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A PRELIMINARY INVESTIGATION OF THE GEOCHEMICAL SURVEY, "AEROMAGNETIC RIDGE" AREA, TENNANT CREEK, N.T.

by

I.R. Pontifex

The information contained in this report has been obtained by the Department of National Development, as part of the policy of the Commonwealth Government, to assist in the exploration and development of mineral resources. It may not be published in any form or used in a company prospectus without the permission in writing of the Director, Bureau of Mineral Resources, Geology and Geophysics.

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CONTENTS

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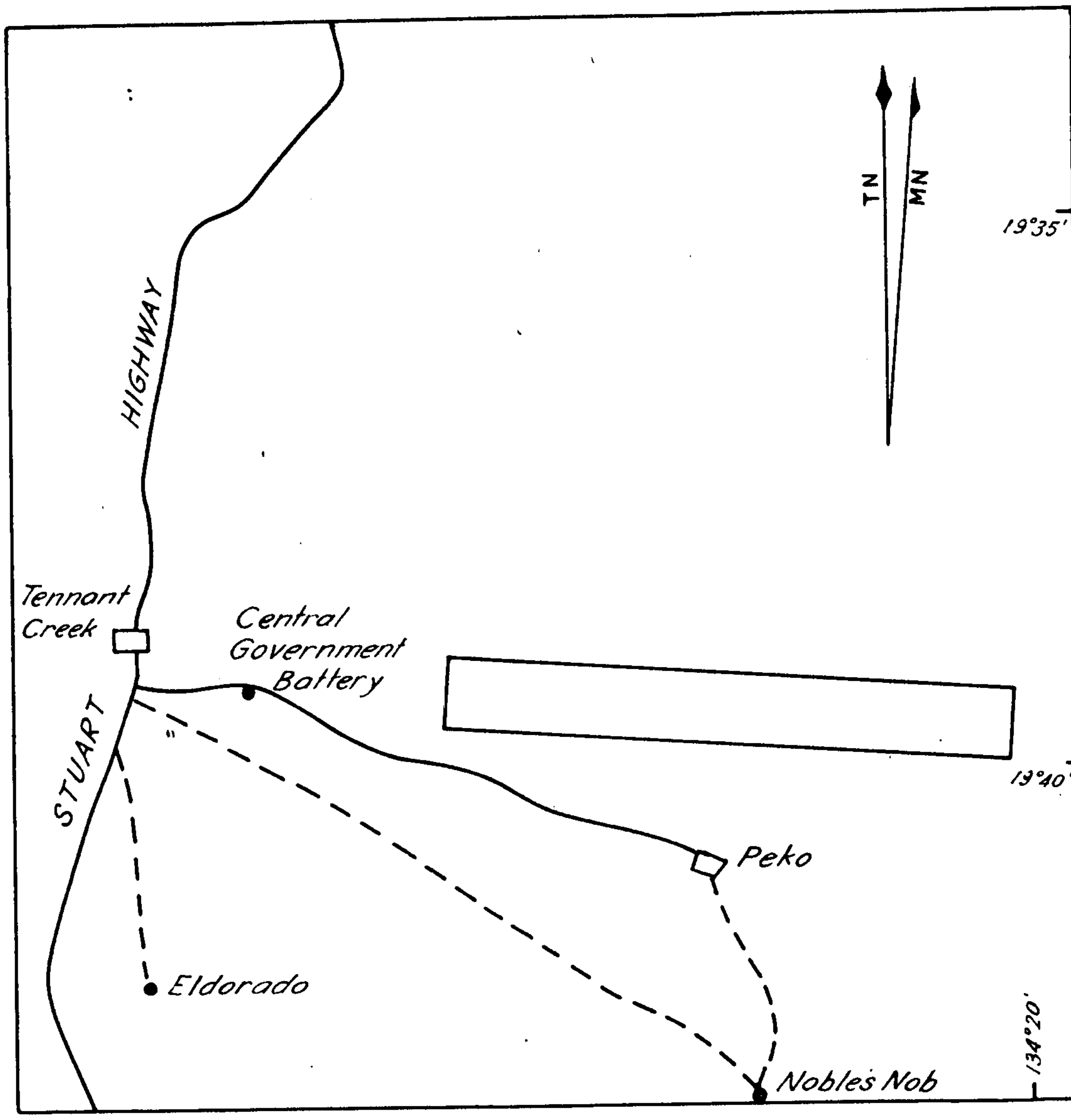
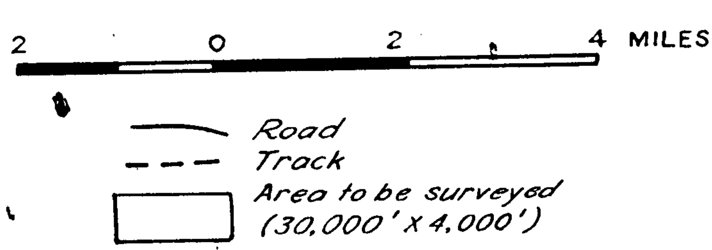


