

87-291-16117

GEOLOGICAL REPORT

ON THE

TOBY 1-4 MINERAL CLAIMS

FILMED

GOLDEN MINING DIVISION  
BRITISH COLUMBIA

NTS 82K 8W

LATITUDE:  $50^{\circ}22'N$

LONGITUDE:  $116^{\circ}27'W$   
26.8'

SUB-RECORDER RECEIVED	
AUG 5 1987	
M.R. #	\$
VANCOUVER, B.C.	

BY

*Owner/Operator:* C. GRAF, P.Eng.

**GEOLOGICAL BRANCH  
ASSESSMENT REPORT**

**16,117**

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## CLAIMS INFORMATION

The property is held by Chris Graf and consists of the Toby 1-4 claims as listed in detail below:

Claim Name	Record No.	Units	Expiry Date
Toby 1	1572	20	7 May 1987
Toby 2	1573	20	7 May 1987
Toby 3	1574	20	7 May 1987
Toby 4	1575	10	7 May 1987
	Total Units:	70 Units	
		=====	

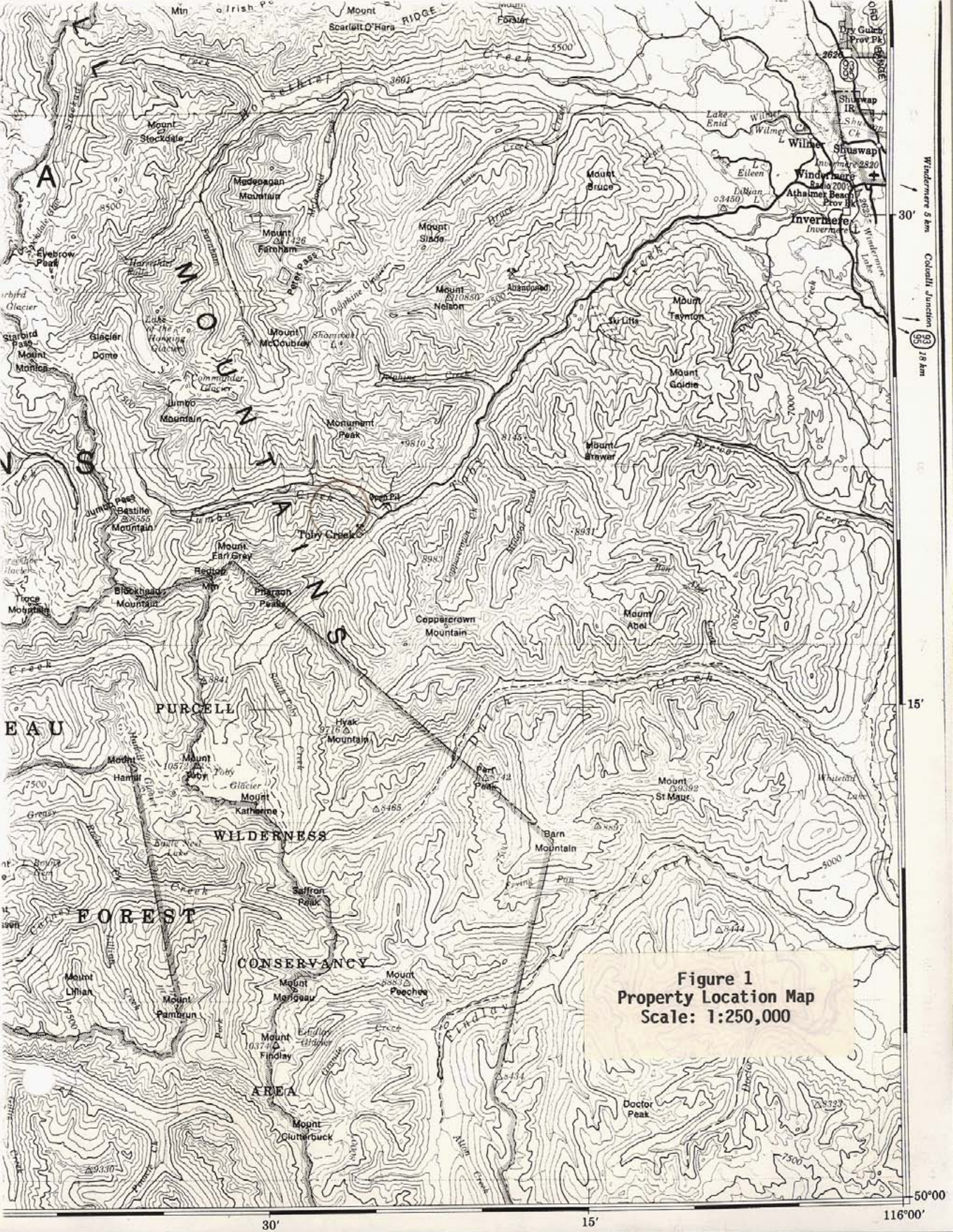
On April 13, 1987 the claims were grouped as the Toby Group # 798.

## LOCATION AND ACCESS

The Toby claims lie on Map Sheet NTS 82K/8W and are north of and adjacent to the Mineral King Mine near the junction of Toby Creek and Jumbo Creek. Access is by 40 km long road up Toby Creek Valley west from the Village of Invermere. The road is paved for 15 km to the Panorama Ski Resort, the remaining 25 km to the claims being a good gravel road suitable for ordinary 2-wheel drive vehicle.

On the claims, slopes are steep and elevations vary from 4500 feet asl in Toby and Jumbo Valleys, to 8300 feet asl along the intervening Mineral King Ridge. Vegetation is moderate, consisting largely of alders, willow and evergreen trees. The highest elevations on the claims are above treeline, and recently there has been extensive logging at lower elevations, particularly along the Jumbo Creek Valley, so vegetation cover does not overly hamper access or mask outcrops.









## HISTORY OF PREVIOUS WORK

### Mineral Exploration

Prospecting for silver-lead-zinc deposits in the Toby Creek-Horsethief Creek drainages began in the 1890's when many mineral discoveries were made. A few properties in the Toby Valley, particularly the Paradise Mine, made small ore shipments between 1901 and 1906, as did others in the belt along McDonald Creek. Further sporadic attempts at exploration were made on several of these prospects during the 1920's, but the only consistent producer was the Paradise Mine which by 1926 had shipped a total of 24,000 tons grading 45% lead and 45 oz. silver.

Showings of lead-zinc-barite mineralization were discovered in 1898 on the Mineral King property; however, rapid exploration and development was hampered by its then remote location near the head of Toby Creek 25 km up stream from the Paradise Mine. The initial showings were explored by two short adits and several surface trenches between 1915 and 1922; however, the results apparently were inconclusive and no ore shipments were made at that time.

There is no public record of further work until 1950 when Sheep Creek Mines Limited Co. acquired the property. They diamond drilled the showings in 1950, 1951 and 1952, and subsequently began underground exploration. The camp, mill, and plant were built on the property in 1953, and production of lead and zinc concentrates began in early 1954. Production in the 1950's averaged 15,000 tons per month, and when closed in 1967 had, after 14 years of continuous mining, totalled roughly 2.3 million tons.

In 1959 barite production began, and up to 1967 a total of 25,114 tons were shipped. Gross content of concentrates was **1,832,416 oz. silver, 1,439,884 lbs. copper, 81,672,177 lbs. lead, 190,827,473 lbs. zinc and 660,064 lbs. cadium.** This works out to a **recovered grade of 4.12 zinc, 1.76% lead, .7 oz/ton silver and .7% cadium.** No data on recoveries are available so it is not possible to calculate the average gross metal content of ore in the ground; however, Fyles reported that head

grades were commonly 15% combined lead-zinc.

During the 1970's the tailings ponds were mined for barite by Mountain Minerals Ltd. which currently owns the claims covering the Mineral King property.

Between 1979 and 1982, Echo Bay Mines Ltd. conducted mineral exploration programs in the Mineral King mine area. Their mineral exploration was directed towards finding replacement and/or Mississippi Valley type lead-zinc-silver deposits within Mt. Nelson dolomite. They found several small lead-zinc-silver showings and concentrated work on the south side of Toby Creek and west of the Mineral King Mine.

