GEOLOGICAL AND GEOCHEMICAL REPORT
on
THE TOODOGGONE PROPERTY
OMINECA M.D. N.T.S.94E/6E
lat.57°20'N,long.127°01'W June14-July18/72
for
DENISON MINES LIMITED
94E/6E, 7W
by
K.G.Sanders,P.Eng. & P.Pisani, Nov.30/72

1604

M.R.

GEOLOGICAL AND GEOCHEMICAL REPORT

ON

THE TOODOGGONE PROPERTY

(NE 1-24, NE 26-49, NE 51, NE 59-61, NE 99-106,
GO 90, GO 92, GO 94, GO 96, GO 98, GO 100, GO 102-114, RI 101-103)

OMINECA M.D. N.T.S. 94E / 6E

LAT. 57°20" N, LONG. 127°01' W June 14-July 8,1972

FOR

DENISON MINES LIMITED

By

K.G.Sanders, P.Eng. and P.Pisani

4091

November 30, 1972

Department of
Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 4091 MAP

Mining Recorder's Office
RECORDED
DEC 22 1972
AT SMITHERS, B.C.

INDEX

INTRODUCTION

An exploration program was carried out over a property held by Denison Mines Limited in the Toodoggone Lake area. The field program was completed in the June 14 - July 8, 1972, period; it included geological mapping and soil,silt, and rock chip sampling and it aimed to assess the potential of the area for gold and silver.

The property adjoins to the south a large group of claims (Saunders, Chappelle), which are being actively explored by Kennco Explorations (Western) Ltd. for gold, silver and copper. To the east it adjoins the Spartan property, held by Quebec Cartier Mining Company and presently inactive.

LOCATION AND ACCESS

The property lies along Saunders Creek, a small stream flowing northward into Toodoggone River, which in turn flows eastward into the Finlay River. It is located 120 miles east of Eddontenajon (on the Cassiar-Stewart highway) and 180 miles north of Smithers (see Fig. 1). It is accessible by helicopter from either locality. The B.C.R. extension, when completed in 1974, will pass about 50 miles to the SW.

CLAIMS

The following is a list of the claims held by Denison Mines Limited: (see Fig. 2).

CLAIM	RECORD No.	CLAIM	RECORD No.
NE 1-24	107463-86 incl.	GO 94	107654
NE 26-49	107488-511 incl.	GO 96	107656
NE 51	107513	GO 98	107658
NE 59-61	107521-23 incl.	GO 100	107660

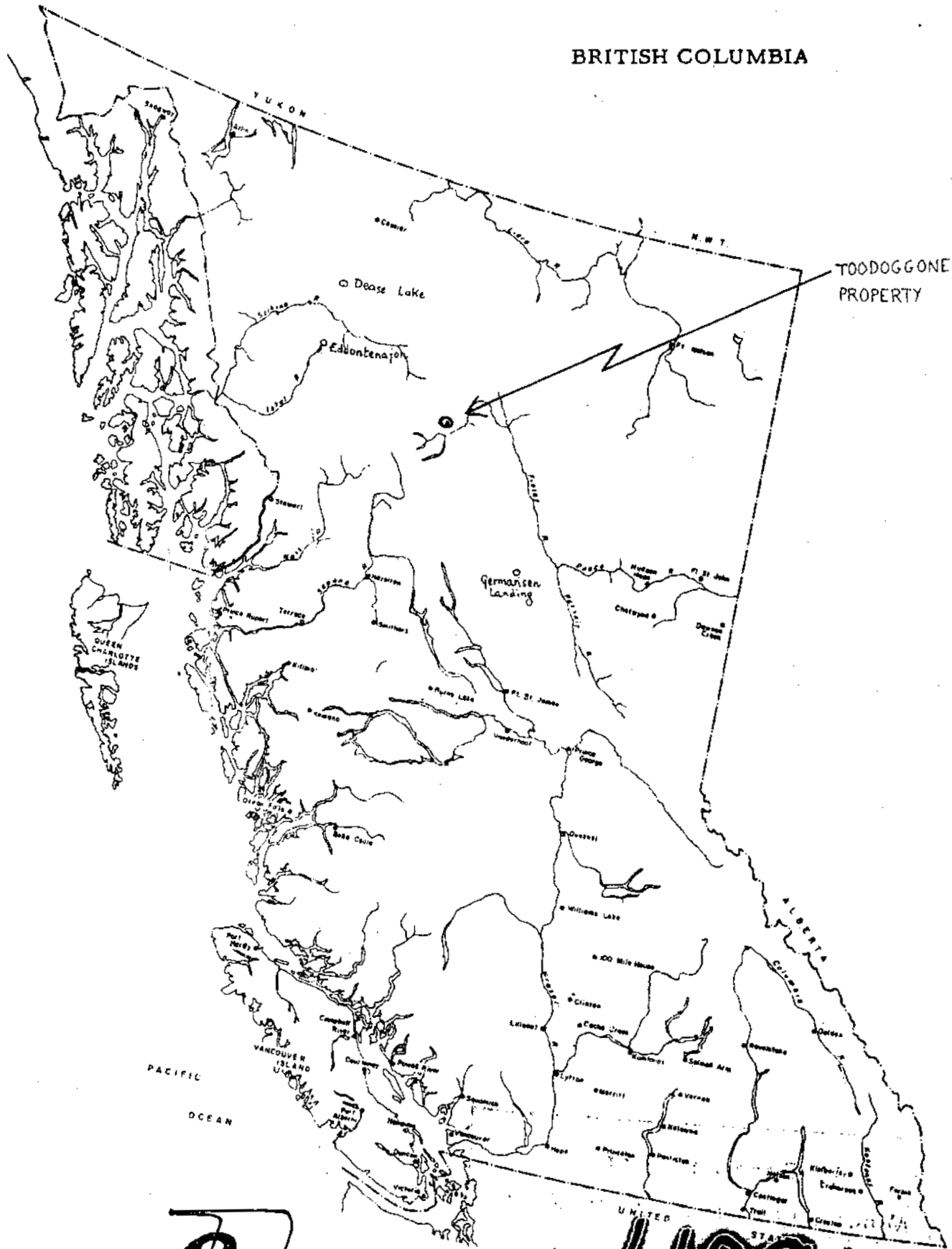
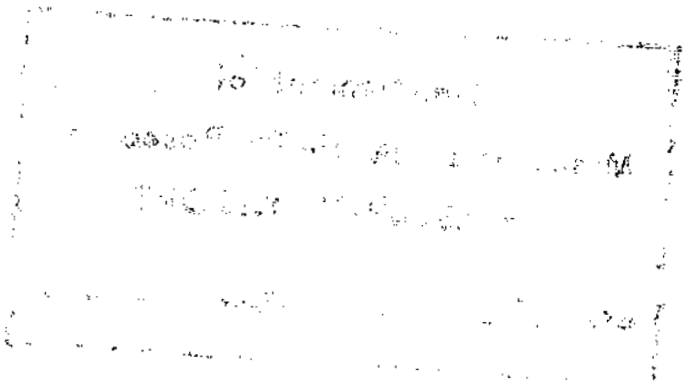


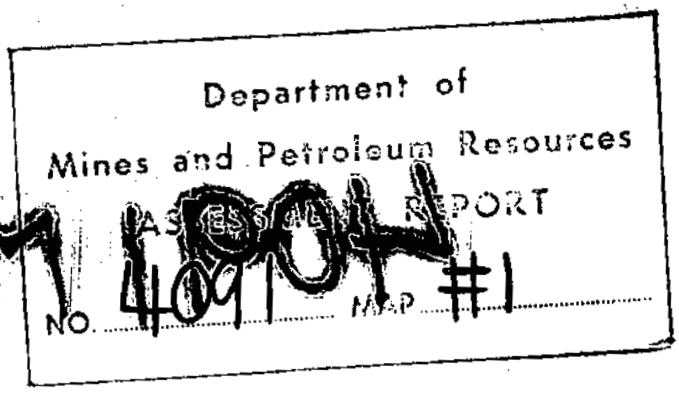
FIG. 1

LOCATION MAP

DENISON MINES LIMITED - VANCOUVER, B.C..

