



Zinc-Lead-Copper Trace Contents
In Tres Hermanas Stock
Luna County, New Mexico

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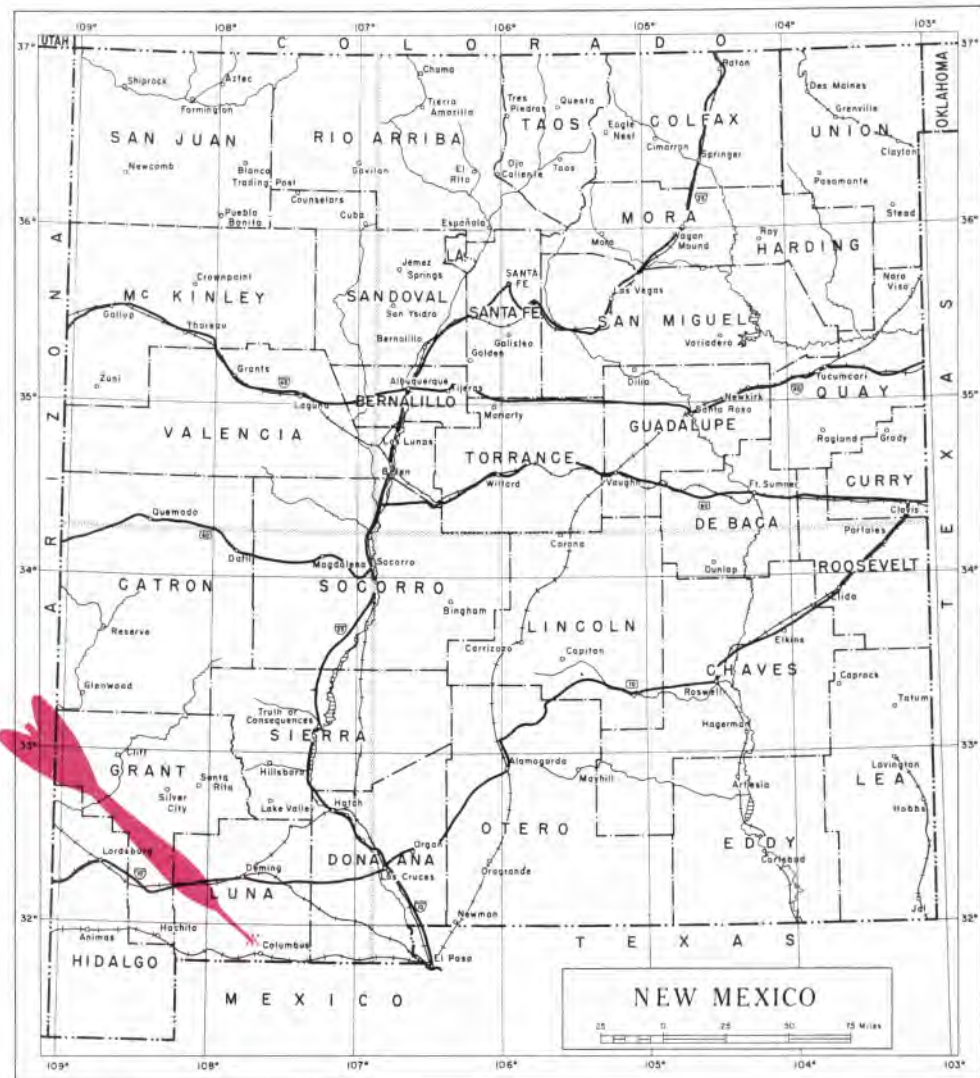
Target Exploration Report E-4

ZINC—LEAD—COPPER TRACE CONTENTS IN TRES HERMANAS STOCK,
LUNA COUNTY, NEW MEXICO

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The main purpose of this series is the immediate release of significant new exploratory information which otherwise would have to await release at a much later date as part of a comprehensive and formal document. These data are preliminary in scope, therefore, subject to revision and correction.

