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J. A. KRUG, SECRETARY

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BUREAU OF MINES  
JAMES BOYD, DIRECTOR

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REPORT OF INVESTIGATIONS

INVESTIGATION OF ZINC-LEAD DEPOSITS ON EXTENSIONS  
OF THE MIAMI TROUGH, OTTAWA COUNTY, OKLA.,  
AND CHEROKEE COUNTY, KANS.



BY

CLINTON C. KNOX



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OTTAWA COUNTY, OKLA., AND CHEROKEE COUNTY, KANS.

By Clinton C. Knox<sup>2/</sup>

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<sup>1/</sup> The Bureau of Mines will welcome reprinting of this report, provided the following footnote acknowledgment is used: "Reprinted from Bureau of Mines Report of Investigations 4415."

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## INTRODUCTION AND SUMMARY

Attention of mine operators and engineers in the Picher zinc-lead field has been drawn increasingly in recent years to marginal ore deposits lying at greater than normal depth below surface in the marked structural depressions known as the Miami and Bendelari troughs.

Not only mining but prospect and development drilling is relatively costly in the bottoms of the structural depressions known as the Miami and Bendelari troughs which cross the center of the Picher field. Nevertheless, operations by various mining companies in recent years have shown that no insuperable problems exist, and with the gradual lowering of grade cut-offs throughout the field, certain potential deep-ore areas, previously only partly explored, seemed worthy of further investigation. Some such areas were called to the attention of Bureau of Mines engineers by lease holders and operators, while others were noted in the course of the Bureau's systematic investigation of Tri-State ore reserves. The writer was assigned to make a study of these possible "trough extensions," in the course of which all available mine maps, drill logs, and prior reports were assembled. Subsequently 41 churn drill holes were bored by the Bureau in the periods October 1944 to May 1945 and October 1946 to April 1947.

The general area under investigation in this project is indicated on figure 1, which likewise shows its relation to nearby towns, roads, and railroads. The location of individual deposits included in the report is indicated more clearly on figure 3.

Mineable ore was found in only two holes, and the structural information procured by drilling was less encouraging than anticipated. This report, however, presents all factual data obtained, in the belief that they may be useful in subsequent prospecting and development projects in the areas investigated. There are also set forth some of the stratigraphic data relative to the Picher field as a whole and the Miami and Bendelari troughs which were assembled in the preliminary investigation of this project.

## ACKNOWLEDGMENTS

The writer, as engineer in charge of the Miami-trough extension project and of the preliminary investigation, was assisted by H. J. Ballinger, mining engineer. General supervision was given by C. H. Johnson, then chief of the Rolla Branch, Mining Division. Acknowledgment is gladly made of the assistance, information, and advice received from the many operators, lessees, owners, drillers, and others concerned with the project. Particularly appreciated was the privilege of underground examination, study of maps, drill records, cuttings, and other data courteously extended by the Eagle-Picher Mining & Smelting Co., the MacArthur Mining Co., the C. K. & E. Mining Co., the Lavrion Mining Co., K. L. Koelker and Carl Plumb (consulting mining engineers), and George M. Fowler (consulting geologist).





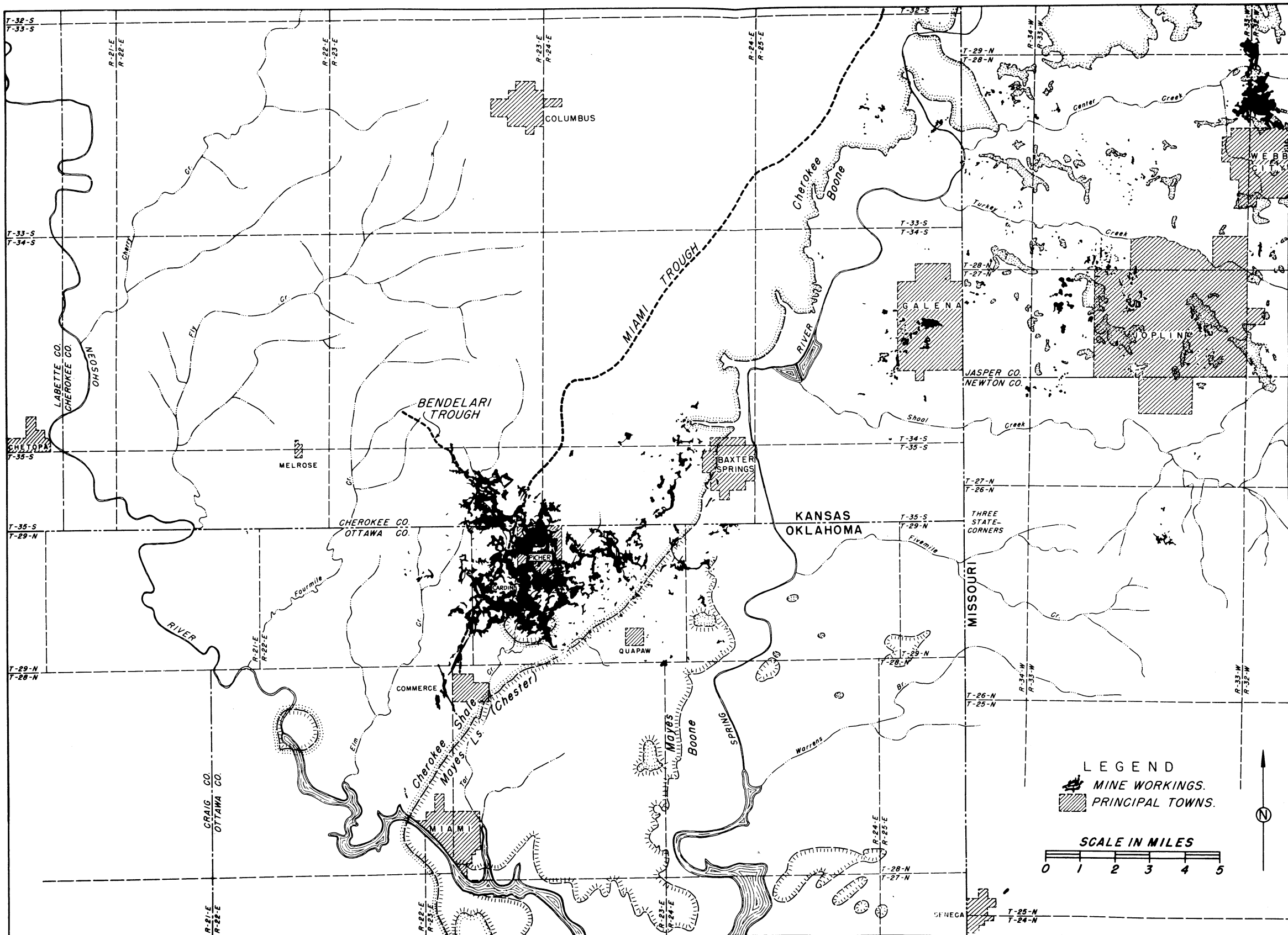


Figure 2. - Ore deposits and general geology of the Tri-State region.





The State Geological Survey of Kansas published results of geophysical investigations on each of the Karcher and Mullen properties of the north Miami-trough area in 1942.<sup>3/</sup> The Federal Geological Survey in 1943 published a set of six maps by E. T. McKnight and others showing much of the structural geology and dolomitized areas in the Picher field, with detailed mapping in areas along the Miami trough. About 1925, the Federal Geological Survey published a set of "subshale" maps by C. E. Siebenthal, which outlined a part of the trough system by showing the configuration on the base of the Cherokee shale. Uncompleted at the time of Siebenthal's death was another set of Picher-field maps showing the elevation of the top of the Short Creek oolitic limestone. The map was complete wherever the necessary data had been furnished by the many cooperating engineers, geologists, and mine and drill operators during the churn drilling up to that time. Some of the same or similar data were furnished the Bureau for use in this report.

#### LOCATION AND ACCESSIBILITY

The Miami trough structure, with an irregular northeasterly trend, extends from about one-half mile west of Commerce, Okla., to a point just west of the MacArthur mine in sec. 6, T. 35 S., R. 24 E., in Cherokee County, Kans. (fig. 2). It is believed possible that the trough may extend southwest to Vinita, Okla., and northeast as far as Asbury, Mo. The areas investigated and reported herein lie in the Picher mining field and are as follows:

1. Crow tract, 1/2 mile southwest of Commerce, Okla., in the NW1/4 sec. 12, T. 28 N., R. 22 E.
2. MacArthur-Sparlin tracts, 5 miles west of Baxter Springs, Kans., on paved highway, U. S. 166.
3. Karcher tract in SW1/4 sec. 34, T. 34 S., R. 23 E.
4. Garrett tract in the NW1/4 sec. 36, T. 34 S., R. 23 E. Paved highway U. S. 69 crosses U. S. 166 5 miles west of Baxter Springs, near the MacArthur mine.

A network of good roads extends throughout the entire Tri-State mining region and access to all mines is relatively easy and convenient. A number of cities and small towns exist throughout the region (fig. 1) where mining labor, and supplies are ordinarily plentiful.

#### PHYSICAL FEATURES AND CLIMATE

The surface of most of the Picher mining field is devoted to farming, except where mining and milling plants, tailing and boulder piles, or occasional caved mines have mutilated the level surface terrain. The surface

<sup>3/</sup> Jakosky, J. J., Dreyer, R. M., and Wilson, C. H., Geophysical Investigations in the Tri-State Zinc- and Lead-Mining District: Kansas State Geol. Survey Bull. 44, pp. 92-100 and 119-130.

drainage is southward along Tar Creek and its small branching seasonal tributaries, which flow into the Neosho River arm of Grand Lake below Miami, Okla. The gentle surface topographic relief of the Picher field slopes from about 800 feet above sea level in Miami up to a maximum of 950 feet on the highest hill in the Picher field - Blue Mound, near Treece, Kans.

Climate and precipitation are generally moderate, affording excellent year-round mine- and mill-operating conditions.

#### GENERAL GEOLOGY

The Tri-State mining region, which has produced over a billion dollars in zinc and lead concentrates, lies on the northwest flank of the Ozark uplift. Various sedimentary strata of shale, sandstone, limestone, chert, and dolomite of several geological systems overlie the granitic basement rocks. Sedimentary thickness ranging from 1,045 to 1,815 feet has been recorded in the few deep wells that have reached the basement rocks in the Tri-State district.

The ores occur in Mississippian formations named in descending order - the Carterville (Chester), Warsaw, Keokuk, Burlington, Reeds Spring, and Fern Glen. Excluding the Chester, these are known as the Boone formation. Unconformably overlying the Chester is the Pennsylvanian Cherokee shale, which covers the greater part of the Picher field, and reaches maximum known depths of 400 feet in certain structurally low areas. The Chester limestone, only occasionally ore-bearing, ranges in thickness from 0 to 150 feet and likewise lies unconformably on the next lowest formation. In the Boone, 16 thin-bedded limestone, dolomite, and chert horizons, which are often recognizable, have been designated from the top down as the B to R beds.<sup>4/</sup> Below the Boone are the Northview shale, Compton limestone, and Chattanooga shale of the Kinderhook group; the Chattanooga underlies only the extreme southern edge of the district. Below the Mississippian rocks is the Cotter limestone of Ordovician age. Deeper sedimentary formations are not reached in ordinary mining or exploratory drilling.

Beds E, G, H, K, M, O, P, and R have yielded the most ore. The mineralization has been controversially ascribed to ascending hot solutions,<sup>4/</sup> artesian circulation,<sup>5/</sup> or descending ground waters.<sup>6/</sup>

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<sup>4/</sup> Fowler, G. M., and Leyden, J. P., The Ore Deposits of the Tri-State District: Trans. Am. Inst. Min. and Met. Eng., vol. 102, 1932, pp. 206-251. See also Knox, C. C., The Melrose Zinc-Lead District, Ottawa County, Okla., and Cherokee County, Kans.: Bureau of Mines Report of Investigations 4337.

<sup>5/</sup> Siebenthal, C.E., Origin of the Zinc and Lead Deposits of the Joplin Region, Missouri, Kansas, and Oklahoma: Geol. Survey Bull. 606, 1915, 283 pp.

<sup>6/</sup> Fowler, G.M., Tri-State Geology: Eng. and Min. Jour., vol. 144, No. 11, 1943, pp. 73-79.

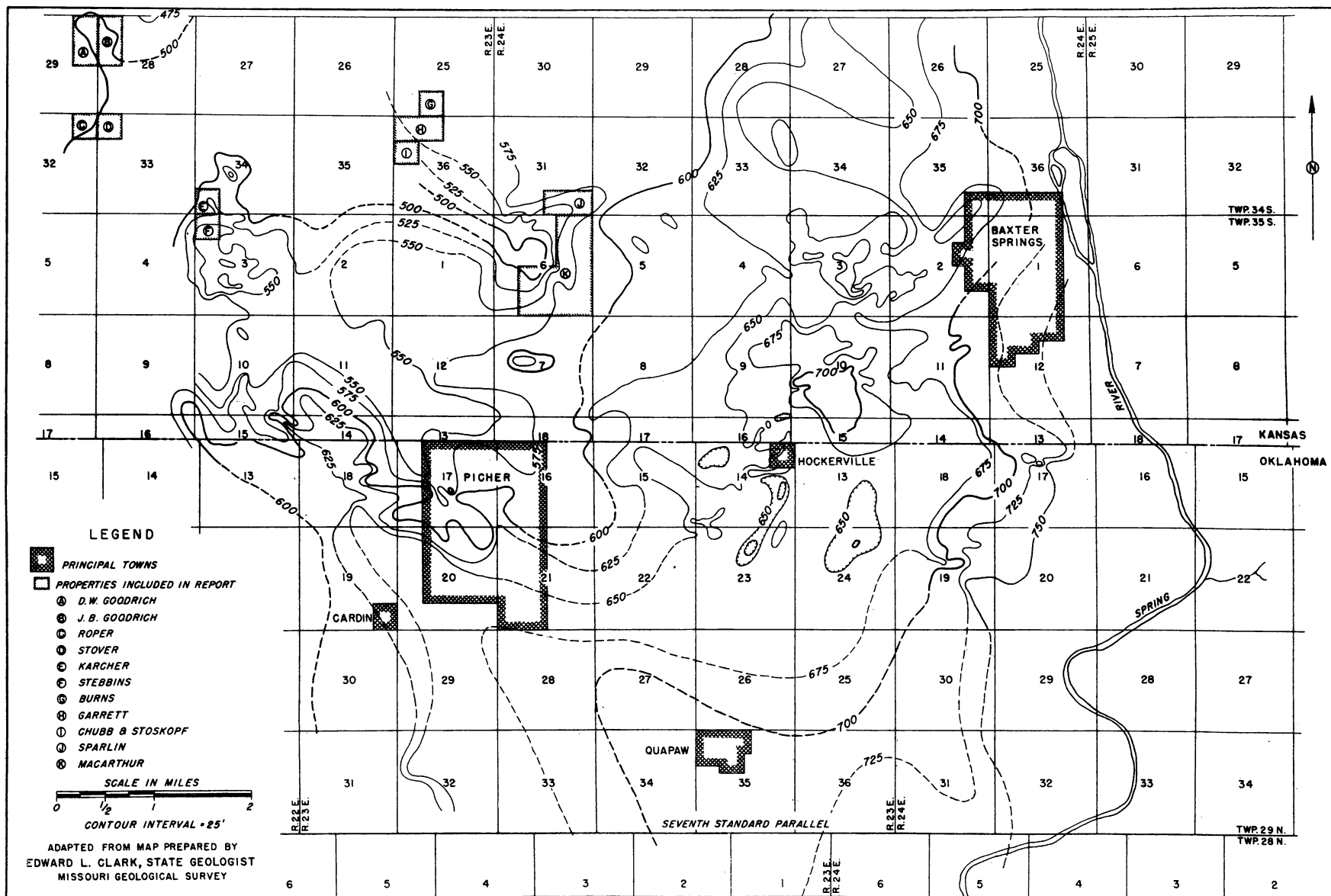


Figure 3. - Contours on top of Short Creek oolite.







Regardless of its origin, however, the ore is generally believed to be related to certain structural features and presumably is formed by disturbances that have prepared the rocks for replacement and deposition.<sup>1/</sup>

Throughout the Tri-State district as a whole, there is a prevailing gentle dip to the northwest, obscured locally by erosional unconformities and marked structural irregularities. In the Picher field the Miami trough, striking northeast, and the Bendelari trough, striking northwest, intersect in the heart of the productive area (fig. 2). The position of the Miami trough is most clearly revealed by the configuration of the base of the Cherokee shale (fig. 4).

