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GEOLOGICAL BRANCH
ASSESSMENT REPORT

20,572

ASSESSMENT REPORT

ON THE

PROSPECTING, GEOLOGICAL AND GEOCHEMICAL

WORK DONE ON THE

PLEIADES CLAIM

KAMLOOPS MINING DIVISION

N.T.S. 83D/3E

LAT. 52 08 30
LONG. 119 06 30

OWNER/OPERATOR: Gary Johnston

By: Gary Johnston
Ray Jalbert
Maureen Johnston

NOVEMBER, 1990

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INTRODUCTION

This report details prospecting, geological, geochemical and geophysical work done on the Pleiades group of claims. The property was staked in September of 1989 by Gary Johnston to cover an amphibolite dike which had been sampled during the summer. The geochemical analysis of the hand specimen indicated total rare earth (REE) values close to 1.5%. The rare earths indicated by the geochemical test were the light lanthanides (La 7400 ppm, Ce 5900 ppm, Nd 1200 ppm, Sm 59 ppm and Eu 18.1 ppm).

In light of the extremely high rare earth values, a comprehensive exploration program was designed for the summer of 1990.

The 1990 program consisted of prospecting, detailed geological mapping, rock chip geochemical sampling, petrographic analysis and geophysical surveys.

The Pleiades group consists of three 2-Post claims, Pleiades 1 to Pleiades 3. They have been grouped for assessment purposes.

LOCATION AND ACCESS

The claims occur in NTS map sheet 83D/3E at approximately 52 degrees 8.5 minutes latitude and 119 degrees 06 minutes longitude. The property is in the Monashee Mountains about twenty kilometers northeast of the town of Blue River.

Access to the property is by the Redsand logging road. The entrance to this road is just north of the Blue River airport on highway #5. At 15.6 Km. the logging road forks. Take the north fork and follow it to the end at 20.1 Km. The road ends in the middle of the claim area.

Active logging is taking place in the valley so the Redsand road is well maintained. However, washouts are frequent in the spring, so travel should be avoided when the snow is melting.

TOPOGRAPHY AND CLIMATE

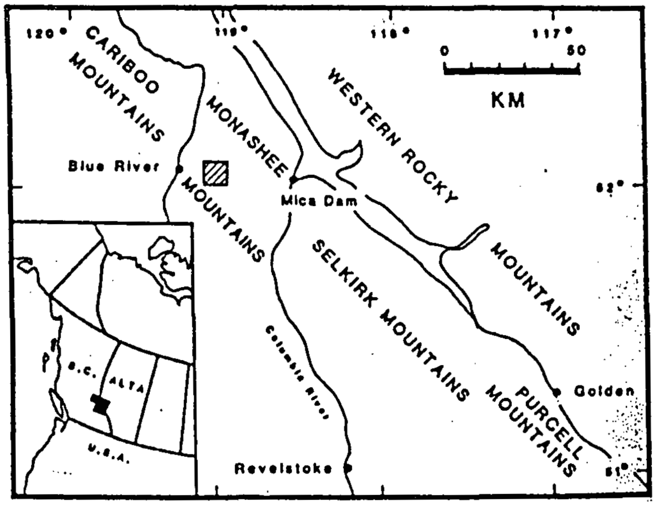
Relief within the claim area ranges from 760 to 1950 meters above sea level. A steep ridge crosses the northeast portion of the claim block. Slopes of 20 degrees are common within the claim block. Mature hemlock, cedar, fir and pine cover the southern and northeast portions. The majority of the claim area is covered by a large clear cut area. The logging road and clear cut area provide easy access to the property.

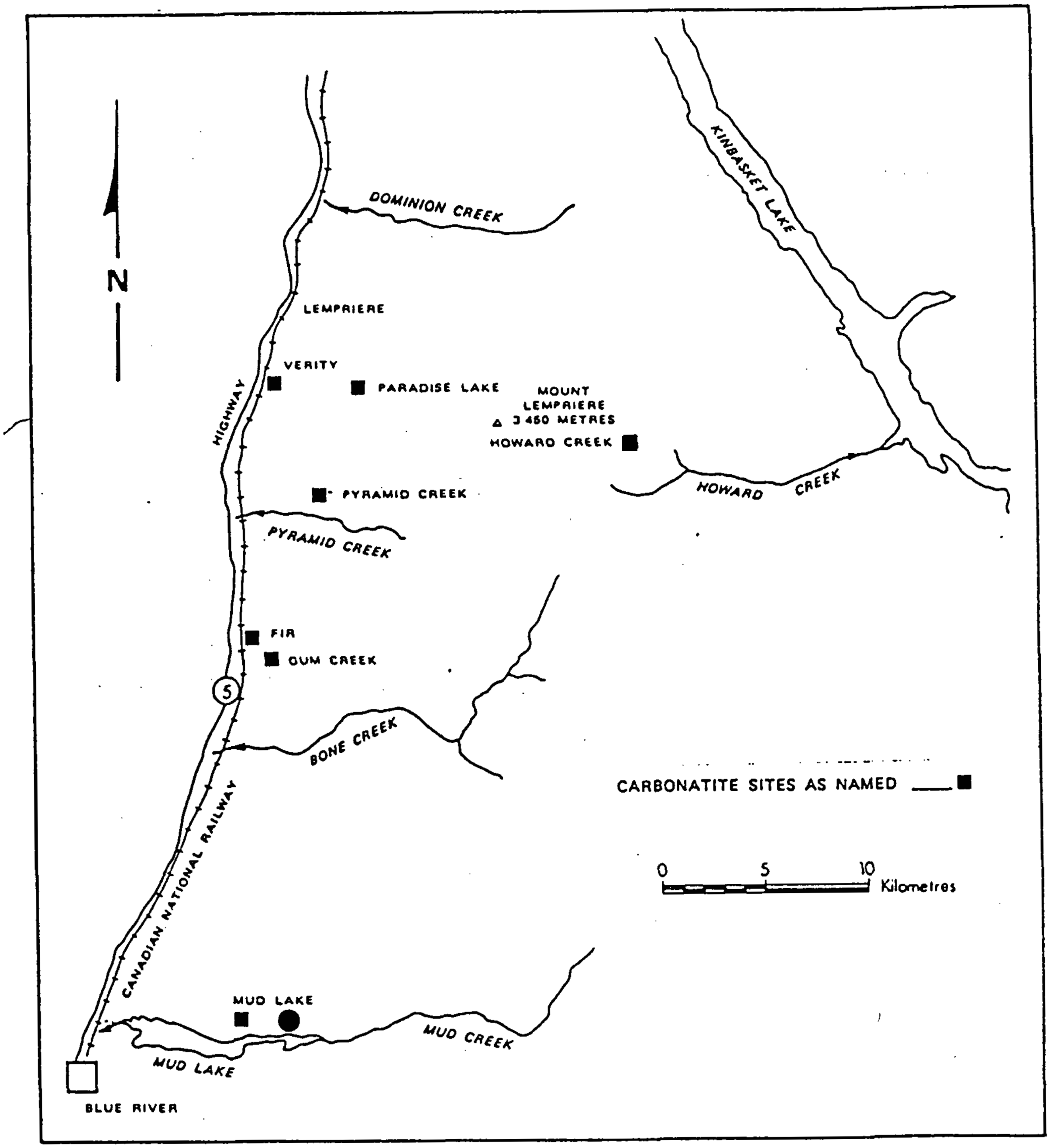
Precipitation averages 130 cm. per year, much of this being snow. Because of the steep hillsides and the heavy precipitation, dirt roads are often washed out.

Figure 1 LOCATION MAP

Blue River Area

Pleiades Group ●





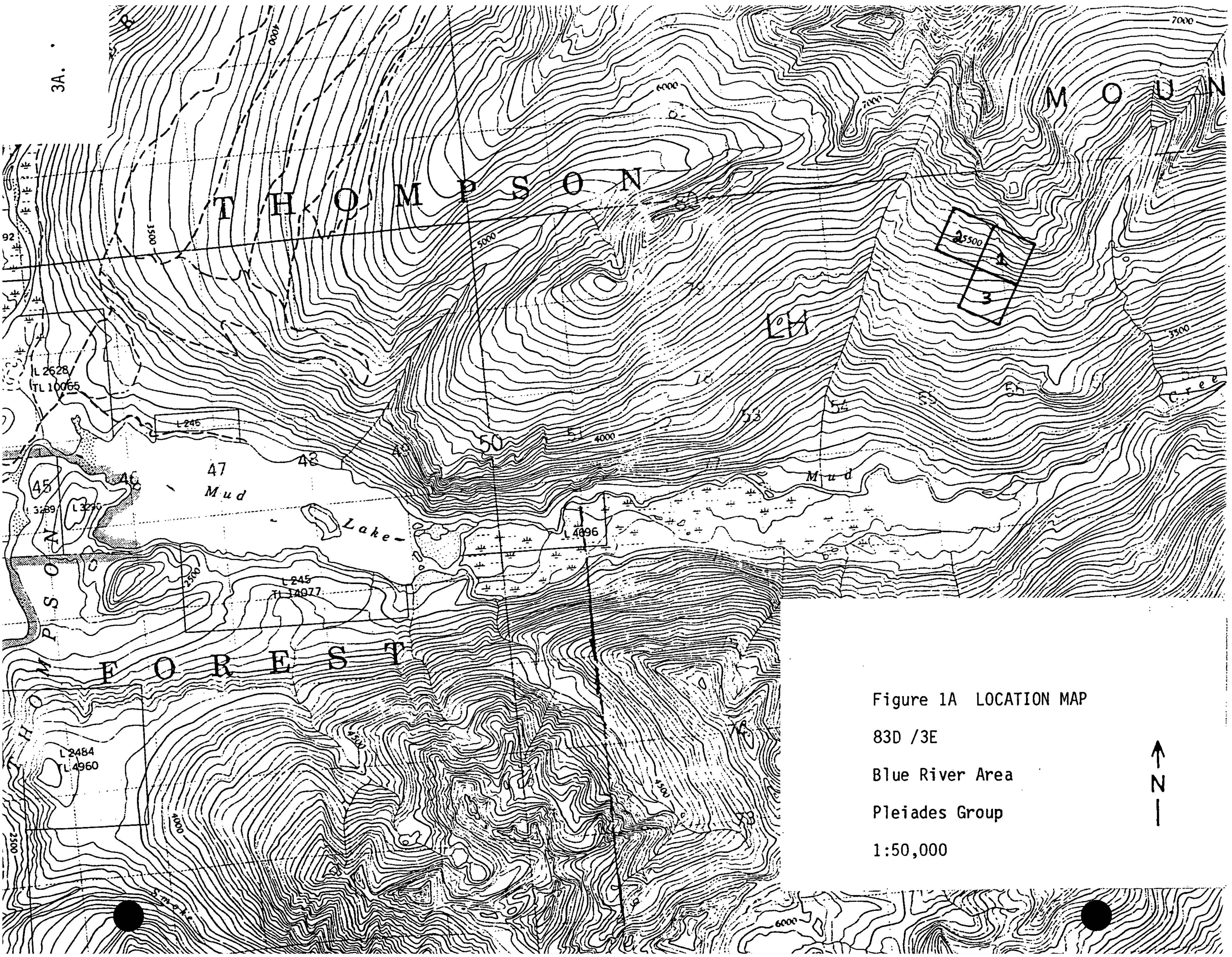


Figure 1A LOCATION MAP

83D /3E

Blue River Area

Pleiades Group

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REGIONAL GEOLOGY

No detailed regional geology surveys have been done in the area of the property. Detailed regional surveys have been completed south of the Mud Creek valley Sevigny (1987); Sevigny, Ghent (1986) and Sevigny, Simony (1989). The area north west of the town of Blue River to the area of the Premier range has been studied by Pell and Simony (1987). The area south of the Malton Gneiss to the Moonbeam creek area has been evaluated by Morrison (1979). Many authors have written about the Mica dam area to the east.

Originally, the rocks in the Blue River prospect area were mapped as the Kaza Group, belonging to the Windermere Period of late Proterozoic age (Campbell, 1967). Campbell mapped an inferred sillimanite isograd running east-west south of the property, along the base of the Mud Creek valley. Also, an inferred staurolite-kyanite isograd was shown running east-west following the ridge north of the property.

South of the Mud Creek valley Wheeler (1965) and Campbell (1964) have traced complexly deformed metamorphic rocks continuously to the region where the Shuswap Metamorphic Complex was originally studied. Within the southern area the Shuswap Metamorphic Complex is formed mainly, if not entirely, from rocks of Windermere age. The latter merge with and become indistinguishable from those of the metamorphic complex north of Mud Creek. The boundary of the Shuswap Metamorphic Complex is taken as the sillimanite isograd within which the gneissose rocks, with much associated pegmatite, are typical of the complex to the south. Lower grade rocks north of the sillimanite isograd are less complexly deformed, have little or no associated pegmatite, and are schistose rather than gneissose.

Recent work (Pell (1984), Pell and Simony (1981, 1982)) has strongly suggested that the area mapped as Kaza Group by Campbell (1967) is actually the Horsethief Creek Group. It is also suggested that this formation extends through the claim area.

Pell and Simony (1987) indicate that strata of the Hadrynian Windermere Supergroup were deposited along the western margin of the ancient North American continent at some time between 900 and 570 Ma. They suggest that two grit-shale-carbonate packages were developed, the second deposited above and outboard of the first. In south-central British Columbia, the first deposited wedge is represented in various localities by the lower 75% of the Horsethief Creek Group, the lower Miette Group, and the Monk formation. The upper portions of the Horsethief Creek Group, the middle and upper Miette Group, the Three Sisters Formation, and the Kaza and lower Cariboo Group sediments constitute the second and younger wedge.

