTENTIAL
- AREA WITH MODERATE POTENTIAL
- △ SITE OF SAMPLE CONTAINING FROM >200 PPM TO 1000 PPM NIOBIUM IN HEAVY-MINERAL CONCENTRATE
- • SITE OF SAMPLE CONTAINING <200 PPM IN NIOBIUM IN HEAVY-MINERAL CONCENTRATE

Base from U.S. Geological Survey, Grandfather Mtn. 1:24,000, 1960, and Linville Falls, 1:62,500, 1956

Geology modified from Bryant and Reed (1966)

MAP B.–NIOBIUM RESOURCE POTENTIAL

EXPLANATION

- pЄga GRANDFATHER MOUNTAIN FORMATION (PRECAMBRIAN)-- Fine to coarse-grained arkose
- pЄw WILSON CREEK GNEISS (PRECAMBRIAN)-- Granitic gneiss
- PHYLLONITE
- CONTACT

STUDIES RELATED TO WILDERNESS

The Wilderness Act (Public Law 88-577, September 3, 1964) and related acts require the U.S. Geological Survey and the U.S. Bureau of Mines to survey certain areas of Federal lands to determine their mineral resource potential. Results must be made available to the public and be submitted to the President and the Congress. This report presents the results of a mineral resource potential survey of the Lost Cove and Harper Creek Roadless Areas in the Pisgah National Forest, Avery and Caldwell Counties, North Carolina. These areas were classified as further planning areas during the Second Roadless Area Review and Evaluation (RARE II) by the U.S. Forest Service, January 1979.

SUMMARY

Uranium-rich rock in the Lost Cove and Harper Creek Roadless Areas occurs widely in the Wilson Creek Gneiss and to a minor extent in the Grandfather Mountain Formation. Vein-type deposits and other occurrences of uranium in foliated rocks in the Wilson Creek Gneiss have uranium resource potential. Speculative resources of uranium in vein-type deposits and in superegene-enriched foliated rocks are estimated to total 4 to 8 million pounds of U_3O_8.

Mineral resources having moderate potential are gold and minerals of thorium, beryllium, niobium, and copper. Stone has a low economic potential; lead, molybdenum, and titanium have low resource potential. These conclusions are based on results of prospect examination, radiometric survey, geochemical survey of stream sediments, saprolite, and bedrock.

INTRODUCTION

The Lost Cove and Harper Creek Roadless Areas comprise 5,708 and 7,163 acres, respectively, in Pisgah National Forest, Avery and Caldwell Counties, North Carolina. The areas are contiguous along Forest Service Route 464 and have similar geology and mineral potential. For the purpose of this report, the two areas will be referred to collectively as the study area.

The study area is on the eastern flank of the Blue Ridge Mountains and is characterized by rugged topography comprising a series of east-west-trending ridges interspersed with steep-sided valleys. Elevations range from about 1,500 to 4,000 ft. Major drainages are Gragg Prong, Harper, North Harper, Lost Cove, and Craig Creeks. Access to the area is provided by the Blue Ridge Parkway and Forest Service Routes 464, 981, and 982. Well-traveled foot trails and abandoned logging roads provide interior access.

GEOLOGY

The Wilson Creek Gneiss of Precambrian or Proterozoic Y age underlies all of the study area except the northwestern third of the Lost Cove Roadless Area. This gneiss consists of metamorphosed plutonic rocks of quartz monzonite to granodiorite composition (Bryant and Reed, 1970; Rankin and others, 1972). Some of these rocks resemble normal granites; others are coarse grained and pegmatitic in texture. Enclosed in these plutonic rocks are a variety of rocks ranging from amphibolite to felspathic or biotitic gneisses and minor metavolcanic rocks. Some of these rock types may be hosts for one or more of the metals or minerals mentioned later in the report, but none of the layers were individually sampled. Phyllonite zones in the Wilson Creek Gneiss are the results of Paleozoic low-grade metamorphism of the Precambrian granitic rocks (Reed, 1964). Nearly all the known occurrences of uranium minerals in the study area are in Wilson Creek Gneiss and associated with phyllonite.

