HIAWATHA RESOURCES INC.

GEOCHEMICAL - GEOLOGICAL REPORT

HIAWATHA GROUP OF CLAIMS

(ROZAN & O.G.G. GROUPS)

NELSON M.D. B.C. NTS 82-F-6 W/2



by

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Osoyoos B. C. May 30, 1990

20131

Province of British Columbia — Ministry of Energy, Mines and Petroleum Resources

# ASSESSMENT REPORT TITLE PAGE AND SUMMARY

TYPE OF REPORT/SURVEY(S): Geochemical - Geological

TOTAL COST: $8,099.33

AUTHOR(S): P.H. Sevensma, Ph.D., P.Eng. SIGNATURE(S): [signature]

DATE STATEMENT OF EXPLORATION AND DEVELOPMENT FILED: May 1, 1990 YEAR OF WORK: 1989-90

PROPERTY NAME(S): Hiawatha Group (OGG Group and Rozan Group combined, 46 units + 31 units = 77 units)

COMMODITIES PRESENT: Au, tungsten, molybdenite, arsenic, bismuth)

B.C. MINERAL INVENTORY NUMBER(S), IF KNOWN:

MINING DIVISION: Nelson B.C. NTS: 82-F-6 W/2

LATITUDE: 49° 23' N LONGITUDE: 117° 22' W

NAMES and NUMBERS of all mineral tenures in good standing (when work was done) that form the property [Examples: TAX 1-4, FIRE 2 (12 units); PHOENIX (Lot 1706); Mineral Lease M 123; Mining or Certified Mining Lease ML 12 (claims involved)]:

Rozan (6 U); Gold 1-2 (2 U); Golden Eagle, 2, 3 & 5 (4 U); Eagle 1 & 2 (19 U); OGG 1-7 (46 Units)

OWNER(S)

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SUMMARY GEOLOGY (lithology, age, structure, alteration, mineralization, size, and attitude):

Granodiorite and "Silver King" porphyry, intruding Pliensbachian Elise volcanics and rusty Sinemurian Archibald sediments. Some production from high-grade quartz veins (146 tons @ 1.47 oz/t gold); also assaying copper, tungsten, molybdenum and bismuth.

REFERENCES TO PREVIOUS WORK: G. Salazar, Ass. Rep. 12720 (1984) and 14280 (1985) P.H. Sevensma 18088 (1988); 18741 (1989) and November 1989.

(over)

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## 1. INTRODUCTION

Three main Geochemical soil surveys by Hiawatha have been carried out on the Rozan and O.G.G. Group, two of which have been reported upon by the writer respectively in January, 1989 (Ass.R. 18188) on the Rozan property and in November 1989 on the O.G.G. Group (Ass. Rep.); the third survey was carried out late in 1989, on line 100 S on the O.G.G. from 800 W to 1750 W, and on the Rozan on lines 800 S and 1000 S from 50 E to 1500 E and 1700 E respectively, (to Spider Creek). All assays were by I.C.P. for 30 metals, and gold by Acid leach and AA on a 10 gm. sample, by Acme Laboratories. In addition, on line 800 S and 1000 S, 10 samples were assayed between 550 E and 1250 E on each line for tin, mercury and fluor values. Only fluor showed five values of interest above 1000ppm. Also, an older soil survey by Lacana in 1986, assayed by Acme, of 50 soil samples and 13 rock samples was reviewed as well as twenty assay data, taken by Hiawatha, on dump samples and vein outcrops, as rock samples, all 30 I.C.P. & Gold acid leach.

The three main surveys were combined and submitted to Prime Geochemical methods for graphic representation at 1:20,000 and study in relation to the underlying geology. Total samples studied are 684 + 87 for gold only, in the P.G. survey.

As well, a short geological survey on the North part of the Rozan was conducted by P. Santos, P. Eng in 1989, to determine possible relationships between the Silver King porphyry outcrops and high gold soil samples and to map the Northern extension of the area previously mapped.

2. PROPERTY

The property consists of the following claims, all contiguous:

| | Name | Record | Area | Anniversary Date |
|---|---|---|---|---|
| 1a | | | | |
| | Rozan | 1281 | 6 Units | October 5th, 1998 |
| | Gold 1 | 4464 | 1 Unit | October 22nd, 1998 |
| | Gold 2 | 4463 | 1Unit | October 22nd, 1998 |
| | Golden Eagle | 1629 | Rev. C.G. | April 1st, 1999 |
| | Golden Eagle 2 | 1004 | Rev. C.G. | April 3rd, 1999 |
| | Golden Eagle 3 | 1005 | Rev. C.G. | April 3rd, 1999 |
| | Golden Eagle 5 | 1006 | Rev. C.G. | April 3rd, 1999 |
| | Eagle 1 | 4961 | 4 Units | February 17th, 1994 |
| | Eagle 2 | 5029 | 15 Units | April 13th, 1994 |
| | | Sub Total | 31 | |
| 2a | O.G.G. 1 | 3696 | 12 | *May 8th, 1991 |
| | O.G.G. 2 | 3339 | 6 | *July 19th, 1991 |
| | O.G.G. 3 | 2623 | 3 | May 6th, 1991 |
| | O.G.G. 4 | 2732 | 4 | September 2nd, 1991 |
| | O.G.G. 5 | 2733 | 9 | *September 2nd, 1991 |
| | O.G.G. 6 | 2703 | 6 | *July 23rd, 1991 |
| | O.G.G. 7 | 3340 | 6 | *July 18th, 1991 |
| | | Sub Total | 46 | |
| | Total Units | | 77 | |

* Subject to approval of this report.

The claims are centered on about 117 degrees 21'W longitude and 49 degrees 24'N latitude, between elevations 7100' and 4200' (2200m and 1300m), NTS sheet 82-F-6, W/2 (Fig. 2).

The claims are accessible by a 16 km bushroad from the road at Blewett along Fortynine Creek to the Rozan portal at elevation 2030m or by a 10km bushroad up Hall Creek to Golden Eagle 2 on Rozan Creek to elevation 1630m, starting at Hall Siding on hiway 6 at elevation 2842 ft. (=870m).

Fortynine and Hall creeks are the only significant placer creeks south of Nelson outside of Erie Creek and Salmo River: both drain the Red Mountain area, where the old Rozan workings are located.

## 3. PHYSIOGRAPHY

The area is quite rugged and heavily forested, but has become more accessible by recent logging roads. This has encouraged renewed mineral exploration which has become increasingly active since about 1985. The mountain summits reach mostly around 7000' with one of the higher ones being Ymir Mountain at 7867' (2400m), on the NW slope of which the Whitewater ski area is located, about 12 km SE of Nelson as the crow flies.

The area lies about 50-100 km North of the South edge of the continental glacier which reached its maximum extent some 16,000 years ago (fig 1). Glacial cirques are therefore relatively small and mostly opening to the N or NW, and glacial overburden is scant above about 5000' (1500m) disappearing altogether at about 6500' (2000m). Above the 1500m contour, geochemical soil sampling can therefore be expected to provide values closely related to the underlying bedrock, and showing only a small downslope creep, if any. North facing slopes have deeper till than the South facing ones.

Notable glacial features encountered so far are a very solid hardpan at about 850 E on the Hall Creek road and some (6-10) 3 to 4 meter large rounded boulders where this road crosses Spider Creek (elev. =4300'=1310m). A ready explanation for these features is not available at present. The glacial history of the area may be more complex than appears at first glance. Hall Creek is a major glacial valley and may have been partially under the influence of the Spokane floods of about 15,000 years ago. Detailed studies since 1925 by Harlin Bretz and his followers have shown that a large glacier flowing down Kootenay Lake valley terminated in the general Pend'Oreille Lake area, thereby blocking the NW flowing Clark Fork - Pend'Oreille River system. This caused the large glacial Missoula Lake to rise to about elevation 4350, making the glacier float when the ice dam was 2000 feet high, backing up an estimated 500 cubic miles of water. This lake would then empty and flood for a short period all the rivers flowing SW from Spokane over the Miocene Columbia basalt plateau to the Columbia River at the Wallula Gap South of Pasco, Washington. It has been estimated that the Clark Fork and Flathead Rivers carried between 8 and 10 cubic miles of water per hour for a few days. There is no doubt that Missoula Lake and these floods must have had a repercussion across the 49th parallel, especially along the N and NW flowing Pend'Oreille river, which joins the Columbia at Waneta a few miles south of Trail, at a present elevation of about 1500 feet, versus Nelson at about 1740 feet. High benches and flood lake sediments show that at least 40 of these floods must have occurred (Fig. 1).

4. GEOLOGY

The claim area covers part of the Rossland Volcanics. This formation is now under active mineral exploration from Rossland to Nelson, and under active geological investigation by Trygve Hoy and K. Andrew since 1987 for the B. C. Geological Survey.

Fig. 2A shows the extent of the Rossland Volcanics South of Nelson to the U.S. Border, and Fig. 2B shows the Section between Nelson and Ymir. The latter shows the geological framework of the Hiawatha property (Fig. 7).

Of importance is the Archibald formation cut by the major Red Mountain Fault bringing it in contact with the later Upper Elise lapilli and crystal tuffs. To the East it is in normal contact with the overlying Lower Elise mafic pyroclastic and flow breccias, in turn overlain by the later Hall formation syncline which continues to the N and NW in the wide Silver King shear, containing the old Silver King Copper-Silver Mine and the Lectus-Pacific Sentinel copper-gold deposits now being drilled. The shear runs into the Granite Poorman "pseudo-diorite" area, which may be related to the Silver King porphyry. The latter porphyry was originally labelled as "quartz diorite" porphyry and is also described as "andesite porphyry". It is known in the Second Relief mine and in the Rossland Mines. It is in fact a diorite porphyry of a type also associated with mineralization in both Central and Northwest B. C., as observed by the writer. On the Hiawatha land, this diorite porphyry occurs in two large masses, trending NW and along which substantial high gold soil anomalies occur, as demonstrated by Pec Santos, P. Eng., in mapping during 1988 and especially in September, 1989 (fig. and text, appendix).

The Archibald Formation, named after its type location on Archibald Creek South of Meadows on Salmo Sheet 82 F/3, also called the Sinemurian beds on the basis of Arnioceras fossils, consists mostly of a fining upwards series of interbedded siltstone and impure grey sandstone in beds 3 to 4 centimeters thick, overlain by a finer grained sequence of rusty weathering, tan siltstones intercalated with grey to black silty argillite and minor graphitic argillite. Near the top of the section in both Erie Creek and Red Mountain, there are a few basaltic andesite flows or sills from 2 to 10 meters thick. This succession correlates with a similar section at the top of the Ymir group (Hoy and Andrew, 1989).

The Archibald is in gradational contact with the overlying lower Elise massive augite porphyry flows with fine argillaceous partings: in some areas a few centimeters thick coquina bed forms the transition (Mulligan, 1952), not observed on Red Mountain.

The base of either the Archibald Formation or the Ymir Group is nowhere exposed, but the Ymir is shown with an inferred contact on possible Lower Cambrian East of Ymir Mountain (Map 1144A, 1964) and about 5km South of Salmo, both small areas only a few km long.

The Elise Formation volcanics are correlated with the shoshonitic volcanics of Tillicum Mountain extending Northward through the Horsefly area into the Toodoggone area, all representing parts of a volcanic arc at its time of cessation of subduction and docking with the Kootenay arc lands to the East, (Ray and Spence, B. C. Geological Fieldwork, Paper 1986-1).

It is of more than passing interest that these volcanics of - Sinemurian-Pliensbachian-Toarcian - times correspond to the formations in the Iskut Golden Triangle, where rocks are also of a high potassium character but in an alkaline intrusive environment (Anderson, G.S.C., Paper 89-1E, P. 145-154), as observed by the writer in the Johnny Mountain area in the early 1980'S (Western Miner, June 1982), during a prolonged period of mineral exploration and where fossils have given the same age span of Sinemurian-Toarcian.

5. MINERAL OCCURRENCES

These are summarized by Hoy & Andrew, B. C. Fieldwork, 1989-1 as follows (Fig. 2B):

a. Rossland: Produced 84,000 kg gold, 105,000 kg silver
b. Nelson Area: Produced 16,750 kg gold, 140,000 kg silver including Ymir area on attached map, in the following categories:

1). Porphyry or stockwork Mo-Cu
2). Skarn Mo, W, Cu, Au
3). Vein gold, silver, Cu; gold, silver, lead, zinc
4). "Conformable gold"

The map includes: 5 porphyry types, 5 skarns, 26 veins of gold-silver-copper, 43 gold, silver, lead, zinc veins, 10 gold-silver veins, 4 "conformable gold" for a total of 93 producers and showings.

However, new developments are occurring all the time and there are now more additions. Some of the silver-gold-lead-zinc veins are probably more gold-copper, especially in the center of the area, like Hiawatha, where the silver-lead-zinc is very weak in the 146 tons reportedly produced and where copper predominates in the dump ore , except for a recent Hiawatha (801) rediscovery on the Eagle 2 claims. Moreover, the minfile for the area, which was due out earlier, has not yet appeared. Statistically, with at least 93 showings and former producers, the camp seems to be missing the one or more big producers that so often form the "epicentre" of a mining district.

In the Rossland area, the 10 main producers are grouped in a small area about 4000 feet by 2000 feet (=1220m by 610m) (Gilbert, 1941) with another 35 small producers and showings as a halo in a total area of 8x10km, versus Nelson's 25x25 km.

The main skarn-type deposits in the Nelson area is the Second Relief (Fig 7), classified by Ettlinger and Rae (B.C.G.S.B., Paper 1989-3) as a skarn. Rossland is not in their list as a skarn, but the description by R. Boyle (G. S.C. Bulletin 280, 1979) mentions wollastonite, actinolite, garnet, epidote, prehnite and tourmaline, suggesting a probable skarn relationship. Neither Rossland nor Second Relief have limestone reported in their wallrocks.

North of the Kootenay River, the Monarch and the Orinoco are listed as copper-gold skarns, but their production figures suggest they are copper-silver deposits, as is the Queen Victoria in this area, with pseudo-diorite wallrocks and a possible Silver King type connection. The Granite-Poorman Mine as does the Vanango prospect nearby, test producing gold and tungsten, lies in the same formation.

## 6. SOIL SAMPLING

Soil sampling was conducted in several steps, by extending the grid as required by previous results.

The last lines not reported previously are:

| | | |
|---|---|---|
| 1+00S from 800 W to 17+50W | | 20 Samples |
| 8+00S from 0+50E to 15+00E | | 30 samples |
| 10+00S from 0+50E to 17+00E | | 34 samples |
| All samples spaced at 50M: | Total | 84 samples |

All these samples were assayed by ICP for 30 metals, plus Au acid leach/AA in ppb. In addition 8+00S from 5+50E to 10+00E and 10+00S from 8+00E to 12+50E were assayed for Hg (ppb), and Sn and F in ppm, although it is not certain that the original drying of the samples was done below 55 degrees to preclude evaporation of Hg and F. Total 20 samples.

At this stage, the total program was large enough to prepare badly needed individual metal maps for a graphic representation by Prime Geochemical Methods (Dr. Stan Hoffman) which was completed, December 15, 1989 (see appendix).

As a result, the above 20 samples for Hg, Sn and F were run in January 1990.

In the field, all samples were taken by trowel of the "B" zone at 8" - 12" deep, placed in a kraft bag and shipped to Acme Analytical Laboratories, where drying was completed. .500 grams were then taken of the -80 mesh portion, digested with 3 ml of 3-1-2 HCL-HNO3-H20 at 95 degrees C for one hour and diluted to 10 ml with water. This leach is partial for some metals and limited for Na, K and Al and probably Bi. Gold requires a special acid leach followed by atomic absorption (AA) on a 10 gm sample; a standard Inductively Coupled Plasma-atomic emission spectroscopic method is used to determine simultaneously 30 metals. The assay results can be recorded on a diskette, and value maps for each of the 30 metals produced by computer. For the Hiawatha project, which covers a relatively large area, a scale of 1:20,000 was selected and 27 maps produced, 15 of which were extensively used and 2 tables prepared for 23 samples of special interest for soils and 38 samples of rock assays of special importance.

The best interpretation is by hand contours of the highest areas, which gives more significant results than computer contouring, and can take into consideration the underlying rock formations. Extensive practice by the writer since 1957 in New Brunswick, B.C. and the Yukon has shown this manual part of the interpretation to be more satisfactory than a mechanical method, especially in the case of gold, where resistant discreet particles are maybe more important than the hydro geochemical effects.

The results should be considered by individual metals in order of decreasing importance, which in the case of Hiawatha can be listed as follows:

Au, W, Zn, Cu, As, Mo, Bi, Pb, Ag, Ni, Co, Mn, Fe, Ba, Sr, and K.1.

1. Gold. There is a strong NW trend, with most highs in the shaft area. Check samples showed that highs could be obtained in low assay locations, and sometimes the reverse. This is mainly due to coarse particles. Sampling with assaying of the +80 mesh metallics or, not as good, total crushing of the sample to - 80 mesh, is required. Both these methods can improve the results in a spectacular manner. The gold is very wide-spread in values of 20-80 ppb, which is very unusual for the general area, as highs often tend to be narrow, with 5-10 ppb on either side on many properties in the area.

   High gold is concentrated along the diorite porphyry contacts, especially in the granodiorite areas. In this first pass not much attention has been paid to the possible presence of monzonite, or to the alteration, except the well visible epidote and magnetite in the high potassium area from 00N-700W to 300W to 100N-650W to 300W to 150N + 125W, where Elise augite porphyry, the diorite porphyry and the "granodiorite" join.

2. Tungsten, W. To the NW close to the Kootenay river, scheelite occurs as streaks and blebs in the Granite Poorman ore, now being test mined by a private company, Algoma Resources. The Hiawatha tungsten anomalies are comparable to those found above the Ima Mine, Lemhi Cy, Idaho, showing W, Mo,and Cu some 300' to 1400' above a small granitic intrusive, and offset to the side. The Mo anomayly is slightly weaker than the Hiawatha one and is closely related to the Copper anomaly, which runs to a 400 ppm center, somewhat stronger than the Hiawatha anomaly. The W in the soils is centered like the others, where it reaches over 80 ppm, but it is quite extensive. The anomalies appear related to the up-dip projection of the tungstenbearing quartz veins emanating from the mineralized granite stock (G. S. C. Special Vol 11, 1971). The mineral is huebnerite, i.e. $MnWO4$.

   Associations scheelite-gold are well known, like the Dublin Gulch gold-scheelite placers derived from the Potato Hills, Yukon, the Red Rose Mine near Hazelton and many others.

   An interesting case of Cu & W skarn is mentioned from China, the report of which shows the Russian training in the absence of any factual data like location, scale, orientation, values, etc. The latter are shown as inner, middle and outer-zones and no ore tonnages or ore grades are mentioned, nor any anomaly values. (Hsia Kuo Chih, 1979, G. S. C. Ec. Geol. Rep. 31) (Fig. 3).

   Of the 37 rock samples on our list, 591, 592, and 593 are samples of our examination ore, and 580018, 19, and 20 are assays of quartz veins, as are 702 to 705, while 701 is a sample of "High" copper in metaseds adjoining diorite porphyry. In many cases in the literature, high tungsten is associated with diorites, like in the Red Rose. In the Salmo area, tungsten and lead-zinc were produced in the Jersey-Emerald Mine.

   On our list of 22 soils, LRD 003 confirms 701 as a Cu-W zone, all "high" golds LD001, 7, 9, 19, 20, 22, and 23 are all W anomalous, and nine other anomalous W are associated with various peaks in gold, molybdenum, copper & zinc (in Archibald), manganese, and bismuth.

   Tungsten is therefore an important indicator mineral for both gold and base-metals in this area.

3. Bismuth. Occurring only sporadically, Bi is nevertheless very important, as it occurs mainly in high gold rock and ore samples of list 1. Antweiler and Campbell (Precious Metals North Cordillora, Vanc., 1981) have clearly shown in Gold in Exploration Geochemistry, that Bi is a nearly ubiquitous trace element in native gold of various origins, and that various additional trace elements plus the Bi, can be indicative of either mesothermal gold, hypothermal gold or porphyry-copper gold.

Pb is present in nearly all categories and tungsten seems to be indicative of porphyry copper-gold deposits. These conclusions are mainly based on a number of deposits in the Absaroka Mountains of Wyoming and Montana.

Outside of Bi in gold, bismuth minerals may also occur.

In Hiawatha ground, good bismuth values occur in all rock samples of high to medium gold values (588 to 592), 58019-20, 702-705, 801 (hi Pb, Zn, Ag, Cu).

Bismuth is a valuable indicator in ore and rock samples, and may be a good pathfinder for gold in soils above 3 ppm.

Study of gold samples from placers in Hall Creek or Nine Mile may indicate a gold porphyry copper origin if both bismuth and tungsten are present as trace elements as an alloy of gold. Ettlinger and Ray (B. B. G. S. B2 1989-3), p85 and page 93, note that the presence of lead, nickel and more commonly, Bi tellurides appear to be a characteristic of many end-number gold skarns, which suggests that anomalous tellurium and bismuth are good geochemical indicators of the skarn's gold potential. This suggests that the weak Bi-anomaly on the Westside of our survey, near the Copper Mountain road, warrants a closer grid, say 20 m onlines 100 m apart, followed by stripping by backhoe over the best values.

4. Molybdenum, Mo. This is a definite but minor constituent of the ore collected on the dump and in the HW underground (Rocks 588 to 592, and 33597). In the soils, there is a definite central anomaly on lines 600S and 800S, between 200 to 700E, with a peak of 41, which is relatively weak and appears to be peripheral to the highest gold are. This compares with Rock sample 33597 at 648 ppm in the HW of the mined-out zone. The strongest copper and zinc lie in the same molybdenum zone.

This disposition is similar to one of the 208 copper-porphyry models no. 17 of the U.S.G.S. (Bull, 1693, 1986) ie. Butte, Montana, based on underground mapping, shown in U.S. Ore Deposits 1933-1967, pp 1396-1398 (Fig. 6).

A short discussion of these models follows later.

5. Copper, Cu. In common with other volcanic areas with which the writer is familiar, Cu is definitely anomalous above about 50 ppm. Cu, 40-50 ppm being a threshold area in that type of terrain.

Several types of well mineralized to ore grade rock samples show significant copper, including copper-magnetite skarn (samples 590 and 591) and lead silver sample 801 in Eagle 2. Significant anomalies in Hiawatha lie in general between 100 and 200 ppm, with a 200 ppm peak. In general, this is moderately anomalous, and a number of these anomalies apppear to overlie the Metasediments of the Archibald.

6. Zinc, Zn. The anomalous Zinc intensifies to the SE, with indications that much of it overlies the Archibald Meta-sediments. An area of special interest lies South of Hall Creek along line S 1000, where only Zinc, Arsenic, Silver and some Copper are present in the soils. This is the area where the Red Mountain fault is projected to cross Hall Creek.

   There is no apparent direct relation between high Gold and Zinc, or high Lead and Zinc, except in sample 801 on the Eagle 2, which is a Cu, Pb, Zn, Ag, Au sample, with high quartz.

7. Silver, Ag. Significant in high copper-gold ore, less in W ore (704, 705) and in high lead. Gold ore is normally low in silver, suggesting predominance of gold-skarn ore.

8. Arsenic, As. Often assumed to be an indicator of gold, but there is much evidence that it can be also an indicator of base metal deposits, even of those low in, or without, arsenic.

   On Hiawatha land, the higher arsenic is associated with Archibald Metasediments (400S, 150W), 600-1000S/600-900 E, although the contact diorite porphyry against Archibald is not yet clearly defined in this area. Porphyry float on lines 800 and 1000 S is reported to be abundant in the 600 E to 1000 E area.

9. Nickel, Ni: Cobalt, Co. Nickel moderate highs (85) are often associated with areas of abundant lamprophyre dykes, as are manganese, strontium, barium and potassium (see rock no. 58011). Except for rock 704, cobalt is always relatively low, mostly in the area 8 to 20 ppm, and even the area underlain by the Elise augite porphyries shows mostly less than 30 ppm. Some +25 ppm Co is related to +80 ppm Ni, and no definite other relationships were observed. Both Ni and Co high areas 800 to 1000 S, E 600 to 1000, are related to high iron.

10. Iron, Fe. Originally, in the upper part of the grid, Fe over about 4.5% was thought to represent oxidized pyrite. Subsequently, much higher iron was found to be associated with the Archibald Metasediments along the Eastside of the grid, this metal assaying up to 9% over the oxidized Red Siltstones. In area 400S, 0-600 E, iron as well as gold overlie diorite porphyry Ap. Some backhoe trenching should investigate this area, as iron appears to be peripheral to gold in several cases.

