This report is preliminary and has not been edited or reviewed for conformity with North Carolina Geological Survey standards and nomenclature.

GEOLOGIC ASPECTS OF THE NOLICHUCKY RIVER AREA, HUNTDALE, NORTH CAROLINA TO CHESTOA, TENNESSEE *

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A spectacular rocky gorge, in places well over half a mile deep, has been formed by the Nolichucky River as it flows through the Unaka Mountains from the Blue Ridge of North Carolina into the Valley and Ridge of Tennessee. Arthur Keith, one of the foremost pioneering geologists in the Appalachians, long ago described it as " . . . one of the wildest [canyons] in the Appalachians . . . " (1907, p. 5), a characterization equally true today.

Special Features

Two features of regional significance give special geologic importance to the bedrock outcrops in and around the gorge. The first is that the extensive sequence of superb exposures along the left bank of the Nolichucky southeastward from the Unaka Springs area is designated as the type section of the Unicoi and Erwin Formations (Keith, 1907, p. 5; King and Ferguson, 1960, p. 36;41). A type section is a reference standard used to formally establish and define a rock-stratigraphic unit and is of continuing importance because it provides a clearly defined base for future workers to refer to and restudy.

The geologic structure revealed by the strata in and around the gorge comprises the second regionally important geologic feature. In this area faulting, folding, and subsequent erosion have formed the complex Mountain City window, a major tectonic feature of the southern Appalachians. The elucidation of this great structure, based in considerable part on exposures in the local area, gives us much insight into the deformational history and geo-mechanics of the Appalachians (see Rodgers, 1970, p. 168 ff.). These insights provide thought-provoking concepts to be examined not only in their own right, but also to be applied in the study of the other great mountain systems of the world.

In addition to the two regionally important features just mentioned, many natural geologic processes and their resulting effects may be readily observed in and along the course of the River. Some of the more prominent are here listed:

1. Spectacular, deep, rocky gorge cut by river action into resistant Cambrian and Precambrian siliceous sediments and granitic rocks.
2. Abundant rock cliffs, walls, and ledges along the course of the River.
3. Extensive bouldery talus slopes below outcropping ledges of massive quartzite beds.
4. Evidence of landslides involving very rapid to slow downslope movement of colluvial masses.
5. Small falls and innumerable rapids in the River; generally most common and pronounced where the strong, resistant beds of quartzite cross the River.
6. Areas of stream-sorted deposits in and along the River's channel. White sandy deposits are at the small sheltered places along the banks, and coarser gravels to cobbles are present in elongate bars, often located on the lee side of individual protective boulders.
7. Layers of ancient vesicular basalt intercalated in some of the rocks.
8. Cataclastic rocks or "shear zones" in the vicinity of faults.

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* Data used in compiling this report has come mainly from the comprehensive paper by Lowry (1950) and other references as indicated in the text, information supplied by James Fagan of the Geologic Branch of the Tennessee Valley Authority, and our own reconnaissance traverses through the area.

Rock Types

The rocks exposed in the area between Huntdale and Chestoa include part of the very old crystalline and metamorphic complex of the Blue Ridge province, often termed the "basement complex", and representatives of the succeeding sedimentary sequence of Late Precambrian and Early Cambrian age. Some of the crystalline rocks may be as old as 1 billion years; the sedimentary units were deposited between about 650 and 550 million years ago. The basement complex, although clearly the result of a complicated series of igneous, metamorphic, and structural events, has by no means been fully deciphered in this part of the southern Appalachians. On the other hand, knowledge of the sedimentary strata, especially their physical parameters and deformational history, is much more complete as a result of careful and thorough studies in this and nearby areas of Tennessee and North Carolina (Lowry, 1950; Ordway, 1959; Shekarchi, 1959; King and Feguson, 1960; Bearce, 1969; Bryant and Reed, 1970).

The basement complex in this area was originally mapped by Keith (1907) as part of the all-inclusive "Cranberry Granite". Locally however, several distinctive sub-units may be distinguished in the field. These include: 1) numerous thin mafic intrusive layers perhaps related to the Bakersville Metagabbro (see Wilcox and Poldervaart, 1958); 2) unakite and unakite-like rocks, gneissic to faintly foliated coarse-grained rocks characterized by unusual colors caused by the presence of pink feldspar, milky to glassy and opalescent bluish quartz, yellowish-green epidote, and dark green chlorite; 3) quartzo-feldspathic calc-silicate bearing rocks; 4) various other gneisses ranging from granitic to dioritic in composition. In addition to these mineralogically distinguished rock types, deformation effects, apparently localized along zones of extensive Late Paleozoic thrust faulting, have reconstituted the original material so as to produce phyllonite, mylonite, proto-mylonite, flaser gneiss, and other cataclastic types.