The two clastic wedges were deposited on a divergent or Atlantic-type margin. Actual rupture of the continental crust need not have occurred prior to Hadrynian sedimentation, and these strata were deposited on quasi-continental crust. Continental separation and the formation of depositional basins could have been accommodated through thinning of the continental crust, both through extensional faulting and ductile stretching.

In central British Columbia, the Hadrynian Windermere Supergroup strata were deformed and metamorphosed during the Late Jurassic Columbian Orogeny. Metamorphic grade locally reaches sillimanite zone of the upper amphibolite facies. Where the rocks have been intensely metamorphosed and deformed, many of the sedimentological features have been destroyed, but the stratigraphic relationships remain intact and identifiable upon careful inspection.

A number of authors have suggested that three stages of folding have taken place in the area (Simony et Al (1980), Pell and Simony (1987)). The area is dominated by northwest-plunging, second-generation folds (F2). They are everywhere superimposed on the upright limb of a major, first-generation (F1), southwest directed fold nappe. Folding also occurred after the peak of metamorphism, but only to a minor degree, and the map pattern is largely unaffected by the later folding events.

Metamorphism began during the first deformation phase as indicated by muscovite and biotite which define a schistosity that is axial planar to F1. Indicators suggest that the higher metamorphic grades were reached late in F2 but that the metamorphic grade was lower again during F3.

Personal communication (Sevigny) suggests that the claim area would be composed mainly of rocks of the Semipelite-Amphibolite Division of the Horsethief Creek Group (Table 1).

Analysis of satellite imagery and air photos suggest that a series of parallel faults or lineaments run through the area. The orientation is northeast-southwest. The largest lineament causes Mud creek to change its direction of flow. This structure can be traced southwest to Adams Lake. Many of the lineaments can be traced across the mud creek valley. The Mud Creek valley appears to be part of a major lineament that can be traced from Vancouver Island into Alberta.

TABLE 1

Summary of Hadrynian (Horsethief Creek Group) Stratigraphy

Upper Clastic Division	- 1000-2000m. Semipelite, pelite quartzite, grit semipelite, pelite, carbonate
Carbonate Division	- 20-300m. Marble, calc-silicate calc-schist, semipelite
Semipelite-Amphibolite	- 600-1500m. Platy semipelite, pelite and para-amphibolite, ortho-amphibolite sheets
Lower Carbonate Unit	- 1-100m. Gray and brownish laminated marble, coarse massive lenses, quartzose marble and calc-silicate beds; Semipelite and pelite beds are common. Best marker bed.
Lower Pelite Division	- 400-800 m. Dark pelite (Al and Fe rich) (Dark mica schist, slate (blue grey)) semipelite, psammite coarse psammite and grit in lower part calcareous conglomerate near top
Grit Division	- 500-3000 m. Feldspathic grit, coarse psammite and conglomerate interbedded with pelite and semipelite, minor carbonate and calc-silicate
...............................Mylonite zone at contact............	
Malton Gneiss	- Grey, granitoid hornblende and biotite gneiss with amphibolitic lenses and layers; local zones of mica schist with metasedimentary aspect.

LOCAL GEOLOGY

During the summer of 1989, an amphibolite outcrop (L 3+50E S 0+06N) was sampled. It drew our attention due to its strange weathered appearance. Samples of the weathered material (89-04-12) and rock (89-04-13) were sent off for geochemical analysis. High Rare Earth Element (REE) values were obtained and the Pleiades property was staked in September, 1989. During the spring and summer of 1990, the area was studied in detail. Map 1 (in pocket) shows the results of the geological mapping. The following interpretation of the local geology is based on information shown on the map, results of petrographic examinations and results of prospecting in the surrounding area.

STRUCTURAL GEOLOGY

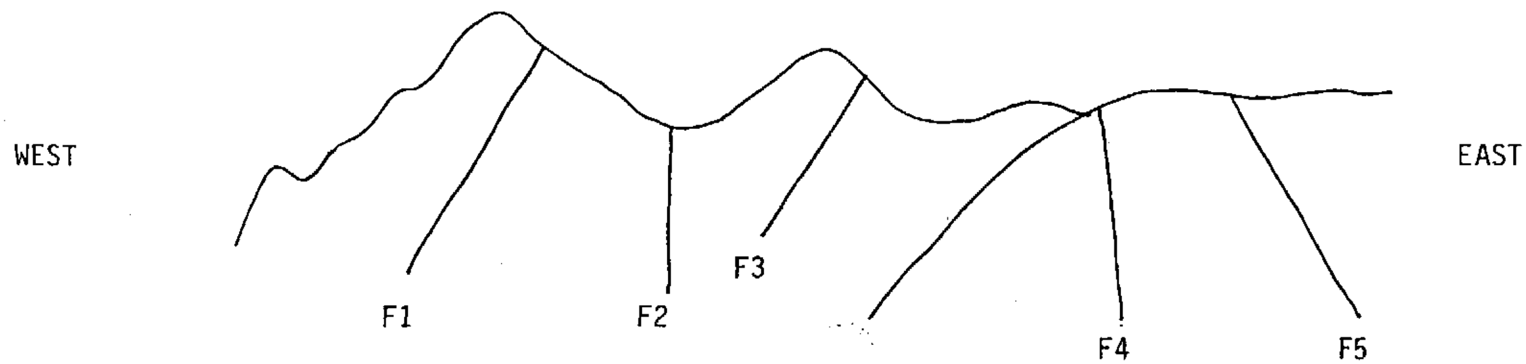
The staked area contains very few outcrops. It is also difficult to prove that the rock showings that have been investigated are really in place.

A series of amphibolite showings were found northwest of the discovery showing, along the edge of the clear cut area. Although hand trenching was done, it could not be determined if these showings were in place. A survey grid was established and geophysical, geological surveys were done. Evidence then appeared to suggest that these showings were not in place. The evidence consisted of two parts. The first evidence was obtained while prospecting on the top of the mountain to the west of the property. From this view point it can be seen that about one half of the mountain to the north of the property has collapsed. A giant slide can be traced over a large area running all the way down to Mud Creek. The small creek just before the Pleiades property marks the west side of the slide. The east edge of both the upper and lower clear cuts mark the eastern edge. In other words, the amphibolite showings appear to be along the eastern edge of the slide area. Much of the surveyed area lies on the slide. Trenching with a backhoe also supported the theory that the amphibolite showings were not in place. The discovery site proved to be 16 feet deep and the second site was only 6 feet deep. There was no evidence of bedrock associated with the showings. A pit was dug between the two showings but the only material found was a sand, formed from weathered metasediments.

The only indications of bedding are determined from cliffs on the upper portions of the mountain which is north and east of the claim area. The beds appear to have a strike of approximately 270 degrees and a dip of 20 degrees. There is no evidence of folding.

Figure 4

DIAGRAM SHOWING FAULTS



F2 and F3 pass through western portion of claim block
F4 cuts below cliff northeast of claim block
F5 forms stream path east of claim block

The area is heavily faulted. This may be seen very clearly from the top of the mountain to the north. Just north of a large hoodoo, that can be seen from the road, there is a good view point overlooking the next mountain to the north. Figure 4 shows a drawing of the faults on this mountain. The faults are obviously very recent. They can be traced across the valley and look like sharp steps with the east side down. Two of the faults go through the hoodoo area then pass under the western portion of the claim area. One fault appears to cut the ridge to the northeast of the claim block and may pass below a cliff that contains a large amphibolite outcrop. The next fault to the east determines the path of a creek east of the property.

The north-south parallel faults appear to be caused by east-west forces that are pulling this area apart. The appearance would suggest that we are looking at a series of parallel normal and reverse faults with oblique movements. The faulting and the slide have occurred after the last glacial age. Considering the number of modern glaciers in this area, these movements must have occurred very recently.

PETROLOGY

The country rock is mostly a quartz feldspar mica gneiss with occasional zones of amphibolite. This corresponds to the semi pelite-amphibolite unit of the Horsethief Creek Group described in the regional geology. These metasediments outcrop on cliffs and on the top of the adjacent mountains.

The discovery showing is composed of an amphibolite composed of hornblende, plagioclase, biotite and sphene. The rare earths are probably associated with phosphate minerals. Apatite is found with some of the amphibolite, however its presence does not necessarily ensure high rare earth values.

Calcite is found often with the amphibolite. In some cases this calcite can be very fluorescent, being bright red in the short wavelengths and a duller purple-red in the long wavelengths. Rare earth elements are known to act as activators in fluorescent minerals. In rare earth activators, the fluorescence process is usually completely confined to the atoms of the rare earth. Also, the color of fluorescence differs little among the different minerals in which one of these rare earth elements may be found. The host mineral is little more than a carrier and a diluent. Further studies will be conducted to see if a relationship exists between fluorescence and rare earth abundance at the Pleiades site. If a relationship does exist, fluorescence surveys would be a good field method to locate the rare earths.

Sevigny (1988) described a classification system for the amphibolites in this area which had 5 categories of mineral assemblages. The mineralogical differences between the categories was based on the presence or absence of garnet, sphene, ilmenite and biotite. The amphibolite occurring at the Pleiades site would appear to be classified as AII using his system.

AII amphibolites contain no garnet, but do contain biotite sphene and ilmenite. What sets them apart from the other amphibolites is the presence of K-feldspar, calcite, apatite and epidote. He describes them as metamorphosed alkaline basalts having low Zr/Y and Zr/Nb, extremely high Ba, Sr, and P_2O_5 contents, low Mg, Cr and Ni abundances. They also contain between 8.17 and 10.73% normative nepheline.

He indicates that the distinct nature of these group II alkaline basalts would suggest a different source region or genetic process. One suggestion is that they were produced during a younger, perhaps Paleozoic intrusive event. The extremely high Ba, Sr, and P_2O_5 abundances of group II alkaline basalts require either a very small degree of partial melting of a typical mantle source or a small degree of partial melting of an enriched mantle source. Unfortunately, he does not describe the rare earth abundances for his samples.

Outcrops to the south of the discovery site (L 4+00E S 1+60S) suggest the presence of metamorphosed igneous alkaline syenites or fenitization associated with a carbonatite intrusive.

Many of the petrographic samples showed signs of intense shearing of the hard minerals.

MINERALIZATION

A high concentration of Light Rare Earths was discovered in amphibolites on the Pleiades property. The results of chemical analysis are given in Appendix B. The analysis was done using Neutron Activation which is very sensitive in detecting the rare earths.

Sample 89-04-13 contains approximately 1.5% total rare earths. As was mentioned in the geology write-up, this showing may not be in place.

Sample 90-04-38A (calcite) and sample 90-04-38B (amphibolite) contain .13% and .10% rare earths respectively. These samples were collected from a large outcrop on the mountain. Its location is off the claim area but is definitely in place. It may be the source for the amphibolites below. Further work will be done to evaluate this deposit.

GEOPHYSICAL SURVEY

SURVEY PARAMETERS

A grid was surveyed on Pleiades 1, 2, and 3 using a compass and hip chain. The grid was installed using north-south lines with a 50 meter spacing and stations 25 meters apart. Flagging, with line and station information written on it, were tied to trees or bushes.

A magnetometer and a gamma ray spectrometer survey was conducted along the grid. A total of 671 magnetometer readings and 671 radiometric readings were obtained on the 16 km. of lines. Readings were obtained at each primary station and anomalous areas were investigated by additional readings between the primary stations.

Following the normal procedure of geophysical surveys, a number of tie backs were conducted by reading at previous stations. Diurnal corrections were made on the magnetic data when required. The variations measured were prorated over time.

INSTRUMENTAL PARAMETERS

Magnetometer

- Scintrex Model MP-2
- Proton Precession
- Range 20,000 to 100,000 nanoTesla
- Accuracy - 1 nanoTesla TOTAL FIELD
- Sensor - omnidirectional, noise cancelling dual coil

Magnetometers are used to detect perturbations in the geomagnetic field created by buried ferromagnetic material. An induced magnetization is produced in any material with a high magnetic susceptibility within the Earth's magnetic field. If strong enough, this induced field produces a localized anomaly in the geomagnetic field. The proton precession magnetometer measures the oscillation frequency of protons in the hydrogen atom. If the geomagnetic field was strong, the protons will precess or oscillate quickly in an attempt to line up their magnetic moments with the field. If the field was weak, the oscillation rate would be slower. As they oscillate, a radio signal will be emitted. Measuring the frequency of this signal allows the calculation of the strength of the geomagnetic field.

Gamma Ray Spectrometer

- McPhar Model TV-1A
- 1 1/2 inch sodium iodide crystal
- three threshold levels
  - Tl at 0.2 Mev

- T2 at 1.6 Mev
- T3 at 2.5 Mev
- Time Constants
  - T1 F (fast) - 1 second
  - T1 S (slow) - 10 seconds
  - T2 - 10 seconds
  - T3 - 10 seconds

Gamma rays entering the crystal interact with the crystal atoms, resulting in free electrons and a light emission (scintillation). The optically coupled photomultiplier converts the light emission to electrical pulses. The magnitudes of the electrical pulses is related to the energy level of the intercepted gamma rays. Various radioactive elements have characteristic gamma energy spectrums. Thorium emits gamma rays with energy levels exceeding 2.5 Mev. Therefore the T3 setting would make the instrument a Thorium detector. T2 will detect Thorium and Uranium. The T1 setting will detect Potassium, Thorium and Uranium. For this survey the T1 fast setting was used.

