AFMECO PTY LTD

DARWIN BASE

Report No. 315FM

EXPLORATION LICENCE 2112

CARRARA RANGE, NORTHERN TERRITORY

ANNUAL REPORT, 1979

by

G.R. ORRIDGE

October 1980 DARWIN

CONTENTS

APPENDICES

LIST OF FIGURES AND PLATES

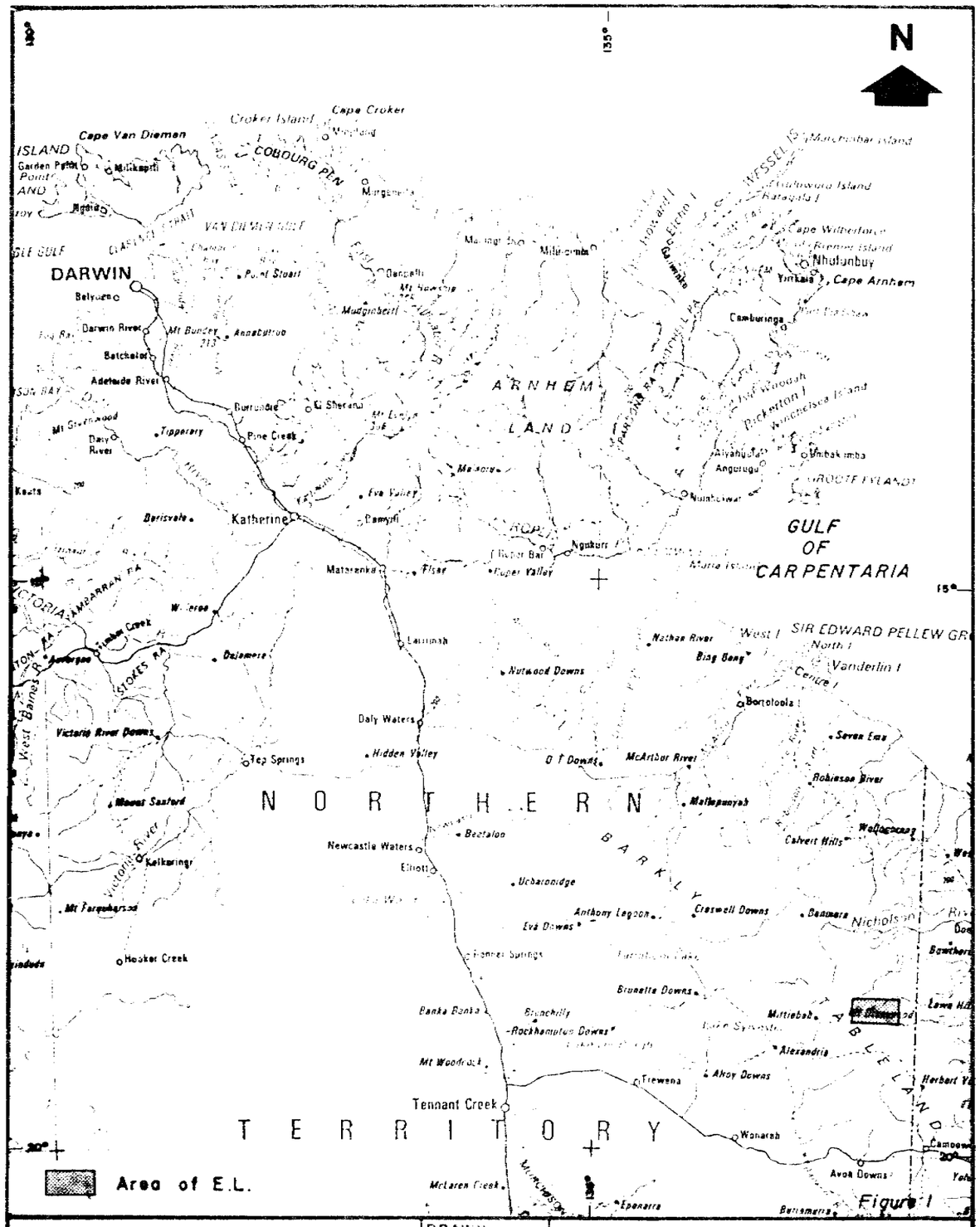
1. INTRODUCTION

Exploration Licence 2112 at Carrara Range is situated in the Northern Territory of Australia between Longitudes 137°25' and 137°50' and Latitudes 18°38' and 18°50' (Fig. 1). It covers an area of approximately 1100 km^2 and was granted to AFMECO for a five year term commencing 10th October 1979. It falls within 1:250,000 map sheet Mount Drummond, 1:100,000 map sheets Mitchiebo and Carrara, and the Pastoral Lease Mount Drummond.

The nearest airstrip, at Mittiebah Homestead, is situated approximately 300 km by air from Mt. Isa and 960 km by air from Darwin. By road distances are approximately 520 km to Mt. Isa (via Camooweal) and 1400 km to Darwin (via Anthony Lagoon and Elliott).

Access to the southern edge of the E.L. area is gained by an east-west fenceline track connecting to Mittiebah Homestead. Old tracks leading north from this fence to Fish Hole Waterhole and Springvale Homestead (abandoned) are largely overgrown and unserviceable. Most parts of the area are accessible (with difficulty) using four wheel drive vehicles, the main problem being staked tyres caused by extensive burnt-out turpentine thickets.

Small permanent waterholes are present on Fish-Hole Creek and Boomerang Creek, and good drinking water is produced at Roads Bore near the SW corner of the E.L. area.



	DRAWN M.B.COMO DATE JAN '80 GEOLOGY NATMAP 1978 APPROVED DWG NO SE53,54.372.1889 REV NO 0	AFMECO PTY. LTD. SCALE 1:5 000 000 0 100 200 300 km CARRARA RANGE PROJECT E.L. 2112 LOCALITY MAP

To Accompany Report No. NT 315F

Physiographically the area falls into two parts. The southern area consists of a plain at an elevation of 260 to 300 metres which forms part of the Barkly Tableland. In the southwest drainage is poorly defined and leads southwards into the internally draining Playford River System. In the southeast Fish-Hole and Boomerang Creeks drain into Carrara Creek and ultimately to the Gulf of Carpentaria.

The northern part is the Carrara Range, a moderately rugged area between 300 and 400 metres elevation, formed by dissection of a sub-Mesozoic erosion surface at about 400 m by superimposed drainage directed northeastwards to the Gulf via the Nicholson River and Lawn Hill Creek. This is part of the Gulf Fall.

In the Barkly Tablelands vegetation consists of Mitchell Grass on the black clay soils with spinifex and eucalyptus woodlands developed on the sandy and lateritic soils bordering the elevated ranges to the north.

Thick turpentine thickets are extensive along the southern edge of the Carrara Range and in laterite areas, but elsewhere the hill country produces open eucalyptus woodlands and spinifex.

The climate is monsoonal with an annual rainfall of about 500 mm occurring principally within the summer months of November to April. During this period the area can be considered inaccessible to motor vehicles.

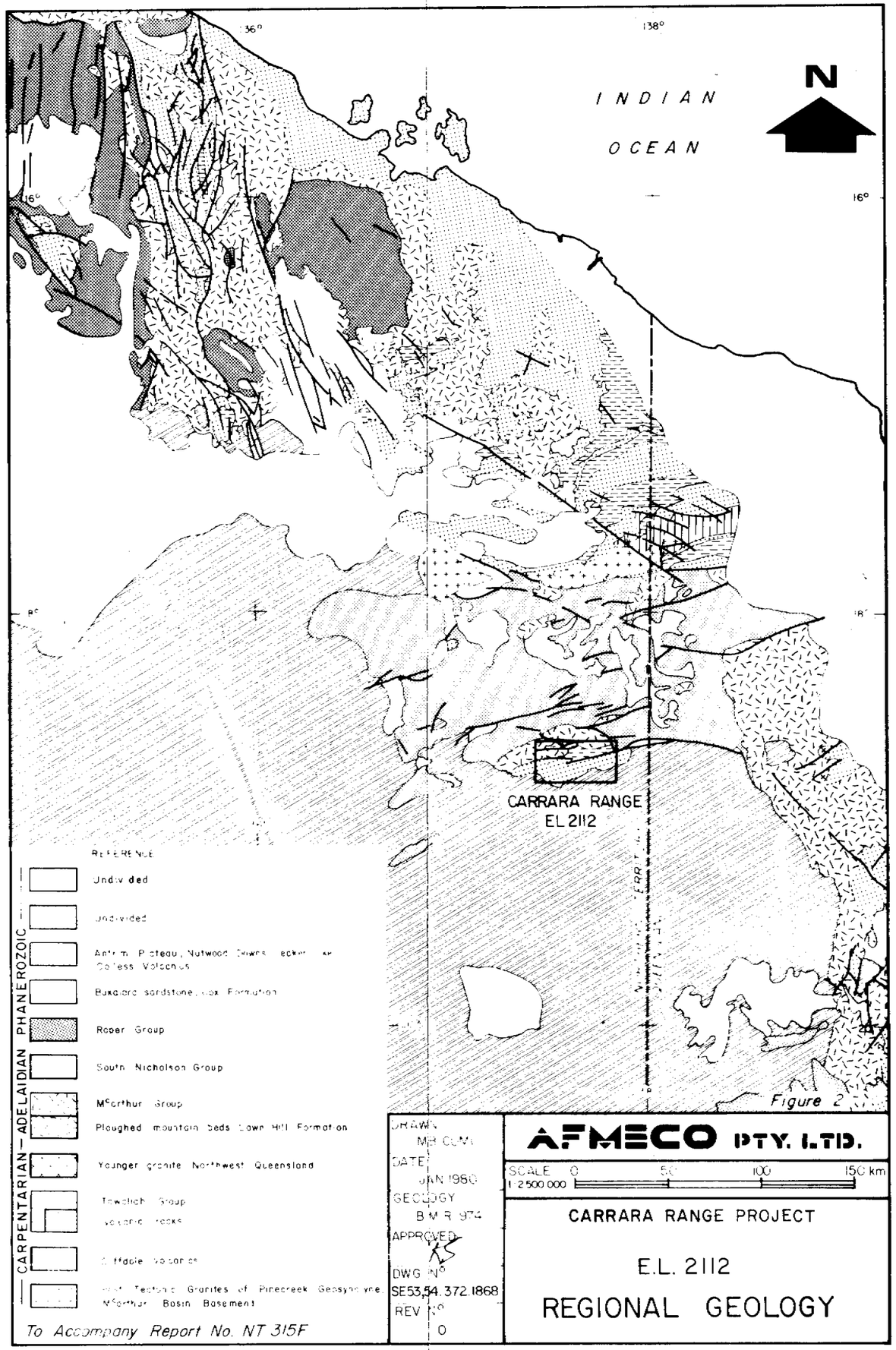
2. REGIONAL GEOLOGICAL SETTING

The Carrara Range is an inlier of Lower Proterozoic and early Middle Proterozoic rocks situated between Upper Proterozoic sediments of South Nicholson Basin to the north and Lower Palaeozoics of the Georgina Basin to the south (Figure 2). The general structure is north-dipping and is complicated by major ENE trending faults and E-W trending domal folds. Minor faulting is also widespread on NE, ENE, NW and E-W trends.