### **Geological Mapping**

The Mineral King Mine-Toby claims area was geologically mapped in a general reconnaissance study of the Windermere Map area by J.F. Walker of the GSC between 1922-24. The area was again geologically mapped in a general way by Reesor of the G.S.C. between 1953-56 (Lardeau East Half Map area). Unfortunately, he accepted and included Walker's mapping of the Toby-Jumbo Creeks area without doing any careful field mapping on his own. To date, the most significant geological mapping was done by J. Fyles of the BCDM between 1957-59. His 1:1,500 scale map covering roughly 25 sq. miles was centered on the Mineral King Mine and entirely includes the Toby Claims. Unfortunately, he accepted at face value Walker's assignment of the formations to the Mt. Nelson and Dutch Creek Formations of the Purcell Supergroup.

### **GEOLOGY OF CLAIMS AREA**

The detailed geological map, Figure 3, prepared from Fyles' 1959 mapping project, is a good representation, of the lithologies, structure and mineralization around the Mineral King Mine area. Fyles, however, assigned all the rock units to the Proterozoic following Walker's 1926 G.S.C. work. The rock types are almost entirely well bedded sediments and comprise black argillites, dolomites, quartzites and conglomerates. Fyles assigned the 300 m to 1000 m thick black





argillite slate sequence to the Dutch Creek Formation. The overlying 500 m to 1800 m thick, dominantly dolomite sequence, with a basal quartzite and minor argillite, was assigned to the Mt. Nelson Formation. The youngest rocks, a conglomerate bed, only located in the mine area along Jumbo Creek, was designated by Fyles to the Toby Formation.

The Mineral King stratabound lead-zinc-barite deposits are located in the lowermost Nelson dolomite, just at the top of the thick Dutch Creek black argillite sequence. Fyles also shows a series of thrust and normal faults occurring along the formational contact in the glory hole of the Mineral King Mine. The gross structure is that of an open, 4 km wide, northwest plunging syncline between two broad anticlines. Also, in this regional scale, the Mineral King Mine appears to lie along the faulted axis of the syncline which is outlined by the thick (Dutch Creek?) black argillite unit at the base, and younger (Mt. Nelson?) dolomite in the core. The fold plunges approximately N25<sup>0</sup>W across Jumbo Creek and under Monument Peak. The Mineral King orebodies also followed a NW plunge for over 3000 feet. It is possible that the anomalously thick black argillite unit and overall synclinal configuration may indicate original deposition in a graben-like sub-basin with later reverse faulting modifying the nature of the overall structure to that of a syncline.

Along McDonald and Delphine Creeks, 5-10 km north and on strike with the Mineral King Mine-Toby claims area, recent mapping by Root of the G.S.C. has re-interpreted the age of the belt of rocks. They were originally assigned by Walker and Reesor to the Precambrian Windermere Group-Horsethief Creek Formation, but through newly discovered fossil localities, are now known to belong to the Devonian age, Mt. Forster and Starbird Formations. Fourteen measured sections show the lithologies of the Mt. Forster Formation to vary considerably along 15 km of strike, and no two sections have completely similar or correlatable lithologies. The Mt. Forster Formation averages 400 m thick and the Starbird Formation averages 70 m thick. The diversity of the Mt. Forster sedimentary lithologies and their similarity to lithologies of the Mt. Nelson, Dutch Creek and Horsethief Creek Formations, leads to the possibility that a large area between Toby Creek and

Horsethief Valley Creek may in fact contain beds of Devonian age rather than Pre-Cambrian as mapped by Walker and Reesor and followed by Fyles. In particular, it is possible that the Mineral King barite sulfide deposits and host rocks belong to the Devonian age-Mt. Forster Formation, not the Dutch Creek-Mt. Nelson Formations as thought by Walker and Fyles. In order to determine the age of the Mineral King orebodies, four samples of barite mineralization were taken by the author and subsequently analysed for sulfur isotope compositions, by the G.S.C. in 1986. The resulting data showed  $^{34}\text{S}$  ‰ to vary from 19.4 to 23.6, which is too light for Precambrian aged sulfates, but fits nicely in the Devonian period. In addition, Cominco Ltd. has discovered a stratabound, dolomitic quartzite-hosted zinc + lead, + barite deposits in Mt. Forster Formation at McDonald Creek 10 km north of the Mineral King Mine.

The Mineral King Mine is thought to belong to the Devonian-Mississippian aged shale-hosted (Sedex) type of barite-zinc-lead deposit which is represented along the northern Rocky Mountain trench by the Cirque deposit, in the Yukon by the Tom-Jason deposits, in Alaska by the Red Dog deposit, and in Europe by the Meggen and Navan deposits. These major world class zinc-lead-barite deposits are all Devonian in age; therefore, the possibility of the Mineral King deposits being Devonian in age is significant as there is potential for a major zinc orebody to occur. The Sullivan Mine, a large Sedex zinc-lead-deposit lies 60 km along the Rocky Mountain trench from the Mineral King area.

#### **WORK DONE IN 1986**

The 1986 exploration program on the Toby claims consisted of soil sampling (328 samples), silt sampling (7 samples), and prospecting for lead-zinc-barite mineralization.

Three east-west contour soil sample lines, with samples taken every 40 m, were run across the Toby 1, 2 claims on the north side of Jumbo Creek, and 288 samples were collected. Along Line 1 at the 6000 foot elevation contour, 99 soil samples were collected over 4 km. Line 2 at the 5500 foot contour was also 4 km long, and 88

soil samples were collected. Line 3 at the 5000 foot contour was 4 km long and 101 samples were collected.

On the Toby 4 claim southwest of the Mineral King Glory Hole, 2 contour soil sample lines were run at the 5700 foot and 5200 foot elevations, and 40 samples were collected at 25 m spacings.

Prospecting was successful in locating a zone of galena-sphalerite bearing quartz stringers along the black argillite-massive dolomite contact in a creek bed at the 4600 foot elevation near the southwest corner of Toby 2 claim. No samples were taken for assay as the mineralization is limited in size and by itself has no economic potential.

#### **SOIL GEOCHEMISTRY**

Three 4 km long east-west contour soil sampling lines at the 6000, 5500 and 5000 foot elevations were run by altimeter and topofil on the Toby 1, 2 claims. Also using altimeter and topofil, 2 lines of soil samples were taken on the Toby 4 claim, and across the Mineral King mine claim boundary at the 5700 foot and 5200 foot elevations.

The samples were taken every 40 m using a mattock to dig a hole 6 inches to 1 foot deep. Many samples were of C horizon material and no attempt was made to distinguish those from any A or B horizon samples.

Once collected the samples were placed in standard paper envelopes, then dried and shipped to Min-En Labs Ltd. in Vancouver for analysis. There they were sieved to -80 mesh and analyzed by the ICP technique for 6 elements, specifically zinc, lead, silver, copper, arsenic, and antimony. Barium was unfortunately not analyzed in the soil samples because of its insolubility and the expenses involved in doing a total digestion technique for only that one element.

The 7 stream sediment samples were analyzed by the ICP technique for 27



elements including zinc, lead, silver and copper and by total digestion and geochem technique for barium, tungsten, mercury and gold.

## DISCUSSION OF RESULTS

Zinc contents of all soil samples ranged from 9 ppm to a maximum of 620 ppm. An anomalous level was arbitrarily chosen to be 100 ppm zinc, and 46 samples contained more zinc than that concentration.

Lead contents of the soil samples ranged from 1 ppm to a maximum of 206 ppm. Anomalous values are arbitrarily selected to be greater than 50 ppm lead and 72 samples are anomalous.

There is generally good correlation between soils with anomalous zinc values and anomalous lead values; however, several samples are anomalous in only zinc or lead.

On Line 1 the anomalous areas are Sample Nos. 15 to 25, 35 to 45, 50 to 60, 78 to 82 and 97 to 99.

On Line 2, anomalous areas are Sample Nos. 10 to 12, 17 to 22, 28 to 33, and 51 to 57.

On Line 3 the anomalous areas are Sample Nos. 20 to 26, 101 - 102, 107, 141-142 and 146-147.

On Line 4 the anomalous areas are Sample Numbers 000 to 006 and 010 to 017.

On Line 5 the anomalous areas are Sample Numbers 005 to 011 and 017 to 019.