11. Manganese, Mn. High Mn over 1500 ppm forms small concentrations. There is no evidence it has scavenged other metals. On the contrary, it appears to be peripheral in a number of cases both to gold and other metals.

    Backhoe trenching on line 1000 S around 900-1000 E can investigate both the peaks of Mn and Bi.

12. Lead, Pb. In 592 ore, Pb = 117. In 801 showing 3.7% (Eagle 2). In soils, Pb of 91 at 200 N, 25 W could be mining contamination, next to the portal. Obviously, any significant lead should be looked for on Eagle 2.

13. Barium, Ba; Strontium, Sr. Barium and Strontium are high when assaying lamprophyres (rock 58011), as well as Ni, Mn, and potassium. In areas of wide dykes of this rock, these elements can be expected to give high assays in the soil.

    There are quartzose veins with gold along these dykes in some cases, or vice versa (ie. dykes along earlier veins).

14. Phosphorus, P. There is one small skarn tungsten deposit mentioned in CIM Special Vol 11, p 116-120, where phosphorus forms a definite anomaly. The deposit occurs in the french Pyrenees, near Salau, where a small granite plug invades Ordovician limestones near the summit ridges. 250 soil samples every 20 meters on lines spaced at 50 m were used; 600 "hydrographic" network samples were taken every 250 m along the streams. Sampling was in the "B horizon at a depth of about 8". Sieving was to -120 mesh and various extractions were used for the different elements.

    Results are as follows:

| | PEAK PPM | ANOMALY PPM | SIZE PEAK | LIMITS | BG PPM |
|---|---|---|---|---|---|
| W | >1200 ppm | >10 | 140 M | 1000 & 1000 M contours | < 5 |
| Cu | >200 ppm | >60 | 70 M | Same to less | ? |
| Zn | >800 ppm | >200 | 30 M | Same, 2nd dispersion | ? |
| Pb | >400 ppm | >50 | 10 M | Same as W, | ? |
| Mo | Nil | >2 | Nil | Nil | BG = 2ppm |
| As | >1600 ppm | >20 | 15 M | Exceeds W, esp. uphill | 10-20 ppm |
| P | >1200 ppm | >400 | >75 m | Well upstream | <400 ppm |
| F | >2000 ppm | >500 | 75 M | Uphill, much larger | 500 ppm ? |

    There was some secondary dispersion, and no sign of a primary halo useful for prospecting for a blind deposit.

    Not much can be made of the phosphorus anomaly; its shape suggests it is peripheral to the main tungsten occurrence.

    The tungsten was found in the "hydrographic" samples at over 20ppm W, 1000m downstream from the main occurrence.

Published maps cover only a width of some 240m E-W and 750m NS, not sufficient to picture the anomaly settings. Further details by J.P. Prouhet, World Mining, Feb. 1969, Vol 22, no. 2: Anglo-American develops French Tungsten Mine.

15. Potassium, K. This metal appears to be mostly related to alteration. There is a significant concentration in the area of lines 0, 5 N and 100 N, 300 to 800W, line 250 S, 0 to 900 E and line 600 S, 150 W to 600 E. The first area corresponds to epidote alteration and an airborne magnetic anomaly suggesting an altered zone with magnetite and epidote as observed in the field. This area requires stripping to obtain rock samples for geochemical analysis. High potash is also related to lamprophyre (sample 58011), 1.34%, and to FW rocks in the adit (S.33596), 0.74%.

16. Metals Showing Only Weak Values

| | |
|---|---|
| Uranium | 5ppm |
| Cadmium | 1-3 ppm |
| Antimony | 2-5 ppm, except road samples F1 to F26, some up to 10 ppm |
| Sodium | .01-.03 % |
| Thorium | 1-8 ppm |

17. Metals With Irregular Distributions

| | | |
|---|---|---|
| Vanadium | Calcium | Chromium |
| Aluminum | Magnesium | Titanium |

Boron (up to weakly anamolous 2 -24 ppm) Warrants further study, as line 100 S to 250 S show a number of low anomalies, suggesting a threshold of perhaps 5 ppm, i.s.o. 10 ppm as used.

Several of these will be reviewed once geological mapping is completed.

## 7. SOIL AND ROCK SAMPLING IN MINERAL EXPLORATION

To consider this subject, reference should be made to a few publications, as follows:

| | |
|---|---|
| 1962 | Hawkes and Webb, Geochemistry in Mineral Exploration, Editor: Carey Croneis |
| 1968 | V. M. Kreiter, Geological Prospecting and Exploration, Mir Publishers, Moscow. |
| 1971 | CIM Special Volume II, Geochemical Exploration, Editors: R. W. Boyle and J. I. McGerrigle. |
| 1979 | Geophysics and Geochemistry in the Search for Metallic Ores., Editor: Peter J. Hood, G.S.C., Economic Geology Report 31. |
| 1984 | Canadian Mineral deposit types, Ec. Geol. Report 36, G.S.C. |
| 1986 | Mineral Deposit Models. U.S.G.S. Bulletin 1693. |

The introduction to the first two gives a condensed historical review, stressing the regional approach taken by the Russians and owners of large concessions like in Northern Rhodesia and elsewhere, leading to an approach to soil sampling quite different from areas where claimstaking was and is the usual technique of exploration.

The Russians notably have developed the study of Primary Halos, which are zones of both rock alteration and/or very weak mineralization forming sometimes vast envelopes around ore-deposits, and which can be detected by petrographic and/or chemical analysis. In this concept, the secondary dispersion which creates anomalous metal content of soils will lead not directly to ore bodies but to Primary Halos, which in turn may lead to a blind ore body. V. Kreiter states that for every 30 to 40 mineral showings, one ore deposit can be found, which is a far cry from our old saw that one showing in a thousand may develop into an orebody.

The first four publications mentioned above give a number of case histories, although regrettably most suffer from a lack of engineering data, like scale, grade and size of ore-deposit, topocontours, and other details of importance. The writer encloses reproductions of some of the more significant and more informative (Fig. 3 to 5).

Recently, low cost methods of analysis and of graphic representation have become available that render study of many low grade elements rapidly and economically feasible.

Since the early 1980's, Inductively Coupled Plasma-atomic emission spectroscopy, ICP, has become available, a low-cost rapid method providing assays of up to 30 elements simultaneously with a detection limit of 0.1 to 5 p.p.m. The detection limit for gold is about 3 ppm, therefore a special acid leach followed by atomic absorption with a 1 ppb detection limit is added to obtain a meaningful gold assay. Recently, the computer print-outs have been improved, with excellent legibility and reproducibility.

However, older data in Government Assessment files, stock-market prospectuses and geological reports, vary from illegible to non-reproducible large maps, and it is therefore still very difficult, or impossible, to gather comparable and usable data, except in specialized publications as noted at the start of this chapter.

As for deposit models, somewhat the same observations apply, as these models depend much on the systems of classifcation used, which vary a great deal from author to author. Also, older rock identification may be incorrect, as they may not be based on petrographic studies, as experienced by the writer. Some of these names keep perpetuating themselves and may reappear even in recent publications.

Examples are: post-quartz pinkish manganiferous dolomite identified as felspar, leading to a locally non-existing class of auriforous pegmatite veins; albitized rock in the Sullivan Mine hanging wall rocks defined as monzonite.

U.S.G.S. Bulletin 1693 classifies close to 4000 deposits worldwide in 14 classes, 34 types, and a total of 90 sub types, each with its geo-chemical signature. Carton cross sections summarize some 20 of the principal categories. While still experimental, this provides a more factual framework to classification. It does not add, however, anything to the concept of the Primary Halo. The same applies to G.S.C. Economic Geology 36 studying 214 Canadian deposits.

Regarding skarn type deposits in B.C., we refer to Precious Metal Enriched Skarns in B.C., by Ettlinger and Ray, paper 1989-3 B.C. Geological Survey Branch, who quote the Nickel Plate (Hedley) and the Phoenix Mine, as two world class deposits responsible for 82% of the PME skarn gold production in B.C. A skarn deposit is defined as one that contains calc-silicates mostly associated with limestone or marble-rich rock sequences.

They do not include Rossland in this category, but R.W. Boyle in Bulletin 280, G.S.C. 1979 lists calc-silicates such as wollastonite, actinolite, garnet, epidote in the alteration zone of this deposit, giving it at least a skarn relationship; it is described as fissure replacements in augite porphyry (Elise formation) and Nelson monzonite. There are strong bodies of diorite porphyry, but these are divergent from the veins. Ettlinger and Ray consider the Second Relief a skarn-deposit; the mined zone lies along the contact of a diorite-porphyry, but there is no lime-stone. The same authors place the French Salsigne Mine in this category, but there are no calc-silicates in this deposit, where veins cut limestone with much biotite alteration. In later years, bedded ore was discovered in the footwall X schists, presumably feeding the veins. The ore assays about 0.3 oz/t gold, 0.113% Bi; 9.4% As; 1.3% Ag and .13% Cu. The writer visited this operation in 1938 before the X schists were known.

A summary of the perusal of these various publications leads to the conclusion that many data are incomplete; for instance, B.C.'s second large gold producer, Rossland, at about 6 million tons @ .46% gold is not even mentioned in G.S.C. report 36 (1984) or U.S.G.S. report 1693 (1986). The 45 million or more Ertsberg in Irian Jaya, at 40% Fe, 2.75% Cu, 0.3 oz/t Ag and 0.2 (or .025?) oz/t Au is only mentioned without data in Ec. Geol. report 36 and not in either U.S.G.S. Bull. 1693 or in the world list of Ettlinger and Ray (1989-3). It is classified as a porphyry copper-gold by J.J. Bache, BRGM 118 (1982) like OK Tedi in Papua, New Guinea. A good little map of 1977 is available (Fig. 5), showing the importance of skarns in this latter deposit.

This focuses attention on figure 15, Model 17, porphyry Cu in U.S.G.S. 1693, showing the gold-copper skarns as a peripheral feature (Butte, Galore Creek) of copper porphyries, or a peripheral feature of granodioritic rocks, like in Model 18b, a cartoon of gold-copper skarns like Whitehorse Copper, Coast Copper, Vananda, and Phoenix. There is also a porphyry Cu-Au model, no. 20c, applicable notably to Afton, Bell Copper, OK Tedi and others (40 examples in U.S.G.S. 1693) (Fig. 8).

In Economic Geology Report 36, R.J. Thorpe and J.M. Franklin have a class 15, of Intrusion-associated Gold Deposits, subdivided into a Sub-alkalic-Felsic, C. Alkalic and C. Mafic.

The same examples used by them, are used by J.J. Bache in BRGM 118, in type 3, deposits "reputedly" discordant in a volcano-sedimentary environment.

His classification of gold deposits is based on 3 large classes: 1. Volcano-sedimentary pre-orogenic deposits; 2. plutono-volcanic post-orogenic deposits, and 3. detrital deposits. Group 1 comprises Lamaque, Belmoral, Camflo at Malarctic; Wilmar (Red Lake), McIntyre, Hollinger; Kirkland Lake camp; Young Davidson; Howey-Hasaga; San Antonio; Kalgoorlie's Golden Mile, and others in both classifications.

However, Thorpe and Franklin indicate that some of these may belong to a "porphyry gold" type, closely related to their class 17, of a. copper-molybdenum, b. Alkalic-copper or c. calc-Alkalic molybdenum, tungsten (tin, bismuth). 17a. also includes Butte, Montana.

This seems to put in doubt the distinction between pre-orgogenic and post-orogenic of Bache's classification, as the intrusions appear to be mostly if not all post-orogenic.

These considerations become somewhat abstract, but point out the problems of incertitude in this field, especially for gold deposits within intrusives (especially diorites?).

In summary, we conclude that at present it is still impossible to predict exactly what type of deposit the Hiawatha soil anomaly may reflect, the more so as some of the underlying geology has not yet been mapped. However, its location on strike with the Second Relief suggests strongly a similar, but larger, type of skarn deposit.

Another important feature is that vein deposits, or skarns, could develop inside an intrusive (like at Butte), or between two intrusives especially in the presence of a major fault like the Red Mountain Fault and many small porphyry intrusives as on the Hiawatha ground.

Also, S shaped curvatures are favorable for the development of ore deposits, like at Galore Creek, where the writer was involved in the original acquistion and development of the claims, or at Equity Silver, in Central B.C.; in both, the main zones are about 2000m long, and in the shape of an elongated S, indicating highly fractured ground well prepared for ore deposition.

The strongly curved Red Mountain Fault also creates an environment favorable for the development of horsetail structures, similar to the Butte area.

Mapping and trenching remains therefore indispensible to get a closer assessment of values in the rocks, including geochemical rock sampling.

## 8. SUMMARY

The 77 unit Hiawatha Group covers an important geological structure, the Red Mountain Fault, a pre-intrusive fault, bringing into contact the oldest Archibald formation with various members of the overlying Elise volcanics. In this area, the fault is strongly curved and folded, changing its strike from a NW-SE trend to a N-S trend, with a NE-SW segment in between. A number of small intrusive plugs are known in this area, originally mapped as quartz-diorite, then as granodiorite and now found to consist for at least 50% of diorite porphyry or andesite porphyry. A large and strong multi-element soil geo-chemical anomaly measuring at least 3000 x 2000m has been located in the claim group, the main element of which is gold, accompanied by significant tungsten, bismuth, molybdenite, arsenic, copper and zinc, and a number of other less diagnostic elements. Silver is low and there is practically no antimony.

The soil survey consisted of a total of 771 sample sites, in addition to 64 old sites of soil and rock assays, run along a road by Lacana in 1986, plus 38 rock samples by Hiawatha, for a total of 873 sample sites.

The soil values suggest a potential skarn-type deposit, with a possibility of a large low-grade copper-gold-moly-tungsten deposit. A mined-out deposit of the skarn type lies 5 km to the South on strike in the Archibald formation, having produced 228,000 tons of .43 oz/t gold. There are no known soil anomalies above the Second Relief, and only very weak ones in its vicinity.

The topography underlying the sampled area is such that only minor creep, contamination or seepage can exist; high gold lies updip from an old shaft, and a number of significant highs lie at or near topographical highs, along the SE ridge from Red Mountain to Hall-Spider Creeks.

Bismuth is an important indicator element; it occurs in weak soil anomalies, and in significant values in all ore rock samples taken by Hiawatha. High molybdenum occurs near and in significant gold samples and high tungsten is present in samples of gold-bearing quartz veins, but only in some of the high gold dump samples from the main adit.

The total anomaly is expected to be indicative of a primary halo belonging to an essentially blind deposit of economic size, with gold and quartz veins of from 3" to 4' only, exposed in the area.

A strong quartz-arsenopyrite zone lies along the government-mapped Red Mountain Fault on the O.G.G. claims, but no soil or rock assays are as yet available in this area. Arsenopyrite related to a blind gold deposit may be detectable up to several hundred meters above the deposit, but factual statements or maps of this feature are hard to come by.

In the Rossland camp, R. W. Boyle, G.S.C. Bull. 280, states (p. 291): "There was a close association between bismuthinite and gold in some stopes, and between molybdenite and gold in others."

Bismuth, can occur as an alloy of gold, or as separate bismuth minerals, which have been found in the same cracks in arseno-pyrite as gold in at least some cases (Fig. 6).

The area of the soil anomaly can be expected to be well fractured and to have horse-tail type structures, very conducive to produce primary, or exogene, haloes.

In summary, the Hiawatha ground covers a strong and large soil anomaly found under the most favourable structural and stratigraphic conditions, only 5 km on strike from a 228,000 ton mined-out deposit of high-grade gold ore of skarn-type. It is a classical example of a situation that has at least a 2/3 chance of being successful in finding an economic deposit. This means that two out of three situations of this type can be expected to be successful, which is exceptionally high, and may be called quasi-certain.

## 9. CONCLUSIONS

This property warrants an aggressive program, to consist of the following:-

1. Road rehabilitation and initial trenching, all by backhoe up from Hall Creek.
2. Cutting of one long cross-line 1200S, to continue across the O.G.G. claims, for a total length of 5 km.
3. Detailed soil and rock sampling in areas of special interest.
4. Geological mapping of lines 600S to 1200S.
5. Prospecting and initial surveying along line 1200S, to obtain representative samples across the O.G.G. quartz-arsenopyrite zone.
6. Magnetic and shallow EM syrveying in those areas that appear of interest.
7. Trenching across geochemically high and geophysially anomalous areas, with detailed rock sampling at least every 2 to 5 meters.
8. Possible deep geophysics by either I.P., or U.T.E.M.
9. Shallow drilling with a light Prospector drill is recomended of some of the identified showings to obtain required geological and grade information.
10. A special geological study of comparative diorite porphyries wherever accessible, and including laboratory petrographic studies, to obtain the necessary information on these rocks to assess their role in locating ore.
11. Normal size drill program.

A study of estimated costs is underway.

P. H. SEVENSMA, Ph. D. P. Eng.
President and Exploration Manager

June 9, 1990.

<u>CERTIFICATE</u>

I, Peter H. Sevensma, of Box 1199, Osoyoos, B.C., DO HEREBY CERTIFY:

1) That I am a Consulting Geologist with business address as above.

2) That I graduated at the University of Geneva, Switzerland in 1937 and that I obtained my Ph.D. in Geological Sciences in 1941 at the same institution, my thesis subject being the study of certain gold mines in Central France.

3) That I am a registered Professional Engineer, member of the Association of Professional Engineers in British Columbia.

4) That I have practiced my profession for the last fifty-three years with the only interruption being the war in the Far East from 1942 to 1946.

5) That I have personally directed the work programs on the Hiawatha property after examining the area in ~~1988~~. 1987. PHS

6) That I am the exploration manager of Hiawatha Resources Inc.

P.H. Sevensma

P.H. Sevensma, Ph.D., P.Eng.

Osoyoos, B.C.
June 11, 1990.

# The World's Greatest Floods

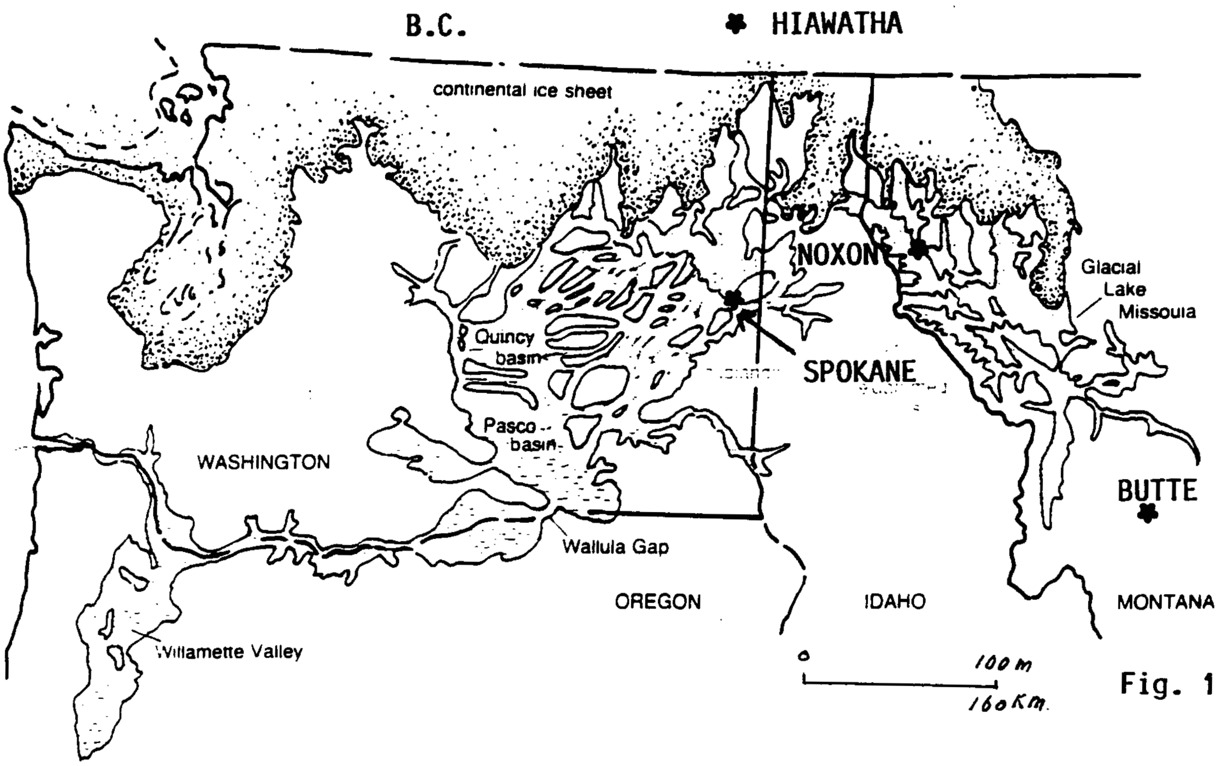



Fig. 1

*Glacial Lake Missoula, the glacier that dammed it, and the channeled scablands of eastern Washington.*

COURTESY ROADSIDE GEOLOGY OF WASHINGTON

D.D. Alt and D.W. Hyndman (1984, 1989)

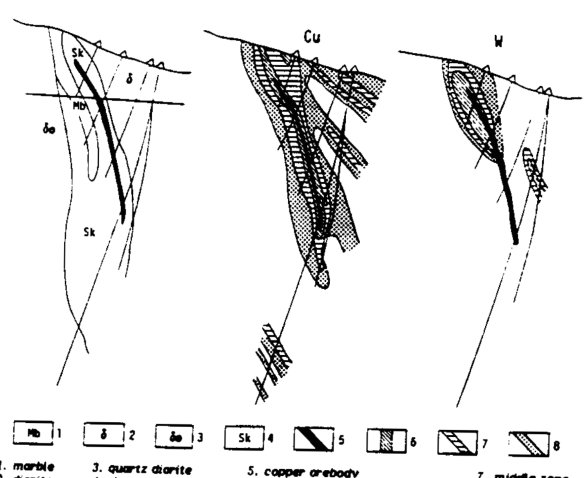
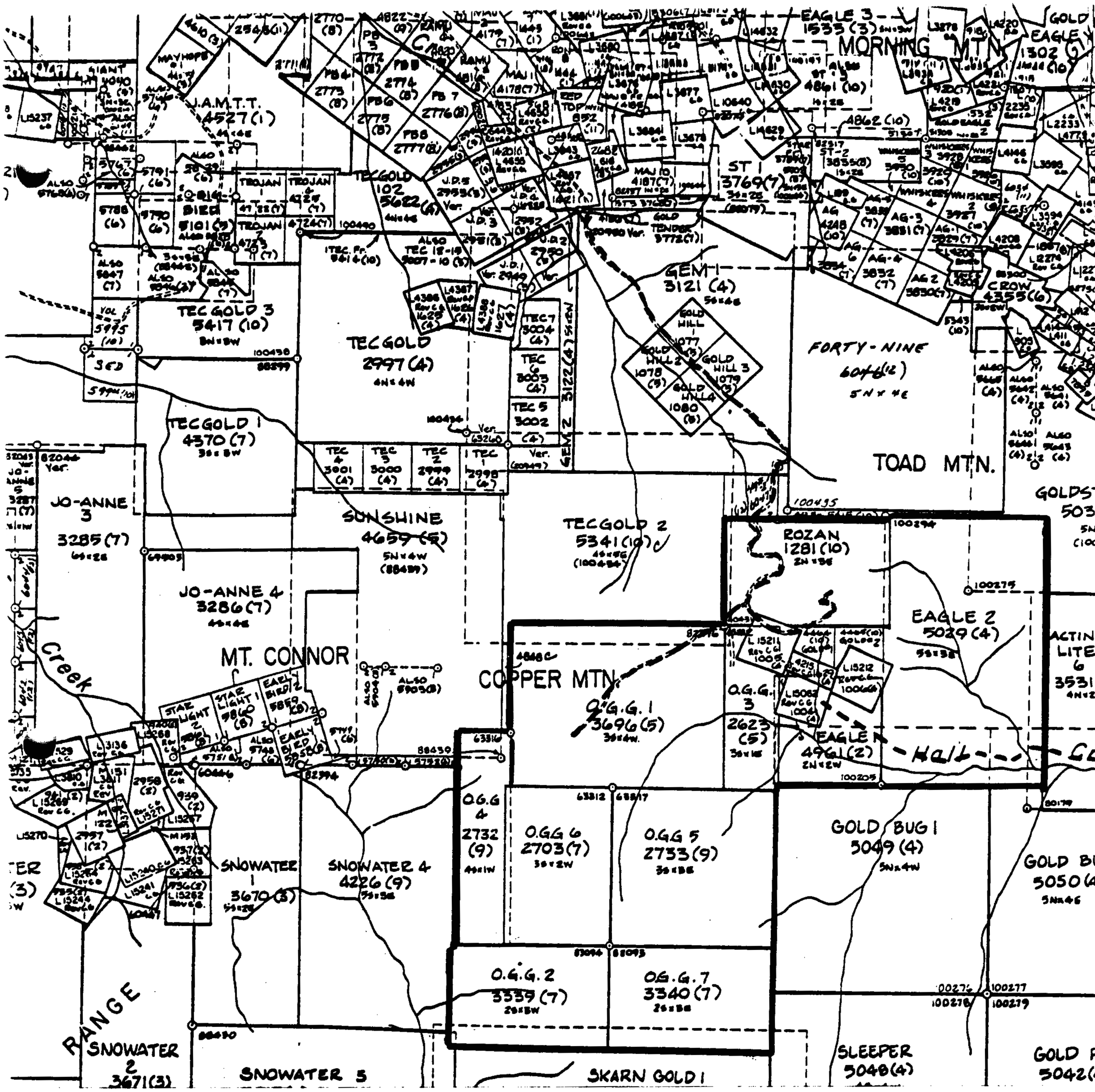
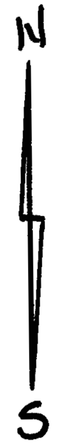



Fig. 3

*Figure 40.8.* Copper and tungsten halos around a skarn copper orebody.

