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GEOLOGICAL REPORT ON THE

DEADMAN STOCK

N.T.S. 116 B/11, B/6
Latitude $64^{\circ} 30'$
Longitude $139^{\circ} 10'$

JULY-AUGUST, 1976

for

CHEVRON STANDARD LIMITED

Minerals Staff

by

Godfrey Walton

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INTRODUCTION

The claims on the Deadman intrusive are composed of the following claim blocks:

A	1-16
B	1-4
AB	1-76
WAD	1-48

The majority of these claims were staked with the idea of uranium exploration; however, some of the WAD claims were staked in the surrounding volcanics for Zn-Pb exploration.

The claim blocks are located 35 miles north of Dawson City and 2 miles northeast of Deadman's Gulch. Geological prospecting, mapping, grid construction, radiometric surveys, rock, silt and soil sampling were carried out by G. Dales, J. Gajda, W. Pritchard and G. Walton from June 30th to July 21st, 1976 and August 6th to August 28th, 1976.

SURVEYS

(A) Geophysical Surveys

The survey was conducted on grids that were constructed early in the season. The line spacing was 400 feet with recorded reading being taken at waist level every hundred feet. The instruments were carried at waist level and left in the "on" position for continuous measurements. The instruments were carried by each member of the party and were rented from Scintrex. For detailed radiometrics a TV-5 multichannel spectrometer was used.

(B) Geochemical Surveys

The following types of data have been combined for this survey:

- i) Soil sampling
- ii) Silt sampling
- iii) Rock sampling

The majority of the soil sampling was conducted concurrently with the geophysical survey with the sample locations being at 200 foot intervals. The rest of the soil samples were taken on elevation contours or close to streams.

The soil samples were supposed to be taken from the B horizon; however, this was not possible in all cases since there was poor soil development. The chemical condition of the soil was not monitored. As a result, the interpretation of the data is a lot harder. It is possible to infer what the chemical condition of the soil is from the data obtained. The soil samples were separated into two distinct groups; one to be analysed for zinc and copper while the majority were analysed for uranium. All of the soil sampling for zinc was done on elevation contours and close to streams, while only one uranium soil sampling survey was done on elevation contours and the other uranium soil sampling was done on pre-constructed grids.

Table 1 lists all the background values by rock type and commodity. The silt sampling was conducted for the three commodities with widely differing results. The 80-mesh size fraction was looked for at all sample sites. However, occasionally medium grained sand was sampled.

The rock sampling was normally done in conjunction with the geological mapping. Two separate scales of mapping were used on areas that had anomalous zones.

In the smaller scale mapping, rock samples were collected to give background values and to locate anomalous zones. Once anomalous zones were located a larger scale sampling and mapping was conducted. Some of the rock samples were used in a petrographic study; however, the majority were analysed for uranium.

Fresh samples that were taken were adequate for the petrographic study. However, for a complete chemical analysis for uranium the samples may not

have been fresh. In one location definite uranium leaching of the surface rocks was found. This will be discussed in more detail in the economic geology section. This, however, leads to the belief that higher uranium values may occur below the surface. The circulation of ground water through rock types which display good porosity will leach any uranium that was present. The gray syenite is a typical example of this problem because it has abundant calcite in the matrix. Once the calcite is dissolved, the rock crumbles causing good porosity and permeability.

C) Interpretation of Data

Each survey produced some anomalous values and subsequent work produced anomalous zones.

The radiometric survey carried out on the grids and while traversing produced several anomalous areas, which were above the values shown in Table 1. The background varies considerably with rock type and thickness of the soil cover. This soil cover could mask some radiometric anomalies in certain areas. When rocks from the radiometrically anomalous zones were assayed the results showed that there was a concentration of uranium and/or thorium. All measurements that were recorded were taken at waist level. This meant readings noted while traversing could be compared to the recorded values. The anomalous zones varied considerably from 5 feet to 1000 feet in width and in length from 50 feet to 3000 feet. The traversing located all of the anomalous zones while the grid work eventually proved the location of these zones after chemical analyses were finished. A soil sampling survey was run on the same grid at the same time as the radiometric grid.

It was this survey that backed up the radiometric grid survey, and further work proved the presence of these anomalous zones. The results of the assays were contoured on a topographic map to see the relationship between the results and the relief.

The anomalous zones appear to be related to stream banks, or on the edge

of ground water channels. Directly beside streams the assay values are lower than a short distance away. The actual stream bed area gives quite low values; however, the areas of limited drainage respond with high values. These areas have a high concentration of organics which attract uranium and cause anomalies.

The grid on the A claim group produced high values and shows the best outline of the streams. This grid also has several anomalous soil values down slope from radiometrically anomalous rocks. These soils were all just analysed for uranium and thorium.

The soil survey in the volcanics was primarily for zinc although lead and copper were analysed once chalcopyrite was seen in hand specimen. The results from the soil horizon gave only background values for all three economic minerals. No anomalous values were received on the soil samples.

The stream silts sampling survey was primarily conducted in the search for zinc. Some silts were analysed for uranium; however, the majority were lead, zinc and copper. The values were all background values; no anomalous assays were recorded (See Table 1).

The rock sampling survey was conducted for two reasons: one for assaying and the other for petrographic study. The assaying showed the background values for each rock type and also several anomalous zones. These zones were initially noticed because of the radioactive anomaly. Each anomalous zone was mapped and sampled (chip and hand specimen) on a detailed grid. Finally, each zone had a series of petrographic samples from them. The petrographic studies (See Appendix B) indicated many interesting points about the uranium mineralization which will require further work to substantiate.

Overall, the geochemical surveys indicated basically the same anomalous zones which will definitely require more work. Each of the surveys have indicated an anomalous area between the two lakes and the east of the stream. This area has produced some highly anomalous float zones;

however, the outcrop gives radioactive values only twice background. The possibility there is something below the surface is quite possible since the area gives quite an anomalous value from the air.

GEOLOGY

A) General Setting

The Cretaceous intrusive is surrounded by Precambrian to Cambrian sediments and volcanics. The volcanics and sediments have been thrust over Devonian shales and Precambrian dolomites. There are a series of thrusts in the area all trending approximately east-west. This is at an angle of 45° to the Tintina Trench. The Trench lies 20 miles to the south west of the stock. It separates rocks that have been regionally metamorphosed from green-schist to amphibolite facies from those rocks that are unmetamorphosed or contact metamorphosed.

The rocks in contact with the intrusive are either volcanics or sediments. Only the northern half of the intrusive and surrounding rocks were examined. The volcanic rocks appeared favourable for zinc-lead mineralization; unfortunately, no mineralization was found. The volcanics were composed of very thinned bedded flows, cherty layers, agglomerates and feldspar porphyry dykes. The zones were cyclic on a scale of 500 feet. Some contact metamorphism is visible in the first half mile from the contact; however, it does not mask the original rock types.

Green's map (accompanying G.S.C. Bulletin 364) shows the intrusive to be an undivided alkali syenite surrounded by undivided volcanics and sediments. The rock types in the intrusive vary considerably in petrology and economic significance.

B) Petrology

The following will be a generalized description of the mineralogy and textures of the major rock types as discussed on the accompanying map (a detailed description can be seen in Appendix B). The following units

were mapped in the field:

Intrusive Rocks:

Gray Hornblende - (+ Garnet) Alkali Syenite
Black/white Hornblende - Garnet Alkali Syenite
 Nepheline - Garnet Monzonite
 Nepheline - (+ Pseudoleucite)-(+Garnet) Alkali Syenite
 - This rock type has numerous lens of rock
 that can be distinguished texturally

Volcanic, Sedimentary and Dyke Rocks:

Carbonate - Hornblende - (+Biotite) - Dacite flow
Biotite - Epidote - Hornblende - Quartz Latite flow
Calcite Matrix - Agglomerate
 - Biotite - Monzonite Porphyry
Graywackes
Arkosic Sandstones

The volcanic group of rock type were not distinguished on the geological map; their relationship can be seen in Figure 1.

The individual units are about ten feet to 50 feet in width. They appear to be striking East-West and dipping almost vertically. The economic minerals seen were pyrrhotite, pyrite and minor chalcopyrite. These minerals increase the interest in these rocks; however, no sphalerite or galena were seen.

The high percentage of calcite in the volcanics was very amazing. Up to 40% of a sample could be calcite which would be totally destroyed once dilute HCl was poured onto the sample. A piece of float showed volcanic fragments surrounded by a calcite matrix. It appears that the calcite was secondary and there was a high partial pressure of CO₂ or at least the fluid composition was high in CO₂. The contact metamorphic effects

put the rocks into a biotite and chlorite hornfel. The hornfel rapidly disappears to produce a normal, unaltered volcanic. Basically, these volcanics have very simple mineralogies.

The sediments were not very prominent in the contact area just northwest of the intrusive where most of the work on contact rocks was done. The only sediments seen were apparently arkosic sandstone and graywackes. They were very hornfelsic and not easily recognizable.

The intrusive rocks appeared quite variable in the field; however, after the petrographic study the mineralogy of the rock types was found to be similar. In the field each rock type was easily distinguished. The field mapping gave the previous divisions under more naive names. The field characteristics of each rock type and their petrography will now be discussed as a rock type and not as individual thin sections (See Appendix B for individual thin section description).

The first rock type is the gray crumbly syenite (field term); this rock was very easily recognized in the field because of its crumbly weathering characteristic. The correct name for this syenite is a hornblende⁺ garnet alkali syenite (See Table 2 for mineralogy). Scapolite was quite common in this rock type; it was present in most sections. Melite and leucite were not present in all sections; they were often present in minor amounts. Sodalite which was seen in hand specimen in the field was not seen during the petrographic study. Since sodalite was only seen on fractures, it is conceivable that none was in any of the samples. Nepheline was seen in a few of the thin sections. However, the presence of quartz with melite appears highly unlikely. The micas were represented by biotite and some muscovite.

The hornblende⁺ garnet alkali syenite was quite coarse grained, but equigranular. The feldspars were euhedral and surrounded by the majority of the other minerals. There was some alteration of the feldspars by clay and sericite. No shearing or cataclastic textures were seen during the petrographic study and the rock had a good, unaltered igneous texture.

The next unit that was mapped was the black and white syenite. This unit had the same mineralogy as the gray syenite but differed in colour and mafic content. Whereas the gray syenite had an average mafic content of 10 percent, the black and white syenite had a mafic content of 25 to 30 percent. The correct name for this unit is hornblende-garnet alkali syenite. This is almost the same as the gray syenite although in this case garnet also appears. Fluorite appears often although it is not always apparent in thin section. The biotite that is present is deuteric after hornblende. The mineralogy of this syenite is similar to the gray syenite.

Texturally the two syenites are similar. They are both coarse grained, equigranular, euhedral feldspars and some minor alteration of the feldspars. There does not appear to be any shearing within the samples; they seem to have crystallized from a melt in a normal series. However, the rock must have crystallized at quite a depth for the crystals to be so large. Its final emplacement was probably as a crystal mush.

The third unit in this intrusive again was easily recognized in the field. This rock type was not studied closely before the field name was applied. It was called a quartz monzonite; however, upon further study, this rock was found to be a nepheline monzonite. The nepheline monzonite was medium grained, equigranular and mafic poor. The smaller grain size and the visible nepheline really helped to distinguish this rock type from the others. The mineralogy was very simple; it was composed of almost entirely feldspar and nepheline with minor amounts of carbonate, muscovite, biotite, garnet, epidote and diopside. The mafic content was very low varying from zero to 10 percent in hand specimens.

This nepheline monzonite is medium grained, equigranular with anhedral grains. It appears that the crystals in this monzonite all crystallized at the same time, because they are all such a uniform size. It would

suggest that this phase crystallized at a constant temperature, since there are no contact phases of this rock type. There are in the other phases where they are close to the volcanics.

In the contact zone between phases there are no fine grained equivalent rocks, unless the flow banded syenite (field term) is considered a contact phase. This flow banded syenite could be a marginal phase of the gray syenite. The other explanation for the flow banded syenite is that it is a dyke cutting across the rock units. This dyke concept, however, does not fit now that the southern showing has been found. This showing is in the contact area of the gray hornblende⁺ garnet alkali syenite and the nepheline monzonite, as all the other showings appear to be. However, they are also in the contact zone between the gray hornblende⁺ garnet alkali syenite and the black and white hornblende-garnet alkali syenite. This apparently indicates that the gray hornblende⁺ garnet syenite is the favourable phase and in certain areas along the contact there is a concentration of uranium minerals because of a suitable environment. The nature of this suitable horizon will be discussed in the economic section.

The flow banded syenite, as it was called in the field, was composed of several phases that differed mainly in texture. The mineralogy does differ slightly but not enough to be significant, except in certain zones where pseudoleucite phenocrysts were abundant (up to 30% of the rock). This zone varied from zero feet to over 1000 feet in width. The mafic content of this zone varies but it is always quite low (5-10%; see Table 1). There are very few phenocrysts in these rocks except a few feldspars and pseudoleucites. The majority of the crystals are anhedral (often rounded, elliptically shaped) and aligned. The petrographic names assigned to these rocks are pseudoleucite tinguaites and a fine-grained biotite-nepheline syenite or a tinguaites. A tinguaites is defined as dyke-like bodies of fine-grained contact rocks of soda syenite that contain nepheline, K-feldspar and aegirine. These contact rocks do not contain any aegirine; however, in all other respects they are tinguaites.

Texturally, they differ considerably because of the aligned crystals and their rounded, equigranular nature. The crystals appear to have been sheared, recrystallized and rolled out. The crystals appear to have crystallized in a high pressure situation and all at the same time.

Since this zone is only found along the contacts of the gray hornblende + garnet syenite, it suggests that the two rock types are related. They can be related either by the same intrusive phase where one would be the contact phase of the other or by being two separate intrusive rocks intruded at approximately the same time and following the same planes of weakness. Before discussing which of these two possibilities it could be, the field relationship between other phases should be mentioned. Blocks of the black and white coarse-grained hornblende-garnet alkali syenite were seen in the gray hornblende + garnet alkali syenite. This indicates that the gray syenite was a later pulse of this intrusion. The exact relationship between the nepheline monzonite and the other phases is not known; although according to the outcrop pattern it appears to be also a separate pulse. There appears to be no zonal arrangement of the phases, so there must have been three separate pulses or intrusions. Since the tinguite is so closely related to the gray syenite, it would appear it is the contact phase of the syenite. Since the gray syenite is the only phase that has a contact phase, it indicates that it was probably the last phase to be introduced. Further mapping could conclusively prove these points.

The petrological overview is a series of three major intrusive phases, one of which is intruded later than the others so that it obtains a contact phases, the tinguaite. It is highly sheared while abundant volatiles were present. The leucites change to pseudoleucite and cause a volume reduction which helps to increase the porosity of this zone. This is quite important for future consideration.

(C) Structure

The structure can be summarized in the following form:

- 1) Minor faulting
- 2) Jointing
- 3) Foliation

Faulting appears to be of little or no consequence as the only visible offsets were in the order of inches or tens of inches. No major faults were documented.

Three sets of joints were observed throughout the intrusive, especially in the tinguaitzone. The near vertical north trending joints are generally more abundant with many of them being smooth and mineral coated. These coatings often respond to an ultra violet lamp--giving a pale green to apple green colour. These colours under an ultraviolet light are typical of uranium bearing minerals. However, these coatings did not always respond to the scintollometer. The fracture density varies from one per foot to 7-10 per foot. The most densely fractured zones are within the tinguite zone. The amount of fracturing appears to be very closely related to the amount of mineralization.

The foliation was only seen in the tinguait and not seen at all in the other phases of the intrusive. The other phases were massive. The foliation was due to shearing either prior to complete solidification or at the time of emplacement. These shear planes have been magnified by erosion and by the transformation of leucite to pseudoleucite. This transformation causes a volume reduction of 30 percent. These pseudomorphs show the majority of strain effects, such as rotation and pressure shadows. The shearing is only on a very small scale and not easily visible in a hand specimen; but it is clearly visible in thin section.

Although the structure appears quite simple, it probably is a very important control of the mineralization. There is possibly a correlation between the intersection of the major joint set and foliation and the amount of mineralization.

(D) Economic Geology

The mineralization in the intrusive was primarily uranium although some thorium mineralization was seen. The surrounding volcanics were examined for copper, zinc mineralization without any success. Appendix C lists the values for the rocks which are located on Map 3. All the rocks that are in the tinguaita zone have a high concentration of uranium and very low concentration of thorium. This is a very important point when the uranium mineralization is considered. Normally, the Th/U ratio is 1:1 while we have ratios from 10:1 to 1:30 or more. This secondary type is very interesting and it is what is believed to be the situation in the tinguaita zone. This enrichment indicates that there have been some secondary processes that have mobilized the uranium but not the thorium. In one locality, there is a vein of a black thorium mineral which may indicate the thorium has also been mobilized but it is not redeposited in the same environment. This secondary process involved in mobilizing the uranium hopefully will concentrate it in one area.

The samples that were analyzed were primarily from zones that had anomalous radiometric values; there are a few samples that can be used to indicate background values for the various rock types. Once zones of mineralization were found, chip samples and detailed mapping was done. The results of this chip sampling can be seen in Appendix C. Since chip sampling only took the surface 2 inches, these results led us to believe surface leaching of these showings is very important. Sampling after this took only large hand samples that were well away from the surface. This type of sampling produced higher results but definitely not as high as subsequent blasting. The blasting was carried out on only one detailed grid and only went down approximately 8 to 10 feet. This change of depth has caused a very large increase in grade.

Detailed grids (see Map 4, 5, 6) were constructed on three sites that showed radiometric highs. Chip samples, hand samples for a petrographic study were taken, and mapping on a scale of one inch to ten feet. This clearly outlined radiometric changes and textural changes in the rocks.

In all cases, the chip sampling did not give good results; but on the grid that was blasted open, samples recovered helped to understand the process occurring in the outcrop surface.

Although the mineralization was found, it was quickly realized that certain common factors defining a theory must occur in each location. In addition a theory must explain why in some areas where the same rock type occurs, there is no mineralization. Finally, it should also explain the varying amounts of uranium mineralization from area to area and the Th:U ratios.