4091 M-1

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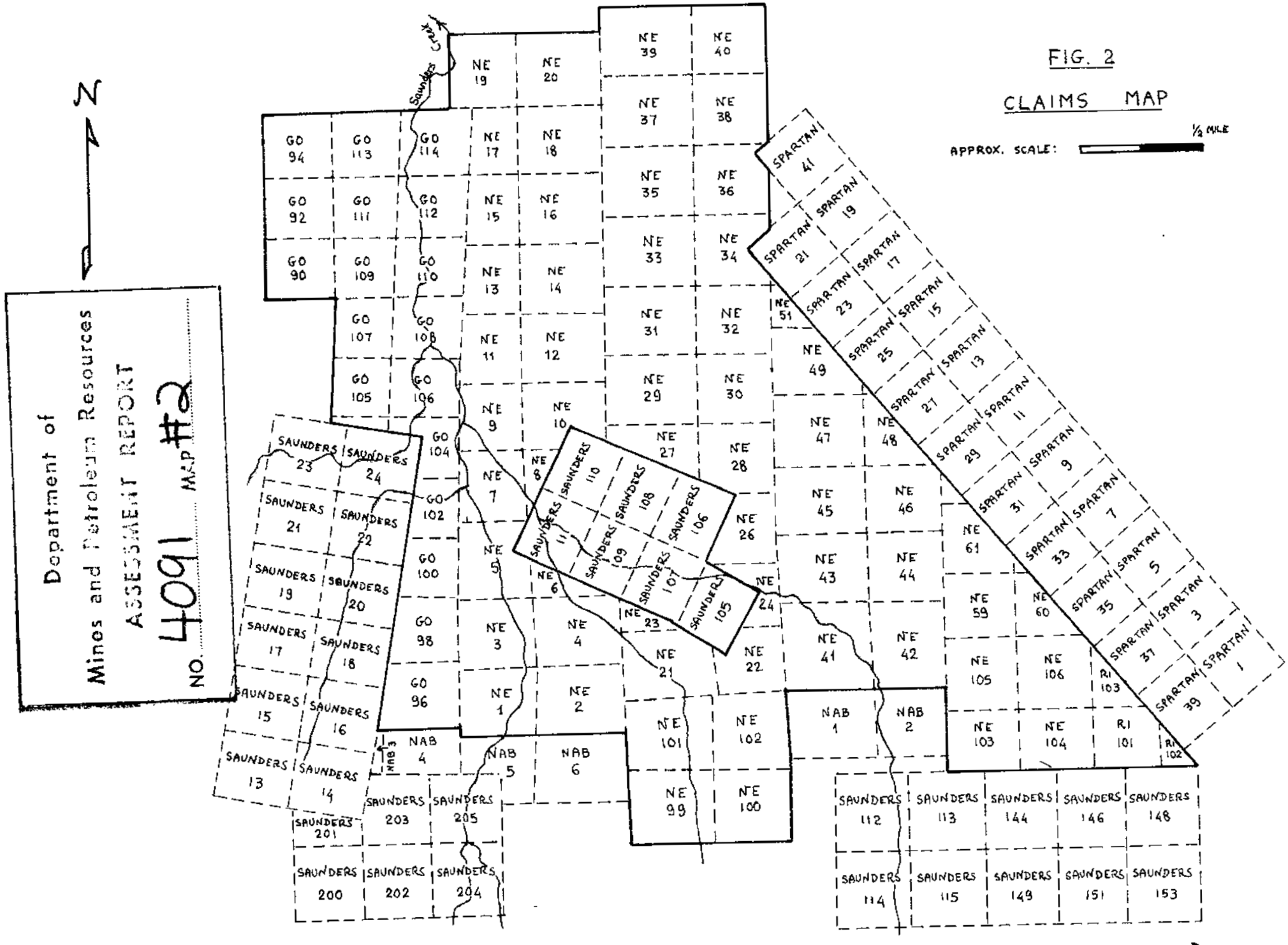
FIG. 2
CLAIMS MAP
APPROX. SCALE: ½ MILE
N
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Saunders Creek
GO 94
GO 113
GO 114
GO 92
GO 111
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GO 108
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GO 102
GO 100
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SAUNDERS 110
SAUNDERS 108
SAUNDERS 106
SAUNDERS 111
SAUNDERS 109
SAUNDERS 107
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SAUNDERS 13
SAUNDERS 14
SAUNDER3 201
SAUNDERS 203
SAUNDERS 205
SAUNDERS 200
SAUNDERS 202
SAUNDERS 204
NAB 3
NAB 4
NAB 5
NAB 6
NAB 1
NAB 2
SPARTAN 41
SPARTAN 19
SPARTAN 21
SPARTAN 17
SPARTAN 23
SPARTAN 15
SPARTAN 25
SPARTAN 13
SPARTAN 27
SPARTAN 11
SPARTAN 29
SPARTAN 9
SPARTAN 31
SPARTAN 7
SPARTAN 33
SPARTAN 5
SPARTAN 35
SPARTAN 3
SPARTAN 37
SPARTAN 1
SPARTAN 39
NE 51
NE 49
NE 47
NE 48
NE 45
NE 46
NE 61
NE 43
NE 44
NE 59
NE 60
NE 41
NE 42
NE 105
NE 106
RI 103
NE 103
NE 104
RI 101
RI 102
SAUNDERS 112
SAUNDERS 113
SAUNDERS 144
SAUNDERS 146
SAUNDERS 148
SAUNDERS 114
SAUNDERS 115
SAUNDERS 149
SAUNDERS 151
SAUNDERS 153

CLAIM	RECORD No.	CLAIM	RECORD No.
NE 99-106	109573-80 incl.	GO 102-114	107662-74 incl.
GO 90	107650	RI 101-103	107129-31 incl.
GO 92	107652		

TOTAL : 82 Claims

For assessment purposes the above claims have been grouped into the following three groups:

TOOD 1 : NE 1-20, GO 90, GO 92, GO 94, GO 96, GO 98, GO 100, GO 102-114

TOOD 2 : NE 21-24, NE 26-36, NE 41-49, NE 51, NE 59-61, NE 99-106, RI 101-103

TOOD 3 : NE 37-40

GEOGRAPHY

The area is mountainous with elevations ranging between 4,000' and 6,500'. The timber line is around the 5,000' level. The topography is characterized by broadly U-shaped valleys, sometimes hanging, separated by ridges, either knife-edged or flat-topped, rising 1,500' - 2,500' above the valleys floor. Glaciation is evidenced by the valley profiles, numerous cirques, local rock drumlins, very rarely by striae and erratics.

Outcrops abound along the ridges, to the top of the valley slopes and in the cirques. Over the remaining areas overburden is presumably shallow and it consists of a thin layer of top soil, not everywhere developed, overlying rock slides and possibly gravelly till. In the valley bottoms thick sandy and silty stream deposits form a flood plain averaging 300' - 500' in width and probably over 100' thick in the center; over this plain the present streams meander, rarely cutting incisions

up to 20' deep.

REGIONAL GEOLOGY

The Toodoggone sheet (N.T.S. 94E) has not been covered by the G.S.C. geological mapping. In 1971 N. C. Carter, of the B.C. Department of Mines, carried out a reconnaissance survey of the area to the south of Toodoggone Lake; his findings will appear in the 1971 B.C. G.E.M. report. The following is an outline of the geology, based on Carter's personal communication.

The area is underlain by a predominantly volcanic assemblage intruded by small monzonitic plugs of the Omineca intrusion. To the SW shallow dipping conglomerates and pebbly sandstones of the Sustut group (Upper Cretaceous to Lower Eocene) unconformably overlie the volcanics. The volcanic assemblage can be subdivided into the Takla group (andesite flows and agglomerates with interbedded minor massive limestone) and a more recent, possibly Upper Cretaceous group, tentatively denominated Toodoggone volcanics, composed of feldspar porphyry breccias, having lithological features similar to the andesitic breccias of the Newman Peninsula. The general structural trend in the area is NW - SE, although dikes and quartz veins striking NE - SW, possibly related to tension fractures, have been observed.

HISTORY

The area to the north of the Toodoggone river has a history of gold placer mining going back to the twenties (see the 1927 A Summary Report of the G.S.C.). In the sixties the interest was centered around the gossan zones, strong and widespread over the whole area, particularly in the Takla volcanics. Kennco, Cominco and Quebec Cartier investigated

the zones for their copper and molybdenum potential apparently with inconclusive results. Only recently the interest has shifted to gold and silver, following the discovery by Kennco of quartz veins in the Takla, containing high gold and silver values in the form of electrum. Unconfirmed reports also indicate that the Toodoggone volcanics have some potential for disseminated type deposits of gold and silver, as suggested by promising results obtained by Kennco in the course of a soil and rock chip sampling program.

GEOLOGY

GENERAL

The property has been geologically mapped using the 1"= ½ mile aerial photo A 12302-24 of the National Topographic Series. All the outcrops have been plotted as well as the largest patches of talus and float. A distinction between the two has been made, meaning by talus the material obviously derived from the immediately over-lying outcrops and by float the broken material whose source, although presumably not far, is not obvious. Six grab samples, representative of the main lithotypes, have been selected and studied in thin section (see Appendix).

