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DU PONT OF CANADA EXPLORATION LIMITED

REPORT OF GEOLOGICAL AND GEOCHEMICAL SURVEYS

on

ICE PROJECT

(I Claims)

This report has been examined by the Geological Evaluation Unit and is recommended to the Commissioner to be considered as representation work in the amount of
$ 4500

Resident Geologist or
Resident Mining Engineer

Considered as representation work under Section 53 (4) Yukon Quartz Mining Act.

Commissioner of Yukon Territory

by

F. M. Smith, P. Eng.

090 608

February 1980

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SPECIFIC PROSPECT - ICE PROJECT; I Claims (335-28)

1. LOCATION AND ACCESS

The I claims of ICE project are located in the north eastern corner of Dorsey Range, Cassiar Mountains, Yukon. The centre of the claim group is at about 60°15'N by 131°33'W on claim sheets 105-B-4 and 5 and 34 km north west of Swift River, Yukon.

The only access is by helicopter from Swift River. Dorsey Lake, 10 km due south, may be used for float plane access to the general area.

Swift River, Yukon, is located at 1033 km on the Alaska highway, approximately 160 km west of Watson Lake and 340 km east of Whitehorse. Fuel, motel and restaurant facilities are available in the hamlet of Swift River.

2. PHYSIOGRAPHY AND VEGETATION (Map KL.79-78)

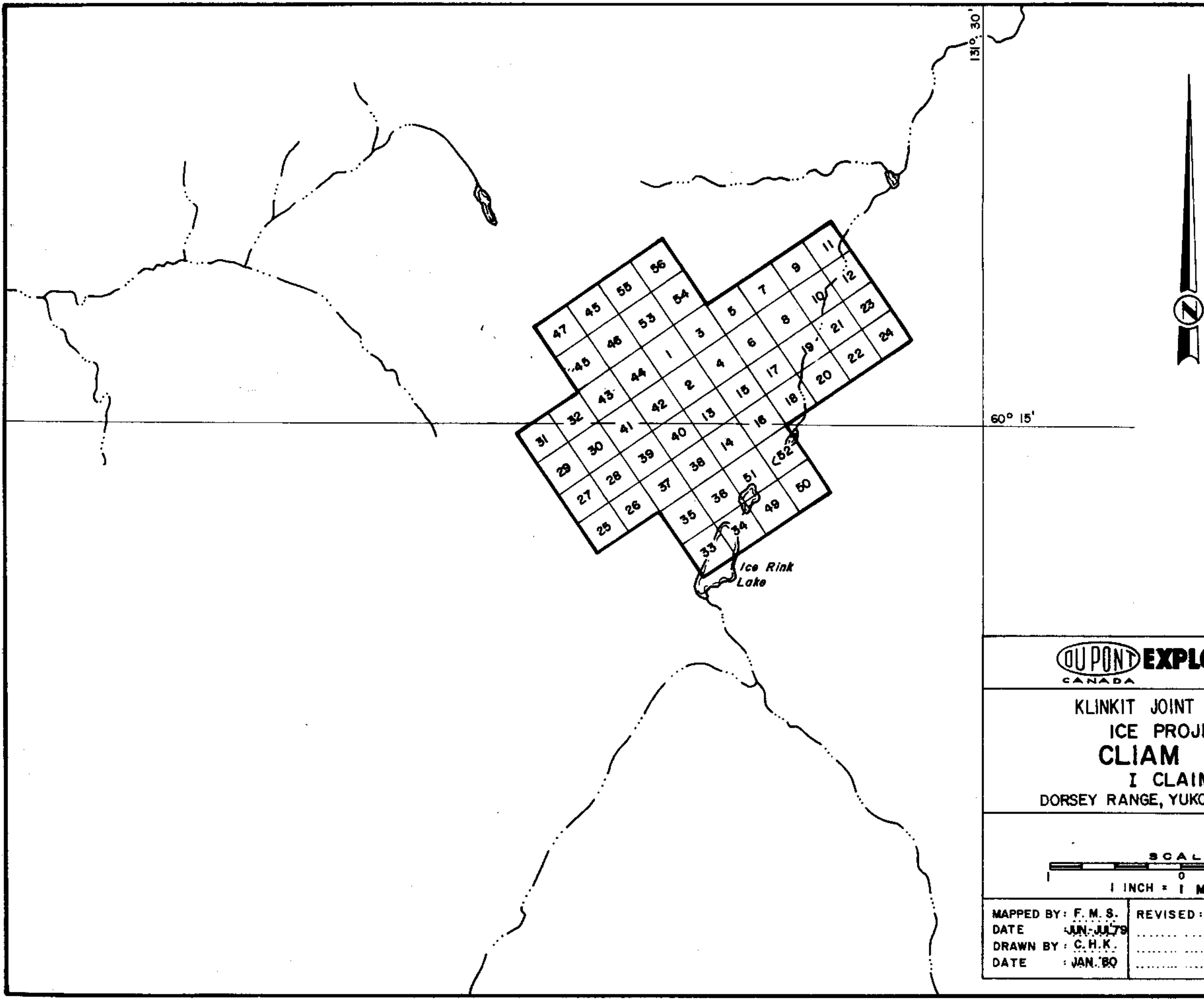
The ICE Project area is divided by a NE trending major valley with lakes (including "ICE RINK" Lake) in the valley floor to the south and sand choked braided creek (Ice Rink Ck) to the north. A steep sided NW trending valley intersects the NE trending valley in the central portion of the claims. Small hanging valley cirques line the south side of the NE trending valley and one large hanging valley occupies the northeastern portion of the claims.

All valley walls are steep "angle of repose" slopes usually covered in talus mixed with minor ground birch, grass and wildflowers. The valley floors and lower portions of south and west facing valleys are usually talus, rock fall and moraine filled with vegetation, principally balsam, black spruce and minor lodge pole pine.

Drainage is principally to the north-east by ICE Rink Creek with the south-east flowing, intermittent ICE Ck draining into the NW trending valley and to the north as Molley Ck. The ICE RINK Ck empties into Ram Creek to the north-east.

3. CLAIMS

The ICE project consists of 56 contiguous Yukon Quart Mining claims on sheets 105-B-4 and 5, Watson Lake Mining District, Yukon. The claims are as follows:



DU PONT CANADA **EXPLORATION**

KLINKIT JOINT VENTURE
ICE PROJECT

CLIAM MAP

I CLAIMS
DORSEY RANGE, YUKON TERRITORY

SCALE
1 0 1
1 INCH = 1 MILE

MAPPED BY: F. M. S. DATE JUN.-JUL.79 DRAWN BY: C.H.K. DATE : JAN.'80	REVISED:	N.T.S. No.: 105 B ACCT No.: 335 - 28 DRWG. No.: KL.79-83

Claim Name	Record No.	Expiry Date
I 1-24	YA36971-YA36944	1980 06 19
I 25-56	YA44353-YA44384	1980 06 22

All claims are subject to a joint venture agreement between Du Pont of Canada Exploration Limited and Duval International Corporation. The claims are currently recorded in the name of Du Pont of Canada Exploration Limited.

4. HISTORY

The I claims were located to cover a geochemically anomalous area located by the Geological Survey of Canada's Uranium Reconnaissance Programme. The stream sample results were released on 1979 June 15 in Whitehorse. A contract staking crew standing by in Swift River covered the anomalous area initially with 24 claims which was later expanded to cover the remainder of the zone.

The anomalous samples were collected from (1) ICE Creek and (2) ICE RINK Creek downstream from ICE Ck.

The results are as below:

Metal (ppm)	Mo	Cu	Fe	Ag	Pb	Zn	pH
Sample 1	25	250	3.65	1.5	74	350	7.4
Sample 2	12	58	1.85	0.6	30	110	7.4

The 250 ppm copper value is the highest value on the 105-B map sheet and one of the highest values for all four map sheets sampled.

There is no record of past staking within the main area of the claims other than the DU claims located and dropped on the western portion of the property (DU 136-152).

One sample collected in 1978 by Louise Eccles on the southwest portion of the property had minor visible scheelite on a joint face. None of the soil or rock samples collected during the evaluation portion of the Klinkit JV programme in the DU claims were analyzed for copper or molybdenum and none of the regional soil or stream samples were collected from the area of the ICE Project.

5. PROPERTY EVALUATION

5.1 Geology (Map KL.79-74, Plate 1, KL.79-80,81,82)

Preliminary mapping at 1:10 000 scale of the gossanous zones in the claimed area has defined two mineralized zones.

The northern zone is the best exposed of the two with several "phases" of the Ram Creek stock outcropping on the south-west facing (i.e., NE side) of the ICE Ck.

The Devono-Mississippian age volcano-sedimentary suite of Sylvester Group (Map unit M3) have been intruded by the undated quartz diorite to quartz monzonite phases of the Ram Creek stock. This 10 km long 0.8 to 3.5 km wide intrusive has been tentatively dated as Jura-Cretaceous by W.Poole (See Appendix II).

The Sylvester sequence within the claim group consists of the volcanic suite with thin sheets of ultramafic rocks within tuffaceous cherts and argillites. Neither graded bedding nor fragmental volcanic rocks were noted in the volcanic suite. Flows and dust tuffs of andesite composition cap the ultramafic serpentinites with tuffaceous argillites as the youngest sequence on the south-west ridge. Cherts and argillites rich in chlorite and intercalated tuffaceous beds are the oldest and thickest units and are usually in contact with the Ram Ck Stock. Thin limy sandstones to sandy limestones are rare in the older chert units. One carbonate horizon caps the serpentinite unit within the volcanic suite. Locally the limy units are altered to skarn consisting of brown and green garnet and diopside.

The Ram Stock has been divided into three basic "phases" to explain field relations. The average unit is a "sheared" or altered granodiorite to quartz monzonite with a pale green cast to porphyritic plagioclase and darker green groundmass (see petrographic descriptions for S.6.22.5b, S.6.22.6, S.7.12.6, S.7.16.12). The quartz, plagioclase and K-Feldspar are all medium to coarse grained with plagioclase up to 1.5 cm in length. Quartz is grey to white in hand specimens and K-feldspar is very hard to recognise without staining. Chlorite after hornblende and biotite forms most of the groundmass. This phase called CR on the map probably forms the bulk of the Ram stock (See Appendix II) from Munson Lake to the ICE project area.

S-7-12-1
QV
TØ
AX
S-7-12-2
M3
Cdn Post
S-7-12-3
CR
S-7-12-4
S-7-12-5
Pyrite
SP
PY
CRI
S-7-12-6
PY
CP
MØ
SI
CRI
Ferro-Mol
S-7-12-7, 7b
PY
MØ
S-7-12-8
M3
S-7-16-11
CR
S-7-16-12
S-7-16-13
MØ
GEOLOGY
(FOR LEGEND SEE DRWG. No. KL. 79-74)
MINERALIZATION - ALTERATION
(FOR LEGEND SEE DRWG. No. KL. 79-74)
SAMPLE NUMBERS

Unit CR 1 (see Plate 2) is a highly altered (in part CR) granitic rock of undetermined composition. In general, the chlorite of CR has been altered to fine pyrite and clay minerals, the K-feldspar and plagioclase have a red-brown colour and the rock has a high density of fine fractures filled with quartz and sulphides (see petrographic descriptions for S.7.12.7b&8, S.7.16.3,5&8).

The contacts of this subphase and the other two intrusive types is usually relatively sharp against CR_2 but diffuse or indistinct against CR. The gossan in Plate 1 is the principal outcrop of this unit CR_1 with CR and Sylvester cherts and argillites to the northwest and CR_2 to the southeast. Plate 2 shows the weakly altered CR proximal to sulphide-rich CR_1.

The final phase, CR_2, may represent a collection of sub-phases or intrusives of various ages (see petrographic descriptions for S.7.16.9,10&13). This unit has a weak gossan and is best exposed on the cirque wall behind the face in Plate 1. In general, the plagioclase feldspars are 0.5 cm long, white and chalky looking. Quartz and K-feldspar are of the same grain size as the plagioclase and biotite appears to be primary. The rock usually is a crowded porphyry with a pale green to grey-green groundmass. Quartz veining and similar late alteration is very rare in all outcrops. Pyrite appears to be a primary mineral in the groundmass in a few samples. During the brief field mapping work unit CR_2 appeared to cut CR and be related to the mineralization event in CR_1.

5.2 Geochemical Surveys

Soil and silt samples were collected and analyzed as described in Appendix II. Copper, molybdenum and tungsten were analyzed by MIN-EN Laboratories Ltd. in North Vancouver by 'AA' for copper and molybdenum and fusion-colourmetric for tungsten.

5.2.1 Copper Geochemistry (Dwg. KL.79-75)

The only anomalous area is coincident with visible gossanous CR1 and CR2 in the north zone.

Background for the area is less than 75 ppm with threshold at 115 ppm Cu with major portions of the north zone over 250 ppm Cu. As the pH of the soils in this area varies from 7.0 to 6.0, there is little movement of copper except as detrital

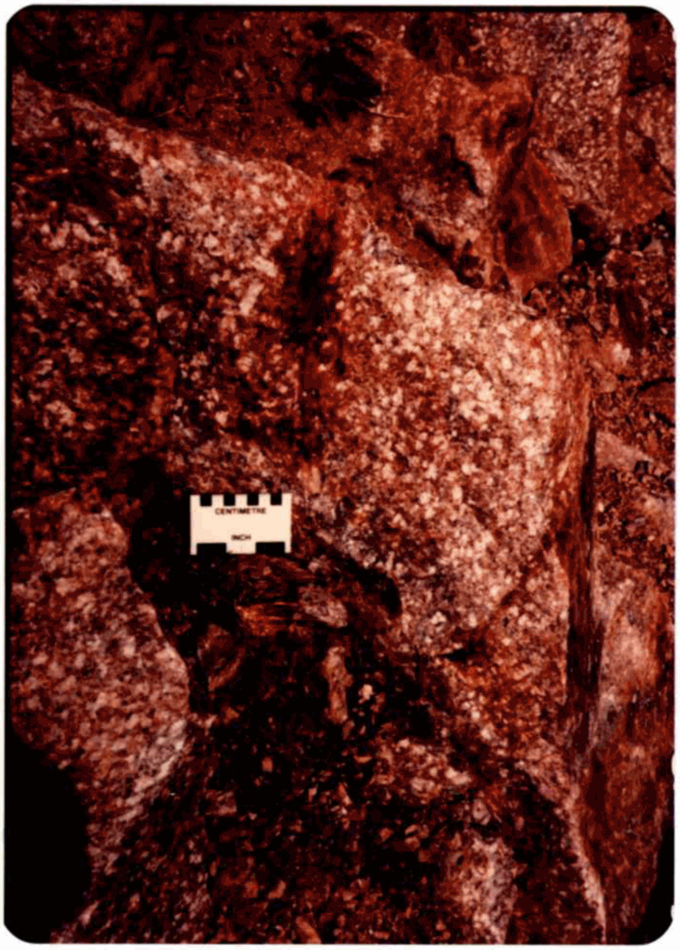


Plate #2

Quartz, tourmaline (black), axinite, pyrite filled fractures in altered Ram Stock (CR) at about S.7.12.3. Note large plagioclase phenocrysts and rusty colour of all outcrop.

grains of sulphide or oxides (e.g. malachite). The geochemistry of the soils reflects the copper content of the rock samples analyzed from this area.

