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THE KENILWORTH MINE, ONTARIO

by

John L. Kirwan

SUMMARY

The Kenilworth Mine, which is about 3 miles south of Timmins, Ontario, produced about 300,000 tons of ore containing 50,731 ounces of gold and 5216 ounces of silver between its discovery in 1912 and its closing in 1964. Underground workings of nearly 7 miles extending to a depth of 1347' have tapped 2 orebodies, though little mining has been done in the lower levels. Reports written in 1963 indicate the presence of some 750,000 tons of ore to be still found underground.

The first 300 feet of underground workings were dewatered in 1984 and over 600 channel and grab samples were taken and assayed, with the result that the old assays on which the 1963 tonnage estimates were made were partly verified. Insufficient time was available, however, to prove this with absolute confidence. These new assays also indicated that gold is distributed in many areas of the mine that were considered to be barren, thus suggesting that these areas may in future be mineable, or with the ore zones might yield a large tonnage low grade deposit. Geological considerations suggest that the two main orebodies may have considerable lateral and vertical extension beyond what was mined in the past, perhaps into the western parts of the property.

A surface exploration program involving geophysical, geochemical and geological work and drilling, to test for westward extension of the ore-bearing horizons on the property is proposed, at a cost of about \$375,000, beginning immediately. An underground exploration and development program to determine the amount of mineable material still in place underground and to discover additional material beyond the known ore zones is also proposed, at an estimated cost of about \$4,000,000, exclusive of capital costs.

THE KENILWORTH MINE
PORCUPINE MINING DISTRICT,
CANADA

by

John L. Kirwan

INTRODUCTION

The property now known as the Kenilworth Mine was discovered in 1912 and produced its last gold in 1964. Even at that time, consultants' reports were in existence which indicated the presence of nearly 750,000 tons of ore-grade material still in place in the old mine workings, with the limitations of the ore-bearing units not yet defined. If the consultants' reports were accurate, there was an untouched mineable deposit waiting to be exploited 20 years ago, even discounting the geological potential of the property. As the price of gold rose in the 1980's these reported 750,000 tons became even more interesting than they were in 1964 and the geological potential of the old mine rose in importance as the

possibility of mining larger tonnage, lower grade gold deposits increased.

In October and November of 1984, the present operators of the Kenilworth pumped out the mine workings to the 300 foot level and the writer and his associates were engaged to determine, insofar as was possible in the short time available, what the economic potential of the property may be and to what extent ore-grade material was yet in place and accessible. An idea of how short the time available to do this was may be obtained from the fact that the 300 foot level (the only level on which the south ore zone was exposed) was dewatered for only 5 days.

The principle tool to accomplish this was that of channel sampling and assaying the drifts and stopes in the old mine workings to locate ore-grade zones but, in view of the short time available, only selected parts of these drifts and stopes were sampled and assayed. In all, about 900 samples were taken: 331 from the 300 foot level, all of which were sent to the assay lab, and 550 from the 100 and 200 foot levels, of which about 100 were assayed, the remaining samples being put in storage for future reference. All of the samples from the South Zone on the 300 foot level were assayed, as this zone was the target area of the present program.

For backup data, a series of assay plans for the various levels is in existence, dated 1938. Part of the present program was conducted to verify these assays so that use could be made in future of these old plans.

By far the greatest economic appeal of the property to the writer, despite the reported 750,000 tons of ore-grade material still in place, is the geological potential. Both the North Zone and the South Zone in the old mine are in geological units that should have great horizontal and vertical persistency and therefore could give rise to gold-bearing zones in which very large tonnages might be expected to exist. This aspect of the Kenilworth, which is now of considerable importance, appears to have been ignored by the earlier operators of the mine.

LOCATION, ACCESS, CLAIMS, TERRAIN, BUILDINGS

The Kenilworth property consists of 15 mining claims in the eastern part of Ogden Township and the western part of Deloro Township, Porcupine Mining Division, District of Cochrane, Ontario (see sketch map, page 4). These claims are within the Regional Municipality of Timmins, about 3 miles (4 km) south of the town center, from where they may be reached by following Pine Street South this distance.

The Main Shaft area forms a knoll which rises over the generally flat terrain about 30 feet (10 m), but many of the buildings have collapsed through age and the main headframe is no longer present, having been destroyed by fire.

The southern part of the ground is occupied by low, swampy terrain which may be the physiographic expression of the Destor Porcupine Fault Zone or one of its branches.

All of the mining activity has been restricted to the easternmost claims, most particularly claims HR938, HR939, HR1008 and P8594. No mining or exploration work is known to have taken place on the westernmost 5 claims (P11483, P8948, P8949, P11344 and P9044) or the easternmost claim, P8555. The intervening claims, P8060, P8061, P8595 and P8852 have no underground workings on them, though some drilling has been reported.

GENERAL GEOLOGY

Geological information for the ground was obtained from company records and from the following published sources:

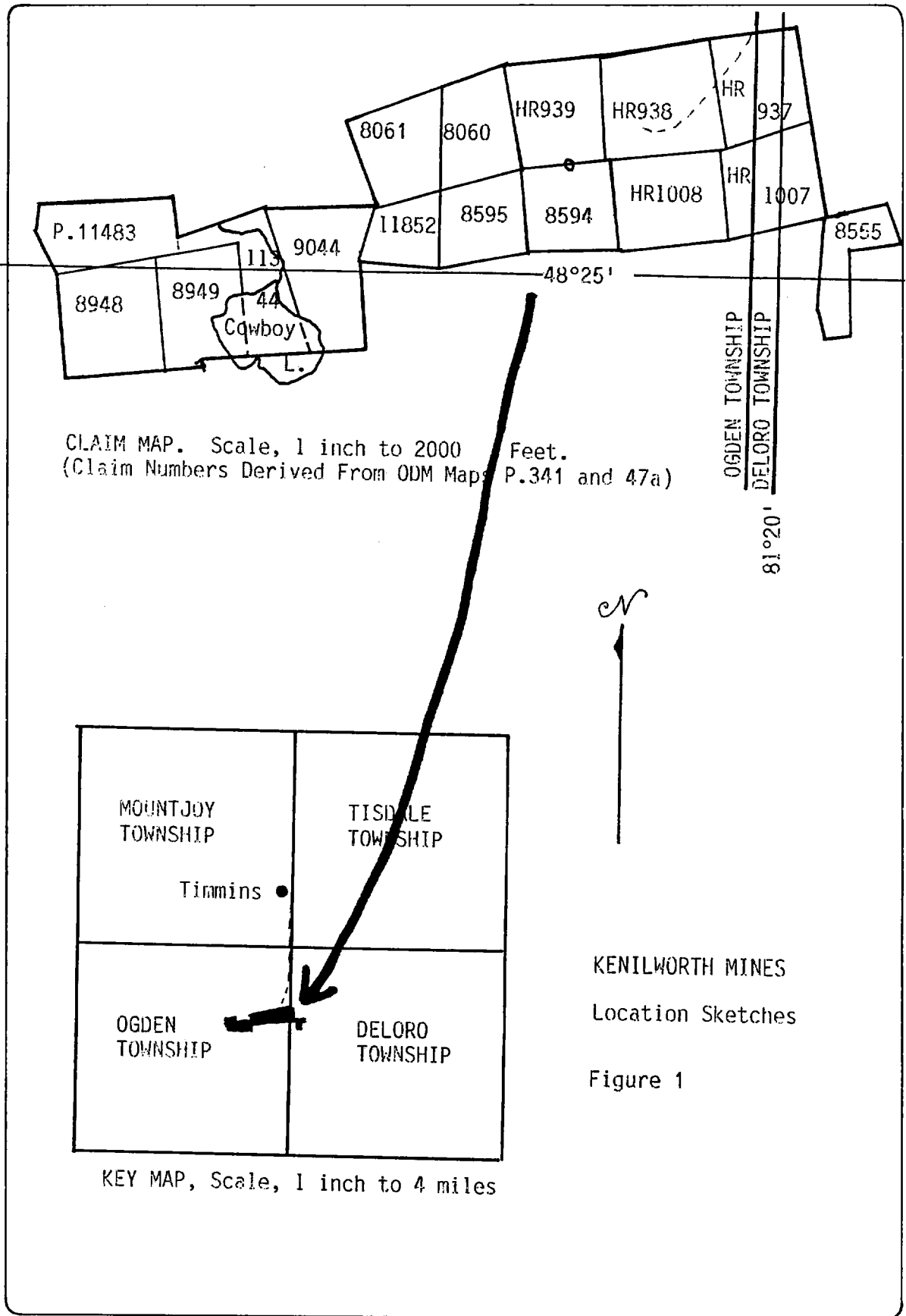
Pyke, D.R., 1982: Geology of the Timmins Area, District of Cochrane. Ontario Geological Survey Report 219, 141 pp plus Map 2455 at a scale of 1:50,000.

Ontario Department of Mines, 1967: Ogden Township. Preliminary Geological Map P.341 at a scale of 1 inch to ¼ mile.

Ontario Department of Mines, 1939: Porcupine Area, Geological Map at a scale of 1:24,000.

In addition to the above, the writer had access to a proprietary detailed aeromagnetic map which covers the claim block and considerable surrounding ground.

A geological map of the ground in the Kenilworth files is, unfortunately, too far deteriorated to be of use.



The single most spectacular structure in the Timmins area, and one which is continuous across northeastern Ontario and western Quebec in the Destor-Porcupine Fault. Many of the mines of the area are spatially associated with this fault, or one of its branches. Although its exact location in the Kenilworth area is not known with precision, it appears to pass through at least the eastern part of the property, either about half a claim up from the southern boundary (as marked on Map P341) or else along this southern boundary as suggested by the aeromagnetic map. In either event the ore-bearing units of the Kenilworth are closely associated with this structure.

The Destor-Porcupine Fault in the Timmins area forms the boundary between the volcanic rocks of the Tisdale Group to the north, with which the large producing mines and past producers are associated and the volcanic and sedimentary rocks of the older Deloro Group to the south with which several smaller past producers are associated. The Kenilworth property is largely north of this fault and is underlain by rocks of the Tisdale Group.

These rocks consist of northwest-trending north-dipping acid and intermediate volcanic rocks and tuffs, at least 2 bodies of quartz porphyry, and a northwest-striking diabase dike. At least one major shear zone is found in the old mine workings, east-west-trending and steeply dipping and exposed for over 300 feet on the 300 foot level. This has in the past been assumed to be the Destor Porcupine Fault itself. Elsewhere in the mine, for example in the North Ore Zone, steeply dipping shearing cuts across the more gently dipping rocks, reorienting them. Within this shearing there is abundant carbonate alteration and intrusion, green fuchsite alteration, quartz veining and gold mineralization.

Carbonate alteration is a ubiquitous feature of the old mine. Calcite, dolomite, ankerite and other carbonates are widely distributed and fuchsite is present, not only in the North Zone, but also elsewhere in the mine.

The gold-bearing zones in overall plan are very close to vertically dipping, with the North Zone dipping very steeply northeastward and the South Zone dipping steeply southward. However, in detail the

zones have a variable dip, sometimes as little as 50°.

The South Zone consists of a well-layered tuff horizon with abundant disseminated sulfides, mostly pyrite, but also chalcopyrite. The zone trends almost east-west. A badly faded and in places illegible ground magnetometer survey of 1963, which covers the ground, shows a nearly coincident magnetic anomaly which could be the expression of the South Zone. If this is so, this zone can be traced on surface, magnetically, for over 2000 feet.

The North Zone is related to a green carbonate (fuchsite) unit that trends, in the vicinity of the Main Shaft, nearly east-west, but which bends northward and finally westward, west from this shaft, to form a flattened, reversed S-shaped body as seen in plan. There is evidence that this body is wrapped around the nose of a porphyry intrusion which extends farther westward. The ore-bearing zone occurs along the north flank of this porphyry. The south flank of the body has not yet been explored and may represent an area for future work.

The aeromagnetic map already referred to shows several highly magnetic bodies on, and in the vicinity of, the Kenilworth ground whose apparent offset suggests the presence of at least 5 north-south faults on the property. The most easterly of these, on the boundary of Ogden Township, appears to have a right-handed displacement of only 100 feet or so. Parallel with this and trending through claims HR939 and P8594 (labelled the Murphy-Ogden Fault on Map P341) a second inferred fault appears to have a left-handed displacement of about 1000 feet (300 m). Two other probable faults which flank Cowboy Lake appear to have displacements of about 500 feet, also left handed, and a fifth fault at the extreme west edge of the property also appears to have a left handed displacement, this time of about 1000 feet. These faults are all very late in the geological history of the area and, though probably having no genetic relationship with the orebodies, may well have displaced these orebodies so that adequate exploration of the ground will require an understanding of the faults.

A portion of the aeromagnetic map, covering the Kenilworth area, and with the inferred faults shown with heavy black lines, is given as Figure 2, page 7.



Figure 2:
Kenilworth Mine Area, Ontario
Aeromagnetic Map
1 inch = 2000 feet

HISTORY OF THE PROPERTY

The following reports were available to the writer on the Kenilworth and its history:

- Ordway, C.A., 1936: Naybob Gold Mines Ltd., Porcupine Mining District. 13 page typescript.
- Erie Canadian Mines, 1938: Two Letters Referring to Logan Porcupine Mines, Ontario Geological Survey Assessment Files, Timmins, File T140.
- Wright, P.G., 1945: Report on Properties Belonging to Naybob. Ontario Department of Mines Files T140, 7pp.
- Armstrong, P., 1949: Report on the Property of Logan-Porcupine Mines Ltd., Ogden-Deloro Townships. 23 page typescript.
- Oja, R.V., Nov. 1963: Letter-Report, Kenilworth Mines Limited, 6 pages.

The ground was staked in 1912 by William Hayden who began development under the name of the Hayden Gold Mines Limited. Work was suspended from 1915 to 1922 owing to priorities dictated by the First World War. Between 1922 and 1932 the operations continued in fits and starts as finances permitted, with a small mill being erected in 1932. Before operations could begin, Hayden Gold Mines, in 1933, went bankrupt though some production taking place in 1932, 1933.

Nabob Gold Mines was incorporated on January 3, 1934, acquired the property and did considerable development work in 1934 and 1935, extending to 1942. The workings, which included a shaft cut to 700 feet with levels cut at 100, 200, 300, 400 550 and 700 feet and lateral workings of 2,300 feet, were extended as follows: the shaft was deepened to 1347 feet with additional levels cut at 825, 950, 1075, 1175, and 1275 feet; 22,021 feet of drifting and 8440 feet of crosscutting were driven; 14 surface holes totalling 9514 feet and 155 underground holes totalling 15,344 feet were drilled; and the mill capacity was raised to 200 tons per day. Production took place in 1935, 1937-1943 and 1948.

Logan Porcupine Mines Limited operated the property in 1949 and later. Some production took place in 1955 and 1957.

Kenilworth Mines Limited operated the mine from 1962 to 1965, producing gold through its operation of the Coniarum Mill at a rate of 600 tons per day in 1963, 1964.

Total production from the mine since 1912 is reported as 304,100 tons, with a yield of 50,731 ounces of gold and 5216 ounces of silver.

The above figures (which are taken from "Gold Deposits of Ontario", Ontario Division of Mines Mineral Resources Circular NO.13, 1971, Part 2, page 85) yield a figure of 0.1668 ounces of gold per ton of rock recovered. Although this figure is respectable in the Timmins area today (Dome Mines reported average is 0.13 Oz./t) it would have been very low in 1964 and probably sub-economic in that or any of the previous years that the mine saw production. These figures may be misleading, however, as Dr. Wright reports in 1945 average grades in the 0.2 to 0.35 range and Armstrong in 1949 quotes production figures of 1939-1941 from the 3rd and 7th level which average 0.269 and overall production ending in 1943 of 213,650 tons with an average grade of 0.210. Part of the lower grade of later production, notably the 1963-64 work, may have been due to dilution of the ore-grade material in mining. On the second level the writer noticed one stope that appeared to be much wider--perhaps five times as wide--as the assay values indicate. This observation may help to verify one legend in the gossip mills of Timmins, a legend that states that the mine closed in 1964, not from lack of ore, but from mining too much rock in order to keep the mill operating near its capacity.

MATERIAL STILL IN PLACE

Oja's report of November, 1963 estimates the following material to be left in place as of that date:

North Zone	138,500 tons, unspecified grade
South Zone	600,000 tons at 0.20 Oz Au/t
Total	<u>735,500 tons proved, possible and probable ore.</u>

A copy of Oja's longitudinal section of the North Zone is given on Page 10 as Figure 3. To the tonnages should be added material which sub outcrops and which can be mined from surface, both over the North Zone and the South Zone. These figures might bring the above estimates to the 750,000 ton range, or greater. However, some mining took place after Oja's work and in this regard the writer noticed areas now mined out which are not so shown on Oja's map--for example the area above the 200' Level marked "213 AREA" (Fig.3).