The results of mapping have been transferred to a map having the same scale as the photo. By scaling off distances on the photo between points whose actual distance is known through chaining, it is observed that the photo scale is about 10% larger than indicated, i.e. roughly 1"= 2,400' rather than 1"= 2,640', Distortion is minor, except for the very outer edge of the photo.

LITHOLOGY

The property is underlain by volcanic flows and breccias, including minor intercalation of tuffaceous sandstones, and

locally cut by narrow basaltic dikes. A description of the lithotypes follows:

1) Porphyry dacite - This is largely predominant rock type, constituting over 95% of the exposures. It is composed of pink or white, seldom orange, euhedral to subhedral plagioclase phenocrysts, averaging 2 mm in size and comprising 10% to 30% of the whole rock; dark green, euhedral amphibole, commonly chloritized, in 1 to 3 mm. long prisms, varying in amount from none to 10%; 5-10% quartz, deep green or white, in 2-5 mm. rounded " drops "; occasionally biotite or pyroxene in scattered phenocrysts. The groundmass is fine grained to aphanitic, medium to dark grey or pinkish, always with a greenish tinge. Petgrographic studies (see P 12, P 23 and P 47) show the groundmass to be predominantly composed of strongly saussuritized plagioclase, chlorite and quartz. The composition of the plagioclase phenocrysts is uncertain: because of its advanced alteration, only two determinations were possible, which indicated a composition of Ab_{70} An_{30} (oligoclase). A tentative distinction has been made in the field between a " pink type " and a " grey type ". The pink type has a lighter colour and finer groundmass, it is more fissile and tends to split in tile shaped fragments and to form knife edged ridges in contrast with the flat ridges of the more massive and weathering resistant grey type. The latter appears to underlie the pink type, although intercalations and transitious are common. Presumably the difference betweent the two rock - types is related to a varying degree of alteration more than to a dissimilar original composition. The dacitic flows predominate over the breccia: in the latter, the fragmental texture is not conspicuous and it is indicated by semi-angular fragments, averaging ¼" - 2" in size, having dark colour and not pronounced porphyritic texture, included

in the usual porphyry dacite.

2) Tuffaceous sandstones - They constitute not more than 2% of the whole assemblage and occur in bands up to 50' wide conformably intercalated with the volcanic flows, becoming more abundant towards the southern end of the property. They are fine to coarse grained, grey-greenish or cream, locally banded, well bedded, with occasional large grains of plagioclase. The modal composition (see P 35) is similar to the one of the porphyry dacite. They are probably composed of fine debris eroded from adjoining volcanic terranes between periods of volcanism, transported by either water or wind and rapidly accumulated.

3) Basalt dikes - Parallel swarms of basaltic dikes, 2'-5' thick and steeply dipping, occur throughout the property. The dikes strike NW-SE, except in one instance where a N-S strike was observed, and are obviously related to shear zones. The contact with the enclosing volcanics is very sharp, with the volcanics displaying minor baking for only a few inches. The rock is a black, fine grained basalt, with a few white feldspar and secondary white quartz grains, 1% disseminated magnetite, and occasionally small amygdules filled with crystalline calcite and quartz.

4) Feldspar - quartz porphyry - It has been observed in the field only along a ridge in the SW corner of the property across a width of 650'. It consists of 1-3 mm. white, rounded or prismatic phenocrysts of plagioclase constituting 40% - 50% of the rock; 10% subhedral glassy quartz; a few flakes of biotite; 0.5% - 3% finely disseminated pyrite, in a dark grey, saussuritic - chloritic matrix. The composition of the plagioclase, by microscopic determination (see P 20), is Ab_{55} An_{45} (andesite). To the north the feldspar-quartz porphyry is cut by a fault. To the

south it comes in contact with pink dacite; the contact is rather sharp, with the dacite including angular fragments of feldspar-quartz porphyry, which would indicate an earlier age of the latter. Although the feldspar-quartz porphyry is microscopically similar to the porphyry dacite, it has been mapped as a separate unit because of its unique macroscopic features, such as the extremely pronounced porphyritic texture, the abundance of subhedral quartz phenocrysts and the unusual amount of pyrite mineralization.

STRUCTURE

Determination of attitudes in the porphyry dacite is made dificult by the generally massive nature of the flows and breccias, the presence of intersecting and strong sets of joints which can be mistaken for bedding and the frequent slumping of beds related to frost action and steep slopes. The general strike appears to be NW-SE, with dip of 30^0 - 70^0 to the NE, but drastic changes over short distances can occur. Jointing is well defined and usually spaced 1' - 3'. Several sets of joints have been mapped, invariably vertical or steeply dipping; the prevalent sets are sub-perpendicular and striking to the NW and NE.

Faults are exposed in few places, in zones as much as 100' wide, displaying fine brecciation, recementation by a network of quartz veinlets, alteration (silicification, carbonation and oxidation) and local leaching. They are topographically expressed by depressions in the ridges and, possibly, by the course of the creeks. Gossan zones and basaltic dikes are commonly associated with the faults, although they can be indicative of simple weakness areas without displacement. One major fault can be followed along the eastern branch of Saunders Creek, striking N-S and extending to the north beyond the watershed; several minor faults, striking NW-SE to WNW-ESE,

are believed to branch off from this fault. No determination as to dips and amount of displacement has been made.

ALTERATION AND MINERALIZATION

Epidote alteration is very widespread through the property, being very intense along a band running N-S along the centre of the property and decreasing on both sides (see Fig.3); it occurs as a replacement of the plagioclase phenocrysts or as coating along fractures or finely disseminated in the groundmass as alteration of plagioclase to saussurite. As a general rule the pink dacite is more affected by epidote alteration than the grey one and the alteration is more intense at higher elevation. It is believed that epidote alteration is the result of regional retrogressive metamorphism in the volcanics rather than of proximity with Omineca intrusion. Not quite so intense but as widespread is the chlorite alteration, which affects the femic minerals, both as phenocrysts and constituents of the groundmass, and imparts a greenish tinge to the rock. Kaolinization, silicification and carbonation are mainly restricted to shear zones.

Gossan zones - are widespread on the property, although they are not comparable in size and intensity with the zones observed in the adjoining Quebec Cartier and Kennco ground. They are 10' to 50' wide and occur in the pink and grey porphyry dacite as well as in the feldspar-quartz porphyry. The rock is medium grained, strongly bleached, siliceous, with 10% small cavities partially coated with limonite. The petrographic study (see P 6) shows it to be constituted by subhedral grains of quartz in a kaolinitic-sericitic matrix, the latter being the product of plagioclase alteration. Gossan is always related to some form of shearing (fracturing or faulting), but is not necessarily indicative of significant mineralization. The brown-orange colour, quite spectacular from a distance, is the result of alteration and weathering in areas of weakness

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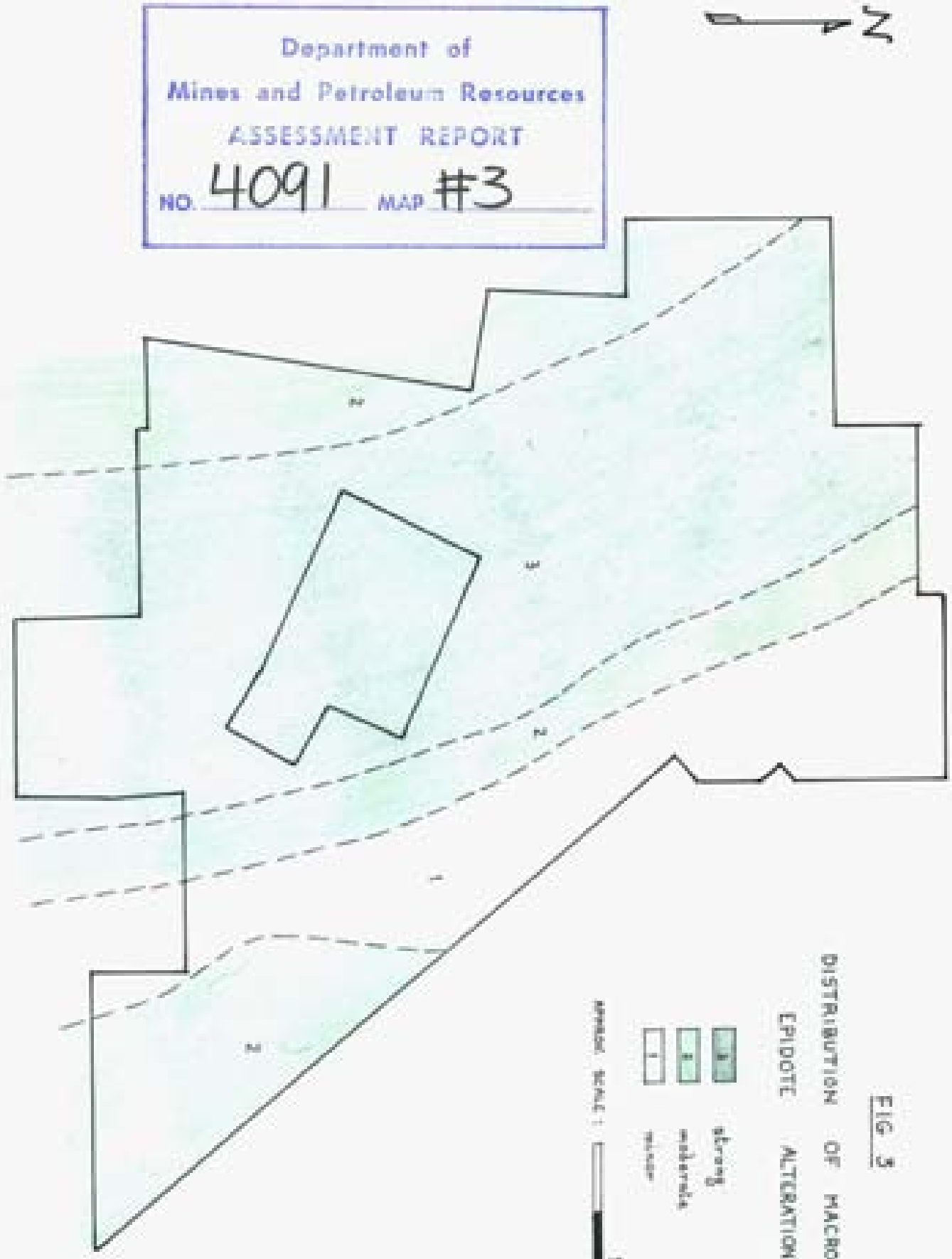