For the purpose of mapping structure and finding ore, the recognition of beds and markers in the mines - particularly in churn-drill cuttings - is of great practical importance. The Short Creek oolitic limestone bed (at the top of the M bed) wherever recognizable is a useful marker and is commonly so used. Elevations on the Short Creek in the Picher field are given in figure 3. The trough structure tends to disappear at this horizon. The oolites are often obliterated however in the ore zones and in other highly fractured and altered areas. A more consistently recognizable horizon in all the Tri-State mining region is the N bed, which is the top stratum of the Grand Falls chert horizon, occurring in the Picher field 25 to 70 feet below the Short Creek oolitic limestone. The N bed is almost always recognizable by its hard, dull-white "porcelain" chert appearing in the churn-drill cuttings within an inconsequential 5- to 10-foot limit of error, even in fractured and altered areas. The typical large, flat, dull-mottled, white primary N bed chert nodules, usually about a foot thick and 8 to 15 feet in diameter are often embedded in some limestone, cotton rock, or secondary glassy chert and are very easily recognized in underground mine workings. The base of the J bed overlies the Short Creek oolitic limestone from 0 to 45 feet and clearly marks the unconformity at the Warsaw-Keokuk contact. The small brown-phosphate pebbles often seen underground marking the contact are said to have first been pointed out by C. E. Siebenthal of the Federal Geological Survey. Those, along with the more consistent greenish to black glauconitic silty limestone of the J bed throughout the Tri-State mining region, are familiar to churn drillers and miners. The J bed furnishes useful approximate reference to the location of the conformable underlying Short Creek oolite and the N-bed chert, and ordinarily prevents mistaking similar white chert sometimes found in D, F, L, and other beds for that of the N bed when structural configuration is mapped.

The zinc and lead ore deposits presumably resulted from replacement along permeable channels in the Mississippian strata. They occur both in steeply dipping runs and as flat-bedded deposits.

The ore trends are believed by some to follow prevailing northeast-southwest and northwest-southeast trends; fracture zones of such directions presumably would result from formation of the major trough structures.

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<sup>1/</sup> Work cited in footnote 6.

referred to, but any such system is largely obscured by the existence of numerous trends and "runs" in other directions. This situation, added to irregular distribution of the ore through many horizons and sharp structural disturbances of the ore-bearing formations, greatly increases the cost of finding and developing the ore bodies.

The Tri-State ores are such that clean, 60-percent zinc concentrates and 78-percent lead concentrates are easily produced; relatively low mining and milling costs can be attained in large-scale open breast-stopping operations. For the first 6 months of 1947, Tri-State region mining operations yielded a total average production of approximately 5,000 tons of zinc concentrate and 800 tons of lead concentrate per week from the mining of a large tonnage of crude ore which averaged only 1.85 percent zinc and 0.30 lead.

### HISTORY

The general history of development, drainage, and mining in the phenomenal Picher field, beginning with the early discoveries of ore near Commerce, Okla., about 1909, is familiar. Some of the more recent developments are significant from a geological standpoint and with respect to prolonging the productive life of the Tri-State Mining region.<sup>8/</sup>

In the interconnected Oklahoma and Kansas mines alone, 25 million gallons of water is pumped each day to maintain the present (July 1947) drainage status. That required pump output is maintained by some 20 mining companies operating 50 pumping plants in the Picher mining field. The large drainage cost is now principally supported by the large-scale, low-cost; mechanized mining operations having large reserves of marginal ore.

During 1945, the Eagle-Picher Mining & Smelting Co. carried on churn drilling exploration, unwatered and drained the deep Foley deposit in the northwest corner of sec. 7, T. 35 S., R. 24 E. This deposit occurred on the M bed horizon at an unprecedented 400- to 450-foot depth along the east wall of the Miami trough. The Foley deposit was also extended by more churn drilling southwesterly into the adjoining Jarrett property and northeasterly into the adjoining Mullen tract. During several previous years, Kansas Explorations, Inc., had operated shallower mines in the immediate vicinity on these three properties where ore was mined only from deposits in the Chester limestone at depths of 220 to 300 feet. Following its deeper developments on the Foley-Mullen-Jarrett deposit, the extensive churn-drill exploration campaign of the Eagle-Picher Mining & Smelting Co. was projected northward onto the Davies, Alva Chubb, J. Orr Chubb, and Foley B leases in the adjoining secs. 1, 6, and 31. The various indicated and inferred marginal ore reserves in that large area ranged in depths to slightly over 500 feet below the surface, often in the Reeds Spring horizon.

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<sup>8/</sup> Ruhl, Otto, Tri-State Zinc-Lead Ore Reserves: Bureau of Mines Report of Investigations 3922, 1946, 7 pp.



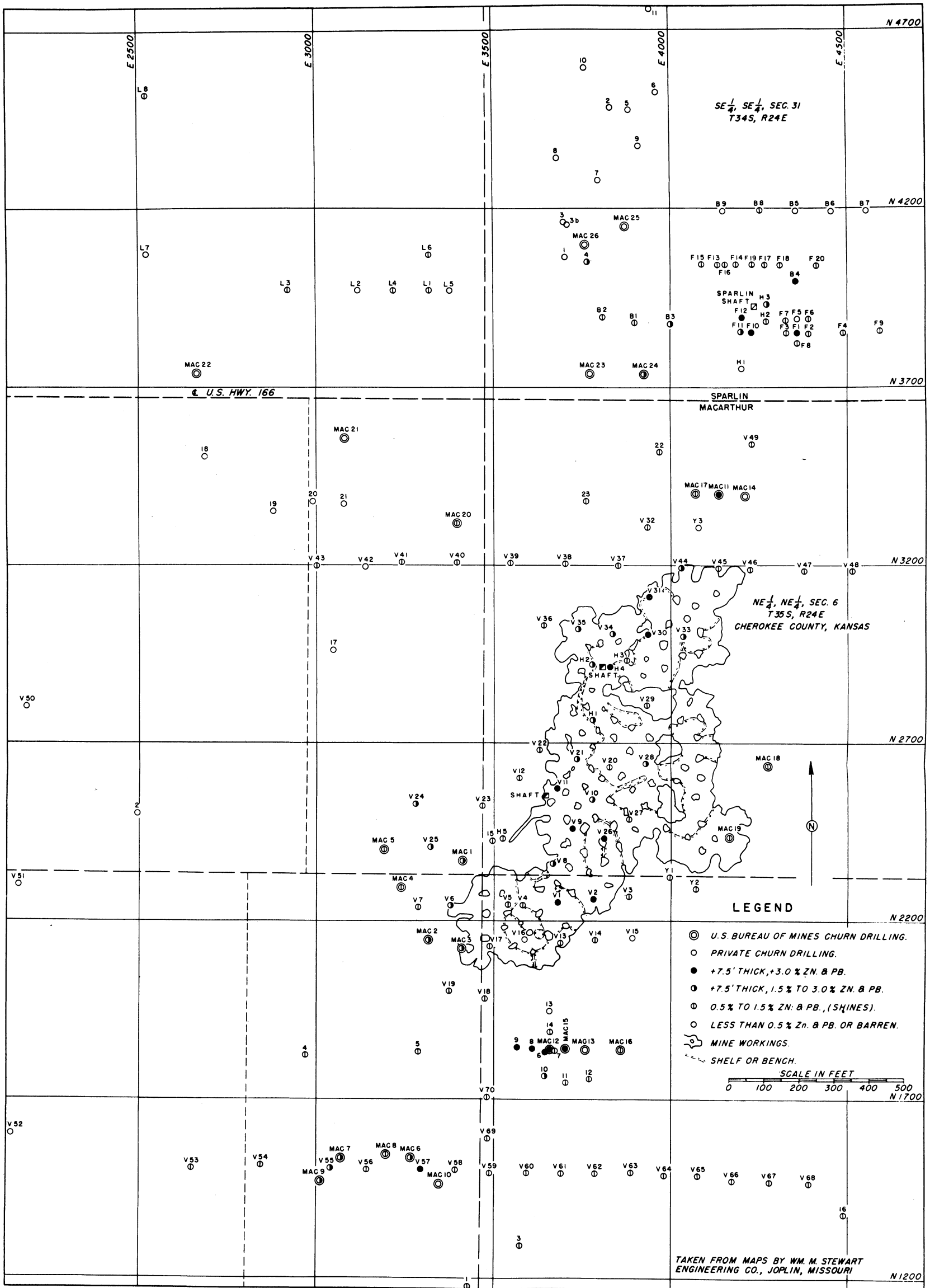


Figure 5. - Churn drilling on MacArthur and Sparlin deposits.



## CHURN DRILLING BY THE BUREAU OF MINES

Properties in the Miami-trough area on which the Bureau of Mines did some churn drilling and the work on the Miami-trough extension project are described under respective headings that follow in the text. Logs of the 19 holes drilled by the Bureau of Mines on its MacArthur project in 1944-45 and the 22 holes more recently completed on 5 properties during its Miami-trough extension project in 1946 and 1947 are given in the Appendix. Churn drilling and sampling procedure followed the practice developed by local operators and the Bureau of Mines in the Tri-State mining district.

MacArthur Mines

The property known as the MacArthur (Embry) comprises all of the NE1/4 sec. 6, T. 35 S., R. 24 E., Cherokee County, Kans., except about 35 acres on the west side of the NW1/4NE1/4 (fig. 5). The MacArthur Mining Co. also operates the new Sparlin mine on the northward adjoining 80 acres in the S1/2 SE1/4 sec. 31, T. 34 S., R. 24 E.

Churn drilling was begun in 1916 and now totals 122 holes on the MacArthur tract, mostly drilled by the Vinegar Hill Zinc Co. in 1923 to 1927. The Bureau of Mines drilled 19 holes on the MacArthur during 1944-45 and two holes in 1946. Drilling and mining on the MacArthur and Sparlin tracts to early 1947 are shown in figure 5.

From 1923 to 1945 the Eagle-Picher, St. Louis, Federal, Beck and MacArthur companies churn-drilled 51 holes on the Sparlin tract; the Bureau of Mines drilled 5 holes in 1946-47.

Although the projected centerline of the Miami trough crosses the Sparlin tract, no deep basin, such as those to the south, is present there. As shown in figure 4, contouring on the base of the shale reveals saddles or bridges across the Miami trough at intervals throughout its explored length. Stratigraphically high-run ore deposits cross the Miami trough in some of those shallower bridges.

The ore in the new Sparlin mine, where the MacArthur Mining Co. sank a 335-foot shaft late in 1946, occurs in the M bed from 300 to 335 feet in depth. Drilling indicates that the reserves pitch down sharply to the Reeds Spring horizon (400-foot level) 200 feet west of the new shaft. Although the extensive underground workings in the MacArthur mine nearby on the south are drained to the 420-foot level, considerable troublesome water inflow was encountered in the new Sparlin shaft at 320 feet. None of the five Bureau of Mines holes definitely indicated ore; nor have they been cut by Sparlin workings, as drifting from the new shaft was just being started, and little production had resulted up to the end of June 1947.

After drilling four check churn-drill holes in 1942, the MacArthur Mining Co. obtained an RFC loan for the initial MacArthur-mine development and drainage. Two 390-foot shafts were sunk, and production was begun near the close of 1942 and continued uninterrupted.

The typical sheet-ground MacArthur ore deposit has been mined from 375 feet in depth in the Grand Falls chert horizon down to 420 feet in depth, which includes about 20 feet of the Reeds Spring horizon. Structurally the MacArthur deposit is localized on a large dome or nose on the east wall of the Miami trough. Because of the many crevices in the cherty sheeted-ore horizon and the heavy artesian sulfur-water flow, recovery of drill cuttings was very difficult and occasionally impossible. It is interesting to note that the actual production to date has almost tripled an ore-reserve estimate made before the initial mine development in 1942.

Many of the old drill holes, as well as some of the first Bureau of Mines holes, indicated freak ore in shallow horizons just below the Pennsylvanian shale in northwesterly striking cross fractures north and south of the MacArthur mine workings. Since the shallow ore bodies cannot be reached practically by any of the present mining development and are too small to warrant separate development, they are not expected to be minable. By the middle of 1947, MacArthur underground mine workings had reached only 2 of the total 21 holes churn-drilled by the Bureau of Mines on that property. The ore around them has been of higher grade than the submarginal indications given by the churn-drill samples.

#### Garrett Mine

The Garrett mine (fig. 6) is in the NW1/4 NW1/4 sec. 36, T. 34 S., R. 23 E., 1-1/2 miles west and 1 mile north of the MacArthur mine. The Garrett ore deposit, 380 to 448 feet in depth, lying partly in the Reeds Spring horizon, extends into the Chubb-Stoskopf property adjoining on the south and into the Burns tract adjoining on the north.

Beginning in 1924 John Green churn-drilled 30 holes on the Garrett lease and 32 holes on the Chubb-Stoskopf lease. On the results of that drilling he was able to interest the Commerce Mining & Royalty Co., which in 1928 drilled 22 holes on the Garrett, 12 on the Chubb-Stoskopf, and 12 on the Burns tract. The properties were subleased to Eagle-Picher Mining & Smelting Co., which drilled 9 more holes on the Garrett tract and 8 on the Burns, besides obtaining other leases in the vicinity and drilling 6 holes on the A. B. Thomas land adjacent on the northwest and 8 holes on another Thomas tract to the southeast. In 1937 the Eagle-Picher Co., began preparations to sink the initial shaft on the Garrett tract.

After unwatering and sinking a 6- by 9-foot shaft to 442 feet in depth, an 80-foot crosscut was driven on the 437-foot level toward the indicated ore reserves, after which the lease was abandoned early in 1939. Thereafter the property remained idle until 1945, when Walters and Childress obtained the lease and drilled one more hole. Then Clarence Zuvekas obtained the Garrett and surrounding leases, totaling 400 acres, and during 1946 drilled eight holes on the Garrett tract, averaging 445 feet in depth, which appreciably extended the indicated ore reserves. In 1947 the Bureau of Mines

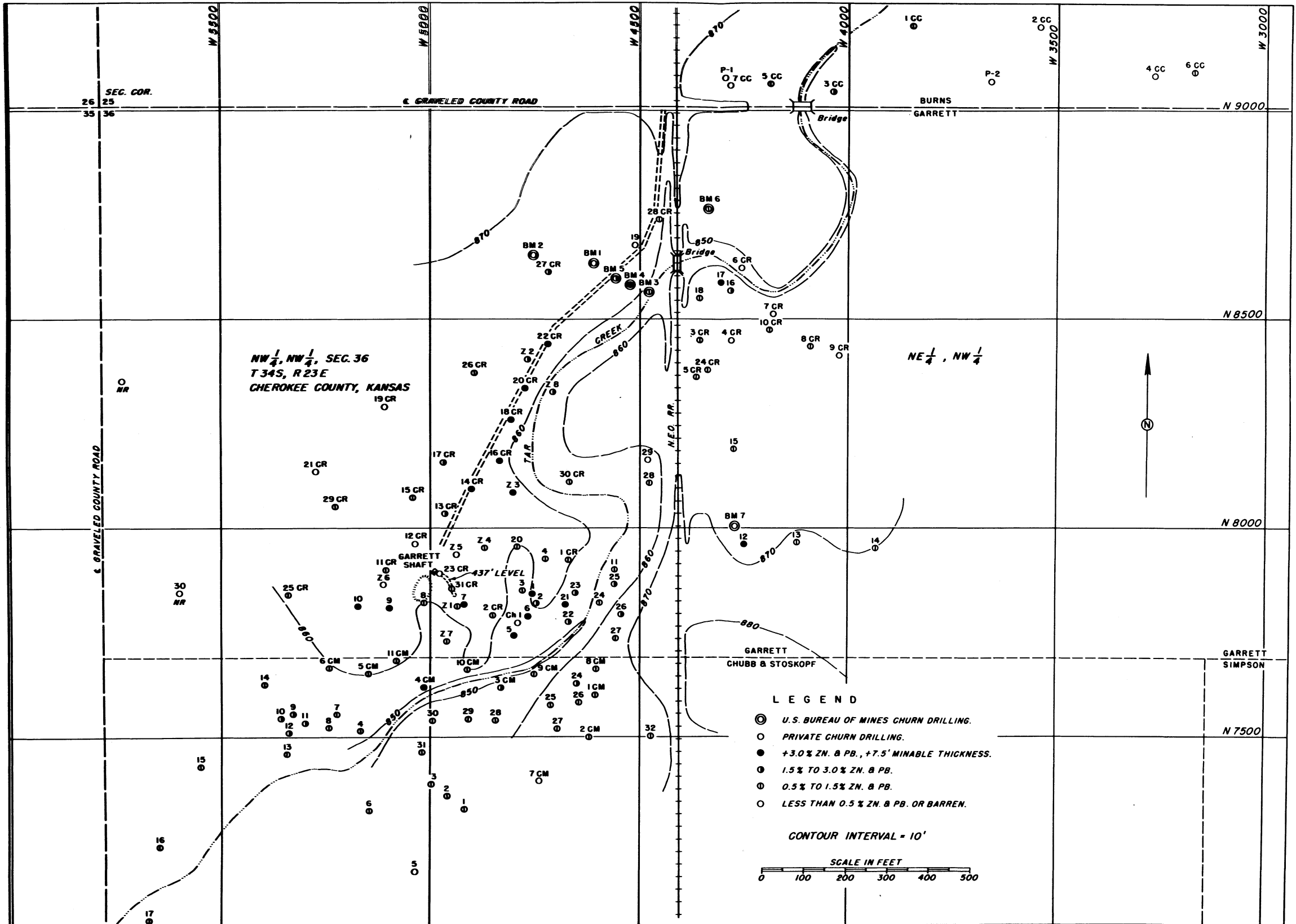


Figure 6. - Churn drilling on Garrett-Chubb-Burns deposit.



