UPDATE ON THE GEOLOGY AND MINERALIZATION IN THE BUCK CREEK AREA THE EQUITY SILVER MINE REVISITED (93L/1W)

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INTRODUCTION

This report includes the results of regional geological evaluations in the Houston area and examination of the open pit operation at the Equity Silver mine in July 1984. Current activity on the Equity property concerns mining the Main Zone ore and exploration drilling on the new Pipe Line Zone. The South Tail pit, which has supplied most of the ore to date is now abandoned (Fig. 58 and Plate IV).

Rock samples collected during regional mapping in the Buck Creek map sheet (Church, 1972) were analysed by J. Barakso of Min-En Laboratories for pathfinder and ore elements including Ag, As, Au, Cd, Co, Cu, Fe, Hg, Mo, Ni, Pb, and Zn. Contour maps prepared from these data showed 'bulls-eye' patterns around what is now the Equity Silver mine. Recently, Barakso extended his analyses to include Ba, F, Sn, and Sr plus the major elements Ca, K, Mg, and Na. Contour patterns for these support the earlier findings (Kowalchuk, *et al.*, 1984). It was concluded that the geochemical dispersion reflects a genetic relationship between the Goosly syenomonzonite body and the Equity ore deposit.

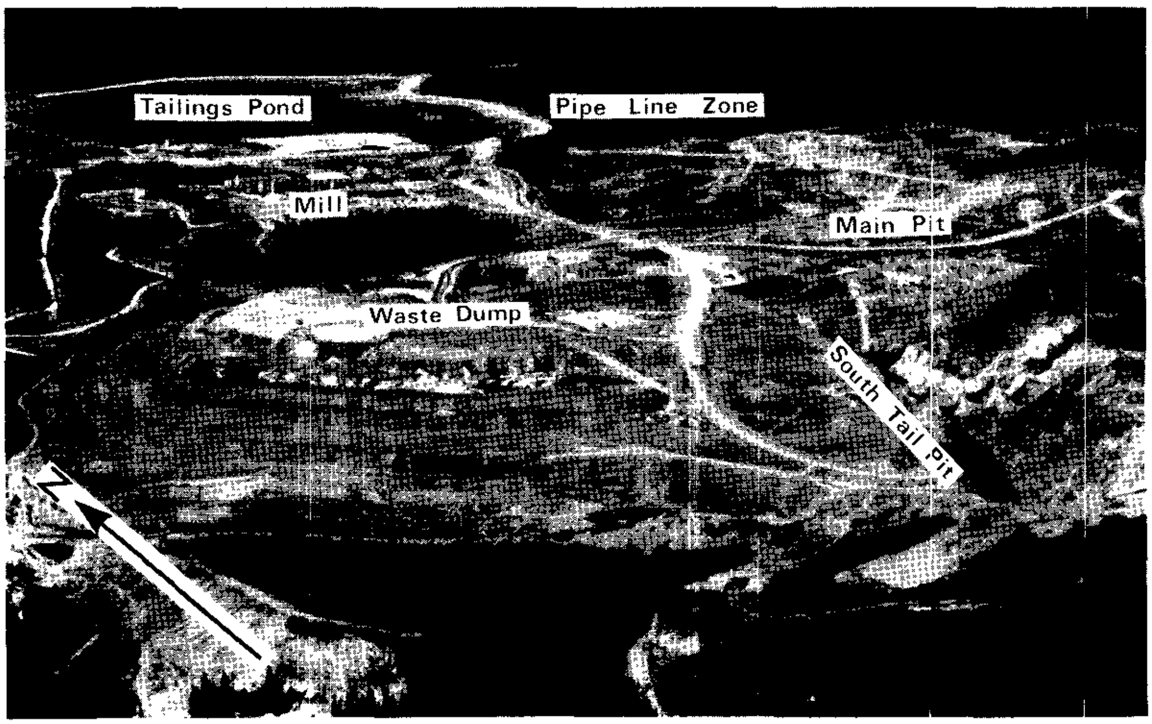


Plate IV. Panoramic view of Equity Silver mine.