Basal arkosic sandstone and siltstone of the Grandfather Mountain Formation of Precambrian or Proterzoic Z age nonconformably overlies the Wilson Creek Gneiss. These rocks are exposed in the northwestern third of the Lost Cove Roadless Area. Small areas of Precambrian metadiabase (Linville Metadiabase) and diorite that underlie a few hundred acres in the study area adjacent to the contact between the Wilson Creek Gneiss and the Grandfather Mountain Formation are not shown on the map.

ASSESSMENT OF MINERAL RESOURCES POTENTIAL

Uranium

High resource potential for uranium is assigned to the eastern part of the Lost Cove Roadless Area and the central and southeastern parts of the Harper Creek Roadless Area (map A) because:

1. Very high uranium contents were found in rock samples, shown by high radiometric readings and high uranium values, determined chemically.
2. Anomalous uranium contents were found in stream sediment.
3. Uranium mineralization is evident in trenches and drill holes at several prospects.
4. Phyllonite, related to uranium mineralization, is widespread (Reed, 1964).

Moderate potential for uranium is assigned to the central part of the Lost Cove Roadless Area and the northwestern and northeastern parts of the Harper Creek Roadless Area because:

1. High uranium contents were found in several rock samples, shown by radiometric and chemical analyses.
2. Uranium has been found locally concentrated in surface materials.

Low potential for uranium is inferred for the western part of the Lost Cove Roadless Area because it is underlain by the Grandfather Mountain Formation, which is much less favorable as a host rock than the Wilson Creek Gneiss that underlies the rest of the study area.

Vein-type Uranium Deposits

Mineral resource potential is highest for vein-type deposits such as those present in the North Harper Creek prospect. Exposures in stream channels in the prospect area show that mineralized rock occurs in discontinuous lenses and pods of quartz-feldspar-rich rock in the Wilson Creek Gneiss. These lenses and pods are intercalated with schists on a scale of a few feet to tens of feet.

About 1,200 ft of drilling by FRAMCO in the Harper Creek Prospect disclosed two intervals of ore-grade mineralized rock at depths of 160 to 280 feet in two of the drill holes. The mineralized rock averaged 0.074 and 0.08 percent uranium in intervals 26 ft and 20 ft thick, which included four 2 ft thick zones that contain greater than 0.1 percent uranium. Geologic logs indicate the uranium minerals are in veinlets and on fractures, that cut across the foliation of lenses and pods of pyritic quartz-feldspar gneiss, sericitic quartz-feldspar-biotite gneiss, and chloritic-sericitic schists, all in the Wilson Creek Gneiss. Mineralized rock averaged greater than 0.05 percent uranium in intervals from 1 to 6 ft thick in five additional holes. Fluorite, pyrite, and pyrrhotite are associated with pitchblende in the veins. The pitchblende contains tiny particles of galena, which probably formed from radiogeneic lead.

Speculative Resources[1]

Speculative uranium resources in vein-type deposits are estimated to total from 4 to 7 million pounds of U_3O_8 in the study area. In determining this estimate, resources were calculated for the North Harper Creek prospect and were based on the two assumptions: (1) that grade and frequency of occurrences of surface mineralization are repeated at depth, and (2) that vein-type mineralization extends for a depth of at least 300 feet. North Harper Creek resource estimates were then extrapolated to areas considered favorable for occurrence of similar mineralization.

Disseminated Uranium in Foliated Rocks

Uranium deposits in schists and shear zones have moderate and high resource potential. These deposits are represented at the surface by disseminated uraninite(?) and uranium secondary minerals in weathered foliated rocks, and have the following in common: localized (highly radioactive) zones 10 to 15 ft long and less than 2 ft thick along foliation; a concentration of radioactivity and secondary uranium minerals along foliation; and a close association of radioactive and nonradioactive granites and quartz-feldspar-rich gneisses.