Since the Th:U ratios in the tinguaites are high on the uranium side, it indicates that subsequent remobilization of the uranium has occurred. Where this uranium has come from is extremely hard to know. If the tinguaites are a contact phase of the gray hornblende + garnet alkali syenite, then the uranium must be being leached out of this alkali syenite and concentrated in the contact zone. This contact zone is a perfect permeable zone. The permeability has been produced by the combined microshearing and the volume reduction produced when leucite transformed into pseudoleucite (D. Tempelman-Kluit, 1969). This subsolidus breakdown occurs under water pressure and the space caused by the breakdown will cause an influx of a fluid phase that helps to remove potash and causes enrichment of soda (D. J. Tempelman-Kluit, 1969). The influx of fluid from the surrounding rock would have helped to bring uranium into the tinguaites; however, the reason for uranium deposition is not completely understood.

However, if Eh and ph diagrams for Fe-S-O-Cu-U-V-Mn are examined, it is possible to delineate the environment that must have existed during the deposition of the uranium ions (Fig. 2).

Some of the uranium bearing minerals that have been identified during the petrographic study are carbonates, although the major uranium bearing mineral was pitchblende. This indicates that a CO₂ fluid was present so that these particular minerals could form. The environment that these minerals formed in is quite limited (see Fig. 2). This environment can have pyrite and

pyrrhotite; but commonly has magnetite and hematite. In many localities magnetite was found to be a good indicator of uranium mineralization. However, there were localities that had magnetite but did not give a radiometric anomaly. These rocks were massive in a jointing and foliation sense. Once surface samples were analyzed, they were anomalous but they were not very high.

This final point is a very important component. The combination of fractures and foliation appear to be required to give the rock permeability so fluid-carrying uranium can move through the tinguaitite. Many times during prospecting only one of the previously-mentioned conditions was not met; but still, no significant uranium mineralization was found.

In summary, the conditions that appeared to be required for significant uranium mineralization are:

- 1) Porosity and permeability
- 2) Source rock
- 3) Basic chemical condition
- 4) CO₂ fluid - for Deadman anyway.

These conditions have been met because the alkali syenites are known to have a high uranium content; porosity and permeability created after subsolidus breakdown of leucite to pseudoleucite under high fluid condition; basic condition indicated by combining magnetite, pyrrhotite, pyrite, hematite, pyrolusite and rhodocrosite and, finally, the presence of uranium carbonates and a carbonate in the intrusive rocks.

CONCLUSIONS

- 1) There appears to have been several phases of the intrusion.
- 2) The petrographic study indicated that the mineralization is secondary and often concentrated along fracture planes. This was also observed in the field.
- 3) Consideration of time of year and the proximity to last snow cover is important to assess surface leaching of uranium deposits.

- 4) It is important to note the presence or absence of the components listed that appear to control uranium showings found in the Deadman stock. These chemical conditions were noted in the Tombstone stock but the fracturing and foliation were not seen.
- 5) It is also important to get fresh samples well below the surface because surface leaching can be quite severe.

RECOMMENDATIONS

- 1) Blast the other grids to see if they show an increase in grade below the surface weathering as shown by detailed grid #1.
- 2) A geochemically-oriented survey for soils, silts, water around the showing to properly evaluate the uranium potential of this stock.
- 3) Consolidate the claims position.
- 4) More detailed mapping and petrological studies in the vicinity of each showing.
- 5) Drill the showings that prove to be good possibilities after blasting has been completed.

ROCK TYPES	RADIOMETRICS (cps)	URANIUM (ppm)			ZINC (ppm)			COPPER (ppm)		
		Soil	Silt	Rock	Soil	Silt	Rock	Soil	Silt	Rock
Volcanics	50 - 150				120	120	120	100	100	150
Gray Syenite	200 - 400	15	10	10						
Black and White Syenite	300	15	10	10						
Nepheline	200	15	10	10						
Monzonite										
Tinguaite Zone	500	15	10	10						
Covered Areas	100 - 400									

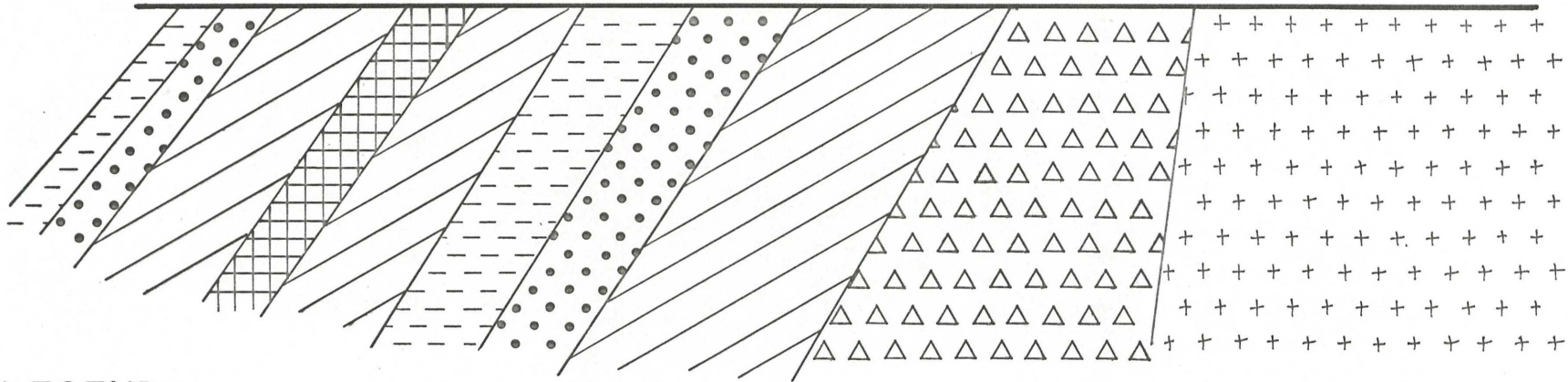
TABLE 1 - BACKGROUND VALUES FOR ROCK TYPES FROM
DEADMAN STOCK

MINERALS	GRAY HORNBLLENDE ALKALI SYENITE	BLACK AND WHITE HORNBLLENDE-GARNET ALKALI SYENITE	NEPHELINE MONZONITE	TINGUAITE OR NEPHELINE SYENITE	PSEUDOLEUCITE TINGUAITE
K-Feldspar	45 - 50%	60%	65%	70%	50%
Plagioclase - Albite	5%	5%	5%	5%	10%
Garnet	0 - 25%	15 - 20%	5%		
Hornblende	5 - 35%	15 - 20%			
Biotite	0 - 5%	5%	5%	5 - 10%	10%
Nepheline	5 - 10%		10%	10%	
Quartz		10% (In Dyke)			
Melite	0 - 10%				
Pseudoleucite					20%
Leucite	1%				
Muscovite	10%		10%	0 - 5%	5%
Uranium Minerals	0 - 5%	2%		0 - 5%	
- Pitchblende					
- Schroeckingerite					
- Uranopilite					
- Andersonite					
Calcite	0 - 5%		5%		
Fluorite	1%	1%		3 - 10%	2 - 5%
Sphene					
TOTAL	100%	100%	100%	100%	100%

TABLE 2 - GENERAL MINERALOGY OF THE INTRUSIVE PHASES OF THE
DEADMAN STOCK

NW

SE



LEGEND


CRETACEOUS

 Deadman Stock undivided

PRECAMBRIAN

 Agglomerate

 Chert to fine silt

 Tuffs

 Flows-acidic at top basic at base


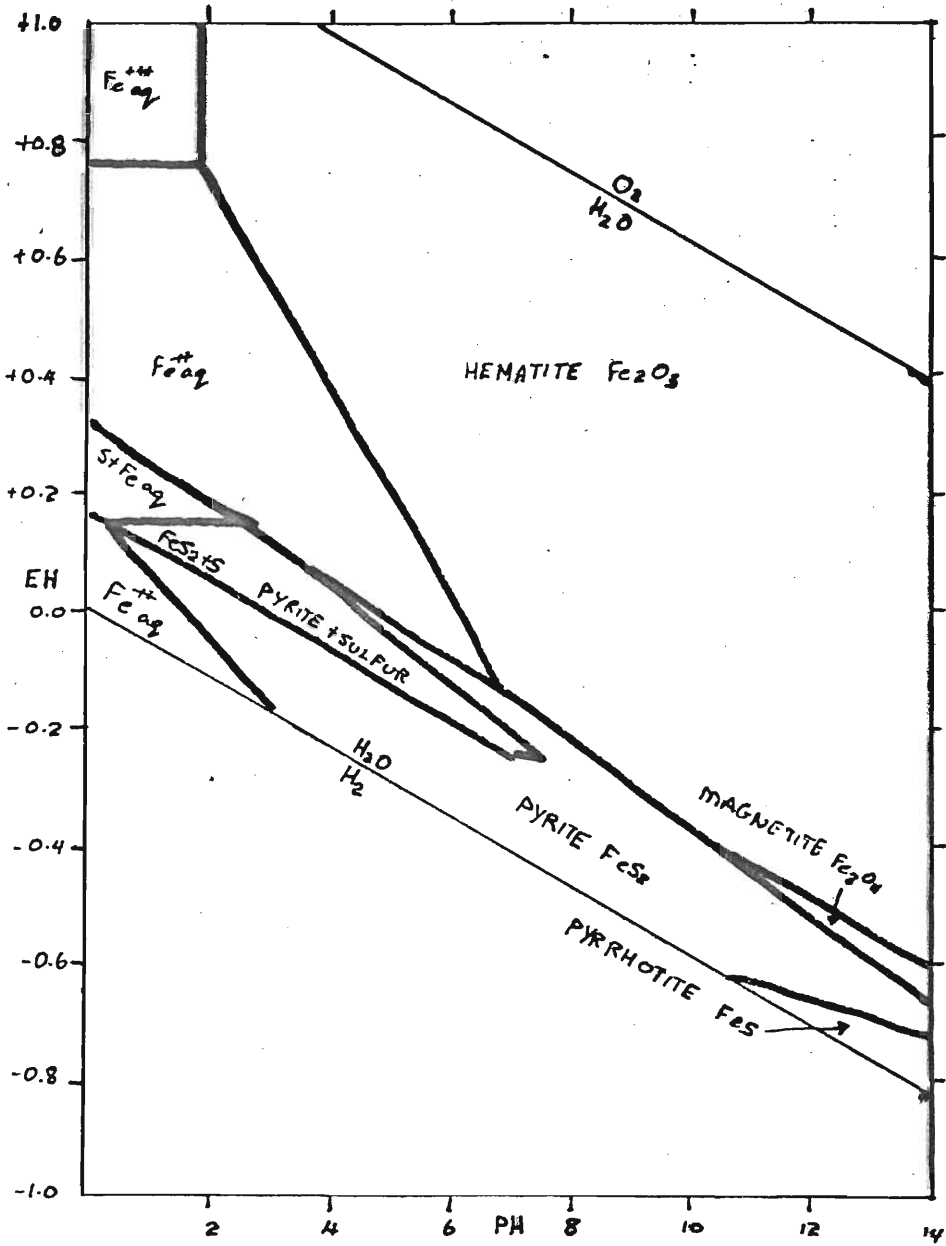
 Biotite hornfels-meta volcanics

FIG. 1

SCHEMATIC CROSS SECTION

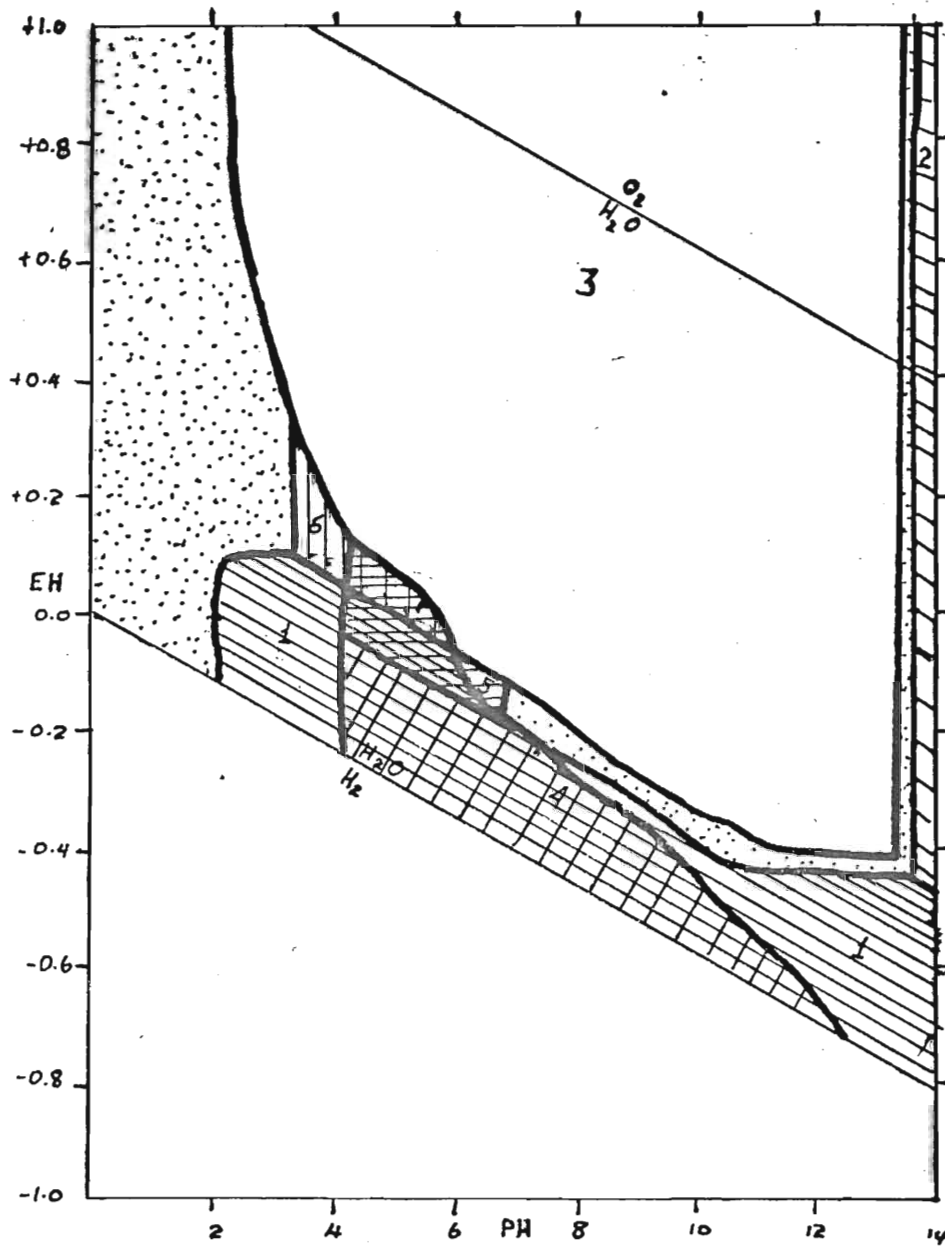
Volcanic Rocks Northwest of Deadman Stock



$\Sigma S = 10^{-1}$
 $\Sigma Fe = 10^{-6}$

at 25°C 1atm

Iron Sulphide



$\Sigma \text{CO}_2 = 10^{-2}$

$\Sigma U = 10^{-4}$
 $\Sigma V = 10^{-3}$
 $\Sigma K = 10^{-3}$

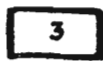
Uranium



Uraninite



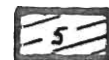
Schoepite



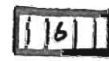
Carnotite



Montroseite



Paramontroseite



Rutherfordine

A P P E N D I X A

G E O C H E M I C A L A N A L Y S I S

<u>Sample Number</u>	<u>Uranium</u>	<u>Thorium</u>	<u>Gold (ppb)</u>
RA-76 - 192	.68%	.004%	5
190	1.65%		5
189	.34%		5
185	1.06%		5
183	.71% #4		5
181	.37%		5
RA-76 - 180	.25%		
GW- 1	.15%		
HW-61	9.7%		
62	.31%		
63	.035%		
64	.008%		
GD-02	.14%	.57%	
GD-05	.18%	.28%	
GD-06	.61%	.025%	
RA-76 - 174	6 ppm		
175	4 "		
177	11 "		
179	950 "		
184	1600 "		
186	1000 "		
187	1200 "		
191	540 "		
34	160 "		
49	64 "		
58	28 "		
71	160 "		
74	120 "		
81	400 "		
82	150 "		
83	160 "		

SAMPLE NUMBER		URANIUM %	THORIUM %
HW 1	A	.02	.005
	B	.04	.006
	C	.008	.004
	D	.003	.004
2	A	.005	.005
	B	.004	.003
	C	.008	.004
	D	.005	.007
	E	.005	.006
3	A	.002	.007
	B	.003	.007
	C	.030	.005
	D	.080	.006
	E	.095	.006
4	A	.002	.006
	B	.002	.008
	C	.085	.011
	D	.030	.007
	E	.004	.004
5	A	.002	.008
	B	.010	.006
	C	.080	.007
10	A	.002	.006
	B	.002	.007
20	A	.002	.006
PIN 1		30 ppm	67 ppm
GW 1A		22 "	79 "
GW 700/850-860		34 "	78 "
GW 800/140-160		27 "	66 "
GW 800/240-249		28 "	82 "
GW 800/445-452		28 "	91 "
GW 800/480-490		30 "	82 "
GW 800/850-860		6 "	58 "

<u>SAMPLE NUMBER</u>	<u>COPPER (ppm)</u>	<u>ZINC (ppm)</u>
RA - 76 - 123	50	60
150	39	58
152	102	53
153	44	50
157	133	53
160	80	51
161	68	53
162	330	15
164	47	73
166	108	63
167	91	50
168	49	86
169	128	50
133	54	160
134	100	110
135	79	118
136	190	36
137	90	80
138	24	128
143	100	39
145	120	52

A P P E N D I X B

PETROGRAPHIC STUDY

General Statement

The rocks from the Deadman Stock can be characterized by the following points:

- 1) Initial crystallization was by a dry magma. This is indicated by pyroxene crystallization.
- 2) Final crystallization was by a wet magma. This is indicated by amphibole and mica crystallization.
- 3) The pyroxene is often rimmed in a corona structure by the amphibole and micas. The corona is due to the differentiation process that has concentrated water in the fluid phase.
- 4) The under saturated nature of the stock, indicated by melilite nepheline and sodalite.
- 5) The presence of uraninite (pitchblende) in the biotite-fluorite rich phases possibly indicates late stage crystallization of uraninite.
- 6) The structure seen in the stock appears to be flow banding rather than shearing. The crystals are elongated and parallel to each other. If it was a result of shearing then the rock would have to be completely recrystallized which does not appear likely.
- 7) The mineralization is associated with fine grained areas that are fractured and may be slightly recrystallized after deposition of uranium.
- 8) The apparent association of magnetite, hematite, pyrite and pyrrhotite with uranium bearing minerals is seen in thin section. The hematite magnetite appear to have been deposited at the same time as the uranium minerals.
- 9) Magnetite is often found in contact phases of stocks (especially alkali rocks) therefore since magnetite was found throughout the tinguaitite zone it indicates that the tinguaitite may be a contact phase of the gray syenite.
- 10) The presence of scapolite in these rocks is very strange. Normally it is only seen as an alteration product but in this case it appears to be a primary mineral. The crystallization sequence can crystallize scapolite if it proceeds far enough; this normally only happens in metamorphic rocks, however, in this case it appears to have happened.