5.2.2 Molybdenum Geochemistry (Dwg. KL.79-76)

Two anomalies are defined by the molybdenum geochemical values. Background for this area is about 12 ppm, threshold of 24 ppm and anomalous over 50 ppm.

The north zone has a few high values, especially low in the talus below the area of the float molybdenite sample S.7.12.7b.

The south zone shows major anomalies not suspected in the preliminary geological mapping. This zone would appear to be related to the apex of the pyritic zone noted on the geological map.

5.2.3 Tin Geochemistry (Dwg. KL.79-77)

The regional soil sample and stream samples were analyzed for tin by XRF methods. The majority of samples relatively anomalous are on the lower portions of the cirque and valley walls. These values probably reflect transport of tin-rich material by valley glaciers from the west through ICE rink pass to Ram creek. There is no indication of tin mineralization of economic interest within the claim block.

5.2.4 Tungsten Geochemistry (Dwg. KL.79-79)

The most prominent anomaly for tungsten is in the area of the north zone. Background for tungsten is less than 8 ppm with threshold about 18 ppm and anomalies in excess of 50 ppm.

The north zone has a large area with plus 50 ppm tungsten, particularly in areas mapped as CR1. In the field, scheelite was noted in several samples where quartz veins rich in pyrite are common.

5.3 Mineralization and Alteration

In the top portion of the south zone, the CR and CR_1 phases are in contact with altered limy units of

Sylvester group sediments. The alteration consists of skarn and replacement or veins carrying sphalerite and galena in skarn and sediments. All skarn zones were examined under ultra-violet lamp but no scheelite was observed.

The south zone mineralization within the very small exposure of CR_1 phase consisted principally of pyrite with very minor chalcopyrite. Although there is a weak molybdenum geochemical anomaly in this area, no molybdenite, or ferro-molybdate was noted. There is considerable calcite in the sediments in the walls and roof of the CR_1 phase and as the pH of the soils in this area is 7.4 or higher molybdenite will be difficult to find in surface outcrops.

Mineralization within the North zone is intimately related to zoned alteration. The alteration styles consist of:

a. Distal barren quartz veins in CR and M3.

b. Closer epidote, axinite and quartz in veins on joint selvedges and in shears. Pyrite is rare in these veins, etc., but sphalerite and galena occur in fine disseminations occasionally.

c. Proximal tourmaline or axinite in quartz veins. There are a few rare occurrences of dry fractures with rosettes of tourmaline in altered M3. The quartz veins can carry considerable pyrite with chalcopyrite and sphalerite.

d. A shell (thin in walls thickening in the roof over the main mineralization) of chlorite after mafic minerals with quartz sericite veins carrying pyrite and disseminated envelope pyrite and chalcopyrite. The trench crosses mixed (d) + (c) zones.

e. A chalcopyrite-pyrite rich zone overlapping a "potassic" (secondary biotite) zone in the roof and around the molybdenite zone. Quartz veins in this portion carry powellite and scheelite at vein selvedges.

f. A molybdenite pyrite chalcopyrite zone or molybdenite pyrite zone has only been located in scree samples and is tentatively proposed on the basis of the float samples and the "molybdenum porphyry model". Scheelite and powellite occur as fine dustings on quartz vein selvedges. Molybdenite occurs as fine flakes on random joints, on the margins of quartz veins but rarely in the cores of quartz veins (see petrographic description of S.7.12.7b).

The area of sulphides in the north zone is approximately 400 m north-south and 200 to 300 m east-west. The outer alteration zone is at least 1000 m east-west with the north extension unmapped.

Table 1 lists the analysis of molybdenum, copper and tungsten for intrusive samples collected within and plotted on map KL.79-74.

No samples collected to date grade sufficiently in copper or molybdenum to indicate there is an outcropping zone of economic significance. The alteration may represent the cusp or top of a mineralized zone of interest but only diamond drilling can determine the size and grade of any buried zone. A proposed induced polarization survey should define the area of subcropping pyritic alteration.

6. CONCLUSIONS AND RECOMMENDATIONS

The intensity and size of the alteration in the north zone justifies a diamond drill programme to determine if the molybdenum zone increased in grade with depth. The alteration assemblage differs from the "porphyry molybdenum" model in the amount of tourmaline and the lack of heavy argillic alteration. In order to define the focus of alteration for drill hole evaluation the whole claim group requires detail mapping at 1:5 000 and alteration and thin section studies of all phases of intrusions. Line-cutting and an IP survey will be required to define the pyritic zones within the alteration assemblage.

APPENDIX I

Geochemical and Assay Procedures

1. Sampling
2. Sample Preparation
3. XRF Determination
4. Min-En Geochemical and Assay Analysis

Table A

Ecko Mineral Analyzer

GEOCHEMICAL AND ASSAY PROCEDURES

1. Sampling

1.1 Soil samples were collected below the root zone on vegetated slopes, or from sand size material on talus slopes, using a prospectors grub hoe for digging. An approximately 0.5 to 1.0 kg sample was put into a Kraft wet-strength bag that had an indestructible pre-numbered tag attached. Standard field data was logged on the tag and the arbitrary co-ordinates from the topo map were recorded for later plotting. Elevation and traverse distance were controlled with metric altimeters and metric hip chains, respectively. Additional control of specific sites was possible with 1:10 000 photo mosaics or 1:5 000 contour maps. Some samples were collected on detail grids (e.g. DU PLATEAU and MC RIDGE) with chained picket stations.

1.2 Geological sample locations were controlled by 1:10 000 photo maps, 1:5 000 topo maps, or picket grids. Notes were logged on International Geosystems' 6B02 Geoform using the "geolog" coding system. Samples of granitic material and "type" specimens were of sufficient size for thin section and whole rock analysis, with a few large samples collected for possible age dating.

1.3 Chip or panel samples were taken with hammer and moil, either on "fresh" rock faces or in vertical walls or horizontal floors of trenches. In general, we attempted to collect 2-3 kg of sample from a 1 m long sample train, with care taken in collecting fines. Only two one-meter-square "panel" samples were attempted; but proved too time-consuming to be cost-efficient. All samples were logged on the same type of data sheets as the soil samples, and bagged in plastic with a pre-numbered tag attached.

1.4 Bulk samples were collected from the area of the fault on trench T9 (i.e., T9N), from the gossanous zone on trench T9 (i.e., T9S) and from the northern end of T10/11 by blasting and hand mucking material. The blasted rock was shovelled into large plastic bags, attempting to mix the size fractions as evenly as possible. Three 45 gallon barrels from each of T9N and T9 were filled and two barrels were collected from T10. The barrels were capped and shipped to Vancouver, from where one barrel from each of T9N, T9S and T10/11 were sent to the Warren Spring laboratory in Great Britain for recovery analysis.

2. Sample Preparation

2.1 Soil samples were dried in two steel cabinet ovens for at least 12 hours. The whole sample was pulverized in a 8" (20 cm) manganese steel disc pulverizer producing a majority of pulverized material finer than 200 mesh, but all was finer than 80 mesh. The rock/soil pulp was split into two equal portions, one bagged in coin envelope and the other put through the tin analysis system (See section 3, XRF Determination) or sent to Min-En Labs for analysis of other elements. Those samples which produced significant tin values by XRF were sent to Min-En for a check analysis by geochemical or assay methods. Those samples not sent to Min-En for duplicate analysis were bagged in coin envelopes and stored separately from the duplicate pulps. All pulps were transported to Vancouver and are stored in the Du Pont of Canada Exploration Ltd.'s warehouse.

2.2 Geological samples were cut on a screw-fed diamond saw. One portion was crushed in a 4" x 6" (10 cm x 15 cm) jaw crusher, pulverized, and split into two pulps. Usually one pulp was analyzed for tin by XRF. The uncrushed sample was retained for binocular microscope examination, labeled, bagged and shipped to Vancouver for storage in the warehouse.

2.3 Rock chip samples were dried, passed through the jaw crusher and split to 1/8 or 1/16 portions in a coarse splitter. The small split was pulverized to form two rock pulps with the fine splitter. All rock chip pulps were analyzed for tin and check assays run on "anomalous" values by Min-En Labs. In November, Min-En was given all rejects (coarse split) to make a large pulp and these pulps were re-assayed.

2.4 The bulk sample had two 3 kg samples removed from one of the T9S barrels for analysis by Warren Spring Laboratory and Duval International Corp.

3. XRF Determination

Analysis of the tin content of rock, soil or rock chip pulps was done at the Swift River Lab., which was designed and set up by Min-En Labs Ltd.

The principal equipment is an Ekco Instruments Ltd, M8524 Mineral Analyzer, which uses a 1 curie promethium/aluminum source filtered by silver/paladium.

Pulped samples were placed in foam cups, covered by metalized mylar, blended by rolling, and inverted on the probe. The sample was exposed for a 10 second count with each of the two filters. The first count (up count) and the difference count (down count) were recorded.

J. Barakso of Min-En, working with Overseas Monitor Corp. of Vancouver, developed a standardizing equation (for the high energy source) using 1978 rock pulps as standards and a series of pulped granite samples with varying amounts of SnO_2 added.

The regression equation is:

$$\text{XRF value} = \frac{2400}{\text{Up count}} \times \text{Down count}$$

Using the standards and 1979 results, we devised two straight-line regressions for the standard curve. These were labeled "ppm" and "%" as they represented the low and high values, respectively.

Thus, when reporting results for the XRF determinations, the low side (50 ppm - 700 ppm) were reported as ppm and the high (0.005% - 5%) were reported as "%". The following tables give the conversion from XRF to % or ppm.

Comparison of XRF % to Min-En assay shows the XRF was consistantly conservative (lower) by varying amounts, but increasingly conservative with increasing tin content. Min-En geochemical analysis uses ammonium-iodide extraction, which will not extract tin bonded in silicates or borates, and only partially liberates tin in sulphides. Thus, XRF determinations of +0.1% where Min-En results are only a few ppm are probably all silicate tin. For reconnaissance work, we utilize the partial extraction by Min-En to separate those areas requiring follow-up examination for cassiterite and those of less importance but having tin silicate or sulphide mineralization.

4. Min-En Laboratory Ltd. utilized two different digestions for geochemical or assay analysis. Geochemical analysis uses the sublimation of tin iodide from a mixture of the pulp and ammonium iodide, and colourimetric comparison against standards to give partial (primarily tin as cassiterite) tin content.

   Assay determination is by fusion and A.A. Analysis to give "total" tin content of the sample.

QUALIFICATIONS

I, F. Marshall Smith, do hereby certify that:

1. I am a geologist residing at 6580 Mayflower Drive, Richmond, British Columbia and am employed by Du Pont of Canada Exploration Limited.

2. I am a graduate of the University of Toronto with a B.Sc. (Honors) degree in geology.

3. I am a registered Professional Engineer in the province of British Columbia.

4. I have practised my profession in geology continuously in Canada for the past 12 years.

5. I carried our the geological mapping and supervised the remainder of work on the ICE claims.

F. Marshall Smith

F. Marshall Smith
1980 May 30

APPENDIX I

STATEMENT OF EXPENDITURES

January 1 - December 31, 1979

ICE PROJECT (I Claims), YT

Casual Labour		$ 56.13
Travel Expenses		409.35
Camp Expenses		2 425.65
Mapping, Gr. Surveys, Maps		3 833.63
Ground Clearing & Trenching		3 450.00
Freight, Hauling, Storage		203.08
Assaying		3 383.36
Salaries - Regular		2 417.88
Salaries - Temporary		2 713.41
Space Charges		31.62
Equipment Rental		252.53
Stationery & Supplies		39.50
Telephone		133.66
Auto Expenses		51.94
Repairs & Mtce (excl. Auto)		10.64
Non Capital Equip. Purchases		209.89
Depreciation Expenses		418.70
	TOTAL	$20 040.97

TABLE A

XRF	% Tin	XRF	% Tin	XRF	% Tin
119	0.005	206	0.44	297	0.90
120	0.010	208	0.45	299	0.91
121	0.015	210	0.46	301	0.92
122	0.020	212	0.47	303	0.93
123	0.025	214	0.48	305	0.94
124	0.030	216	0.49	307	0.95
126	0.040	218	0.50	309	0.96
128	0.050	220	0.51	311	0.97
130	0.060	222	0.52	313	0.98
132	0.070	224	0.53	315	0.99
134	0.080	226	0.54	317	1.00
136	0.090	228	0.55	319	1.01
138	0.10	230	0.56	321	1.02
140	0.11	232	0.57	323	1.03
142	0.12	234	0.58	325	1.04
144	0.13	236	0.59	327	1.05
146	0.14	238	0.60	329	1.06
148	0.15	240	0.61	331	1.07
150	0.16	242	0.62	333	1.08
152	0.17	244	0.63	335	1.09
154	0.18	246	0.64	337	1.10
156	0.19	248	0.65	339	1.11
158	0.20	250	0.66	341	1.12
160	0.21	252	0.67	343	1.13
162	0.22	254	0.68	345	1.14
164	0.23	256	0.69	347	1.15
166	0.24	258	0.70	349	1.16
168	0.25	260	0.71	351	1.17
170	0.26	262	0.72	353	1.18
172	0.27	264	0.73	355	1.19
174	0.28	266	0.74	357	1.20
176	0.29	268	0.75	359	1.21
178	0.30	270	0.76	361	1.22
180	0.31	272	0.77	363	1.23
182	0.32	274	0.78	365	1.24
184	0.33	276	0.79	367	1.25
186	0.34	277	0.80	369	1.26
188	0.35	279	0.81	371	1.27
190	0.36	281	0.82	373	1.28
192	0.37	283	0.83	375	1.29
194	0.38	285	0.84	377	1.30
196	0.39	287	0.85	379	1.31
198	0.40	289	0.86	381	1.32
200	0.41	291	0.87	383	1.33
202	0.42	293	0.88	385	1.34
204	0.43	295	0.89	387	1.35

Table A (cont.)