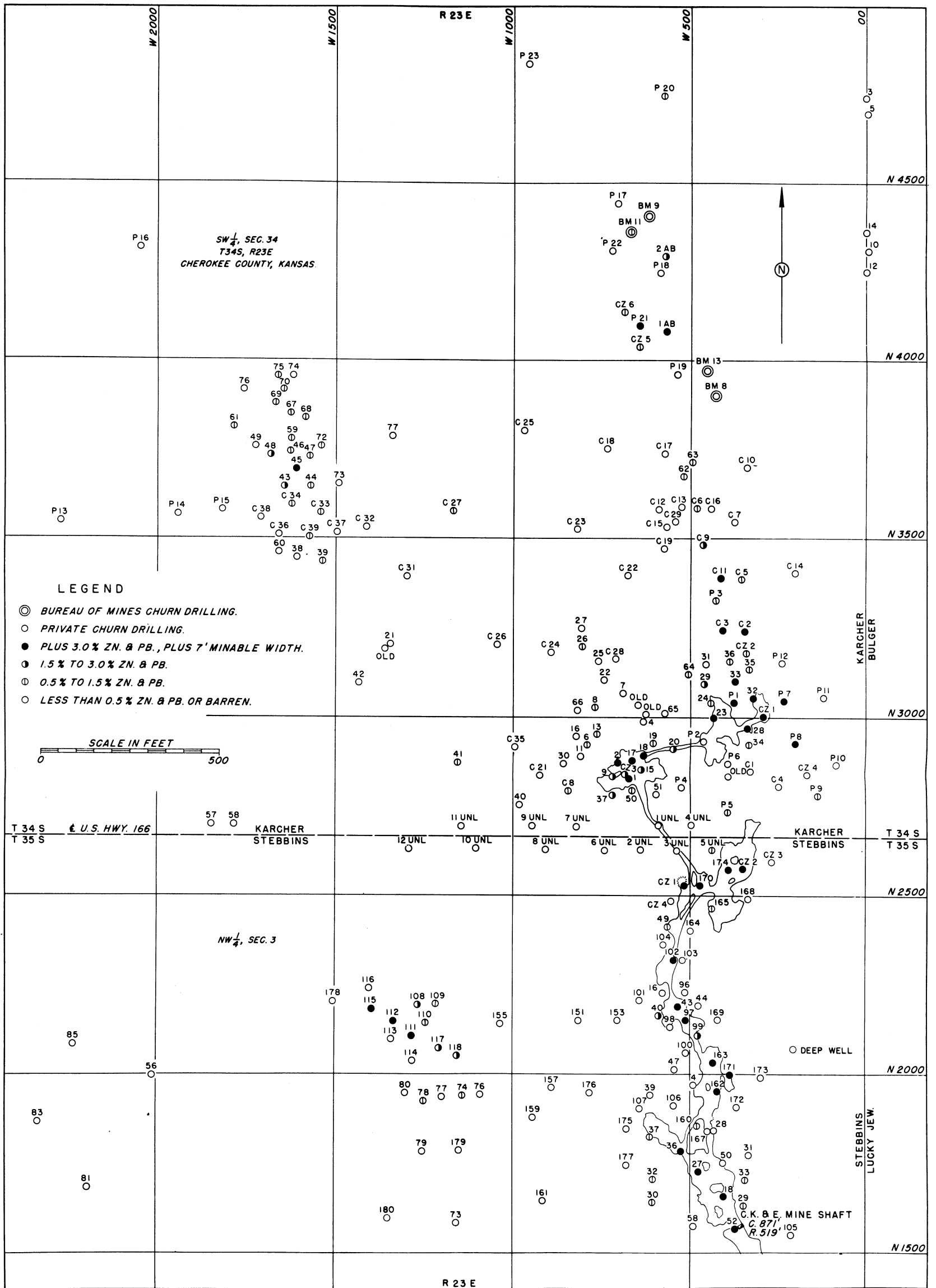


Figure 7. - Churn drilling on Karcher deposit.





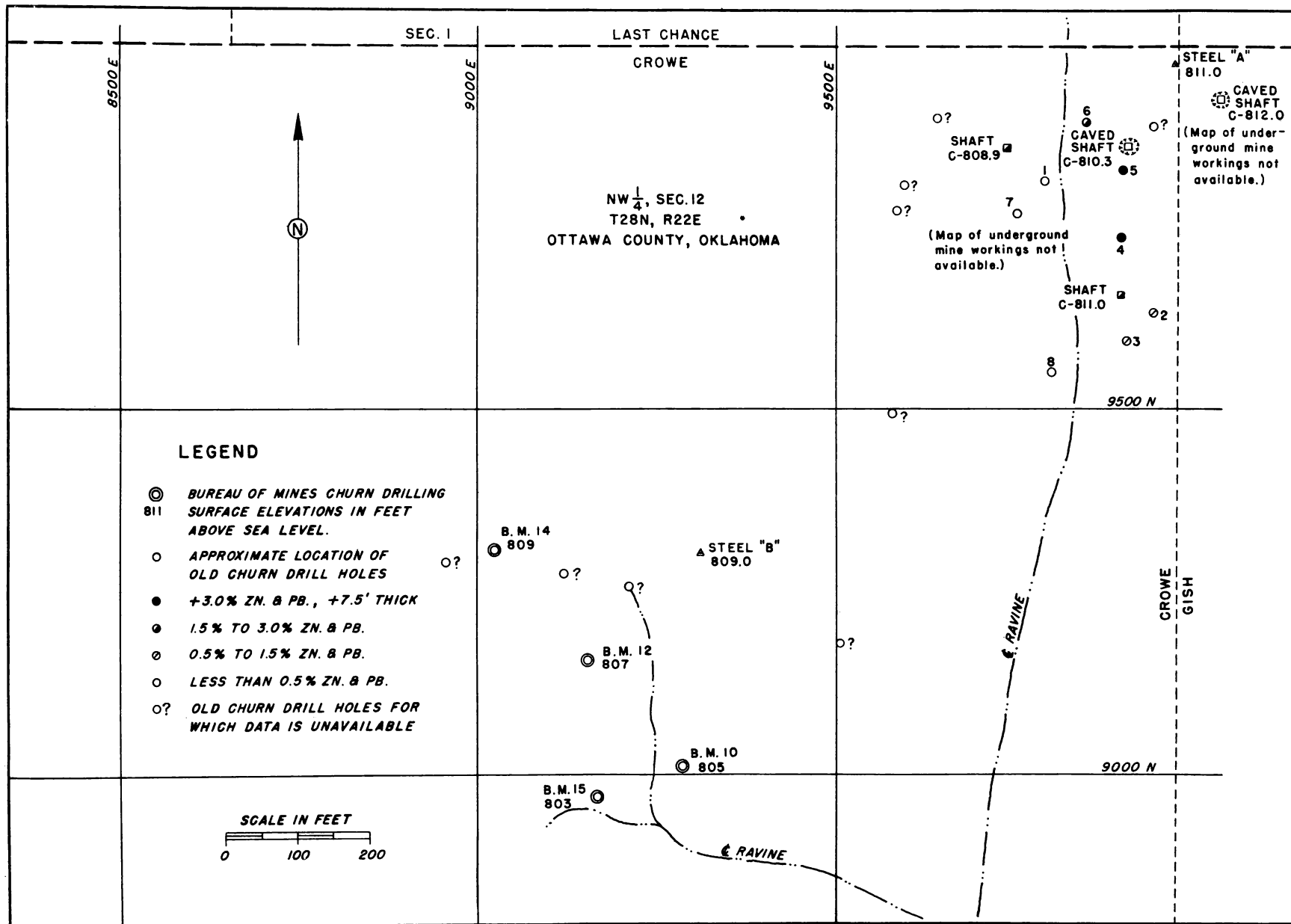


Figure 8. - Churn drilling on Crowe deposit.



drilled seven holes in flanking inferred-ore areas, which further extended the indicated ore reserves.<sup>9/</sup>

Stebbins and Karcher Mines and Other Leases  
of the C. K. & E. Mining Co.

In 1941 the newly formed C. K. & E. Mining Co., owned by C. L. Childress, K. L. Koelker, and F. W. Evans, obtained the Stebbins lease and reopened the mines on it. Expected to be only a relatively small clean-up mining operation, it was soon extended by underground drifting development and exploration and lengthened the northwestern arm of the productive Picher mining field another 1/4 mile along the Bendelari trough.

Subsequently the C. K. & E. Mining Co. obtained leases on about 400 acres of virgin land extending about 2 miles farther northwestward along the same trend. This acreage (fig. 7) included the Karcher, Goodrich, Roper, Stover, and other ore deposits, which had previously been indicated and inferred by old churn drilling in the days when such flooded marginal ores, ranging from 340 to 440 feet in depth, were considered unminable.

The Karcher deposit, occurring in the M bed from 340 to 400 feet in depth 300 feet north of the Stebbins line, was indicated to be too small to warrant sinking a new 400-foot shaft. Therefore, a crosscut in waste was driven from the extreme northward Stebbins workings to initiate development of the Karcher. A flood had been anticipated upon tapping the subterranean water channels in the Karcher ore body but fortunately did not materialize; and mine production in the Karcher ore deposit to June 1947 had slightly exceeded expectations, particularly with respect to the lead production.

In April 1947 the Bureau of Mines drilled four holes on an inferred northward extension of the Karcher ore deposit in an effort to delineate enough ore reserves to warrant sinking a shaft but failed to indicate minable ore in any of the holes.

The Roper-Stover ore deposit occurs generally on the M-bed horizon at 385 to 440 feet in depth below the surface; the J. B. Goodrich deposit, 1/2 mile farther north, generally occurs from 350 to 390 feet in depth, usually indicated in the G and H beds, but few of the holes penetrated through the M bed.

Crowe Mine

Such data as were available from the old churn drilling on the Crowe property (fig. 8) 1/2-mile southwest of Commerce, Okla., just beyond the southernmost known segment of the Miami trough, inferred structural and stratigraphic conditions similar to those on the Sparlin property near the

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<sup>9/</sup> The latter drilling finally resulted in September 1947 in the granting to Zuvekas by the RFC of a loan of \$165,000 for unwatering and developing the mine.

opposite end of the trough. During early-day Commerce mining operations highly productive mines had been extended to the northeast corner and along the east side of the Crowe property, which lies in the NW1/4 sec. 12, T. 28 N., R. 22 E. Some ore was also mined from the shallow Chester limestone formation on the 90-foot level of the Crowe mine - a good part of the lead-zinc ore in the Commerce locality had occurred in that Chester strata. Then in 1936, the late S. E. Henderson, who was manager of one of the larger Picher-field mining and milling operations (Cameron & Henderson, Inc.), drilled eight holes at the Crowe mine, sank two new shafts, and mined relatively good ore from about the 190-foot level of the Crowe mine. It has not been possible, however, to find a map of these workings. Also, during the earlier days some relatively small underground mining operations, 1 mile northwest of Miami, Okla., (2 miles southwest of the Crowe mine) furnished an appreciable zinc-lead ore production.

The Bureau of Mines had planned to drill an initial reconnaissance cross section southwest of the Crowe mine and normal to the southwesterly projection of the Miami trough centerline. Only two of the holes were completed, and two others were stopped just below the base of the Pennsylvanian shale. No ore was found.

## APPENDIX

Bureau of Mines  
Core-Drill-Hole LogsMacArthur Project No. 15-179  
NE 1/4 sec. 6, T. 35 S., R. 24 E.  
Cherokee County, Kans.  
MacArthur Mining Co. LeaseStarted: Oct. 2, 1944  
Completed: Oct. 20, 1944  
Struck water at 385 feet  
Water stands at 370 feetHole No. MAC-1  
Coordinate location: 2368N-3413E  
Collar elevation - 857 feet

Feet		Formation
From	To	
0	30	Soil and sub soil
30	76-1/2	Limey shale
76-1/2	90	Shale
90	95	Sand
95	135	Shale
135	140	Gray lime
140	142	Shale
142	180	Lime (trace of oil at 150-155)
180	185	Gray and brown lime, light gray flint
185	190	Gray lime and sand spar
190	200	Lime
200	220	Lime and light blue flint
220	240	Gray and light blue flint, gray lime
240	250	Light and blue flint, sand spar
250	255	Light and blue flint, sand spar, fair shines zinc
255	257-1/2	Light and blue flint, sand spar, fair shines zinc and trace lead
257-1/2	262-1/2	Light and dark blue flint, trace zinc
262-1/2	285	Soft white flint
285	290	White and light blue flint (soft)
290	305	White and blue flint, sand spar, trace of oolite
305	340	Gray lime and gray flint
340	355	Gray lime, gray and white flint
355	375	Light blue flint, some gray lime
375	380	Blue flint. Fair shines zinc
380	382-1/2	Blue flint. Traces zinc
382-1/2	385	Dark blue flint. Trace lead (water stands at 370 feet)
385	392-1/2	Dark blue flint. Trace lead and zinc
392-1/2	395	Dark blue flint. Fair shines zinc
395	397-1/2	Dark blue flint. Traces zinc and lead
397-1/2	400	Dark blue flint. Traces zinc and fair shines lead
400	405	Dark blue flint. Traces lead

## Hole No. MAC-1 (cont)

Feet		Formation
From	To	
405	407-1/2	Dark blue flint, crevicy. Good shines zinc, shines lead
407-1/2	410	Black and blue flint. Good shines zinc and lead
410	412-1/2	Black and blue flint. Thin shines zinc and lead
412-1/2	417-1/2	Black, blue and white flint, some Reeds. Trace zinc.
417-1/2	419	Black, blue and white flint.

