CENTRAL BRITISH COLUMBIA

COMPUTER PROCESSING OF GEOCHEMICAL DATA SHOWING THE PRIMARY DISPERSION OF ELEMENTS NEAR THE EQUITY MINE (SAM GOOSLY) (93L/1W)

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INTRODUCTION

Application of the desk top computer in processing geochemical data is demonstrated using rock analyses from the Goosly area and Equity mine (MI 93L-1), southeast of Houston, British Columbia.

In the course of regional mapping and survey of mineralization, hand specimens were collected from accessible bedrock exposures covering a wide region between Houston, Burns Lake, and Francois Lake, including the Equity mine site. Through the Rock Library System sponsored by the Ministry and separate agreements with interested mining exploration companies, the samples were subsequently analysed for a selection of major and minor elements to establish background levels. Samples were collected, analysed, and the data processed by the authors with the cooperation and assistance of Kennco Explorations, (Western) Limited, Anaconda American Brass Limited, and Placer Development Limited.

GEOLOGICAL SETTING

Mineralization was first discovered in the Goosly area in 1967, the geology being described later by Ney, *et al.*, 1972; Wojdak, 1974; Wetherell, 1979; and various reports by the Ministry from 1969 to the present.

The Goosly area is underlain by diverse assemblages of Jurassic to Eocene volcanic and sedimentary rocks cut by a number of small igneous intrusions (Fig. 6).

The principal stratigraphic divisions comprise a basement sequence of deformed Mesozoic metasedimentary rocks and younger, less deformed cover rocks. The basement is poorly exposed and consists mostly of Lower Cretaceous conglomerate and volcaniclastic units assigned to the Skeena Group and some maroon tuff breccia believed to be Sinemurian age (Hazelton Group). The cover rocks are generally well exposed and consist of intermediate and felsic volcanic rocks recognized as the Late Cretaceous Tip Top Hill, Eocene Goosly Lake andesitic lavas and breccias, and Eocene Buck Creek dacitic 'plateau' lavas.

The main intrusions are a syenomonzonite-gabbro stock and a somewhat smaller granitic body described variously as having quartz monzonite, adamellite, or granite composition. These intrusions are younger than the basement strata and may be volcanic necks or feeders to the young volcanic assemblages.

At the Equity mine, erosion has sliced through the cover rocks exposing a zone of disseminated and massive sulphides rich in pyrite, chalcopyrite, and tetrahedrite, some pyrrhotite, and minor sphalerite and magnetite. The main mineralized zone lies immediately west of the syenomonzonite-gabbro intrusion. The

