DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

MISCELLANEOUS FIELD STUDIES
MAP MF-1474-C

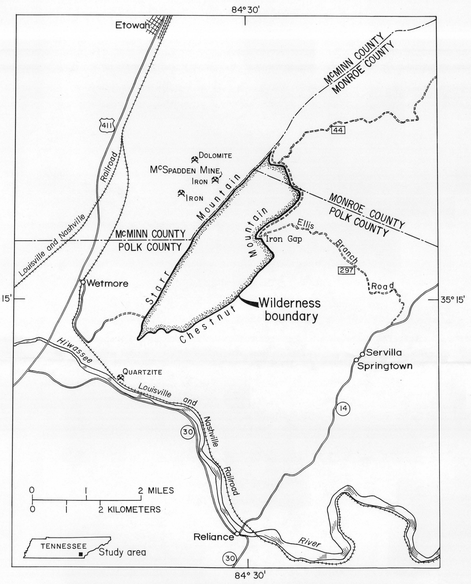
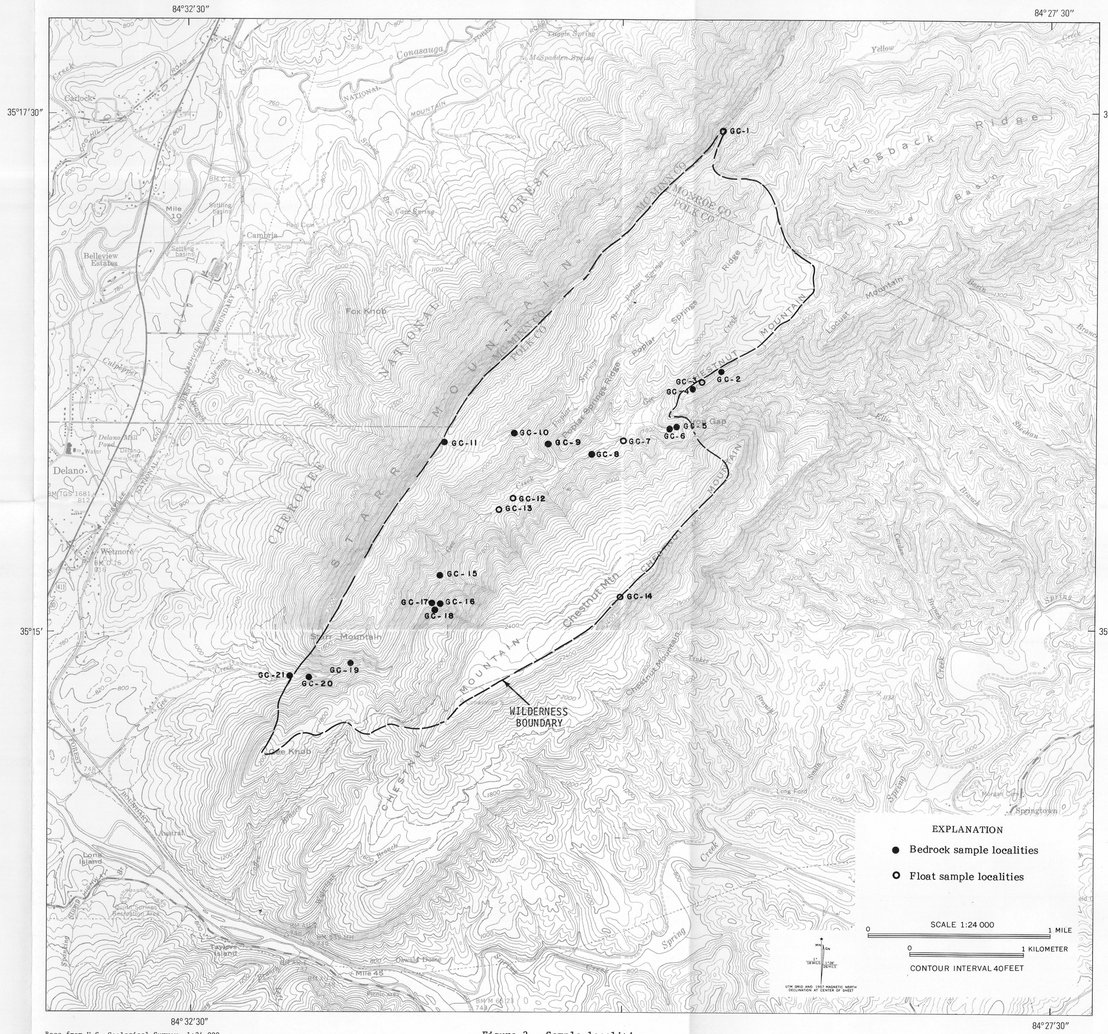
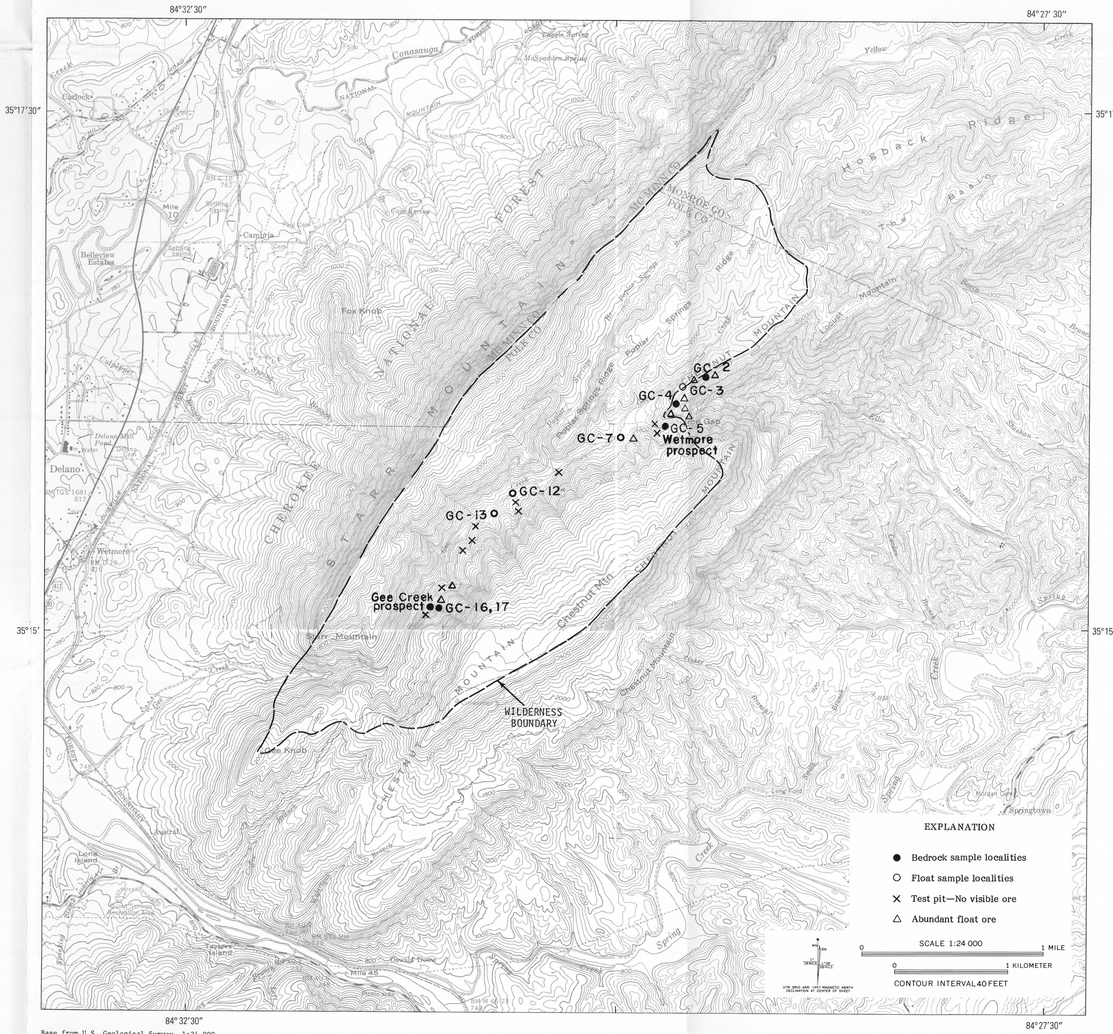


