Bureau of Mines
Report of Investigations 4575

INVESTIGATION OF THE K. T. DOME ZINC-LEAD MINE OWEN AND HENRY COUNTIES, KY.

BY WILLIAM A. BECK

United States Department of the Interior —November 1949

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A Century of Conservation

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UNITED STATES DEPARTMENT OF THE INTERIOR
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by

William A. Beck[1/]

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INTRODUCTION AND SUMMARY

The K. T. Dome mine in Owen and Henry Counties, Ky., has been operated intermittently under several different owners since the early nineteen hundreds.

1/ Mining engineer, U. S. Bureau of Mines, Raleigh Division.

No record of total production is available, but it is said that during 1943 and 1944, while being operated by the Twin Valley Mining Co., 30 cars of zinc concentrates and 10 cars of lead concentrates were shipped.

The vein can be traced for about 10 miles along the strike from Lockport, Henry County, to Big Twin Creek in Owen County. It pinches and swells both vertically and horizontally and is reported to average 20 inches in width.

In order to develop additional reserves on the property, the Bureau of Mines drilled four holes on the south extension of the vein.

Drilling disclosed that the vein dips to the west on the south side of the Kentucky River and is continuous along the strike and in depth. However, the extent of mineralization in the vein varies widely.

ACKNOWLEDGMENTS

Acknowledgment is due William Beiser and Lee Marriott, officials of the K. T. Dome Mining Syndicate, Inc., for their assistance and cooperation during the project, and to Arnold L. Brokaw of the Federal Geological Survey for his assistance in logging the drill cores.

The samples were analyzed by R. Kronstadt, Metallurgical Division, Raleigh Branch.

LOCATION AND OWNERSHIP

The K. T. Dome mine is on the northeast bank of the Kentucky River, about 2 miles northwest of Gratz, Owen County, Ky., and about 9 miles by road west of Owenton, the county seat (fig. 1).

The property consists of a 10-acre plant site and leases on the mineral rights of about 1,500 acres of land, which together cover 7 miles of the strike length of the Lockport-Gratz vein. It is owned by the K. T. Dome Mining Syndicate, Inc., 500-526 East Front St., Cincinnati 2, Ohio. The officers of the Syndicate are William Schroeppel, president, and Leon Hallstead, vice-president, both of Buffalo, N. Y., William Beiser, treasurer, Cincinnati, Ohio, and Lee Marriott, mining engineer and general manager, Gratz, Ky.

HISTORY

The early history of the development of the vein deposits in the Lockport-Gratz district is a record of a search for lead and silver. No organized effort was made to exploit the deposits until 1866, when a Wisconsin company did some developing on the Lockport vein near Lockport, Henry County. Nothing of importance resulted from their efforts, and they withdrew from the field.

About the same time, an organization known as Steward & Co. took over some holdings in Henry County. They were succeeded by Parker & Co. of Philadelphia, and in 1874 the Silver & Spar Mining Co. took over the deposits.

Numerous attempts to work the deposits in central Kentucky were made during the following years, and most of them were unsuccessful because the