Socorro



SUMMARY

Zinc, lead and minor copper-bearing replacement-type and vein-type deposits occur in Paleozoic sedimentary rocks and Tertiary volcanic rocks adjoining the Tres Hermanas granite-quartz monzonite stock, Luna County, New Mexico. Trace metal zinc, lead and copper anomalies are spatially related to each other within the stock. Zinc and lead anomalies are almost congruent. Spatial relationship exists between the anomalous trace concentrations of zinc-lead-copper in the stock and the external hydrothermal deposits in the Paleozoic sedimentary rocks and Tertiary volcanics. In the alluvial area north of the stock anomalies of zinc, lead and copper occur. These anomalous values suggest possible nearby sources of metal content in the bedrock.

INTRODUCTION

The Tres Hermanas Tertiary granite-quartz monzonite stock, and to a limited extent the alluvial area to the north, were studied in respect to their base trace element content. Purpose of the investigation was to determine possible interrelationships of trace metal anomalies and known mineralized areas both within and without this so-called productive stock.

The Tres Hermanas Mining district has produced moderate amounts of lead and zinc; and to a very minor extent, silver, gold and copper (Griswold, 1961). Estimated production from all metals approximates \$500,000.

Location

The area investigated is in the Tres Hermanas Mountains, Luna County, New Mexico, and includes the Tres Hermanas Mining district. The area is a few miles northwest of Columbus and lies between long $107^{\circ}41'6''$ and $107^{\circ}48'30''$ W. and lat $31^{\circ}51'49''$ and $31^{\circ}57'6''$ N.

Previous Work

Lindgren's (1909) account of the Tres Hermanas district and Anderson's (1957) report are the most notable contributions. Darton (1916 and 1917) supplied additional information on the mineral deposits. Balk's (1962) geologic map and Griswold's (1961) report on Luna County are also useful.

GEOLOGIC SETTING

The Tres Hermanas Mountains consist essentially of a sub-circular granite-quartz monzonite stock intruded into Paleozoic and Cretaceous sediments and several types of Tertiary volcanic rocks. The stock was later intruded by monzonite, latite, and rhyolite dikes of Tertiary age and basalt dikes of late Tertiary or early Quaternary age. Alluvial fans studded with eroded basalt flows surround the mountains. East-dipping Paleozoic sediments are in contact with the northeastern and northwestern corners of the stock. Generally west-dipping Lower Cretaceous sediments crop out along the west side of the area in a northwest-trending ridge. Tertiary volcanics are exposed east of these and Quaternary gravels on the west. All except the Quaternary gravels are cut by numerous faults.

Lithologic Groups

The lithologic units in this area consist of sedimentary, intrusive and extrusive rocks (fig. 1).

Sedimentary Rocks

The sedimentary rock units consist of Silurian, Mississippian-Permian, Lower Cretaceous and Quaternary formations with some probable Tertiary alluvium beneath the more recent deposits (Kottlowski, F. E., and Foster, R. W. 1963). The Paleozoic sequence crops out north of the Tres Hermanas stock with a total thickness approximating 2,000 feet.

Rocks of probable Early Cretaceous age are approximately 1,530 feet thick. Because of faulting, the actual sequence is probably much thicker.

Quaternary sedimentary rocks consist of alluvial fan materials unconformably overlying all older rocks.

Intrusive Rocks

Intrusive rocks consist of: intrusive andesite, granite-quartz monzonite, monzonite, latite and rhyolite dikes, and basalt dikes.

Hornblende-rich intrusive andesite occurs as two subrectangular bodies (Griswold, 1961, p. 25) on the northeastern margin of the Tres Hermanas Mountains. The andesite is thought to be older than the quartz monzonite.

Granite-quartz monzonite forms a roughly circular stock of about ten square miles in the central part of the Tres Hermanas Mountains. The intrusive body invades the andesite flow sequence along the southern edge of the stock and Paleozoic sediments along the northern boundary. Apophyses extend outward from the central mass into the older rocks. Dikes with identical composition to the quartz monzonite stock, but varying in texture from aphanitic to porphyritic, occur in and extend outward from the stock along fractures.