WEST

EAST

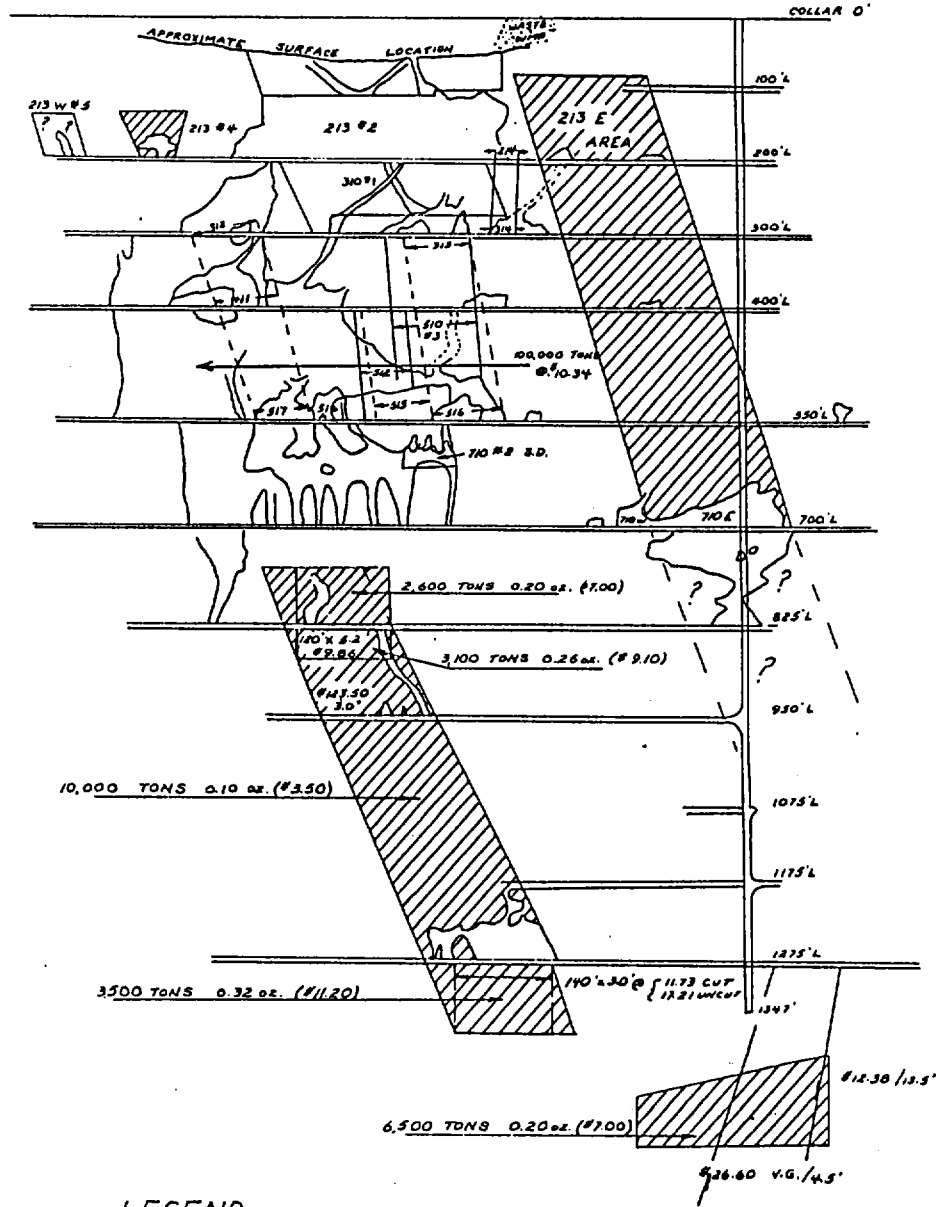


Figure 3: Oja's Nov. 1963 Section of the North Zone with his Estimate of Ore Reserves at that date.

This area is now partly mined for a distance of nearly 50 feet above the drift along a length of 250 feet and across a width of nearly 40 feet. The stope is now about a quarter filled with what appears to be broken ore.

Although the mine was originally developed on the South Zone and the North Zone was not discovered until 1938, it is the North Zone that has received most attention in previous reports and has been most extensively exploited. The South Zone, however, has more estimated tonnage potential, at least as described in previous reports, and, being related to sulfide-bearing tuffs, should have a more persistent grade. For these reasons, the South Zone became the object of the dewatering operations in 1984. Nonetheless, the writer thought that the North Zone also has larger tonnage potential than had previously been reported, and for that reason gave it considerable attention as the mine was dewatered.

THE 1984 SAMPLING

The objects of the underground work in 1984 were several: to sample the drifts and stopes, assay the results and find out if they approximated the values found on older plans; to sample and assay areas of mineralization as a means of determining what material is still in place; to visually inspect the stopes to determine what material has been removed since the last reports were written on the deposit in 1963.

Where possible, back samples were taken. However, as certain parts of the mine were only accessible for a few days it was not possible to take such samples as it would have required the building of scaffolds, restoration of ladders, and the expenditure of time beyond that which was available. In these areas, grab samples were taken.

Sampling was done under contract to Canlo Resources of Porcupine, Ontario, specialists in this field. Channel samples were taken as 6 inch swaths of coalescing rock chips along the lines indicated on the accompanying maps. In the writer's opinion, the sampling method used was excellent.

Samples were assayed by the fire assay method by Pamour Analytical Services of Schumacher, Ontario and by Bell-White Laboratories of Haileybury, Ontario, the results being presented on assay certificates in ounces of gold per ton of rock, the values used on the accompanying 1984 maps. Also included in this report are photocopies taken from assay plans dated 1937 and 1938. These latter are expressed in dollars. Some plans are labelled as to the value of gold at \$35 per ounce, and it is assumed that all plans used that value. However, the possibility also exists that the older value of \$20.67 per ounce was used on some plans.

The writer did not have access to assay plans, if they ever existed, from the latest underground work at the Kenilworth in 1963 and 1964. One area on the 200 foot level of the mine had assay values painted on the walls in yellow. Several of these areas were resampled in the original channels and produced remarkably similar results. Elsewhere it was seldom possible to resample old channels, partly because of difficulty in reaching the backs, particularly of stopes, partly because of the areas being subsequently mined out and the channels removed thereby, and partly because of the existence of many sets of channels dating from different periods resulting in confusion as to which channel is represented on a particular assay plan.

RESULTS OF THE 1984 WORK

Verification of Old Assays

The accompanying appendix to this report contains not only the results of the 1984 sampling, but photocopies of assay plans from earlier work on the same areas. As a general summary of the results of the two surveys it can be said that there is remarkable similarity, with the 1984 work, on the average, yielding slightly lower results. In the North Orebody, for example, on the first level, a zone that assayed moderately in 1938 before stoping was done assayed well in 1984. Farther down the drift where the 1938 sampled area has not been destroyed, the generally low values then obtained were repeated in 1984. Sparser sampling of the same orebody on the second level, however, failed to repeat the high values obtained in the 1930's and yielded only low gold values. See pages A-1 through A-7 below.

As time did not permit the resampling of the stope areas to see what material is still in place, a group of muck samples was taken from the floor of the stope and from the ore passes. These yielded the values shown on page 14 below, some 20 giving an average of 0.17 ounces of gold to the ton. Note, however, the range of gold values obtained from sample 301: 5 assays yielded values ranging from 0.01 to 1.31 ounces. Such is the sporadic nature of the gold mineralization that replicate determinations from the same sample, let alone the same zone, yield widely different results. Muck samples from a stope, also in the North Orebody, yielded an average value of 0.035 in 12 samples (page 15 below). Note that the repeat assaying of 1964 work in the stope on the 200 foot level (page 14, samples 776-7-8) yielded very similar results.

From the South Orebody, exposed only on the 300 foot level in 1984, 17 muck samples from a stope near the eastern part of the mine yielded an average of 0.104 ounces of gold to the ton of rock (page 16 below).

Also on the 300 foot level, South Orebody, the channel samples of 1984 yielded an average grade of 0.035 whereas the 1938 average was nearly 3 times that at 0.096 (pages A-13, A-14). Other values are similar to, or erratically lower, than those obtained earlier (pages A-15 onwards). A gross average for all 331 samples taken from the 300 foot level, stopes, drifts, crosscuts and "blank" areas included, averages 0.07, which itself approaches a mineable grade at the present time. A section of drift on the 300 foot level which gave an average assay of 0.067 in 1937 yielded an average of 0.047 in 1984, but with fewer samples and across the full width of the drift instead of the more restricted width given earlier (pages A-23, A-25; there are somewhat different parts of the drift covered, too, A-25 continuing considerably eastward).

The sporadic nature of the distribution of gold in the rocks of the Timmins area (the "nugget effect") requires the taking of a vast number of samples for assay, or else a large bulk sample for mill testing, if accurate estimates of the gold content of a mine area are to be obtained. The writer has found that the more channel samples taken, the higher the average indicated grade of the material will be.

KENILWORTH MINE, OGDEN TOWNSHIP, ONTARIO
200 FOOT LEVEL
GOLD ASSAYS FROM MUCK SAMPLES

<u>Sample</u>	<u>Assay</u>	<u>Reassay</u>	<u>Notes</u>
301	.71	1.31 .35 .56 .01	
320	.02		Mushroom Stope
326	.062		Mushroom Stope
330	.221		Mushroom Stope
340	trace		
350	.212		
353	.014		
354	.082		
358	.225		
366	.063		
370	.013		
386	.104		
392	.034		
393	trace		
400	.020		
779	.120		2' Back Sample: Large Stope
780	1.32	1.55	Large Stope
781	.164		"
782	.004		"
783	.006		"
776	.720	.724	1.9' Repeat of 1964 sample which assayed .67
777	1.30	1.20	1.5' Repeat of 1964 sample which assayed 1.02
778	.086		1.5' Repeat of 1964 sample which assayed .34
AVERAGE	.17, Excluding Reassays (Numbers 776, 777, 778)		

Sampling by Canlo Resources, 1984

KENILWORTH MINE, OGDEN TOWNSHIP, ONTARIO, 300 FOOT LEVEL
GOLD ASSAYS FROM MUCK SAMPLES, 1984

<u>Sample</u>	<u>Assay</u>	<u>Reassay</u>
458	trace	
459	trace	
460	.020	
461	.002	
462	.004	
463	.056	
464	.014	
465	.254	.224
466	.032	
467	.008	
468	trace	
469	.020	
	<hr/>	
AVERAGE	0.035	OZ AU/TON

SAMPLING BY CANLO RESOURCES, 1984

KENILWORTH MINE, OGDEN TOWNSHIP, ONTARIO, 300 FOOT LEVEL
GOLD ASSAYS FROM MUCK SAMPLES, 1984

<u>Sample</u>	<u>Assay</u>	<u>Reassay</u>
812	.060	
813	.110	
814	.130	
815	.102	
816	.10	
817	.062	
818	.095	.110
819	.100	
820	.200	.223
821		
822	.052	
823	.090	
824	.080	
825	.348	.328
826	.178	
827	.062	
828	.006	
829	.004	

AVERAGE 0.104 OZ AU/T

SAMPLING BY CANLO RESOURCES, 1984

Considering the erratic nature of the distribution of gold in the area and in the Kenilworth Mine, and considering the variable assays that may come from one sample only, and considering further the small number of samples taken in the present work compared with the relatively large numbers taken over the years previously, and considering yet further the fact that the assays reported here include all of the values and the total width of the drifts whereas those reported earlier refer, when averaged, to selected, higher grade portions of the drifts, it is believed that the present sampling did in fact verify the general accuracy of the earlier sampling and assaying. It would therefore be legitimate to assume that tonnage and grade estimates made from those assays were accurate. However, the figures produced by Oja and others in 1963 were most likely derived, at least in part, from assays made in that year. Except for the assays already referred to, which were painted on the wall of the stope on the 200 foot level (and which resampling verified) these figures are not now available.

Estimate of Material Still In Place

As already mentioned, the tonnage estimates made by Oja do not make allowances for the material which was mined after his report was written, which was probably in excess of 50,000 tons from the North Orebody. However, this loss is probably offset by material which occurs between the mine workings at depth and the surface, so the approximately 750,000 tons of material reported by Oja to be still in place, very likely is.

The writer believes that Oja's and other estimates of tonnage based on work in the vicinity of the old mine workings are probably very conservative. Both the North Orebody, which is spatially related to a green carbonate, or fuchsite, zone, and the South Orebody, which is in sulfide-bearing tuffs, are related to geological units that can be expected to have considerable persistence, both in a lateral and a vertical sense. The green fuchsite is considered to be both spatially and genetically related to a major fault that is parallel with the Destor Porcupine Fault which passes through or near the property's

southern edge. Making allowances for offsets by crossfaults (see page 6 above) the faults and fault-related orebodies would have very great horizontal and vertical persistency. The tuff horizons, being mainly of sedimentary origin, would also have lateral and vertical persistency, though the quality of the mineralization might broadly vary if this mineralization is facies related or hydrothermally induced. For reason of this assumed persistency it is believed that the Kenilworth property offers an exceptionally promising target for exploration for high tonnage deep and long orebodies and that the westward and eastward extension of the property is desirable. Even greater tonnage possibilities may exist if the widespread dissemination of low gold values throughout the mine and a large swath of the property exists so as to permit large scale mining of low grade ore.

EXPLORATION

The Kenilworth offers several exploration and development possibilities:

- a. for large tonnage, low grade gold mineralization, for which a program of drilling, underground sampling and assaying, and bulk sampling would be warranted.
- b. for development of the known gold-bearing zones and the known or estimated tonnage reported to now be present in them. For this possibility a program of compilation of data, dewatering and detailed sampling and drilling would be warranted.
- c. for along strike extensions of the known gold-bearing zones, both the North Orebody and the South Orebody. To accomplish this, a program of linecutting, geophysical and geological surveying, geochemical surveying, and drilling would be warranted.
- d. for the location of other gold-bearing orebodies on the property for which the geological understanding of the ground that would come from c. above would be a necessary preliminary to more direct exploration work in the form of drilling or striping.

The implimentation of one of these programs over another would be a management decision based on corporate goals and available money. However, items c. and d. above offer the most promising targets at present, in the writer's opinion.

Because of the fact that some of the surface work will require winter conditions, so that geophysical traversing can be done over the swampland and Cowboy Lake, it is recommended that consideration be given to item c. above immediately. However, underground work can, of course, take place at any time of the year. The following is proposed:

General Property Exploration

- i. A geophysical grid should be cut over the entire area of the claims oriented north-south from one or more east-west baselines, with the line spacing at no more than 100 feet and the pickets every 50 feet. Estimated cost, \$5000.
- ii. A detailed magnetometer survey of the ground should be conducted with an instrument capable of a sensitivity of 1 gamma and a station interval, on the property, of 25 feet. The contoured map should be presented at a scale of 200 feet to the inch and contoured at the most detailed that space will permit, at times 5 gammas. Estimated cost, including detailed contouring, \$3000.
- iii. Four VLF surveys should be conducted on the lines, with station intervals of 50 feet or less, two normal dip angle surveys using Cutler, Maine and Annapolis, Maryland as the source stations, and two contoured field strength surveys using the same two stations. The results should be contoured (the dip angle surveys requiring Fraser filtering to accomplish this) and presented as maps at a scale of 200 feet to the inch. Estimated cost, including some additional surveying and interpretation, \$5000.
- iv. On every second picket line (with fill-in on intervening lines as warranted, Induced Polarization surveys should be conducted using a pole-dipole array or a dipole-dipole array, a spacing of 50 feet and an $n = 1, 2, 3, 4$. Estimated cost of the survey, some supervision and preliminary interpretation, would be in the \$15,000 - \$20,000 range.
- v. Detailed geological mapping, as soon as weather permits, should be done at a scale of 1 inch to 100 feet (for photoreduction to 200 feet to the inch) over the entire claim block and include detailed photointerpretation, aeromagnetic map interpretation, compilation of data from surrounding properties, and chemical analyses with related studies. A cost of \$15,000 is estimated.
- vi. A row of overburden drill holes along the south boundary of the property, to test for depositional till gold values, should be drilled. Estimated cost, including the recovery and examination of bedrock samples, \$10,000 to \$15,000.
- vii. Based on the results of the interpretation and integration of all of the above data, a program of diamond drilling should be conducted. This would cost, in this area, approximately \$25 per foot, including supervision, logging, and assaying of the core (every inch of core). For an initial 10,000 feet of drilling this would amount to an estimated cost of \$250,000.

- viii. A further budget of \$25,000 should be planned to cover costs of supervisory work, interpretation and integration of the results, and consultant's fees for presentation of results and other services.
- ix. For this general property examination an estimated \$335,000 would be required to which a \$40,000 contingencies fee should be added to yield a total of about \$375,000.

General Mine Exploration/Development

Initial work on the underground workings of the old mine can be done, say down to 550 feet, without the erection of a headframe and hoisting equipment. However, the removal of gold-bearing rock for bulk sampling or mining purposes will and, as work at depths of 1000 or 1300 feet will be required sooner or later, a management decision to build such a headframe and supply hoisting equipment will be necessary. Exactly when this will be warranted will be a matter for financial discussions, as will its size and eventual use, whether temporary or permanent. The consideration, too, that active mining may make the company ineligible for government exploration grants and tax writeoffs may be important. Cost considerations in the following recommendations are not made with the cost of any buildings or capital equipment in mind. Much equipment should be bought rather than rented if work is anticipated to last more than a few months, which the following recommendations suggest.

- i. Dewater in phases, first to 550 feet and thereafter progressively to the bottom, refurbish manways, supply ventilation as needed, repair safety features, etc. Estimated 300 days at an average of \$3000 per day: estimated average cost of \$1,000,000.
- ii. Completely resample underground workings, redetermine average gold content not only of stopes but of all areas of mine. Estimated cost for 300 days, including assays and plotting of results, \$750,000, to which about \$250,000 should be added to handle construction of scaffolding and other access requirements for a total of about \$1,000,000.
- iii. Compile all old data onto new level plans and sections, geologically map underground workings, integrate surface and underground data, supervise technical aspects of work, \$250,000.
- iv. Conduct a program of diamond drilling, bulk sampling, lab and mill testing, core assaying, and ore testing. This should be

done almost on a contingency basis as the technical and the operational data that will warrant parts of the program will be generated on a daily basis. However, a budget in the order of \$1,000,000 would be a reasonable number, in the writer's opinion.

- v. For this general underground examination an estimated cost in the approximate amount of \$3,500,000 is proposed.

The above-proposed exploration programme is designed to explore the Kenilworth property with all of the four goals, a, b, c, and d, mentioned above (on page 18). This would cost approximately four million dollars to accomplish. In the writer's opinion, this amount is amply warranted to be spent by the results of the 1984 work, by the gold-bearing material known to be left in place as reported by previous workers, by the known geological indications of extensions to the orebodies, and by geological considerations of a more regional nature. The Kenilworth mine represents a first-class target for the discovery of more ore in the old mine workings, for the development of material already known to be in place underground, and for the discovery of additional ore-grade material elsewhere on the property and on surrounding ground.

