DARWIN MINE

Inyo County, California

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Inyo County, California

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By:

J. M. Cormie, P. Eng.
Geologist

Toronto, Ontario
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CONCLUSIONS AND RECOMMENDATIONS

The Darwin Mine has been profitable in the past and could be again.

The situation will be further improved by combining the Darwin and Shoshone mines into a single milling operation.

The ore reserves need to be enlarged rapidly, but there are many places underground where ore might be found, even without the new Defiance levels.

It is recommended, therefore, that the property be leased, competent management installed, and an immediate start made on a development and exploration program to be carried out in conjunction with current mining and milling operations.

At the same time, plans should be made to deepen the Defiance shaft at least 2 levels, starting preferably not later than six months after property acquisition.

Later some exploratory work should be undertaken on other parts of the property to include both diamond drilling and geophysical surveying.

DARWIN MINE

Inyo County

California

INTRODUCTION

The Darwin mine is a consolidation of several old silver-lead-zinc producers now owned by The Anaconda Company. It was leased about four years ago to West Hill Copper Mines Ltd. of Toronto, through a wholly-owned subsidiary, West Hill Explorations Ltd. This company has been operating the mine and mill for three years, but are now giving up the lease due to poor operating results.

Mr. Dudley L. Davis, Consulting Geologist, formerly Resident Geologist for Anaconda, believed that the mine had considerable potential and brought it to the attention of R. S. Stronach Jr., P. Eng., Exploration Manager for Mexicanus Explorations Limited. The latter examined the property and wrote a Preliminary Report, dated September 4, 1970. He agreed with Davis and felt that much of the present trouble was due to poor management. Accordingly, Mexicanus was induced to begin talks with Anaconda relative to the acquisition of a lease when the West Hill company dropped out.

The writer was asked to make a report on the property, dealing particularly with ore reserves and exploration potential. This was done in a period from October 26 to November 9, 1970. Other aspects of the Darwin situation were studied at the same time and for varying periods by Messrs. Clyde Lendrum, H. Brodie Hicks, E. Devereaux, Harlow H. Wright, R. S. Stronach and D. L. Davis. The two latter were there throughout the writer’s visit.

GENERAL INFORMATION

The Darwin silver-lead-zinc district is in the Darwin quadrangle, New Coso Mining District, Inyo County, southeastern California. It is 35 miles southeast of Mount Whitney and 40 miles west of Death Valley. The village of Darwin is the only town in the quadrangle, about a mile from the Darwin mine and 38 miles by road from the town of Lone Pine in the Owens Valley.

Road and highway connections are good.

The country is desert with sparse vegetation.

Water is obtained from wells and springs and is said to be ample.

The topography consists mostly of broad rolling plains between low mountain ranges which trend N10-20W. Elevations in the quadrangle vary from extremes of 1,960 to 7,731 feet. The main portal of the mine is at about 5,000 feet.

Company houses on the site are available for a mining crew.

The property consists of 125 patented and unpatented mining claims, and 40 mill site claims, all owned by Anaconda and administered through their Salt Lake City office. Twelve of these claims form a separate group and one, the Columbia, is by itself. The rest are all in one contiguous group.

HISTORY

Oxidized silver-lead ores were found at Darwin in 1874, and were mined extensively between 1875 and 1880. Three smelters were built during this period.

By 1888, the rich surface ores had been exhausted and the district was nearly dormant. From then until World War I, production was intermittent and some of the principal producers had been consolidated with the Darwin Silver Company.

By 1945, most of the silver-lead-zinc part of the district had come under one management, generally referred to as the Darwin Mines.

The property was bought by The Anaconda Company, who operated it more or less continuously until 1957.

The Darwin Mines consist of the Bernon, Columbia, Defiance, Driver, Essex, Independence, Lane, Liberty Group, Lucky Jim, Promotory, Rip Van Winkle and Thompson. Most of their production has come from the Defiance, Essex, Independence and Thompson mines.

The silver-lead-zinc ores of the Darwin quadrangle are the most important economically, but talc has been mined continuously since 1917, and tungsten intermittently since 1941.

GENERAL GEOLOGY

The Darwin quadrangle is underlaid by Paleozoic sediments ranging in age from Ordovician to Permian, in a sequence approximately 14,200 feet thick. These were intruded in the Cretaceous by two batholiths and several small plutons, mainly quartz monzonite; and were overlain unconformably by volcanic rocks and sediments of Cenozoic age. Most of the mineral deposits occur around the margin of the Coso Range batholith in the southwest part of the area. The silver-lead-zinc and tungsten deposits are in limestone of late Paleozoic age, and mostly in silicated zones close to an intrusive contact. Dolomite is usually, though not always, unfavourable. Within a mineralized district certain beds are more favourable than others.

Individual deposits occur as replacement bodies along faults, as bedded replacements commonly near the crests of folds, and as steep, irregular or pipe-like bodies. Faulting is usually apparent as one of the controls. In the Darwin district most of the ore is close to steep-dipping faults striking N50-70E, which are thought to have served as feeder channels, mineralization diminishing away from them.

The area is noted for the great variety of minerals, both primary and secondary. The primary sulphides are mostly galena, sphalerite, pyrite; less common are pyrrhotite and chalcopyrite. Argentiferous galena is the principal ore mined, along with sphalerite. Scheelite is fairly common, sometimes in considerable concentration.

DARWIN SILVER-LEAD-ZINC DISTRICT

Silver-lead-zinc deposits are widely distributed throughout the Darwin quadrangle, but the largest are in the Darwin Hills, north and east of the town of Darwin. The Darwin district can be divided into an eastern and a western part. Most of the silver-lead-zinc has come from the latter, while the eastern part, which started as a silver-lead district, is now mostly of interest for its tungsten deposits.

According to the California Division of Mines, Special Report 51, the total value of production from the Darwin quadrangle from 1875 to 1952 is $37,500,000, of which $29,000,000 came from the Darwin district itself. During the same period there was produced, according to the same authority,

Gold	5,913.81 oz.
Silver	7,630,492 oz.
Copper	1,489,396 lbs. or 744.7 short tons
Lead	117,566,900 lbs. or 58,783.5 short tons
Zinc	52,124,947 lbs. or 26,062.5 short tons

Prior to 1942, only the high grade, oxidized, silver-lead ore was mined and the values must have been erratic.

From 1902 to 1942 production of 102,524 tons is recorded, with average recovery of 0.03 oz. gold, 8.7 oz. silver, 0.2% copper, 7.3% lead per ton. Probably little zinc was recovered.

Since 1942 production of sulphide ore has exceeded that of the oxide. The average grade of sulphide ore is given as about 6 oz. silver, 6% lead and 6% zinc, but there was also a considerable tonnage of direct-shipping ore in the same period which contained 20-30% lead.

The Darwin Hills are mostly underlain by the Keeler Canyon formation of Pennsylvanian and Permian age, which is 4,000 feet thick. The lower 2,300 feet is mostly limestone, but the upper part contains abundant shale, with

interbedded limestone. The lower part of the Keeler canyon formation is the host rock for most of the silver-lead-zinc deposits of the Darwin district.

The Paleozoic rocks are intruded by a monzonite stock along the central part of the Darwin Hills and the Coso Range batholith outcrops locally along their west side.

There are many faults, some of them important in localizing ore. The largest is the Darwin tear fault which strikes N70W and has a displacement of 2,300 feet, north side west.

DARWIN MINE

The Darwin mine includes the workings owned by The Anaconda Company which are developed by the 6,300-foot Radiore adit on the 400-foot level. They are the Bernon, Defiance, Essex, Independence, Rip van Winkle and Thompson workings and the Driver prospect, the most important of which are the Defiance, Thompson, Essex and Independence. The last three are now grouped as the Thompson mine.

The Keeler Canyon formation underlies most of the mine area, except for an intrusive stock in the vicinity of the Defiance, Thompson and Independence workings. The limestone beds are mostly heavily silicated west of the stock for distances of up to 4,000 feet. The favourable zone lies between the stock and the northerly-striking Davis thrust. This interval varies in horizontal width up to 800 feet and has been altered to a dense, white silicate rock. The stock is mostly quartz monzonite and granodiorite.