XRF	% Tin	XRF	ppm tin	XRF	ppm tin
389	1.36	91.4	0	91	0
391	1.37	91.8	10	92	15
393	1.38	92.1	20	93	40
395	1.39	92.5	30	94	70
397	1.40	92.9	40	95	95
417	1.5	93.3	50	96	120
437	1.6	93.6	60	97	145
457	1.7	94.0	70	98	175
477	1.8	94.4	80	99	200
497	1.9	94.8	90	100	225
517	2.0	95.1	100	101	250
537	2.1	95.5	110	102	275
557	2.2	95.9	120	103	300
577	2.3	96.2	130	104	325
597	2.4	96.6	140	105	350
616	2.5	97.0	150	106	400
636	2.6	98.9	200	107	425
656	2.7	100.8	250	108	450
676	2.8	102.6	300	109	475
696	2.9	104.5	350	110	500
716	3.0	106.4	400	111	525
816	3.5	108.3	450	112	550
915	4.0	110.1	500	113	575
1115	5.0	113.9	600	114	600
1314	6.0	117.6	700	115	625
1514	7.0	121.4	800	116	650
1713	8.0	125.1	900	117	675
1912	9.0	128.9	1000	118	700
2112	10.0				

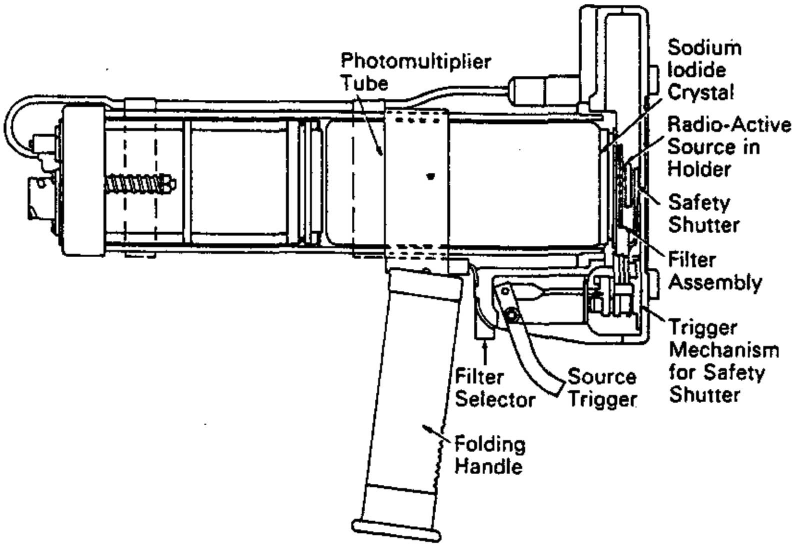
EKCO Mineral Analyser

The Ekco Mineral Analyser was developed by Ekco in association with the British Institute of Geological Sciences and the United Kingdom Atomic Energy Authority.

QUICK, ACCURATE, EFFICIENT

- **Analysis in less than 30 seconds**
- **X-ray fluorescence and scaler techniques give greater accuracy**
- **P.H.A. improves efficiency**
- **Auto subtract device – difference reading is shown as a net count**
- **Simple press-button operation**
- **Easy-read digital presentation**
- **Portable, lightweight solid state design**
- **Power options – rechargeable batteries or A.C. mains**

Rugged go-anywhere construction



Applications

Mining Industry On site assay of ores, off-stream sample analysis of ore pulp and tailings. Ore sorting for blending and storage.

Whilst the Ekco Mineral Analyser was primarily designed for use in the Mining Industry it has applications in much wider fields.

Steel and Metals. Analysis of alloy in ingot, sheet, bar and tubes. Assay of slags. Scrap sorting. Alloy identification of extrusions and forgings. Coating thickness measurement. Analysis of electroplating bath solutions.

Chemicals. Analysis of elemental chemical compositions.

Petroleum. Analysis of additives and impurities in petrol, lubricating oils, hydrocarbons and petroleum products.

General Description

PROBE M8563

The radioisotope is held in a 'central-source' arrangement which has an automatic, fail safe shutter. This obviates any possible error due to partial opening.
The two filters are in a 'spectacle frame' and a toggle on switch places the required filter before the tillator window and switches scale count direction.
By using spare heads with different sources and filters the analyser can be changed to cover a wide range of applications.
The complete probe is constructed in aluminium alloy. It is light, easy to operate and has a fold away pistol-grip handle.

MINERAL ANALYSER M8524

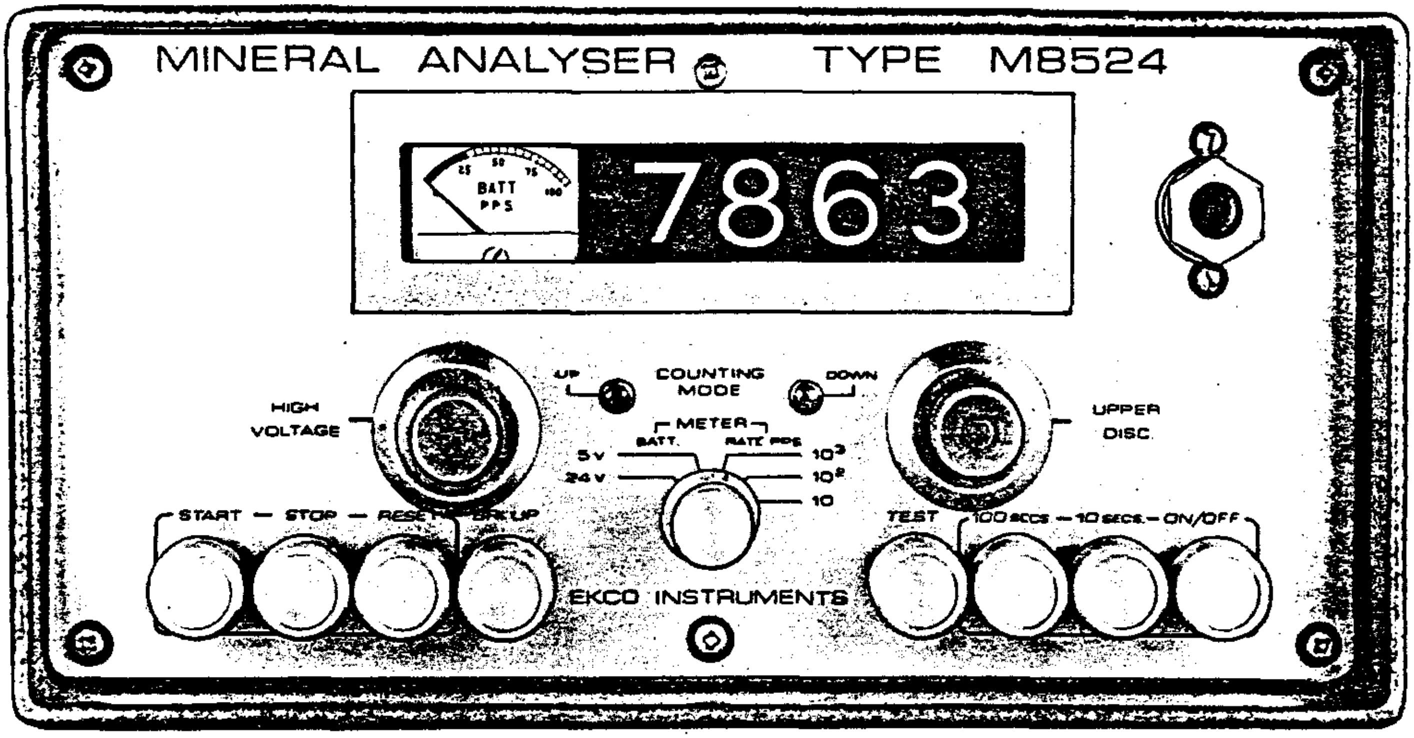
This provides seven specific functions: bi-directional counting; timing, pulse-height analysis, H.V. supply; amplifier; ratemeter and display. Circuit board mounted integrated devices are used throughout, apart from the H.V. Unit which is contained in an easily removable thermal insulated can. This form of construction simplifies servicing, maintains a high packaging density and gives exceptional reliability. The rechargeable batteries give ten hours continuous use. The battery pack can be replaced by an identical sized power unit for mains operation; this will also act as a battery charger.

Carrying Case

The complete equipment is carried in a waterproof case. It is lined with expanded polythene and gives the instrument the climatic and environmental protection it requires in its 'go-anywhere' role. The shoulder straps are designed so that the instrument can be secured at waist level, leaving the operator's hands free.

LABORATORY STAND M8568

A special stand is available for the simple conversion of the mineral analyser to a bench-mounted system. The probe is inverted and screwed to the underside of the stand and the system is ready for operation.
Adjustable blocks are incorporated to position core samples over the face of the probe. Powdered samples in the special containers, which are available, may also be placed on the probe face.



Operation

The mineral analyser may be used as a hand-held instrument with the probe unit pressed against the mineral sample (rock face, rock sample, metal sheet, etc.) or as a laboratory system with the probe mounted on a stand.

The probe trigger is pulled, exposing the gamma (or X) ray source and irradiating the sample.

The 'counting time' is selected by pressing the appropriate push-buttons and the count is initiated by pressing the Reset and Start buttons.

On completion of the 'up' count the filters are changed, by simply operating a toggle-lever on the probe unit, which also automatically changes the mode to 'subtract'. The Start button on the analyser is again pressed.

The resulting 'difference count' may be converted to a 'percentage concentration' by comparison with a calibration graph of a standard sample.

Table of approximate detectable limits, 10 seconds counting time

Metal	**Source**	**Filter**	**Detectable Limit**
Titanium	5 mCi ^{55}Fe	Ti/Sc	0·1 %
Iron	30 mCi ^{238}Pu	Mn/Cr	0·2 %
Nickel	30 mCi ^{238}Pu	Co/Fe	0·06 %
Copper	30 mCi ^{238}Pu	Ni/Co	0·05 %
Zinc	30 mCi ^{238}Pu	Cu/Ni	0·02-0·04 %
Molybdenum	2 mCi ^{109}Cd 0·4 Ci ^{147}Pm/Al Brems	Zr/Y Zr/Y	0·005-0·01 % 0·05 %
Tin	1 Ci ^{147}Pm/Al Brems 10 mC Am241	Ag/Pd	0·02-0·03 % 0·05 %
Lead	0·3 mCi ^{57}Co(K) 30 mCi ^{238}Pu(L)	Ir/Re Ge/Ga	0·03-0·06 % 0·05-0·1 %
Tungsten	0·3 mCi ^{57}Co(K) 30 mCi ^{238}Pu(L)	Yb/Ho Cu/Ni	— 0·5 %
Arsenic	30 mCi ^{238}Pu	Ge/Ga	0·1 % (estimated)
Cobalt	30 mCi ^{238}Pu	Mn/Fe	0·1 % ,,
Niobium	2 mCi ^{109}Cd	Y/Sr	0·01 % ,,
Chromium	30 mCi ^{238}Pu	V/Ti	0·3 % ,,
Manganese	30 mCi ^{238}Pu	V/Cr	0·3 % ,,
Silver	1 Ci ^{147}Pm/Al Brems.	Ru/Rh	0·03 % ,,
Gold	0·3 mCi ^{57}Co(K)	W/Ta	0·04 % ,,

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Name and Address	Home Phone No.
CARLSON, Dayle M. R.R. #6 Cobourg, Ontario K9A 4J9	(416) 372-2782
COLWELL, Jennifer H. Box 108 Atlin, BC V0W 1A0	651-7670
CONNOLLY, Linda Brentwood College Mill Bay P.O. Mill Bay, BC V0R 2P0	743-5521
DIONNE, Camille H. 515 Hendry Avenue North Vancouver, BC V7L 4C6	987-3940
DITSON, Gwen M. 3943 W. Broadway, Vancouver, BC V6R 2C2	228-1618
FLORENCE, Diane Box 41 Atlin, BC V0W 1A0	651-7520 or 651-7543
GOAD, Bruce E. 304-1000 Markham Road Winnipeg, Manitoba R3T 2M2	261-1003
JONES, Murray I. 350 Belgo Road Kelowna, BC V1X 2Z6	765-5897
MATO, Gonzalo D. 5566 Catania Circle Vancouver, BC V6T 1N2	228-8875
MICHELL, Cathy F. Box 63 Heffley Creek, BC V0E 1Z0	578-7745
MURPHY, Beverly M. Box 57 Atlin, BC V0W 1A0	651-7637

Name and Address	Home Phone No.
WHITICAR, Doug M. 662 Pembroke Avenue Coquitlam, BC - V3K 2N1	939-4100

APPENDIX II

Petrographic Reports

TABLE 1

Whole Rock Analysis

Tag No.	Mo (ppm)	Cu (ppm)	W (ppm)	Sample No.
6964A	30	265	11	S.7.12.3
6965A	13	335	65	S.7.12.4
6966A	38	155	80	S.7.12.5
6967A	7	950	48	S.7.12.6
6968A	2	110	30	S.7.12.7
6995A	88	780	80	S.7.12.7b
6996A	340	360	250	S.7.12.8
6997A	130	1090	14	S.7.16.3
6998A	117	470	125	S.7.16.4
6999A	8	970	75	S.7.16.5
6959A	2	245	11	S.6.22.5c
6960A	4	245	8	S.6.22.5b
6961A	4	188	9	S.6.22.5a
6962A	3	21	7	S.6.22.6
6810A	10	33	5	S.7.15.11
6811A	155	108	15	S.7.15.12
6812A	14	117	5	S.7.15.13
6800A	6	76	80	S.7.16.6
6801A	3	290	15	S.7.16.7
6802A	24	960	14	S.7.16.8
6803A	8	140	5	S.7.16.9
6804A	7	270	175	S.7.16.10
6805A	6	49	5	S.7.16.11
6806A	5	200	22	S.7.16.12
6807A	30	62	7	S.7.16.13
6808A	4	330	9	S.7.16.14
6809A	104	82	190	S.7.16.15

VP
Vancouver Petrographics Ltd.