Respectfully submitted,

John L. Kirwan



At Timmins, Ontario,
December 14, 1984

DECLARATION

I, John Laurence Kirwan of the City of Timmins, Province of Ontario, Canada, and of the Town of Centre Harbor, State of New Hampshire, United States of America, do state:

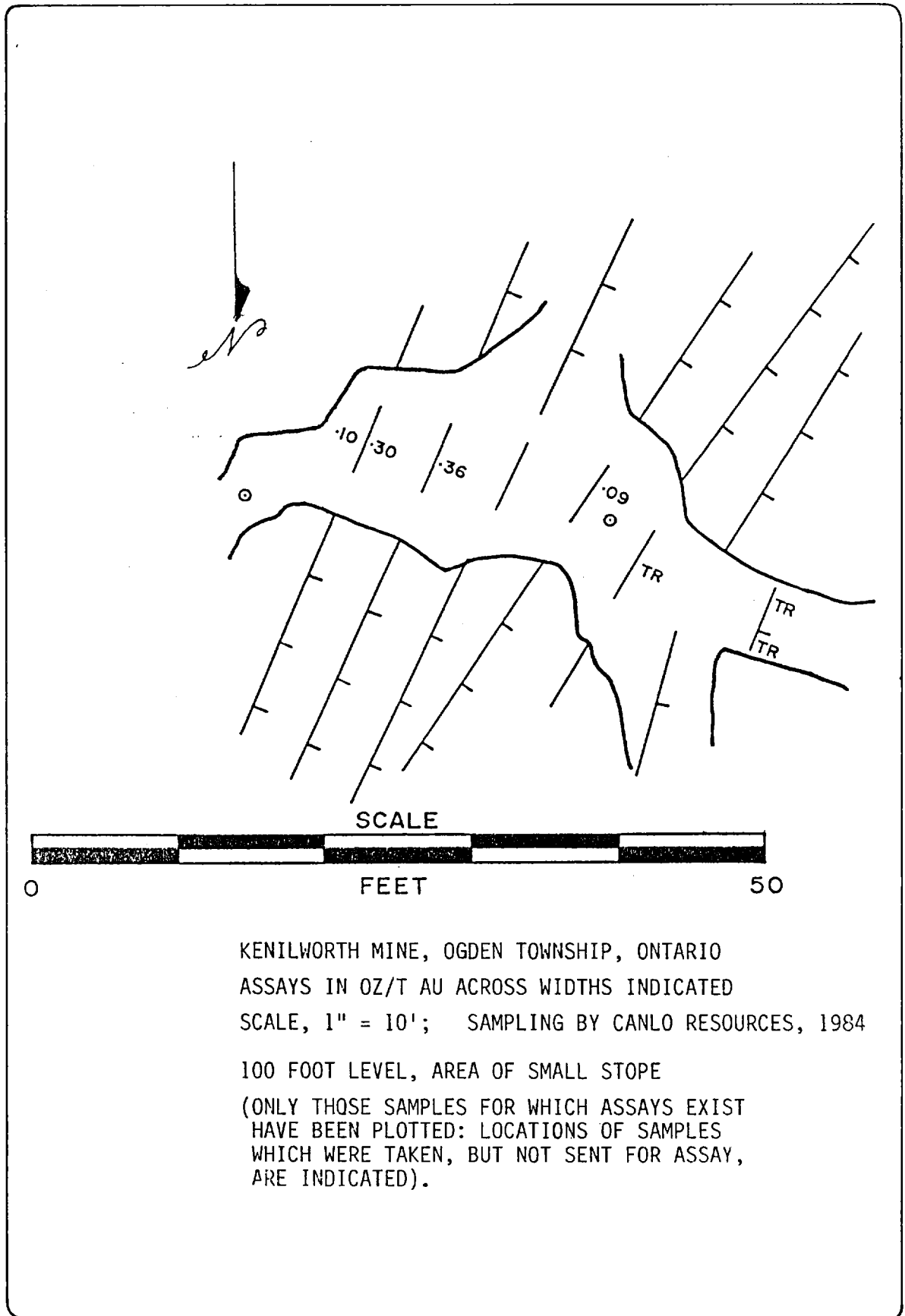
1. that I am a practising Consulting Geologist with offices at 116 Golden Avenue, South Porcupine, Ontario and in Old Meredith Road, Centre Harbor, N.H.
2. that I am President of Earth Resources Associates (John L. Kirwan and Associates Limited) which was incorporated in the Province of Ontario in 1976.
3. that I have practised my profession as Geologist continuously since 1961 and as Consulting Geologist continuously since 1972.
4. that I am a Professional Engineer in the Province of Ontario and in the State of New Hampshire and that my license to practise in either jurisdiction is not under suspension or revocation. I am also a Life Fellow of the Geological Association of Canada and of the Royal Geographical Society in England and am a Life Fellow, Fellow, or Member of other professional associations in the USA, Ireland, England and Brazil.
5. that I am a graduate with the degree of Bachelor of Science in Geology and Mathematics from Carleton University in Canada and with the degrees of Master of Science and Doctor of Philosophy, both in Geology, from the University of London in England.
6. that I am familiar with the material contained in this report, having examined the original material myself, supervised other Professionals in their work on the property, and visited the property on numerous occasions.
7. that I do not now have, and do not anticipate receiving, any direct or indirect interest in the property.
8. that the opinions expressed in this report are my own.

Respectfully submitted,



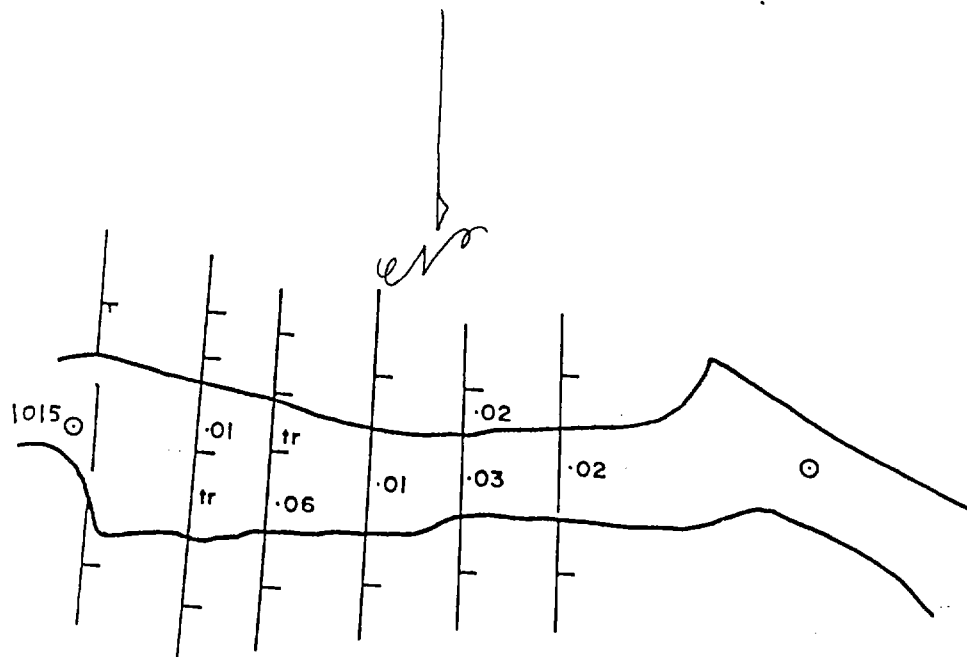
John L. Kirwan

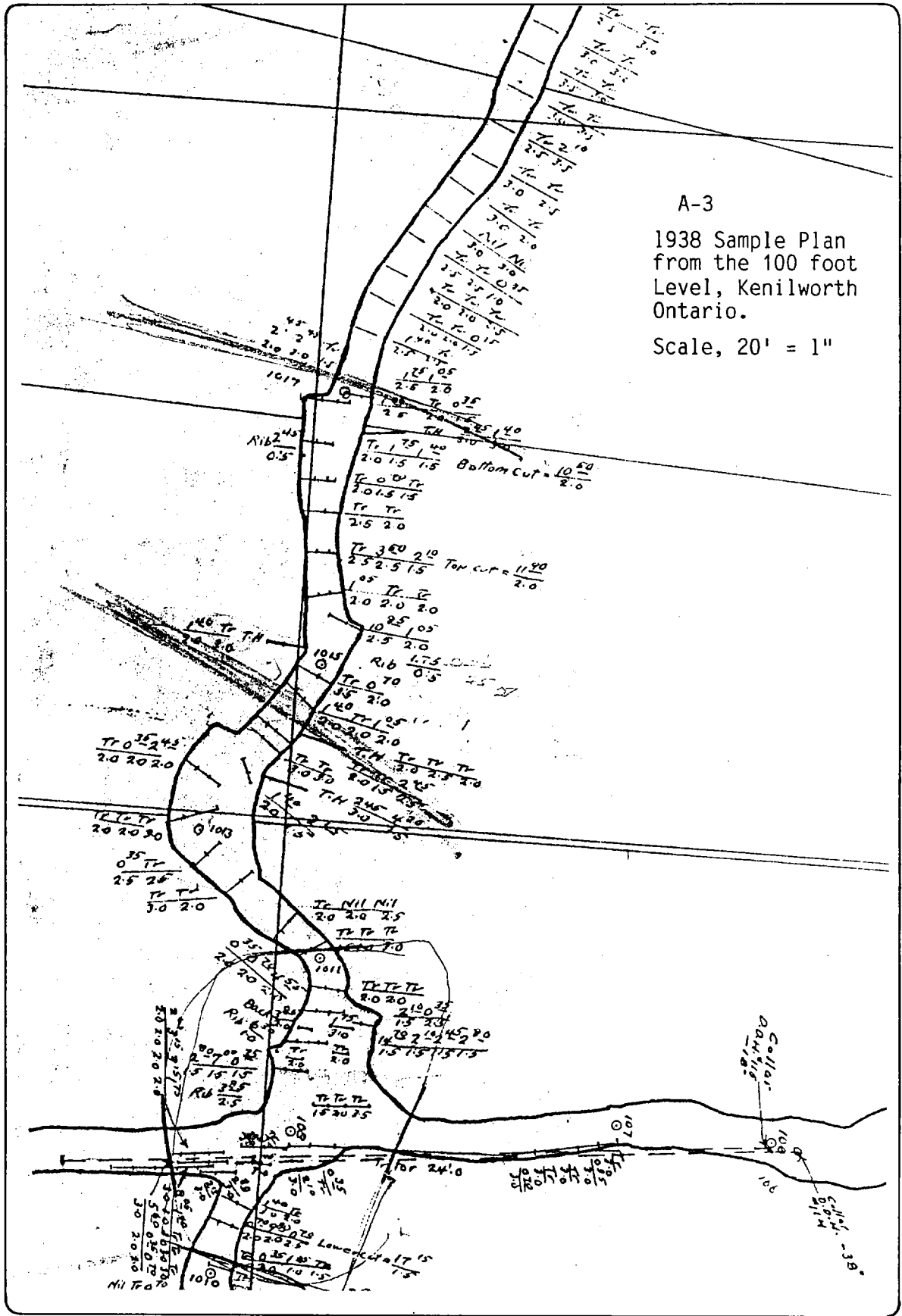
APPENDIX
PAGES A-1-A-46



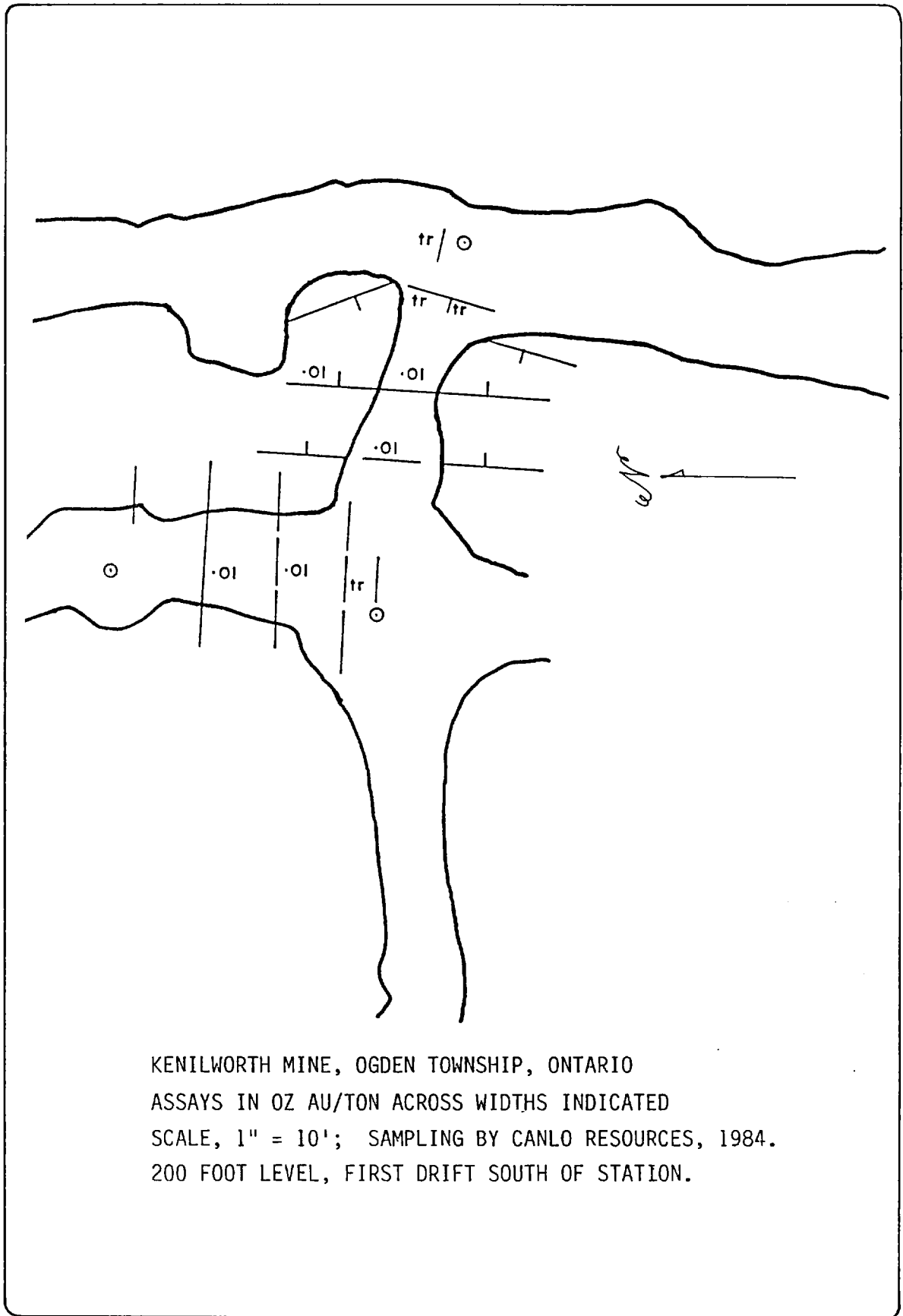
KENILWORTH MINES, OGDEN TOWNSHIP, ONTARIO
ASSAY VALUES IN OZ/T AU ACROSS WIDTHS INDICATED
SCALE, 1" = 10'; SAMPLING BY CANLO RESOURCES, 1984

100 FOOT LEVEL
1015 STATION AREA (WEST OF STOPE)





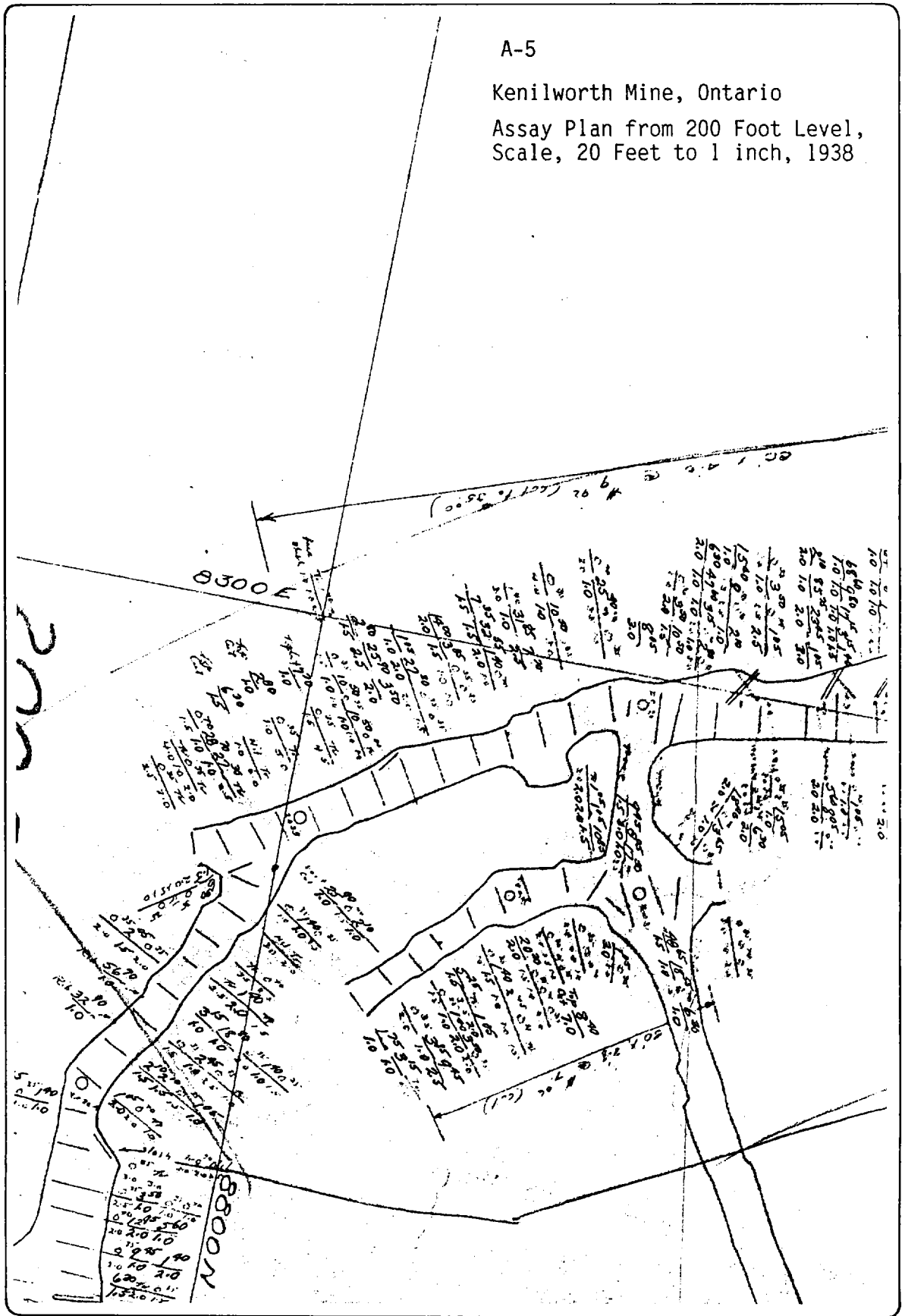
A-3
 1938 Sample Plan
 from the 100 foot
 Level, Kenilworth
 Ontario.
 Scale, 20' = 1"



