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Robert Mine

Boundary Falls.

GEOLOGY OF THE SKOMAC MINE AND BOUNDARY FALLS AREA

Geology of the Skomac Mine and Boundary Falls Area

Introduction

The Skomac mine is a recently revived small gold and silver operation in the Boundary Falls area located 5.5 kilometers southwest of Greenwood. The workings consist of several adits on a quartz vein system traceable on three Crown-granted claims, the Nonsuch, Republic, and Last Chance.

The first mine development began in the period 1894 to 1896 when adits nos. 1 and 2 were driven on the Nonsuch claim, and an inclined shaft was sunk on the Last Chance claim. The only noted production from this era, amounting to a few carloads of crude ore, was recorded by Republic Gold Mines Ltd. in 1904. Although the mine appears to have been thoroughly examined and sampled in 1922, no additional work was undertaken in the area for the next 40 years. The property was then acquired by Skomac Mines Ltd. who reopened the old workings on the Last Chance claim. From 1962 to 1964 a total of 670 tonnes of ore was mined from adits nos. 4 and 5 and shipped to the Trail smelter. Except for a small production by leasers in 1969, the mine remained closed for 10 years.

The current period of mining activity began in 1974 when Robert Mines Ltd. gained control of the property. Adit no. 6 on the Nonsuch claim was opened at this time. Operations during the spring and summer months of 1975 yielded a total of 434 tonnes of ore and an additional 548 tonnes in 1976. In October 1976, no. 7 adit was started to investigate the downward extension of the vein system and by December excavations had advanced about 110 meters

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to a point almost under the previous workings. The only work undertaken in 1977 was a program of diamond drilling from no. 7 adit to test parallel vein structures. A small mill was also transported to the property at this time.

Physiography

The Skomac mine together with a few other small workings overlooking Boundary Creek south of Greenwood are part of what was once referred to as Smith's Camp.

The mine site is situated at the base of a diorite face (Plate 1) where the slopes rising gently from Boundary Falls (elev. 2250') steepen abruptly through about 700 meters of relief to a series of wooded summits on the north and west. General rounding of ridges and peaks in the area resulted from Pleistocene glaciers moving southwest at about 210 degrees. In the valley of Boundary Creek a broad apron of sand and gravel was deposited and then eroded by melt waters from the last glacial period.

General Geology

The area is underlain by a wide ranging section of Tertiary, Mesozoic, Upper Paleozoic, and older basement rocks. These formations have undergone several episodes of deformation and are intruded by granite, diorite, serpentine, and a variety of dykes.

The relative stratigraphic position and age of the formations is assessed by degree of metamorphism and intrusive relationships. Fossil evidence provide some specific control.

Stratigraphy

The table of formations for the region, adapted from previous studies, is only partly applicable to the Boundary Falls area. Missing are important units from the Tertiary and Mesozoic assemblages (*).

UNITS	LITHOLOGY
Tertiary	
Marron F.	Felsic Lavas
Kettle River F.*	Clastic Sedimentary Rocks
Triassic	
Eholt F.*	Basic Lavas with some Limestone Lenses
Brooklyn F.	Limestone*, Sharpstone Conglomerate, Acid and Intermediate Volcanics
Permian-Carboniferous	
Skomac F.	Black Shales and some Clastic Sedimentary Rocks
Knob Hill F.	Quartzites, some Marble and Amphibolites
Basement Complex	Schists and Gneisses

Basement Complex

Rocks of the basement complex are exposed in a small area along Highway 3 and the Kettle Valley Railway. These are contacted quartz-mica schists and gneisses of archaic origin and unknown thickness.

Similar rocks occur beyond the east boundary of the map-area near the Oro Denoro mine (Church, 1976, G.E.M., 1976, in press) and on the slopes of Mt. Wright (G.E.M., 1970, pp.413-425).

Knob Hill Formation

The Knob Hill Formation as described by Seraphim (1956) at Phoenix consists of chert and metamorphosed volcanic rocks of assumed early Paleozoic age. In the map-area the formation is mostly thinly bedded chert and quartzite with some intercalated argillaceous and carbonate facies.

The chert beds, estimated by Seraphim to be a few hundred metres thick on Deadman Ridge northeast of Phoenix, are at least 700 metres thick in the Boundary Falls area. The only marker is a sinuous northerly dipping band of marble near the middle of the pile that can be traced for a distance of about 150 metres westerly from the campsite on Highway 3.

Volcanic derived units are few amounting to scattered outcrops of chlorite schist and amphibolite.

Skomac Formation

The name Skomac Formation is tentatively proposed for dark argillite and clastic beds exposed in and near the workings of the Skomac mine. These are correlated with similar beds east of Boundary Creek on Mt. McLaren and the north slope of Mt. Attwood, that unconformably overlie both basement schists and phases of the Knob Hill Formation. The age of the Skomac Formation has been determined by the Paleontogy Subdivision of the Geological Survey of Canada as Paleozoic and tentatively (Carboniferous or Permian) from molluscan shells including ?Warthia sp.?, ?Atomodesma?, and others similar to Bitaunioceras. There fossils were

assembled by the writer from a small lense of fossiliferous grey limestone in argillite located about 500 metres west of the Skomac mine.

Thickness of the Skomac Formation, determined with difficulty because of folding, is estimated to be between 100 and 200 metres in the Boundary Falls area and, according to Granby geologists (personal communication) 300 to 700 metres on Mt. Attwood.