The petrographic study has produced several very interesting observations that don't point to the definite location of the ore body. However, it appears to have identified uranium phases that are too fine grained to see in hand specimen. In addition combining the microscopic work with autoradiographs the location of other radioactive minerals can be pin pointed and identified.

RA-76-01 Biotite Syenite Location: South east of Grid #1

<u>Mineralogy</u>	<u>Description</u>	<u>Percentage</u>
K-feldspar	- composed majority of the rock	50
Plagioclase	- mostly in matrix or exsolved	5
Biotite	- deuteric and primary	15
Fluorite	- purple on edges - due to radiation damage	5
Uraninite	- medium grain	5
Schoeckingerite	discrete crystals and around uraninite	10
Hornblende	- surrounded by biotite	10

Textures

The crystals are equigranular and anhedral. A lot of the biotite is contained within the feldspars which secludes this biotite from the mineral assemblage. There are other biotite crystals which may be deuteric that are in contact with the other minerals.

The feldspars are rounded in many cases which appears to indicate that there has been some recrystallization after the initial crystallization.

Radioactivity

Mineral grains fluorescence when a ultra violet lamp is held over the thin sections.

RA-76-03

Hornblende Syenite

Location: Cirque wall above
upper lake.

<u>Mineralogy</u>	<u>Description</u>	<u>Percentage</u>
K-feldspar	- rounded to hexagonal, anhedral crystals	75
Plagioclase	- as exsolved particles in K-feldspar	5
Hornblende	- crystals - anhedral to euhedral	15 - 20
Fluorite	- interstitial	2 - 5
Scapolite	- interstitial	2

Textures

The general appearance of the thin section is that of a medium grained intrusive rock that may have undergone a partial recrystallization. The feldspars show this recrystallization far better than the hornblende crystals. There seems to be no alteration of the hornblende.

Radioactivity

No sign of radioactivity.

RA-76-04

Hornblende-Garnet Syenite

Location: Cirque wall above
upper lake

<u>Mineralogy</u>	<u>Description</u>	<u>Percentage</u>
K-feldspar	- sometimes rounded otherwise partial crystals	55
Plagioclase	-	10
Hornblende	- distinct crystals - anhedral	10
Garnet	- anhedral blobs, remnants as interstitial around feldspar	15
Melilitite	- interstitial	5
Biotite	- some rimming hornblende	5
Diopside	- zoned crystals innerzone contain numerous inclusions	2
Limonite	- staining	1

Textures

Coarse to medium grained with some recrystallized grains surrounding large grains of feldspar. Limonite staining pervasive the large grains of feldspar up to 1½ centimeter in diameter although they can be starting to recrystallize. In the recrystallized area have rounded crystals and some very fine grains crystals of feldspar with biotite and hornblende and garnet.

Radiation

No sign of radiation seen.

RA-76-05 Garnet Syenite Location: Cirque wall above upper lake

<u>Mineralogy</u>	<u>Description</u>	<u>Percentage</u>
K-feldspar	- (as laths	55 - 60
Plagioclase	-, (10
Nepheline	- interstitial	5
Muscovite		1
Garnet	- large crystals. In some cases they are found broken	20 - 25
Fluorite	- purple	5
Biotite	-	1 ✓

Textures

Medium grained with some euhedral feldspar laths. The garnet tends to be broken with fluorite and a possible uranium mineral located in the fractures. Where the fluorite is in contact with this unknown mineral it is purple and the purple colour decreases away from the mineral in a piece of fluorite. Biotite appears to be an alteration product of garnet.

Radiation

Minor evidence of radiation. Purple colouring in fluorite is caused by radiation damage. The fluorite is associated with a fine grained, interstitial material that is possibly uranium bearing but it is too fine grained for optical determination.

RA-76-06

Hornblende-Garnet Syenite Location:

cirque wall above
upper lake

<u>Mineralogy</u>	<u>Description</u>	<u>Percentage</u>
K-feldspar	- exsolution of plagioclase	50 - 60
Plagioclase	- quite altered to clays	52
Nepheline	- interstitial grains	5
Diopside	-	2
Hornblende	- associated with fluorite in a fracture zone	10
Garnet	- zoned, euhedral crystal - fractured	10
Fluorite	- associated with the hornblende	3
Calcite	- associated with hornblende and fluorite in fractures	1
Andesonite	-	4
Uranopilite	- found in fractures as grains	5

Textures

The rock is composed of coarse grained feldspar and garnet primarily with fracture zones composed of medium to fine grain hornblende, fluorite, carbonate, uranium bearing mineral and minor amounts of feldspar. The feldspar in these fracture zones appears to be highly altered. The crystals outside these fracture zones are not very broken up and appear quite fresh and clear, although the feldspar is starting to alter to clays.

Radiation

Radioactive damage is visible in the fluorite crystal. No metamict crystals were seen but uranium bearing minerals were identified in certain fracture zones.

RA-76-07

Garnet Syenite

Location: cirque wall above
upper lake

<u>Mineralogy</u>	<u>Description</u>	<u>Percentage</u>
K-feldspar	- occurs as laths and some rounded crystals	55
Melitite	-	10
Garnet	- enhedral crystals in clusters	30
Carbonate	-	1
Diopside	- around garnet crystals	5
Fluorite	-	1
Scapolite	- interstitial	2

Textures

The rock is medium to coarse grained and equigranular. Most of the feldspar occurs as laths although some rounded crystals do occur. Interstitial scapolite and diopside is found between feldspar and garnet, the two major constituents of the rock. While only trace amounts of carbonate and fluorite were seen.

Radioactivity

No visible signs of radioactivity.

RA-76-08

Diopside Syenite

Location: ridge between Grid 3
and lower lake

<u>Mineralogy</u>	<u>Description</u>	<u>Percentage</u>
K. feldspar	- laths well twinned	65
Plagioclase	- albite twin, ragged crystal outline, no recrystallization	10
Nepheline	- interstitial grains of nepheline	8
Sphene	-	1
Diopside	- large enhedral crystals, green colours, broken	15
Biotite	-	1
Fluorite	-	1

Textures

The rock is medium to large grained with the feldspar crystals ranging across the grain size with diopside consisting primarily of larger crystal. There appears to be little or no evidence of recrystallization while other rocks indicate recrystallization.

Radioactivity

There are no visible signs of radioactivity.

RA-76-09

Scapolite Syenite

Location: Below Grid 3 and
above lower lake

<u>Mineralogy</u>	<u>Description</u>	<u>Percentage</u>
K-feldspar	- mainly recrystallized but some remnant grains left	65 - 70
Plagioclase	- found in the ground mass -possible Albite	5
Biotite	- disseminated in a groundmass	5 - 7
Fluorite	-	1
Scapolite	- scattered throughout as intersitital crystals	15
Nepheline	- several grains all together	5

Textures

Medium grained and equigranular with complete recrystallization having occurred. The major constituent appears to be K-feldspar with the rest of the assemblage being quite minor in comparison. The Scapolite is found throughout this section indicating it was definitely stable.

Radioactivity

No visible signs of radioactivity.

RA-76-10

Nepheline Monzonite

Location: below Grid 3 and
above lower lake

<u>Mineralogy</u>	<u>Description</u>	<u>Percentage</u>
K-feldspar	- highly altered grains	50
Plagioclase	- also albitization and pericline and albite twinning	50
Nepheline	-	20
Diopside	- large grains that are broken and altered	7
Biotite	-	2
Fluorite	-	1

Textures

The rock is medium grained but locally where it is not recrystallized it appears coarse grained. The plagioclase has albite and pericline twins in the unrecrystallized crystals. While the K-feldspar appears to be much larger grained and higher birefringence. The feldspar are highly altered to clays, in most grains. The diopside crystals also appear altered to hornblende.

Radioactivity

There were no visible signs of radioactivity.

RA-76-11a

Biotite-Garnet Scapolite Syenite

Location: above lower
lake

<u>Mineralogy</u>	<u>Description</u>	<u>Percentage</u>
K-feldspar	- large euhedral and anhedral crystals	30 - 35
Plagioclase	- interstitial	5
Garnet	- abundant euhedral crystals	25
Scapolite	- abundant anhedral crystals	30
Fluorite	- minor	1 x
Biotite	-	10
Carbonate	- minor - trace	1 x

Textures

The rocks appear quite coarse grained with very little evidence for recrystallization. The amount of scapolite is quite amazing; it is found interstitial to feldspar and garnet, and ranks as one of the major constituents of the rock. The rock is quite typical of the majority of the rock in the Deadman Stock because of the coarse grained size and anhedral crystals. The recrystallization appears to be mainly in the zones of alteration and mineralization.

Radioactivity

Some fluorescence under ultra violet light, however, mineral not seen in thin section.

RA-76-11b Garnet-Diopside-Scapolite Syenite Location: above lower lake

<u>Mineralogy</u>	<u>Description</u>	<u>Percentage</u>
K-feldspar	- large anhedral crystals	40 - 45
Plagioclase	-	5
Scapolite	- interstitial, anhedral crystals	10
Garnet	- very large zoned crystals	10 - 15
Fluorite	- purple highly radiated	1
Biotite) Hornblende)	- tend to rim diopside and garnets	7
Diopside	- small altered crystals	15
Pitchblende	-	1
Carbonate		1 x

Textures

The rock varies from medium to coarse grained. The fluorite is high radiated. The feldspar is very large and shows good cleavage. There are zones or fractures that show abundant opaques and purple fluorite. It is highly probable that these opaques are pitchblende or uraninite because of their habit that they portray (irregular shape, dendritic).

Radiation

The fluorite was coloured (purple) because of radiation damage to the structure of fluorite.

RA-76-11c

Diopside-Garnet-Scapolite Syenite

Location: above lower lake

<u>Mineralogy</u>	<u>Description</u>	<u>Percentage</u>
K-feldspar	- coarse grained, euhedral to anhedral	45
Plagioclase	-	5
Scapolite	- abundant grains, associate with feldspar and garnet	20
Diopside	- minor crystals, anhedral and fine to medium grained	5 - 10
Biotite	-	5
Fluorite	-	1 X

Textures

The coarse grained feldspars are surrounded by abundant scapolite and garnet with minor amounts of diopside, biotite, and fluorite. There is minor evidence for recrystallization but the majority of the feldspars appear to be the originally crystallized grains.

Radioactivity

There is no visible sign of radioactivity.

RA-76-12

Diopside Syenite

Location: below Grid 3,
above lower lake

<u>Mineralogy</u>	<u>Description</u>	<u>Percentage</u>
K-feldspar)	- small and large rounded grains	75
Plagioclase)		5
Diopside	- aggregates of small grains	20
Biotite	-	5
Fluorite	-	1
Sphene	-	X

Textures

The rock is fine to medium grained with larger crystals of feldspar that have been rounded. The grains appear to be recrystallizing because areas that were presumably one grain are now made up of several smaller grains of the same mineral. There are very few large rounded feldspar left.

Radioactivity

No visible sign of radioactivity

RA-76-13

Hornblende Syenite

Location: Cirque wall above upper lake

<u>Mineralogy</u>		<u>Description</u>	<u>Percentage</u>
K-feldspar	-	rounded, anhedral crystals, some exsolution	65 - 70
Plagioclase	-		5
Hornblende	-	massive, anhedral grains	20
Biotite	-	very minor	5
Sphene	-		1 x
Hematite	-	along crystal boundaries	1 x
Garnet	-	minor grains in one corner of slide	1

Textures

The rock varies in grain size from medium to coarse. The major constituent other than feldspar is hornblende. It occurs as an aggregate of small rounded and anhedral crystals.

Radioactivity

There is no visible sign of radioactivity.

RA-76-14

Garnet-Diopside Scapolite Syenite

Location: Cirque wall
above upper lake

<u>Mineralogy</u>	<u>Description</u>	<u>Percentage</u>
K-feldspar	- rounded, anhedral crystals	55
Plagioclase	-	5
Diopside	- numerous anhedral crystal	25
Garnet	-	10
Scapolite	-	8 - 10

Textures

The rock is medium grained, equigranular with all crystals being anhedral. The diopside appears to be rimming the garnet crystals. The diopside and garnet probably coexisted at the formation of the melt.

Radioactivity

There was no visible sign of radioactivity

RA-76-15

Garnet-Diopside Syenite

Location: Cirque wall above
upper lake

<u>Mineralogy</u>	<u>Description</u>	<u>Percentage</u>
K-feldspar)	- large anhedral - euhedral grains	65
Plagioclase)	-	5
Garnet	- highly zoned, euhedral grains	15
Diopside	- numerous anhedral grains	15
Hornblende	- small rim around one of the crystals	1

Textures

This rock is coarse grained and consists of feldspar pyroxene and garnet. All these phases are anhydrous which is important when considering the type of melt these rocks came from. Any amphibole present appears to be primarily a late phase due to water enrichment in the later fluids.

Radioactivity

There is no visible sign of radioactivity

RA-76-16

Garnet-Scapolite Syenite

Location: South-east of
Grid 1

<u>Mineralogy</u>	<u>Description</u>	<u>Percentage</u>
K-feldspar	- medium grained - rounded - anhedral crystals	65
Scapolite	- interstitial	10
Hornblende	- anhedral crystals	5
Garnet	- anhedral - euhedral crystals	15
Biotite	-	5

Textures

This rock is medium grain, equigranular and the crystals appear anhedral. There is some resemblance of laths in the feldspars however the majority are hexagonal or rounded. There are abundant triple junctions that appear to indicate crystal formation all at the same time.

Radioactivity

There is no visible sign of radioactivity.

RA-76-17

Hornblende-Garnet Syenite

Location: South-east of
Grid 1

<u>Mineralogy</u>	<u>Description</u>	<u>Percentage</u>
K-feldspar	- concentrated at one end (leucocratic end of section)	55
Scapolite	-	5
Garnet	- concentrated at melanocratic end of section; zoned	20
Hornblende	- concentrated at melanocratic end of section; zoned	15
Biotite	-	1
Diopside	- minor at one end in dyke like body	5

Textures

The rock is very coarse grained and appears quite well segregated. The mafics are all concentrated on one end of the thin section. The feldspars in the leucocratic end of the section are lath shaped while in the melanocratic end of the section they are interstitial to the euhedral garnets.

Radioactivity

There is no visible signs of radioactivity.

RA-76-18

Nepheline Syenite

Location: Grid #3

<u>Mineralogy</u>	<u>Description</u>	<u>Percentage</u>
K-feldspar	- lath shaped and anhedral crystals	60 - 65
Plagioclase	- albite twinning, ragged crystal	10 - 15
Nepheline	-	10
Biotite	- small book	5
Carbonate	- associated with opague	5
Muscovite	-	5
Diopside	- very minor	1
Hematite	- major opague	3

Textures

The rock is medium to coarse grained and equigranular. The major constituent is feldspar, not only K-feldspar but also some plagioclase. In previous sections very little plagioclase was seen.

Radioactivity

There is no visible sign of radioactivity.

RA-76-19

Biotite-Scapolite Syenite

Location: Grid #3

<u>Mineralogy</u>	<u>Description</u>	<u>Percentage</u>
K-feldspar)	- primarily recrystallized small anhedral	70 - 80
Plagioclase)	- crystals; two crystals have not been recrystallized but are highly altered	15 - 7
Scapolite	- good cleavage - clean and clear (simi- lar to muscovite)	5
Nepheline	-	2
Biotite	- radioactive halves	5
Epidote	-	1
Apatite	-	1 ✓
Fluorite	-	1 ✓
Magnetite	-	1 ✓
Leucoxene	- alteration of magnetite	1 ✓

Textures

The rock is fine to medium grained, equigranular although there are some large rounded feldspars. The majority of the ground mass appears to have recrystallized and the large feldspar are the remains.

Radioactivity

There is no visible sign of radioactivity.

RA-76-20

Scapolite Syenite

Location Grid #3

<u>Mineralogy</u>	<u>Description</u>	<u>Percentage</u>
K-feldspar)	- predominantly small minerals, some	70 - 60
Plagioclase)	- large altered crystals	5
Scapolite	- pervasive, in some instances it rims opaques (magnetite)	10 - 5
Biotite	- scattered throughout section	7
Nepheline	- in ground mass	3
Limonite	- stain	
Zircon	-	1 ✓
Zeolite?	-	10
Fluorite	-	1 ✓

Textures

The rock is fine to medium grained, mainly equigranular but there are some large rounded remnant feldspar. The rimming of opaques by scapolite is very informative because it indicates a sequence of events. The opaque appears to be magnetite so the scapolite would form later in the crystallization sequences either as an actual phase or as an alteration product.

Radioactivity

Only sign of radioactivity is the presence of zircon and some purple fluorite.

RA-76-21

Biotite-Scapolite Syenite

Location: Grid #3

<u>Mineralogy</u>	<u>Description</u>	<u>Percentage</u>
K-feldspar)	- small crystals, anhedral, equigranular	65 - 70
Plagioclase)	-	1 - 5
Nepheline	- constitutes part of the ground mass	2 - 5
Carbonate	- very minor	2
Biotite	- distributed throughout	7 - 10
Scapolite	- distributed throughout slide; associated with opaques and feldspar	7 - 10
Diopside	- minor	2
Hematite	-	1 ✓

Textures

The rock is fine to medium grained, equigranular with the majority of the crystals being anhedral. There is a brown clay type material on top of portions of the slide whether this is grinding material or an alteration product is hard to say. However, since it cuts across grain boundaries into entirely different minerals it is probably a fine grinding powder.

Radioactivity

There is no visible sign of radioactivity. The only material to fluorescence is the grinding material(?).

