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ZINC AND LEAD RESERVES OF SOUTHWEST WISCONSIN: *THE UNDRILLED LEAD DIGS OF SOUTHWEST WISCONSIN*

by

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Zinc and Lead Reserves of Southwest Wisconsin

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This study was made possible by the existence of the *Wisconsin Mineral Development Atlas* which consists of a series of section maps drawn to a scale of 200 feet to the inch and showing all mappable data related to past mining and prospecting in the district. The underground workings of hundreds of mines are depicted. Locations and reference numbers of about thirty thousand prospect drill holes are shown on the maps that cover Grant, Iowa and Lafayette counties.

Accompanying the *Atlas* maps is a drill hole library that contains detailed stratigraphic and mineralogic logs of the section penetrated and lead and zinc assays of mineralized zones. The locations, logs and assays of drill holes were largely contributed by mining companies on a confidential basis. Thus, to prevent public identification of individual deposits, the calculated reserves are reported here simply by counties and not by the sections in which they occur. Work copies of drill hole maps, drill hole thickness and grade evaluations and tonnage grade evaluations can all be identified by section, township and range and are on file for any legitimate future access.

Only those drill holes showing a potential of future mining thickness and grade were used in calculating reserves. Some Grant County drillings reported the mineralization as only "fair zinc," "good lead" or simply as "zinc" or "lead." These drillings could not be used in quantitative summaries but do still indicate sites for future prospecting.

Drill Hole Categories

An initial study of the locations and relationships of potentially minable mineralized holes made it quite obvious that there are six categories of drill holes: 1) Isolated Loners, 2) Adjacent Loners, 3) Extension Loners, 4) Isolated Groups, 5) Adjacent Groups and 6) Extension Groups. In order to understand the value of these drill hole types, it is necessary to know that the common district mining method was to drift mine along the pitch at the most favorable horizon to the terminus of the pitch. Then the operation would retreat-mine back to the shaft or entrance taking out high stope pitch ore, then low pitch ore, next taking up the floor and finally robbing the pillars.

Isolated loners are single drill holes that contain potentially minable thickness and grade, but are not close or obviously related to any other drilling or deposit. An isolated loner cannot define a minable deposit, but if it occurred as part of a relatively closely-spaced group of similar holes it would be assigned to an area of tonnage-grade influence.

Adjacent loners are single drill holes that contain potentially minable thickness and grade and are located within mining distance of an adjacent mine but outside the actual workings. Many mines of this district had a history of periodic minings and shutdowns depending on economics and emergency need for the minerals. The mines are relatively shallow and dewatering is not a major factor.

Extension loners contain potentially minable thickness and grade and are located ahead of a drift face, thus indicating an unmined extension of the pitch.

Any new prospector to this area would use loner holes to develop an exploration plan for further drilling.

Isolated groups consist of closely-spaced drill holes containing potentially minable thickness and grade and apparently are not related to any known mine or deposit. These clusters represent ideal sites for future drilling with the potential of being developed into deposits of minable tonnage. The largest known unmined deposit in southwest Wisconsin is of this category.

Adjacent groups are clusters of related drill holes that contain potentially minable thickness and grade and are positioned immediately adjacent to previous mine workings. Reopening of the mine would make adjacent deposits accessible.

Extension groups are clusters of related drill holes that contain potentially minable thickness and grade and are positioned immediately ahead of a mine face. Extension groups indicate that former mining stopped before the terminus of the pitch was reached. Reopening of these mines would make such deposits readily accessible.

Summaries of distribution of these types of drill holes in the three counties follow in Table 1.

	Grant County	Iowa County	Lafayette County
Isolated Loners	31	20	167
Adjacent Loners	33	31	204
Extension Loners	6	13	37
Isolated Groups	30	34	154
Adjacent Groups	25	45	128
Extension Groups	18	42	95

Table 1. Numbers of loners and groups by type and county.

Calculated Reserves

The calculated zinc and lead reserves of southwestern Wisconsin are given in Table 2 by drill hole categories and by county. The lead percentage is underestimated because while many of the drill holes reported visible galena, no assays were made. This appears to result whenever smaller operators tried to reduce assaying expenses.

