INFORMATION CIRCULAR 43

COPPER, LEAD, AND ZINC CONCENTRATIONS IN STREAM SEDIMENT, METASVILLE QUADRANGLE WILKES AND LINCOLN COUNTIES, GEORGIA

by
Robert H. Carpenter

THE GEOLOGICAL SURVEY OF GEORGIA

DEPARTMENT OF MINES, MINING AND GEOLOGY

Jesse H. Auvil, Jr.
State Geologist and Director

ATLANTA

1971

For convenience in selecting our reports from your bookshelves, they will be color-keyed across the spine by subject as follows:

Red	Valley & Ridge mapping and structural geology
Dk. Purple	Piedmont & Blue Ridge mapping and structural geology
Maroon	Coastal Plain mapping and stratigraphy
Lt. Green	Paleontology
Lt. Blue	Coastal Zone studies
Dk. Green	Geochemical and Geophysical studies
Dk. Blue	Hydrology
Olive	Economic geology Mining directory
Yellow	Environmental studies Engineering studies
Dk. Orange	Bibliographies and lists of publications
Brown	Petroleum and natural gas
Black	Field trip guidebooks.

Colors have been selected at random, and will be augmented as new subjects are published.

COPPER, LEAD, AND ZINC CONCENTRATIONS IN STREAM SEDIMENT, METASVILLE QUADRANGLE WILKES AND LINCOLN COUNTIES, GEORGIA

by

Robert H. Carpenter

THE GEOLOGICAL SURVEY OF GEORGIA

DEPARTMENT OF MINES, MINING AND GEOLOGY

Jesse H. Auvil, Jr.
State Geologist and Director

ATLANTA

1971

CONTENTS

ILLUSTRATIONS

COPPER, LEAD, AND ZINC CONCENTRATIONS IN STREAM SEDIMENT — METASVILLE QUADRANGLE, WILKES AND LINCOLN COUNTIES, GEORGIA

By

Robert H. Carpenter [1]

ABSTRACT

Copper, lead, and zinc concentrations are reported for 72 stream sediment samples collected from the Metasville Quadrangle. In analysis, the samples (minus 80 mesh) were digested in perchloric acid and the solutions were analyzed by atomic absorption spectrophotometry. Statistically determined anomaly threshold values are 44 ppm zinc, 32 ppm copper, and 37 ppm lead. Metal values are lognormally distributed.

Both anomalies and known mineral occurrences are located along the periphery of a metadacite unit. Copper-zinc-lead-gold mineralization associated with this unit has been described for the Magruder Mine (Lincoln Co., Ga.), the Chambers Prospect (Wilkes Co., Ga.), and the Jennings and Dorn Mines (McCormick Co., S. C.). In the Metasville Quadrangle, five geochemical anomalies are recognized. Two reflect mineralization at the Magruder Mine and Chambers Prospect and two occur along the margin of the metadacite unit and probably reflect a similar type of mineralization.

A single anomaly occurs in the vicinity of hornblende gneiss and amphibolite and is probably unrelated to the metadacite unit.

INTRODUCTION

This report describes a stream sediment geochemical investigation of the Metasville 7½' Quadrangle in Wilkes and Lincoln Counties, Georgia (Figure 1). Trace element concentrations of copper, lead, and zinc as determined by atomic absorption methods are reported for 72 samples.

Hurst and others (1966) describe stream sediment and soil geochemical surveys on the Metasville Quadrangle as a part of a regional reconnaissance investigation of mineral resources of the Central Savannah River Area. Of 580 samples collected in the survey, 26 were taken from the Metasville Quadrangle. These samples were analyzed for copper by semi-quantitative spectrographic analysis. Values were reported in 3 categories: few hundred ppm, trace, and weak trace. Analyses were made on the minus 115 mesh, nonmagnetic, heavy mineral fraction. Detailed soil geochemical surveys were made in the vicinity of the Magruder Mine. The minus 200 mesh fraction of soil samples were analyzed with an x-ray vacuum spectrograph for copper and zinc. Concentrations are reported as counts per second in several concentration ranges. In both types of analysis, metal concentrations are indicated on a relative basis and the actual concentrations are not reported.

In addition to trace element studies, Hurst and others (1966) describe concentrations of gold, kyanite, barite, magnetite, ilmenite, rutile, manganese nodules, and ferruginous nodules in the minus 32, plus 60 mesh, heavy mineral fractions.