RA-76-22

Biotite Scapolite Syenite

Location: Grid #3

<u>Mineralogy</u>	<u>Description</u>	<u>Percentage</u>
K-feldspar)	- hematite alteration	65 - 75
Plagioclase)	-	5 - 10
Nepheline	- very minor	2
Scapolite	- small crystals	10 - 5
Biotite	- small crystals	15 - 10
Fluorite	- trace amounts	1
Hematite	- as an alteration of feldspars and along fractures	1

Textures

The rock is fine to medium grained, equigranular and the crystals are anhedral. There are some large K-feldspar crystals that have some clay alteration however they are limited in extent.

Radioactivity

There is no visible sign of any radioactivity.

RA-76-23

Biotite-Scapolite (Pseudoleucite) Syenite

Location: Grid #3

<u>Mineralogy</u>	<u>Description</u>	<u>Percentage</u>
K-feldspar	- hematite alteration of K-feldspar	65 - 70
Scapolite	- abundant small anhedral crystals	10 - 15
Biotite	- abundant small anhedral crystals	10
Pyrite)		
Magnetite)		5
Limonite	- staining	
Pseudoleucite	- composed of zeolite, K-feldspar, nepheline	5
Zeolite(?)	- as another phase in the pseudoleucite	2

Textures

The rock is fine to medium grained. There are some K-feldspar phenocrysts however the matrix is equigranular. The pseudoleucite appears to be composed of K-feldspar, nepheline and some zeolite. It is possible that another phase is in the pseudoleucite mixed up with the zeolite but X-ray diffraction must be used to identify the phase.

Radioactivity

There is no visible sign of any radioactivity.

RA-76-24

Biotite-Scapolite Syenite

Location: Grid #3

<u>Mineralogy</u>	<u>Description</u>	<u>Percentage</u>
K-feldspar	- equigranular to porphyritic	65 - 75
Plagioclase	- equigranular; fine to medium grain	5 - 10
Scapolite	- , anhedral, equigranular	5 - 10
Biotite	- anhedral, equigranular	5 - 10

Textures

The rock is fine to medium grained with porphyritic K-feldspar. The matrix is equigranular. The phenocryst of K-feldspar contain a lot of inclusions of opaques (possibly hematite) however the opaques are too fine to identify.

Radioactivity

There is no visible sign of radioactivity.

RA-76-25

Biotite-Hornblende-Garnet Syenite

Location: Grid #1

<u>Mineralogy</u>	<u>Description</u>	<u>Percentage</u>
K-feldspar)	- small, equigranular	50 -65
Plagioclase)		0 - 5
Hornblende	- found rimming garnet	15 -20
Garnet	- small anhedral crystals, occasionally zoned	10 -15
Biotite	- small anhedral crystals	10

Textures

The rock is fine to medium grained, equigranular and the crystals are generally anhedral. The hornblende rimming the garnet appears to be quite important because of the sequence of events that it indicates.

Radioactivity

There is no visible sign of radioactivity.

RA-76-26

Biotite-Scapolite Syenite

Location: Grid #1

<u>Mineralogy</u>	<u>Description</u>	<u>Percentage</u>
K-feldspar)	- a big selective type of alteration	70 - 60
Plagioclase)	- (hematite) has occurred in some areas of the thin section	10
Scapolite	=	5 - 10
Carbonate	-	1
Biotite	- spread throughout the section	10 - 15
Fluorite	- interstitial but minor	1
Nepheline	- only two small grains were identified	1
Hornblende	- very minor	2

Textures

The rock is composed of fine to medium grained, equigranular but anhedral crystals. There has been some alteration of what used to be feldspars(?). Since the alteration is so intense it is hard to recognize the former crystals. However since it is hematite alteration I presumed it was a feldspar.

Radioactivity

There is no visible sign of any radioactivity.

RA-76-27

Biotite-Fluorite Syenite

Location: Grid #1

<u>Mineralogy</u>	<u>Description</u>	<u>Percentage</u>
K-feldspar	- occurs as phenocryst and in the matrix	70 - 60
Plagioclase	- in matrix	5 - 10
Diopside	- small anhedral crystals	5
Biotite	- scattered anhedral crystals	10 - 15
Fluorite	- interstitial, very purple when close to opaque	10
Limonite	- staining	1 - 2
Pitchblende	-	2 - 3

Textures

The rock is fine to medium grained, and equigranular. It is porphyritic at times but the majority of the feldspar phenocrysts have recrystallized. A zeolitic(?) alteration of feldspars has occurred to produce brownish grit in some areas. In the majority of the case there is no remnant crystals however in one locality the feldspar is clearly shown.

Radioactivity

The evidence for radioactivity is the presence of pitchblende and the highly coloured fluorite.

RA-76-28

Biotite-Fluorite Syenite

Location: Grid #1

<u>Mineralogy</u>	<u>Description</u>	<u>Percentage</u>
K-feldspar	- large and small crystals	65 - 70
Plagioclase	-	5 - 10
Diopside	- small grains	1 - 5
Biotite	- small anhedral grains	15 - 10
Fluorite	- fracture fill	5 - 10
Pitchblende	- discrete grains surrounded by purple fluorite	1 - 2

Texture

The matrix appears to be a flow structure. The formation of the crystals was during a very mobile stage, either later recrystallization or during actual crystallization. However the alignment of crystals definitely

indicates a highly volatile stage of crystallization either for the first or second time.

Radioactivity

The presence of pitchblende as discrete crystals which are surrounded by purple fluorite indicate a minor amount of uranium. There appears to be a definite decrease from the previous section (RA-76-27).

RA-76-29 Scapolite-Syenite Location: Grid #1

<u>Mineralogy</u>	<u>Description</u>	<u>Percentage</u>
K-feldspar	- anhedral, equigranular grains	80 - 85
Plagioclase	-	1 - 5
Garnet	- remnant grains	3 - 5
Scapolite	- interstitial grains	5 - 7
Biotite	- medium size crystals	5

Textures

The rock is medium grained, equigranular with anhedral crystals. The feldspar is definitely a major constituent of this rock. The other mineral appears to either be remnant crystals or a fracture filling crystals. The grains are not twinned but have good triple point.

Radioactivity

There is no evidence for any radioactivity.

RA-76-30 Biotite-Fluorite Location Grid #1

<u>Mineralogy</u>	<u>Description</u>	<u>Percentage</u>
K-feldspar)	- occurs as medium sized grains,	65
Plagioclase)	- equigranular and rounded to almost lath shaped	10
Nepheline	-	1 ✓
Biotite	- dispensed throughout the rock	15
Fluorite	- fracture filling grains	10
Pitchblende(?)-	possibly one of the opaque - brown gray in transmitted light	1 ✓

Textures

This rock is medium grained and equigranular. The fluorite content is quite high but not all of it is purple which indicates that the uranium content is quite low.

Radioactivity

The presence of purple fluorite and a questionable identification of pitchblende. Since this sample is close to a zone in the detailed area that has produced several high uranium results some fluorite should be expected.

RA-76-31

Biotite-Fluorite Syenite

Location: Grid #1

<u>Mineralogy</u>	<u>Description</u>	<u>Percentage</u>
K-feldspar)	-	50 - 65
Plagioclase)	- large and small crystals	0 - 15
Biotite	- abundant anhedral crystals, pleochroic halos.	25
Fluorite	- occurs as a fracture fill and is all purple	15 - 10
Hematite	- primarily as grains	1
Scapolite	-	1
Pitchblende	- occurs as discrete crystals and fracture filling	2 - 3
Zircon	-	1

Textures

The rock is medium grained with phenocrysts of feldspar. There is about 5% opaques in the section of which only 2 - 3% is pitchblende. The rest of the opaque are hematite and magnetite. The fluorite and pitchblende appear to be along zones or fractures and could be late stage differentiates or a later metasomatic event.

Radioactivity

The presence of pitchblende and purple fluorite make this section very promising.

RA-76-32

Hornblende Syenite

Location: Grid #1

<u>Mineralogy</u>	<u>Description</u>	<u>Percentage</u>
K-feldspar	- large and small grains of feldspar	55 - 65
Plagioclase	-	10 - 15
Scapolite	- interstitial	2
Biotite	- replacing hornblende and as discrete crystals	2
Pyrrhotite	-	10
Uranopilite	-	4
Hornblende	- large aggregate crystals	10 - 15
Diopside	- surrounded by hornblende; as remnants	2
Fluorite	- aggregate of crystals, associated with hornblende	1

Textures

The rock has a medium to coarse grain size with the feldspars being slightly porphyritic. The presence of purple fluorite helps to make this section economically interesting. The slight orientation of feldspars give the rock the flow banded texture that is characteristic of its nature.

Radioactivity

There is the presence of fluorite and uranopilite to indicate some radioactive minerals. However there is not a lot of radiation effects in this sample.

HW-61

Biotite Syenite

Location: Cirque wall above
upper lake

<u>Mineralogy</u>	<u>Description</u>	<u>Percentage</u>
K-feldspar	- broken crystals - anhedral	40 - 45
Plagioclase	-	5 - 10
Biotite	- mix with pitchblende	25 - 30
Pitchblende	- associated with biotite, swartzite and fluorite	15 - 20
Swartzite?	- yellow pleochroic mineral - fracture filling	5
Fluorite		1
Hornblende	- associated with biotite, fluorite and pitchblende	2

Textures

The pitchblende appears to be concentrated in zones associated with the biotite. The rock is medium grained and equigranular. The feldspar is quite highly fractured that are filled with limonite. The feldspar also filled with small opaque inclusions so the thin section appears quite dirty.

Radioactivity

There is a lot of indicators of high radioactivity. The pitchblende is in very high concentration. The assay value was 9.1% U which should be expected after examining the thin section.

HW-62

Chlorite(?) - Garnet Syenite

Location: below Grid #1

<u>Mineralogy</u>	<u>Description</u>	<u>Percentage</u>
K-feldspar	- large grains, altered to clays	60 - 70
Plagioclase	-	0 - 5
Garnet	-	10 - 13
Chlorite	- isotropic, light green, medium relief	20
Scapolite	-	1

Texture

The rock is quite coarse grained, generally equigranular but the crystals are anhedral. Some of the plagioclase and K-feldspar are altered to clays. There is a mineral identified as a chlorite but it may be a thorium bearing mineral. There is not a definite description of the thorium bearing minerals to properly identify it.

Radioactivity

Definite potential for radioactivity because it comes from a thorium bearing veins however the thorium mineral is hard to identify.

APPENDIX C

General Statement

There are several common factors seen in each of the four showings. They are as follows:

- 1) A high density of fractures or foliation planes.
- 2) An increased percentage of biotite and fluorite in high grade samples.
- 3) An association of the gray syenite with the showing.
- 4) An association of magnetite and hematite with the high grade samples.
- 5) Surface leaching of some of the samples.

The first four factors appear to control the mineralization while the fifth makes it quite hard to locate mineralized zones.

Showings

Sampling lines were run every ten feet perpendicular to the base line with chip sample being taken across the radiometrically distinguished zones.

Petrographic samples were taken at spot locations (see Map 4, 5, 6). Unfortunately the chip sample only encompassed the top two inches where surface leaching was a major problem. However later blasting of the number one grid located the mineralization and produced samples ranging in grade from .6% to 1.6% U_3O_8 . This indicates that surface leaching can be an important consideration and an examination of rocks below the surface is definitely required. The samples that were taken for petrographic work were fresher and resulted in uranium minerals being identified.

The base line was run parallel to the foliation in this grid so cross lines cut across the major radiometric zones. The foliation appears to be a flow banding that has been caused by the introduction of this phase (tinguaite or syenite phase) under pressure. The present mapping indicates that there are a series of lenses; however, this is possibly a function of the state of mappable ground. The majority of the contact area is covered by talus.

The mineralization is definitely late and could either be the last phase of crystallization or even part of the subsolidus stage. The uraninite could have been introduced during the subsolidus transformation of leucite to pseudoleucite. This transformation introduces water fluids enriched in sodium ions which take away potassium and cause a volume reduction in the rock of 1%. However, there is a good possibility that this fluid carried carbon dioxide and therefore it would be capable of transporting uranium. The uranium would be deposited in the form of uraninite when the carbon dioxide has escaped. The mineralization appears, at the present time, in zones that are highly foliated and therefore they would act as permeable channel for the escaping carbon dioxide fluid.

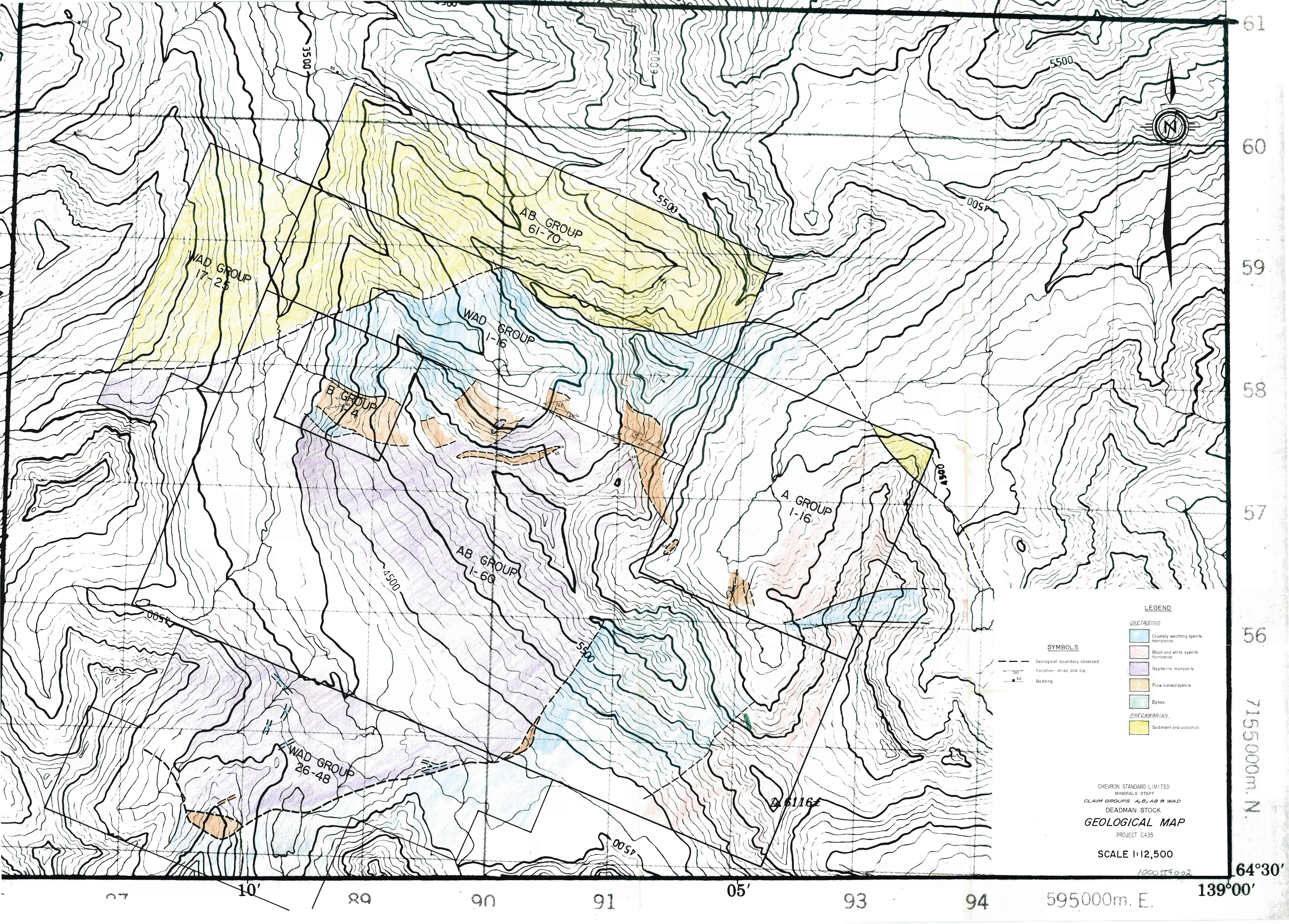
The number two grid is located in a highly fractured or foliated zone of the hornblende alkali syenite but appears to be close to the contact of the hornblende alkali syenite and the nepheline monzonite. These other zones require more work to go deeper into fresher rock that may produce higher grade samples. All high grade samples have been taken from areas close to the contact of the hornblende alkali syenite and the other phases of the stock and therefore in areas where this contact is covered an effort to uncover it must be made.

In the newly located area to the south the mineralization is associated with biotite and fluorite. This same association is seen in the other showings which indicates the late stage of the uraninite formation. The exact situation present at the new showing is not known since it was only located two days prior to our demobilization. The samples located produced encouraging results of .3% to 1.1% extractable U_3O_8 .

The Th:U ratio are very important and indicate uranium mobilization. In the majority of the stock and surrounding area a ratio of 10:1 for Th:U was found. However in all these showings a ratio of 1:10 Th:U was found. This indicates that the uranium which is more soluble than the thorium has been concentrated. There are other localities that just have thorium mineralization. Although the two minerals may have been together at one time they now appear to have been differentially remobilized to form separate concentrates. This is very significant because it increases the chances of finding an economic uranium body with no thorium.

In the office time has been spent studying the mineral associations that were found to see if there were any common assemblages. The common minerals that were associated with uraninite were feldspar biotite, fluorite, magnetite, with minor pyrite, pyrrhotite and hematite. To see if these minerals would ever occur together Eh-ph diagrams were constructed from known data at 25°C and atmosphere (see Figure 2). These diagrams indicate the overlap of the phases. However they do not portray the actual conditions at the time of uraninite formation. The possibility of these phases existing or forming under the same conditions is indicated by this figure.

Since there is a problem with leaching of the surface rocks and there appears to be an increase in uranium content at depth a drill program is proposed for next year. This program proposes to sample the zone at depth so that we have a better grasp of the tonnage and grade of these zones. In addition the remaining contacts will be prospected. The location of the proposed drill lines are shown in map.