Copper-tungsten halo around a skarn-deposit along a quartz diorite Hsia Kuo-chih, 1977
G.S.C. Ec. Geology Rep. 31, p. 804




CLAIM MAP, MARCH 29, 1990

HIAWATHA CLAIMS, ROZAN,

EAGLE 1, EAGLE 2, OGG 1-7

NTS 82-F-6, W/2 Nelson, M.D., B.C.

Figure 2

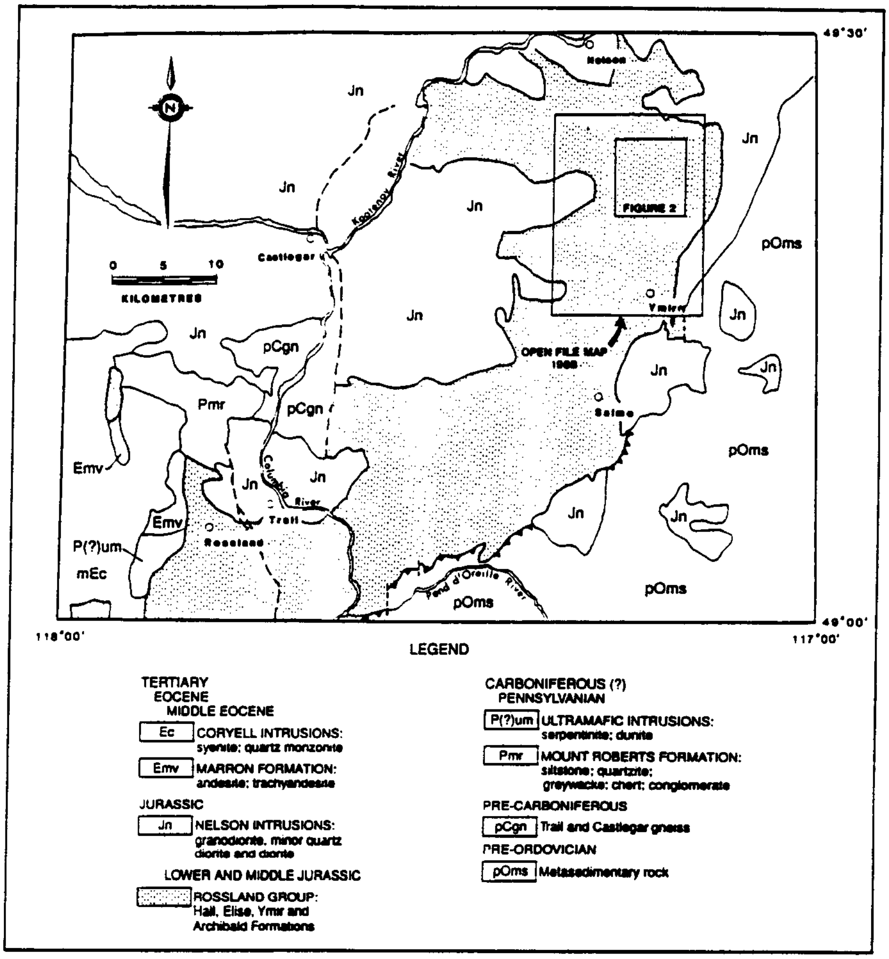



Figure 1-1-1. Map showing distribution of Rossland Group in southeastern British Columbia and location of Figure 1-1-2 and Open File map. Regional geology after Little (1960, 1964, 1982), Fyles (1984), Simony (1979), Corbett and Simony (1984), and Parrish (1984).

Fig. 2A

ROSSLAND GROUP

B.C.G.S.B., 1988-1. T. Hoy and K. Andrew

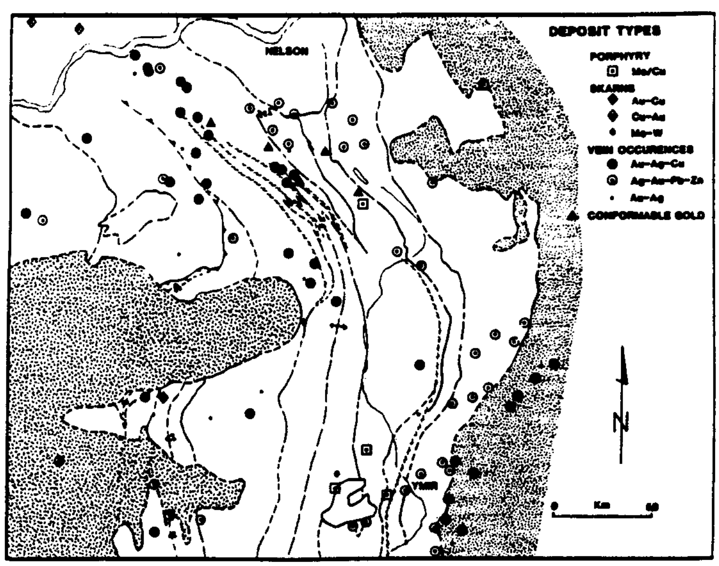



Figure 1-4-7. Metallic mineral deposit types of the Nelson map area.

Fig. 2B

MINERAL DEPOSITS, NELSON-YMIZ

B.C.G.S.B., 1989-1. T. Hoy and K. Andrew

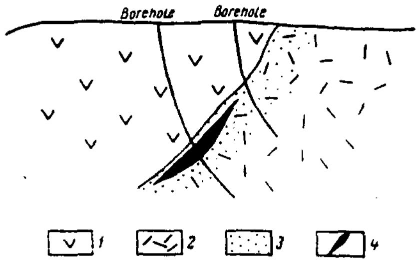



Fig. 7. Diagram of a copper pyrite body with primary dispersion halo
1—porphyrites; 2—albitophyres; 3—primary dispersion halo, 4—ore body

**FIGURE 1.**

Courtesy of V.M. Kreiter
Geological Prospecting and Exploration
1968. Mir Publishers. Moscow.

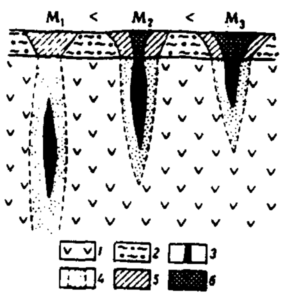



Fig. 75. Variations in the quantity of metal in secondary dispersion halos depending on the level of the erosion surface of the ore-bearing zones.
1 - bedrock; 2 - eluvial-diluvial formations; 3 - ore body; 4 - primary halos. 5 and 6 - secondary halos (5 - with a low content of the metal; 6 - with a high content); M - metal reserves in the secondary halo.

**FIGURE 2.**

Courtesy of A.A. Beus and S.V. Grigorian
Geochemical Exploration Methods for Mineral Deposits. 1975. Moscow.
Translated by A.A. Levinson & R. Tetruk-Schneider
Applied Publishing Ltd., Wilmette, Ill., U.S.A.

**FIGURE 3**

Courtesy of L.V. Ochinnikov and S.V. Grigorian
Primary Halos in Prospecting for Sulphide Deposits
in Geochemical Exploration. CIM, SVll, 1971.

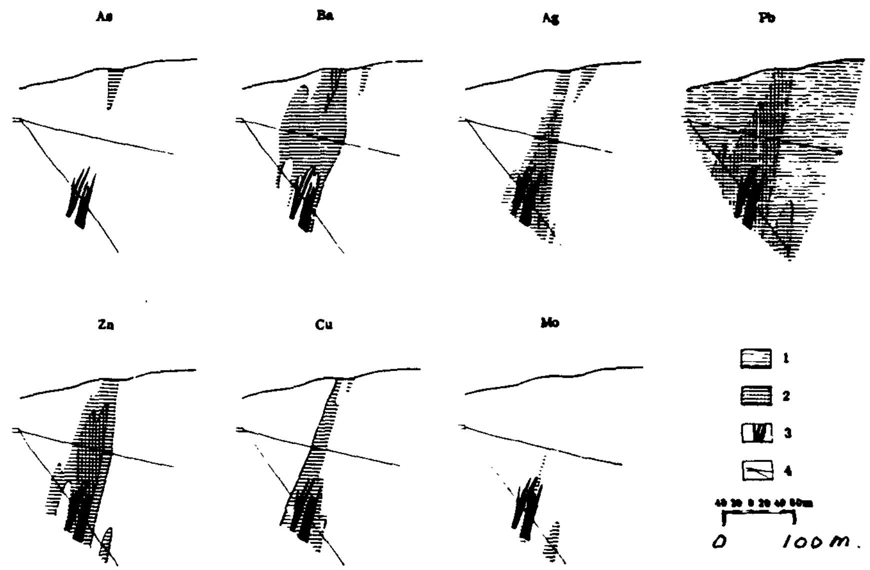



**FIGURE 1 — The Endogenous Geochemical Halos Around Lead-Zinc Orebodies in Skarns.**
Elemental contents (in per cent) in dispersion halos: 1 — As 0.0015-0.003, Ba 0.01-0.1, Ag 0.00003-0.0001, Pb 0.003-0.01, Zn 0.005-0.01, Cu 0.003-0.05, Mo 0.0003-0.001; 2 — Ba 0.1-0.2, Ag 0.0001-0.008, Pb 0.01-1.0, Zn 0.01-1.0; 3 — orebody; 4 — prospecting boreholes.

**FIGURE 3**

| | | | | | |
|---|---|---|---|---|---|
| 1. | As | 15- 30 | 2. | Ba | 2,000- 3,000 |
| | Ba | 100-1,000 | | Ag | 1- 80 |
| | Ag | 0.3- 1 | | | |
| | Pb | 30- 100 | | Pb | 100-10,000 |
| | Zn | 50- 100 | | Zn | 100-10,000 |
| | Cu | 30- 500 | 3. | Orebody | |
| | Mo | 3- 10 | 4. | Exploratory core holes | |

Elemental Contents (in ppm) in dispersion halos.

## PRINCIPLE OF PRIMARY HALO

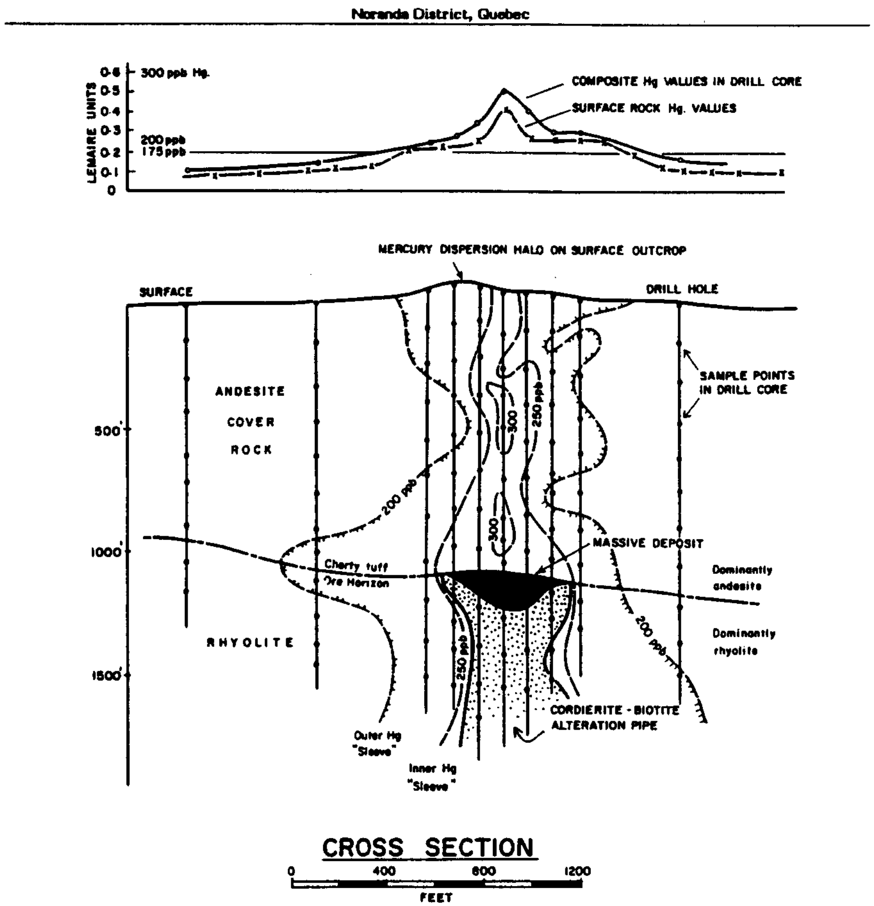
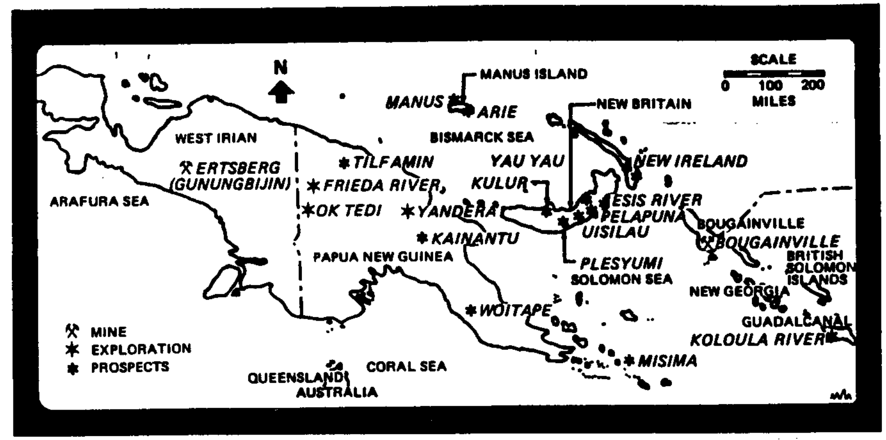


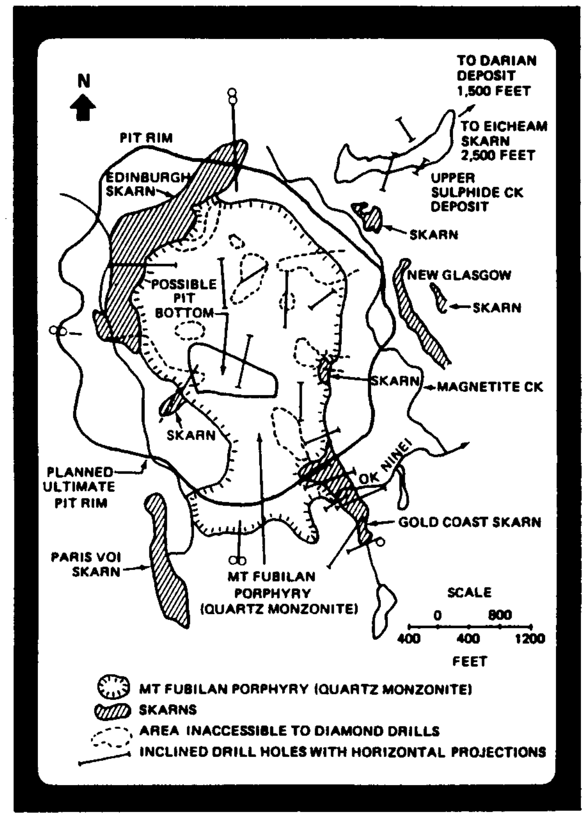

*Figure 26.4. Section — Relationship of mercury dispersion halo to a blind massive sulphide deposit, Noranda district.*

NORANDA AREA. NORBEC DEPOSIT,
4 Mill Tons @ 2.8% Cu, 4.7% Zn, 1.4 oz/t Ag, ± 1 gr/t Au
Mercury Halo of deposit discovered by geological work.
G.S.C., Ec. Geol. Report 31, 1979

Fig. 5

WORLD MINING, MAY 1977

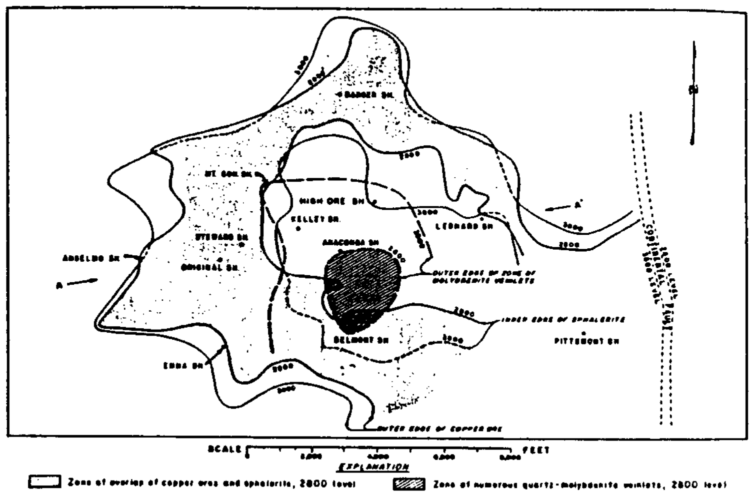



OK Tedi
1:30,000

NEW GUINEA, ERTSBERG AND OK TEDI

1396 Ore Deposits of the United States, 1933–1967 Part 10 Chap. 65

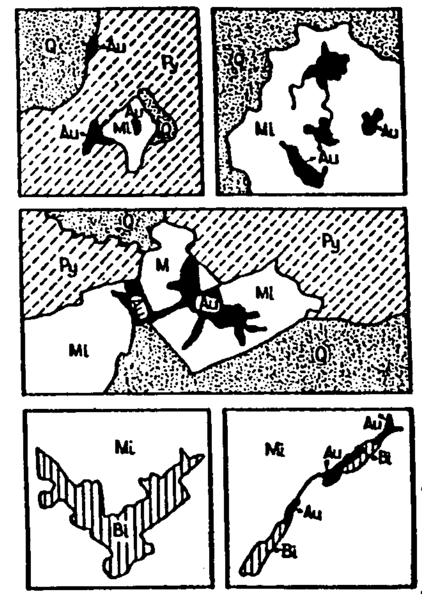


# BUTTE, MONTANA

Distribution of Cu and Zn around a central Mo core, 2800 level.

Fig. 6

112 *Origine et formation des gisements d'or*

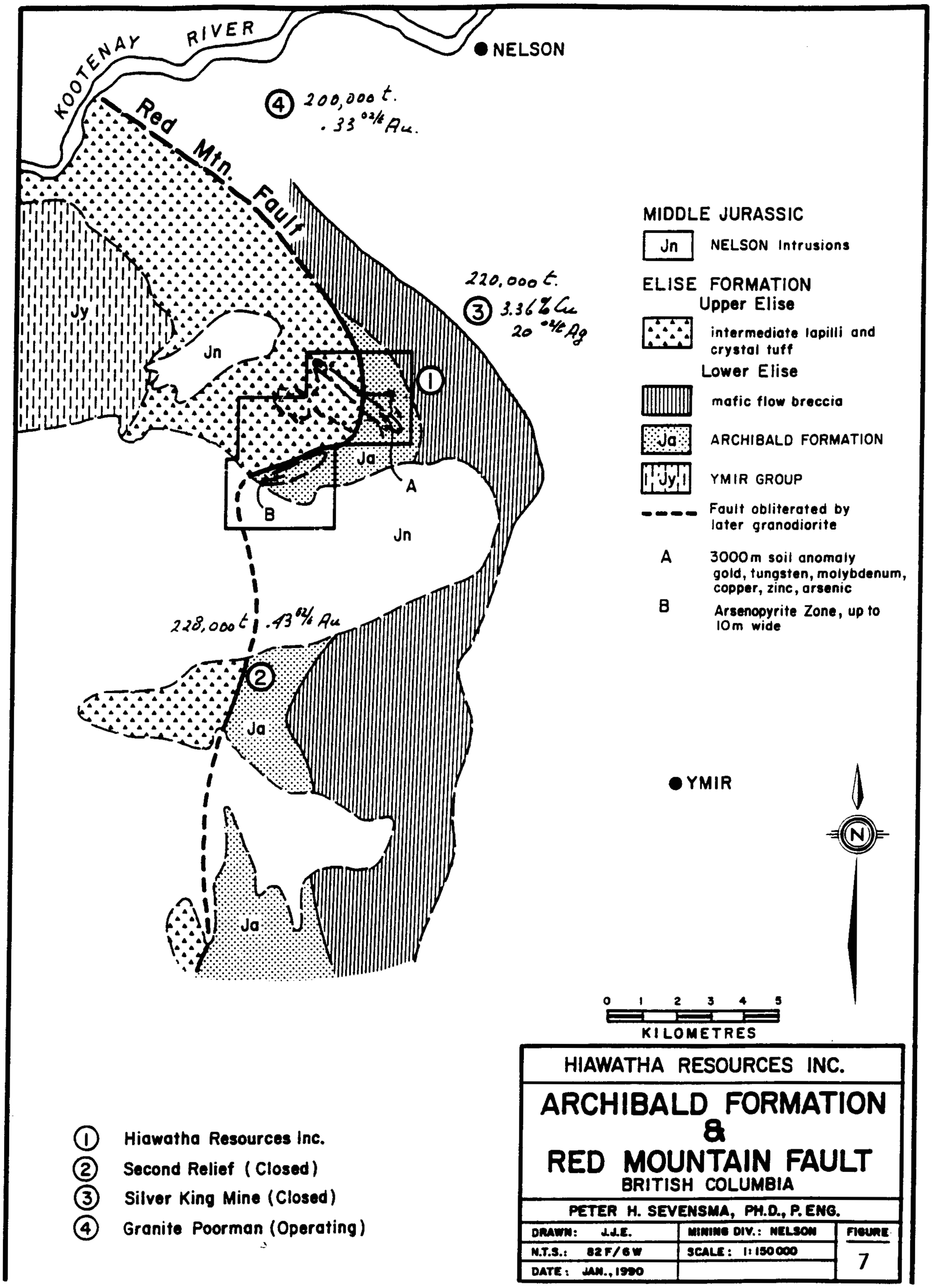



# SALSIGNE MINE, FRANCE

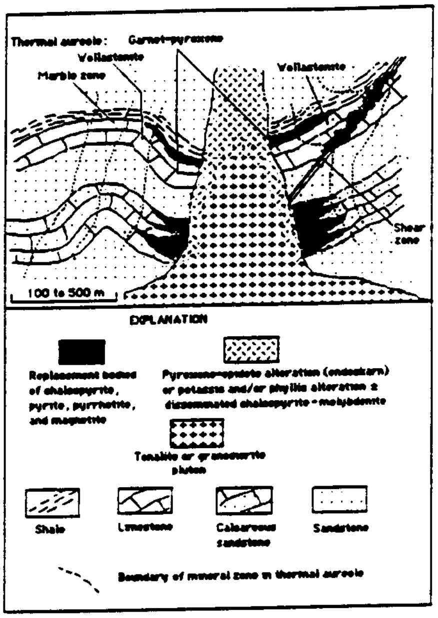
Polished Sections. Enl. ± 20 x

| | | | | | |
|---|---|---|---|---|---|
| Q | = | quartz | Cp | = | chalcopyrite |
| Mi | = | arsenopyrite | Bi | = | bismuth minerals |
| Py | = | pyrrhotite | Au | = | gold |

Courtesy of M. Legraye, Liege, 1942




SUMMARY MAP, STRATIGRAPHY, structure and mineralization.




