THE ALLIN PROPERTY AND EQUITY-TYPE MINERALIZATION, CENTRAL BRITISH COLUMBIA

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INTRODUCTION

The Allin discovery is approximately 4.5 kilometres east of the Equity Silver mine and 38 kilometres southeast of Houston (Figure 1) in central British Columbia (Latitude 54°11.3', Longitude 126°11.5'). Access to the area is by an all-weather gravel road from the town of Houston and seasonal logging roads from the village of Colleymount on the north shore of Francois Lake.

This report outlines evidence of additional Equity-type replacement mineralization related to the Goosly syenomonzonite-gabbro stock. The study is based on drift sampling guided by a thorough knowledge of the local geology. The discovery of high grade boulders in drift on the Allin property represents a success for the British Columbia Prospectors Assistance '94/95 Program which provided funds for prospecting.

ALLIN PROPERTY

The alteration on the east side of the Goosly intrusion above Allin Creek has been known since 1964 when Summit Oil Limited first staked the area. In 1969 Kennco Exploration Limited cut lines to test the alteration zone, however, a thick till cover hampered investigations (Ney *et al.*, 1972). The property was restaked by Kengold Mines Limited in 1986 as the DEV and GO claims, then the property was optioned to Normine Resources Limited. In 1987 work was commissioned to Westview Resources Limited and subsequently several programs were completed including geochemical, resistivity and magnetometer surveys and diamond drilling. The drilling revealed that the same Mesozoic-age rocks hosting the Equity ore bodies west of the Goosly stock also occur east of the stock on the Allin property, although with a somewhat greater ratio of lava flows to clastic rocks (Garagan, 1988). Additional drilling in 1993, by Equity Silver Mines Limited, traced a zone of pyritization and propylitic alteration eastward onto the Allin claims (Wall, 1993). Recent logging in the Allin Creek area has facilitated access to the property and has led to the discovery of well mineralized float, similar to Equity ore, associated with a silver soil anomaly. The discovery encouraged further work on the Allin property by the second author supported by the British Columbia Prospectors Assistance Program in 1994/95. The property was optioned to Hudson Bay Exploration and Development Co. Ltd. in 1996/97 and is the focus of continuing exploration (Wojdak, 1997).

Mineralization

Mineralization on the Allin property is not well defined because of thick forest cover and overburden. Westview Resources was able to outline a silver anomaly covering a south-trending elongated area (~1 kilometre by 200 metres) of glacial drift having a local source (Figure 2). Drilling on the Allin property intersected moderately to intensely altered volcanic rocks (quartz-sericite and quartz-chlorite alteration) containing up to 15 per cent pyrite (Wall, 1993), which are similar to clasts in the overlying glacial drift and the host rocks at the Equity deposit. Pyrite occurs as fracture fillings and disseminations throughout the host rocks accompanied by pyrrhotite and minor amounts of sphalerite, chalcopyrite, arsenopyrite, galena and tetrahedrite.

The Allin property covers part of the alteration halo adjacent to the Goosly stock east of the Equity Silver Mines property (Kowalchuck *et al.*, 1984). The Equity and Allin mineralization / alteration occurs in a lithogeochemical halo that surrounds the Goosly stock (Church and Barakso, 1990). The halo is believed to be the result of activation of hydothermal solutions during intrusion of the stock.

Recent drift prospecting in the Allin Creek area (Klein, 1994 and 1995) found numerous subangular fragments similar in mineralogy and chemical composition to the Equity ore (Photos 1, 2 and 3; Tables 1 and 2). For example, drift sample no. 5 (Table 1, this report) assays 0.48 ppm gold, 54 ppm silver, 1.23 per cent copper, 123 ppm lead, 1137 ppm zinc and 571 ppm arsenic. This is similar to sample SG-67A collected from the discovery exposure at the Equity deposit which yielded 0.28 ppm gold, 50 ppm silver, 1.36 per cent copper, 280 ppm lead, 450 ppm zinc and 684 ppm arsenic (Church and Barakso, 1990). In general, the ore samples from the Equity mine are similar to drift clasts from the Allin area (Tables 1 and 2, Figure 5).

The drift samples are typically enriched in sulphides with replacement textures, have relatively minor gangue minerals and average 1.6 ppm gold, 125 ppm silver and 1.8 per cent copper. The rocks hosting the sulphides in these samples are generally similar to the fine grained sericitized and chloritized Jurassic volcanic rocks that occur immediately east and west of the Goosly intrusion and host the Equity ore deposit.