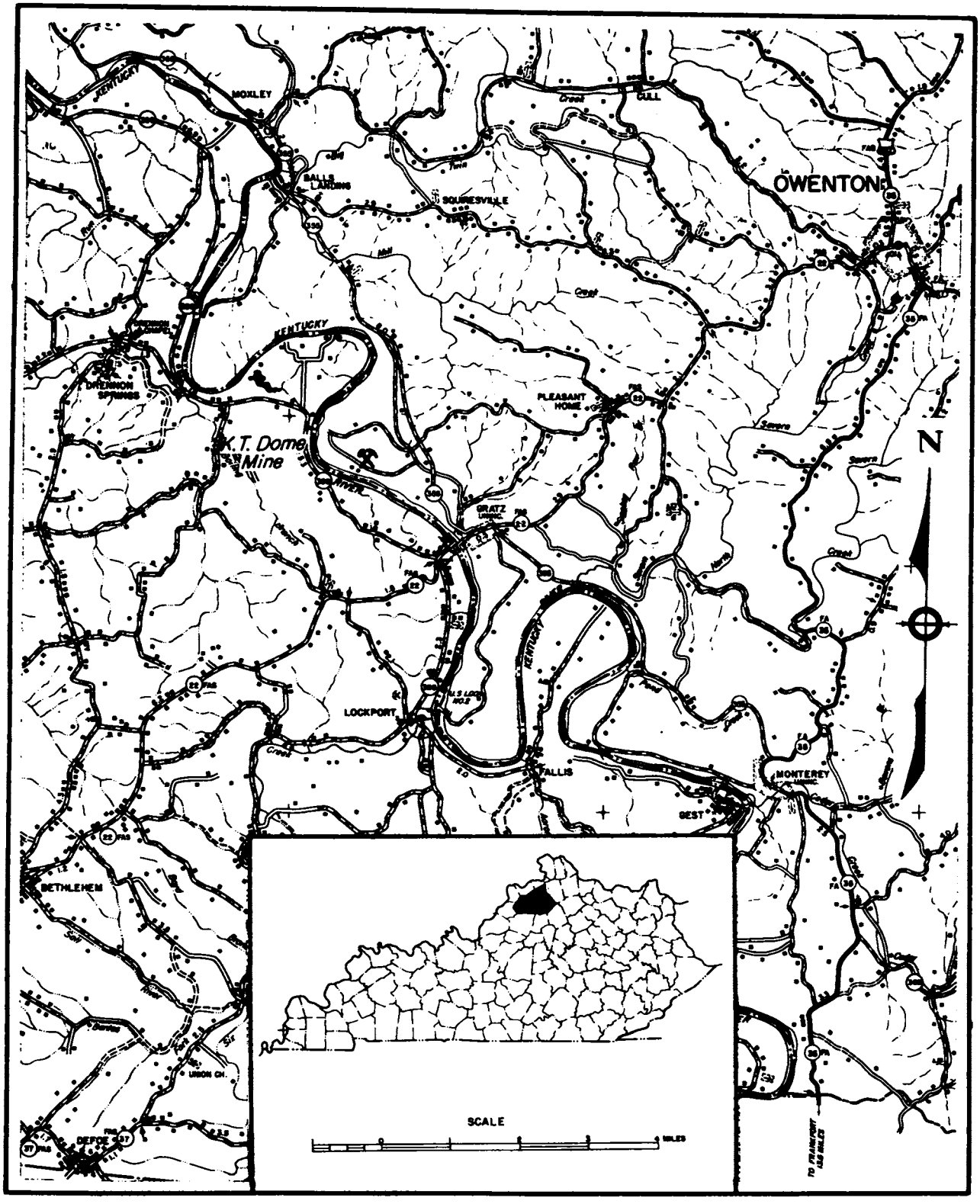

Figure 1. - Location of K. T. Dome mine, Owen County, Ky.

operators devoted their efforts to the recovery of lead and zinc and attached no importance to the barite, calcite, and fluorite that make up the bulk of the vein materials.

In 1904 A. M. Miller called attention to the working of the Lockport mines by the Lockport Lead Mining Co. at Lockport, Henry County, and to the plant of the Ohio Lead Mining Co. at Gratz, Owen County, where about 50 tons of ore was being treated daily to produce between 5 and 6 tons of lead concentrates.

In 1913, Fohs reported the Ohio Lead Mining Co. was still operating at Gratz, and that the Union Mining Co. at Lockport was sending its ore to the Madison Lead Co. at Madison, Ind., for treatment instead of to the mill at Paducah.2/

After 1913, the deposit at Gratz remained idle until it was reopened by the Twin Valley Mining Co. in 1940 under the control of the Mercer Fluorspar Mining Co. William Beiser, one of the officials, stated that 30 cars of zinc concentrates and 10 cars of lead concentrates were shipped during 1943 and 1944.

In 1945 The K. T. Dome Mining Syndicate, Inc., took over the holdings. It began operation in the latter part of that year and has shipped 10 cars of zinc concentrates. The last 5 cars averaged more than 65 percent zinc. Since the expiration of the subsidy on zinc, it has made no further shipments. Development work has continued on a small scale on the 278-foot level of the Ohio shaft where the level has been advanced 355 feet to the south, and three stopes are being developed.

PHYSICAL FEATURES

The area traversed by the Lockport-Gratz vein is a limestone plateau that has been dissected to form low rolling hills. The Kentucky River, which crosses the vein and meanders through the hills, has entrenched itself in a narrow gorgelike valley approximately 125 feet deep. Away from the river, the relief varies moderately with a range of approximately 100 feet.

DESCRIPTION OF THE DEPOSIT3/

Sphalerite and galena occur in an almost vertical fissure vein of barite and calcite that in general trends in a north-south direction. The vein has been traced from Lockport, Henry County, north to Big Twin Creek in Owen County, a distance of about 10 miles. The center of mineralization appears to be near the Owen-Henry County line in the vicinity of the Kentucky River, where the K. T. Dome mine is situated. The vein swells and pinches, both vertically and horizontally, and averages about 20 inches in width in the area around the K. T. Dome mine. At depth it dips steeply to the east on the Owen County side of the Kentucky River (and steeply to the west on the Henry County side.)

2/ Robinson, Lewis Cass, Vein Deposits of Central Kentucky: Kentucky Geol. Survey, ser. VI, vol. 41, 1931, pp. 24-26.

3/ Klepser, H. J., Geologist, U. S. Geological Survey: Unpublished report, September 1947.

The country rock is interbedded limestone and shale of the Lexington formation, which in turn is underlain by the Highbridge limestone formation. Both are middle Ordovician formations. The structure of this portion of Kentucky is dominated by the Cincinnati geanticline, which is a broad, low arch that extends from central Ohio and Indiana across Kentucky into Tennessee. Normal faults associated with the anticline have become the loci of mineralization. The Lockport-Gratz vein was so formed and is probably the most important of those in central Kentucky.

The Knox dolomite underlies the Ordovician limestone. This is a brittle dolomite that fractures readily and thus makes an excellent host rock for a breccia-type ore deposition. The Gratz-Lockport vein occurs along a fissure with a small amount of horizontal movement, and it is possible that the Knox might be brecciated for some distance on either side of the fault. Assuming that this deposit was formed by ascending solutions, this brecciated zone of the Knox might contain larger ore bodies of zinc than those present near the surface in the Ordovician limestones. It is in the Knox dolomite that the Mascot-Jefferson City, Tenn., zinc occurs.

THE ORE

The principal ore minerals present in The K. T. Dome mine are sphalerite and galena in a gangue of calcite and barite. Barite and galena are more predominant on the upper levels, whereas at depth they are less abundant, and calcite and sphalerite are the main constituents of the vein.

MINE WORKINGS AND PRESENT PLANT INSTALLATION

The K. T. Dome mine deposit has been developed by four shafts known as the Ohio, Cedar, Pennyroyal, and Mill Shafts and an open cut about 40 feet deep and 150 feet long about 1,200 feet north of the Mill shaft (figs. 2 and 5). At the present time, the only work being carried on is development work on a small scale in the stopes on the 278-foot level south of the Ohio shaft and intermittant work with a drag-line in the open cut.

The Mill shaft on the north end of the operation is 185 feet deep, the Pennyroyal 60 feet, the Cedar 75 feet, and the Ohio shaft is reported to be 560 feet deep. No work has been done in the Ohio shaft below the 278-foot level where they are now working.