The area was selected for study to evaluate known mineralization and anomalies indicated by Hurst and others (1966). Significant mineralization in the vicinity of the Magruder Mine made the Metasville Quadrangle one of the more promising areas in the Piedmont. Because the stream sediment coverage by Hurst and others (1966) was of a reconnaissance nature, it was felt that a more detailed coverage including analyses for lead and zinc, as well as copper, would serve to define potential mineralized areas more precisely.

ACKNOWLEDGMENTS

The author wishes to express his appreciation to the Georgia Department of Mines, Mining and Geology for providing financial support for this investigation under the Contract Mapping Program.

[1] Dr. Carpenter is Associate Professor of Geology, University of Georgia.

Figure 1. Map indicating location of Metasville Quadrangle

GENERAL GEOLOGY AND MINERAL DEPOSITS

The general geology of Wilkes and Lincoln Counties is presented on county maps prepared by Crawford (1968a, 1968b). Major rock units shown on the Metasville Quadrangle are: 1) a hornblende gneiss-biotite gneiss-amphibolite sequence; 2) metadacite; 3) biotite and/or muscovite granite, and 4) porphyritic granite. The general trend of the rocks indicated by attitude measurements is about N 70° E. The rocks dip steeply both to the northwest and southeast.

The Magruder Mine, formerly known as the Seminole Mine, is the most notable sulfide deposit in the east Georgia Piedmont. The mineralization and accounts of mining are described in reports by Watson (1904), Jones (1909), Shearer and Hull (1918), Peyton and Cofer (1950), Fouts (1966), and Hurst and others (1966). In 1855 the mine was opened as a gold mine. Subsequently it was mined sporadically for copper, lead, gold, and silver. Since 1938, there has been no mining at the property. The Magruder Mine and the Chambers Prospect (located about 0.6 miles west of the Magruder Mine) were drilled by the U. S. Bureau of Mines in 1948-1949. The drilling consisted of 10 diamond drill holes totaling 3,784 feet (Peyton and Cofer, 1950). In 1955-1956, the Tennessee

Copper Company drilled 3 holes (Hurst and others, 1966).

Mineralization at the Magruder Mine is in the metadacite unit of Crawford (1968a, 1968b) but on a local scale it is more intimately related with biotitic, sericitic, and quartzitic schist. Silicification, sericitization, and chloritization are alteration features associated with the mineralization. Five distinct veins were recognized. These veins strike between N 20° E and N 45° E and dip steeply to the northwest. Mineralized zones pinch and swell erratically. Sulfides tend to occur along silicified shear zones, although impregnations of sulfides in altered country rock are also common. Primary sulfide minerals include pyrite, chalcopyrite, sphalerite, and galena. Secondary minerals formed by weathering include covellite, chalcocite, cuprite, anglesite, tenorite, and native copper. Higher gold values tend to be related to chalcopyrite and high silver values to galena. Gahnite and barite are gangue minerals associated with the sulfides. The nature of the alteration and association of sulfide minerals suggests that the deposit is mesothermal, formed at moderate depths, at temperatures between 200° and 300° C.

Method of Study

Samples were collected from bars and sandy accumulations in small streams. Attempts were made to sample uniformly and to avoid sampling sediment that contained abundant organic matter, iron and/or manganese oxide, and trash (tin cans, garbage, etc.). Samples were stored in polyethylene bags, dried under infrared lamps, and screened to minus 80 mesh with stainless steel screens.

The minus 80 mesh fractions were analyzed by atomic absorption spectrophotometry for copper, lead, and zinc by the Rocky Mountain Geochemical Corporation. In their procedure, a 0.5 gm sample boiled in 5 cc perchloric acid for a one hour period and the solution is diluted to 25 cc with distilled water prior to analysis.

Anomaly threshold values were estimated by a statistical technique recently described by Lepeltier (1969). In this procedure, analytical values are placed in class intervals and the percentage of samples in each class interval is determined. By plotting the upper limit of each class interval vs. cumulative percent on log-normal probability paper a "best fit" line through the points provides interpretive information. If the line is straight, the indicated distribution is a single log-normal distribution; little or no mineralization indicates that the defined distribution is that of background (unless the entire area under study is mineralized). Breaks in slope generally indicate that multiple distributions exist. If it is assumed that the lower distribution is background, then the break points serve as limiting values (threshold values) for the anomalous distributions.