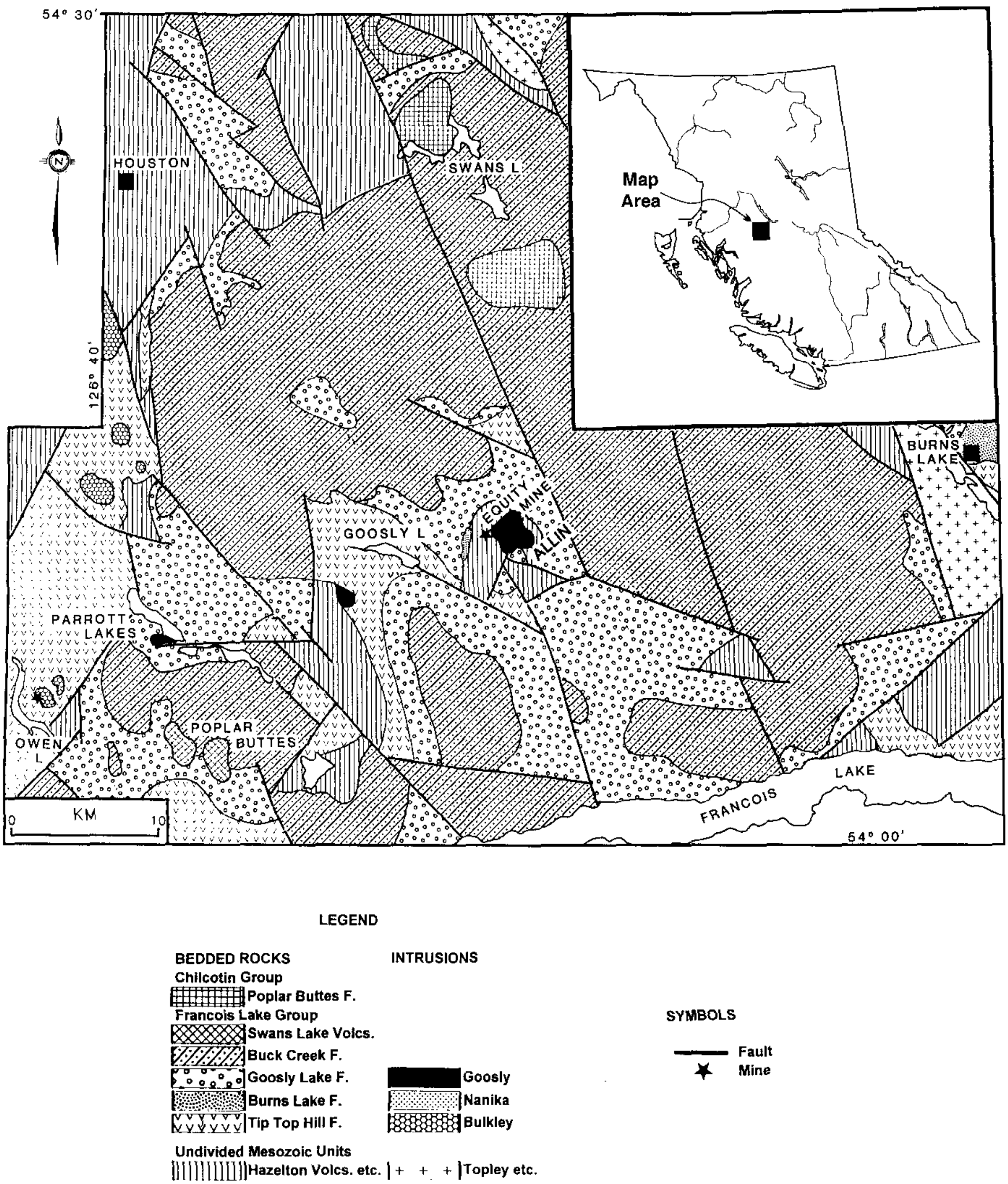

Figure 1. Geological map of the Buck Creek basin, Houston area, Central British Columbia.

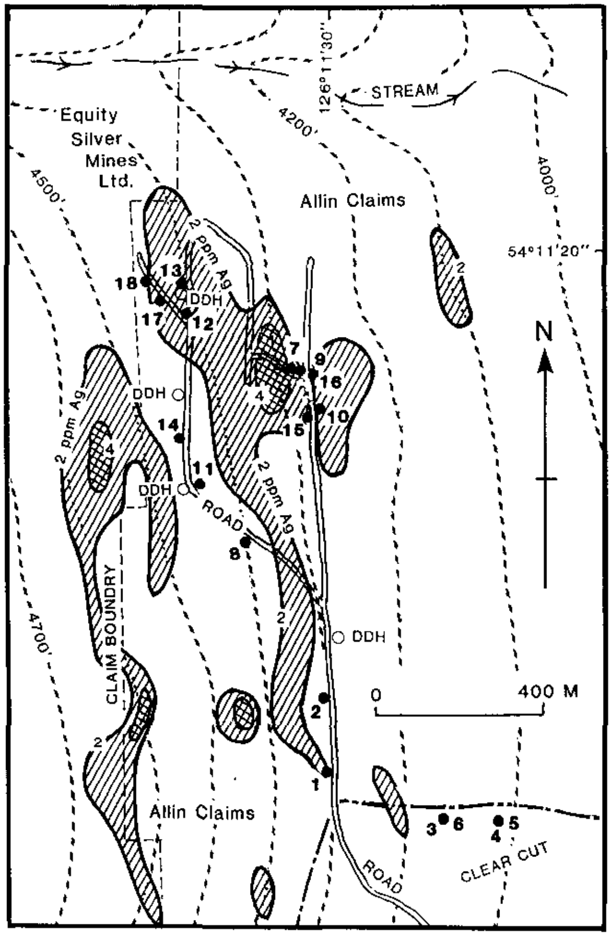

Figure 2. Anomalous silver-soil geochemistry and location of mineralized drift samples (dots - bold numbers correspond to assays in Table 1) Allin prospect.

The source of the drift samples was originally thought to be the Equity ore body. This is consistent with interpretations that the Fraser pulse of Pleistocene regional glaciation moved easterly across the area scraping the bedrock exposures west of the Allin property (Church and Barakso, 1990; Fulton, 1995). However, the authors found no entrained mineralized boulders extending eastward from the Equity deposit. Furthermore this direction of ice movement does not explain the south-trending silver soil anomaly with which the drift samples on the Allin property are associated.

