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PRELIMINARY RESULTS OF GEOLOGIC AND GEOCHEMICAL INVESTIGATIONS IN THE HYDER AREA, SOUTHEAST ALASKA

by

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Introduction

Preliminary field work was done by the authors in the Hyder area from August 23 to August 28, 1990, as part of a cooperative project with the U.S. Bureau of Mines in the Ketchikan Mining District. Geologic traverses were designed to gain familiarity with the rock types in the area, with minimal helicopter support, in anticipation of detailed geologic mapping in 1991. The accompanying annotated geologic traverse map (Plate 1) records observations from this reconnaissance. The continuation of this project has been postponed due to external constraints, and this Public Data File serves as our report on the Hyder area to the U.S.Bureau of Mines as part of cooperative agreement No.C0101019.

Discussion

The geology of the Hyder area consists of volcanic and volcaniclastic sediments of the Hazelton Group, which were intruded by Jurassic/Triassic Texas Creek granodiorite. The Hyder quartz monzonite pluton and associated dikes intruded the area in Tertiary time; the youngest intrusion was by lamprophyre dikes (Buddington, 1929; Grove, 1971; Smith, 1977; Alldrick, 1987). The Hazelton Group rocks have been subdivided by Canadian geologists where they crop out across the border from the Hyder district (Alldrick, 1987), but stratigraphic work remains to be done throughout the Hazelton Group in the Hyder area.

A sample of cherty argillite from within layers of tuffaceous sediments in the Double Anchor property (Plate 1) was analyzed by Micropaleo Consultants, Inc., San Diego, California, for radiolarians. Their report states that the sample "yielded some spherical and conical objects which may be radiolarians. However, there is no evidence of the usual porous wall structure of radiolarians and the possibility that these objects represent some other unknown fossils or inorganic artifacts cannot be excluded." (S.A. Kling, written communication, 1990).

Table 1 reports the results of whole rock major oxide and selected trace element analyses and CIPW norms of eight igneous rocks which represent the various magmatic events in the district. Sample sites are shown on Plate 1. The last column of Table 1 lists "discriminant scores" for the intrusive rocks. These scores reflect the similarity in composition between the analyzed Hyder rocks and intrusive rocks associated worldwide with gold. The scores were derived from a discriminant function, described in Burns and others (1991), which is applicable only to silica-saturated intrusive rocks, (but not aplites), which have not been altered, and which are not part of a porphyry copper system. A discriminant score of 0.00 indicates no favorability for associated non-porphyry gold, 100.00 indicates an excellent probability for associated non-porphyry gold. The scores in Table 1 show low favorability for the samples from the Hyder quartz monzonite pluton and associated dikes. The score from the Texas Creek granodiorite pluton is low, 12.21, and probably reflects the effects of alteration, which can make even the most gold-favorable samples score low. (Unfortunately, our fresh sample from Texas Creek granodiorite got lost in the mail). Therefore, our data do not allow a statistical prediction as to the favorability of the Texas Creek granodiorite for gold mineralization. Our sample of a porphyritic dike (Premiere porphyry?) which intruded Texas Creek granodiorite scores high (81.31), in keeping with its common association with gold in nearby areas. A lamprophyre dike scores 100.00, as is typical for dikes of this composition.

Table 2 contains the results of geochemical analyses of seventeen rock grab samples. These samples were collected from anomalously veined, altered and/or sulfide-rich sites. Sample sites are shown on Plate 1.

Table 4 reports lead isotope ratios from galenas taken from mineralized quartz veins in four locations in the Hyder area. Analyses were done by R.W. Hurst of Chempet Research Corporation, Moorpark, California. Errors are quoted at the 1 sigma standard error of the mean and occur in the last decimal place(s); for example, 19.100(10) = 19.100 ± 0.010. The analytical method reported by Chempet is as follows: 1-3 mg of sample were extracted using 6.2 N HCl + 8 N HNO_3 (4 : 1 ratio). Lead was separated using anion exchange chromatography (HBr and HCl methods). Lead isotopic compositions were measured on a 30 cm radius, 90 degree sector TIMS. Isotopic fractionation ranged from 0.040 to 0.081% per atomic mass unit during the course of this study as measured relative to NBS SRM 981 lead (R.W. Hurst, written communication, 1991).