GEOPHYSICAL INTERPRETATION

RADIOMETRIC MAP

The radiometric map (Map 3 - pocket) shows a number of interesting anomalies.

In general, the lower elevations have lower radiation counts. As was mentioned in the geology write-up, the portion of the claims southwest of a diagonal drawn across the area is covered by slide debris. The radiation levels are very low in this region. This is due to the increased thickness of overburden. Radiation levels increase as one goes up the mountain and begins to encounter outcrops. This effect can be seen clearly on the 3-D plot (Figure 3).

The 3-D plot also shows three areas that have higher radiation levels.

The first area is centered around Line 0+50E and Station 3+70N. It is part of a high north-south trend that runs down the mountain into the clear cut area below. There were no obvious outcrops in this area so the source of the radiation can not be identified.

The second anomalous area extends from L 3+00E S 4+00N to L 4+25E S 4+500N. Again, no obvious outcrop were found.

The third area covers the area from station 3+25N to 4+50N on line 5+00E. There were no outcrops in this area but amphibolite debris was discovered.

The discovery amphibolites enriched with rare earths do not show up as radiation sources in this survey. This is unusual for uranium and thorium are often associated with rare earth deposits.

MAGNETIC MAP

The magnetic data was presented on Map 2 (in pocket). The regional value for the magnetic field is approximately 58050 nT.

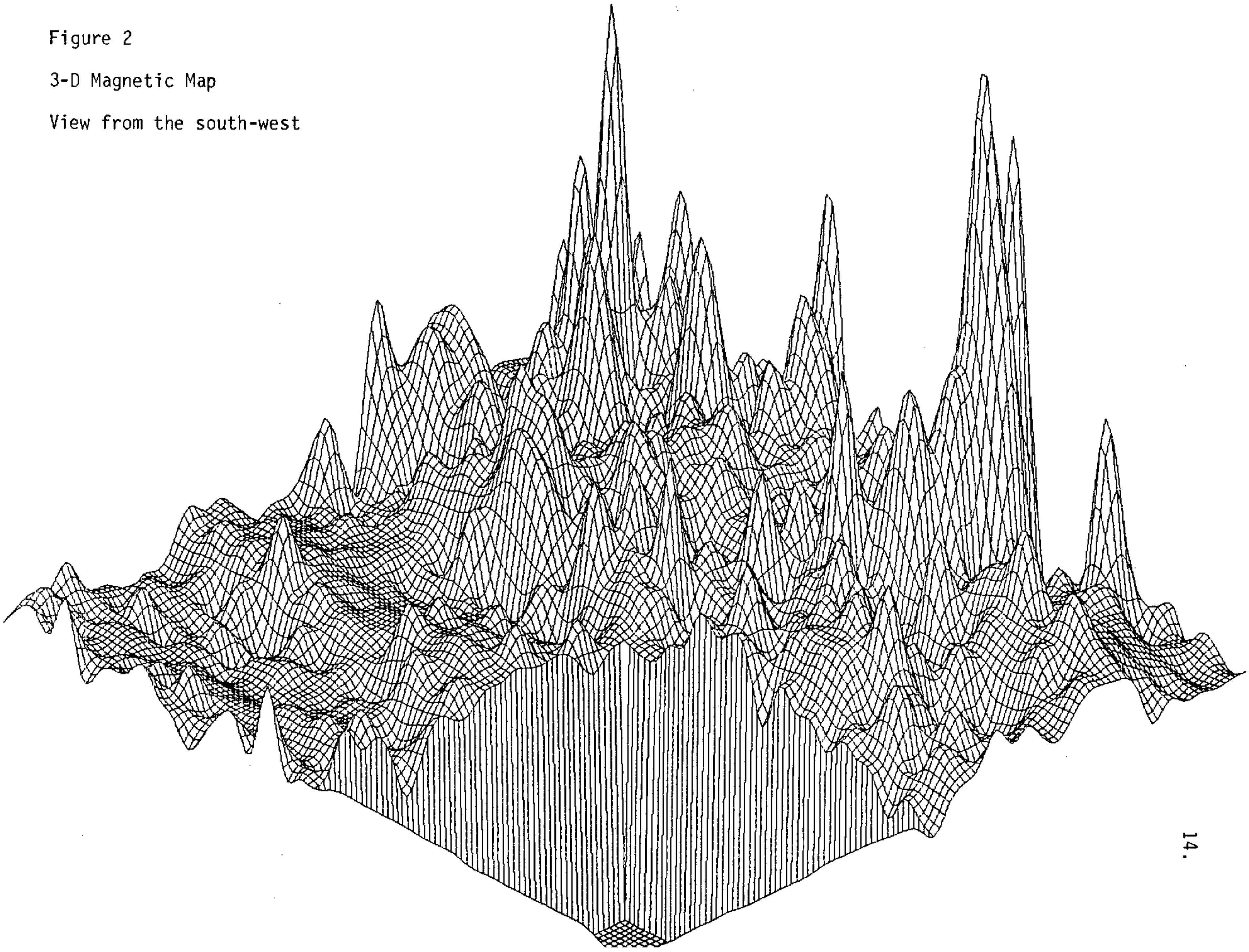
The slide area again appears to be rather flat. The magnetic field increases further up the mountain as bedrock comes closer to the surface. The 3-D map (Figure 2) shows this effect.

Two anomalous magnetic areas occur within the survey region.

Figure 2

3-D Magnetic Map

View from the south-west



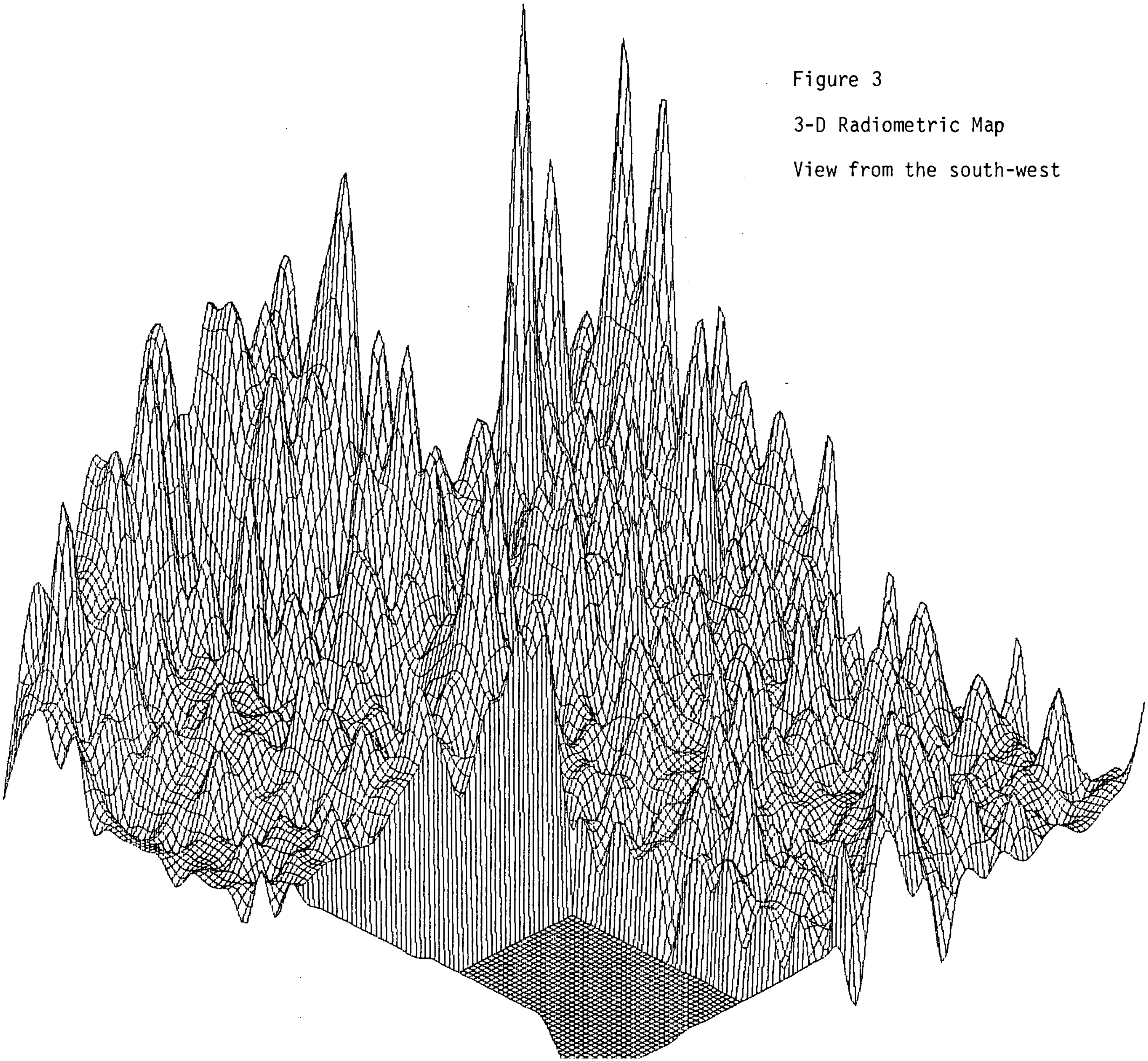


Figure 3

3-D Radiometric Map

View from the south-west

The first one occurs as a east-west trend centered on L 4+00E S 1+50S. There is a series of outcrops that can be traced along this anomaly. Petrographic and geochemical examination of samples from this outcrop suggest that it is a Syenite Gneiss. This Gneiss is either the result of regional metamorphism of an igneous alkaline syenite or it could be the result of fenitization associated with carbonatite intrusives. The magnetic response is due to the presence of approximately 5% magnetite. There is no radiation associated with this magnetic anomaly.

The second magnetic high occurs in the area of Line 4+00E and Station 4+25N. A radiation anomaly occurred in the same location. No outcrops were found however.

The magnetic map shows no evidence of faulting. Considering the age and type of faults discovered in the area, this is to be expected.

The country rock is a Gneiss with a low magnetic susceptibility. This explains the flat background values. Any material with a slightly higher magnetic susceptibility would stand out in this environment.

The discovery amphibolite showing (L 3+50E S 0+06N) had a 350 nT magnetic anomaly. The other amphibolite showing were lower with a typical value of 50 nT.

The remaining radiation anomalies, discovered on the radiometric map, did not have a magnetic signature.

CONCLUSIONS

The geological and geophysical data collected on the Pleiades group of claims is clouded by the uncertainty concerning the lack of true outcrops.

The high Rare Earth values obtained along with the evidence of alkaline syenites or fenitization would suggest a nearby carbonatite complex. Further prospecting should be conducted in the area to see if a nearby source does exist.

APPENDIX A

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APPENDIX B

GEOCHEMICAL DATA

Rock samples were analyzed using two methods; INAA (Au + 34) and INAA + ICAP (52 elements).

The INAA and the INAA(ICAP) analysis was done at Activation Laboratories in Ancaster, Ontario.

The INAA method stands for Instrumental Neutron Activation Analysis. It is an analytical technique which is dependant on measuring gamma radiation which is emitted by the radioactive isotopes produced by irradiating samples in a nuclear reactor. Each element which is activated will emit a "fingerprint" of gamma radiation which can be measured and quantified. The advantages to using the INAA technique include:

1. No chemistry is required.
2. INAA is a multielement technique capable of determining up to 35 elements simultaneously.
3. INAA is exceptionally sensitive to a number of trace elements including gold, the rare earths, platinum group metals and many other elements like arsenic, antimony, tantalum, uranium, thorium, etc.

The Inductively Coupled Plasma Emission Spectrometry (ICAP) technique relies on placing the sample material into solution using either single acid, mixed acids or fusion techniques using fluxes. The sample solution is then introduced into a radio frequency excited plasma (8000 degrees K). Each element in the solution produces a characteristic spectrum. The intensity of the spectral lines are proportional to the quantity of the element present. The advantages of this technique include:

1. ICAP is a multielement technique.

2. Elements determined by ICAP are very complimentary to the INAA method.

DESCRIPTION OF GEOCHEMICAL SAMPLES

89-04-12 - Location L 3+50E S 0+06N
Weathered Amphibolite - Thin black layer on top - red material below

89-04-13 - Location L 3+50E S 0+06N
Amphibolite (pale blue incrustation)

89-05-03 - Location L 3+50E S 0+06N
Amphibolite - fair amount of Apatite - coarse grained Calcite with reddish or blackish crystals - from hand dug pit - .5 meter deep
Lead fire assay done.

89-05-10 - Location L 1+60E S 0+00N
Gneiss - with Apatite and brassy sulphides on fractures

89-07-01 - Location L 0+05E S 1+50N
Amphibolite - Apatite coating

89-06-06 - Location L 5+00E S 0+75S
Tiger stripe Gneiss (light brown litreous crystals?)

89-05-08 - Location L 3+25E S 0+19N
Amphibolite - with massive apatite - black crystals weathering red? - white bands, not calcite?
Thin section done

89-05-10 - Location L 1+60E S 0+00 N
Gneiss (with apatite and sulphides)

89-06-51 - Location L 1+90E S 0+11N
Amphibolite (small amount of apatite) (white crystals?)