LEGEND

- CRETACEOUS**
- Crumbly weathering syenite hornblende
 - Block and white syenite hornblende
 - Nepheline monzonite
 - Flow banded syenite
 - Dykes
- PRECAMBRIAN**
- Sediment and volcanics

SYMBOLS

- Geological boundary observed
- Foliation-strike and dip
- Bedding

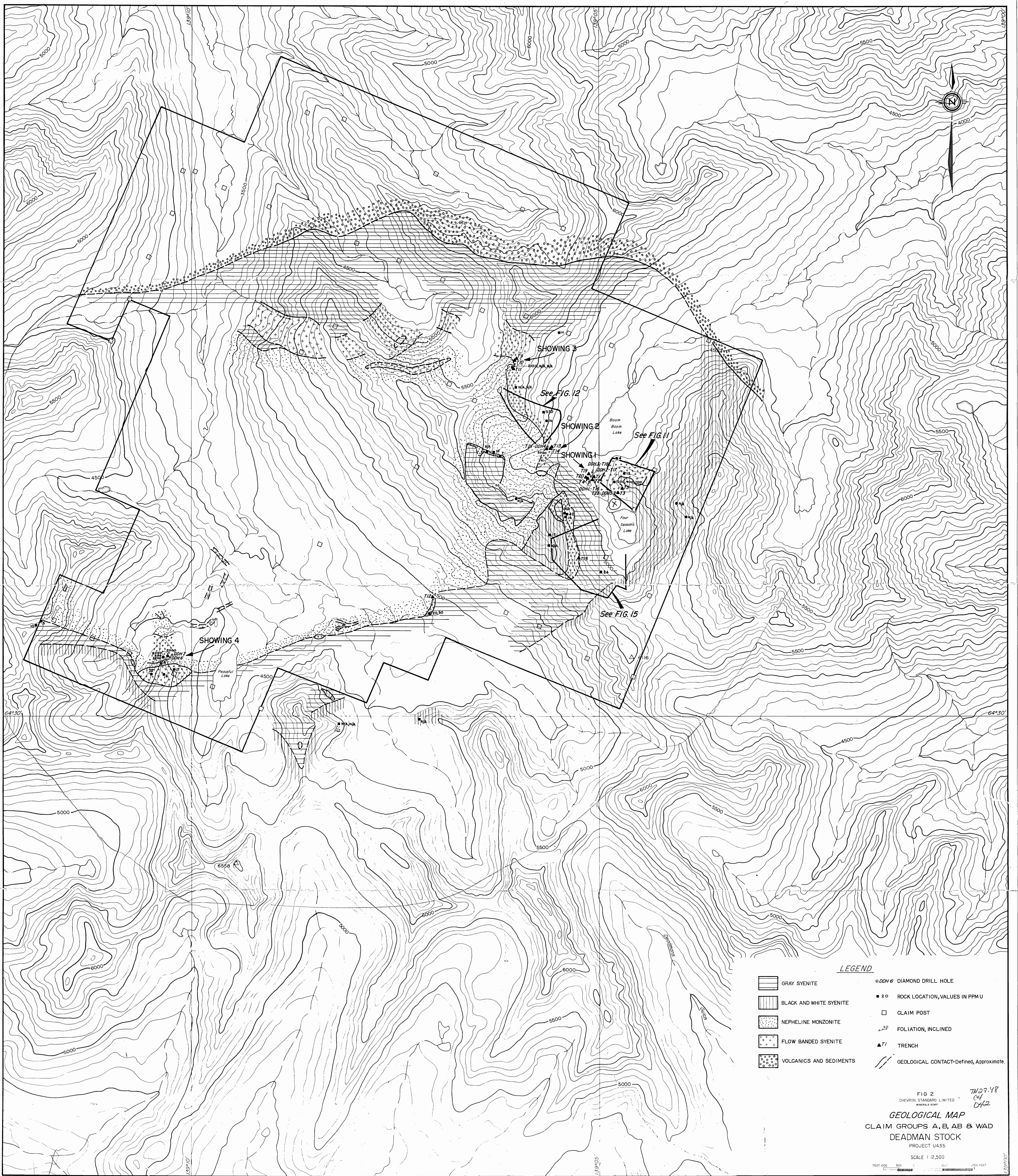
CHEVRON STANDARD LIMITED
 MINERALS STAFF
 CLAIM GROUPS A, B, AB, WAD
 DEADMAN STOCK
GEOLOGICAL MAP
 PROJECT C435

SCALE 1:12,500

1000559002

61
60
59
58
57
56
7155000m. N.
64°30'

07 10' 29 90 91 05' 93 94 595000m. E. 139°00'



LEGEND

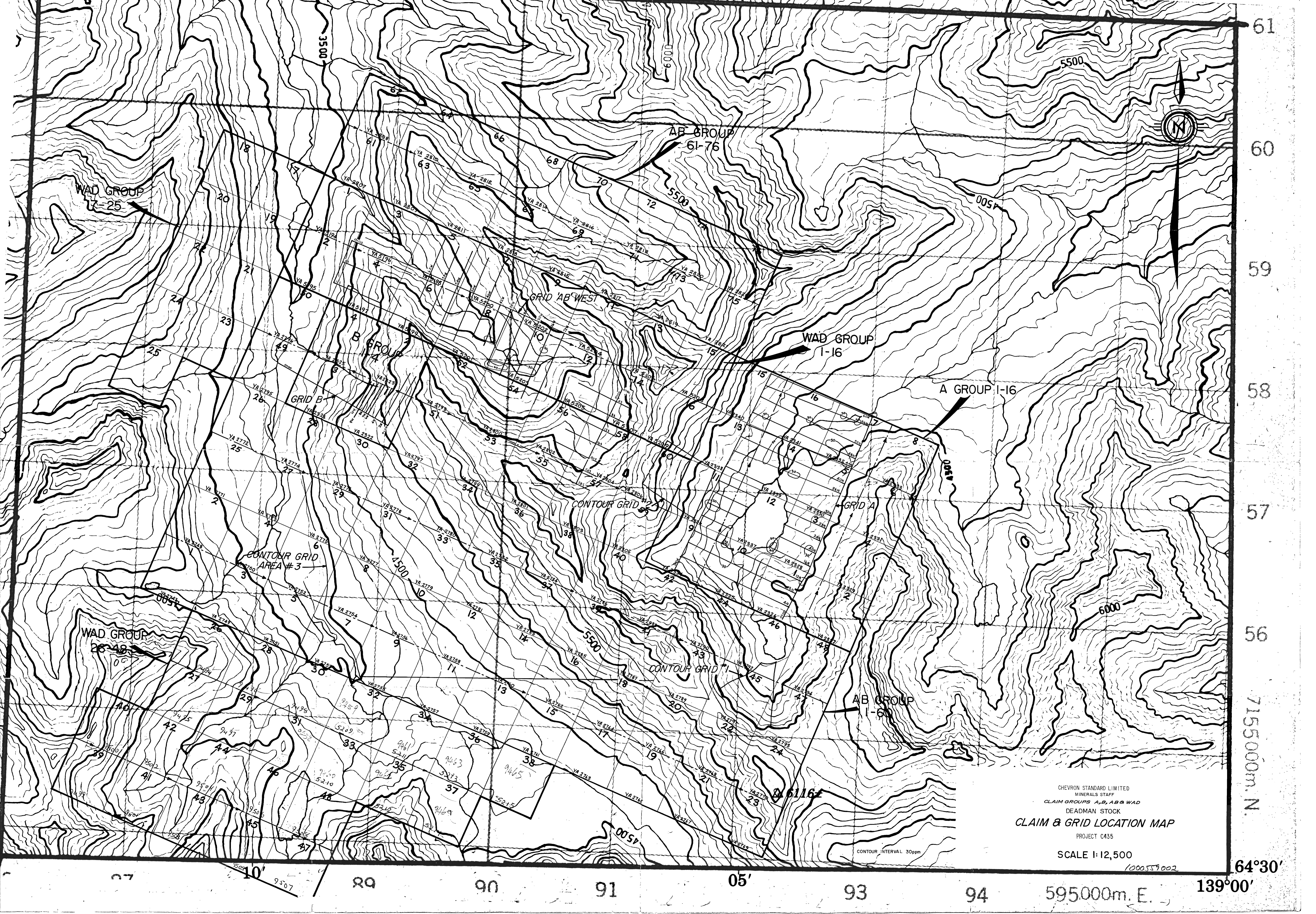
- | | | | |
|--|-------------------------|--|--|
| | GRAY SYENITE | | DIAMOND DRILL HOLE |
| | BLACK AND WHITE SYENITE | | ROCK LOCATION, VALUES IN PPM U |
| | NEPHELINE MONZONITE | | CLAIM POST |
| | FLOW BANDED SYENITE | | FOLIATION, INCLINED |
| | VOLCANICS AND SEDIMENTS | | TRENCH |
| | | | GEOLOGICAL CONTACT-Defined, Approximate. |

FIG 2
 CHEVRON STANDARD LIMITED
 MINERALS STAFF
GEOLOGICAL MAP
 CLAIM GROUPS A, B, AB & WAD
 DEADMAN STOCK
 PROJECT U435
 SCALE 1:12,500

FEET 0 500 1000

1000559002

7/27/88
 C4
 D42



WAD GROUP
1-25

AB GROUP
61-76

B GROUP
1-16

WAD GROUP
1-16

A GROUP
1-16

CONTOUR GRID
AREA # 3

CONTOUR GRID

GRID A

WAD GROUP
26-48

AB GROUP
1-60

6116

CHEVRON STANDARD LIMITED
MINERALS STAFF
CLAIM GROUPS A,B,AB,WAD
DEADMAN STOCK
CLAIM & GRID LOCATION MAP
PROJECT C435

SCALE 1:12,500

1000559002

CONTOUR INTERVAL 30ppm

61

60

59

58

57

56

7155000m. N.

64°30'

87

10'

89

90

91

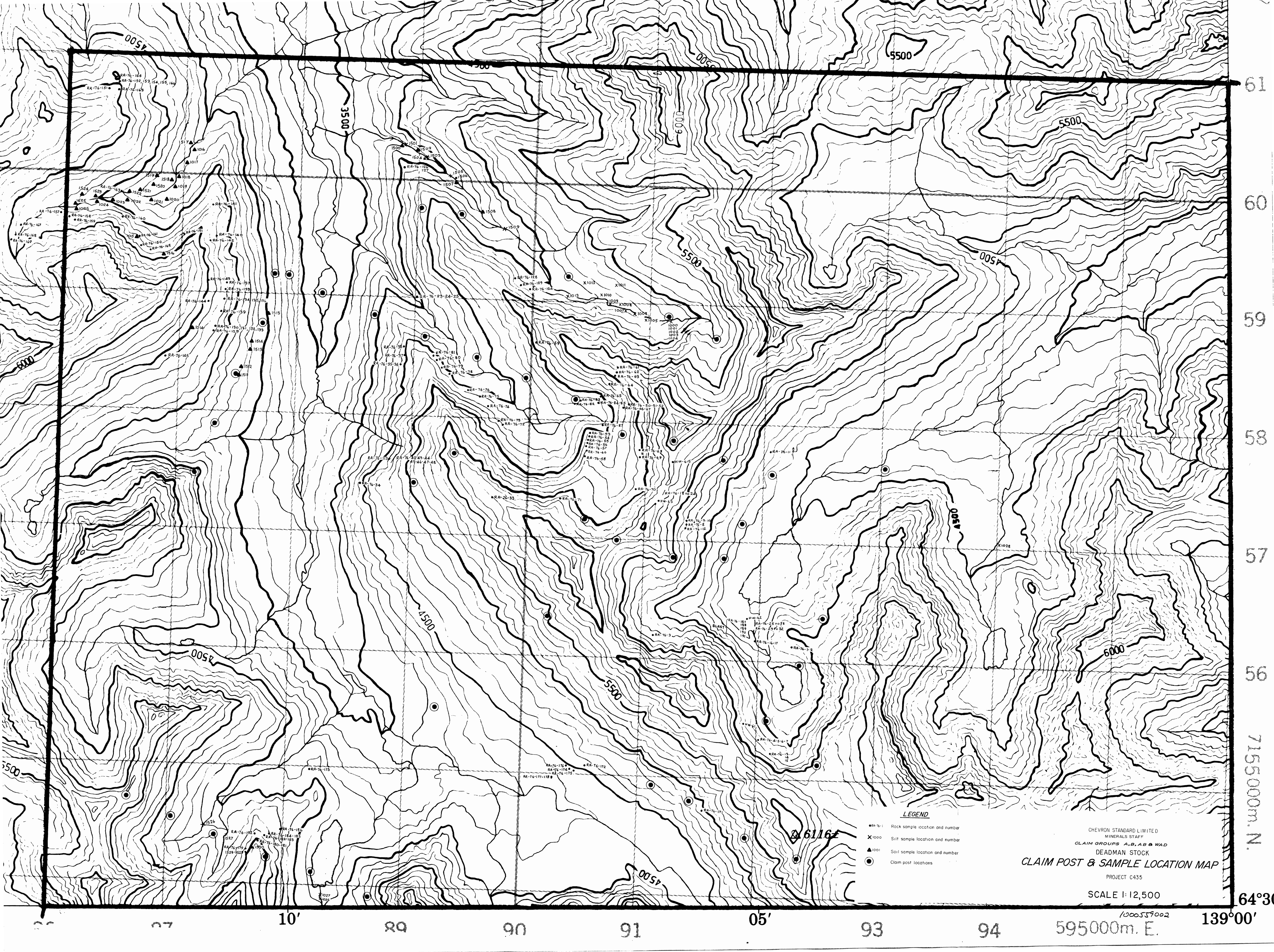
05'

93

94

595000m. E.

139°00'



LEGEND

- RA-76-1 Rock sample location and number
- X 1000 Silt sample location and number
- ▲ 1001 Soil sample location and number
- Claim post locations

CHEVRON STANDARD LIMITED
 MINERALS STAFF
 CLAIM GROUPS A,B,AB & WAD
 DEADMAN STOCK
CLAIM POST & SAMPLE LOCATION MAP

PROJECT C435
 SCALE 1:12,500



1000557002
 595000m. E.

61
60
59
58
57
56
7155000m. N.
64°30'

07 10' 89 90 91 05' 93 94 139°00'

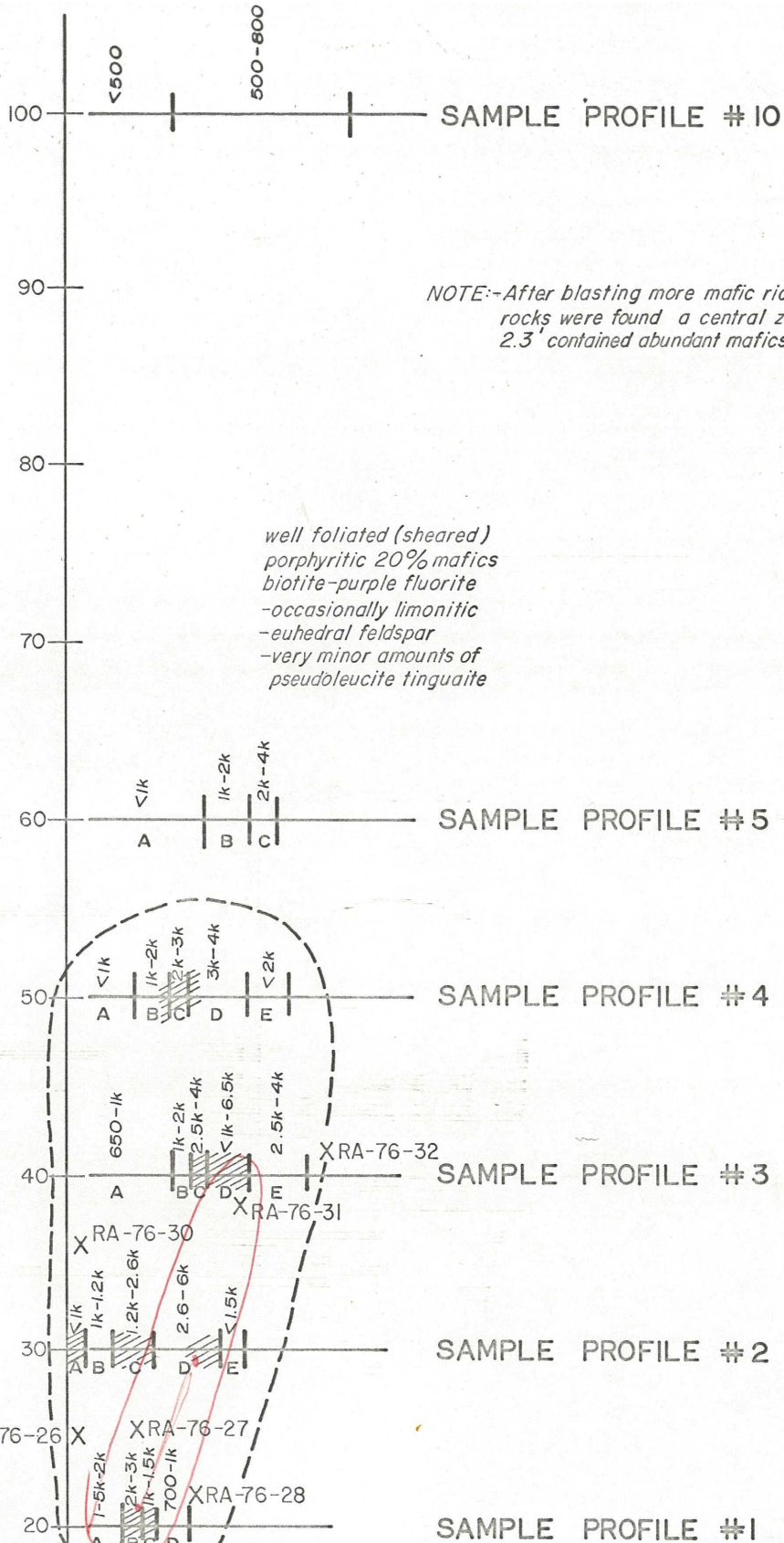
DETAILED SAMPLE GRID # 1

LEGEND

- 500 Radiometrics in cps
-  Limonitic zones
- XRA-76-29 Petrographic location and sample number
- A Chip sample zone (see Appendix B)
-  Extent of pit after blasting 8-10 feet deep
- k 1000 cps

XRA-76-25

- medium grained nepheline syenite
- massive
- leucocratic
- minor epidote alteration
- 10% mafics-hornblende



NOTE:-After blasting more mafic rich rocks were found a central zone 2.3' contained abundant mafics.

well foliated (sheared)
porphyritic 20% mafics
biotite-purple fluorite
-occasionally limonitic
-euhedral feldspar
-very minor amounts of
pseudoleucite tinguaita