There is evidence of a second glacial event in vicinity of the Equity ore deposit (formerly the Sam Goosly prospect) where glacial erratics appear to have moved southerly (Church, 1970). Ney *et al.* (1972) concluded that the silver soil anomalies in this area were for the most part ice-transported, and a very close correspondence was obtained between the up-ice cutoff in soil sample values on the northeast and the projected surface trace of the ore deposit. According to Tipper (1994) a second pre- or post-Fraser glaciation event from an ice dome may be responsible for apparent glacial reversals in the area as noted by previous authors. This scenario could also explain the dispersion of mineralized drift on the Allin property where local glaciation may have eroded bedrock from an altered and mineralized zone located east of the Goosly intrusion and deposited the debris in south-trending alignments.

EQUITY DEPOSIT

The Equity deposit is similar to the Allin Creek mineralization located 4 kilometres to the east. The Equity deposit was a significant gold, silver and copper producer for 13 years. The Equity Silver mine began production in 1980 on what was originally known as the Sam Goosly prospect. Early exploration in the 1960's was centred mostly on a small granitic body that hosts low grade porphyry-style mineralization. By 1969 attention was refocussed on an area located about a kilometre to the east near the Goosly syenomonzonite-gabbro stock (Figure 1; Dostal *et al.*, 1998). The area adjacent to the Goosly stock subsequently became the site of the Main, Waterline, Southern Tail and Northern ore zones of the Equity deposit (Figure 3). Mining of these zones was completed in 1993. Production from the Equity mine is summarized in Table 3.

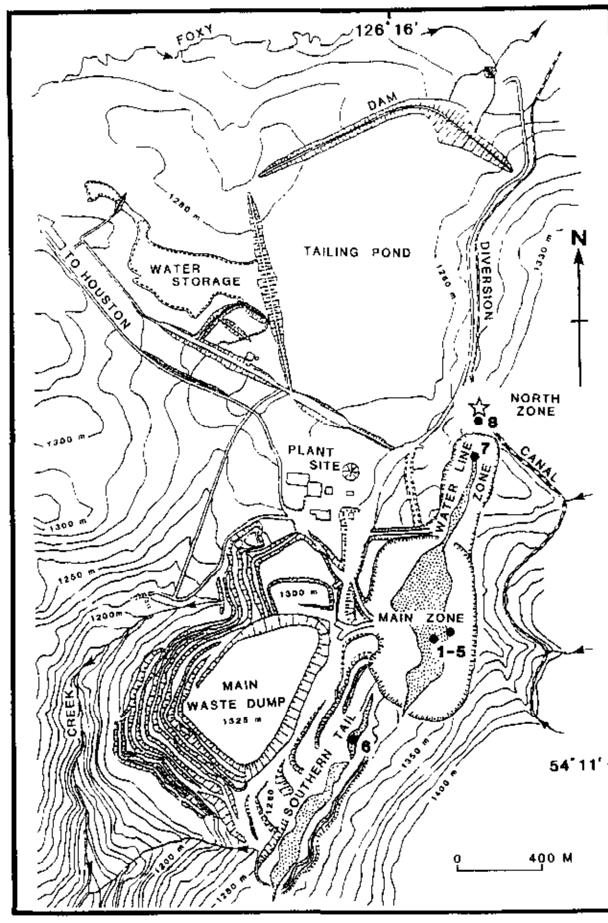

Figure 3. Plan view of the Equity Silver mine showing the ore zones (stippled) and sampling stations (dots - bold numbers correspond to assays in Table 2).

TABLE 1

ANALYTICAL RESULTS OF DRIFT SAMPLING, ALLIN PROPERTY

Lab. No.	Au ppm	Ag ppm	Cu %	Pb ppm	Zn ppm	Ni ppm	Co ppm	As ppm
1	0.78	145	1.78	484	2,138	40	46	1,158
2	5.09	505	10.00	59	13,175	44	16	575
3	0.51	79	1.15	329	387	148	19	3,653
4	1.56	136	0.63	400	14,755	85	15	592
5	0.48	54	1.23	123	1,137	60	17	571
6	2.61	257	1.26	512	240	35	27	1,200
7	1.24	23	0.48	48	137	57	24	510
8	2.05	119	2.36	179	30,136	33	11	1,657
9	2.62	210	2.08	752	558	19	9	265
10	0.25	19	0.96	34	5,226	17	11	1,032
11	0.17	4	0.99	24	53	17	8	15
12	0.97	55	1.89	43	1,505	38	13	732
13	1.38	85	1.34	363	5,071	16	6	918
14	3.89	77	0.37	1,324	1,158	90	17	989
15	0.69	40	5.93	18	9,205	8	2	354
16	0.49	229	5.11	103	9,761	22	17	2,460
17	0.18	2	0.64	17	53	89	113	16
18	12.42	395	8.16	846	1,152	38	11	2,999

(Samples collected by G.H. Klein; results from unpublished reports by Klein 1994, 1995)

TABLE 2

ANALYSES OF ORE SAMPLES, EQUITY MINE

No.	Au ppm	Ag ppm	Cu %	Pb ppm	Zn ppm	Ni ppm	Co ppm	As ppm
1	0.96	178	7.30	83	4,500	119	20	1,800
2	2.14	157	3.59	48	1,500	164	65	1,300
3	7.09	103	3.47	65	9,900	28	11	410
4	3.06	211	0.28	734	120	24	9	1,400
5	4.04	203	0.36	396	140	20	8	910
6	6.69	203	4.50	69	5,700	38	17	450
7	2.44	114	1.67	105	690	138	155	850
8	16.10	164	7.60	87	11,809	49	25	199
9	0.28	50	1.36	280	450	300	96	684

(Samples collected by B.N. Church; Nos. 1-6 from Church and Barakso, 1990; Nos. 7-8, this report)