FIG. 3
DISTRIBUTION OF MACROSCOPIC EPIDOTE ALTERATION

more than of actual introduction of mineralized solutions: the plagioclase has been altered and partially removed, the femic minerals have been removed, the syngenetic (and epigenitic ?) Fe sulphides and oxides have altered to limonite and, to a lesser degree, to goethite, which migrated and redeposited along the weathered surface of the rock and in the overlying soil. The process of leaching and redeposition of secondary Fe oxides is a continuous one and persisted long after the shearing took place. This is confirmed by an outcrop of Pleistocene conglomerate, observed in the SE corner of the property, constituted by ¼-½" subrounded volcanic fragments in a sandy friable matrix. The matrix has a bright orange colour from much disseminated limonite, obviously as a result of deposition of Fe oxides leached from the underlying dacite. The same rock-type was observed 200' to the south, completely unmineralized. The implication is that gossans are mostly the result of alteration and weathering in weakness areas, although some mineralization has presumably occured along such areas. The significance of gossan as a guide to gold and silver is discussed in the " Relationship between geology and geochemistry "

Pyrite is disseminated in trace amounts in the volcanics, exceeding 1% only in the feldspar-quartz porphyry band.

CONCLUSIONS

The dominant rock type on the property is a porphyry dacite grading into porphyry andesite (5%-10% quartz represents the border line between dacite and andesite). The main form of alteration is saussuritation, very prominent all through. Both lithology and alteration features are typical of the upper division of the Takla formation of Jurassic age. N.C.Carter, during his 1971 mapping, has interpreted the property as being underlain by Takla volcanics to the north and Toodoggone volcanics to the south, the contact corresponding in places to our

interpreted contact between grey and pink porphyry dacite. Although admittedly only tentative conclusions can be drawn by the mapping of such a small area, it is believed that grey and pink porphyry dacite belong to the same formation, the lithological dissimilarities being the result of different alteration and minor variation in primary composition, and that the whole property is underlain by upper Takla volcanics. No intrusive plugs nor signs of contact metamorphism have been recognized in the field. Quartz veins,which are the host rock for the high grade gold and silver found in the Kennco ground, were not observed either in outcrops or float: considering the large amount of exposures, this fact strongly suggest that no quartz veins occur on the Denison property.

The local structural trend coincides with the regional one, i.e. NW-SE, but some strong shearing running N-S has been mapped.

GEOCHEMISTRY

GENERAL

Lines spaced 800' apart were chained and flagged in a N-S or E-W direction, according to the prevailing topography. Soil samples were collected at 200' intervals wherever feasible; where no sufficent soil was available rock chips from outcrops or rock slides were collected.

The program was integrated with additional rock chip sampling along the ridges at 200' or 400' intervals and silt sampling along the major streams at 1,000' intervals. In total 744 soil, 197 rock chip and 45 silt samples were collected. The results have been transferred to two 1"-400' plates.

SOIL AND ROCK CHIPS SAMPLING

a) Geochemical environment - The fast rate of physical

weathering and erosion, caused by the steep slopes prevailing over most of the property, has prevented the formation of distinct soil horizons. The soil along the valley slopes with a gradient of over 10^0, constituting about two thirds of the aerial extent of the property, is characterized by shallowness, free drainage, weak horizons differentiation and high proportion of intermixed rock debris. Where the topography is more gentle, particularly to the north, a well developed brown-orange " B " horizon directly underlies a 2"-4" thick " A_0" layer. Over about 1/6 of the area no soil is present, either because of rock outcrops or slides.

b) Sampling - The soil samples were taken with a shovel from the top of the " B " horizon, wherever possible, at depths ranging between 2" and 14". Along the valley slopes a depth of over 8" could seldom be reached, because of a continuous layer of debris underlying the thin soil cover; the soil is usually medium to dark brown, sandy, with much intermixed gravel. In the areas of gentle slopes the " B " horizon was usually reached with no difficulty. Where no sufficient soil was available, about 10 small rock chips were taken at random in a 10' radius around the station site.

c) Analyses - The soil samples were analyzed for Ag and the rock chips for Ag and Au in the Vancouver laboratory of Bondar-Clegg & Co. Ltd. The samples were dried in infra-red heated oven at 40^0 to 50^0 C (or crushed) and sifted to -80 mesh. Ag and Au were extracted by hot aqua-regia and determined by atomic absorption (Ag) and fire assay (Au).

d) Discussion of the results - A histogram of the Ag

values in the soil and rock chips samples has been prepared (see Fig. 4): it shows that the background is 0.7 Ag p.p.m. and the threshold 1.1 Ag p.p.m. for the rock chips samples and 1.3 Ag p.p.m. for the soil samples. On this basis several anomalous areas have been outlined, characterized by small size, moderate contrast and a not well defined orientation to the N or NNE. One noticeable exception is the anomaly on line 40S, 60E, having a peak value of 70 times the threshold (in a rock chip sample). The anomalies themselves are concentrated in a broad band trending WNW-ESE and running along the central part of the property (see Fig.5).

The anomalies are probably superjacent, i.e. they practically overlie the metal source; this assumption is based on the following observations:

1. The close relation existing between contiguous soil and chips samples; the slightly higher values of the soil samples are caused by minor enrichment in the residual soil due to the relatively higher immobility of silver.

2. The poor secondary dispersion of the anomalies: while erosion is keeping place with oxidization, the metal is being leached from the soil as it moves down the slopes. Therefore the Ag content in the soil approximately reflects the content in the underlying rock, be it in situ or slidden. This fact, while on one side limits the effectiveness of geochemistry by narrowing the surface expression