The Paleozoic rocks in the mine area strike northerly and dip 30 to 70 West. They are intersected by four sets of faults. One set strikes 50-70 East and dips steeply North. These are mineralized and are associated with most of the orebodies. The Defiance, Copper, Water Tank and Mickey Summers faults are in this group. A second set, which includes the Essex ore zone, strikes N65W and dips steeply, parallel to the Darwin tear fault. A third set are thrust faults that strike northerly and dip 30° to 40° West, the most prominent being the Davis thrust. It is very important because it forms the west boundary of the mineralized zone. A fourth set of faults strikes northerly, dips steeply, and is also often mineralized and associated with many of the orebodies.

Ore in the Darwin mine is mainly close to the N50-70E pre-mineral, feeder faults. Individual orebodies occur as replacements of certain favourable beds, as replacement bodies in fault zones and as irregular or pipe-like bodies in silicated limestones.

Defiance Workings

There were two bedded veins at the surface, 60 feet apart stratigraphically, located between two parallel granodiorite sills. These veins were 5 – 10 feet thick, 300 and 460 feet long and mined respectively 400 and 670 feet down dip. The sills pinch out at about the same depth as the veins. Below the 400 level the orebodies change to irregular, pipe-like replacements in a vertical fissure zone, which persists to the current bottom level at 1,300 feet. The main orebody in the Defiance pipe on any one level is typically about 100 x 50 feet, extending in one case from above the 400 level to about the 520 elevation, and in another from the 700 to 1000 levels. There was a virtually barren horizon at the 1100 level, but the ore came in again strongly on the 1200 and 1300 levels though not fully developed on the latter. It looks as if it will be comparable there to other levels in both grade and size. The downward continuation of the Defiance pipe below 1300 is one of the prime exploration targets in the mine, but until the shaft is deepened can only be explored by means of inclined holes.

Thompson Workings

These workings include the former Thompson, Independence and Essex mines. They are now largely mined out, but ore reserve blocks remain in all of them and ore is still being found and mined in the Independence and Essex workings. The Essex workings are only 230 feet southwest of the Independence portal, and the two areas can really be classed as one mine, though different orebodies.

The Essex is different from the other major orebodies since it is in or associated with a fault zone which strikes N70W. This fault is cut off by the Davis thrust and the main Essex orebody lies below it, in the fault, and in steep, north-dipping fractures close to both the Essex fault and the monzonite contact. Ore extends for distances of up to 400 feet from the Essex zone along these north-south faults. Favourable beds in the vicinity have also been mineralized to form the bedded deposits typical of the Darwin

area. The Essex zone has been mined from just below the surface to the bottom or 800 level, a vertical distance of about 1,000 feet. The orebodies on any one level occur in a horizontal distance of 600-700 feet along the fault.

The size and grade of the Essex zone on the 800 level is similar to conditions immediately above, if not as rich as the oxide ore in the upper levels, and exploration below that level will be the main exploration effort in the Thompson mine. The shaft is down to the 900 level though only the station has been cut so far, and crosscutting to the Essex zone could start any time.

The Independence ore at the north end of the zone occurs in large, irregular, bedded replacement, above, below and between monzonite sills off the main stock. Ore was mined from the 100-foot level to the surface, 250 feet along strike and 120 feet wide, 30% of which was ore. A monzonite sill occupies the interval between 100 and 200 feet, and below that is the largest bedded replacement in the district. It occurs in a 160-foot interval between an upper sill mentioned above and another, anticlinal-shaped sill below. This ore has been mined discontinuously between the sills, for a maximum strike-length of 500 feet, and westward down the upper contact of the lower sill for 700 feet to the 400 level. Smaller bedded orebodies occur below the lower sill between the 400 and 600 levels.

ORE RESERVES

For practical purposes the Darwin ore reserves can be divided into two classes: Ore in and around the old workings which is being mined now, or could be made available within a few months, and which is classed as probable; and possible ore, mainly such as is expected to be found below the bottom levels on the Defiance and Essex zones.

The last ore reserve estimate was made in April 1969, and the figures given below include blocks left over from then plus any new ore that has been found since. Development and particularly exploration have been curtailed recently, more so since July 1970, and the reserves have been correspondingly depleted.

The original zones have been largely mined out and the blocks shown below are merely unmined remnants, but ore is still being found in the old workings, and probably would continue to be, in response to a sustained development program. The following figures are believed to be a minimum, and judging by past experience in this area it is expected that at least as much more again will be found as development proceeds. Anaconda never had more than a year's ore supply in sight, and in the 10 years they operated apparently had no trouble in keeping ahead of the mill.

PROBABLE ORE

Mine	Section	Location	Block	Tons	Ag	Pb	Zn
Defiance	B416	864 Rse.	L10	2,300	2.3	0.3	12.6
		721 St.	L14	4,500	4.5	1.0	15.0
	Defiance	827 Rse.	M26	1,100	4.2	12.0	15.8
		DDH 570-22	M31	8,400	3.6	7.1	6.7
		1016 St.	M12	3,800	3.5	1.8	10.5
		Below 1016 St.	M15	4,700	2.3	5.1	8.8
		1210 Dr.	M35	1,800	7.6	9.8	8.3
		1213 Rse.	M36	2,000	4.0	6.2	10.0
	430	Above 914 St.	F-1	1,400	3.0	6.0	10.0
		917 St.	F-2	4,500	5.0	3.0	8.0
		Below 1208 St.	F-30	3,400	3.7	7.1	10.3
		Below 1115	F-29	2,500	4.0	6.4	6.1
		DDHs 1221-22	F-31	10,000	5.0	6.1	10.5
		1304 Dr.	F-32	5,500	5.4	0.4	16.2
		DDH 1301	F-33	500	6.0	4.0	20.0
	1002	DDHs 1124-25	R7	900	24.0	3.2	0.7
		1014 Dr.	R2	1,200	2.9	4.9	7.7
				58,500	4.5	4.6	10.3
Thompson	179	Under 3B115 Dr.	T-1	1,800	11.0	1.5	5.7
		Under 589 Dr.	T-10	2,000	4.5	4.5	7.0
	Essex	T-710 St.	E7	1,600	5.0	2.0	10.0
		T-813 St.	E15	1,200	5.4	3.9	7.5
		T-803 Dr.	E20	700	6.0	3.5	6.5
		T-716 Rse.	E22	600	5.2	1.8	12.3
		T-803 Dr.	E26	750	2.0	6.0	7.0
		T-803 Dr. W.	E29	500	2.5	5.0	9.5
		T-818 St.	E30	600	5.0	5.0	7.0
	292	Below 402 Dr.	N19	1,000	17.0	1.0	1.0
	B458	A-501 Rse.	K-2	225	7.5	5.8	8.5
	B	3B-575 St.	5-6	3,200	15.0	1.0	2.5
				14,175	8.7	2.7	6.1

POSSIBLE ORE

Mine	Section	Location	Block	Tons	Ag	Pb	Zn
Defiance	B416	864 Rse.	L11	5,000	2.3	0.3	12.6
		DDH 813	L12	2,500	28.5	3.8	6.3
		DDH 906	L13	2,100	16.6	1.2	4.4
	430	Below 1304 Dr.	F34	12,000	5.4	0.4	16.2
		Below F31	F35	22,000	5.0	6.1	10.5
				43,600	6.7	3.5	11.8
Thompson	Essex	Below T818 Dy.	E32	2,500	5.0	5.0	7.0
		Below T813 Dr.	E31	3,000	6.0	3.5	6.5
	292	Below T819 Dr.	N20	4,000	5.0	7.0	8.0
		DDH T814	E32	3,000	2.5	7.2	7.5
	B458	A-501	K7	600	9.3	4.8	7.5
				13,100	4.0	5.8	7.2
Probable Ore			Defiance	58,500	4.5	4.6	10.3
			Thompson	14,175	8.7	2.7	6.1
				72,675	5.3	4.2	9.5
Possible Ore			Defiance	43,600	6.7	3.5	11.8
			Thompson	13,100	4.9	5.8	7.2
				56,700	6.3	4.0	10.7
Total Probable and Possible				129,375	5.7	4.1	10.0

The mine costs including supervision, look as if they might be not more than $15.00/ton. According to recent calculations by Mr. R. S. Stronach, the break-even point cones at about 15 units (Ag-/Pb-/Zn).