The southern edge of the Precambrian outcrop is marked by the ENE Littles Range Fault. Magnetic surveys suggest a possible repetition of the Lower and Middle Proterozoic sequences beneath Cainozoic/Palaeozoic cover south of the fault.

The stratigraphy of the Carrara Range (Figure 3) shows general similarities to the Lower and Middle proterozoic sequences of the Murphy Inlier (100 kms to the N) and Lawn Hill Platform (100 kms to the E) but detailed correlations are difficult.

The Murphy Metamorphics at Carrara Range are very similar to those exposed in the Benmara area and consist of quartz sericite schists (greenschist facies) representing meta-argillite and meta-siltstone. The lower sandstone member of the Carrara Range Formation, which rests unconformably on the Murphy Metamorphics, is a medium grained pebbly sandstone, probably shallow marine in origin, and is similar to the equivalent (?) Westmoreland Formation near Benmara. It differs markedly from the much thicker conglomeratic fluviatile-deltaic Westmoreland Formation of the type area near Westmoreland.


INDIAN
OCEAN
N
136°
138°
16°
18°
CARRARA RANGE
EL 2112
TERRITORY
REFERENCE
CARPENTARIAN – ADELAIDIAN PHANEROZOIC
Undivided
Undivided
Antrim Plateau, Nutwood Downs ecker ss
Galiess Volcanics
Bukalara sandstone, ...ex Formation
Roper Group
South Nicholson Group
McArthur Group
Ploughed mountain beds Lawn Hill Formation
Younger granite Northwest Queensland
Tawallah Group
volcanic rocks
Stiddle Volcanics
Post Tectonic Granites of Pinecreek Geosyncline
McArthur Basin Basement
To Accompany Report No. NT 315F
Figure 2
DRAWN
MP COVI
DATE
JAN 1980
GEOLOGY
BMR 974
APPROVED
DWG No
SE53,54.372.1868
REV No
0
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50
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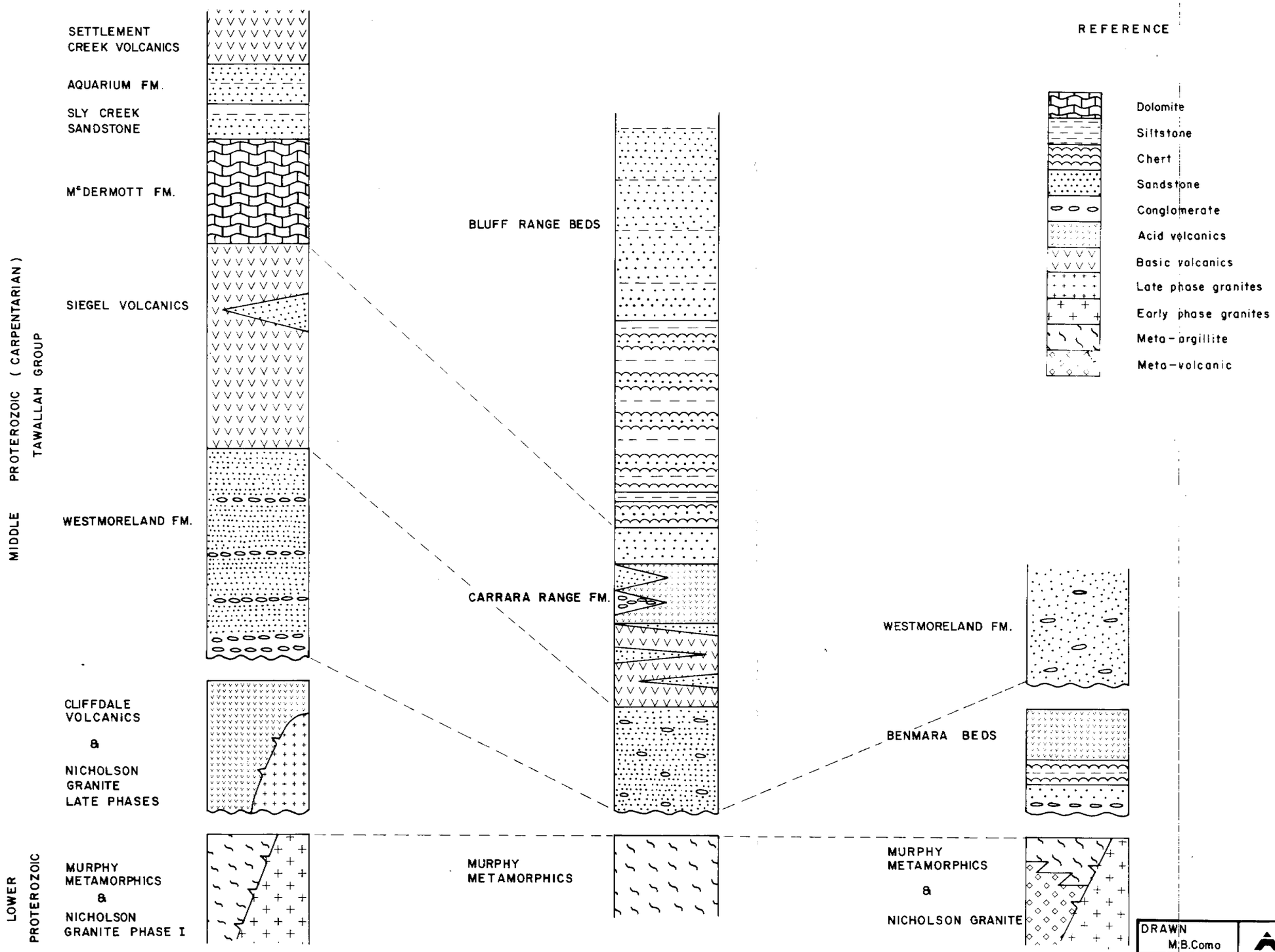
CARRARA RANGE PROJECT
E.L. 2112
REGIONAL GEOLOGY



REFERENCE

- Dolomite
- Siltstone
- Chert
- Sandstone
- Conglomerate
- Acid volcanics
- Basic volcanics
- Late phase granites
- Early phase granites
- Meta-argillite
- Meta-volcanic

Figure 3

To Accompany Report No. NT 315F

DRAWN	M.B.Como
DATE	March 1980
GEOLOGY	G.Orridge
APPROVED	
DWG. N°	SE53-12.372.1750
REV. N°.	0

AFMECO PTY. LTD.

Vertical Scale 1:20000 (200 100 0 500 1000 m)

CARRARA RANGE PROJECT

EL 2112

STRATIGRAPHIC CORRELATIONS

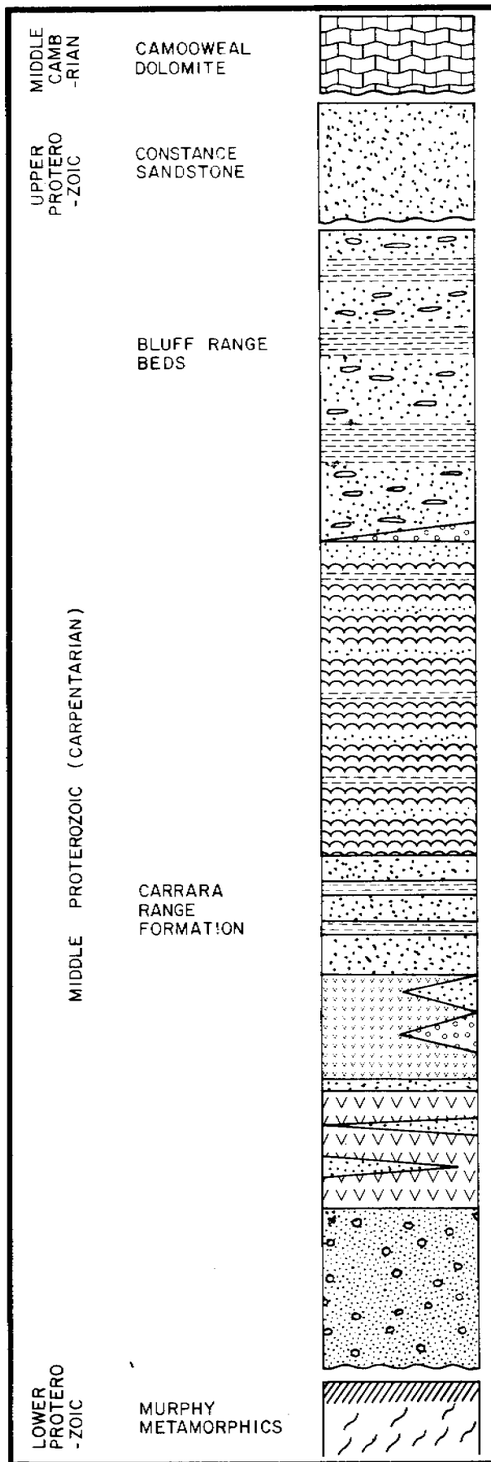


Figure 4

To Accompany Report No. NT 315F

DRAWN	R.P.S.
DATE	FEB. 1980
GEOLOGY	G.ORRIDGE
APPROVED	C.J. Strong
DWG. No.	SE53-12.372.1748
REV. No.	0

AFMECO PTY. LTD.

Vertical Scale: 1:20 000 approx. 0 500 1000m

CARRARA RANGE PROJECT

E.L. 2112

STRATIGRAPHY

The overlying basic and acid volcanics, with interbedded sandstones, may correlate with the Seigels Volcanics of the Murphy Inlier although the acid volcanic phases are relatively more important in the Carrara Range.

Sandstones at the top of the Carrara Range formation show a transition upwards into sandy cherts and stromatolitic cherts (possibly dolomites subsurface) which are the lower members of the Bluff Range Formation. The upper members consist of interbedded feldspathic sandstones, siltstones, minor chert and conglomerate. The sedimentary facies of carbonates, sandstones and argillites is similar to the McDermott Formation, Sly Creek Sandstone and Aquarium Formation, which overlie the Siegel Volcanics north of the Murphy Inlier.