90-03-08 - Location L 4+00E S 1+60S
Fine grained dark coloured material? High susceptibility - Magnetic high - Thin section done

90-04-39 - Location Off Grid
North along line 5+00E to top of mountain - center zone (upper) - Amphibolites (calcite + Apatite)

90-04-37 - Location Off Grid
North along Line 5+00E to top of mountain - east side
Amphibolite with calcium carbonate

90-04-14 - Location Off Grid
Red stain area on mountain west of Pleiades - Skarn? -full of Graphite - small sulphides - Thin section done

90-04-15 - Location Off Grid
Red stain area on mountain west of Pleiades -Skarn? center zone - stringers of quartz - blue sulphides bronzy sulphides - Graphite

90-04-38A - Location Off Grid
north along line 5+00E to top of mountain - center zone - calcite

90-04-38B - Location Off Grid
north along line 5+00E to top of mountain - center zone - Amphibolite (calcite coating)

GEOCHEMICAL ANALYSES

SAMPLE #	AU ppb	AG ppm	AS ppm	BA ppm	BR ppm	CA %	CO ppm	CR ppm	CS ppm	FE %	HF ppm
89-04-12	<5	<5	10	620	<1	11	61	230	<2	13.4	9
89-04-13	<96	<49	120	<1000	<12	<18	72	150	<7	10.2	<6
89-05-03	7		22	435	<1		28	120	<0.5		7.9
89-05-10	<5		<2	2125	<1		7	110	4.5		6.4
89-07-01	104	<5	<2	210	<1	10	29	150	<2	6.50	9
89-06-06	42	<5	<2	180	<1	<1	<5	28	3	2.40	4
89-05-08	181	23.0	4	1970	<1		27	630	<0.5		4.5
89-05-10	93	16.0	3	1950	<1		5	100	6.0		6.3
89-06-51	68	16.0	4	450	<1		20	740	2.5		5.7
90-03-08	<5	<0.1	<2	80	<1		3	41	<0.5		2.9
90-04-39	<5	<0.2	<2	1300	<1		23	190	1.6		8
90-04-37	<5	<0.2	<2	416	<1		28	1300	0.9		4
90-04-14	<5	<0.2	<2	519	<1		9	130	1.6		6
90-04-15	<5	0.2	<2	214	<1		12	140	0.9		5
90-4-38A	7	<5	<2	1500	<1	<2	47	660	<2	9.59	7
90-4-38B	35	<5	<2	1300	<1	<2	7	170	<2	2.40	4

GEOCHEMICAL ANALYSES

SAMPLE #	HG ppb	IR ppb	MO ppm	NA ppm	NI ppm	RB ppm	SB ppm	SC ppm	SE ppm	SN %	SR %
89-04-12	<1	<6	<5	19500	220	<30	<0.2	32	<5		<0.05
89-04-13	<19	<100	<24	21900	<820	<160	<1.4	25	<45		<0.40
89-05-03		<5	<5		60	<20	4.1	34	<3		0.04
89-05-10		<5	77		60	71	0.6	12	<3		0.05
89-07-01	<1	<5	<5	8620	<50	<30	0.4	24	<5	<0.01	0.33
89-06-06	<1	<5	<5	38500	<50	69	0.2	1.7	<5	<0.02	<0.05
89-05-08	<1	<5	<5		940	93	34	40	<3	<0.02	0.04
89-05-10	<1	<5	44		20	79	23	12	<3	<0.01	0.06
89-06-51	<1	<5	<5		100	<20	31	43	<3	<0.02	0.11
90-03-08	<1	<5	<5		<10	<10	<0.2	2.5	<3		0.01
90-04-39	<1	<5	<5		110	<10	0.4	19	<3	<0.01	0.12
90-04-37	<1	<5	<5		190	<10	0.5	49	<3	<0.01	0.04
90-04-14	<1	<5	<5		20	72	0.4	18	<3	<0.01	0.05
90-04-15	<1	<5	<5		30	32	0.5	17	<3	<0.01	0.02
90-4-38A	<1	<5	<5	32400	<62	60	0.8	21	<5	<0.03	0.26
90-4-38B	<1	<5	<5	64500	<61	<30	0.7	28	<5	<0.03	<0.05

GEOCHEMICAL ANALYSES

SAMPLE #	TA ppm	TH ppm	U ppm	W ppm	ZN ppm	LA ppm	CE ppm	ND ppm	SM ppm	EU ppm	TB ppm
89-04-12	<1	12	<0.5	<4	130	340	390	165	20	6.0	2.3
89-04-13	<13	87	<7.7	<21	<290	7400	5900	1200	59	18.1	<3.6
89-05-03	<1	8.5	1.5	<3	110	120	230	100	16	4.8	1.7
89-05-10	<1	33	3.0	<3	55	86	160	54	9.2	1.9	1.3
89-07-01	12	6.9	1.6	<4	69	110	190	110	19	5.7	1.8
89-06-06	6	6.0	<0.5	<4	<50	60	78	36	5.2	1.1	0.7
89-05-08	<1	12	<0.5	<3	285	110	120	40	6.1	1.7	<0.5
89-05-10	<1	32	4.7	<3	215	88	120	43	8.3	1.6	<0.5
89-06-51	8	18	1.2	<3	155	200	270	95	15	4.3	<0.5
90-03-08	5	6.2	2.2	<3		77	120	60	8.1	1.2	1.4
90-04-39	<1	15	<0.5	<3	25	77	87	19	3.0	1.0	<0.5
90-04-37	<1	2.6	0.9	<3	35	54	70	29	4.5	1.5	<0.5
90-04-14	2	7.8	2.2	<3	35	34	59	33	5.4	1.4	0.9
90-04-15	1	7.4	1.5	<3	55	32	55	29	5.4	1.4	0.9
90-4-38A	<1	18	<1.0	<4	<58	580	600	110	7.7	2.2	<0.5
90-4-38B	4	21	<0.8	9	286	320	510	170	18	5.9	<0.5

GEOCHEMICAL ANALYSES

SAMPLE #	YB ppm	LU ppm	BE ppm	CU ppm	PB ppm	V ppm	NB ppm	BI ppm	ZR ppm	Y ppm	
89-04-12	2.96	0.30									
89-04-13	<2.20	<0.47									
89-05-03	1.90	0.29	5	20		300			71	38	
89-05-10	3.80	0.55	6	30		100			218	42	
89-07-01	2.67	0.42									
89-06-06	2.60	0.46									
89-05-08	1.25	0.25	<1	85	200	236	<50	<100	150	24	
89-05-10	2.88	0.51	2	55	150	60	<50	<100	240	40	
89-06-51	1.53	0.28	<1	40	150	282	<50	<100	240	34	
90-03-08	4.50	0.70	3	<5	50	4	50	<100	150	48	
90-04-39	1.42	0.22	1	110	<50	120	<30		423	15	
90-04-37	0.78	0.17	<1	150	<50	300	<30		178	13	
90-04-14	3.46	0.64	<1	55	<50	170	<30		178	32	
90-04-15	3.10	0.55	2	60	<50	180	<30		170	36	
90-4-38A	<0.17	0.06									
90-4-38B	2.15	0.57									

GEOCHEMICAL ANALYSES

SAMPLE #	SiO2 %	Al2O3 %	Fe2O3 %	CaO %	MgO %	Na2O %	K2O %	TiO2 %	MnO %	P2O5 %	
89-04-12											
89-04-13											
89-05-03	44.21	6.03	13.77	18.01	9.42	3.24	.47	2.43	.26	1.74	
89-05-10	64.32	16.37	3.89	.85	1.49	7.26	3.61	0.72	.04	.06	
89-07-01											
89-06-06											
89-05-08	52.47	8.85	8.37	11.21	9.05	5.66	1.24	1.28	.14	.54	
89-05-10	64.68	16.72	3.90	.89	1.40	7.59	3.64	0.74	.04	.06	
89-06-51	52.31	7.65	8.21	14.21	8.30	5.45	0.20	2.12	.16	1.12	
90-03-08	63.78	17.47	4.58	3.26	0.77	8.46	1.06	0.41	.43	<0.02	
90-04-39	52.04	16.14	5.54	8.14	6.27	7.12	0.76	0.30	.11	.04	
90-04-37	50.42	4.37	9.96	14.24	13.02	4.04	0.32	0.94	.18	.12	
90-04-14	51.98	14.58	6.96	15.48	3.45	0.33	2.30	1.31	.11	.10	
90-04-15	51.59	12.43	8.06	15.56	4.78	1.27	1.14	1.41	.15	.14	
90-4-38A											
90-4-38B											

APPENDIX C

PETROGRAPHIC ANALYSIS

DESCRIPTION OF PETROGRAPHIC SAMPLES

89-06-08 - Location Off Grid
Area approximately 500 meters due north of the west stake post.
Muscovite Biotite Schist

89-05-08 - Location L 3+25E S 0+19N
Amphibolite
Geochemistry done

89-06-12 - Location Off Grid
Area on cliff north of Line 1+00E

90-03-08 - Location L 4+00E S 1+60S
Area of magnetic high
Geochemistry done

90-04-14 - Location Off Grid
Red stain area on mountain west of Pleiades site

90-05-08 - Location L 3+00E S 2+75N
Amphibolite - may be in place

90-04-38A - Location Off Grid
Mountain cliff north of Line 5+00E
Center zone of Amphibolite outcrop

90-04-39 - Location Off Grid
Mountain cliff north of Line 5+00E
Center upper zone of Amphibolite outcrop

90-05-04 - Location Off Grid
South end of mountain ridge which runs north of Line 5+00E

90-04-38B - Location Off Grid
Mountain cliff north of Line 5+00E
Center zone of Amphibolite outcrop

90-04-37 - Location Off Grid
Mountain cliff north of Line 5+00E
East side of Amphibolite outcrop

90-05-05 - Location Off Grid
Below Hoodoo - above and east of camp site

COSMIC VENTURES
Box 4056
Spruce Grove
Alberta, T7X 3B3

PETROGRAPHIC ANALYSIS

....

Analysis by Maureen Johnston, P.Geol.

CLIENT
GARY JOHNSTON

SPECIMEN NUMBER
89-06-08 (Thin Section)

DATE

....

Mineralogy

Mineral	%
MUSCOVITE	50
BIOTITE	40
QUARTZ	5
GARNET	5
OPAQUE	<1
	100%

Mineral Descriptions

MUSCOVITE: Euhedral crystals, several mm. in length; well developed foliation. Optical Properties: Colorless in plane light; third order interference colors; parallel extinction.

BIOTITE: Anhedral masses to subhedral crystals dispersed throughout muscovite matrix; medium to coarse grained. Also observed as small, rounded inclusions in garnets. Optical Properties: Light to dark brown pleochroism; anomalous interference colors; parallel extinction.

QUARTZ: Anhedral masses, approximately 1 mm. in diameter. Interstitial between mica crystals. Optical Properties: Colorless in plane light; first order interference colors; slight undulatory extinction.

GARNET: Rounded to subhedral crystals varying from 0.5 to 2 mm. in diameter. Occur mostly within anhedral biotite masses and contain inclusions of biotite. Optical Properties: Pinkish color in plane light; isotropic; high positive relief.

OPAQUE: Elongated crystals up to several mm. in length; occur adjacent to garnets and along cleavage/crystal boundaries in biotite. Identification is not possible in thin section.

Specimen Number
89-06-08 (Thin Section)

....

Texture

This section has a schistose texture produced by foliation of medium to coarse crystals of muscovite and biotite. Quartz occurs interstitial between mica crystals and garnet porphyroblasts occur with biotite masses.

Alteration

Some slight alteration of garnet to chlorite is observed.

Petrogenesis

This rock was likely a pelitic sediment that has been altered by regional metamorphism (upper greenschist facies) to mica schist. Opaque minerals are associated with the metamorphism with mobilization likely occurred during the growth of garnets.

Comments

ROCK NAME: MUSCOVITE BIOTITE SCHIST

COSMIC VENTURES
Box 4056
Spruce Grove
Alberta, T7X 3B3

PETROGRAPHIC ANALYSIS

....

Analysis by Maureen Johnston, P.Geol.

CLIENT
GARY JOHNSTON

SPECIMEN NUMBER
89-05-08 (Thin Section)

DATE

....

Mineralogy

Mineral	%
HORNBLENDE	64
PLAGIOCLASE	15
BIOTITE	20
SPHENE	1
	100%

Mineral Descriptions

HORNBLENDE: Subhedral lathlike crystals, approximately 2 mm. in length. Crude alignment of long dimension of crystals. Hornblende shows alteration to biotite around outer edges. Optical Properties: Green to yellow pleochroism; second order interference colors; inclined extinction; 56/124 cleavage.

PLAGIOCLASE: Masses of granoblastic crystals, interstitial between hornblende laths. Optical Properties: Colorless in plane light; first order interference colors.

BIOTITE: Occurs as alteration of hornblende and as medium grained euhedral crystals throughout the section along with hornblende. Optical Properties: Brown to yellow pleochroism; anomalous birefringence; parallel extinction.

SPHENE: Subhedral crystals, approximately 1 mm. in diameter. Occur dispersed throughout the section. Optical Properties: Reddish brown color in plane light; anomalous birefringence; high relief.

Specimen Number
89-05-08 (Thin Section)

. . . .

Texture

The rock is composed of medium grained subhedral laths of hornblende and euhedral biotite with interstitial masses of granoblastic plagioclase. The texture is slightly schistose resulting from crude orientation of hornblende crystals.