Both the Ohio and Mill shafts are at present equipped and the Ohio is in operating condition, but the Mill shaft is filled with water. Ore is hoisted in buckets, which hold about 800 pounds, by a hoisting engine mounted in the headframe. Because of the narrow vein, it is necessary to break considerable wall rock in stoping. However, as the ore is relatively soft and breaks readily into fine sizes, most of the wall rock can be eliminated at the surface by sorting the mixed ore and waste on a 3-inch grizzly. The lead-zinc minerals and the calcite-barite gangue pass through the grizzly openings, whereas the coarse waste rock is caught on the grizzly rails and rejected.

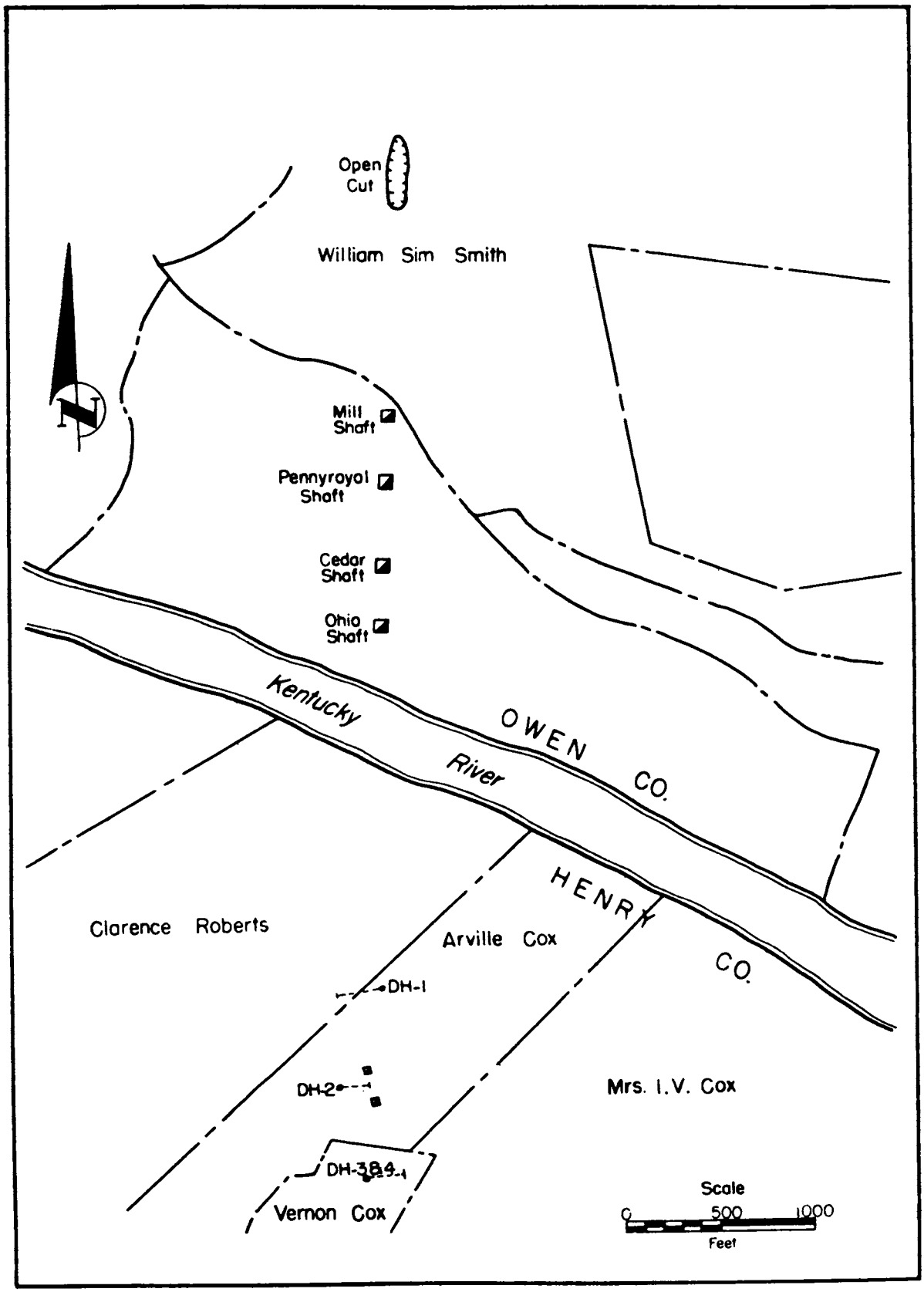

Figure 2. - Plan map of K. T. Dome mine area.