Although this technique is quite simple, it has proved in many cases to be as useful as more sophisticated computerized interpretive methods. However, in the Metasville area variability in rock types may also cause different backgrounds and threshold values. Ideally threshold values should be determined separately for each rock unit. In the present study, this was not feasible since data from only 72 samples is inadequate for such statistical treatment.

Results

Curves showing distributions of copper, lead, and zinc and indicated threshold values are presented in Figure 2. Indicated threshold values are 32 ppm copper, 37 ppm lead, and 44 ppm zinc. Locations of anomalous samples are shown in Figures 3-6. The distribution of certain prominent rock units as mapped by Crawford (1968a, 1968b) in the vicinity of the anomalies is presented in Figure 5. Individual anomalous areas are discussed below.

Anomaly A (Magruder Mine area). Extremely high values are shown along Mine Branch downstream from the Magruder Mine. The anomaly reflects to a large extent tailings and smelter products which have washed into the stream. Immediately downstream from the old mill site, sediment contains 515 ppm copper, 420 ppm lead, and 275 ppm zinc. The dispersion trail is detectable downstream for approximately 2 miles for copper data, and 1 mile for lead and zinc data.

Anomaly B. Anomaly B is a zinc anomaly indicated by a single sample containing 70 ppm zinc. The anomaly probably reflects mineraliza-