Figure 1.--Index map of Gee Creek Wilderness and nearby abandoned mines and quarries.



Base from U.S. Geological Survey, 1:24,000
Etowah, Oswald Dome, 1967; Mecca, McFarland, 1957

Figure 2.--Sample localities.



Base from U.S. Geological Survey, 1:24,000
Etowah, Oswald Dome, 1967; Mecca, McFarland, 1957

Figure 4.--Limonite localities.

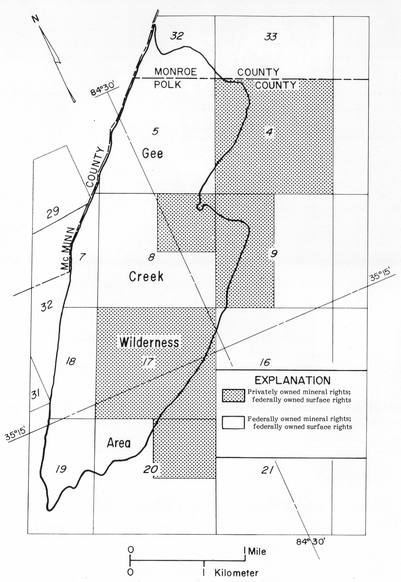


Figure 3.--Mineral rights in Gee Creek Wilderness and vicinity.

MAPS SHOWING MINES, QUARRIES, AND PROSPECTS, WITH ANALYSES OF SAMPLES, GEE CREEK WILDERNESS, POLK AND MONROE COUNTIES, TENNESSEE

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1983

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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 on 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 a part of the results of a mineral survey of the Gee Creek Wilderness in Cherokee National Forest, Polk and Monroe Counties, Tennessee. The Gee Creek Wilderness was established by Public Law 93-622, January 3, 1975.

INTRODUCTION

This report is part of a series that assesses the mineral potential of the Gee Creek Wilderness (fig. 1). Other reports in the series describe the geology (Epstein, 1983a), geochemistry (Epstein, 1983b), and a summary interpretive report (Epstein, Gazdik, and Behum, 1983).

During the recent U.S. Bureau of Mines field investigation, 21 samples were collected (fig. 2) and were submitted to the Bureau's Reno Metallurgy Research Center, Reno, Nev., for analyses. All samples were tested for 40 elements by semiquantitative spectrographic analyses. Additional testing by atomic absorption, neutron activation, and wet chemical techniques was performed for selected elements on some samples. Two shale samples were submitted to the Bureau of Mines, Tuscaloosa Metallurgy Research Center, Tuscaloosa, Ala., for evaluation of ceramic properties.

SURFACE AND MINERAL OWNERSHIP

In 1916, the U.S. Government purchased a large block of land from the Ocoee Timber Company for inclusion in the Cherokee National Forest. Mineral ownership and the right to mine these minerals were retained in perpetuity by the company on a small part, 1,920 acres (777 hectares), of the 1916-purchase land. Nearly half the encumbered land is included in the 2,493 acres designated as the Gee Creek Wilderness (fig. 3). There are no other outstanding surface or mineral rights within the wilderness area boundaries.