A-5

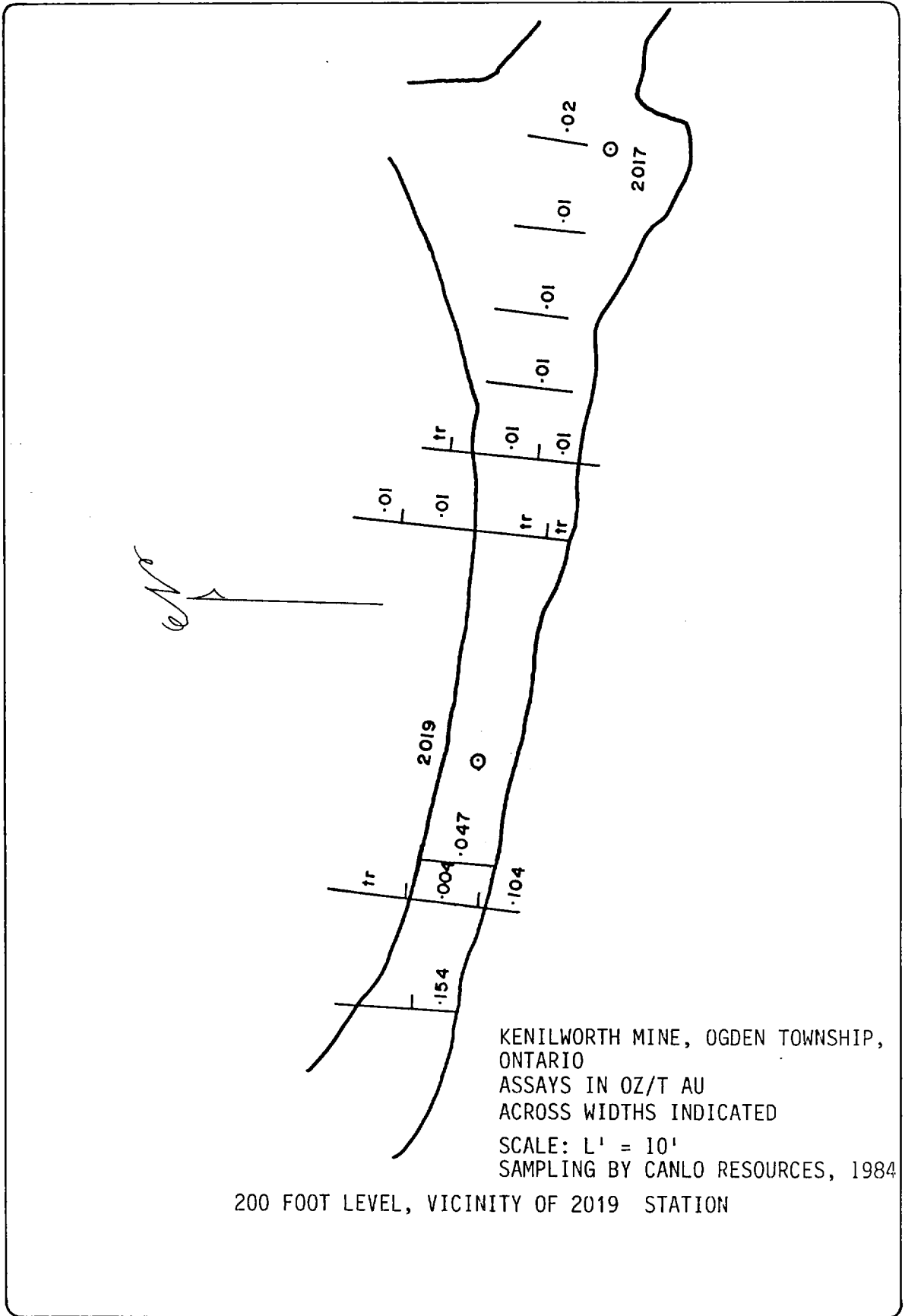
Kenilworth Mine, Ontario

Assay Plan from 200 Foot Level,
Scale, 20 Feet to 1 inch, 1938

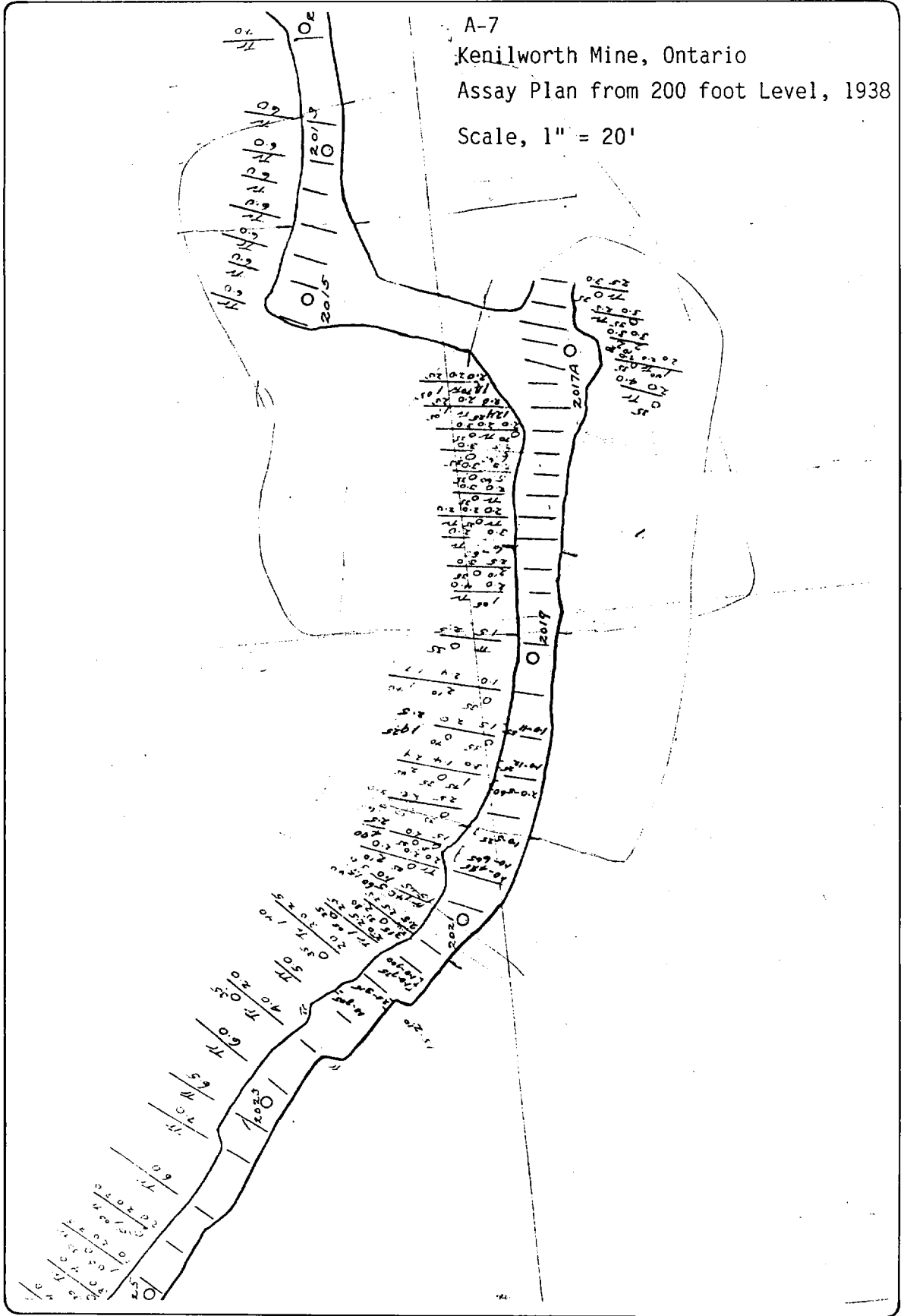


EARTH RESOURCE ASSOCIATES

JOHN L. KIRWAN

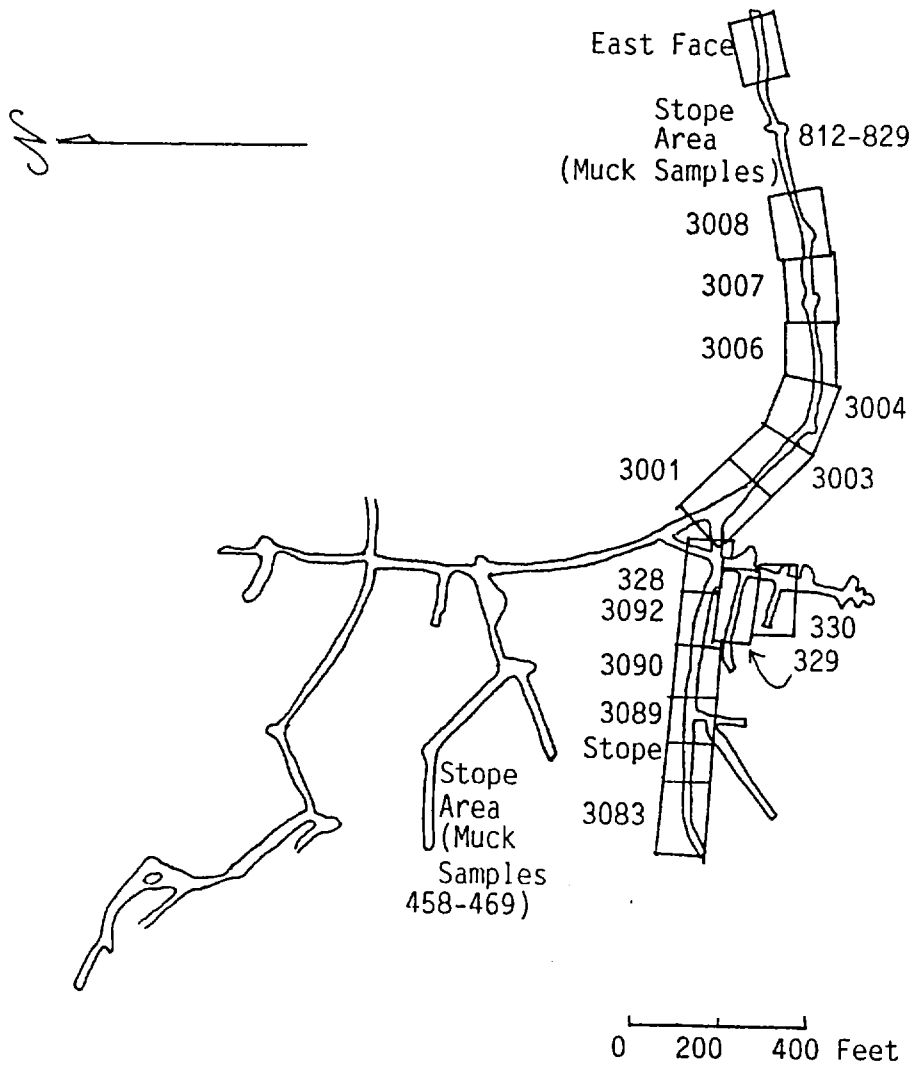


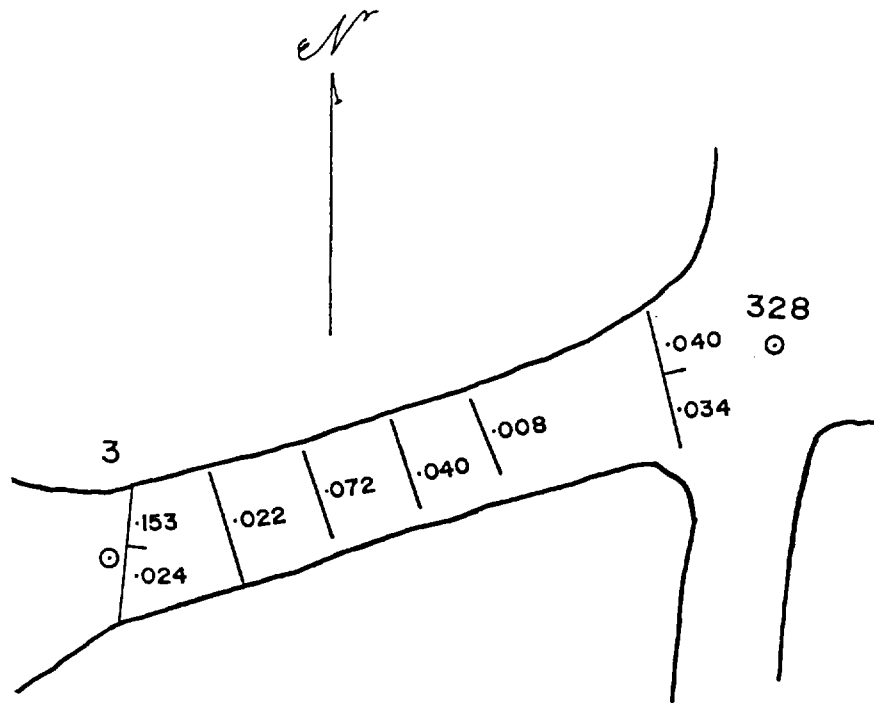
A-7
 Kenilworth Mine, Ontario
 Assay Plan from 200 foot Level, 1938
 Scale, 1" = 20'