Extrusive Rocks

Three main extrusive rock units of probable Tertiary age are recognized: early latite, intermediate andesite, and later latite.

The early latite consists of a sequence of breccias, tuffs and subordinate flows exposed along the western part of the district (fig. 1).

Andesites surround almost the entire southern edge of the Tres Hermanas Mountains. The rock is purplish gray, layered to massive, and is composed of flows, breccias, agglomerates and tuffs.

The later latite consists of breccias tuffs and flows. This unit crops out at the southern end of the Tres Hermanas Mountains (fig. 1).

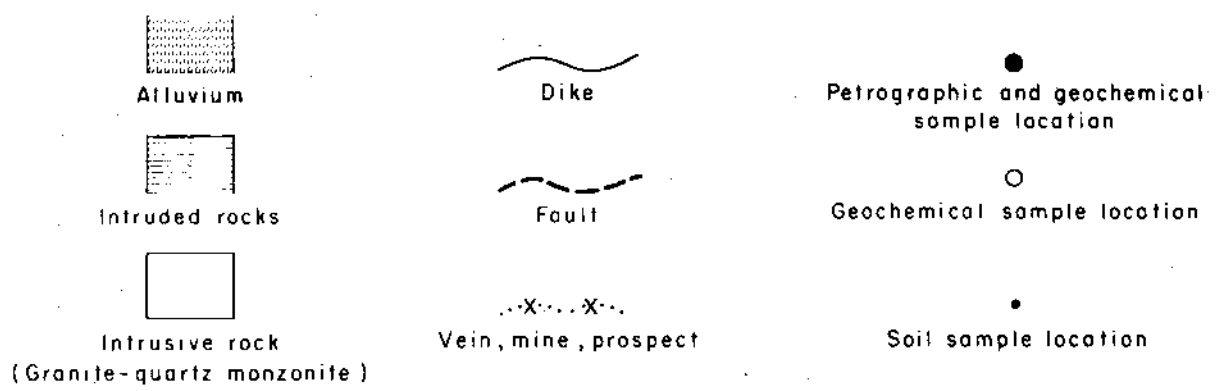
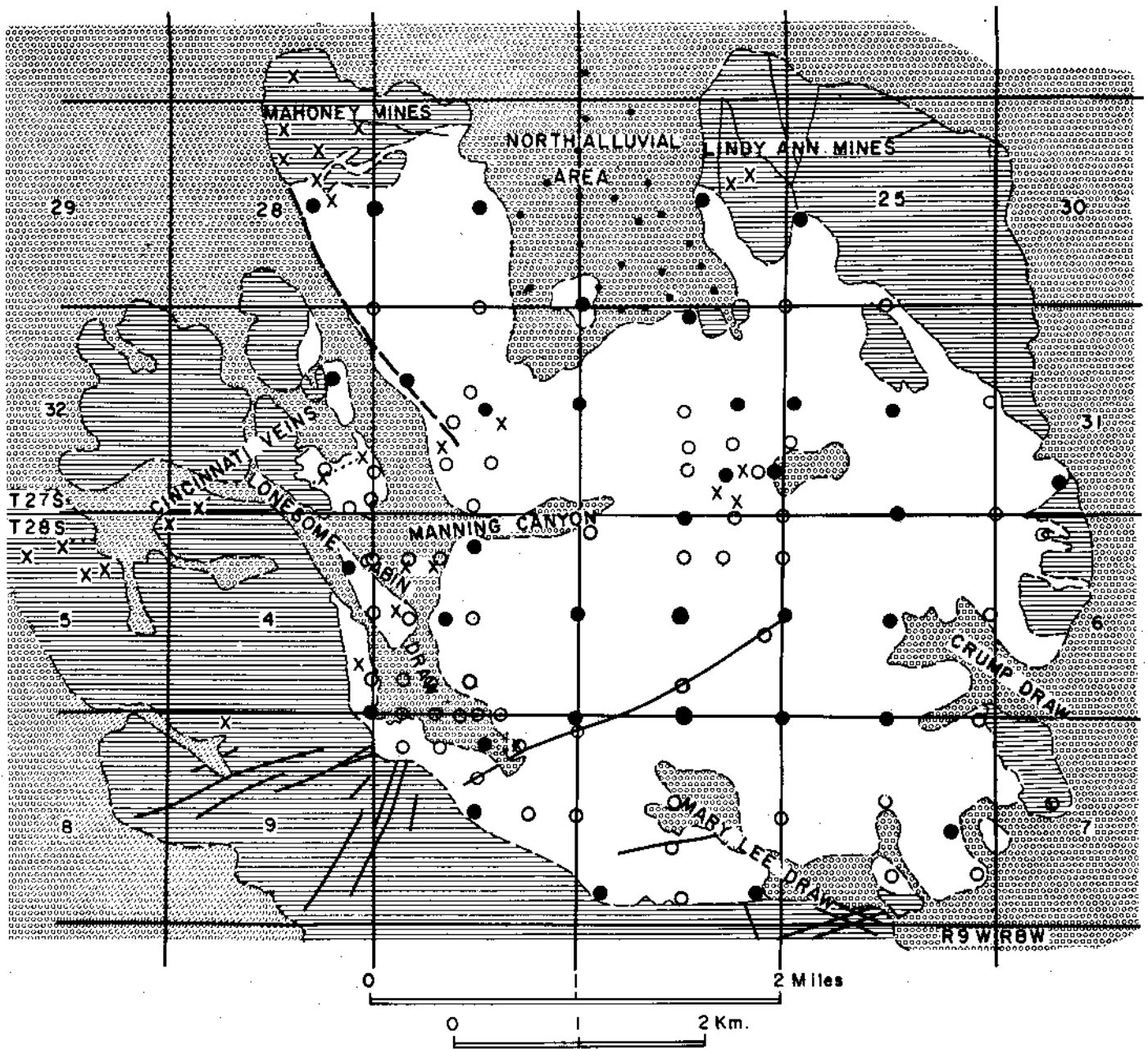