Rocks overlying the basement in this area are almost entirely siliceous clastic types, ranging from conglomerate and coarse sandstone and quartzite through siltstone and shale. A small portion of the region is underlain by carbonate strata and a few thin mafic volcanic layers are present several thousand feet stratigraphically above the basement. From oldest to youngest the stratified beds are assigned to the following formations: Snowbird, Sandsuck * Unicoi (includes the few mafic volcanic layers), Hampton, Erwin, Shady Dolomite, and Rome. Summary descriptions are presented in Table 1; more detailed discussions may be found in Lowry (1950), Rodgers (1953), King and Ferguson (1960), and references therein. All these strata, with the exception of the Sandsuck, Shady, and Rome, crop out prominently in the gorge of the Nolichucky and are responsible for the bold, spectacular rock cliffs, ledges, and rocky, white-water rapids in the River.

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* In this area sedimentary strata lying beneath the Unicoi Formation are assigned to the Sandsuck and Snowbird Formations following the detailed work of Lowry (1950). However, as a result of subsequent comprehensive study of equivalent strata, mainly in the Great Smoky Mountains area some 60 miles to the southwest (King et al., 1958), it has been necessary to reevaluate, and in some instances revise the assignments made in earlier reports for these sub-Unicoi beds. In the local area such revision may perhaps be warranted; however, to do so properly will require a major stratigraphic study well beyond the scope of this brief summation.

TABLE 1 -- STRATIGRAPHIC UNITS

Age (millions of years)	Formation	Thickness (feet)	Description
	Rome Formation	1,500	Mainly thin-bedded maroon siltstone and shale. Contains a few beds of massive, light-gray dolomite.
	Shady Dolomite	1,000	Dark- to light-gray, massive to thinly laminated dolomite; yellow-brown plastic residuum containing jasperoid masses is distinctive.
Early Cambrian (540-570)	Erwin Formation	1, 00	Interbedded layers of thick-bedded, white vitreous quartzite, siltstone and shale.
	Hampton Formation	1,500	Dark greenish-gray silty and argillaceous shale; abundant layers of thin-bedded feldspathic sandstone throughout.
	Unicoi Formation	upper part 2,500; lower part 1,800	White feldspathic quartzite with minor siltstone in upper part; feldspathic conglomerate and coarse-grained quartzite in lower part. Contains several layers of amygdaloidal greenstone in lower part.
	---- Disconformity ----		
Late Precambrian (570-650)	Sandsuck Formation	1,000	Dark silty slate, calcareous at places, with discontinuous layers of silty sandstone, quartzite, and conglomerate.
	Snowbird Formation	3,500	Mostly well-sorted, white feldspathic quartzite. Beds of siltstone and slate common in upper portion; pebbly layers prevalent in lower portion.
	---- Nonconformity ----		
Precambrian (possibly as old as one billion years)	Basement complex		