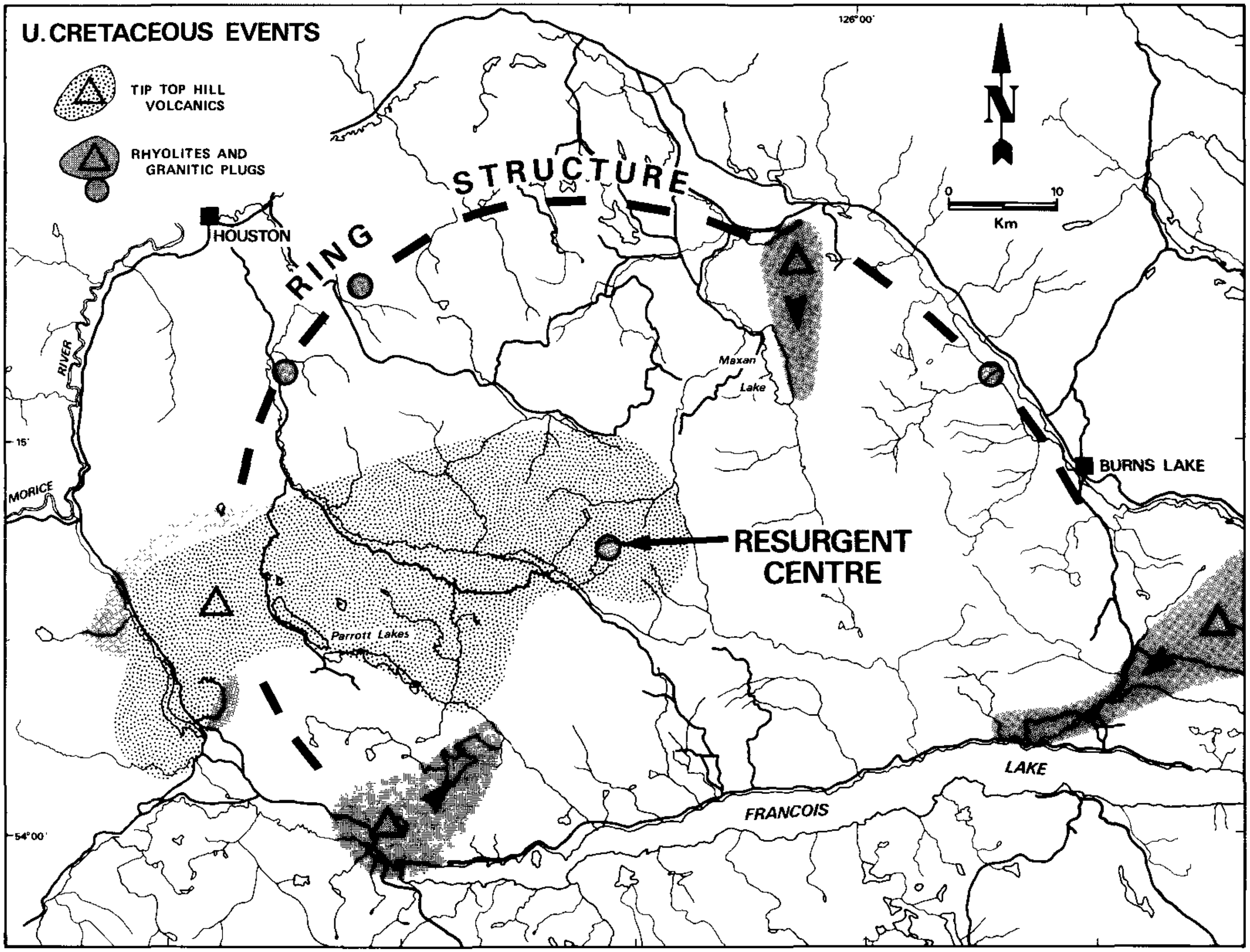


Figure 59a. Volcanogenesis of the Buck Creek basin, Upper Cretaceous events.