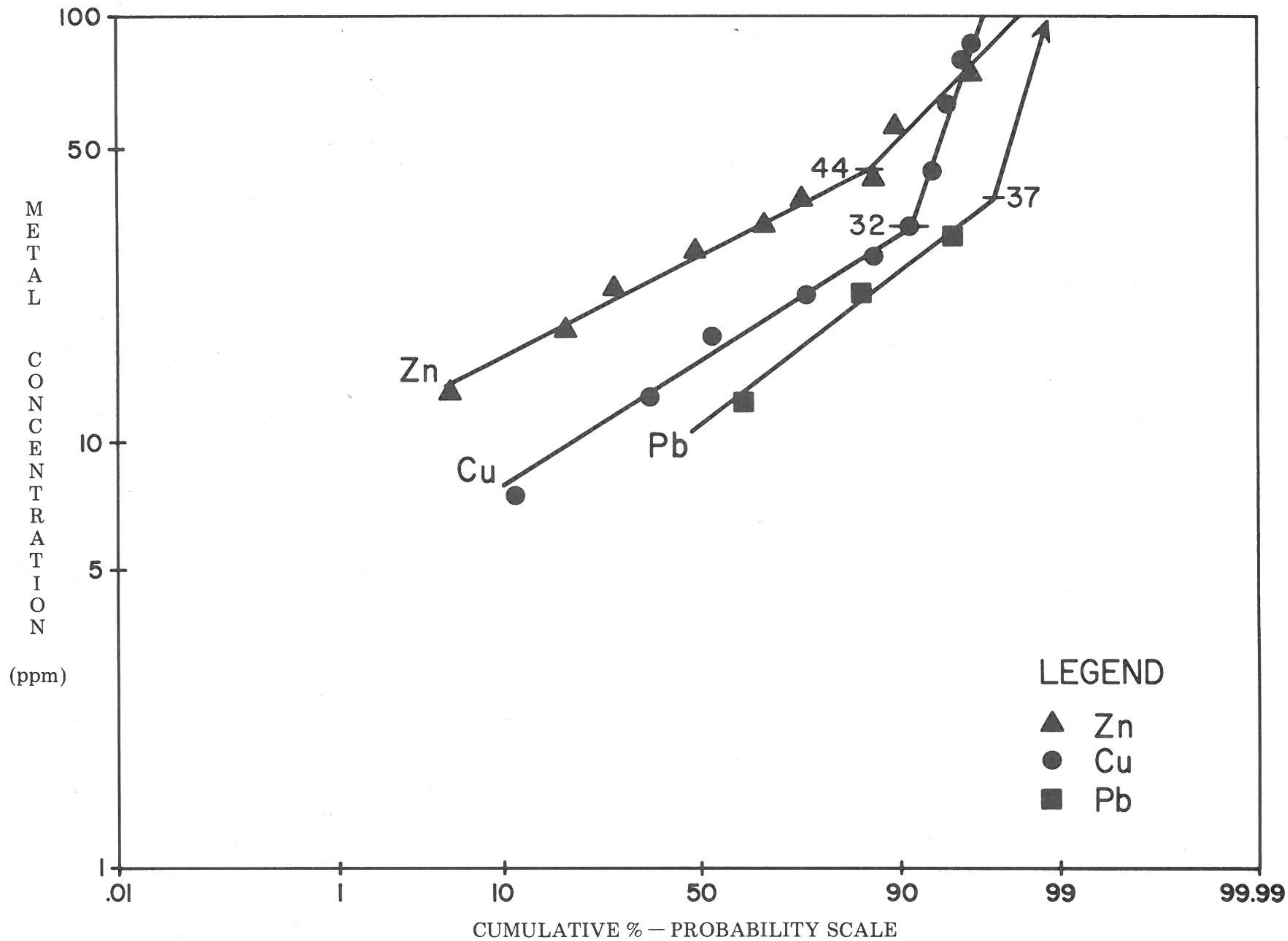

Figure 2. Diagram showing distribution of copper, zinc, and lead on log-probability plot and indicated threshold values.

tion at the Chambers Prospect located about 500 feet upstream from the sample site. According to Peyton and Cofer (1950), stringers of sphalerite occur in a 12 ft. crosscut extending from a shaft 60 feet deep. A significant intersection of sphalerite is reported in one of three drill cores taken from the property by the Bureau of Mines. In BM-1, a 33.2 foot intersection between 111 feet and 144.2 feet averages 3.7% Zn with a thin zone assaying as high as 12% Zn. The entire interval between 101.6 feet and 162.0 feet is mineralized since all intervals assay above 0.19% Zn and most are above 0.5% Zn. The hole was drilled at a 45° angle, roughly perpendicular to the dip estimated from surface exposures.

According to the geologic map of Wilkes County (Crawford, 1968a) the prospect is located about 500 feet east of the metadacite unit in the hornblende gneiss-biotite gneiss-amphibolite sequence.

Anomaly C. This anomaly is located in the southeastern portion of the quadrangle on a tributary of Florence Creek. A single sample contains 50 ppm zinc. The anomalous sample locality is in the hornblende gneiss-biotite gneiss-amphibolite sequence about 1000 feet south of the boundary with the metadacite unit. The anomalous drainage also includes quartz-muscovite-sericite schist bands which are commonly pyritic. These bands may represent hydrothermally altered zones.

Anomaly D. A sample from Curry Creek is anomalous for copper (60 ppm) and zinc (50 ppm) and a sample taken from a nearby tributary is anomalous for zinc (60 ppm). Both sample localities are within the metadacite unit but the drainage areas represented are mainly underlain by the hornblende gneiss-biotite gneiss-amphibolite sequence, and a biotite and/or muscovite granite intrusive.

Anomaly E. A sample collected from Goshen Branch a short distance above the confluence with Mill Creek is anomalous for zinc (60 ppm) and copper (65 ppm). Principal rock types in the drainage include hornblende gneiss and amphibolite and biotite and/or muscovite granite.

Anomalies A and E partically coincide with anomalies reported by Hurst and others (1966). An anomaly reported by Hurst and others (1966) southeast of the community of Metasville was not detected in this study.

CONCLUSIONS

Five distinct stream sediment anomalies are recognized on the Metasville Quadrangle. Four occur near the contact of a large metadacite body and the adjacent country rocks. The most intense anomaly (Anomaly A) occurs downstream from the smelter and tailings storage area at the Magruder Mine. The dispersion tail can be traced for a distance of at least 2 miles downstream by anomalous copper values.

Anomaly B reflects mineralization at the Chambers Prospect. In a diamond drilling survey by the U. S. Bureau of Mines, a 33.2 feet interval averaging 3.7% Zn was encountered at this prospect.

The metadacite unit extends to the northeast into South Carolina. Mineralization comparable to that described for the Magruder Mine occurs at the Jennings and Dorn Mines in metadacite in McCormick County, South Carolina (Bell, 1968). Based on a stream sediment geochemical survey in this area, Bell (1968) concluded that gold, barium, copper, lead, and zinc have a zonal arrangement around a segment of the metadacite unit.

In summary, the distribution of anomalies, mines, and prospects indicate that mineralization in the area is spatially related to a large metadacite body. The marginal portion of this body and the adjacent country rocks appear to constitute the best exploration targets.

REFERENCES

Bell, Henry, III, 1968, Results of geochemical sampling and geologic reconnaissance in McCormick County, South Carolina: (abstract) Paper presented at Southeastern Section Meeting of the Geological Society of America, Durham, North Carolina.

