

REPORT
of
EXPLORATION PROGRAMME
conducted
19 MAY - 1 AUGUST, 1980



for
RIO ALTO EXPLORATION LTD.

This report has been examined by the Geological Evolution Unit and the member of the Commission to be considered in the amount of

Office of the Supervising Mining Recorder
NOV 10 1980
WHITEHORSE
Resident Geologist or
Mining Engineer
Yukon Territory

Considered as representation work under
Section 53 (4) Yukon Quartz Mining Act

B. R. BAXTER
Supervising Mining
Commissioner of Yukon Territory

Rusty Springs Prospect
N.T.S. Map Sheet 116-K-8 and 9
Porcupine Ranges
Yukon Territory

090685

JOE BANKOWSKI

SEPTEMBER 1980

WHITEHORSE, YUKON TERRITORY



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\$ 52,800.00

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SECTION A: PREVIOUS WORK

While prospecting the area around the known YETI iron deposit in 1975, Rio Alto prospectors discovered galena, sphalerite and tetrahedrite float at the TIM showing. Subsequently, 96 quartz claims around the TIM showing and 3 iron claims at the YETI iron deposit were staked during the fall of 1975 and the winter of 1976.

The YETI iron deposit was bulk sampled in 1976 and a preliminary programme of geological mapping, geochemical soil sampling and hand-trenching was conducted on the Rusty Springs property. A report by M. N. Chernoff, P.Geol. (Alta.) suggested the possibility of the mineralization at RUSTY SPRINGS being hydrothermal in nature and related to a shallow, igneous, acid intrusion.

In 1977, the programme was continued and expanded on the RUSTY SPRINGS property with additional geological mapping, geochemical soil sampling and a drilling programme. Thirteen holes for a total footage of 3200' were drilled using a Hydra-Wink Badger AQ drill. Mineralization at surface and in drill holes prompted the staking of an additional 284 quartz claims and 12 iron claims to form a total of 380 quartz claims on the RUSTY SPRINGS property and 15 iron claims at the YETI iron deposit. A geological thesis by G. Schoel concluded that the mineralization at RUSTY SPRINGS appeared to be most similar to Mississippi Valley type occurrences.

In the winter of 1978, fuel, equipment and supplies were brought in by tractor-train. Two grid systems were cut for a total of 40 line miles. Additional geological mapping, geochemical soil sampling, bulk sampling and drilling was also conducted. Two Hydra-Wink drills were then employed to complete 30 drill holes with a combined footage of 6035'. A geological thesis by D. Hansen emphasized the "domal" structure of RUSTY SPRINGS and also classified the mineralization as most similar to Mississippi Valley type deposits.

In 1979, more geological mapping and geochemical soil sampling was

carried out; In addition, a geophysical programme of I.P. (P.F.E.) and gravity surveys was performed. A geological thesis by J. Bankowski classified the mineralization at RUSTY SPRINGS as hydrothermal-exhalative in nature.

SECTION B: DRILLING PROGRAMME

Twenty-seven diamond drill holes were drilled in summer, 1980 on Orma Hill by Caron Diamond Drilling Limited for a total footage of 6000'. Ground conditions near surface were generally poor with abundant, deeply weathered, sandy and unconsolidated material present and therefore an HQ size, triple-barrel system coupled to a Longyear Super-38 drill was chosen as the optimum drilling equipment. Even so, many problems were encountered due to the unconsolidated nature of the ground. Casing had to be driven to considerable depth to stabilize the holes and many holes necessitated a reduction of HQ size rod to NQ size, with the HQ rod being reamed in behind the NQ rod to act as casing. As a result, about 3500' of the core is NQ size with the remainder being HQ.

Drilling was slow in the unconsolidated Carboniferous strata with the rods having to be pulled often and with a need for deep casing. As a result, 12-hour drill shifts in this material averaged only about 20' with an average core recovery of 60% to 70%.

Drilling in the consolidated Devonian strata, however, was rapid, with drill shifts averaging about 50' and core recovery averaging 90% or better.

The holes themselves are generally shallow, averaging about 200' in depth; the deepest completed hole was DDH 80-12 at 527' and the shallowest completed holes were DDH 80-2 and -15 both at 87'. DDHs 80-5A, -24 and -26 were terminated due to technical difficulties. DDHs 80-7, -17, -18, -21 and -26 were drilled at an angle of 60°, while the remainder were vertical holes.

The salient features of the drill holes are as follows:

DDH 80-1

- Drilled vertically to a depth of 227'.
- 27' to 29' of white, massive quartz pebbles + Cu-carbonate staining.
- 38'4" to 38'7" of massive tetrahedrite.
- 38'7" to 50'5" of quartz and decomposed limestone + minor Cu-carbonate.

Assay

<u>Sample #</u>	<u>Depth</u>	<u>oz/T Ag</u>	<u>% Pb</u>	<u>% Cu</u>	<u>% Cd</u>
1	25'-29'	0.4	0.69	0.21	.003
2	29'-34'	2.99	0.57	0.19	.003
3	38'-43'	59.08	24.57	2.53	.004
4	34'-37'	0.82	0.78	0.24	.002
5	37'-38'	44.73	17.13	2.80	.003
6	43'-48'	0.77	4.4	0.99	.003
7	48'-50'4"	4.21	4.66	4.31	.004
8	60'3"-64'6"	2.29	1.94	2.5	.005

DDH 80-2

- Drilled vertically to a depth of 87'.
- 59' to 87' with slight Cu-carbonate staining.

DDH 80-3

- Drilled vertically to a depth of 97'.
- 0' to 22' and 72' to 73'7" with slight Cu-carbonate staining.
- 73'7" to 74' of massive tetrahedrite.
- 74' to 77' at minor tetrahedrite and Cu-carbonate.

Assay

<u>Sample #</u>	<u>Depth</u>	<u>oz/T Ag</u>	<u>% Cu</u>	<u>% Pb</u>	<u>% Cd</u>
9	72'-77'	25.47	3.34	13.72	.002

<u>Sample #</u>	<u>Depth</u>	<u>Au</u>	<u>Ag</u>	<u>Pb</u>	<u>Zn</u>	<u>Cu</u>
A-31	0'-22'	-	14.0	475	698	1000+
A-32	22'-37'	-	17.5	172	952	628
A-33	37'-57'	-	9.0	88	971	30
A-34	57'-72'	-	19.3	362	912	345
B-31	22'-37'	.01	16.5	176	1045	468
B-32	37'-57'	.03	5.4	78	990	45
B-33	57'-72'	.01	20.6	502	950	400

(In ppm)

DDH 80-4

- Drilled vertically to a depth of 132'.
- 108'7" to 112' with minor galena.
- 113' to 118'9" with minor tetrahedrite and Cu-carbonates.

Assay

<u>Sample #</u>	<u>Depth</u>	<u>oz/T Ag</u>	<u>% Cu</u>	<u>% Pb</u>	<u>% Cd</u>
10	108'7"-112'6"	1.41	0.05	0.75	.001
11	112'6"-115'0"	8.97	0.90	9.94	.002
12	115'0"-119'4"	1.16	0.25	0.3	.003

<u>Sample #</u>	<u>Depth</u>	<u>Au</u>	<u>Ag</u>	<u>Pb</u>	<u>Zn</u>	<u>Cu</u>
A-41	0'-22'	-	19.9	104	1350	60
A-42	22'-42'	-	21.8	70	1200	130
A-43	46'-62'	-	8.4	1150	1175	462
A-44	62'-82'	-	12.5	148	1120	61
A-45	82'-102'	-	7.7	282	865	246
B-41	0'-22'	.03	18.4	180	1350	57
B-42	22'-42'	.03	21.8	66	1120	116
B-43	42'-62'	.01	8.8	825	1120	400
B-44	62'-82'	.03	17.2	100	1080	46
B-45	82'-102'	.03	7.3	218	770	283

(in ppm)

DDH 80-5

- Drilled vertically to a depth of 209'.
- 125'3" to 129' of massive tetrahedrite and minor quartz.