Comparing the Hyder lead ratios with data published by Canadian geologists from the adjacent Stewart mining district in British Columbia (Alldrick and others, 1987; Godwin and others, 1991; Alldrick and others, 1990), all four Hyder samples cluster near the average Tertiary composition in terms of $^{207}Pb/^{206}Pb$ versus $^{208}Pb/^{206}Pb$ (Figure 1). The average compositions in Figure 1 are taken from Alldrick and others (1987). According to conclusions drawn by the Canadian geologists, there were two short-lived ore-forming events in the region. The older, Jurassic, event is thought to have formed cogenetically with calc-alkaline Hazelton Group rocks of the Stikinia terrane about 190 million years ago (Alldrick and others, 1987). The mineralization suite generally associated with this event is gold-silver-copper-zinc-lead (Godwin and others, 1991) The Tertiary mineralization, generally associated with silver-zinc-lead ± molybdenum, is interpreted by Alldrick and others (1987) as epigenetic veins related to Eocene intrusion of plutons, such as the Hyder quartz monzonite. The Riverside and Mountain View deposits are tungsten-bearing, with a high silver to gold ratio (Erickson, 1946; Byers and Sainsbury, 1956) in keeping with the above observations about Tertiary mineralization. The Texas Creek and Double Anchor quartz-sulfide veins, described by Buddington (1929), might be expected to have a similar metallogenic suite.

Acknowledgements

We gratefully acknowledge the geologists with Keewatin Engineering in Hyder, who generously shared time and information about the geology of the Hyder district. Major oxide analyses were done by X-ray Assay Laboratories, Don Mills, Ontario, and trace metal geochemistry was done by Chemex Labs Ltd., Vancouver, British Columbia. Sample preparation and analytical procedures as reported by these companies are shown on Table 3.

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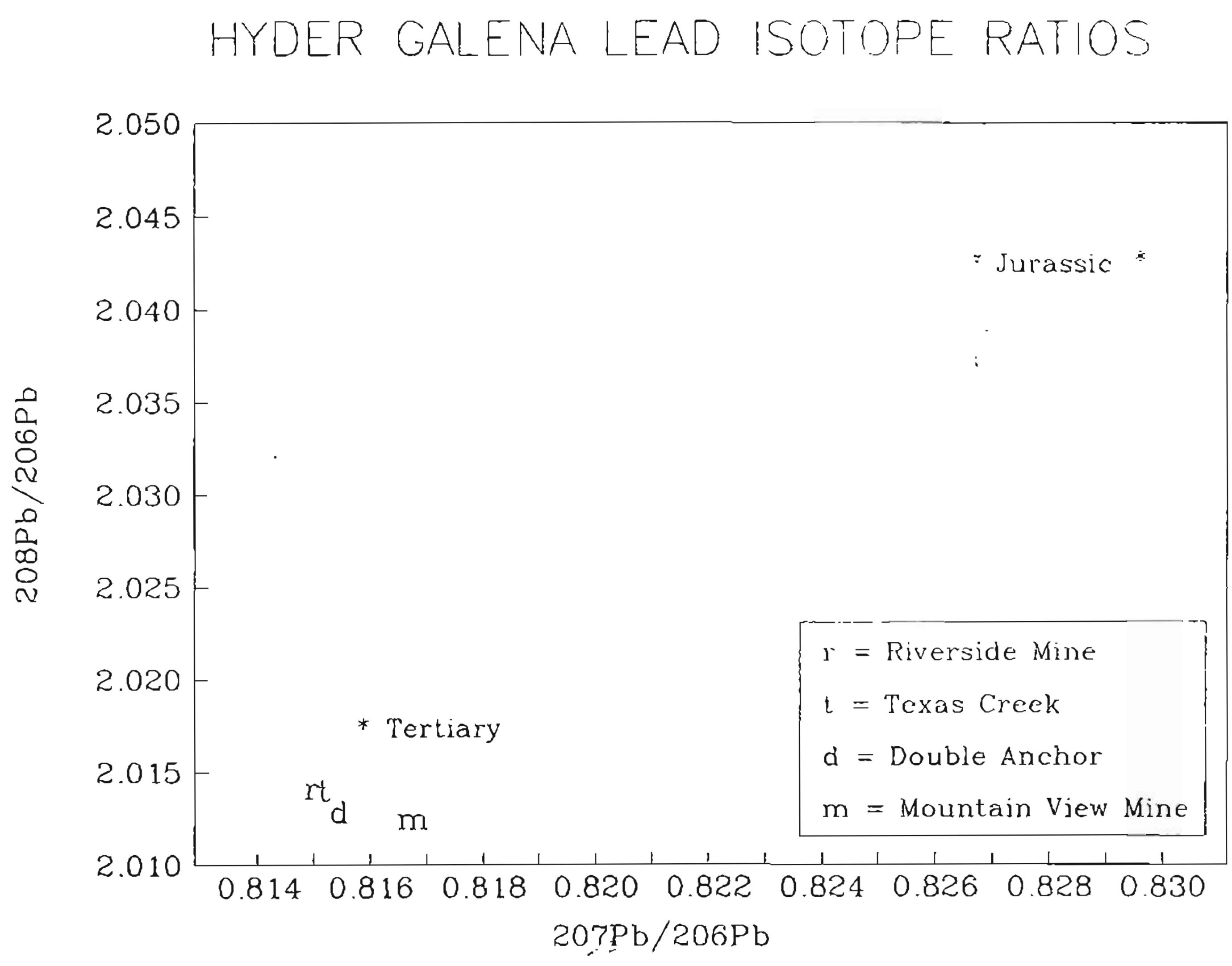