The reserves in no way indicate a maximum potential for southwest Wisconsin. Considering the known genetic relationship between surface lead digs and the lower pitch-flat deposits and the fact that there are vast lead dig areas that have not been prospected by drilling, the reserve potential is somewhat staggering.

GRANT COUNTY

	Tons	% of County Total	% Zn	% Pb
Isolated loner	115,998	4.51	4.28	0.79
Adjacent loner	94,216	3.66	5.85	0.52
Extension loner	12,723	0.49	4.73	0.00
Isolated group	747,092	29.02	4.75	0.67
Adjacent group	388,537	15.09	6.27	0.28
Extension group	1,216,109	47.23	5.28	0.41
Grant County Totals	2,574,675	100.00	5.25	0.49

IOWA COUNTY

	Tons	% of County Total	% Zn	% Pb
Isolated loner	37,280	3.40	5.80	0.31
Adjacent loner	51,324	4.68	4.72	0.47
Extension loner	12,316	1.12	7.36	0.57
Isolated group	322,850	29.45	5.16	0.59
Adjacent group	237,449	21.66	4.95	0.40
Extension group	434,886	39.68	5.27	0.22
Iowa County Totals	1,096,105	100.00	5.18	0.39

LAFAYETTE COUNTY

	Tons	% of County Total	% Zn	% Pb
Isolated loner	634,475	7.21	4.40	0.97
Adjacent loner	535,996	6.09	4.66	0.58
Extension loner	90,577	1.03	4.08	0.46
Isolated group	4,408,512	50.08	4.63	0.51
Adjacent group	1,542,599	17.52	5.18	0.30
Extension group	1,591,276	18.08	5.24	0.29
Lafayette County Totals	8,803,435	100.00	4.82	0.47

SOUTHWEST WISCONSIN

	Tons	% of Total	% Zn	% Pb
Grant County	2,574,675	20.64	5.25	0.49
Iowa County	1,096,105	8.79	5.18	0.39
Lafayette County	8,803,435	70.57	4.82	0.47
GRAND TOTALS	12,474,215	100.00	4.94	0.47

Table 2. Reserves of lead and zinc by drill category, county and average metal content.

THE UNDRILLED LEAD DIGS OF SOUTHWEST WISCONSIN

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Introduction

Extensive lead mining in southwest Wisconsin began in the early 1830s. Mining methods were simple and primitive. A shallow pit would be dug, normally without cribbing, to bedrock. If a concentration of galena was found in the basal residual soil on top of bedrock the miners reached out with special hoes and dragged the residual "float" galena to the center of the pit from where it was hoisted to the surface. When the working distance of the special hoe was reached, the miners simply dug another adjacent pit and the extraction process was repeated. This continued as long as enough residual galena was encountered to make the effort worthwhile. No effort was made to backfill the closely spaced pits which left a pockmarked surface area commonly referred to as a "sucker hole area" or a "badger hole area" or simply a lead dig area".

By 1900 lead digs covered a very high percentage of southwest Wisconsin's hills, ridges, and uplands. In the early 1940s Allen Heyl (USGS) commented to O. E. DeWitt (Vinegar Hill geologist) about the large number of dig areas. DeWitt replied, "You should have been here in 1915. There were twice as many as now". Today it is difficult to observe dig areas simply by driving through the district. A large percentage have been leveled and reclaimed for agricultural and land development purposes.

The Wisconsin Mineral Development Atlas (hereafter termed "the Atlas") was conceived in the early 1940s by U. S. Geological Survey (USGS) and U. S. Bureau of Mines (USBM) personnel working in the district. An attempt was made to record all known mining-related data on section maps (scale: 1 inch = 200 feet). Underground mine workings, shafts, lead dig areas, drill holes, etc. were very accurately mapped. An accompanying drill hole log library containing logs of more than 30,000 prospect drill holes was developed. Field data were collected mainly by USGS personnel. Mining companies contributed mine maps and drill hole records. USBM personnel were responsible for constructing the maps and entering the pertinent data.

The USGS and USBM eventually closed their Platteville offices and in 1960 turned the Wisconsin Mineral Development Atlas over to the Wisconsin Geological and Natural History Survey (WGNHS). Since then state survey personnel have been adding data to the maps and constructing new maps as time and funding allows.