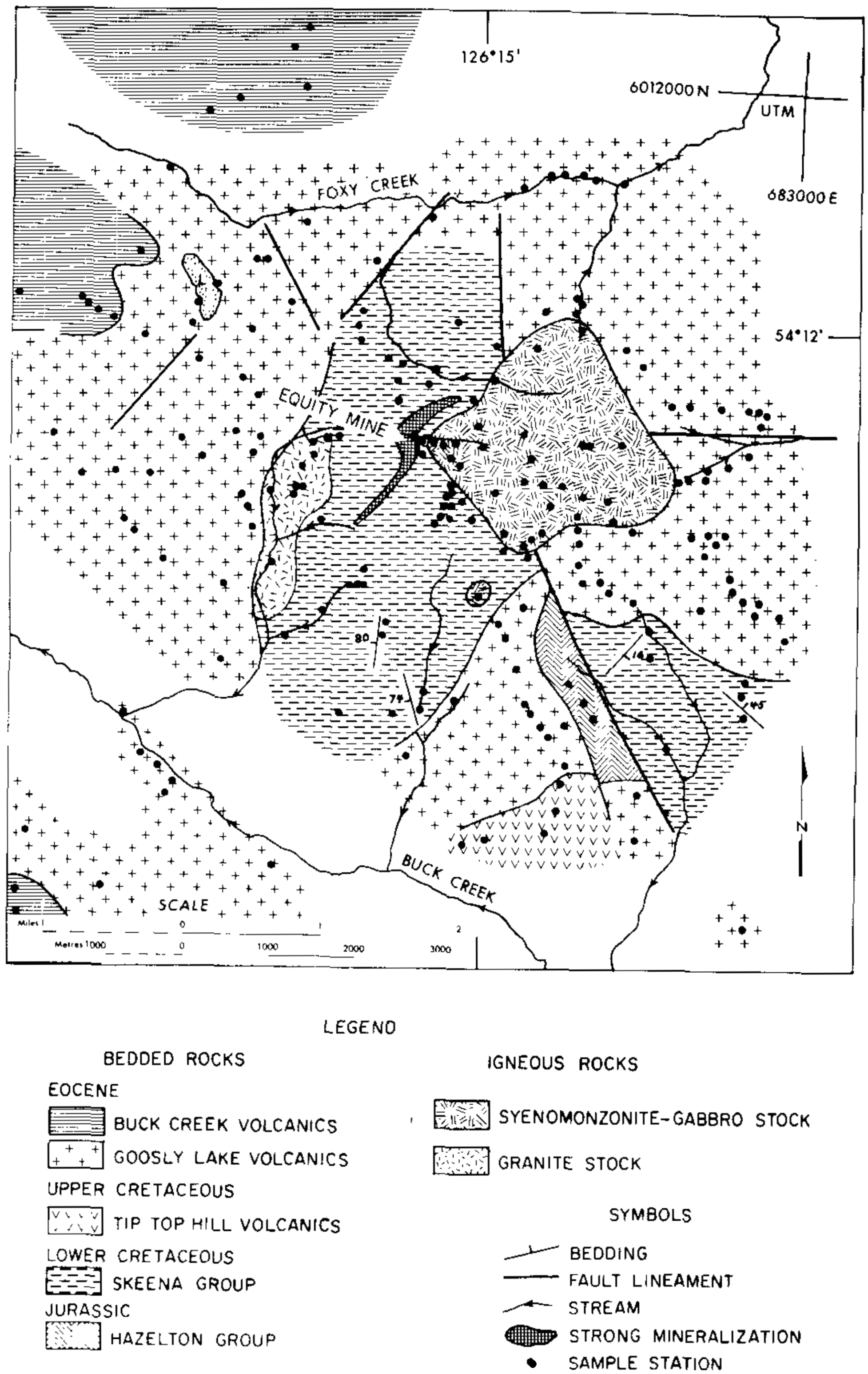

Figure 6. Geological map and sample locations near the Equity minesite (MI 93L-1), Goosly area (NTS 93L/1W).

aluminous alteration accompanying this mineralization appears to be the same age as the intrusion and is characterized by such minerals as andalusite, pyrophyllite, and scorzalite. A sharp-walled tail-like appendage of the mineralized zone strikes southwest toward the granitic intrusion and penetrates a phyllitic alteration aureole adjacent to this body.

PROCEDURES

The treatment and analysis of rock samples were routine and need not be enlarged on here (Church, *et al.*, 1976), however, some commentary is necessary to explain the geostatistical methods.

The procedure of averaging and contouring geochemical results on a geological base may provide useful insight into element distribution, shedding light on metallogenesis. In the present example a synthesis of scattered results was achieved by the moving average method whereby a grid of averaged values was generated for each element preparatory to contouring. The best results were obtained using a 2-kilometre diameter integrating circular window on a 1-kilometre-sided equilateral triangular grid base. This compact triangular base with equidistant adjacent points was found to give greater control for drawing contours than a square grid.

A computer program designed for a desk top computer that performs the integrating-averaging function is given in Table 1. Input is data on the UTM location of samples, chemical results, coordinates for the starting point for integration, and field limits. Output is a list of averaged values and corresponding UTM coordinates for points in the triangular grid array.