TABLE 3
PRODUCTION STATISTICS (Company Data)

Ore Zones	Tonnes	Au g/t	Ag g/t	Cu %	Pit Area
Southern	6 860 000	1.3	121.8	0.42	750 x 250m
Main	24 205 000	0.9	96.5	0.32	850 x 500m
Waterline	2 614 000	1.2	86.9	0.33	450 x 200m
Northern	226 600	4.2	147.8	0.46	underground
Waste Tip	76 000 000	tonnes			

Mineralization

The Equity mine is located in a window of Mesozoic age rocks in a small uplifted area near the centre of the Buck Creek basin. The elliptical or elongated ore zones at the mine are aligned north-northeast (025°) subparallel to the steep westerly dipping strata. The total strike length of the deposit is approximately 2 kilometres (Figure 3). The Main zone, at the centre of the Equity deposit, is in contact with the Goosly stock that is also the locus of a major magnetic anomaly (Figure 4 this report; Church and Pettipas, 1990). The Equity ore occurs in a brecciated tongue of dust-tuff within a succession of dacitic volcanic breccia and conglomerate beds containing chert pebbles. Similar units are exposed southeast of the mine on the north shore of Francois Lake and contain fragments of Weyla fossils of Jurassic age. Brecciation of the Jurassic-age pyroclastic rocks caused by the intrusion of the Goosly stock, has provided channelways for metalliferous hydrothermal solutions that caused the alteration and formed fracture filling and replacement-type ore (Church and Barakso, 1990).

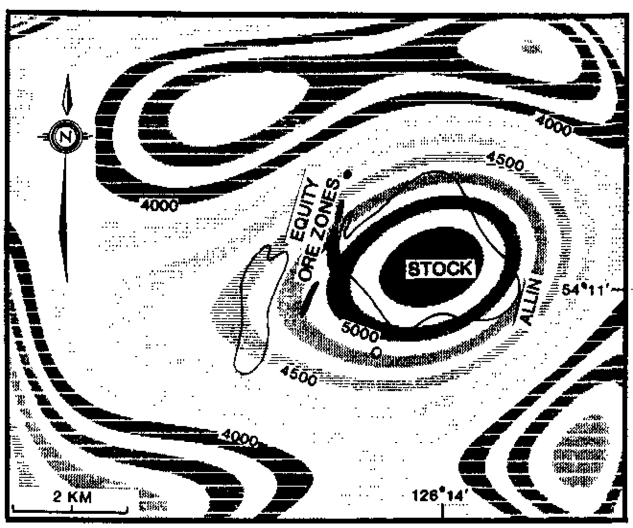

Figure 4. The Goosly stock and mineralized zones projected onto aeromagnetic contours (contours are nanateslas on a 6th order polynomial surface - based on data from Church and Pettipas, 1990).

The age of mineralization is similar to the age range of Goosly stock and adjacent altered rocks - 48.3 ± 1.7 to 54.3 ± 2.2 Ma based on K/Ar analyses of micaeous and whole rock samples (Church, 1970; Ney *et al.*, 1972; Church and Barakso, 1990). However, the country rocks contain multiple generations of sericite inherited from repeated cycles of metamorphism/alteration at the distal extremities of the Southern Tail zone beyond the main mineralization and thermal halo of the Goosly stock (Wodjak and Sinclair, 1984). In this area, the Southern Tail zone is a narrow vein-like body that formed at relatively cool temperatures of < 200°C - below the temperature of formation of some muscovite/sericite (Deer et al., 1962). Consequently, the K/Ar 'age' of sericitized host rocks in the area, reported to be 58 ± 2 Ma by Cyr et al. (1984), is probably an average age of multiple metamorphic and mineralizing events including the age of the nearby granitic intrusion that ranges from 56 ± 2.3 to 61.1 Ma (Church, 1970; Ney et al., 1972). It may be incorrect, therefore, to accept this as the age of mineralization for the Equity deposit as suggested by Cyr et al. (1984).

The Equity Silver orebodies consist of discordant lenses of massive sulphides which range from a few to several metres thick within the alteration envelope. In the Main zone the massive sulphide lenses consist mostly of coarse to medium-grained pyrite, pyrrhotite and chalcopyrite filling fissures, and replacement ore comprised of the same minerals together with minor amounts of sphalerite, tetrahedrite, arsenopyrite and locally magnetite. The alteration envelope is an aluminous assemblage several hundred metres wide composed of medium to high-temperature minerals that include andalusite, scorzalite, pyrophyllite, corundum, tourmaline, sericite and clay minerals; silicification is minor. Fine-grained disseminated pyrite, chalcopyrite and tetrahedrite occur throughout the zone of alteration. Mineralization temperatures, determined from fluid inclusions, decrease markedly from 625°C in the Main zone to 200°C in the Southern Tail zone (Wojdak and Sinclair, 1984). The Southern Tail zone is a narrow orebody with sharp contacts and a relatively thin alteration envelope of sericitic and chloritic metavolcanic rocks. Fragments of brecciated host rock are rimmed and replaced by arsenopyrite. The Waterline zone is a narrow extension of the Main zone ore body and has a similar mineralogy but contains somewhat higher gold values. The North zone was discovered and delineated by several drilling programs between 1983 to 1987 in the area 900 metres northeast of the Equity mill site (Figure 3). The North zone strikes northward from the Waterline zone where it is accessed by a 300-metre drift adit driven into the floor of the open pit in October 1992. The North orebody is 15 metres wide, dips steeply to the west and plunges north. As in the Main and Waterline zones, the massive sulphide ore of the North zone consists mostly of coarse- to medium-grained pyrite, pyrrhotite and chalcopyrite replacing dacitic tuff and tuff breccia (Photo 4). A well mineralized grab sample from near the portal of the lower adit returned the following assay result: 2.44 ppm gold, 114 ppm silver, 1.67% copper, 105 ppm lead, 690 ppm zinc, 39.4% iron, 850 ppm arsenic, 33 ppm antimony, 155 ppm cobalt and 138 ppm nickel. A second sample taken midway between the portal and face assayed 16.1 ppm gold, 164 ppm silver, 7.6% copper, 87 ppm lead, 1809 ppm zinc, 26% iron, 199 ppm arsenic, 163 ppm antimony, 25 ppm cobalt and 49 ppm nickel. These new assay values are added to the previously published data for the Equity mine shown in Table 2; sample locations are plotted on Figure 3.