Drilling for uranium in schists and shear zones in the study area has totaled about 6,740 ft. The results indicate that the zone of surface oxdiation and supergene processes reach to depths of 20 to 80 feet. Potential primary uranium source rocks may include vein-type deposits or disseminated uranium minerals in foliated rocks. The surface anomalies may represent local concentrations of supergene uranium.

Speculative Resources

Geologic information from FRAMCO indicates that mineralization at Craig Creek, in the southern part of the Harper Creek Area is disseminated in a sericite schist unit that extends 900 ft along strike, has a surface width of 150 ft, and dips 60° to the southeast. Assuming an average value of C.05 percent uranium extending to depths of 20-80 ft downdip within the schist unit, we infer that speculative uranium resources in supergene-enriched, foliated rocks may total as much as 600,000 pounds of U_3O_8 in three similar deposits within the study area.

Thorium and Rare Earths

Monazite was found in most streams sampled and could readily be recovered if any placer mining is undertaken. Thorite is also present and could be recovered along with the monazite. In the study area, the cerium group of rare earths is in monazite and in the less-common allanite. Florencite is associated with gray monazite in biotite-rich layers in gneiss south of the study area and may well occur with the gray monazite found in the basin of Raider Camp Creek. In districts outside of the study area, gray monazite is exceptionally rich in europium, but that has not been demonstrated in the gray monazite within the study area.

The resource potential for thorium is moderate, but the small market for the metal probably will not permit development of the deposits. Rare-earth elements are so intimately associated with thorium that they are likely to be recovered only as a byproduct with thorium.

Niobium

Niobium concentrations, as much as 5,000 parts per million (ppm) in heavy-mineral concentrates (map B), indicate that the metal may be mineable as a primary ore or byproduct when its bedrock source is known. The large overlap of the niobium and uranium areas suggests that the niobium might be produced as a byproduct of uranium mining.

Beryllium

The very high beryllium content of 100 ppm, or more, in heavy-mineral concentrates collected in the eastern part of the Lost Cove Roadless Area and the northern part of the Harper Creek Roadless Area probably reflect the presence of beryllium minerals in the bedrock, but none have been sought (map C). Beryllium minerals may be in high enough concentrations to be ore in one or more of the many types of rock present in the Wilson Creek Gneiss. Concentrations containing as little as 20-ppm beryllim may also indicate mineralization.

Molybdenum

Molybdenum was found in association with uranium in many samples from the southern part of the Harper Creek Roadless Area. There is little to indicate a significant potential for discovery of economic deposits of molybdenum. Its presence, however, might be an indicator of uranium minerals where the uranium may have been leached from the outcrops.

Lead

Lead is present in amounts as much as several hundred ppm in many of the geochemical samples (Siems, and others, 1981). Most of it is of radiogenic origin, formed by the disintegration of thorium in monazite and zircon. There is no evidence of significant lead potential in the study area.

Titanium

A magnetite-ilmenite deposit in the Wilson Creek Gneiss near Richlands has been described by Kerr (1875), Nitze (1893), and Bryant and Reed (1966). We found no evidence of similar titanium deposits in the study area.

Gold, Tungsten (Scheelite), and Copper

Gold and scheelite ($CaWO_4$) are found in a large area near Kawana and near the southwestern boundary of the Harper Creek Roadless Area (map D). Copper was found spectrographically in moderately high concentrations ranging from 20 to 70 ppm in the same areas. Although the gold might form the basis for small placer mines in the study area, and the scheelite may occur in mineable concentrations, the major significance of this mineral assemblage is to indicate that some rocks of the study area are mineralized. The nature and depth of related metal deposits, if any, are unknown.

Stone

Both the Wilson Creek Gneiss and the basal arkosic unit of the Grandfather Mountain Formation have been quarried nearby for stone. Stone in the study area has a low economic potential because of an abundance of similar material closer to markets and good transportation routes.

Oil and Gas

Recent seismic surveys provide evidence of extensive sedimentary rocks below the metamorphic rocks of the Carolinas. Sedimentary rocks are exposed about 5 miles west of the Harper Creek Roadless Area. Like any extensive body of sedimentary rock, this one might contain oil or gas. The potential for oil and gas in the study area is unknown.