Follow-up soil sampling and prospecting should focus on all these areas, particularly on Line 1 at Sample Numbers 15 to 25, 35 to 45, and 50 to 60.

Other priority areas for follow-up work would be on Line 2 at Sample Nos. 28 to 33 and 51 to 57, on Line 3 at Sample Nos. 20 to 25, on Line 4 at Sample Nos. 000 to 006 and 010 to 017 and line 5 at Sample Nos. 005 to 011.

## **RECOMMENDATIONS AND CONCLUSIONS**

Further exploration work using the Devonian-Missippian age Sedex barite-lead-zinc model is warranted for the Mineral King Mine-Toby Claims area. This work should include follow-up soil sampling and prospecting the areas shown by the 1986 work to be anomalous in zinc and lead.

Systematic rock sampling of the host carbonate beds should be done near the Mineral King Mine deposits in order to collect **conodont** fossils for age dating.

Also, more barite samples should be collected for sulphur isotope analysis in order to confirm the Devonian age indicated by the 1986 data.

**COST STATEMENT****TOBY CLAIMS 1986 EXPLORATION COSTS****WORK DONE OCTOBER 5-11, 1986****FIELD**

1 Geologist, 7 days @ \$250/day	\$ 1,750.00
3 Samplers, 7 days @ \$175/day	3,675.00
Rooms, Food, Fuel	1,216.59
Maps & Geochem Supplies	150.00
Airfare (Vancouver-Cranbrook-return)	275.00
Truck Rentals	560.00
Honda 4-wheeler rental	210.00
Geochem Analysis	2,424.95

**OFFICE**

1 Geologist, 3 days @ \$250/day	750.00
Secretarial	150.00
Drafting	1,085.00

Total:	<u>\$ 11,163.54</u> =====
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**BIBLIOGRAPHY**

- B.C. Minister of Mines Annual Reports, 1904, Page 106; 1906, Pages 143-147; 1916, Pages 83-94.
- B.C. Department of Mines, Assessment Report Nos. 8639, 9829 and 9846.
- Claypool, G.E. The Age Curves of Sulphur and Oxygen Isotopes in Marine Sulphate and their Mutual Interpretation, Chemical Geology 28, Pages 199-260.
- Freiholz, G. The Stratigraphic and Structural Setting of a Lead-Zinc Occurrence near Invermere, southeastern B.C., University of Calgary, M.Sc. Thesis, 1983.
- Fyles, J.T. Mineral King Mine, B.C. Minister of Mines, Annual Report, 1967, Pages 262-269.
- Geology of the Mineral King Mine Area, B.C. Minister of Mines Annual Report, 1958, Pages 74-84
- Norford, B.S. Devonian Stratigraphy of the Margins of the Rocky Mountain Trench, Trench, Columbia River, Southeastern B.C., Bulletin Can. Pet. Geology, V29, No. 4, Pages 540-560.
- Ressor, J.E., 1973 Geology of the Lardeau Map Area, East Half, B.C. G.S.C. Memoir 369
- Root, K.G. 1985 Reinterpretation of the Age of Succession of Paleozoic Strata Delphine Creek, southeastern B.C. In current research Part A, Geol. Survey of Canada, Pages 727 - 730.

**APPENDIX I**  
**SOIL GEOCHEM ICP RESULTS**

PROJECT NO: TDB

705 WEST 15TH ST., NORTH VANCOUVER, B.C. V7M 1T2

FILE NO: 6-10975/P1+2

ATTENTION: C.GRAF/B.PAULSON

(604)980-5814 OR (604)988-4524

\* TYPE SOIL GEOCHEM \* DATE: NOV 4, 1986

(VALUES IN PPM)	AG	AS	CU	PB	SB	ZN
T-1-86 000	.2	1	9	7	1	16
T-1-86 001	.3	1	10	36	2	51
T-1-86 002	1.1	1	5	9	2	28
T-1-86 003	.1	1	16	27	3	32
T-1-86 004	.5	1	16	15	1	54
T-1-86 005	.3	1	11	36	1	-115
T-1-86 006	.2	1	17	-53	3	74
T-1-86 007	.2	1	8	24	1	58
T-1-86 008	.5	1	14	-54	1	-158
T-1-86 009	.1	1	10	34	2	51
T-1-86 010	.1	1	12	23	1	-37
T-1-86 011	.1	3	22	41	4	43
T-1-86 012	.1	1	9	26	1	58
T-1-86 013	.1	1	12	27	1	54
T-1-86 014	.1	1	11	30	1	57
T-1-86 015	.4	1	18	45	4	48
T-1-86 016	.1	34	22	44	7	40
T-1-86 017	.4	26	27	-57	7	45
T-1-86 018	.4	28	31	-61	8	47
T-1-86 019	.6	36	29	-62	8	53
T-1-86 020	.6	19	32	-60	8	47
T-1-86 021	.6	18	19	45	7	39
T-1-86 022	.4	14	30	-53	8	49
T-1-86 023	.6	30	45	-65	-11	61
T-1-86 024	.1	21	23	47	5	40
T-1-86 025	.1	5	18	47	5	33
T-1-86 026	.1	1	13	25	2	17
T-1-86 027	.1	1	8	26	2	19
T-1-86 028	.1	1	8	30	1	25
T-1-86 029	.4	1	20	23	1	25
T-1-86 030	.1	1	8	23	1	18
T-1-86 031	.1	1	9	22	3	24
T-1-86 032	.1	1	8	20	3	16
T-1-86 033	.1	1	11	17	1	28
T-1-86 034	.2	1	65	32	1	25
T-1-86 035	.7	-97	77	-156	-16	87
T-1-86 036	.1	1	9	20	1	22
T-1-86 037	.3	24	35	-74	8	54
T-1-86 038	.2	1	9	-64	1	-414
T-1-86 039	.4	1	15	-73	3	-476
T-1-86 040	.3	1	10	-80	1	-557
T-1-86 041	.6	1	11	-88	1	-620
T-1-86 042	.1	1	16	41	1	339
T-1-86 043	.3	1	25	49	4	419
T-1-86 044	.4	1	16	21	1	83
T-1-86 045	.6	1	15	25	1	95
T-1-86 046	.6	1	11	6	1	63
T-1-86 047	.4	49	56	-57	8	40
T-1-86 048	.6	1	38	45	6	44
T-1-86 049	.4	1	45	33	4	60
T-1-86 050	.5	13	33	44	7	41
T-1-86 051	.4	31	47	-67	9	46
T-1-86 052	.3	1	19	-61	4	84
-86 053	.4	1	49	-51	4	73
-86 054	.4	26	40	55	6	-141
T-1-86 055	.4	39	25	48	7	37
T-1-86 056	.2	16	21	-55	6	53
T-1-86 057	.7	16	33	61	8	48
T-1-86 058	.8	28	23	-168	8	-260
T-1-86 059	.3	1	20	-58	3	-130