The lead dig areas recorded in the Atlas are shown on the maps as a closed line of half circle symbols with the limbs of the half circles pointing into the dig areas. This compilation of undrilled lead dig areas of southwest Wisconsin was made by measuring such areas on all of the section maps in the Atlas. Accompanying this report is a hand written tabulation of the dig areas by Atlas section reference numbers covering Grant, Green, Iowa, and Lafayette counties. Section, township, and range of section reference numbers can be obtained by referring to the section reference key map for each county or by turning to the section reference map in the Atlas and observing the section, township, and range numbers on the upper northeast border of the map.

The Imortance Of Lead Dig Areas

Lead dig areas have direct relationship to the deeper pitch - flat deposits which have produced the major zinc - lead ores of the district. Figure 1 shows the relationship between pitches, flats, crevices, and openings which are essentially mineralized fractures and mineralized enlarged solution openings. The vein minerals were deposited by rising epithermal solutions and consist mainly of sphalerite (ZnS), galena (PbS), marcasite (FeS_2) pyrite (FeS_2), and calcite ($CaCO_3$). Above the water table, due to the presence of free oxygen, the sphalerite, marcasite, and pyrite were oxidized and produced a weak sulfuric acid that dissolved the calcite. Galena is extremely resistant to oxidation and became concentrated in the base of the residual soil horizon immediately on top of bedrock. If the land surface were horizontal so would be the underlying bedrock surface and as erosion slowly lowered the entire region, the residual (float) galena would lie directly over the underlying pitch, flat, crevice, and opening deposits. This is well illustrated in Fig. 2 which shows the horizontal positional relationship between the Crawhall mine workings and the lead digs that exploited the residual galena produced by erosion of the Crawhall crevices and openings. The east-west trending Crawhall mine lies directly