JAMES VINNELL, Manager
JOHN G. PAYNE, Ph. D. Geologist

P.O. BOX 39
8887 NASH STREET
FORT LANGLEY, B.C.
VOX 1JO

PHONE (604) 533-1155

Report for: Marshall Smith,
Dupont Exploration,
102 - 1550 Alberni,
VANCOUVER, B.C., V6G 1A5

Invoice 1950

Samples: 12 samples of fresh and altered granodiorite, with copper and molybdenum mineralization (locally tungsten)

The samples are grouped into rock types as follows:

1) Quartz-rich Hornblende Granodiorite (with lesser biotite, sphene)

   a) coarse grained : S-7-16-12 py, po
   b) medium grained : S-7-12-6 po, cp
   c) porphyritic : S-7-16-9 py, cp (cv)
   d) altered : S-6-22-5b py, po, cp

2) Quartz-poor Hornblende Granodiorite (no biotite or sphene)

   a) hornblende altered to actinolite, calcite, tourmaline: S-6-22-6 (cp)
   b) mafic minerals destroyed or rare

      S-7-16-10 (minor biotite, sphene); py,po,cp,(cv)
      S-7-16-13 (minor biotite, trace sphene); py,cp

3) Strongly Altered Rocks of Unknown Parentage (Group 1 or Group 2)

   abundant secondary quartz, pyrite and chalcopyrite, molybdenite in some

S-7-12-7B	py,cp,mb
S-7-12-8	py,cp (minor scheelite in hand sample)
S-7-16-3	cp,py,mb
S-7-16-5	py,po,cp,(cv)
S-7-16-8	cp (py in late veins)

K-feldspar forms megacrysts in many of the samples. In some samples some of the K-feldspar appears to be formed by replacement of plagioclase, and it is possible that much of the K-feldspar is of secondary origin.

In most samples where it formed an original mineral, biotite is completely altered to chlorite and minor Ti-oxide. Hornblende generally is fresh, except in sample S-6-22-6, where it is altered to actinolite, calcite, and tourmaline; this is the only sample in the suite to contain secondary calcite and tourmaline.

Secondary actinolite forms clusters of needle-shaped crystals in several samples: S-7-12-6, S-7-16-5, S-7-16-8, and S-7-16-13.

The most outstanding feature of the strongly altered rocks is the presence of secondary quartz (in part with sericite) as patches and veinlets cutting original minerals, especially K-feldspar megacrysts. If the K-feldspar is of secondary origin, its introduction was prior to that of the quartz veins.

John Payne
John Payne, February 198

S-6-22-5b Altered (Biotite)-Hornblende Granodiorite

plagioclase	30-35%	
K-feldspar	20-25	
quartz		
original	15-20	
secondary	10-12	
hornblende	3- 5	
sphene	1- 1½	
biotite	0.5	(altered completely to chlorite, Ti-oxide)
Ti-oxide	0.3	
apatite	minor	
zircon	trace	
epidote	2- 3	
pyrrhotite	1½-2	(partly altered to hematite, pyrite, siderite?)
pyrite	½- 1	
chalcopyrite	0.2	
chlorite	0.2	

Plagioclase forms medium to coarse grains (up to a few mm across) showing variable alteration. Some are slightly to moderately altered to randomly oriented very fine grained sericite flakes. Others are strongly altered to sericite, with or without limonite and very fine grained epidote. Some are moderately to strongly altered to a very fine intergrowth of quartz (secondary, related to veins) and sericite; this alteration occurs in irregular patches in the altered grains.

K-feldspar forms grains ranging from 0.5 mm to megacrysts several mm across. Perthitic intergrowths of plagioclase are much coarser than in most samples, with irregular lenses up to 0.05 mm thick. The megacrysts are cut by abundant quartz veinlets, some of which contain moderate to abundant sericite.

Quartz forms grains averaging 0.5 to 1.5 mm in size; coarser grains show very wavy extinction, and some grains show irregular subparallel zones with slightly variable extinction positions between zones. This texture is the result of deformation.

Secondary quartz occurs in patches and veins as described above. Also some quartz patches are recrystallized to a fine grained irregular mosaic with grain size 0.05-0.1 mm.

Hornblende forms subhedral grains up to 0.7 mm across, with light to medium green color. A few are slightly altered to epidote, but most are relatively fresh.

Sphene forms irregular to subhedral grains up to 0.7 mm across; locally minor chlorite occurs with sphene, but generally sphene occurs by itself surrounded by quartz and feldspars.

Biotite forms several grains up to 1 mm across. They are completely altered to light green chlorite with scattered very fine grained Ti-oxide

Ti-oxide also forms several patches up to 0.7 mm across of very fine grained aggregates, some of which are associated with chlorite.

Apatite forms scattered anhedral grains averaging 0.05-0.1 mm in size. Zircon forms a few stubby prismatic grains up to 0.1 mm long.

Epidote forms patches and veinlets, in part with chlorite and Ti-oxide. Some epidote is extremely fine grained, while other patches are up to 0.5 mm in grain size. Some epidote is associated with clusters of pyrrhotite.

(continued)

S-6-22-5b (continued)

Pyrrhotite forms irregular clusters and vein-like zones up to a few mm across. Grain size is mainly 0.1-0.3 mm. Most pyrrhotite is altered along grain borders and fractures to secondary pyrite and hematite, and possibly siderite. Locally chalcopyrite occurs along borders of pyrrhotite clusters.

Pyrite forms irregular to subhedral cubic grains averaging 0.2-0.3 mm in size, with a few up to 1 mm across.

Chalcopyrite forms scattered irregular patches with grains averaging 0.05-0.2 mm in size.

The rock is cut by a few late hematite veinlets.

S-6-22-6 Altered Hornblende Quartz Monzonite

The rock contains megacrysts of K-feldspar, coarse plagioclase grains, and irregular clusters of altered hornblende in an irregular finer grained groundmass of quartz and feldspar.

K-feldspar	35-40%	
plagioclase	30-35	(moderately altered to sericite, epidote?)
quartz	10-15	
hornblende	10-15	(altered to secondary amphibole, calcite, tourmaline)
Ti-oxide	2- 3	(includes non-reflective opaque)
epidote	1- 2	
chlorite	minor	
apatite	minor	
zircon	trace	
chalcopyrite	trace	

K-feldspar forms irregular megacrysts up to about 10 mm across; they contain irregular to rounded inclusions of plagioclase and quartz averaging 0.1-0.4 mm across, and many contain tiny veinlets of quartz averaging 0.02-0.03 mm wide. K-feldspar also forms very fine grained, irregular intergrowths in the groundmass, intergrown with quartz.

Plagioclase forms irregular coarse grains up to 2.5 mm across. They are generally moderately altered to very fine grained sericite flakes. Some grains are moderately to strongly altered to patches of extremely fine grained epidote? (high relief, low birefringence, light yellowish green to green color).

Quartz forms irregular clusters of grains up to 0.5 mm in grain size, and is more common as fine to very fine grained intergrowths with K-feldspar and lesser plagioclase in the groundmass.

Hornblende forms original grains up to 1 mm long, and clusters of grains up to 2.5 mm across. Hornblende is completely altered to irregular to subparallel aggregates of very fine to medium grained actinolite, with patches of calcite up to 1 mm in size common in many clusters. A few grains contain fine to medium grained intergrowths of calcite and tourmaline. Tourmaline forms skeletal grains, commonly in one optic orientation throughout an original hornblende grain; pleochroism of tourmaline ranges from pale yellowish green to medium bluish green. Ti-oxide (including non-reflective opaque, possibly leucoxene) forms scattered clusters of elongate grains generally associated with actinolite; grains average 0.2-0.5 mm long.

Epidote forms a few irregular patches of grains averaging 0.05-0.2 mm in size, commonly associated with altered amphibole, and locally with quartz veinlets in K-feldspar. Minor epidote forms patches with grain size 0.03-0.05 mm in plagioclase.

Chlorite occurs in one grain 0.5 mm across, possibly as a replacement of original biotite; associated with chlorite is minor calcite.

Apatite forms scattered clusters of irregular grains averaging 0.02-0.05 mm across.

Zircon forms a few subhedral to euhedral grains averaging 0.03-0.05 mm across.

Chalcopyrite forms a few irregular grains averaging 0.02 mm across associated with Ti-oxide.

S-7-12-6 Hornblende-Biotite Granodiorite

plagioclase	40-45%	
K-feldspar	20-22	
quartz	20-22	
biotite	3- 5	(completely altered to chlorite-epidote-Ti-oxide)
hornblende	3- 4	
sphene	2- 3	
pyrrhotite	2- 2½	(in part altered to secondary Fe-minerals: pyrite, hematite-limonite,siderite?)
epidote	1	
chalcopyrite	½- 1	
actinolite	minor	
pyrite	trace	
zircon	trace	

veinlet: actinolite

The rock is medium to coarse grained with a few patches of fine to very fine grained groundmass of quartz and feldspars.

Plagioclase forms anhedral to locally subhedral grains averaging 0.5 to 2 mm across. It is moderately to strongly altered to fine grained sericite flakes and extremely fine to fine grained epidote? (possibly including some secondary amphibole). Alteration is variable throughout the sample with some grains altered mainly to sericite and some mainly to epidote?.

K-feldspar forms perthitic megacrysts up to 5 mm across, and also finer grained intergrowths with quartz and plagioclase in the finer grained groundmass. Plagioclase in perthitic intergrowths is finer grained and less prominent than in sample S-7-16-12. Plagioclase also forms abundant inclusions from 0.05-0.3 mm in size scattered through perthitic K-feldspar.

Quartz forms grains averaging 0.5-1 mm in size, commonly with irregular wavy extinction.

Biotite forms books up to 1.5 mm across. These are completely altered to chlorite with lesser Ti-oxide and locally minor epidote.

Hornblende forms subhedral to ragged grains averaging 0.5-1 mm in size. Color ranges from light to medium green. Actinolite forms a few clusters of acicular grains up to 0.5 mm in length, in either random or subparallel orientations. These clusters may represent alteration of original hornblende.

Sphene forms anhedral to euhedral wedge-shaped grains averaging 0.1-0.5 mm in size, generally associated with biotite and/or sulfides.

Pyrrhotite forms anhedral patches up to 0.5 mm across; grains are slightly to moderately altered along their borders to secondary iron minerals, including pyrite (possibly after marcasite) and probably Fe-carbonate. Commonly associated with pyrrhotite are patches averaging 0.1-0.2 mm across of chalcopyrite. Chalcopyrite also occurs alone in clusters of grains averaging 0.05-0.1 mm in size associated with quartz. Pyrite forms a few anhedral to euhedral grains averaging 0.02-0.03 mm in size.

Epidote forms a few patches of irregular grains from 0.05-0.2 mm in size with quartz in K-feldspar megacrysts.

Zircon fors a few subhedral grains up to 0.05 mm across with biotite.

The rock is cut by an irregular discontinuous veinlet up to 0.5 mm wide composed of randomly oriented clusters of very fine grained amphibole, probably actinolite.

S-7-16-5 Altered Granodiorite

The sample is moderately brecciated, with veins of quartz and quartz-sericite, with a few irregular patchy veins of epidote-actinolite-sulfides.

original rock?

plagioclase	30-35%	
K-feldspar	20-25	
quartz	20-25	
chlorite	1	(after biotite?)
sphene	0.3	
apatite	minor	
zircon	trace	

alteration

quartz veins	5- 7	
sericite(veins)	2- 3	
epidote	4- 5	
actinolite	2- 2½	
pyrite	1½-2	
pyrrhotite	1- 1½	(strongly altered to pyrite, hematite)
chalcopyrite	0.3	
covellite	trace	
chalcocite	trace	

Plagioclase forms anhedral to subhedral grains up to a few mm long. Alteration is variable to sericite flakes; in weakly altered grains sericite is randomly oriented, and in some strongly altered grains it is in large part oriented.

K-feldspar forms a few megacrysts up to a few mm across, with a fine perthitic texture. These are commonly cut by late quartz and quartz-sericite veinlets.

Quartz forms irregular grains from 0.5 to 2 mm in size; coarser grains have strongly wavy extinction.

Chlorite forms a few patches up to 0.7 mm across; some of these appear to pseudomorph original biotite, while others are secondary and consist of fibrous to radiating aggregates commonly associated with pyrite and epidote.

Sphene forms a few anhedral to euhedral grains up to 0.5 mm long.

Apatite forms a few clusters of grains averaging 0.05-0.1 mm in size.

Zircon forms one subhedral grain 0.12 mm long.

The most common alteration is fine to very fine grained quartz-sericite veins, commonly with patches of extremely fine grained epidote. Very fine to fine grained quartz veins and patches are less common. An irregular patchy veinlike zone consists mainly of very fine to fine grained epidote with patches of actinolite needles and scattered pyrite and pyrrhotite. Actinolite also forms scattered clusters of acicular grains up to 0.3 mm long scattered through the rock. Pyrite occurs as irregular to subhedral grains mainly from 0.05-0.15 mm in size, with a few grains up to 0.5 mm across. A few coarser grains contain a few tiny inclusions of pyrrhotite. Pyrrhotite occurs with pyrite and alone as clusters of irregular to rounded grains averaging 0.05-0.15 mm in size. Most grains are moderately to very strongly altered to hematite and pyrite.

Chalcopyrite forms a few irregular clusters of grains averaging 0.05 mm in size, with a few up to 0.15 mm across. Two patches 0.15 mm across contain covellite and chalcocite in fine grained intergrowths with pyrite-hematite after pyrrhotite.

S-7-16-8 Altered Leuco-quartz monzonite

The sample contains abundant quartz veinlets and veins, and original texture is probably mainly destroyed. Secondary biotite is present locally.

K-feldspar	30-35%
plagioclase	15-20
quartz	20-25
epidote	1½-2
biotite	1- 1½
chalcopyrite	1- 1½
hematite	0.3
sphene	0.3
actinolite	minor

quartz veins and veinlets	12-15%
late hematite-pyrite-epidote veins	1-1½

K-feldspar forms irregular grains up to 1.5 mm across and a few megacrysts up to several mm across. Most grains are perthitic with abundant very fine irregular lenses of plagioclase. They are cut by numerous quartz veinlets with average grain size 0.05 mm.

Plagioclase forms subhedral to anhedral grains averaging 1 mm in size. Alteration is very variable, with many grains very strongly altered to very fine grained sericite. Epidote locally forms patches, commonly in cores of plagioclase grains, associated with quartz and/or albite. A few grains are only slightly altered to sericite.

Quartz forms patches up to a few mm across. Some are coarse grained and others consist of fine grained strongly interlocking aggregates.

Epidote forms irregular patches up to 0.7 mm across, generally consisting of fine grained aggregates.

Biotite forms irregular patches and discontinuous vein-like zones with grains averaging 0.1-0.25 mm in size. Pleochroism is from pale to medium brown.

Chalcopyrite forms irregular grains from 0.05 to 0.5 mm in size scattered through the rock.

Sphene forms a few subhedral grains, mainly 0.15 mm in size, with one grain 1.5 mm long.

Actinolite forms a few irregular clusters of acicular grains averaging 0.3-0.5 mm in length.

The rock is cut by numerous discontinuous quartz veinlets with grain size averaging 0.03-0.05 mm; such veinlets appear to be more abundant in K-feldspar than in plagioclase. The rock is cut by a major set of quartz veins in one corner of the section; grain size is mainly fine to medium.