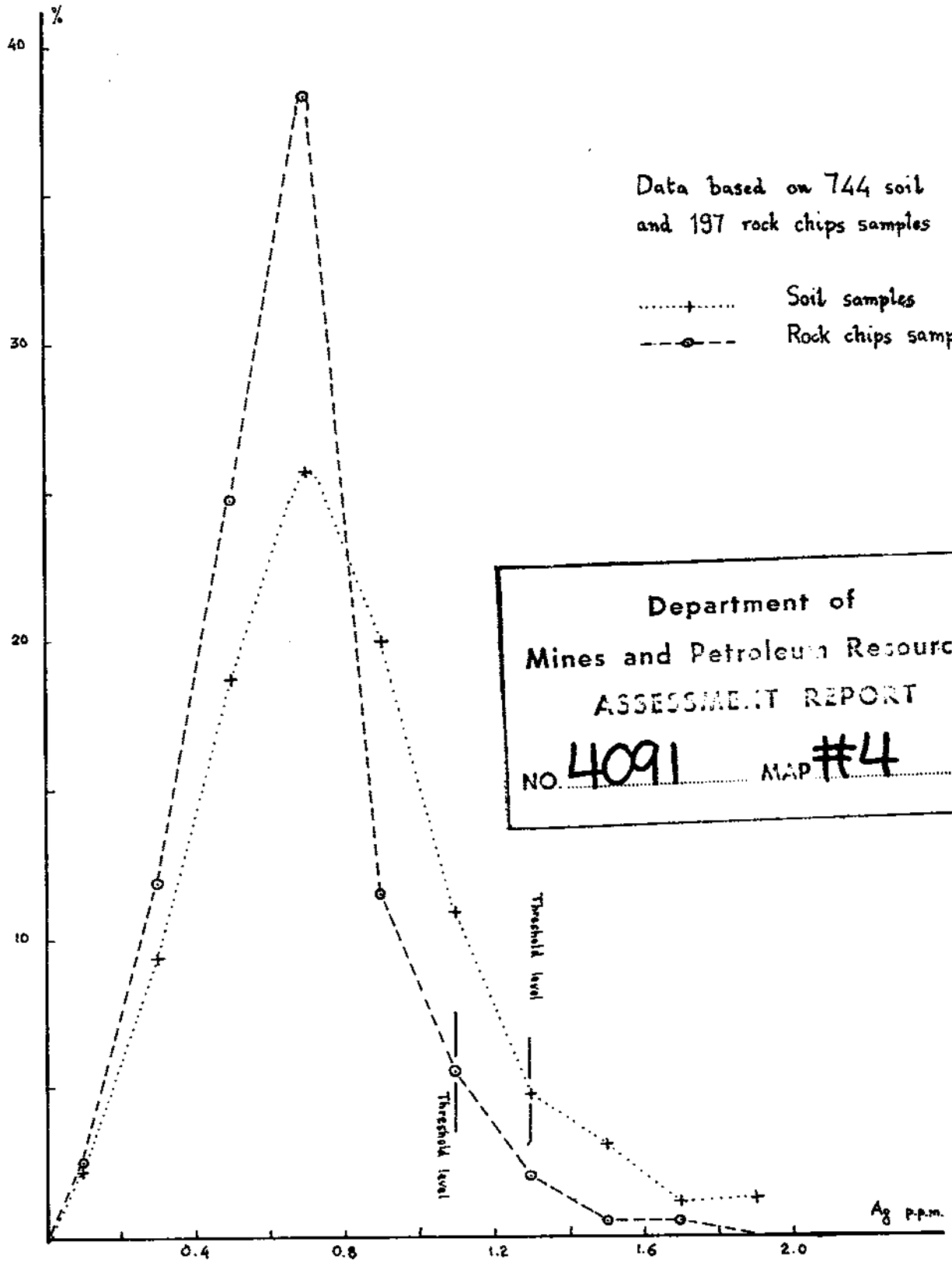

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FIG. 4

HISTOGRAM SHOWING
SILVER DISTRIBUTION
IN SOIL AND ROCK CHIPS SAMPLES

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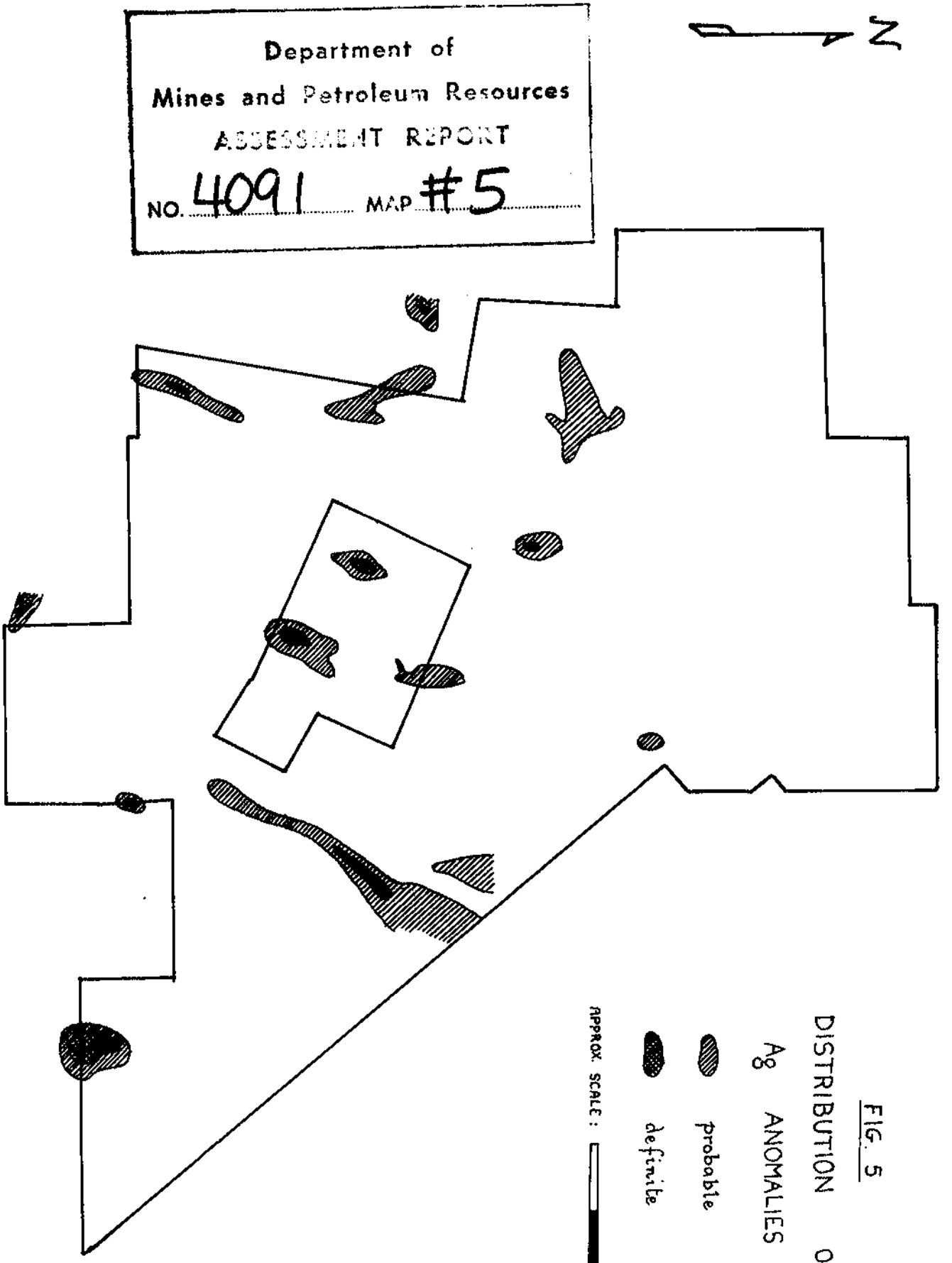

FIG. 5
DISTRIBUTION OF Ag ANOMALIES

of buried mineralized zones, on the other side facilitates the determination of their localization.

Gold values, determined only in the rock chips samples, are generally low, exceeding 25 p.p.b. only in three locations; in two of these locations Ag content is above threshold level (2.4 p.p.m. and 78.0 p.p.m.). Although evidence at present is not conclusive, it is likely that Au values closely correlate with Ag values.

The expected mineralized targets, on the basis of the geological setting and of information from adjoining properties, are of two types: low grade, disseminated type deposits and high grade, narrow veins. Geochemical results all but eliminate potential for the disseminated type; they do not disprove the possibility of a vein type deposit. In this respect even individual highs can be significant and should be followed up by closer sampling. It should be kept in mind that mineralized veins, because of the small size of the target, poor dispersion of the metal and the wide size of the sampling grid used in this first exploration phase, could have been completely missed by the geochemical survey.

SILT SAMPLING

Fine grained sediments from the active channels were sampled and analyzed for Ag and Au with the same procedure described for the soil samples. Metal content is not related to the grain size of the collected samples. Ag values are quite homogeneous, ranging between 0.6 and 1.4 p.p.m., with no apparent high in any particular area. Au values are more heterogeneous, ranging between < 5 and 55 p.p.b., and are consistently higher than background along the western branch of Saunders Creek.

CONCLUSIONS

The following conclusions can be drawn from the results of the geochemical sampling program:

- The soil over possibly two thirds of the property is of residual type and, notwithstanding the high topographical relief, roughly reflects the metal content of the immediately underlying rock.

- In the northern portion of the property the soil profile is better developed and a more pronounced dispersion has taken place.

- Values from soil and rock chip samples are closely related, with the soil samples showing a slightly higher metal content.

- Several silver anomalies have been outlined of small size and contrast. The anomalies have a preferential trend to the N and NNE, and are concentrated in a broad band running to the WNW.

- The most significant anomaly is located around line 40S, 60E, where a peak of 78.0 P.P.M. of Ag and 590 p.p.b. of Au (equivalent to about $ 5.50 / ton at current prices) was obtained in a rock chip sample.

- This anomaly, as well as the other anomalies having peak values of, say, over 3.0 p.p.m. of Ag, should be further investigated with closer sampling. An interval of 50' for soil samples and 10' for rock chip samples is recommended.