SOUTHWEST END OF
Love Station
Riverview
Chestnut Knob
Gentry Gap
Grassy Knob
Highrock
Slipper Spur Gap
LITTLE BALD
High Rocks
Whistling Gap
TENNESSEE
NORTH CAROLINA
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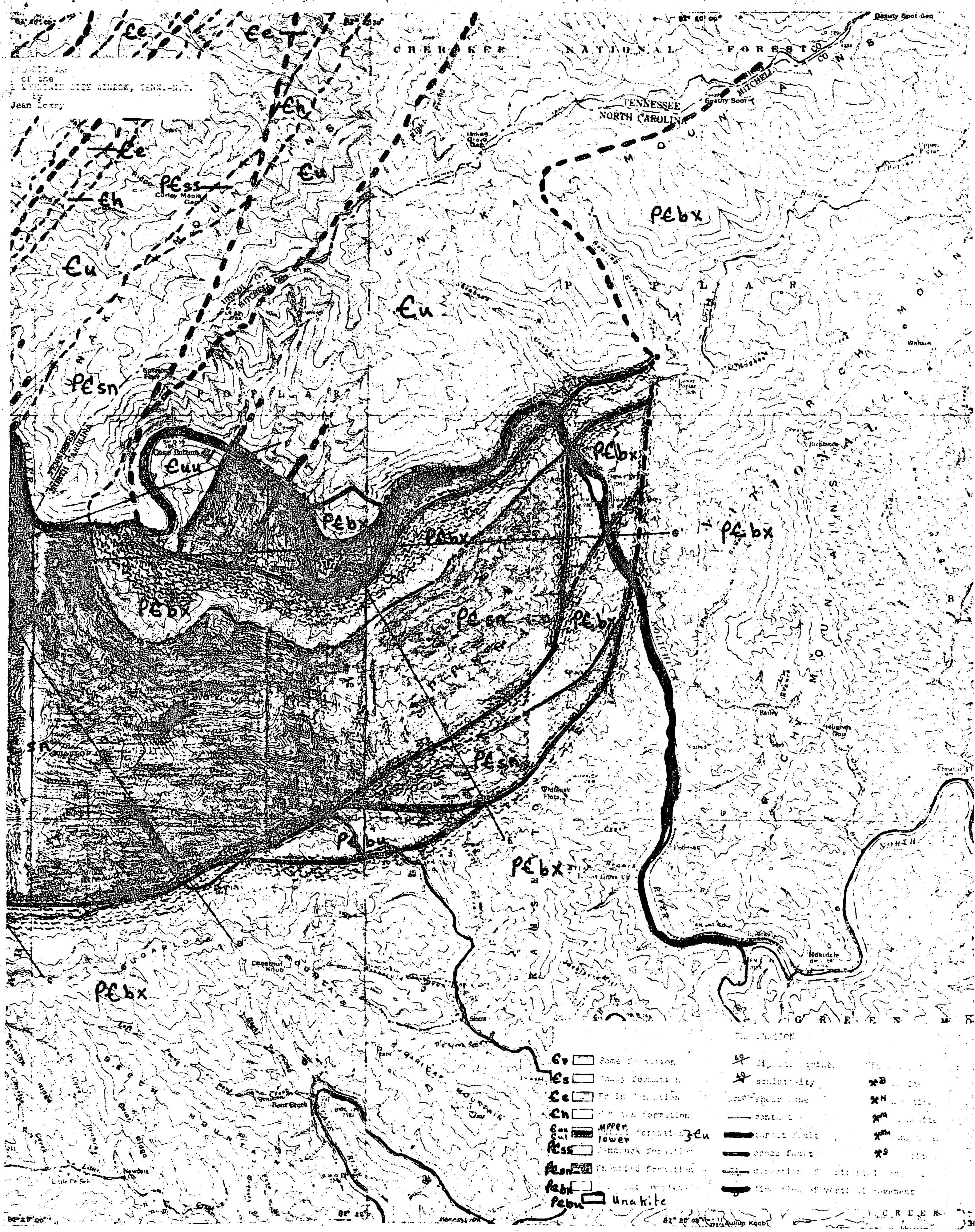

(Geology from Lowry (1950) and Rodgers (1953) with minor emendations)

Mineral Resources

Along the Nolichucky River between Huntdale and Chestoa no mining or quarrying is presently known to be taking place and all past production and prospecting has been on a very small scale. It is unlikely that there are any commercially significant mineral deposits along the course of the River with the sole possible exception of barite.

Within the gorge of the Nolichucky near the Peterson Community there are remnant shallow depressions which probably indicate abandoned sand and gravel borrow pits. Other areas of sand and gravel undoubtedly exist at various places in and along the River; however the absence of nearby markets make it uneconomical for these deposits to be exploited.

Fifty or more small pits and trenches, most of which are less than three feet deep, are present on the hillside east of Cane Bottom. Large trees growing in some of the pits imply that the excavations are at least 50 to 75 years old. A brief field examination failed to disclose any unusual minerals and a search of all available records did not reveal any mining activity in the area; thus, the true purpose of the excavations is in doubt. It is suspected though, that the pits represent an unsuccessful prospecting effort for barite.

During construction of the railway locally occurring stone was utilized and the local field stone has also been used for chimneys and foundations in homes and buildings in the immediate area. Use of locally obtainable materials in construction, of course, is common in the mountains and generally does not indicate a unique commodity, but rather is indicative of the isolated self-sufficiency of the region's inhabitants.