3. PREVIOUS EXPLORATION

Exploration in the Carrara Range for basemetals, phosphate and uranium was undertaken sporadically by a number of companies between 1958 and 1972. Most work was concentrated in the volcanic rocks near Mt. Drummond. In general previous exploration was lacking in useful geological mapping, magnetic surveys, sensitive gamma ray spectrometry, comprehensive geochemical cover and drilling.

Mount Isa Mines employed two prospectors over a six week period in 1958 to check out the volcanics near Mt. Drummond. No evidence of mineralisation was discovered.

Anaconda in 1966 undertook a helicopter survey of the Adelaidian Mullera Formation to search for phosphate. Results were negative.

Between 1967 and 1969 Australian Geophysical undertook geological and geochemical reconnaissance in a search for basemetals. They located a small "gossan", following a northeast shear in the Murphy Metamorphics, which contained anomalous Cu Ni Co values but no identifiable sulphide boxworks. They did not analyse for uranium. An induced polarisation survey over the "gossan" did not locate an anomalous source.

In 1972 CRA carried out stream sediment and geological reconnaissance of the volcanic rocks, together with an airborne radiometric survey using an AAEC 239 ratemeter on 500 m and 1000 m spaced lines. Some contour flying of volcanic-sandstone contacts and ground scintillometer checks were

undertaken. High background basemetal geochemistry was reported over the volcanic rocks but no significant uranium geochemistry was encountered. Three-times background radiometrics were found over the upper part of the volcanic section but only background values were recorded over the Murphy Metamorphics.

4. EXPLORATION CARRIED OUT

4.1 AERIAL PHOTOGRAPHY

The area of E.L. 2112 was flown under contract by Kevron Aerial Surveys of Perth in July 1979. Flight lines were east-west and 1:50,000 scale black and white photography was taken, for controlling navigation of subsequent airborne geophysical surveys, and 1:25,000 scale colour photography was taken for mapping purposes.

Base maps at 1:25,000 scale were prepared by Peter Livings and Associates of Perth using the Kevron photography and control data supplied by the Division of National Mapping.

4.2 GEOPHYSICS

Geometrics International Corporation completed an aerial magnetic and radiometric survey of the Carrara Range in August 1979.

The area was flown at a mean terrain clearance of 80 metres, at a flying speed of 105 knots on N-S flight lines 400 metres apart.

Instrumentation consisted of a G-803 proton magnetometer with a recording sensitivity of 0.25 gamma each 1.0 second, and a GR-800 Differential Gamma Ray Spectrometer interfaced with a 1000 cubic inch slab crystal detector. Data was collected in both digital and analog format.

Flight path recovery was by a Geocam 35 mm tracking camera.

Detailed specifications of the survey are provided in Appendix I.

During the course of geological and geochemical surveys radioactivity was monitored using Scintrex BGS2 and Saphymo-Stel SPP2 scintillometers.

Preliminary profiles of the aerial geophysical data were examined prior to the field reconnaissance and a number of anomalous zones were selected for field checking.

Detailed interpretation of the geophysics was possible only when final plots of the data were available after completion of the field reconnaissance.

4.3 GEOLOGICAL MAPPING

A party of three geologists and one field assistant were employed for a period of three weeks in a programme of geological and geochemical reconnaissance. Areas of particular geological interest, selected from the air photography, such as the volcanic areas at Mt. Drummond and the outcrop of the Murphy Metamorphics, were examined in some detail. Elsewhere geological observations were acquired during the stream traversing for geochemical surveys and ground checking of radiometric anomalies.

Geological information from the field and the aerial geophysical results were utilised in the preparation of photogeological maps from the 1:25,000 scale colour photography (see Plate 1).

4.4 GEOCHEMICAL SURVEYS

Stream sediment sampling was carried out over most parts of the Carrara Range Formation at intervals of 1 to 2 km along the main drainage channels and from principal junctions. Sampling of areas of Bluff Range Beds was less comprehensive because of difficult access. The -80 mesh fraction of the samples were sieved in the field and sent to Analabs, Perth for analysis of Th, U, V, Mo, Cu, Pb, Zn, Ni and Co. A total of 186 stream sediments were collected and analysed.

A total of 80 samples of representative rock types and of material from radiometrically anomalous localities were analysed by Analabs for U, Th, V, F, K. P, Mo, Cu, Pb, Zn, Co and Ni.

5. RESULTS OBTAINED

5.1 GEOPHYSICS

The results of the airborne magnetic survey are presented as residual magnetic contours (the regional gradient having been removed) in Plate 4. The main magnetic feature is a strong arcuate high in the east-central part of the area. This lies immediately to the south of the belt of mapped acid volcanics and is believed to be due to basic to intermediate volcanics beneath soil cover. In the west this feature fans out due to flattening of dips and opening out of the fold structure. A detached WNW-trending high at the eastern extremity of the volcanic belt is apparently in Bluff Range Beds and does not correlate with mapped volcanics. This needs field checking.

The Bluff Range Beds and the Murphy Metamorphics inlier do not have a significant magnetic expression.

Broad magnetic features in soil covered areas in the south closely parallel the trends of the volcanic rocks further north. They may indicate a repetition of the volcanic sequence beneath the Cainozoic/Palaeozoic cover.

The results of the airborne gamma ray spectrometer survey are presented as uranium contours, and potassium and uranium/thorium ratio profiles in Plates 5, 6 and 7.

The uranium gamma ray intensity contours show a zone of high intensity in the east central part of the area, exactly coincident with a zone of very high potassium activity, and these features correspond precisely with the outcrop of acid volcanic rocks of the Carrara Range Formation. The highest uranium activity of 100 cps is about 5 times background.

Broad irregular extensions of moderately high potassium activity south of the zone of acid volcanics is probably related to sub-outcrop of basic-intermediate volcanics.

On the ground the acid volcanics produced counts in the range 100 to 350 cps SPP2, the basic volcanics usually less than 100 cps.

An isolated potassium-magnetic anomaly (Any 866), with x2 background uranium, is located 3 km along strike ENE of the main volcanic zone. It may represent an unrecognised volcanic area or alternatively a basic intrusive.

Areas of lateritised Bluff Range Beds in the northeast show numerous areas of 2x to 3x background uranium. They are lacking in coincident potassium, U/Th or magnetic anomalies. Field checking showed that the laterites produce up to 200 counts/sec SPP2 and contain low to moderate uranium (<3 to 10 ppm) and thorium (<4 to 40 ppm).

One small 2x background uranium anomaly in this area (Any 3817), with a coincident U/Th "spike", is not apparently related to laterite or volcanics. It remains to be field checked.

In the northwest several inliers of acid volcanics produce their characteristic coincident K/U anomalies. However a number of uranium "thumbprint" anomalies of 2x to 3x background, with coincident U/Th "kicks", have no associated potassium activity. They are in Carrara Range Formation or Bluff Range Beds close to the contacts of these units. Field checking is desirable (Anys 4430, 4537, 4438, 4239 and 4343).

A number of low order (x2 background) uranium anomalies, with coincident U/Th "kicks", occur in the Murphy Metamorphics. Anomaly 7017 is located over outcrops of siliceous ironstones at the Murphy Metamorphics/Carrara Range Formation unconformity. Ground checks disclosed counts of up to 320 cps SPP2 and contents of up to 140 ppm U in the outcrop.

Radiometrics over the soil covered areas in the south gave only background readings.

5.2 GEOCHEMISTRY

Stream Sediment Sampling

The location of sediment samples is plotted in Plate 2. The analytical results are given in Appendix II and are summarised in Table 1.

Uranium values are generally very low at or below the 3 ppm limit of detection. Only 8 samples exceeded 3 ppm, the maximum being 6 ppm. No samples are considered to be anomalous.

Weakly anomalous copper, zinc and cobalt anomalies (up to 140 ppm Cu, 127 ppm Zn, 32 ppm Co) are present in a small area of basic volcanics ten kilometres east of Mount Drummond. This may indicate trace basemetal sulphides in the volcanics. It is not considered to be of economic significance. No anomalous results are recognised in the Pb, Th, Ni, Mo and V analyses.

Rock Sample Analyses

The location of rock samples is plotted on Plate 3. Analytical results are given in Appendix III and summarised in Table 2.

The main points of interest are the following:-

(i) the low uranium levels in the acid volcanics average only 2 ppm and have a maximum of 7 ppm. This correlates with the low background stream geochemistry, but is surprising in view of the high uranium radiometry over the volcanics.

(ii) the high lead values (up to 800 ppm) associated with the acid volcanics occur not only in lavas but also in interbedded sandstone, argillites (possibly tuffaceous) and conglomerate matrix.

(iii) the laterites and silcretes show relatively high uranium and thorium contents (average 4 ppm U and 13 ppm Th) but are low in other metals.

(iv) the samples of siliceous ironstone from the Murphy Metamorphics contain some anomalous values in copper, lead, uranium and vanadium (maximum values 1150 ppm Cu, 385 ppm Pb, 140 ppm U and 2600 ppm V), and also have relatively high average values of zinc and cobalt.

TABLE 1

CARRARA RANGE STREAM SEDIMENTS

Total of 186 analyses of -80 mesh fraction

METAL	RANGE ppm	EST. BACKGROUND ppm	EST. THRESHOLD ppm	ANOMALIES
Cu	10-140	20	60	8 samples +60
Pb	4-26	10	?	none
Zn	8-127	20	60	6 samples +60 Zn all with +60 Cu
Co	3-36	10	30	2 samples +30 Co both with +60 Cu
Ni	5-37	20	?	none
U	<3-6	<3	?	none
Th	<4-20	5	?	none
Mo	<3-20	10	?	none
V	10-390	?	?	none

TABLE 2

CARRARA RANGE

ROCK SAMPLE GEOCHEMISTRY

ROCK TYPE		Cu ppm	Pb ppm	Zn ppm	Co ppm	Ni ppm	U ppm	Th ppm	Mo ppm	V ppm	K %
Acid Volcanics Carrara Range Fmn 20 samples	Range	15-80	10-800	20-90	10-45	5-35	<3-7	<4-45	<3-7	15-460	3.8-8.5
	Average	34	82	38	21	14	2	23	1	122	7.0
	Anomalies	-	2 samples	-	-	-	-	-	-	-	-
Sandstones Carrara Range Fmn 13 samples	Range	15-55	5-585	10-35	<5-10	<5-10	<3-7	<4-35	<3-8	15-130	0.12-3.2
	Average	29	60	25	8	8	3	10	2	43	1.0
	Anomalies	-	1 sample	-	-	-	-	-	-	-	-
Sandstones, siltstones, cherts Bluff Range Beds 23 samples	Range	15-130	10-70	15-105	5-115	<5-75	<3-8	<4-50	<3-30	10-140	0.1-7.4
	Average	31	23	39	17	18	2	8	4	34	0.4
	Anomalies	-	-	-	-	-	-	-	-	-	-
Murphy Metamorphics Siliceous Ironstones 5 samples	Range	50-1150	30-385	45-195	36-60	35-95	<3-140	<4-30	4-15	80-2600	
	Average	540	137	130	48	61	37	10	8	840	
	Anomalies	4 samples	2 samples	-	-	-	2 samples	-	-	2 samples	
Laterites & silcrete 7 samples	Range	20-95	20-45	10-45	<5-40	10-35	<3-10	<4-40			
	Average	41	32	32	18	23	4	13			
	Anomalies	-	-	-	-	-	-	2 samples			

(v) some of the sandstones from the Carrara Range Formation and the Bluff Range Beds show relatively high levels of uranium and thorium (up to 8 ppm U and 50 ppm Th). This is probably due to heavy-mineral layers in the sands.