Figure 1 – Generalized geologic map of area.

Structural Setting

Major structural feature in the Tres Hermanas area is the sub-circular stock of granite-quartz monzonite. Xenolithic masses of marblized and silicified limestones up to half a mile in length occur at or near the granite-quartz monzonite intrusive contact (fig. 1). Dikes of monzonite, rhyolite, and latite of predominantly northeastward trends (although one is north northwest, and several are west northwest) and up to two miles in length, occur in the intrusive and andesite volcanic rock sequence.

Paleozoic sediments on the north end of the granite-quartz monzonite stock are gently to moderately inclined from northward to eastward. Cretaceous sediments of northwest trend and some very steep dips crop out about two miles west of the main stock. Structure of the Tertiary volcanic rocks has not been determined. Almost flat-lying, much younger eroded basalt forms an incomplete arc around the intrusive and intruded sedimentary and volcanic rocks.

Large-scale folds are unknown in the area. Faults are present and cut all rock units. As many as four sets developed.

The granite-quartz monzonite is highly jointed with two steeply inclined dominant sets of northeast and northwest trend visible. Two nearly horizontal and steeply inclined north-south and east-west sets are also present.

Igneous dikes in the area generally parallel the east-northeast fault set. A west-northwest set of dikes also occurs in the southeast part of the area.

Mineral Deposits

Types of mineral deposits in the Tres Hermanas area are: limestone replacement bodies (mantos), and vein deposits along vertical fractures and/or faults (Griswold, 1961, p. 51).

The manto-type ore bodies are the most productive in the district. These bodies are limited to the "lower marble unit" of the Escabrosa Limestone (Mississippian). The largest deposits occur in the Mahoney mines area adjacent to the northwest part of the stock.

The vein ore is similar to the manto ore bodies, though the ore zones are much more irregular. Mineralized zones are as much as four feet thick. Locally they may consist of numerous closely spaced veinlets. The veins are best developed in the latite flows and breccias and occur mainly to the west of the intrusive mass. There the west-trending steeply dipping Cincinnati-Marie vein system consists of a series of short disconnected veins with an aggregate length of 10,000 feet.