Model 18b

**Figure 57.** Cartoon cross section of Cu skarn deposit showing relationship between contact metamorphic zones, ore bodies, and igneous intrusion.

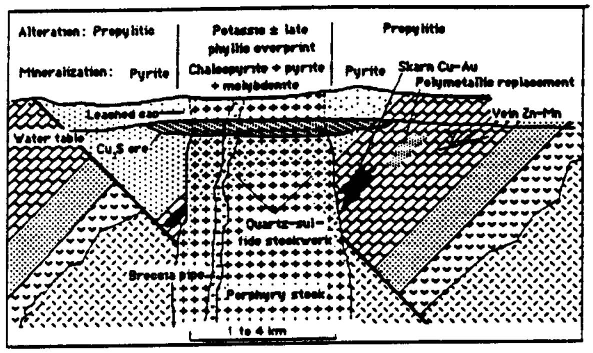



**Figure 50.** Cartoon cross section illustrating generalized model for porphyry Cu deposits showing relation of ore minerals, alteration zoning, supergene enrichment and associated skarn, replacement, and vein deposits.

Table 3. Types of hydrothermal alteration characteristic of porphyry copper and other deposit models

| Type of alteration and synonyms | Original mineral | replaced by | Appearance |
|---|---|---|---|
| Potassic alteration (K-silicate) | plagioclase———— | K-feldspar | Rocks look fresh but may have pinkish K-feldspar veinlets and black biotite veinlets and clusters of fine biotite after mafic phenocrysts. |
| | hornblende———— | fine-grained biotite + rutile + pyrite or magnetite. Anhydrite | |
| Sodic-calcic alteration (albitic) | K-feldspar———— | oligoclase or albite | Rocks are hard and dull white. Biotite is absent. Veinlets of actinolite, epidote, and hematite have hard, white alteration haloes. |
| | biotite———— | actinolite + sphene | |
| Phyllic alteration (quartz-sericite) | plagioclase———— | sericite | Rocks are soft and dull to lustrous white. Pyrite veinlets have distinct, soft translucent gray, sericite haloes. Tourmaline rosettes may be present. |
| | hornblende and biotite———— | sericite + chlorite + rutile + pyrite | |
| Propylitic alteration | plagioclase———— | albite or oligoclase + epidote or calcite | Rocks are hard and dull greenish gray. Veinlets of pyrite or chlorite and epidote lack prominent alteration haloes. |
| | hornblende and biotite———— | chlorite + rutile + magnetite or pyrite | |
| Argillic alteration | plagioclase———— | clay + sericite | Rocks are soft and white. Tongue will stick to clay-altered minerals. |
| | mafic minerals———— | clay + sericite + chlorite + pyrite | |
| High alumina (alsic, advanced argillic) | All original and earlier hydrothermal minerals converted to pyrophyllite, alunite, andalusite, corundum, and diaspore with variable amounts of clay and sericite. | | Rocks are light colored and moderately soft. |

Model 17



Model 20c

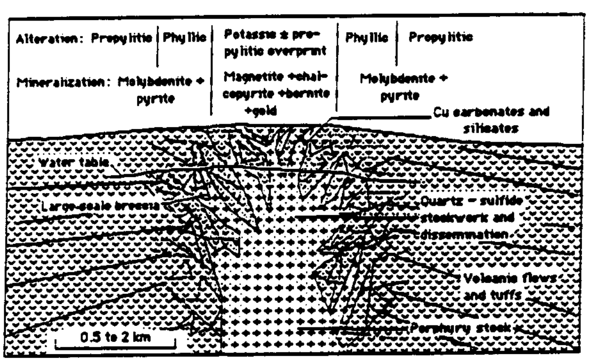
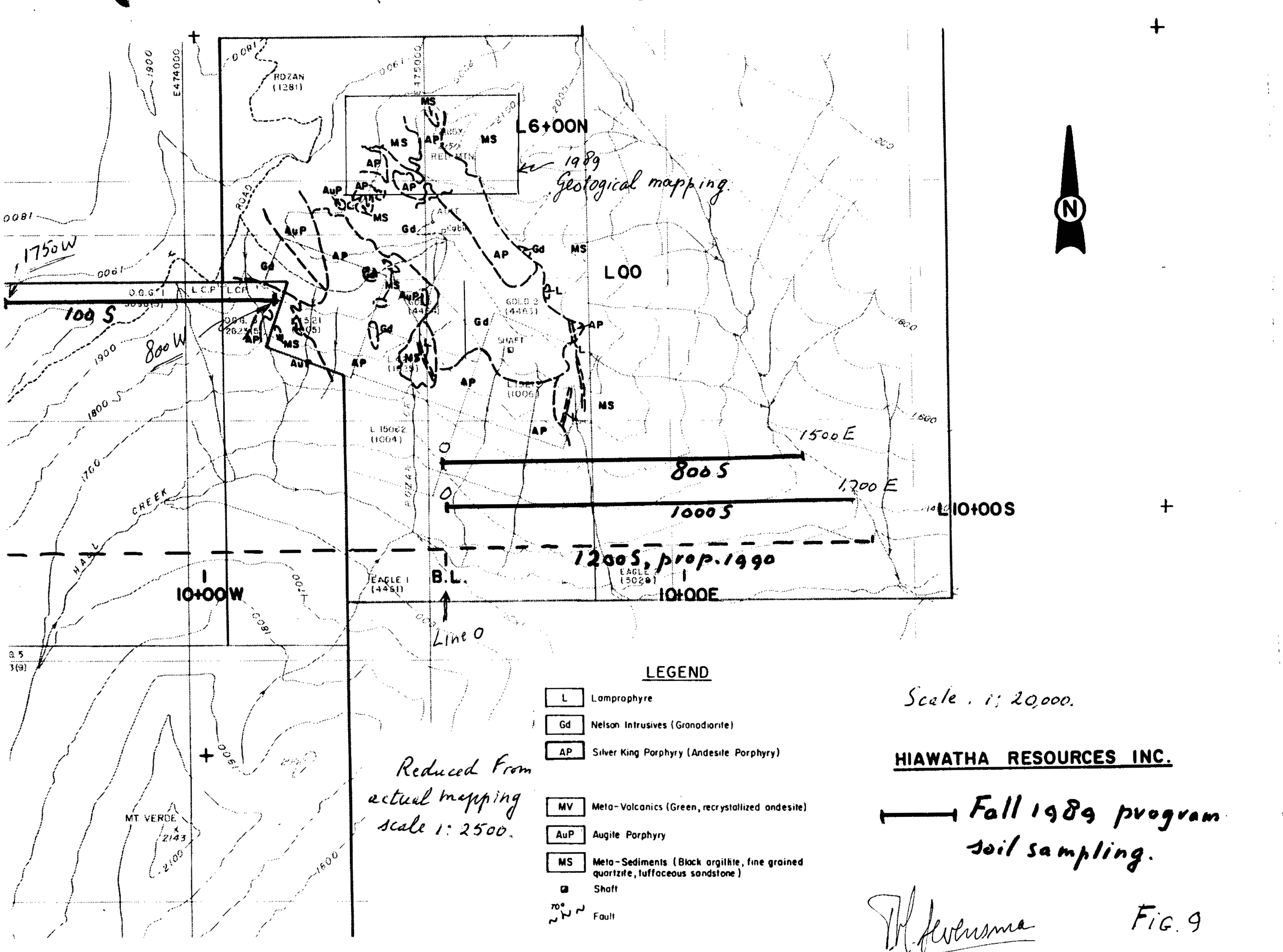



**Figure 77.** Cartoon cross section of porphyry Cu-Au deposit. Modified from Langton and Williams (1982).

U.S.G.S. BULLETIN 1693 (1986)

Models re Porphyries and Skarns

Fig. 8



ROZAN (1281)
E474000
E475000
MS
AP
AuP
Gd
L
RUBY
RED MTN
L6+00N
1989 Geological mapping
L00
1750W
109 S
800W
GOLD 2 (4463)
SHAFT
L 15062 (1004)
(1006)
1500E
800 S
1200 E
1000 S
L10+00S
1200S, prop. 1990
EAGLE I (4461)
EAGLE 2 (5020)
B.L.
10+00W
10+00E
Line 0
HALL CREEK
ROAD
MT VERDE 2143
N
LEGEND
L Lamprophyre
Gd Nelson Intrusives (Granodiorite)
AP Silver King Porphyry (Andesite Porphyry)
MV Meta-Volcanics (Green, recrystallized andesite)
AuP Augite Porphyry
MS Meta-Sediments (Black argillite, fine grained quartzite, tuffaceous sandstone)
Shaft
Fault
Reduced from actual mapping scale 1: 2500.
Scale. 1: 20,000.
HIAWATHA RESOURCES INC.
Fall 1989 program soil sampling.


FIG. 9

**P. J. (PEC) SANTOS, P.Eng.**
*Consulting Geologist*

**626 - 9th Ave. Castlegar, B.C., Canada V1N 1M4**
**(604) 365-3078 — (604) 365-2432 Messages**

Sept. 20, 1989

Dr. Pieter Sevensma, Ph D, P. Eng., Pres.
Hiawatha Resources Ltd.
Box 1199, Osoyoos
B.C. VOH 1VO

Dear Dr. Sevensma,

Re: Geologic Mapping
Rozan Property, B.C.

Enclosed you will find a copy of the geologic map of the Rozan property, a geologic section, and a smpling map. As per your instruction I have mapped in detail the area west of the Base Line to the road and east of the Base Line to the east on lines 2N to 6N . I took some samples of the mineralized material close to the intrusive contacts and these are plotted in the sampling map. The samples have been shipped to Acme Lab for the 30-metal ICP analyses. I did not do anymore sampling since you may not want to continue this type of work at this time. For the same reason I did not do any work on the area of the old road north of Red Mountain. In addition to this work I did check the area where some of the high gold geochem assays were taken from.

There is a spot on the north edge of the cliff on Red Mountain north of the end of the Base Line where one has a good view of the cross section of Red Mountain so I drew the attached geologic cross section. To make this section more useful I projected on to the section data from lines 3N and 2.5 N. The resulting cross section suggest a correlation between the high gold soil samples with the intrusive contacts particularly with the Silver King Porphyry (AP) and the Nelson Intrusives (Gd) and to a lesser extent with the AP and the Rossland Group (MS, AuP, and MV).

I have checked several of the areas with anomalous gold in the soils. My findings are as follows:

(a) Line 2.5N, 4W (2110 ppb Au) : The station is directly below where the AP contains minute, hairline veinlets of pyrite near the contact with Gd.

(b) Line 3.5N, 2E (168ppb Au): The sample is underlain by MS near the AP contact.

(c) Line 4.5 N, .75E (210 ppb Au) : The sample is underlain by MS near the contact with an AP dyke.

(d) Line 2.5N, 5.5W (560 ppb Au): The sample is underlain by AuP near the AP contact

(e) Copper Mountain Road (470 ppb Au): The sample was taken from the narrow valley between Copper Mountain and the slope on west side of the Rozan claim. The nearest outcrop is AuP and MV with lenses of calc-silictaes.

 Appendix 1.

(f) Copper Mountain-Rozan Road (315 ppb Au): The sample was taken from the flat area north of Red Mountain, the overburden consists of talus from the nearby cliffs and thin soil.

(g) West ends of lines ON, .5N and 1N ( 189 ppb, 205 ppb, and 285 ppb Au): No outcops here but the geology is probably similar to that of the Copper Mountain station (470ppb Au).

(h) Line 1S, 7.5W (440 ppb Au): The sample is near an outcrop of MV with quartz stringers.

(i) Line 3.5 N, 2E (168ppb Au) and Line 2N 3.5E (216 ppb Au). These samples are underlain by rusty MS with diss. py and po.

I did not check anymore localities since it will tke considerable time to do them.

The anomalous gold in the soils follows a trend almost parallel to the intrusive contacts.

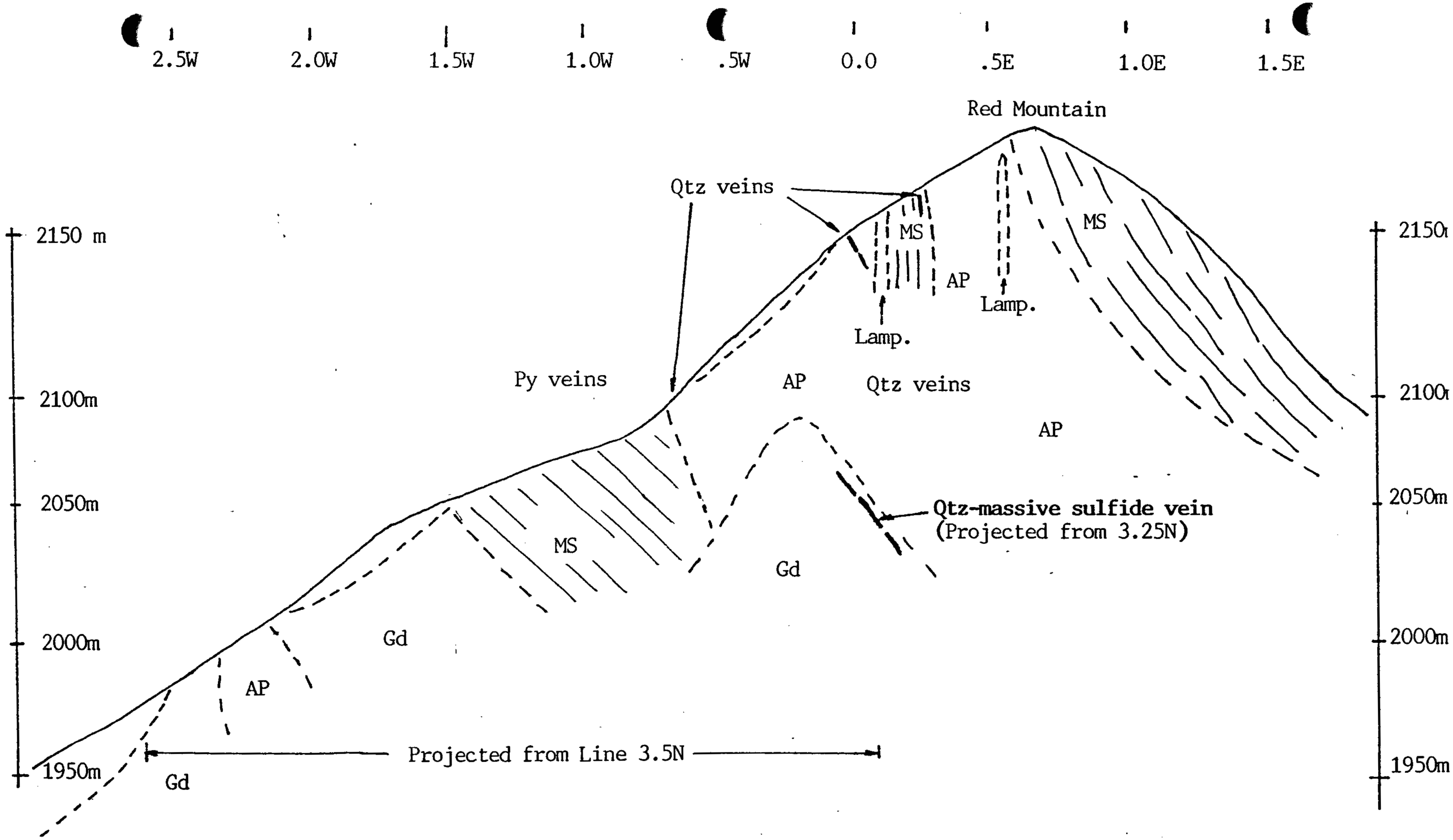
There appears to be three types of gold/silver mineralization in the property: (a) Gold-bearing massive sulfides with quartz found in the Gd, (b) Disseminated gold near the intrusive contacts (AP and/or Gd) with the MS, AuP, MV or with the AP itself, and (c) A fault-controlled mineralization between Copper Mountain and Red Mountain. Data on this type is still sketchy.

Further work on the property should include a thorough sampling of the outcrops at the intrusive contacts. This detailed geologic map will be a suitable guide. The map is also a suitable guide in laying out the priority areas for geophysical work.

Enclosed also you will find our invoice.

Yours truly,

P. J. Sant




Composite Geologic Section Through Lines 3.5N and 6N Looking North

P. J. (PEC) SANTOS P. ENG.
*Consulting Geologist*

Project Title
ROZAN PROPERTY
HIAWATHA RESOURCES INC.
Nelson M.D., B.C.
CANADA

| | |
|---|---|
| DATE: Sept. 1989 | SCALE: 1:2000 |
| DRAWN BY: P. J. SANTOS | PLATE NO. |

Lamprophyre

Gd — Nelson Intrusives (Granodiorite)

AP — Silver King Porphyry (Andesite Porphyry)

Rossland Group

MV — Meta-Volcanics (Green, recrystallized andesite)

AuP — Augite Porphyry

MS — Meta-Sediments (Black argillite, fine grained quartzite, tuffaceous sandstone)

70 — Dip and Strike of quartz veins and bedding

70 — Dip and Strike of joints

70 — Dip and Strike of dykes

x AP — Andesite Porphyry Boulders

x Gd — Granodiorite Boulders

x AuP — Augite Porphyry Boulders

x MV — Meta-Volcanic Boulders

x MS — Meta-Sediment Boulders

x Lamp — Lamprophyre Boulders

Outline of Outcrop

Geologic Contact

U D 70 70 Fault

Qtz. — Quartz

Lamp — Lamprophyre

py — Pyrite

po — Pyrrhotite

Trench — Dump

Portal

Claim Post

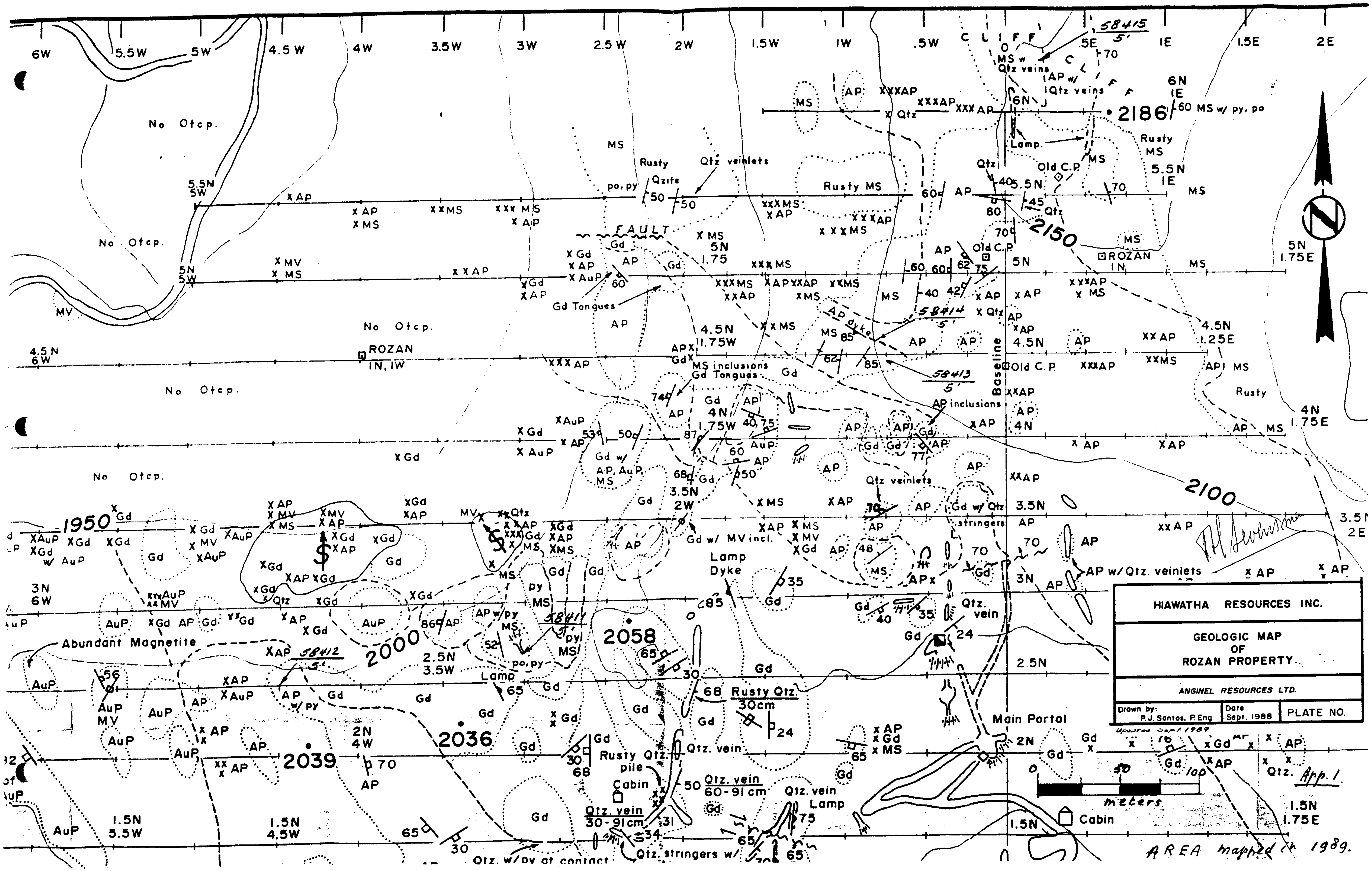
Shaft — Test Pit

Trail

2.5N.4W — Means 250 meters North, 400 meters West

$ — Rock Slide

*Appendix I*


HIAWATHA RESOURCES INC.
GEOLOGIC MAP OF ROZAN PROPERTY
ANGINEL RESOURCES LTD.
Drawn by: P.J. Santos, P.Eng
Date Sept. 1988
PLATE NO.
Updated Sept. 1989
App. 1
meters
AREA mapped in 1989.
No Otcp.
FAULT
Gd Tongues
MS inclusions
Gd Tongues
AP dyke
AP inclusions
Baseline
Abundant Magnetite
Old C.P.
ROZAN 1N
ROZAN 1N, 1W
Lamp Dyke
Rusty Qtz 30cm
Rusty Qtz pile
Qtz. vein 60-91cm
Qtz. vein 30-91cm
Qtz. vein
Lamp
Main Portal
Cabin
Qtz. w/py at contact
Qtz. stringers w/
Gd w/ MV incl.
AP w/Qtz. veinlets
Gd w/ Qtz stringers
Qtz veinlets
MS w/ py, po
MS w Qtz veins
AP w/ Qtz veins
CLIFF
2186
2150
2100
2058
2036
2039
2000
1950
58415 5'
58414 5'
58413 5'
58412 5'
58411 5'
6W
5.5W
5W
4.5W
4W
3.5W
3W
2.5W
2W
1.5W
1W
.5W
.5E
1E
1.5E
2E