5.3 GEOLOGICAL MAPPING

The regional geological setting is described in Section 2 and the stratigraphy in Figure 3. Plate 1 presents the results of photogeological interpretation and field traversing.

The Murphy Metamorphics outcrop poorly and consist of soft, easily weathered, quartz sericite schists. The rocks are strongly foliated and commonly intensely contorted particularly close to the Littles Range Fault. Nevertheless primary sedimentary lamination is well preserved and suggests that the original sediments were thinly bedded silty shales and siltstones. Thin, laminated, dark, ferruginous chert interbeds were noted at one locality. Metamorphism is of greenschist facies.

Massive, highly siliceous ironstones occur widely and are commonly but not exclusively found at the contact (sometimes faulted) with the unconformably overlying Carrara Range Formation. In several localities the ironstones appeared to show a transition through ferruginous schist into normal white Murphy Metamorphics. At one locality isolated blocks of sandstone appeared to be enclosed by the ironstones. No sulphide boxworks were observed.

The ironstones have apparently formed by accumulation of iron and other metals in the vicinity of the unconformity. The silica is probably a recent superficial development. The origin of this formation cannot be ascertained on the available data. More detailed mapping, supplemented by petrographic studies and possibly drilling, would be required.

The Carrara Range Formation commences with a lower sandstone member of about 500 m thickness. It is typically a medium grained to gritty and pebbly quartz sandstone usually sub-rounded and containing little feldspar (5-10%). Small scale cross bedding and ripple marking is commonly observed, but measurable bedding planes are rare because of the blocky jointing and strong surface silicification.

Overlying the basal sandstones are volcanics of indeterminate composition interbedded with thin, often feldspathic, sandstones. The volcanics are always totally weathered to mottled ferruginous clays and are generally soil covered except in small gulleys and washouts. Their radiometric, magnetic and geochemical character suggests a basic to intermediate composition, i.e. basalt or andesite. The thickness is probably of the order of 300-500 metres.

Overlying the basic volcanics is a well exposed section of acid volcanics consisting of spheroidal and vesicular lavas interbedded with feldspathic quartz sandstones, rare argillites (poorly exposed), and lenses of volcanic agglomerate, volcanic conglomerate and quartzite conglomerate. The sequence shows rapid changes in thickness and lateral variations in facies between the volcanic and sedimentary layers. Thickness varies between 200 and 400 metres approximately.

The typical lavas are fresh, pink to dark red rocks, with fresh potassic and sodic feldspars and quartz phenocrysts abundantly dispersed through the aphanitic matrix. Vesicular varieties commonly contain the bright green clay mineral celadonite as a cavity filling.

The upper sandstone member of the Carrara Range Formation varies from about 100 to 300 m in thickness. It is generally similar to the lower member but notably contains a number of beds of highly feldspathic sandstone, heavy mineral layers and siltstone interbeds.

There is a transition upwards into the Bluff Range Beds and the base of this formation is taken to be the first appearance of algal cherts or stromatolitic beds. The lower part consists of possibly 1000 metres thickness of interbedded pale coloured cherts, sandy cherts, sandstones and siltstones. The cherts vary from finely banded types, usually with a wavey lamination, to fine and coarse breccias. Stromatolites are well developed at some horizons and are very ferruginous in places. No carbonates were observed but it is very probable that much of the "chert" represents supergene silicification of dolomites.

The upper section of the Bluff Range Beds consists of interbedded sandstones and micaceous siltstones. The sandstones are medium grained feldspathic and well bedded and characteristically contain abundant platelets of clay and silt. The clay and feldspars frequently weather out and are replaced by iron oxides to give a highly ferruginous outcrop.

The Upper Proterozoic and Middle Cambrian formations were not examined during the present survey.

A complex history of Cainozoic weathering, erosion and deposition is evidenced by the high level erosion surfaces and laterites in the north and by a variety of terrace gravel levels and valley silcretes and ferricretes along the southern drainages. However this was not studied in detail.

Structure

The Murphy Metamorphics inlier occurs in the core of a major E-W elongated dome which is truncated on the south by the Littles Range Fault. This is an ENE trending regional structure which has an apparent vertical displacement of at least 3000 metres, downthrowing to the south. Further north are a series of E-W to ENE trending faults sub-parallel to the Littles Range Fault and downthrowing both to the north and south. There are in addition a great number of minor faults on E-W, ENE, NE and NW trends. On the flanks of the central dome the NE trending faults have an apparent dextral displacement and the NW trending faults are apparently sinistral. To the north and northeast of the central dome the formations dip away generally northwards at flat to moderate angles (25°-40°) varied by local shallow synclinal and anticlinal E-W trending folds.

To the west and northwest the structure is complicated by block faulting and a series of complex generally west plunging synclines and basins which bring the outcrop of the younger Bluff Range Beds south to the line of the Littles Range Fault.

Structural trends in the Lower Proterozoic basement are uncertain because of poor exposure and local complications associated with the major faults.

APPENDIX I

(CARRARA RANGE, NORTHERN TERRITORY)

EXPLORATION LICENCE 2112

SPECIFICATIONS FOR AIRBORNE MAGNETIC AND RADIOMETRIC SURVEY

EG&G geoMetrics
International Corporation

E.7947

ANNEXURE 'A' TO SERVICE AGREEMENT

Afmeco Pty. Ltd.
and
geoMetrics International Corporation

SPECIFICATIONS FOR FIXED WING AIRBORNE
MAGNETIC AND RADIOMETRIC SURVEY

1. SURVEY AREA:

geoMetrics shall carry out a fixed wing airborne magnetic and radiometric survey of approx. 9,900 km. in the general Benmara Area, Northern Territory. The areas to be flown are defined on a 1:250,000 scale map supplied by Afmeco, and are known as areas A, B, C and D.

2. FLYING SPECIFICATIONS:

2.1 Traverse flight lines will be flown in North-South directions, in Blocks A, B and D, and in an East-West direction in Block C. Traverse spacing will be 400m in Blocks B, C and D and 800m in Block A. THERE WILL BE PROVISION FOR AN ADDITIONAL 20% OF FLYING IF REQUESTED BY AFMECO.
Tie or control lines will be flown normal to the traverse lines and will be spaced approx. 10 km. apart.

The area will be flown at a mean terrain clearance of 80 meters and at a flying speed of 105 knots, unless topographical conditions and/or aircraft safety dictate otherwise.

2.2 Magnetometer sensitivity will be 0.25 nT.

2.3 All data will be collected in both digital and analog format.

19 Gertrude Street • Arncliffe • Sydney, NSW 2205 • Australia • Telephone: 597-4544 • Telex: AA 23624

2.4 Navigation and flight path recovery will be accomplished by visual navigation techniques. Flight lines will be started and ended using visual references from 1:25,000 scale photomaps.

As the aircraft flies down straight lines, a 35mm strip camera will record the actual flight path. This film will be used to position the flight lines on aerial photographs by image matching.

3. COMPILATION:

The map compilation will be performed using computer techniques. The field tapes will be edited and the total field corrected for the observed time variations (diurnal). Location data will be derived from the digitised flight path recovery. The International Geophysical Reference Field (I.G.R.F.) is considered to represent the major regional background and will be removed from the observed and edited total field data prior to compilation of the Total Intensity Map.

Profile and tie-lines will be adjusted to minimise intersectional errors, the data interpolated to a grid and machine contoured. The maps will be presented at a scale of approximately 1:20,000. 25 000

4. DELIVERABLE ITEMS:

4.1 One set of photo base maps as derived from a mosaic assembled by geoMetrics prior to flight commencement, from photos supplied by Afmeco. These base maps will be at a scale of approx. 1:25,000. Aircraft's flight path and recovered fiducials will also be shown.

4.2 One set of maps showing contours of total magnetic intensity (I.G.R.F. removed). The contour interval will be as low as field gradient permits, with an objective interval of 2 gammas.

4.3 One set of maps showing contours of total radiation intensity (corrected for altitude and background).

4.4 All data derived during the course of the survey will be the absolute property of Afmeco and will be delivered to Afmeco at the completion of the survey.

5. INSTRUMENTATION:

5.1 Aircraft -
Britten-Norman Islander Model BN-2A
Objective flying speed 105 knots
Range - 5½ hours

5.2 Equipment -

a) Magnetometer
geoMetrics airborne proton magnetometer model G-803 which will provide a recording sensitivity of 0.25 gamma each 1.0 second. Two (2) analog outputs are provided on a 10 inch Hewlett-Packard recorder; 25 and 250 gammas for a full scale deflection.

b) Recording Altimeter
Sperry AA200 Radar Altimeter.

c) A Geocam 35mm tracking camera with wide angle lens and continuous strip.

d) An integrated Navigation System, comprising -

(i) Decca Radar Doppler Type 72.
(ii) Sperry C-9 Gyro stabilised compass.

e) A geoMetrics' Differential Gamma Ray Spectrometer, Model GR-800 which is interfaced to a polycin slab crystal detector of volume 1,000 cubic inches.

f) A geoMetrics' Digital Acquisition System, Model G-704 recording the following on magnetic tape -

(i) Magnetometer
(ii) Data scan/fiducial number identical to that recorded on the camera film.
(iii) Manually inserted information, i.e. survey area, flight line number and line direction.
(iv) Radar Altimeter (by analog-to-digital conversion).
(v) Gamma Spectral Data (uncorrected).

g) A 6-channel analog recorder, Model MARS-6, recording -

Altitude
Magnetics
Total Count
Potassium
Thorium
Uranium

The three (3) differential channels will be corrected for compton scatter in analog real time only.

5.3 Synchronisation of all data gathered in the course of a flight is achieved by sequential imposition of fiducials or event marks on all records simultaneously.