Mineralogy

The principal metals found in the Tres Hermanas Mining district are zinc and lead, with subordinate silver, copper and gold. A typical suite of minerals follows (Griswold, 1961, p. 61):

<i>Primary Zone</i>		<i>Secondary Zone</i>	
Ore	Gangue	Ore	Gangue
Sphalerite	Calcite	Willemite	Calcite
Galena	Pyrite	Calamine	Limonite
Chalcopyrite	Wollastonite	Smithsonite	Manganese Oxides
Willemite (?)	Garnet	Hydrozincite	Quartz
Scheelite (tactite zone)	Epidote	Cerussite	
Gold (vein zones)	Magnetite	Anglesite	
Silver (vein zones)	Quartz	Azurite	
		Malachite	
		Cerargyrite (?)	

GEOCHEMICAL PATTERNS OF ZINC, LEAD, COPPER

Background values for zinc, lead, and copper for the stock were calculated from fresh rock samples (1, 2, 6, 7, 9, 15, 55 and 56) showing least alteration. These results were used to determine the average background values for the heavy metal content of the stock. The average background value for zinc was 49 ppm, lead 33 ppm, and copper 6 ppm.

Anomalous patterns of zinc, lead and copper concentration of 99 samples collected from the Tres Hermanas stock are shown on figs. 2, 3 and 4.

Zinc

Using an average background value of 49 ppm of zinc for the stock, three major divisions of zinc concentrations are shown: 1) concentrations of zinc less than 80 ppm, 2) zinc values from 80 to 100 ppm, and 3) zinc greater than 100 ppm. High zinc concentrations occur in eight areas. Eight anomalous areas more than 100 ppm are shown in fig. 2.

Lead

Two major divisions are made for the lead content: 1) background to 50 ppm, and 2) over 50 ppm. Nine anomalous areas more than 50 ppm are shown on fig. 3.

Copper

High values of copper were not detected. The highest copper content (19 ppm) occurs in sample 50 in the northwest part of the stock. Two divisions are made: 1) concentrations above 10 ppm, and 2) copper concentrations more than 6 ppm but less than 10 ppm. Seven anomalous areas more than 10 ppm are shown on fig. 4.

Relation of Zinc, Lead and Copper Anomalies to Known Mineralized Areas

The outlined geochemical anomalies and the known mineralized zones both within and around the Tres Hermanas stock show definite spatial associations. The lead-zinc-copper anomalies are closely associated in space and occur near or adjacent to mineralization.

The lead-zinc producing Mahoney mines in the northwest part of the area are located north and slightly west of anomalies Z-1, L-1 and C-1. The Lindy Ann group of mines are just northeast of anomalies Z-2, L-2 and C-2 at the northeastern margin of the stock.

Low-grade lead-zinc content was recovered from an intensely pyritized zone in the areas of anomalies L-3, C-3 and the southern or lower part of anomaly Z-2, in the central part of the stock. Anomalies L-4 and C-4 and a narrow southwestward extension of anomaly Z-2 occur in the granite-quartz monzonite trending across the Manning Canyon and adjacent to the Lonesome Cabin Draw.

The lead-zinc Marie mine and mines of the Cincinnati vein system on the west central margins of the stock occur about 700 feet north of anomalies Z-3, L-5, L-6 and C-5.