## Selected soil and rock samples of special significance, requiring further investigation

1. Rocks

| Location | Mo | Cu | Pb | Zn | Ag | Ni | Co | Mn | Fe | As | Sr | Bi | Ba | K% | W | Au | Type |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | x | x | x | x | x | x | x | x | x | x | | x | x | | x | x | |
| L. 0368 | 8 | 68 | 7 | 50 | .1 | 20 | 10 | 337 | 4.28 | 12 | 32 | 2 | 118 | .55 | 1 | 6 | Miscellaneous on |
| L. 0369 | 20 | 46 | 15 | 120 | .3 | 47 | 10 | 424 | 5.03 | 24 | 78 | 2 | 46 | .19 | 1 | 3 | outcrops, |
| L. 0370 | 13 | 197 | 3 | 32 | .1 | 16 | 15 | 251 | 3.30 | 3 | 59 | 2 | 24 | .15 | 18 | 12 | Lacana, above |
| L. 0387 | 2 | 272 | 7 | 46 | .2 | 7 | 26 | 450 | 5.96 | 7 | 16 | 2 | 45 | .72 | 4 | 18 | road. |
| L. 0392 | 1 | 2 | 2 | 6 | 1 | 2 | 1 | 487 | 1.72 | 2 | 40 | 4 | 59 | .16 | 1 | 55 | |
| 588 | 230 | 29 | 19 | 13 | 2.3 | 4 | 9 | 85 | 9.77 | 12 | 9 | 61 | 28 | .09 | 1 | 26300 | Dump |
| 589 | 31 | 12 | 6 | 10 | .6 | 2 | 4 | 80 | 4.90 | 8 | 23 | 37 | 40 | .16 | 2 | 5995 | 6', upper portal |
| 590 | 251 | 452 | 29 | 53 | 15.8 | 6 | 20 | 315 | 56.51 | 129 | 3 | 71 | 11 | .03 | 1 | 16200 | Pit, 18" |
| 591 | 11 | 359 | 28 | 53 | 15.3 | 17 | 13 | 198 | 20.38 | 102 | 34 | 108 | 61 | .20 | 14 | 10080 | 18" vein |
| 592 | 123 | 24 | 117 | 9 | 3.2 | 1 | 2 | 39 | 3.54 | 9 | 56 | 55 | 67 | .15 | 12 | 5220 | Qzt. vein |
| 593 | 12 | 165 | 7 | 42 | .5 | 17 | 10 | 330 | 4.17 | 5 | 93 | 2 | 132 | .21 | 21 | 119 | Vn on road |
| 33596 | 11 | 159 | 14 | 152 | .2 | 25 | 14 | 640 | 5.01 | 11 | 87 | 2 | 76 | .74 | 1 | 71 | FW stope |
| 33597 | 648 | 9 | 25 | 32 | .2 | 11 | 4 | 443 | 1.98 | 5 | 59 | 2 | 39 | .23 | 1 | 490 | HW stope. |
| 58003 - 10 | 6 | 54 | 13 | 98 | .1 | 24 | 5 | 333 | 3.81 | 5 | 79 | 2 | 139 | .57 | 1 | 3 | MS (NE) |
| 58011 | 1 | 79 | 21 | 70 | .1 | 85 | 26 | 758 | 4.82 | 7 | 459 | 2 | 1488 | 1.34 | 1 | 4 | Lamprophyre |
| 58012 - 17 | | | | | | | | | No Special Interest | | | | | | | | |
| 58018 | 8 | 8 | 2 | 15 | .1 | 4 | 3 | 147 | 4.05 | 10 | 24 | 2 | 69 | 19 | 90 | 72 | 6S 3E Qtz Vein |
| 58019 | 7 | 6 | 19 | 9 | 2.3 | 3 | 1 | 73 | 4.79 | 4 | 13 | 31 | 32 | .16 | 1302 | 19920 | Shaft on vein 280 S to 300 E |
| 58020 | 9 | 9 | 3 | 10 | .7 | 3 | 2 | 122 | 4.38 | 6 | 9 | 19 | 31 | .21 | 153 | 8860 | Dump at above. |
| 701 | 15 | 248 | 2 | 39 | .4 | 10 | 8 | 237 | 3.29 | 2 | 68 | 2 | 25 | .14 | 41 | 8 | Pit (7mE of LRD 003) |
| 702 | 9 | 9 | 21 | 4 | .7 | 2 | 6 | 192 | 1.30 | 2 | 3 | 90 | 22 | .03 | 67 | 159 | End of |
| 703 | 3 | 20 | 16 | 26 | .7 | 4 | 8 | 520 | 2.20 | 2 | 12 | 50 | 50 | .16 | 21 | 86 | new road, |
| 704 | 11 | 14 | 31 | 9 | 7.0 | 5 | 69 | 87 | 6.45 | 3 | 5 | 167 | 15 | .06 | 73 | 640 | 650 S, |
| 705 | 6 | 12 | 16 | 10 | 5.3 | 3 | 2 | 403 | 1.71 | 2 | 9 | 647 | 31 | .08 | 1724 | 225 | 070 W. |
| 801 | 4 | .28% | 3.7% | .56% | 68.6 | 29 | 14 | 363 | 1.90 | 68 | 76 | 43 | 30 | .06 | 1 | 1700 | Eagle 2,900 N, 800 E. |
| 802 | 2 | 183 | 32 | 12 | .7 | 40 | 14 | 64 | 6.45 | 1427 | 4 | 2 | 9 | .01 | 1 | 3 | "Rozan" Qtz., as above. |

## 2. Soils

| Location | | Mo | Cu | Pb | Zn | Ag | Ni | Co | Mn | Fe | As | Sr | Bi | Ba | K% | W | Au | Type |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LRD. | 003 | 20 | 313 | 19 | 103 | .1 | 43 | 35 | 891 | 8.05 | 4 | 53 | 2 | 302 | .17 | 54 | 90 | Hi W Cu 7m W of 701 |
| | 001 | 1 | 29 | 9 | 53 | .1 | 13 | 10 | 410 | 3.16 | 2 | 24 | 4 | 77 | .08 | 1 | 255 | Hi Au |
| | 007 | 1 | 65 | 11 | 83 | .1 | 30 | 15 | 465 | 4.02 | 4 | 21 | 2 | 105 | .10 | 4 | 160 | |
| | 009 | 4 | 106 | 11 | 78 | .1 | 21 | 16 | 479 | 4.00 | 5 | 24 | 2 | 86 | .10 | 6 | 185 | Near contact Lamp - JGD and AP body |
| | 019 | 1 | 59 | 10 | 82 | .2 | 28 | 16 | 686 | 4.40 | 6 | 34 | 2 | 148 | .09 | 4 | 175 | |
| | 020 | 3 | 51 | 13 | 75 | .4 | 22 | 16 | 506 | 4.47 | 5 | 23 | 2 | 95 | .08 | 5 | 210 | |
| | 022 | 1 | 35 | 20 | 70 | .2 | 18 | 10 | 370 | 3.70 | 5 | 19 | 2 | 65 | .06 | 11 | 150 | |
| | 023 | 5 | 25 | 12 | 77 | .4 | 21 | 11 | 475 | 3.97 | 2 | 15 | 2 | 77 | .07 | 41 | 180 | U = 7 Hi W |
| 200 N, 25 W | | 14 | 46 | 91 | 269 | 1.4 | 27 | 14 | 918 | 4.91 | 12 | 56 | 3 | 197 | .15 | 1 | 1730 | Could be contamination. |
| 400 S, 400 W | | 6 | 73 | 22 | 107 | .4 | 18 | 16 | 524 | 4.78 | 5 | 59 | 2 | 86 | .12 | 116 | 119 | W. Peak. |
| 400 S, 150 W | | 33 | 198 | 23 | 229 | .9 | 80 | 32 | 620 | 6.98 | 53 | 45 | 2 | 281 | .21 | 17 | 52 | Hi in base-met. |
| 250 S, 500 E | | 3 | 24 | 34 | 85 | .1 | 15 | 11 | 675 | 3.89 | 10 | 27 | 3 | 75 | .07 | 18 | 2625 | Au Peak. |
| 600 S, 600 E | | 41 | 181 | 22 | 214 | .5 | 83 | 16 | 924 | 9.04 | 51 | 95 | 2 | 482 | .20 | 42 | 168 | Mo Peak. |
| 800 S, 400 E | | 13 | 94 | 16 | 278 | .2 | 35 | 25 | 955 | 5.17 | 12 | 34 | 3 | 135 | .09 | 21 | 112 | Zn High. |
| 800 S, 450 E | | 21 | 200 | 13 | 196 | .4 | 41 | 22 | 809 | 5.55 | 22 | 67 | 7 | 120 | .12 | 17 | 73 | Cu High. |
| 800 S, 900 to 1000 E | | 1 | 61 | 29 | 208 | .3 | 136 | 32 | 1691 | 6.64 | 9 | 228 | 2 | 1421 | .68 | 1 | 10 | Hi, Zn, Mn, Sr, Ba, K. |
| 1000 S, 1000 E | | 2 | 102 | 16 | 291 | .3 | 46 | 31 | 3068 | 5.03 | 20 | 90 | 3 | 427 | .22 | 5 | 133 | Hi, Zn, Mn Peak |
| 1000 S, 1050 E | | 3 | 80 | 17 | 304 | .1 | 102 | 35 | 913 | 6.26 | 16 | 156 | 3 | 758 | .52 | 6 | 74 | Zn Peak. |
| 100 S, 1050 W | | 8 | 141 | 14 | 83 | .2 | 19 | 18 | 581 | 4.56 | 9 | 145 | 2 | 59 | .07 | 35 | 92 | Good W. |
| 1000 S, 900 E | | 3 | 63 | 15 | 147 | .4 | 58 | 20 | 824 | 4.62 | 14 | 63 | 13 | 329 | .14 | 5 | 60 | Bi peak. |
| 800 S, 050 E | | 3 | 94 | 24 | 271 | .3 | 55 | 26 | 1487 | 5.63 | 113 | 58 | 2 | 116 | .18 | 22 | 52 | As peak. |

ACME ANALYTICAL LABORATORIES LTD.
852 E. HASTINGS ST. VANCOUVER B.C. V6A 1R6
PHONE(604)253-3158 FAX(604)253-1716

DATE RECEIVED: JAN 25 1990
DATE REPORT MAILED: Jan 30/90.

# GEOCHEMICAL ANALYSIS CERTIFICATE

ICP - .500 GRAM SAMPLE IS DIGESTED WITH 3ML 3-1-2 HCL-HNO3-H2O AT 95 DEG. C FOR ONE HOUR AND IS DILUTED TO 10 ML WITH WATER. THIS LEACH IS PARTIAL FOR MN FE SR CA P LA CR MG BA TI B W AND LIMITED FOR NA K AND AL. AU DETECTION LIMIT BY ICP IS 3 PPM.
- SAMPLE TYPE: SOIL PULP HG ANALYSIS BY FLAMELESS AA. F - NAOH FUSION - SPECIFIC ION ELECTRODE ANALYSIS.

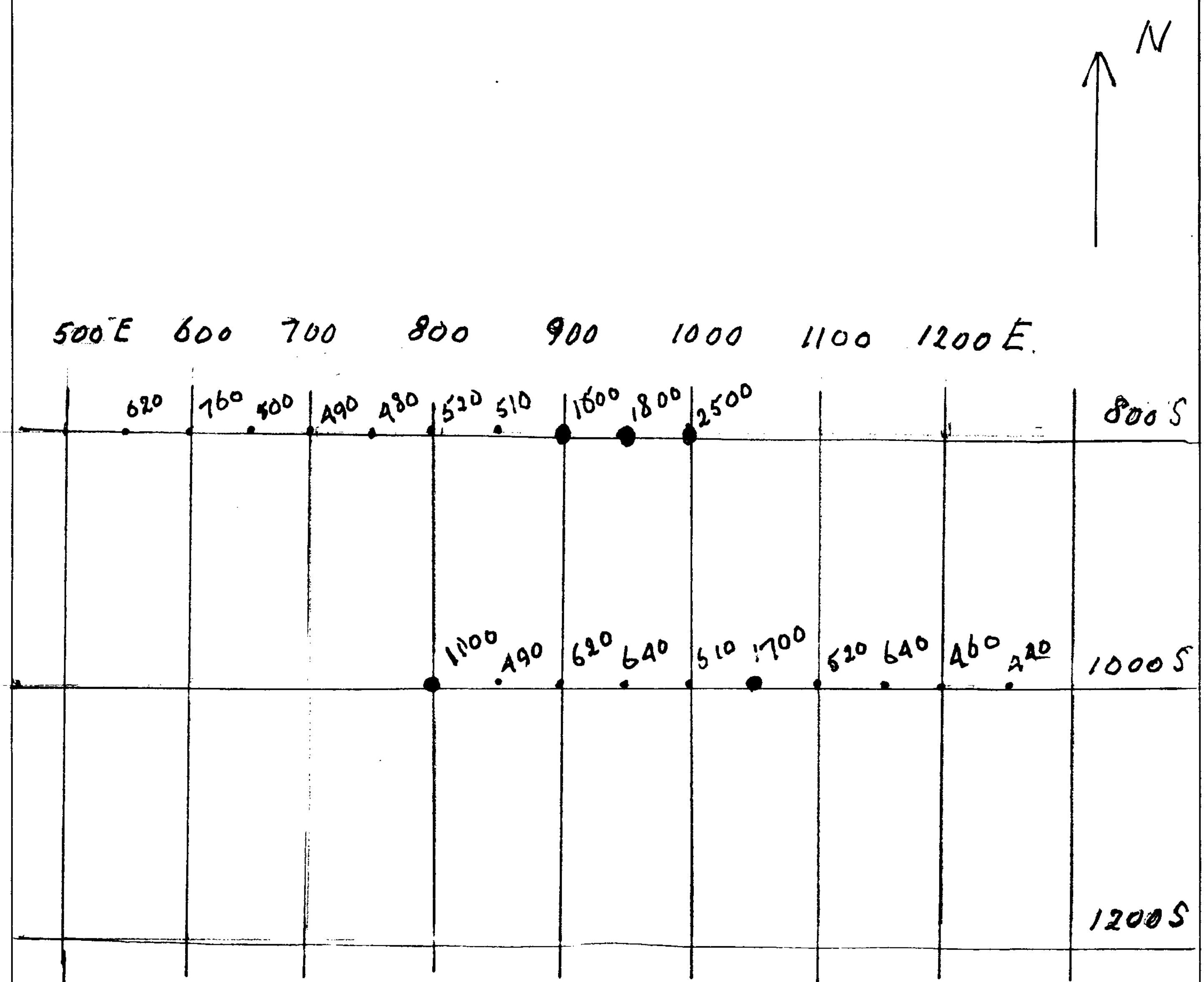
SIGNED BY.......... D.TOYE, C.LEONG, J.WANG; CERTIFIED B.C. ASSAYERS

**Hiawatha Resources FILE # 89-4634R Page 1**

| SAMPLE# | Sn PPM | Hg PPB | F PPM |
|---|---|---|---|
| 8+00S 5+50E | 1 | 10 | 620 |
| 8+00S 6+00E | 1 | 5 | 760 |
| 8+00S 6+50E | 1 | 5 | 500 |
| 8+00S 7+00E | 1 | 5 | 490 |
| 8+00S 7+50E | 1 | 5 | 480 |
| 8+00S 8+00E | 2 | 5 | 520 |
| 8+00S 8+50E | 1 | 5 | 510 |
| 8+00S 9+00E | 1 | 5 | 1600 |
| 8+00S 9+50E | 2 | 5 | 1800 |
| 8+00S 10+00E | 1 | 10 | 2500 |

**Hiawatha Resources FILE # 89-4634R Page 2**

| SAMPLE# | Sn PPM | Hg PPB | F PPM |
|---|---|---|---|
| 10+00S 8+00E | 1 | 5 | 1100 |
| 10+00S 8+50E | 1 | 10 | 490 |
| 10+00S 9+00E | 1 | 5 | 620 |
| 10+00S 9+50E | 1 | 5 | 640 |
| 10+00S 10+00E | 1 | 10 | 610 |
| 10+00S 10+50E | 2 | 5 | 1700 |
| 10+00S 11+00E | 1 | 5 | 520 |
| 10+00S 11+50E | 1 | 5 | 640 |
| 10+00S 12+00E | 1 | 10 | 460 |
| 10+00S 12+50E | 1 | 5 | 440 |




Only F = fluorine is anomalous, as above in ppm. It is highly mobile under acid, neutral and alcaline conditions. Sn = tin is insoluble under all conditions and only shows values of 1 or 2 ppm. Hg = mercury has high mobility as vapour, and medium to low mobility in solution. Values of 5-10 ppb are background only in this survey, which used rejects of samples taken earlier in 1989 for ICP 30 metals determinations.

P H Sevensma

| | | |
|---|---|---|
| Hiawatha Resources Inc. | | |
| Soil Survey Sn, Hg, F | | |
| Peter H. Sevensma Consultants Ltd., Vancouver, B.C. | | |
| Jan. 1990 | Scale: 0 meters 125 | Fig: App. 3. |

ACME ANAL[illegible]CAL LABORATORIES LTD. 852 E. HASTINGS ST. VANCOUVER B.C. V6[illegible] 1R6 PHONE(604)253-3158 FAX(604)253-1716

# GEOCHEMICAL ANALYSIS CERTIFICATE

ICP - .500 GRAM SAMPLE IS DIGESTED WITH 3ML 3-1-2 HCL-HNO3-H2O AT 95 DEG. C FOR ONE HOUR AND IS DILUTED TO 10 ML WITH WATER.
THIS LEACH IS PARTIAL FOR MN FE SR CA P LA CR MG BA TI B W AND LIMITED FOR NA K AND AL. AU DETECTION LIMIT BY ICP IS 3 PPM.
- SAMPLE TYPE: Soil -80 Mesh AU* ANALYSIS BY ACID LEACH/AA FROM 10 GM SAMPLE.

**DATE RECEIVED:** SEP 29 1989 **DATE REPORT MAILED:** Oct 3/89. **SIGNED BY**..........D.TOYE, C.LEONG, J.WANG; CERTIFIED B.C. ASSAYERS

## Hiawatha Resources File # 89-4006

| SAMPLE# | Mo PPM | Cu PPM | Pb PPM | Zn PPM | Ag PPM | Ni PPM | Co PPM | Mn PPM | Fe % | As PPM | U PPM | Au PPM | Th PPM | Sr PPM | Cd PPM | Sb PPM | Bi PPM | V PPM | Ca % | P % | La PPM | Cr PPM | Mg % | Ba PPM | Ti % | B PPM | Al % | Na % | K % | W PPM | Au* PPB |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1+00S 17+50W | 2 | 34 | 12 | 78 | .1 | 6 | 8 | 495 | 4.81 | 7 | 5 | ND | 1 | 19 | 1 | 2 | 2 | 87 | .17 | .105 | 4 | 13 | .69 | 81 | .13 | 15 | 2.25 | .01 | .11 | 2 | 2 |
| 1+00S 17+00W | 2 | 21 | 16 | 43 | .5 | 17 | 7 | 355 | 3.69 | 2 | 5 | ND | 2 | 25 | 1 | 2 | 2 | 69 | .15 | .074 | 7 | 44 | .41 | 75 | .17 | 6 | 1.95 | .01 | .05 | 2 | 3 |
| 1+00S 16+50W | 2 | 21 | 16 | 60 | .1 | 21 | 8 | 513 | 3.30 | 2 | 5 | ND | 2 | 31 | 1 | 2 | 2 | 69 | .19 | .101 | 10 | 61 | .64 | 91 | .19 | 5 | 2.03 | .01 | .07 | 1 | 3 |
| 1+00S 16+00W | 1 | 35 | 19 | 73 | .1 | 29 | 10 | 599 | 3.10 | 5 | 5 | ND | 1 | 36 | 1 | 2 | 2 | 60 | .26 | .108 | 11 | 61 | .89 | 94 | .10 | 20 | 2.52 | .02 | .07 | 1 | 5 |
| 1+00S 15+50W | 2 | 52 | 33 | 58 | .2 | 25 | 10 | 400 | 3.54 | 9 | 5 | ND | 2 | 38 | 1 | 2 | 2 | 66 | .29 | .111 | 12 | 47 | .76 | 87 | .12 | 7 | 3.22 | .01 | .07 | 2 | 15 |
| 1+00S 15+00W | 3 | 44 | 17 | 62 | .3 | 21 | 11 | 659 | 4.11 | 4 | 5 | ND | 1 | 45 | 1 | 2 | 2 | 79 | .28 | .155 | 12 | 53 | .72 | 84 | .14 | 10 | 2.63 | .01 | .08 | 1 | 109 |
| 1+00S 14+50W | 4 | 66 | 18 | 74 | .2 | 16 | 10 | 763 | 4.97 | 5 | 5 | ND | 2 | 32 | 1 | 2 | 2 | 60 | .18 | .149 | 10 | 31 | .67 | 54 | .10 | 5 | 4.39 | .01 | .07 | 5 | 167 |
| 1+00S 14+00W | 3 | 33 | 19 | 64 | .2 | 38 | 11 | 470 | 4.08 | 5 | 5 | ND | 3 | 107 | 1 | 2 | 2 | 73 | .51 | .266 | 29 | 80 | .97 | 87 | .15 | 10 | 2.51 | .01 | .07 | 1 | 14 |
| 1+00S 13+50W | 1 | 15 | 14 | 42 | .2 | 18 | 6 | 225 | 3.20 | 4 | 5 | ND | 3 | 29 | 1 | 2 | 2 | 84 | .15 | .102 | 8 | 57 | .54 | 50 | .21 | 8 | 1.45 | .01 | .05 | 1 | 9 |
| 1+00S 13+00W | 2 | 16 | 13 | 36 | .1 | 8 | 4 | 259 | 1.72 | 2 | 5 | ND | 1 | 18 | 1 | 2 | 2 | 43 | .13 | .060 | 8 | 22 | .43 | 52 | .12 | 4 | 1.37 | .01 | .08 | 2 | 10 |
| 1+00S 12+50W | 1 | 18 | 16 | 36 | .1 | 21 | 8 | 204 | 4.56 | 2 | 5 | ND | 3 | 32 | 1 | 2 | 2 | 102 | .17 | .108 | 12 | 74 | .60 | 64 | .24 | 10 | 1.82 | .01 | .05 | 1 | 24 |
| 1+00S 12+00W | 2 | 26 | 14 | 54 | .1 | 28 | 9 | 201 | 4.13 | 3 | 5 | ND | 5 | 24 | 1 | 2 | 2 | 71 | .15 | .115 | 16 | 76 | .65 | 69 | .20 | 7 | 3.05 | .01 | .05 | 1 | 13 |
| 1+00S 11+50W | 2 | 29 | 19 | 61 | .2 | 30 | 10 | 205 | 4.69 | 2 | 5 | ND | 5 | 17 | 1 | 2 | 2 | 77 | .11 | .195 | 9 | 105 | .81 | 83 | .22 | 4 | 4.42 | .01 | .07 | 2 | 6 |
| 1+00S 11+00W | 5 | 61 | 16 | 96 | .1 | 34 | 17 | 675 | 4.80 | 2 | 5 | ND | 3 | 54 | 1 | 2 | 2 | 88 | .28 | .181 | 9 | 65 | .99 | 179 | .17 | 20 | 4.07 | .01 | .10 | 3 | 57 |
| 1+00S 10+50W | 8 | 141 | 14 | 83 | .2 | 19 | 18 | 581 | 4.56 | 9 | 5 | ND | 3 | 145 | 1 | 2 | 2 | 65 | 1.31 | .097 | 6 | 27 | .66 | 59 | .14 | 13 | 5.78 | .01 | .07 | 35 | 92 |
| 1+00S 10+00W | 4 | 43 | 15 | 88 | .2 | 27 | 12 | 395 | 5.05 | 5 | 5 | ND | 5 | 34 | 1 | 2 | 2 | 86 | .23 | .211 | 8 | 54 | .78 | 75 | .17 | 8 | 3.92 | .01 | .08 | 11 | 60 |
| 1+00S 9+50W | 3 | 41 | 16 | 110 | .1 | 39 | 15 | 500 | 5.78 | 12 | 5 | ND | 6 | 29 | 1 | 2 | 3 | 103 | .18 | .234 | 9 | 80 | 1.10 | 104 | .21 | 4 | 3.73 | .01 | .12 | 8 | 52 |
| 1+00S 9+00W | 2 | 49 | 14 | 81 | .1 | 47 | 13 | 356 | 4.22 | 2 | 5 | ND | 5 | 34 | 1 | 2 | 2 | 75 | .22 | .237 | 13 | 95 | 1.06 | 116 | .17 | 4 | 4.23 | .01 | .09 | 4 | 20 |
| 1+00S 8+50W | 2 | 37 | 16 | 90 | .2 | 57 | 15 | 354 | 4.96 | 2 | 5 | ND | 6 | 112 | 1 | 2 | 2 | 80 | .47 | .326 | 29 | 110 | 1.24 | 171 | .19 | 17 | 3.86 | .01 | .10 | 3 | 50 |
| 1+00S 8+00W | 6 | 42 | 14 | 79 | .1 | 17 | 9 | 353 | 3.52 | 5 | 5 | ND | 2 | 27 | 1 | 2 | 2 | 60 | .16 | .132 | 10 | 34 | .66 | 86 | .12 | 5 | 3.97 | .01 | .06 | 7 | 57 |
| STD C/AU-S | 18 | 62 | 38 | 132 | 6.6 | 67 | 31 | 1002 | 3.94 | 37 | 18 | 6 | 37 | 47 | 18 | 14 | 20 | 57 | .49 | .089 | 38 | 56 | .87 | 174 | .05 | 35 | 1.90 | .06 | .14 | 13 | 48 |

ACME ANALYTICAL LABORATORIES LTD. 852 E. HASTINGS ST. VANCOUVER B.C. V6A 1R6 PHONE(604)253-3158 FAX(604)253-1716

# GEOCHEMICAL ANALYSIS CERTIFICATE

ICP - .500 GRAM SAMPLE IS DIGESTED WITH 3ML 3-1-2 HCL-HNO3-H2O AT 95 DEG. C FOR ONE HOUR AND IS DILUTED TO 10 ML WITH WATER.
THIS LEACH IS PARTIAL FOR MN FE SR CA P LA CR MG BA TI B W AND LIMITED FOR NA K AND AL. AU DETECTION LIMIT BY ICP IS 3 PPM.
- SAMPLE TYPE: Soil -80 Mesh AU* ANALYSIS BY ACID LEACH/AA FROM 10 GM SAMPLE.