Assay

<u>Sample #</u>	<u>Depth</u>	<u>oz/T Au</u>	<u>oz/T Ag</u>	<u>% Cu</u>	<u>% Pb</u>	<u>% Zn</u>	<u>% As</u>	<u>% Sb</u>
13	124'-129'	.002	36.5	1.65	23.3	0.24	1.05	0.79

DDH 80-6

- Drilled vertically to a depth of 128'.
- Essentially barren.

DDH 80-7

- Drilled at an angle of 60° with a northeast bearing to a depth of 367'.
- Very minor tetrahedrite patches from 149' to 155'.

DDH 80-8

- Drilled vertically to a depth of 197'.
- 132'1" to 132'10" of massive tetrahedrite.

Assay

<u>Sample #</u>	<u>Depth</u>	<u>oz/T Au</u>	<u>oz/T Ag</u>	<u>% Cu</u>	<u>% Pb</u>	<u>% Zn</u>	<u>% As</u>	<u>% Sb</u>
14	132'11"- 132'10"	<.002	26.3	2.59	16.5	0.31	1.30	0.58

DDH 80-9

- Drilled vertically to a depth of 125'.
- Essentially barren.

DDH 80-10

- Drilled vertically to a depth of 150'.
- Minor Cu-carbonate traces from 96'10" to 100'.

DDH 80-11

- Drilled vertically to a depth of 372'.
- Essentially barren.

DDH 80-12

- Drilled vertically to a depth of 527'.
- Essentially barren.

DDH 80-13

- Drilled vertically to a depth of 202'.
- Essentially barren.

DDH 80-20

- Drilled vertically to a depth of 120'.
- Essentially barren.

DDH 80-21

- Drilled at an angle of 60° and a southwest bearing to a depth of 201'.
- Essentially barren.

DDH 80-22

- Drilled vertically to a depth of 126'.
- Essentially barren.

DDH 80-23

- Drilled vertically to a depth of 125'.
- Essentially barren.

DDH 80-24

- Drilled vertically to a depth of 12'.
- Barren; terminated due to lack of drilling water.

DDH 80-25

- Drilled vertically to a depth of 284'.
- Essentially barren.

DDH 80-26

- Drilled at an angle of 60° and a northeast bearing to a depth of 77'.
- Barren; terminated to facilitate camp break-up.

SECTION C: TRENCHING

Six trenches, designated T #1 - T #6, were cut on Orma Hill this summer using a Caterpillar D-7-C bulldozer equipped with a single-toothed ripper (Figures 1 and 2). The trenches generally strike east and lie perpendicular to a northwest-striking mineralized zone.

T #1

- Located between lines 8+50N to 9+50N and lines 0+60W to 2+10W. This trench is about 170' long and averages 40' inwidth. It was cut close to the Orma showing to provide information on the mineralization seen at this showing. In the course of excavation, a zone of abundant galena, quartz and hematite fragments with minor tetrahedrite in a matrix of coarse, gossanned sand was uncovered (Figure 2). The trench was deepened to about 6' in the vicinity of this zone and shallows towards the ends of the trench.

T #2

- Located between lines 10+05N to 11+25N and lines 0+80W to 3+30W. This trench is about 250' long and averages 30' in width. It was cut 100' northwest of T #1 to establish continuation of the mineralized zone. The same mineralized zone was uncovered (Figure 2) and at roughly the middle of the zone a vein of quartz with galena and tetrahedrite was uncovered. The mineralized zone was initially cut to a depth of 6' with the ends of the trench outside the zone being more shallow. Later excavation deepened the trench to about 12' in the vicinity of the mineralized zone and uncovered a stockwork-like system of mineral-bearing quartz veins.

T #3

- Located between lines 12+20N to 13+00N and lines 2+00N to 3+50W. This trench is about 150' long with an average width of 30'. It was cut about 150' northwest of T #2 to establish continuation of the mineralized zone. The trench was cut to a depth of only about 3' in the projected strike of the mineralized zone and subsequently only minor Pb and Cu mineralization were uncovered along this strike.

T #4

- Located between lines 13+50N to 14+30N and lines 1+90W to 4+30W. This trench is about 240' long with an average width of 50'. It was cut about 100' northwest of T #3 to try and intersect the projected mineralized zone but, as with T #3, was only cut to a depth of about 3' and uncovered only minor Cu and Pb mineralization along the projected zone.

T #5

- Located between lines 7+10N to 7+85N and lines 0+50E to 1+80W. The trench is about 250' long, with an average width of 60'. It was cut about 150' southeast of T #1 to establish continuation of the zone of mineralization but was not completed due to extremely muddy ground. The trench was cut to a depth of about 4' and no mineralization was noted.

T #6

- Located between lines 0+00 to 0+60S and lines 1+00E to 0+30W. The trench is about 130' long with an average width of 40'. It was cut to establish the nature of the mineralization at the ORMA showing and to confirm the extension of the mineralized zone projected across T #1, 2, 3 and 4. A stockwork-like system of galena and tetrahedrite-bearing quartz veins was uncovered along this projected strike. The trench is cut to about 12' in depth through the mineralized zone and shallows towards the ends of the trench.

SECTION D: GEOLOGY

The geological work conducted at the RUSTY SPRINGS property this summer can be grouped as follows:

- 1) Detailed geological mapping of Orma Hill on a scale of 1" = 100' (Figure 1);
2. Logging and sampling of core obtained from the drilling program;
3. Detailed mapping and sampling of bulldozer trenches cut this summer on Orma Hill (Figure 2).

The mapping information, in conjunction with drill hole data, resulted in the conclusion that Orma Hill is completely capped by Carboniferous (Mississippian) age strata, probably correlatable to the Hart River Formation. This strata unconformably overlies Middle Devonian Ogilvie Formation strata which displays an irregular surface with substantial relief. It is within the Carboniferous strata that virtually all the mineralization is restricted.

A zone of mineralization roughly 50' wide with a strike length of about 2400' was delineated on Orma Hill (Figures 1 and 2) through known showings and new mineralization uncovered by trenching and the clearing of drill sites.

The mineralization within this zone is in the form of galena, hematite

and tetrahedrite-bearing quartz stockwork systems. Several carefully selected samples of tetrahedrite yielded assays of 438 oz Ag/T from T #6 near the southeastern end of the zone, 234 oz Ag/T from T #2 near the center of the zone and 111 oz Ag/T from the tetrahedrite showing at the northwestern end of the zone (Figure 1).

It had been previously thought that mineralization seen in some 33 showings as of 1979 was hosted in Devonian dolostones of the Ogilvie Formation. This mineralization was predominant as irregular patches of cubic galena, tetrahedrite and amber sphalerite in a matrix of quartz, often with accessory calcite and pyrite as dodecahedrons or in disseminated form. Virtually all the mineralization was found close to an overlying black chert-shale sequence assigned to the Unnamed Shale Unit or Canol Formation of Upper Devonian age. The patchy nature of the mineralization, its symmetric morphology (i.e. cubic galena, large euhedral crystals of iron-deficient sphalerite) and its proximal location close to an overlying unit naturally led to the conclusion that this mineralization was unconformity-related, Mississippi Valley type in nature. The overlying, metal-rich Canol Formation was most often referred to as the source of the metals. Ground preparation of the Devonian Ogilvie Formation by means of prolonged sub-aerial exposure and/or by sub-surface dissolution by underground aquifer systems led to the formation of caves, vugs and an overall porosity which, in the presence of organically-derived hydrogen sulphide (H_2S), precipitated metals from solutions emanating from the overlying shale. The abundant quartz and high silver content of galena and tetrahedrite, however, are contrary to this style of mineralization. The high silver content was attributed to the anomalous silver content of the overlying shales, while quartz was assumed to be due to remobilization of silica from organically-precipitated chert (i.e. chert-replaced sponge spicules) within the Ogilvie Formation and/or overlying chert of the Canol Formation.