LOCALITY MAP



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Bureau of Mineral Resources, Geology and Geophysics

To accompany Record 1965/47

March 1965

A PRELIMINARY INVESTIGATION OF THE GEOCHEMICAL SURVEY, "AEROMAGNETIC RIDGE" AREA, TENNANT CREEK, N.T.

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SUMMARY

A study of the ore mineralisation at Tennant Creek indicates that the type of ore body which is most likely to be detected in this field by geochemical exploration methods is one mineralogically analagous to the Peko type. The mineral assemblage of the Peko orebody indicates that the elements which are most likely to derive from it and which may be present in surrounding trace element dispersion haloes are Cu, Bi, Pb, Zn, Co, Mo, As and Sb.

In the Aeromagnetic Ridge area the absence of known mineralisation and the general lack of outcrop means that the interpretation of geochemical results will be largely based on comparisons with mineralisation from other parts of the field; also to gain the maximum geological information about this area it will be necessary to project any geological trends from the surrounds onto the Aeromagnetic Ridge grid.

During the initial drilling it was found that the profiles intersected by the auger were markedly consistent and that the various horizons could be quickly and adequately logged graphically. The correlation of the auger holes drilled in the western third of the Aeromagnetic Ridge grid revealed a fossil lateritised erosion surface through the area at an average depth of 12ft.

A spectrographic analysis of the soil profiles indicates a relatively consistent pattern of the abundance and distribution of trace amounts of Cu, Co, Mo, V, Ni and Pb in each. No other elements were detected. From the values obtained and the values recorded in previous geochemical surveys at Tennant Creek the back-ground values for these elements in the Aeromagnetic Ridge area were estimated.

The copper values showed considerable differentiation which is directly related to mineralogical variations of horizons in the profiles. This phenomenon is partly due to the formation of the fossil laterite profile and partly due to the foreign origin of material in some of the horizons. This evidence indicates that trace element dispersion patterns which may be delineated in these horizons may not be related to super-jacent ore.

The ideal samples for geochemical prospecting should therefore be taken from weathered bedrock, below the leached horizons of the laterite profile.

INTRODUCTION

This report sets down the results of a preliminary geochemical investigation of an area known as Aeromagnetic Ridge, Tennant Creek Goldfield (see locality Map).

Aeromagnetic anomalies 1 to 2 miles N. and N.W. of Peko Mine were discovered by the Bureau of Mineral Resources in 1958 and the association of copper-gold-bearing orebodies in the Tennant Creek Goldfield with the type of magnetic anomalies in the Aeromagnetic Ridge area renders it ideal for detailed exploration.

Accordingly a geochemical survey was planned. Weathered bedrock samples for trace elements analysis were collected by an auger drill from an average depth of 20 feet at points on a surveyed grid which covers an area of 30,000 feet by 4000 feet. It was planned to drill 60,000 feet. The programme was supervised by D. Dunnett and R. Harding and it commenced on May 4, 1964.