SAMPLE PROFILE # 5

SAMPLE PROFILE # 4

SAMPLE PROFILE # 3

SAMPLE PROFILE # 2

SAMPLE PROFILE # 1

CHEVRON STANDARD LIMITED

DETAILED SAMPLE GRID # 1

CLAIM NUMBER A10

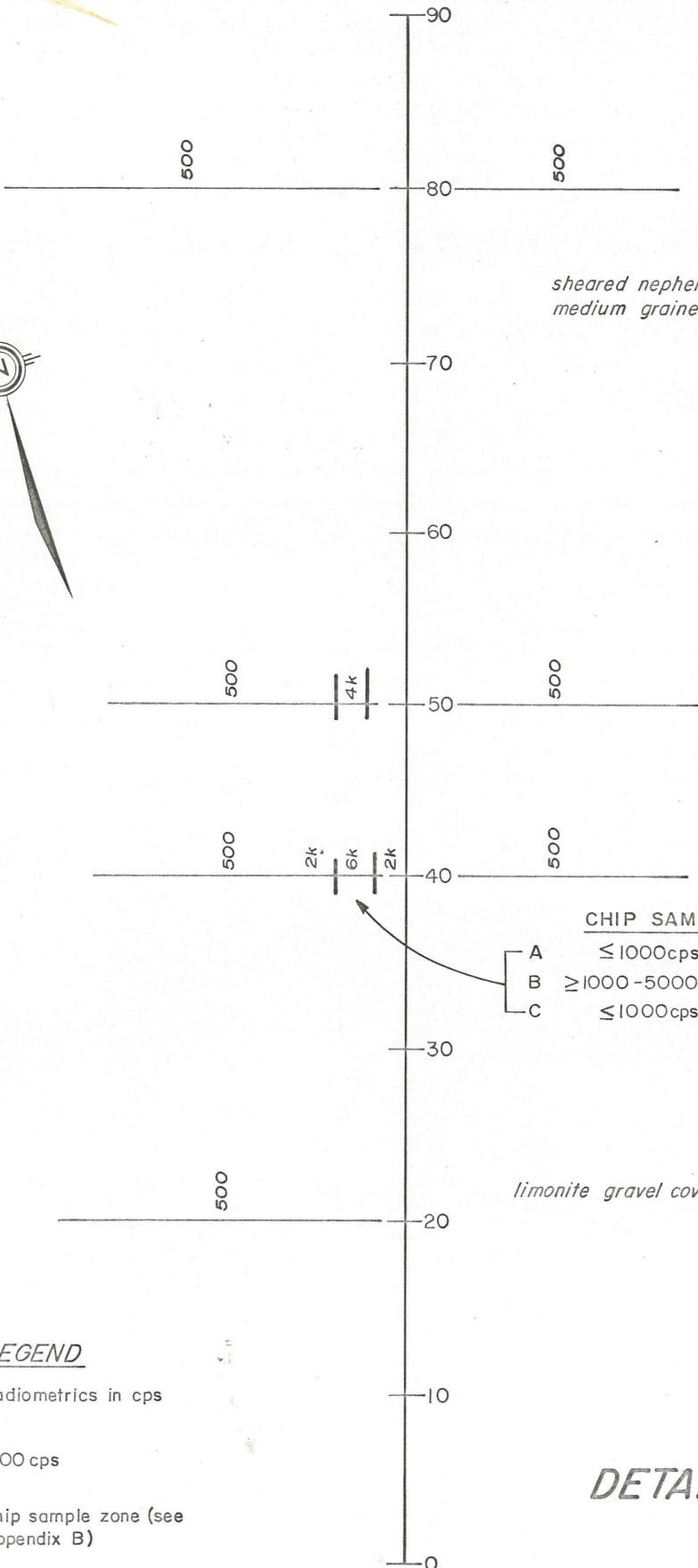
PROJECT C435

SCALE IN FEET



DETAILED SAMPLE GRID #2

strike of grid line is 18°



*sheared nepheline syenite
medium grained*

*very well foliated
N20E/60W*

*A small vein of black pitchblende
was located in the sheared gray syenite.*

CHIP SAMPLES

A	≤ 1000cps	thickness 72"
B	≥ 1000-5000cps	thickness 18"
C	≤ 1000cps	thickness 50"

LEGEND

- 500 Radiometrics in cps
- k 1000 cps
- A Chip sample zone (see Appendix B)

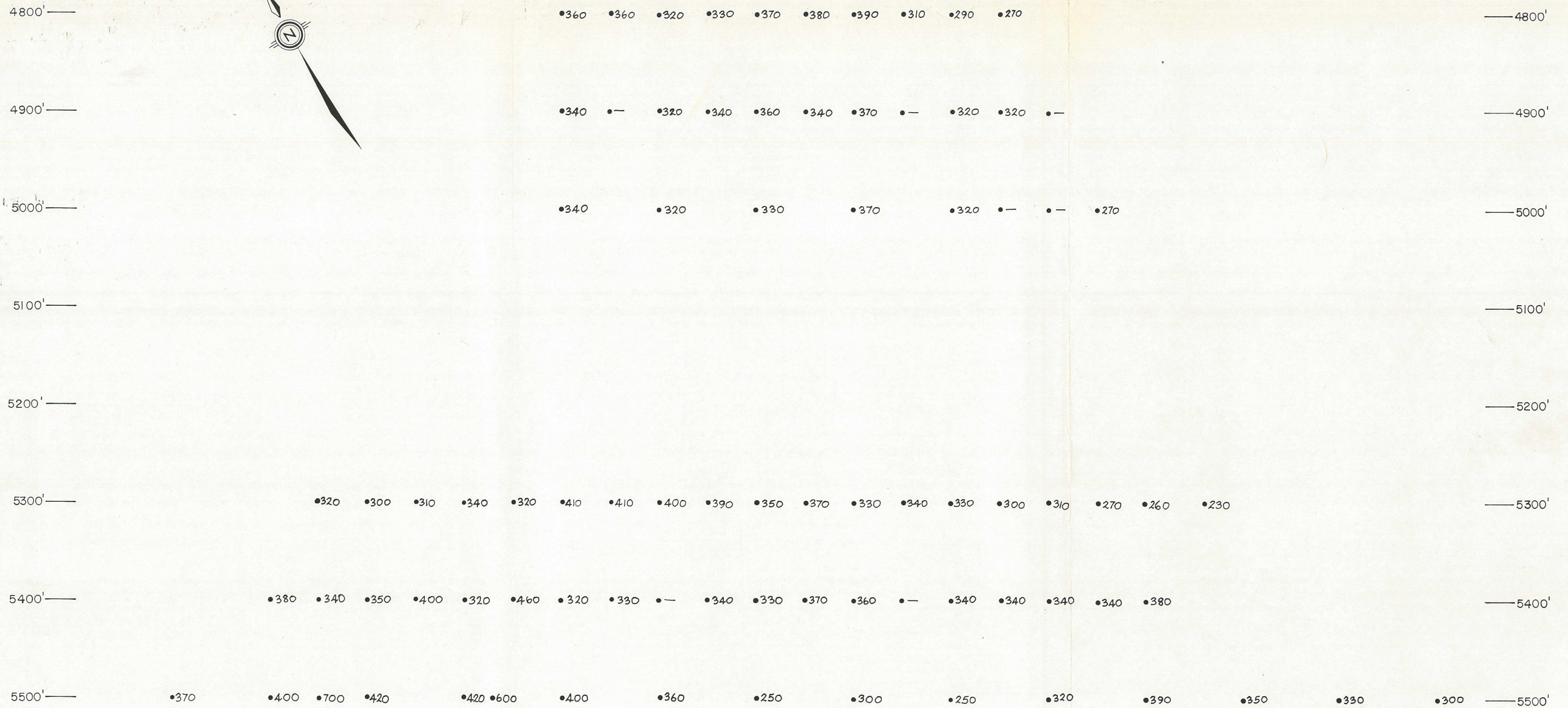
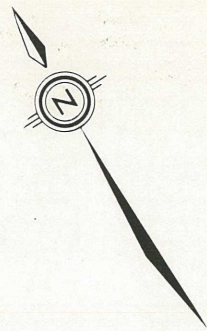
CHEVRON STANDARD LIMITED

DETAILED SAMPLE GRID # 2

CLAIM NUMBER A9
PROJECT C435

SCALE IN FEET





LEGEND

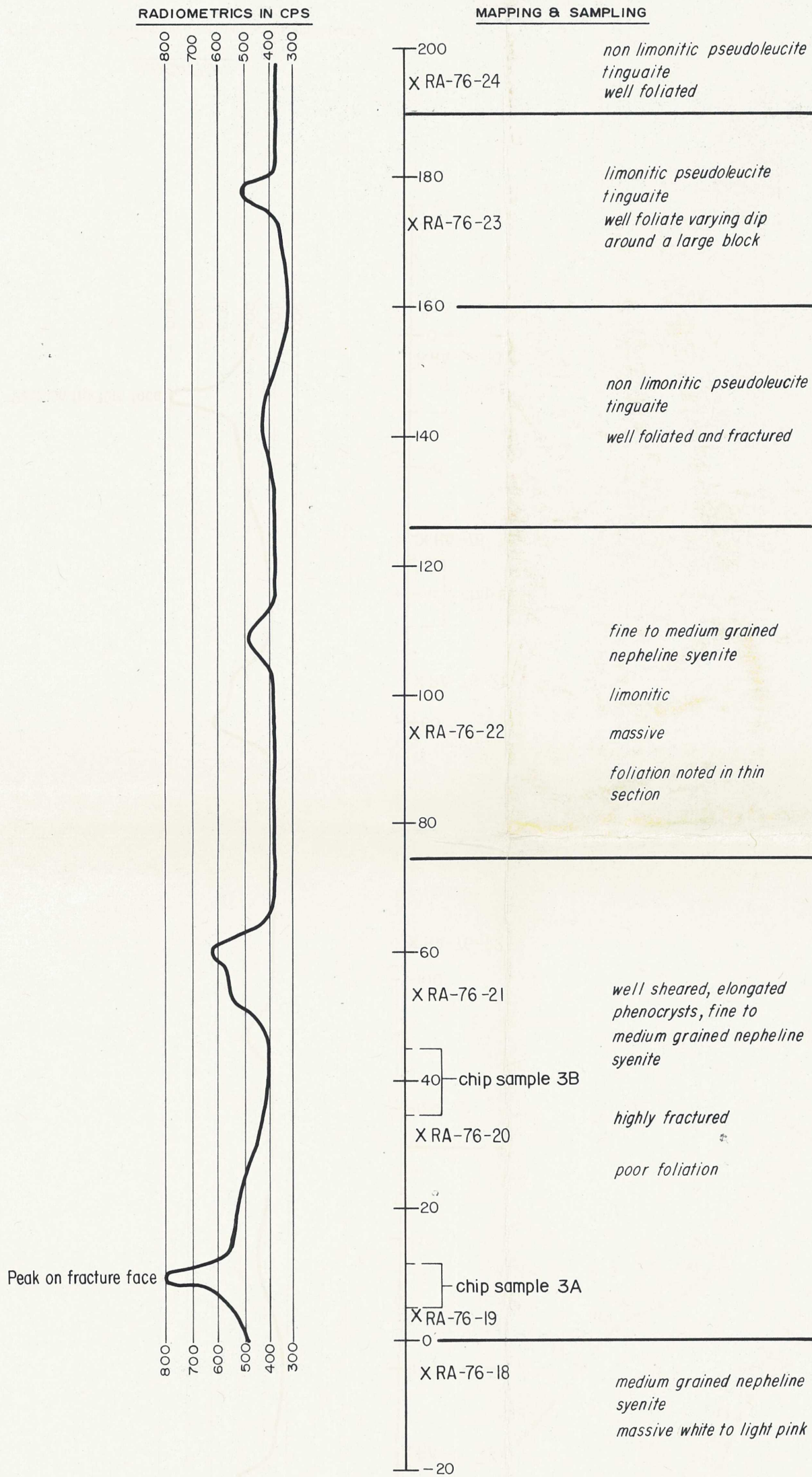
Scintillometer value in counts per second
Instrument:-Scintrex BGS ISL.

Elevation interval 100 feet

CHEVRON STANDARD LIMITED
MINERALS STAFF
CLAIM GROUP
RADIOMETRIC SURVEY
CONTOUR GRID #1
PROJECT C435
SCALE IN FEET
400 0 400 800



DETAILED SAMPLE GRID # 3
strike of grid line is 16°



LOCATION

X RA-76-20 Petrographic location and sample number

3A Chip sample zone (see appendix B)