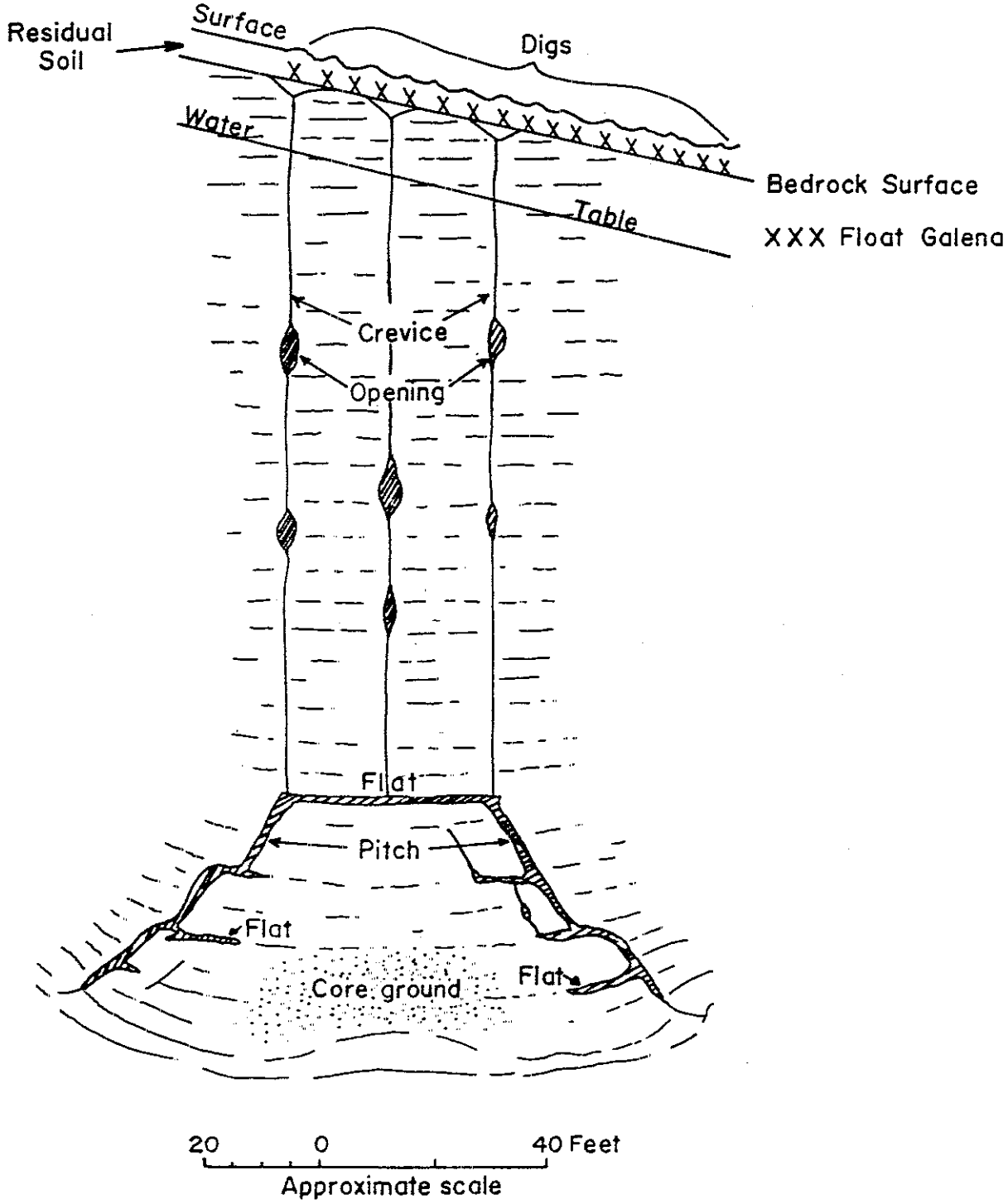

Figure 1 — Diagrammatic section showing the relationship between pitch, flat, crevice, opening, and residual "float" galena deposits and surface lead digs. An alteration of Fig. 64. Flint and Brown. USGS Bul 1027-K. 1956.

under a broad east-west trending ridge. Fig. 3 shows the relationship between the Kennedy mine workings and the digs that mined the residual galena derived from the erosion of the Kennedy crevice and opening deposits. The Kennedy workings lie under the southwest valley wall of Bull Branch. The land surface and bedrock surface slope to the northeast. The lead dig area that parallels the Kennedy mine workings is clearly offset as much as 200 feet to the northeast. This is caused by the residual (float) galena having slowly migrated by creep down the sloping bedrock surface. This relationship of topographic position of the lead dig area to the genetically related vein deposits should be understood when using lead dig areas as a guide to prospect drilling.

Prospect drilling of a lead dig area may not discover a minable deposit. Any of the ore-bearing units in Fig. 1 could be missing due to the lack of sufficient zinc and lead sulfide mineralization. One or both pitches and associated flats could be missing. A good example of this insufficient mineralization is the double pitch-flat structure exposed in the north wall of the second roadcut on Hwy. 151 east of Barneveld, Wisconsin. The fractures are only slightly mineralized with iron sulfide. However, the woods on top of the ridge extending northerly from the roadcut contain a rather extensive lead dig area. The related crevices and openings must have contained enough galena to produce a minable residual galena deposit on top of bedrock.