HYDER GALENA LEAD ISOTOPE RATIOS
208Pb/206Pb
2.050
2.045
2.040
2.035
2.030
2.025
2.020
2.015
2.010
207Pb/206Pb
0.814
0.816
0.818
0.820
0.822
0.824
0.826
0.828
0.830
* Jurassic *
* Tertiary
rt
d
m
r = Riverside Mine
t = Texas Creek
d = Double Anchor
m = Mountain View Mine

Figure1

Table 1: Hyder major oxide and trace element analyses and CIPW norms

Sample Number	SiO2 (wt%)	Al2O3 (wt%)	FeO (wt%)	Fe2O3* (wt%)	Fe2O3 (wt%)	MgO (wt%)	Na2O (wt%)	K2O (wt%)	CaO (wt%)	MnO (wt%)	TiO2 (wt%)	P2O5 (wt%)	LOI (wt%)	Total (wt%)
90DNS105	67.10	15.60	1.70	2.82	0.93	1.07	4.01	3.91	2.92	0.07	0.50	0.18	1.31	99.30
90DNS113	55.60	16.90	4.70	6.05	0.83	2.47	0.75	4.58	5.32	0.16	0.49	0.32	5.93	98.05
90DNS134	57.70	15.40	3.90	6.76	2.43	3.40	2.84	2.49	5.68	0.15	0.54	0.23	4.23	98.99
90DNS135	69.40	15.40	1.10	2.36	1.14	0.78	4.29	3.69	2.62	0.06	0.36	0.14	0.47	99.45
90RR55a	67.90	15.80	1.30	3.06	1.62	1.12	4.49	3.49	3.06	0.07	0.46	0.17	0.31	99.79
90RR56a	63.90	16.20	2.10	4.19	1.86	1.63	4.84	2.51	4.58	0.11	0.55	0.22	0.70	99.20
90RR56e	72.50	14.80	0.10	0.35	0.24	0.03	3.51	7.59	0.35	0.04	0.04	0.05	0.31	99.56
90WG227b	44.90	12.80	6.60	10.30	2.97	8.40	0.50	5.23	8.11	0.20	1.64	0.73	4.77	96.85