KENILWORTH MINE,
OGDEN TOWNSHIP, ONTARIO

Plan of 300 Foot Level
Showing Individual
Sample Plans





KENILWORTH MINE, OGDEN TOWNSHIP, ONTARIO

ASSAY VALUES IN OZ AU/TON
ACROSS INDICATED

SCALE, 1" = 10 FEET

SAMPLING BY CANLO RESOURCES, 1984

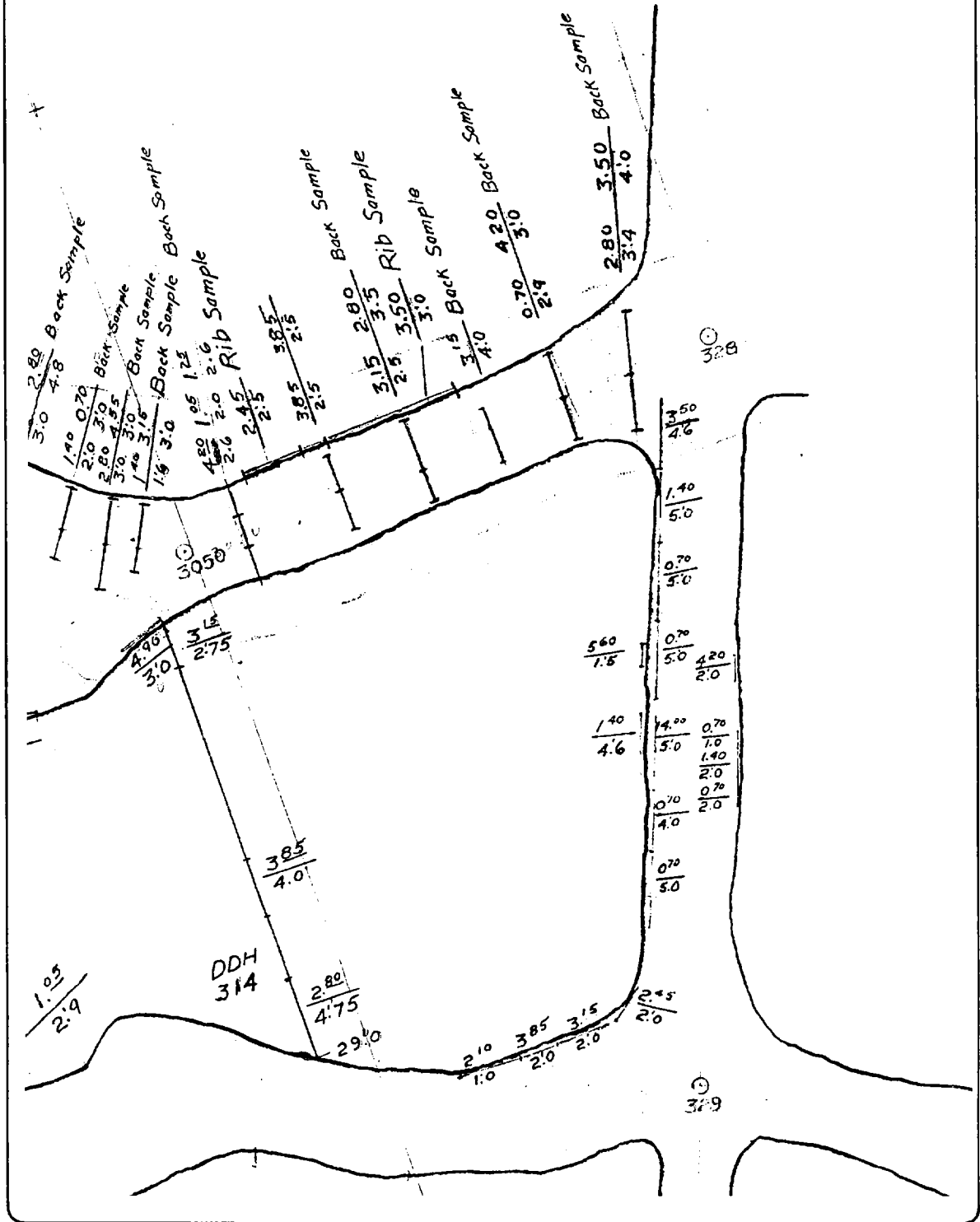
300 FOOT LEVEL, STATION 328 AREA

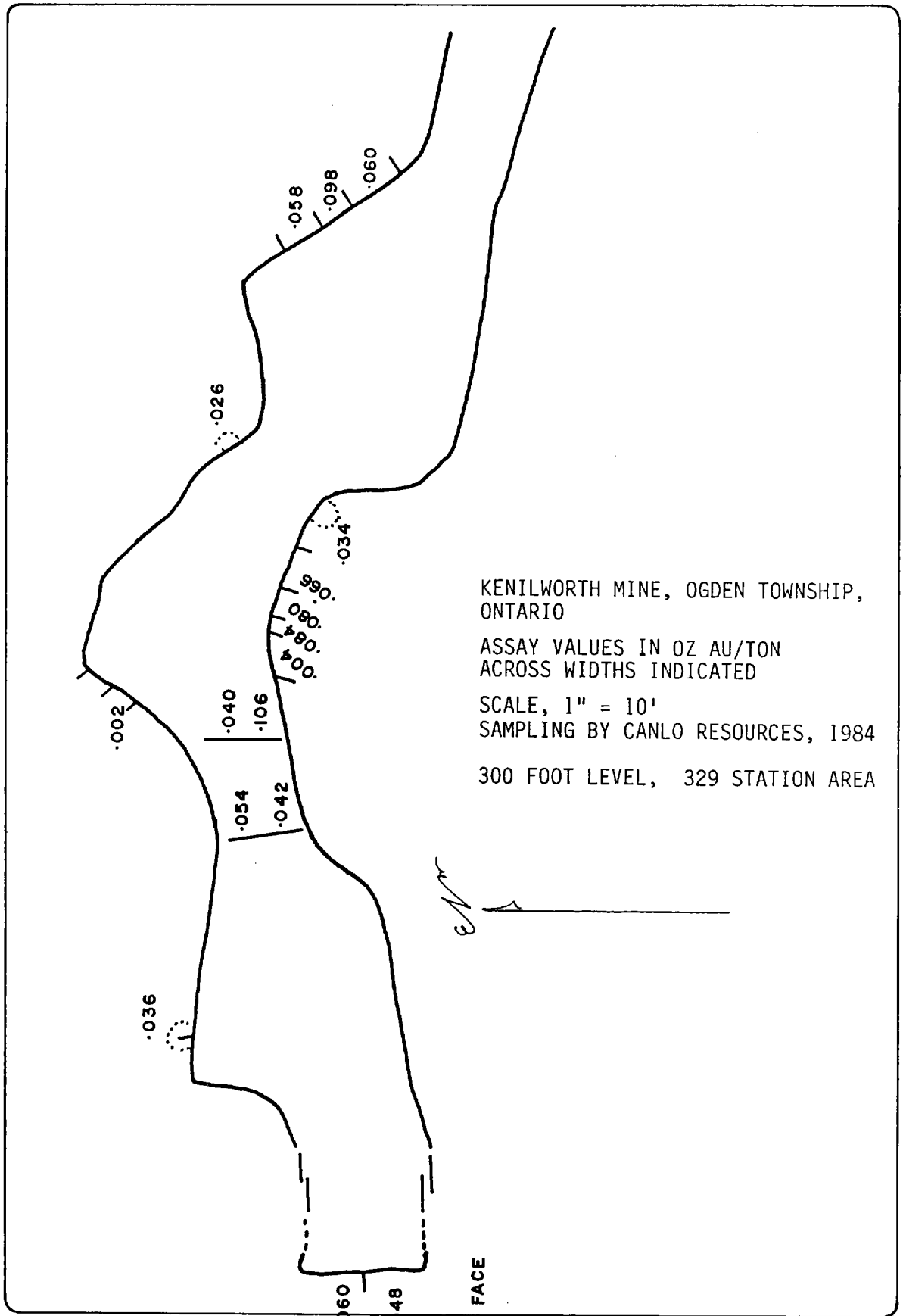
A-10

Kenilworth Mine, Ontario

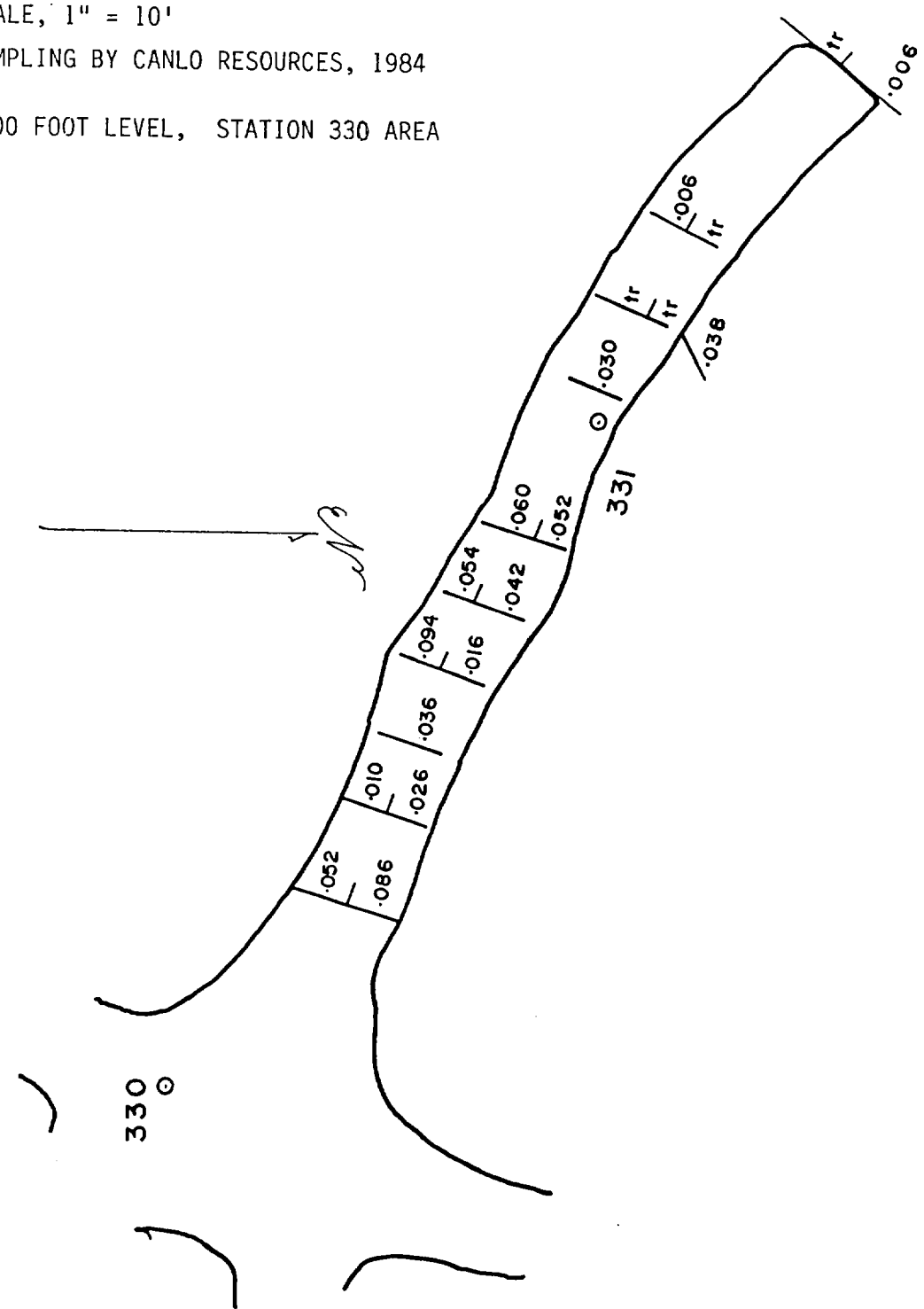
Assay Plan for part of
the 300 foot level, 1938

Scale, 10 feet to 1 inch





KENILWORTH MINE, OGDEN TOWNSHIP, ONTARIO
ASSAY VALUES IN OZ AU/TON ACROSS WIDTHS INDICATED
SCALE, 1" = 10'
SAMPLING BY CANLO RESOURCES, 1984
300 FOOT LEVEL, STATION 330 AREA



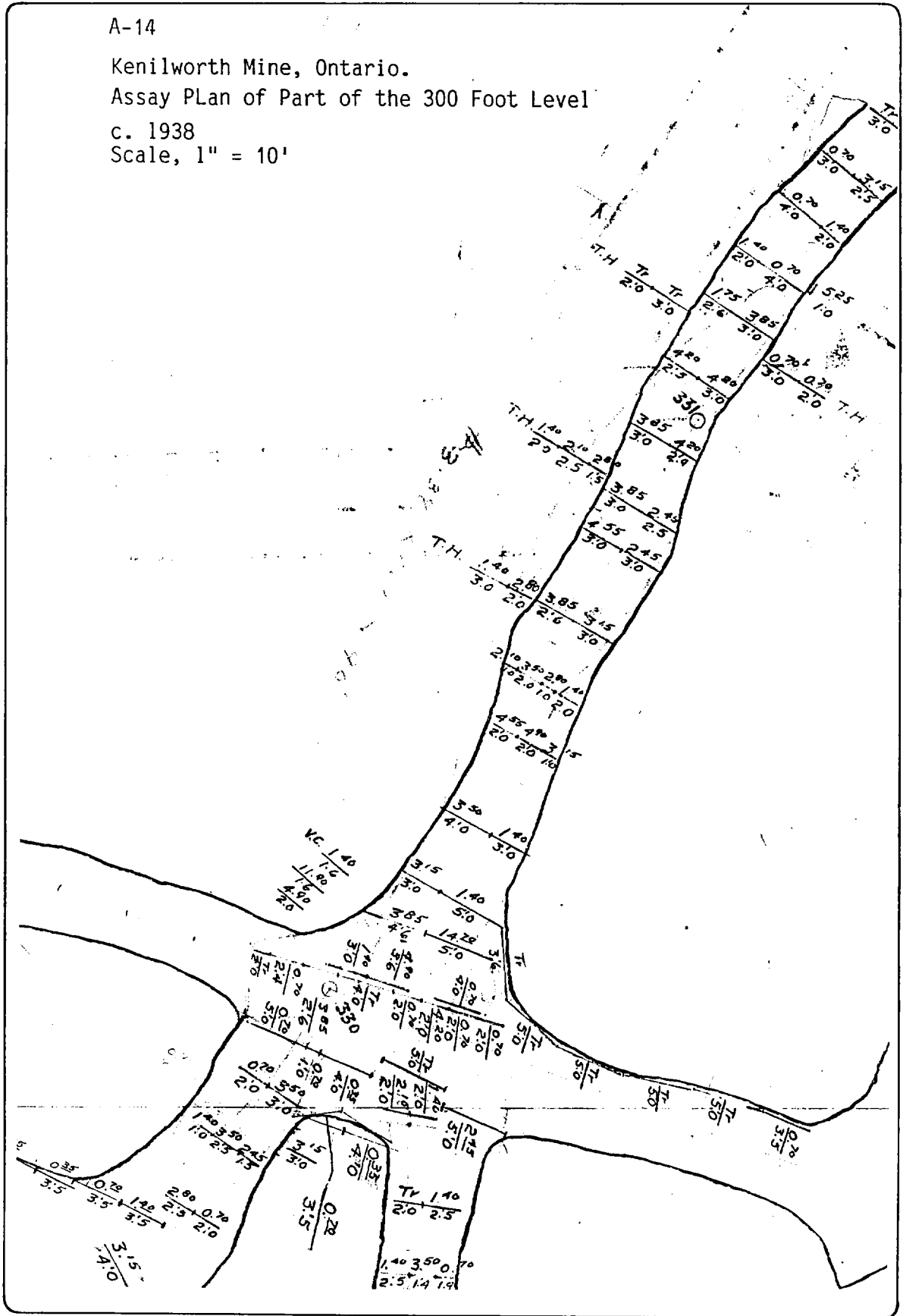
A-14

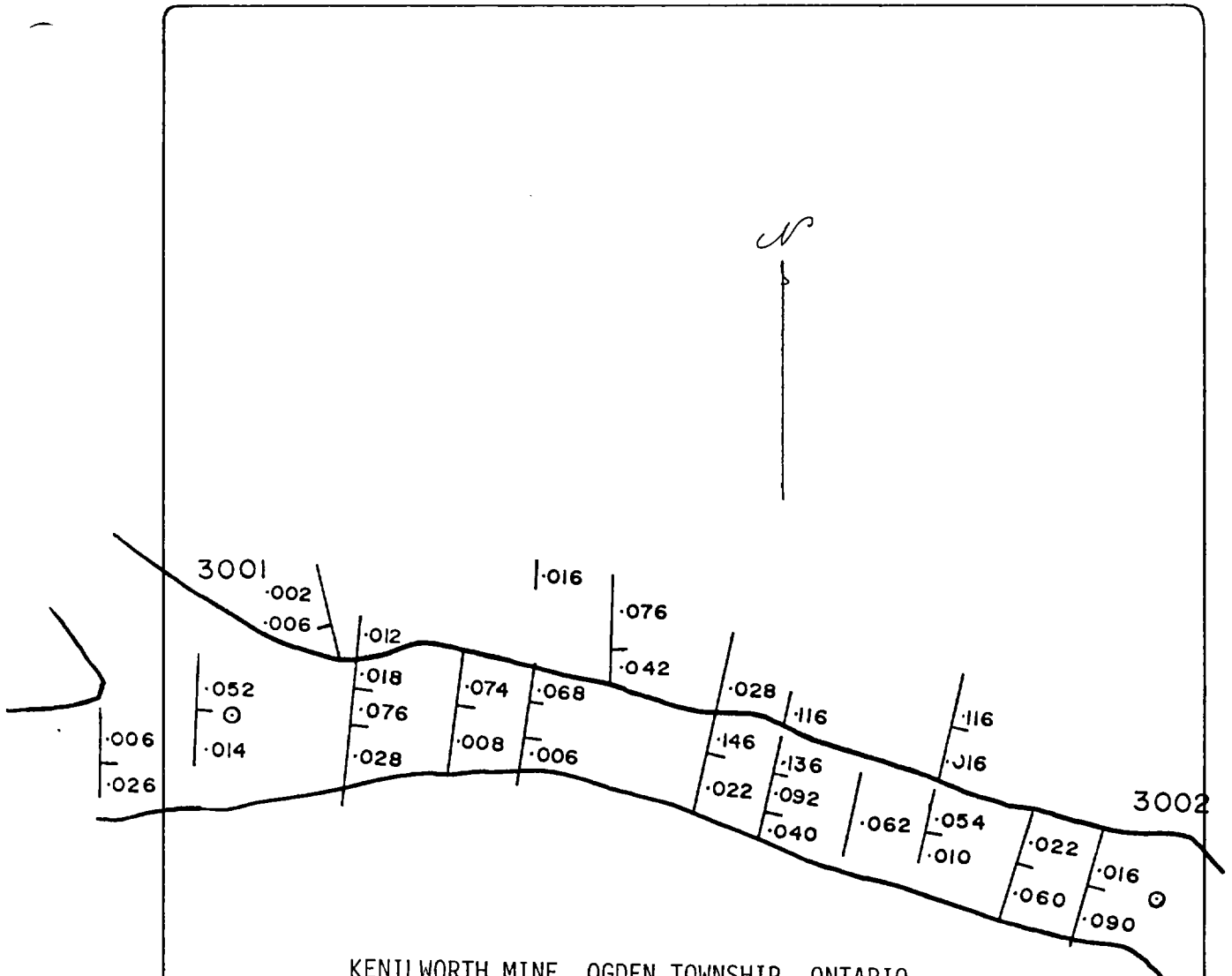
Kenilworth Mine, Ontario.

Assay Plan of Part of the 300 Foot Level

c. 1938

Scale, 1" = 10'





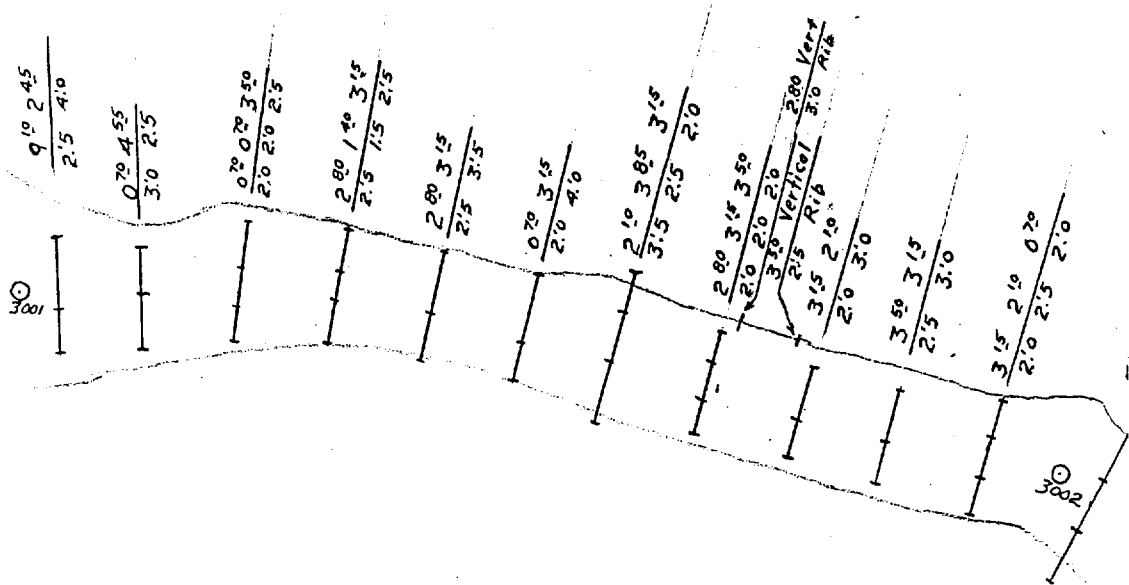
KENILWORTH MINE, OGDEN TOWNSHIP, ONTARIO
 ASSAY VALUES IN OZ AU/TON ACROSS WIDTHS INDICATED
 SCALE, 1" = 10'; SAMPLING BY CANLO RESOURCES, 1984
 300 FOOT LEVEL; 3001 STATION AREA

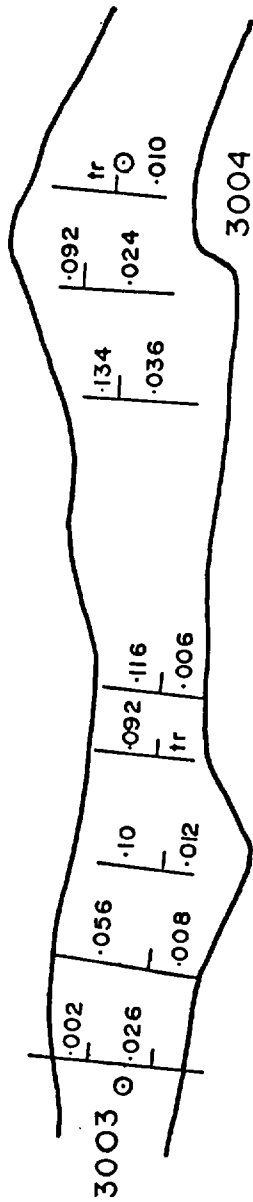
A-16

Kenilworth Mine, Ontario. Assay Plan of Part of the 300' Level
South Ore Body

Scale, 1" = 10'