Evidence from work conducted at the RUSTY SPRINGS property this summer, however, would suggest a different style of mineralization than that concluded from earlier work. Mapping and examination of surface strata on Orma Hill (Figure 1) revealed a zone of silica replacement and alteration from approximately line 0+00-5+00E to line 21+00N-3+00W and extending south of this line. Limestones to the north of this line were found to be light grey

in colour and compact, with no alteration and very minor fracturing. Crinoid stems were noted and dolomite crystals were absent. To the south of this line, limestone is darker grey, silicic, sanded, decomposed, fractured and sometimes brecciated. The rocks are predominant as float with little outcrop and poor exposure. Abundant blocks of hematite and quartz with minor pyrite are closely associated with the altered limestone float. It is within this altered, silicic zone that all the mineralization on Orma Hill occurs. Much coarse, gossanned, carbonate sand is found within this zone from the leaching and decalcification of pre-existing limestone. Minor green sandstones and grey siltstone were also noted.

Drilling on Orma Hill revealed that altered surficial strata rests on a relatively unaltered, unconformable basement of Devonian dolostone which has an irregular, high relief surface. The contact of the altered surficial strata and the underlying Devonian dolostone was generally sharp. It was the personal opinion of D. C. Templeman-Kluit (geologist, Indian Affairs) that surface strata on Orma Hill was Mississippian (Carboniferous) Hart River Formation. In view of the obvious dissimilarity of carbonates in the two units and the presence of siltstone and sandstone in the upper unit, this author agrees. The absence of an Upper Devonian section on the Ogilvie Formation would allow sufficient time to develop a karstic, irregular, unconformable surface. Both Carboniferous and Devonian strata exhibited much fracturing and brecciation of the carbonates; this was best seen in core of the Ogilvie Formation where breccia clasts native to the host rock were supported in a matrix of fine-grained material alien to the hosting rock. This implies that underground aquifer systems caused solution collapse of the host rock into introduced material. Considerable dark, carbonaceous-argillaceous material containing disseminated pyrite was present and was presumably introduced in the same manner. Other forms of brecciation in the Devonian may be due to the development of a karstic, unconformable surface. Tectonic activity which caused doming on the RUSTY SPRINGS property may also have caused brecciation and fracturing in the Devonian and Carboniferous strata by dynamic force and subsequent intrusion of quartz veins.

Mineralization seen in drill holes on Orma Hill was generally in Carboniferous strata close to the Carboniferous-Devonian contact (Figures 4,

5 and 6). The implication is that mineralized solutions passed through Devonian strata and moved along the contact, which would represent a line of weakness.

The excavation of a trench (T #1, Figures 1 and 2) to better define the mineralization of the GALENA BOULDER showing exposed a zone of mineralization some 30' wide, within which large blocks of massive, deformed galena, hematite (some botryoidal), abundant small angular pieces of quartz and minor tetrahedrite occur in a gossanned, coarse, carbonate sand. Galena from this zone was highly deformed, with some samples having borders of highly deformed, fine-grained "steel" galena passing inwards to less deformed galena to a core of highly deformed "flow structured" galena. This would imply several phases or "pulses" of forcefully-introduced galena. This mineralized zone was again bisected in T #2 but differed from that in T #1 since it contained less hematite and more tetrahedrite. A quartz vein up to 2' wide containing abundant galena and tetrahedrite was exposed. Carbonate country rock next to the vein was foliated and slightly folded, suggesting forceful emplacement. T #3 and #4 also bisected the projected zone but did not penetrate deep enough and uncovered only minor galena and tetrahedrite. The northwest end of the projected zone encloses the PYRITE and TETRAHEDRITE showings. The PYRITE showing has abundant large clasts and dodecahedrons of pyrite in a massive, white quartz matrix. The TETRAHEDRITE showing has massive, fine-grained tetrahedrite up to 2' thick in a matrix of quartz and silicified limestone.

T #5 was not completed due to bad ground and did not uncover any mineralization. T #6 was cut beside the ORMA showing and exposed a quartz stockwork system with abundant tetrahedrite oxidized to Cu-carbonate and galena. The northeast end of the zone is, in general, more weathered and oxidized than the northwest end. Another quartz vein bearing abundant galena and tetrahedrite was uncovered at line 0+90S-1+05E (Figure 1). At line 3+00S-1+05E an outcrop of silicified limestone hosting a quartz vein was uncovered during construction of a drill site. Here, tetrahedrite seems to have replaced limestone adjacent to the quartz vein but has since oxidized to malachite and azurite.

Some carefully selected samples of massive tetrahedrite along the zone yielded the following (refer to Figure 1):

<u>Location</u>	<u>Sample #</u>	<u>oz/T Ag</u>	<u>% Cu</u>	<u>% Pb</u>	<u>% Zn</u>
T #6: 0+50S-0+30E	"0"-1	438.0	25.8	7.9	2.11
T #2: 10+20N-1+80W	T2-1	234.0	11.8	23.0	1.36
Tetrahedrite showing: 20+60N-4+25W	TS-1	111.0	4.25	39.4	0.80

A geochemical soil sampling every 10' across the face of T #6 yielded the following:

<u>Location</u>	<u>Sample #</u>	<u>oz/T Ag</u>	<u>% Cu</u>	<u>% Pb</u>	<u>% Zn</u>
0+50S-0+20E	"0"-2	8.69	0.80	2.20	0.06
0+50S-0+30E	"0"-3	9.05	1.00	2.00	0.09
0+50S-0+40E	"0"-4	8.18	0.67	9.10	0.03

Abundant vitreous, aquamarine blue to black, friable natroalunite, $(\text{Na},\text{K})\text{Al}_3(\text{SO}_4)_2(\text{OH})_6$, was found this summer in drill holes and on surface in the area from lines 0+00 to 4+00S and 0+00 to 2+00W (Orma grid). Identification was courtesy of Ian Hutchins (geochemist, University of Calgary). Gibbsite, $\text{Al}(\text{OH})_3$, a beige hydrate, was also identified from core sample but was minor in abundance and occurrence.

Jim Morin (geologist, D.I.N.A.) discussed the natroalunite occurrence on Orma Hill and suggested that alunite $\text{KAl}_3(\text{SO}_4)_2(\text{OH})_6$ is typical of the uppermost sections of many hydrothermal deposits such as Goldfields, Nevada in the southwestern United States. It is a secondary, alteration mineral which replaces primary minerals such as orthoclase KAlSi_3O_8 in the presence of acidic, sulphur-rich solutions. A cream-coloured sulphate was seen associated with the natroalunite and some samples observed were composed of natroalunite that graded into this sulphate. Other workers on the property had referred to this mineral as gypsum $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ and have described it as an evaporite. It does, however, display conchoidal fracture unlike evaporites and, due to its close association with natroalunite, this author suggests that the mineral is alunite and not gypsum.

DDH 80-5 intersected nearly 30' of natroalunite at the top of this hole. The occurrence and quantity of this mineral on Orma Hill strongly suggests the possibility that a primary, orthoclase-rich rock such as a

granitic plug existed on Orma Hill but has since been replaced by natroalunite and alunite. Weathering and oxidation of abundant pyrite could have supplied a sulphuric acid solution to cause the replacement of granite by alunite and natroalunite but the quantity of these minerals makes it much more likely that an acidic, sulphur-rich solution has been supplied by a hydrothermal system. This would make Orma Hill the focus of hydrothermal activity on the property as now known and would account for the highly oxidized and decomposed nature of surficial strata on Orma Hill.