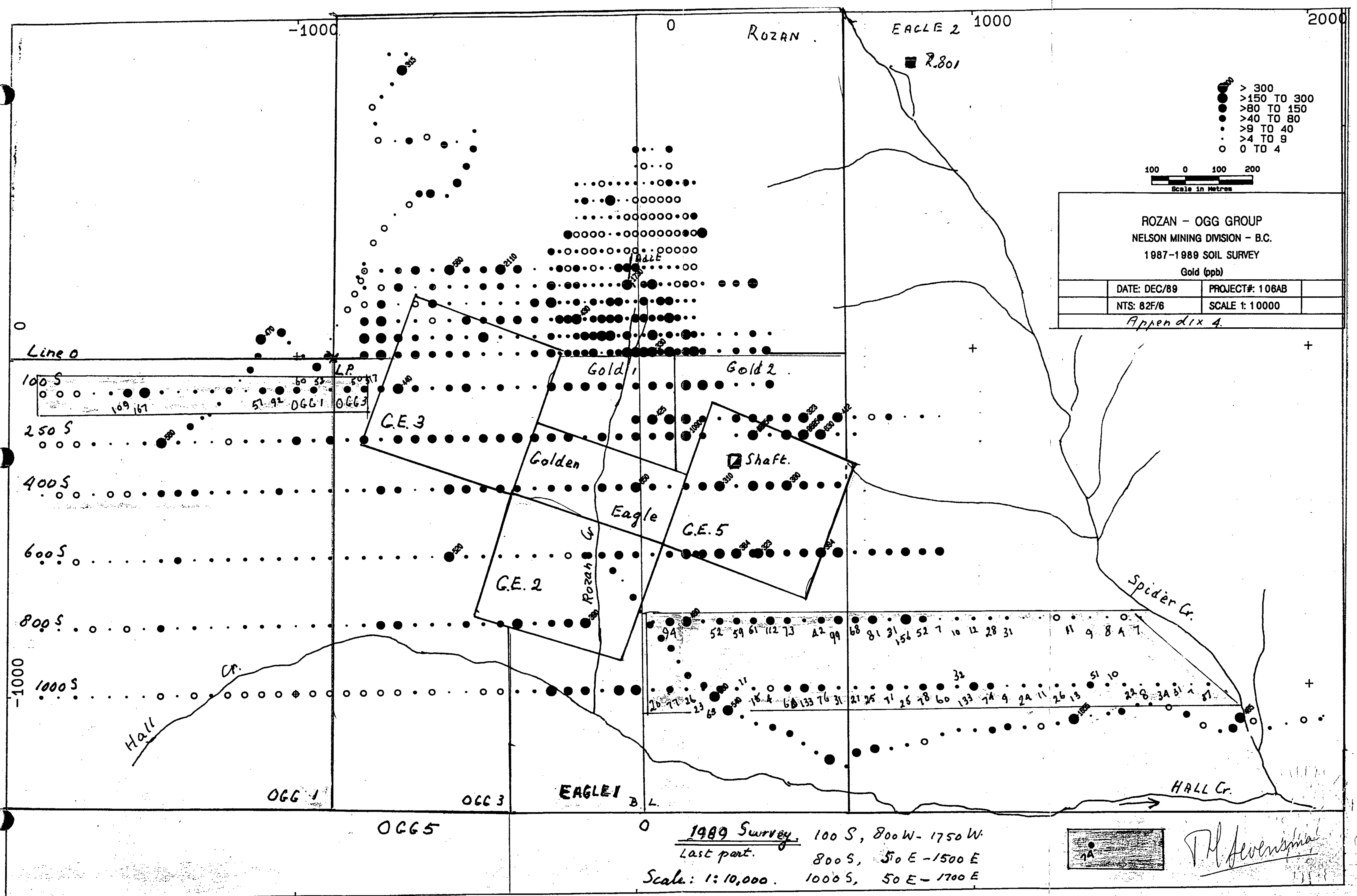
**DATE RECEIVED:** NOV 5 1989 **DATE REPORT MAILED:** Nov 8/89 **SIGNED BY** C. Leong .D.TOYE, C.LEONG, J.WANG; CERTIFIED B.C. ASSAYERS

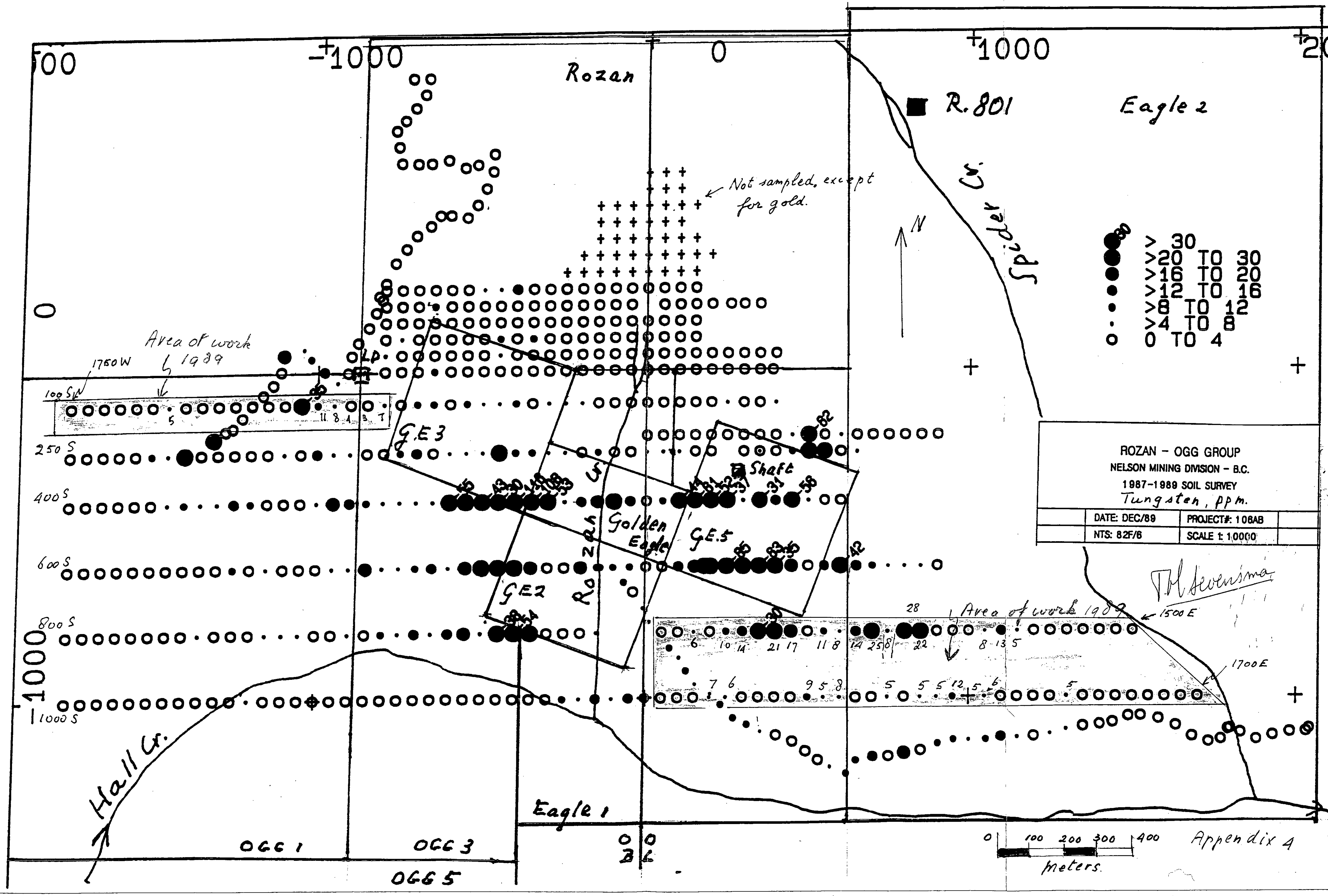
## Hiawatha Resources File # 89-4634 Page 1

| SAMPLE# | Mo PPM | Cu PPM | Pb PPM | Zn PPM | Ag PPM | Ni PPM | Co PPM | Mn PPM | Fe % | As PPM | U PPM | Au PPM | Th PPM | Sr PPM | Cd PPM | Sb PPM | Bi PPM | V PPM | Ca % | P % | La PPM | Cr PPM | Mg % | Ba PPM | Ti % | B PPM | Al % | Na % | K % | W PPM | Au* PPB |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8+00S 0+50E | 2 | 22 | 15 | 172 | .2 | 16 | 11 | 1370 | 3.47 | 3 | 5 | ND | 1 | 28 | 1 | 2 | 2 | 51 | .25 | .316 | 6 | 22 | .38 | 220 | .14 | 3 | 3.04 | .01 | .06 | 2 | 18 |
| 8+00S 1+00E | 6 | 44 | 23 | 76 | .4 | 19 | 10 | 513 | 3.74 | 4 | 5 | ND | 1 | 39 | 2 | 3 | 2 | 66 | .39 | .073 | 9 | 29 | .57 | 87 | .09 | 2 | 2.90 | .01 | .09 | 4 | 94 |
| 8+00S 1+50E | 2 | 50 | 23 | 76 | .2 | 35 | 13 | 357 | 3.80 | 2 | 5 | ND | 2 | 22 | 1 | 2 | 2 | 67 | .17 | .140 | 8 | 43 | .77 | 108 | .13 | 6 | 3.64 | .01 | .08 | 6 | 460 |
| 8+00S 2+00E | 1 | 37 | 19 | 84 | .2 | 44 | 13 | 409 | 3.57 | 4 | 5 | ND | 2 | 19 | 1 | 2 | 2 | 58 | .16 | .150 | 6 | 46 | .80 | 159 | .15 | 4 | 3.85 | .01 | .07 | 2 | 20 |
| 8+00S 2+50E | 3 | 75 | 11 | 85 | .1 | 110 | 19 | 477 | 4.03 | 6 | 5 | ND | 2 | 27 | 1 | 2 | 2 | 67 | .29 | .086 | 9 | 107 | 1.94 | 163 | .15 | 5 | 4.16 | .01 | .16 | 10 | 52 |
| 8+00S 3+00E | 6 | 62 | 18 | 104 | .1 | 31 | 16 | 530 | 4.12 | 6 | 5 | ND | 2 | 29 | 1 | 2 | 2 | 67 | .24 | .121 | 10 | 37 | .85 | 99 | .15 | 3 | 3.72 | .01 | .10 | 14 | 59 |
| 8+00S 3+50E | 16 | 117 | 27 | 155 | .3 | 30 | 20 | 883 | 5.05 | 9 | 5 | ND | 2 | 33 | 1 | 2 | 2 | 73 | .18 | .097 | 7 | 32 | .83 | 142 | .16 | 9 | 4.42 | .01 | .10 | 30 | 61 |
| 8+00S 4+00E | 13 | 94 | 16 | 278 | .2 | 35 | 25 | 955 | 5.17 | 12 | 5 | ND | 2 | 34 | 2 | 2 | 3 | 75 | .13 | .077 | 6 | 28 | .67 | 135 | .14 | 12 | 3.29 | .01 | .09 | 21 | 112 |
| 8+00S 4+50E | 21 | 200 | 13 | 196 | .4 | 41 | 22 | 809 | 5.55 | 22 | 5 | ND | 1 | 67 | 1 | 2 | 7 | 73 | .33 | .165 | 7 | 29 | .80 | 120 | .11 | 10 | 4.56 | .01 | .12 | 17 | 73 |
| 8+00S 5+00E | 5 | 51 | 15 | 134 | .2 | 46 | 17 | 687 | 4.87 | 10 | 5 | ND | 3 | 33 | 2 | 3 | 2 | 63 | .30 | .076 | 9 | 32 | .68 | 153 | .19 | 13 | 4.80 | .03 | .07 | 4 | 12 |
| 8+00S 5+50E | 7 | 83 | 33 | 285 | .3 | 68 | 26 | 1111 | 7.33 | 19 | 5 | ND | 2 | 43 | 2 | 2 | 2 | 97 | .36 | .194 | 9 | 55 | 1.36 | 297 | .18 | 9 | 4.00 | .02 | .20 | 11 | 42 |
| 8+00S 6+00E | 6 | 79 | 33 | 188 | .4 | 76 | 29 | 1658 | 5.79 | 21 | 5 | ND | 1 | 48 | 3 | 2 | 2 | 82 | .29 | .167 | 17 | 57 | 1.44 | 343 | .19 | 14 | 3.35 | .01 | .19 | 8 | 99 |
| 8+00S 6+50E | 15 | 104 | 9 | 169 | .5 | 50 | 17 | 819 | 6.70 | 28 | 5 | ND | 1 | 39 | 2 | 2 | 5 | 89 | .15 | .130 | 6 | 50 | .90 | 128 | .12 | 15 | 3.96 | .01 | .12 | 14 | 68 |
| 8+00S 7+00E | 19 | 140 | 20 | 160 | .3 | 37 | 9 | 382 | 9.43 | 29 | 5 | ND | 1 | 26 | 1 | 3 | 6 | 80 | .10 | .118 | 6 | 34 | .81 | 61 | .11 | 10 | 3.89 | .01 | .15 | 25 | 81 |
| 8+00S 7+50E | 4 | 59 | 20 | 235 | .2 | 29 | 20 | 1487 | 7.04 | 43 | 5 | ND | 1 | 38 | 1 | 2 | 2 | 84 | .21 | .094 | 7 | 32 | .86 | 97 | .13 | 9 | 3.29 | .01 | .11 | 8 | 31 |
| 8+00S 8+00E | 5 | 98 | 20 | 205 | .3 | 47 | 19 | 860 | 6.38 | 60 | 5 | ND | 2 | 37 | 1 | 4 | 2 | 82 | .21 | .088 | 7 | 36 | .92 | 114 | .12 | 13 | 4.14 | .01 | .10 | 28 | 156 |
| 8+00S 8+50E | 3 | 94 | 24 | 271 | .3 | 55 | 26 | 1487 | 5.63 | 113 | 5 | ND | 1 | 58 | 3 | 2 | 2 | 84 | .50 | .107 | 12 | 50 | 1.20 | 116 | .09 | 13 | 3.59 | .02 | .18 | 22 | 52 |
| 8+00S 9+00E | 1 | 70 | 31 | 204 | .3 | 170 | 32 | 1411 | 6.20 | 9 | 5 | ND | 3 | 234 | 2 | 4 | 2 | 73 | 1.14 | .489 | 55 | 61 | 2.97 | 1420 | .24 | 8 | 4.03 | .02 | .56 | 1 | 7 |
| 8+00S 9+50E | 1 | 56 | 27 | 196 | .3 | 109 | 31 | 1730 | 6.50 | 13 | 5 | ND | 3 | 170 | 2 | 3 | 2 | 77 | .94 | .374 | 28 | 88 | 2.50 | 1253 | .33 | 5 | 3.79 | .02 | .45 | 1 | 10 |
| 8+00S 10+00E | 1 | 56 | 28 | 225 | .3 | 129 | 34 | 1931 | 7.21 | 5 | 5 | ND | 4 | 282 | 2 | 5 | 2 | 83 | 1.51 | .532 | 55 | 91 | 3.02 | 1590 | .32 | 24 | 3.47 | .03 | 1.02 | 1 | 12 |
| 8+00S 10+50E | 2 | 67 | 27 | 157 | .2 | 46 | 19 | 1186 | 4.91 | 13 | 5 | ND | 1 | 46 | 2 | 2 | 2 | 81 | .28 | .147 | 11 | 52 | 1.20 | 297 | .16 | 6 | 3.75 | .01 | .13 | 8 | 28 |
| 8+00S 11+00E | 2 | 45 | 18 | 127 | .3 | 31 | 15 | 1107 | 4.69 | 8 | 5 | ND | 2 | 23 | 1 | 2 | 2 | 75 | .15 | .104 | 6 | 34 | .79 | 154 | .16 | 6 | 3.80 | .01 | .08 | 13 | 31 |
| 8+00S 11+50E | 2 | 26 | 15 | 120 | .3 | 15 | 12 | 1812 | 3.63 | 7 | 5 | ND | 1 | 20 | 1 | 2 | 2 | 57 | .15 | .233 | 5 | 23 | .42 | 146 | .14 | 3 | 3.53 | .01 | .06 | 5 | 6 |
| 8+00S 12+00E | 2 | 34 | 13 | 123 | .3 | 19 | 11 | 693 | 4.43 | 10 | 5 | ND | 1 | 19 | 1 | 2 | 2 | 84 | .15 | .131 | 5 | 40 | .74 | 108 | .15 | 8 | 2.81 | .01 | .06 | 1 | 8 |
| 8+00S 12+50E | 1 | 37 | 13 | 113 | .6 | 24 | 14 | 635 | 4.15 | 8 | 5 | ND | 1 | 22 | 1 | 2 | 2 | 69 | .18 | .140 | 5 | 39 | .76 | 94 | .15 | 2 | 3.69 | .01 | .06 | 1 | 2 |
| 8+00S 13+00E | 2 | 63 | 7 | 94 | .2 | 30 | 15 | 398 | 4.18 | 18 | 5 | ND | 1 | 30 | 1 | 2 | 2 | 71 | .22 | .102 | 7 | 48 | .99 | 95 | .14 | 11 | 3.69 | .01 | .08 | 1 | 11 |
| 8+00S 13+50E | 2 | 55 | 13 | 111 | .3 | 28 | 18 | 778 | 4.59 | 12 | 5 | ND | 1 | 42 | 1 | 2 | 2 | 86 | .34 | .139 | 6 | 51 | .92 | 173 | .13 | 2 | 2.97 | .01 | .07 | 1 | 9 |
| 8+00S 14+00E | 2 | 55 | 15 | 83 | .4 | 30 | 14 | 514 | 4.21 | 16 | 5 | ND | 1 | 34 | 1 | 2 | 2 | 75 | .28 | .119 | 8 | 47 | 1.04 | 115 | .12 | 12 | 3.87 | .01 | .08 | 1 | 8 |
| 8+00S 14+50E | 1 | 55 | 14 | 111 | .4 | 23 | 14 | 680 | 3.88 | 12 | 5 | ND | 1 | 36 | 1 | 2 | 2 | 69 | .34 | .157 | 6 | 40 | .75 | 133 | .11 | 13 | 2.66 | .01 | .09 | 1 | 4 |
| 8+00S 15+00E | 2 | 88 | 12 | 91 | .4 | 33 | 22 | 943 | 4.73 | 14 | 5 | ND | 1 | 36 | 1 | 2 | 2 | 76 | .28 | .161 | 9 | 60 | 1.33 | 110 | .10 | 4 | 2.74 | .01 | .18 | 1 | 7 |
| STD C/AU-S | 18 | 62 | 38 | 133 | 7.1 | 67 | 31 | 1022 | 4.27 | 42 | 19 | 8 | 37 | 47 | 19 | 15 | 19 | 58 | .48 | .100 | 37 | 57 | .91 | 174 | .06 | 38 | 2.02 | .06 | .14 | 11 | 51 |