Analyses of samples, Percent metal				Analyses of samples, Percent metal			
Section		Zinc	Lead	Section		Zinc	Lead
375	380	0.92	-	395	397-1/2	0.60	0.18
380	382-1/2	0.40	-	397-1/2	400	-	1.30
382-1/2	385	-	0.02	400	402-1/2	-	0.30
385	387-1/2	0.54	0.41	402-1/2	405	-	0.10
387-1/2	390	0.34	-	405	407-1/2	3.20	0.76
390	392-1/2	1.98	0.25	407-1/2	410	2.22	0.94
392-1/2	395	2.60	-	410	412-1/2	0.58	0.21

Started: Oct. 9, 1944  
Completed: Oct. 28, 1944  
Struck water at 385 feet  
Water stands at 375 feetHole No. MAC-2  
Coordinate location: 2148N-3317E  
Collar elevation - 855.5 feet

Feet		Formation
From	To	
0	20	Soil and gravel
20	136	Soapstone and shale
136	195	Gray lime
195	250	Gray lime, some gray flint
250	252-1/2	Gray lime, blue and gray flint
252-1/2	255	Some gray lime, blue and gray flint, black shale, trace zinc
255	270	Blue and gray flint, trace zinc
270	272-1/2	Blue and gray flint, some gray lime
272-1/2	280	Soft white flint
280	285	Soft white and blue flint
285	350	Blue and gray flint, brown lime
350	370	Soft gray flint, brown lime
370	377-1/2	Blue and gray flint
377-1/2	380	Blue and gray flint, shines lead
380	382-1/2	Blue and gray flint, fair shines lead and zinc

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Hole No. MAC-2 (cont)

Feet		Formation
From	To	
382-1/2	385	Blue, gray and brown flint, selvage, water, fair shines lead and zinc
385	387-1/2	Blue, gray and brown flint, selvage, traces of lead and zinc
387-1/2	390	Blue, gray and brown flint, traces of lead and zinc
390	392-1/2	Blue and brown flint, trace zinc
392-1/2	395	Blue and brown flint, jasperoid, trace zinc
395	400	Blue and brown flint, jasperoid, fair shines zinc
400	402-1/2	Blue, gray, brown and black flint, jasperoid, fair shines lead and zinc
402-1/2	405	Blue, gray, brown and black flint, jasperoid, good shines lead and zinc
405	407-1/2	Blue, gray, brown flint, good shines lead and zinc
407-1/2	410	Blue, gray and brown flint, fair shines lead and zinc
410	417-1/2	Reeds - shines lead and zinc
417-1/2	421	Reeds - no ore

Analyses of samples, Percent metal				Analyses of samples, Percent metal			
Section	Zinc	Lead		Section	Zinc	Lead	
380	382-1/2	0.78	0.33	400	402-1/2	1.12	0.47
382-1/2	385	0.40	0.10	402-1/2	405	0.98	0.58
385	387-1/2	0.24	0.03	405	407-1/2	1.04	0.94
387-1/2	390	0.22	0.03	407-1/2	410	1.16	0.89
390	392-1/2	0.20	-	410	412-1/2	0.40	0.17
392-1/2	395	0.20	-	412-1/2	415	0.34	0.11
395	397-1/2	0.80	-	415	417-1/2	0.56	0.09
397-1/2	400	0.58	-				

Started: Oct. 21, 1944  
 Completed: Nov. 14, 1944  
 Struck water at 380 feet  
 Water stands at 385 feet

Feet		Formation
From	To	
0	148	Soil, subsoil and shale
148	150	Sugar lime
150	155	Sugar lime and mundic. Traces zinc

Hole No. MAC-3 (cont)

Feet		Formation
From	To	
155	170	Sugar lime, blue flint and mundic. Traces zinc
170	200	Gray lime
200	225	Gray lime and white soft flint
225	245	Gray lime, light blue and gray flint
245	250	Gray flint. Open ground. Traces lead
250	255	Gray flint. Hog chaw. Shines lead
255	260	Gray and brown speckled flint, some blue flint. Hog chaw. Thin traces lead
260	265	Gray flint. Hog chaw. Trace lead
265	270	Blue and gray flint, some brown lime. Hog chaw. Thin shines lead
270	275	Blue, gray and black flint. Hog chaw. Traces lead and zinc.
275	280	Blue, gray and brown flint. Hog chaw. Fair shines zinc. Trace lead.
280	287-1/2	Blue, gray and brown flint. Hog chaw. Thin shines zinc and lead.
287-1/2	290	Blue and gray flint. Hog chaw.
290	300	Gray and some blue flint.
300	305	Gray flint - some blue flint.
305	370	Blue and gray flint. Hog chaw.
370	375	Blue and gray flint.
375	380	Blue, gray and brown flint and jasperoid. Traces lead and zinc.
380	382-1/2	Blue, gray and brown flint and jasperoid. Fair shines zinc, shines lead.
382-1/2	385	Blue, gray and brown flint and jasperoid. Thin shines zinc, shines lead.
385	387-1/2	Blue, gray and brown flint and jasperoid. Very thin shines zinc and lead.
387-1/2	392-1/2	Blue, gray and brown flint and jasperoid. Fair shines zinc
392-1/2	395	Blue, gray and brown flint and jasperoid. Good shines zinc, shines lead.
395	397-1/2	Blue, gray and brown flint and jasperoid. Traces zinc.
397-1/2	400	Blue, gray and brown flint and jasperoid. Fair shines zinc
400	402-1/2	Blue, gray and brown flint and jasperoid. Good shines zinc.
402-1/2	405	White, gray and dove colored flint. Thin shines zinc.
405	415-1/2	White, gray and dove colored flint. Traces zinc
415-1/2	417-1/2	White, gray and dove colored flint. Thin shines zinc.
417-1/2	421	White, gray and dove colored flint. No ore.

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Hole No. MAC-3 (cont)

Analyses of samples, Percent metal				Analyses of samples, Percent metal			
Section		Zinc	Lead	Section		Zinc	Lead
380	382-1/2	0.62	0.12	395	397-1/2	0.46	
382-1/2	385	0.40	0.07	397-1/2	400	1.24	
385	387-1/2	0.36	0.07	400	402-1/2	2.32	
387-1/2	390	3.32		402-1/2	405	1.08	
390	392-1/2	1.36		405	407-1/2	0.64	
392-1/2	395	1.04	0.10				

Started: Oct. 30, 1944  
 Completed: Nov. 23, 1944  
 Struck water at 380 feet  
 Water stands at 355 feet

Hole No. MAC-4  
 Coordinate location: 2292N-3239E  
 Collar elevation - 857.5 feet

Feet		Formation
From	To	
0	20	Soil and clay
20	142	Shale
142	144	Lime
144	155	Lime and some mud
155	195	Lime and shale
195	225	Gray lime, gray flint and some shale
225	250	Gray lime and gray flint
250	255	Gray lime, blue and gray flint
255	257-1/2	Blue and gray flint. Traces zinc
257-1/2	260	Blue and gray flint. Thin shines zinc
260	262-1/2	Blue and gray flint. Trace zinc
262-1/2	265	Blue and gray flint
265	267-1/2	Gray and some blue flint
267-1/2	285	Gray flint
285	290	Gray flint, some blue flint
290	295	Gray and blue flint, brown lime and oolite
295	330	Brown lime and gray flint
330	355	Brown lime
355	380	Brown lime, blue and gray flint
380	382-1/2	Gray flint and brown lime
382-1/2	385	Gray and blue flint, some brown lime. Fair shines lead.
385	390	Gray, blue and brown flint. Thin shines lead
390	397-1/2	White, gray and dove flint. Thin shines lead and zinc.
397-1/2	400	Gray, white and dove spotted flint and jasperoid. Traces zinc.
400	402-1/2	Gray, white and dove spotted flint and jasperoid (no ore)

Hole No. MAC-4 (cont)

Feet		
From	To	Formation
402-1/2	405	Gray, white and dove spotted flint and jasperoid. Thin shines lead and zinc.
405	407-1/2	Blue, black and gray flakey flint. Traces lead and zinc.
407-1/2	410	Blue, black and gray flakey flint. Trace lead.
410	412-1/2	Gray, blue, brown and black flint. Trace lead.
No samples were assayed.		

Started: Nov. 15, 1944  
 Completed: Dec. 7, 1944

Hole No. MAC-5  
 Coordinate location: 2398N-3190E  
 Collar elevation - 858.1 feet

Feet		Formation
From	To	
0	15	Soil and clay
15	65	Clay and shale
65	139	Shale
139	165	Gray lime
165	190	Gray lime, some light brown lime
190	265	Gray lime
265	270	Blue, gray and brown speckled flint. Fair shines zinc
270	272-1/2	Blue, gray and white flint. Fair shines zinc
272-1/2	277-1/2	Blue gray and white flint. Thin shines zinc
277-1/2	280	Blue, gray and white flint
280	282-1/2	Blue, gray and soft white flint
282-1/2	300	Soft white flint
300	305	Soft white flint, some brown lime
305	310	Gray flint and brown lime
310	370	Some gray flint and brown lime
370	375	Brown lime and gray flint
375	380	Brown lime and gray flint (Grand Falls)
380	390	Brownish gray lime, blue and gray flint
390	395	Gray flint and blue lime
395	400	Spotted flint, blue and gray flint, gray lime, thin traces of zinc.
400	402-1/2	Gray and black flint, gray lime (Reeds)
402-1/2	405	Blue flint and gray flint, zinc trace
405	410	Blue and gray flint, no zinc
410	415	Brownish flint
415	417-1/2	Brownish flint, gray flint and gray lime, thin traces of zinc
417-1/2	420	Brownish flint and gray lime
No samples were assayed.		

Started: Nov. 24, 1944  
 Completed: Dec. 20, 1944  
 Struck water at 372 feet  
 Water stands at 358 feet

Hole No. MAC-6  
 Coordinate location: 1536N-3266E  
 Collar elevation - 855 feet

From	To	Formation
0	25	Soil and clay
25	138-1/2	Shale
138-1/2	160	Gray lime
160	205	Dark gray lime, some gray flint
205	220	?
220	225	Gray lime and cotton rock, extra thin trace zinc and lead
225	227-1/2	Gray lime and light blue flint, thin trace lead and zinc
227-1/2	230	Gray lime and light blue flint, no trace
230	237-1/2	Gray lime and flint. Thin trace zinc and lead
237-1/2	240	Hog chaw flint. No trace
240	245	Hog chaw blue flint, some gray lime
245	250	Mundic. Thin trace zinc and lead
250	252-1/2	Blue flint, white and gray flint
252-1/2	255	Gray lime, blue, white and gray flint. Thin trace zinc and lead
255	262-1/2	Gray lime and blue flint. Thin trace lead and zinc
262-1/2	265	White and gray flint. Trace zinc
265	275	Gray flint. No trace
275	295	White, gray and blue flint, some white lime
295	300	Gray and blue flint, gray lime
300	305	Gray, white and light blue flint, gray lime
305	310	White, gray and brown flint, some spotted flint and gray lime
310	315	White and gray flint, some spotted flint, gray and brown lime
315	320	Mostly brown lime, gray flint, some white flint, some white flint with brown spots
320	325	Brown lime and gray putty lime, brown and white flint
325	335	Gray lime, brown, blue and white flint
335	345	Brown lime, brown, gray and white flint
345	350	White and gray flint, very hard
350	355	White and gray flint, a little gray lime
355	365	Gray flint, some gray lime, little spotted flint
365	367-1/2	Gray, white and brown flint, spotted flint, a little blue and black flint
367-1/2	370	Gray and white flint, spotted flint, gray lime, little black and blue flint
370	372-1/2	Brown, gray and blue flint, a little white, black and spotted flint

Hole No. MAC-6 (cont)

Feet		Formation
From	To	
372-1/2	375	Brown, gray and blue flint, some spotted flint. Thin lead trace (Grand Falls)
375	377-1/2	Brown, gray, blue and spotted flint, very hard
377-1/2	385	Brown, gray, black and spotted flint
385	387-1/2	Brown, black and spotted flint. Zinc fair
387-1/2	392-1/2	Brown, gray, blue and white flint, some spotted flint, trace zinc (Reeds)
392-1/2	394-1/2	Brown, gray, blue and white flint, some spotted flint and black flint. Trace zinc.

## Analyses of samples - Percent metal

Section		Zinc
385	387-1/2	3.04
387-1/2	390	0.34
390	392-1/2	0.22

Started: Dec. 8, 1944  
 Completed: Jan. 1, 1945  
 Struck water at 390 feet  
 Water stands at 285 feet

Hole No. MAC-7  
 Coordinate location: 1535N-3068E  
 Collar elevation - 856 feet

Feet		Formation
From	To	
0	25	Soil and clay
25	145	Dark blue shale
145	148	Gray lime, mundic
148	155	Light and dark gray lime, mundic
155	165	Gray lime, some white and gray flint and some spotted flint
165	170	Gray lime, some white flint and mundic
170	175	Gray lime
175	180	Gray lime, mud seam
180	185	Light gray and dark gray lime
185	205	Light gray and dark gray lime, blue flint
205	220	Gray and brown lime and light blue flint
220	225	Gray lime and light blue flint
225	230	Gray and light blue flint
230	235	Gray lime, gray and light blue flint
235	240	Gray lime, gray and white flint
240	245	Gray lime, some gray flint
245	250	Gray flint, some gray lime
250	255	Gray flint, rotten gray lime, some blue and white flint



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Hole No. MAC-7 (cont)

Feet		Formation
From	To	
255	260	Rotten gray lime, blue gray and white flint
260	265	Rotten gray lime, blue gray flint
265	270	Blue mud, gray lime. Good zinc. Lead shines.
270	272-1/2	Blue mud, gray lime. Fair shines zinc. Lead shines.
272-1/2	275	Blue mud, gray lime. Zinc shines and lead shines
275	280	Blue mud, gray lime, gray and blue flint. Zinc shines
280	285	Gray, white and blue flint. Thin trace lead and zinc.
285	290	Gray and blue flint, mundic.
290	295	Gray and blue flint, cotton rock
295	305	Gray and blue flint
305	315	Gray and blue flint, brown lime
315	340	Brown lime, little white flint
340	350	Gray and white flint, gray lime
350	355	Gray lime, white flint, with black spots or mottled flint
355	370	Light brown, gray and white flint
370	375	Gray and blue flint, gray lime
375	385	White, gray and brown flint, gray lime (Grand Falls)
385	395	Brown, blue, black, gray and white flint, thin trace zinc
395	405	Brown, blue, black, gray and white flint, some lime, zinc shines (Reeds)
405	412-1/2	Brown, blue, black, gray and white flint, some lime, fair zinc shines
412-1/2	415	Brown, blue, black, gray and white flint. Thin zinc shines
415	417-1/2	Brown, blue, black, gray and white flint. Very thin trace zinc
<u>Analyses of samples - Percent metal</u>		<u>Analyses of samples - Percent metal</u>
<u>Section</u>	<u>Zinc</u>	<u>Section</u>
	<u>Lead</u>	<u>Zinc</u>
265	270	2.14
		0.52
270	272-1/2	1.00
		0.25
405	407-1/2	1.56
		0.84
		1.20

Started: Dec. 21, 1944  
 Completed: Jan. 15, 1945  
 Struck water at 375 feet  
 Water stands at 355 feet

Hole No. MAC-8  
 Coordinate location: 1544N-3195E  
 Collar elevation - 854.8 feet

Feet		Formation
From	To	
0	145	Shale

2724

Hole No. MAC-8 (cont)

Feet		Formation
From	To	
145	150	Gray lime
150	160	Gray lime, some gray and white flint, ground very hard at this point.
160	165	Gray lime, gray and white flint
165	170	Gray lime and white flint
170	180	Brown lime and white flint
180	185	Brown and some putty lime, white flint
185	190	Gray lime, gray mud and some shale
190	210	Brown lime, some gray flint and some shale
210	215	Brown lime, gray flint, some shale
215	225	Brown lime, some gray flint
225	240	Brown lime, gray, blue and brown flint
240	260	Blue gray lime and some gray flint, a little shale
260	265	Rotten gray blue lime, blue and white spotted flint, some white flint and shale
265	270	Rotten gray blue lime, blue and white spotted flint, some real white flint
270	280	Oolitic lime, some very fine trace mundic
280	285	Gray and white flint, some white and blue spotted flint
285	290	Very dark gray flint
290	300	Brown lime, gray lime, gray, white and blue flint
300	330	Brown and gray lime, white and blue flint, some mottled flint
330	340	Brown lime, gray and some white flint
340	345	Gray flint, brown flint, gray and brown lime, some green lime like shale
345	350	Gray lime, gray and some white flint, some green like shale
350	360	White and gray butcher knife flint, gray lime, little green like shale
360	372-1/2	Some dark gray lime, white flint, gray mottled or spotted flint, gray with black spots (Grand Falls)
372-1/2	375	Brown flint, gray-white and gray flint with brown spots, black spots and other various colors, faint thin lead trace
375	377-1/2	Black, gray and blue flint, trace lead thin (Reeds)
377-1/2	380	Dark blue, gray and white flint, zinc shines
380	382-1/2	Dark blue, gray and white flint, thin zinc shines
382-1/2	385	Gray and white flint, zinc trace
385	387-1/2	Black, gray and blue flint, thin zinc trace, trace mundic
387-1/2	390	Gray, blue and black flint, thin zinc trace
390	393-1/2	Gray, blue and black flint
		No samples were assayed.