Therefore, the grade must be kept as close to 20 units as possible and it looks as if this could be done, judging by the ore reserve estimate above, while being prepared to accept some dilution and to eliminate low grade stopes. There has to be a much greater effort made towards grade control. A proper sampling system must be established in the stopes, there must be more control over the miners who are all on contract, and greater discrimination concerning what is put in the mill and what sent for waste.

EXPLORATION AND DEVELOPMENT

If the mine is to have a long life major new orebodies must be found. There are various possibilities, all hinging on a sustained development program. In the ten years they operated here, The Anaconda Company found that to maintain ore reserves, they had to do 0.089 feet of development and 0.065 feet of diamond drilling per ton of ore mined. The development figure, though, included such items as raises, sub levels, etc., much of which could be called stope preparation, and if the term is confined to development and exploration only, then a figure of 0.05 feet per ton of ore mined would probably be about right. Development has been curtailed recently except for shaft-sinking, and almost eliminated since that was finished last June. To keep the mill operating, replenish and increase the ore reserves, and generally to put the mine in a comfortable position in that respect, it is proposed here that a stepped-up exploration program be started if Mexicanus takes over and that it be continued for at least six months. This should include half a dozen development rounds per day plus diamond drilling. If this program is successful, as expected, it could then be reduced, if desired, to a lesser figure and held there indefinitely.

At the end of the 6-month period, shaft-sinking should be started in the Defiance zone, preferably for not less than two new levels. Then, assuming developments on the Essex 900 level were satisfactory, consideration would have to be given to going deeper there also.

The object would be to put in reserves 200,000 tons of two years' ore at the contemplated rate.

As can be seen from the list given below, there are many places throughout the two mines which are worth investigating, and as work proceeds others will become apparent. One of the most obvious is the Essex 900 levels where there is only the shaft station, and there only 350 feet of drifting is needed to reach the projected position of the ore on the 800 level. The two recent good-grade silver intersections in the Water Tank Fissure on the 800-

foot level of the Defiance Mine opens up an intriguing situation, and one that has not been explored anywhere below the 400 level. For instance, what happens when the bedded, 864-721 zone intersects this fissure a level or two below the 800 level? Such depth development of the Water Tank Fissure will not be considered until work on the 800-level has been finished. This is singled out an example only, and there are other similar situations to be investigated, particularly on the lower levels of the Defiance mine, from the 1000 level down. Another is the intersection of the 434 and Defiance fissures around the 1400 level. There is ore in the 434 on 1200 level (1215 drift) and the intersection area below should be even more favourable.

Besides the known zones there are other fissures striking N50-70E, which, while not having been very productive to date, belong to a group that seems to be closely associated with the mineralization, and which should, therefore, be investigated further. Among these are the Rip Van Winkle, Bernon and Copper fissures. Apart from surface work about all that is known of then is in the area intersected by the Radiore adit. There is no obvious reason why they should not make ore in favourable circumstances; and, following the present development of the Water Tank Fissure, it is recommended that these other structures be explored. Very little work has been done on them and it may be that the only difference between them and the more productive fissures is the fact that substantial orebodies were found in the latter at and near the surface. Work would then have been concentrated on them, and the others neglected.

PROPOSED DEVELOPMENT – Defiance Mine

▪ Continue 826 drift 120 south along DDH 813 to Water Tank Fissure, and drift 100 feet each way ----------	320 ft.
▪ Drive sublevel on 13th floor of 827 Rse 40' to ore in DDH 712 ----	100 ft.
▪ Continue 1002 drift 300' to W. T. F. and drift 100' each way -----	500 ft.
▪ Raise on ore in DDH 1014C ----------	50
▪ 1030 St., 7th Floor, drive 40' SE to ore in DDH 570-22 ----------	40
▪ Follow sulphides left side of face, 1036 drift, minimum ----------	25
▪ Cross-cut and drift from 1126 to ore in DDHs 1124 & 1125 ------	150
▪ 1208 Raise – drive sublevel to ore in DDH 1109 ----------	50
▪ 1210 drift – drive 50' westerly under ore cut in DDH 1110 -------	50
Raise to 2nd floor and drift 50 feet in ore ----------	70
▪ Sublevel from 1213 rse. on 7th floor to ore in DDH 1105 ----------	100
▪ Drive along sulphides in 1215 drift ----------	50
▪ Drive from 1301 westerly along DDH 1301 to sulphides and drift	100
▪ Drift SE from 1304 along mineralized bed ----------	50
▪ Drift NE from 1306 to point under ore cut in DDH 1224 ----------	75
On 3rd and 4th floors	
▪ Raise to 1200 cutting on 3rd, 4th, 5th, 10th, 11th and 12th floors ---	100
and drift on 4th and 10th floors (2 x 50) ----------	100
Total drifting	1930
Possible (See below)	220
	2150

Proposed drilling

▪ Continue DDH 814 50' to cut W. T. F. above ore in DDH 813 ----	50
▪ Drill from present face of 826 Dr. -	
2 down holes to cut W. T. F. at 900L	300
2 down holes NE to cut 721 bed	250
▪ Two horiz. holes from face of 930 drift to cut projection 1002 bed	150
- after drilling drive 930 drift 100' minimum to 1002 bed	100
▪ Drill NW from face 923 drift to cut ore in DDH 906 if ore in hole drift 120 feet	200
▪ 901 – drill 3 short holes, 2 x 100 -/ 1 x 40	240
▪ Drill 1 hole from 1105, SW, to check assay (40 oz. in DDH 1127)	80
Total Diamond Drilling Defiance mine	1270

PROPOSED DEVELOPMENT – Thompson Mine

▪ Drive northwest to cut ore in DDH A-518, drift and raise in ore zone ----------	100 ft.
▪ Raise from 547 drift to ore cut in DDH A-461 ----------	100
▪ Drive from 637 raise to ore cut in DDH 615 ----------	50
▪ Crosscut north from 803 drift to ore cut in DDH T-805 and drift thereon ----------	50
▪ Continue T-817 drift northerly along intersection of the 818 bedded ore zone and steep fissures under T-818 slope ----------	50
▪ Crosscut to the Essex ore zone on 900 level and drift ----------	900
Total Drift, etc.	1250

Proposed drilling

▪ 3A9 drift – develop silver zone above 3A level by diamond drilling, minimum ----------	500 Ft.

	Footage		Cost
Total development	4400 feet x $50	=	$220,000
Total drilling	1770 feet x $10, say	=	20,000
Shaft sinking (2 levels)	200 feet x $300	=	60,000
		TOTAL	$300,000

This development should take about six months, followed, or accompanied, by shaft sinking. The proposed diamond drilling is only the start of what should, along with the development, settle down into a continuous program. There will be about 400 feet of drifting to reach the Defiance zone on the new levels so that if shaft-sinking is delayed for six months it will be about eighteen months before ore can be delivered from them. The Essex ore zone from the present 900 level could be made available within the 6-month period.

LONG RANGE EXPLORATION

Developments in the established areas are expected to be productive for a long time, but an effort should be made to find new zones as soon as possible. This is a well-mineralized district, and the favourable geology is traceable for several miles. Some projects which could be included here have been mentioned already, others not:

1. Other fissures in the mine area (Water Tank, Copper, etc.)
2. New levels opened up by shaft-sinking
3. Defiance – Lane Zone
4. Lucky Jim Area

Defiance – Lane

The first two projects above have been discussed already. The Lane workings are about a mile east of the Darwin and east of the monzonite stock. They are also on the eastward extension of the Defiance fissure, the only one that has been traced through the intrusive. There was no replacement ore there, but a good fissure vein, which was the site of the first mill in the district. Mr. Davis has always wondered if the monzonite might not be more sill– than stock-like; and that it might be possible, therefore, to get below it along this fissure, and into a situation where the fissure cuts the favourable limestone formation near the igneous contact. The obvious approach would be geophysics, probably induced potential. But an Anaconda geophysicist, who visited the property, pointed out that the small pyrite content of the monzonite would probably interfere with such a survey. It seems that the best method would be to drill the zone, particularly west of the Lane mine where the fissure is strong-looking and where there was a small lead-zinc body in the monzonite itself. A section drilled here to some depth would be worthwhile exploration.