TABLE 1. COMPUTER PROGRAM FOR MOVING AVERAGES FUNCTION
(On a Wang 2200A computer)

```
100 DIM A(15)
110 INPUT "RADIUS OF INTEGRATING CIRCLE",Z
120 T=0:S=0:P=0:INPUT "COORDINATES OF CENTRE OF FIRST CIRCLE",A,B
130 INPUT "EASTING AND NORTHING INTERVALS",G,H
140 Ø=A:Q=B
150 FOR I=1 TO 3: READ A(I): NEXT I
160 IF A(1)=-1 THEN 180: IF SQR((A(1)-Ø)²+((2(2)-Q*1)²)>Z THEN 150
170 S=S+1:T=T+LOG(A(3)):GOTO 150
180 IF S=0 THEN 190:Y=EXP(T/S):SELECT PRINT 211(156):PRINT Ø;",";Q,Y
190 Ø=Ø-Z:S=0:T=0
200 IF Ø<A-G THEN 220
210 RESTORE :GOTO 150
220 S=0:T=0:Q=Q-.866 * Z:P=P+0:IF INT(P/2)=P/2 THEN 240
230 Ø=A-.5*Z:GOTO 250
240 Ø-A
250 IF B-Q<=H THEN 210 :END
260 DATA ____, ____, ____, .................... -1, 0, 0
```

Note: The SELECT PRINT 211 (156) statement links the Wang 2200A computer to an IBM Selectric typewriter output.

RESULTS

Many elements were tested but the most interesting results were obtained for silver, copper, arsenic, mercury, barium, and fluorine.

TABLE 2. CORRELATION MATRIX

	Ag	Cu	As	Hg	Ba
Cu	0.47				
As	0.50	0.39			
Hg	0.13	0.18	0.20		
Ba	–0.08	–0.03	–0.25	–0.14	
F	–0.10	–0.05	–0.31	0.01	0.42