The author spent from May 4 to May 22 in the field to assist with the geochemical survey and to study known ore mineralisation and how it may influence geochemical prospecting.

NOTES ON ORE MINERALISATION IN THE TENNANT CREEK FIELD

Gold and copper mineralisation in the Tennant Creek field is associated with ironstone bodies, and the search for ore is largely guided by locating and prospecting these. The ironstone bodies in the primary zone consist essentially of quartz and magnetite which are of hydrothermal origin and are localised in shear or breccia zones. The oxidised equivalent of these bodies consists of quartz, hematite and associated hydrous iron oxides.

Individual bodies are lenticular or tabular in shape, their size ranges from 1 foot to 100 feet wide (average about 30 feet); up to 400 feet long and from a few feet to 1200 feet in rake length. The lenses generally strike east. Commonly they are distributed along discontinuous lines which are essentially planar, near vertical shear zones which may extend along strike for several miles. The ironstones are probably derived from acid igneous rocks which intrude the Warramunga sediments.

A detailed mineragraphic study by the author of samples from more than 50 ironstone-gold occurrences and about 30 samples from ironstone-copper occurrences (unpub. rep.) indicates that many of the ironstones were brecciated subsequent to their deposition. Following this, some of the resultant breccia zones facilitated the introduction and localisation of hydrothermal metasomes which deposited by replacement, firstly sulphide minerals and at a later stage, gold and bismuth minerals. The origin of these metasomes is not definitely known but they are considered by the author to be genetically unrelated to the acid igneous rocks and the ironstones.

The best known sulphide orebody in the field is at Peko Mine in which Edwards (1955-58) and other workers have observed the following suite of minerals in the primary zone.

Most abundant minerals :

Magnetite	Fe_3O_4
Pyrite	FeS_2
Chalcopyrite	$CuFeS_2$
Pyrrhotite	Fe_5S_6 - $Fe_{16}S_{17}$

Subordinate minerals :

Marcasite	FeS_2
Galena	PbS
Arsenopyrite	FeAsS
Bismuthinite	Bi_2S_3
Bismuth	Bi
Hematite (primary)	Fe_2O_3
Cobaltite	(CO, Fe) AsS
Sphalerite	ZnS
Wittichenite	$3\ Cu_2\ S\ Bi_2S_3$
Matildite	$Ag\ S\ Bi_2\ S_3$
Tetrahedrite	$3\ Cu_2\ S\ Sb_2\ S_3$
Gold	Au

The volume percent of these minerals varies considerably with depth, but the order of abundance is as follows:

Magnetite
Chalcopyrite
Iron sulphides
Others

In the zone of secondary enrichment the following minerals occur: Native Cu and Bi, Gold, Cuprite, Chalcocite, Covellite, Malachite, Chrysocolla, Cobalt bloom, hematite, limonite.

The cut-off grade of copper ore at Peko is about 5%. Gangue minerals and products of wall rock alteration are mainly quartz and chlorite with variable amounts of sericite, kaolin, talc and minor calc-silicates.

The gold lodes in the field are generally found in the zone of supergene enrichment, localised in shear zones within brecciated quartz hematite bodies or mudstones. The gold is commonly associated with a group of related hydro-micas, bismuth minerals and minor quartz. The largest gold mine on the field is Nobles Nob where the average grade of ore is 32 dwts. per ton and the cut-off grade is about 10 dwts of Au per ton. Sulphide minerals are rare in the Nobles Nob ore.

Warramunga sediments in which all the orebodies are located would provide an acidic, siliceous essentially non reacting environment for dispersed trace elements. They are extremely low in calcium content; in the zone of weathering they contain abundant hydrous iron oxides and various clays.

RELEVANCE OF ORE MINERALISATION TO THE GEOCHEMICAL SURVEY

From the above assessment the following factors appear to be relevant to the conduct of the geochemical programme and to the interpretation of analytical results.

(i) Significance of the Aeromagnetic anomaly at Aeromagnetic Ridge.