5.4 A geoMetrics Recording Base Station Magnetometer, Model G-806. will be used as a diurnal monitor and run continuously during survey periods.

6. REJECTION CRITERIA:

6.1 Line Spacings - geoMetrics to refly or infill at its own expense when spacing between adjacent lines exceeds 1.5 times the defined line separation for a distance of 5 km. or more.

6.2 Altitude and Flying Speed - as safety permits, and at the sole discretion of the pilot in command.

6.3 Diurnal - flying shall not be conducted during those periods when total magnetic intensity field variations, as recorded by storm monitor station, exceed 5nT in 5 minutes (non-linear deviation).

6.4 Calibrations - the following calibrations will be effected -

(i) Magnetometer - heading errors corrected to ±1.0nT prior to acquiring survey data. Noise level not to exceed ± 1 gamma.

(ii) Altimeter - the altimeter will be calibrated prior to acquiring survey data by flying over the same strip of flat ground at altitudes of 90, 120, 150 and 180 meters. Recording of this data will be made in both analog and digital modes.

(iii) Gamma Ray Spectrometer - the spectrometer will be calibrated prior to and at the completion of each data collection flight, by using hand samples of uranium, thorium and potassium equivalent with the equipment set at a one second interval. Recording of these calibrations will be made in analog mode.

A test line of 5 km will be flown before and after each data collection sortie in order to determine the repeatability of the isorad data.

A background check will be made before and after each data collection sortie by flying a test line at a barometric altitude of 850 meters.

APPENDIX II

(CARRARA RANGE, NORTHERN TERRITORY)

EXPLORATION LICENCE 2112

ANALYTICAL RESULTS

STREAM SEDIMENT AND WATER SAMPLES

APPENDIX II: EL - CARARRA RANGE, N.T.

ANALYTICAL RESULTS, STREAM SEDIMENT SAMPLES

(Results expressed in parts per million)

Sample No.	Cu	Pb	Zn	Co	Ni	U	Th	Mo	V
975	40	9	26	13	20	x	4	9	140
76	17	6	18	14	14	x	7	8	65
77	31	9	28	17	16	x	6	15	90
78	26	8	25	11	16	x	6	15	75
79	20	6	17	6	10	x	x	10	65
980	20	7	16	9	13	x	x	15	70
81	28	8	19	16	19	x	10	10	120
82	20	8	23	16	23	x	9	5	110
83	22	9	21	16	20	x	15	10	85
983	21	8	21	15	20				
84	23	8	19	11	24	x	6	15	75
85	66	13	45	27	32	x	10	10	230
86	27	9	24	15	21	x	10	10	120
87	28	8	23	11	15	x	x	10	80
88	20	6	15	5	12	4	9	9	30
89	24	9	19	8	15	x	x	15	55
990	28	10	23	10	16	x	10	15	45
91	23	8	18	9	14	x	6	10	70
991	18	7	15	6	12				
92	31	8	23	12	18	x	x	15	70
93	17	5	13	7	10	x	5	10	50
94	22	8	17	11	17	x	7	10	65
95	25	7	22	12	14	x	7	10	80
96	24	8	19	14	18	x	5	15	150
97	54	15	46	33	30	x	4	9	270
98	90	16	56	36	37	x	10	9	320
99	42	12	40	18	21	x	x	10	180
1000	45	14	47	27	34	x	7	8	200
1000	48	16	50	30	36				
1015	35	9	43	16	19	x	6	15	140
16	35	10	21	11	20	x	4	10	70
17	35	10	39	17	24	x	5	15	170
18	39	10	40	19	26	x	9	10	150
19	- NO SAMPLE-					NOT LOCATED			
1020	66	10	57	23	25	x	4	8	200
21	56	12	52	27	33	x	x	10	220
1022	37	10	40	18	22	x	6	9	180
1022	38	11	40	19	22				
23	40	11	46	24	26	x	5	7	160
24	25	8	19	8	12	x	x	10	60
1034	35	12	39	16	24	x	7	15	150
35	29	11	30	15	20	x	9	9	160
1040	38	10	44	15	20	x	5	9	150
41	33	10	37	15	18	x	5	9	140
42	26	7	28	9	15	x	4	8	90
43	54	19	97	26	27	x	4	9	390
1043	54	19	100	28	27				
44	38	9	35	14	20	x	x	10	100
45	37	11	30	12	19	x	10	15	110

Sample No.	Cu	Pb	Zn	Co	Ni	U	Th	Mo	V
46	76	13	75	18	24	x	9	15	140
47	68	17	90	25	28	x	7	x	260
48	75	16	80	32	36	x	10	10	240
49	120	18	96	28	31	x	4	7	220
1050	65	14	69	18	22	x	5	15	180
1101	41	10	45	18	22	x	8	6	15
1101	39	10	43	20	21				
02	22	10	26	13	20	x	7	x	180
03	29	12	28	17	21	x	x	x	170
04	32	9	29	11	14	x	4	4	70
05	19	5	17	7	10	x	x	5	55
06	18	9	20	11	12	x	10	10	45
07	23	6	15	6	11	x	x	7	50
08	21	10	20	13	13	x	10	10	60
1109	17	7	12	7	11	x	7	10	40
1109	17	7	13	7	12				
1110	28	10	17	12	12	x	9	4	50
11	27	6	19	7	10	x	x	9	25
12	19	5	15	4	6	x	6	x	40
13	17	8	13	6	10	x	x	6	45
14	24	10	21	6	8	x	6	7	45
15	21	8	15	5	8	x	x	7	30
16	16	7	15	5	9	x	x	6	40
1117	18	8	14	6	8	x	9	6	30
1117	18	8	14	6	9				
18	13	8	12	7	8	x	4	x	35
19	14	8	13	5	7	x	6	5	45
1120	15	7	13	5	6	x	x	4	30
21	12	5	11	5	7	x	x	x	40
22	16	8	14	7	8	x	6	4	45
23	16	8	16	8	10	4	6	9	40
24	21	8	17	11	12	x	x	8	75
1125	15	5	13	8	14	3	8	10	40
1125	15	7	13	8	15				
26	17	7	14	7	9	x	4	9	35
27	15	5	17	6	8	x	x	7	25
28	11	4	8	5	5	x	x	x	25
29	12	5	10	5	10	x	x	9	30
1130	14	7	12	7	9	4	x	8	50
31	12	12	12	7	8	x	x	4	45
32	14	11	13	5	7	x	4	6	35
1133	11	11	11	4	8	x	5	6	25
1133	10	10	11	4	8				
34	11	7	8	4	7	x	x	6	30
35	13	9	11	4	9	x	6	6	40
36	12	21	14	5	7	x	6	x	35
37	11	18	15	4	8	x	7	4	40
38	16	23	25	10	15	x	15	7	85
39	20	14	20	5	10	3	10	5	40
1140	16	26	17	5	8	x	9	7	45
1141	11	9	11	5	8	x	8	x	35
1141	11	11	18	6	9				
42	16	10	14	4	8	4	9	6	35
43	9	8	9	3	7	x	x	5	25

Sample No.	Cu	Pb	Zn	Co	Ni	U	Th	Mo	V
44	13	13	14	5	8	4	x	7	35
45	14	8	11	5	8	x	6	x	30
46	10	7	11	7	8	x	10	x	30
47	15	8	14	6	8	4	5	5	40
48	20	8	18	6	8	x	x	5	35
1149	10	5	11	5	7	x	x	x	30
1149	10	5	11	6	7				
1150	15	6	13	6	8	3	6	5	35
51	140	22	127	24	34	x	6	10	280
52	10	10	9	4	8	x	x	7	25
53	30	26	18	11	35	NOT LOCATED			
54	33	16	28	12	18	x	8	20	55
55	40	13	31	8	18	x	10	15	35
1156	28	14	18	8	18	x	7	20	45
1156	29	11	19	8	17				
57	26	11	23	9	17	x	15	15	55
58	108	21	63	12	30	NOT LOCATED			
59	35	11	27	9	19	x	20	15	50
1160	25	11	19	7	14	x	7	20	40
61	28	11	22	8	16	x	15	15	45
62	23	18	22	10	14	x	10	15	95
63	15	10	12	6	10	x	x	5	40
1164	10	6	9	4	7	x	4	7	25
1164	10	6	13	4	7				
65	13	7	10	4	13	x	5	7	25
66	28	9	19	8	13	x	6	15	60
67	34	10	22	10	17	x	5	10	110
68	16	8	11	5	11	x	x	15	35
69	23	10	18	6	14	x	x	8	25
1170	31	13	23	9	16	x	8	10	50
71	26	10	20	5	15	x	x	8	25
1172	14	9	14	6	8	x	x	x	35
73	14	11	12	7	14	x	x	8	50
74	16	8	13	7	10	x	6	6	60
75	38	10	27	8	15	x	7	6	40
76	14	10	15	7	11	x	6	x	65
77	17	12	16	6	12	3	6	7	50
78	20	15	22	8	12	x	x	x	60
79	25	16	32	15	18	x	9	9	50
1180	29	18	39	19	21	x	9	x	55
1180	28	18	38	19	21				
1191	39	21	45	20	21	x	5	10	50
1192	24	20	35	15	18	3	10	5	55
93	43	12	33	10	15	x	4	15	35
94	27	10	21	7	16	x	x	9	30
95	30	9	21	7	14	x	x	15	35
96	27	9	24	9	17	x	7	10	50
97	27	10	23	8	14	x	4	7	40
1198	18	8	15	7	16				
99	19	6	15	7	12	x	5	8	45
1200	21	12	25	10	18	2	10	15	50
1251	13	6	11	5	8	x	x	8	30
52	12	6	10	4	9	x	5	x	30
53	14	7	12	6	11	3	8	8	50