Alteration

Hornblende is partially altered to biotite around outer edges.

Petrogenesis

This rock is an amphibolite that likely resulted from regional metamorphism of a mafic source rock, perhaps a volcaniclastic or greywacke. Retrograde alteration has produced minor amounts of biotite.

Comments

ROCK NAME: AMPHIBOLITE

COSMIC VENTURES
Box 4056
Spruce Grove
Alberta, T7X 3B3

PETROGRAPHIC ANALYSIS

Analysis by Maureen Johnston, P.Geol.

CLIENT

GARY JOHNSTON

SPECIMEN NUMBER

89-06-12 (Polished Thin Section)

DATE

Mineralogy

Mineral	%
QUARTZ	30
PLAGIOCLASE	20
HORNBLENDE	20
K-FELDSPAR	15
MUSCOVITE	5
IRON OXIDE	5
CARBONATE	2
GRAPHITE	1
PYRRHOTITE	1
SPHENE	1
PENTLANDITE	trace
CHALCOPYRITE	trace
PYRITE	trace
	100%

Mineral Descriptions

QUARTZ: Elongated, sheared particles varying in particle size up to 500 microns in length. Occurs in quartz-rich layers with sulphide mineralization. Optical Properties: Colorless in plane light; first order interference colors; intense undulatory extinction resulting from shearing.

PLAGIOCLASE: Subhedral columnar crystals, approximately 500 microns in length. Mostly intermediate to calcic composition. Occurs in layers of granoblastic crystals. Optical Properties: Pale brown in plane light resulting from argillaceous alteration; low first order interference colors; some polysynthetic twinning.

HORNBLENDE: Anhedral to subhedral lathlike crystals, approximately 1 mm. in length. Some crystals appear to be fractured. Occurs in subparallel layers; somewhat foliated. Optical Properties: Light to dark green pleochroism; second order interference colors; 56/124 cleavage.

K-FELDSPAR: Subhedral columnar crystals, approximately 500 microns in length. Intense argillaceous alteration. Occurs in granoblastic layers with plagioclase. Optical Properties: Light brown color in plane light; low relief; low first order interference color.

MUSCOVITE: Subhedral crystal fragments; disperse throughout with foliation parallel to gneissic layering of rock. Optical Properties: Colorless in plane light; third order interference colors; parallel extinction.

IRON OXIDE: Very fine grained secondary mineral along grain boundaries throughout section.

CARBONATE: Very fine grained particles along grain boundaries with iron oxide.

GRAPHITE: Occasional euhedral crystal; approximately 1 mm. in diameter. Optical Properties: Brownish color in incident light; pleochroic; strong anisotropism.

PYRRHOTITE: Rounded blebs, approximately 100 microns in diameter. Dispersed throughout the layers of sheared quartz. Optical Properties: Pinkish brown in incident light; slightly pleochroic and anisotropic.

SPHENE: Euhedral crystals, approximately 500 microns in length; dispersed throughout the feldspar layers with long dimension parallel to foliation of specimen. Optical Properties: Brown color in plane light; anomalous birefringence; high relief.

PENTLANDITE: Occurs as exsolution lamallae within pyrrhotite and occasional free particle within sheared quartz. Optical Properties: Creamy yellow color in incident light; isotropic.

CHALCOPYRITE: Occasional particle within shear quartz. Optical Properties: Lemon yellow color in incident light; isotropic.

PYRITE: Occasional particle within the sheared quartz. Optical Properties: Bright creamy white in incident light; isotropic.

Specimen Number
89-06-12 (Polished Thin Section)
....

Texture

The specimen is fine grained with a gneiss texture produced by alternating layers of granoblastic plagioclase and K-feldspar, foliated hornblende and muscovite, and quartz that has been sheared into fragments elongated parallel to foliation. Minor sulphide mineralization occurs throughout the layers of sheared quartz.

Alteration

Feldspars show intense argillaceous alteration.
Secondary iron oxide and carbonate occur throughout the section along grain boundaries.
Quartz has been intensely sheared and fractured into elongated fragments; hornblende and muscovite show evidence of fracturing.

Petrogenesis

This rock is a gneiss produced by regional metamorphism, likely from mafic volcaniclastic source. An episode of shearing, perhaps subsequent to the introduction of quartz, produced layers of sheared quartz with minor sulphide mineralization and fractured earlier formed hornblende and mica. The feldspars have resulted from recrystallization. Later alteration has altered feldspars to secondary clays with iron oxide and carbonate.

Comments

ROCK NAME: FELDSPAR QUARTZ HORNBLENDE GNEISS

COSMIC VENTURES
Box 4056
Spruce Grove
Alberta, T7X 3B3

PETROGRAPHIC ANALYSIS

....

Analysis by Maureen Johnston, P.Geol.

CLIENT

GARY JOHNSTON

SPECIMEN NUMBER

90-03-08 (Polished Thin Section)

DATE

....

Mineralogy

Mineral	%
K-FELDSPAR	50
PLAGIOCLASE	20
TITANO-AUGITE	20
MICA	5
MAGNETITE	5
	100%

Mineral Descriptions

K-FELDSPAR: Subhedral columnar crystals, 1-2 mm. in diameter. Occur in granoblastic texture with plagioclase. Some alteration to secondary clay. Optical Properties: Light brown alteration color in plane light; low first order interference color; negative relief.

PLAGIOCLASE: Subhedral columnar crystals, approximately 1 mm. in diameter in granoblastic texture with K-feldspar. Some alteration to secondary clay and some strained extinction. Optical Properties: Light brown in plane light; low first order interference color with polysynthetic twinning.

TITANO-AUGITE (+/- AEGERINE): Anhedral crystal masses, becoming fibrous. Crystals occur in discontinuous subparallel layers. Magnetite occurs as fine grained inclusions in augite. Some aegerine appears to occur with the augite. Optical Properties: Brown or somewhat pleochroic brown/green in plane light; anomalous dark birefringence except aegerine which shows upper order colors; large extinction angle; pyroxene cleavage.

MICA: Usually muscovite. Occurs as apparent alteration at margins of pyroxene masses. Optical Properties: Colorless to brown in plane light; upper order interference colors; parallel extinction.

MAGNETITE: Rounded to irregular masses up to 200 microns in length. Occurs as inclusions within titano-augite. May contain inclusions of ilmenite. Optical Properties: Light brown in incident light; isotropic.

Specimen Number
90-03-08

....

Texture

This section has a gneiss texture produced by alternating layers of fine to medium grained granoblastic K-feldspar and plagioclase and elongated masses of titano-augite.

Alteration

Feldspars show some alteration to secondary clay minerals.

Petrogenesis

This rock is a gneiss, likely resulting from regional metamorphism of an igneous alkaline syenite. Alternately, the rock could be the result of fenitization with the introduction of alkali elements in association with carbonatites.

Comments

ROCK NAME: SYENITE GNEISS

COSMIC VENTURES
Box 4056
Spruce Grove
Alberta, T7X 3B3

PETROGRAPHIC ANALYSIS

....

Analysis by Maureen Johnston, P.Geol.

CLIENT
GARY JOHNSTON

SPECIMEN NUMBER
90-04-14 (Polished Thin Section)

DATE

....

Mineralogy

Mineral	%
QUARTZ	30
CHERT	20
BIOTITE	20
K-FELDSPAR	10
PLAGIOCLASE	10
MUSCOVITE	5
IRON OXIDE	5
PYRRHOTITE	trace
PENTLANDITE	trace
CHALCOPYRITE	trace
PYRITE	trace
	100%

Mineral Descriptions

QUARTZ: Elongated, sheared particles varying in particle size up to 500 microns in length. Occurs with the feldspars in a sheared mass cut by chert stringers. Optical Properties: Colorless in plane light; first order interference colors; intense undulatory extinction resulting from shearing.

PLAGIOCLASE: Elongated, sheared crystals, approximately 500 microns in length. Mostly sodic to intermediate composition. Optical Properties: Pale brown in plane light resulting from argillaceous alteration; low first order interference colors; some polysynthetic twinning.

BIOTITE: Subhedral crystals approximately 1 mm. in length dispersed throughout the sheared quartz/feldspars. Foliation of the long dimension of the crystals. Optical Properties: Light to dark red pleochroism; anomalous interference colors; parallel extinction.

K-FELDSPAR: Elongated, sheared crystals, approximately 500 microns in length. Some argillaceous alteration. Occurs in granoblastic layers with plagioclase and quartz. Optical Properties: Light brown color in plane light; low relief; low first order interference color.

MUSCOVITE: Subhedral crystal fragments; disperse throughout with foliation parallel to biotite. Optical Properties: Colorless in plane light; third order interference colors; parallel extinction.

CHERT: Occurs in stringers cutting sheared quartz/feldspar/biotite. Sulphide mineralization occurs throughout chert. Optical Properties: Pale brown in plane light; low first order interference color; wavy extinction pattern.

IRON OXIDE: Very fine grained secondary mineral along grain boundaries throughout section.

PYRRHOTITE: Rounded blebs, approximately 50 microns in diameter. Dispersed throughout the stringers of chert. Optical Properties: Pinkish brown in incident light; slightly pleochroic and anisotropic.

PENTLANDITE: Occurs as occasional exsolution lamallae within pyrrhotite and occasional free particle within the chert. Optical Properties: Creamy yellow color in incident light; isotropic.

CHALCOPYRITE: Occasional particle within the chert. Optical Properties: Lemon yellow color in incident light; isotropic.

PYRITE: Occasional particle within the chert. Optical Properties: Bright creamy white in incident light; isotropic.

Specimen Number
90-04-14 (Polished Thin Section)
....

Texture

The specimen is composed of fine grained quartz, plagioclase and K-feldspar in a granoblastic texture of elongated, sheared particles. Foliated biotite and minor muscovite occur throughout as isolated crystals. Stringers of chert containing traces of sulphide mineralization occur throughout.

Alteration

Feldspars show minor argillaceous alteration.

Secondary iron oxide occurs throughout the section along grain boundaries.
Quartz and feldspars have been intensely sheared.

Petrogenesis

This rock was likely a metasediment (quartz feldspar biotite gneiss) that has subsequently been subjected to dynamic metamorphism resulting in intense shearing of the hard minerals. Chert has been introduced along with minor sulphide mineralization.

Comments

ROCK NAME: SHEARED QUARTZ FELDSPAR BIOTITE GNEISS

COSMIC VENTURES
Box 4056
Spruce Grove
Alberta, T7X 3B3

PETROGRAPHIC ANALYSIS

Analysis by Maureen Johnston, P.Geol.

CLIENT
GARY JOHNSTON

SPECIMEN NUMBER
90-05-08 (Thin Section)

DATE

Mineralogy

Mineral	%
HORNBLENDE	84
PLAGIOCLASE	5
QUARTZ	5
CHERT	5
SPHENE	1
	100%

Mineral Descriptions

HORNBLENDE: Subhedral lathlike crystals, approximately 1-2 mm. in length. Crude alignment of long dimension of crystals. Optical Properties: Green to yellow pleochroism; second order interference colors; inclined extinction; 56/124 cleavage.

PLAGIOCLASE: Anhedral masses, interstitial between hornblende laths. Optical Properties: Colorless in plane light; first order interference colors; composition is sodic to intermediate.

QUARTZ: Rounded crystals, approximately 500 microns in diameter. Occur along hornblende crystal boundaries and as inclusions within hornblende. Optical Properties: Colorless in plane light; first order interference colors.

CHERT: Occurs in stringers cross cutting the section. Optical Properties: Light brown in plane light; low order interference color with wavy extinction pattern.

SPHENE: Subhedral crystals, approximately 500 microns in diameter. Occur dispersed throughout the section. Optical Properties: Reddish brown color in plane light; anomalous birefringence; high relief.

Specimen Number
90-05-08 (Thin Section)
....

Texture

The rock is composed of medium grained subhedral laths of hornblende interstitial masses of anhedral plagioclase. Small, rounded crystals of quartz occur along grain boundaries and within hornblende giving it a sieve-like appearance. Occasional stringers of chert cut the section. The texture is slightly schistose resulting from crude orientation of hornblende crystals.

Alteration

Traces of epidote are observerd adjacent to chert stringers.

Petrogenesis

This rock is an amphibolite that likely resulted from regional metamorphism of an alkaline mafic volcanic or volcaniclastic. Quartz shows no evidence of strain and may have crystallized subequent to metamorphism. Chert was introduced later in stringers.

Comments

ROCK NAME: AMPHIBOLITE

COSMIC VENTURES
Box 4056
Spruce Grove
Alberta, T7X 3B3

PETROGRAPHIC ANALYSIS

Analysis by Maureen Johnston, P.Geol.

CLIENT
GARY JOHNSTON

SPECIMEN NUMBER
90-04-38A (Thin Section)

DATE

Mineralogy

Mineral	%
HORNBLENDE	92
CALCITE	2
APATITE	2
SPHENE	2
BIOTITE	2
	100%

Mineral Descriptions

HORNBLENDE: Subhedral lathlike crystals, approximately 1-4 mm. in length. Crude alignment of long dimension of crystals. Hornblende shows patchy growth of secondary amphibole throughout crystals. Optical Properties: Green to yellow pleochroism; second order interference colors; inclined extinction; 56/124 cleavage.

CALCITE: Anhedral crystals and very fine grained masses; interstitial between hornblende laths. Optical Properties: Colorless to pale brown in plane light; extreme order interference colors; rhombohedral cleavage and twinning.