[1] Speculative resources are defined as undiscovered resources that may occur either in known types of deposits in favorable geologic settings or in types of deposits as yet unrecognized for their economic potential. If exploration confirms their existence and reveals enough information about their quantity, grade, and quality, they will be reclassified as identified resources (U.S. Bureau of Mines and U.S. Geological Survey, 1980, p. 3).

SELECTED REFERENCES

Bryant, Bruce, and Reed, J. C., 1966, Mineral resources of the Grandfather Mountain window and vicinity, North Carolina: U.S. Geological Survey Circular 521, 13 p.

________, 1970, Geology of the Grandfather Mountain window and vicinity: U.S. Geological Survey Professional Paper 615, 190 p.

Griffitts, W. R., Duttweiler, K. A., and Whitlow, J. W., 1982, Geology and geochemistry of the Lost Cove and Harper Creek Roadless Areas, North Carolina: U.S. Geological Survey Map MF-1391-B, scale 1:48,000 [in press].

Kerr, W. C., 1875, Report of the geological survey of North Carolina; v. 1, Physical geography, resume, economical geology: North Carolina Geological Survey, 325 p.

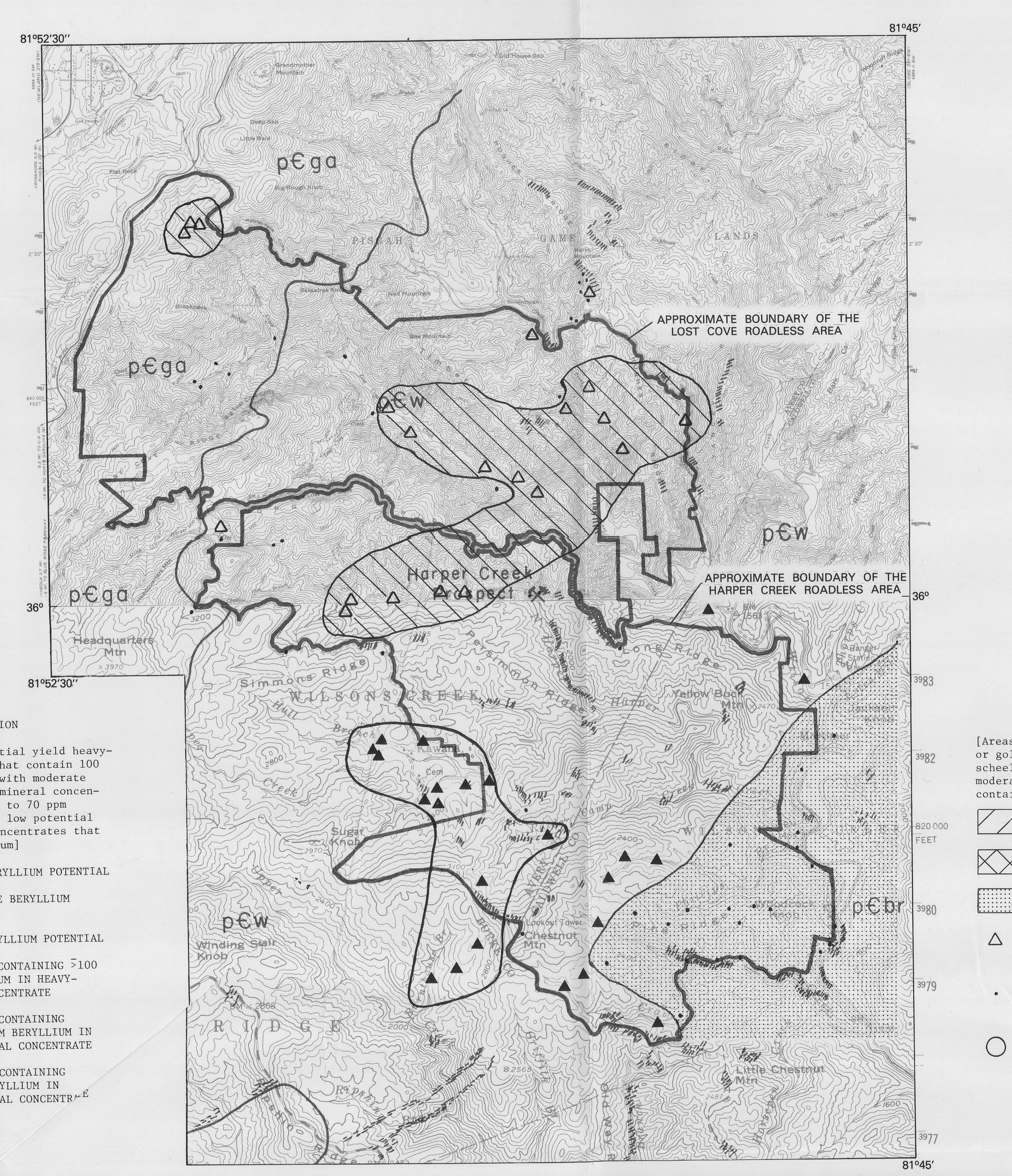
Nitze, H. B. C., 1893, Iron ores of North Carolina: North Carolina Geological Survey Bulletin 1, 239 p.