Started: Jan. 2, 1945  
 Completed: Jan. 23, 1945  
 Struck water at 145 feet  
 Water stands at 360 feet

Hole No. MAC-9  
 Coordinate location: 1470N-3010E  
 Collar elevation - 853.9 feet

Feet		Formation
From	To	
0	15	Soil and clay
15	145	Shale
145	150	Mud seam, some water
150	160	Light gray limestone, some mundic
160	180	Light gray and dark gray limestone, some mundic
180	185	Gray limestone
185	190	Light brown and gray limestone, some gray flint
190	195	Dark gray limestone
195	200	Dark gray limestone, light blue flint
200	215	Light gray limestone, very little white flint
215	220	Light gray limestone, blue flint
220	230	Gray limestone, blue and white flint
230	235	Rotten white flint, gray limestone
235	245	Gray limestone, blue and white flint
245	250	Gray limestone, rotten gray flint
250	255	Gray limestone, light blue flint, gray flint, gray mud and jasperoid
255	260	Opening, lost cuttings
260	265	Gray limestone, gray and blue flint. Open ground
265	270	Gray limestone, gray and blue flint. Open ground, zinc shines
270	280	Gray limestone, gray and blue flint. Open ground, traces zinc
280	285	Gray and blue flint and dark gray limestone
285	305	Blue, gray flint and some gray limestone
305	315	Gray and blue flint, brown limestone
315	325	Brown limestone, little white flint
325	330	Brown limestone, little gray flint, greenish shale
330	335	Brown limestone, little gray flint
335	340	Brown lime, gray and white flint
340	345	Gray and white flint, some brown limestone
345	355	Gray and white flint, gray and brown limestone
355	360	Brown limestone, gray and white flint
360	375	Gray flint and gray and brown limestone
375	395	Gray, blue, brown and white flint and black jasperoid, zinc shines
395	400	Gray, light blue and brown flint
400	405	Gray, light blue and brown flint, fair zinc shines
405	412-1/2	Gray, light blue and brown flint, light zinc shines
412-1/2	415	Gray, light blue and brown flint, thin zinc shines
415	423	Gray, light blue flint, dark gray limestone, thin zinc shines

## Hole No. MAC-9 (cont)

Analyses of samples - Percent metal			Analyses of samples - Percent metal		
Section		Zinc	Section		Zinc
380	385	1.12	400	402-1/2	2.20
385	387-1/2	1.04	402-1/2	405	1.08
387-1/2	390	0.44	405	407-1/2	0.54
390	392-1/2	0.20	407-1/2	410	0.68
395	400	1.34	410	412-1/2	0.66

Started: Jan. 16, 1945  
 Completed: Feb. 8, 1945  
 Struck water at 365 feet  
 Water stands at 355 feet

Hole No. MAC-10  
 Coordinate location: 1463N-3347E  
 Collar elevation - 854 feet

Feet		Formation
From	To	
0	4	Black soil
4	22	Yellow clay
22	135	Gray shale
135	140	Brown lime, some light gray and some white flint
140	145	Brown-gray lime, light and dark blue flint, light green and bright green shale, black shale, gray selvage, black-green shale cemented together, mundic
145	170	Brown lime, gray lime, some white and gray flint, black and green shale, mundic
170	195	Brown and gray lime, gray flint, black and green shale, some white flint
195	200	Brown and gray lime, some white and gray flint
200	205	Little black and brown shale, some knife flint
205	220	Gray, blue and white flint
220	235	Gray lime and gray flint
235	245	Hog-chaw and gray flint
245	250	Gray and white flint
250	260	Gray, white and blue flint
260	270	White cotton-rock, gray flint, a little selvage
270	275	White, gray and spotted flint, a little gray selvage, shale
275	280	Gray and pale blue flint, brown lime
280	285	Gray lime and gray flint
285	290	Brown lime, gray and pale blue flint
290	295	Brown lime, gray lime and white flint
295	300	Gray lime, white flint and brown lime
300	305	Gray lime and gray flint
305	310	Brown lime and gray flint
310	315	Brown lime, very little gray flint
315	320	Brown lime, gray flint and gray lime

Hole No. MAC-10 (cont)

Feet		Formation
From	To	
320	325	Brown lime, gray and pale blue flint
325	330	Brown lime, dark gray flint
330	335	Brown lime, gray lime and gray flint
335	340	Brown lime, gray lime and blue flint
340	345	Gray lime and gray flint
345	350	Light gray flint and gray lime
350	360	Brown and gray lime
360	365	Brown and gray lime, blue flint
365	367-1/2	Blue and gray flint, zinc trace
367-1/2	370	Black, blue, gray and brown flint, trace zinc
370	372-1/2	Gray and blue flint, black lime
372-1/2	376	Gray and blue flint
No samples were assayed		

Started: Jan. 22, 1945      Hole No. MAC-11  
 Completed: Feb. 13, 1945      Coordinate location: 3398N-4137E  
 Struck water at 310 feet      Collar elevation - 863 feet  
 Water stands at 305 feet

Feet		Formation
From	To	
0	20	Soil and yellow clay
	20	Shale
123	135	Gray lime, white and rotten gray lime, mundic
135	150	Dark gray lime, green shale
150	155	Gray lime, gray flint, some green and black shale
155	165	Gray lime, gray flint, some green shale
165	180	Gray lime, very little gray flint
180	185	Gray lime and shale seams
185	190	Gray flint, very little white flint
190	195	Gray flint, very little white flint, trace selvage
195	200	Gray flint, very little white flint, selvage
200	205	Gray lime
205	215	Gray lime and gray flint
215	220	Gray lime, very little blue flint
220	245	Light gray lime, very little gray flint
245	250	Light gray lime, gray flint
250	255	Dark gray lime, gray flint, selvage
255	260	Dark gray lime, pale blue flint, selvage, little spotted flint
260	265	Dark gray lime, dark blue flint, selvage
265	270	Gray lime, blue and gray and white flint, little selvage, trace zinc and lead
270	275	Gray lime, gray, blue and white flint, trace zinc and lead

2724

Hole No. MAC-11 (cont)

Feet		Formation
From	To	
275	280	Gray, blue and white flint, selvage, lead shines, trace zinc
280	285	Blue, gray and white flint, gray lime, selvage, lead shines and trace zinc
285	290	Blue, gray and white flint, gray lime, selvage, lead and zinc shines
290	292-1/2	Gray, white and blue flint, very little gray lime, selvage zinc and lead shines
292-1/2	295	Gray, white and blue flint, very little gray lime
295	297-1/2	Gray, white and blue flint, gray lime, selvage, zinc and lead shines
297-1/2	300	Gray, white and blue flint, gray lime, zinc and lead shines
300	305	Gray, white and blue flint, gray lime, zinc trace
305	310	Gray, blue, white and spotted flint, gray lime, zinc trace
310	315	Gray, white and spotted flint, gray lime, thin trace zinc
315	320	Gray, blue and brown flint, selvage, trace zinc and lead
320	325	Gray, blue, brown and white flint, trace zinc and lead
325	330	Gray, blue and brown flint, trace lead
330	335	Gray, blue and spotted flint, trace lead, trace mundic
335	340	Gray, blue and spotted flint, trace lead and zinc
340	345	Gray and blue flint, brown lime
345	350	Brown, blue and gray flint, trace mundic (Grand Falls)
350	355	Gray, blue and brown flint, lime
355	360	Gray flint and brown lime
360	365	Gray and blue flint, brown lime
365	370	Brown lime and gray flint (Reeds)
370	375	Gray, brown and white flint, brown lime
375	380	Gray, brown and white flint, lime
380	388	Gray flint and lime

Analyses of samples - Percent metal				Analyses of samples - Percent metal			
Section		Zinc	Lead	Section		Zinc	Lead
275	280	4.10	0.87	290	292-1/2	1.20	0.24
280	285	3.02	0.72	292-1/2	295	0.60	0.07
285	287-1/2	1.30	0.44	295	297-1/2	1.04	0.15
287-1/2	290	1.66	0.29	297-1/2	300	0.86	0.66

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Date started: Jan. 24, 1945 Hole No. MAC-12  
 Date completed: Feb. 13, 1945 Coordinate location: 1840N-3660E  
 Collar elevation - 852 feet

Feet		Formation
From	To	
0	25	Soil and clay
25	200	Shale
200	205	Flint boulders and shale, zinc ore and lead shines
205	210	Brown flint boulders, zinc ore and lead shines
210	215	Gray flint and lime, trace zinc and lead, open ground
215	220	Gray and white flint, mundic, thin shines zinc, open ground
220	225	Gray and white and black flint, mundic, zinc trace, open ground
225	230	Gray, white and black flint, mundic, zinc shines, lead trace, open ground
230	235	Gray, blue and brown flint, gray lime, zinc shines, lead trace
235	245	No cuttings - broken ground
245	247-1/2	Gray flint, zinc shines, trace lead
247-1/2	250	Gray flint, spotted flint, zinc shines, trace lead
250	254	No cuttings - broken ground

Analyses of samples - Percent metal

Section		Zinc	Lead
200	205	3.28	0.71
205	210	2.32	0.31
225	230	1.40	0.24
230	235	1.42	0.19
245	247-1/2	1.10	0.12
247-1/2	250	1.00	0.29

Date started: Feb. 10, 1945 Hole No. MAC-13  
 Date completed: Mar. 3, 1945 Coordinate location: 1838N-3760E  
 No water Collar elevation - 854 feet

Feet		Formation
From	To	
0	25	Surface and clay
25	159	Shale
159	165	Gray lime and shale
165	175	Gray lime, trace flint
175	180	Lime, lead shines
180	185	Flint, trace lime, lead traces

Hole No. MAC-13 (cont)

Feet		Formation
From	To	
185	190	Brown flint, gray flint, lime, lead traces
190	195	Brown and gray flint, trace lead
195	200	Pale blue and gray flint, trace lead
200	205	Pale blue and gray flint, thin trace lead, very broken ground
205	210	Pale blue, gray and brown flint, thin trace lead, ground is very broken--caving
210	225	Pale blue and gray flint, lead and zinc trace
225	229	Gray and blue flint, trace lead and zinc
No samples were assayed.		

Date started: Feb. 14, 1945 Hole No. MAC-14  
 Date completed: Mar. 7, 1945 Coordinate location: 3393N-4211E  
 Collar elevation - 863.6 feet

Feet		Formation
From	To	
0	25	Surface and clay
25	118	Shale
118	125	Gray flint, lime, mundic, selvage and shale
125	130	Gray lime, flint and mundic
130	135	Lime, trace flint
135	165	Lime
165	170	Lime and selvage
170	175	Lime, selvage and mundic
175	185	Lime and selvage
185	190	Lime
190	195	Lime and trace gray flint
195	205	Lime and gray flint
205	215	Lime, gray flint and selvage
215	225	Lime, gray and white flint
225	255	Lime and flint
255	265	Flint and lime
265	270	Gray flint, pale blue flint, thin trace zinc
270	275	Gray flint, trace lime
275	280	Gray flint, trace lime, thin trace zinc
280	290	Lime, gray and blue flint, thin trace zinc
290	295	Gray lime, brown lime, thin trace zinc
295	305	Brown lime and flint, thin trace zinc
305	310	Gray, blue, white, spotted flint, gray lime, trace zinc
310	315	Brown lime, gray and blue flint
315	320	Brown lime, gray and blue flint, thin trace zinc

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Hole No. MAC-14 (cont)

Feet		Formation
From	To	
320	325	Blue, gray, white, spotted flint, gray and brown lime, zinc trace, mundic
325	330	Gray, blue and brown flint, lime and mundic
330	335	Brown lime, gray and blue flint
335	340	Brown lime, gray and blue flint, thin trace zinc
340	350	Brown lime and gray flint
350	360	Gray flint and lime
360	365	Gray flint and lime (Grand Falls)
365	370	Gray flint and gray lime, thin trace zinc
370	375	Gray, blue and brown flint, gray lime
375	380	Gray, blue and brown flint, gray lime, thin trace zinc
380	385	Gray, blue and brown flint, lime
385	390	Gray, blue and brown flint, lime (Reeds)
390	395	Gray, blue and brown flint, trace lead and zinc
395	400	Gray, blue and brown flint

No samples were assayed.

Date started: Feb. 14, 1945      Hole No. MAC-15  
 Date completed: April 4, 1945      Coordinate location: 1841N-3702E  
 Struck water at 385 feet      Collar elevation - 854.3 feet

Feet		Formation
From	To	
0	25	Surface and clay
25	194	Shale
194	200	Sand spar, lead and zinc shines
200	207-1/2	Sand spar, trace flint, lead and zinc shines
207-1/2	210	Sand spar, flint, lead and zinc shines
210	215	Gray and brown flint, trace lead and zinc
215	220	Light gray, brown and spotted flint, trace lead and zinc
220	225	Dark gray, brown and spotted flint, trace lead and zinc
225	230	Dark gray, brown and spotted flint, thin trace lead and zinc
230	235	Gray, blue and brown flint, tiff, thin trace lead and zinc
235	240	Dark gray and brown flint, trace brown lime, selvage, thin trace lead and zinc
240	245	Gray, brown flint, tiff, trace lead and zinc
245	250	Blue and brown flint, thin trace zinc
250	255	Gray, blue, brown and spotted flint, thin trace zinc - ground very broken

Hole No. MAC-15 (cont)

Feet		Formation
From	To	
255	260	Gray, blue, brown, spotted and black flint
260	265	Gray, brown and spotted flint, thin trace zinc
265	270	Gray, brown and spotted flint, dark gray lime, thin trace zinc
270	275	Light gray, dark gray, brown and spotted flint, trace zinc
275	285	Light gray, dark gray, brown and spotted flint, thin trace zinc
285	290	Gray, brown and spotted flint, thin trace zinc
290	300	Light and dark blue flint, very thin trace zinc
300	315	Light and dark gray, blue and spotted flint, thin trace zinc
315	320	Dark blue, spotted and dark brown flint, thin trace zinc
320	325	Dark blue, spotted and dark brown flint, selvage, thin trace zinc
325	335	Dark gray, dark brown and spotted flint, thin trace zinc
335	340	Dark gray, dark brown and spotted flint, zinc trace
340	345	Dark gray, dark brown and spotted flint, thin zinc trace
345	350	Light gray, dark gray and spotted flint
350	355	Dark gray, dark brown and light gray flint
355	365	Dark gray, dark brown, light gray and spotted flint
365	370	Opening - no cuttings
370	380	Light and dark gray spotted flint, trace zinc and lead
380	385	Light gray, dark gray and spotted flint, jasperoid, trace zinc
385	390	Dark gray, light gray and brown flint, thin trace zinc (Grand Falls)
390	395	Dark gray and brown flint, thin trace zinc
395	400	Dark gray spotted blue flint trace zinc (Reeds)
400	404	Dark gray, spotted blue and dark brown flint, trace zinc

Analyses of samples - Percent metal

Section		Zinc	Lead
200	205	2.58	2.22
205	207-1/2	2.62	1.81
207-1/2	210	2.16	0.21
210	215	2.22	0.49

Date started: March 5, 1945      Hole No. MAC-16  
 Date completed: March 24, 1945      Coordinate location: 1838N-3861E  
 Collar elevation - 855.9 feet

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Hole No. MAC-16 (cont)

Feet		Formation
From	To	
0	160	Cherokee shale
160	170	Gray selvage and mundic
170	175	Gray, blue, and dark brown flint, selvage, mundic, shale
175	180	Dark and light gray flint, selvage, mundic, thin trace lead
180	185	Gray lime, selvage, gray flint, thin trace lead and zinc
185	190	Shale, gray lime, selvage, gray flint, thin trace mundic, lead and zinc
190	195	Blue shale, gray lime, mundic, zinc shines, lead traces
195	200	Gray lime, black-green shale, trace zinc and lead, mundic
200	205	Blue mud, gray lime, shale, mundic, thin trace zinc
205	210	Dark gray, brown and spotted flint, shale, mundic, tiff, thin trace lead and zinc - open ground
210	225	Gray, brown flint, mundic, shale, thin trace lead and zinc - ground very broken
225	230	Light gray, dark gray and brown flint, mundic, trace lead and zinc
230	235	Light gray, dark gray and brown flint, mundic, thin trace lead and zinc, a little shale falling in
235	240	Light gray, dark gray and spotted flint, shale, mundic, trace zinc
240	245	Gray, brown and spotted flint, thin trace zinc and lead
245	250	Dark gray and brown flint - broken ground
250	254	Dark gray and brown flint

Analyses of samples - Percent metal

Section		Zinc	Lead
185	190	0.44	0.01
190	195	0.62	0.03

Date started: March 9, 1945  
 Date completed: April 7, 1945  
 Struck water at 35 feet  
 Water stands at 310 feet

Hole No. MAC-17  
 Coordinate location: 3400N-4070E  
 Collar elevation - 862.2 feet

Feet		Formation
From	To	
0	20	Soil and clay
20	119	Shale

Hole No. MAC-17 (cont)

Feet		Formation
From	To	
119	125	Shale, mundic and gray flint
125	140	Gray lime, shale and mundic
140	145	Light and dark gray lime, shale and mundic
145	150	Light and dark gray lime, black and green shale
150	155	Gray lime and shale
155	160	Dark and light gray lime, light gray selvage and shale
160	165	Gray lime, black-green shale, gray selvage
165	175	Gray lime and black-green shale
175	190	Gray lime and green shale
190	195	Brown and gray lime
195	210	Gray lime, brown lime and gray flint
210	215	Light and spotted flint, gray lime and tiff
215	220	Light and blue flint, gray lime and green shale
220	225	Gray lime, trace blue flint
225	230	Gray lime, trace blue flint, black-green shale
230	245	Gray lime, gray and blue flint
245	250	Light-dark gray flint, very little gray lime
250	255	Light-dark gray flint, trace gray lime
255	260	No cuttings - open ground
260	265	Dark-gray and blue flint, selvage, tiff, thin trace lead
265	270	Dark-gray, blue and spotted flint, selvage
270	280	Light gray, blue and spotted flint, tiff, thin trace lead
280	290	Light gray and blue flint, selvage, zinc shine, lead trace
290	302-1/2	Light and dark gray and blue flint, zinc shine, lead trace
302-1/2	307-1/2	Light gray flint, zinc shines, lead trace
307-1/2	310	Light gray, brown, gray and spotted flint, zinc and lead trace
310	315	Light gray, brown, gray and spotted flint, zinc traces
315	320	Light gray spotted and blue flint, thin trace zinc
320	326	Light gray and blue flint