MAP 6

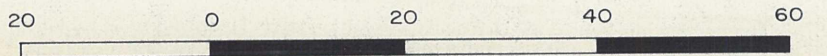
CHEVRON STANDARD LIMITED

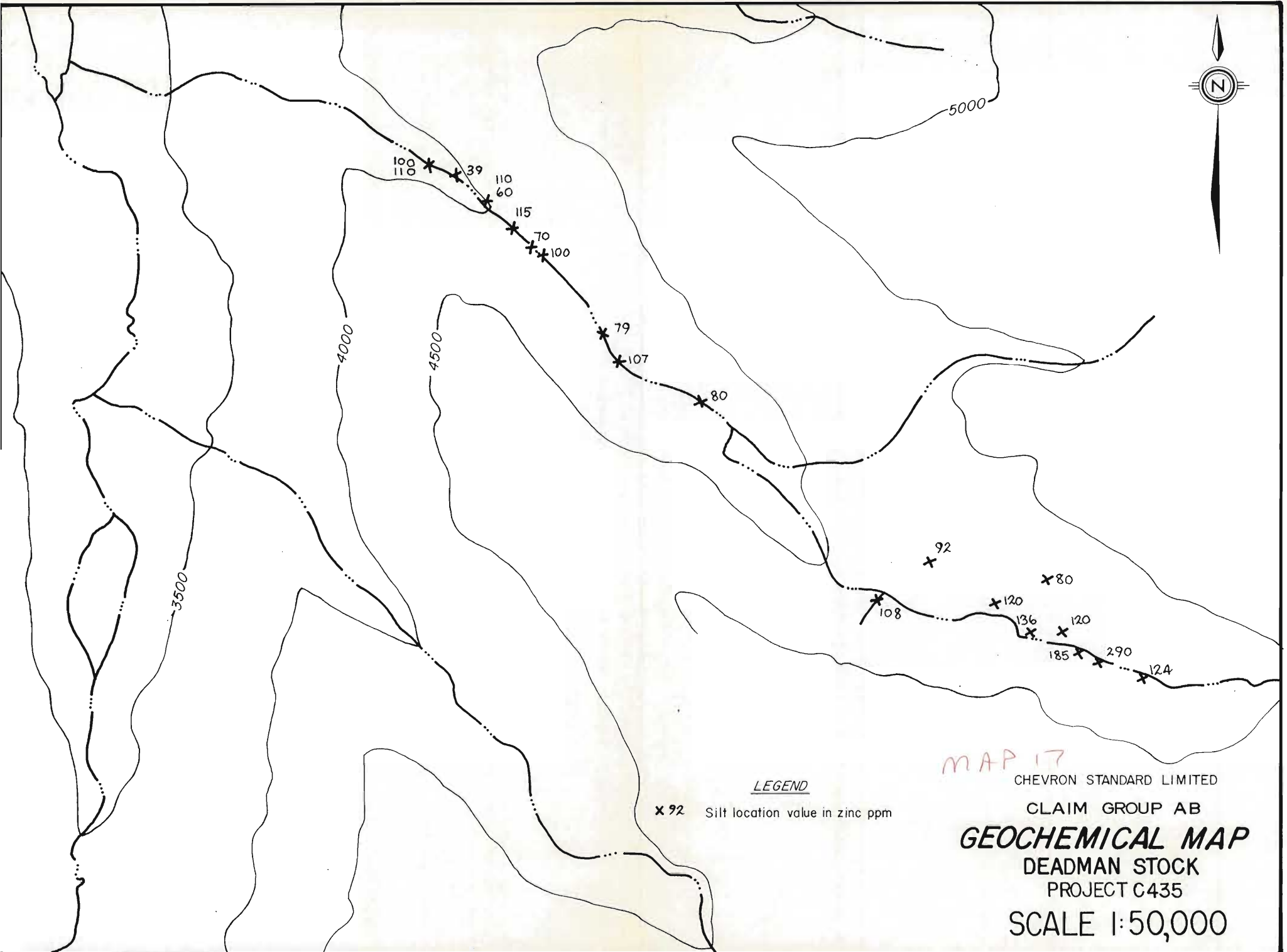
DETAILED SAMPLE GRID # 3

CLAIM NUMBER AB60

PROJECT C435

SCALE IN FEET





LEGEND

x 92 Silt location value in zinc ppm

MAP 17

CHEVRON STANDARD LIMITED

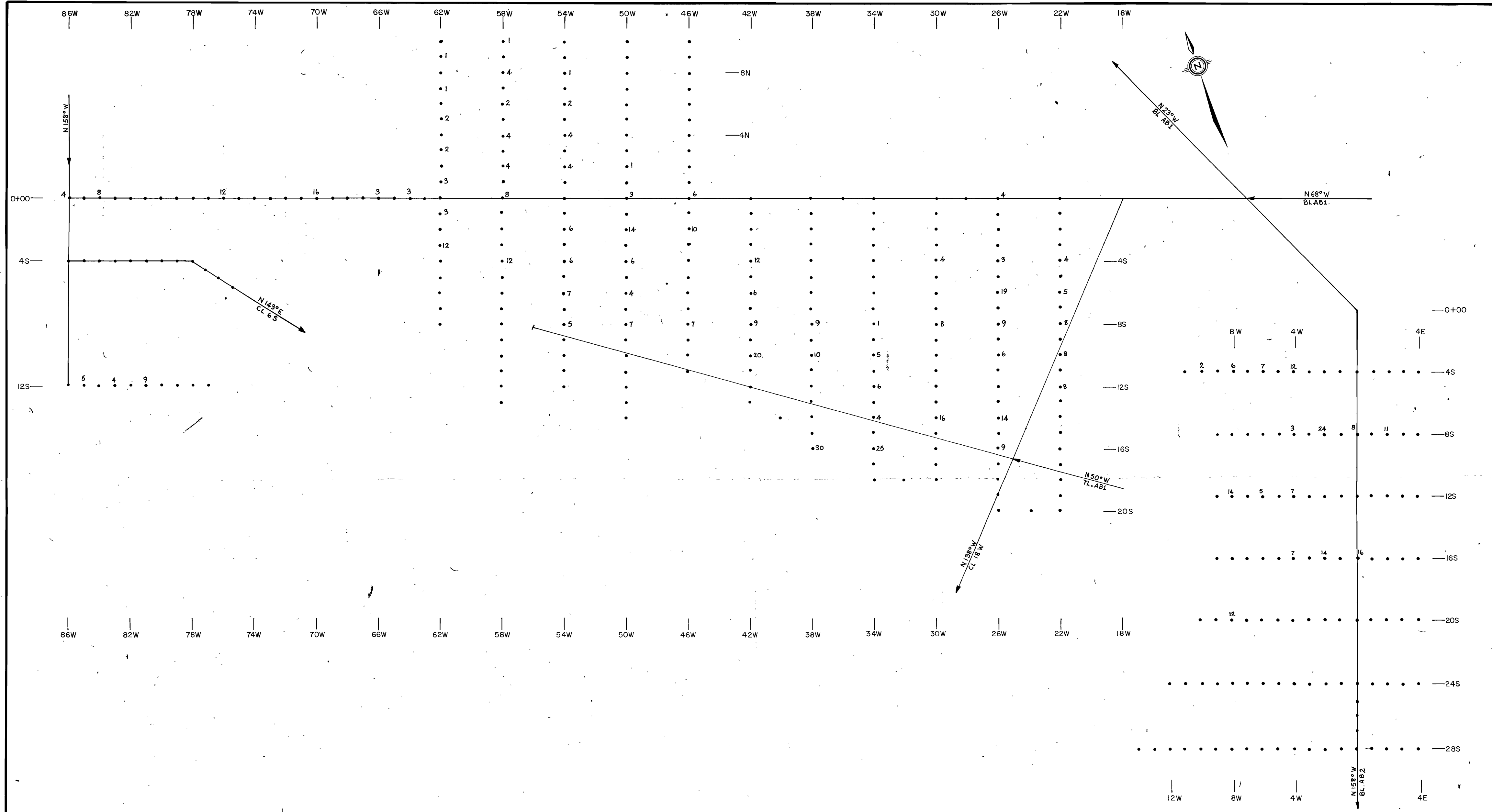
CLAIM GROUP AB

GEOCHEMICAL MAP

DEADMAN STOCK

PROJECT C435

SCALE 1:50,000



86W 82W 78W 74W 70W 66W 62W 58W 54W 50W 46W 42W 38W 34W 30W 26W 22W 18W

N 158° W
 0+00
 4
 4S
 12S

86W 82W 78W 74W 70W 66W 62W 58W 54W 50W 46W 42W 38W 34W 30W 26W 22W 18W

0+00
 4S
 8S
 12S
 16S
 20S
 24S
 28S
 12W 8W 4W 4E

8N
 4N

N 143° E
 CL 6 S

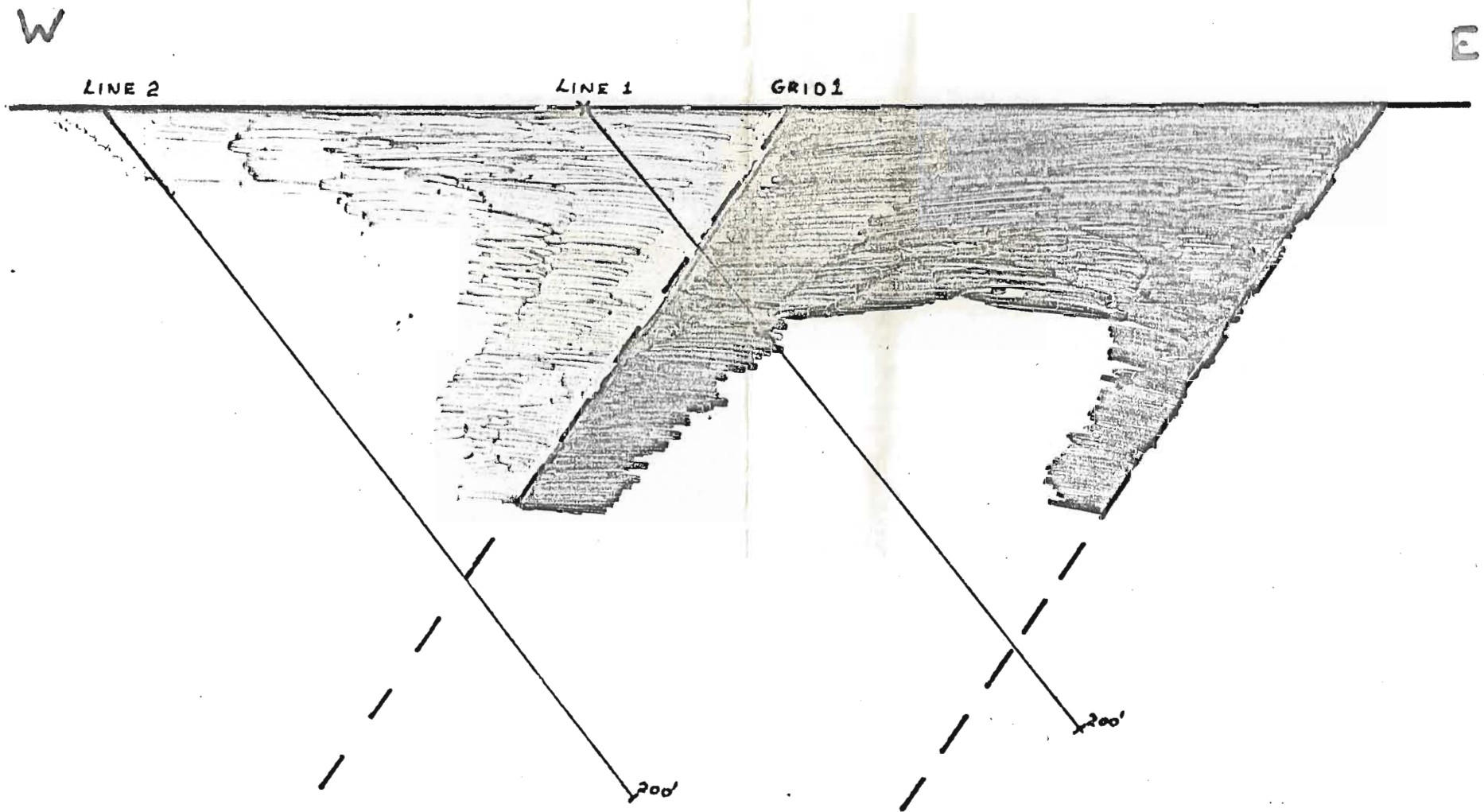
N 50° W
 7L AB1

N 138° W
 CL 18 W

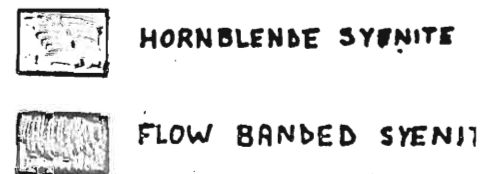
N 158° W
 BL AB2

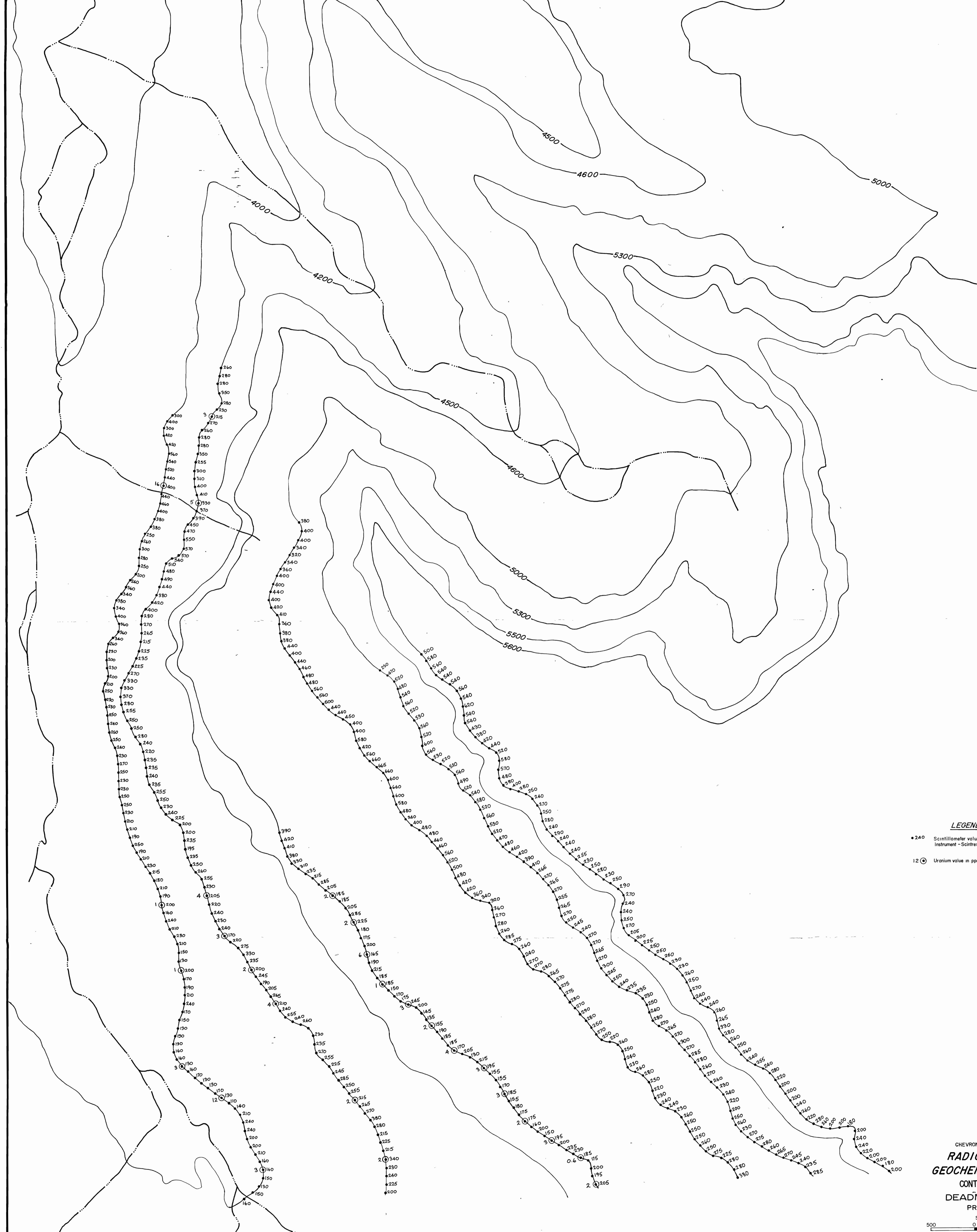
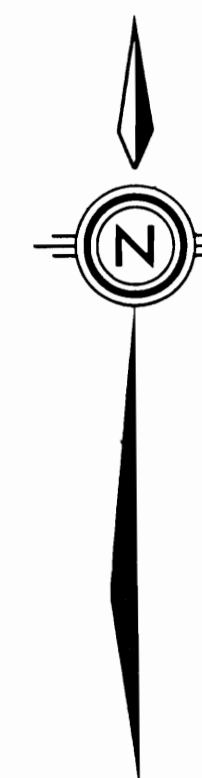
LEGEND
 • 10 Uranium value in ppm

CHEVRON STANDARD LIMITED
 MINERALS STAFF
 MAP 16 CLAIM GROUP
 SOIL SAMPLING SURVEY
 GRID 'AB' WEST
 PROJECT C435
 SCALE IN FEET
 400 0 400 800
 1000559002



PROPOSED DRILL LOCATIONS
FOR GRID 1

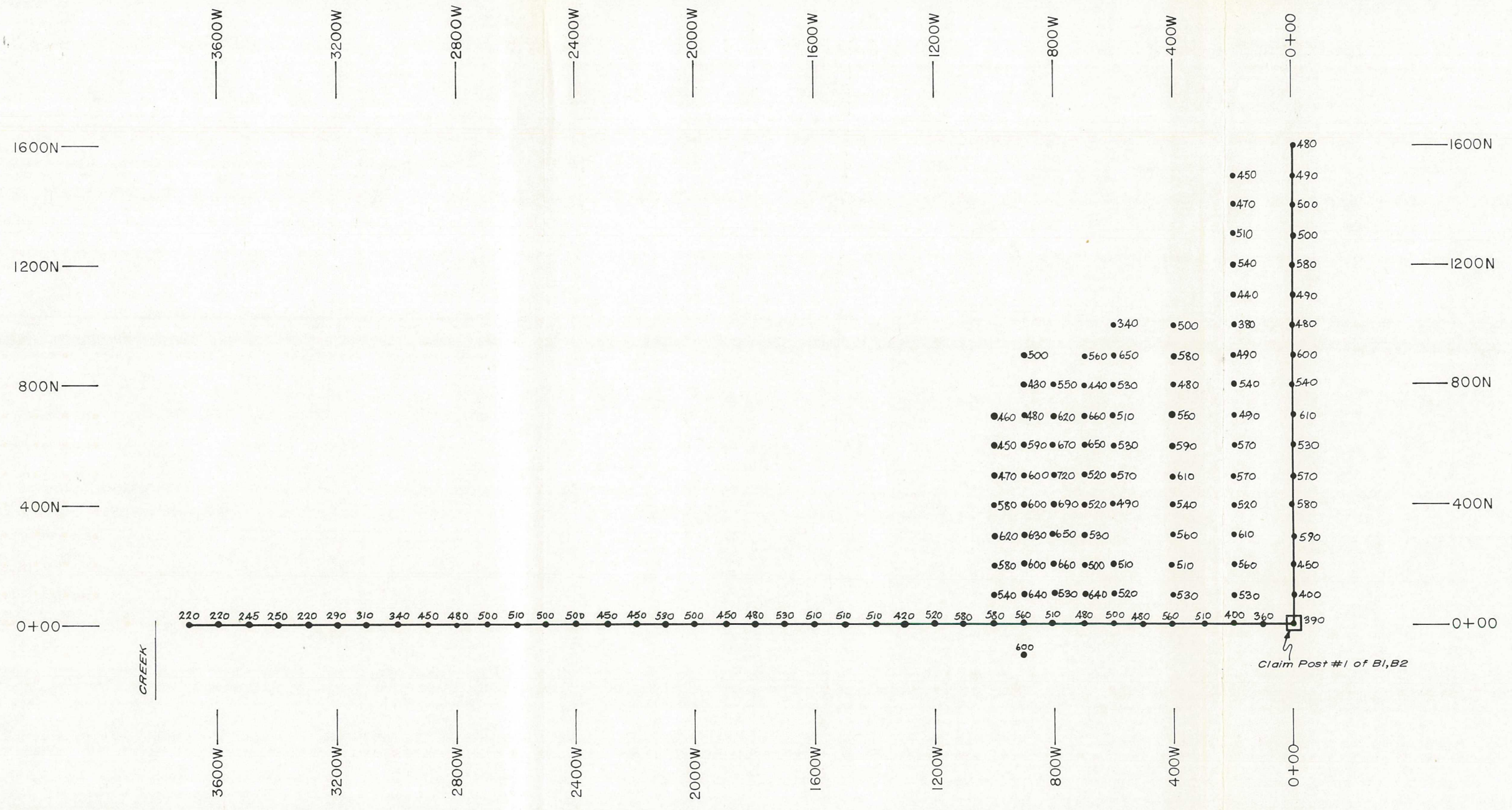
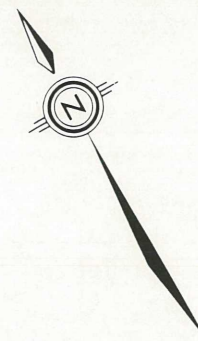




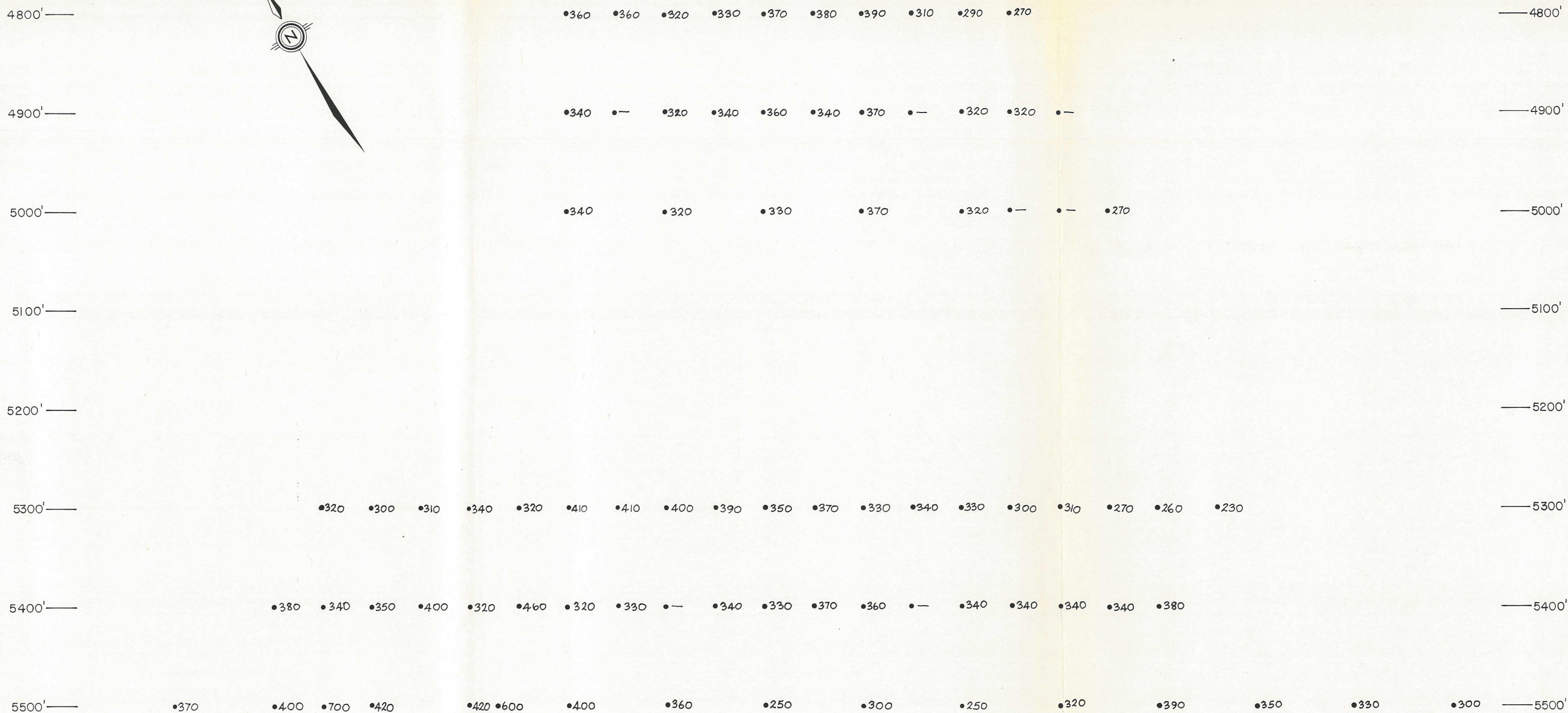
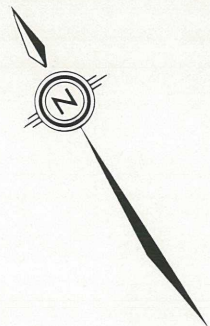
LEGEND
● 240 Scintillometer value in counts per second
Instrument - Scintrex BGS 15L
12 ○ Uranium value in ppm