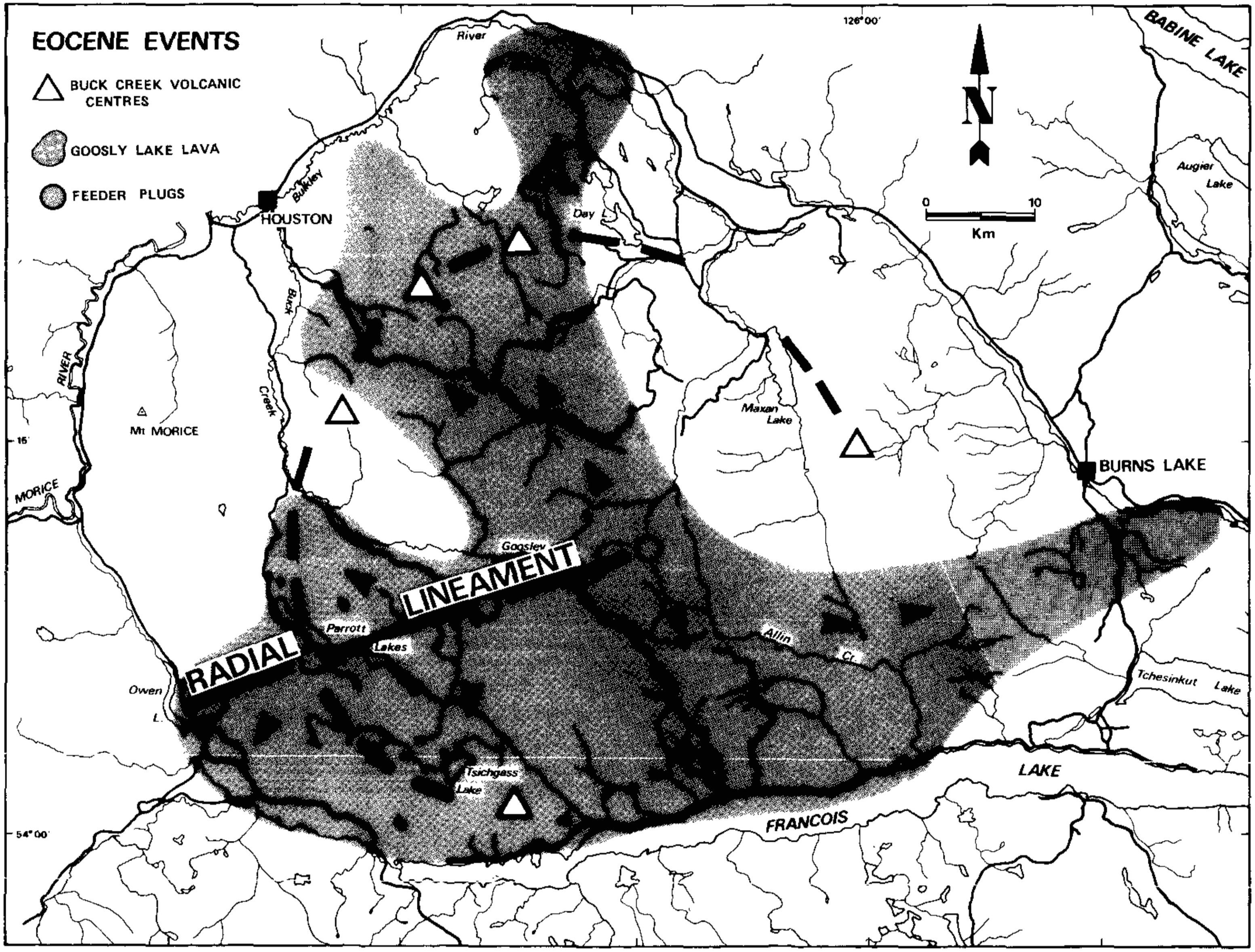
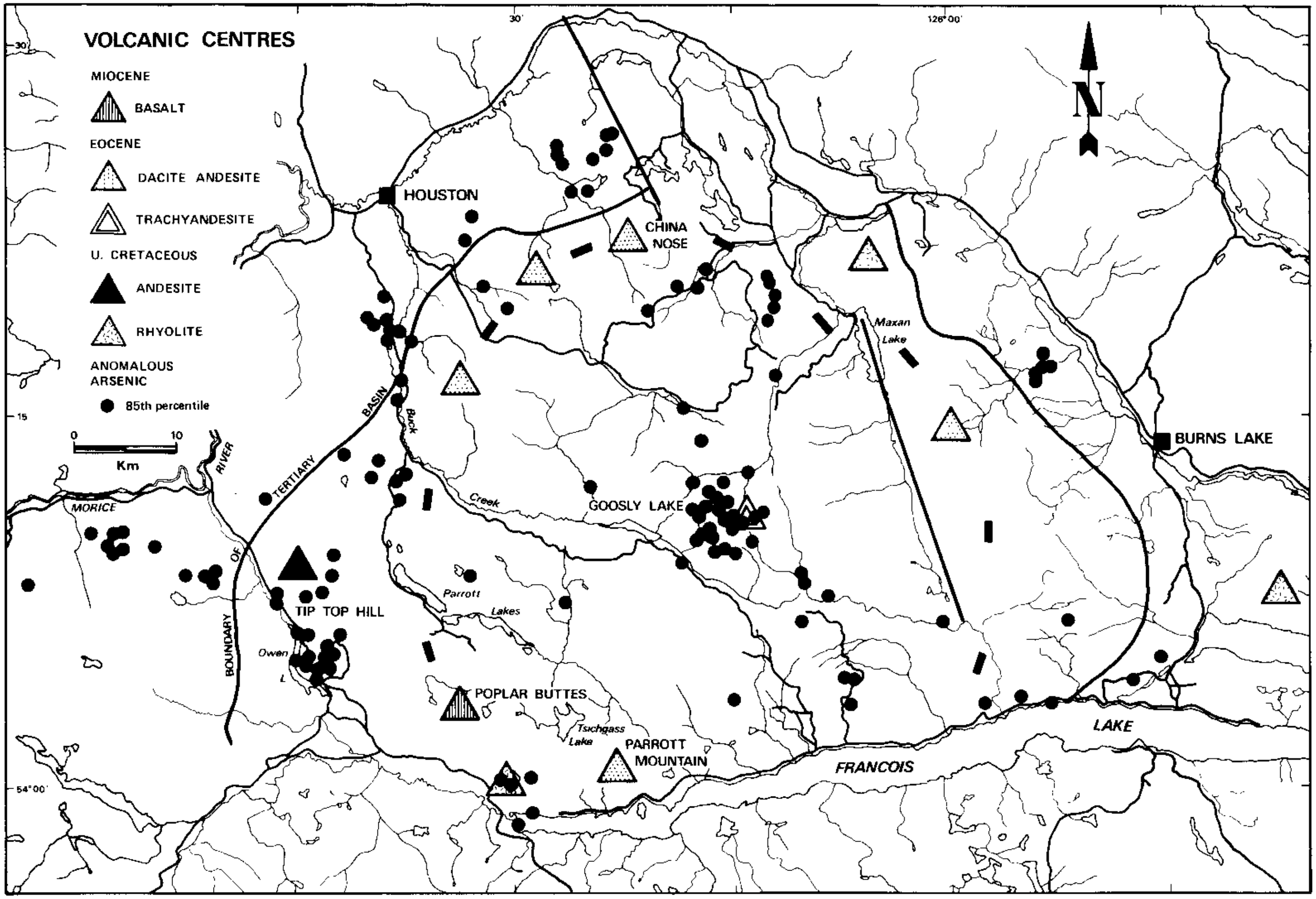