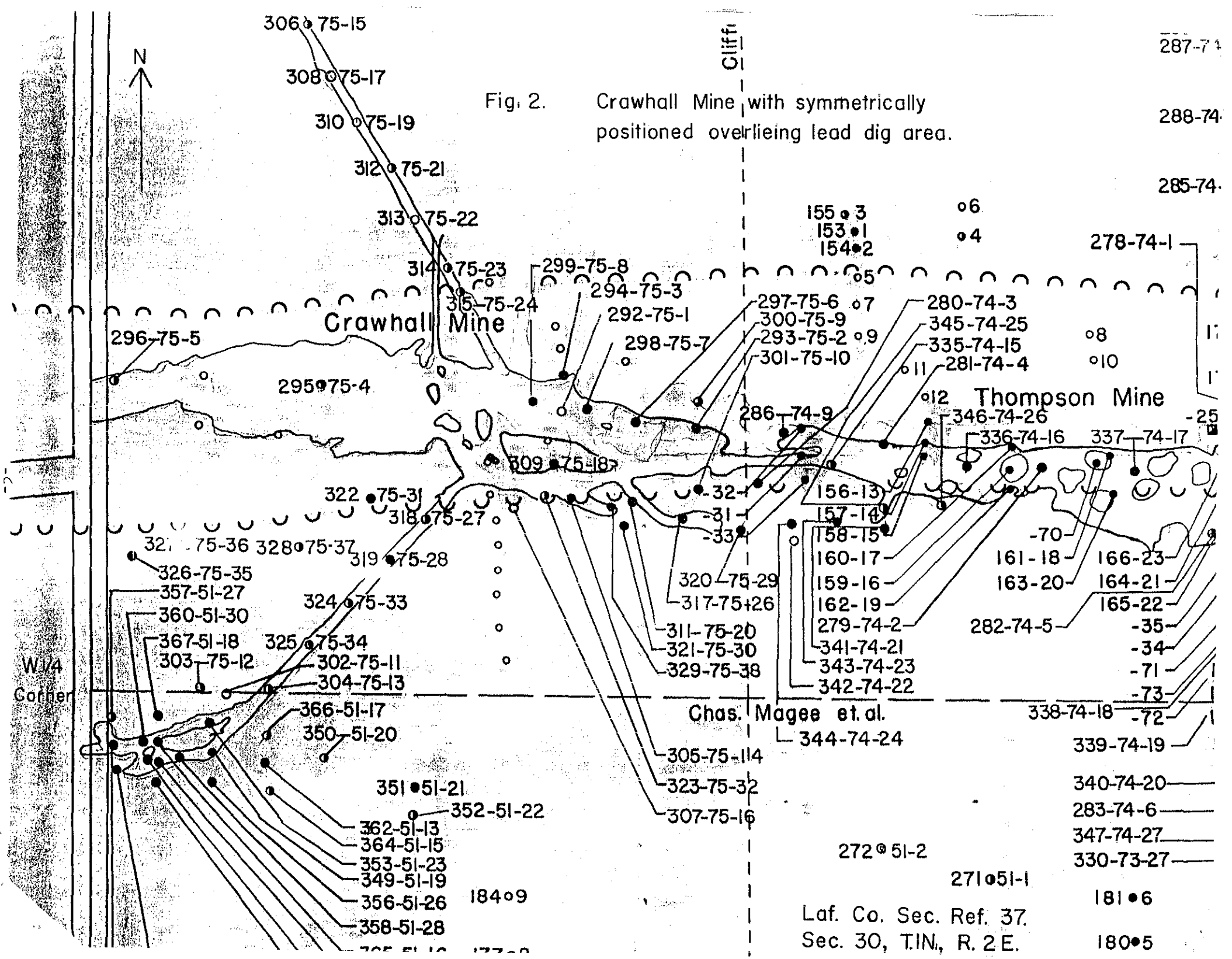

Fig. 2. Crawhall Mine with symmetrically positioned overlieing lead dig area.