Petrographically the rocks are rather siliceous. The laminar bedded carbonaceous argillites that are most common are interbedded locally with cherty sandstones and chert pebble conglomerate. Norm calculations from chemical data (Analysis, No. 1) of black pyritiferous argillite gives 74 per cent quartz.

Overlying what appears to be Skomac black argillite on the steep hillside above Boundary Creek in the northeast section of the map-area is a previously undescribed unit. This consists in its lower part of a conglomerate with chert blocks and a greenish grey argillite, plus a considerable thickness of light coloured volcanic breccias and sediments above the beds dip westerly and are truncated there by a diorite intrusion which forms the main mass of the hill.

Although the exact age of these rocks is uncertain they are placed between the Skomac and Brooklyn Formations.

Brooklyn Formation

A small outlier of rather pure chert pebble conglomerate and sandstone in the northwest corner of the map-area is apparently all that remains of the Middle Triassic Brooklyn Formation. A similar rock, described by Granby geologists as having an "aeolian" origin occurs at the northwest edge of the Ironsides pit at Phoenix.

The beds dip northerly, are slightly rusted, and well indurated. Sections of massive chert in the pile appear to be reefs of underlying Knob Hill Formation, the probable source rock.

Marron Formation

The only bedded Tertiary rocks underlie the hilly terrain in the southwest part of the map-area. These are medium brown homogenous lavas comprising what is recognized as Park Rill andesites - the uppermost member of the Marron Formation. In thin section the lavas have a merocrystalline texture consisting of small equant crystals of biotite, pyroxene, and plagioclase and minor apatite and magnetite in brown glass.

Although bedding attitudes are obscure the andesites have evidently been displaced downward and tilted easterly against the east-bounding fault of the Toroda Creek graben.

Igneous Intrusions

The igneous intrusions consist of late Paleozic - early Mesozoic diorite, a few small Cretaceous ? granitic intrusions, serpentine bodies, and numerous Tertiary dykes.

Old Diorite Complex

An old diorite complex exposed immediately north of the Skomac mine is correlated with unit 9 on MacNaughton's (1945) map of the Greenwood-Phoenix area.

The rocks of the complex are mostly in the diorite-gabbro range (Analysis, No. 3) although some contact phases and dyke offshoots trend to granodiorite. In thin section a typical sample consists of a mixture of subhedral plagioclase 50 to 60 per cent and amphibole 25 to 40 per cent with a small amount of interstitial quartz and alkali feldspar.

The age of the diorite is either late Paleozoic or early Mesozoic, the intrusion being bracketed by the Permo-Carboniferous Skomac Formation which it cuts and the Middle Triassic Brooklyn Formation which contains diorite clasts. The cutting relationships are displayed in vicinity of the mine where diorite and granodiorite apophyses, although commonly reduced to chlorite schist by intense shearing, clearly penetrate Skomac argillite beds. The upper age limit is defined by the sharpstone conglomerate beds exposed in highway cuts east of Phoenix where clasts of medium grained diorite are mixed with Knob Hill chert and fragments of basement schist etc. The diorite clasts are thought to have been derived from a large diorite intrusion exposed a few kilometers to the southwest near the Winnipeg mine.

Granitic Intrusions

Small granitic intrusions, probably related to the Cretaceous Wallace Creek batholith, are exposed in the central and southeast parts of the map-area. These intrude the Knob Hill chert beds accompanied by aplite and quartz-feldspar porphyry dykes. In thin section the rocks consist of about 30 per cent quartz, some crushed alkali feldspar (usually microcline), altered plagioclase, fine grained mica, clay, and carbonates.

Ultramafic Rocks

Splays and lenses of serpentized peridotite are found north and south of the mine site on major shear zones near the contacts of the Skomac argillite. The rocks are brownish grey where weathered and greenish black on fresh surfaces. Although little remains of the primary mineralogy, the rocks having been thoroughly altered to antigorite-talc-carbonate schist, norm calculations based on chemical data (Analysis, No. 4) indicates an original composition of approximately 60 per cent olivine and 40 per cent orthopyroxene.

There is no direct evidence on the age of the serpentine although certainly it is younger than either the diorite complex or ~~Skaha~~ Skamac Formation which it intrudes. Church (G.E.M., 1970, p.416) suggested a Cretaceous age for serpentine cutting quartz porphyry on the Lexington property and Lone Star mine near the international border. Granby geologists correlate the Lexington quartz porphyry with the Wallace Creek batholith dated 125 ± 5 and 140 ± 5 m.y. (G.E.M., 1974, p.49; G.E.M., 1976, in press).

Tertiary Intrusions

The most significant Tertiary intrusions are microdiorite dykes found scattered generally throughout the central part of the map-area. Large microdiorite dykes cut through the workings of the Skomac mine and diggings on the Boundary Falls and Tunnel claims to the south.

Petrographically the rocks consist of about 50 per cent zoned plagioclase microphenocrysts, 10 per cent subhedral augite and smaller crystals of feldspar and biotite with accessory magnetite and some interstitial quartz. A marked similarity in mineralogy, texture, and chemical composition indicates that these are feeders to the adjacent Park Rill andesite lavas (Analyses, Nos. 5 and 6).

Structure

The full picture of this geologically complex region is obscured by imperfect exposure, nevertheless, a general structural synthesis is possible based on a broad view of the terrain and detailed study of the available outcrops.