CHEMICAL SIGNATURE OF EQUITY-TYPE MINERALIZATION

The chemical signature of the Equity mineralization can be investigated by using a correlation matrix for the ore forming and pathfinder elements. As well, multiple regression of element variables can be performed using methods adapted from Sinclair (1982), Matysek *et al.* (1982) and Church (1987). The product moment correlation matrix is determined (Table 4) using log transformed values for gold, silver, copper, lead, zinc, arsenic, cobalt and nickel from the assay data in this report and Church and Barakso (1990). Of the 28 pairs of elements generated by this procedure Cu-Zn, Ag-Pb and Co-Ni are among the pairs that show a good positive correlation. There is also a three-way positive correlation between As-Ag-Pb. These correlations reflect common associations of the principal ore-forming chalcophile elements. The low Pb-Ni correlation is explained by the usual occurrence of nickel with high temperature sulphide deposits and the usual association of lead with low temperature ores. Some of the other low and negative correlations, especially Zn-Pb and Cu-Pb, and may be a feature of the Equity-type in common with some high temperature pyrometasomatic deposits that also show strong negative Cu-Pb correlations (Ray *et al.*, 1988).

TABLE 4
CORRELATION MATRIX (r2)

	Au	Ag	Cu	Pb	Zn	As	Co	Ni
Au	1.00	0.73	0.31	0.44	0.18	0.31	-0.05	-0.06
Ag		1.00	0.41	0.58	0.38	0.72	-0.10	0.05
Cu			1.00	-0.29	0.59	0.15	-0.06	-0.04
Pb				1.00	-0.10	0.53	-0.09	0.06
Zn					1.00	0.34	-0.26	-0.13
As						1.00	-0.08	0.16
Co							1.00	0.77
Ni								1.00

The mineralization can be characterized by multiple regression analysis (Ostle, 1960, page 202). This is expressed in terms of the ore forming and important ancillary elements by the following equation based on 26 assays from Tables 1 and 2:

Log (Au) = -5.54 + 1.00Log(Ag) - 0.0386 Log(Cu) + 0.0623Log(Pb) - 0.449Log(As)

where Au, Ag and Pb are given in terms of ppm and Cu and As are reported in per cent.

Coef. of Determination = 0.637 (Ostle, p. 180)
Coef. of Multiple Correlation = 0.799 (Ostle, p. 223)
Standard Error of Estimate = 0.801 (Ostle, p. 215)

An evaluation of the samples solely from the Equity deposit (Table 2 and SG-67A) yields a somewhat different equation:

Log(Au) = -7.5 + 1.79 Log(Ag) - 0.563 Log(Cu) - 0.7 Log(Pb) - 1.355 Log(As)

which is similar to that for selected samples from the Allin Creek area (Table 1; nos. 2, 3, 5, 6, 12, 13, 14, 15 and 16):

Log (Au) = -7.06 + 0.82 Log(Ag) - 0.226 Log(Cu) + 0.286 Log(Pb) - 0.919 Log(As).

The first equation, based on the most comprehensive collection of samples obtained from the area by the authors, is believed to best represent the Equity-type deposit profile.

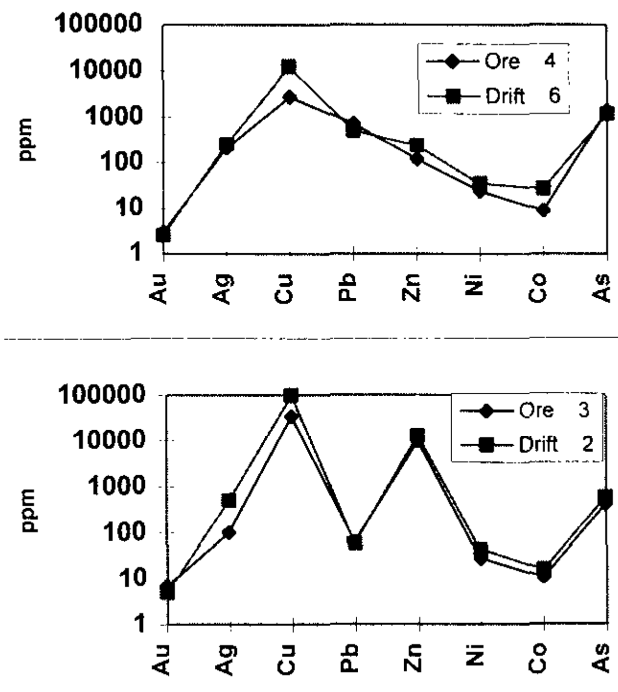

Figure 5. Comparison of Equity ore samples (diamonds) and Allin drift samples (squares).