(VALUES IN PPM)	AG	AS	CU	PR	SB	ZN
T-1-86 060	.6	16	21	44	6	59
T-1-86 061	.4	1	12	33	1	99
T-1-86 062	.5	1	11	34	1	-151
T-1-86 063	.6	1	27	-50	1	77
T-1-86 064	.4	19	21	38	8	89
T-1-86 065	.4	1	48	45	2	82
T-1-86 066	.5	1	26	47	3	72
T-1-86 068	.4	1	13	34	2	23
T-1-86 069	.3	1	14	29	1	36
T-1-86 070	.4	1	27	30	1	69
T-1-86 071	.3	1	16	34	1	41
T-1-86 073	.4	1	13	14	1	75
T-1-86 074	.2	1	14	33	1	45
T-1-86 075	.5	1	10	24	1	-152
T-1-86 076	.4	1	18	26	2	58
T-1-86 077	.5	1	9	15	1	81
T-1-86 078	.5	15	37	49	7	46
T-1-86 079	.6	14	29	40	7	36
T-1-86 080	.7	2	14	-81	6	85
T-1-86 081	.6	1	14	35	2	58
T-1-86 082	.7	-122	36	-78	-18	47
T-1-86 083	.5	1	14	33	3	32
T-1-86 084	.7	1	15	49	3	68
T-1-86 085	.8	1	18	43	1	44
T-1-86 086	.7	1	13	10	1	43
T-1-86 087	.4	1	16	33	3	42
T-1-86 088	.7	1	13	27	1	54
T-1-86 089	.5	1	12	25	2	29
T-1-86 090	.3	1	15	30	4	30
T-1-86 091	.4	3	15	27	5	30
T-1-86 092	.6	1	20	43	1	52
T-1-86 093	.4	1	11	23	1	37
T-1-86 094	.6	1	15	23	1	48
T-1-86 095	.6	1	12	23	1	41
T-1-86 096	.6	9	17	33	5	41
T-1-86 097	.7	12	24	-50	7	58
T-1-86 098	.5	22	20	-54	7	87
T-1-86 099	.7	4	26	39	5	68
T-2-86 000	-1.2	1	7	2	1	15
T-2-86 001	-1.7	1	7	10	4	11
T-2-86 002	1.1	1	4	1	1	10
T-2-86 003	.8	1	12	23	1	29
T-2-86 004	.6	1	11	32	1	32
T-2-86 005	.7	1	22	29	2	39
T-2-86 006	.6	1	15	18	1	37
T-2-86 007	.7	1	17	35	4	34
T-2-86 008	.7	1	14	17	1	59
T-2-86 009	.5	1	10	29	2	39
T-2-86 010	2.0	1	43	-149	4	-156
T-2-86 011	1.0	1	13	17	1	77
T-2-86 012	1.0	1	16	-59	1	-159
T-2-86 013	.9	1	10	19	1	55
T-2-86 014	.7	1	22	36	4	51
T-2-86 015	.7	1	13	37	2	94
T-2-86 016	.5	1	11	23	1	29
T-2-86 017	.5	15	21	45	6	50
T-2-86 018	.9	19	36	-57	8	57
T-2-86 019	1.2	23	34	-65	-10	56
T-2-86 020	1.0	6	21	47	7	48
T-2-86 021	1.2	26	82	88	-10	55

VALUES IN PPM )	AS	AS	CU	PR	SB	ZN
T-2-86 022	1.0	12	21	44	6	35
T-2-86 023	.4	1	7	20	2	30
T-2-86 024	.4	1	8	18	2	23
T-2-86 025	.5	1	1	21	1	15
T-2-86 026	.4	1	4	27	1	44
T-2-86 027	.4	1	11	30	3	55
T-2-86 028	.6	-38	44	-72	8	65
T-2-86 029	.6	5	17	-51	5	44
T-2-86 030	.7	-31	25	-71	8	57
T-2-86 031	.9	-35	35	-85	-10	85
T-2-86 032	.7	6	18	.60	6	64
T-2-86 033	.7	-40	35	-67	-10	36
T-2-86 034	.5	1	17	23	5	24
T-2-86 035	.7	1	28	21	1	38
T-2-86 036	.6	1	15	33	3	75
T-2-86 037	.6	1	9	37	2	42
T-2-86 038	.6	1	4	13	1	38
T-2-86 039	.5	1	4	24	1	58
T-2-86 040	.9	1	11	25	1	64
T-2-86 041	.7	1	19	25	2	39
T-2-86 042	.7	1	22	30	4	57
T-2-86 043	.6	1	5	24	1	155
T-2-86 044	.5	1	2	30	1	180
T-2-86 045	.5	1	4	24	1	63
T-2-86 046	.8	4	23	41	5	54
T-2-86 047	.8	1	18	41	2	81
T-2-86 048	.8	1	22	32	5	44
T-2-86 049	.6	1	14	29	1	41
T-2-86 050	.7	1	18	37	5	40
T-2-86 051	1.1	11	25	-51	8	39
T-2-86 052	.7	-34	28	-62	-10	50
T-2-86 053	.5	-29	24	-57	8	70
T-2-86 054	-1.5	22	25	-95	-12	42
T-2-86 055	-1.4	-71	38	-160	-16	90
T-2-86 056	1.1	-61	48	-129	-14	-121
T-2-86 057	.8	18	46	-73	8	59
T-2-86 058	.8	1	7	18	1	43
T-2-86 059	.5	1	6	29	4	51
T-2-86 060	.6	34	25	44	9	31
T-2-86 061	.8	12	15	35	5	42
T-2-86 062	.9	-45	26	-54	-10	46
T-2-86 063	.6	1	16	36	2	94
T-2-86 064	.6	1	16	-55	3	81
T-2-86 065	.6	1	11	28	1	-100
T-2-86 066	.6	1	15	30	3	88
T-2-86 067	.5	1	7	23	3	48
T-2-86 068	.7	1	11	33	1	103
T-2-86 069	.6	1	7	30	2	90
T-2-86 070	.4	1	14	25	3	35
T-2-86 071	.6	1	10	26	1	70
T-2-86 072	.7	1	10	24	1	64
T-2-86 073	.5	1	9	26	1	77
T-2-86 074	.7	1	8	32	3	54
T-2-86 075	.6	1	19	41	4	50
T-2-86 076	.6	1	5	19	1	58
T-2-86 077	.5	1	12	30	2	59
T-2-86 078	.6	1	11	22	1	41
T-2-86 079	.6	1	3	38	3	37
T-2-86 080	.9	1	7	23	1	88
T-2-86 081	.8	1	11	18	3	25

PROJECT NO: TOBY

705 WEST 15TH ST., NORTH VANCOUVER, B.C. V7M 1T2

FILE NO: 6-10975/P7+8

ATTENTION: C. GRAF/G. PAULSON

(604)980-5814 OR (604)988-4524

\* TYPE SOIL GEOCHEM \* DATE: NOV 4, 1986

(VALUES IN PPM)	AG	AS	CU	PB	SB	ZN
T-2-86 082	.3	1	13	26	4	24
T-2-86 083	.6	24	27	49	7	39
T-2-86 084	.2	1	13	38	3	71
T-2-86 085	.3	1	19	32	3	85
T-2-86 086	.5	1	14	31	2	68
T-2-86 087	.2	1	14	35	1	86
T-3-86 000	.4	1	11	11	1	56
T-3-86 001	.2	1	12	26	1	48
T-3-86 002	.3	1	13	22	1	51
T-3-86 003	.3	1	4	8	1	28
T-3-86 004	.2	3	23	29	5	32
T-3-86 005	.4	1	14	16	1	50
T-3-86 007	.4	1	13	24	1	56
T-3-86 008	.3	1	19	31	2	52
T-3-86 009	.4	1	13	19	1	53
T-3-86 010	.4	1	27	39	3	38
T-3-86 011	.4	1	16	21	1	45
T-3-86 012	.5	1	24	33	2	38
T-3-86 013	.4	2	28	40	5	56
T-3-86 014	.4	9	25	36	4	56
T-3-86 015	.4	1	17	32	1	41
T-3-86 016	.4	1	12	22	1	24
T-3-86 017	.8	-37	39	-111	14	58
T-3-86 018	.6	1	14	13	1	55
T-3-86 019	.2	1	11	24	1	43
T-3-86 020	.5	1	15	21	1	-102
T-3-86 021	.4	1	15	32	1	-112
T-3-86 022	.6	29	38	-54	8	72
T-3-86 023 40M	.5	24	36	-55	7	66
T-3-86 024	.6	-43	36	-59	9	57
T-3-86 025	.3	29	39	-58	8	74
T-3-86 026	.1	3	19	40	2	51
T-3-86 027	.1	1	13	27	1	32
T-3-86 028	.1	1	11	19	1	29
T-3-86 029	.1	8	19	24	3	24
T-3-86 030	.3	1	17	10	1	53
T-3-86 031	.2	1	20	19	1	31
T-3-86 032	.8	1	26	36	1	42
T-3-86 033	.3	1	14	18	1	53
T-3-86 034	.3	1	9	22	1	95
T-3-86 035	.3	1	21	26	1	42
T-3-86 036	.1	1	9	20	1	20
T-3-86 037	.1	1	13	14	1	20
T-3-86 038	.7	1	28	-89	1	31
T-3-86 039	.2	1	10	12	1	22
T-3-86 040	.2	13	23	31	3	33
T-3-86 041	1.1	1	11	11	3	9
T-3-86 042	1.1	1	7	7	3	9
T-3-86 043	.5	1	13	26	1	17
T-3-86 044	.3	1	13	22	1	25
T-3-86 045	.1	1	13	20	2	25
T-3-86 046	.8	1	12	18	1	30
T-3-86 047	.7	1	16	23	1	39
T-3-86 048	.3	10	20	33	4	31
T-3-86 049	.5	1	15	24	1	31
T-3-86 050	.2	1	11	27	1	25
T-3-86 051	.6	1	15	12	1	25
T-3-86 052	.4	1	11	21	1	38
T-3-86 053	.4	1	9	21	1	33
T-3-86 054	.5	1	11	20	1	44



COMPANY: ACTIVE MINERALS LTD.