1. Ideally the aeromagnetic anomaly can be assumed an expression of an E-W elongate zone of ironstone mineralisation of the type found cropping out in the field.

2. Irrespective of the presence of a massive ironstone body, this anomaly does reflect an extensive E-W trending lineament, presumably a shear of the type commonly responsible for the localisation of ore in this field.

3. Since gold and copper ores are associated with zones of the type suggested in 1 and 2 "Aeromagnetic Ridge" is a favourable area for detailed exploration.

(ii) Choice and significance of path-finder elements.

The type of ore body most likely to be detected by geochemical exploration at Tennant Creek is postulated to be a sulphide type, mineralogically analagous to the Peko body. Based on the Peko ore mineral assemblage the elements which may derive from the ore are Cu, Pb, Zn, Bi, As and Co, Cu and Pb are likely to be the most abundant.

The results of previous surveys of Tennant Creek and geochemical results from other areas of similar environment indicate that Cu, Zn and Mo can be expected to be more mobile than the other elements mentioned. Arsenic is also a relatively mobile element and although it occurs in restricted abundance in the Tennant Creek ores it may prove to be a significant path-finder element.

On a mineralogical basis Bi is the most significant indicator element of the gold lodes at Tennant Creek. Bismuth may also be of good specific indicator element of sulphide ore since it is more mobile in primary mineralisers than the other ore metals but it does not migrate far from its primary location in a secondary form.

Molybdenum is used widely in other areas as an indicator of copper mineralisation and it may be useful at Tennant Creek.

The above suggests that the order of preference of path-finder trace elements is Cu, Bi, Pb, Zn, As, Mo, Co.

(iii) Dispersion of trace elements and their spatial relationship to ore.

1. Since the ore bodies are generally localised in near vertical shears the migration of trace elements derived from ore will be greater in the vertical plane than in an horizontal or oblique direction.

2. Accordingly, the areal extent of a secondary dispersion pattern should have a close spatial relationship to the size and shape of underlying ore bodies from which they are derived.

3. Therefore the approximate width (N-S dimension) of the most intense part of any significant secondary dispersion pattern is expected to be about 50 ft. This means that in areas drilled at 100 to 200 ft. N-S intervals which produce values even slightly greater than background may need to be drilled at closer N-S intervals to adequately test the area. The maximum sample interval in an E-W direction should be 400 ft.

4. Considering a typical ironstone-copper ore relationship the higher trace element values may be expected close to the axial zone of the aeromagnetic anomaly.

(iv) Significance of auger cuttings to ore mineralisation.

1. The cuttings will probably consist of barren, weathered, iron-rich clastic sedimentary rock fragments.

2. Ore, gangue or hydrothermal alteration minerals detected in the cuttings should warrant deeper holes and closer spaced drilling in the vicinity.

3. The discovery of granite or porphyry in the cuttings is probably an indication of the source rock for ironstone mineralisation but not necessarily of sulphide or gold minerals.

4. The discovery of calc-silicates or other basic rocks may indicate proximity to sulphide mineralisation.

FIELD WORK IN THE AEROMAGNETIC RIDGE AREA

(i) Topography and Climate

Over most of the area to be drilled the land surface consists of flat bulldust flats with patches of ferruginous scree and sand. Around the NW perimeter, low hills of shale, siltstone and scree rise up to 15 ft. above the flats inside the area and these rise steeply to mesa like hills up to 100 ft. high outside. Through the centre of the area low rises of sedimentary rocks and minor quartz reefs rise as high as 15 ft. above the flats. Iron and silica rich screes generally accompany the outcrop.

Drainage in the area consists of shallow, wide wash-away zones which rarely develop into well defined rut like channels up to 10 ft. deep and 15 ft. wide; these contain coarse alluvium. Localised shallow depressions are characteristic of the area.

The vegetation consists of spinifex bush and ligh scrub.

The climate at Tennant Creek is arid with cool winters and extremely long hot summers. The annual rainfall is 14 inches and is usually restricted to February and March.