Analyses of samples - Percent metal

Section		Zinc
280	285	0.32
285	290	0.72
290	295	0.96
295	300	0.90
300	302-1/2	0.76
302-1/2	305	0.54
305	307-1/2	0.32

Date started: April 7, 1945      Hole No. MAC-18  
 Date completed: April 20, 1945      Coordinate location: 2637N-4279E  
 Struck water at 387 feet      Collar elevation - 866 feet  
 Water stands at 380 feet

From		To	Formation
0	25		Soil and clay
25	118		Shale
118	125		Brown lime, shale, gray flint and mundic
125	130		Brown lime, gray lime and green selvage
130	135		Gray and brown lime
135	140		Gray lime and green selvage
140	145		Gray lime, shale and selvage
145	150		Gray and brown lime and shale
150	160		Gray lime and brown lime, gray flint
160	165		Gray and brown lime, gray and blue flint
165	170		Gray, brown and blue lime, gray and blue flint
170	180		Gray lime, gray and blue flint, shale
180	185		Gray cotton rock flint, gray lime
185	190		Gray cotton rock flint and gray and brown lime
190	195		Brown lime and gray flint
195	205		Gray and brown lime, trace gray and blue flint
205	215		Brown and gray lime, gray flint
215	220		Gray and brown lime, gray flint
220	225		Gray and brown lime, trace gray flint
225	230		Light gray, dark gray and brown lime
230	235		Light gray, dark gray and brown lime, gray blue flint
235	240		Light gray, dark gray and brown lime, gray-blue flint and mundic
240	245		Light gray, dark gray and brown lime, gray blue flint
245	250		Light gray, dark gray and brown lime gray flint
250	255		Light gray lime and blue flint
255	260		Light gray, dark gray and blue flint, gray lime, zinc trace
260	265		Gray cotton rock flint, gray lime, zinc shines
265	270		Gray cotton rock flint, gray lime, zinc trace
270	275		Gray cotton rock and blue flint, gray lime zinc trace
275	280		Gray cotton rock and light blue flint, brown lime, thin trace zinc
280	285		Gray, blue and spotted flint, selvage, thin trace zinc, mundic
285	290		Brown lime, blue, gray and spotted flint, selvage
290	295		Gray flint and brown lime, thin trace zinc
295	300		Light gray flint, brown lime and green shale
300	305		Brown lime, light gray flint and green shale
305	310		Brown lime and light gray flint

Feet		Formation
From	To	
310	315	Brown lime and cotton rock flint
315	320	Brown lime, cotton rock flint, very little flint
320	340	Brown lime and gray flint
340	350	Gray lime and gray flint
350	365	Gray lime, gray and blue flint
365	370	Light gray, dark gray and blue flint, lime
370	375	Dark gray, dark brown and spotted flint, lead and zinc shines
375	380	Dark brown, dark gray and blue flint, zinc and lead
380	382-1/2	Dark brown and dark gray flint, trace lead and zinc
382-1/2	385	Dark gray, dark brown and blue spotted flint, zinc shines
385	387-1/2	Dark gray, dark brown and black flint, zinc shines and lead trace (Reeds)
387-1/2	390	Dark gray, dark brown and black flint, thin trace lead and zinc
390	400	Dark gray, dark brown flint, trace lead

Analyses of samples - Percent metal

Section		Zinc
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370	375	0.70
375	380	0.28
380	382-1/2	0.34
382-1/2	385	1.08
385	387-1/2	0.30

Date started: April 21, 1945      Hole No. MAC-19  
 Date completed: May 4, 1945      Coordinate location: 2433N-4167E  
 Struck water at 380 feet      Collar elevation - 862 feet  
 Water stands at 380 feet

Feet		Formation
From	To	
0	25	Surface and clay
25	130	Shale
130	140	Dark and light gray lime, shale
140	150	Dark and light gray lime, black shale
150	155	Dark and light gray lime, black shale, green selvage
155	165	Dark and light gray lime, shale
165	170	Gray lime, gray flint, open selvage
170	195	Gray flint, gray lime, shale

Hole No. MAC-19 (cont)

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Churn-Drill-Hole LogsMiami-Trough Extension Project No. 15-201  
MacArthur Tract  
Cherokee County, Kansas

Feet		Formation
From	To	
195	205	Gray lime, very little flint
205	215	Gray lime, very little light gray flint
215	220	Gray lime, very little light gray flint, shale
220	230	Gray lime, light gray and blue flint, selvage
230	235	Gray lime, light gray flint, selvage
235	245	Gray lime, light and dark gray flint
245	250	Light gray, dark gray and blue flint, trace zinc
250	255	White, gray and blue flint, very little lime, trace zinc
255	265	White, gray and blue flint, very little lime, thin trace zinc
265	270	White flint, very little dark gray flint, trace zinc
270	275	White flint, gray and blue flint, selvage, trace zinc
275	280	White, gray and blue flint, green selvage, trace zinc
280	285	White, gray and blue flint, brown lime, trace zinc
285	290	Brown lime, white, gray and blue flint, trace zinc
290	305	Brown lime and gray flint
305	310	Brown lime, gray lime, little flint, thin trace zinc
310	325	Brown and gray lime, little flint
325	330	Brown and gray lime, gray and blue flint
330	335	Brown lime, very little gray and blue flint
335	340	Brown lime, white and gray flint
340	350	Brown lime, light and dark gray flint
350	360	Brown lime, light and dark gray flint and blue flint
360	365	Light gray, dark gray and blue flint, brown lime, trace zinc (Grand Falls)
365	370	Gray, black and blue flint, trace zinc
370	375	Dark gray, light gray, blue, black and spotted flint, thin zinc shines, very few cuttings
375	377-1/2	Dark gray, light gray, blue, black and spotted flint, zinc shines
377-1/2	380	Dark gray, light gray, blue, black and spotted flint, zinc shines
380	390	Light gray, dark gray, black and brown flint, thin zinc shines
390	395	Light gray, dark gray, black and brown flint, zinc shines (Reeds)
395	402	Light gray, dark gray and black flint, thin zinc trace
<u>Analyses of samples - Percent metal</u>		
<u>Section</u>		<u>Zinc</u>
375	377-1/2	1.04
377-1/2	380	1.74
380	382-1/2	0.84
382-1/2	387-1/2	0.82
387-1/2	390	2.04
390	395	0.84

Started: Oct. 11, 1946	Hole No. MAC-20
Completed: Oct. 28, 1946	Coordinate location: 3315N-3395E
Struck water at 372 feet	Collar elevation - 861
Water stands at 328 feet	

Feet		Formation
From	To	
0	33	Surface, soil, clay and gravel
33	45	Sandstone
45	125	Shale
125	130	Gray Chester limestone, pyrite, shale
130	150	Gray Chester limestone
150	180	Gray and some light tan limestone, some thin shale seams
180	195	Gray, some speckled and a very little gray chert and shale seams
195	200	Gray limestone
200	230	Gray and tan limestone, a very little gray chert
230	235	Gray and some brown limestone, gray chert
235	245	Tan limestone, gray chert
245	265	Tan and gray limestone, gray and a very little white chert, some cotton rock 255-260 feet
265	270	Gray and some light blue chert, gray limestone
270	275	Gray, some white and blue chert
275	290	Loose gray and some blue chert, cotton rock, many crevices
290	295	Gray and tan chert
295	305	Cotton rock, some gray and tan chert
305	310	Gray and light blue chert
310	315	Gray chert, gray and brown limestone
315	320	Gray chert, brown limestone, some green selvage
320	345	Brown limestone, gray and white chert
345	365	Gray and some white limestone, gray chert, shale seams
365	370	Gray and some brown limestone, gray chert
370	375	Gray and some white chert, gray limestone, shale seams
375	380	Gray and blue mottled chert, gray limestone, trace zinc sulfide
380	385	Gray, tan, a very little blue and white chert, gray limestone, trace zinc sulfide, many crevices
385	387-1/2	Gray, tan, white and a very little blue chert, pyrite, shale seams, gray limestone, many crevices, zinc sulfide shines



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Hole No. MAC-20 (cont)

Feet		Formation
From	To	
387-1/2	390	Gray, tan, white and a very little blue chert, pyrite, shale seams, gray limestone, many crevices, zinc sulfide shines
390	395	Loose coarse gray, tan and some white chert, a very little gray limestone, shale seams, trace zinc sulfide
395	397-1/2	Gray, tan, white and some brown chert, many crevices
397-1/2	400	Brecciated gray and tan spotted chert, recemented with brown limestone
400	407	Gray, brown, some blue and a little white chert, black limestone
407	415	Gray, brown, some white spotted and a little blue chert, brown and black limestone
415	420	Black, dark and light gray, some white-tan spotted chert, jasperoid, brown and black limestone with a disseminated trace zinc sulfide
420	427-1/2	Dark gray and blue spotted chert, brown limestone
427-1/2	434	Dark gray, blue and brown spotted chert, brown and black limestone

Analyses of samples - Percent metal

Section		Zinc
385	387-1/2	0.78
387-1/2	390	0.86

Date started: Oct. 29, 1946  
 Date completed: Nov. 13, 1946  
 Struck water at 315 feet  
 Water stands at 340 feet

Hole No. MAC-21  
 Coordinate location: 3562N-3084E  
 Collar elevation - 868 feet

Feet		Formation
From	To	
0	22	Surface soil, clay and gravel
22	162	Shale
162	185	Dark to light gray Chester limestone
185	190	Dark to light gray Chester limestone, a bright shale seam
190	210	Dark speckled Chester limestone
210	225	Brown Chester limestone with a very little white chert
225	235	Brown Chester limestone, some white and gray chert

Hole No. MAC-21 (cont)

Feet		Formation
From	To	
235	250	Gray and tan limestone, gray and white chert
250	270	Gray and tan chert, some tan and a little white limestone, many crevices
270	275	Gray to bluish gray and some mottled chert, crevices
275	280	Light to dark gray chert, brown and glauconitic limestone crevices
280	285	Loose coarse gray to bluish gray chert, brown limestone
285	295	Gray, tan, white and some mottled chert
295	300	Light to dark gray and some brown chert, crevices
300	310	Gray, some tan and white chert
310	325	Hard gray, tan, and a little white chert
325	330	Gray, tan, white spotted and a few pieces of green chert
330	337-1/2	Same as above but becoming loose and with trace lead sulfide
337-1/2	345	Loose dull white and brown spotted chert, trace lead sulfide
345	350	Dull gray, tan and white spotted and some gray and white translucent chert, trace lead sulfide
350	355	Black, dark to light gray and some white chert, jasperoid, trace lead sulfide
355	370	Gray, tan and white chert, jasperoid
370	375	Gray, tan, white and a little dark gray chert
375	380	Gray, tan, white and a little black chert, trace zinc sulfide
380	382-1/2	Gray, white, brown and some spotted chert, trace zinc sulfide
382-1/2	385	Dull white, gray and some spotted chert
385	400	Gray to dark gray, brown and some black chert, brown limestone
400	405	Gray to dark gray spotted and black chert
405	445	Gray to dark gray, black and brown chert

No samples were assayed.

Bureau of Mines  
Churn-Drill-Hole Logs

Miami-Trough Extension Project No. 15-201  
Sparlin Tract  
Cherokee County, Kansas

Started: Nov. 14, 1946  
Completed: Nov. 27, 1946  
Struck water at 375 feet  
Water stands at 310 feet

Hole No. MAC-22  
Coordinate location: 3742N-2663E  
Collar elevation - 865 feet

Feet		Formation
From	To	
0	23	Surface soil and clay and gravel
23	150	Shale
150	155	Soft loose gray limestone, gray chert, pyrite
155	200	Gray Chester limestone, a few pieces of gray chert
200	260	Brown and gray limestone, white and some gray chert
260	265	Soft, loose, dull gray and blue chert, brown and some glauconitic limestone
265	270	Loose coarse dull gray, blue, white leached chert, brown limestone, trace lead sulfide
270	285	Coarse dull gray blue and tan chert, some gray limestone
285	295	Cotton rock, gray and a little brown limestone, leached gray chert
295	300	Gray and white mottled chert, brown limestone
300	305	Firm gray to light blue and some white chert, brown limestone
305	365	Gray chert, brown limestone
365	375	Dull white and gray chert, some brown limestone
375	380	Gray to bluish chert, some brown limestone, trace zinc sulfide
380	385	Dull gray, light blue, brown and some white spotted chert, trace lead sulfide
385	390	Dark to light gray chert, a very little jasperoid
390	395	Dull gray, white, some translucent chert, trace zinc sulfide
395	400	Brown, blue, dull gray and white chert
400	408	Dark gray, brown and black chert, a very little black limestone
408	410	Dark gray and brown chert, dark brown and gray shelly limestone
410	420	Dark gray, brown and tan chert, brown and some gray limestone
420	425	Dark gray, brown and some black chert, brown limestone, trace zinc sulfide

2724

## Hole No. MAC-22 (cont)

Feet		Formation
From	To	
425	431	Dark gray, brown and some black chert and brown limestone
No samples were assayed		

Date started: Nov. 28, 1946  
Date completed: Dec. 14, 1946  
Struck water at 312 feet  
Water stands at 312 feet

Hole No. MAC-23  
Coordinate location: 3740N-3773E  
Collar elevation - 861 feet

Feet		Formation
From	To	
0	24	Surface soil and clay
24	117	Shale
117	122	Gray Chester limestone, some shale and pyrite
122	125	Gray Chester limestone and selvage
125	135	Gray Chester limestone
135	195	Gray to bluish gray limestone, gray and white chert
195	210	Gray limestone and gray chert
210	245	Gray and some tan limestone, gray chert
245	250	Brown and some gray chert, gray limestone
250	260	Gray and light blue chert, some brown limestone
260	265	Gray to dark gray chert, shaley brown and greenish glauconitic limestone
265	270	Gray to dark gray chert
270	275	Loose gray, some white and light blue chert
275	285	Loose white, blue and gray chert
285	295	Loose gray chert
295	300	Loose gray to light blue chert, few crystals zinc sulfide, trace lead sulfide
300	305	Loose gray, blue and brown chert, some oolitic limestone, faint trace zinc sulfide and lead sulfide
305	310	Gray, blue and brown chert, oolitic limestone
310	330	Gray, tan, light blue and white chert, some sandy limestone
330	335	Loose coarse gray, white and some dark gray chert, brown sandy limestone, selvage
335	338	Gray, white and tan translucent and some spotted chert
338	340	Gray, white and tan chert, calcite crystals
340	350	Gray, white and dark brown chert
350	360	Gray, white and light blue chert
360	367-1/2	Gray and light blue chert
367-1/2	387-1/2	Gray to dark gray, brown and a little blue chert
387-1/2	390	Gray to dark gray and some black chert

## Hole No. MAC-23 (cont)

Feet		Formation
From	To	
390	400	Gray, brown, dark blue and black chert
400	415	Dark gray and blue chert, brown limestone
415	420	Brown limestone, dark gray chert
No samples were assayed		

Date started: Dec. 16, 1946      Hole No. MAC-24  
 Date completed: Dec. 31, 1946      Coordinate location: 3738N-3927E  
 Struck water at 330 feet      Collar elevation - 861 feet  
 Water stands at 314 feet

Feet		Formation
From	To	
0	25	Soil, clay and gravel
25	70	Shale
70	75	Interbedded sandstone and shale
75	110	Shale
110	115	Chester limestone, much pyrite
115	140	Soft Chester limestone, selvage seam
140	170	Chester limestone, some gray chert
170	180	Gray, black and brown limestone, gray chert
180	185	Gray limestone, very little gray chert
185	235	Gray and tan limestone, a little gray chert
235	240	Gray chert, some brown limestone
240	245	Gray and some green stained chert, gray and brown limestone, green selvage
245	255	Gray and blue chert, some gray and brown limestone
255	260	Gray to light blue chert and selvage
260	270	Gray to light blue and some brown chert
270	285	Cotton rock, gray and blue chert
285	315	Gray and blue chert, brown limestone
315	320	Brown to dark gray limestone, gray chert
320	325	Brown to dark gray and some black limestone, gray chert, calcite crystals
325	330	Brown limestone, gray chert
330	335	Blue and tan translucent chert, shale seams
335	360	Gray, blue, tan and white chert
360	365	Dark gray, blue, brown to light tan chert
365	370	Blue, tan and gray chert, trace zinc sulfide
370	380	Gray, tan, some blue and a little black chert, jasperoid
380	387-1/2	Gray, brown and blue chert, jasperoid, trace zinc sulfide

## Hole No. MAC-24 (cont)

Feet		Formation
From	To	
387-1/2	390	Gray, brown and blue chert, jasperoid, good zinc shines
390	392-1/2	Gray and black chert, jasperoid, fair zinc shines
392-1/2	395	Gray and blue chert, jasperoid, black and brown limestone, calcite crystals, trace zinc sulfide
395	400	Dark gray, tan and black chert, brown limestone, trace zinc sulfide
400	405	Black and gray chert, gray and brown limestone
405	410	Brown and black limestone, dark gray chert