Sample Number	CIPW NORMATIVE MINERALS												
	Qtz	Cor	Or	Ab	An	Di	Hy	Ol	Mt	Hem	Ilm	Ap	Total
90DNS105	21.21	0.00	23.58	34.63	13.29	0.24	4.29	0.00	1.38	0.00	0.97	0.43	100.00
90DNS113	17.53	1.96	29.38	6.89	26.38	0.00	14.75	0.00	1.31	0.00	1.01	0.80	100.00
90DNS134	14.80	0.00	15.53	25.36	23.13	4.07	11.75	0.00	3.72	0.00	1.08	0.56	100.00
90DNS135	23.97	0.00	22.03	36.67	11.99	0.18	2.48	0.00	1.67	0.00	0.69	0.33	100.00
90RR55a	20.91	0.00	20.73	38.19	12.72	1.13	2.69	0.00	2.36	0.00	0.88	0.40	100.00
90RR56a	15.36	0.00	15.06	41.58	15.29	5.08	3.32	0.00	2.74	0.00	1.06	0.52	100.00
90RR56e	22.56	0.30	45.19	29.92	1.42	0.00	0.08	0.00	0.34	0.01	0.08	0.12	100.00
90WG227b	0.00	0.00	33.56	4.59	18.72	15.89	2.71	14.64	4.68	0.00	3.38	1.84	100.00

Fe2O3* = All iron as Fe2O3. (a) = See text for discussion. – – = Not applicable.

Table 1: Hyder major oxide and trace element analyses and CIPW norms

Sample Number	Cr (ppm)	Rb (ppm)	Sr (ppm)	Y (ppm)	Zr (ppm)	Nb (ppm)	Ba (ppm)	Description	Discriminant Score (a)
90DNS105	24	125	744	0	165	18	1610	Hyder dike	54.08
90DNS113	16	137	169	0	60	0	3010	Daley Creek-Andesitic tuff	-
90DNS134	149	70	732	12	92	0	2960	Premiere(?) porphyry in Texas Ck. gd	81.31
90DNS135	23	94	884	31	134	0	2180	Hyder quartz monzonite	0.01
90RR55a	24	84	943	0	155	0	2350	Hyder dike	0.00
90RR56a	29	68	607	22	106	12	2220	Altered Texas Creek granodiorite	12.21
90RR56e	26	454	148	25	66	52	725	Aplite dike in Texas Ck granodiorite	-
90WG227b	407	97	2630	16	242	16	3390	Lamprophyre dike	100.00

$Fe_2O_3^*$ = All iron as Fe_2O_3. (a) = See text for discussion. – = Not applicable.

Table 2: Hyder rock geochemical analyses

Sample Number	Au (ppb)	As (ppm)	Ag (ppm)	Co (ppm)	Cu (ppm)	Fe (%)	Mn (ppm)	Mo (ppm)	Ni (ppm)
90DNS108b	<5	4	<0.5	11	9	4.34	260	1	3
90DNS124	2560	420	124.5	111	883	14.75	155	15	94
90DNS128	4060	610	177.0	5	886	7.97	245	2	5
90DNS133	<5	9	0.0	4	12	2.88	595	2	3
90RR48a	2460	4800	200.0	7	703	8.37	340	7	2
90RR56d	<5	50	3.5	<1	10	2.48	665	<1	1
90RR56g	<5	11	1.0	<1	2	0.44	130	<1	1
90RR56h	75	7	0.5	2	75	2.72	265	2	2
90RR63a	8510	>10000	172.5	81	5700	>15.00	90	1	8
90WG206	45	68	4.0	9	127	2.67	485	2	29
90WG207	20	32	1.0	12	88	2.52	235	<1	13
90WG208	<5	8	0.5	1	16	0.44	155	1	4
90WG209	285	230	12.0	45	412	10.80	1730	<1	6
90WG216	<5	2	1.0	19	119	4.02	255	<1	17
90WG219c	>10000	42	39.5	21	1405	5.61	60	12	7
90WG219d	90	2	<0.5	10	32	3.96	795	<1	3
90WG227a	180	440	4.5	15	288	9.31	2580	<1	11