GENESIS OF THE EQUITY DEPOSIT

The various theories on the origin of the Equity ore deposit were outlined by Ney *et al.* (1972), Wojdak and Sinclair (1984), Cyr *et al.* (1984), Church and Barakso (1990).

Cyr *et al.* (1984) adopted the hypothesis, first suggested very early in exploration, that the mineralization on the Equity Silver property occurs as part of a porphyry system related to a small late Cretaceous / early Tertiary-age granitic stock near the west boundary of the property. Schroeter and Panteleyev (1988) amplified this line of argument and classified the deposit as 'Transitional' between porphyry copper and epithermal systems (also, see Cox and Singer, 1996; Panteleyev, 1995).

However, this model and classification is in sharp contrast to the earlier view of Ney, Anderson and Panteleyev (1972). They suggested that the mineral deposition had volcanogenic affiliations related to the Jurassic-age volcanic pile hosting the deposit (no black ores but Kuroko-like in geological setting and style of mineralization). With the beginning of mining in 1980, new exposures showed that the ore was comprised mostly replacement sulphides and discordant fissure fillings and was clearly not syngenetic. Textures and structures of the Equity deposit give strong evidence of metasomatism in keeping with Lindgren's metasomatic classification and Gilbert and Parks (1996) description of replacement ores.

This was more consistent with an intrusion-related, porphyry style of mineralization, however, the Main ore zone is more than a kilometre from the proposed 'source' granite body and the mineralization and alteration bears little similarity to that in porphyry copper environments Nielson (1969).

Wojdak and Sinclair (1984) propose that the principal ore mineralization represents a late high temperature hydrothermal mineralizing episode that resulted in widespread wall-rock alteration. Wojdak and Sinclair imply that no direct link need exist between the weak early phyllic alteration related to the porphyry mineralization associated with the granitic body and the strong acid leaching alteration associated with the silver-copper-gold-arsenic deposition in the Jurassic volcanic rocks. Salinity and temperature data from fluid inclusions suggest that circulating meteoric waters were involved in the ore mineralization. The convective hydrothermal system apparently developed subsequent to fracturing and brecciation induced by shallow igneous intrusions. Nielson (1969) favours the Eocene-age Goosly stock as the thermal engine and concentrating agent for the mineralizing solutions. The breccia zone at the Equity deposit, which bears a geometrical relationship to the margin of the intrusion, is believed to be the principal control for ore emplacement.

The sequence of events leading to mineralization on the Equity Silver property, summarized by Church and Barakso (1990), combines the main elements of the epigenetic theories. Initially a small granitic stock intruded Jurassic volcanic and metasedimentary rocks resulting in weak porphyry copper mineralization in the immediate vicinity of the stock (no associated volcanism). Several million years later the larger Goosly syenomonzonite-gabbro intrusion, with several phases and many offshoot dikes, was emplaced a few kilometres east of the granite, brecciating the adjacent host rocks. Outward movement of hydrothermal solutions from the Goosly stock produced a broad aureole of alteration and sulphide dissemination, replacement and fracture filling. A late stage hyrothermal event followed accompanied by a resurgence of igneous activity that intruded earlier formed parts of the mineral deposit. These events produced silver, copper and arsenic lithogeochemical halos about the Equity deposit and Goosly intrusion.

CONCLUSIONS

Drift prospecting combined with geochemical methods and a knowledge of local geology and glacial history has been successful in delineating a new exploration target for Equity-type mineralization in the Allin Creek area, southeast of Houston B.C..

A large southerly-trending silver-soil geochemical anomaly, east of the Goosly stock near Allin Creek, appears to be caused by a zone of mineralization similar to the Equity deposit. Diamond drilling on the Allin property intersected Jurassic dacitic breccia and dust tuff formations similar to the rocks hosting the ore at the Equity mine. Drift samples from the area of the soil anomaly on the Allin property include many subangular clasts with sulphide disseminations, replacements and fracture fillings characteristic of the Equity mineralization.

To aid in the search for similar deposits, a description of Equity-type mineralization is presented in this report which includes a chemical signature expressed in terms of a correlation matrix and multiple regression analysis of available assay results.

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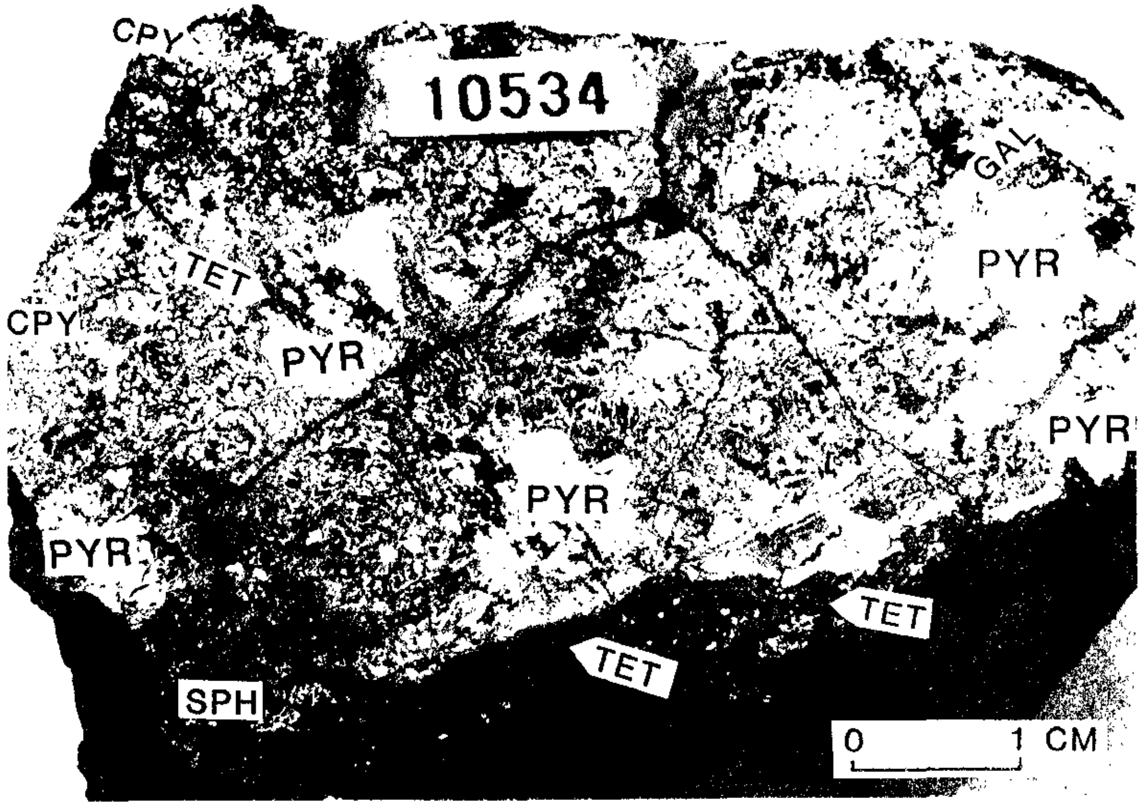