Little can be said here about the basement schists and gneisses other than that the general trend of foliation is west and northwest. Dips are mostly northerly although reversals and contortions are common.

The Knob Hill Formation which has a more regular fabric that the basement schists also trends northwest. Undulatory warping of the strata is combined locally with

some spectacular rumples, the deflections plunging about 45 degrees to the northeast (Fig. 2).

Deformation of the Skomac Formation appears to be the result of vertical movement of the diorite complex against relatively incompetent shales and argillites during intrusion. Such appears to be the origin of the large sharp-crested syncline viewed west of the mine site (Fig. 3) and small chevron-type flexures (Plate 2A). Elsewhere the effect of this deformation seems to have also touched the underlying Knob Hill Formation imparting a set of crinkle lineations, the mean attitude of which (304^{o} pl 18^{o} NW) is subparallel to the Skomac folding (309^{o} pl 10^{o} NW).

The majority of fractures measured throughout the area dip steeply to the east or southeast and strike between 020 and 040 degrees, a direction along which there appears to have been some gliding related to folding of the Knob Hill Formation and a direction of Tertiary dyke intrusion and faulting. The interconnected northerly-trending chain of faults cutting through the west part of the map-area are related to the Toroda Creek graben and represent major gravity and strike slip displacement.

Mining and Mineralization

The Skomac mine is on the southeast facing hillside between elevations 850 and 1000 metres (elev. 2250 and 3260 feet) approximately 2.5 kilometres north of Boundary Falls. There are seven adits comprising the workings for which production records are available only on nos. 4 to 7

(Fig. 4). Adits nos. 1 to 3 are on what appears to be a parallel vein system and are further down slope.

From an estimated total of 7500 tonnes of rock mined, 1688 tonnes of crude ore have been shipped yielding 16.4 kg. gold, 653 kg. silver, 43.6 tonnes of lead, and 23.9 tonnes of zinc.

The main break transecting the property is about 180 metres long having an average dip to 50 degrees northeast and a somewhat variable southeasterly strike. Within the total strike distance there are four known ore zones or "shoots" labelled AA, A, B, and C. These consist of thickened mineralized quartz lenses each of which are 15 to 35 metres in length.

Interruption of the vein is caused by pinching, fault offsets, and cross-cutting dykes. In adits nos. 4, 5, and 6 zones A and B are separated by a 10 metre-thick cross-cutting microdiorite dyke dipping 45 degrees northeast. Zones B and C are separated by a combination of pinching of the vein and offsetting faults with sinistral strike slip displacement.

Comparing the averaged assay results there is a consistent dominance of lead over zinc and precious metal enrichment in the most southerly zones A and AA. Also silver to lead ratios decrease regularly from AA to C.

Zone	Tonnes Shipped	Au ppm	Ag ppm	Pb %	Zn %
AA	257	4.46	538.3	2.1	1.8
A	176	5.83	973.7	4.4	2.4
B	258	2.40	507.4	3.3	2.0
C	288	2.06	308.6	2.6	1.4

The estimated average modal composition of the ore shipped is 58 per cent (by weight) argillite, 25 per cent quartz, 10 per cent pyrite, 4 per cent galena, 2.5 per cent sphalerite, 0.5 per cent chalcopyrite, accessory tetrahedrite, and perhaps some native silver? (Plate 2B).

Origin of the vein structure is thought to be the result of regional shearing stress deflected into and taken up by the incompetent formations along the diorite contact. The ore shoots aligned as they are at approximately 015^{o} pl 40^{o} NE, almost at right angles to the principal slip direction, are probably channel ways developed consequent of shearing much in the manner postulated for the emplacement of Dentonia vein at nearby Jewel Lake (G.E.M. 1974, pp.39 to 51).

Age of the Skomac vein is certainly younger than the argillite and serpentine host rocks and may be late Cretaceous or early Tertiary. That the mineralization is older than the large cross-cutting microdiorite dyke is clear, however, it can be demonstrated on the Boundary Falls claim to the south that a similar dyke has effected sulphide metasomatic replacement of adjacent carbonate beds. Alteration and to some extent pyritization of the cross-cutting dyke in the Skomac mine suggests that the intrusion may have followed closely in the wake of the main mineralization event.

Key to Analyses

(1) Skomac pyritiferous argillite, No. 5 adit Skomac mine

(2) Park Rill andesite, Mason Formation 1400 metres southwest of mine site

(3) Basic diorite 800 metres north of mine site

(4) Serpentinite 50 metres north of No. 4 adit

(5) Tertiary ~~diabase~~ microdiorite dyke on Boundary Falls claims, 1500 metres north of Boundary Falls

(6) Tertiary microdiorite dyke at No. 4 portal.