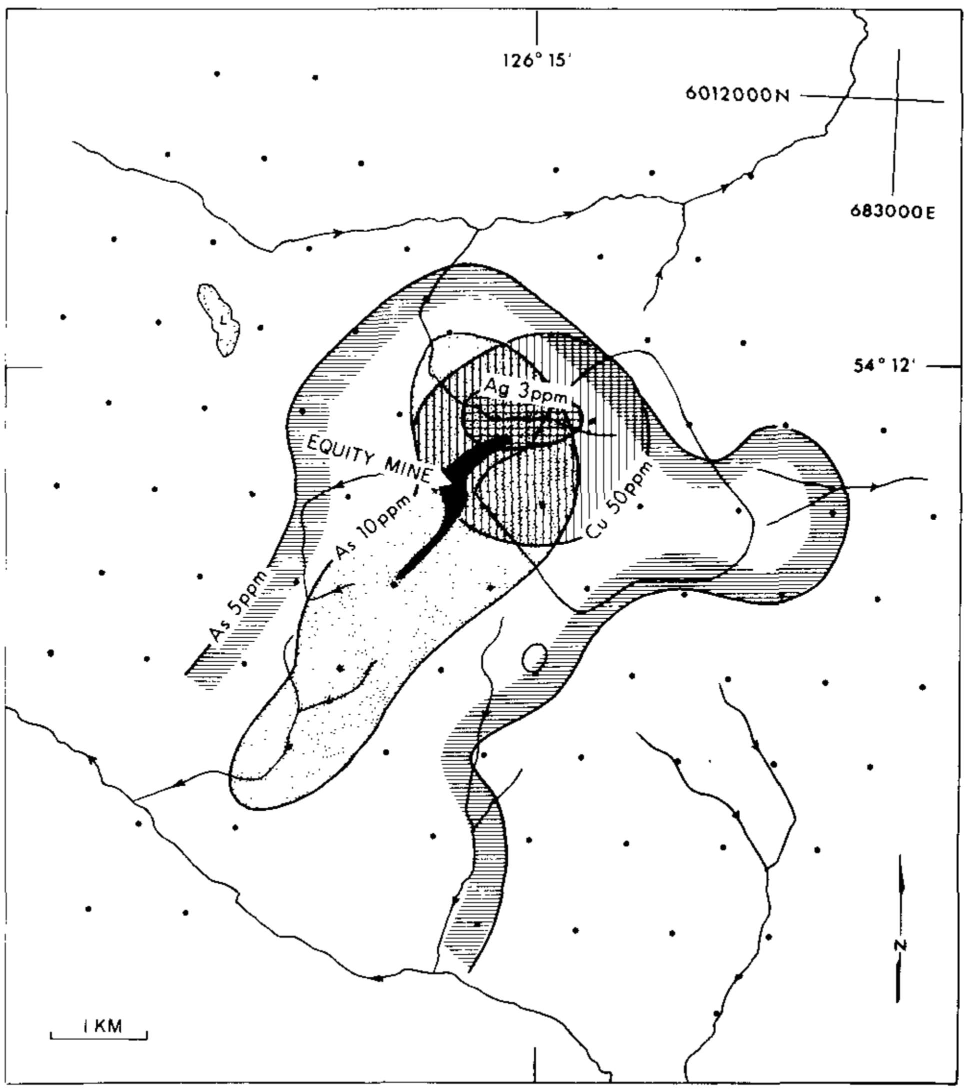

Figure 7. Moving average grid showing lithogeochemical contours for silver, copper, and arsenic in the Goosly area; stipple and hachuring on up-side of contours.

Silver and copper are dispersed in bull's-eye fashion on the contour maps and are centred toward the north end of the Equity ore zone (Fig. 7). Silver greater than 3 ppm is concentrated in a small area of mostly mineralized pre-Tertiary country rock. Copper greater than 50 ppm is coincident but more widely distributed and extensively overlaps the west side of the syenomonzonite-gabbro intrusion. Arsenic above 10 ppm forms an elongated zone that extends beyond the silver-copper bull's eye and covers much of the area peripheral to the main Equity ore zone and the tail offshoot. Arsenic greater than 5 ppm encompasses almost the entire window of the pre-Tertiary rocks that host the ore, the syenomonzonite-gabbro intrusion, and a weak gossan area immediately east of the intrusion. The behaviour of barium and fluorine is antipathetic to the metallic elements (Fig. 8). This is shown by the 1 500-ppm contour for barium and the