MIN-EN LABS ICP REPORT

(ACT:GEO27) PAGE 1 OF 1

PROJECT NO: TOBY

705 WEST 15TH ST., NORTH VANCOUVER, B.C. V7M 1T2

FILE NO: 6-10975/P9+10

ATTENTION: C.GRAF/B.FAULSON

(604)980-5814 OR (604)988-4524

\* TYPE SOIL GEOCHEM \* DATE: NOV 4, 1986

(VALUES IN PPM )	AS	AS	CU	PR	SB	ZN
T-3-86 101	.2	1	9	14	1	-206
T-3-86 102	.1	1	12	24	1	-107
T-3-86 103	.1	1	13	28	1	61
T-3-86 104	.1	1	12	17	2	42
T-3-86 105	.3	1	13	23	1	44
T-3-86 106	.2	11	19	34	4	31
T-3-86 107	.7	-39	29	68	9	57
T-3-86 108	.3	1	16	23	1	77
T-3-86 109	.4	21	34	46	6	47
T-3-86 110	.3	1	14	18	1	84
T-3-86 111	.3	1	12	29	2	36
T-3-86 112	.5	22	25	46	7	52
T-3-86 113	.3	1	13	30	1	-102
T-3-86 114	.3	1	10	23	1	88
T-3-86 115	.7	1	20	13	1	32
T-3-86 116	.2	10	19	33	4	32
T-3-86 117	.2	1	15	-73	1	66
T-3-86 118	.1	1	21	34	3	45
T-3-86 119	.2	1	21	31	2	48
T-3-86 120	.7	1	17	1	1	65
T-3-86 121	.3	1	11	21	1	96
T-3-86 122	.3	1	28	28	1	92
T-3-86 123	.5	1	18	17	1	-103
T-3-86 124	.4	1	18	27	1	96
T-3-86 125	.4	1	59	46	4	-136
T-3-86 126	.3	1	18	19	1	-113
T-3-86 127	.5	1	12	12	1	95
T-3-86 128	.5	1	12	10	1	67
T-3-86 129	.5	1	8	4	1	31
T-3-86 131	.5	1	15	25	1	52
T-3-86 132	.2	1	9	22	1	59
T-3-86 133	.3	11	23	47	5	44
T-3-86 134	.2	20	43	41	7	32
T-3-86 135	.2	18	32	47	7	42
T-3-86 136	.3	1	33	32	5	44
T-3-86 137	.2	1	20	30	4	45
T-3-86 138	.2	14	34	42	15	44
T-3-86 139	1.0	1	17	9	1	38
T-3-86 140	.3	1	23	35	2	95
T-3-86 141	.4	11	32	-52	7	-127
T-3-86 142 40M	.7	-49	40	-60	10	74
T-3-86 143	.4	1	18	32	1	54
T-3-86 144	.6	1	28	23	1	54
T-3-86 145	.4	1	23	41	3	68
T-3-86 146	.6	-73	-117	-84	13	63
T-3-86 147	.5	-31	40	47	7	45
T-4-86 000	.5	1	16	43	1	-184
T-4-86 001	.5	1	20	39	3	65
T-4-86 002	.6	1	9	37	1	-187
T-4-86 003	.5	1	9	-206	1	-560
T-4-86 004	.4	1	11	-93	1	-356
T-4-86 005	.6	1	27	76	2	-480
T-4-86 006	.7	1	54	26	3	618
T-4-86 007	.3	13	37	41	5	54
T-4-86 008	.3	16	37	34	6	59
T-4-86 009	.4	1	25	38	4	52
T-4-86 010	.5	10	34	-60	6	-117
T-4-86 011	.6	9	39	-59	6	90
T-4-86 012	.3	1	13	48	4	-169
T-4-86 013	.5	1	25	-75	4	-195

COMPANY: ACTIVE MINERALS LTD.

MIN-EN LABS ICP REPORT

(ACT:GED27) PAGE 1 OF 1

PROJECT NO: TDBY

705 WEST 15TH ST., NORTH VANCOUVER, B.C. V7M 1T2

FILE NO: 6-1097S/P11

ATTENTION: C.GRAF/G.PAULSON

(604)980-5814 OR (604)988-4524

\* TYPE SOIL GEOCHEM \* DATE: NOV 4, 1986

(VALUES IN PPM )	AG	AS	CU	PR	SB	ZN
T-4-86 014	.2	1	32	45	4	-134
T-4-86 015	.1	1	15	-53	1	-164
T-4-86 016 40M	.1	1	5	23	1	25
T-4-86 017	.5	1	17	-86	3	-197
T-4-86 018	.1	1	13	26	2	66
T-4-86 019	.2	1	13	42	3	92
T-4-86 020	.3	1	82	-59	2	79
T-5-86 000	.3	1	21	39	1	-132
T-5-86 001	.2	1	46	45	6	81
T-5-86 002	.3	1	13	26	1	-114
T-5-86 003	.3	1	12	24	1	-119
T-5-86 004	.3	1	32	15	1	55
T-5-86 005	.3	26	36	-56	6	76
T-5-86 006	.7	20	36	-62	7	71
T-5-86 007	.2	9	30	42	5	53
T-5-86 008	.6	13	42	-61	6	92
T-5-86 009	.2	18	27	44	7	49
T-5-86 010	.5	1	18	36	3	66
T-5-86 011	.3	1	17	-51	3	-282
T-5-86 012	.2	1	12	21	2	79
T-5-86 013	.3	1	11	21	1	59
T-5-86 014	.5	1	40	34	1	53
T-5-86 015	.2	1	21	27	2	67
T-5-86 016	.6	1	28	27	1	77
T-5-86 017	.5	1	30	32	1	-105
T-5-86 018	.6	1	29	33	1	-144
T-5-86 019	.2	1	14	28	2	-136

COMPANY: ACTIVE MINERALS LTD.

MIN-EN LABS ICP REPORT

(ACT:GE027) PAGE 1 OF 3

PROJECT NO: TOBY

705 WEST 15TH ST., NORTH VANCOUVER, B.C. V7M 1T2

FILE NO: 6-1097

ATTENTION: C. GRAF/G. PAULSON

(604)980-5814 OR (604)988-4524

\* TYPE SOIL GEOCHEM \* DATE: NOV 5, 1986

(VALUES IN PPM)	AG	AL	AS	B	BA	BE	BI	CA	CD	CO	CW	FE
J001 20M	.1	6780	65	9	25	4.5	6	6290	3.9	10	18	27300
J002	.4	6980	8	8	127	3.1	2	12880	4.2	6	21	29120
J003	.4	8330	50	6	29	4.6	5	9570	4.6	8	34	29610
✓ J004 40M	.2	7830	22	11	141	4.0	4	6570	5.8	8	29	31840
✓ J005	.2	5660	12	6	107	3.7	3	3060	2.9	10	31	25820
✓ J006	.5	13960	1	15	195	3.8	2	48780	3.6	7	20	37700
✓ J006B	.4	13080	1	15	155	3.3	3	53670	5.6	6	15	33000
J007	.5	8070	33	8	38	3.8	6	6140	3.6	7	27	35150
J008	.2	9520	1	7	27	2.5	1	2830	3.3	7	23	38950
J009	.3	4870	17	5	95	2.5	3	13300	4.7	5	12	21930
J010	.6	4510	28	7	108	2.9	5	30400	5.9	5	22	25480
✓ J011	.3	7350	23	8	248	3.6	5	3510	3.6	6	32	31460
✓ J012	1.1	16250	1	14	490	3.9	4	4040	7.9	7	31	40530
J013	.6	5240	11	5	446	3.0	6	39840	4.0	5	24	22040
J014	.5	7940	19	12	380	3.7	5	31520	4.4	6	27	26550
✓ SILT 1	.5	5250	56	7	126	4.9	6	13670	4.0	10	42	30430
✓ SILT 2	.6	5630	16	9	374	3.5	4	42370	3.4	6	31	31200
✓ SILT 3	.8	5490	21	7	904	3.8	7	54380	4.7	6	31	31360
TOBBY SILT 01	.4	5450	19	8	168	3.4	5	30660	4.0	5	20	24940
TOBBY SILT 02	.4	5770	25	8	134	3.7	3	10930	5.0	6	31	26750