CHURCH - SKOMAC MINE

— TABLE OF CHEMICAL ANALYSES —

	1	2	3	4	5	6
Oxides Recalculated to 100 –						
SiO_2	85.56	59.37	52.43	47.05	59.78	59.32
TiO_2	0.33	1.00	0.22	<0.04	0.96	1.06
Al_2O_3	6.79	15.67	19.45	1.06	15.51	15.82
Fe_2O_3	1.55	3.59	1.15	2.63	2.24	2.15
FeO	2.25	2.40	5.57	5.82	3.51	4.33
MnO	0.01	0.19	0.14	0.13	0.90	0.12
MgO	1.37	3.60	8.59	42.70	4.15	4.27
CaO	0.56	7.23	8.06	0.61	5.26	6.03
Na_2O	0.24	3.35	3.51	—	3.58	3.60
K_2O	1.54	3.60	0.88	—	4.11	3.30
	100.00	100.00	100.00	100.00	100.00	100.00
Oxides as Determined –						
$+H_2O$	—	1.28	3.24	8.63	1.66	1.91
$-H_2O$	.09	1.16	0.28	0.20	0.20	0.45
CO_2	3.19	1.12	0.41	0.76	1.69	1.43
P_2O_5	0.21	0.24	0.20	0.20	0.32	0.28
S	1.38	0.01	0.01	0.02	0.01	0.02
SrO	0.004	0.10	0.025	0.0004	0.11	0.10
BaO	0.07	0.15	0.03	0.0006	0.15	0.13

Figures and plates to accompany report on The Geology of Skomac Mine at Boundary Falls

by N. Church

Fig. 1 Geology of the Boundary Falls Area, Greenwood.

Fig. 2 Equal area plot of bedding attitudes and lineations.

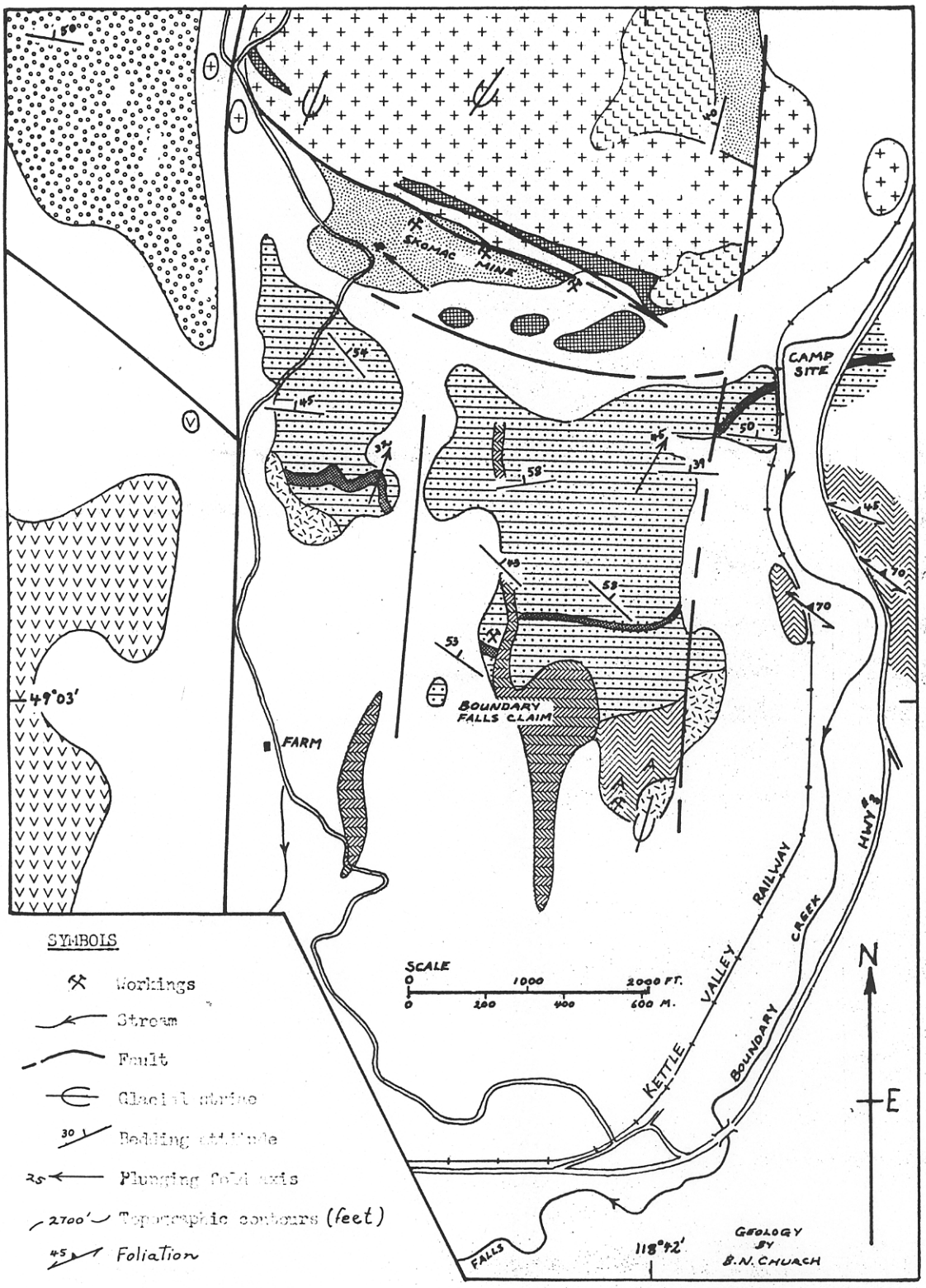
Fig. 3 Detailed geology of the Skomac Mine area.

Fig. 4 Underground geology of the Skomac Mine.

Plate 1 Panorama of the Skomac Mine site.

Plate 2A Chevron folds in Skomac metasediments .