The rock is cut by narrow late veins composed of epidote with scattered pyrite grains up to 0.5 mm in size. Many pyrite grains are moderately to completely altered to hematite.

S-7-16-9 Porphyritic Hornblende Granodiorite

The rock contains a few megacrysts of plagioclase, K-feldspar, and quartz; medium to coarse grained plagioclase and hornblende, and a fine to very fine grained groundmass dominated by quartz and K-feldspar.

megacrysts	
K-feldspar	5- 7%
plagioclase	2- 3
quartz	5- 7
plagioclase	30-35
amphibole	7-10
quartz	20-25
K-feldspar	15-20
sphene	1½-2
pyrite	1½-2
epidote	1- 1½
chlorite	0.3
biotite	minor
chalcopyrite	minor
covellite	trace

Plagioclase forms a few subhedral megacrysts up to 10 mm long. Most plagioclase grains average 0.5-1.5 mm in size. They are moderately to strongly altered to very fine grained sericite flakes and/or extremely fine grained patches of epidote. Epidote alteration tends to be very patchy within grains.

K-feldspar forms a few megacrysts up to 1.5 cm long. These are slightly perthitic with irregular lenses of exsolution plagioclase. K-feldspar megacrysts also contain scattered very fine to fine grained inclusions of quartz and lesser plagioclase.

Quartz forms rounded megacrysts averaging 2-3 mm across; grains commonly show strongly wavy extinction.

Quartz and K-feldspar form fine to very fine grained intergrowths interstitial to coarser grains; quartz averages 0.05-0.1 mm in size, while K-feldspar averages 0.1-0.3 mm across. Grain borders are very irregular.

Amphibole, mainly primary hornblende with possibly some secondary actinolite after hornblende forms subhedral to euhedral diamond-shaped prismatic grains up to 0.5 mm across and 1.5 mm long. Pleochroism is from light to medium green. Locally secondary actinolite forms clusters of fibrous grains up to 0.3 mm long.

Sphene forms subhedral to anhedral grains averaging 0.2-0.5 mm in size, with a few grains up to 1.2 mm across. Commonly it is intergrown with epidote. Epidote forms irregular grains averaging 0.15-0.2 mm in size associated with sphene and/or pyrite.

Pyrite forms irregular grains averaging 0.05-0.15 mm in size, and a few subhedral cubic grains. Some grains have thin rims of hematite. Chalcopyrite forms scattered irregular grains averaging 0.03-0.05 mm in size. Covellite forms one cluster 0.2 mm across of very fine grains adjacent to a pyrite grain partly altered to hematite.

Biotite forms one ragged book 0.5 mm across. Pleochroism is weak from light to medium brownish green. Chlorite forms one patch 1.2 mm across with intergrown Ti-oxide; this aggregate is probably a replacement of biotite.

S-7-16-10 Altered Leucogranodiorite

The rock is medium to coarse grained with a few K-feldspar megacrysts, and abundant very fine grained groundmass dominated by quartz, K-feldspar, epidote, and lesser sulfides and apatite.

plagioclase	45-50%	
quartz	17-20	
K-feldspar	15-20	
groundmass	7-10	(mainly quartz, K-feldspar)
epidote	1½-2	
sphene	1- 1½	
pyrrhotite	1- 1½	
pyrite	1- 1½	
limonite-hematite	½	
biotite	½	(completely altered to quartz, Ti-oxide, epidote)
chlorite	0.3	
chalcopyrite	0.3	
apatite	trace	
allanite?	trace	
covellite	trace	
zircon	trace	

Plagioclase forms anhedral grains up to a few mm across, averaging 0.5-1 mm. They are moderately to strongly altered to sericite flakes, with local patches of epidote up to 0.15 mm across. Some plagioclase grains are strongly replaced by K-feldspar, with corroded cores of plagioclase enclosed in irregular rims of K-feldspar.

Quartz forms grains from 0.2 to 1.5 mm in size, generally with strongly wavy extinction. It also occurs in irregular very fine grained patches associated with K-feldspar and lesser epidote, sulfides, and apatite.

K-feldspar forms a few perthitic megacrysts similar to those in sample S-7-12-6. It also occurs in very fine to fine grained intergrowths with quartz as described above, and as replacement of some plagioclase grains.

Epidote forms very irregular grains and clusters of grains, commonly associated with opaque.

Sphene forms anhedral to euhedral grains averaging 0.2-0.7 mm in size.

Pyrrhotite forms irregular patches of grains up to 0.5 mm in size. A few patches are slightly to moderately altered to secondary Fe-minerals as in sample S-7-12-6. Chalcopyrite occurs as grains up to 0.1 mm across associated with pyrrhotite, and as scattered grains up to 0.05 mm across without any other sulfide. Pyrite forms anhedral, commonly corroded grains up to 0.25 mm across, and a few euhedral cubic grains up to 0.15 mm across. Limonite-hematite forms scattered patches after pyrrhotite and possibly after pyrite. Covellite forms a few clusters up to 0.1 mm across of extremely fine grained aggregates associated with epidote.

Biotite forms a few grains up to 0.8 mm long; these are completely altered to quartz with lesser Ti-oxide and minor epidote.

One patch consists of chlorite-epidote-allanite?(as in S-7-16-12). Allanite forms an elongate lathy grain 1 mm long, with light to medium brown pleochroism. Chlorite forms an extremely fine grained patch 0.3 mm across, and epidote forms a cluster of grains averaging 0.05-0.15 mm in size.

Apatite forms scattered subhedral grains up to 0.1 mm long associated with the very fine grained groundmass.

Zircon forms a few subhedral grains averaging 0.1 mm across.

S-7-16-12 Hornblende Granodiorite

The rock is mainly medium to coarse grained, with a few megacrysts of K-feldspar up to several mm across.

plagioclase	35-40%	
quartz	25-30	
K-feldspar	15-20	
hornblende	7-10	
biotite	3- 4	(completely altered to chlorite-quartz-epidote)
sphene	1½-2	
allanite?	minor	
hematite-limonite	minor	
apatite	minor	
zircon	minor	
pyrrhotite	trace	
pyrite	trace	

Plagioclase forms anhedral grains from 0.5 to a few mm across. Alteration is moderate to either very fine grained sericite flakes or very fine grained actinolite? needles or both.

Quartz forms anhedral patches up to a few mm across; grains are up to a few mm across and have wavy extinction.

K-feldspar forms irregular grains of variable size, including a few megacrysts up to a few mm across. Coarser grains are perthitic with irregular lenses of plagioclase in subparallel orientation. Most coarser grains also contain inclusions of plagioclase up to 0.5 mm across.

Hornblende forms subhedral elongated prismatic grains averaging 0.5-1 mm long. Grains are light to medium green in color with weak pleochroism. Grains are fresh, but commonly have ragged outlines.

Biotite? forms grains up to 1.5 mm across. It is completely altered to aggregates of chlorite and quartz, with minor epidote and local Ti-oxide. Quartz forms patches of grains with size averaging 0.1-0.2 mm.

Sphene forms subhedral to euhedral grains averaging 0.3-0.5 mm in length. Grains are scattered in the rock and are not particularly concentrated with hornblende.

Allanite forms a few anhedral to subhedral grains commonly with hornblende. Grain size is mainly 0.15-0.25 mm, with one elongate grain 1.8 mm long. The mineral is pleochroic from light orange-brown to medium-dark brown. Surrounding the largest grain are abundant irregular to subhedral grains of zircon. Zircon elsewhere forms subhedral to euhedral grains from 0.05-0.15 mm in size.

Apatite forms subhedral grains up to 0.15 mm long, generally associated with hornblende.

Pyrrhotite and pyrite form scattered irregular grains averaging 0.01-0.03 mm in size. Some coarser pyrite grains have thin rims of hematite. Hematite-limonite forms patches up to 0.3 mm across, possibly after iron sulfides.

S-7-16-13 Altered Leucogranodiorite

The rock is mainly a medium to coarse grained granodiorite with a few megacrysts of K-feldspar and quartz up to a few mm across. Original mafic minerals are not abundant; minor biotite is preserved in one part of the section.

plagioclase	35-40%	(strongly altered to epidote or quartz-epidote)
K-feldspar	30-35	
quartz	15-20	
biotite	0.3	
apatite	minor	
zircon	trace	
sphene	trace	
epidote	5- 7	
actinolite	2- 3	
hematite	2- 3	
pyrite	trace	
chalcopyrite	trace	

veins:
quartz-epidote-actinolite-hematite

Plagioclase forms grains averaging 0.5-1 mm in size, with a few up to a few mm long. Most plagioclase grains are strongly altered. The most common alteration is to patches of extremely fine grained epidote. Less commonly epidote forms irregular grains and clusters up to 0.15 mm in size. About 25% of plagioclase grains are altered to extremely fine to very fine grained quartz with or without very fine grained epidote; these alteration zones tend to follow vague vein-like zones which cut irregularly through the rock.

K-feldspar forms irregular grains up to several mm across; most grains are strongly perthitic, wih very abundant very fine grained plagioclase intergrown in K-feldspar. K-feldspar is cut by numerous veinlets of very fine grained quartz.

Quartz forms a few megacrysts up to a few mm across and interstitial grains from 0.3 to 1.5 mm in size. Most grains show strongly undulatory extinction.

Biotite forms a few ragged books up to 1 mm across. Pleochroism is from light to medium brown.

Apatite forms a few subhedral grains averaging 0.1 mm in length.

Zircon forms a few subhedral grains averaging 0.05-0.1 mm across.

Sphene forms one subhedral grain 0.25 mm across associated with secondary actinolite.

Epidote forms abundant irregular patches of grains averaging 0.05-0.15 mm in size, commonly associated with actinolite. Actinolite forms subparallel to fibrous aggregates of grains averaging 0.2-0.3 mm in size; these clusters are scattered through the rock, and are concentrated in patches with epidote.

Hematite forms irregular patches of grains up to 0.3 mm across, probably mainly after iron sulfides. Pyrite and chalcopyrite form scattered grains averaging 0.02-0.03 mm in size, mainly enclosed in quartz.

The rock is cut by a fine grained vein composed mainly of quartz with lesser epidote, hematite, and minor actinolite.

S-7-12-7B Siliceous-Altered Quartz Monzonite

The rock is the most strongly altered sample in the suite.

Original rock		
K-feldspar	30-35%	(possibly in part secondary)
plagioclase	10-15	
quartz	10-15	
biotite	minor	(completely altered to quartz, Ti-oxide)
Ti-oxide	1½-2	
apatite	trace	
zircon	trace	
secondary minerals		
quartz (fine)	20-25	
(coarse)	7-10	(late vein)
epidote	0.5	
pyrite	0.5	
muscovite	2- 3	
molybdenite	minor	
chalcopyrite	minor	
limonite	1½-2	(probably after pyrite)

Plagioclase forms scattered medium to coarse grains with a few grains up to a few mm across. Some grains appear to be partly replaced by K-feldspar. Others are variably altered, from weakly to strongly, to very fine grained sericite flakes, and locally to patches up to 0.5 mm across of epidote. Some plagioclase is replaced in part by very fine grained patches of quartz and lesser sericite.

K-feldspar forms grains ranging up to megacrysts a few mm across. These are strongly cut and replaced by fine grained patches and veinlets of quartz and of quartz-sericite. K-feldspar is slightly perthitic as in most other samples.

Quartz forms irregular grains from 0.3 to 1.5 mm in size.

Biotite forms one grain 1 mm long. It is completely replaced by fine grained quartz intergrown with trains of extremely fine grained Ti-oxide along original biotite cleavage. Minor epidote may be present as well.

Ti-oxide forms irregular patches up to 0.7 mm long of very fine to fine grained aggregates.

Apatite forms scattered grains from 0.05-0.1 mm in size. Zircon forms one euhedral grain 0.2 mm long.

The rock is dominated by secondary quartz veins and patches; these replace plagioclase and K-feldspar, and occur as veinlike zones cutting feldspars and quartz. The major quartz vein contains coarse anhedral grains with patches of fine grains along vein borders.

Epidote forms irregular patches averaging 0.2-0.5 mm across in quartz. Muscovite and sericite occur in some quartz veins and patches as very fine grained random to subparallel aggregates.

Pyrite forms irregular grains and patches of grains up to 0.5 mm in grain size. Some are associated with epidote. Chalcopyrite forms scattered patches averaging 0.03-0.1 mm in size. Molybdenite forms in a few irregular veinlets up to 0.15 mm wide, with ragged interlocking flakes up to 0.1 mm long. Limonite occurs in the weathered part of the sample along a major fracture, probably after pyrite.

S-7-12-8 Altered Leucogranodiorite

The sample is moderately brecciated and contains abundant fine grained to very fine grained quartz veinlets. Breccia veins appear to be mainly sericite with scattered Ti-oxide and sulfides.

quartz	30-35%	(includes about 10% quartz veinlets and patches)
plagioclase	25-30	
K-feldspar	25-30	
epidote	2- 3	
pyrite	2- 3	
Ti-oxide	1- 1½	
apatite	minor	
chalcopyrite	0.3	
zircon	trace	

Quartz occurs in several different textures. It forms scattered grains averaging 0.3-0.5 mm in size, commonly with strongly undulatory extinction. It forms a few patches several mm across composed of fine grained (0.05-0.2 mm) moderately interlocking aggregates. Very fine grained secondary quartz occurs in patches with or without epidote and as discontinuous veinlets cutting all primary minerals.

Plagioclase forms grains averaging 0.7-1.5 mm in size. Most grains are moderately to strongly altered to very fine grained sericite and epidote. A few grains are relatively fresh, and may be secondary albite (no composition was determined).

K-feldspar forms perthitic grains averaging 0.3-0.7 mm in size, with a few megacrysts up to 3 mm across. They are cut by abundant late very fine grained quartz veinlets.

Epidote forms scattered patches up to 1 mm across consisting of very fine to medium grained aggregates. Some contain opaque (pyrite) and some are associated with secondary quartz.

Pyrite forms scattered irregular to subhedral grains and clusters of grains ranging from 0.05 to 0.5 mm in size. Chalcopyrite forms irregular patches averaging 0.05-0.15 mm in size; some are rimmed by hematite.

Ti-oxide forms clusters up to 0.5 mm across of very fine grained aggregates.

Apatite forms scattered patches of elongate prismatic grains up to 0.2 mm long.

Zircon forms a few euhedral grains up to 0.05 mm in size.

Breccia veins (one main vein shown in thin section) consist of subparallel fine to very fine grained aggregates of sericite with scattered Ti-oxide and pyrite.

S-7-16-3 Altered Quartz Monzonite

The sample contains megacrysts of K-feldspar and a few of plagioclase in an irregular medium grained intergrowth of feldspars and quartz, with scattered patches and irregular vein-like zones containing abundant epidote, chlorite, and chalcopyrite.