A composite map of I.P. (P.F.E.) and gravity anomalies obtained from last summer's geophysical program with all drill holes and showings was drawn (Figure 3). As can be seen from the map, only three drill holes (drilled in 1978) penetrated the I.P. anomalies and, unfortunately, these were in the weaker areas of the anomalies and, in addition, were fairly shallow holes.

Hole 78-23 located at line 1+50N-22+00E (Mike Hill grid system) was drilled vertically to a depth of only 128' on the 30% contour of an extensive I.P. anomaly. The hole was essentially barren but did have some quartz veining and brecciated limestone. Holes 78-6 and 78-7 located at line 19+75S-65+50E were both drilled from the same collar into the 15% contour of an isolated I.P. anomaly. Hole 78-6 was drilled vertically to a depth of 200'. This hole was heavily pyritic with very abundant disseminated pyrite, blebs of pyrite and flat lying pyrite bands at 90'. Hole 78-7 was drilled at an angle of 45° and a bearing of 330° to a depth of 202'. This hole also had abundant disseminations and blebs of pyrite.

A gravity anomaly on Orma Hill was penetrated by drill holes #6, 7 and 8 (1977), 78-103, 104 and 106 (1978) and 80-1, 2, 3, 22 and 23 (1980).

Holes #6 and 7 were essentially barren, with minor Cu-carbonate staining near surface. Hole #6 was drilled vertically to a depth of 207' while hole #7 was drilled at an angle of 45° and a southerly bearing to a depth of 297'; both holes were essentially barren. Hole #8 was drilled at an angle of 45° and a westerly bearing to a depth of 202'. This hole passed through a total of 52' over which assays were quoted as 20.8 oz Ag/T to 132.8 oz Ag/T. As all three holes were drilled from the same collar in the

4.00 MGAL contour of the gravity anomaly, it would seem that holes #6 and 7 were drilled away from the trend of mineralization, while hole #8 was drilled more or less parallel to the trend of mineralization close to the contact of the Devonian and Carboniferous strata. Data obtained from this year's drill program confirms that this contact dips roughly 45° to the west on Orma Hill.

Hole 78-103 was drilled vertically to a depth of 258' on the border of the 3.00 MGAL contour and had a fair amount of pyrite in the lower section of the hole. Hole 78-104 was drilled at an angle of 60° and a northeast bearing to a depth of 163' in the 3.50 MGAL contour; it had 17.58 oz Ag/T from 93' to 98'. Hole 78-106 was drilled vertically to a depth of 198' in the 3.00 MGAL contour and was essentially barren.

Hole 80-1 was in the 4.00 MGAL contour; 80-2 and 80-22 were both in the 3.50 MGAL contour and holes 80-3 and 80-23 were in the 3.00 MGAL contour of the gravity anomaly. Hole 80-1 had 3" of massive tetrahedrite from 38'4" to 38'7"; hole 80-2 had minor Cu-carbonate staining from 59' to 87'; hole 80-3 had 10" of massive tetrahedrite from 73'7" to 74', and holes 80-22 and 80-23 were essentially barren.

A more complete description of the 1980 drill holes mentioned above can be found in Section B: Drilling.

SECTION E: SUMMATION AND RECOMMENDATIONS

The RUSTY SPRINGS property hosts Cu, Pb, Zn and Ag mineralization predominantly within Mississippian (Carboniferous) Hart River Formation strata. In view of the high quartz and silver content, the presence of appreciable natroalunite and alunite, deformation in galena as well as the host rocks adjacent to mineralized veins, tectonic activity responsible for the doming of strata on the property and the vein nature of the mineralization, it is suggested that the mineralization is hydrothermal in nature.

This mineralization is probably related to the tectonic activity which caused the doming seen on the property. A relatively shallow intrusion may have supplied the energy for this tectonic activity and the mineralized solutions which moved along resultant faults and fractures. A portion of this intrusion, in the form of a granitic plug now altered to alunite and natroalunite, possibly exists on Orma Hill.

The mineralization may have been concurrent with tectonism or may be younger. Since the mineralization is in Carboniferous age strata, it has a maximum age of Carboniferous but requires isotope analysis for accurate age dating.

Orma Hill is seen as the focus of hydrothermal activity as now known on the property since it is the most heavily altered, oxidized area and hosts what may possibly have been a granitic plug. In addition, a zonation of metals can be seen in the mineralized zone moving away from T #6 northwesterly. The ratio of ounces per ton Ag over percent Pb (oz/T Ag/% Pb) is 55.4 in T #6 at the southeastern end of the zone, 10.2 in T #2 near the center of the zone and 2.8 at the far end of the zone. Such metal zonation is typical of hydrothermal deposits.

The mineralized zone on Orma has an effective strike length of some 2400' and is defined by several showings and bulldozer trenches. The abundance and continuity of mineralization within this zone is largely unknown and requires further work. It is recommended that additional trenching and stripping of overburden be undertaken to better delineate the zone and establish the quantity of mineralization contained therein. A caterpillar D-7-C bulldozer is still on the RUSTY SPRINGS property and would be adequate for this work.

The nature of I.P. (P.F.E.) anomalies obtained from last summer's geophysical program at RUSTY SPRINGS is largely unknown. Two of three drill holes which penetrated the lower contours of an I.P. anomaly were heavily pyritic and could possibly represent a peripheral Fe cap surrounding bodies of Cu, Zn and Pb sulphide. It is recommended that the highest contours of these I.P. anomalies be drilled to a depth of at least 300', preferably using the same type of drilling equipment as used in this year's program. Prime

targets for drilling are designated I.P. #1 to #3 (Figure 3) and are located as follows:

I.P. #1:	Lines 19+00S - 42+00E
I.P. #2:	Lines 1+00N - 25+00E
I.P. #3:	Lines 55+00S - 40+00E

The gravity anomaly located on Orma Hill was penetrated by a total of 11 drill holes; four of these had significant mineralization and several showings are also located in this gravity anomaly. The anomaly may be due to a high amount of silica, sulphate and sulphide on Orma Hill but it cannot be stated with certainty that the other gravity anomalies on the property also host mineralization as these other anomalies have not been drilled. It is therefore recommended that the strongest of these gravity anomalies be drilled in the same manner as that used for the I.P. anomalies. Prime targets are designated G #1 to #3 and are located as follows:

G #1:	Lines 7+00S - 10+00E
G #2:	Lines 47+00S - 33+00E
G #3:	Lines 5+00N - 6+00E

I.P. anomalies #1 and #2 and gravity anomaly #3 are located on the valley floor and should be drilled in late winter/early spring before the ground thaws and becomes swampy and muddy. I.P. anomaly #3 and gravity anomalies #1 and #2 are located on the flanks of Mike Hill and could be drilled later as poor ground is not an important factor.

In conclusion, the RUSTY SPRINGS property holds good potential for the discovery of economic Cu, Pb, Zn and Ag sulphide mineralization and this potential should be exploited by bulldozer trenching and diamond core drilling of established targets.