Crawford, T. J., 1968a, Geologic map of Wilkes County, Georgia: Central Savannah River Area Planning & Development Commission and the Geology Department, University of Georgia.

Crawford, T. J., 1968b, Geologic map of Lincoln County, Georgia: Central Savannah River Area Planning & Development Commission and the Geology Department, University of Georgia.

Fouts, J. A., 1966, The Geology of the Metasville area, Wilkes and Lincoln Counties, Georgia: Unpublished M.S. thesis, Department of Geology, University of Georgia.

Hurst, V. J., Crawford, T. J., and Sandy, John, 1966, Mineral resources of the Central Savannah River Area: Central Savannah River Area Planning and Development Commission and the Department of Geology, University of Georgia, 467 p.

Jones, S. P., 1909, Second report on the gold deposits of Georgia: Ga. Geol. Surv. Bull. 19.

Lepeltier, Claude, 1969, A simplified statistical treatment of geochemical data by graphical representation: Econ. Geol., v. 64, no. 5, p. 538-550.

Peyton, A. L. and Cofer, H. R., Jr., 1950, Magruder and Chambers copper deposits, Lincoln and Wilkes Counties, Georgia: U. S. Bureau of Mines, Rept. Inv. 4655.

Shearer, H. K., and Hull, J. P. D., 1918, The pyrite deposits of Georgia: Ga. Geol. Surv. Bull. 33.

Watson, T. L., 1904, The Seminole copper deposit of Georgia: U. S. Geol. Surv. Bull. no. 225, p. 182-186.