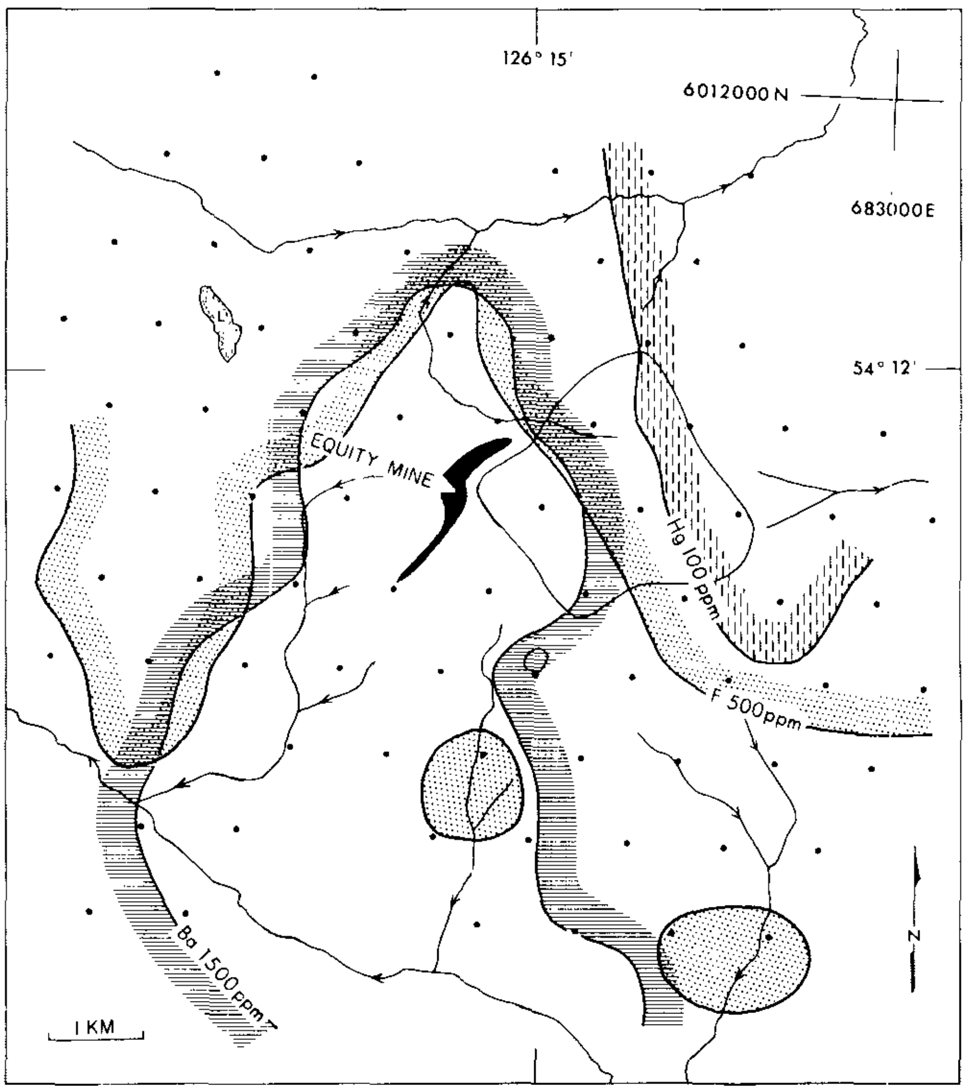

Figure 8. Moving average grid showing lithogeochemical contours for barium, fluorine, and mercury in the Goosly area; stipple and hachuring on up-side of contours.

500-ppm contour of fluorine which are entirely outside the intensely mineralized areas. Mercury is remote from the mineralized zone and is concentrated primarily in the area east of the syenomonzonite intrusion.

The behaviour of the elements is illustrated by the accompanying correlation matrix (Table 2). As might be expected from the above discussion, the element pairs silver-copper, silver-arsenic, and barium-fluorine show fair positive relationships, having coefficients 0.47, 0.50, and 0.42 respectively.

DISCUSSION

Simple computer techniques have assisted in the preparation of contour maps showing the primary dispersion of elements about the Equity ore zone in the Goosly area. Especially useful for this purpose are silver, copper, and arsenic, which seem to display increasing mobility outward from a source area. Converse to the behaviour of these metals, a depletion of barium, fluorine, and mercury is conspicuous in the areas of intense mineralization.

A general transgression of element contours across major geological boundaries suggests overprinting of a younger event on the ore system. This could be a late episode in the main stage of mineralization or simply leakage from a pre-existing orebody. The former is suggested because dyke offshoots from the syenomonzonite intrusion are altered and there is some apparent damming of ore solutions by the dykes.

It can also be pointed out that some of the alteration in the host rocks in the vicinity of the Equity orebody, dated 48.3 Ma by Wetherell (1979), is younger than the main intrusions, whereas the average age of alteration in the host rocks, 54.2 Ma, is essentially the same as the age of the syenomonzonite-gabbro intrusion, 54.3 Ma, as determined by Kennco Explorations, (Western) Limited (1969) (Table 3).

TABLE 3. POTASSIUM–ARGON DATES FROM THE GOOSLY AREA

No.	Unit	Material Analysed	K *per cent*	Ar^{*40} (10^{-5} cc STP/g)	Apparent Age *Ma*
1 x	granite	biotite	6.552	1.624	62.7
2 y	granite	biotite	7.09	1.601	57.2
3 x	syenomonzonite	biotite concentrate	3.087	0.6610	54.3
4 y	syenomonzonite	biotite	7.53	1.475	49.7
5 x	host rock	sericite	5.240	1.165	56.3
6 z	host rock	whole rock	4.795	1.0992	58.1
7 z	host rock	whole rock	3.75	0.7132	48.3

Key to Analyses:

x Collected by B. N. Church for Kennco Explorations, (Western) Limited and dated by Geochron Laboratories Inc., 1969 (not previously reported).

y Collected by B. N. Church and dated by N. C. Carter at the University of British Columbia; reported in *B.C. Ministry of Energy, Mines & Pet. Res.*, Geology, Exploration and Mining, 1972, p. 359.

z Collected by D. G. Wetherell and dated by J. E. Harakal at the University of British Columbia; reported in *B.C. Ministry of Energy, Mines & Pet. Res.*, Geological Fieldwork, 1979, Paper 1980-1, p. 125.