Away from the gorge itself but within several miles of the River a number of minerals have been prospected from time to time and some minor production has taken place in the past. These are plotted on the accompanying map and listed in Table 2.

Based on occurrances in the vicinity, knowledge of the local geology, past prospecting activity, and geologic similarities to other areas in the North Carolina-Tennessee region, we conclude it is unlikely that there are any commercially significant mineral deposits along the River between Huntdale and Chestoa. The only possible exception is barite; the geologic setting and the presence of old prospect pits may be deemed a sufficient basis to justify additional exploration. Particular attention should probably be paid to possible barite mineralization similar to the Moccasin Gap type of the Unicoi Formation as described from the Del Rio district some 30 miles further southwest (Ferguson and Jewell, 1951) as well as vein or replacement mineralization of the cataclastically deformed basement rocks similar to the occurrances at the nearby Chandler Mine (Maher, p. 17, 1970).

TABLE 2 -- MINERAL COMMODITIES, NOLICHUCKY RIVER AREA

Map No.	Commodity	Name	Production	Location by State Coordinate	Reference
1	barite	Chandler mine	2-3 car-loads	622,500 N; 3,021,600 E, TN	Maher, 1970, p. 17; 29
2	barite	unnamed prospect	unknown	625,600 N; 3,028,600 E, TN	Maher, 1970, p. 29; Lowry, 1950, p. 136
3	barite	unnamed prospect	unknown	618,100 N; 3,048,600 E, TN	Maher, 1970, p. 29 Lowry, 1950, p. 136
4	barite	unnamed prospect	unknown	618,000 N; 3,045,000 E TN	Maher, 1970, p. 29; Lowry, 1950, p. 136
5	barite (?)	unnamed prospects	unknown	865,000-865,700 N; 995,000-996,000 E, NC	
6	copper	Joe Horton prospect	none	860,700 N; 1,018,000 E, NC	Wilson, 1973, p. 33
7	crushed stone	unnamed	unknown	623,300 N; 3,033,500 E, TN	Shekarchi, 1959, pl. 1
8	crushed stone	unnamed	unknown	627,300 N 3,033,900 E, TN	Shekarchi, 1959, pl. 1
9	dimension stone	Spivey Mt. quarries	unknown	850,900 N; 1,000,200 E, NC	Councill, 1955, p. 17
10	hematite	Gilbert Branch prospect	unknown	628,600 N; 3,034,600 E, TN	Lowry, 1950, p. 137
11	hematite	unnamed prospect	unknown	617,200 N; 3,046,500 E, TN	Lowry, 1950, p. 136
12	magnetite	unnamed prospect	unknown	617,200 N; 3,045,400 E, TN	Lowry, 1950, p. 136
13	manganese	Unaka Springs prospect	3½ tons	638,100 N; 3,051,500 E, TN	King et al., 1944, p. 255 Lowry, 1950, p. 137
14	manganese	Peterson prospect	several tons	646,800 N; 3,058,600 E, TN	King et al., 1944, p. 255
15	molybdenite	Bird Creek prospect	none	858,000 N; 1,024,200 E, NC	Wilson, 1973, p. 34
16	sand and gravel	unnamed	unknown	848,100-849,000 N; 1,012,700-1,013,200 E, NC	

SOUTHWEST END OF THE MOUNT
Love Station
Riverview
Coffee Ridge
Faith Tabernacle
Gentry Gap
Grassy Knob
Highrock
Slipper Spur Gap
High Rocks
Whistling Gap
LITTLE BALD
Rich Gap
TENNESSEE
NORTH CAROLINA