Photocopied from a Plan of 1938





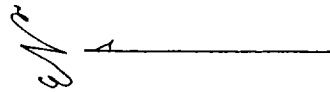
KENILWORTH MINE,
OGDEN TOWNSHIP, ONTARIO

ASSAY VALUES IN OZ AU/TON
ACROSS WIDTHS INDICATED

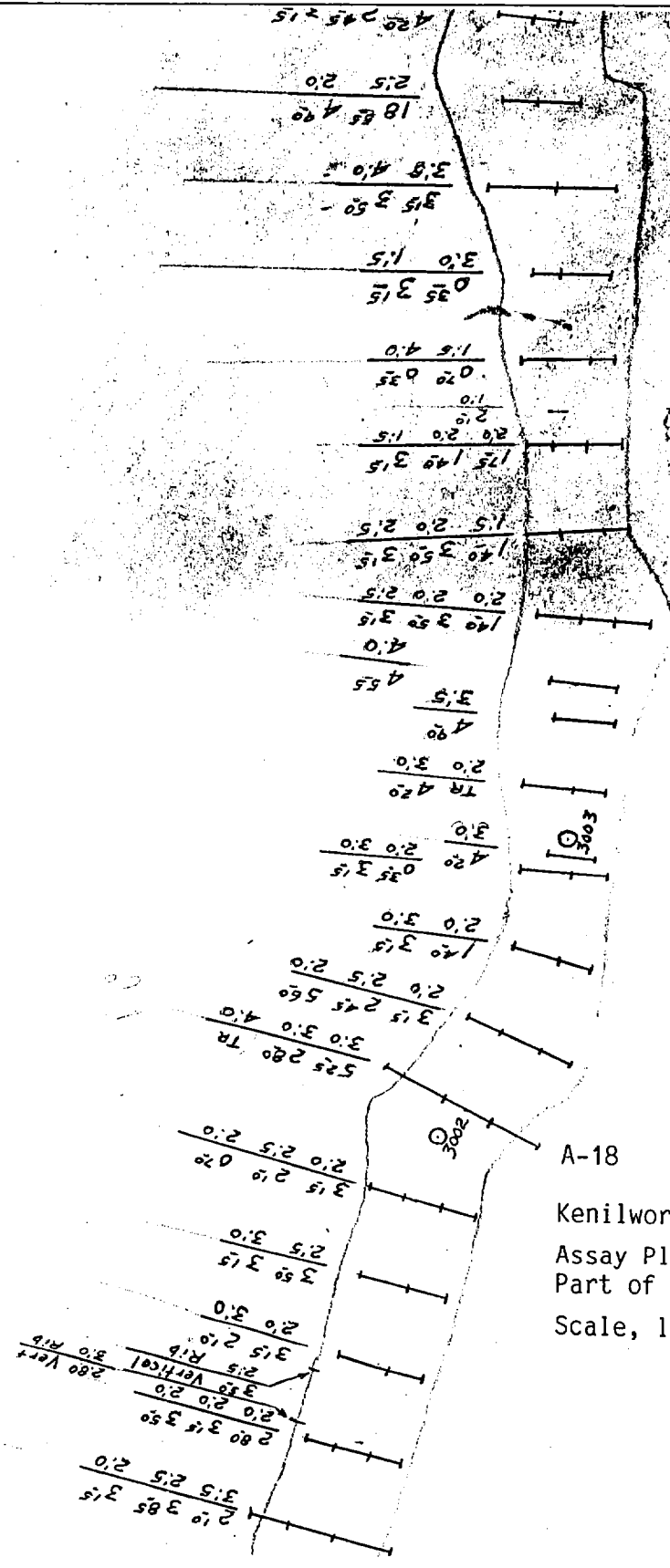
SCALE, 1" = 10'

SAMPLING BY CANLO RESOURCES, 1984

3003 STATION AREA, 300 FOOT LEVEL

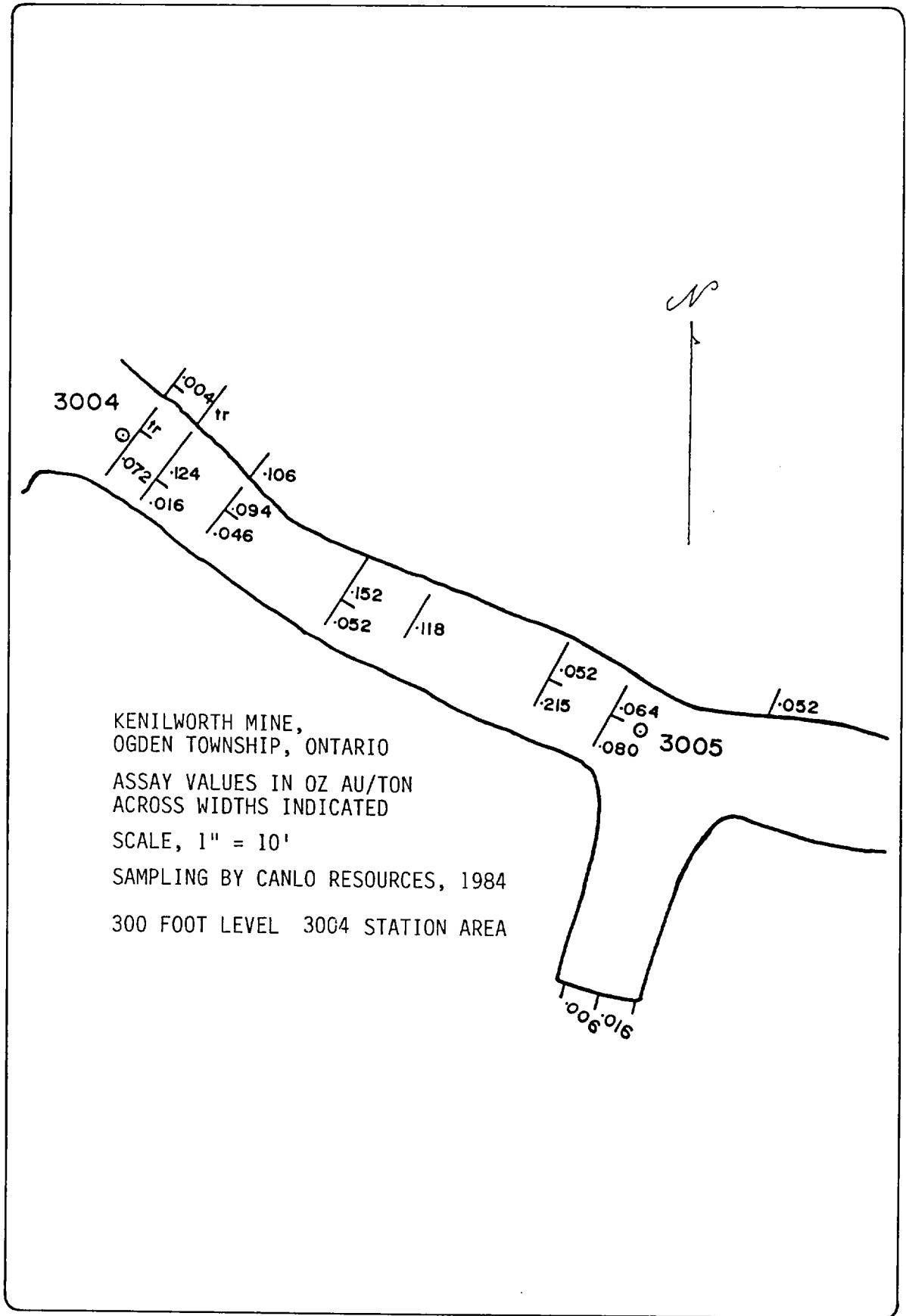


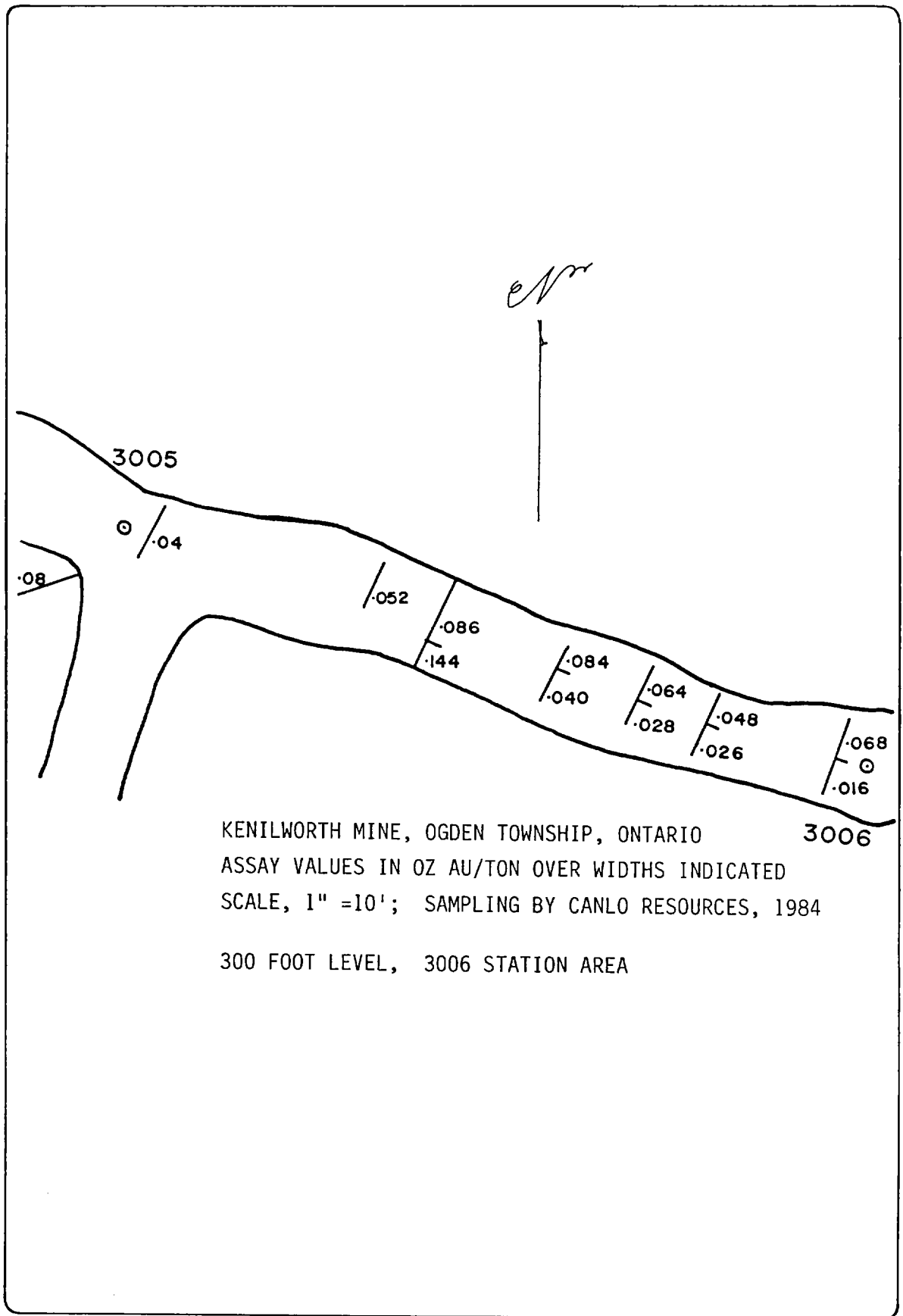
301 EAST DRILL
Back Check Sam



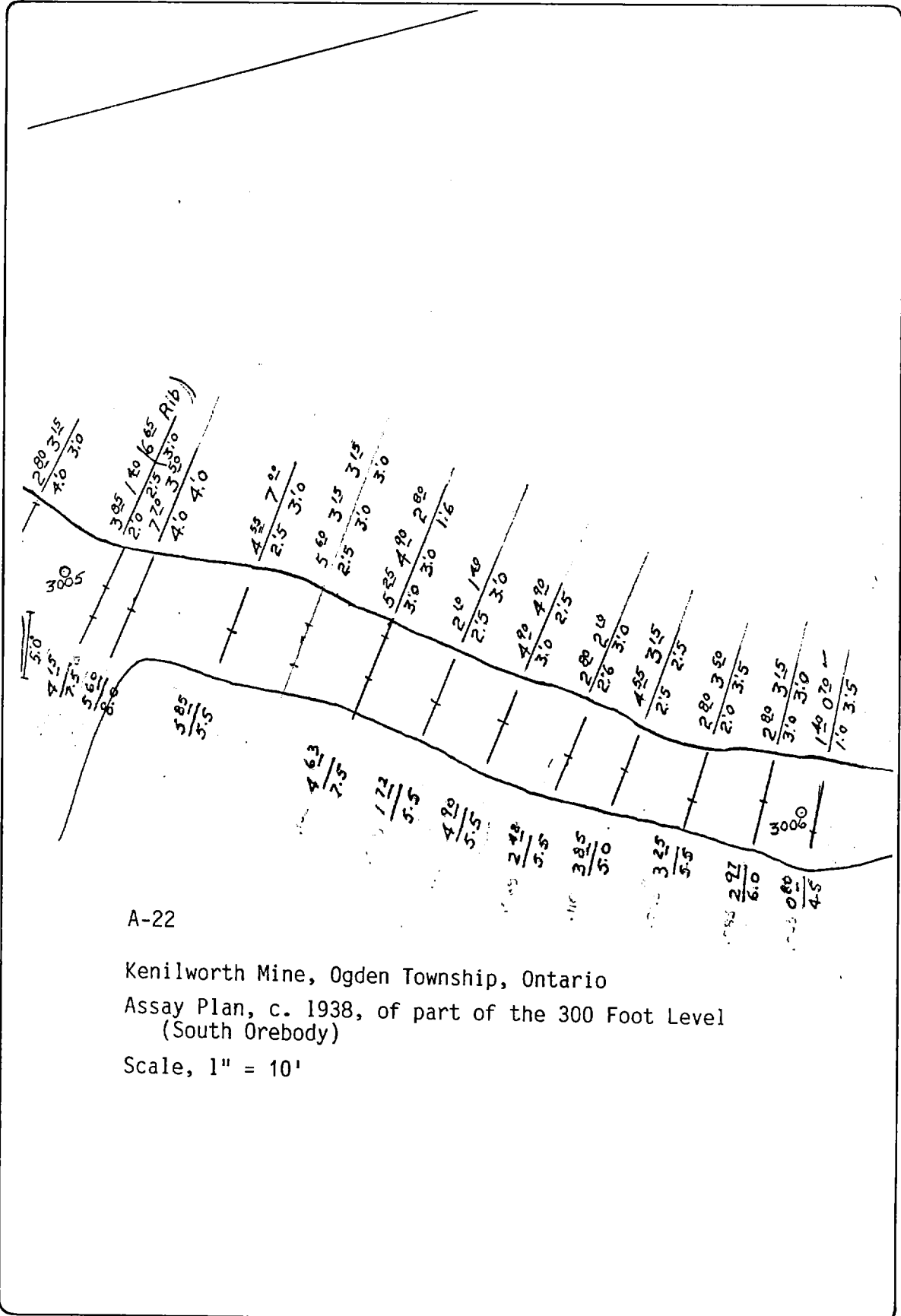
A-18

Kenilworth Mine, Ontario
Assay Plan, 1938, of
Part of the 300 Foot Level
Scale, 1" = 10'