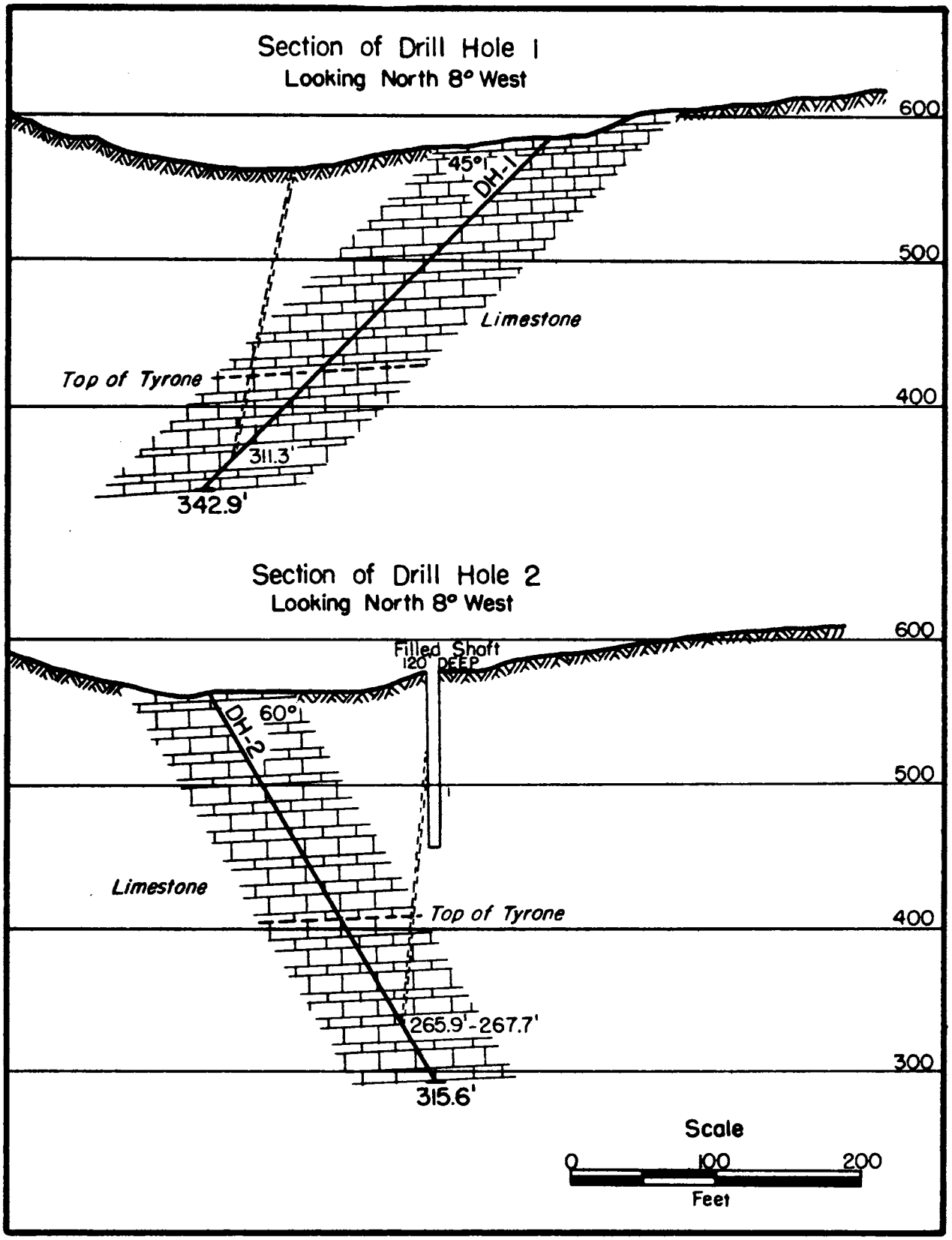

Figure 3. - Sections of Lockport-Gratz vein, Henry County, Ky.