APATITE: Anhedral to slightly elongated crystals; interstitial between hornblende laths. Approximately 1 mm. in length. Optical Properties: Colorless in plane light; first order interference color; moderate positive relief.

SPHENE: Subhedral crystals, approximately 500 microns to 2 mm. in diameter. Occur dispersed throughout the hornblende. Optical Properties: Reddish brown color in plane light; anomalous birefringence; high relief.

BIOTITE: Minor amounts of anhedral biotite occur as secondary alteration of hornblende. Optical Properties: Reddish brown pleochroism; anomalous birefringence; parallel extinction.

Specimen Number
90-04-38A (Thin Section)

....

Texture

The rock is composed of medium to coarse grained subhedral laths of hornblende interstitial masses of anhedral calcite. The texture is slightly schistose resulting from crude orientation of hornblende crystals.

Alteration

Hornblende is partially altered to biotite.

Petrogenesis

This rock is an amphibolite that likely resulted from regional metamorphism of an alkaline mafic volcanic or volcaniclastic associated with calcite. Retrograde alteration has produced minor amounts of secondary biotite. Sphene and apatite are likely associated with formation of the amphiboles. Calcite may have occurred later.

Comments

ROCK NAME: AMPHIBOLITE

COSMIC VENTURES
Box 4056
Spruce Grove
Alberta, T7X 3B3

PETROGRAPHIC ANALYSIS

Analysis by Maureen Johnston, P.Geol.

CLIENT

GARY JOHNSTON

SPECIMEN NUMBER

90-04-39 (Thin Section)

DATE

Mineralogy

Mineral	%
HORNBLENDE	80
PLAGIOCLASE	5
CALCITE	5
CHERT	5
FIBROUS AMPHIBOLE	4
SPHENE	1
	100%

Mineral Descriptions

HORNBLENDE: Subhedral lathlike crystals, approximately 2 mm. in length. Crude alignment of long dimension of crystals. Hornblende shows minor patchy alteration to fibrous amphibole. Optical Properties: Green to yellow pleochroism; second order interference colors; inclined extinction; 56/124 cleavage.

PLAGIOCLASE: Anhedral masses, interstitial between hornblende laths. Optical Properties: Colorless in plane light; first order interference colors; composition is sodic to intermediate.

CALCITE: Anhedral masses interstitial between laths of hornblende. Optical Properties: Light brown in plane light; extreme birefringence; rhombohedral cleavage and twinning.

CHERT: Masses of chert occur interstitial between hornblende crystals. Optical Properties: Light brown in plane light; low order interference color with wavy extinction pattern.

FIBROUS AMPHIBOLE: Acicular to fibrous crystals occurring as minor alteration of hornblende. May be alkaline in composition. Optical Properties: Blue/green pleochroism; upper second order interference colors; incline extinction.

SPHENE: Subhedral crystals, approximately 1 mm. in diameter. Occur dispersed throughout the section. Optical Properties: Reddish brown color in plane light; anomalous birefringence; high relief.

Specimen Number
90-04-39 (Thin Section)

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Texture

The rock is composed of medium grained subhedral laths of hornblende interstitial masses of anhedral plagioclase, calcite and chert. The texture is slightly schistose resulting from crude orientation of hornblende crystals.

Alteration

Hornblende is partially altered to a secondary fibrous amphibole.

Petrogenesis

This rock is an amphibolite that likely resulted from regional metamorphism of an alkaline mafic volcanic. Calcite and chert were introduced later, likely during or subsequent to metamorphism. Retrograde metamorphism has produced fibrous amphibole, likely alkaline, that may be associated with the introduction of calcite and other interstitial minerals.

Comments

ROCK NAME: AMPHIBOLITE

COSMIC VENTURES
Box 4056
Spruce Grove
Alberta, T7X 3B3

PETROGRAPHIC ANALYSIS

....

Analysis by Maureen Johnston, P.Geol.

CLIENT
GARY JOHNSTON

SPECIMEN NUMBER
90-05-04 (Thin Section)

DATE

....

Mineralogy

Mineral	%
K-FELDSPAR	40
QUARTZ	10
PLAGIOCLASE	20
HORNBLENDE	25
PYROXENE	3
SPHENE	1
OPAQUE	1
APATITE	trace
	100%

Mineral Descriptions

K-FELDSPAR: Subhedral columnar crystals, 2-3 mm. in diameter. Minor argillaceous alteration occurs. Optical Properties: Light brown in plane light; low first order interference color; negative relief.

QUARTZ: Occurs in layers of sheared particles. Particles are elongated parallel to the foliation of the rock. Optical Properties: Colorless in plane light; first order interference colors; intense undulatory extinction.

PLAGIOCLASE: Occurs in granoblastic masses with K-feldspar. Subhedral columnar crystals, approximately 1 mm. in diameter. Sodic to intermediate in composition. Optical Properties: Pale brown alteration color in plane light; low first order interference color; polysynthetic twinning with kinked twin bands resulting from shearing.

HORNBLENDE: Subhedral prismatic crystals 2-4 mm. in length. Occurs in nearly continuous, subparallel layers with minor pyroxene. Optical Properties: Blue/green/yellow pleochroism; second order interference colors; amphibole cleavage.

PYROXENE: Occasional granular mass, approximately 1 mm. in diameter. Occurs with hornblende. Optical Properties: Pale green in plane light; second order interference colors; right angle cleavage; moderate positive relief; diopside or similar mineralogy.

SPHENE: Euhedral crystals, approximately 1 mm. in length. Dispersed throughout the section. Optical Properties: Brown color in plane light; anomalous birefringence; high relief.

OPAQUE: Occasional euhedral crystals as inclusions within the hornblende. Identification is not possible in thin section.

APATITE: Occasional subhedral crystal, approximately 500 microns in diameter. Optical Properties: Colorless in plane light; low order interference color; positive moderate relief.

Specimen Number
90-05-04

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Texture

This rock is medium grained and has a gneiss texture produced by alternating layers of granoblastic K-feldspar/ plagioclase, hornblende, and sheared quartz.

Alteration

The feldspars show minor argillaceous alteration.

Petrogenesis

This rock may be a high grade metamorphic from an alkaline igneous source (syenite, etc.) or may be the result of fenitization with potassium metasomatism associated with carbonatites and other alkaline intrusives. Shearing or dynamic metamorphism has occurred subsequent to the crystallization of quartz.

Comments

ROCK NAME: K-FELDSPAR HORNBLENDE QUARTZ GNEISS

COSMIC VENTURES
Box 4056
Spruce Grove
Alberta, T7X 3B3

PETROGRAPHIC ANALYSIS

....

Analysis by Maureen Johnston, P.Geol.
CLIENT
GARY JOHNSTON
SPECIMEN NUMBER
90-04-38B (Thin Section)
DATE

....

Mineralogy

Mineral	%
K-FELDSPAR	65
PLAGIOCLASE	20
QUARTZ	10
BIOTITE	5
SERICITE	trace
IRON OXIDE	trace
	100%

Mineral Descriptions

K-FELDSPAR: Mostly microcline. Some perthitic intergrowths with albite. Occurs as coarse columnar crystals. Intense alteration to secondary clay minerals. Optical Properties: Brown color in plane light because of secondary clays; low first order interference color; negative relief; gridiron twinning of microcline or perthitic intergrowths.

PLAGIOCLASE: Coarse columnar crystals in equigranular texture with the K-feldspar. Composition is sodic. Intense alteration to secondary clay minerals. Optical Properties: Brown color in plane light due to secondary clays; low first order interference color; uniaxial negative.

QUARTZ: Occurs in stringers. Individual crystals are equant to slightly elongated; approximately 1 mm. in length. Some evidence of stress; undulatory extinction. Quartz at contact with feldspars has been granulated/recrystallized to a chert-like material. Optical Properties: Colorless in plane light; first order interference color; no cleavage.

BIOTITE: Euhedral fibrous crystals occur at contacts between feldspars. Optical Properties: Light to dark brown pleochroism;

anomalous birefringence; parallel extinction.

SERICITE: Traces observed at K-feldspar grain boundaries. Optical Properties: Colorless to pale green in plane light; third order interference colors.

IRON OXIDE: Fine grained secondary mineral along with biotite. Optical Properties: Reddish color in plane light; bluish grey in incident light; red internal reflections.

Specimen Number
90-04-38B (Thin Section)

....

Texture

The rock is phaneritic coarse grained plutonic with equigranular texture of interlocking crystals of K-feldspar and plagioclase. Stringers of granoblastic quartz occur throughout with granulation and recrystallization of quartz at feldspar contacts. Fibrous biotite and secondary iron oxide occur at contacts between quartz and feldspars.

Alteration

K-feldspar and plagioclase have been intensely altered to secondary clay minerals. Some sericite occurs at K-feldspar contacts.

Petrogenesis

This rock is likely an igneous intrusive, perhaps a pegmatite or alternately, may be the result of alkali metasomatism and high grade metamorphism. Quartz was introduced subsequent to crystallization and was then subjected to shearing and recrystallization.

Comments

ROCK NAME: SYENITE PEGMETITE(?)

COSMIC VENTURES
Box 4056
Spruce Grove
Alberta, T7X 3B3

PETROGRAPHIC ANALYSIS

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Analysis by Maureen Johnston, P.Geol.

CLIENT
GARY JOHNSTON

SPECIMEN NUMBER
90-04-37 (Thin Section)

DATE

....

Mineralogy

Mineral	%
HORNBLENDE	93
CALCITE	5
APATITE	1
SPHENE	1
	100%

Mineral Descriptions

HORNBLENDE: Subhedral lathlike crystals, approximately 1-4 mm. in length. Crude alignment of long dimension of crystals. Hornblende shows patchy growth of secondary amphibole throughout crystals. Optical Properties: Green to yellow to olive green pleochroism; second order interference colors; inclined extinction; 56/124 cleavage.

CALCITE: Anhedral crystals and very fine grained masses; interstitial between hornblende laths. Optical Properties: Colorless to pale brown in plane light; extreme order interference colors; rhombohedral cleavage and twinning.

APATITE: Anhedral to slightly elongated crystals; interstitial between hornblende laths. Approximately 2 mm. in length. Optical Properties: Colorless in plane light; first order interference color; moderate positive relief.

SPHENE: Subhedral crystals, approximately 1 mm. in diameter. Occur dispersed throughout the hornblende. Optical Properties: Reddish brown color in plane light; anomalous birefringence; high relief.

Specimen Number
90-04-37 (Thin Section)

....

Texture

The rock is composed of medium to coarse grained subhedral laths of hornblende interstitial masses of anhedral calcite. The texture is slightly schistose resulting from crude orientation of hornblende crystals.

Alteration

Hornblende is partially altered to secondary amphibole within the larger crystals, suggesting a secondary metamorphic event.

Petrogenesis

This rock is an amphibolite that likely resulted from regional metamorphism of an alkaline mafic volcanic or volcaniclastic associated with calcite. Retrograde alteration has produced minor amounts of secondary amphibole. Sphene and apatite are likely associated with formation of the amphiboles. Calcite may have occurred later.

Comments

ROCK NAME: AMPHIBOLITE

COSMIC VENTURES
Box 4056
Spruce Grove
Alberta, T7X 3B3

PETROGRAPHIC ANALYSIS

Analysis by Maureen Johnston, P.Geol.

CLIENT
GARY JOHNSTON

SPECIMEN NUMBER
90-05-05 (Thin Section)

DATE

Mineralogy

Mineral	%
K-FELDSPAR	60
QUARTZ	15
PLAGIOCLASE	10
HORNBLENDE	10
BIOTITE	3
SPHENE	2
	100%

Mineral Descriptions

K-FELDSPAR: Subhedral columnar crystals, 2-4 mm. in diameter. K-feldspar is growing around a nucleus of 250 micron rounded quartz particle. Minor argillaceous alteration occurs. Optical Properties: Light brown in plane light; low first order interference color; negative relief.

QUARTZ: Occurs in layers of sheared particles. Particles are elongated parallel to the foliation of the rock. Some quartz also occurs within K-feldspar. Optical Properties: Colorless in plane light; first order interference colors; intense undulatory extinction.

PLAGIOCLASE: Occurs in granoblastic masses with K-feldspar. Subhedral columnar crystals, approximately 1 mm. in diameter. Sodic to intermediate in composition. Optical Properties: Pale brown alteration color in plane light; low first order interference color; polysynthetic twinning.

HORNBLENDE: Anhedral to nearly fibrous masses up to several millimeters in length. Masses are elongated to form foliation within rock. Optical Properties: Dark to medium green pleochroism; second order interference colors; amphibole cleavage.

BIOTITE: Occasional patchy alteration of hornblende. Optical Properties: Red to light reddish brown pleochroism; anomalous interference colors; parallel extinction.

SPHENE: Euhedral crystals, approximately 1 mm. in length. Dispersed throughout the section. Optical Properties: Brown color in plane light; anomalous birefringence; high relief.

Specimen Number
90-05-05

Texture

This rock is medium to coarse grained and has a crude gneiss texture produced by alternating layers of granoblastic K-feldspar/plagioclase, fibrous hornblende, and sheared quartz.

Alteration

The feldspars show minor argillaceous alteration.

Petrogenesis

This rock may be a high grade metamorphic from an alkaline igneous source (syenite, etc.) or may be the result of fenitization with potassium metasomatism associated with carbonatites and other alkaline intrusives. Shearing or dynamic metamorphism has occurred subsequent to the crystallization of quartz.