Rankin, D. W., Espenshade, G. H., and Neuman, R. B., 1972, Geologic map of the west half of the Winston-Salem quadrangle, North Carolina, Virginia, and Tennessee: U.S. Geological Survey Map I-709-A, scale 1:250,000.

Reed, J. C., 1964, Geology of the Linville Falls quadrangle, North Carolina: U.S. Geological Survey Bulletin 1161-B, 53 p.

Siems, D. F., Whitlow, J. S., Griffitts, W. R., Duttweiler, K. A., and Arbogast, Belinda, 1981, Preliminary report on the Lost Cove and Harper Creek Roadless Areas, North Carolina: U.S. Geological Survey Open-File Report 81-1245, 4 p.

U.S. Bureau of Mines and U.S. Geological Survey, 1980, Principles of a resource/reserve classification for minerals: U.S. Geological Survey Circular 831, 5 p.



EXPLANATION

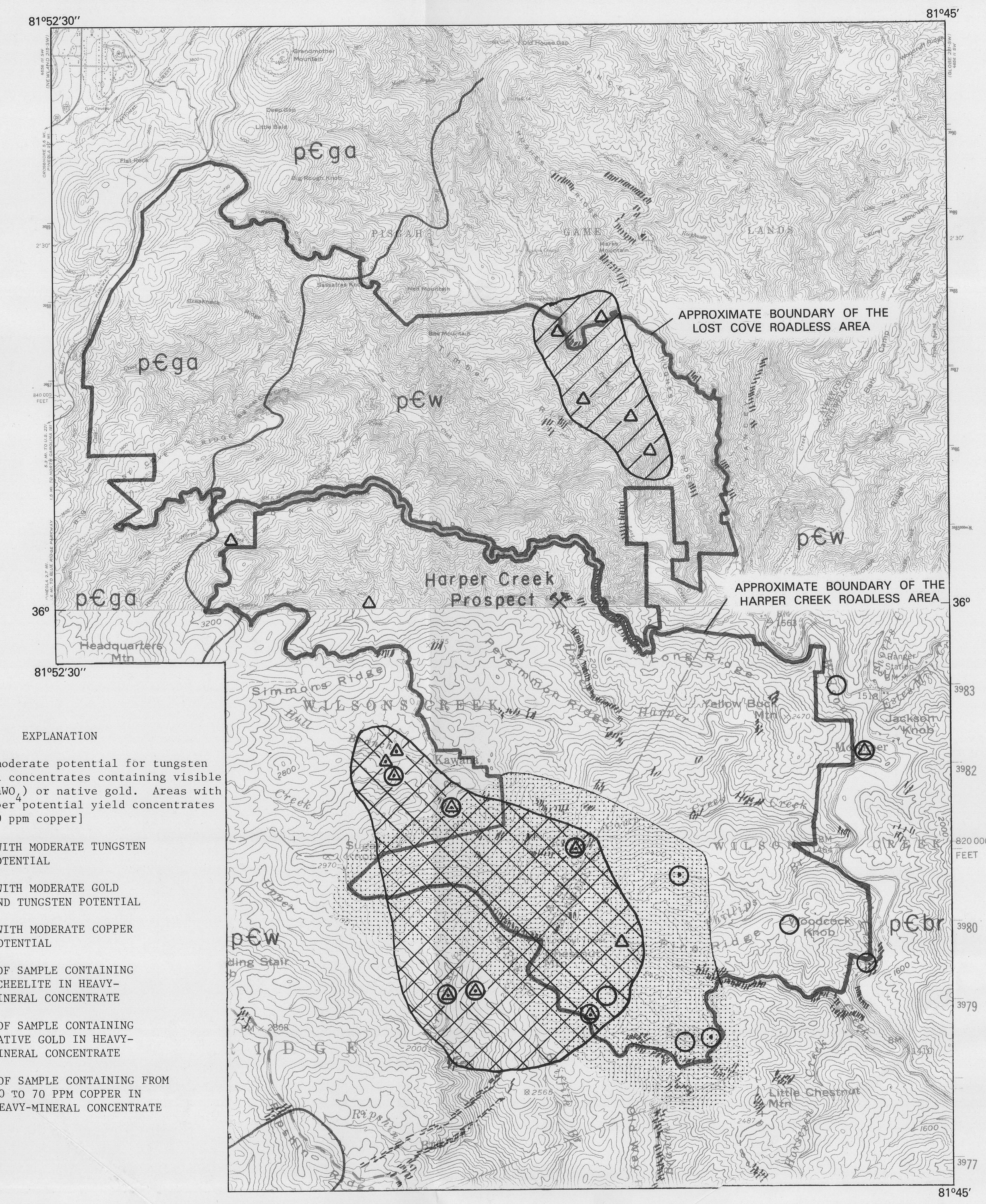
[Areas with high potential yield heavy-mineral concentrates that contain 100 ppm beryllium. Areas with moderate potential yield heavy-mineral concentrates that contain 20 to 70 ppm beryllium. Areas with low potential yield heavy-mineral concentrates that contain 20 ppm beryllium]