- Silt sampling was rather inconclusive, except

for suggesting that the western portion of the property has a somewhat better potential for gold.

RELATIONSHIP BETWEEN GEOLOGY AND GEOCHEMISTRY

The large extent of exposures allows an understanding of the relationship existing between geochemical results and geological (lithology, structure and alteration) features of the rock. The following observations can be made:

1) Most of the anomalies fall over the pink porphyry dacite, although this is no proof that there is a relation between lithology and metal content.

2) There is no connection between epidote or chlorite alteration and geochemical values. This confirms the hypothesis that such alteration is of regional, retrogressive type and does not reflect any localized, hydrothermal activity.

3) The orientation of the individual anomalies and the alignment of the anomalies themselves might be a reflection of the two main structural trends, to the NW-SE and to the N-S.

4) The few samples collected in gossan zones show a higher than background gold content (maybe related to residual enrichment) and a background or higher than background silver content. It is not clear whether the local enrichment is directly related to gossan or it is the result of shearing which also caused the development of gossan. In either case gossan zones are useful mineralogical guides for ore search.

5) The best sample was collected in moderately gossanized pink dacite, which differed from the regular gossan in the unusual amount of goethite and in the higher degree of brecciation. Those features should be kept in mind and used as indicative criteria in the future search for ore.

SUMMARY AND RECOMMENDATIONS

The 1972 field program over the Denison property aimed to assess its potential for silver and gold. On the basis of information from adjoining properties, the targets were expected to be in the form of narrow quartz veins or large disseminated bodies in the volcanics. The geological and geochemical survey has suggested that the potential for either form of mineralization is low. However, not enough is known about the area to exclude the existence of other types of deposits. In particular, the possibility of cavity filling shear zones or tectonic breccia deposits should be further investigated. In the light of the understanding acquired during the 1972 program, it is recommended to investigate small selected areas by detailed geological mapping and close spaced soil and rock chips sampling. The following guides are believed to be of particular significance.

- Gossan zones
- Goethite associated with limonite in the gossan zones
- Topographic depressions along ridges
- Microfracturing

Respectfully submitted,

K. D. Sanders

K. G. Sanders, P.Eng.

P. Pisani

P. Pisani

Vancouver, B.C.
November 30, 1972

STATEMENT OF COSTS

Field Wages:

P.Pisani, geologist. Geological mapping, silt sampling, June 14 - July 8, 1972. 25 days @ $925/montb	$ 750.00
R.Chouinard, geologist. Soil and rock chip sampling, June 14 - July 8, 1972. 25 days @ $30/day	750.00
P.Roman, helper. Soil and rock chips sampling, June 14 - July 8, 1972. 25 days @ $12/day	300.00
Total field wages	$1,800.00

Field Expenses:

Food for three men. 25 days @ $6.00/man/day	$ 450.00
Camp expenses	100.00
Helicopter charges: setting up and dismantling camp, supply trips. Okanagan Helicopters Ltd. 9:30 hours @ $250/hour	2,375.00
Total field expenses	$2,925.00

Analytical Expenses:

986 Ag analyses @ $1.00/analysis	$ 986.00
242 Au analyses @ $3.00/analysis	726.00
789 soil and silt samples preparations @ $.20/sample	157.80
197 rock chips samples preparation @ $.75/sample	147.75
Shipping charges	63.45
6 Au, Ag, Cu assays @ $8/assay	48.00
6 thin sections	154.00
Total analytical expenses	$2,283.00

Compilation Expenses:

P.Pisani, geologist. Data interpretation and report writing. Oct. 1 - 15, 1972. 15 days @ $925/month	$ 462.00

K.Sanders, geologist, Data interpretation and supervision. 5 days @ $50/day.....$ 250.00

Preparation of report (drafting, typing, reproductions etc.)..... 500.00

Total compilation expenses.....$1,212.00

GRAND TOTAL.....$8,220.00

The total amount is pro-rated for purposes of assessment work as follows:

TOOD # 1	Group:	$ 3,920.00
TOOD # 2	Group:	3,900.00
TOOD # 3	Group:	400.00

Respectfully submitted,

K. G. Sanders, P.Eng.

P. Pisani

November 30, 1972

GEOLOGIST'S CERTIFICATE

I, Paolo Pisani, of the district of North Vancouver, B.C. do hereby certify that:

1. I am a geologist and my permanent address is 303 - 900 Berkley Rd., North Vancouver, B.C.

2. I have received a degree in Geology at the University of Milano, Italy, in 1963.

3. I have practiced my profession in Canada for the past six years.

4. I am an employee of Denison Mines Limited and as such I have been personally involved in the exploration program over the Toodoggone property.

P. Pisani

P. Pisani, Geologist

November 30, 1972
North Vancouver, B.C.

ENGINEER'S CERTIFICATE

I, Kenneth G. Sanders of 1940 Limerick Place, North Vancouver, B.C., hereby certify that:

1. I am a practicing Geological Engineer.

2. I am a graduate of the University of Toronto (B. A. Sc., 1949).

3. I have practiced my profession for the past 23 years.

4. I am a registered member of the Association of Professional Engineers of British Columbia.

5. I am an employee of Denison Mines Limited as a district Manager and as such I have personally supervised the geochemical and geological program over the Toodoggone property.

K. G. Sanders

K. G. Sanders, P.Eng.

November 30, 1972
North Vancouver, B.C.

J.A. CHAMBERLAIN CONSULTANTS LTD.

875 ESQUIMALT AVE.
WEST VANCOUVER
CANADA · 604·926-3078

Denison Mines Ltd.

Petrography of Six Rock Samples

P- 6
P-12
P-20
P-23
P-35
47

October 19, 1972

J. A. Chamberlain

CONTENTS

ILLUSTRATIONS

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INTRODUCTION

Six handspecimens were received from Paul Pisani of Denison Mines Ltd., along with corresponding thin sections, on October 12, 1972. It was requested that a routine petrographic analysis be carried out. The present report summarizes the results of this work.

PETROGRAPHY

SAMPLE P-6

Megascopic: a white, medium grained siliceous rock with a yellowish brown weathered surface. The sawn surface exhibits perhaps 10 percent voids as subspherical to irregualr openings, some of which are lined with orange-brown material, probably limonite. The texture is massive.

Microscopic: quarts constitutes roughly 50 percent of the section. It occurs uniformly disseminated through the section in subhedral 0.1 to 0.5 mm grains. The quartz grains for the most part occur "floating" in a matrix of fine grained, semi-opaque material. The opacity no doubt is due to the presence of ultrafine particles of iron oxide. The main matrix mineral appears to be kaolinite with lesser quantities of sericite. A few relict grains of feldspar in the section confirms that this mineral was originally a major constituent.

A rapid modal analysis gives:

quartz	50%	
Kaolinite	35	originally feldspar
sericite	10	
Fe-oxide	< 5	
Opaques	< 1	
	100%	

The rock was originally granitic in composition. It may have contained significant quantities of sulphide which were transported out of the oxidation zone during weathering. Because only a small amount of iron oxide remains, the implication would be that the original sulphides had a high ratio of iron to copper (i.e. were low in copper). However, this is pretty tenuous on the basis of a single specimen.

SAMPLE P-12

Megascopic: a massive-textured rock containing abundant pink phenocrysts in a fine grained dark green matrix. Disseminated grains of pyrite up to 0.5 mm in diameter are present in trace amounts.

Microscopic: the porphyritic texture of the rock is emphasized under the microscope. The phenocrysts, up to 1.5 mm in diameter, are feldspar, now almost completely saussuritzed. Relict polysynthetic twinning is preserved locally, confirming original plagioclase. A few pleochroic chlorite phenocrysts are also present, possibly derived from amphibole. The outlines of most phenocrysts are notably corroded, and many core areas contain irregualr clots of minerals from the groundmass. The groundmass is partly aphanitic and semi-opaque, but also contains abundant angular (fragmental?) grains of similar composition as the phenocrysts.

The composition of the plagioclase could not be determined, so the rock is best classed as an altered feldspar porphyry of igneous origin.

SAMPLE P-20

Megascopic: a strongly mottled dark grey and white rock, porphyritic in white feldspar. The phenocrysts are largely in the 1 to 3 mm diameter range. The matrix is fine grained and medium grey in colour. Trace quantities of disseminated pyrite were noted. Again, the fabric of the rock is massive.

Microscopic: the phenocrysts are largely subhedral plagioclase in varying stages of alteration. Two determinations of composition were in the $Ab_{55}An_{45}$

range (andesine). Quartz in relatively euhedral fresh grains constitutes about one quarter of the phenocrysts. Chlorite, saussurite, magnetite and other opaques make up the rock matrix. The bulk composition is roughly as follows:

Plagioclase	40%	
Quartz	15	
"Saussurite"	40	(groundmass)
Chlorite	3	
Opaques	2	
	100%	

The rock is an altered feldspar-quartz porphyry of igneous origin. If the plagioclase determination is representative, a more specific name would be altered dacite porphyry.