MAP 11
CHEVRON STANDARD LIMITED
**RADIOMETRIC &
GEOCHEMICAL SURVEY**
CONTOUR GRID #3
DEADMAN STOCK
PROJECT C435

SCALE IN FEET
0 500 1000
1000515002



CHEVRON STANDARD LIMITED
MINERALS STAFF
CLAIM GROUP
RADIOMETRIC SURVEY
GRID 'B'
PROJECT C435
SCALE IN FEET
400 0 400 800

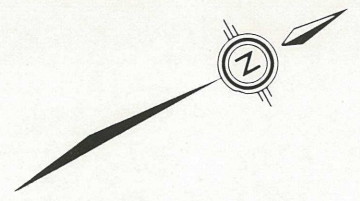
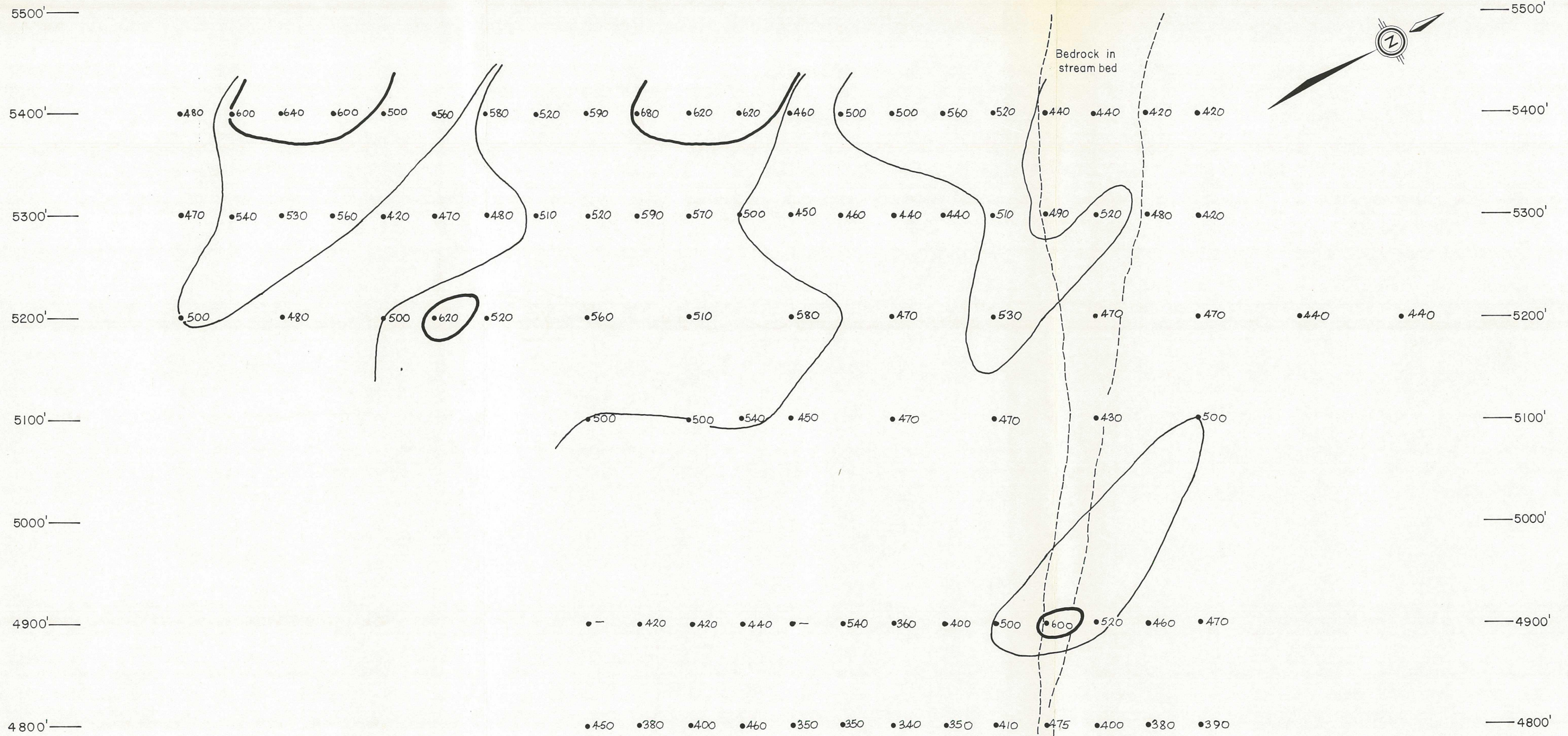


LEGEND

Scintillometer value in counts per second
 Instrument:- Scintrex BGS ISL .

Elevation interval 100 feet

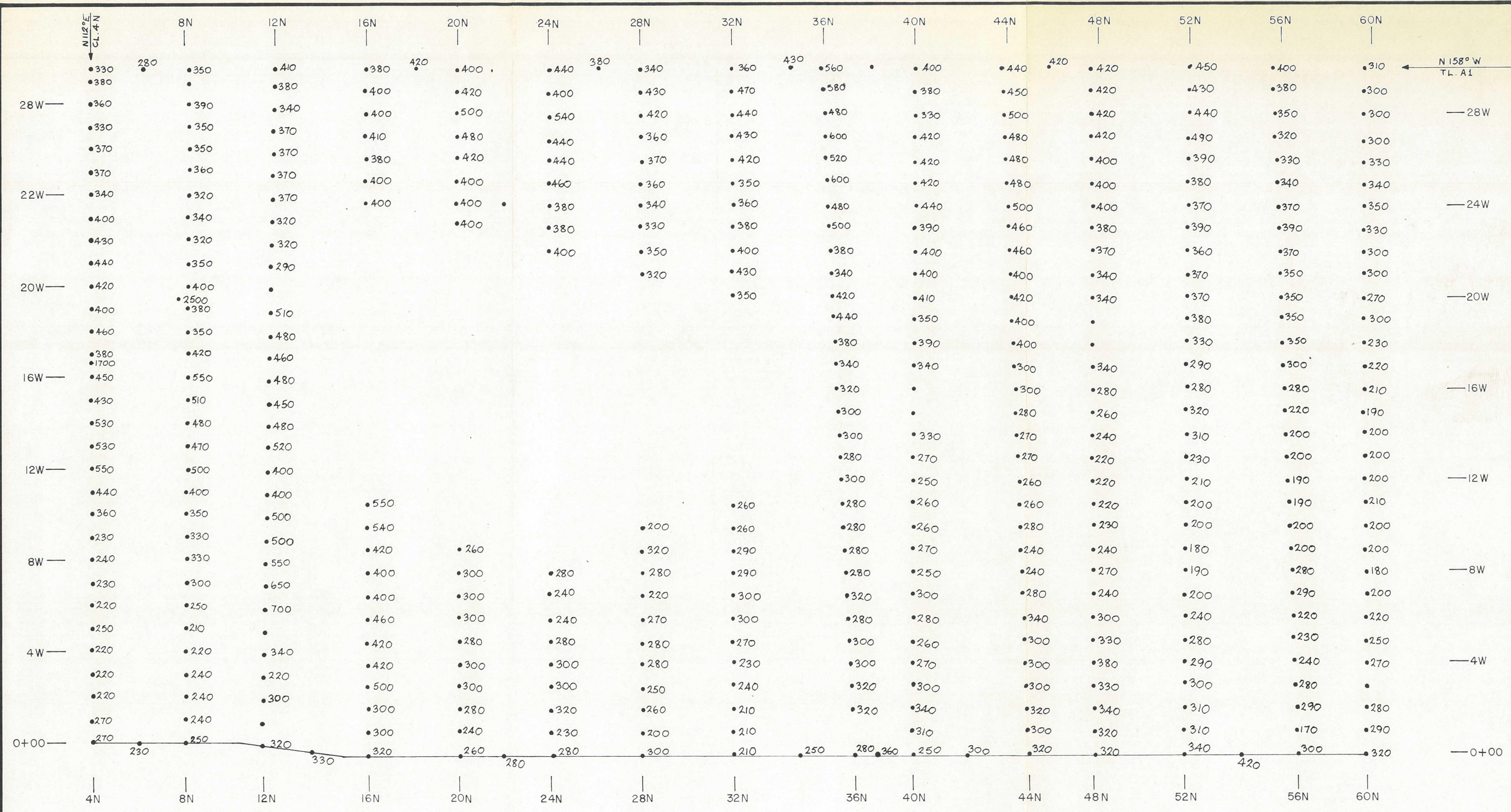
CHEVRON STANDARD LIMITED
 MINERALS STAFF
 CLAIM GROUP
RADIOMETRIC SURVEY
CONTOUR GRID #1
 PROJECT C435
 SCALE IN FEET
 400 0 400 800



LEGEND

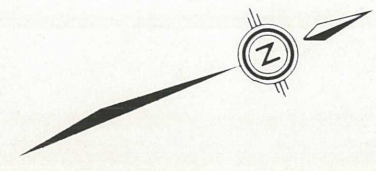
- 510 Scintillometer value in counts per second
Instrument:-Scintrex BGS ISL.
- Contour 500 counts per second
- Contour 600 counts per second
- Elevation interval 100 feet

CHEVRON STANDARD LIMITED
MINERALS STAFF
CLAIM GROUP
RADIOMETRIC SURVEY
CONTOUR GRID #2
PROJECT C435
SCALE IN FEET
400 0 400 800

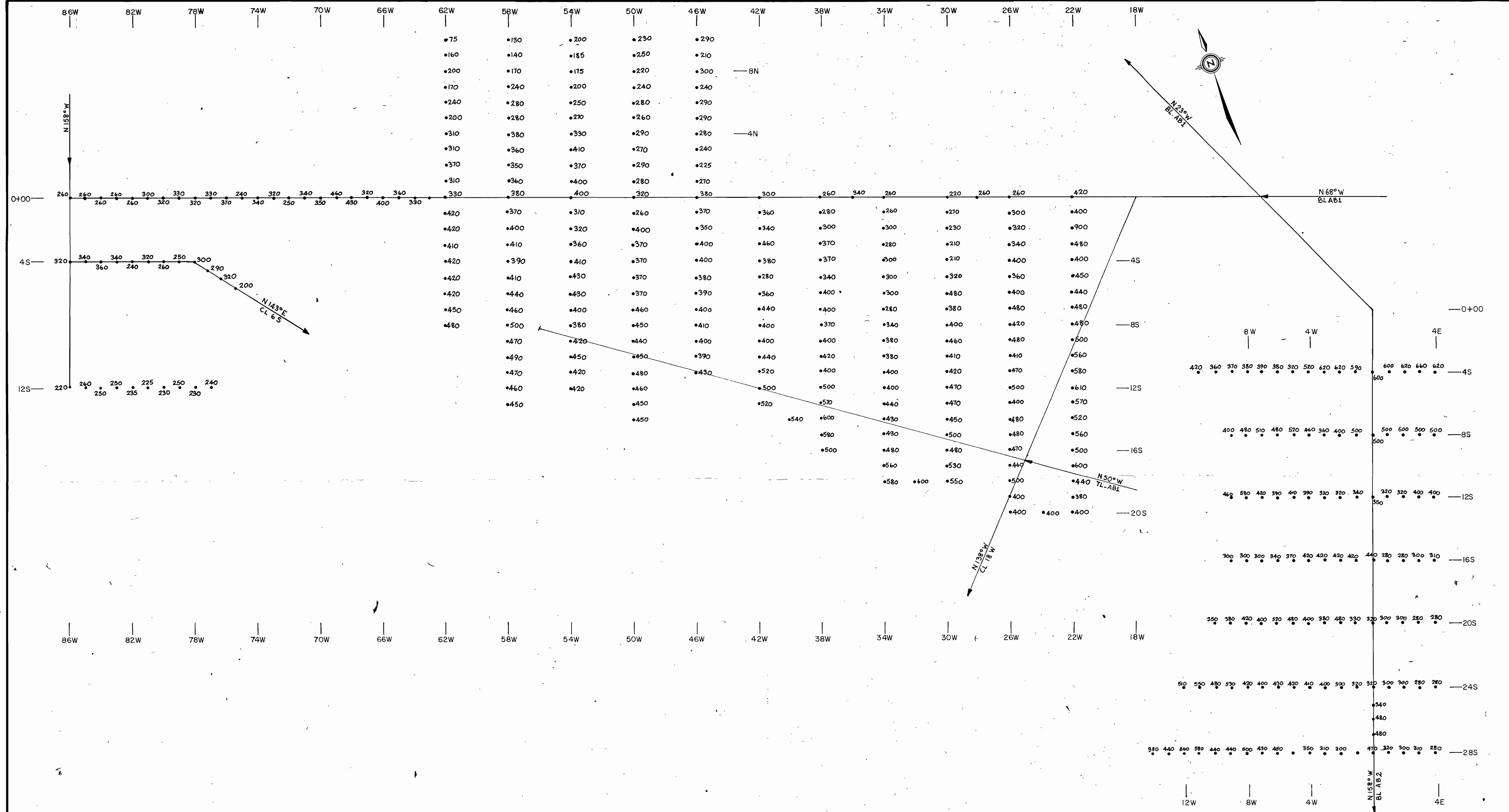


LEGEND

• 510 Scintillometer value in counts per second
Instrument: Scintrex BGS ISL.



CHEVRON STANDARD LIMITED
MINERALS STAFF
CLAIM GROUP
RADIOMETRIC SURVEY
GRID A
PROJECT C435
SCALE IN FEET
0 400 800



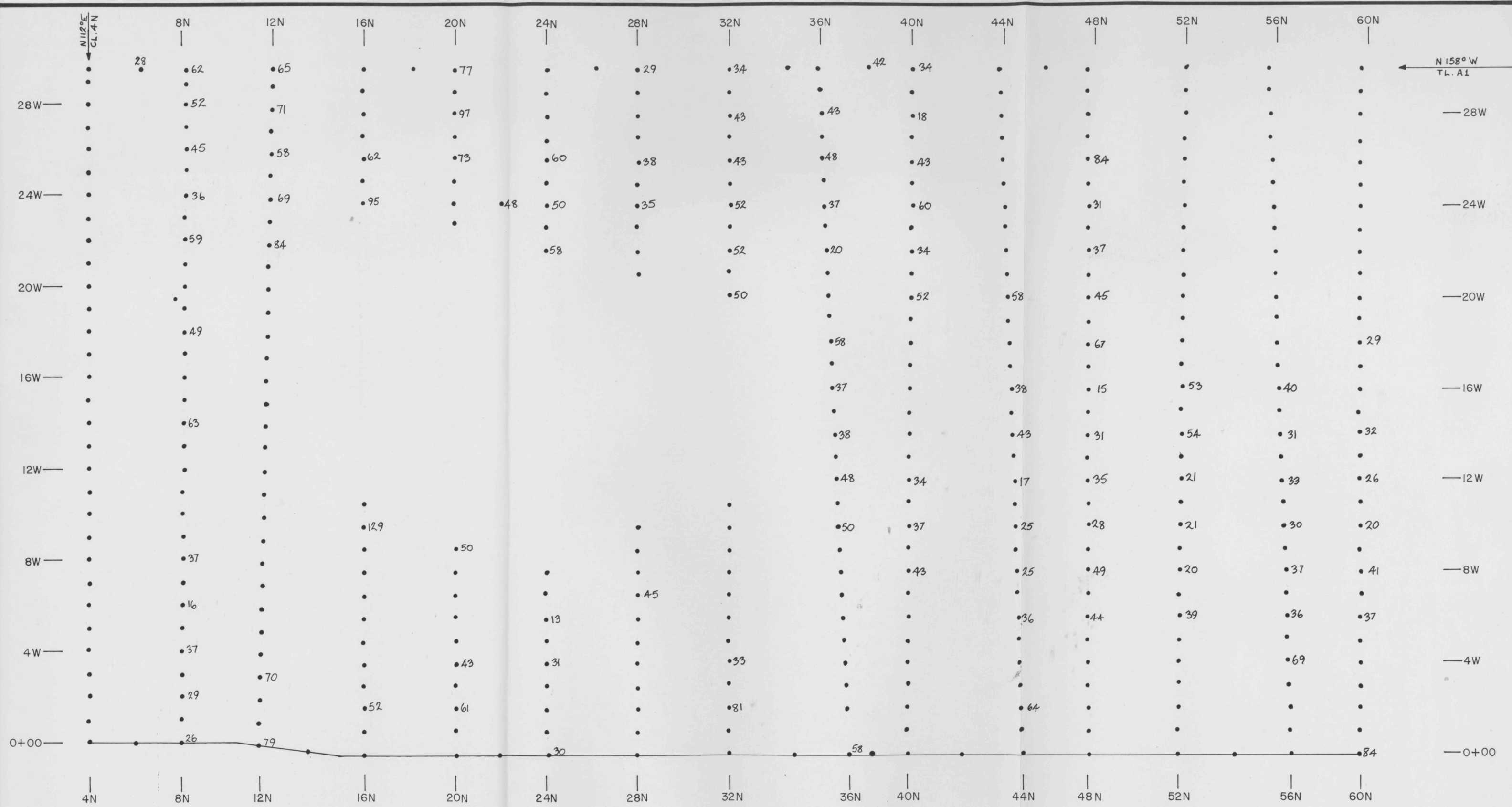
LEGEND

• 50 Scintilometer value in counts per second
 Instrument - Scintrex BGS 1SL

CHEVRON STANDARD LIMITED
 MINERALS STAFF
 CLAIM GROUP
RADIOMETRIC SURVEY
GRID 'AB' WEST
PROJECT C435

SCALE IN FEET
 400 0 400 800

1000559002



LEGEND
 •30 Thorium value in ppm.

MAP 14
 CHEVRON STANDARD LIMITED
 MINERALS STAFF
 CLAIM GROUP
SOIL SAMPLING SURVEY
GRID A
PROJECT C435
 SCALE IN FEET
 400 0 400 800