Plate 2B Polished section of sample of Skomac quartz vein showing pyrite and galena (bright), tetrahedrite (medium grey), and sphalerite (dark grey).


STOMAC MINE
CAMP SITE
BOUNDARY FALLS CLAIM
FARM
49°03'
118°42'
SCALE
0 1000 2000 FT.
0 200 400 600 M.
KETTLE VALLEY RAILWAY
BOUNDARY CREEK
HWY 3
N
E
GEOLOGY BY B.N. CHUACH
SYMBOLS
Workings
Stream
Fault
Glacial striae
Bedding attitude
Plunging fold axis
2700' Topographic contours (feet)
Foliation
Layered rocks
Marron F., [illegible]
Brooklyn F., quartzites
Unnamed epiclastics
Stomac F., argillites and some coarser clastics
Knob Hill F., marble/chert
Basement complex, (A-amphibolites)
Intrusive intrusions
Tertiary intrusions
Serpentinite
Granitic intrusions
Old Morite complex

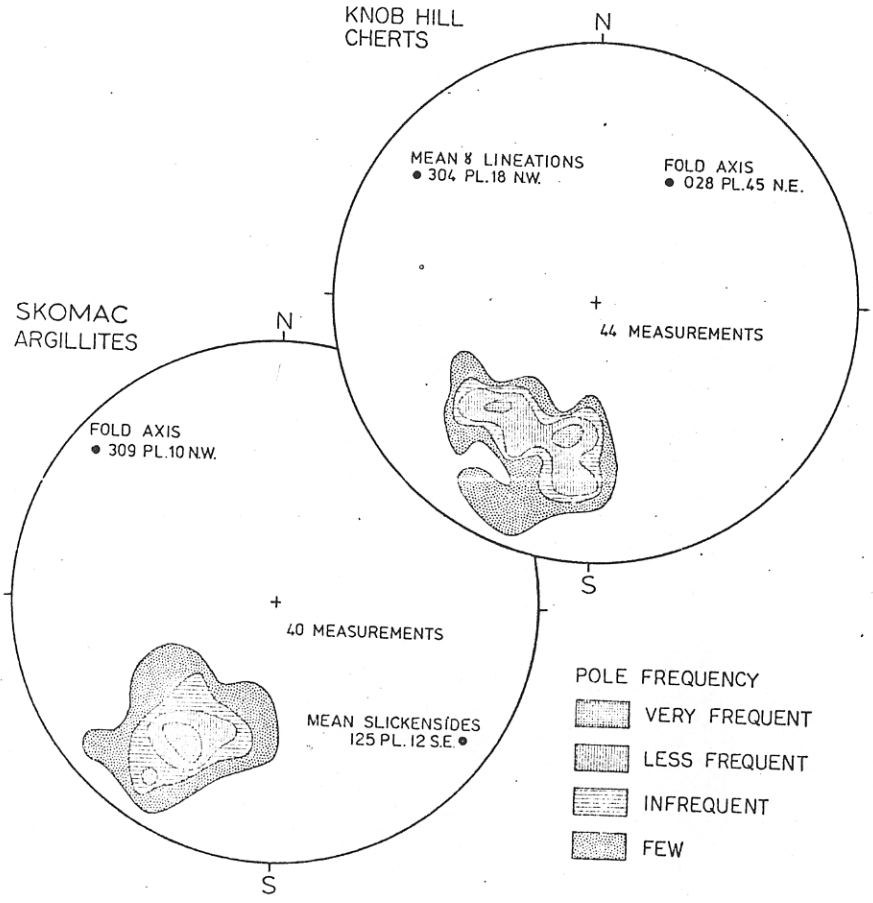


Fig. 2 Equal area plot of bedding attitudes and lineations.