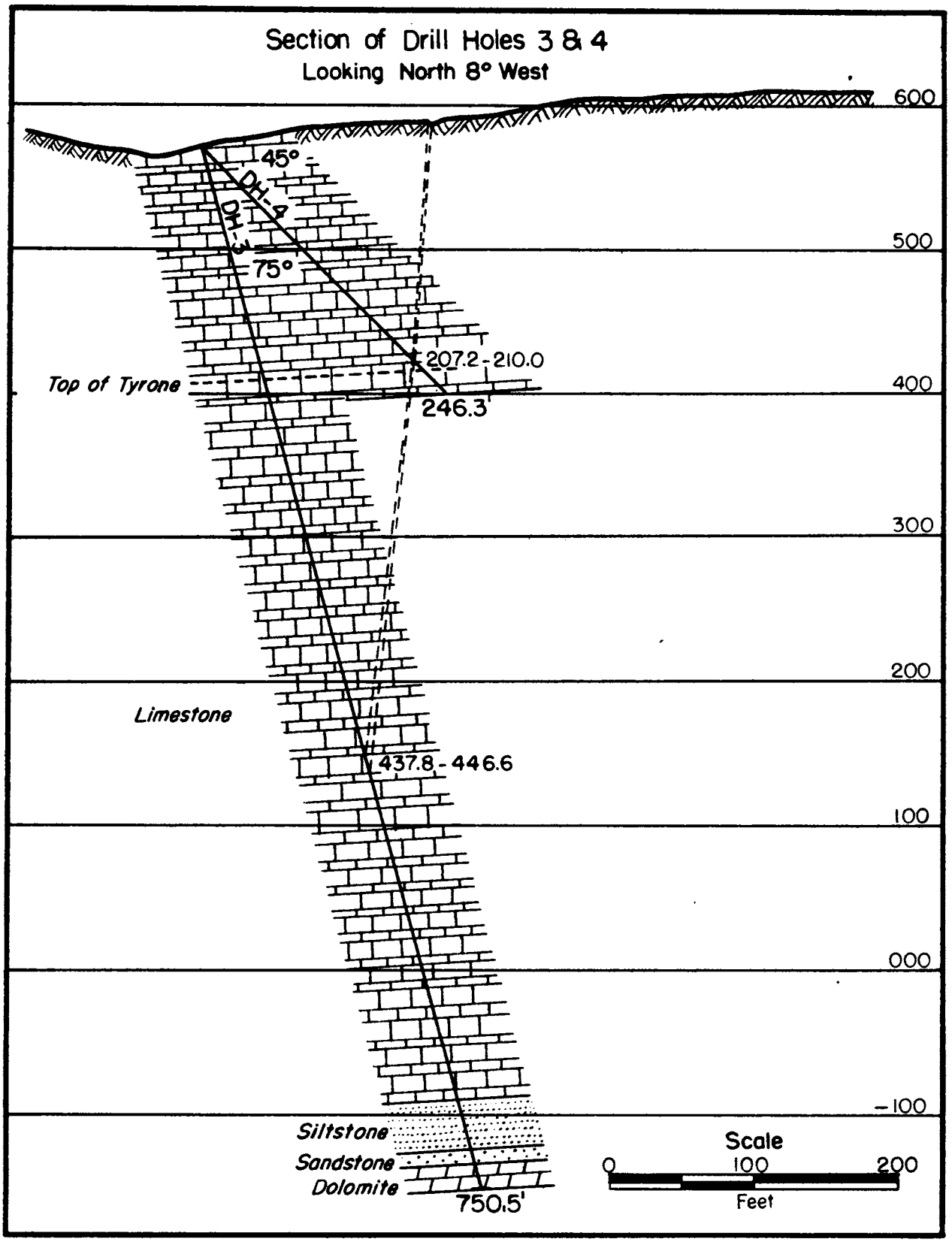

Figure 4. - Section of Lockport-Gratz vein, Henry County, Ky.

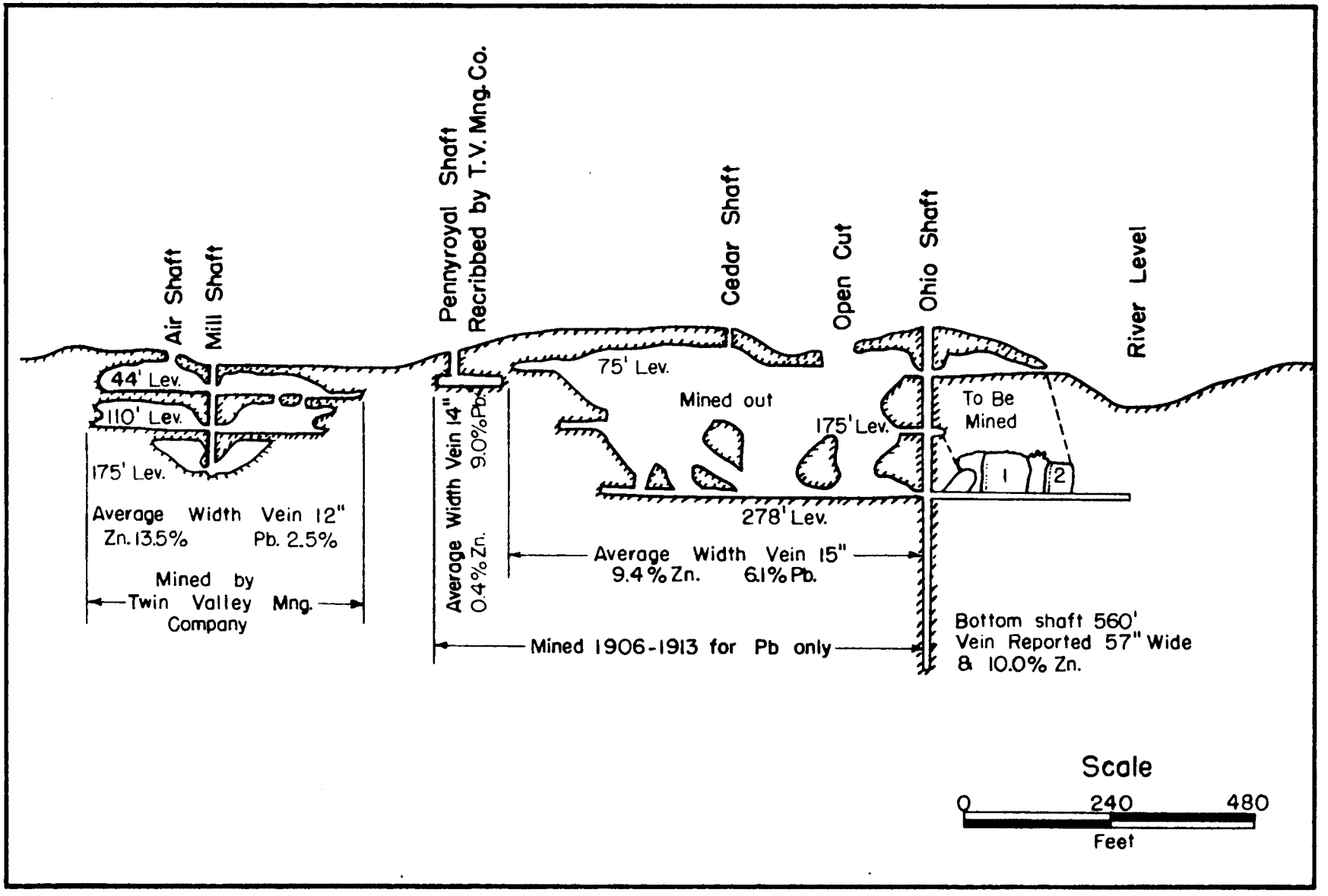

Figure 5. - Longitudinal section of K. T. Dome mine, Owen County, Ky.