Figure 59b. Volcanogenesis of the Buck Creek basin, Tertiary events.



ELEMENTS OF THE BUCK CREEK CALDERA
SHOWING VOLCANIC CENTRES AND ANOMALOUS ARSENIC LOCATIONS

Figure 60. Elements of the Buck Creek caldera showing volcanic centres and anomalous arsenic localities.

According to this model, the Goosly stock and accompanying dykes intruded Mesozoic host rocks mobilizing juvenile and connate solutions. This produced a broad alteration halo containing sulphide disseminations, replacement lenses, and vein fillings. It is possible that the Goosly stock was only a source of heat and solutions which redistributed and concentrated ore metals; however, there is evidence that some elements moved directly from the intrusion.

This mineralization resulted in the Equity deposit with a total estimated reserve of 27.4 million tonnes averaging 105.6 grams per tonne silver, 0.95 gram per tonne gold, 0.38 per cent copper, and 0.08 per cent antimony.

GEOLOGICAL SETTING

The geology of the Buck Creek area and Equity mine was discussed in detail previously in several Ministry publications by Church (1969 to 1973 and 1981) and Schroeter (1974, 1979).

The Equity mine is located within an erosional window of uplifted Eocene and Lower Cretaceous beds near the mid-point of the Buck Creek basin. This central uplift appears to be the result of a resurgency in a large caldera. The perimeter of the 'Buck Creek caldera' is delineated roughly by a series of rhyolite outliers and the semi-circular alignment of Eocene volcanic centres scattered between Francois Lake, Houston, and Burns Lake. A prominent 30-kilometre-long lineament, trending west-southwest from the mine and central uplift, appears to be a radial fracture coinciding with the eruptive axis of the Tip Top Hill volcanics (77.1±2.7 Ma) and a line of syenomonzonite stocks and feeder dykes to an assemblage of 'moat volcanics', which include the Goosly Lake lavas and breccias (49.7±1.8 Ma) (Figs. 59 and 60).

The principal host rocks at the Equity mine are Mesozoic volcanic and sedimentary beds correlative in part with fossiliferous* Skeena Group units exposed on the north shore of Francois Lake. The chief sulphides are pyrite, chalcopyrite, pyrrhotite, and tetrahedrite, with minor amounts of galena, sphalerite, and some sulphosalts. These are accompanied by clay minerals, chlorite, specularite, and locally sericite, pyrophyllite, andalusite, tourmaline, and minor amounts of scorzalite and corundum.

LITHOGEOCHEMISTRY

A primary lithogeochemical study was completed on 2 119 rock samples from the Buck Creek map-area, including the Equity mine site. The results for precious and base metals highlight the known ore deposits, many mineral showings, and some previously unrecorded mineral occurrences.

*Conglomerates containing pelecypods and gastropods including *Trigonia emoryi*, Lower Cretaceous.

Arsenic proved to be an excellent pathfinder for the ore minerals and confirmed caldera structures. The regional pattern for anomalous arsenic is annular in general form with a centrally located concentration over the resurgent area of the caldera (Fig. 60).

Dispersion of elements in vicinity of the Equity mine was described by Church, *et al.*, (1981) and Kowalchuck, *et al.*, (1984). Figure 61 is a reproduction from Kowalchuck with K added to the Ag, As, Cu composite pattern. To ensure a realistic representation of results contours for these elements were constructed using a $1/r^2$ radial weighting factor applied to a grid of moving average values.