APPENDIX

=====

DIAMOND DRILL HOLE LOCATIONS, 1980

DDH 80-1	-	0+00 , 0+50W
80-2	-	1+00S, 1+10W
80-3	-	1+20S, 1+10W
80-4	-	1+50S, 1+80W
80-5	-	2+60S, 1+90W
80-6, 7	-	3+50S, 3+00W
80-8	-	2+00S, 3+00W
80-9	-	5+00S, 3+00W
80-10	-	5+00S, 1+50W
80-11	-	1+00S, 7+00W
80-12	-	3+00S, 6+50W
80-13	-	5+00S, 7+00W
80-14	-	3+00N, 5+00W
80-15	-	6+00N, 5+00W
80-16	-	8+00N, 5+00W
80-17	-	8+75N, 2+60W
80-18	-	12+40N, 3+30W
80-19	-	10+15N, 1+30W
80-20, 21	-	8+75N, 0+75W
80-22	-	1+00S, 1+00E
80-23	-	3+00S, 0+95E
80-24	-	2+70S, 3+60E
80-25, 26	-	2+00N, 6+30W

(Orma Grid System)



Figure 1

*Note: diamond drill holes prefixed:
 ○ DDH 78-7 etc. drilled 1980
 ○ DDH 78-1 " " " 1978
 ○ DDH 1 " " " 1977

Geology of Orma Hill, Kusty Springs, 1980. (Orma grid line)
 Scale: 1" = 100' Drawn by: J. Bankowski, August, 1980.
 ○ - diamond drill hole location, o/b - overburden (vegetation)
 --- assumed contact, - - - observed contact, imaginary contact.

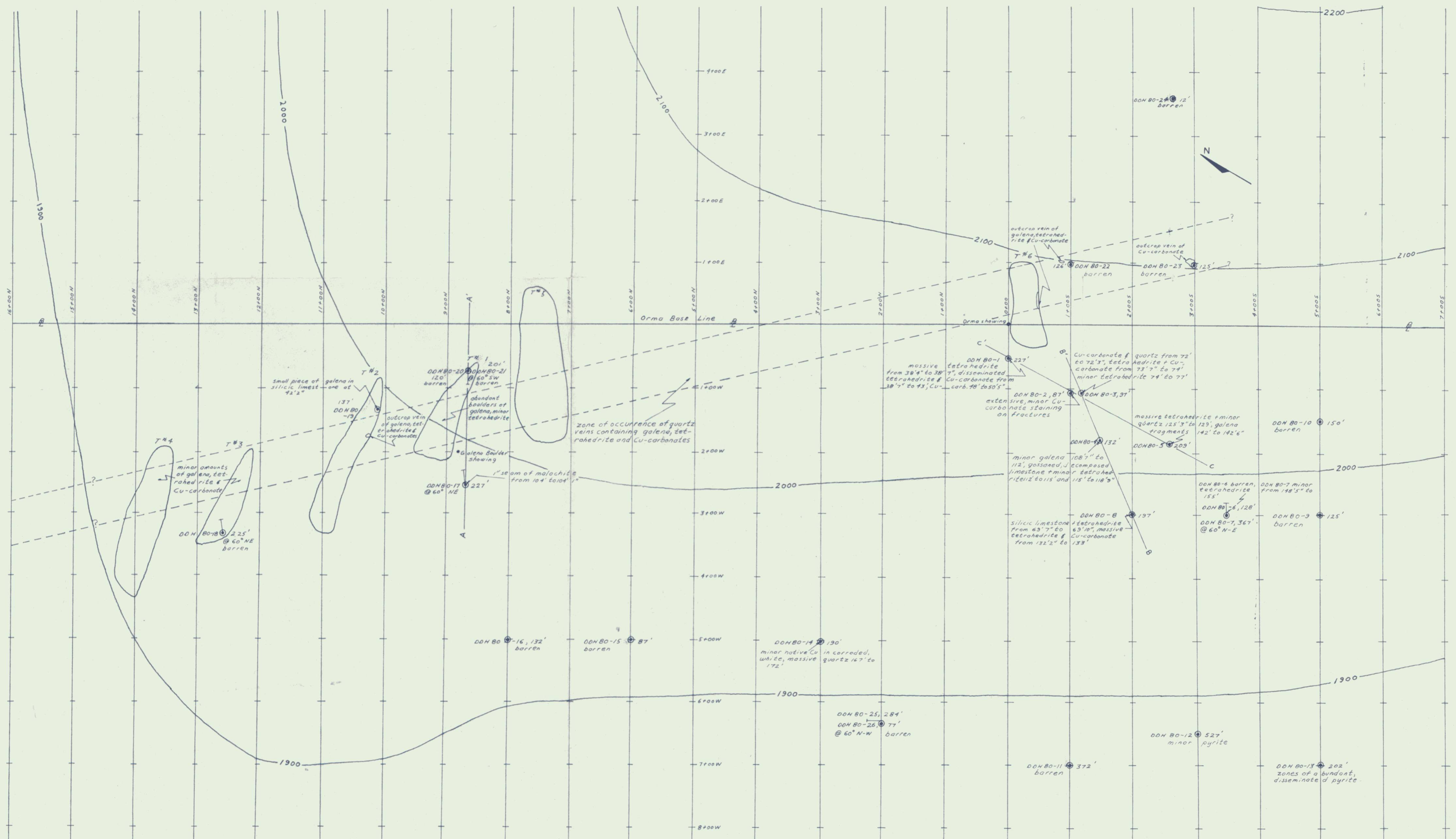


Figure 2

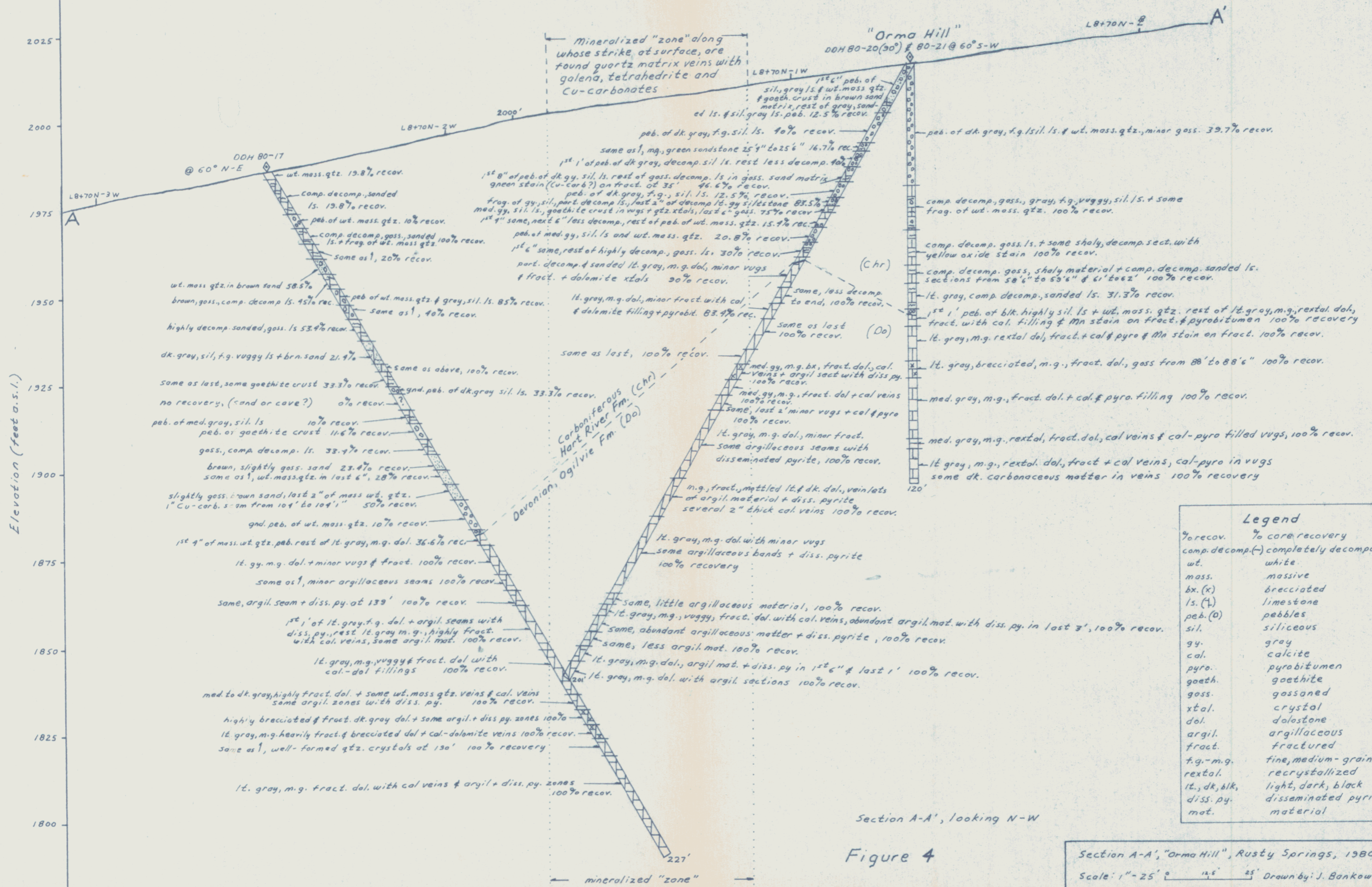
Diamond Drill Hole and Trench Location Map
 Orma Hill, Rusty Springs, 1980.
 Scale: 1" = 100' Drawn by: J. Bankowski