The Lane mine has a recorded production of 11,944 tons from which was recovered:

Gold	1,547 oz.
Silver	75,866 oz (6.3 oz/ton)
Copper	38,738 lbs.
Lead	1,820,888 lbs.

It was developed by two shafts to 800 and 600 feet depth and by an adit 1300 feet long. The total production was probably greater than the above figures because for some years it was included in the Darwin group.

Lucky Jim

The favourable lower Keeler Canyon formation has been traced north for at least 3 miles, all of it mineralized judging by the number of old workings, and all intruded by small, irregular bodies of the monzonite. The ore, though, was all in small, fissure veins from which there was some production, but no replacement-type orebodies were found. In fact, none have been found outside the main Darwin mine.

The Anaconda Company owns the Lucky Jim mine and some of the intervening ground between it and the main Darwin property, which, together with the Lane property, form a single, contiguous claim group. The Lucky Jim has 7,690 feet of level workings and is developed to 860 feet below the collar of the main shaft. A total of 40,400 tons were mined to 1924 which averaged 18.39 oz. silver and 12.58% lead. The ore occurs in a fault zone which strikes N60-75E, and, therefore, belongs to the same group as those associated with the major orebodies in the Darwin mine. There are also other old workings in the vicinity under other ownership.

This whole area looks very favourable, and there seems no reason why replacement bodies might not be found. For instance, the monzonite might coalesce some place to form a larger mass not exposed on the surface, where conditions might be more favourable than when associated with the smaller intrusions.

How to find a replacement orebody is another matter. Geochemistry is probably useless due to the widespread mineralization. The same geophysicist mentioned above suggested induced potential, plus a magnetometer survey to try to indicate the presence of a larger intrusive mass not exposed at the surface. There is likely also scope for more detailed geological study.

Respectfully submitted,
John M. Cormie, P. Eng.
Consulting Geologist

Toronto, Ontario.
November 11, 1970.

UPDATE

DARWIN MINE

Inyo County, California

AN EXCELLENT ZINC EXPLORATION OPPORTUNITY

Summary and Recommendations

Excellent zinc sulfide exploration targets are present in two settings in the vicinity of the Darwin Mine: bedded replacements and crosscutting breccia pipes. Three targets are ready to drill; a fourth needs minor additional definition work. Known zinc mineralization and projections of bedding-controlled sulfide ore along the main mine zones comprise a combined target of 10 million tons, grading 8-10% zinc. Recent recognition of a separate and younger intrusive phase as the principal mineralizing event provides the greatest encouragement for locating significant new tonnages of Zn-Pb-Ag ore. These new observations and interpretations post-date all previous mining and exploration activities; they have never been tested.

Drilling of the two highest priority targets is strongly recommended: around the roots of the Essex/Thompson breccia pipe and along strike from the Defiance bedding replacement ore zone. If initial drilling tests are successful, other identified targets and the remainder of the permissive environment should be systematically explored and tested.

Overview

The Darwin district produced at least 1.1 million short tons of Ag-Pb-Zn ore from 1875 to 1976; the majority was mined by Anaconda from 1945-1957. Sulfide ore produced since 1942 averaged 6% lead, 6% zinc, and 6 oz/ton silver. The last reserve calculation in 1970 lists 129,000 tons of 4.1% Pb, 5.7 oz/ton Ag, 10.0% Zn. Little of the bedded zinc (low lead-silver) was mined by previous operators, particularly below the 600 level in the Defiance

and Thompson/Essex zones. Two Anaconda holes (DA-1, TD 2,201 ft.; DA-2, TD 2,302 ft.), drilled in 1938 to test the skarn breccia pipes at depth, constitute the only exploration drilling during the last twenty years. Although these two deep core holes were directed at tungsten targets, both cut encouraging zinc mineralization.

Excellent zinc exploration targets are present at Darwin in two settings: bedding replacements and crosscutting breccia pipes. Both are sulfide ore targets: bedding replacement targets are higher tonnage; breccia pipe targets are higher grade. The four delineated targets lie adjacent to the major lead-silver-zinc mineralized environments exploited in the Defiance and Thompson mines. Of these, three are ready to drill; the fourth needs minor additional definition work.

Known zinc mineralization and projections of bedding-controlled sulfide ore along the main mine zones comprise a combined target of 10 million tons, grading 8-10% zinc. Tonnage and grade potential estimates are based on geometry of permissive host environments, zinc grades in drill holes and underground workings, and documented ore thickness based on underground mining and drill hole intercepts. Bedding zinc replacement targets are predicated on ore carrying a minimum grade of 8% zinc over an ore thickness of 10 feet. These parameters are consistent with ore zones mined in the past (ore horizons up to 30 feet thick are documented). Breccia pipes range from 44 to 130 feet in diameter, with ore extending for over 1,000 feet vertically. Both breccia pipe ore zones (Thompson/Essex and Defiance) were productive at the deepest mine levels and remain open at depth. Average ore grade and silver values are higher in the breccia pipes than in bedding replacement ore. Much of the direct shipping ore came from the breccia pipes.

Geology

The Darwin Pb-Ag-Zn deposits are localized in several crosscutting structural and bedded skarn zones within Paleozoic carbonate and siliceous clastic units near the west contact of the Darwin stock. All sedimentary units adjacent to the stock are now metamorphosed to marble and calc-silicate or siliceous hornfels. The Darwin stock is composed of monzonite and monzodiorite, dated at 174 MA (U/Pb), outcropping over an area of ½ by 2 miles. The Davis thrust system, on the west side of the district, is about 20 million years younger than the Darwin stock. Key features include:

- Several deeply dipping N60-70E and N60W faults cut both the Paleozoic rocks and the stock; strands of these faults both cut and are cut by the Davis thrust faults. These high-angle faults control skarn development along the Darwin stock contact and also act as primary ore controls for fissure and crosscutting "skarn breccia pipe" mineralization.

- Intersections of the high-angle mineralizing structures with the crest of the Darwin anticline and with second order, doubly plunging north-trending folds on the flanks of the anticline localize important mineralization in favourable reactive carbonate beds.

- The principal Darwin orebodies occur several hundred feet west of the stock contact.

- Newberry attributes the lead-silver-zinc skarn (but not scheelite skarn) and fissure/breccia pipe ore in the district to a younger intrusive event evidenced by granite porphyry and aplite. Recognition of this separate and younger intrusive phase as the principal mineralizing event post-dates all significant mining and exploration activities. It provides the greatest encouragement for significant new tonnages of Zn-Pb-Ag ore because:
  - Granite porphyry or aplite plugs core both productive breccia pipes.

- Zn:Pb ratios increase toward the presumed source of the younger granite porphyry and aplite. Classical metal zoning suggests a source of hydrothermal fluids and metals at depth to the west of the Darwin mines.

- Several exposures of granite porphyry and breccia, including a prominent zoned breccia pipe (500 ft x 700 ft), have recently been identified along the crest of Darwin Ridge (Newberry et al, 1991). At least two of these untested zones are weakly mineralized at the surface. Other occurrences may be located by systematic mapping.

Mineralization

- The most important Pb-Ag-Zn deposits (Defiance and Thompson/Essex mines) occur on steeply west-plunging "skarn breccia pipes", near the crest of the Darwin anticline.

- The Defiance deposit has been developed to the 1300 level, about 1,500 feet below the surface; the Thompson mine has been mined to the 900 Level, about 1,100 feet below the surface. Both deposits remain open at depth.

- High zinc grades are well documented: about 183 drill holes have sulfide intercepts of significant zinc, >300 locations were identified with ore grade zinc and zinc:lead ratios over two. Many high-zinc headings and stopes were producing +15% zinc at the time of Anaconda's shutdown. The latter were particularly pronounced in the deep levels of the Defiance mine (900-1200 levels)

- The downward increase in both zinc grades and Zn:Pb ration is clear from Newberry's sections and Cyprus' compilation of drill hole and production data.