Sample No.	Cu	Pb	Zn	Co	Ni	U	Th	Mo	V
54	11	6	16	4	9	x	x	4	30
55	15	6	13	4	8	x	5	9	25
1256	16	8	16	6	12	x	x	4	40
1256	17	8	16	6	12				
57	20	9	18	7	13	x	7	4	40
58	14	4	11	4	9	x	x	x	15
59	14	5	13	6	9	3	8	8	30
1260	14	5	14	6	10	x	x	x	30
61	12	4	12	4	7	x	x	7	25
62	13	5	12	4	7	x	x	x	20
63	11	6	10	4	7	x	7	3	25
1264	16	10	16	8	12	x	x	x	40
1264	16	10	17	8	12				
65	13	10	16	7	10	x	9	6	45
66	19	6	20	6	12	x	7	9	25
67	12	6	12	3	6	x	x	5	20
68	18	7	26	5	9	x	x	4	20
69	23	8	19	5	9	6	8	3	25
1270	14	5	16	3	8	3	8	4	10
71	31	8	25	6	12	x	4	9	40
1272	24	5	20	5	13	x	x	4	30
1272	24	7	18	5	15				
73	21	8	30	5	9	x	6	x	30
1274	14	7	13	6	12	x	5	6	30
75	14	9	19	6	10	x	x	10	35
76	19	10	16	6	11	x	x	7	25
77	20	5	16	3	6	x	x	6	25
78	20	6	17	3	8	x	x	7	25
79	19	6	15	4	7	x	x	10	20
1280	26	9	19	6	11	x	x	6	35
1280	26	9	19	6	11				
81	15	7	10	4	8	x	x	10	35
82	14	6	11	3	7	x	x	4	15
83	10	6	10	3	6	x	x	8	20
84	20	7	15	4	10	x	x	4	25
85	24	7	16	5	9	x	x	10	25
86	26	8	19	6	12	x	x	5	30
87	30	10	23	7	11	4	6	6	35
1288	15	7	11	4	9	x	4	5	25
1288	16	7	13	4	9				
89	21	9	15	6	12	x	x	5	50
1290	30	9	21	8	16	x	6	9	65
91	17	7	12	5	9	x	5	5	40
92	18	10	13	6	11	x	x	10	30
93	13	10	11	5	8	x	6	8	35
2211	35	9	23	9	18	x	x	10	30
12	28	11	21	8	14	x	x	7	55
13	33	11	23	8	17	x	4	x	60
14	55	12	36	7	15	3	6	10	35

ANALYTICAL RESULTS, WATER SAMPLES

(Results expressed in mg/l)

Sample No.	Cu	Pb	Zn	Co	Ni	U	Th	V	F	TFR* (conductivity)
1014	0.02	x	0.1	x	0.05	x	x	2	0.352	426

* TFR - Total Filtrable Residue.

APPENDIX III

(CARRARA RANGE, NORTHERN TERRITORY)

EXPLORATION LICENCE 2112

ANALYTICAL RESULTS

ROCK SAMPLES

Sample No.	Formation	Field Identification	Counts/sec SPP2	Cu ppm	Pb ppm	Zn ppm	Co ppm	Ni ppm	F ppm	U ppm	Th ppm	Mo ppm	V ppm	P %	K %
A 1025	Murphy Metamorphics	Siliceous ironstone	70-80	760	30	175	60	95	290	9	4	7	120	0.52	0.71
26	Bluff Range Beds	Leached fine grained sandstone with cavities after clay pellets	25-35	50	20	50	10	<5	223	3	7	<3	35	0.02	0.53
27	Murphy Metamorphics	Siliceous ironstone	60-80	50	30	110	45	70	290	<3	<4	8	80	0.68	1.1
28	Carrara Range Fmn	Decomposed ferruginous volcanic - no quartz	40-50	90	35	75	30	35	322	4	10	<3	500	0.07	0.53
29	Carrara Range Fmn	Decomposed ferruginous volcanic - minor quartz	110-140	55	25	45	25	10	203	3	9	4	200	0.07	7.6
A 1030	Murphy Metamorphics	Fractured & ferruginous quartz-sericite schist	80-90	140	205	45	35	35	349	10	30	4	90	0.22	1.2
31	Bluff Range Beds	Ferruginous sandy chert breccia	25-30	130	65	45	15	15	41	8	10	30	30	0.13	0.10
32	Carrara Range Fmn	Porphyritic white-spotted red brown acid volc.	70-90	55	25	70	30	15	300	<3	10	3	230	0.22	8.1
33	Carrara Range Fmn	Porphyritic white-spotted red brown acid volc.	150-200	30	25	40	15	10	125	<3	40	4	20	0.05	7.3
36	Murphy Metamorphics	Siliceous ironstone	240-320	600	385	195	50	110	253	25	10	15	1300	0.37	0.87
37	Murphy Metamorphics	Siliceous ironstone	240-320	1150	35	125	55	125	260	140	8	8	2600	0.43	0.53
38	Carrara Range Fmn	Medium grained feldspathic sandstone	30-40	45	10	25	<5	<5	92	<3	7	3	130	0.02	0.30
39	Carrara Range Fmn	Fresh porphyritic red acid volcanic	230-250	30	20	35	15	5	192	7	40	<3	30	0.02	6.6
A 1051	Carrara Range Fmn	Coarse to gritty or medium silicified sandstone	25-40	55	585	35	5	10	81	<3	<4	8	45	0.02	0.18
52	Carrara Range Fmn	Purple silicified fine grained sandstone	40	50	15	30	15	5	220	3	4	<3	120	0.03	1.1
53	Carrara Range Fmn	Greenish volcanic breccia - possibly a dyke	25	70	10	140	35	25	537	4	5	<3	208	0.08	0.13
54	Carrara Range Fmn	Red weathered acid(?) volcanic & quartz veinlets	100	65	15	30	25	20	111	<3	<4	<3	140	0.02	6.2
55	Carrara Range Fmn	Brownish micaceous siltstone (?)	75-100	300	585	120	40	40	223	<3	15	<3	120	0.05	4.7
56	Carrara Range Fmn	Sandstone lens within volcanics		25	5	15	5	<5	72	<3	5	<3	15	0.04	0.12
57	Carrara Range Fmn	Acid volcanic	170-230	20	15	25	20	10	102	<3	35	<3	25	0.02	6.8
58	Carrara Range Fmn	Acid volcanic	170-230	15	20	25	20	5	144	<3	45	<3	30	0.02	6.5

Sample No.	Formation	Field Identification	Counts/sec SPP2	Cu ppm	Pb ppm	Zn ppm	Co ppm	Ni ppm	F ppm	U ppm	Th ppm	Mo ppm	V ppm	P %	K %
A 1059	Carrara Range Fmn	Acid volcanic	170–320	35	585	25	15	5	138	5	40	<3	40	0.03	6.9
A 1060	Carrara Range Fmn	Acid volcanic	170–230	30	20	25	20	5	170	4	45	<3	15	0.06	7.7
61	Carrara Range Fmn	Acid volcanic		80	20	90	45	50	401	<3	6	<3	340	0.05	3.8
62	Carrara Range Fmn	Acid volcanic		25	25	35	25	5	228	<3	40	<3	25	0.06	7.4
63	Carrara Range Fmn	Weathered brown fissile clay	200	60	280	50	50	70	630	NA	NA	NA	400	0.16	6.4
64	Carrara Range Fmn	Medium to coarse grained sandstone	25	15	20	15	5	<5	119	3	15	<3	20	<.01	0.56
65	Carrara Range Fmn	Reddish silicified feldspathic sandstone	25–30	45	20	35	10	5	129	6	<4	<3	35	0.01	2.0
66	Carrara Range Fmn	Acid volcanic	220	30	15	35	20	5	196	3	10	<3	45	0.02	7.1
67	Carrara Range Fmn	Matrix of volcanic conglomerate		50	790	40	15	5	251	7	50	<3	85	0.07	4.5
68	Carrara Range Fmn	Reddish medium grained sandstone	60	25	25	25	10	<5	295	8	35	<3	30	0.08	0.96
69	Carrara Range Fmn	Red acid volcanic	230	30	20	35	15	5	155	<3	45	<3	35	0.08	7.2
A 1070				75	10	35	10	10	193	<3	7	<3	80	0.05	1.7
71	Bluff Range Beds	Red-white banded stromatolitic chert-shale	40	40	15	50	10	10	179	5	9	<3	30	0.15	0.42
72	Bluff Range Beds	Grey siltstone with ferruginous spotting	120	25	25	30	15	5	312	4	15	<3	30	0.03	5.0
73	Carrara Range Fmn	Feldspathic micaceous medium grained sandstone	60–80	15	15	30	15	5	212	3	20	<3	45	0.04	3.2
74	Carrara Range Fmn	Dark purple ferruginous coarse grained sandstone		20	15	35	10	5	144	<3	9	<3	25	0.09	0.36
75	Carrara Range Fmn	Medium to fine grained sandstone	180	30	30	25	5	5	1203	10	25	5	20	0.85	2.7
76	Carrara Range Fmn	Medium to find grained sandstone feldspathic with dark spots	180	20	15	30	10	5	2355	10	4	<3	20	1.8	0.6
77	Carrara Range Fmn	Coarse to medium grained feldspathic sandstone	25	20	10	10	5	<5	291	<3	4	<3	20	0.2	0.4
78	Carrara Range Fmn	Red acid volcanics with greenish mineral	100–125	25	20	25	20	15	316	<3	10	<3	390	0.05	8.5

Sample No.	Formation	Field Identification	Counts/sec SPP2	Cu ppm	Pb ppm	Zn ppm	Co ppm	Ni ppm	F ppm	U ppm	Th ppm	Mo ppm	V ppm	P %	K %
A 1079	Carrara Range Fmn	Red aphanitic volcanic with hematite blebs		65	800	80	30	35	257	6	15	7	460	0.07	5.9
A 1080	Carrara Range Fmn	Acid volcanic		20	25	30	15	5	121	7	50	4	35	0.07	7.5
81	Carrara Range Fmn	Acid volcanic	300	20	10	20	15	10	266	<3	9	<3	190	0.03	6.0
82	Carrara Range Fmn	Acid volcanic with numerous green clay spots	170-230	15	15	25	15	20	117	<3	6	<3	35	0.07	9.3
83	-	Laterite	125	40	240	45	40	25	228	4	6	7	860	0.04	0.41
84	-	Laterite	125	95	25	35	10	10	55	<3	4	<3	550	0.01	0.22
85	-	Laterite	100	40	25	40	15	30	169	<3	5	4	85	0.01	0.06
86	Carrara Range Fmn	Red acid volcanic	220	15	25	20	10	10	106	3	<4	<3	30	0.04	8.2
87		Coarse grained feldspathic sandstone	150	15	20	20	5	10	1840	<3	<4	6	40	2.4	0.16
88	-	Laterite	200	35	35	30	20	35	228	10	<3	6	100	0.49	0.26
89				35	15	75	10	10	161	<3	6	<3	80	0.16	0.40
A 1090	-	Lateritic gravel	75-100	25	35	20	30	25	22	<3	5	8	390	0.03	0.11
91				15	35	15	5	5	181	<3	8	8	30	0.02	0.05
92	Bluff Range Beds	Fine-medium grained massive sandstone	50-60	10	25	15	<5	5	23	3	10	<3	15	0.02	0.10
93	Bluff Range Beds	Fine-medium grained flagstone	50-60	15	15	20	5	5	51	3	7	3	30	0.01	0.21
94	-	Silcrete	100-125	20	25	10	<5	10	5	6	30	6	85	0.01	0.21
95	-	Laterite	100-125	30	35	40	10	25	188	6	40	7	180	0.02	0.14
96	Bluff Range Beds	Lateritised banded sandy chert	100	35	15	25	<5	<5	1090	6	9	<3	20	2.0	0.16
97	Bluff Range Beds	Lateritised banded sandy chert	100	30	20	45	10	20	110	3	<4	4	15	0.28	0.14
98	Bluff Range Beds	Lateritised banded sandy chert	100	30	15	30	5	15	85	<3	<4	4	15	0.25	0.14