- AREA OF HIGH BERYLLIUM POTENTIAL
- AREA OF MODERATE BERYLLIUM POTENTIAL
- AREA OF LOW BERYLLIUM POTENTIAL
- △ SITE OF SAMPLE CONTAINING >100 PPM BERYLLIUM IN HEAVY-MINERAL CONCENTRATE
- ▲ SITE OF SAMPLE CONTAINING 20 TO 70 PPM BERYLLIUM IN HEAVY-MINERAL CONCENTRATE
- • SITE OF SAMPLE CONTAINING <20 PPM BERYLLIUM IN HEAVY-MINERAL CONCENTRATE

Base from U.S. Geological Survey, Grandfather Mtn. 1:24,000, 1960, and Linville Falls, 1:62,500, 1956

Geology modified from Bryant and Reed (1966)

MAP C.–BERYLLIUM RESOURCE POTENTIAL



EXPLANATION

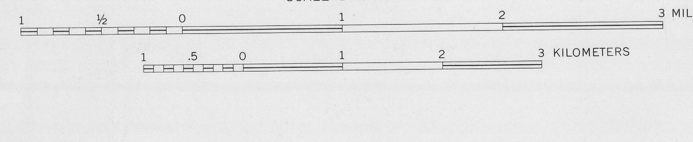
[Areas with moderate potential for tungsten or gold yield concentrates containing visible scheelite ($CaWO_4$) or native gold. Areas with moderate copper potential yield concentrates containing 20 ppm copper]