ILLUSTRATIONS

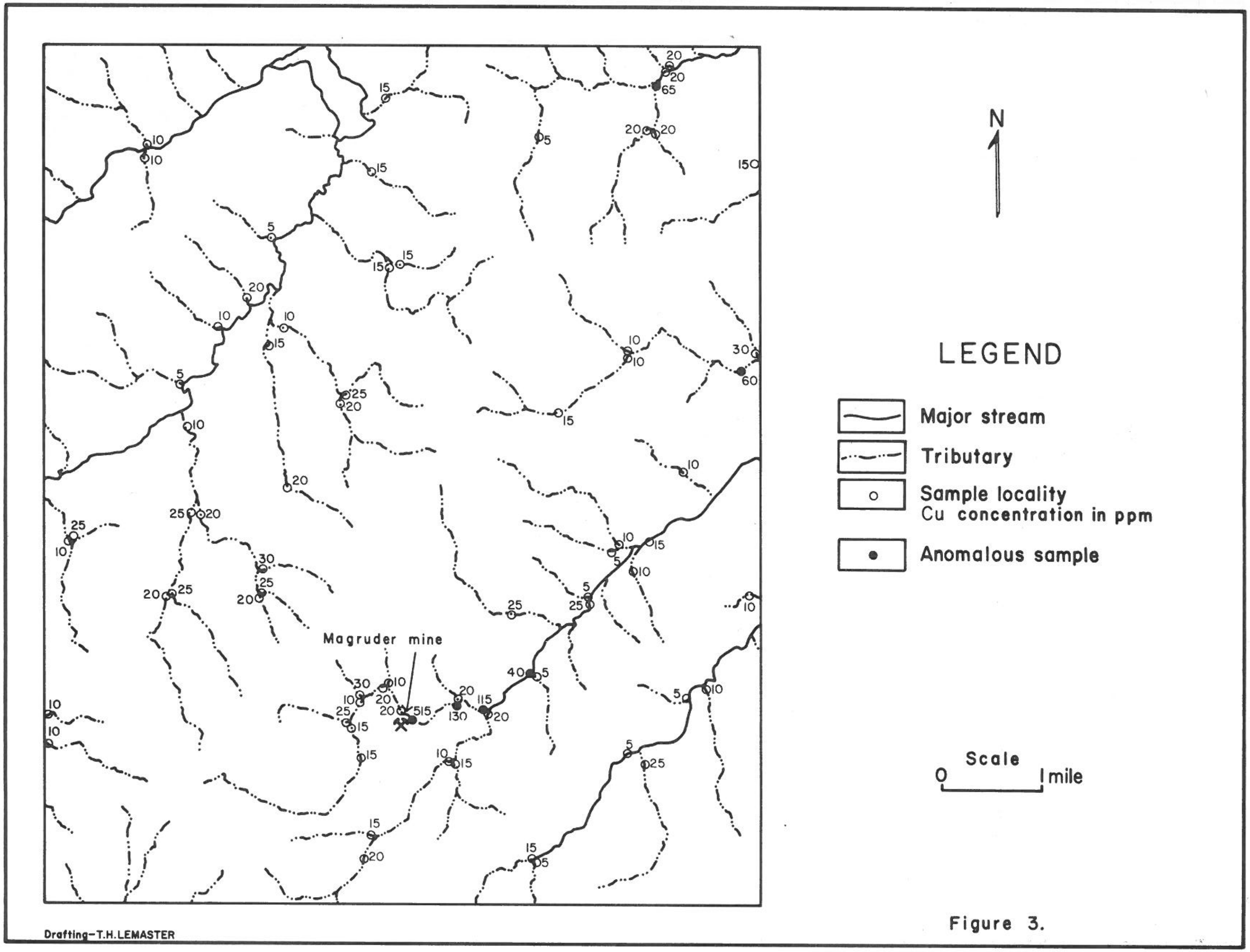

Figure 3. Drainage map of the Metasville Quadrangle showing concentrations of copper in stream sediment samples.