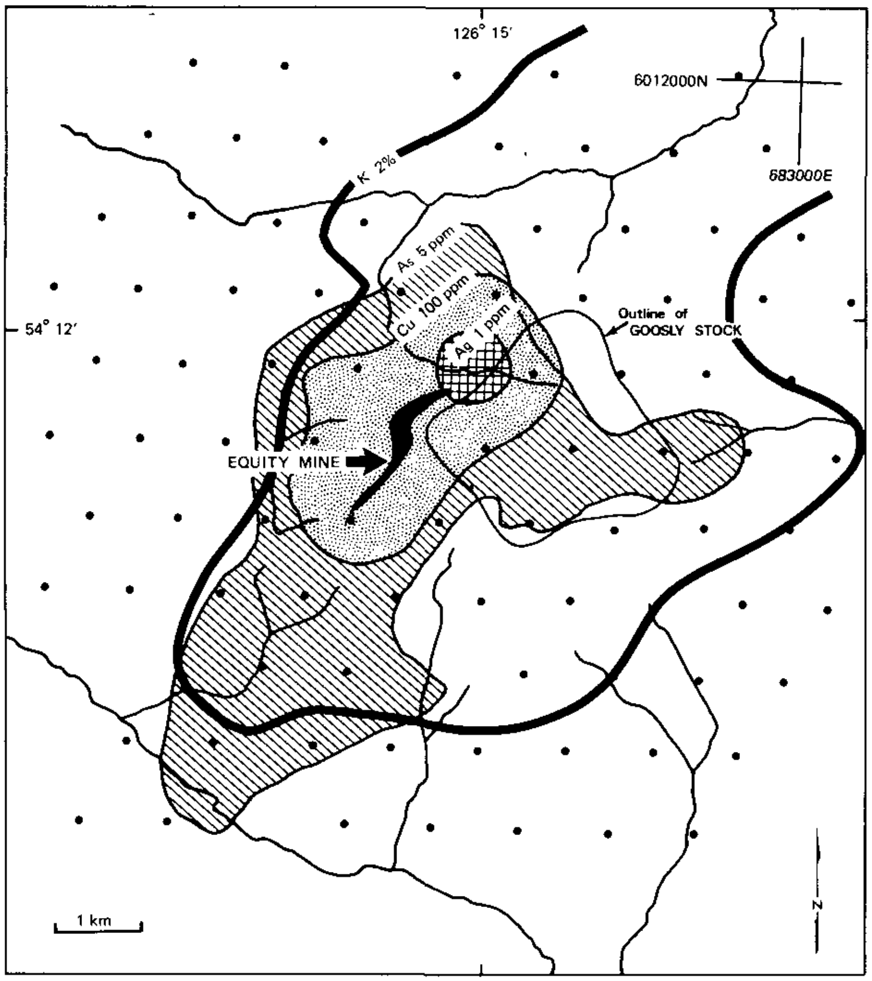


Figure 61. Composite lithogeochemistry for pathfinder and ore elements, Equity Silver mine (modified after Kowalchuk, et al., 1984).

The element contours are mostly closed about the Equity orebody. Silver exceeds 1 ppm within a 1-square-kilometre area covering part of the Main Zone and the undeveloped Pipe Line Zone to the northeast. Copper is above 100 ppm over the entire orebody and distal terrain radially for about 1 kilometre. Arsenic greater than 5 ppm includes much of the pre-Tertiary window containing the ore zone, the Goosly stock, and a gossan zone at the east contact of the stock. Potassium shows the greatest dispersion forming a broad northeast-elongated aureole extending well beyond the Goosly stock and metal anomalies.

The transgression of element contours across geological boundaries is a conspicuous feature of the Equity deposit. Sulphides are found throughout the Skeena stratigraphy including sulphide stringers in the basal clastics, ore mineralization of the dust tuff, and disseminations in the overlying volcanic pile and subjacent Tertiary rocks. This evidence points to the Goosly stock as the main source of mineralizing solutions.

DISCUSSION

Mining on the Equity property since April 1980 has afforded an excellent opportunity to study this deposit (Fig. 58). With recent delineation of the Pipe Line Zone, north of the main pit, the full length of the orebody is now known to exceed 1 500 metres. Open pit excavation began on the South Tail Zone, situated midway between the Waste Dump granite and the Goosly syenomonzonite stock and is now underway on the Main Ore Zone to the northeast at the contact of the syenomonzonite. The Pipe Line Zone, centred about 1.5 kilometres northeast of the Waste Dump granite, appears to be an extension of the Main Zone wrapping around the northwest flank of the syenomonzonite. A peculiar ring dyke-like appendage of the syenomonzonite is exposed in the main pit where it divides part of the ore and strikes toward the Pipe Line Zone.

A number of conspicuous felsic dykes are exposed in the pits. These consist of bladed feldspar porphyry offshoots of the syenomonzonite stock, pulaskite feeder dykes related to the Goosly Lake lavas, and young quartz-feldspar porphyry dykes that cut the syenomonzonite body and adjacent ore zone. Emplacement of some of these dykes during the mineralizing episode is indicated by local hydrothermal alteration of the dykes to clay minerals, the apparent damming and concentration of sulphides along some intrusive contacts, and the occurrence of disseminations and veinlets of ore minerals within some dykes (Plates V and VI).