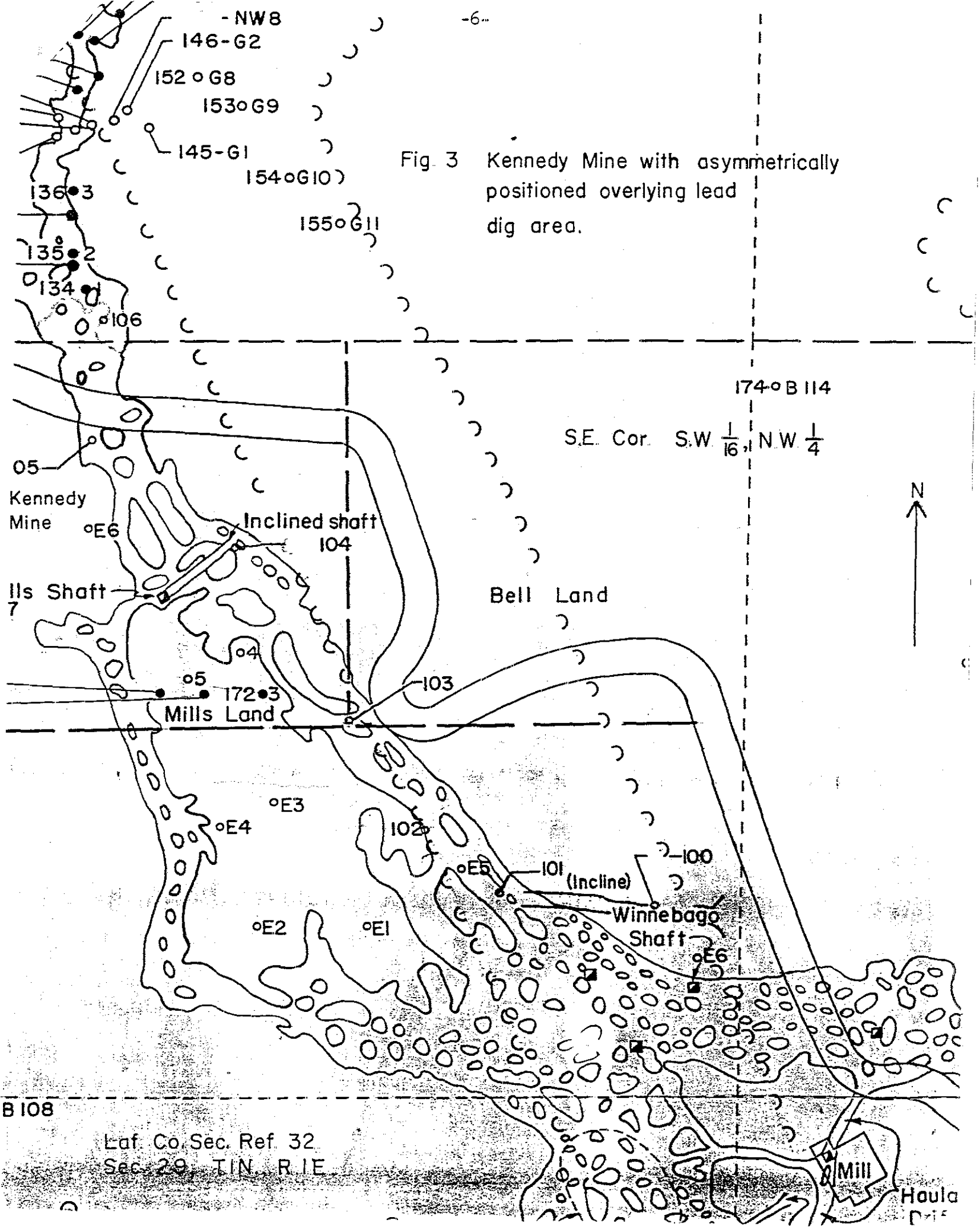

Fig. 3 Kennedy Mine with asymmetrically positioned overlying lead dig area.

Mapped and Measured Undrilled Lead Dig Areas

Only those mapped lead dig areas that had not been prospect drilled or had not received sufficient drilling to adequately prospect them were included in the total areas given below.

County	Square Feet	Acres	Square Miles	Square Kilometers
Grant	452,219,000	10,382	16.22	42.01
Green	34,960,000	803	1.25	3.24
Iowa	304,800,000	6,997	10.93	28.31
Lafayette	294,230,000	6,755	10.55	27.33
Total	1,086,209,000	24,937	38.95	100.89

Conclusions

The total of 38.95 square miles of known undrilled lead dig areas obviously adds a tremendous potential to southwest Wisconsin's mineral producing ability.

There are many additional unmapped dig areas in Grant, Green, Iowa, and Lafayette counties. Large portions of these counties have never been field mapped in detail for the presence of lead digs. At least four dig areas that have not been field mapped are known to exist in Green County. Unmapped digs are known to exist in Dane, Columbia, Crawford, Richland, Sauk, and Vernon counties.

August 1990

Suppliment to Report: Mapped and Measured Undrilled Lead Dig Areas, August 1990

During the spring semester of 1991 student help entered the following areas of previously unrecorded undrilled lead dig areas on the Wisconsin Mineral Development Atlas maps.

County	Square Feet	Acres	Square Miles	Square Kilometers
Grant	320,000	7	.01	.03
Iowa	1,025,000	24	.04	.10
Lafayette	340,000	8	.01	.03

The revised total (to date) undrilled lead dig areas in southwest Wisconsin is given in the following table.

County	Square Feet	Acres	Square Miles	Square Kilometers
Grant	452,539,000	10,389	16.23	42.04
Green	34,960,000	803	1.25	3.24
Iowa	305,825,000	7,021	10.97	28.41
Lafayette	294,570,000	6,763	10.56	27.36
Total	1,087,894,000	24,976	39.01	101.05

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