– = not analyzed

Table 2: Hyder rock geochemical analyses

Sample Number	Pb (ppm)	Zn (ppm)	W (ppm)	Ba (ppm)	Au (oz/T)	Description
90DNS108b	6	44	3	3800	-	Pyritic andesite in contact with Hyder dike
90DNS124	>10000	686	2	200	-	Texas Discovery prospect-qtz vein w/ sulfides
90DNS128	>10000	2890	<2	100	-	Qtz vein w/ sulfides in green tuffaceous ss
90DNS133	56	114	<2	1820	-	Texas Creek granodiorite, minor pyrite
90RR48a	>10000	>10000	<2	560	-	Andesite w/ py, sphalerite, epidote, CO3 alteration
90RR56d	612	394	<2	320	-	Texas Creek granodiorite, tectonized & foliated
90RR56g	168	88	<2	500	-	Texas Creek granodiorite, w/ augen gneiss fabric
90RR56h	80	144	5	620	-	Texas Creek granodiorite w/ qtz-sulfide vein
90RR63a	>10000	9730	<2	80	-	Gal, py, sphalerite, chalcopyrite qtz vein in seds
90WG206	574	154	2	6500	-	Siliceous tuff w/ sulfides
90WG207	126	60	<2	4200	-	Siliceous tuff w/ sulfides
90WG208	158	26	<2	380	-	Qtz vein in sheared andesite(?)
90WG209	166	1745	2	1300	-	Pyritic green andesite
90WG216	18	62	3	4300	-	Pyritic meta-andesite
90WG219c	604	702	<2	40	0.908	Limonite-stained qtz vein w/ sulfides
90WG219d	80	254	2	1580	-	Dark grey cataclasite
90WG227a	336	5250	<2	900	-	Greenstone (andesite?) w/ sulfide up to 4 cm

- = not analyzed

Table 3

Rock trace metal analyses: (Chemex)

SAMPLE PREPARATION
Geochem ring to approx 150 mesh
Crush and split (0-10 pounds)
PERCHLORIC-NITRIC-HYDROFLUORIC D

ANALYTICAL PROCEDURES

DESCRIPTION	METHOD	DETECTION LIMIT	UPPER LIMIT
As ppm: HNO3-aqua regia digest	AAS-HYDRIDE/EDL	1	10000
Ag ppm: 9 element, soil and rock	ICP-AES	0.5	200
Co ppm: 9 element, soil & rock	ICP-AES	1	10000
Cu ppm: 9 element, soil & rock	ICP-AES	1	10000
Fe %: 9 element, soil & rock	ICP-AES	0.01	15.00
Mn ppm: 9 element, soil & rock	ICP-AES	5	10000
Mo ppm: 9 element, soil & rock	ICP-AES	1	10000
Ni ppm: 9 element, soil & rock	ICP-AES	1	10000
Pb ppm: 9 element, soil and rock	ICP-AES	5	10000
Zn ppm: 9 element, soil & rock	ICP-AES	2	10000
Au ppb: Fuse 10 g sample	FA-AAS	5	10000
W ppm: K pyrosulfate fusion	COLORIMETRIC	2	1000
Ba ppm: HClO4-HNO3-HF digestion	AAS	10	10000
Au oz/T: 1/2 assay ton	FA-GRAVIMETRIC	0.003	20.000

Rock major oxide and trace element analyses: (XRAL)

	METHOD	DETECTION LIMIT
WRMAJ %	WR	0.01
WRMIN PPM	WR	10.
FEO %	WET	0.1

Table 4 HYDER GALENA LEAD ISOTOPE RATIOS

Sample	206Pb/204Pb	207Pb/204Pb	208Pb/204Pb	Location
90DNS111	19.102(22)	15.567(16)	38.474(43)	Riverside Mine
90DNS124	19.093(4)	15.564(3)	38.453(6)	Texas Ck. Discovery
90DNS128	19.066(10)	15.547(9)	38.377(13)	Double Anchor
90WG219e	18.836(6)	15.384(7)	37.908(12)	Mountain View Mine

Analyzes by R.W. Hurst, Chempet Research Corporation, Moorpark, California