(ii) Geology of the Aeromagnetic Ridge Area

Shales, siltstones and tuffaceous sandstones of the Warramunga Group crop out in the area; some are locally lateritised, leached and bleached. Cleavage striking east and generally vertical is well developed.

Quartz reefs, up to 3 feet wide are common in the hills west and north of the area. These are localised along the east striking cleavage planes and are barren of metallic minerals. Several massive quartz-hematite bodies are localised along E-W shear-breccia lineaments about ¼ mile N.W. of the N.W. corner of the survey area.

Minor quartz reefs and associated quartz screes are sporadically distributed through the area; some contain small amounts of specularite and tourmaline.

Peko and Golden 40, occur within 2 miles of the centre of the "Aeromagnetic Ridge". The ore at Peko is massive, in the Golden Forty area minor sulphides of non-economic concentration are disseminated in shear zones below the water table level over an area about 1 mile E-W by ¼ mile N-S. There are no known trends of these mineralised zones toward Aeromagnetic Ridge, however a photo linear feature striking about N.E. runs through Peko Mine and across the eastern end of the survey area.

(iii) Relevance of topography and geology to the geochemical survey

1. Because of the absence of known ore mineralisation in this area the observations made of known ores in the field form the basis for interpretation of geochemical results of this programme.

2. Because of the lack of outcrop in this area the surrounding hills should be mapped and where possible, structural trends, particularly any shears and mineralised zones, should, where appropriate, be projected into the area being surveyed. The relationship between geochemical anomalous zones and projected structure should be established.

3. Variations in the distribution and abundance of the trace elements due to irregular effects of weathering caused by the present day topography and drainage will be a minimum.

4. The effect of climate on the weathering profile and consequently on trace elements distribution should be fully investigated and considered in the geochemical interpretation.

(iv) <u>Gridding, sampling, logging, and drilling conditions</u>

Some of the factors concerning these techniques have been previously noted in this report. This section is a summary of the procedures adapted to the current programme.

1. Gridding. A 400 ft. square grid was pegged by contract prior to the commencement of the survey. Intermediate pegging was done by field assistants as drilling progressed.

2. Sampling. The drillers off-sider samples the continuously ejecting auger cuttings each 2 ft. of penetration. These are put on the ground in sequence for logging. One sample is taken from the horizon to be analysed as instructed by the supervising geologist. This material is collected from the drilling bit and attached drillstem. The average number of samples collected per week is about 200.

3. Logging. The soil profiles intersected in the first 1/3rd of the programme, were markedly consistent in their composition. Consequently the author considered that for logging purposes a classification of each horizon could be made on the basis of the composition of the coarse fragments and also the colour of the fine fraction. Both of these features are characteristic of individual horizons. Each class, (or horizon) could be designated by a symbol and the profile logging then done graphically. As a result a classification was devised in the field, (this is discussed in detail later in this report in the section on laboratory studies). On graph paper the positions of each drill hole along the appropriate N-S traverse line were spotted on a surface profile, the soil type and its thickness were then marked off on a vertical section of each hole. This method of logging saves time, it enables an immediate correlation between each profile and subsequently the compilation of a continuous section which clearly and quickly illustrates the distribution of each soil type.

4. Drilling Conditions.

   Drilling is generally good however extremely slow progress is made in the ferruginised silicified "gravel" horizon which is generally present in each hole.

   The drilling rate for one rig up until May 22, including moving between sites averaged between 350 and 400 ft. per 9 hour day continuous drilling. A second rig on the job averaged between 300 and 350 ft. per day under the same conditions. The average depth of hole was 20 ft. On this basis the drilling time for the planned 60,000 ft. of drilling on this project is about 14 weeks.

LABORATORY INVESTIGATION

The aim of this investigation was to make a detailed mineralogical and geochemical analysis of 9 complete soil profile samples from the area covered during the time spent in the field. This area is within 000N, 4000N and 000E, 6000E. The holes were selected at random and the profiles intersected are representative of the profiles in the vicinity of each hole.