COMPANY: ACTIVE MINERALS LTD.  
 PROJECT NO: TOBY  
 ATTENTION: C. GRAF/G. PAULSON

MIN-EN LABS ICP REPORT  
 705 WEST 15TH ST., NORTH VANCOUVER, B.C. V7M 1T2  
 (604) 980-5814 OR (604) 988-4524

(ACT:GEO27) PAGE 2 OF 3  
 FILE NO: 6-1097  
 DATE: NOV 5, 1986

(VALUES IN PPM)	K	LI	MG	MN	MO	NA	NI	P	PB	SB	SR	TH
J001 20M	280	11	9020	330	8	10	20	390	44	8	14	1
J002	1540	13	12340	534	7	30	17	520	40	4	13	1
J003	310	26	7920	440	9	20	24	490	56	7	29	1
J004 40M	1440	14	8340	622	7	30	21	570	54	6	15	1
J005	1160	4	1710	771	4	40	17	910	32	4	13	1
J006	3580	36	37970	400	9	20	23	700	43	6	35	1
J006B	3650	34	37100	318	9	20	20	670	42	6	31	1
J007	540	21	7990	338	7	20	23	660	41	7	19	1
J008	520	14	6350	353	5	20	17	760	23	3	18	1
J009	670	9	10650	563	7	20	14	470	39	5	11	1
J010	780	7	19600	433	8	10	16	600	57	6	20	1
J011	790	10	4500	837	6	40	14	480	45	5	15	1
J012	1350	14	4140	600	6	110	11	630	151	3	26	1
J013	950	13	21590	337	7	20	18	600	52	7	26	1
J014	2170	20	24010	419	9	40	23	540	59	8	22	1
SILT 1	450	10	9170	473	9	30	26	590	66	11	17	2
SILT 2	1190	12	24320	423	8	30	23	490	63	8	25	1
SILT 3	1180	13	30930	570	10	30	25	550	97	10	44	1
TOBBY SILT 01	1350	12	21290	379	8	30	19	570	54	7	27	1
TOBBY SILT 02	930	8	9420	539	7	30	16	490	56	7	18	1

COMPANY: ACTIVE MINERALS LTD.

MIN-EM LABS ICP REPORT

(ACT:6E027) PAGE 3 OF 3

PROJECT NO: TOBY

705 WEST 15TH ST., NORTH VANCOUVER, B.C. V7M 1T2

FILE NO: 6-1097

ATTENTION: C. GRAF/B. PAULSON

(604)980-5814 OR (604)988-4524

\* TYPE SOIL GEOCHEM \* DATE: NOV 5, 1986

(VALUES IN PPM)	U	V	ZN
J001 20M	1	5.7	44
J002	1	5.5	42
J003	1	6.9	55
J004 40M	1	9.6	46
J005	1	5.1	30
J06	1	26.8	40
J006B	1	24.6	31
J007	1	5.9	43
J008	1	2.9	39
J009	1	5.4	35
J010	2	3.9	61
J011	1	10.0	85
J012	2	15.8	692
J013	2	4.8	31
J014	1	12.2	47
SILT 1	1	4.5	53
SILT 2	1	8.4	44
SILT 3	2	9.8	54
TOBBY SILT 01	1	7.3	47
TOBBY SILT 02	1	8.5	64



**APPENDIX II**  
**SULPHUR ISOTOPE ANALYSIS DATA**



Energy, Mines and  
Resources Canada

Énergie, Mines et  
Ressources Canada

Earth Sciences

Sciences de la Terre

Geological Survey of Canada  
601 Booth Street  
Ottawa, Ontario  
K1A 0E8

Commission géologique du Canada  
601, rue Booth  
Ottawa (Ontario)  
K1A 0E8

Your file    *Votre référence*

Our file    *Notre référence*

July 21, 1987

Mr. C. Graf,  
Active Minerals Explorations Ltd.  
Suite 1010 - 837 West Hastings St.  
Vancouver, B.C.  
V6C 1B6

Dear Chris:

I owe you a letter to confirm the information transmitted to you in a telephone conversation a few weeks ago.

1. The S-isotope data on five of your six samples are as follows:

SP-4664 (R86MK001)	+ 22.5
SP-4665 (R86MK004)	+ 19.4
SP-4666 (R86MK005)	+ 26.5
SP-4667 (R86MK006)	+ 23.6
SP-4668 (no number)	+ 14.6

2. The missing sample has been found; it had been inadvertently mis-labeled as a second half of SP-4664. It has been assigned the number SP-4669 and both it and 4664 are being re-submitted for analysis. I can only assume 4668 and 4669 are equivalent to your sample numbers 002 and 003 although these numbers could not be seen anywhere on the samples.
3. Sample SP-4668 yields an anomalously low value, the reason for which is unclear. The sample itself is very different from the others you sent. All other samples consist of more-or-less massive barite with galena occurring as streaks or wisps with minor amounts of honey-coloured sphalerite. SP-4668, on the other hand, consists mostly of honey sphalerite in a matrix of mainly barite. One possible reason for the low S-isotope value might be a poor separation of very light-coloured sphalerite from barite. A mixture of sulphide and sulphate would definitely tend to "lighten" the sulphate isotope values.

...2

4. For the record, several years ago I had three samples of barite from the Mineral King dump analyzed with the following results:

SP-981	+ 24.3
SP-982	+ 26.8
SP-983	+ 29.6

These results are more in line with the majority of your samples (except 4668, of course). If one excludes this value, Mineral King barites (your samples plus mine) range from +29.6 to +19.4 with an average of +24.7.

5. I enclose copies of relevant pages from the paper by Claypool et al. on the S-isotope curves for seawater. Fig. 9 is a general curve for the Phanerozoic. The Mineral King barite values would seem to fit best somewhere in the Siluro-Devonian. A detail of the Devonian is shown in Fig. 6 and I would suggest the data best fit the Upper Devonian.

As you can see, S-isotopes don't produce an unequivocal age but do seem to indicate a Cambrian or Proterozoic age is unlikely. We'll see what values 4664 and 4669 give when they're re-done but I would suggest that, in the meantime, a good attempt be made to secure conodonts from the host carbonates. If they're Devonian, they should (a) have a good conodont population, and (b) yield a correspondingly good age which should settle the question.

I hope these results are helpful; I think it's the best we can expect for dating by S-isotopic means. I'll keep you posted on the new results when they come in.

Sincerely,



D.F. Sangster

Mineral King Mine; samples ranged from  $\delta^{34}\text{S}$  19.4‰ to  $\delta^{34}\text{S}$  26.5‰