HISTORY OF MINING AND PROSPECTING AND PRESENT STUDIES

Mining has not been of major importance in the immediate vicinity of Gee Creek. During the 19th and early 20th centuries, brown iron ore was produced in small quantities from mines in Polk, Monroe, and McMinn Counties and smelted locally. There are no active iron mines at present; brown iron ore deposits are generally too small to be conducive to modern mining practices, and frequently contain too much phosphorous to be competitive with with available iron ores. Dolomite has been quarried on the western flanks of Starr Mountain (Hayes, 1895) from an Ordovician formation that does not occur within the wilderness boundaries. Quartzite from the south side of Gee Knob near the Hiwassee River was once quarried for use as fluxstone for the Ducktown copper smelters (Carter, 1968). Locations of some of these inactive mines and quarries are shown on fig. 1.

Iron

Deposits of goethite and other iron oxides which occur throughout the folded rocks of the Appalachian Mountains are commonly called "limonite" or "brown iron" ores. Mountain ore, a type of brown iron ore that is generally associated with fault planes and tends to be thin, shallow, and steeply dipping (Maher, 1964, p. 20 and 21), is found locally along faults adjacent to and in the Gee Creek Wilderness.

Limonite deposits occur along the Great Smoky and Fox Knob faults west of the wilderness boundary (Hayes, 1895). Hayes shows two iron mines on the west flank of Starr Mountain, less than a mile from the wilderness. One, the McSpadden mine (fig. 1), was reopened during World War I and several carloads of ore a day were shipped over a 1½ to 2 year period (U.S. Bureau of Mines files). In response to the War Minerals Program in 1949, the U.S. Bureau of Mines sampled the McSpadden deposit (table 1) and reported that it warranted further study. Nothing could be learned of the other mine.

Hayes' map also shows an iron-rich zone in the wilderness along the Gee Creek fault. Two iron prospects in this zone, the Gee Creek and the Wetmore, have been reported in the literature.

Gee Creek prospect. The Gee Creek prospect was first described by Willis (1886). During World War II, the prospect was sampled by the U.S. Bureau of Mines (table 1), and was designated the Trew and Pell prospect.

The limonite at the prospect crops out noticeably on the north slope of a steep-sided tributary stream valley. Although only 350 ft (107 m) from the creek, it must be approached from above because of sheer sandstone cliffs which face Gee Creek in this part of its course. The lowest exposure (fig. 4, sample GC-17) is a 15-ft (5-m) high, dark-colored, solid, rounded mass overlain by intermittent exposures of dense limonite for an additional 15 ft (5 m) up the hillside. The top of this exposure is at 1,580 ft (482 m).

At elevation 1,640 ft (494 m), about 25 ft (8 m) above the highest natural exposure at the Gee Creek prospect, a logging road cuts across a limonite trend for approximately 35 ft (11 m) (sample GC-16); the roadcut produced a vertical exposure 5 ft (2 m) high. There is a possibility that limonite is continuous from the outcrop below, giving a total exposure of 55 or 60 ft (17 or 18 m). The limonite at this upper location is lumpy and vesicular and occurs as rounded, boulderlike masses surrounded by a distinctive red and yellow clay. Voids are filled with a loose, yellow, sandy material or, less frequently, manganese oxide. Large blocks of iron-rich float were traced northeastward along trend for 300 ft (91 m).

Analyses of random chip samples from outcrops at this prospect (table 1) indicate that the limonite, although high in iron, has a phosphorous content too high to be acceptable in the present iron market.

Wetmore prospect. Another iron outcrop investigated by the U.S. Bureau of Mines for the War Minerals Program was designated as the Wetmore prospect. The outcrop is at the head of Gee Creek near Iron Gap at elevation 1,860 ft (567 m), along a logging road on the northern side of Gee Creek gully. Above the road, prospectors have exposed a rounded mass of limonite, 15 ft (5 m) high by 20 ft (6 m) wide (sample GC-5). The limonite is hard and has an irregular red, yellow, and black mottling on fresh surfaces. Country rock is not exposed and the limonite is surrounded by the characteristic red and yellow clayey soil. Nebo Sandstone is visible in the roadcuts 60 ft (18 m) above and also 60 ft (18 m) below the limonite. Two caved prospect pits a short distance below the Wetmore prospect contain no visible limonite.