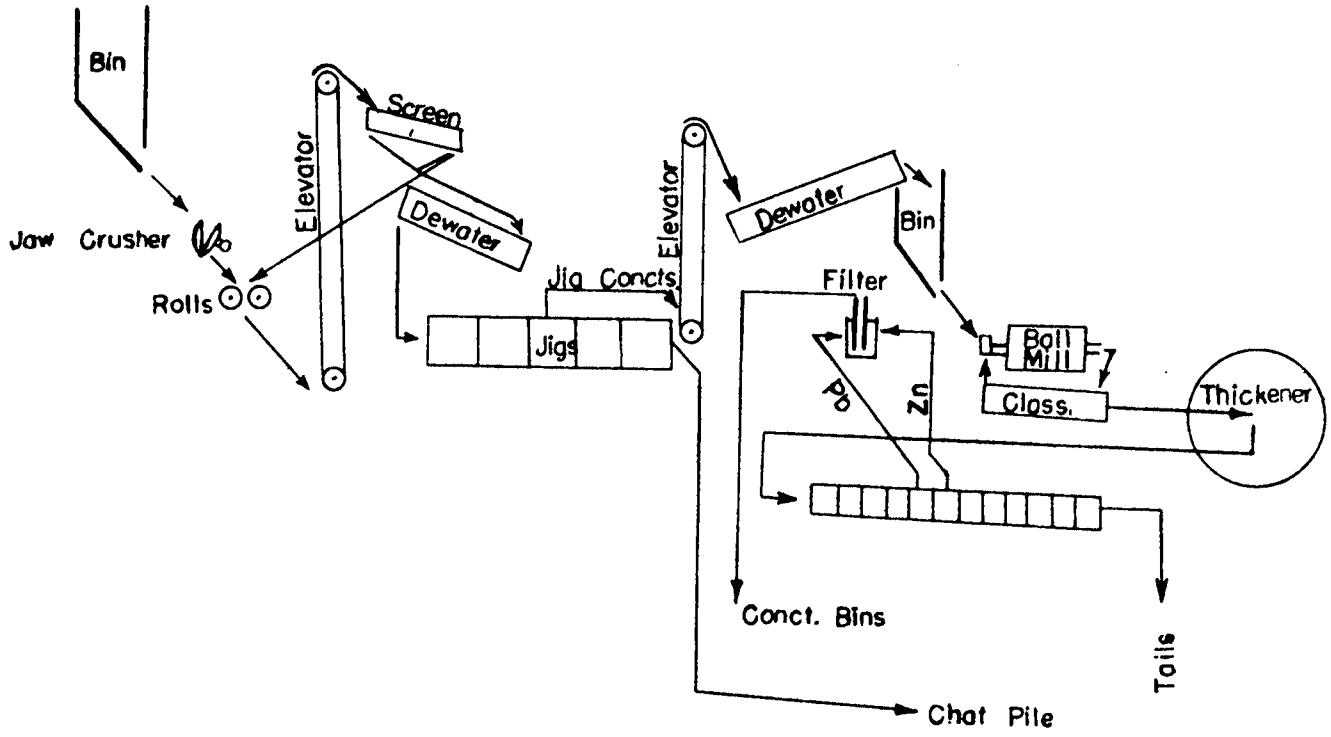

Figure 6. - Flow sheet of the K. T. Dome mine mill, Owen County, Ky.

Previous to 1944, all the mining was done by open stoping. The ore blasted onto the drift floor and then shoveled into buckets mounted on low flat cars. Later, chutes were installed, and the present system of shrinkage stoping was adopted.

The mill is equipped with a jaw crusher, rolls, screens, jigs, ball mill, classifier, thickener, and flotation concentrating units (fig. 6).

Power for the operation is produced at the mill site by two 75-horsepower caterpillar Diesel generating units and one 75-horsepower Chicago pneumatic hothead engine, which is directly connected to a 375 c.f.m. air compressor. A second compressor, having a capacity of 175 c.f.m., is electrically driven. Power is also available from an R.E.A. line tied in with the Company's circuit.

WORK BY THE BUREAU OF MINES

The Bureau of Mines diamond-drilled four holes on The K. T. Dome mine property, totaling 1,655.3 feet, during the period between April 27, 1948, and July 14, 1948.

All holes were drilled on the south extension of the vein in Henry County across the Kentucky River from the Ohio shaft.

As the vein is known to dip to the east in the Ohio shaft, drill hole 1 was drilled at an angle of 45° from the east side of the vein. Evidently the vein had pinched at this place, and only several small calcite stringers were cut, the largest being about 1 inch wide (figs. 2 and 3).

Drill holes 2, 3, and 4 were angle holes drilled from the west side and proved that the vein was dipping westward in this section (figs. 2 and 3).

Drill hole 3 was a 75° hole and, after passing through the vein at 453.3 feet, was continued to 750.5 feet to find the location of the Knox dolomite (figs. 2 and 4). This was cut at 731.8 feet. Vein matter was cut in five places from 404.5 feet to 453.1 feet, the largest being from 437.5 feet to 446.6 feet. This section was composed mostly of calcite with very little sphalerite. The smaller sections cut were more highly mineralized with sphalerite. No galena was found in any of the core.

Drill hole 4 was a 45° hole at the same location as hole 3. It was drilled to get information as to the dip of the vein and also to determine the character of the ore at a higher level (figs. 2 and 4). The vein was cut from 207.3 feet to 210.0 feet and was composed of barite and calcite with a small amount of galena and a lesser amount of sphalerite.

Drill hole 2 was a 60° hole midway between holes 1 and 3 (figs. 2 and 3). The vein was cut from 265.9 feet to 267.7 feet and was very little mineralized.

GENERAL

Postal and telephone service is available at Gratz, Ky. The closest railway connection for railway express and freight is at Worthville, about 12 miles by paved road from the mine. Supplies by motor express from

Lexington, Frankfort, Louisville, and Cincinnati are delivered at Owenton, 9 miles from the property.

The property is in a farming community, and living quarters and skilled labor are scarce.