Comments

ROCK NAME: K-FELDSPAR HORNBLENDE QUARTZ GNEISS

APPENDIX D

COST STATEMENT

COST STATEMENT

June 28 to July 4 / 1990

Gridding, Geophysics, Geology

Gary Johnston (Geophysicist) 5.5 days X $300/day..	1650.00
Ray Jalbert (Technologist) 5.5 days X $150/day....	825.00
Magnetometer rental 3.5 days X $50/day...........	175.00
Gamma Ray Spectrometer rental 1 day X $25/day....	25.00
Food and accommodation (camp) 11 man days X $25/day..........................	275.00
Travel 1/2 X 1160 km X .25/km (Shared with work on another claim)................................	145.00
Subtotal	3095.00

July 25 to July 30 / 1990

Trenching, Geology, Geophysics

Gary Johnston (Geophysicist) 5 days X $300/day....	1500.00
Ray Jalbert (Technologist) 5 days X $150/day......	750.00
Magnetometer rental 1 day X $50/day.............	50.00
Gamma Ray Spectrometer rental 1 days X $25/day...	25.00
Trenching - backhoe..............................	240.00
Food and accommodation (camp) 10 man days X $25/day..........................	250.00
Travel 1/2 X 1160 km X .25/km (Shared with work on another claim)................................	145.00
Subtotal	2960.00

Report Preparation

Gary Johnston (Geophysicist) 3 days X $300/day....	900.00
Maureen Johnston (Geologist) Hand Specimen Examination 2 days X $300/day...................	600.00
Supplies (Photocopies, paper, etc.)..............	100.00
Field Supplies (Flagging, stakes, batteries).....	100.00
Phone and Postage................................	25.00
Geochemical Analysis.............................	660.00
Petrographic Analysis............................	800.00
Subtotal	3185.00

TOTAL EXPLORATION COST..........$9240.00

APPENDIX E

STATEMENTS OF QUALIFICATION

STATEMENT OF QUALIFICATIONS

I, Maureen D. Johnston of Box 4056, Spruce Grove in the Province of Alberta, hereby certify as follows:

1. That I graduated from the University of Alberta in 1968 with a B.Sc. (Honours) in Geology.
2. That I graduated from the University of Western Ontario in 1971 with an M.Sc. in Geochemistry and Mineralogy.
3. That I have prospected and actively pursued geology and mineralogy prior to my graduation and have practiced the profession of geology since 1968.
4. That I am a partner in Cosmic Ventures, a geophysical and geological consulting company with offices located near Spruce Grove, Alberta (APEGGA Permit # P4469).
5. That I am a professional geologist licensed in the Province Alberta.

Dated the 19th day of August, 1990 at Spruce Grove in the Province of Alberta.

Maureen D. Johnston, P. Geol.

STATEMENT OF QUALIFICATIONS

I, Ray Jalbert of 5609-54 Ave, St. Paul in the Province of Alberta, hereby certify as follows:

1. That I graduated from the Northern Alberta Institute of Technology in 1978 with a diploma in the Earth Resources Program (Minerals Option).
2. That I am a member of the Alberta Society of Engineering Technologists. (C.E.T.)
3. That I have prospected since 1979 in Alberta, the Northwest Territories and British Columbia.
4. That I have extensive experience in the Petroleum Exploration industry.
5. That I have worked for the geophysical consulting company Cosmic Ventures doing various geophysical surveys.
6. That I am a member of the Edmonton Geological Society.

Dated the 6th day of October, 1990 at St. Paul in the Province of Alberta.

Ray Jalbert

STATEMENT OF QUALIFICATIONS

I, Gary L. Johnston of Box 4056, Spruce Grove in the Province of Alberta, hereby certify as follows:

1. That I graduated from the University of Alberta in 1966 with a Bachelor of Science Degree in Physics.

2. That I have prospected and actively pursued geology and geophysics prior to my graduation and have practiced the profession of geophysics since 1966.

3. That I have worked in the area of geophysical research, geophysical exploration and have taught geophysics for many years.

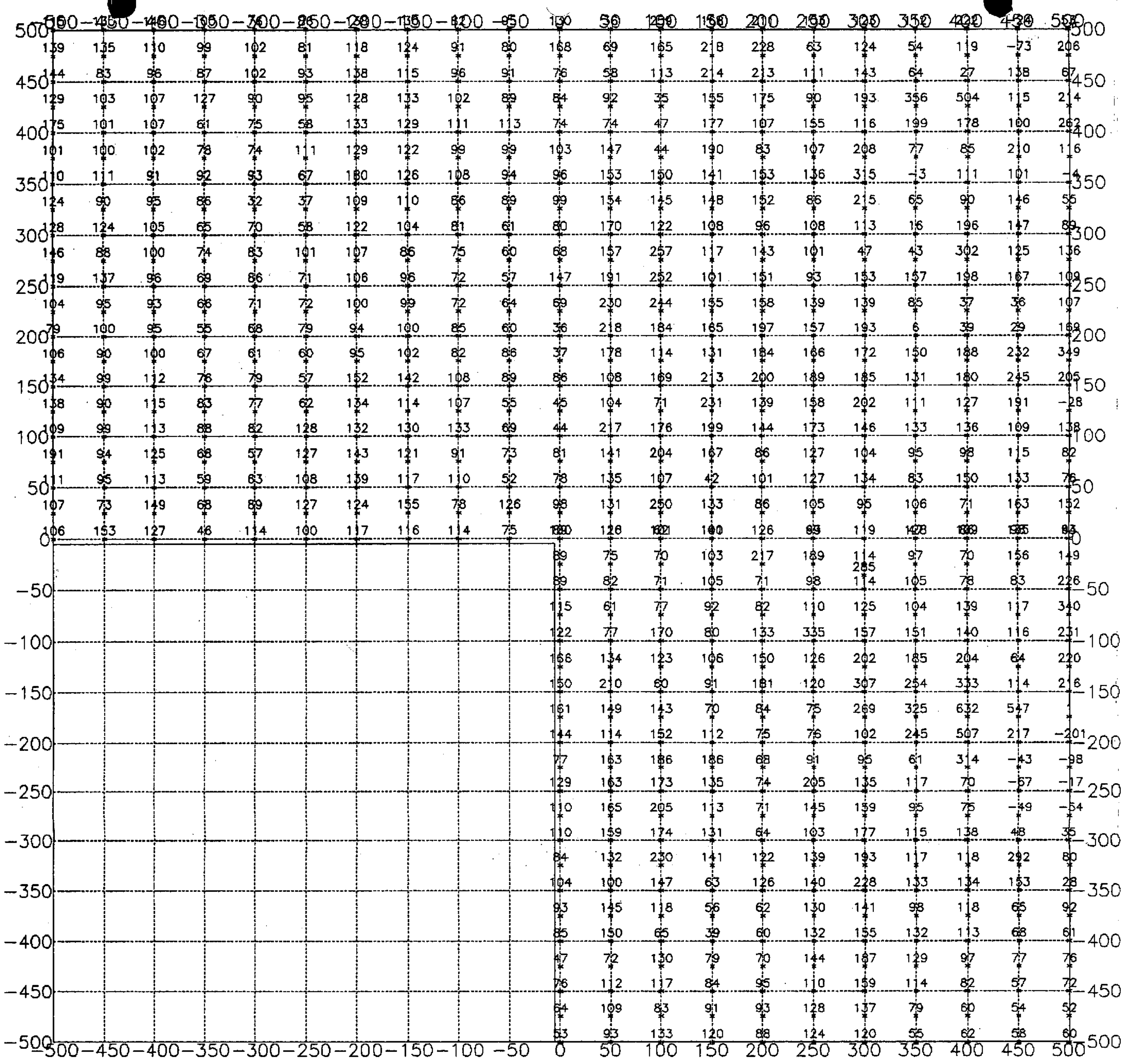
4. That I am a partner in Cosmic Ventures, a geophysical and geological consulting company with offices located near Spruce Grove, Alberta (APEGGA Permit # P4469).

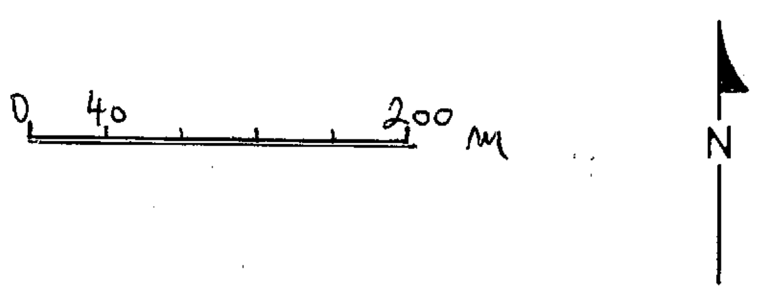
5. I am a Professional Geophysicist licensed in the Province of Alberta.

Dated the 28th day of September, 1990 at Spruce Grove in the Province of Alberta.

Gary Johnston

Gary L. Johnston, P. Geoph.



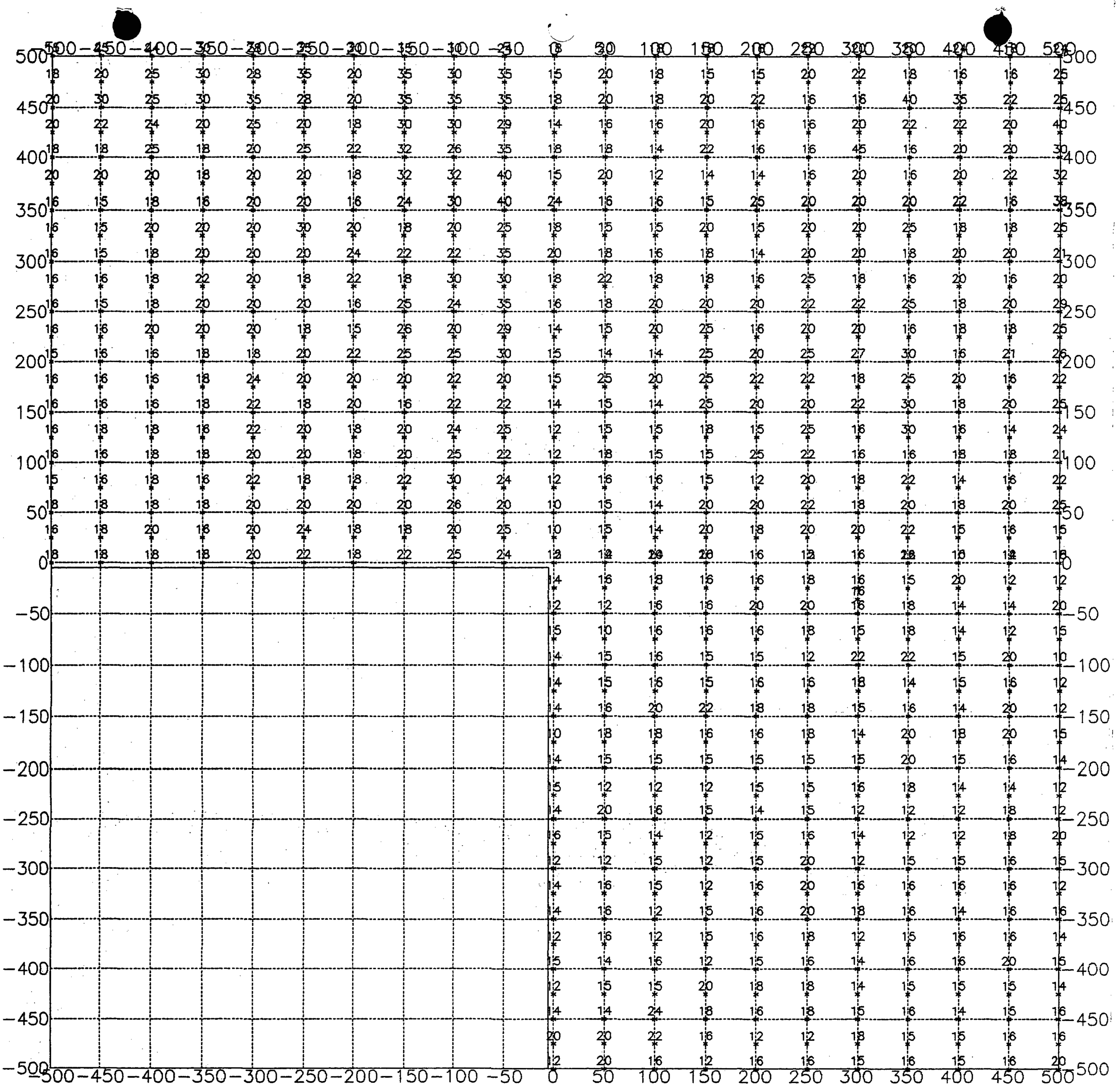


COSMIC VENTURES

PLEIADES GROUP

POSTED MAGNETIC VALUES
Units - nanoTeslas
(Datum - 58000 nT)