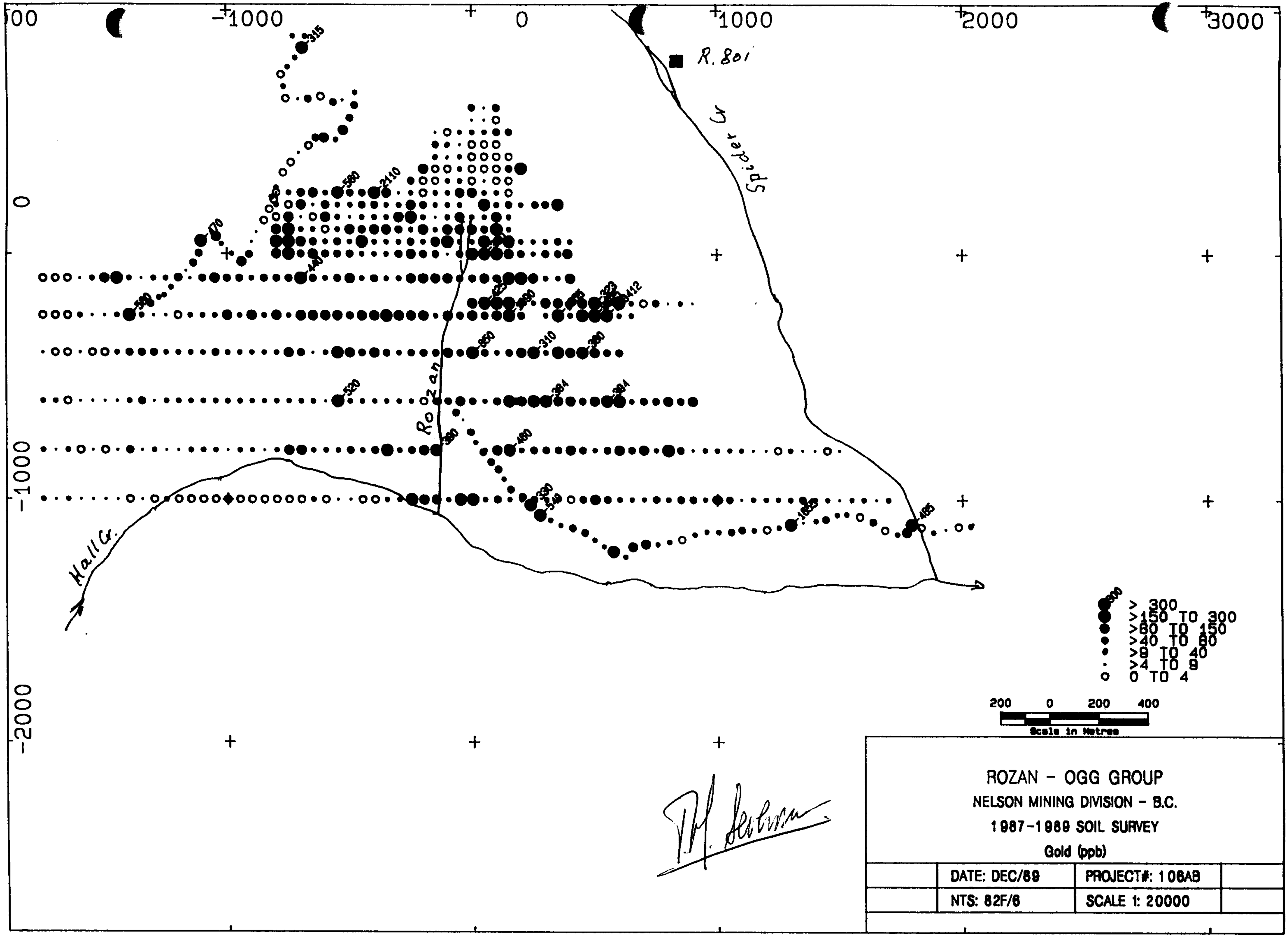
T.H. Seelman

| SAMPLE# | Mo PPM | Cu PPM | Pb PPM | Zn PPM | Ag PPM | Ni PPM | Co PPM | Mn PPM | Fe % | As PPM | U PPM | Au PPM | Th PPM | Sr PPM | Cd PPM | Sb PPM | Bi PPM | V PPM | Ca % | P % | La PPM | Cr PPM | Mg % | Ba PPM | Ti % | B PPM | Al % | Na % | K % | W PPM | Au* PPB |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10+00S 0+50E | 2 | 47 | 8 | 88 | .1 | 24 | 14 | 1386 | 4.08 | 8 | 5 | ND | 2 | 31 | 1 | 2 | 2 | 76 | .24 | .137 | 8 | 31 | .77 | 151 | .15 | 2 | 3.19 | .01 | .07 | 4 | 20 |
| 10+00S 1+00E | 3 | 38 | 12 | 90 | .1 | 21 | 15 | 629 | 4.46 | 9 | 5 | ND | 2 | 33 | 1 | 2 | 2 | 80 | .27 | .080 | 9 | 30 | .69 | 112 | .17 | 3 | 3.12 | .01 | .06 | 2 | 77 |
| 10+00S 1+50E | 6 | 59 | 11 | 138 | .1 | 26 | 20 | 1117 | 4.87 | 7 | 5 | ND | 2 | 53 | 1 | 2 | 2 | 99 | .54 | .054 | 14 | 34 | 1.22 | 106 | .18 | 11 | 3.26 | .02 | .08 | 3 | 26 |
| 10+00S 2+00E | 4 | 53 | 14 | 153 | .1 | 39 | 17 | 768 | 4.08 | 6 | 5 | ND | 2 | 39 | 1 | 2 | 2 | 72 | .40 | .093 | 8 | 44 | .91 | 105 | .15 | 10 | 3.03 | .01 | .10 | 7 | 23 |
| 10+00S 2+50E | 3 | 37 | 9 | 94 | .1 | 25 | 13 | 602 | 4.11 | 4 | 5 | ND | 2 | 32 | 1 | 2 | 2 | 69 | .30 | .094 | 9 | 32 | .76 | 117 | .14 | 9 | 2.77 | .01 | .09 | 6 | 63 |
| 10+00S 3+00E | 2 | 31 | 15 | 105 | .1 | 19 | 13 | 556 | 3.87 | 10 | 5 | ND | 2 | 22 | 1 | 2 | 2 | 60 | .21 | .198 | 6 | 21 | .47 | 115 | .17 | 7 | 3.67 | .01 | .08 | 1 | 11 |
| 10+00S 3+50E | 2 | 34 | 8 | 143 | .1 | 24 | 15 | 517 | 3.81 | 4 | 5 | ND | 3 | 19 | 1 | 2 | 2 | 70 | .17 | .148 | 6 | 24 | .59 | 186 | .17 | 2 | 4.11 | .02 | .08 | 4 | 15 |
| 10+00S 4+00E | 2 | 25 | 16 | 183 | .1 | 17 | 13 | 595 | 3.56 | 4 | 5 | ND | 3 | 19 | 1 | 2 | 2 | 54 | .19 | .157 | 5 | 17 | .36 | 149 | .19 | 2 | 3.61 | .02 | .08 | 1 | 4 |
| 10+00S 4+50E | 3 | 52 | 10 | 85 | .1 | 25 | 13 | 484 | 3.45 | 11 | 5 | ND | 3 | 27 | 1 | 2 | 3 | 56 | .26 | .097 | 9 | 24 | .58 | 106 | .16 | 2 | 4.49 | .01 | .09 | 2 | 60 |
| 10+00S 5+00E | 4 | 59 | 10 | 128 | .1 | 29 | 17 | 841 | 4.67 | 7 | 5 | ND | 2 | 34 | 1 | 2 | 2 | 85 | .35 | .131 | 9 | 37 | 1.01 | 168 | .15 | 5 | 2.99 | .01 | .13 | 9 | 133 |
| 10+00S 5+50E | 3 | 48 | 10 | 95 | .1 | 31 | 14 | 810 | 4.35 | 7 | 5 | ND | 3 | 32 | 1 | 2 | 2 | 73 | .23 | .113 | 11 | 32 | .80 | 132 | .13 | 3 | 3.02 | .01 | .08 | 5 | 76 |
| 10+00S 6+00E | 3 | 97 | 6 | 113 | .1 | 40 | 20 | 1090 | 4.36 | 5 | 5 | ND | 2 | 57 | 1 | 2 | 2 | 82 | .45 | .112 | 13 | 36 | 1.15 | 172 | .16 | 3 | 4.38 | .01 | .19 | 8 | 31 |
| 10+00S 6+50E | 2 | 64 | 14 | 135 | .1 | 85 | 22 | 1112 | 4.71 | 16 | 5 | ND | 4 | 78 | 1 | 2 | 2 | 80 | .55 | .154 | 18 | 69 | 1.85 | 473 | .25 | 10 | 4.25 | .02 | .26 | 2 | 21 |
| 10+00S 7+00E | 3 | 67 | 11 | 183 | .1 | 39 | 26 | 1862 | 4.81 | 9 | 5 | ND | 1 | 80 | 1 | 2 | 2 | 81 | .89 | .174 | 23 | 30 | 1.36 | 287 | .13 | 5 | 4.01 | .04 | .22 | 3 | 25 |
| 10+00S 7+50E | 3 | 68 | 63 | 172 | .1 | 44 | 19 | 1518 | 4.10 | 15 | 5 | ND | 1 | 88 | 1 | 2 | 3 | 76 | 1.09 | .139 | 23 | 43 | 1.29 | 230 | .11 | 4 | 3.78 | .02 | .22 | 5 | 71 |
| 10+00S 8+00E | 4 | 70 | 32 | 176 | .2 | 92 | 24 | 1396 | 4.59 | 21 | 5 | ND | 4 | 161 | 1 | 2 | 2 | 71 | 1.02 | .253 | 62 | 57 | 2.18 | 618 | .18 | 2 | 3.86 | .02 | .32 | 4 | 25 |
| 10+00S 8+50E | 6 | 67 | 24 | 202 | .1 | 30 | 18 | 1344 | 4.07 | 24 | 5 | ND | 1 | 33 | 1 | 2 | 2 | 67 | .27 | .148 | 11 | 29 | .83 | 122 | .07 | 3 | 3.34 | .01 | .14 | 5 | 78 |
| 10+00S 9+00E | 3 | 63 | 15 | 147 | .4 | 58 | 20 | 824 | 4.62 | 14 | 5 | ND | 3 | 63 | 1 | 2 | 13 | 83 | .43 | .089 | 14 | 43 | 1.33 | 329 | .19 | 3 | 3.59 | .02 | .14 | 5 | 60 |
| 10+00S 9+50E | 5 | 54 | 28 | 163 | .1 | 37 | 22 | 2097 | 4.22 | 13 | 5 | ND | 1 | 92 | 2 | 2 | 11 | 80 | .80 | .139 | 24 | 37 | 1.17 | 234 | .10 | 9 | 3.22 | .03 | .13 | 12 | 32 |
| 10+00S 10+00E | 2 | 102 | 16 | 291 | .3 | 46 | 31 | 3068 | 5.03 | 20 | 5 | ND | 1 | 90 | 3 | 2 | 3 | 80 | .65 | .184 | 17 | 42 | 1.06 | 427 | .13 | 2 | 3.09 | .03 | .22 | 5 | 133 |
| 10+00S 10+50E | 3 | 80 | 17 | 304 | .1 | 102 | 35 | 913 | 6.26 | 16 | 5 | ND | 5 | 156 | 2 | 2 | 3 | 88 | .90 | .245 | 25 | 80 | 2.42 | 758 | .33 | 2 | 4.24 | .02 | .52 | 6 | 74 |
| 10+00S 11+00E | 1 | 38 | 13 | 194 | .1 | 40 | 22 | 929 | 4.04 | 11 | 5 | ND | 3 | 49 | 1 | 2 | 2 | 63 | .32 | .319 | 9 | 44 | .71 | 496 | .23 | 3 | 3.49 | .02 | .11 | 3 | 9 |
| 10+00S 11+50E | 3 | 49 | 11 | 122 | .1 | 28 | 16 | 912 | 4.66 | 9 | 5 | ND | 2 | 37 | 1 | 2 | 2 | 96 | .27 | .062 | 7 | 41 | .95 | 213 | .19 | 3 | 3.43 | .02 | .09 | 4 | 24 |
| 10+00S 12+00E | 3 | 54 | 10 | 118 | .1 | 31 | 17 | 671 | 4.28 | 10 | 5 | ND | 2 | 32 | 1 | 2 | 2 | 81 | .25 | .073 | 8 | 37 | .88 | 157 | .17 | 5 | 4.16 | .02 | .09 | 2 | 11 |
| 10+00S 12+50E | 2 | 51 | 11 | 98 | .1 | 26 | 17 | 745 | 3.98 | 12 | 5 | ND | 2 | 35 | 1 | 2 | 2 | 74 | .31 | .104 | 7 | 35 | .85 | 151 | .15 | 10 | 4.31 | .02 | .08 | 2 | 26 |
| 10+00S 13+00E | 4 | 55 | 13 | 97 | .2 | 23 | 15 | 721 | 3.81 | 7 | 5 | ND | 3 | 27 | 1 | 3 | 2 | 66 | .26 | .099 | 7 | 30 | .71 | 105 | .16 | 3 | 4.05 | .01 | .07 | 5 | 13 |
| 10+00S 13+50E | 4 | 58 | 10 | 115 | .1 | 29 | 18 | 1110 | 4.24 | 7 | 5 | ND | 2 | 28 | 1 | 2 | 2 | 76 | .25 | .078 | 9 | 35 | .82 | 154 | .17 | 2 | 3.71 | .02 | .08 | 3 | 51 |
| 10+00S 14+00E | 2 | 63 | 6 | 125 | .2 | 47 | 20 | 896 | 4.43 | 12 | 5 | ND | 3 | 42 | 1 | 2 | 2 | 80 | .33 | .102 | 12 | 48 | 1.16 | 237 | .20 | 7 | 3.66 | .01 | .12 | 1 | 10 |
| 10+00S 14+50E | 2 | 58 | 10 | 116 | .1 | 29 | 18 | 1020 | 4.33 | 11 | 5 | ND | 1 | 40 | 1 | 2 | 2 | 82 | .40 | .099 | 8 | 43 | 1.04 | 147 | .14 | 6 | 3.20 | .01 | .09 | 2 | 22 |
| 10+00S 15+00E | 1 | 54 | 8 | 113 | .1 | 27 | 21 | 938 | 4.46 | 9 | 5 | ND | 2 | 34 | 1 | 2 | 2 | 86 | .34 | .099 | 6 | 44 | 1.04 | 158 | .17 | 5 | 3.27 | .01 | .08 | 1 | 8 |
| 10+00S 15+50E | 1 | 57 | 9 | 83 | .2 | 25 | 17 | 444 | 3.82 | 15 | 5 | ND | 3 | 30 | 1 | 2 | 2 | 66 | .27 | .116 | 6 | 37 | .80 | 112 | .15 | 4 | 3.90 | .01 | .07 | 1 | 34 |
| 10+00S 16+00E | 1 | 48 | 8 | 85 | .2 | 24 | 16 | 463 | 3.71 | 8 | 5 | ND | 3 | 24 | 1 | 2 | 2 | 62 | .20 | .125 | 7 | 34 | .71 | 135 | .16 | 2 | 3.94 | .01 | .06 | 1 | 31 |
| 10+00S 16+50E | 1 | 39 | 11 | 131 | .2 | 22 | 18 | 900 | 4.10 | 9 | 5 | ND | 3 | 26 | 1 | 2 | 2 | 69 | .21 | .259 | 5 | 36 | .79 | 122 | .13 | 2 | 3.94 | .01 | .06 | 3 | 7 |
| 10+00S 17+00E | 1 | 61 | 10 | 110 | .2 | 27 | 18 | 900 | 4.25 | 7 | 5 | ND | 2 | 44 | 1 | 2 | 2 | 80 | .39 | .088 | 8 | 44 | .87 | 137 | .16 | 2 | 2.34 | .01 | .08 | 1 | 37 |
| STD C/AU-S | 17 | 61 | 38 | 132 | 7.1 | 67 | 29 | 991 | 3.93 | 38 | 18 | 7 | 36 | 47 | 17 | 15 | 24 | 55 | .48 | .089 | 36 | 53 | .87 | 174 | .06 | 32 | 1.90 | .06 | .14 | 11 | 51 |


ROZAN - OGG GROUP
NELSON MINING DIVISION - B.C.
1987-1989 SOIL SURVEY
Gold (ppb)
DATE: DEC/89
PROJECT#: 106AB
NTS: 82F/6
SCALE 1: 10000
Appendix 4.
> 300
>150 TO 300
>80 TO 150
>40 TO 80
>9 TO 40
>4 TO 9
0 TO 4
Scale in Metres
Rozan
Eagle 2
R.801
Line 0
100 S
250 S
400 S
600 S
800 S
1000 S
L.P.
OGG 1
OGG 3
OGG 5
Eagle 1
B.L.
C.E. 3
C.E. 2
C.E. 5
Gold 1
Gold 2
Golden
Eagle
Shaft.
Rozan Cr.
Spider Cr.
Hall Cr.
HALL Cr.
1989 Survey, Last part.
100 S, 800 W - 1750 W.
800 S, 50 E - 1500 E
1000 S, 50 E - 1700 E
Scale: 1:10,000.



Rozan
R.801
Eagle 2
Not sampled, except for gold.
N
Spider Cr.
> 30
>20 TO 30
>16 TO 20
>12 TO 16
>8 TO 12
>4 TO 8
0 TO 4
ROZAN - OGG GROUP
NELSON MINING DIVISION - B.C.
1987-1989 SOIL SURVEY
Tungsten, ppm.
DATE: DEC/89
PROJECT#: 106AB
NTS: 82F/6
SCALE 1: 10000
Area of work 1989
1750 W
100 S
250 S
400 S
600 S
800 S
1000 S
G.E 3
G.E.5
GE2
Golden Eagle
Rozan Cr.
Shaft
1500 E
1700 E
Hall Cr.
Eagle 1
OGG 1
OGG 3
OGG 5
0 100 200 300 400
meters.
Appendix 4



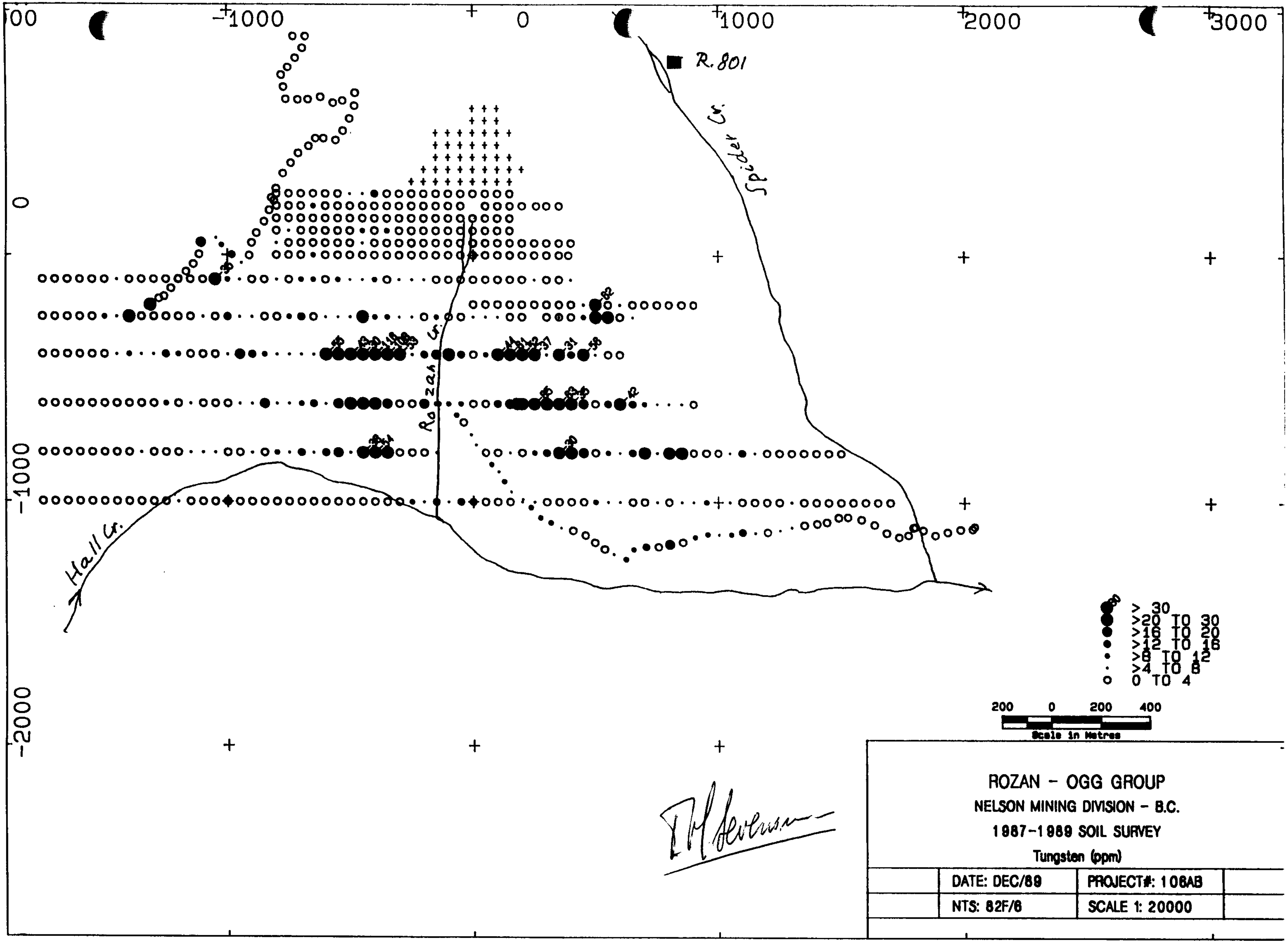

ROZAN - OGG GROUP

NELSON MINING DIVISION - B.C.

1987-1989 SOIL SURVEY

Gold (ppb)

| | |
|---|---|
| DATE: DEC/89 | PROJECT#: 106AB |
| NTS: 82F/6 | SCALE 1: 20000 |



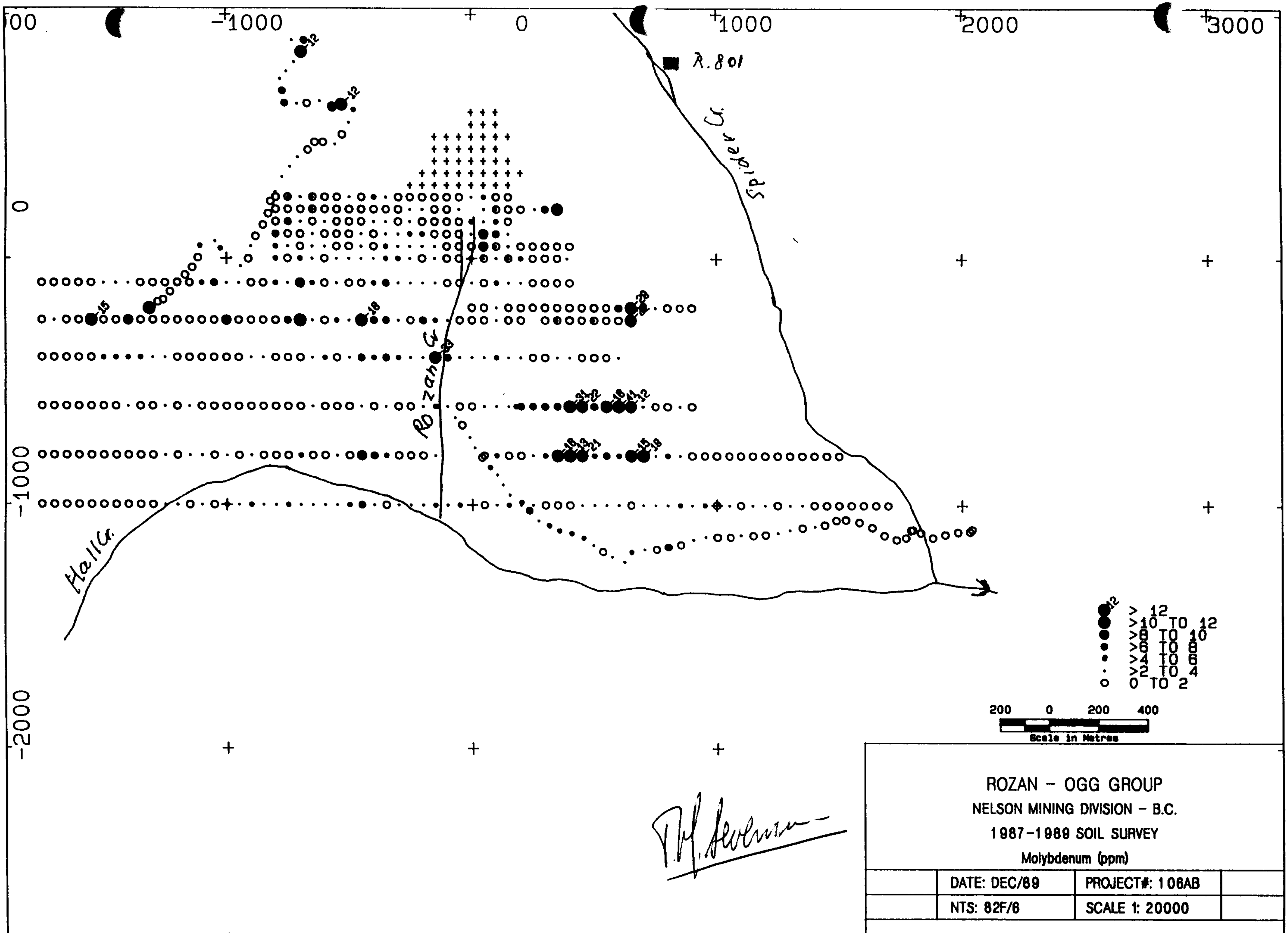

ROZAN - OGG GROUP

NELSON MINING DIVISION - B.C.

1987-1989 SOIL SURVEY

Tungsten (ppm)

| DATE: DEC/89 | PROJECT#: 106AB |
|---|---|
| NTS: 82F/6 | SCALE 1: 20000 |



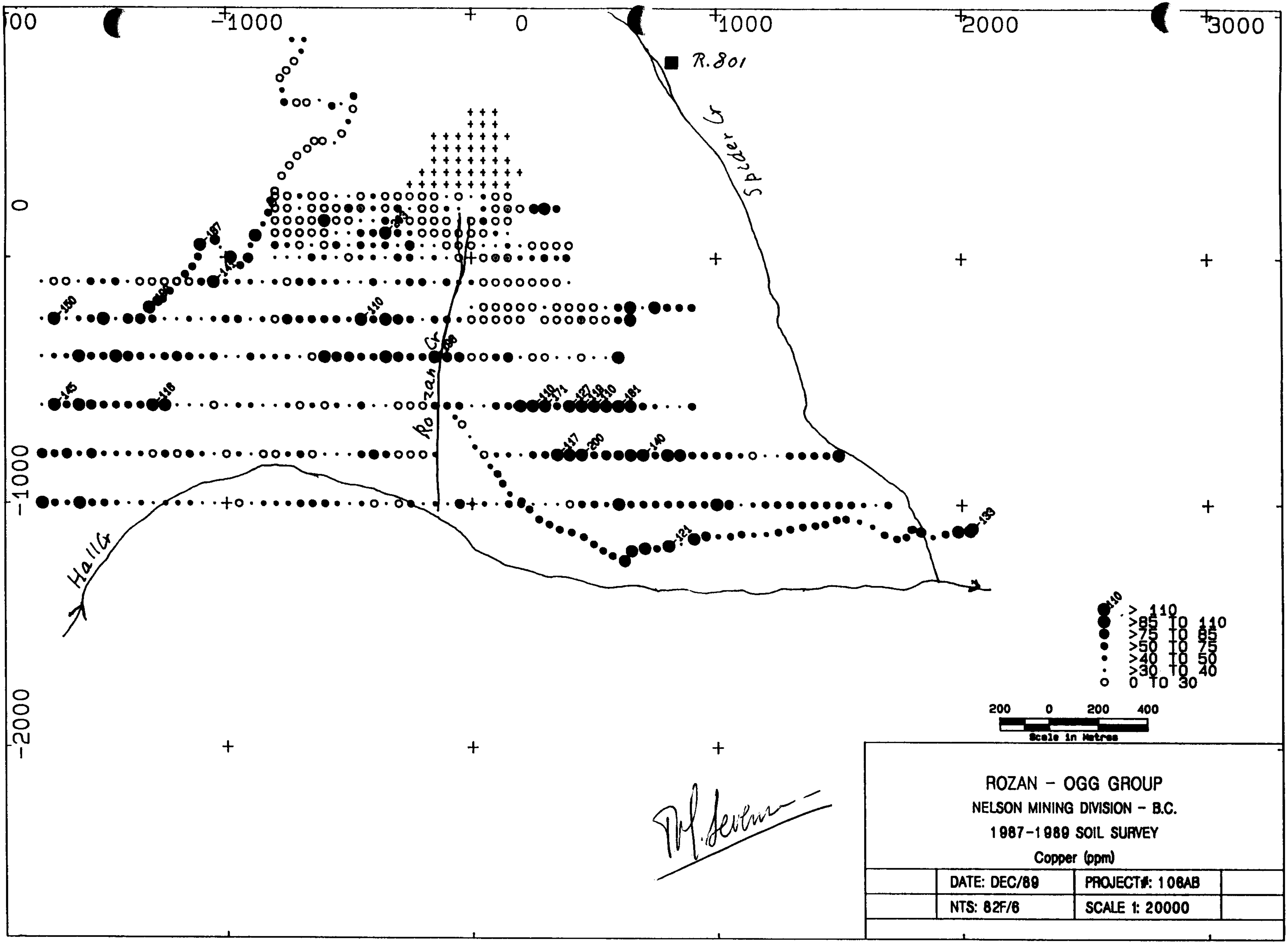

ROZAN – OGG GROUP

NELSON MINING DIVISION – B.C.