Limonite outcrops were also located northeast of the Wetmore prospect (samples GC-2 and 4). Numerous large blocks of limonite occur in the roadbed and ditches of Forest Service Route 297 from Iron Gap to sample locality GC-2, a distance of about 0.5 mi (0.8 km), suggesting the persistance of the limonite bed. North of sample locality GC-2, a trail of limonite float and small outcrops indicate that the limonite zone veers more to the east, away from the wilderness.

Samples taken from the Wetmore prospect (table 1) and localities GC-2, 3, and 4, generally show the limonite to be more siliceous, lower in iron, and equally high in phosphorous when compared to samples taken from the Gee Creek prospect area. There are noticeably more sand- and silt-sized quartz grains in this limonite. High phosphorous content would discourage possible development.

Miscellaneous iron prospects. Prospecting has been active along much of the nearly 2 mi (3.2 km) distance between the Gee Creek and Wetmore prospects. Caved pits and trenches, too numerous to show individually, are indicated on figure 4. Dense concentrations of limonite float in the streambed below the workings and the presence of the characteristic yellow clayey soil found as the matrix for outcropping ore bodies, suggest that limonite bodies, although not exposed, occur in at least three localities. These are shown on figure 4 as sample localities GC-7, 12, and 13. Because none of the pits examined contain limonite exposures, they are not discussed individually.

Sandstone

Some years ago, quartzite was quarried less than 1 mi (1.6 km) southeast of the wilderness by the Tennessee Copper Company for use in their Ducktown smelters (Carter, 1968, p. 352). The quarry is located along the Hiwassee River and is visible from U.S. Route 30 (fig. 1). The remains of what was probably a crushing plant and the flume that carried water to it are visible on the east bank of Gee Creek immediately south of the wilderness boundary. Beach sands from South Carolina now provide silica for the Ducktown smelters.

The Hesse and Nebo Sandstones in the wilderness have limited economic potential. Neutron activation analyses (table 2) and thin-section analyses (Epstein, 1983b, table 3) show that a few isolated beds have a high silica content, but all have impurities of feldspar, fine-grained iron oxides, and sericite that would be difficult to remove. Only sample GC-6 (table 2) represents an outcrop of apparently friable sandstone with a silica content that, without extensive beneficiation could meet glass sand requirements.

Most of the sandstones in the wilderness could be easily crushed to produce sand, and the quartzite units are probably suitable for road metal.

Shale

Two shale samples were tested for ceramic properties and bloating characteristics (table 3). Both proved suitable for structural clay products. Sample GC-21 could be used for building or floor brick and fires satisfactorily for these at 1100°-1200°C.; sample GC-9 is suitable for building brick at kiln temperatures of 1000°-1100°C. The latter sample bloated with good pore structure at 1200°-1250°C., and would be useful in lightweight aggregate. The shales in the wilderness have little development potential because of distance from markets.

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Maher, S. W., 1964, The brown iron ores of east Tennessee: Tennessee Division of Geology Report of Investigations 19, 63 p.

Willis, Bailey, 1886, Notes on the samples of iron ore collected in east Tennessee, in Report on the mining industries of the United States: U.S. 10th census, 1880, v. 15, p. 332.

Table 1.--*Analyses of iron-rich samples*

[Unless otherwise indicated, analyses were performed by U.S. Bureau of Mines, Reno Metallurgy Research Center, Reno, Nev. Fe and Mn were determined by atomic absorption; S, by combustion-titration; P, by X-ray analyses; and SiO_2, by neutron activation.]