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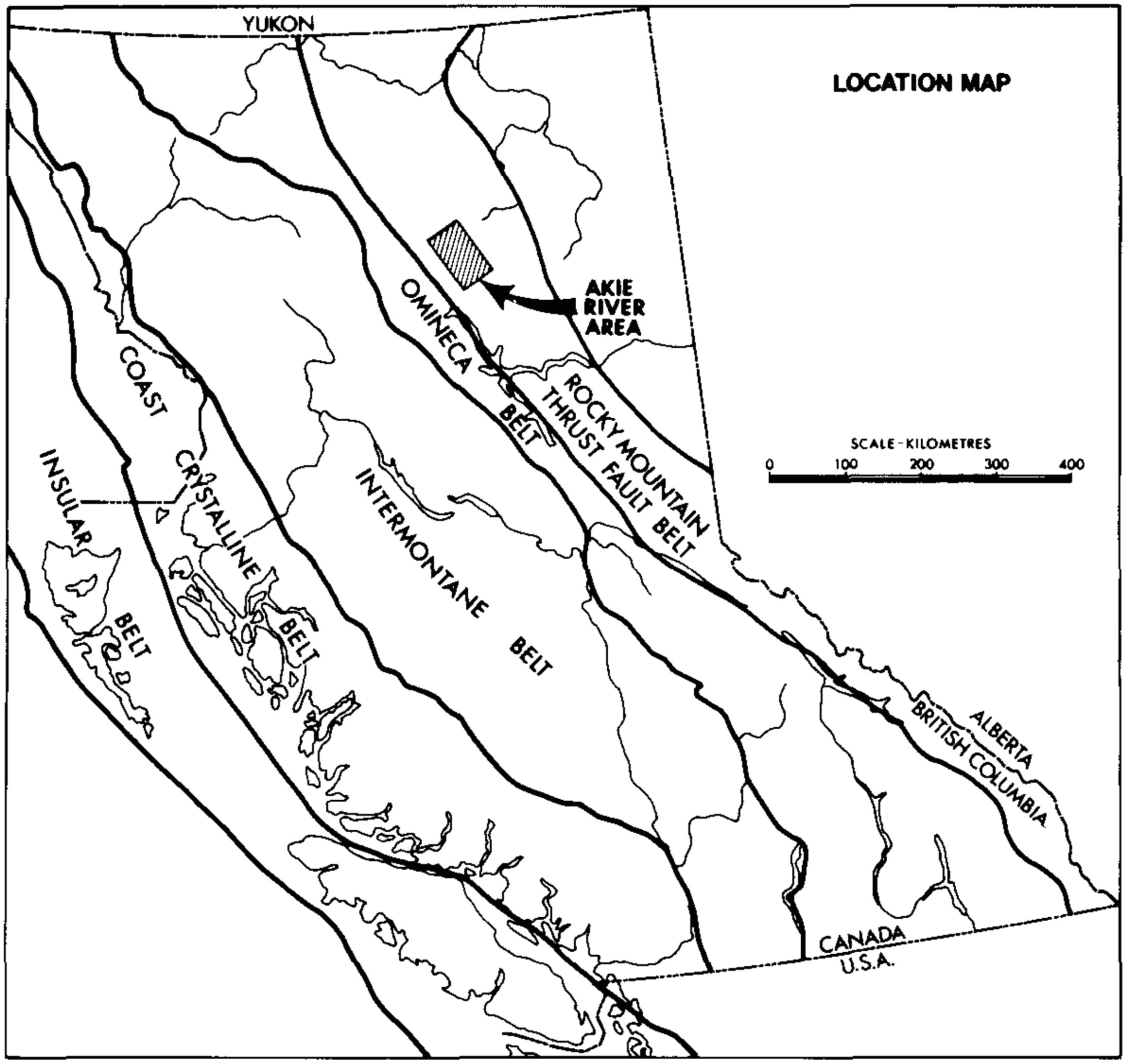

Figure 9. Location and tectonic setting of the Akie River project area, NTS 94F.