- Anomalous surface rock chip assays from two recently identified breccia pipes suggest these surface exposures could represent ore-bearing features at depth.

Note: This summary report relies heavily on the compilation and evaluation work of P. H. Hahn, completed in 1992 for Cyprus Metals Exploration Company.

H. G. Brown 5/10/02

DARWIN MINE

Inyo County, California

EXPLORATION TARGETS

- Four priority exploration targets need little additional work prior to drill testing:

1. Deep Defiance Target. Geologic mapping and observations by Anaconda geologists, Newberry, Wetzel and Hahn, suggest that bedded replacement zinc sulfide mineralization is increasingly well developed and thicker below the 900 Level, in proximity to the skarn/breccia pipe. This pipe is cored by a granite porphyry plug below the 1,000 Level, and the Zn:Pb >2 envelope increases in size downward. Anaconda hole DA-1, designed to cut the roots of the Defiance pipe and to test a conceptual tungsten skarn target at the stock contact, is 700 feet from the most promising bedding replacement zinc target. Nevertheless, it cut numerous thin zones of skarn between 1,500 and 2,000 feet down-hole, including massive garnet skarn from 1,848 to 1,974 feet. These zones carry strongly anomalous zinc (0.3-0.4%).

   This is the best documented and most favorable drill target developed: the target is centered about 300 feet below the 1300 Level in the Defiance mine with ore potential in the 2-5+ million ton range. Zinc-rich ore is present over a vertical interval of more than 500 feet in the deep workings of this mine. One or two steeply inclined drill holes of about 1,800 feet each would test this target.

2. Thompson-Essex Zone. DA-2(-73°) cut a 500 feet interval (1,000-1,500 feet depth) of calc-silicate hornfels, pyroxene skarn, and massive pyrite breccia, including 177 feet averaging 2.6% zinc beneath existing workings. The best intercept in this hole, 44 feet of 5.5% zinc (including 20 feet of 10.0% zinc), occurs at the

contact with the Darwin Stick (1,800 feet depth). Permissive geometry suggests a 2-5 million ton target is possible.

3. Radiore Breccia Pipe. The outcropping porphyry-skarn breccia pipe, centered on the Water Tank Fissure zone and covering about six acres, is strongly anomalous in zinc and other metals. An attractive target surrounds the projected intersection of this nearly vertical pipe with mineralized bedded replacement horizons in the Defiance Mine. A 1,500 foot hole at -60^{o} will cut the center of the target area. An array of two or three drill holes would provide the best test of the target beds.

4. Northern Breccia Pipe. This pipe is dominantly granite porphyry with encouraging skarn and skarn matrix breccia clasts, indicating that the pipe cut carbonate rocks at dept. Anomalous metal contents at surface suggest a drill target at depth, possibly at the level of the deeper Thompson mine workings where high zinc predominates. A vertical hole drilled to a depth of about 1,800 feet would be a good first test of the roots of this pipe.

- Additional exploration:

5. The small granite porphyry outcrops on the crest of Darwin Ridge between the Bernon and Copper Fissures should be mapped and sampled to determine if this zone constitutes the surface exposure of another mineralized body at depth. Workings below this area on the 400 Level should be carefully examined for indications of nearby crosscutting structure or breccias.

6. Systematically explore the Darwin Hills trend for evidence of breccia pipe development. The Defiance and Thompson mines are certainly the best mineralized features in this trend, bout should significant additional mineralization be discovered in either area, much more intensive exploration is warranted between them and on strike. Lead-silver-zinc mineralization is known in fissure veins

and skarns from the Lucky Jim area on the north to the Promontory mine on the south, a distance of more than four miles parallel to the trend of the Darwin stock.

- Lucky Jim Mine Area – prominent clusters of Pb-Ag-Zn mines and prospects are located over one-half square mile around the Lucky Jim mine, north of the productive Darwin Mine area.

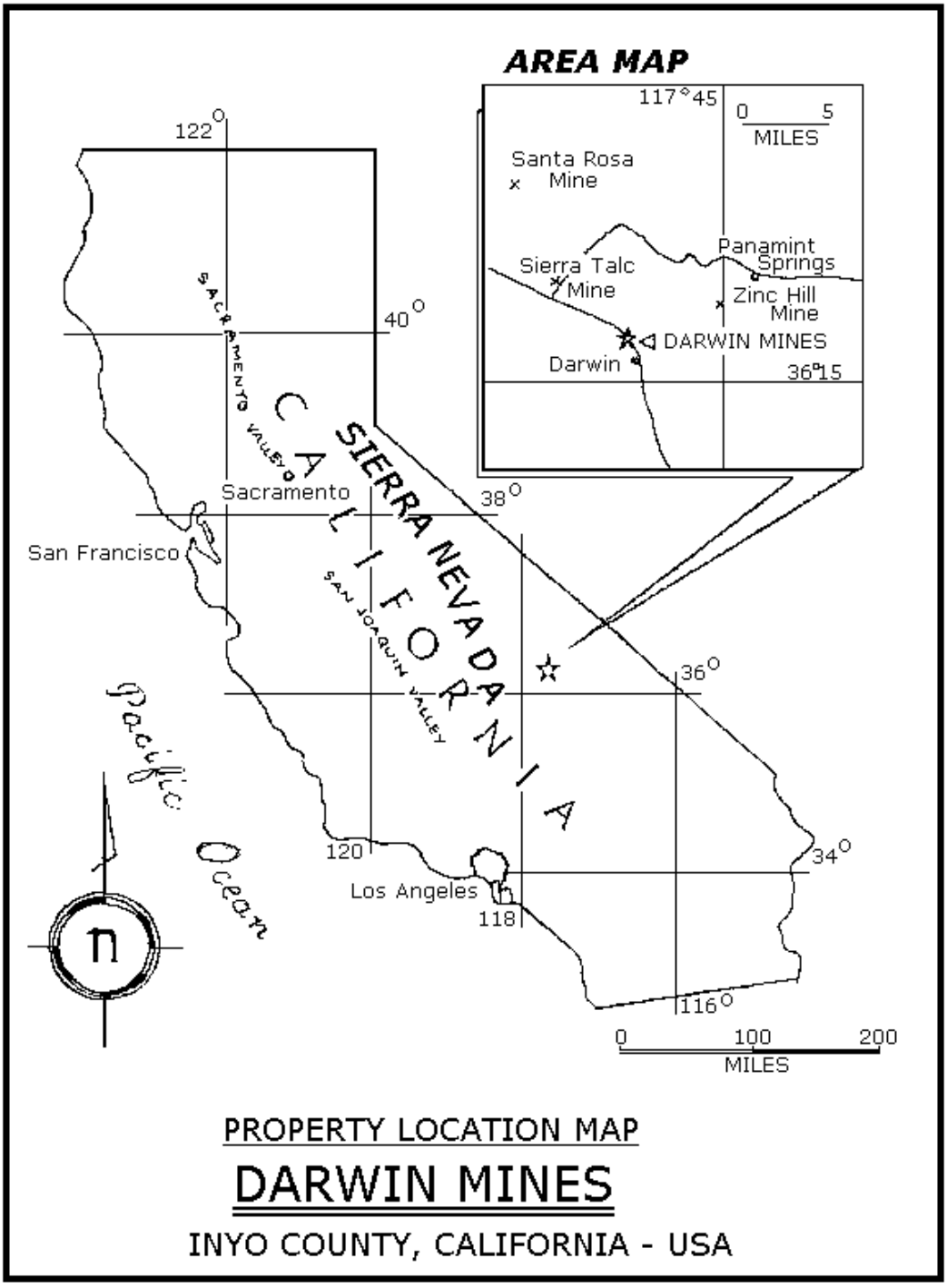
- Numerous prospects occur along the trend to the south of Darwin town site.

Recommendations

- Drill testing of the two highest priority targets is strongly recommended. These are:
    1. The roots of the Essex/Thompson breccia pipe, and
    2. The projection of the Defiance bedding replacement ore zone.

- The remainder of the permissive environment and the other targets should be systematically drill tested if success is achieved in the initial test.