- 50 P.F.E. anomalies (percent)
- 3.00 Bouguer Gravity anomalies (MGAL)
- ⊕ Mineralized showings
- ⊙ 78-16 Diamond Drill Holes

Figure 3

Composite Map showing Geophysical Anomalies & Diamond Drill Holes (1977, 1978 & 1980) (+ showings) Rusty Springs, 1980. Scale: 1" = 500' 250 500 Drawn by: J. Bankowski, Aug./80



Legend	
% recov.	% core recovery
comp. decomp. (-)	completely decomposed
wt.	white
mass.	massive
bx. (x)	brecciated
ls. (l)	limestone
peb. (o)	pebbles
sil.	siliceous
gy.	gray
cal.	calcite
pyro.	pyrobitumen
goeth.	goethite
goss.	gossaned
xtal.	crystal
dol.	dolostone
argil.	argillaceous
fract.	fractured
f.g.-m.g.	fine, medium-grained
rextal.	recrystallized
lt., dk., blk.	light, dark, black
diss. py.	disseminated pyrite
mat.	material

Section A-A', "Orma Hill", Rusty Springs, 1980.
Scale: 1" = 25' 0" 12.5' 25' Drawn by: J. Bankowski

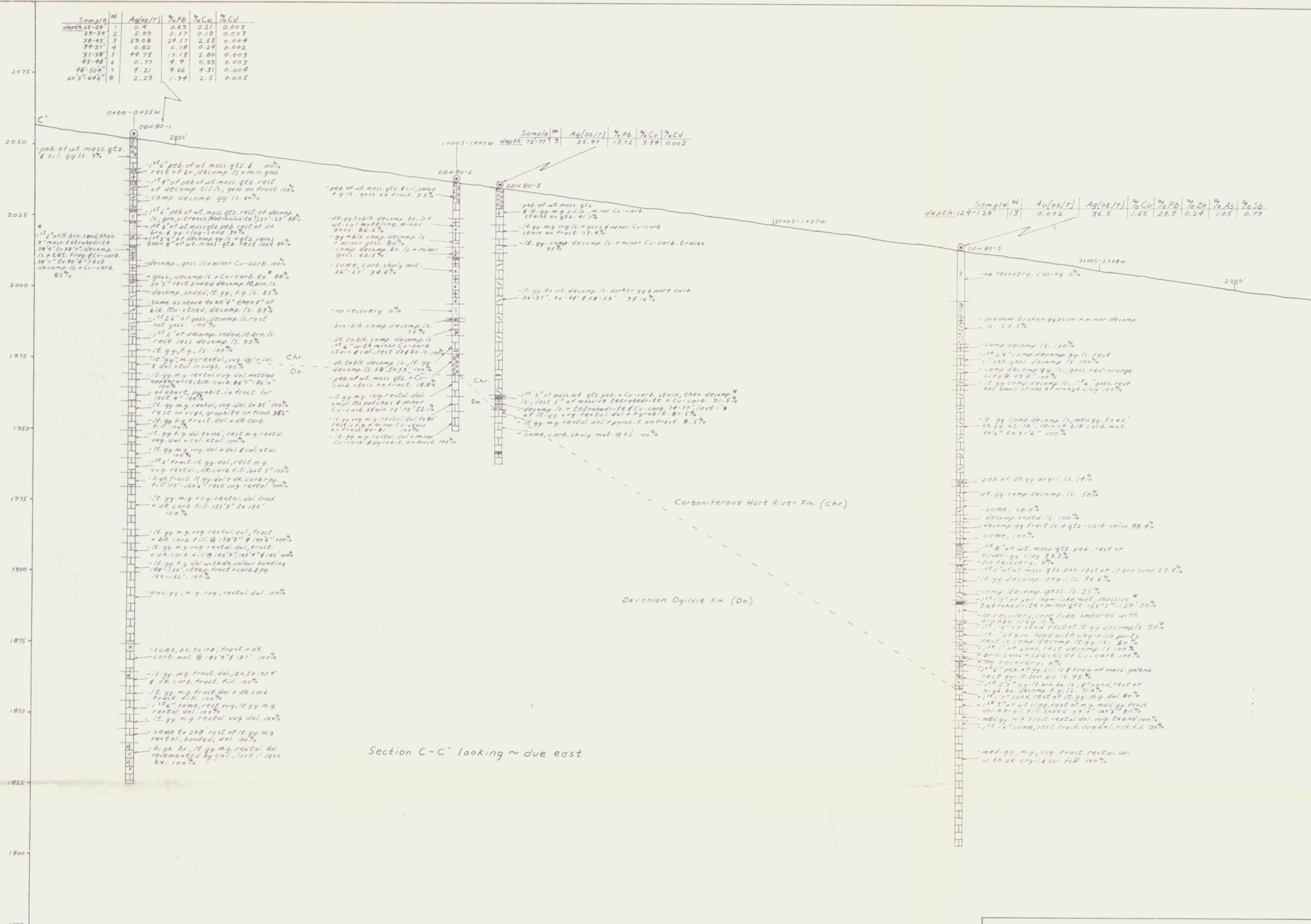


Figure 6

Cross-section C-C', Ormo Hill, Rusty Springs, 1980.
 Scale: 1" = 25'
 Drawn by: J. Bankowski, Aug. 1980
 (refer to cross-section A-A' for legend)



Certificate of Analysis

TO Rio Alto Explorations
Box 4550
Whitehorse, Yukon

REPORT NO. A-40-29

DATE August 22, 1992

Page 10

I hereby certify that the following are the results of analyses made by us upon the herein described rock samples

MARKED	oz./ton	%	%	%					
	g	Cu	Pb	Zn					
DOH 80-16 { 31 100'-125'	0.07	0.01	0.05	0.05					
32 125'-132'	0.02	0.01	0.04	0.04					
T#6 (tet. chips) 0-1	408.0	25.8	7.90	2.11					
geochem. 0-2 0+50S, 0+20E	8.69	0.80	2.20	0.06					
soil 0-3 " 0+30E	9.05	1.00	2.00	0.09					
samples 0-4 " 0+40E	0.10	0.67	2.10	0.00					
0-5 " 0+50E	1.09	0.24	1.49	0.02					
0-6 " 0+60E	0.25	0.00	0.71	L0.01					
0-7 " 0+70E	0.42	0.09	1.99	0.01					
Tetrahedrite sh. TS-1 (tet. chips)	111.0	4.25	39.4	0.80					
T#2 (tet. chips) T2-1	204.0	11.8	28.0	1.36					

L denotes less than

BONDAR-CLEGG & COMPANY LTD.