SAMPLE P-23

Megascopic: the rock is porphyritic in pink feldspar with phenocrysts averaging about 1.5 mm in diameter. A bright green mineral occurs in irregular grains and patches locally. The rock texture is massive with a generally igneous aspect.

Microscopic: under crossed nicols, the phenocrysts are found to be even more abundant than indicated in handspecimen. The sizes of the phenocrysts range downward from 4 mm to groundmass-size. Most feldspar phenocrysts are euhedral to subhedral and are in varying stages of alteration. The dominant species is plagioclase with minor K feldspar. Two determinations were made which indicate a composition of $Ab_{70}An_{30}$ (oligoclase). Subhedral to fragmental quartz also constitutes part of the coarser fraction. The green mineral noted in handspecimen occurs in fine grained clumps and appears to be late-generation epidote. Typical textures are noted in Figure 1.

The mineralogical abundances are estimated as follows:

Plagioclase	40%
Quartz	20
Epidote	10
K feldspar	8
Chlorite	2
Spinel	1
Opaques	2
"Saussurite"	17
	100%

The rock is classed as an altered feldspar-quartz porphyry (igneous origin), or quartz latite porphyry.

SAMPLE P-35

Megascopic: a fine grained, massive textured rock having a uniform, pale greenish-grey colour.

Microscopic: a relatively equi-granular rock consisting of fine anhedral grains of plagioclase, quartz and epidote in an aphanitic groundmass of semi-opaque material. The recognizable minerals are either fragmental or sharply corroded, presenting a distinctly chaotic texture (Figure 2). A few grains of pale green spinel of identical type to that observed in P-23 occur in this section. No plagioclase determinations were possible. The mode is approximately as follows:

Plagioclase	30%
Epidote	23
Quartz	5
Spinel	1
Opaques	1
"Saussurite"	40
	100%

This rock exhibits no distinctly volcanic or tuffaceous features. The grains are notably angular, suggesting either a deformational history, or rapid sedimentary accumulation. The mineralogy is remarkably similar to that of specimen P-23, and this may be useful when taken in the light of field relationships.

SAMPLE 47

Megascopic: a rock similar in appearance to P-23, except with somewhat coarser textures both in respect to phenocrysts and matrix. Phenocrysts constitute roughly 50 percent of the rock.

Microscopic: the phenocrysts, up to 4 mm in diameter, are relict grains of K feldspar largely altered to clay minerals. Pennine (chlorite) is

fairly abundant in the groundmass, along with quartz and small quantities of fine opaques.

The modal composition of the rock is as follows:

Feldspar (mainly K spar)	45% (largely altered)
Chlorite	40
Quartz	12
Opaques	3
	100

The rock is classed as a rhyolite. Its texture and alteration suggest the most appropriate name to be altered rhyolite porphyry.

Respectfully submitted

J. A. Chamberlain, P.Eng., Ph.D.

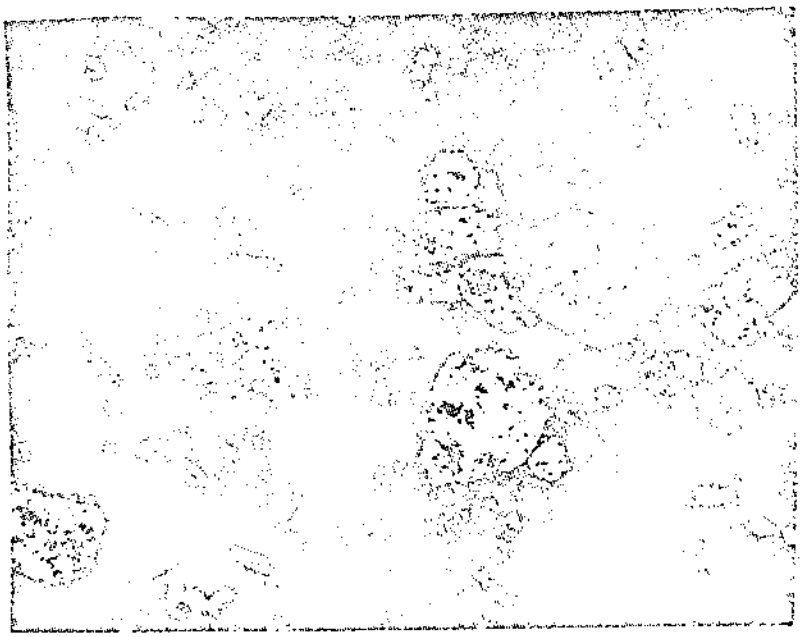


Figure 1 Thin section P-23 showing typical porphyritic textures with phenocrysts of plagioclase and quartz. Note chaotic, fragmental aspect of groundmass. Mag = 28

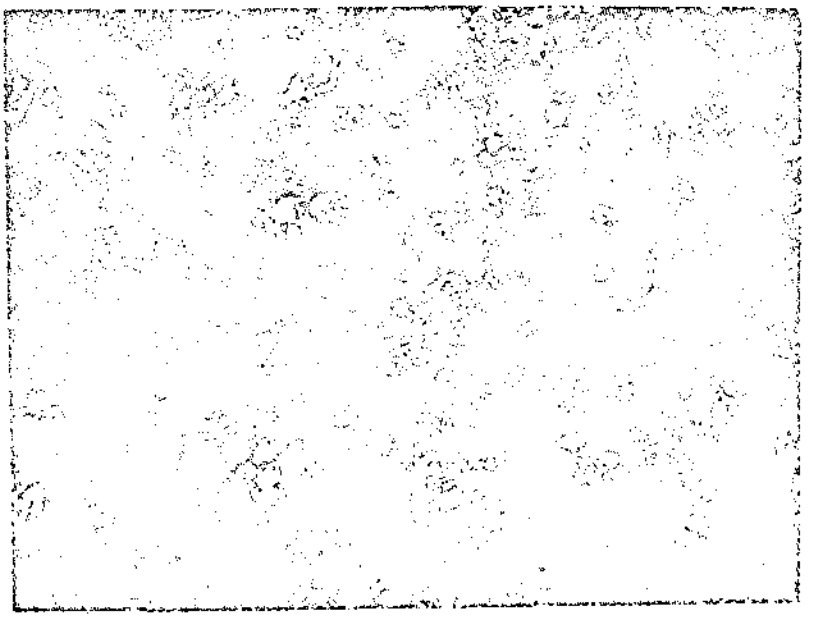
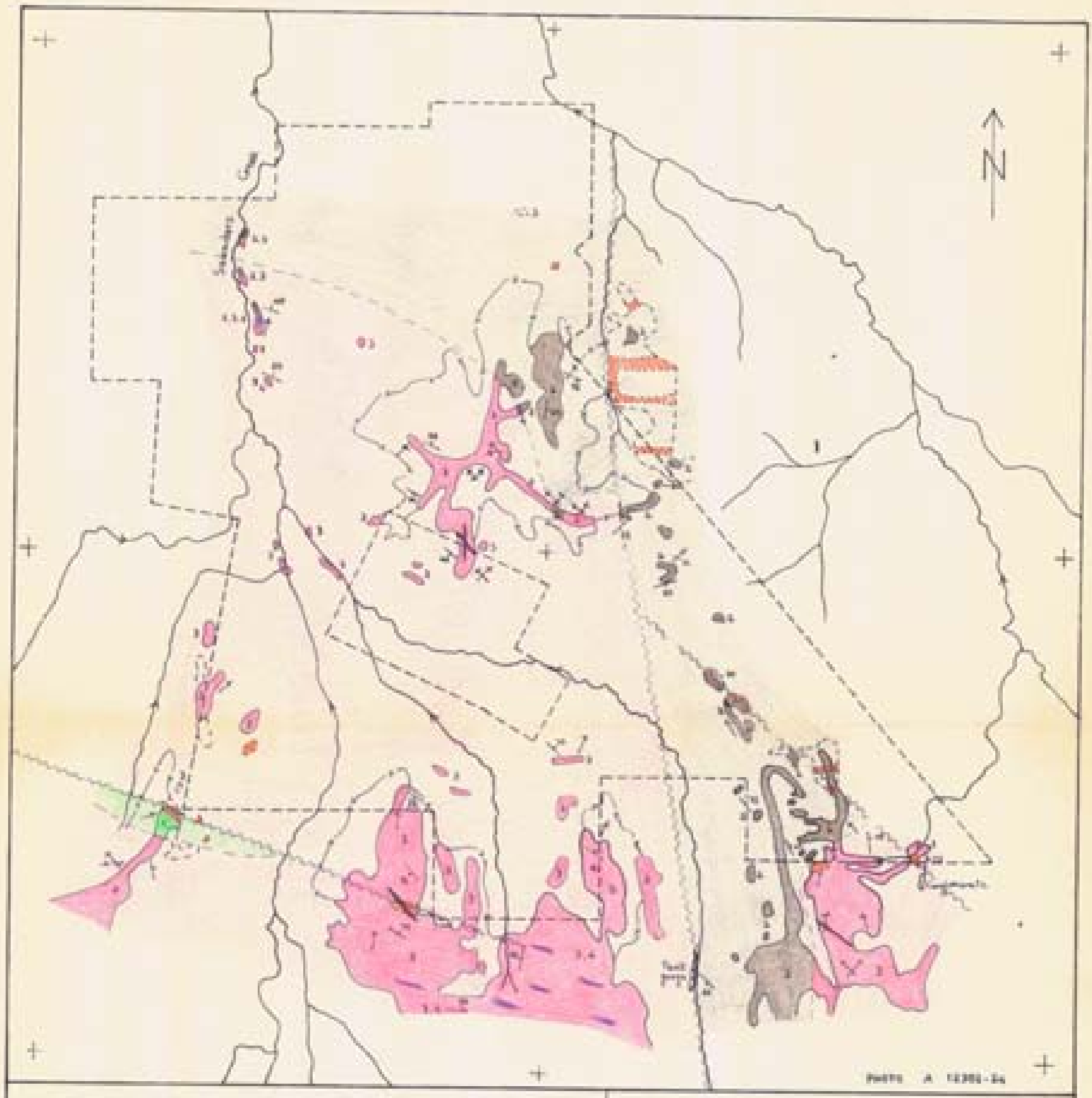