Drill Hole Sample Analyses, K. T. Dome Mine

Hole	Interval, feet	Length, feet	Core recovery, percent	Analysis, percent			Remarks
				Zn	Pb	$BaSO_4$	
3.....	404.5-405.8	1.3	100	8.28	n.d		Diamond drill core.
3.....	419.4-423.0	3.6	100	I.82	n.d		Do.
3.....	426.7-428.3	1.6	100	3.41	n.d		Do.
3.....	437.7-441.7	4.0	100	.12	n.d		Do.
3.....	441.7-446.6	4.9	100	.02	n.d		Do.
3.....	452.2-453.3	1.1	100	.53	n.d		Do.
4.....	207.2-210.0	2.8	25	.13	.48	43.20	Do.
4.....	198.4-211.8	-	-	.34	n.d	2.96	Sludge
2.....	265.8-267.6	1.8	61	.09	n.d	4.04	Diamond drill core.
2.....	265.1-268.1	-	-	.59	n.d	.76	Sludge

DRILL-HOLE LOG

Core-drill hole: No. 1
Elevation: 582 feet
Depth: 342.85 feet

Location: Arville Cox Property, Henry County, Ky.
Inclination: 45° S. 82° W.

Logged by Arnold L. Brokaw, U. S. Geological Survey.

Interval, feet	Description
0.0-9.0	Surface clay.
9.0-53.7	Gray, coarsely crystalline, fossiliferous limestone with thin-bedded shaly partings. From 43.0 feet shaly partings more numerous.
53.7-83.5	Medium-gray crystalline limestone with black shale partings. Shale partings 30 percent of core.
83.5-93.3	Dark-gray to black, medium-grained, highly fossiliferous limestone with shale partings up to 4 inches wide; 1/4 inch calcite bands at 86 and 87 feet.
93.3-170.6	Medium-gray, coarsely crystalline, fossiliferous limestone with numerous shale partings and limestone nodules in the shale.
170.6-218.4	Dark-gray, fine-grained, highly fossiliferous limestone with numerous calcite-filled fractures.
218.4-232.3	Medium-gray, coarse-grained, crystalline limestone, fossiliferous and with shale partings.

Figure 7. - Mill shaft house and mill.

Figure 8. - Chat pile and barite settling pond.

Figure 9. - Rear view of Bureau of Mines diamond-drill set-up, showing sludge collector, pump, and drill.

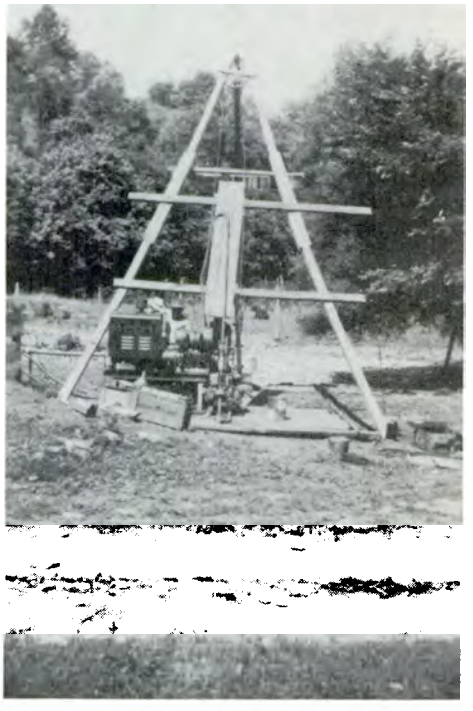

Figure 10. - Front view of Bureau of Mines diamond-drill set-up.

Core-drill hole: No. 1 (Cont'd.)

Interval, feet	Description
Top of Tryone formation	
232.3-262.9	Light-brown, dense limestone with scattered calcite crystals and few shaly partings.
262.9-263.7	Green bentonite with disseminated pyrite.
263.7-292.0	Buff, very dense limestone with a few shaly partings and numerous calcite-filled fractures, three at 274 feet about 1/8 inch each; last 15 feet slightly darker.
292.0-309.6	Light-brown, fine-grained limestone with darker-brown mottles (dolomite mottles?).
309.6-312.0	Light-brown, medium-grained limestone with few shaly partings, 1 inch coarsely crystalline calcite at 311.3 feet; 1/4 inch calcite stringer at 311.6 feet.
312.0-325.5	Light-brown, very fine-grained limestone with occasional shaly partings; 1/8 inch vertical calcite stringers at 321.8 and 323.8 feet.
325.5-333.0	Buff, fine-grained limestone; 1/4 inch calcite stringer at 330.6 feet.
333.0-342.85	Light-brown, fine-grained limestone with heavy blue mottling. Hole bottomed at 342.85 feet.

Core-drill hole: No. 2
Elevation: 564 feet
Depth: 315.58 feet
Location: Arville Cox Property, Henry County, Ky.
Inclination: 60° N. 82° E.

Logged by William A. Beck, U. S. Bureau of Mines.

0.0- 4.5	Overburden.
4.5-181.8	Gray, crystalline, fossiliferous limestone with numerous shaly partings.
Top of Tryone formation	
181.8-315.58	Light-brown, dense limestone with few shaly partings. 1/2 inch calcite stringer at 186.4 feet; 1/4 inch calcite stringer at 188.4 feet; 1 inch calcite stringer at 193.0 feet; 202.8 to 203.0 feet green bentonite; 265.88 to 267.68 feet; crystalline calcite containing a few specks of galena and a little barite; 1 inch calcite stringer at 268.65. Hole bottomed at 315.58 feet.

Core-drill hole No. 3
Elevation: 572 feet
Depth: 750.55 feet

Location: Vernon Cox Property, Henry County, Ky.
Inclination: 75° N. 82° E.

Logged by Arnold L. Brokaw, U. S. Geological Survey.