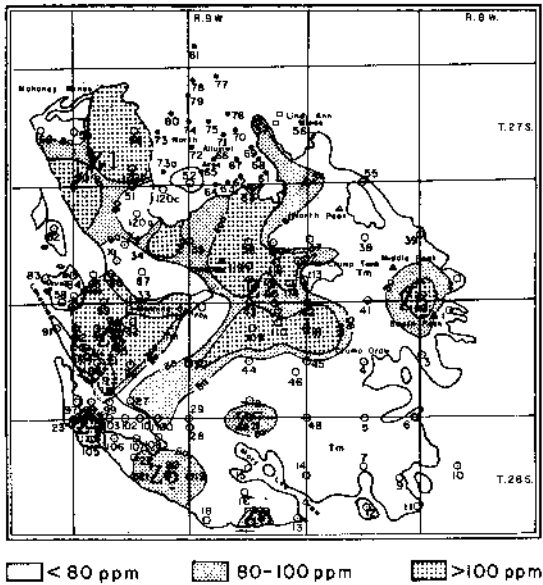


Figure 2 — Zinc content.
(anomalies marked Z)

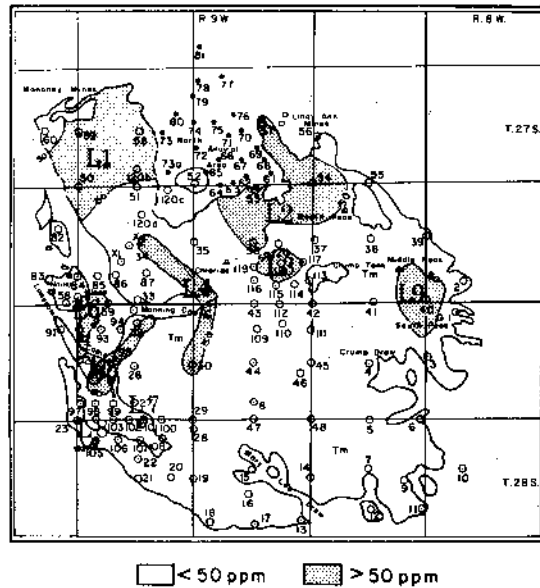


Figure 3 — Lead content.
(anomalies marked L)

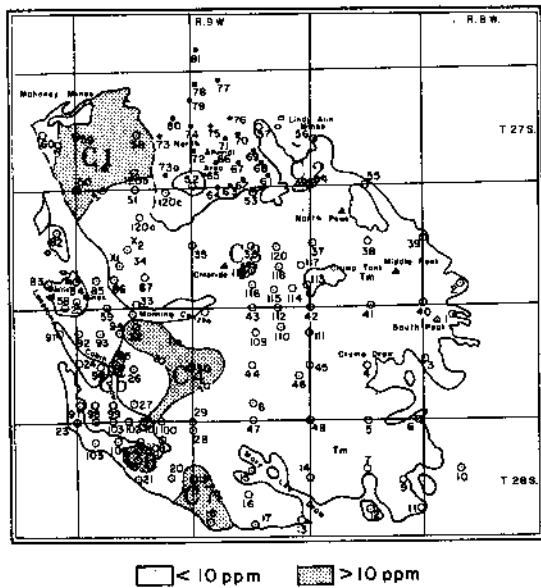
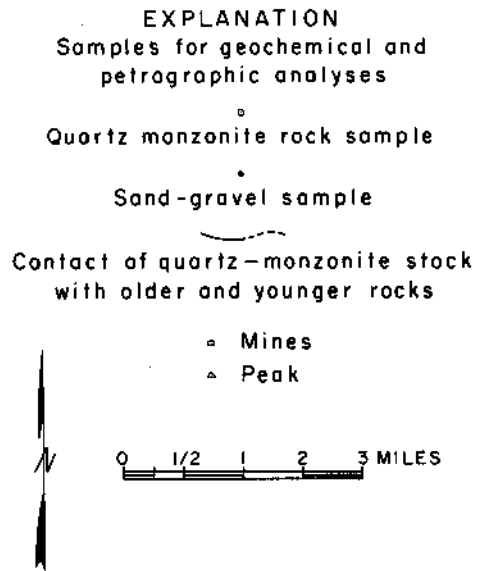


Figure 4 — Copper content.
(anomalies marked C)



GEOCHEMICAL PATTERNS IN NORTH ALLUVIAL AREA

An alluvial-covered area forms a conspicuous topographic and geologic re-entry into the granite-quartz monzonite stock in the northern part in sections 26, 24 and 34. A few rhyolite and latite dikes, limestone and granite-quartz monzonite exposures crop out in this area. These rocks appear to have been invaded by numerous small rhyolite and latite dikes.