Sample No.	Formation	Field Identification	Counts/sec SPP2	Cu ppm	Pb ppm	Zn ppm	Co ppm	Ni ppm	F ppm	U ppm	Th ppm	Mo ppm	V ppm	P %	K %
A 1099	Bluff Range Beds			15	10	15	5	5	160	<3	20	7	25	0.10	3.5
A 1100	Carrara Range Fmn	Matrix of volcanic cobble conglomerate		20	10	25	5	5	137	<3	25	3	30	0.12	3.6
A 1181				40	30	40	10	10	579	3	9	7	65	0.18	0.92
82	Bluff Range Beds	Thin bedded fine grained micaceous sandstone	50-60	30	70	45	15	25	226	6	10	<3	15	0.13	0.15
83	Bluff Range Beds	Iron & manganese stained fine grained	40-50	15	20	30	5	5	401	<3	15	<3	80	0.02	0.53
84	Bluff Range Beds	to gritty feldspathic-lithic sandstones	40-50	20	15	20	5	10	86	<3	<4	10	25	0.34	0.22
85	Bluff Range Beds	with strong green colouration.	40-50	25	15	20	5	10	434	5	50	<3	30	0.03	7.4
86	Bluff Range Beds	Chert-clay conglomerate with sandy matrix	40-50	25	15	20	<5	10	134	<3	<4	7	70	0.04	1.7
87	Bluff Range Beds	Finely laminated cherty sandstone	40-50	50	10	15	5	10	63	<3	8	6	65	0.09	0.45
88	Bluff Range Beds	Ferruginous stromatolitic chert & shale	40-50	55	20	70	85	40	42	<3	10	<4	10	0.17	0.56
89	Bluff Range Beds	Ferruginous stromatolitic chert & shale	40-50	15	10	20	5	5	240	<3	5	5	20	0.02	0.14
A 1190	Bluff Range Beds	Manganese-stained laminated chert-sandstone		20	30	35	<5	10	137	<3	<4	3	10	0.22	0.65
A 2101	Bluff Range Beds	Ferruginous poorly sorted medium-coarse sandstone	50	30	25	90	60	50	267	<3	<4	6	6	0.01	0.15
02	Bluff Range Beds	Banded chert cobbles from intra-formational breccia	40-60	30	25	20	10	10	145	<3	<4	<3	25	0.02	0.14
03	Bluff Range Beds	Grey-blue shale	50-60	15	15	15	10	5	456	3	<4	6	140	0.60	0.07
04	Bluff Range Beds	Brecciated ferruginous sandstone	50-100	30	30	85	115	65	164	3	5	<3	15	0.02	0.41
05	Carrara Range Fmn	Red acid volcanic	260	15	15	20	10	5	88	6	<4	10	9	0.09	1.0
A 2201	Bluff Range Beds	Manganese-stained laminated chert-sandstone		75	20	105	80	75	62	<3	5	<3	40	0.36	0.25
A2202	Carrara Range Fmn	Fractured & manganese stained acid		20	15	65	35	30	90	<3	15	3	120	0.33	6.1

APPENDIX IV

(CARRARA RANGE, NORTHERN TERRITORY)

EXPLORATION LICENCE 2112

OPEN FILE REPORT SUMMARIES

OPEN-FILE REPORT NO. CR 58/13

COMPANY Mt Isa Mines

TENEMENT A to P 511

TITLE Final Report Calvert A to P 511 by G.C. Batty

WORK CARRIED OUT Investigation of BMR radiometric anomalies and stream sediment geochemistry in parts of Mountain, Running, Gold, Rocky and Redbank Creeks. Intensive prospecting by supervised experienced Company prospectors. Expenditure of $9,970 over two seasons field work.

RESULTS OBTAINED No mineralisation was discovered. Follow up of BMR radiometrics on the ground using Philips geiger counters revealed 2 x background over Nicholson Granite.

Prospecting at Mt. Drummond by two men over a six week period produced negative results.

Stream sediment surveys (analyses carried out in the field for Cu, Pb) located anomalies downstream from known mineralisation in the Redbank area.

OPEN FILE REPORT NO. CR 66/2

COMPANY Anaconda Australia

TENEMENT A to P No. 1541

TITLE Report on Prospecting Authority 1541 by J.W. Smith

WORK CARRIED OUT Reconnaissance sampling of the Mullera Formation (Adelaidian) for phosphate using a helicopter over a six day period.

RESULTS OBTAINED Highest values obtained were only 850 ppm P in a lenticular nodular bed.

OPEN FILE REPORT NO. CR 67/40

COMPANY Australian Geophysical Pty Ltd

TENEMENT A to P 1732

TITLE Phase 1 Investigation of the Vulcan, Gorge Creek and Carrara Range Areas by K. McMahon and Partners

WORK CARRIED OUT In Area 7 (the Carrara Range) the programme consisted of geological reconnaissance and stream sediment sampling.

RESULTS OBTAINED The Bluff Range Beds were found to contain highly ferruginous and manganiferous shales south of Springvale Homestead and south of Western Creek. Sporadic high Zn and Pb values were found in associated stream sediments.

A "gossan" of 10 m x 100 m in the Murphy Metamorphics was anomalous in Cu/Ni/Co.

No U analyses or radiometrics were carried out.

OPEN FILE REPORT NO. CR 69/2

COMPANY Australian Geophysical Pty Ltd

TENEMENT A to P 1733

TITLE Final Report on Operations in the Carrara Range by K. McMahon and Partners.

WORK CARRIED OUT Soil sampling was carried out of the Carrara Range Volcanics and the Murphy Metamorphics. Geological geochemical and Induced Polarisation surveys were made of "gossans" in the Murphy Metamorphics.

RESULTS OBTAINED The "gossans" were found to be located along a NNE trending fracture zone in phyllites. They were manganiferous and slightly anomalous in copper. No extensive sulphide boxworks were identified.

The I.P. survey gave negative results - i.e. no conductors.

OPEN FILE REPORT NO. CR 72/50

COMPANY CRA Explorations

TENEMENT EL 762

TITLE Mt Drummond Final Report by K.M. Ehrenberg

WORK CARRIED OUT Geological reconnaissance, geochemistry (62 stream sediment and 5 rock samples from 342 km^2 area) and radiometrics.

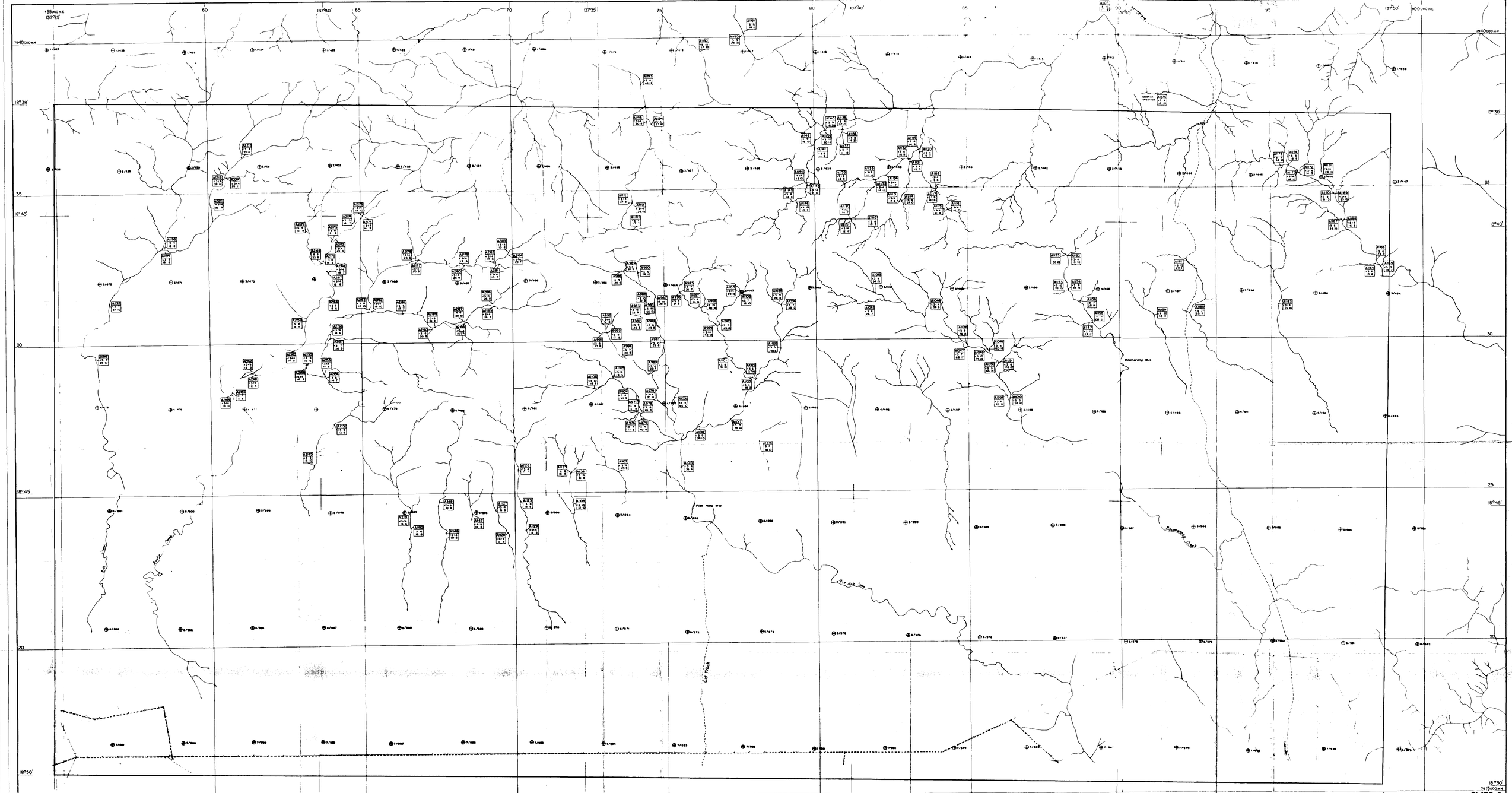
The area was flown on lines 500 m and 1000 m apart at 100 knots and 60-70 M.L.C. using an AAEC 239 Ratemeter. Some contour flying of the volcanic-sandstone contacts and ground scintillometer checking was also done.