K-feldspar	30-35%	
plagioclase	25-30	
quartz	20-25	
epidote	2- 3	
chalcopyrite	2- 2½	
chlorite	2- 2½	
pyrite	0.3	
Ti-oxide	0.3	
molybdenite	minor	
apatite	minor	
hematite	minor	
Mineral X	trace	(one grain in chalcopyrite)

coarse quartz vein	3-5
quartz-sericite veinlets	5
hematite veinlets	minor
quartz-albite-chlorite vein	minor

K-feldspar forms a few megacrysts up to several mm across, and irregular grains averaging 0.5-1 mm in size. Most grains contain abundant very fine irregular lenses of exsolution plagioclase. Megacrysts are cut by very abundant veinlets composed of quartz and quartz-sericite, with average grain size 0.03-0.05 mm. Some sericite is stained yellow-brown by limonite.

Plagioclase forms grains up to a few mm across. Some appear fractured and fragmented, with fragments slightly rotated. Alteration is mainly moderately strong to very fine grained sericite flakes. Some grains are altered in patches to quartz-sericite as in the quartz-sericite veinlets.

Quartz forms irregular grains up to 2 mm in size intergrown with feldspars as part of the original rock. Secondary quartz occurs in quartz-sericite veinlets and patches and in a coarse quartz lens (or vein), the latter composed of fine to very fine grained moderately interlocking grains with a few coarser grains. One late vein contains quartz with patches of chlorite and locally plagioclase (albite?).

Epidote and chlorite commonly occur together as irregular patches up to 2 mm across, commonly associated with chalcopyrite and/or Ti-oxide. Chlorite also forms fibrous, slightly radiating clusters averaging 0.2 mm across, and patches up to 0.5 mm across composed of randomly oriented aggregates of flakes averaging 0.03-0.05 mm in grain size. Epidote forms some very fine grained patches intergrown with quartz, sulfides, and hematite.

Ti-oxide forms a few patches up to 0.5 mm long, composed of very fine grained irregular aggregates.

Apatite forms scattered irregular grains up to 0.15 mm across, and acicular grains up to 0.15 mm long.

Chalcopyrite forms irregular patches from 0.02-0.25 mm in size. One patch contains a grain 0.05 mm across of Mineral X with the following properties: medium grey, low reflectivity, hardness about that of chalcopyrite, isotropic, no internal reflectivity. Pyrite forms scattered irregular to subhedral grains averaging 0.1-0.25 mm in size.

(continued)

S-7-16-3 (continued)

Molybdenite forms a few irregular veinlets composed of irregular flakes averaging 0.05 mm long. Some are intergrown with sericite, and probably are related to the quartz-sericite veinlets.

Hematite occurs as an alteration along the borders of some chalcopyrite patches, and locally replaces almost all of some patches. It also occurs as late crosscutting veinlets.

Ram Stock

Distribution

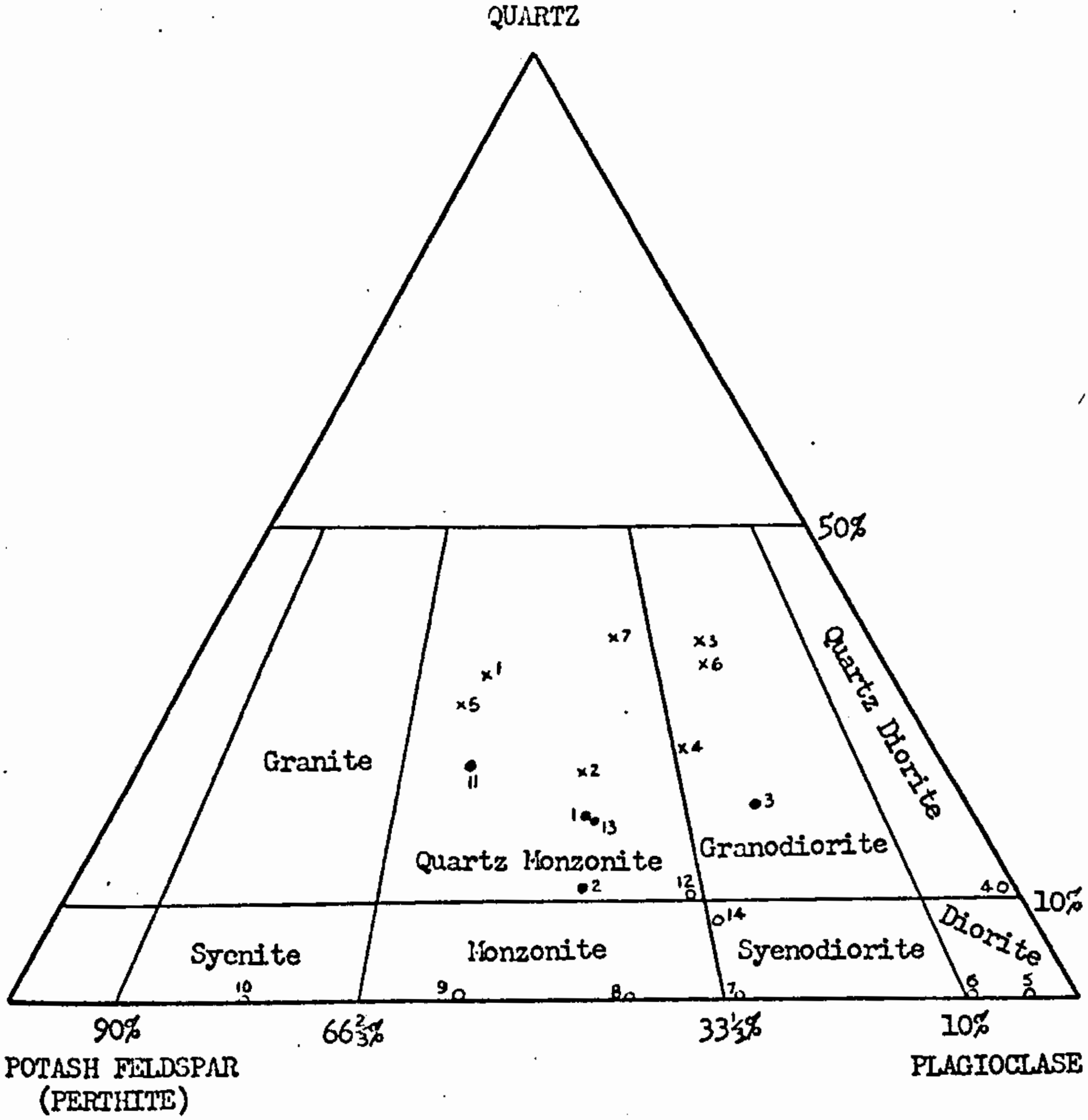
The Ram stock is an elongate granitic intrusion forming the core of a dissected ridge of rugged mountains on the northeast border of the Dorsey Range between Crescent Lake and Morley River. The stock is about 16 miles long and from 1/2 mile to 2 miles wide. It intrudes the Dorsey and Sylvester groups and lies more or less parallel to the regional northwest trend. A single outcrop of similar rock is exposed on the crest of a ridge about two miles southwest of the mouth of Rudy Creek.

Most investigations of the stock were made by assistants during a period in which the writer was confined to camp by personal injury.

Lithology

The Ram stock is a foliated and saussuritized, quartz-rich granitic rock of presumed original quartz monzonite and granodiorite composition (figures 39 and 40, and table 6). The stock is notably coarse grained. Grains of white or buff potash feldspar and dark grey-green plagioclase vary from 4 to 15 mm. in diameter. Biotite and hornblende are commonly less than 3 mm. in diameter. The rocks are too coarse grained for accurate determination of composition by modal analysis of normal-sized thin sections. In the field, the rocks were referred to as 'green granites' (table 4).

In thin section, the potash feldspar is a microperthite with patchy



Ram stock . . . . × 1-7

Logjam stocks, interiors . . . ● 1-3, 11, 13
Logjam stocks, borders . . . ○ 4-10, 12, 14

Figure 39. Modes of seven specimens from Ram stock and fourteen specimens from Logjam stocks (see table 6 and figures 40 and 41).

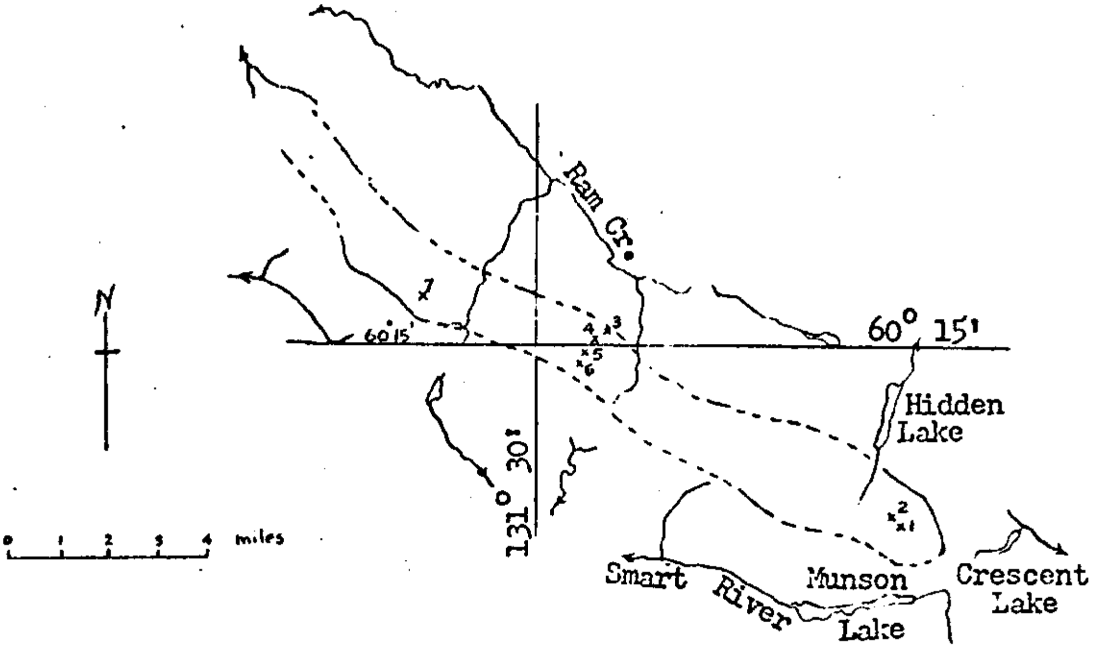


Figure 40. Diagram of Ram stock, showing location of specimens selected for modal analysis (see table 6 and figure 39).

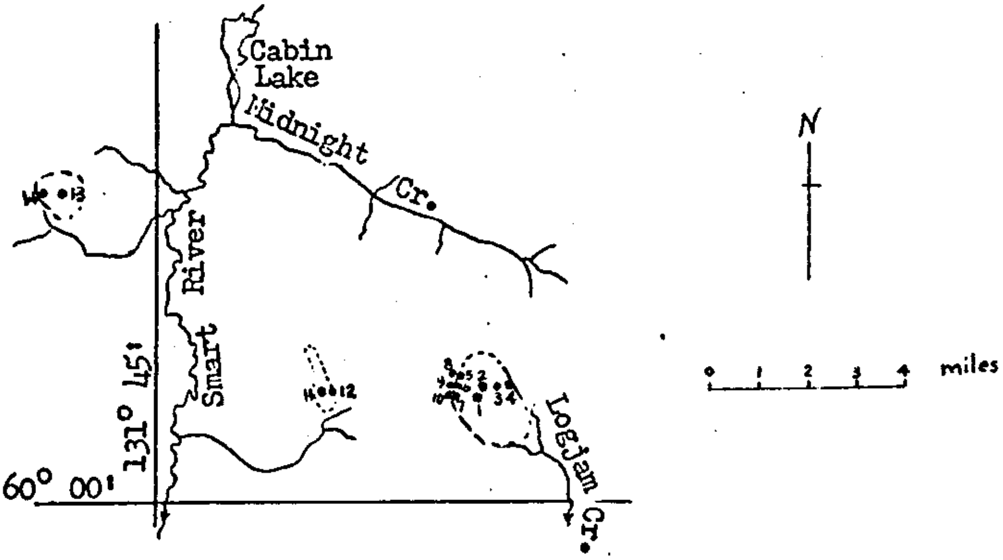


Figure 41. Diagram of Logjam stocks, showing location of specimens selected for modal analysis (see table 6 and figure 39).

Table 6. Modal analyses[1] of rocks of the Ram stock and Logjam stocks

Ram Stock

Specimen Number	1	2	3	4	5	6	7
Quartz	34	23	38	23	30	32	35
Potash feldspar[2]	36	32	16	21	40	15	22
Plagioclase[3]	28	40	45	43	26	43	35
Mafic minerals[4]	2	5	1	13	4	10	8
% An in plagioclase[5]		5			5		9
Number of points counted[6]	1400	3690*	1348	1400	1400	1400	1000

Logjam Stocks

Specimen number	1_a	2_a	3_a	4_b	5_b	6_b	7_b	8_b	9_b	10_b	11_a	12_b	13_a	14_b
Quartz	17	10	18	7	-	-	-	-	-	-	22	6	18	5
Potash feldspar[2]	33	38	18	1	2	6	13	14	46	36	39	19	36	22
Plagioclase	40	45	52	52	32	57	35	20	33	11	27	36	41	47
Mafic minerals[7]	10	7	12	40	66	37	52	66	21	53	12	39	5	26
% An in plagioclase[5]	34-16	33-14	5	33		41			34		5	43	32-14	33-20
Number of points counted[6]	452	588	944	810	600	660	504	573	932	570	822	704	647	705

Accessory minerals were not counted, but total less than 4%. These include sphene, apatite, and iron ore.

1 not corrected for density of minerals.

2 mainly microperthite with less than 10% albite.

3 saussurite (albite, epidote-clinozoisite, and green and white micas).

4 hornblende, biotite, and alteration products (actinolite?, green and white micas, sphene, and iron ore).

5 determined on universal stage by extiction angles on albite twins with (010) and (001) planes vertical. Curves of Winchell (1951). Core to rim zoning indicated.

6 thin sections of normal size and shape; traverse spacing 2 mm.; point spacing 4.8 points per mm.

7 hornblende, biotite, and alteration products; plus augite in specimens of hybrid rocks.