DRAWN BY G.J.	SCALE 1:4000	
DATE 91-04-29	JOB NO.	MAP NO. 4

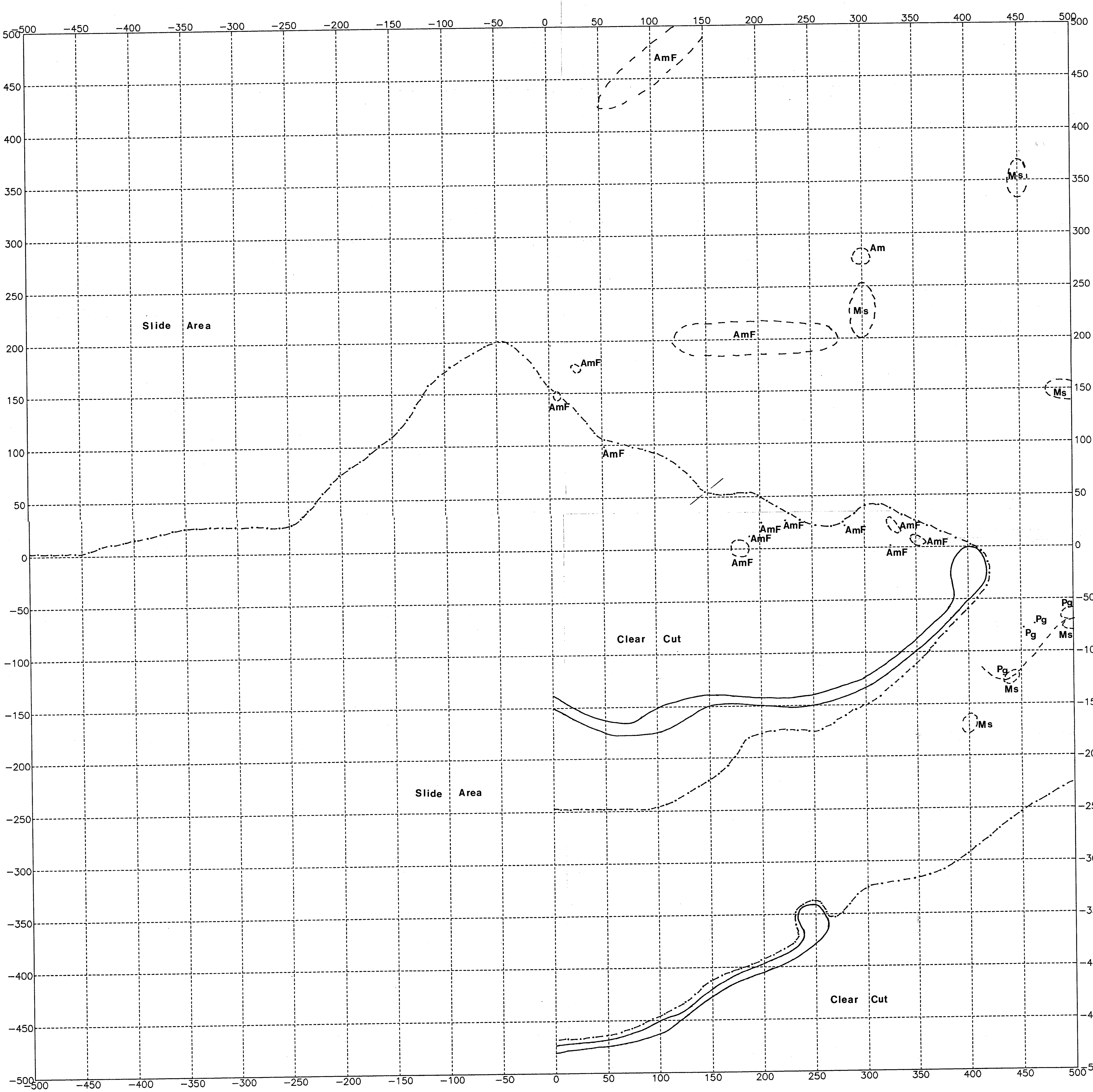


COSMIC VENTURES

PLEIADES GROUP

POSTED RADIOMETRIC VALUES
Units - Counts per Second

DRAWN BY G.J.	SCALE 1:4000	
DATE 91-04-29	JOB NO.	MAP NO. 5

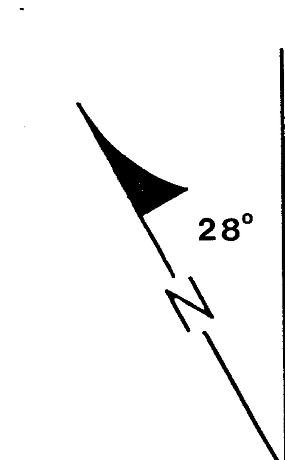


LEGEND

Roads	
Inferred contacts	
Edge clear cut	
Cliff	
Pegmatite	Pg
Amphibolite	Am
Amphibolite float	AmF
Metasediment	Ms

GEOLOGICAL BRANCH
ASSESSMENT REPORT

20,572



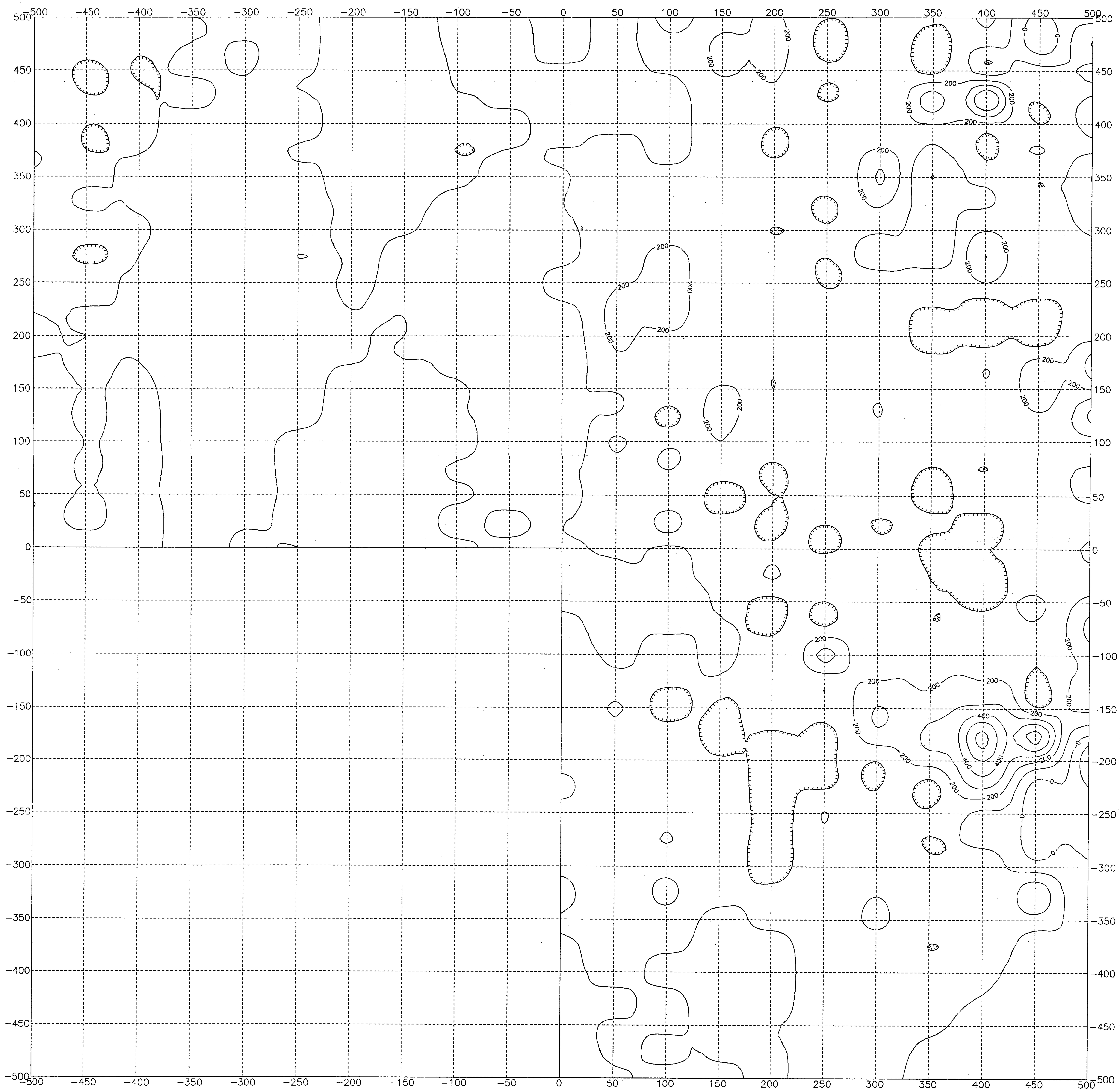
COSMIC VENTURES

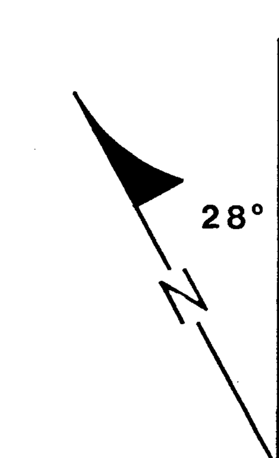
PLEIADES GROUP

GEOLOGY MAP

Outcrop Samples

DRAWN BY G.J.	SCALE 1:2000	
DATE 90-11-13	JOB NO.	MAP NO. 1



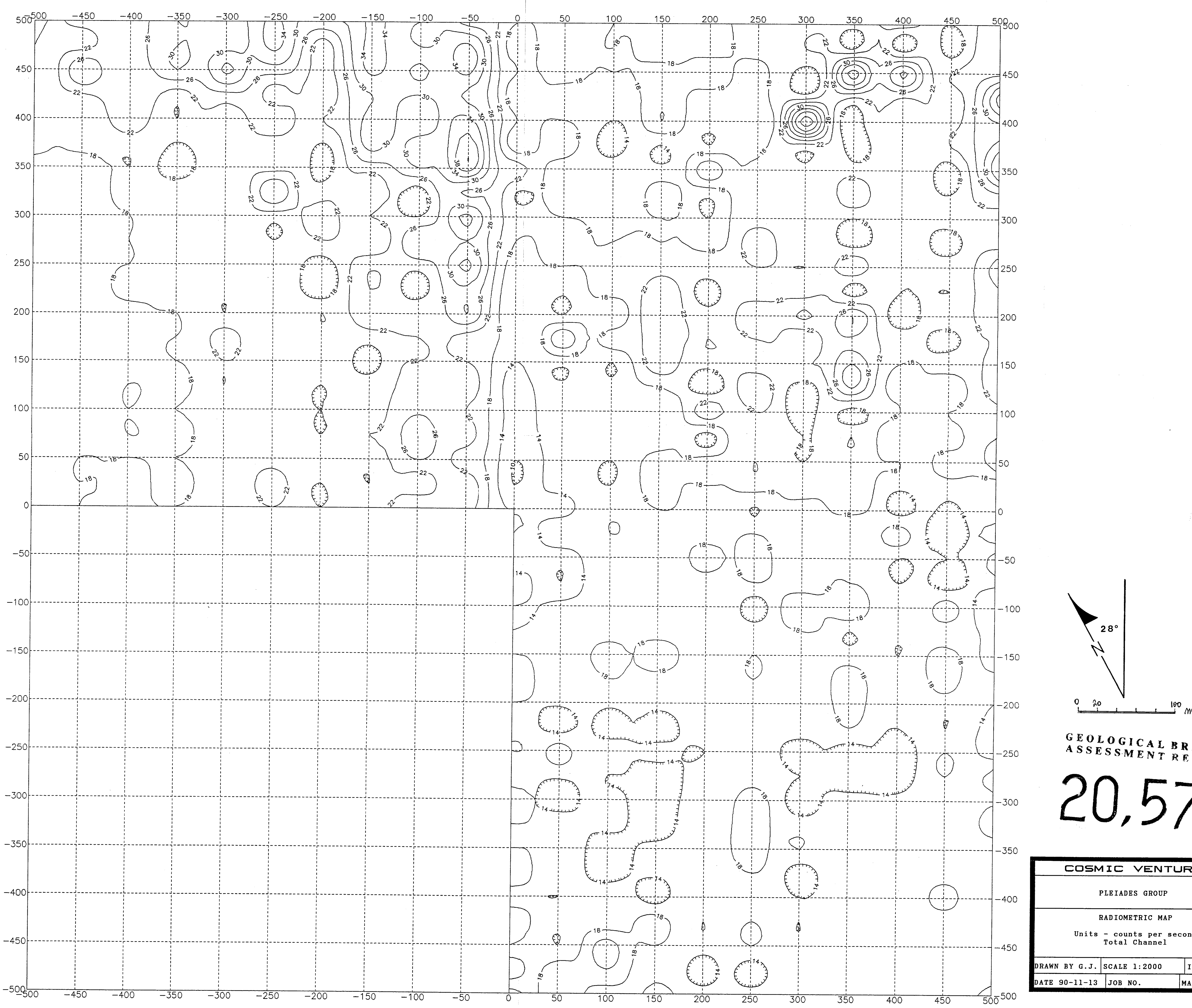


GEOLOGICAL BRANCH
ASSESSMENT REPORT

20,572

0 20 100 m

COSMIC VENTURES		
PLEIADES GROUP		
GROUND MAGNETIC MAP Units - nanoTesla (Datum - 58000 nT)		
DRAWN BY G.J.	SCALE 1:2000	Int. 100nT
DATE 90-11-13	JOB NO.	MAP NO. 2



GEOLOGICAL BRANCH
ASSESSMENT REPORT

20,572

COSMIC VENTURES		
PLEIADES GROUP		
RADIOMETRIC MAP Units - counts per second Total Channel		
DRAWN BY G.J.	SCALE 1:2000	Int. 4 cps
DATE 90-11-13	JOB NO.	MAP NO. 3