Sample number or location	Fe	Mn	S	P	SiO_2	Description
	percent					
GC-2	43.7	0.05	0.020	0.60	20.6	Outcrop
GC-3	40.0	4.1	.014	.69	16.5	Float
GC-4	35.6	.1	.011	.47	26.3	Outcrop
GC-5, Wetmore prospect	42.6	.04	.014	1.50	12.6	Do.
Wetmore prospect1/	43.1	.40	.08	1.33	19.8	Do.
Do.2/	51.92	--	--	.08	--	Do.
GC-7	48.8	3.1	.016	.09	12.4	Float
GC-12	12.7	.2	.008	.07	75.5	Do.
GC-13	50.0	3.4	.007	.62	6.6	Do.
GC-16	50.0	4.4	.140	.61	7.9	Outcrop
GC-17, Gee Creek prospect	47.6	6.2	.016	1.60	9.2	Do.
Gee Creek prospect3/	43.74	--	--	.72	--	Upper outcrop
Do.3/	49.40	--	--	1.42	--	Lower outcrop
McSpadden mine1/	51.84	.85	--	.72	8.14	Chip across ore zone
Do.1/	53.68	.80	--	.74	7.32	Grab from dump
Do.2/	52.16	1.22	--	.58	--	Ore

1/ Analysis from U.S. Bureau of Mines War Minerals Program files.
2/ Analysis submitted to U.S. Bureau of Mines in 1947 by C. F. Keith, Jr., one-time mineral rights owner.
3/ Analysis from Willis, 1886.

Table 2.--*SiO_2 content of selected sandstone samples*

[Neutron activation analyses by U.S. Bureau of Mines, Reno Metallurgy Research Center, Reno, Nev.]

Sample number	SiO_2 (percent)	Sample description	Formation
GC- 6	97.6	Coarse-grained, friable	Nebo
GC-10	92.4	Medium-grained, subangular, mostly friable	Hesse/Murray
GC-14	89.3	Coarse-grained, very friable	Nebo
GC-15	92.3	Medium-grained, well cemented	Hessee/Murray
GC- 1	95.3	Medium-grained, well cemented	Nebo
GC-11	97.1	Medium-grained, well cemented	Nebo

Table 3.--*Evaluation of shale samples*

[Testing performed by U.S. Bureau of Mines, Tuscaloosa Metallurgy Research Center, Tuscaloosa, Ala. Tests are preliminary and will not suffice for plant or process design.]

SAMPLE GC-9

Raw properties: water of plasticity, 17.2 percent; working properties, plastic; drying shrinkage, 2.5 percent; dry strength, fair; pH, 6.3; effervescence with HCl, none.

	Temp. (°C)	Munsell color	Mohs' hardness	Linear shrinkage (percent)	Absorption (percent)	Apparent porosity (percent)	Bulk density (gm/cc)
Slow firing test:	1000	5 YR 6/8	2.5	4	11.4	22.7	1.99
	1050	2.5 YR 6/8	5.0	4	11.0	22.0	2.01
	1100	2.5 YR 5/6	5.0	5	4.6	10.4	2.26
	1150	--	--	Expanded	--	--	--

	Temp. (°C)	Absorption (percent)	Bulk density (gm/cc)	Bulk density (lb/ft³)	Remarks
Preliminary bloating test: positive	1100	5.0	1.73	107.7	Partial expansion
	1150	5.7	1.43	89.1	Good pore structure
	1200	5.8	1.07	66.6	Good pore structure
	1250	5.3	.79	49.5	Good pore structure (sticky)

SAMPLE GC-21

Raw properties: water of plasticity, 14.9 percent; working properties, plastic; drying shrinkage, 2.5 percent; dry strength, good; pH, 6.2; effervescence with HCl, none.

	Temp. (°C)	Munsell color	Mohs' hardness	Linear shrinkage (percent)	Absorption (percent)	Apparent porosity (percent)	Bulk density (gm/cc)
Slow firing test:	1000	5 YR 6/8	3	2.5	15.5	26.4	1.84
	1050	2.5 YR 6/8	3	5.0	11.7	23.8	1.97
	1100	2.5 YR 5/6	4	5.0	6.5	14.3	2.03
	1150	10 R 5/4	5	5.0	3.1	7.1	2.21
	1200	10 R 4/2	5	5.0	1.8	3.9	2.22
	1250	--	-	Melted	--	--	--

Preliminary bloating test: negative

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