50%

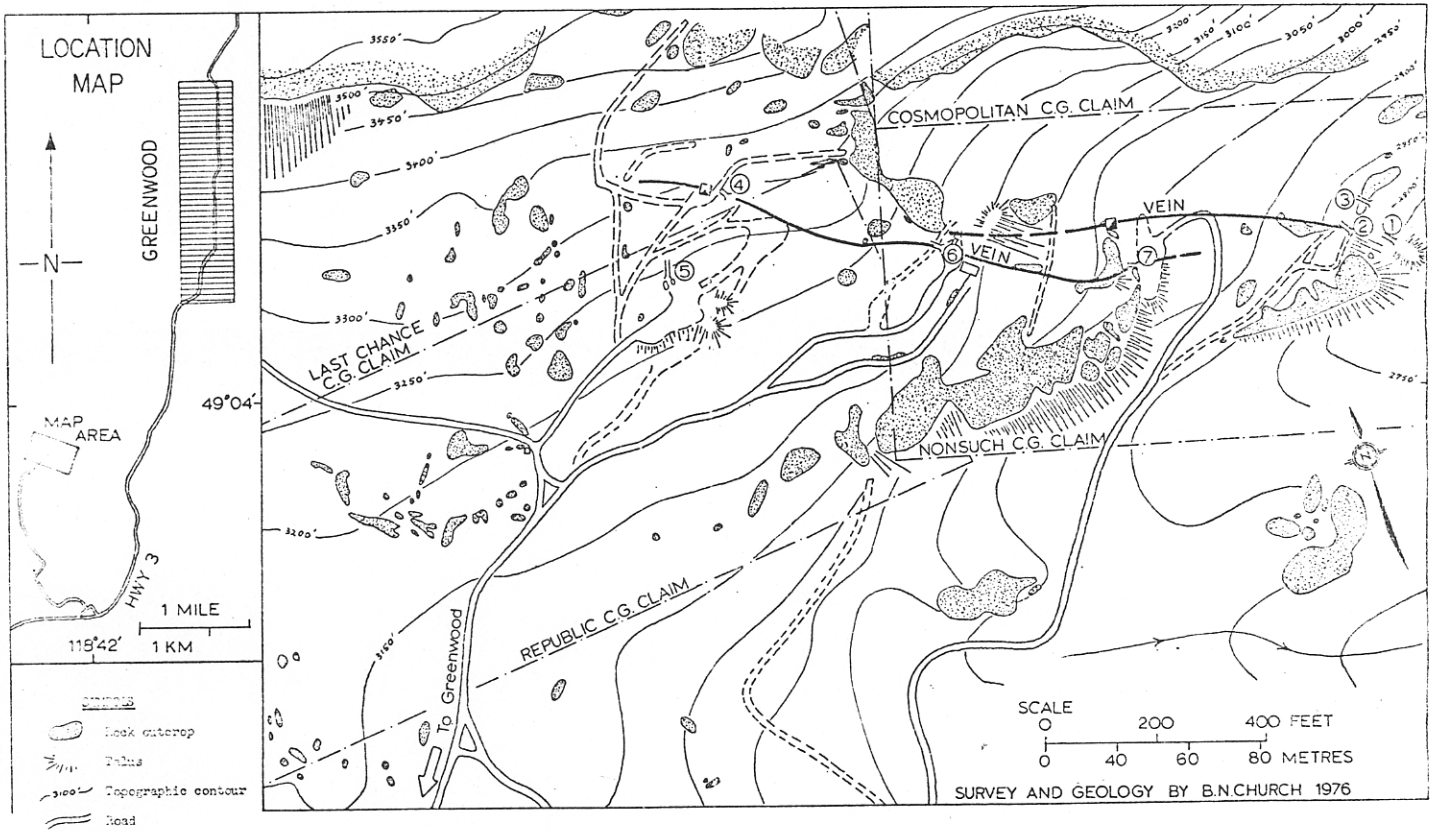
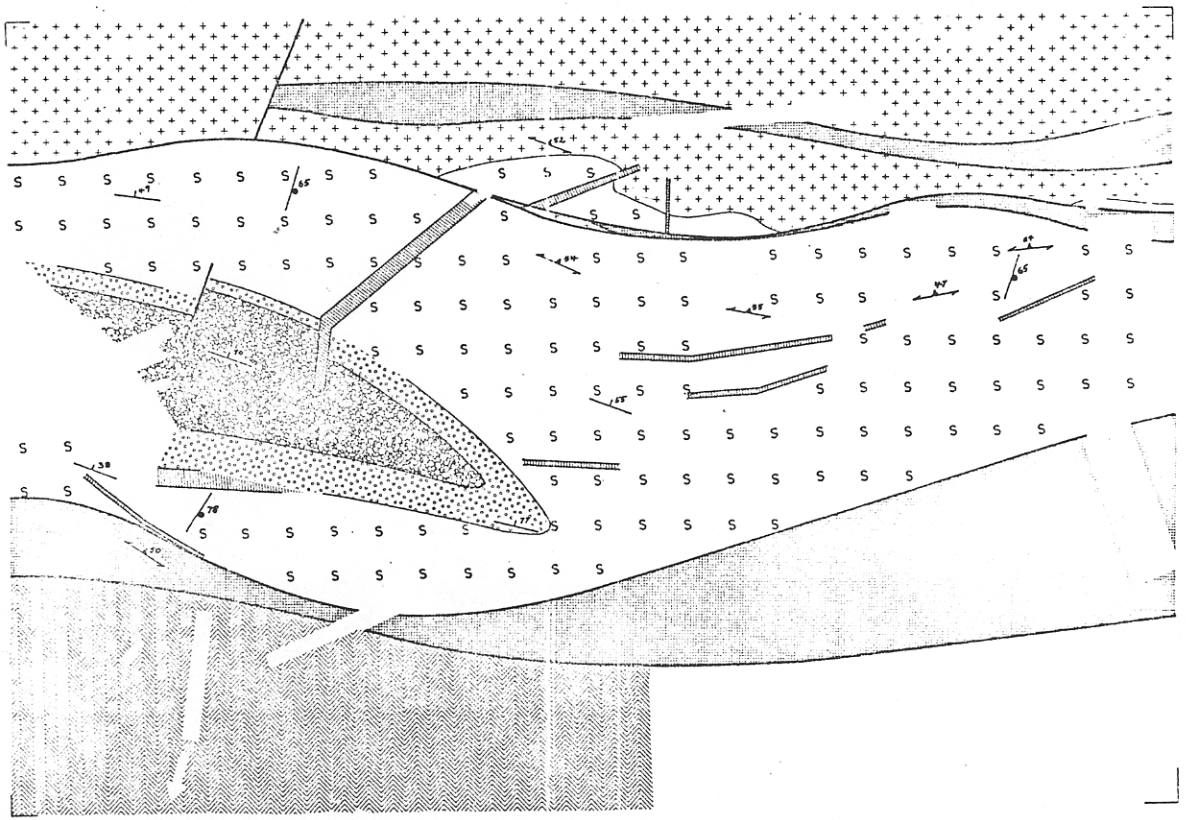


Fig. 3 Detailed geology of the Skomac Mine area.