Analyses of samples - Percent metal

Section		Zinc
387-1/2	390	2.40
390	392-1/2	1.36
392-1/2	395	0.52

Date started: Jan. 1, 1947      Hole No. MAC-25  
 Date completed: Jan. 20, 1947      Coordinate location: 4152N-3873E  
 Struck water at 315 feet      Collar elevation - 857 feet  
 Water stands at 315 feet

Feet		Formation
From	To	
0	20	Surface clay and soil
20	140	Shale
140	150	Limestone boulders, shale, pyrite, trace lead sulfide
150	160	Soft gray Chester limestone, selvage, trace lead sulfide
160	190	Gray Chester limestone, selvage and shale seams
190	215	Soft gray limestone, some gray chert
215	225	Loose coarse gray and blue chert, calcite crystals
225	235	Gray and blue chert
235	240	Soft gray limestone, gray chert
240	250	Gray to dark gray chert, selvage seams
250	265	Loose coarse dull gray and some light gray chert, calcite crystals, selvage
265	270	Dark gray and a little blue shelly chert, glauconitic limestone mud and selvage
270	285	Gray and blue shelly flint
285	295	Gray and blue chert, selvage and mud

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Hole No. MAC-25 (cont)

Feet		Formation
From	To	
295	300	Dull dark and light gray shelly chert
300	330	Dull gray, light gray and some blue chert, selvage
330	340	Gray, blue and brown chert
340	345	Gray and some blue translucent chert
345	360	Gray blue and brown chert
360	362-1/2	Dull gray, tan and dark blue chert
362-1/2	365	Dull gray, tan and dark blue chert, jasperoid, trace zinc sulfide
365	370	Dull gray and blue chert, jasperoid
370	375	Gray and some light gray brown and blue chert
375	380	Gray, dark blue and black chert, brown limestone, trace zinc sulfide
380	390	Very dark gray, brown, blue and black chert, trace zinc sulfide
390	400	Very dark gray and blue chert, brown limestone
400	405	Blue chert, dark brown limestone
405	410	Dark brown to black limestone, a little blue chert
410	415	Black to dark brown limestone, some dark gray and blue chert

No samples were assayed

Date started: Jan. 21, 1947  
 Date completed: Feb. 8, 1947  
 Struck water at 310 feet  
 Water stands at 310 feet

Hole No. MAC-26  
 Coordinate location: 4100N-3760E  
 Collar elevation - 859 feet

Feet		Formation
From	To	
0	25	Clay, gravel and sand
25	90	Shale
90	95	Interbedded shale and sandstone
95	135	Shale
135	140	Much pyrite, some gray Chester limestone, a slight trace lead sulfide
140	150	Gray Chester limestone, a very little gray chert
150	190	Gray Chester limestone
190	195	Gray chert and gray limestone
195	205	Dark to light gray limestone, gray chert
205	215	Gray and a very light blue chert
215	220	Gray and some light gray chert, gray limestone, slight trace zinc sulfide
220	230	Gray chert, gray limestone
230	250	Gray and some blue chert

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Hole No. MAC-26 (cont)

Feet		Formation
From	To	
250	260	Dark gray and blue chert, brown and a little greenish glauconitic limestone
260	270	Gray and blue chert
270	275	Light to dark gray chert
275	285	Shelly gray, blue and brown chert
285	300	Gray and blue chert
300	305	Shelly gray, blue and brown chert
305	310	Loose gray, blue and brown chert
310	320	Loose gray and blue chert, brown sandy decomposed limestone
320	335	Loose gray and brown chert
335	338	Gray and blue chert, jasperoid, zinc sulfide shines
338	340	Gray and blue chert, jasperoid, trace zinc sulfide
340	342	Gray and blue chert and jasperoid
342	355	Gray, brown and a few pieces of blue chert
355	360	Gray, brown and white chert
360	362-1/2	Gray to dark gray and some brown chert
362-1/2	380	Gray mottled, dark gray and brown chert
380	390	Dense dark gray, brown and blue chert
390	410	Dense dark gray, brown and blue chert, trace zinc sulfide, an 8-inch crevice at 389 feet
410	415	Black and brown limestone, dense dark gray and brown chert

No samples were assayed

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Churn-Drill-Hole Logs

Miami-Trough Extension Project No. 15-201  
Garrett Tract  
Cherokee County, Kansas

Date started: Oct. 29, 1946      Hole No. EM-1  
Date completed: Nov. 16, 1946      Coordinate location: 8630N-4609W  
Struck water at 304 feet      Collar elevation - 866 feet  
Water stands at 230 feet

Feet		Formation
From	To	
0	12	Soil, clay and gravel
12	169	Shale
169	185	Gray Chester limestone
185	195	Speckled gray and tan Chester limestone
195	200	Gray limestone, gray and light blue chert, struck a pocket of natural gas which flowed very strong for 2 hours
200	210	Tan limestone, gray and blue chert
210	215	Brown and gray shelly limestone
215	225	Tan and gray limestone
225	230	Tan and gray limestone, some gray chert
230	245	Tan and gray shelly limestone, some gray chert
245	250	Tan limestone, gray chert
250	255	Tan limestone, gray and some blue chert
255	260	Brown limestone, gray, light blue and a little brown chert
260	265	Hard brown limestone, gray chert
265	285	Brown limestone, gray and a little blue chert
285	290	Soft brown, gray and greenish gray glauconitic limestone, very little gray chert
290	295	Soft glauconitic limestone, brown and a little gray chert
295	305	Brown and gray limestone, some gray chert
305	310	Loose brown and gray limestone, some gray chert, many crevices, very few cuttings recovered
310	315	Soft gray chert, some gray limestone
315	340	Soft leached gray chert, cotton rock
340	345	Opening, no cuttings removed
345	355	Soft but firm gray chert, cotton rock
355	360	Loose coarse gray spotted chert, cotton rock
360	365	Firm brown limestone, gray chert
365	370	Gray chert, gray limestone
370	375	Opening 372-375 - no cuttings recovered

## Hole No. EM-1 (cont)

Feet		Formation
From	To	
375	380	Loose soft gray white chert, cotton rock
No samples were assayed		
NOTE: Continuation in depth by churn drilling and driving successive strings of casing proved impossible so the hole was abandoned upon order of the project engineer.		

Date started: Nov. 18, 1946      Hole No. EM-2  
Date completed: Dec. 2, 1946      Coordinate location: 8651N-4755W  
Struck water at 249 feet      Collar elevation - 868 feet  
Water stands at 220 feet

Feet		Formation
From	To	
0	14	Soil, clay, gravel and boulders
14	20	Interbedded sandstone and shale
20	207	Shale
207	210	Gray chert, pyrite, shale
210	212	Loose coarse gray chert
212	216	Loose coarse gray chert, gray limestone
216	225	Firm gray chert
225	245	Gray chert, gray limestone
245	250	Lost cuttings in crevice
250	260	Very loose and coarse gray chert, boulders
260	265	Very loose and coarse gray and light blue chert
265	275	Loose and coarse gray and white leached chert
275	290	Very loose cotton rock, white and gray chert
No samples were assayed.		

NOTE: Continuation in depth by churn drilling and driving successive strings of casing proved impossible so the hole was abandoned upon order of the project engineer.

Date started: Dec. 4, 1946      Hole No. EM-3  
Date completed: Dec. 20, 1946      Coordinate location: 8562N-4475W  
Struck water at 390 feet      Collar elevation - 859 feet  
Water stands at 220 feet

Feet		Formation
From	To	
0	6	Soil, clay and gravel
6	10	Sandstone

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Hole No. EM-3 (cont)

Feet		Formation
From	To	
10	161	Shale
161	170	Gray Chester limestone, some gray chert
170	190	Gray Chester limestone
190	200	Gray chert, tan limestone
200	210	Gray limestone, gray chert
210	250	Gray limestone, gray, some white chert
250	255	Brown limestone, light blue chert
255	275	Brown limestone, gray chert
275	280	Brown limestone, gray and some brown chert
280	285	Brown to light brown limestone, a little gray chert, selvage
285	290	Greenish-gray glauconitic limestones
290	295	Gray, blue and brown mottled chert, glauconitic limestone
295	305	Gray, blue and some white flint
305	310	Gray, blue and white chert, brown oolitic limestone and some silicified oolites
310	330	White and gray chert, brown limestone
330	350	Brown limestone gray and white chert
350	365	Brown limestone, some gray chert
365	370	Brown to light brown limestone, a little gray chert
370	375	Light to dark gray and some spotted chert, trace zinc sulfide and lead sulfide
375	390	Gray, white, light tan and some translucent chert, a slight trace of zinc sulfide and lead sulfide
390	395	Gray chert, trace lead sulfide
395	400	Gray, tan and translucent chert, slight trace lead sulfide
400	402-1/2	Gray, blue, brown and some white chert, jasperoid trace lead sulfide and slight trace zinc sulfide
402-1/2	407-1/2	Same as above with trace zinc sulfide and lead sulfide
407-1/2	410	Same as above with zinc sulfide and lead sulfide shines
410	412-1/2	Same as above
412-1/2	415	Dark gray, brown, blue and some dark gray and black mottled chert, fine quartz crystals, zinc sulfide and lead sulfide shines
415	417-1/2	Light to dark gray mottled and some white chert
417-1/2	420	Gray, brown mottled, some white and black chert, slight trace lead sulfide
420	422-1/2	Gray, blue and brown chert, slight trace lead sulfide and zinc sulfide
422-1/2	425	Light to dark gray, brown and black chert, traces zinc sulfide and lead sulfide
425	427-1/2	Same as above
427-1/2	430	Light to dark gray, brown and black chert
430	436	Black, dark gray and brown chert

Hole No. EM-3 (cont)

Analyses of samples - Percent metal

Section	Zinc	Lead
407-1/2 410	0.28	0.32
410 412-1/2	0.54	0.18
412-1/2 415	1.22	0.32
422-1/2 425	0.64	0.03

Date started: Dec. 22, 1946  
 Date completed: Jan. 11, 1947  
 Struck water at 390 feet  
 Water stands at 220 feet

Hole No. EM-4  
 Coordinate location: 8579N-4.522W  
 Collar elevation - 862 feet

Feet		Formation
From	To	
0	12	Soil, clay and gravel
12	163	Shale
163	170	Gray Chester limestone, pyrite, some gray chert
170	190	Gray Chester limestone
190	200	Gray limestone, gray chert
200	235	Brown and tan limestone, gray chert
235	245	Cotton rock
245	250	Cotton rock, gray chert, brown limestone
250	280	Brown limestone, gray and brown mottled chert
280	285	Brown limestone, some gray chert
285	295	Shelly brown and glauconitic limestone
295	305	White and gray chert
305	320	White and gray chert, brown limestone
320	340	Gray and white chert, brown limestone
340	375	Brown limestone, gray and white chert
375	380	Gray, white and tan, translucent chert
380	400	Hard dull gray and white chert
400	405	Gray, brown and white mottled chert, a few calcite crystals, good zinc sulfide shines; 1.00% Zn
405	407-1/2	Gray, brown and white mottled chert, crevices, zinc sulfide shines; 0.50% Zn
407-1/2	410	Gray, brown and white mottled chert, calcite crystals, very good zinc sulfide ore; 11.28% Zn
410	412-1/2	Gray, brown and white mottled and some dark gray chert, good zinc sulfide ore; 4.54% Zn
412-1/2	415	Dark gray, tan and a little black chert, crevices, zinc sulfide ore; 4.40% Zn
415	417-1/2	Gray, white, tan and black chert, fair zinc sulfide ore; 1.68% Zn
417-1/2	420	Light to dark gray and black chert, crevices, zinc sulfide shines; 0.76% Zn

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Hole No. EM-4 (cont)

Feet		Formation
From	To	
420	422-1/2	Gray to dark gray and black chert with zinc sulfide shines; 0.66% Zn
422-1/2	425	Firm gray to dark gray and black chert, fair zinc sulfide shines
425	427-1/2	Gray to dark gray, tan and black chert, traces zinc sulfide and lead sulfide
427-1/2	430	Gray to dark gray, tan and black chert, slight traces zinc sulfide and lead sulfide
430	435	Black limestone, very dark brown, dark gray and black spotted chert, some small crevices

Date started: Jan. 13, 1947  
 Date completed: Feb. 1, 1947  
 Struck water at 387 feet  
 Water stands at 225 feet

Hole No. EM-5  
 Coordinate location: 8595N-4556W  
 Collar elevation - 865 feet

Feet		Formation
From	To	
0	12	Soil, clay and gravel
12	16	Interbedded sandstone and shale
16	90	Shale
90	92	Coal
92	96	Interbedded sandstone and shale
96	168	Shale
168	172	Gray limestone
172	174	Shale, much pyrite
174	195	Gray Chester limestone
195	230	Brown and some gray limestone, gray and light blue chert
230	240	Brown and gray limestone, white chert
240	250	Cotton rock, white chert, tan limestone
250	285	Brown limestone, gray, tan and blue chert
285	295	Greenish-gray glauconitic limestone, some dark blue, gray and tan chert
295	305	Gray and some white chert, a little gray limestone
305	310	Light to dark gray chert, brown to tan limestone
310	315	Gray and white chert
315	330	Gray chert and brown limestone
330	365	Brown to tan limestone, some gray chert
365	371	Gray and brown limestone, gray and tan chert, a slight trace zinc sulfide
371	375	Brown to tan limestone, some gray chert

Hole No. EM-5 (cont)

Feet		Formation
From	To	
375	385	Gray, white and tan translucent chert, trace lead sulfide
385	390	Dull gray, white and a little brown chert, a few small cuttings
390	395	Dull gray, white and some tan chert, soft tan secondary limestone
395	402-1/2	Gray, tan and white mottled and some dark gray chert, pyrite
402-1/2	405	Gray, brown and blue chert
405	407-1/2	Blue, brown and dark gray chert, an 8-inch opening at 406 feet
407-1/2	410	Blue, brown and dark gray chert, selvage seams
410	412-1/2	Loose dark to light gray and brown chert, a few coarse zinc sulfide crystals
412-1/2	415	Same as above but with selvage seams, zinc sulfide shines and trace lead sulfide
415	417-1/2	Same as above but with fair zinc sulfide ore and trace lead sulfide
417-1/2	420	Dark gray, brown and blue chert, fair zinc sulfide shines
420	422-1/2	Dark gray, brown, blue and black chert, zinc sulfide shines
422-1/2	425	Same as above
425	427-1/2	Light to dark gray, blue, black and some gray spotted chert, fair zinc sulfide ore, trace lead sulfide
427-1/2	430	Dark to light gray, brown, white and some black spotted chert zinc sulfide shines and trace lead sulfide
430	432-1/2	Dark gray, brown and black chert, black limestone, selvage seams, trace zinc sulfide and lead sulfide
432-1/2	435	Same as above but with lead sulfide shines
435	438	Black limestone, dark gray chert, marcasite

Analyses of samples - Percent metal

Section	Percent metal		
	Zinc	Lead	
412-1/2	415	0.90	0.18
415	417-1/2	3.66	0.10
417-1/2	420	0.74	0.04
420	422-1/2	0.68	0.02
422-1/2	425	0.82	0.02
425	427-1/2	2.02	0.03
427-1/2	430	0.84	0.10
430	432-1/2	0.48	0.05
432-1/2	435	0.24	0.50

Date started: Feb. 3, 1947  
 Date completed: Feb. 18, 1947  
 Struck water at 399 feet  
 Water stands at 225 feet

Hole No. EM-6  
 Coordinate location: 8761N-4335W  
 Collar elevation - 865 feet

Feet		Formation
From	To	
0	12	Soil, clay and gravel
12	16	Interbedded sandstone and shale
16	162	Shale
162	190	Gray Chester limestone
190	205	Pale brown limestone, gray chert
205	210	Gray chert, tan and gray limestone
210	250	Gray and white chert, tan limestone
250	280	Brown limestone, gray and white mottled and a little blue chert
280	315	Soft cotton rock, leached white chert, gray and white limestone, a greenish selvage seam at 304 feet and an open crevice at 315 feet
315	335	Firm pale brown limestone, gray and white chert
335	355	Brown limestone, gray, white, some blue and little tan chert, seams of dark brown selvage and some mud
355	365	Brown and some gray limestone, gray and white chert
365	370	Gray, tan and white chert, brown limestone, dark brown selvage seams
370	395	Leached and limey dull gray and white chert
395	400	Dense light to dark gray, white, brown and black chert, jasperoid, trace lead sulfide, a crevice at 399 feet
400	402-1/2	Hard light to dense dark gray, brown white and black chert, jasperoid, green selvage seams, many small crevices, lead sulfide shines
402-1/2	405	Very hard gray tan, white and some black chert, trace lead sulfide
405	410	Hard light to dark gray, white, brown, and black chert, green selvage seams, trace lead sulfide
410	412-1/2	Same as above but without lead sulfide mineralization
412-1/2	415	Same as above but with numerous small crevices and lead sulfide shines
415	422-1/2	Dense dark to light gray, brown, white and black chert, many small crevices, trace lead sulfide
422-1/2	425	Black jasperoid, black dense dark gray, blue and some pieces of small dull white chert, many crevices
425	430	Same as above but with more dull white chert and also coatings of small quartz crystals in numerous crevices
430	434	Hard dense gray, dark brown, some white and light blue chert, a slight trace of lead sulfide