(1) Descriptive mineralogy

Detailed mineralogical studies were made of the coarse fragments that remained after the clays and fine silts were decanted from each specimen. The colour of this clay fraction is characteristic and this, together with its approximate proportion in each sample is also recorded. Several thin and polished sections were also examined.

Arising from this examination the following idealised profile is considered to be representative of the profiles intersected in the area sampled.

Mineralogy

Horizon Symbol		(a) = proportion and color of fines in sample. (b) = composition and proportion of main components in the course fraction.	Idealised thickness
Surface		Fe, Si rich sand and wind polished scree.	
A		red brown bulldust, Fe, Si rich sand.	0 - 2 ft.
B1	(a)	60% red-brown bulldust and silt.	2 - 10 ft.
	(b)	80% subangular, polished Fe, Si rich sand. 10% subangular, polished fine goethite and hematite grains, some case-hardened with Si. 10% hematised and goethite rich fine fragments of shale.	
B2	(a)	30% red-brown bulldust and silt.	10 - 16 ft.
	(b)	60% red-brown, tabular, subangular wind polished shale and tuffaceous siltstone pebbles (fossil scree), these are enriched and case hardened with Fe and Si. 20% residual goethite, hematite, (some magnetic), quartz and chert, all polished. 20% Fe, Si rich subangular polished sand.	
B3		transition B2-C1, commonly contains abundant chert.	16 - 18 ft.
C1	(a)	70% white, pale red or buff, clay and sericite.	18 - 24 ft.
	(b)	80% white or slightly mottled pink and buff, bleached, leached sericite shale and siltstone fragments. 10% pale red sericite shale bleached and goethite stained along partings.	

		10% quartz sand with adhering mica and clay.	
C2	(a)	70% pale red, buff, clay and sericite.	24 - 32 ft.
	(b)	80% pale red mottled leached and slightly bleached fragments of sericitic shale and siltstone. Some ferruginous, and stained with hydrous iron. 10% white bleached sericitic shale. 10% quartz grains with adhering mica and clay.	
D	(a)	50% pale red, clay and sericite.	32 -
	(b)	pale red slightly leached fragments of deeply weathered sericitic shale siltstone and tuffaceous sandstone, some spotted white.	
Bedrock.		Pale red shales and siltstones.	

Although the sequence is essentially the same in each profile the thickness of each horizon may vary and some of the upper horizons may be present.

(2) Interpretation of the mineralogy

The major factors have a significant bearing on the geochemical interpretation of this area:

(a) The recognition of a fossil erosion surface, represented by the B2 horizon;

(b) the recognition of a laterite profile related to this old surface.

(a) Fossil erosion surface. The ferruginised, silicified, commonly case-hardened and wind-polished pebbles in the B2 horizon are analagous to the scree material found in localised patches on the present day erosion surface. This correlation suggests that the components of this horizon were deposited under similar conditions that control the accumulation of present day surface scree, i.e., they represent a buried erosion surface.

Most of the material in the B2 horizon probably derived by the disintegration of the underlying rocks and the accumulation of this debris in situ. During this process the fragments were lateritised and wind polished. Some of the material however, particularly the sand-silt fraction, would have been transported from the surrounding environs. Evidence of wind erosion of the grains suggests that the transporting medium was wind however the profile of the base of the B1 horizon indicates that surface topography was more irregular than at present and this may have facilitated greater movement and concentration of surface debris by water.

Horizon A appears to be dominantly of aeolian origin.

(b) Laterite profile. The ferruginised and silicified fossil erosion surface and the underlying sequence of horizons which are enriched in clay and sericite and progressively less leached with increasing depth are characteristic of a laterite profile.

Climatic and topographic conditions were apparently suitable for the incipient development of laterite at the time of exposure of the B2 surface. Presumably, meteoric waters permeated the rocks to the present C1 and to a lesser degree the C2 horizon in the wet season. From these horizons they leached iron and to a lesser extent silica. In the hot arid period an upward capillary migration of the ground waters into an oxidising environment caused the precipitation of iron and silica in the near surface horizon. The resultant insoluble products are a mixture of hydrous iron oxides, hematite and silica, which upon disintegration form what is essentially the residual lateritic gravel of the B2 horizon.