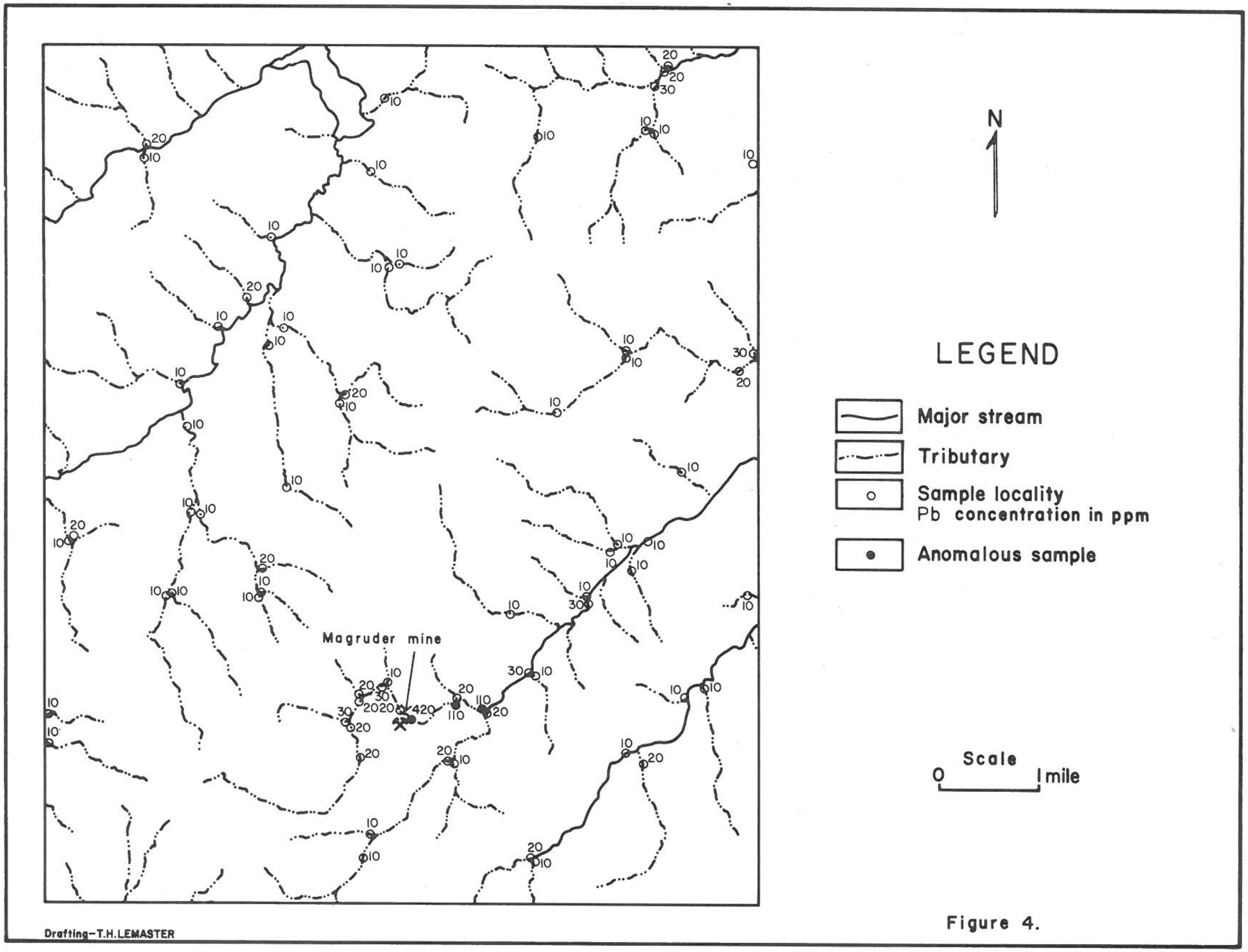

Figure 4. Drainage map of the Metasville Quadrangle showing concentrations of lead in stream sediment samples.

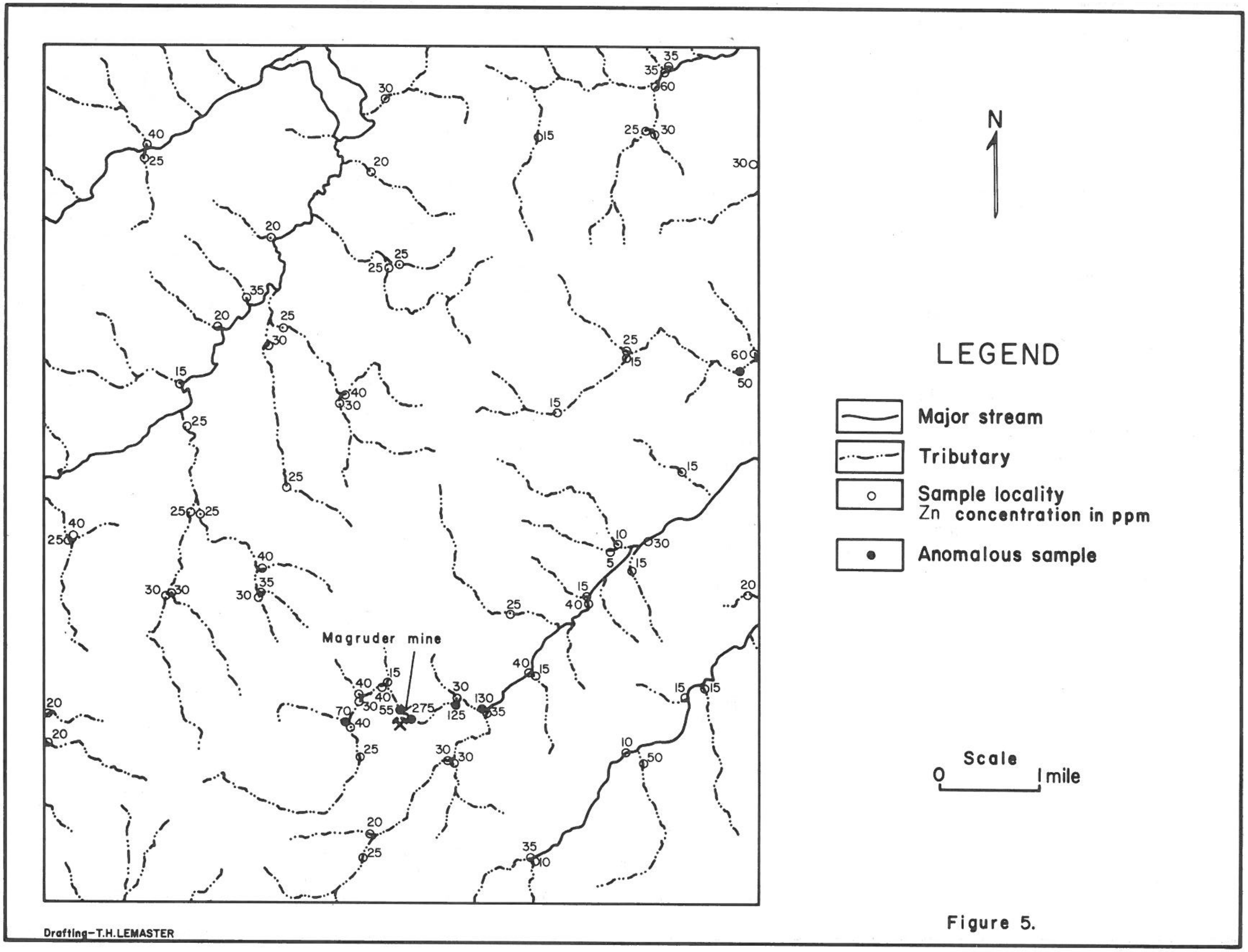

Figure 5. Drainage map of the Metasville Quadrangle showing concentrations of zinc in stream sediment samples.