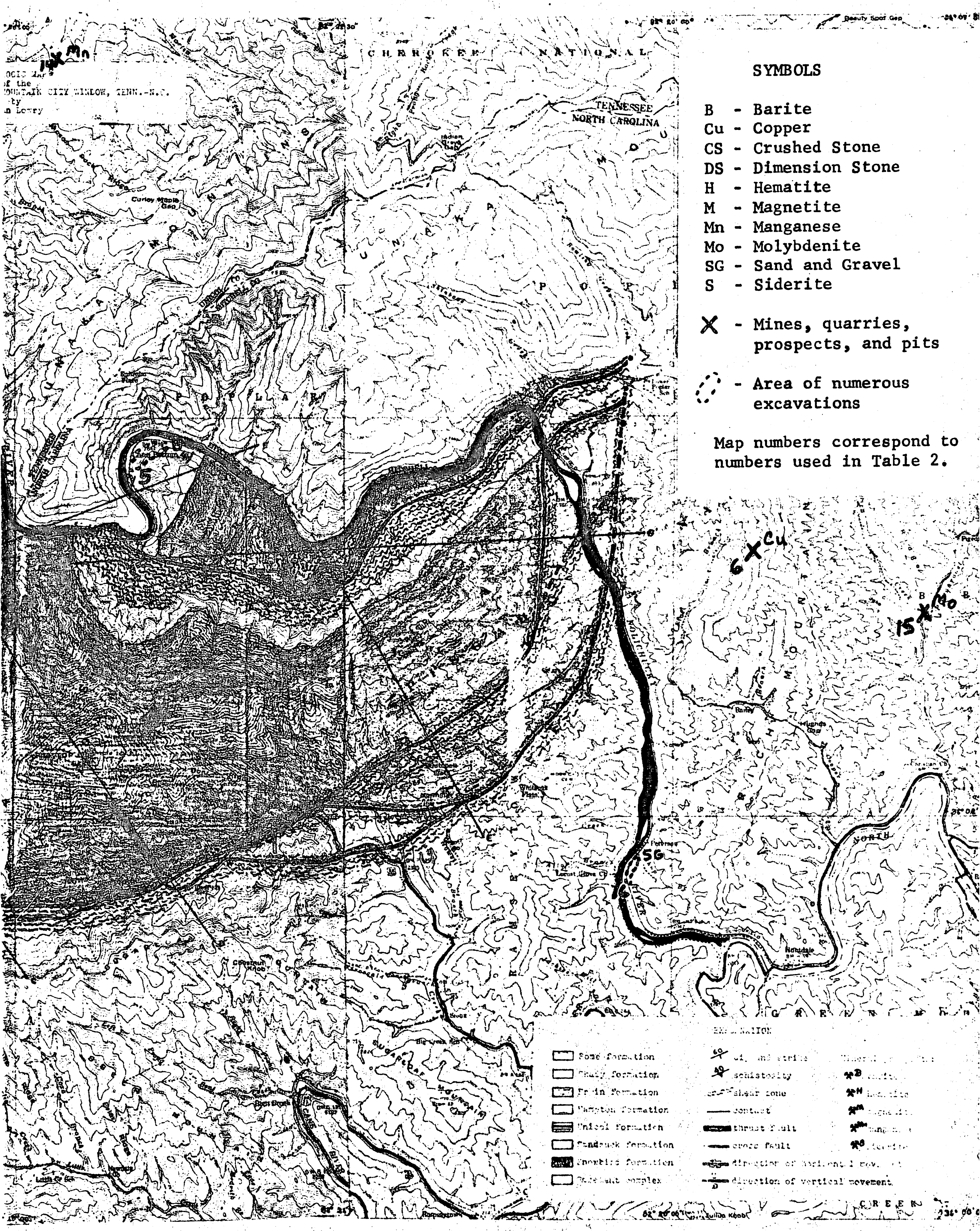
SYMBOLS
B - Barite
Cu - Copper
CS - Crushed Stone
DS - Dimension Stone
H - Hematite
M - Magnetite
Mn - Manganese
Mo - Molybdenite
SG - Sand and Gravel
S - Siderite
X - Mines, quarries, prospects, and pits
Area of numerous excavations
Map numbers correspond to numbers used in Table 2.
Mn
6 Cu
15 Mo
SG
TENNESSEE
NORTH CAROLINA
CHEROKEE NATIONAL
Beauty Spot Gap
Curley Maple Gap
NOLICHUCKY
Thrust fault
Cross fault
direction of vertical movement

TABLE 2 -- MINERAL COMMODITIES, NOLICHUCKY RIVER AREA, cont.

Map No.	Commodity	Name	Production	Location by State Coordinate	Reference
17	siderite	unnamed	unknown	618,100 N; 3,043,200 E, TN	Lowry, 1950, p. 137
18	siderite	unnamed	unknown	621,100 N; 3,047,500 E, TN	Lowry, 1950, p. 137
19	siderite	unnamed	unknown	621,000 N; 3,047,900 E, TN	Lowry, 1950, p. 137
20	siderite	unnamed	unknown	622,700 N; 3,044,100 E, TN	Lowry, 1950, p. 137
21	siderite	unnamed	unknown	641,900 N; 3,040,500 E, TN	Lowry, 1950, p. 137

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