Figure 2 Thin section P-35 showing typical chaotic (fragmental?) textures.



LEGEND

- outline of outcrop
- outline of float
- outline of talus
- bedding
- jointing (inclined, vertical)
- geological contact
- fault
- property boundary

- green
- basalt dikes
- 4 — fragmental sediments
- 3 — pink porphyry dacite
- 2 — grey porphyry dacite
- 1 — feldspar-quartz porphyry

DENISON MINES LIMITED

TOODOGGONE PROPERTY

GEOLOGY

APPROXIMATE SCALE	DATE
1" = 1/2 MILE	NOV. 1972
GEOLOGIST	REF.
P. PISANI	94 E/6 E

To accompany "Geological and Geochemical Report" by K. G. Sanders, P.Eng. and P. Pisani, dated November 30 1972.

K. G. Sanders

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PFile 4091

Department of
Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 4091 MAP #7

To accompany "Geological and Geochemical Report" by K.G. Sanders and P. Pisani, dated November 30, 1972

K.G. Sanders P. Pisani

LEGEND

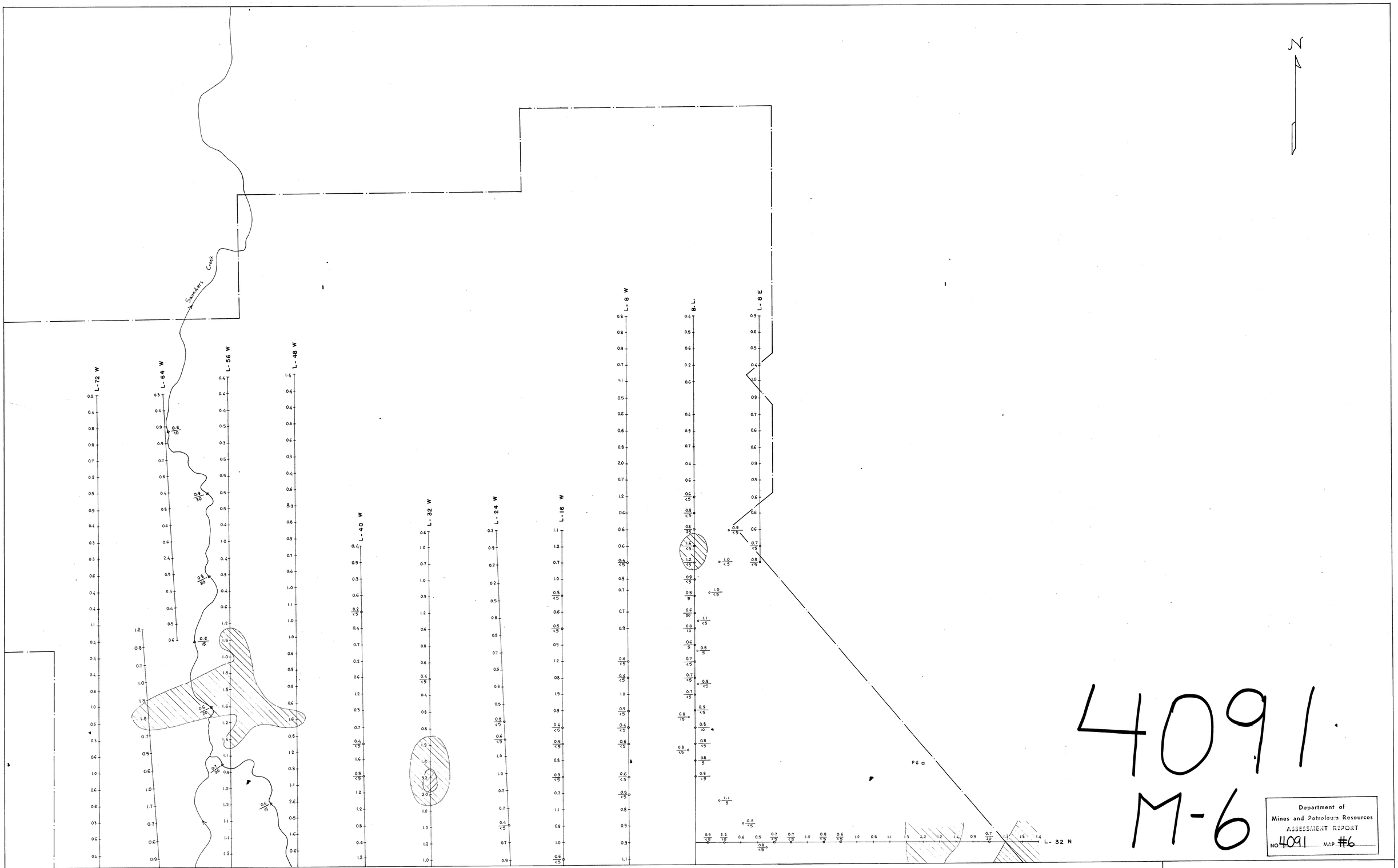
0.8 / 1	Soil Sample with Ag p.p.m.
○ 0.7 / 5	Rock Chip Sample with Ag p.p.m. / Au p.p.b.
△ 0.8 / 15	Silt Sample with Ag p.p.m. / Au p.p.b.
(symbol)	Grab Sample with assay results
□ P6	Sample for thin section
(hatched) Probable Ag Anomaly	Soil Sample : Ag > 1.3 p.p.m.; Rock Chip Sample : Ag > 1.1 p.p.m.
(cross-hatched) Definite Ag Anomaly	Soil Sample : Ag > 2.6 p.p.m.; Rock Chip Sample : Ag > 2.2 p.p.m.
—·—	Property Boundary

DENISON MINES LIMITED

TOODOGGONE PROPERTY

GEOCHEMICAL SURVEY

SCALE	DATE	REF.	PLATE
1" = 400'	NOV. 1972	94 E/6 E	SOUTH



4091

M-6

Department of
Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 4091 MAP #6

To accompany "Geological and Geochemical Report" by K.G. Sanders and P. Pisani, dated November 30, 1972

K.G. Sanders P. Pisani

LEGEND

- 0.6/1 — Soil Sample with Ag p.p.m.
- ○ 0.7/<5 — Rock Chip Sample with Ag p.p.m. / Au p.p.b.
- △ 0.8/15 — Silt Sample with Ag p.p.m. / Au p.p.b.
- Grab Sample with assay results
- □ P6 — Sample for thin section
- Probable Ag Anomaly — Soil Sample : Ag > 1.3 p.p.m.; Rock Chip Sample : Ag > 1.1 p.p.m.
- Definite Ag Anomaly — Soil Sample : Ag > 2.6 p.p.m.; Rock Chip Sample : Ag > 2.2 p.p.m.
- Property Boundary

DENISON MINES LIMITED

TOODOGGONE PROPERTY

GEOCHEMICAL SURVEY

SCALE	DATE	REF.	PLATE
1"= 400'	NOV. 1972	94 E/6 E	NORTH