The leached sericitic shales were progressively depleted in iron and some silica leaving them relatively rich in sericite and clays. The clays were not analysed but their conditions of formation and association with sericite suggest that they are mainly illite or hydro-micas largely derived by the chemical alteration of the sericite and probably to a lesser extent, by the decomposition of argillaceous rocks in-situ.

(3) Spectro-chemical analyses

Semiquantitative chemical analyses were done of each sample at the B.M.R. Laboratory on the optical emmission spectrograph. The values of p.p.m. Cu, Pb, Zn, Bi, Co, Mo, V, and Ni are set out in the following tables which show the drill hole co-ordinate, the trace element content of the sample and the horizon the sample represents.

i. p.p.m. Copper

Grid Coordinates	2800E 2800N	2800E 3900N	3200E 000N	3600E 2100N	4800E 2800N	5600E 3800N	6000E 1500N	000E 2100N	1600E 400N
Horizon									
A	25	25	-	-	25	15	-	-	-
B1	25	25	15	-	15	15	15	15	25
B2	15	15	-	20	25	20	10	-	-
B3	-	-	-	-	-	10	-	-	-
C1	5-	5-	10	10	5	5-	-	5	5
C2	10	5-	5	5	5	5	5-	5-	5
D	-	-	-	-	-	-	5-	-	-

ii. p.p.m. Cobalt

Grid Coordinates	2800E 2800N	2800E 3900N	3200E 000N	3600E 2100N	4800E 2800N	5600E 3800N	6000E 1500N	000E 2100N	1600E 400N
Horizon									
A	12	12	-	-	12	12	-	-	-
B1	15	12	15	-	12	12	12	10	12
B2	12	12	-	15	15	12	12	-	-
B3	-	-	-	-	-	15	-	-	-
C1	5	10	5-	12	12	12	-	12	10
C2	5	10	5-	10	10	10	30	12	5
D	-	-	-	-	-	-	10	-	-

5- less than 5 p.p.m.

- horizon not present

iii. p.p.m. Molybdenum

Grid Coordinates	2800E 2800N	2800E 3900N	3200E 000N	3600E 2100N	4800E 2800N	5600E 3800N	6000E 1500N	000E 2100N	1600E 400N
Horizon									
A	5	10	-	-	7	7	-	-	-
B1	5	7	5	-	5	5	7	10	5
B2	15	7	-	7	5	10	10	-	-
B3	-	-	-	-	-	5	-	-	-
C1	7	5	5	7	5	5	5	5	5
C2	7	5	5	5	5	5	5	5	5
D	-	-	-	-	-	-	5	-	

\- horizon not present

iv. p.p.m. Vanadium

Grid Coordinates	2800E 2800E	2800E 2900N	3200E 000N	3600E 2100N	4800E 2800N	5600E 3800N	6000E 1500N	000E 2100N	1600E 400N
Horizon									
A	100	100	-	-	100	100	-	-	-
B1	200	100	100	-	100	150	150	200	150
B2	200	150	-	200	200	300	200	-	-
B3	-	-	-	-	-	200	-	-	-
C1	100	150	100	150	100	100	-	100	200
C2	200	150	150	150	150	100	200	200	100
D	-	-	-	-	-	-	200	-	-

\- horizon not present

v. p.p.m. Nickel

Values were 5 p.p.m. or -5 p.p.m. No variation in distribution was exhibited.

vi. p.p.m. Lead

Pb was detected only in the following samples :

2800E 2800N } A horizon 10 p.p.m.
B1 horizon 10 p.p.m.

3200E 000N } A horizon 10 p.p.m.

5600E 3800N } C2 horizon 15 p.p.m.

vii. p.p.m. Bismuth and Zinc

Bi and Zn were not detected.