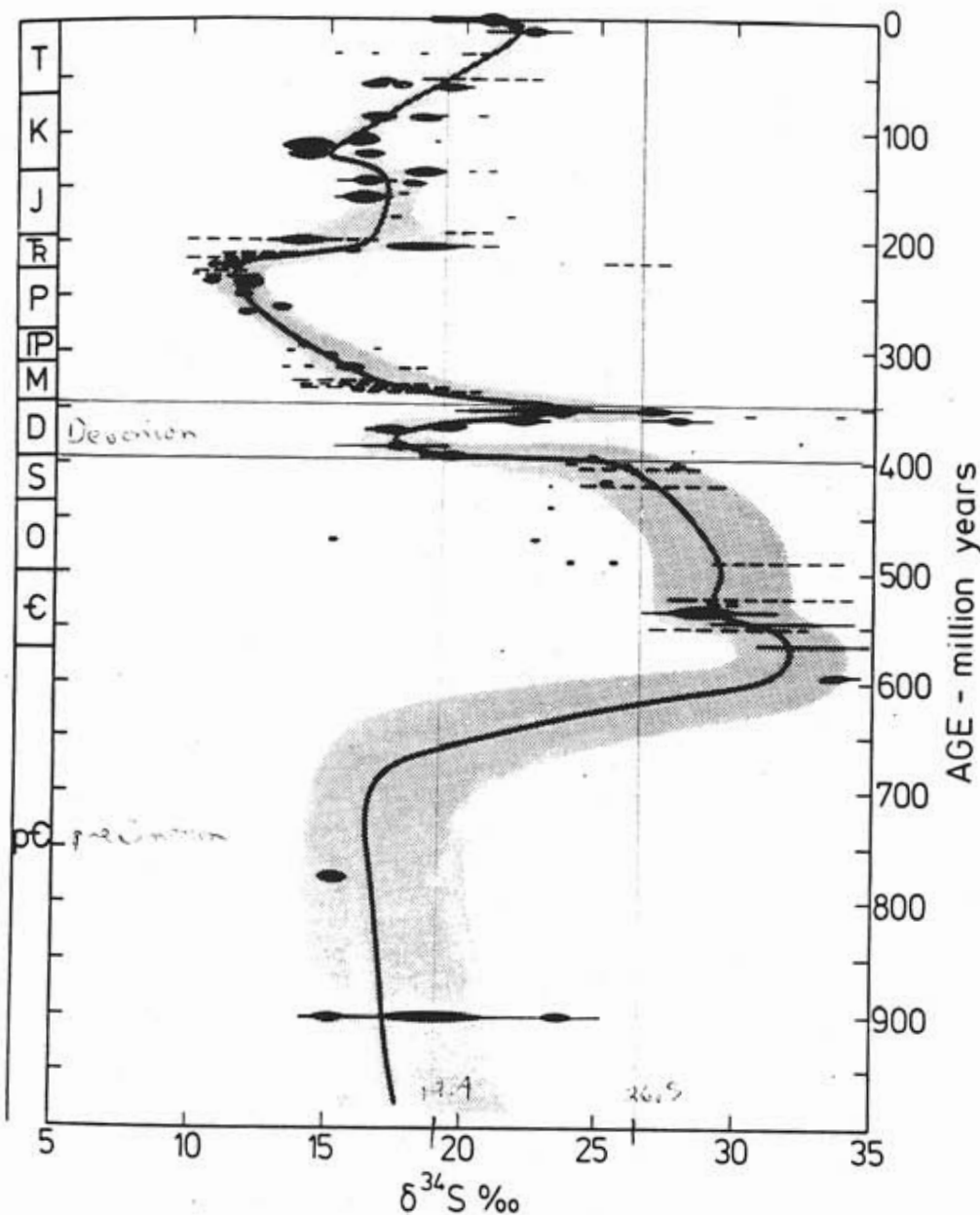


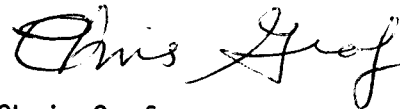
Fig. 9. Summary sulfur isotope age curve for sulfate. All data from our work, and most of those published elsewhere (for references see Figs. 4-8) are shown as solid areas or lines that qualitatively indicate the number of analyses, plotted at their most probable age. Horizontal dashed lines signify the range of relatively few analyses. The heavy line is our best estimate (see text) for  $\delta^{34}\text{S}$  of sulfate mineral in equilibrium with the world ocean surface sulfate of that date. The shaded area is our estimate of the uncertainty of this curve.

The Devonian is the main time period with sulfate isotopes between 19.4 and 26.5 ‰. The Cambrian rocks are almost always lighter, and the Carboniferous rocks are almost always heavier.

## STATEMENT OF QUALIFICATIONS

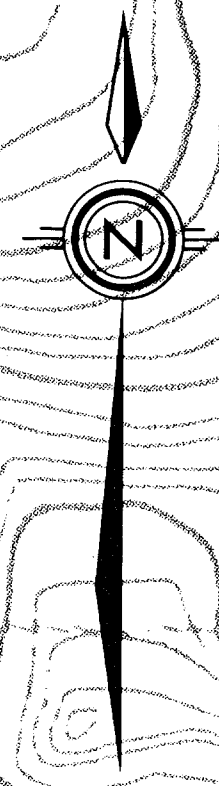
I, Chris Graf, do hereby declare that:

- (1) I graduated from the University of British Columbia, Vancouver, British Columbia in 1974 with a B.Ap.Sc. Degree in Geological Engineering.
- (2) That I am a registered Professional Engineer in the Province of British Columbia.
- (3) That I have practised my profession for ten years with numerous mining companies in British Columbia.



Chris Graf  
1010 - 837 West Hastings Street  
Vancouver, B.C.  
V6C 1C4





Monument Peak

TOBY 2

TOBY 1

Soil Line T1 (6000' contour)

Soil Line T2 (6500' contour)

Soil Line T3 (6000' contour)

TOBY 3

TOBY 4

Soil Line T4 (6700' contour)

Soil Line T5 (6200' contour)

Junbo Creek

MINERAL KING MINE  
GLORY HOLE  
Zn, Pb, Ag, Ba

MINERAL KING MINE (CLOSED)  
Zn, Pb, Ag, Ba

Open Pit

LEGEND

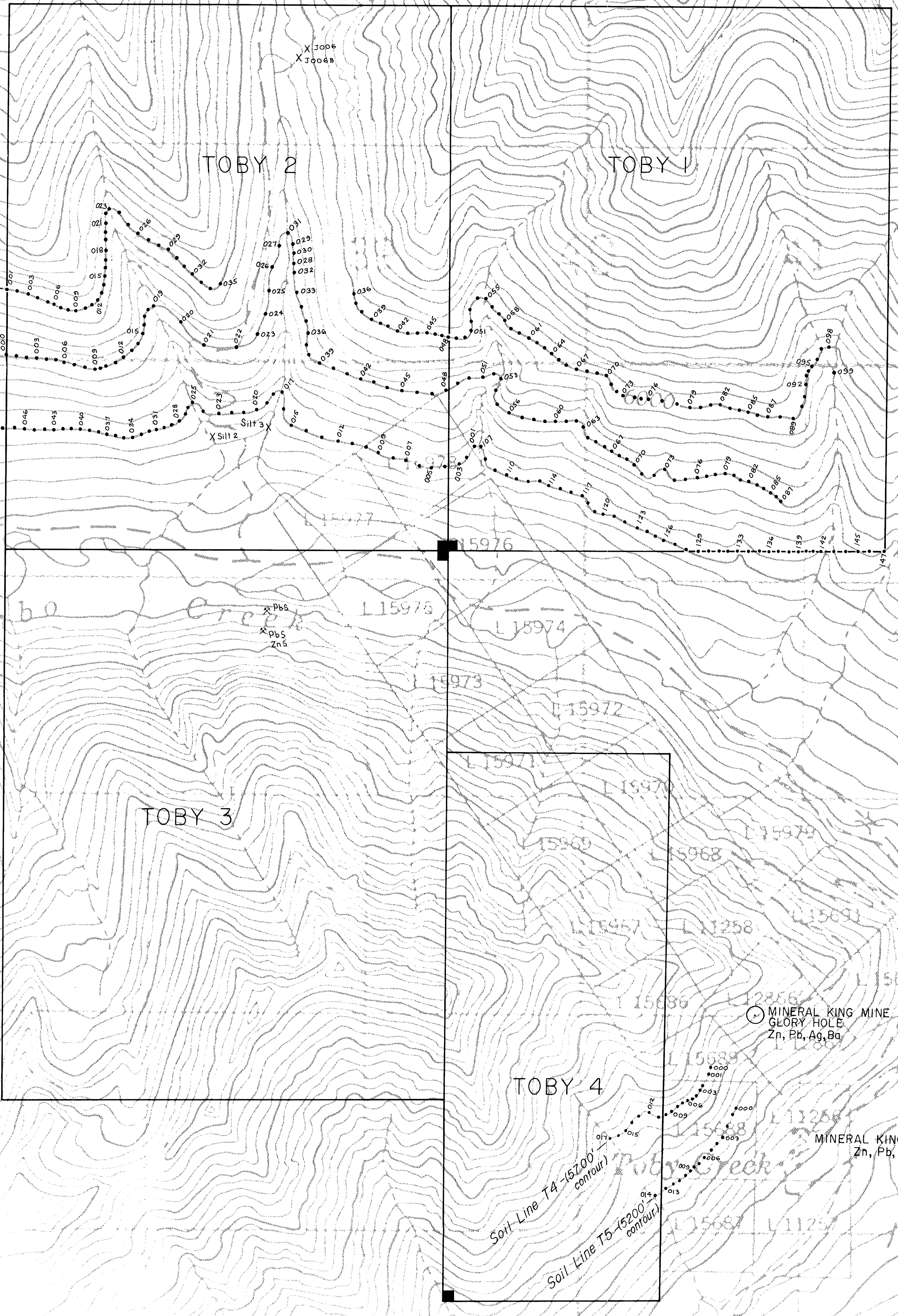
- Soil Sample
- X Silt Sample
- ◊ Mineral Occurrence