* average of three thin sections

a rocks from interior of stocks. b hybrid rocks from border of stocks.

microcline twinning, and is commonly bent and fractured (figure 42). The original plagioclase has everywhere been saussuritized. Secondary white and greenish micas and indeterminant opaque material are disseminated throughout albite (An_5-An_9) pseudomorphously replacing the original plagioclase. Epidote comprises much of the opaque material and also occurs as larger grains and aggregates, and in veinlets. Albite twins are poorly developed, and most grains are bent and broken. Quartz is strongly strained, but not sheared into interlocking laminae common in the western border zone of the Cassiar batholith (figure 28). In the Ram stock, most of the quartz grains contain irregular areas and stringers of a micro-mosaic of polygonal quartz grains. Stringers and veinlets of similar polygonal quartz grains cut the feldspars. Pleochroic light brown to green, euhedral hornblende predominates over biotite. The hornblende is partly altered to actinolite, chlorite, sphene, and iron ore, Biotite, uncommon and irregularly distributed, is probably primary, but may, in part, be secondary after hornblende. These mafic minerals constitute from 1% to 13% of the seven analysed thin sections. Sphene, apatite, iron ore, and carbonate are common accessories.

Most of the rocks are more or less deformed; figure 42 represents a rock showing about average deformation. One specimen (modal analysis number 5 of figures 39 and 40, and table 6) is a porphyry of unknown structural relations, consisting of a dense green groundmass enclosing large quartz, potash feldspar, and plagioclase euhedral phenocrysts. In thin section, the rock is unstrained, but saussuritized. The quartz phenocrysts have been

Figure 42. Thin section of Ram stock one mile west of Crescent Lake. Modal analysis number 1 of figures 39 and 40, and table 6. Partly crossed nicols. Magnification 8.5 diameters. Q - quartz; K - stained potash feldspar; P - plagioclase; E - epidote.

corroded by the groundmass. The rock may be a dyke genetically related to the stock, but intruded after the emplacement and deformation of the stock. Aplite and pegmatite dykes were not recognized.

Little is known about inclusions in the stock. The grey-green colour, variable texture, shearing, and saussuritization have made it difficult to recognize inclusions. West of Tern Lake, some rocks within the stock are composed of abundant hornblende with turbid plagioclase, potash feldspar, actinolite, chlorite, and sphene; these rocks may be altered volcanic rocks from the nearby Sylvester group. Near Crescent Lake, the stock intrudes a dioritic body, but the few inclusions noted do not differ from the saussuritized diorites or quartz diorites southeast of the contact.

Structural Relations

Sampling was insufficient and modal analyses too inaccurate to show any possible variations in composition and mineral species throughout the stock.

Most of the stock has been strained to some degree. The foliation, consequent upon shearing, more or less parallels the vertical or steeply dipping southwest contact and is either vertical or steeply dipping elsewhere. The southwest contact is concordant but the northeast contact is apparently strongly discordant. The wall rocks of the stock are not noticeably more sheared than those farther from the contacts. The dioritic body southeast of the stock is not sheared. The small outcrop south of Rudy Creek lies within 1,500 to 2,500 feet of the unsheared dioritic rocks. The outcrop shows a pronounced vertical foliation presumably parallel to concealed borders of the dyke or plug. The nearby chert and slate dip 60 degrees southwest.

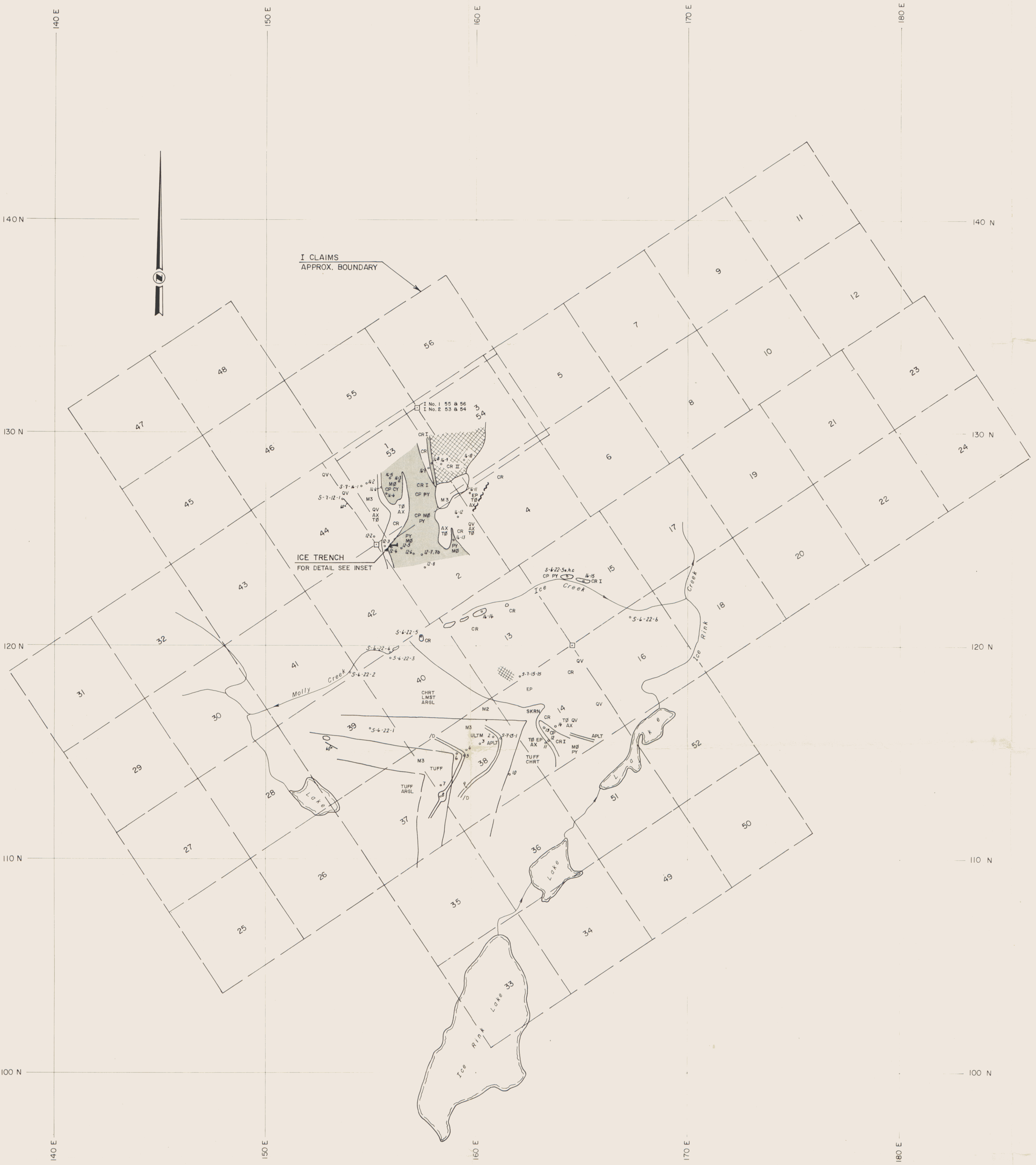
Logjam Stocks

Distribution

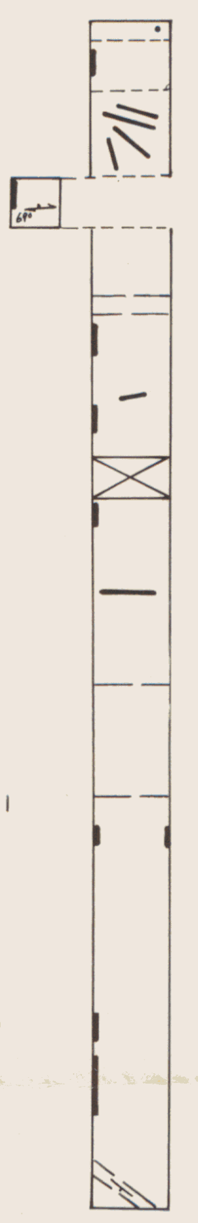
The Logjam stocks comprise three stocks of quartz monzonite (table 4) with borders of quartz-poor rocks, which intrude the Dorsey and Sylvester groups and the dioritic and ultramafic rocks in the southwestern part of the report-area.

Lithology

The interior of the stocks consists of massive or slightly porphyritic, medium-grained, pinkish grey biotite-hornblende quartz monzonite (figures 39 and 41, and table 6). Most of the plagioclase is oligoclase-andesine, zoned from about An_{33} to An_{14}. Some is unzoned albite (An_5). In thin section, some of the grains are strongly zoned and lack albite twins, others are prismatic with well-developed albite twins, and a few are excessively clouded with secondary white mica. Quartz occurs interstitially to plagioclase and mafic minerals, and is only slightly strained. Potash feldspar is pink microperthite, and forms the largest grains in the rock; some of the grains are 6 mm. in diameter. Microcline twinning is absent, but carlsbad twinning universal. The microperthite grains envelope and enclose all minerals. Pleochroic green to brown,



ICE TRENCH



CHIP SAMPLE No.	GEOLOGY	DESCRIPTION	FRACTURES (per m^2)
4659 B	CR : PP5	SER AX TØ GSD SUL	2-3 3-5
	V	QZ PY AX	
4411 B		SIL GSD PY	8 (216°/69° E)
4410 B	PXDK CR : PP5	HB PP CU PY	
4660 B		CU OX TØ SER SIL	
4461 B	V	TØ AX QZ SIL PY	
	CR : PP5 V CR : PP5	CU OX AX QZ PP	2
	PXDK	AX SIL PX	
PANEL I 4662 B	CR : PP5	SIL PP GSD	
4663 B		FEL SH CU OX	
4412 B			
		PY	12
		AX	
	PXDK	AP	

INSET

SCALE 1 : 500

ABBREVIATIONS

MINERALS

AS	ARSENOPYRITE
AX	AXINITE
BI	BIOTITE
CA	CALCITE
CH	CHALCEDONY
CT	CASSITERITE
CU	COPPER
FU	FLUORITE
GA	GARNET
GL	GALENA
GR	GRAPHITE
HB	HORNBLENDE
HE	HEMATITE
IL	ILLITE
LI	LIMONITE
MG	MAGNETITE
MN	MANGANESE
MØ	MOLYBDENITE
MS	SERICITE
MU	MUSCOVITE
OX	OXIDES
PX	PYROXENE
PY	PYRITE
QC	QUARTZ (CHERT)
QT	QUARTZ & TOURMALINE
QZ	QUARTZ
SL	SPHALERITE
SU,SUL	SULFIDE
TØ	TOURMALINE
CP	CHALCOPYRITE
EP	EPIDOTE
SH	SCHEELITE

DESCRIPTORS

BLK	BLACK
EQ	EQUIGRANULAR
FEL	FELDSPATHIC
G$	GREISEN
GSD	GOSSANED
IB	INTERBEDDED
LIM	LIMY
MSS	MASSIVE
PD	POD
PEB	PEBBLY
PG	PEGMATITIC
PP	PORPHYRITIC
SD	SEDIMENTARY
SIF	SILICIFIED
SR	SERIATE
VC	VOLCANOCLASTIC
/D	DYKE
mc	MIAROLITIC CAVITIES
V	VEIN
<V	MICROVEIN
W/	WITH

LEGEND

CRETACEOUS OR TERTIARY

SG SEAGULL BATHOLITH

EQ2 (or 3,4,5,6) — average crystal size
PP2 (or 3,4,5) — groundmass crystal size
SR2 - 7 — variation in crystal size
APLT — APLITE

2 = <0.25 mm
3 = 0.25 - 1.00 mm
4 = 1.00 - 2.00 mm
5 = 2.00 - 4.00 mm
6 = 4.00 - 16.00 mm
7 = >16.00 mm

JURASSIC - CRETACEOUS (?)

CR CASSIAR - RAM STOCK

I Younger potassic stock or phase with sulfides, no hornblende laths

II Younger potassic stock possible mineralizer with primary hornblende laths minor alteration

PERMIAN - MESOZOIC

DIØR	DIORITE
PXNT	PYROXENITE
BI PXNT	BIOTITE PYROXENITE
PERD	PERIDOTITE
BC/D	BASIC DYKE
BR	BROCK INTRUSIONS

VAL MAFIC - ULTRAMAFIC SUITE

MISSISSIPPIAN (PENNSYLVANIAN ?)

M3 UPPER SYLVESTER GROUP

ARGL	ARGILLITE
ANVC	ANDESITIC VOLCANIC ROCKS
VCSD	VOLCANO-SEDIMENTARY ROCKS
VLCC	VOLCANO-CLASTIC ROCKS
SCHS	SCHIST

M2 LOWER SYLVESTER GROUP

LIMS	LIMESTONE
MARL	MARL
SLAT	SLATE
ARGL	ARGILLITE
SHAL	SHALE
QZIT	QUARTZITE
CONG	CONGLOMERATE
CHRT	CHERT
VOLC	VOLCANIC
SKRN	SKARN
SUHØ	SULFIDE HORIZON
ARQZ	ARGILLACEOUS QUARTZITE
BRXX	BRECCIA
GNIS	GNEISS
SCHS	SCHIST