(4) Background Values

In 1963, 633 auger drill samples of weathered shale from various areas of Tennant Creek were analysed at the B.M.R. Laboratory. (B.M.R. Record 1963/121). Although no detailed mineralogical studies of the samples have been made their composition is essentially the same as the weathered shales of Aeromagnetic Ridge and therefore a direct comparison of the trace metal abundance in these samples and in those collected on an orientation basis of Aeromagnetic Ridge can be made. The lateritic gravel material has not been found to any significant extent in other parts of the field.

The following table shows the number of samples, their content of p.p.m. Ni, Co, Cu, Mo, Pb, V, Bi, Zn and also the number of samples from the 633 total in which these elements were detected. All samples analysed by the optical emission spectrograph.

Value p.p.m.	Ni	Co	Cu	Mo	Pb	V	Bi	Zn
5-	588	589		11				
5	11	11	4	7				
10-			467	40	516	216		
10	5	4	91	4	33	207		
20	10	2	52		21	118		
30	5	3	7		5	58		
50	4	20	9			23		
70	6	1			27	3		
100		3	2		11	1		
200	4		1		15			
300					2			
300					3			
No. samples in which elements found	633	633	633	62	633	626	Not detected	

These analyses indicate that the most widespread elements in the weathered shales that can be detected by the optical emission spectrograph are Cu, Pb, Co, Ni and V. Mo has a restricted distribution, Bi and Zn are absent.

In the Aeromagnetic Ridge area a similar distribution and abundance of elements were detected with the exception that Pb was generally absent and Mo was present in most samples.

The background values derived from these analyses are :

Element	Background range p.p.m. (regional)	Background range p.p.m. (Aeromagnetic Ridge)
Cu	5-10	3-7
Ni	3-5	3-5
Co	3-5	approx. 10
Mo	5-7	5-7
Pb	5-10	?
V	7	100
Zn	?	?
Bi	?	?

The significance of the high vanadium background at Aeromagnetic Ridge is not apparent at this stage. The average content of Bi and shales is 2 p.p.m.

In the 'Aeromagnetic Ridge' area the concentration of Cu, Co and to a lesser extent Mo is consistently greater in the ferruginous horizons than in the shales, hence their background values are relatively higher than those given for the shales. The background values of these elements in the ferruginous horizons are:

Element	Background range p.p.m.
Cu	15-20
Co	10-15
Mo	7-10

Values of more than 2x the background established for the various lithotypes may indicate the presence of significant amounts of epigenetic metals in the vicinity of the sample.

5. Correlation, mineralogy and geochemistry, Aeromagnetic Ridge

The variation in the concentrations of Cu, Co and less significantly Mo can be directly related to mineralogical differentiation in the soil profile. Other elements show no correlation between their concentration and mineralogical variations of sample material.

The ferruginous horizons (particularly B2 and B1) contain a relatively high concentration of Cu and Co. In the underlying leached shales the trace element values, particularly of Cu, are commonly less than the regional background value. This relative enrichment of Cu in the B1 and B2 horizon appears to have been brought about during the lateritisation of these horizons. During this process the Cu was leached from the C1 and C2 horizon, transported and finally deposited along with the iron-oxides and silica.

Alternatively, the generally high concentrations of Cu in the B1 and B2 horizons and also in the A horizon may have been introduced with the transported components of foreign origin which occur in these horizons.

The differentiation of trace element concentration produced by lateritisation is expected to be accentuated by variations in the topography of the fossil erosion surface. For this reason it is suggested that an isopach map of the B2 horizon should be compiled since this would delineate such features as fossil drainage patterns which may help to establish any relationship of the fossil erosion surface with the variation of trace element abundance in the B and possibly C horizons.

The fact that the distribution of trace elements in the upper horizons can be caused by the extraneous factors described above suggests that some trace element dispersion patterns which may be delineated in these horizons may not be related to superjacent ore.

For this reason it is essential that in the Aeromagnetic Ridge area samples collected for the purpose of geochemical prospecting must be taken from weathered bedrock, below the leached horizons of the laterite profile.