**16,117**

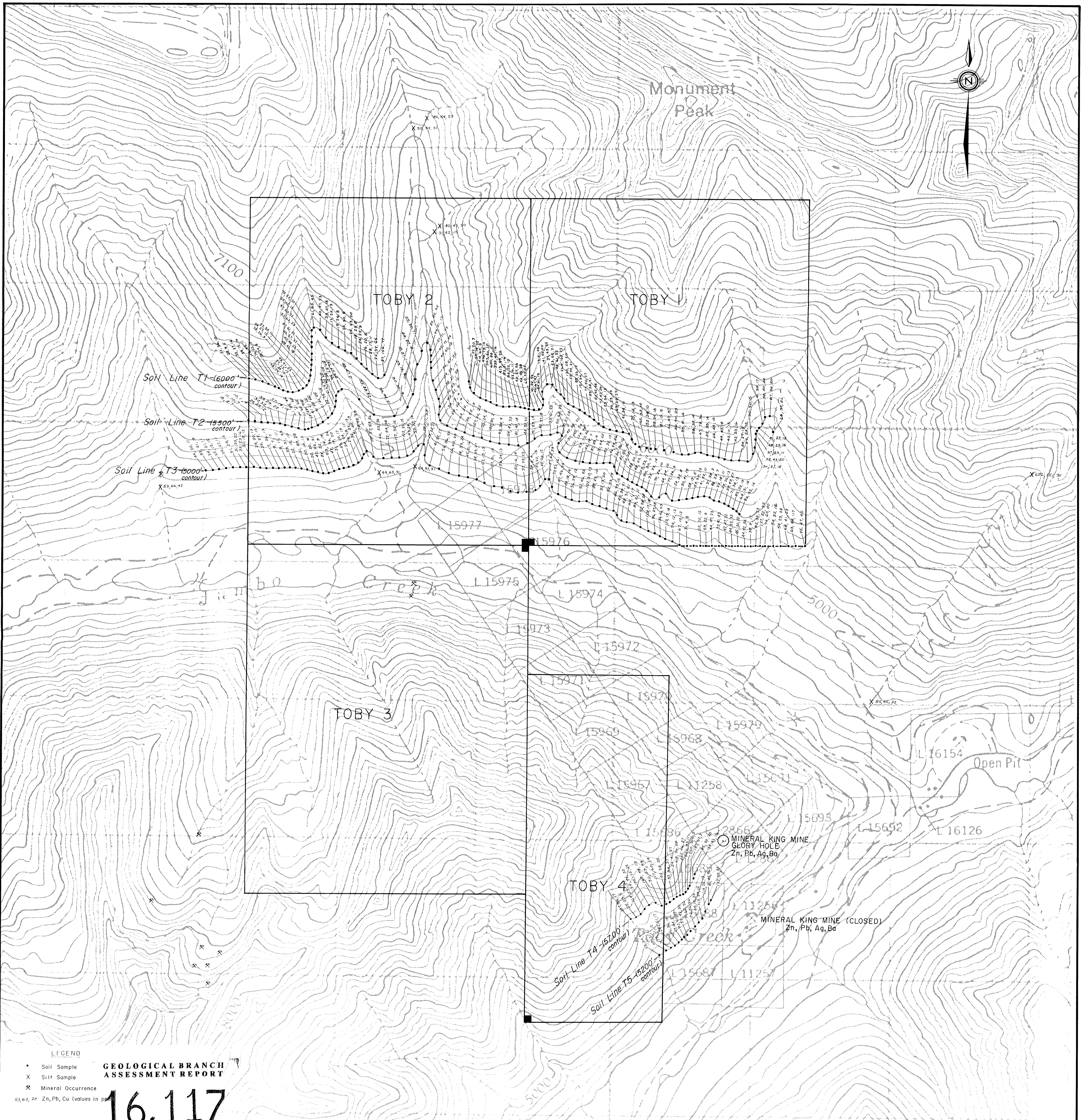
**ACTIVE MINERALS LTD.**

**TOBY PROJECT**  
TOBY 1-4 CLAIMS  
GEOCHEMISTRY  
SAMPLE LOCATIONS  
TOBY CREEK AREA, BRITISH COLUMBIA

MAPPED BY: \_\_\_\_\_ DATE: \_\_\_\_\_  
 DRAWN BY: \_\_\_\_\_ DATE: \_\_\_\_\_  
 DATE: May, 1987







**LEGEND**

- Soil Sample
- X Silt Sample
- ⊗ Mineral Occurrence

**GEOLOGICAL BRANCH  
ASSESSMENT REPORT**

63,62,27 Zn, Pb, Cu (values in pp)

**16,117**

FIGURE 3

**ACTIVE MINERALS LTD.**

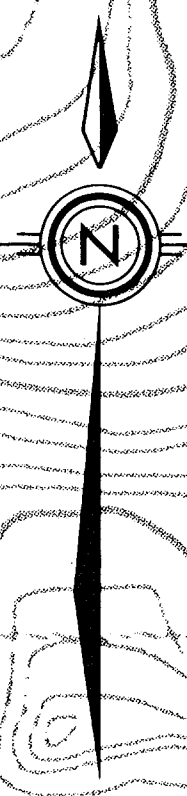
**TOBY PROJECT  
TOBY 1-4 CLAIMS  
GEOCHEMISTRY  
ZINC, LEAD, COPPER  
TOBY CREEK AREA, BRITISH COLUMBIA**

1:10,000

0 300 600 m  
0 1000 2000 ft

MAPPED BY	REVISED	N.T.S. No.
DATE		FIELD WORK BY
DATE May, 1967		DATE
		DRAWN BY





Monument Peak

TOBY 2

TOBY 1

Soil Line T1 (6000' contour)

Soil Line T2 (5500' contour)

Soil Line T3 (5000' contour)

Jumbo Creek

TOBY 3

TOBY 4

Toby Creek

Open Pit

MINERAL KING MINE  
GLORY HOLE  
Zn, Pb, Ag, Ba

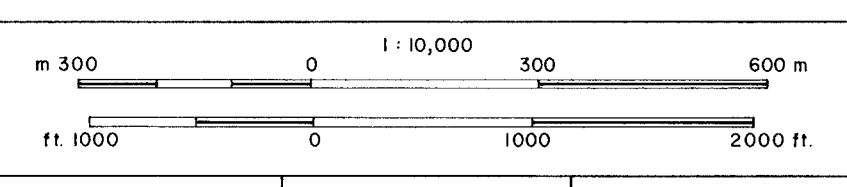
MINERAL KING MINE (CLOSED)  
Zn, Pb, Ag, Ba

LEGEND  
• Soil Sample  
X Silt Sample  
\* Mineral Occurrence  
Ag, As, Sb (values in ppm)

**16,117**

ACTIVE MINERALS LTD.

TOBY PROJECT  
TOBY 1-4 CLAIMS  
GEOCHEMISTRY  
SILVER, ARSENIC, ANTIMONY  
TOBY CREEK AREA, BRITISH COLUMBIA



MAPPED BY: \_\_\_\_\_ DATE: \_\_\_\_\_  
REVISED: \_\_\_\_\_  
NTS. No.: \_\_\_\_\_  
FIELD WORK BY: \_\_\_\_\_ DATE: \_\_\_\_\_  
DRAWN BY: \_\_\_\_\_ DATE: \_\_\_\_\_  
DATE: May, 1987