Interval, feet	Description
0.0- 4.5	Overburden.
4.5- 28.8	Medium-gray, coarsely crystalline, fossiliferous limestone with numerous shale partings.
28.8- 47.6	Medium-gray, medium-grained, fossiliferous limestone with numerous shale partings. Bands of coarse-grained limestone 37.5 to 38.5 and 42.8 to 43.6 feet.
47.6- 48.7	Black, calcareous shale.
48.7- 56.8	Coarsely crystalline gray limestone with numerous shale partings. Small fracture filled with calcite and pyrite at 49.7 feet.
56.8- 61.1	Medium-gray, medium-grained fossiliferous limestone with shale partings which contain pyrite.
61.1- 98.0	Gray, coarsely crystalline limestone with numerous shale partings.
98.0-122.0	Dark-gray, fine-grained, fossiliferous limestone with shale partings with limestone nodules in the shale.
122.0-127.8	Medium-gray, coarse-grained, fossiliferous limestone with shaly partings and bands of dark-gray limestone.
127.8-152.0	Dark-gray, fine-grained limestone, highly fossiliferous, with shaly partings.
152.0-168.8	Medium-gray, coarsely crystalline, fossiliferous limestone with shale partings.
Top of Tryone formation	
168.8-190.5	Light-brown, fine-grained limestone with shaly partings and calcite-filled vugs. At 187.5 feet, green bentonite. Pyrite-filled fractures.
190.5-203.6	Very dense, buff limestone with few shale partings.
203.6-205.6	Medium-gray, fine-grained limestone with calcite birds-eyes.
205.6-218.2	Light-buff, blue-mottled, very dense limestone with few shale partings.
218.2-223.7	Medium-gray, fine-grained, mottled, fossiliferous limestone with numerous shale partings.
223.7-251.6	Light-buff, blue-mottled, very dense limestone with few shale partings. Green shale at 229 feet.
251.6-258.0	Light-buff, dense limestone with thin shale partings.
258.0-290.0	Light-gray, mottled, fine-grained limestone with several calcite-filled fractures.
290.0-296.7	Medium-gray, fine-grained limestone with numerous calcite stringers parallel to bedding.
296.7-300.7	Light-brown, dense, mottled limestone.
300.7-354.4	Medium-grained, buff limestone with light-brown mottling.
354.4-380.4	Fine-grained, light-brown, brown-mottled limestone. Weathered zone at 376.5 to 377.0 feet.
380.4-404.0	Brown, medium-grained, mottled limestone. Few shale partings.

Core-drill hole No. 3 (Cont'd.)

Interval, feet	Description
404.0-407.0	Medium-gray, coarsely crystalline limestone, brecciated with rosin and crystalline sphalerite and coarsely crystalline calcite from 404.5 to 405.8 feet, containing 25 to 30 percent sphalerite.
407.0-417.0	Light-brown, fine grained, mottled limestone.
417.0-423.0	Medium-gray, fine-grained limestone with shaly partings. 419.4 to 423.0 feet mixture of calcite and brecciated limestone containing rosin sphalerite with few specks of galena. Less than 5 percent sphalerite.
423.0-426.7	Brown, crystalline limestone.
426.7-428.3	Coarsely crystalline calcite containing about 7 percent sphalerite.
428.3-437.5	Brown, crystalline limestone.
437.5-446.6	Coarsely crystalline, vuggy calcite with little sphalerite except at contact at 446.6 feet. About 0.2 foot into limestone.
446.6-447.0	Brown, crystalline limestone.
447.0-452.2	Light-brown, dense limestone with numerous shale partings at 451.7 feet; calcite filled fracture.
452.2-453.1	Calcite vein with little sphalerite and limestone fragments.
453.1-479.1	Medium-brown, fine-grained, dense limestone with numerous shale partings.
479.1-491.2	Light-brown, dense limestone, very few shaly partings.
491.2-504.1	Medium-brown, fine-grained, mottled limestone with numerous shale partings.
504.1-504.9	Green, calcareous shale.
504.9-531.8	Medium-gray, medium grained limestone with very numerous shale partings.
531.8-607.8	Medium-brown, fine-grained, mottled limestone. Dolomite mottling.
607.8-641.0	Medium-brown, very fine-grained, fossiliferous limestone with numerous shale partings.
641.0-687.3	Light-buff, fine-grained, mottled, having thin, shaly partings; four calcite stringers at 667 feet. At 672.3 feet, 1 inch calcite vug. 676.0 to 676.7 feet fracture zone, fractures filled with calcite.
687.3-721.8	Calcarious silt stone, light-gray, medium texture. At 715.9 feet 1/4 inch fine-grained pyrite.
721.8-731.8	Gray, medium-grained sandstone, rounded and frosted grains, with calcarious matrix. Disseminated pyrite throughout.
Top of Knox (?) formation	
731.8-750.5	Medium-gray, coarsely crystalline dolomite with shaly partings at 737.6 to 738.1 feet and 738.5 to 739.1 feet containing finely disseminated pyrite. 739.1 to 750.55 feet very vuggy with dolomite crystals in vugs. Hole bottomed at 750.55 feet.

Core-drill hole: No. 4
Elevation: 572 feet
Depth: 246.30 feet

Location: Vernon Cox Property, Henry County, Ky.
Inclination: 45° N. 82° E.

Logged by William A. Beck, U. S. Bureau of Mines.

Interval, feet	Description
0.0- 7.5	Overburden.
7.5-219.9	Gray, crystalline, fossiliferous limestone with numerous shaly partings; 1 inch calcite stringer at 201.85 feet; 1/2 inch calcite stringer at 206.7 feet; 207.20 to 210.0 feet, crystalline calcite and barite containing some galena and tiny pyrite crystals.
Top of Tryone formation	
219.9-246.3	Light-brown, dense limestone with few shaly partings; 1/8 inch calcite stringer at 225.0 feet; 1/2 inch calcite stringer at 228.2 feet; 1.5 inch calcite stringer at 232.7 feet and calcite vein from 235.5 to 235.8 feet. Hole bottomed at 246.3 feet.