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## Hole No. EM-6 (cont)

Analyses of samples - Percent metal		
Section		Lead
400	402-1/2	0.39
412-1/2	415	0.57

Date started: Feb. 10, 1947  
 Date completed: March 4, 1947  
 Struck water at 388 feet  
 Water stands at 220 feet

Hole No. EM-7  
 Coordinate location: 8003N-4271W  
 Collar elevation - 868 feet

Feet		Formation
From	To	
0	15	Soil, clay and gravel
15	115	Shale
115	125	Interbedded sandstone and shale
125	160	Shale
160	165	Shale, limestone boulders, pyrite
165	170	Gray Chester limestone
170	180	Gray Chester limestone, interbedded shale seams, some water
180	190	Gray and blue to light blue chert, gray limestone, a small crevice
190	200	Gray and blue chert, brown limestone
200	205	Gray limestone, some gray and blue chert
205	220	Gray limestone, a very little gray chert
220	230	Gray and blue chert, some gray limestone
230	245	Gray limestone, gray chert
245	260	Brown limestone, gray and some dark gray chert
260	265	Gray, blue and brown chert, gray shelly partially glauconitic limestone
265	270	Gray, blue and brown chert, brown limestone
270	275	Leached gray and white chert, cotton rock, some gray limestone
275	295	Cotton rock, leached gray and white chert, some gray limestone
295	300	Leached white, gray and some brown chert
300	305	Gray chert, brown limestone
305	310	Gray and brown limestone, gray chert
310	315	Brown limestone, gray chert
315	320	Gray chert, a very little gray limestone
320	345	Gray chert, brown limestone
345	355	Brown limestone, gray and some blue to light blue chert
355	360	Very dull gray and white chert
360	380	Leached gray and white chert, gray limestone



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Hole No. BM-7 (cont)

Bureau of Mines  
Churn-Drill Hole Logs

Miami Trough Extension Project No. 15-201  
Karcher Tract  
Cherokee County, Kansas

Feet		Formation
From	To	
380	385	Gray, blue and brown chert, jasperoid
385	390	Gray to dark gray, brown, tan and some white chert, jasperoid
390	395	Many crevices, no cuttings recovered
395	400	Loose gray to dark gray, tan and some light gray mottled chert, jasperoid
400	405	Gray mottled, some white, dark gray and tan chert, jasperoid
405	410	Loose coarse pieces of gray, dark gray and some white chert, calcite crystals
410	415	Dark to light gray and some white chert, jasperoid
415	420	Loose light to dark gray, tan, white, black and some gray and white mottled chert, jasperoid
420	425	Same as above but becoming more firm
425	428	Hard light to dark gray, some gray and white mottled and some black chert, some dark brown limestone
No samples were assayed		

Date started: Feb. 19, 1947  
Date completed: March 4, 1947  
Struck water at 343 feet  
Water stands at 300 feet

Hole No. BM-8  
Coordinate location: 3907N-431W  
Collar elevation - 862 feet

Feet		Formation
From	To	
0	18	Soil, clay and gravel
18	200	Shale
200	215	Gray Chester limestone, some gray chert
215	230	Light brown limestone, gray and white chert
230	245	Leached white chert, cotton rock
245	250	Leached white chert, tan limestone
250	255	Tan limestone, gray and tan chert
255	265	Tan limestone, white and gray chert
265	270	Gray and some dark gray chert, brown limestone, marcasite
270	290	Brown and tan limestone, some gray chert
290	300	Brown limestone, gray, blue and brown chert, marcasite
300	310	Gray, blue, tan and some mottled chert, brown limestone
310	320	Gray and blue chert, brown limestone
320	325	Gray, blue and brown chert, brown limestone, calcite crystals, a crevice at 323 feet
325	350	Gray and a few pieces of brown chert
350	355	Loose gray and white chert, calcite crystals, numerous crevices, an opening at 343 feet
355	360	Gray to light blue chert, a trace lead sulfide
360	365	Opening at 362-365 feet; no cuttings recovered
365	370	Soft loose gray and white mottled chert, calcite and marcasite crystals, trace lead sulfide
370	375	Loose gray and brown mottled chert, calcite and marcasite crystals, a trace lead sulfide
375	390	Loose gray, brown and blue mottled chert, limey dark brown sandy spar, calcite crystals
390	395	Gray, brown and white chert, dark brown sandy spar, some brown limestone
395	400	Loose gray translucent, white and tan mottled and some brown chert, jasperoid
400	405	Firm dull gray and white chert
No samples were assayed.		

Date started: March 5, 1947      Hole No. BM-9  
 Date completed: March 20, 1947      Coordinate location: 4415N-621W  
 Struck sulphur water at 325 feet      Collar elevation - 870 feet  
 Water stands at 300 feet

Feet		Formation
From	To	
0	18	Soil, clay and gravel
18	22	Brown sandy shale
22	25	Interbedded sandstone and shale
25	160	Shale
160	172	Interbedded sandstone and shale
172	200	Shale
200	215	Gray Chester limestone
215	220	Gray Chester limestone, some gray chert
220	225	Light brown and some gray limestone, gray chert
225	235	Light brown limestone, a very little gray chert
235	250	Cotton rock, some gray chert, a little gray limestone
250	255	Light brown limestone, some cotton rock
255	260	Light brown limestone, some gray chert
260	295	Light brown limestone, gray chert
295	310	Brown limestone, gray, some brown and a little blue chert
310	320	Blue, gray and brown chert, brown limestone
320	325	Brown limestone, blue, gray and black chert
325	330	Gray, brown and blue chert
330	335	Gray and some dark gray chert
335	350	Cotton rock, gray chert, some gray limestone
350	360	Gray, white and some multi-colored chert, a few pieces brown oolitic limestone, calcite crystals
360	365	Gray chert, brown limestone
365	370	Many crevices, no cuttings recovered
370	375	Loose gray, blue and white chert, some brown limestone, very few cuttings recovered
375	380	Loose gray, blue and white chert, some brown limestone and brown sand
380	385	Firm gray white and brown chert
385	390	Firm gray and brown and mottled chert, brown limestone
390	395	Same as above with a little white chert
395	400	Gray, white and brown chert, jasperoid, trace lead sulfide
400	405	Gray, white and brown translucent chert, jasperoid, slight trace lead sulfide
405	407-1/2	Gray to dark gray, brown and white chert, jasperoid
407-1/2	417-1/2	Gray, tan and white translucent chert, a few domomite crystals

## Hole No. BM-9 (cont)

Feet		Formation
From	To	
417-1/2	420	Gray mottled and some dense dark gray chert
420	425	Dense dark, light gray and some multi-colored chert, brown limestone
425	430	Dense dark gray to blue and some multi-colored chert, brown limestone
No samples were assayed		

Date started: March 22, 1947      Hole No. BM-11  
 Date completed: April 1, 1947      Coordinate location: 4370N-673W  
 Struck water at 305 feet      Collar elevation - 870 feet  
 Water stands at 300 feet

Feet		Formation
From	To	
0	18	Soil, clay, gravel
18	155	Shale
155	180	Sandstone
180	200	Shale
200	210	Gray Chester limestone
210	225	Gray Chester limestone, a very little gray chert
225	250	Light brown and some gray limestone
250	285	Light brown limestone, gray chert
285	295	Light brown limestone, blue and some gray chert
295	310	Light to dark brown limestone, gray, blue and some brown chert
310	320	Brown limestone, gray, brown and blue chert
320	325	Gray to dark gray and some light blue chert, calcite crystals, zinc sulfide shines, trace lead sulfide
325	327-1/2	Many crevices, "open", no cuttings recovered
327-1/2	330	Loose gray and white mottled and some brown chert
330	345	Loose gray, white and brown chert
345	350	Loose gray, white and brown chert, many crevices, very few cuttings recovered
350	355	Opening, no cuttings recovered
355	360	Loose brown oolitic limestone, gray chert, calcite crystals, many crevices
360	365	Loose brown oolitic limestone, gray chert, calcite crystals, many crevices
365	370	Gray and white chert, calcite crystals, some crevices
370	375	Loose-gray and white chert, some brown limestone, many crevices
375	380	Loose gray to dull gray, tan and some light blue chert, many crevices

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Hole No. EM-11 (cont)

Feet		Formation
From	To	
380	390	Soft gray, white and some light blue chert, tan limestone, some brown sandy decomposed limestone, trace lead sulfide
390	395	Dull gray, tan and white mottled chert, some jasperoid
395	400	Light to dark brown, white and some gray translucent chert
400	405	Gray, tan, light blue translucent and dull white chert
<u>Analyses of samples - Percent metal</u>		
<u>Section</u>		<u>Lead</u> <u>Zinc</u>
320	325	0.72    0.02

Date started: April 2, 1947  
 Date completed: April 21, 1947  
 Struck water at 360 feet  
 Water stands at 300 feet

Hole No. EM-13  
 Coordinate location: 3978N-452W  
 Collar elevation - 863 feet

Feet		Formation
From	To	
0	4	Soil, clay, gravel
4	8	Sandstone
8	18	Clay
18	199	Shale
199	215	Gray Chester limestone
215	220	Gray Chester limestone, selvage seams
220	230	Gray limestone, gray chert
230	245	Cotton rock, some leached gray chert
245	250	Gray and light brown limestone
250	300	Gray and light brown limestone, much marcasite
300	320	Brown limestone, gray and some blue chert, selvage seams
320	325	Gray to dark gray and black chert, calcite crystals, selvage with decomposed black and greenish glauconitic limestone
325	345	Gray to dark gray chert, dark brown muddy selvage, much marcasite
345	360	Cotton rock, gray and white leached chert, marcasite
360	365	Fractured gray, brown and white multi-colored chert, dark brown sugar-like jasperoid, some silicified oolites, marcasite and a trace of zinc sulfide (est. 0.40% zinc) in an apparent steeply-dipping fissure with a hard footwall which deflected the hole
2724		

Hole No. EM-13 (cont)

Feet		Formation
From	To	
365	375	Fractured white, gray and tan chert, dark brown sugar-like jasperoid, calcite crystals, trace zinc sulfide (est. 0.40% zinc) in the steeply-dipping fissure which continued to 375 feet in depth
375	385	Hard gray to dark gray, tan and white multi-colored chert, some dark brown jasperoid
385	390	Hard dull gray, white and some tan chert, a little brown jasperoid
390	395	Hard dull gray white, some tan and some translucent chert
395	400	Dull gray and white chert
No samples were assayed		

NOTE: Upon reaching 375 feet in depth, the driller fed much cast iron into the crooked hole which had followed an apparent steeply-dipping fissure with a hard footwall below 360 feet. After a full day of pounding and grinding with the drill bit, the hole was straightened sufficiently for drilling to be continued to completion at 400 feet in depth.

Bureau of Mines  
Churn-Drill-Hole Logs

Miami-Trough Extension Project No. 15-201  
Crowe Tract  
Ottawa County, Oklahoma

Date started: March 5, 1947  
Date completed: March 21, 1947  
Struck water at 245 feet  
Water stands at 175 feet

Hole No. EM-10  
Coordinate location: 9009N-9288E  
Collar elevation - 805 feet

Feet		Formation
From	To	
0	20	Soil and clay
20	33	Sand and river gravel
33	42	Cherokee shale, much pyrite
42	60	Gray oil-stained Chester limestone, some gray chert
60	80	Soft light and dark gray oil-stained limestone
80	85	Gray limestone, gray chert
85	90	Gray limestone, some cotton rock, a little gray chert
90	95	Cotton rock, gray limestone
95	105	Blue and gray chert, tan limestone
105	150	Soft light brown limestone, blue and gray chert
150	175	Shelly brown limestone, blue chert
175	180	Black and some brown limestone, blue chert
180	190	Black limestone, a little white chert
190	195	Same as above but with a slight trace of heavy white mineral (possibly barite?)
195	200	Hard fine grained brown oolitic and a little gray limestone, some gray chert
200	205	Brown limestone, gray chert
205	215	Soft brown limestone, gray chert, calcite crystals in seams
215	230	Gray, brown and some multi-colored chert, some brown limestone
230	240	Brown limestone, gray chert
240	245	Soft dull white and some blue chert, cotton rock
245	250	Dull gray and white chert
250	255	White and gray chert, trace brown limestone
255	260	Gray, a little white and blue glassy chert
260	280	Dull white and gray chert, a very little gray limestone
280	285	Pale brown limestone, dull white and gray chert
285	290	Pale brown and gray limestone, gray and light blue chert
290	295	Pale brown and gray limestone, some gray chert
295	300	Pale brown and gray limestone, some dark blue chert
300	305	Gray to dense dark gray limestone, dense dark gray chert
305	315	Dense dark gray and some shelly brown limestone, dense dark gray and some blue chert

No samples were assayed

Date started: March 21, 1947  
Date completed: April 3, 1947  
Struck water at 258 feet  
Water stands at 178 feet

Hole No. EM-12  
Coordinated location: 9157N-9156E  
Collar elevation - 807 feet

Feet		Formation
From	To	
0	23	Soil and clay
23	31	Sand and river gravel
31	50	Cherokee shale
50	90	Gray Chester limestone
90	105	Gray limestone, some gray chert
105	115	Tan limestone, light blue and gray chert
115	130	Gray limestone, gray chert
130	150	Tan limestone, light blue and gray chert
150	165	Brown limestone, blue chert
165	170	Brown and some speckled shelly limestone, blue chert
170	175	Brown shelly limestone, gray chert
175	180	Brown limestone, gray and some dark gray chert
180	185	Brown shelly limestone, gray, blue, brown and some dark gray chert
185	190	Black, dark brown and some gray limestone, a very little gray chert
190	200	Black limestone, a slight trace of white heavy mineral
200	205	Brown to light brown oolitic and some black limestone
205	210	Gray and blue chert, brown partially oolitic limestone and some silicified oolites
210	215	Brown limestone, gray chert
215	225	Brown limestone, gray and some blue chert
225	240	Brown and gray to dark gray limestone, a very little gray chert
240	245	Brown and some gray limestone, some leached white chert
245	250	Brown and dull white chert
250	255	Dull gray and white leached chert
255	260	Cotton rock, leached dull gray and white chert
260	263	Cotton rock, leached gray, white and some blue chert

No samples were assayed.

Date started: April 3, 1947  
Date completed: April 7, 1947  
No water encountered

Hole No. EM-14  
Coordinate location: 9308N-9023E  
Collar elevation - 809 feet

Feet		Formation
From	To	
0	24	Soil, clay and some gravel
24	36	Sand and creek gravel

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Hole No. EM-14 (cont)

Feet		Formation
From	To	
36	58	Shale
58	60	Much pyrite, gray Chester limestone
60	65	Gray Chester limestone, some pyrite, a little gray chert
65	70	Light and some dark gray speckled Chester limestone
70	100	Same as above with a very little gray chert
100	105	Same as above with a little gray chert
105	110	Gray limestone, gray and blue chert

NOTE: The upper strata penetrated by this hole indicated that the lower subsurface stratigraphy and geological conditions would be very similar to those found in previous unfavorable holes in the vicinity. Therefore, the hole was stopped at 110 feet in depth by order of the project engineer.

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Date started:	April 7, 1947	Hole No. EM-15
Date completed:	April 10, 1947	Coordinate location: 8967N-9166E
No water encountered		Collar elevation - 803 feet

Feet		Formation
From	To	
0	21	Soil and clay
21	31	Creek sand and gravel
31	48	Shale
48	55	Gray Chester limestone, much pyrite, a loose seam of bright green shale and selvage
55	60	Light to dark gray Chester limestone
60	65	Same as above but with a very little gray chert
65	70	Gray chert, tan limestone, marcasite
70	85	Dark gray speckled buff limestone and cotton rock, some gray chert
85	90	Tan partially speckled limestone, leached blue to light blue chert, some cotton rock
90	95	Cotton rock, brown limestone, blue and gray chert

No samples were assayed.

NOTE: The upper strata penetrated by this hole indicated that the lower subsurface stratigraphy and geological conditions would be very similar to those found in previous unfavorable holes in the vicinity. Therefore, the drilling of the hole was stopped at 95 feet in depth by order of the project engineer.