Crystal fractionation of the Goosly intrusions is apparently responsible for the wide range of magmas in the line of gabbro-syenomonzonite stocks, related dykes, and Goosly Lake volcanic rocks. This evolution results in a regular progression in chemistry and mineralogy from basic to felsic rock types (Fig. 62 and Table 1). The natural products of this process

TABLE 1
CHEMICAL ANALYSES OF GOOSLY INTRUSIVE ROCKS

	1	2	3	4	5	6	7	8	9
Oxide recalculated to 100:									
SiO_2	49.12	49.35	51.77	51.64	51.84	53.90	54.65	54.79	56.11
TiO_2	1.51	1.31	1.42	2.89	1.46	1.51	1.88	1.35	1.35
Al_2O	16.66	16.34	16.68	16.00	17.56	17.25	17.57	17.60	17.63
Fe_2O_3	2.49	2.35	1.54	6.28	2.81	5.31	4.11	3.48	2.94
FeO	6.12	7.42	7.60	4.63	4.79	2.42	3.75	4.29	3.46
MnO	0.20	0.17	0.19	0.15	0.14	0.11	0.14	0.14	0.06
MgO	6.85	11.93	7.89	4.42	5.78	3.85	3.98	4.64	2.73
CaO	13.55	6.83	8.11	6.55	9.88	7.77	6.25	6.35	6.51
Na_2O	3.00	3.62	4.41	5.42	4.82	5.08	4.25	3.86	5.60
K_2O	0.50	0.68	0.39	2.02	0.92	2.80	3.42	3.50	3.61
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Oxides as determined:									
H_2O-	2.65	4.27	3.02	2.80	4.84	1.10	1.90	1.31	2.51
H_2O+	0.90	2.02	0.72	0.58	0.51	0.89	0.18	0.37	0.50
CO_2	0.69	0.41	5.50	0.10	0.60	1.15	0.07	40.01	0.82
S	0.04	0.05	0.24	0.06	0.01	0.62	0.40	0.02	0.09
P_2O_5	0.28	0.09	0.15	0.27	0.18	0.59	0.91	0.71	2.64
BaO	0.07	0.02	0.07	0.04	0.02	0.28	0.27	0.29	0.27
SrO	0.05	0.05	0.07	0.04	0.05	0.12	-	0.14	0.08
Molecular Norm:									
Q_2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Or	2.95	3.82	2.27	11.93	5.36	16.40	20.15	20.58	21.02
Ab	26.88	31.71	39.00	46.93	39.40	43.06	38.02	34.47	43.74
Ne	0.00	0.00	0.00	1.01	1.94	1.27	0.00	0.00	3.47
An	30.48	25.71	24.22	13.37	23.24	15.87	18.72	20.27	12.14
Wo	14.65	2.94	6.17	7.64	10.03	8.93	4.88	4.43	7.87
En	2.93	2.49	4.17	0.00	0.00	0.00	6.83	9.39	0.00
Fs	1.41	0.83	2.19	0.00	0.00	0.00	1.93	2.85	0.00
Fo	11.97	22.24	12.97	9.15	11.80	7.90	3.10	2.52	5.57
Fa	5.75	7.40	6.83	0.00	4.95	0.00	0.88	0.76	1.86
Il	0.38	0.46	0.59	3.92	0.29	2.08	1.21	1.11	1.30
Mt	2.60	2.40	1.59	4.72	2.89	2.45	4.28	3.62	3.03
He	0.00	0.00	0.00	1.23	0.00	2.03	0.00	0.00	0.00
Cr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Key to Analyses

Geology, Exploration and Mining in British Columbia, 1969, p. 148 (No. 7); 1970, p. 124, (Nos. 1, 4, and 6); and 1970, p. 138 (No. 9).

New analyses Nos. 2, 3, and 5 from Gillan sill and No. 8 from the Goosly stock.

were heat, water, and fugitives such as potassium, boron, and phosphorus (significant components in the altered rocks of the Equity mine) and other ore constituents.