- Acquire true color aerial photographs of the Darwin Trend (approximate cost = $3,000) to aid in identification and mapping of mineralized exposures.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Panamint Springs
Sierra Talc Mine
Zinc Hill Mine
DARWIN MINES
Darwin
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122°
40°
SACRAMENTO VALLEY
SIERRA NEVADA
CALIFORNIA
Sacramento
38°
San Francisco
SAN JOAQUIN VALLEY
36°
Pacific Ocean
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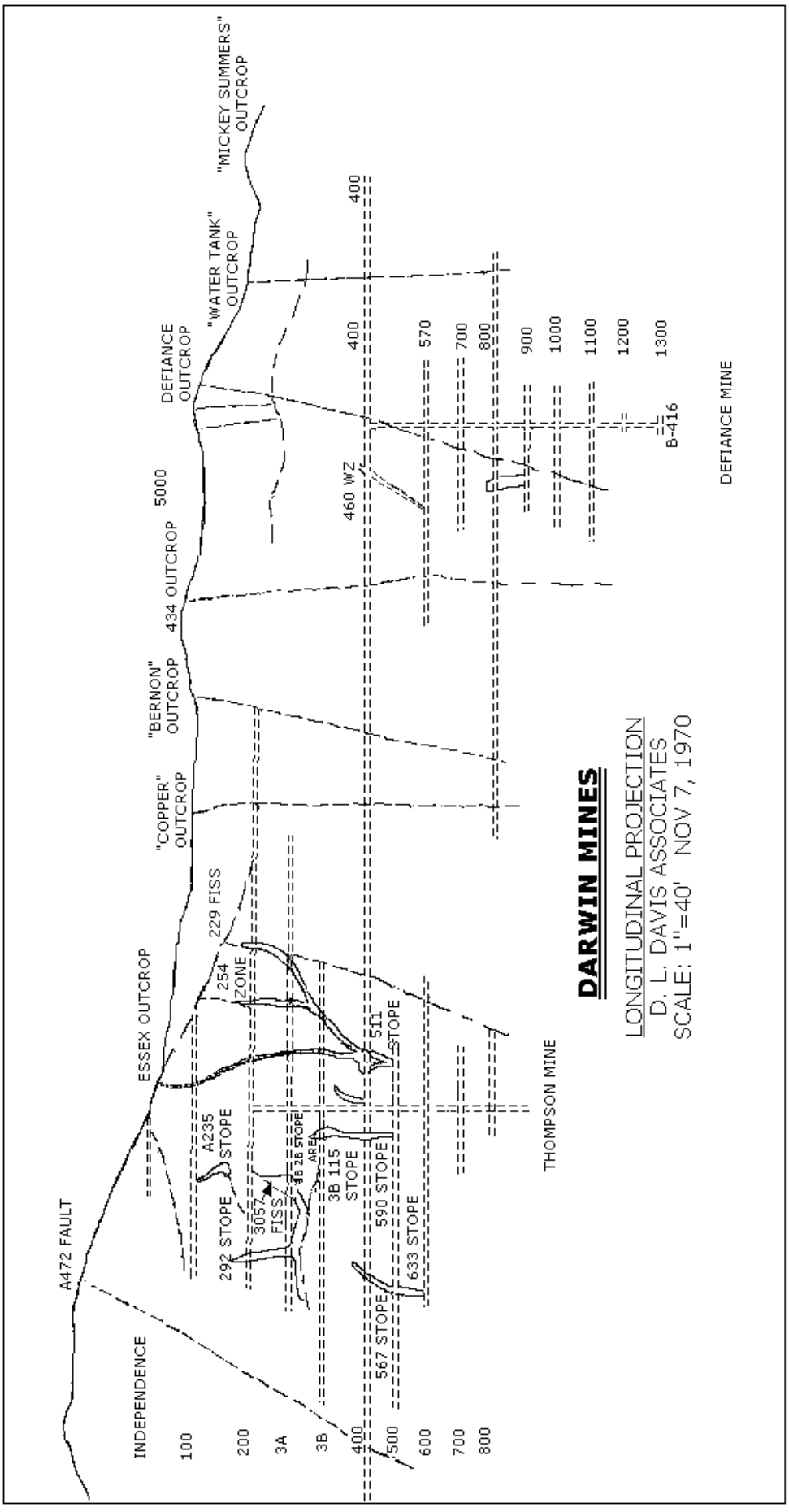