Zinc, lead and copper content from the minus-120 fraction of all the alluvial samples gave the following results.

Zinc

Zinc concentrations (two times least background) are plotted in fig. 5.

Higher zinc concentrations are nearer the intrusive-sedimentary rock contacts and tend to increase upstream toward the granite-quartz monzonite. A possible enrichment of zinc occurs in the sedimentary rocks near or just to the south of the highest point of the zinc anomaly.

Lead

Lead values (two times least background) are shown by fig. 5. The lead results are somewhat similar to zinc except that the eastern high is absent.

Additional study is required to determine the possibility of lead-zinc mineralization in the areas of these anomalies.

Copper

Copper concentrations (two times more than background) are plotted in fig. 5 at a 1-ppm contour interval. The pattern of copper concentrations deviates a little from that of zinc and lead, behaving somewhat similarly to that expressed in the stock.

The zinc, lead and copper ratios for the alluvial area simulates those for the stock, and is in the same approximate ratio as that for past production for the area.

CONCLUSIONS

Intrusive Stock

A major conclusion is that the geochemical anomalies of zinc, lead and copper are spatially related within the stock; though the copper anomalies are neither as prominent, nor probably as significant.

Some anomalies of definite trends, and possibly significant in the genesis of mineral deposits occur in the northwestern corner of the stock near the Mahoney mining area. One anomaly occurs in the western part of the stock where the anomaly shows a somewhat westerly trend. In the southwestern part of the stock, another anomaly with a southwesterly trend occurs. The general east-west trend of the prominent zinc and lead geochemical anomalies in the intrusive body point directly toward the formerly productive Cincinnati-Marie vein-system of westerly trend in the Tertiary volcanic rocks. Whether mineralized replacement zones exist at depth in the covered sedimentary rocks in this area is not known. The probability, however, seems favorable.

Most of the major geochemical anomalies of zinc, lead and copper occur near the margin of the stock and in proximity to ore-susceptible formations. Ore-bearing solutions probably migrated