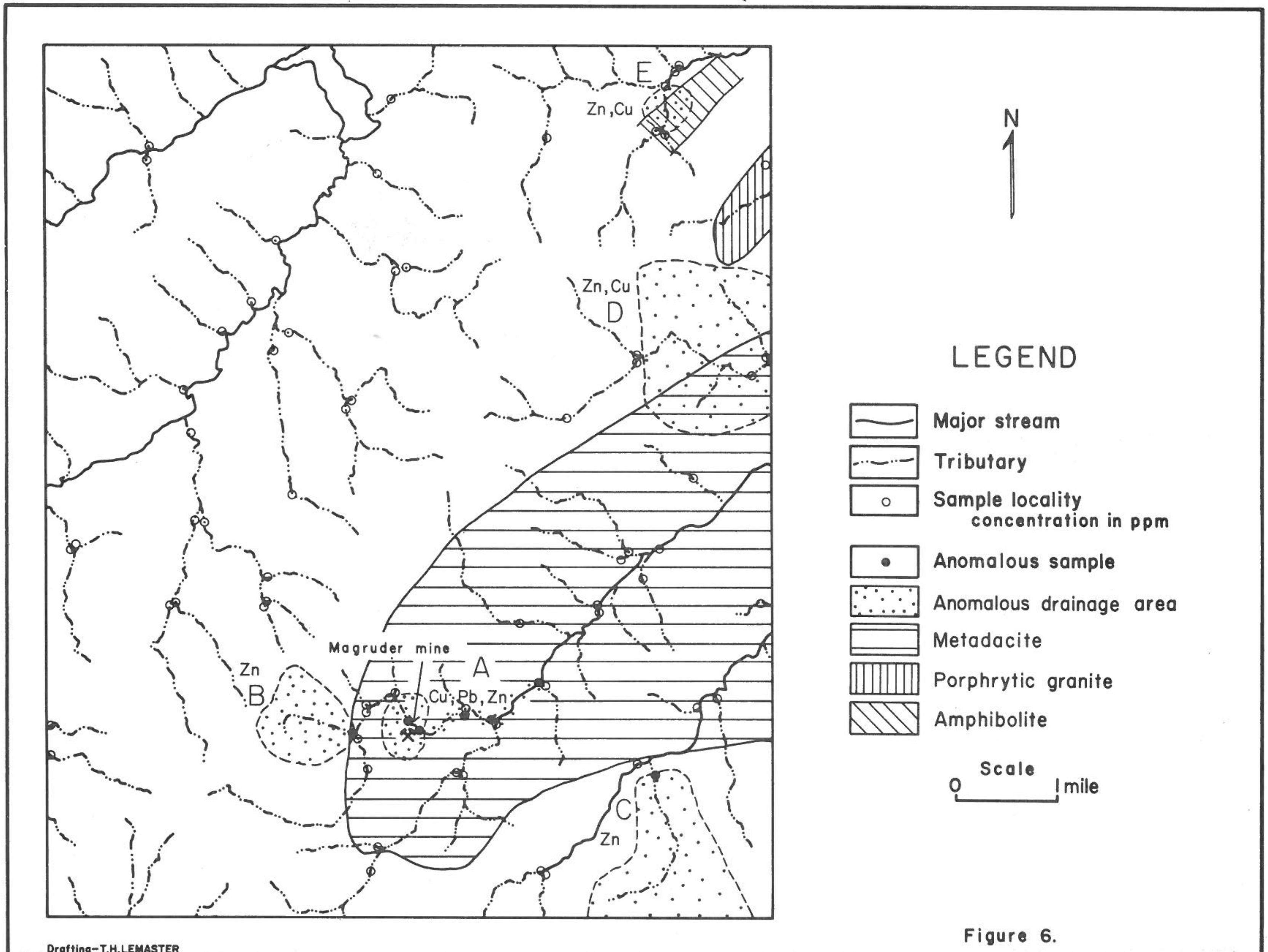

Figure 6. Drainage map of the Metasville Quadrangle showing location of anomalies and the distribution of certain rock types. (Geology taken from Crawford, 1968a, 1968b).