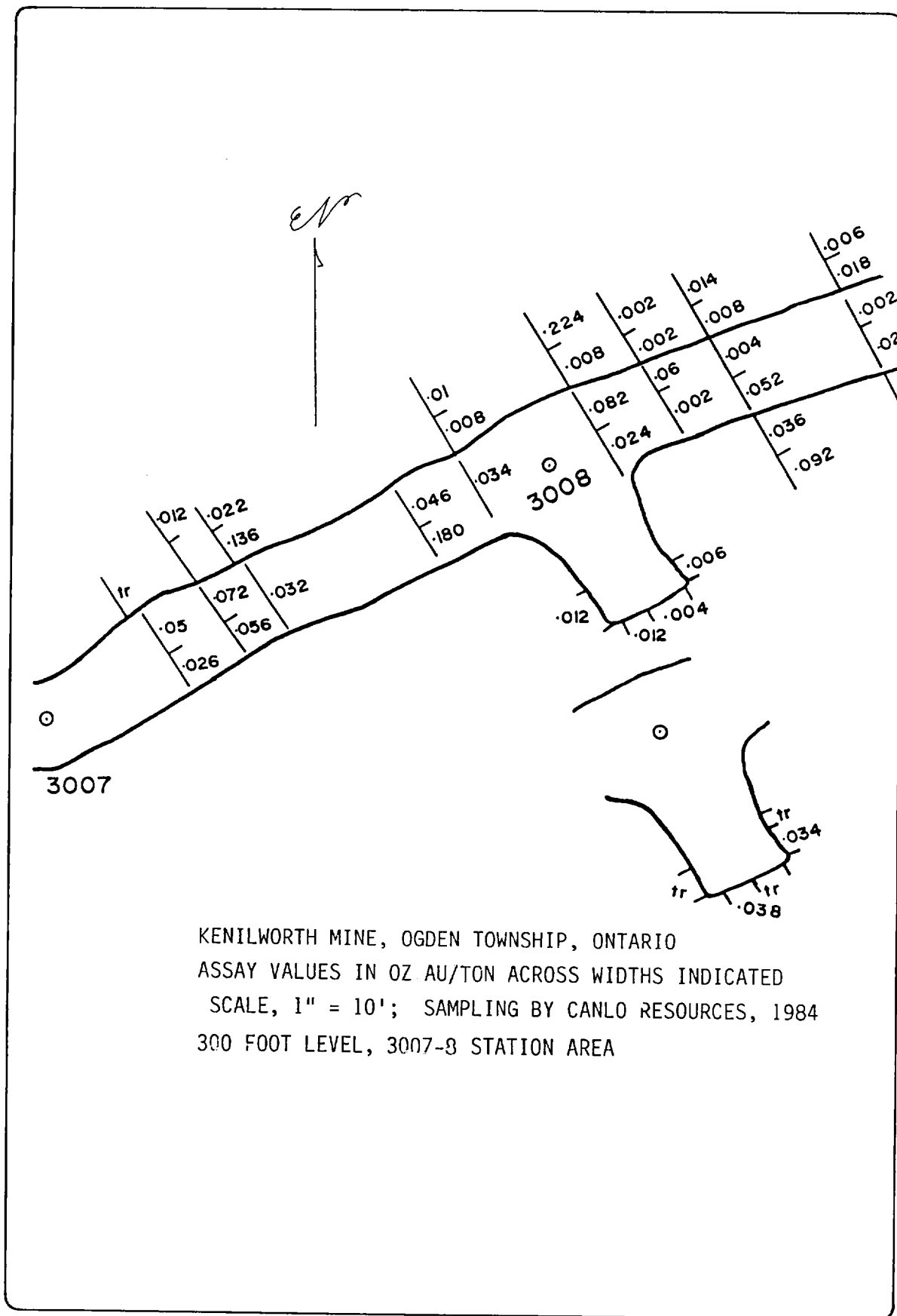




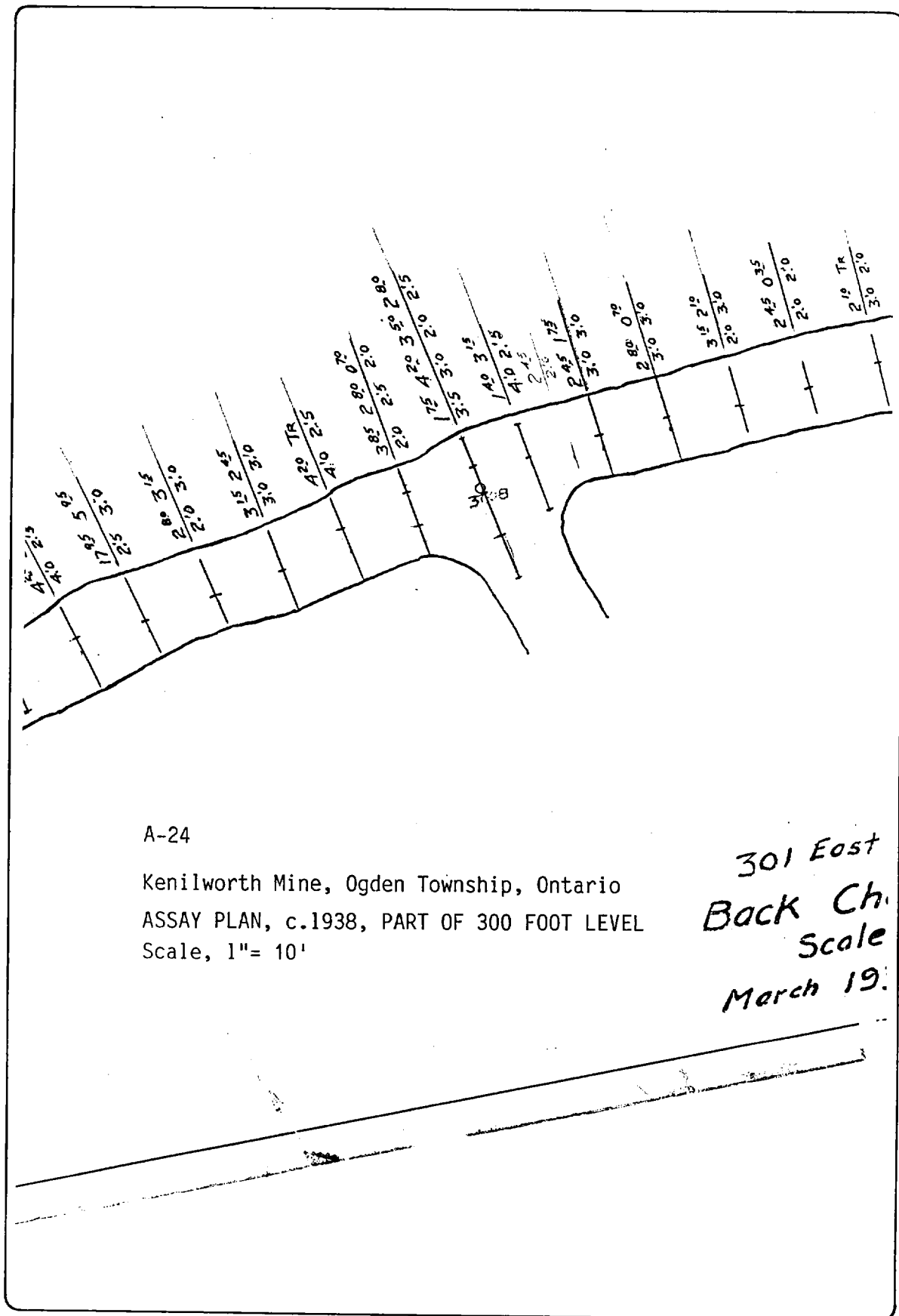
KENILWORTH MINE, OGDEN TOWNSHIP, ONTARIO
ASSAY VALUES IN OZ AU/TON OVER WIDTHS INDICATED
SCALE, 1" = 10'; SAMPLING BY CANLO RESOURCES, 1984
300 FOOT LEVEL, 3006 STATION AREA



Kenilworth Mine, Ogden Township, Ontario
 Assay Plan, c. 1938, of part of the 300 Foot Level
 (South Orebody)
 Scale, 1" = 10'



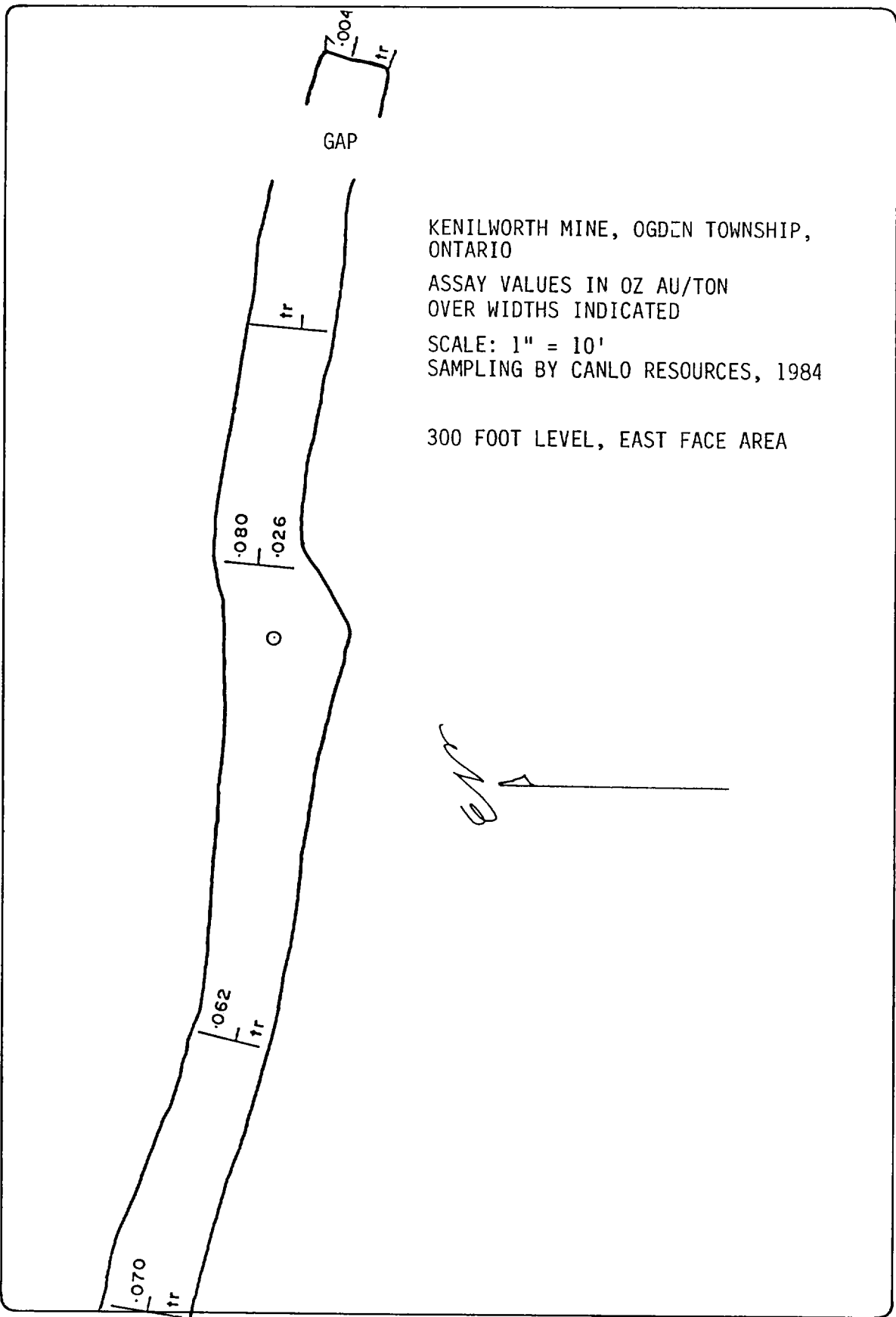
KENILWORTH MINE, OGDEN TOWNSHIP, ONTARIO
ASSAY VALUES IN OZ AU/TON ACROSS WIDTHS INDICATED
SCALE, 1" = 10'; SAMPLING BY CANLO RESOURCES, 1984
300 FOOT LEVEL, 3007-8 STATION AREA



A-24

Kenilworth Mine, Ogden Township, Ontario
 ASSAY PLAN, c.1938, PART OF 300 FOOT LEVEL
 Scale, 1" = 10'

301 East
 Back Ch.
 Scale
 March 19.



KENILWORTH MINE, OGDEN TOWNSHIP,
ONTARIO

ASSAY VALUES IN OZ AU/TON
OVER WIDTHS INDICATED

SCALE: 1" = 10'