Red underlay for Fig 3

LEGEND

BEDDED ROCKS

Skomac Metasediments

Conglomerate and sandstone / silty argillite with carbonate clasts / black argillite and slates

Basement Complex

Metaquartzite and amphibolite

INTRUSIVE ROCKS

Microdiorite + granodiorite dykes

Serpentinized ultramafic rocks

Diorite and granodiorite

Fig. 4 Underground Geology of the Skoonka Mine.

Screen patterns except tunnel cross-sections

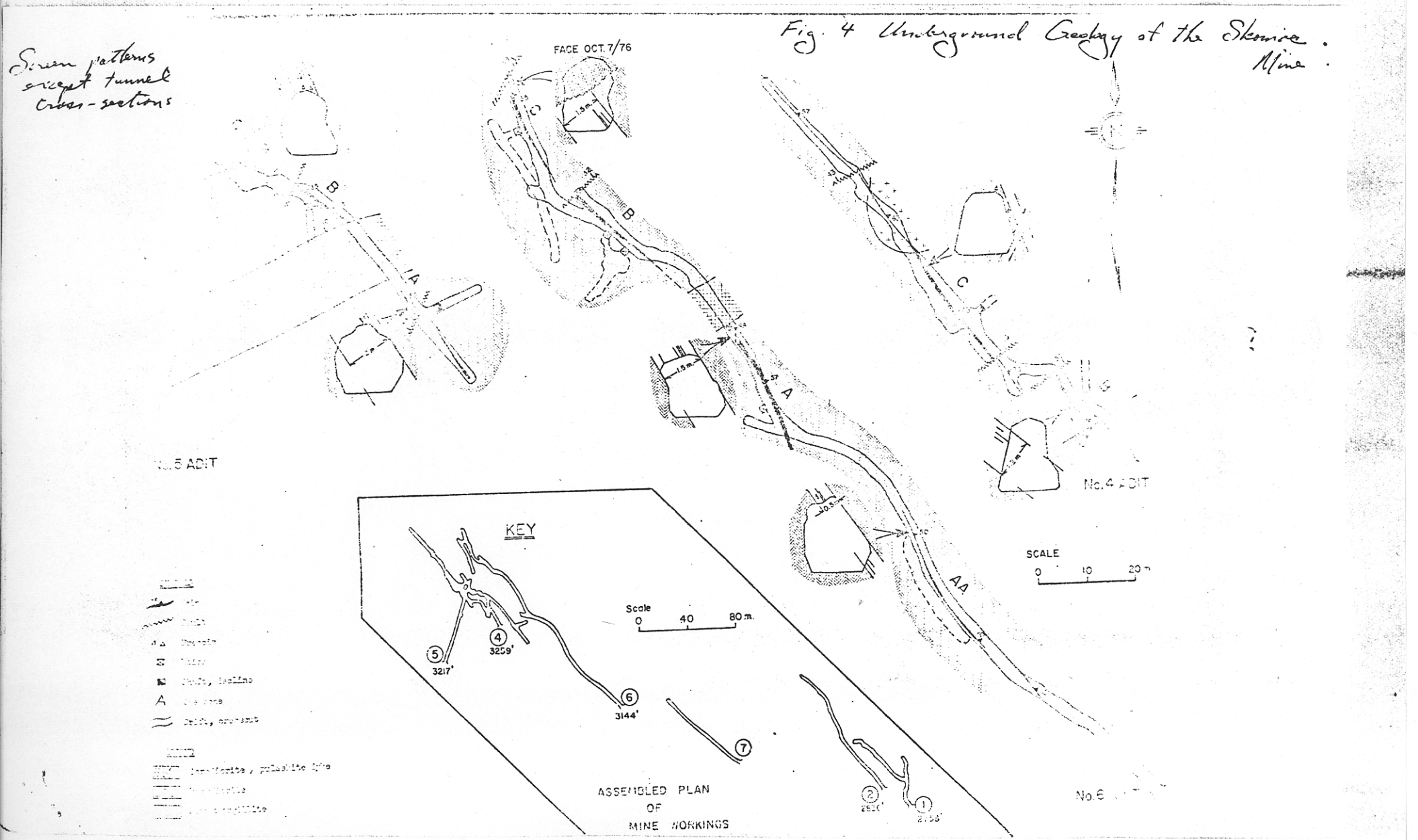


Plate 1 Panorama of the Skomac Mine site, looking northerly at the main portals (numbered)