Photo 1 Mineralized float from Allin prospect; pyrite megacrysts in matrix of fine grained mixed sulphides of pyrite, chalcopyrite, sphalerite, tetrahedrite and galena, replacing tuff breccia.

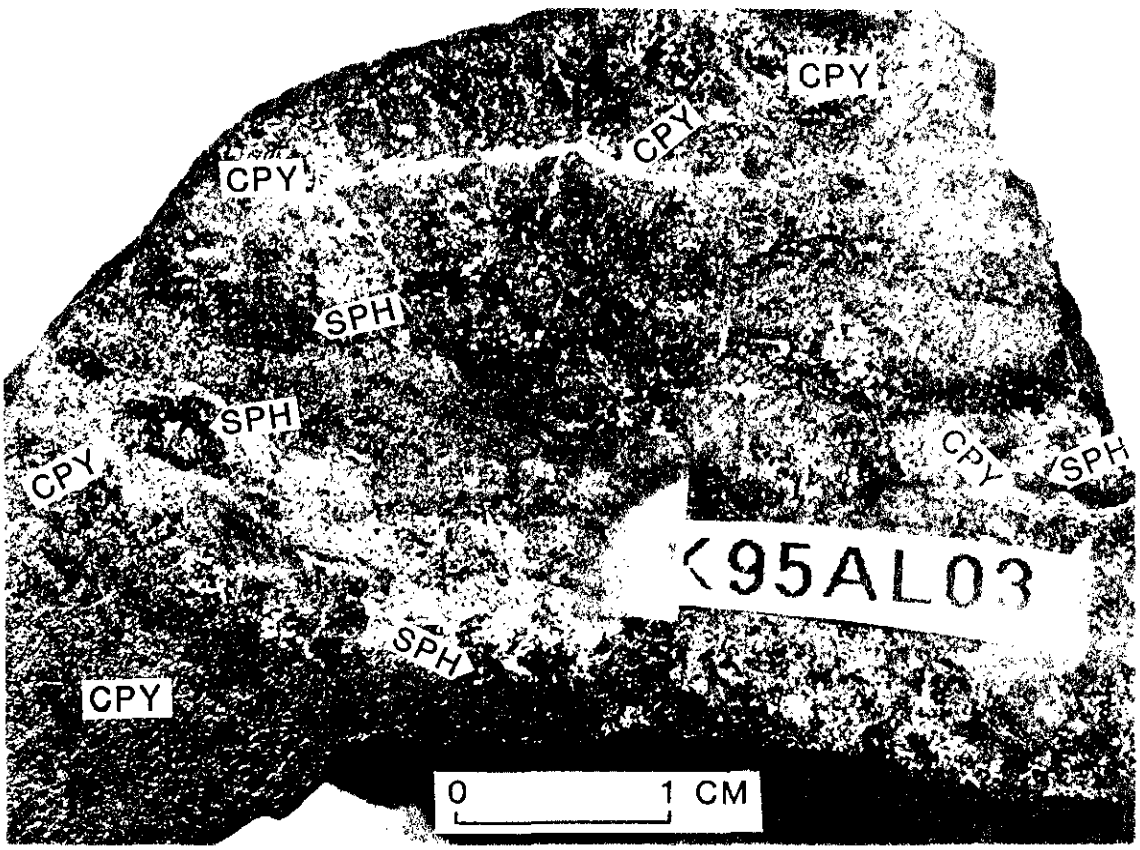

Photo 2 Mineralized float from Allin prospect; chalcopyrite, pyrite and sphalerite dissemination.