MILES
PROPERTY LOCATION MAP
DARWIN MINES
INYO COUNTY, CALIFORNIA - USA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"MICKEY SUMMERS" OUTCROP
229 FISS
254 ZONE
A235 STOPE
292 STOPE
3057 FISS
16 26 STOPE AREA
3B 115 STOPE
590 STOPE
633 STOPE
567 STOPE
511 STOPE
460 WZ
B-416
THOMPSON MINE
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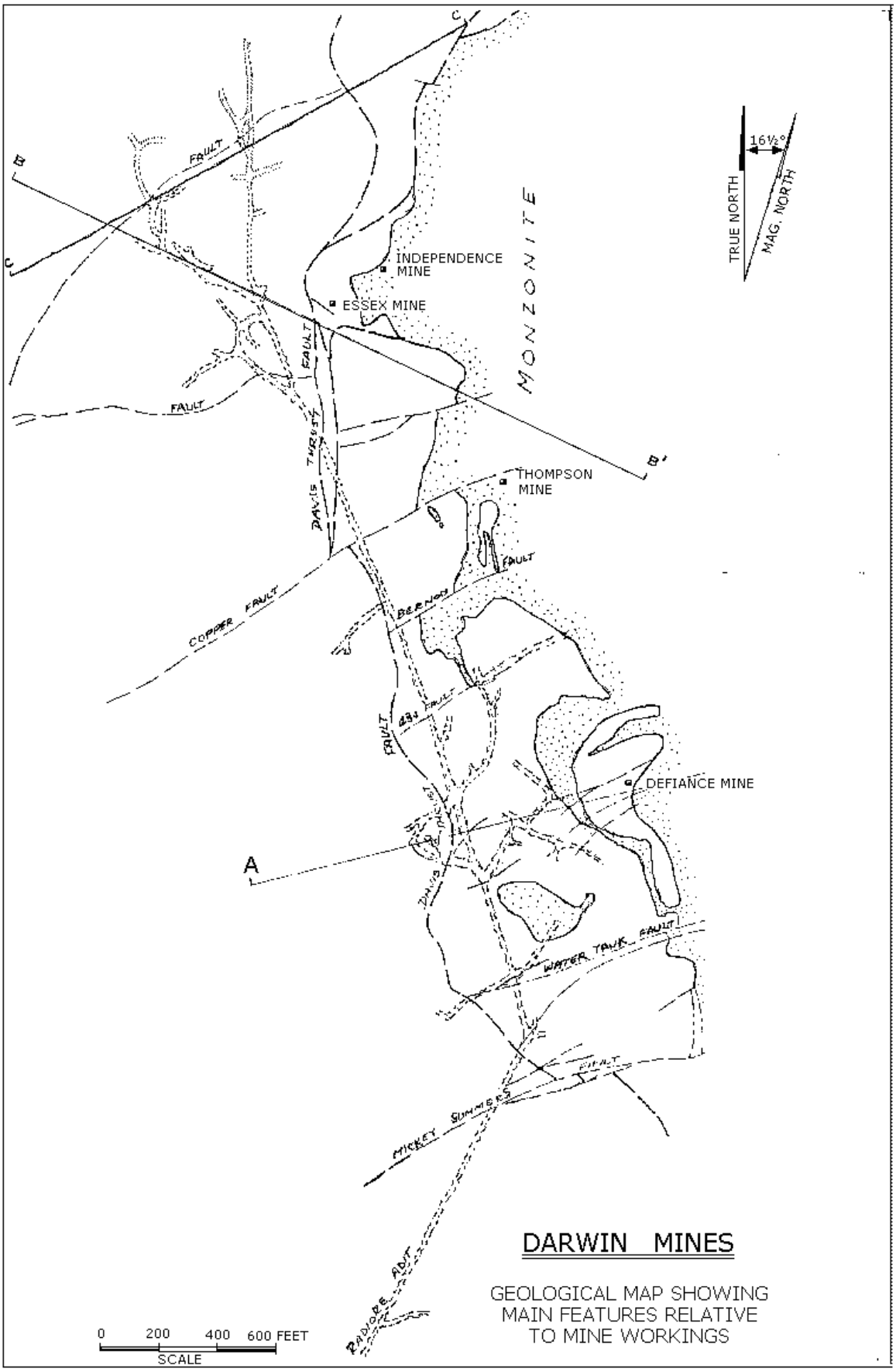
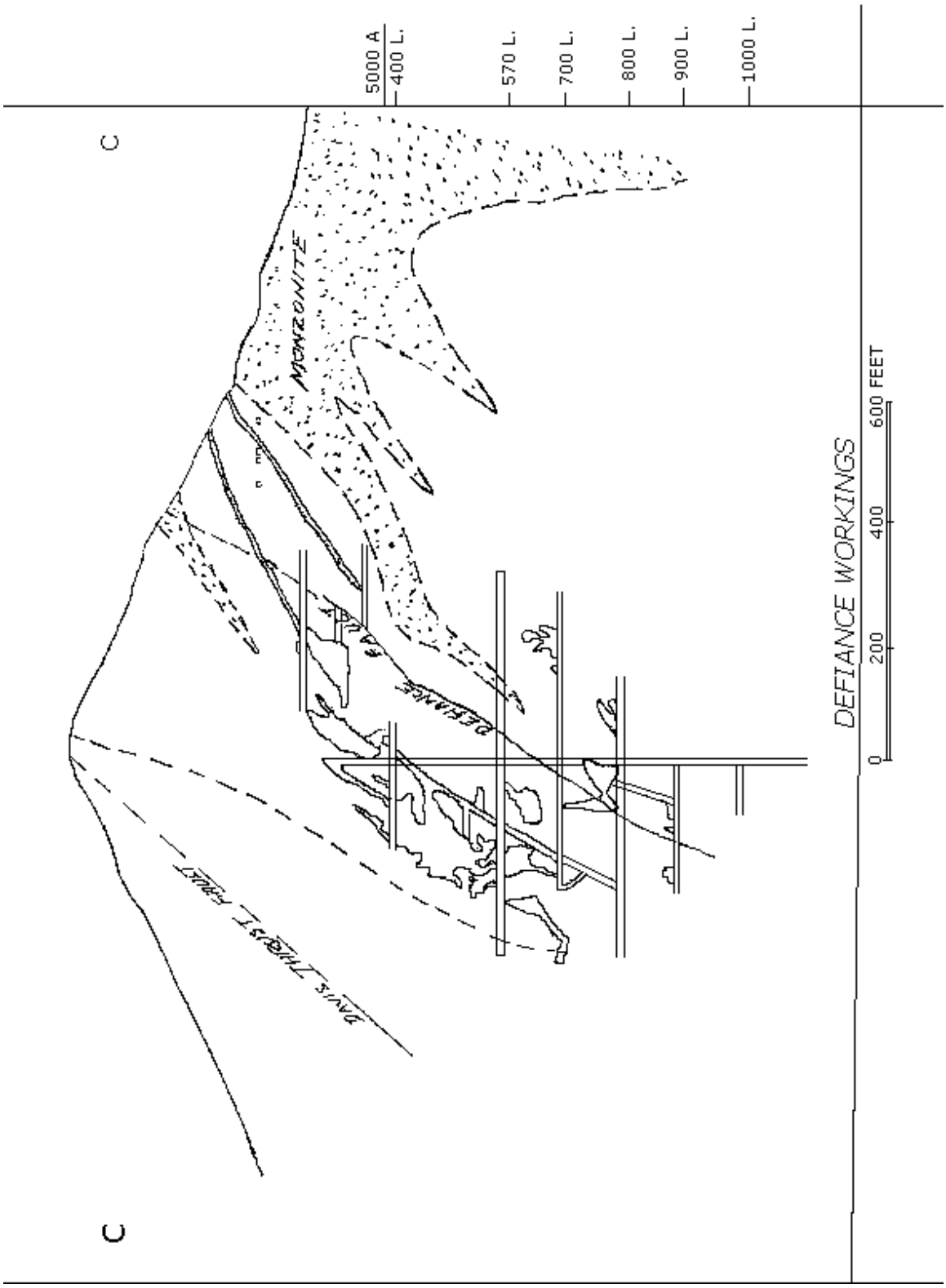
1300
DARWIN MINES
LONGITUDINAL PROJECTION
D. L. DAVIS ASSOCIATES
SCALE: 1"=40' NOV 7, 1970