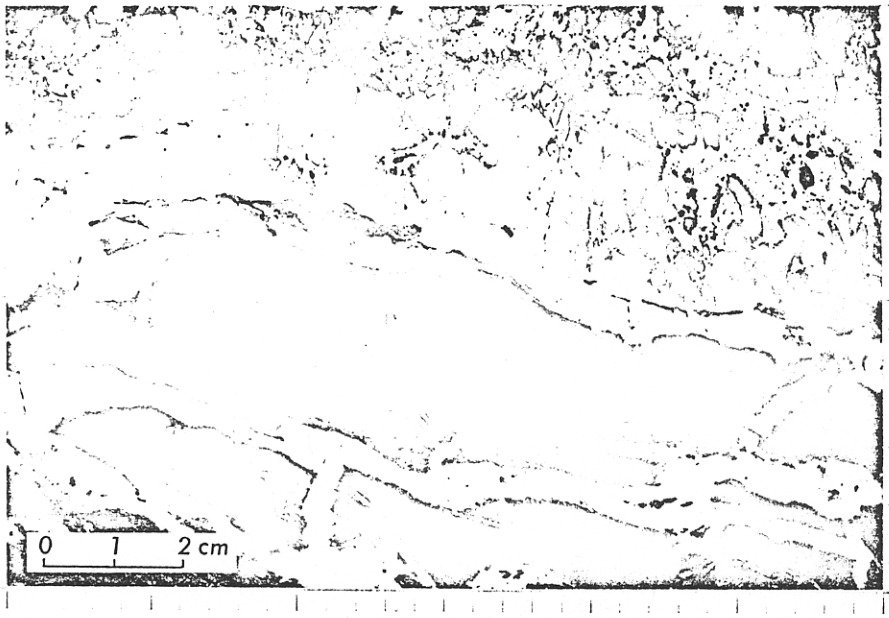
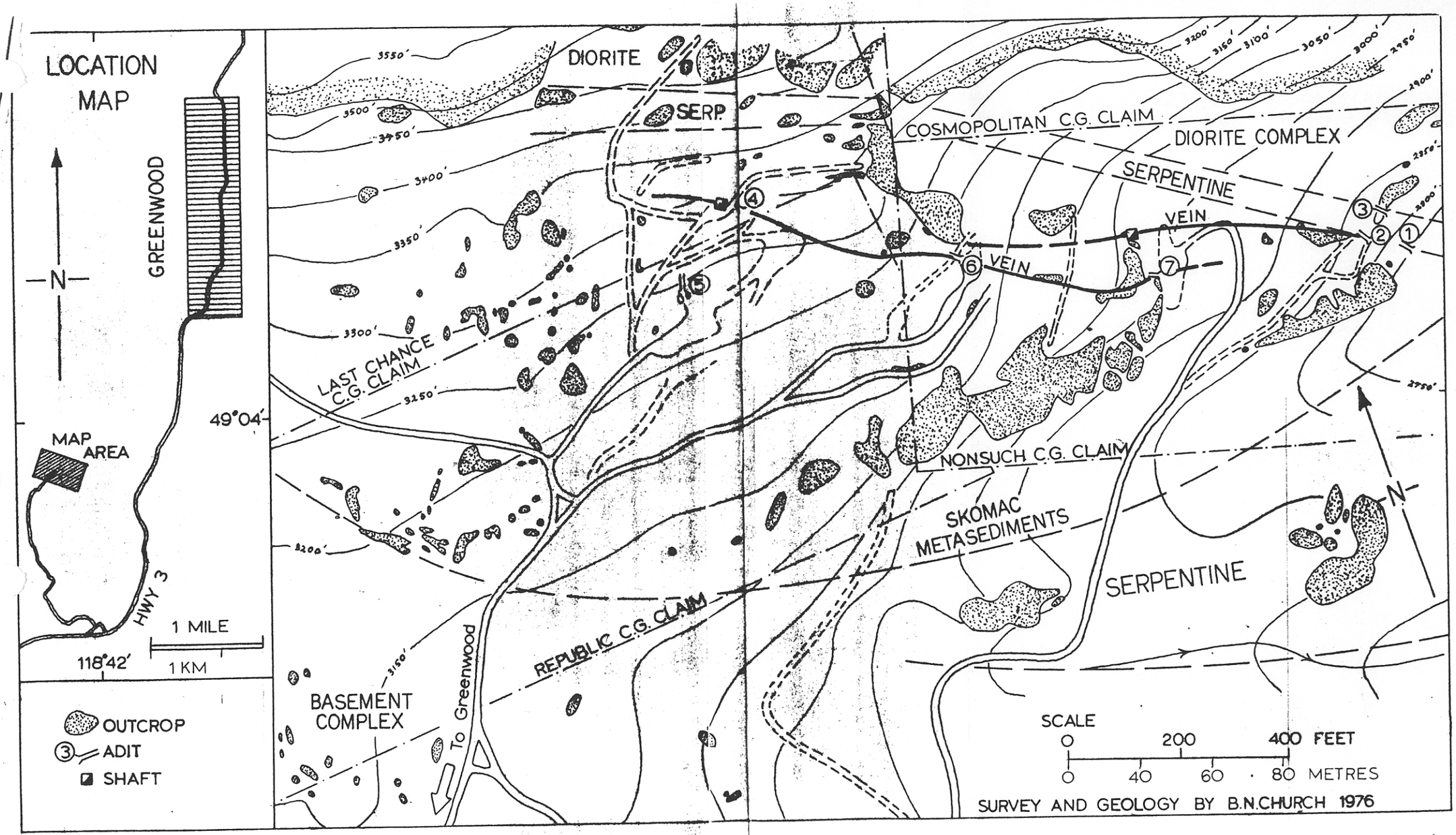


Plate 2B Polished section of sample of Skomac quartz vein showing pyrite and galena (bright), tetrahedrite (medium grey), and sphalerite (dark grey).

Plate 2A Chevron folds in Skomac metasediments .

J. J. DARLING CORP TACOMA WASH. U.S.A.



GEOLOGY OF THE SKOMAC MINE, GREENWOOD AREA