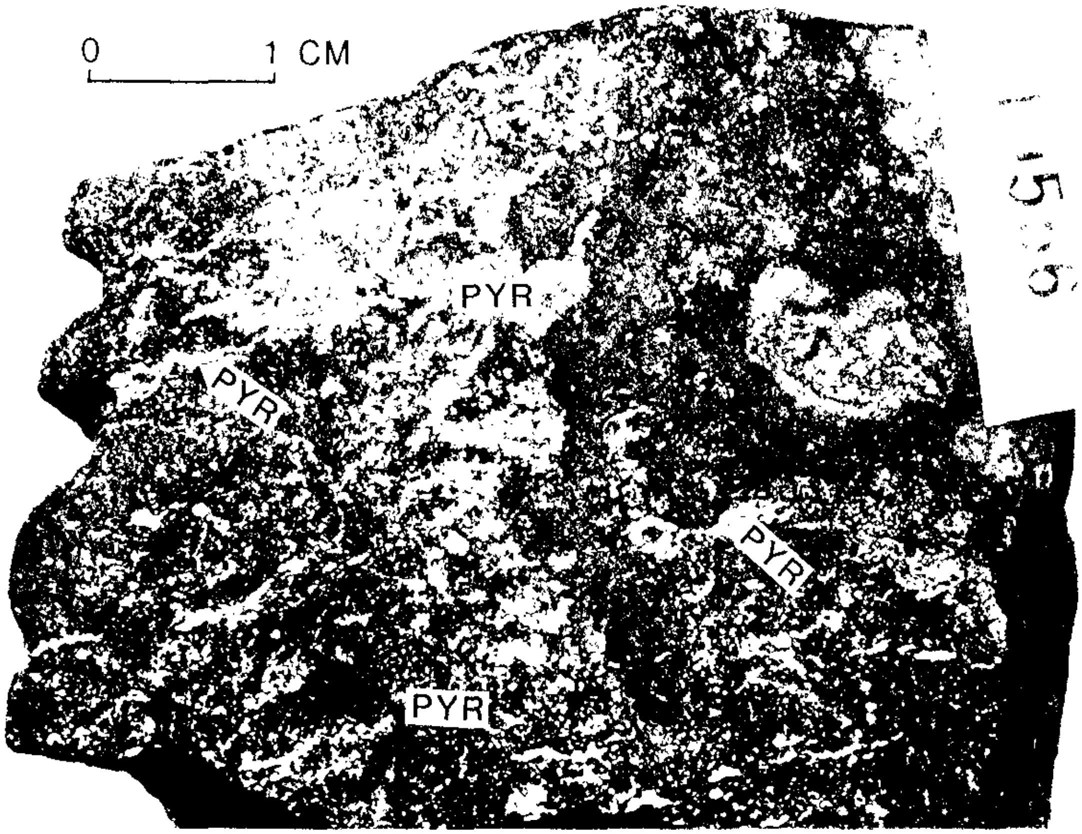

Photo 3. Mineralized float from Allin property; auriferous pyrite dissemination and filling in tuff breccia.

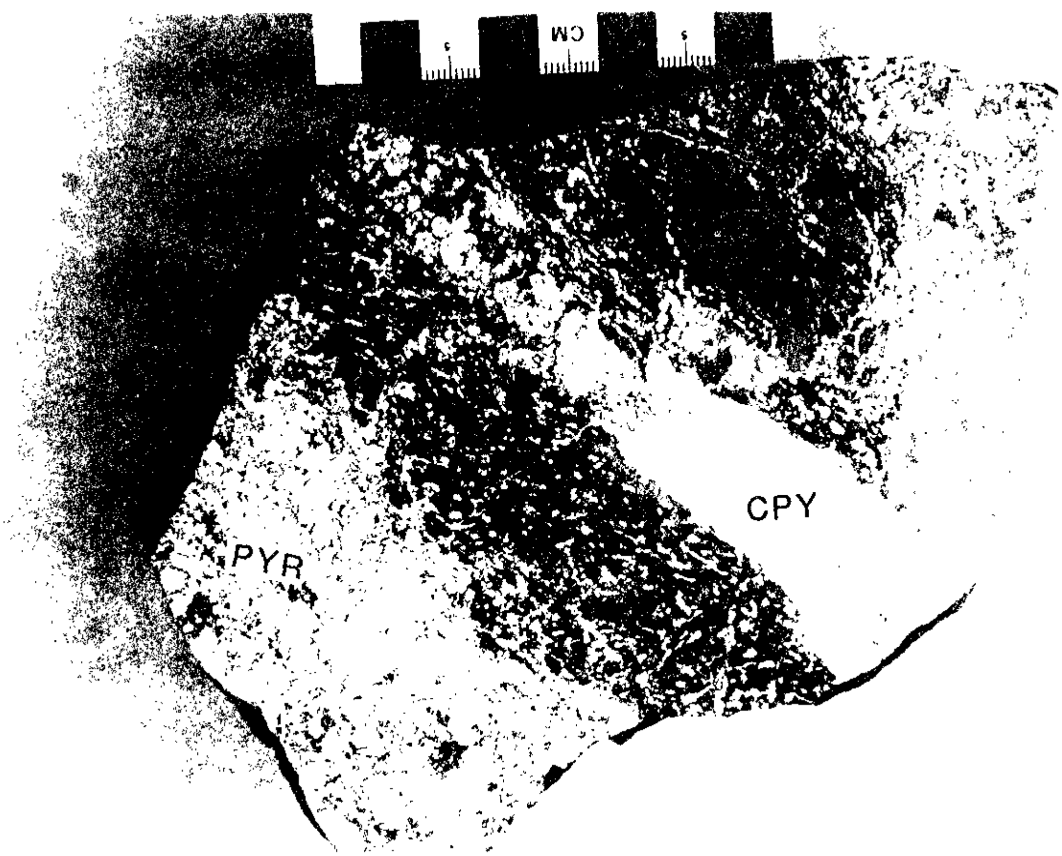

Photo 4. Sulphide replacement and fracture filling of dacitic tuff breccia; medium to coarse grained pyrite (grey), pyrrhotite and chalcopyrite (bright); sample from North zone, Equity mine.