DARWIN MINES

GEOLOGICAL MAP SHOWING
MAIN FEATURES RELATIVE
TO MINE WORKINGS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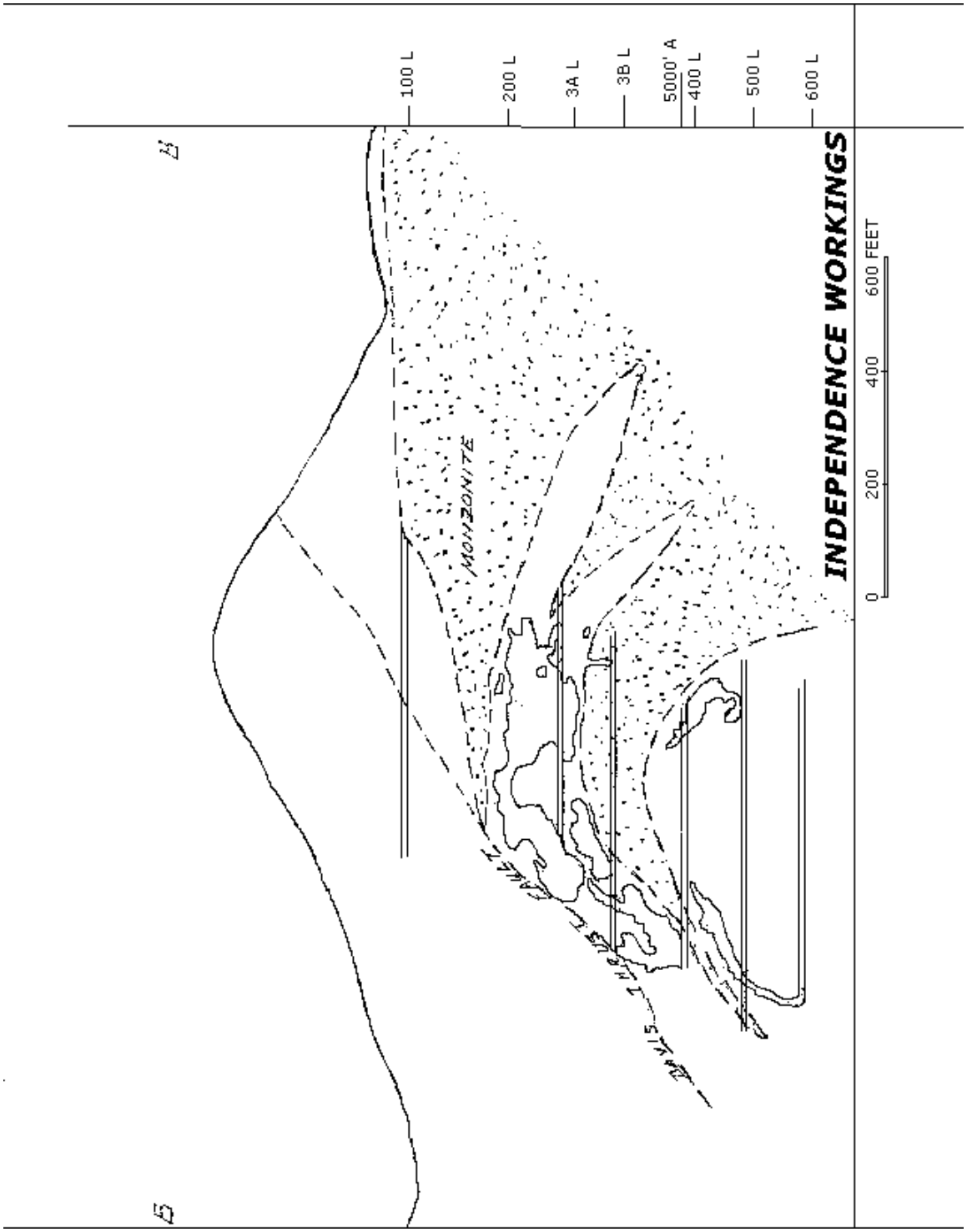
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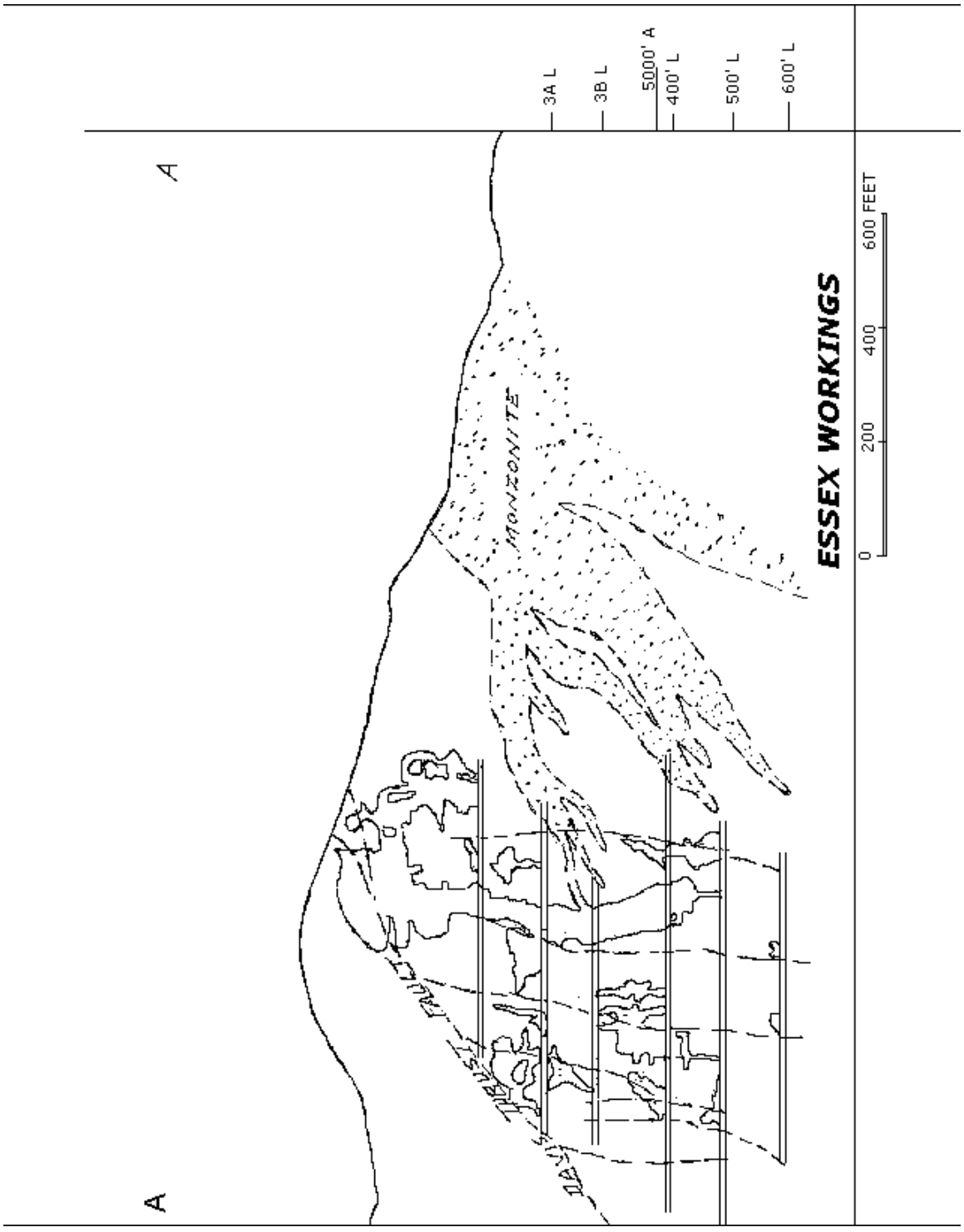
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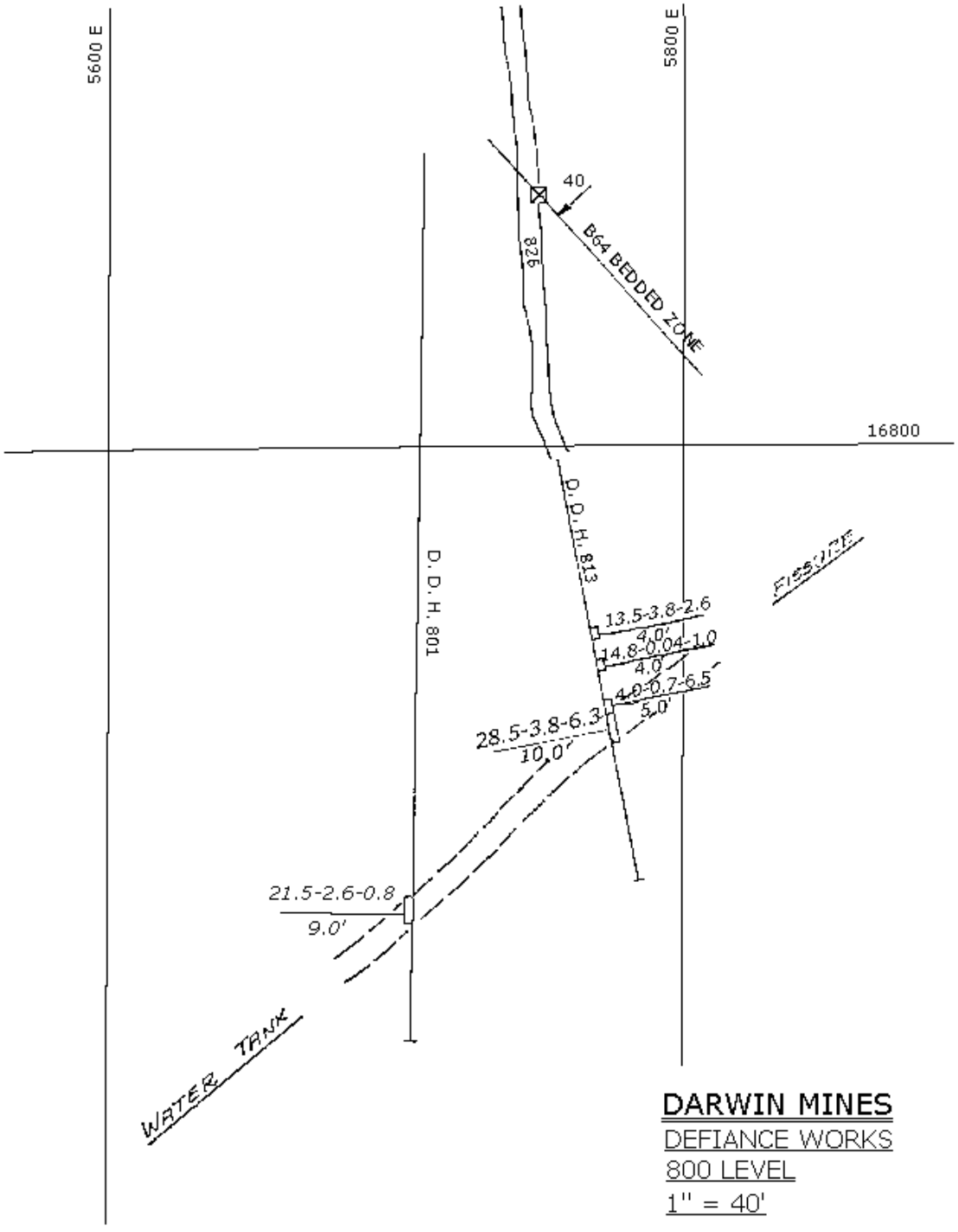
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16800
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4.0'
14.8-0.04-1.0
4.0'
4.0-0.7-6.5
5.0'
28.5-3.8-6.3
10.0'
21.5-2.6-0.8
9.0'
WATER TANK
DARWIN MINES
DEFIANCE WORKS
800 LEVEL
1" = 40'