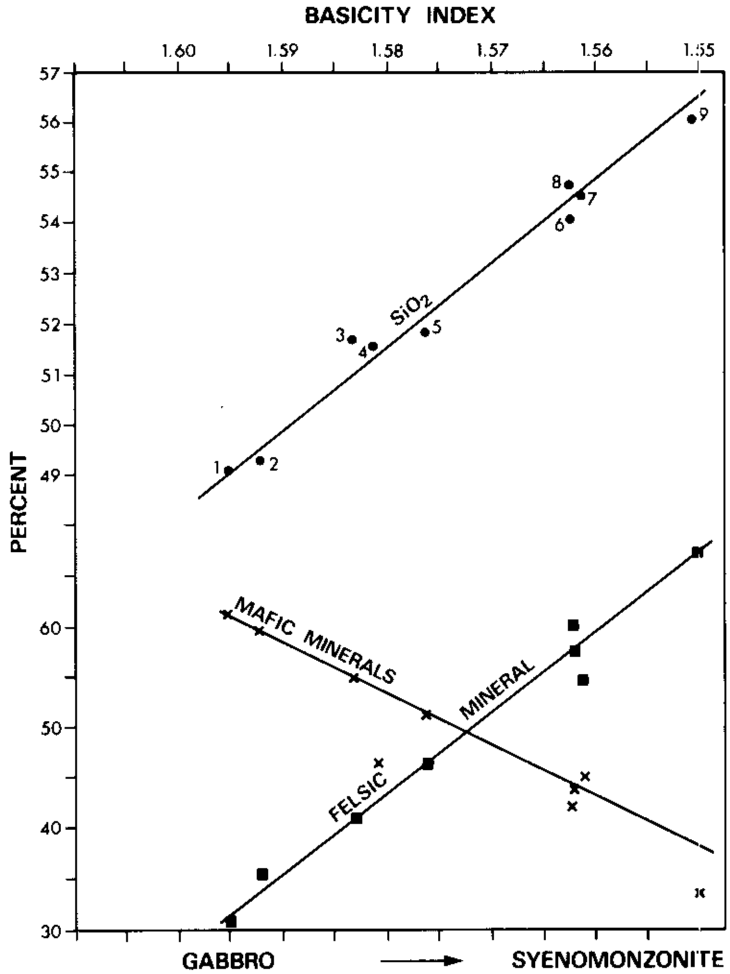


Figure 62. Mixing diagram showing chemical and mineralogical consanguinity of Goosly intrusions in the Buck Creek area (analyses numbers are keyed to data in Table 1).

METALLOGENIC MODEL

A model suggesting the sequence of events leading to mineralization at the Equity silver mine is illustrated on Figure 63. Initially, a small granitic stock intruded Skeena Group (Lower Cretaceous) volcanics and metasediments resulting in weak porphyry copper-molybdenum mineralization. Several million years later a larger gabbro-syenomonzonite body, with many offshoot dykes, was emplaced several hundred metres to the east, brecciating the adjacent dacite dust tuff unit of the Skeena Group (stage 2). Outward movement of hydrothermal solutions from the

Plate V. Pulaskite dyke with sulphide ponded (?) at the footwall contact, veinlets of ore sulphides occur within the dyke.

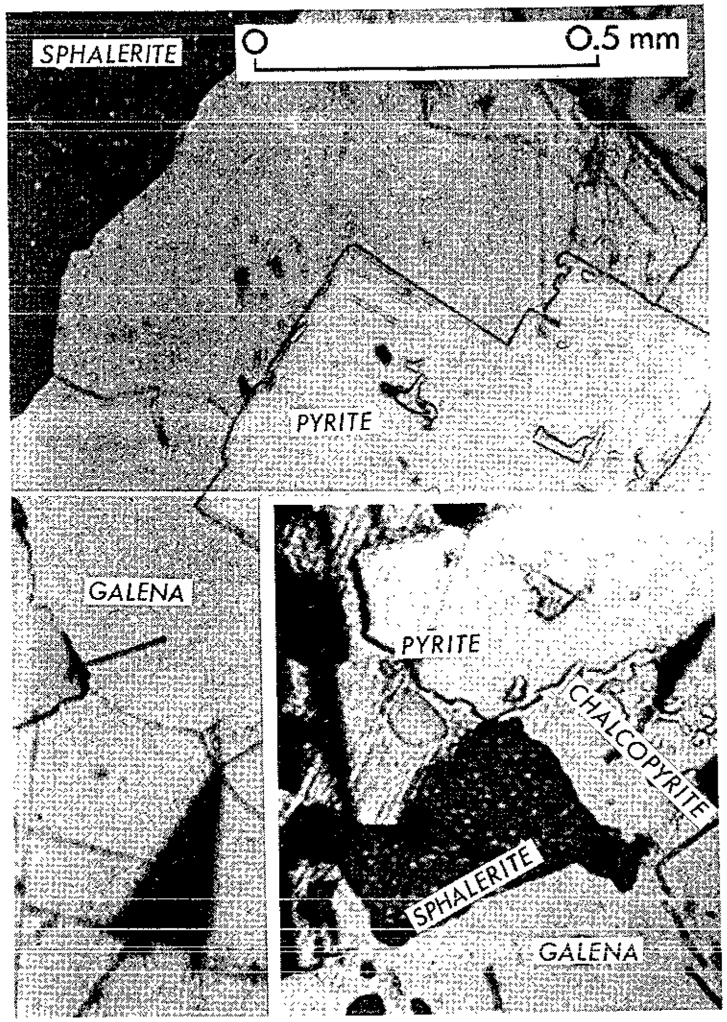


Plate VI. Photomicrograph of a sulphide veinlet within the Tertiary pulaskite dyke.

syenomonzonite produced a broad aureole of alteration and sulphide dissemination, replacement, and filling (stages 3 and 4). A late stage hydrothermal event followed, accompanying resurgence of igneous activity. These events produced silver, copper, arsenic, and potassium lithogeochemical haloes about the Equity ore zone and to some extent around the syenomonzonite intrusion.