NOTE:

Rejects retained two weeks
Pulps retained three months
unless otherwise arranged.

Steve Leppin

RIO ALTO

EXPLORATION LTD.

Telephone 403 / 261-6661 • Suite 710, 610 8th Avenue S.W., Calgary, Alberta, Canada T2P 1G5

19 June 1980

RUSTY SPRINGS FIRE ASSAY RESULTS: sample run NO. 1-80

SAMPLE NO.	oz/ton Ag	% Pb	% Cu	% Cd	
00H 80-1 {	1 25'-29'	0.4	0.69	0.21	0.003
	2 29'-34'	2.99	0.57	0.19	0.003
	3 38'-43'	59.08	24.57	2.53	0.004
	4 34'-37'	0.82	0.78	0.24	0.002
	5 37'-38'	44.73	17.13	2.80	0.003
	6 43'-48'	0.77	4.4	0.99	0.003
	7 48'-50'4"	4.21	4.66	4.31	0.004
	8 60'3"-64'6"	2.29	1.94	2.5	0.005
00H 80-3 — 9 72'-77'	25.47	13.72	3.34	0.002	
00H 80-4 {	10 108'7"-112'6"	1.41	0.75	0.05	0.001
	11 112'6"-115'	8.97	9.94	0.90	0.002
	12 115'-119'4"	1.16	0.3	0.25	0.003

NOTE: THESE RESULTS TELEPHONED FROM E.A. BROWNLESS (CALGARY) TO P.S. WHITE (WHITEHORSE) JUNE 19 11 am 1980- AND HAVE NOT BEEN RECONFIRMED BY CHECKING WITH THE ACTUAL ASSAY SHEETS.



BONDAR-CLEGG & COMPANY LTD.

136B INDUSTRIAL RD, WHITEHORSE, YUKON Y1A 4X1

PHONE: (403) 667-6523

TELEX: 036-8-460

Certificate of Analysis

TO Paul White & Associates
2151 - 2nd Avenue
Whitehorse, Yukon

REPORT NO. ... A - 40 - 66

DATE ... July 31, 1980

I hereby certify that the following are the results of analyses made by us upon the herein described rock samples Rusty Springs

MARKED	oz/ton	oz/ton	%	%	%	%	%		
	Au	Ag	Cu	Pb	Zn	As	Sb		
00H 80-5 #10 121'-129'	0.002	36.5	1.65	23.3	0.24	1.05	0.79		
00H 80-6 #14 132'1"-132'10"	L0.002	26.3	2.99	16.5	0.31	1.30	0.58		

L denotes less than

BONDAR-CLEGG & COMPANY LTD.

NOTE:

Rejects retained two weeks
Pulps retained three months
unless otherwise arranged.

Steven Simpson

19 June 1980

GEOCHEM SAMPLES FROM FIRST RUN - GENERAL TESTING LAB. VANCOUVER B.C. - LARRY WONG

SAMPLE	AU	Ag	Pb	Zn	Cu	<u>all in p.p.m.</u>
80-2 { A 21 12'-18'	-	19.7	314	747	143	
80-2 { A 22 18'-37'	-	19.5	170	1037	24	
80-2 { A 23 37'-54'	-	16.1	134	802	835	
80-2 { A 24 54'-59'	-	12	600	990	924	
80-3 { A 31 0-22'	-	14	475	698	1000 +	
80-3 { A 32 22'-37'	-	17.5	172	952	628	
80-3 { A 33 37'-57'	-	9.0	88	971	30	
80-3 { A 34 57'-72'	-	19.3	362	912	345	
80-4 { A 41 0-22'	-	19.9	104	1350	60	
80-4 { A 42 22-42	-	21.8	70	1200	130	
80-4 { A 43 42-62	-	8.4	1150	1175	462	
80-4 { A 44 62-82	-	12.5	148	1120	61	
80-4 { A 45 82-102	-	7.7	282	865	246	
<hr/>						
80-2 { B21 12'-26'	0.01	22.2	400	865	176	
80-2 { B22 26'-49'	.04	16.8	170	1080	31	
80-2 { B23 49'-54'	.03	44.2	364	738	956	
80-2 { B24 54'-59'	.01	13.4	460	950	851	
80-3 { B 31 22'-37'	.01	16.5	176	1045	468	
80-3 { B 32 37'-57'	.03	5.4	78	990	45	
80-3 { B 33 57'-72'	.01	20.6	502	950	400	
80-4 { B 41 0-22	.03	18.4	180	1350	57	
80-4 { B 42 22-42	.03	21.8	66	1120	116	
80-4 { B 43 42-62	.01	8.8	825	1120	400	
80-4 { B 44 62-82	.03	17.2 (12.2?)	100	1080	46	
80-4 { B 45 82-102	.03	7.3	218	770	283	

NOTE: ABOVE RESULTS TRANSCRIBED FROM PHONE CALL LEE RUDICHUK CALGARY TO PS WHITE HORSE 19 June 3 PM. and HAVE NOT BEEN CROSS CHECKED AGAINST ACTUAL ASSAY SHEETS.



BONDAR-CLEGG & COMPANY LTD.

136B INDUSTRIAL RD, WHITEHORSE, YUKON Y1A 4X1

PHONE: (403) 667-6523

TELEX: 036-8-460

Certificate of Analysis

TO Rio Alto Explorations
Box 4550
Whitehorse, Yukon

REPORT NO. A-40-99

DATE September 17, 1980

I hereby certify that the following are the results of analyses made by us upon the herein described rock samples

MARKED	%	%							
	As	Sb							
0 - 1 T#6 (tetrahedrite chips)	10.4	5.20							

BONDAR-CLEGG & COMPANY LTD.

NOTE:

Rejects retained two weeks
Pulps retained three months
unless otherwise arranged.

Steven Simpson



BONDAR-CLEGG & COMPANY LTD.

136B INDUSTRIAL RD, WHITEHORSE, YUKON Y1A 4X1

PHONE: (403) 667-6523

TELEX: 036-8-460

Certificate of Analysis

TO Rio Alto Explorations
Box 4550
Whitehorse, Yukon

REPORT NO.

DATE

I hereby certify that the following are the results of analyses made by us upon the herein described rock samples

MARKED	oz/ton	%	%	%					
	Ag	Cu	Pb	Zn					
DDH 80-11 {	01 25'-50'	0.26	0.05	0.06	0.45				
	02 50'-75'	0.13	0.02	0.04	0.28				
	03 75'-100'	0.16	0.02	0.03	0.29				
	04 100'-125'	0.09	L0.01	0.02	0.06				
	05 125'-150'	0.12	L0.01	0.01	0.04				
	06 150'-175'	L0.05	L0.01	0.02	0.03				
	07 175'-200'	0.07	L0.01	0.01	0.05				
	08 200'-225'	0.13	0.01	0.01	0.03				
	09 225'-250'	0.06	L0.01	L0.01	0.10				
	10 250'-275'	L0.05	L0.01	L0.01	0.03				
DDH 80-14 {	11 275'-300'	L0.05	0.01	L0.01	0.09				
	12 300'-325'	L0.05	0.01	0.04	0.09				
	13 325'-350'	L0.05	L0.01	L0.01	0.01				
	14 350'-372'	L0.05	L0.01	L0.01	0.01				
	15 0-25'	0.16	0.02	0.03	0.11				

BONDAR-CLEGG & COMPANY LTD.