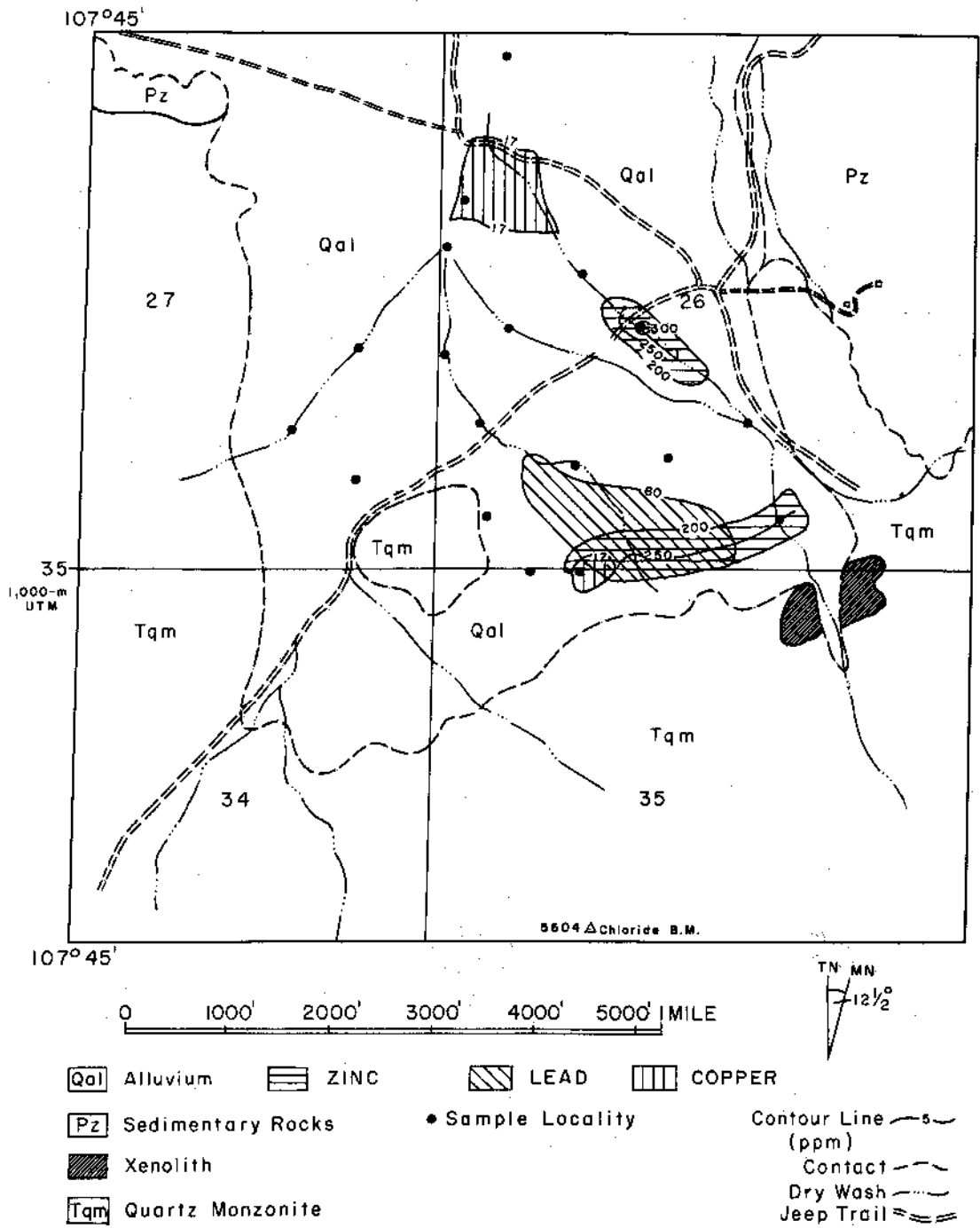


Figure 5 – Zinc, lead, and copper anomalies twice lowest value (ppm) in north alluvial area.

toward these more favorable stratigraphic horizons. Major geochemical anomalies in the central part of the stock are quite removed from the known sedimentary rock sequence. A possible receptive formation may have covered the intrusive body in this area at one time, as suggested by the xenoliths. Whether buried xenoliths carry ore mineralization is not known.

Thus, spatial relations do exist between geochemical anomalies of zinc, lead and copper among themselves and also with: 1) the north marginal Paleozoic sedimentary rocks and the known mineralized areas, 2) certain petrographic characteristics of the stock, and 3) rock alteration by argillization, sericitization, pyritization and chloritization. Ratios of metals in the high anomalies correspond to the ratio of metals mined from known ore bodies. Each of these empirical relationships might be used in a more intensive exploration program to outline favorable target areas within, and on the margins of, the intrusive stock.

North Alluvial Area

In the alluvial area, in sections 26 and 27, patterns of zinc and lead concentrations in the soils generally coincide. Higher-than-background values of these metals occur in the southern part of the area near the presumed sedimentary-intrusive contact. Copper, which is low (maximum 20 ppm), has its higher values in the downstream side of the alluvial area and does not coincide with the patterns for lead and zinc. The ratio of highest zinc:lead:copper concentrations in the alluvial area is 3:1:0.2. The highest value of zinc occurs in the mid-northeastern side of the alluvial area; the highest value of lead, in the southern part of the alluvial area near the contact; the highest value of copper, in the northcentral part of the alluvial area. Potential mineralized zones for zinc in the bedrock are in the southern part of the alluvial area near the contact and in the northwestern part near the contact. Possible lead mineralization may occur in the southern part near the contact. Copper mineralization is not as favorable, though anomalous areas occur in the central part of the alluvial area and in three locations in an arcuate area bordering the southern contact. More detailed sampling, geologic mapping, and some physical exploration should yield adequate data to evaluate the economic potential of these anomalous areas.

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