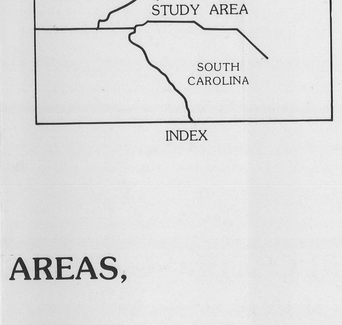
- AREA WITH MODERATE TUNGSTEN POTENTIAL
- AREA WITH MODERATE GOLD AND TUNGSTEN POTENTIAL
- AREA WITH MODERATE COPPER POTENTIAL
- △ SITE OF SAMPLE CONTAINING SCHEELITE IN HEAVY-MINERAL CONCENTRATE
- • SITE OF SAMPLE CONTAINING NATIVE GOLD IN HEAVY-MINERAL CONCENTRATE
- ○ SITE OF SAMPLE CONTAINING FROM 20 TO 70 PPM COPPER IN HEAVY-MINERAL CONCENTRATE

Base from U.S. Geological Survey, Grandfather Mtn. 1:24,000, 1960, and Linville Falls, 1:62,500, 1956

Geology modified from Bryant and Reed (1966)

MAP D.–GOLD, TUNGSTEN(SCHEELITE), AND COPPER RESOURCES POTENTIAL





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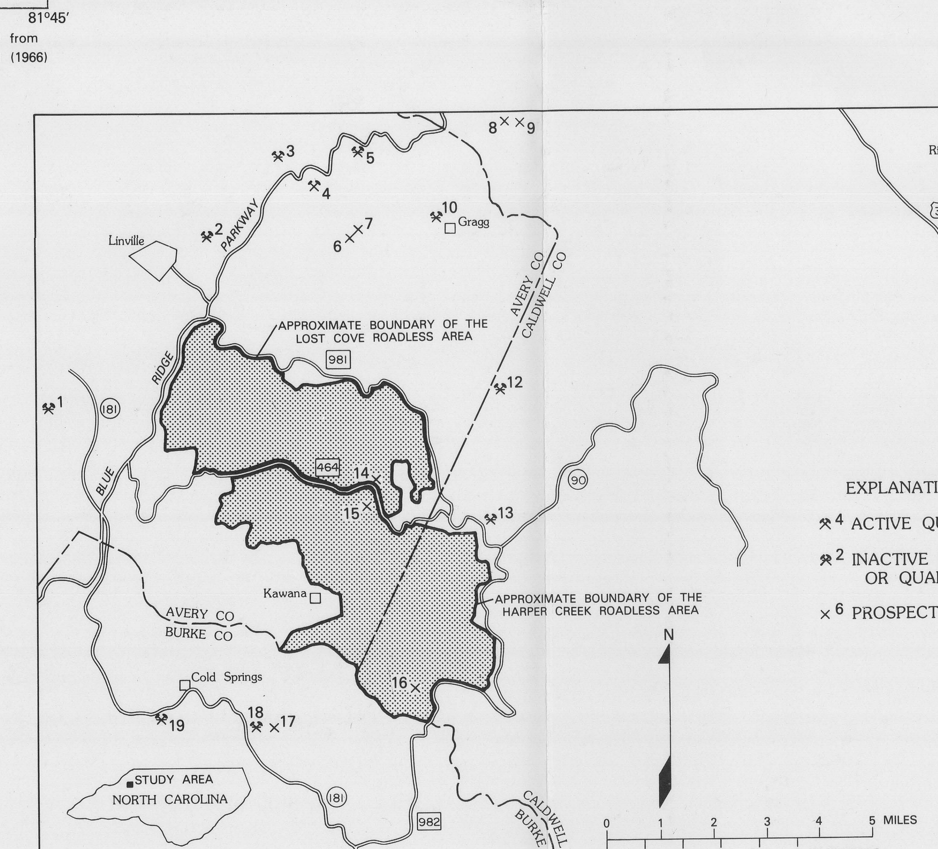

INDEX MAP SHOWING LOCATION OF THE LOST COVE AND HARPER CREEK ROADLESS AREAS, AVERY AND CALDWELL COUNTIES, NORTH CAROLINA

MINERAL RESOURCE POTENTIAL MAP OF THE LOST COVE AND HARPER CREEK ROADLESS AREAS, AVERY AND CALDWELL COUNTIES, NORTH CAROLINA

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1982

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