AGE UNKNOWN

DB/D	DIABASE DYKE
PXDK	PYROXENE - PORPHYRY DYKE
RYDK	RHYOLITE DYKE

SYMBOLS

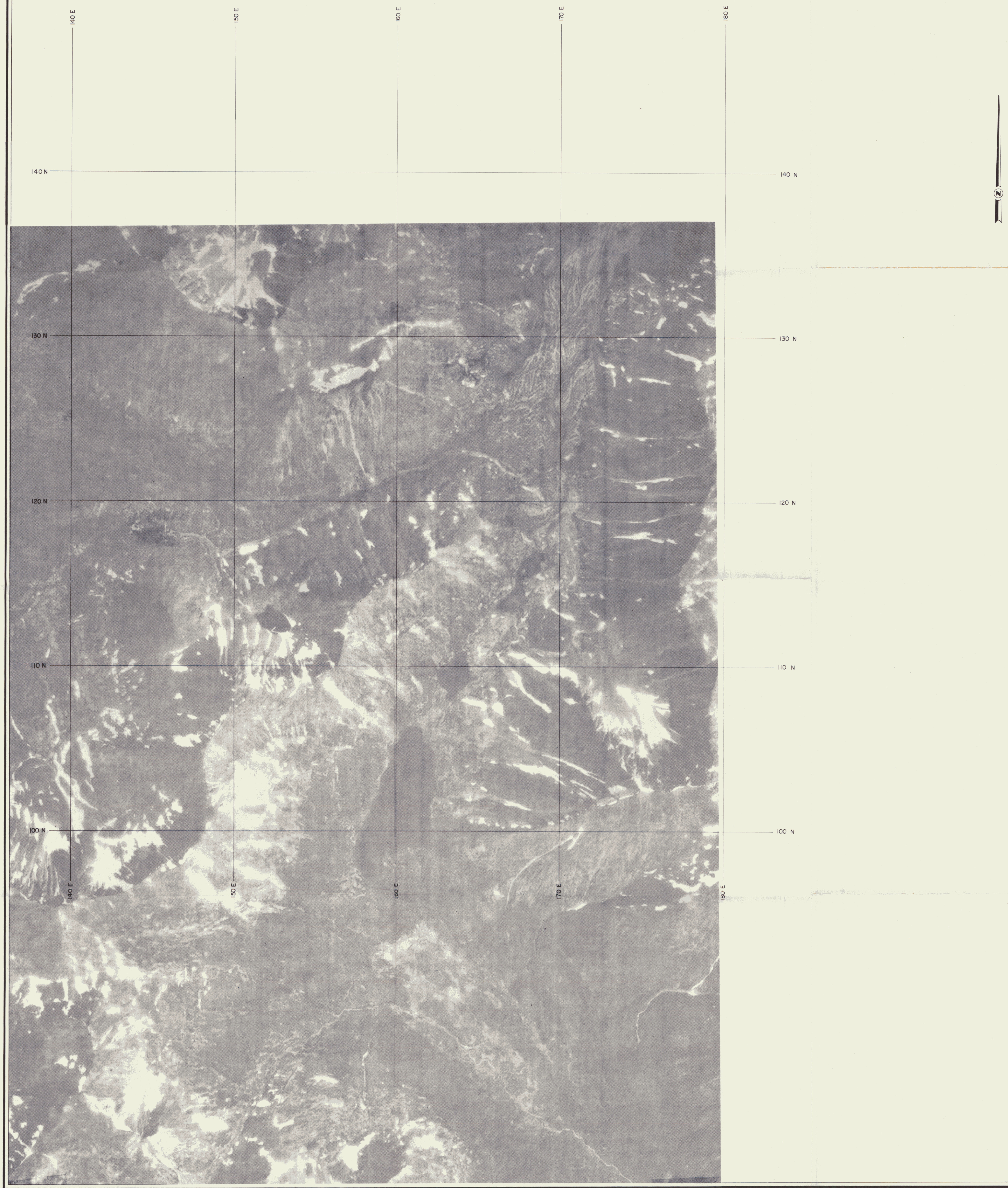
- - - - - -	EDGE OF TALUS
	OUTCROP
	CONTACT OBSERVED
	CONTACT APPROXIMATE
	CONTACT ASSUMED
G — G	CONTACT GRADATIONAL
	FAULT (showing direction of movement)
A — A	ALTERATION AREA
45	BEDDING - INCLINED, VERTICAL
50	JOINTING - INCLINED, VERTICAL
55	FOLIATION - INCLINED, VERTICAL
	VEIN - INCLINED, VERTICAL
	AREA OF SMALL VEINS
	ANTICLINE - UPRIGHT, OVERTURNED
S	AXIAL PLUNGE
▨ or ●	GOSSANED AREAS
° or ×	GEOLOGY / ROCK SAMPLE STATION
⊗	THIN SECTION
⊕	TRACE ELEMENT / WHOLE ROCK ANALYSES
◕	THIN SECTION & TRACE ELEMENT / WHOLE ROCK ANALYSES
├──┤ or ×──┤	CHIP SAMPLE
Rock A (Rock B)	ROCK A more frequent than ROCK B
··· ——— ···	GULLY
←———	CREEK
⊡	CLAIM POST

DU PONT EXPLORATION
CANADA

KLINKIT JOINT VENTURE
ICE PROJECT
GEOLOGY
I CLAIMS
DORSEY RANGE, YUKON TERRITORY

1 : 10 000
m 300 200 100 0 300 600 m
SCALE

MAPPED BY :	F. M. S.	REVISED :	N.T.S. No. :	105 B
DATE :	JUN. - JULY '79		ACCT No. :	335 - 28
DRAWN BY :	C.H.K.		DRWG. No. :	KL. 79 - 74
DATE :	JAN. 1980			



DU PONT CANADA **EXPLORATION**

KLINKIT JOINT VENTURE
ICE PROJECT
PHOTOMAP
I CLAIMS

DORSEY RANGE, YUKON TERRITORY

1 : 10 000

m 300 200 100 0 300 600 m

SCALE

MAPPED BY :	F. M. S.	REVISED :	N. T. S. No. :	105 B
DATE :	JUN.- JULY '79		ACCT No. :	335 - 28
DRAWN BY :	C. H. K.		DRWG. No. :	KL. 79 - 75
DATE :	JAN. 1980			

LEGEND

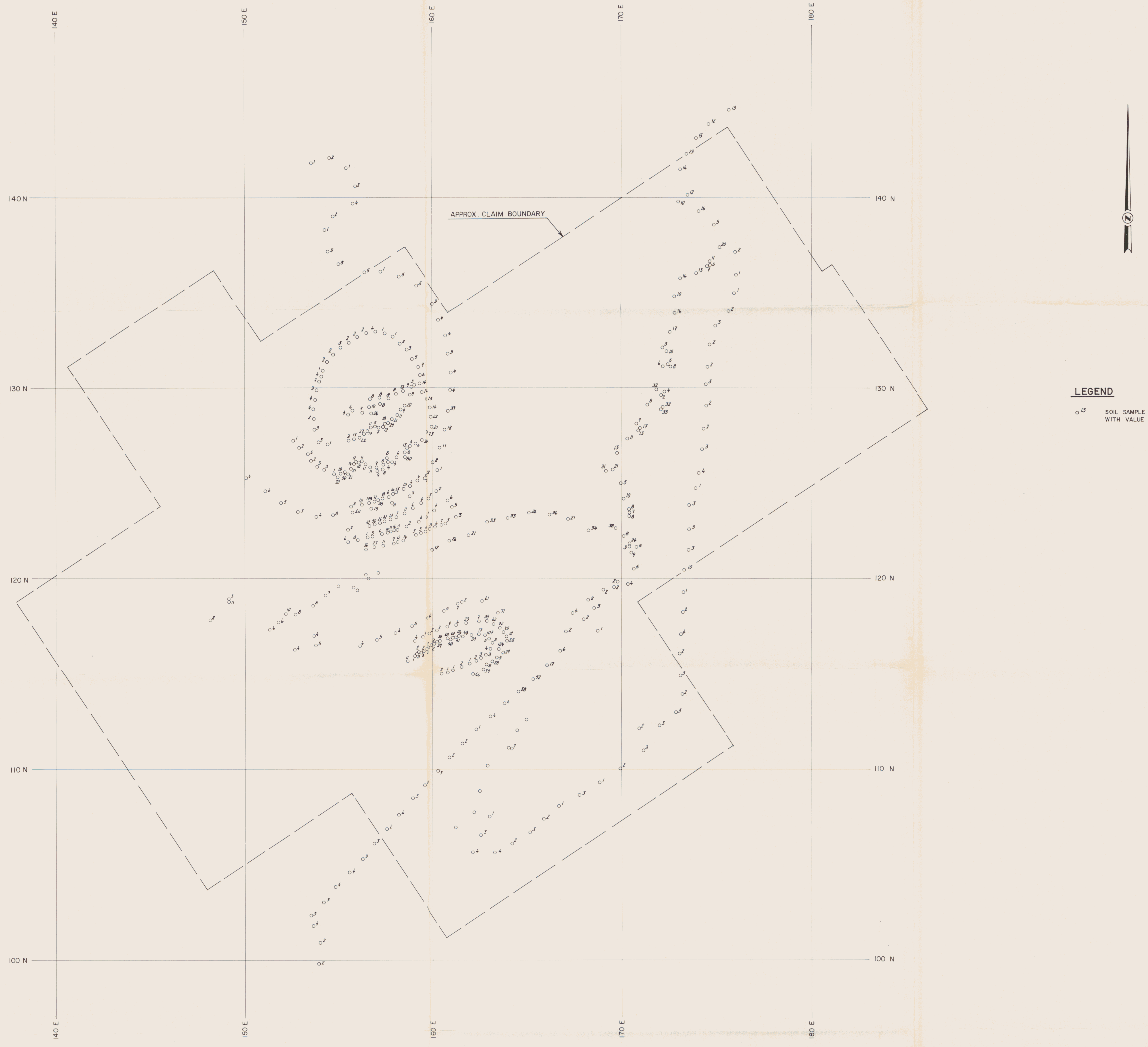
○ 130 SOIL SAMPLE STATION WITH VALUE FOR Cu IN PPM.

DU PONT EXPLORATION
CANADA

KLINKIT JOINT VENTURE
ICE PROJECT
Cu GEOCHEMISTRY
I CLAIMS
DORSEY RANGE, YUKON TERRITORY

1 : 10 000
m 300 200 100 0 300 600 m
SCALE

MAPPED BY :	F. M. S.	REVISED :	N. T. S. No. : 105 B
DATE :	JUN.- JULY '79		ACCT No. : 335 - 28
DRAWN BY :	C. H. K.		DRWG No. : KL. 79 - 76
DATE :	JAN. 1980		



LEGEND

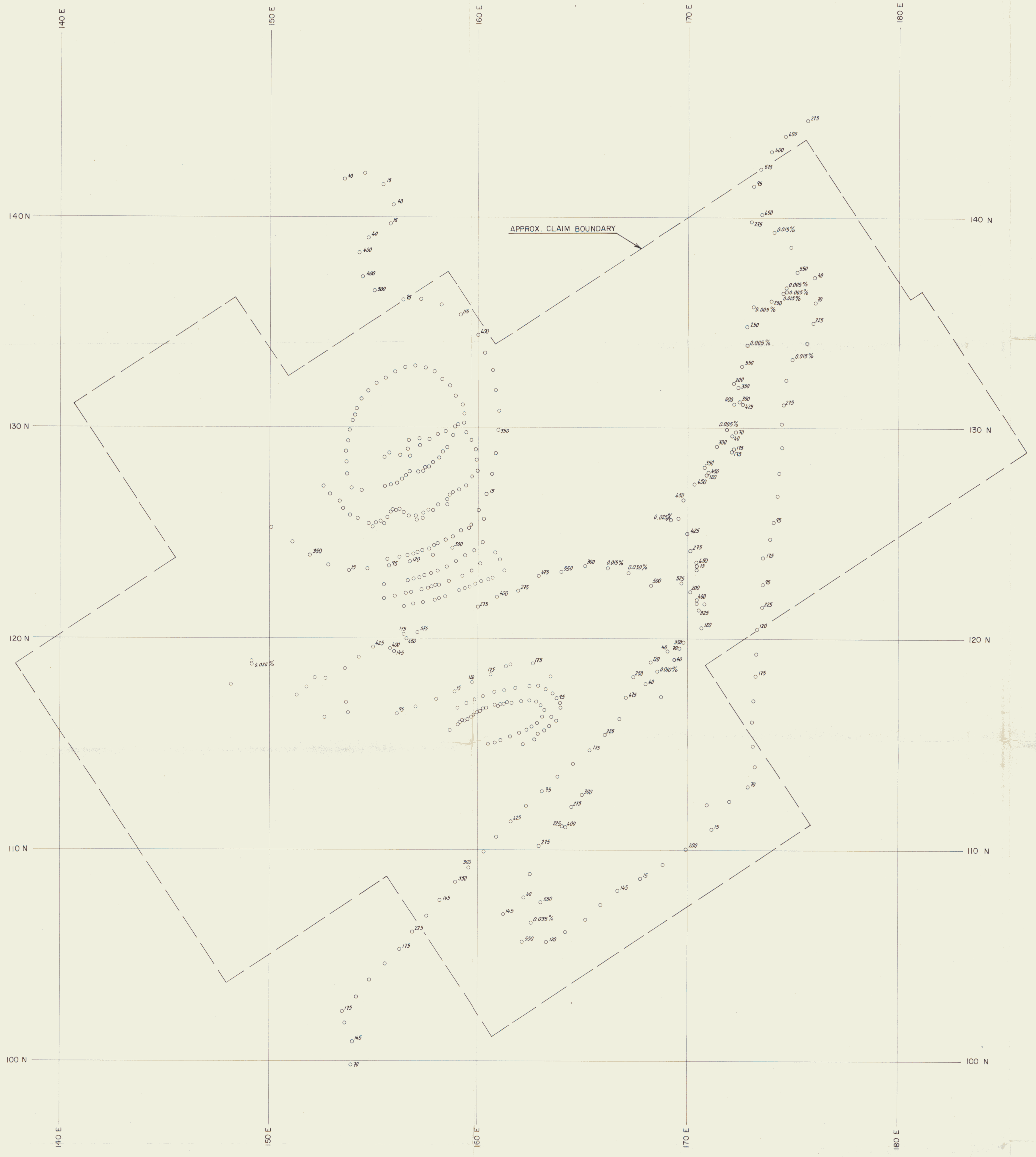
○13 SOIL SAMPLE STATION WITH VALUE FOR Mo IN PPM.

DU PONT EXPLORATION
CANADA

KLINKIT JOINT VENTURE
ICE PROJECT
Mo GEOCHEMISTRY
I CLAIMS
DORSEY RANGE, YUKON TERRITORY

1 : 10 000
m 300 200 100 0 300 600 m
SCALE

MAPPED BY : F. M. S.	REVISED :	N.T.S. No. :	105 B
DATE : JUN.-JULY '79		ACCT No. :	335 - 28
DRAWN BY : C.H.K.		DRWG. No. :	KL.79-77
DATE : JAN. 1980			



LEGEND

○ 300	SOIL SAMPLE STATION WITH VALUE FOR Sn IN PPM.
○ 0.015%	SOIL SAMPLE STATION WITH VALUE FOR Sn IN PERCENT

DU PONT EXPLORATION
CANADA

KLINKIT JOINT VENTURE
ICE PROJECT
GEOCHEMISTRY
I CLAIMS
DORSEY RANGE, YUKON TERRITORY

1 : 10 000
m 300 200 100 0 300 600 m
SCALE

MAPPED BY :	F. M. S.	REVISED :	N.T.S. No. :	105 B
DATE :	JUN.-JULY '79		ACCT No. :	335 - 28
DRAWN BY :	C.H.K.		DRWG. No. :	KL.79-78
DATE :	JAN. 1980			

LEGEND

○10	SOIL SAMPLE STATION WITH VALUE FOR W IN PPM.

DU PONT EXPLORATION
CANADA

KLINKIT JOINT VENTURE
ICE PROJECT
W GEOCHEMISTRY
I CLAIMS
DORSEY RANGE, YUKON TERRITORY

1 : 10 000
m 300 200 100 0 300 600 m
SCALE

MAPPED BY :	F. M. S.	REVISED :	N.T.S. No. :	105 B
DATE :	JUN.-JULY '79		ACCT No. :	335 - 28
DRAWN BY :	C. H. K.		DRWG. No. :	KL. 79 - 79
DATE :	JAN. 1980			