NOTE:

Rejects retained two weeks
Pulps retained three months
unless otherwise arranged.

Steven Simpson
.....



Certificate of Analysis

TO Rio Alto Explorations
Box 4550
Whitehorse, Yukon

REPORT NO. 1-10-??

DATE August 22, 1990

Page 2

I hereby certify that the following are the results of analyses made by us upon the herein described rock samples

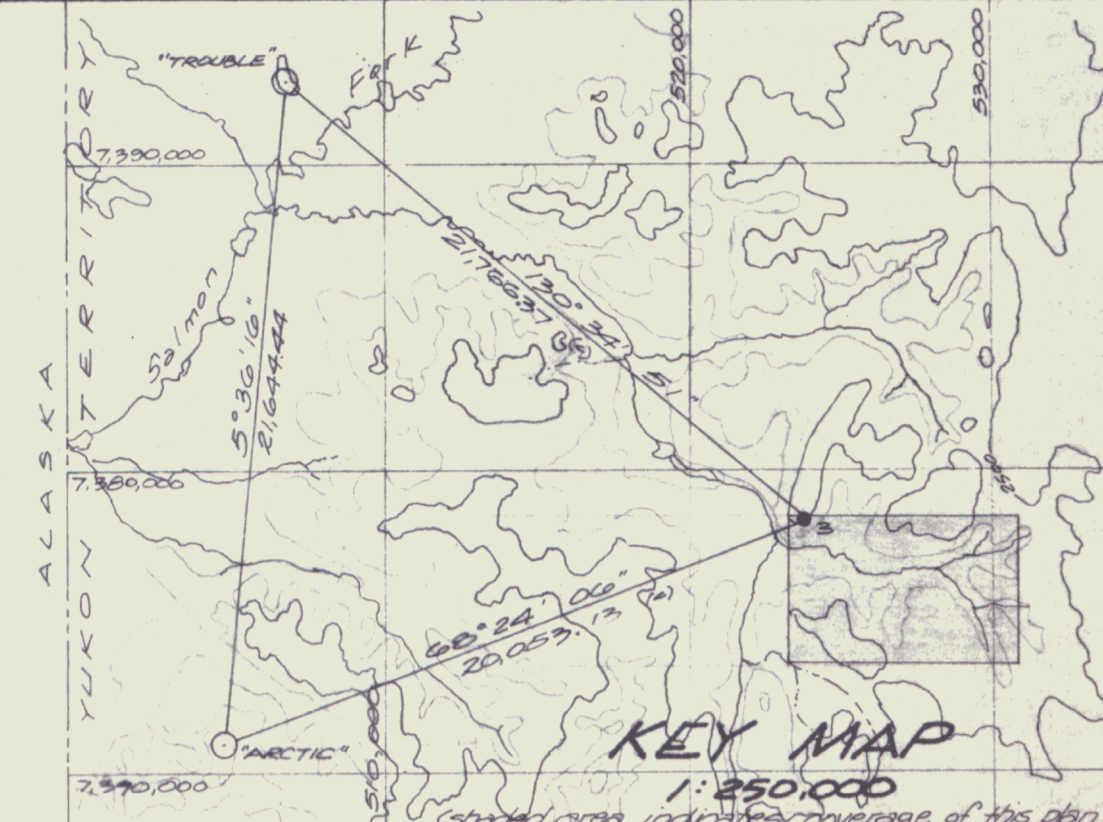
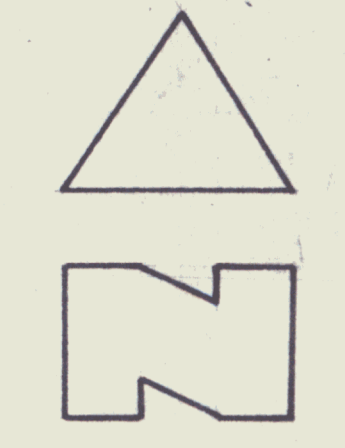
MARKED	oz/ton	%	%	%					
	Ag	Cu	Pb	Zn					
DDH80-14 {	16 25'-50'	0.06	0.01	0.01	0.19				
	17 50'-75'	0.09	0.01	0.02	0.17				
	18 75'-100'	0.10	0.01	0.01	0.62				
	19 100'-125'	0.05	0.01	0.01	0.04				
	20 125'-150'	0.07	0.01	0.07	0.50				
DDH80-15 {	21 150'-175'	0.18	0.03	0.09	0.58				
	22 175'-190'	27.2	0.69	5.00	0.07				
	23 0'-25'	1.39	0.05	0.41	0.11				
	24 25'-50'	0.15	0.01	0.06	0.00				
	25 50'-75'	0.19	0.01	0.06	0.01				
DDH80-16 {	26 75'-87'	0.28	0.02	0.04	0.17				
	27 0'-25'	0.12	0.03	0.07	0.07				
	28 25'-50'	0.12	0.02	0.13	0.13				
	29 50'-75'	0.09	0.01	0.05	0.08				
	30 75'-100'	0.20	0.01	0.05	0.09				

BONDAR-CLEGG & COMPANY LTD.

NOTE:

Rejects retained two weeks
Pulps retained three months
unless otherwise arranged.

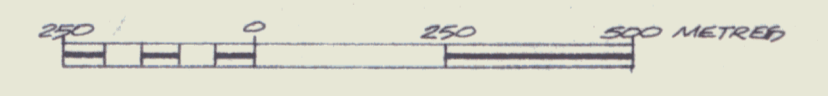
Steven Lempin
.....



UTM COORDINATES

STATION	UTM COORDINATES	
	NORTHING	EASTING
CONTROL STATIONS		
TROUBLE	7,372,433.01	507,174.42
ARCTIC	7,370,952.04	509,060.60
2	7,376,072.66	525,050.62
3	7,378,333.55	527,057.74
4	7,378,106.76	527,034.06
CS	7,372,470.76	527,143.44
CG	7,376,624.13	526,401.26
LOCATION POSTS		
1	7,374,564.35	526,986.70
2	7,376,190.45	527,003.33
3	7,375,740.64	527,047.69
4	7,375,285.92	527,007.16
5	7,373,163.22	527,548.80
6	7,375,423.03	526,644.73
7	7,375,855.58	526,684.66
8	7,376,280.68	526,711.81
9	7,376,734.83	526,726.63
10	7,375,964.10	527,700.32
11	7,376,356.33	527,753.36
12	7,377,241.50	527,832.64
13	7,377,003.33	526,931.61
14	7,376,243.44	529,605.56
15	7,376,047.94	529,594.73
16	7,375,800.26	529,583.13
17	7,375,371.67	529,574.66
18	7,375,565.78	527,611.75
19	7,374,737.22	527,541.57
20	7,376,803.53	527,794.81
21	7,375,005.71	526,513.02
22	7,374,224.11	526,955.07
BASELINE STATIONS		
1300N	7,376,520.67	527,070.56
1400S	7,375,814.71	527,493.61
5500S	7,374,725.48	526,172.15

LOCATION PLAN
RUSTY SPRINGS AREA
 YUKON TERRITORY
 FOR
 RIO ALTO EXPLORATION LTD
 AND
 PAUL S WHITE MANAGEMENT
 SCALE 1:10,000



LEGEND

- Control Stations
- Baseline Stations
- Location Posts
- Geophysical Grid

Coordinates have been derived from those published for topographic stations "TROUBLE" and "ARCTIC" and are referred to the 141° W Meridian of Longitude.

Distances used in coordinate calculations have been reduced to the projection plane by a scale factor of 0.99950. These distances are shown on plan.

21 CLAIM NO.
 (1A)2846 GRANT NO.

Prepared by
MBW SURVEYS
 Whitehorse Yukon Territory