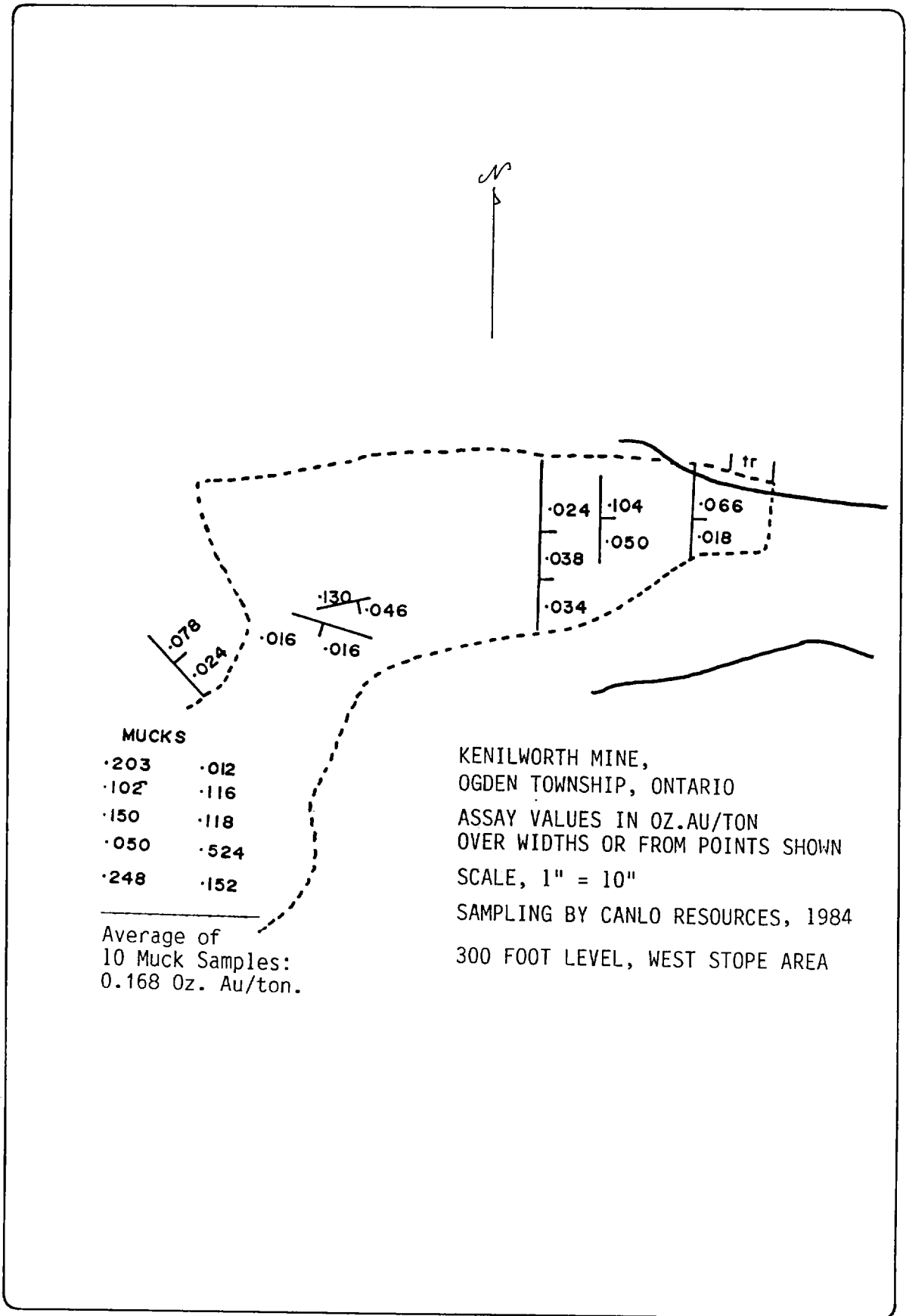
SAMPLING BY CANLO RESOURCES, 1984

300 FOOT LEVEL, EAST FACE AREA

EARTH RESOURCE ASSOCIATES

JOHN L. KIRWAN

○



A-28

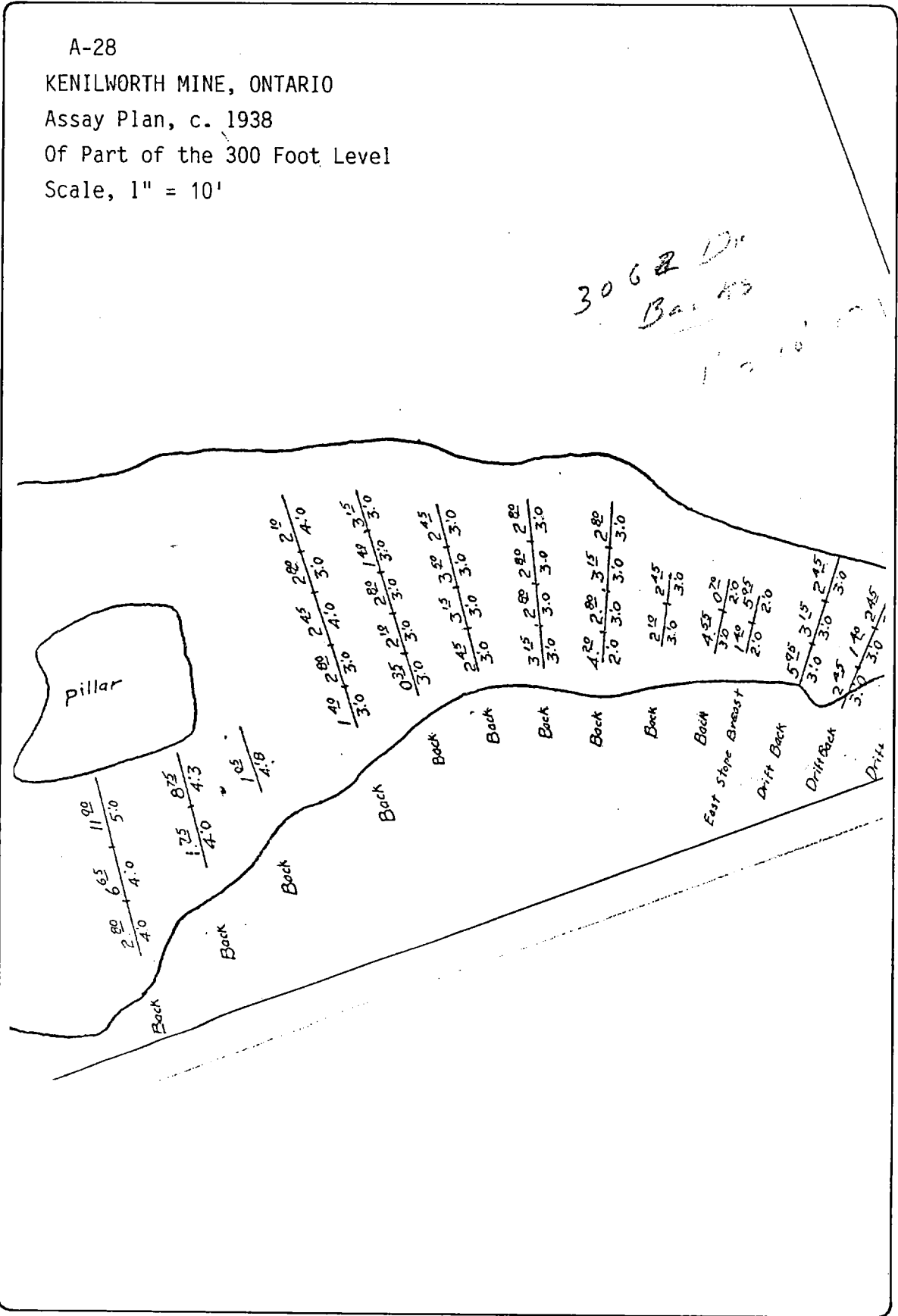
KENILWORTH MINE, ONTARIO

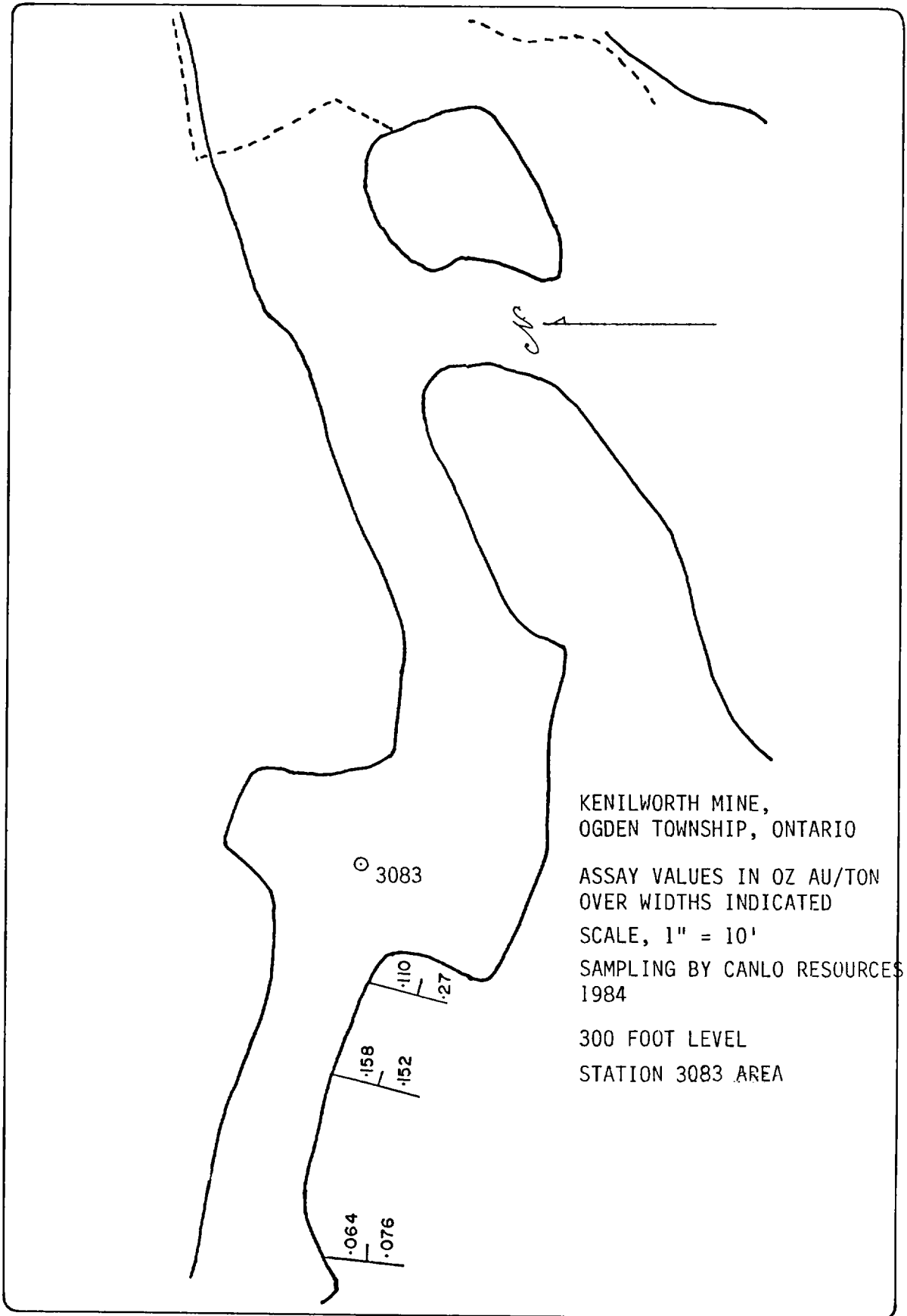
Assay Plan, c. 1938

Of Part of the 300 Foot Level

Scale, 1" = 10'

3062 Dr
Bar 40





KENILWORTH MINE,
OGDEN TOWNSHIP, ONTARIO

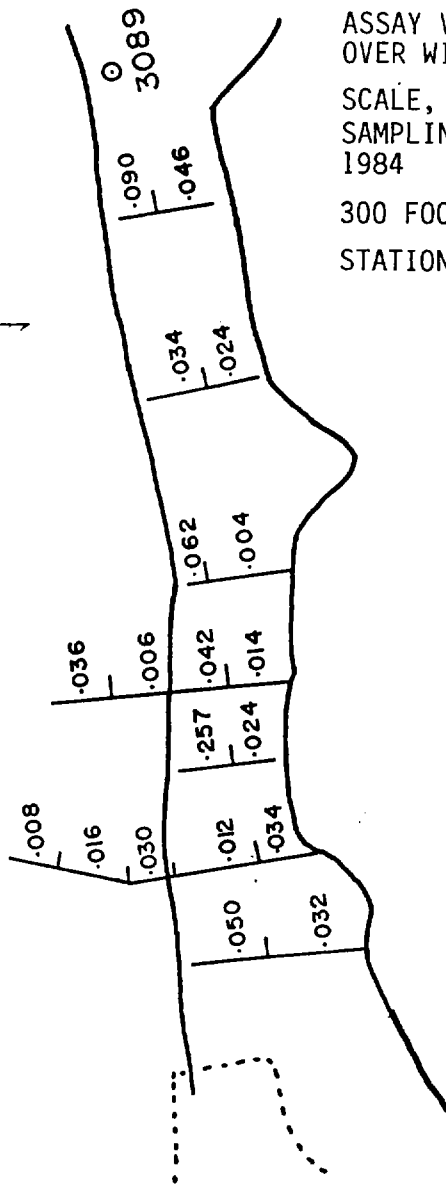
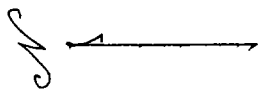
ASSAY VALUES IN OZ AU/TON
OVER WIDTHS INDICATED

SCALE, 1" = 10'

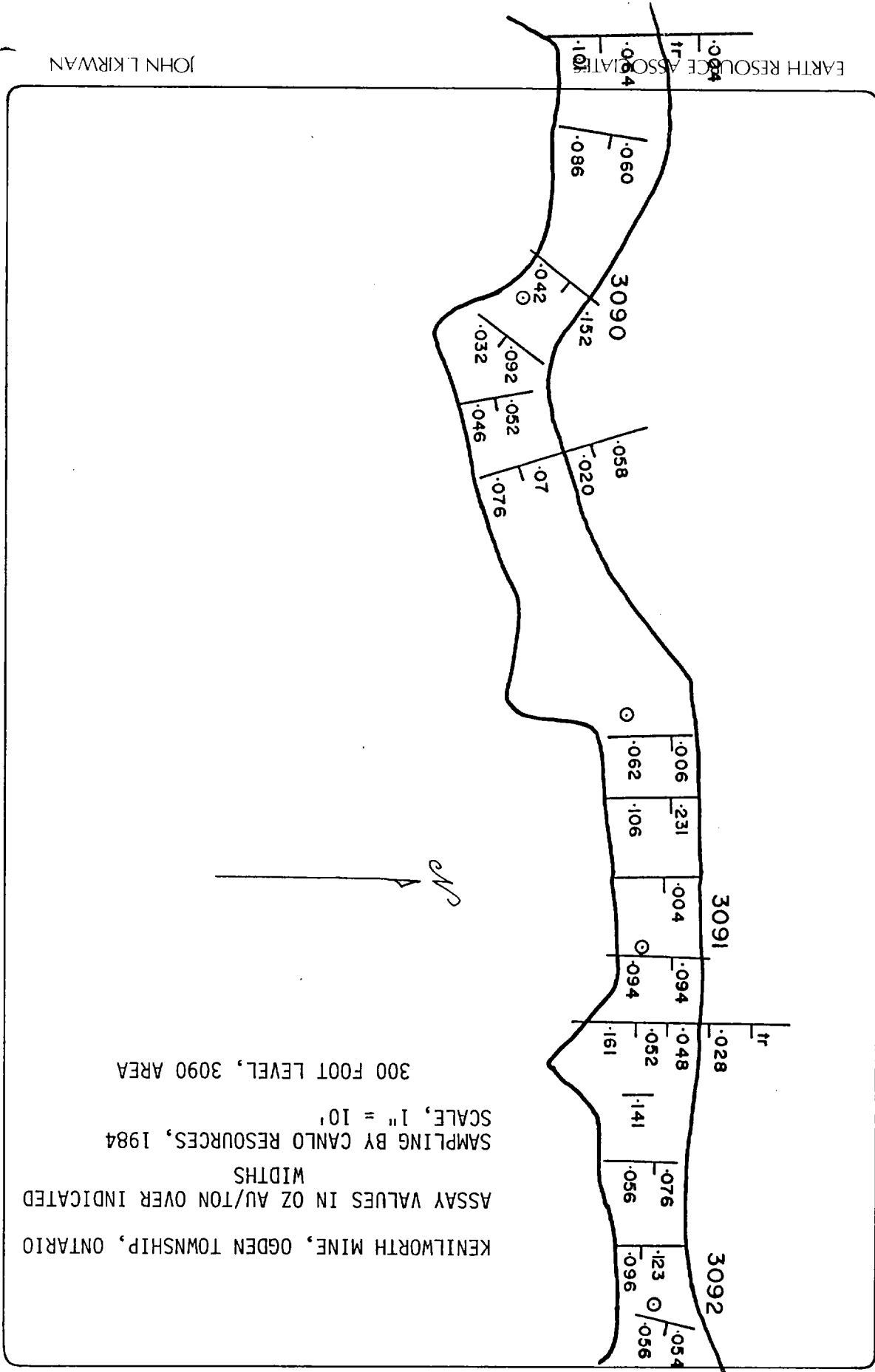
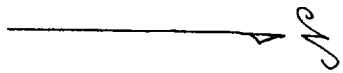
SAMPLING BY CANLO RESOURCES
1984

300 FOOT LEVEL
STATION 3083 AREA

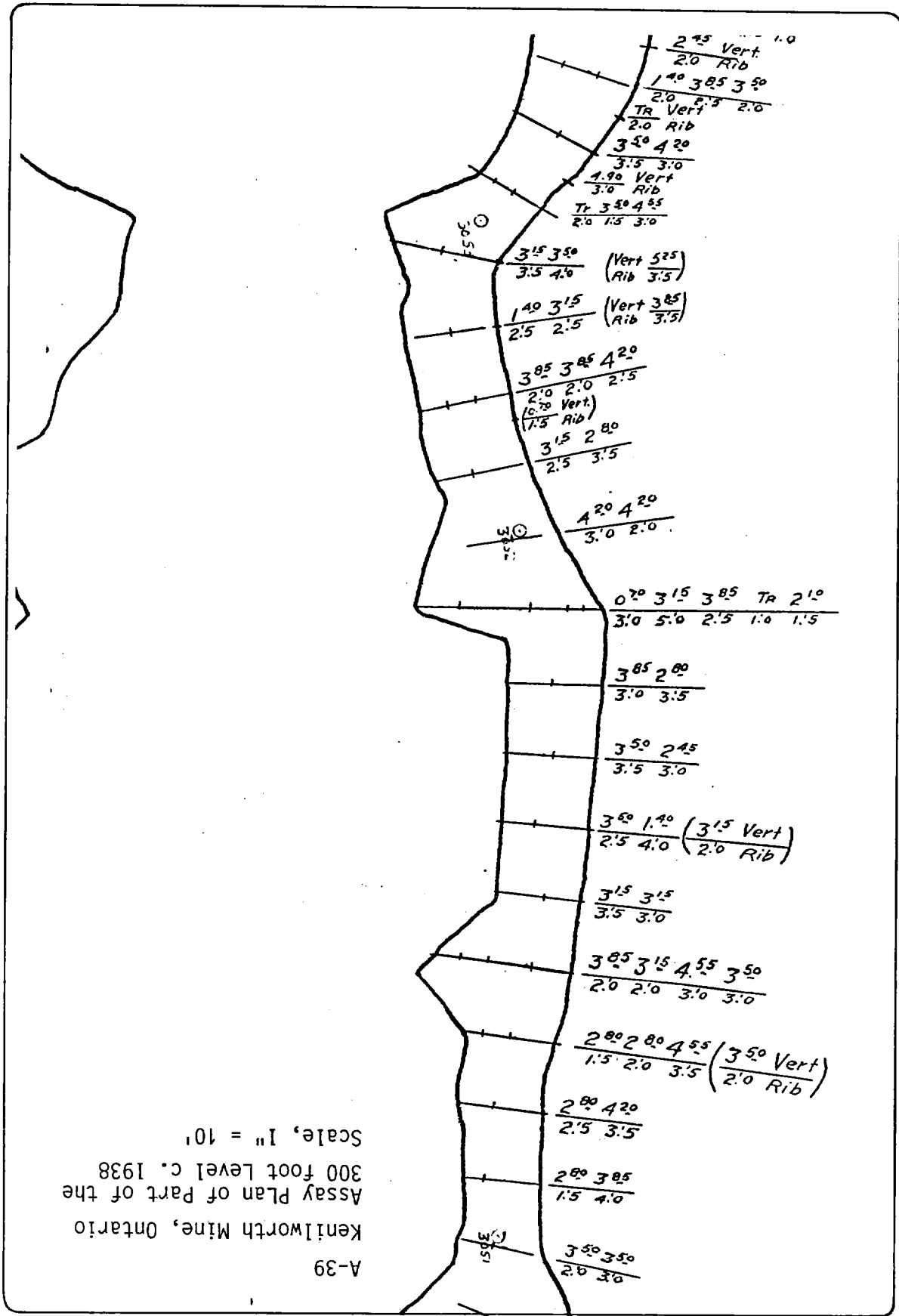
KENILWORTH MINE,
OGDEN TOWNSHIP, ONTARIO
ASSAY VALUES IN OZ AU/T
OVER WIDTHS INDICATED
SCALE, 1" = 10'
SAMPLING BY CANLO RESOURCES,
1984
300 FOOT LEVEL
STATION 3089 AREA



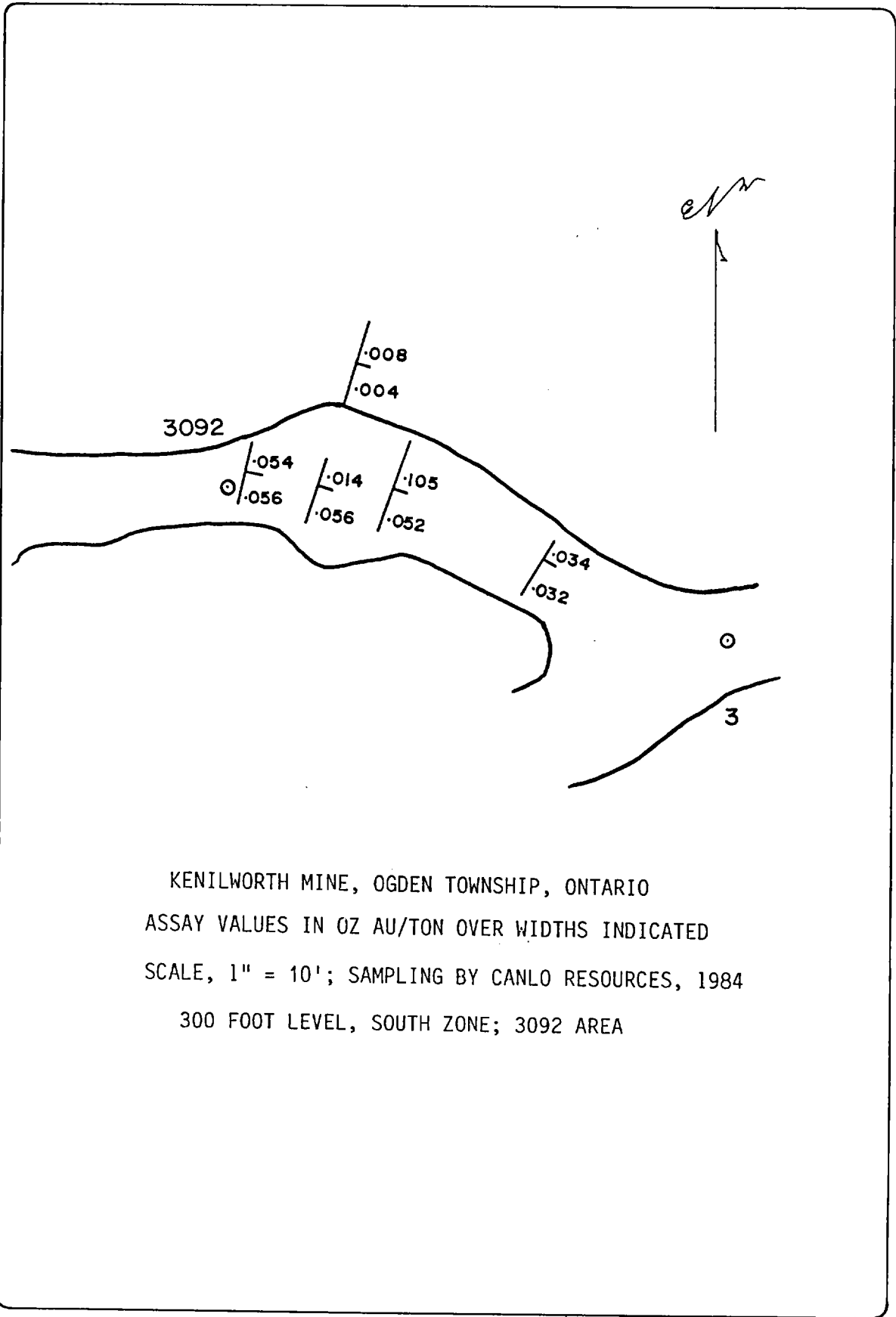
KENILWORTH MINE, OGDEN TOWNSHIP, ONTARIO
 ASSAY VALUES IN OZ AU/TON OVER INDICATED
 WIDTHS
 SAMPLING BY CANLO RESOURCES, 1984
 SCALE, 1" = 10'
 300 FOOT LEVEL, 3090 AREA



EARTH RESOURCE ASSOCIATES
 JOHN L. KIRWAN



A-39
 Kenilworth Mine, Ontario
 Assay Plan of Part of the
 300 foot Level c. 1938
 Scale, 1" = 10'



KENILWORTH MINE, OGDEN TOWNSHIP, ONTARIO
ASSAY VALUES IN OZ AU/TON OVER WIDTHS INDICATED
SCALE, 1" = 10'; SAMPLING BY CANLO RESOURCES, 1984
300 FOOT LEVEL, SOUTH ZONE; 3092 AREA