These evaluations are intended to shed more light on the Equity deposit with the view to assisting further exploration in the Buck Creek area.

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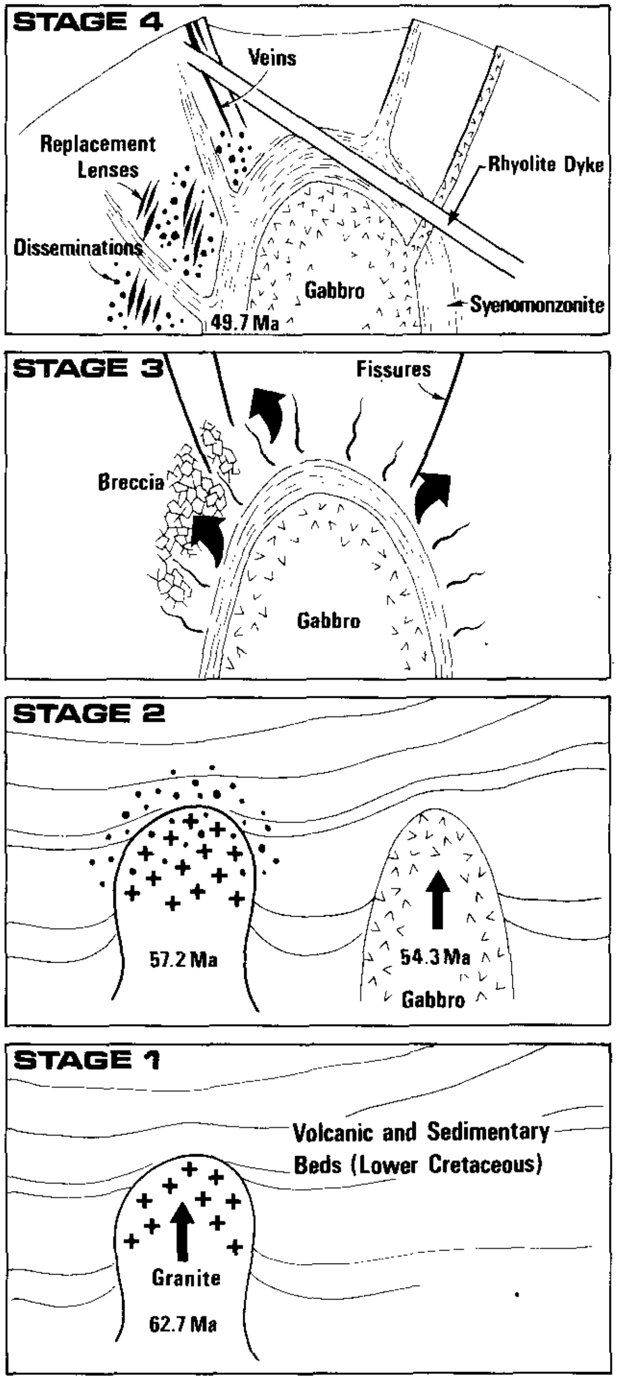

Figure 63. Metallogenic model showing the stages of igneous intrusion leading to mineralization at the Equity Silver mine.

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TABLE 2

SILICATE ANALYSES CALCULATED FROM MODAL DATA COMPARED WITH CHEMICAL RESULTS

	WASTE DUMP GRANITE		GOOSLY SYENOMONZONITE	
	1	2	3	4
Oxides Recast to 100%	**Calculated**	**Chemical**	**Calculated**	**Chemical**
SiO_2	66.8	66.2	54.3	54.6
Al_2O_3	17.2	16.0	19.9	17.6
Fe_2O_3	2.6	2.1	6.6	4.1
FeO	1.3	1.6	3.4	3.8
MgO	1.1	1.3	1.6	4.0
CaO	4.0	3.2	6.2	6.3
Na_2O	3.5	4.3	3.9	4.3
K_2O	3.4	3.6	4.1	3.4
H_2O	0.1	1.7	Tr	1.9
	100.00	100.00	100.00	100.00
Modal %				
Quartz	25		2	
Orthoclase	19		25	
Plagioclase (An_{45})	50		58	
Biotite	4		2	
Augite	-		8	
Magnetite	2		5	
	100		100	

Key to Analyses:

1 - Silicate composition calculated from modal results on granite (GEM, 1969, p. 146)

2 - Silicate composition from chemical analysis of granite No. 1 (GEM, 1969, p. 148, No. 1 in Table)

3 - Silicate composition calculated from modal results on syenomonzonite (GEM, 1969, p. 147)

4 - Silicate composition from chemical analysis of syenomonzonite (GEM, 1969, p. 148, No. 2 in Table)