1987–1989 SOIL SURVEY

Molybdenum (ppm)

| | | |
|---|---|---|
| DATE: DEC/89 | PROJECT#: 106AB | |
| NTS: 82F/6 | SCALE 1: 20000 | |



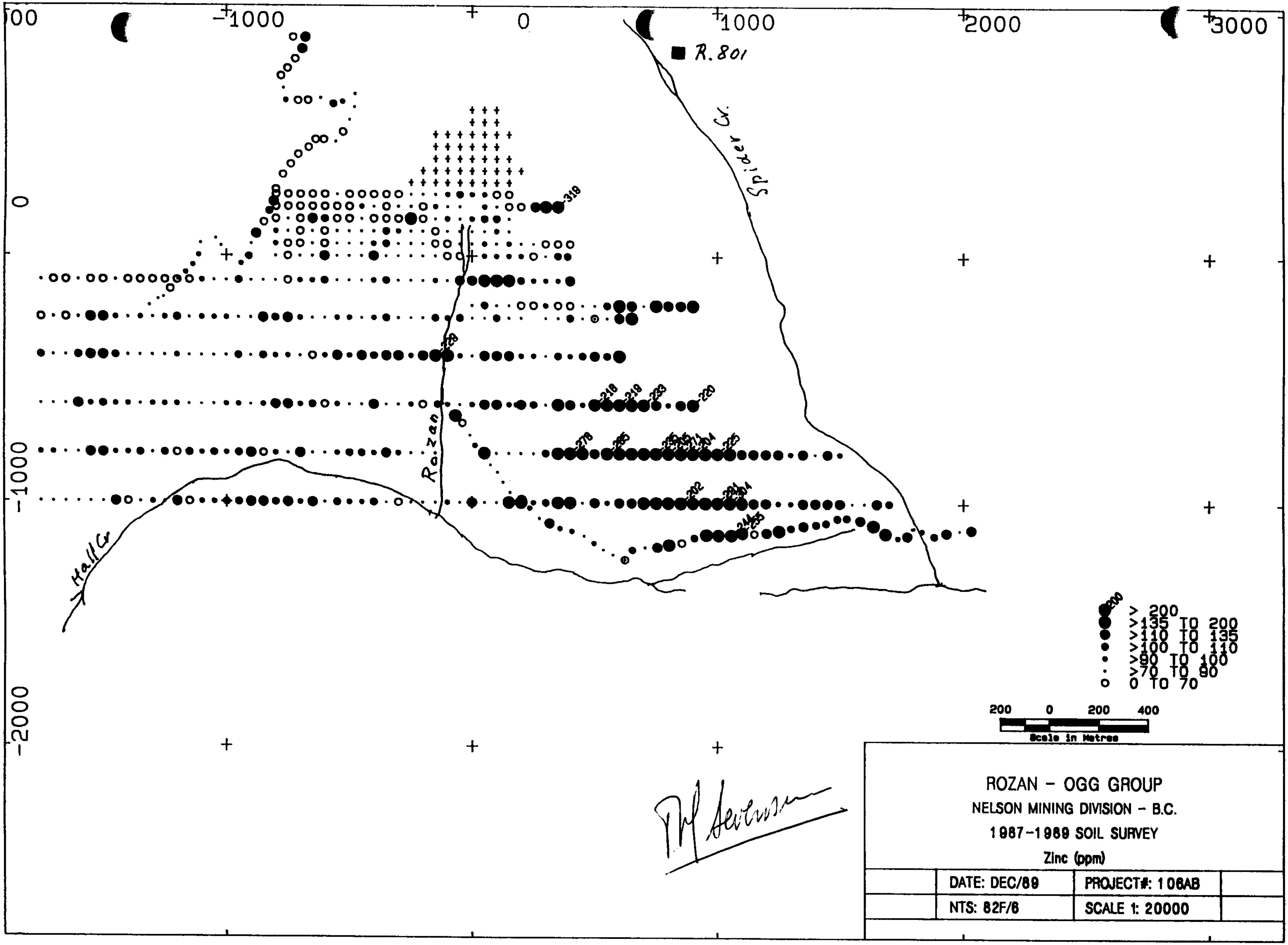

ROZAN - OGG GROUP

NELSON MINING DIVISION - B.C.

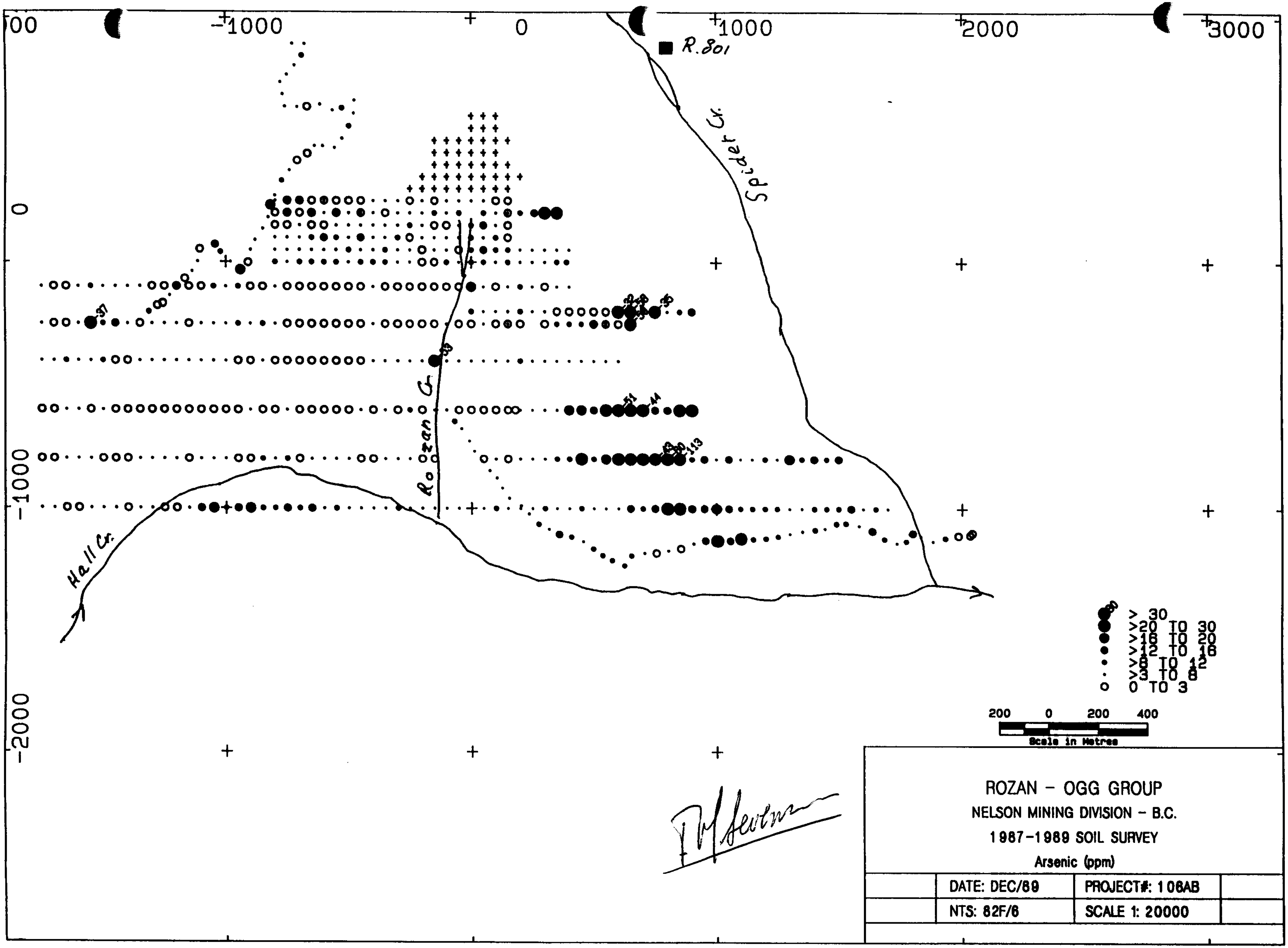
1987-1989 SOIL SURVEY

Copper (ppm)

| | | | |
|---|---|---|---|
| | DATE: DEC/89 | PROJECT#: 106AB | |
| | NTS: 82F/6 | SCALE 1: 20000 | |



R.801
Spider Cr.
Rozan
Hall Cr
> 200
>135 TO 200
>110 TO 135
>100 TO 110
>90 TO 100
>70 TO 90
0 TO 70
Scale in Metres
ROZAN - OGG GROUP
NELSON MINING DIVISION - B.C.
1987-1989 SOIL SURVEY
Zinc (ppm)
DATE: DEC/89
PROJECT#: 106AB
NTS: 82F/6
SCALE 1: 20000



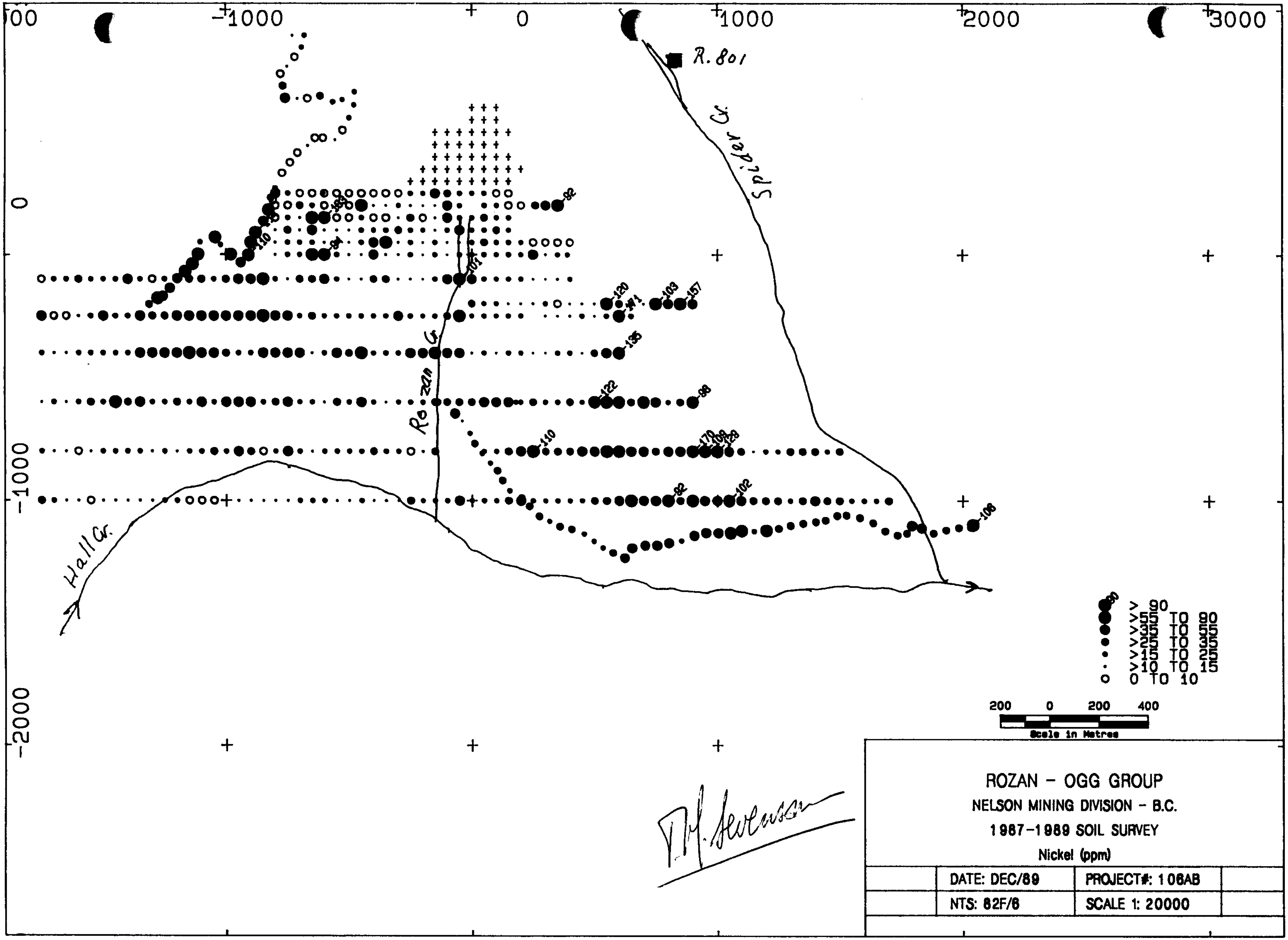

ROZAN – OGG GROUP

NELSON MINING DIVISION – B.C.

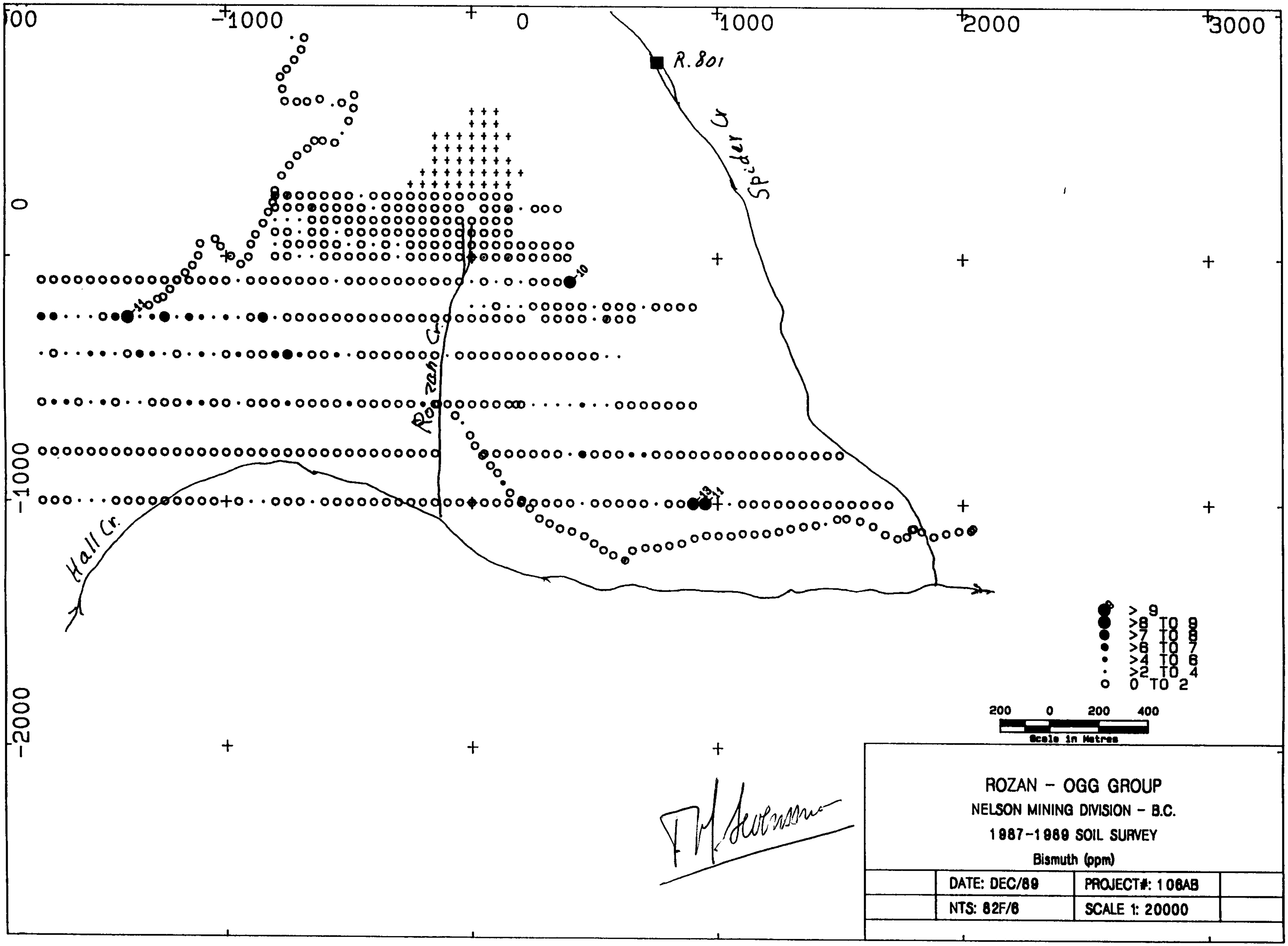
1987–1989 SOIL SURVEY

Arsenic (ppm)

| | | | |
|---|---|---|---|
| | DATE: DEC/89 | PROJECT#: 106AB | |
| | NTS: 82F/6 | SCALE 1: 20000 | |



R. 801
Spider Cr.
Rozan Cr.
Hall Cr.
> 90
>55 TO 90
>35 TO 55
>25 TO 35
>15 TO 25
>10 TO 15
0 TO 10
200 0 200 400
Scale in Metres
ROZAN - OGG GROUP
NELSON MINING DIVISION - B.C.
1987-1989 SOIL SURVEY
Nickel (ppm)
DATE: DEC/89
PROJECT#: 106AB
NTS: 82F/6
SCALE 1: 20000




ROZAN - OGG GROUP

NELSON MINING DIVISION - B.C.

1987-1989 SOIL SURVEY

Bismuth (ppm)

| DATE: DEC/89 | PROJECT#: 106AB |
|---|---|
| NTS: 82F/6 | SCALE 1: 20000 |

COST STATEMENT, GEOCHEMICAL & GEOLOGICAL REPORT, HIAWATHA

| | | |
|---|---|---|
| 1. | Jack Denny, October 1989 | |
| | Linecutting, 4.2 km @ $275 per km | $1,160.00 |
| | Soil sampling, 84 samples | 332.30 |
| 2. | Pee Santos, Geological mapping September 1989 | 1,400.00 |
| 3. | Eric Denny, August 1989, Transportation | 200.00 |
| 4. | Assaying, ICP 30 metals and gold Acme Analytical, Sep/89 - Jan/90 | 1,292.15 |
| 5. | Accomodation, Oct 1-3/89 | |
| | Alpine Motel | 129.60 |
| | Meals | 40.00 |
| 6. | Map printing, Fairbanks, Nelson, B.C. | 144.00 |
| 7. | Field supervision, P.H. Sevensma, 3 days | 600.00 |
| | *Transportation, 600 km @ 0.50* | *300.—* |
| 8. | Prime Geochemical Report | 1,156.50 |
| 9. | Map printing, Oct/89 - Apr/90 | 194.78 |
| 10. | Typing, estimated | 150.00 |
| 11. | Report | 1,000.00 |
| | | $8,099.33 |

PHS

P.H. Sevensma

*Appendix 6.*

# REFERENCES

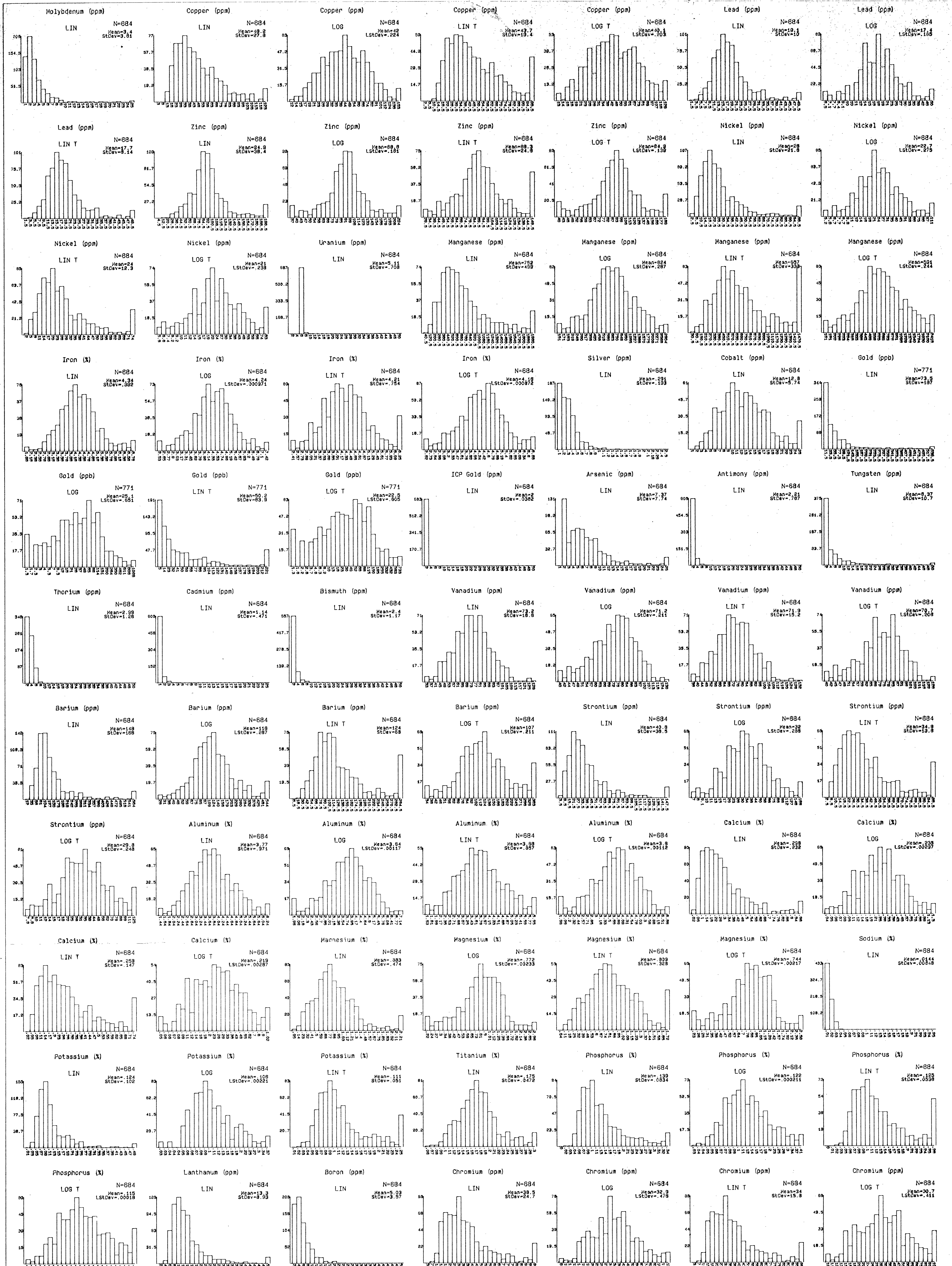
## PREVIOUS REPORTS BY

## P. H. SEVENSMA, Ph.D., P. Eng.


| | | Expenses Filed |
|---|---|---|
| 1. | Rozan Property, Geological and Geochemical Report December, 1988 | $25,165.16 |
| 2. | Nelson, B.C., Hiawatha Resources Inc. Private offering memorandum, May 1989 | --- |
| 3. | OGG Property Airphoto Geological Interpretation and Geochemical Data, May 1, 1989 | $ 3,657.76 |
| 4. | OGG Geochemical Report, November 24m 1989 | $ 4,622.56 |


P.H. Sevensma

App. 7.




## DISTRIBUTION HISTOGRAMS

LIN = LINEAR
LOG = LOGARITHMIC
LINT= TRUNCATED LINEAR
LOGT= TRUNCATED LOGARITHMIC

## SAMPLE SELECTION CRITERIA:

| | |
|---|---|
| SAMPLE TYPE | 50 |
| PROPERTY CODE | A/B |
| LSE CODE | ALL |
| OB ORIGIN | ALL |
| SAMPLE TEXTURE | ALL |
| SOIL HORIZON | ALL |
| BEDROCK GEOLOGY | ALL |
| NORTH LIMIT | NONE |
| SOUTH LIMIT | NONE |
| EAST LIMIT | NONE |
| WEST LIMIT | NONE |

20131

ROZAN - OGG GROUP
NELSON MINING DIVISION - B.C.
1987-1989 SOIL SURVEY
HISTOGRAMS

| | |
|---|---|
| DATE: DEC/89 | PROJECT#: 106AB |
| NTS: 82F/6 | Appendix 8. |