RESULTS OBTAINED The geochemical analyses were for Pb, Ni, Cu, Co, Zn, Mo, Ag and U. High background basemetals were found over the volcanics. Uranium was entirely less than 2 ppm.

In radiometrics counts of +3 times background were recorded over the upper contact of the volcanics with the sandstones. The Murphy Metamorphics gave only background readings.

To Accompany Report No. NT 315F *PLATE 1*

REVISION	DATE	REV No. 0	AFMECO PTY. LTD.
		APPROVED	SCALE 1:50000 1000 0 1000 2000m
		DRAWN R.P.S.	CARRARA RANGE PROJECT
		DATE March 1980	E.L. 2112
		GEOLOGY J.C. Rippert G.R. Orridge	GEOLOGY
DWG Nº SE53-12.372.1864			



REFERENCE

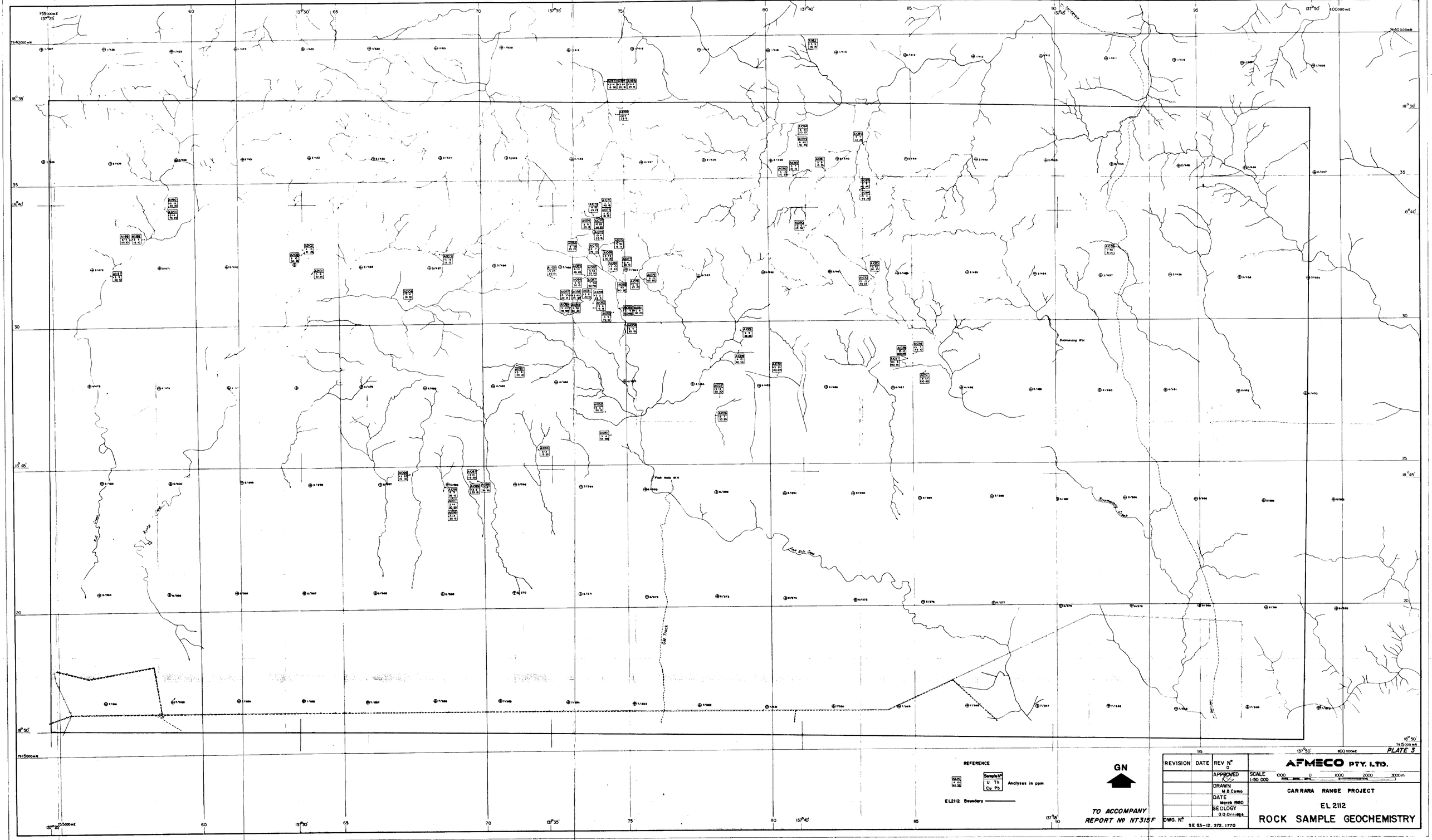
Sample No. / U Th Cu Pb — Analyses of −80 % fraction Values in ppm

EL 2112 Boundary

GN

TO ACCOMPANY REPORT No. NT 315F

REVISION	DATE	REV No. 0	AFMECO PTY. LTD.
		APPROVED	SCALE 1:50000 (1000 0 1000 2000 3000 m)
		DRAWN N.B.Como	CARRARA RANGE PROJECT
		DATE March 1980	EL 2112
		GEOLOGY G.O.Orridge	STREAM SEDIMENT GEOCHEMISTRY
DWG. No. SE 53-12. 372.1769			PLATE 2



REFERENCE

Sample No
U Th
Cu Pb
Analyses in ppm

EL2112 Boundary

GN

TO ACCOMPANY REPORT No NT315F

REVISION	DATE	REV No 0
		APPROVED
		DRAWN M.B.Como
		DATE March 1980
		GEOLOGY D.O.Orridge
DWG. No		SE 53-12, 372, 1770

APMECO PTY. LTD.

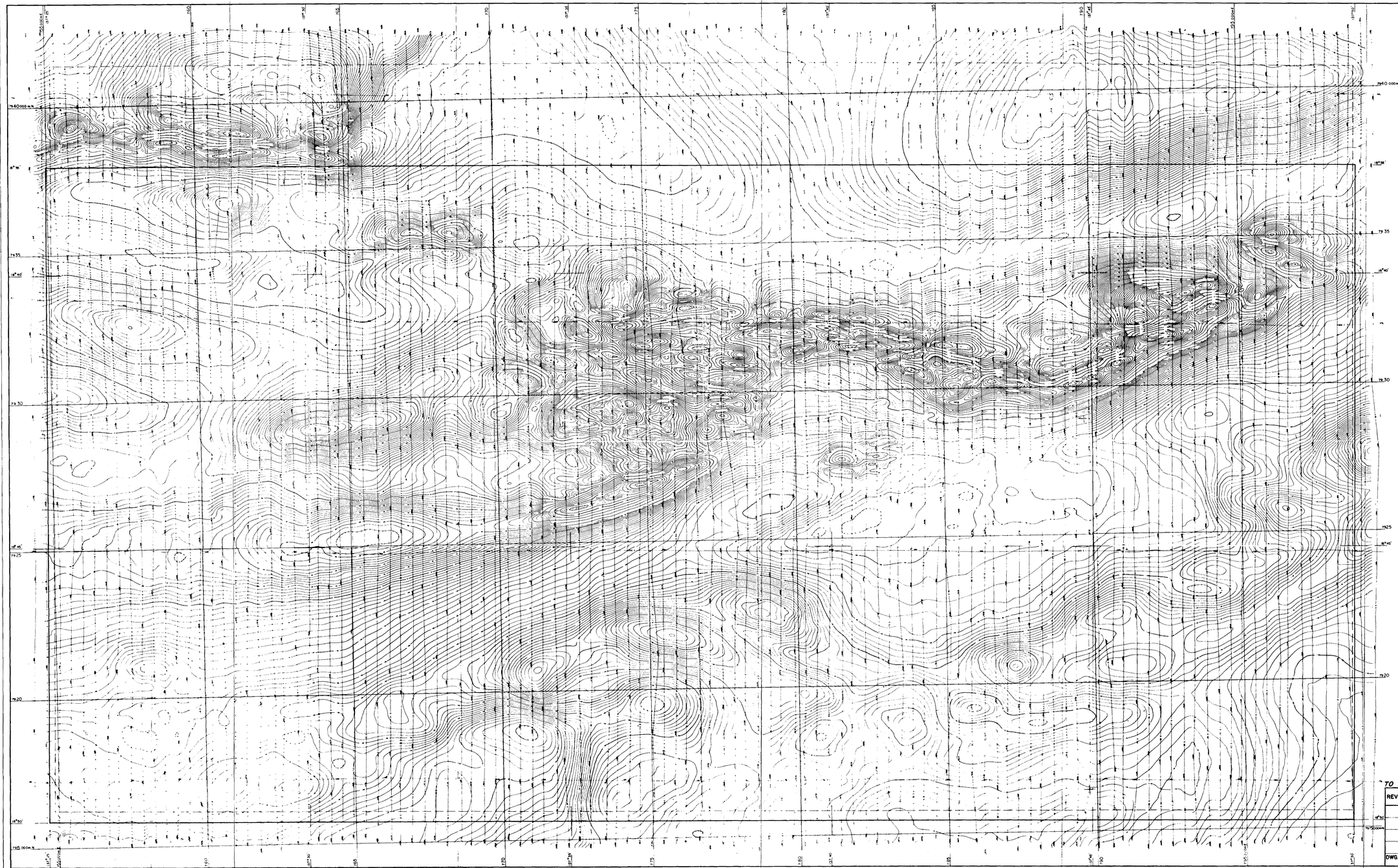
SCALE 1:50 000 (1000 0 1000 2000 3000 m)

CARRARA RANGE PROJECT

EL 2112

ROCK SAMPLE GEOCHEMISTRY

PLATE 3



REFERENCE

Extent of flight area

Exploration Licence boundary

SURVEY AND COMPILATION BY

EG&G GEOMETRICS

CONTOUR INTERVAL	40 GAMMAS
DATUM	1975 IGRF UPDATED TO 1979
FLIGHT LINE SPACING	800 METRES
FLIGHT ALTITUDE	80 METRES MTC
FLOWN AND COMPILED	1979 – 1980
INSTRUMENT	GEOMETRICS G-803 PROTON MAGNETOMETER

GN

TO ACCOMPANY REPORT N° NT 315F

PLATE 4

REVISION	DATE	REV. N° 0
		APPROVED
		DRAWN M.B.Comb
		DATE April 1980
		GEOLOGY

DWG. N° SE 53-12. 372. 1912

AFMECO PTY. LTD.

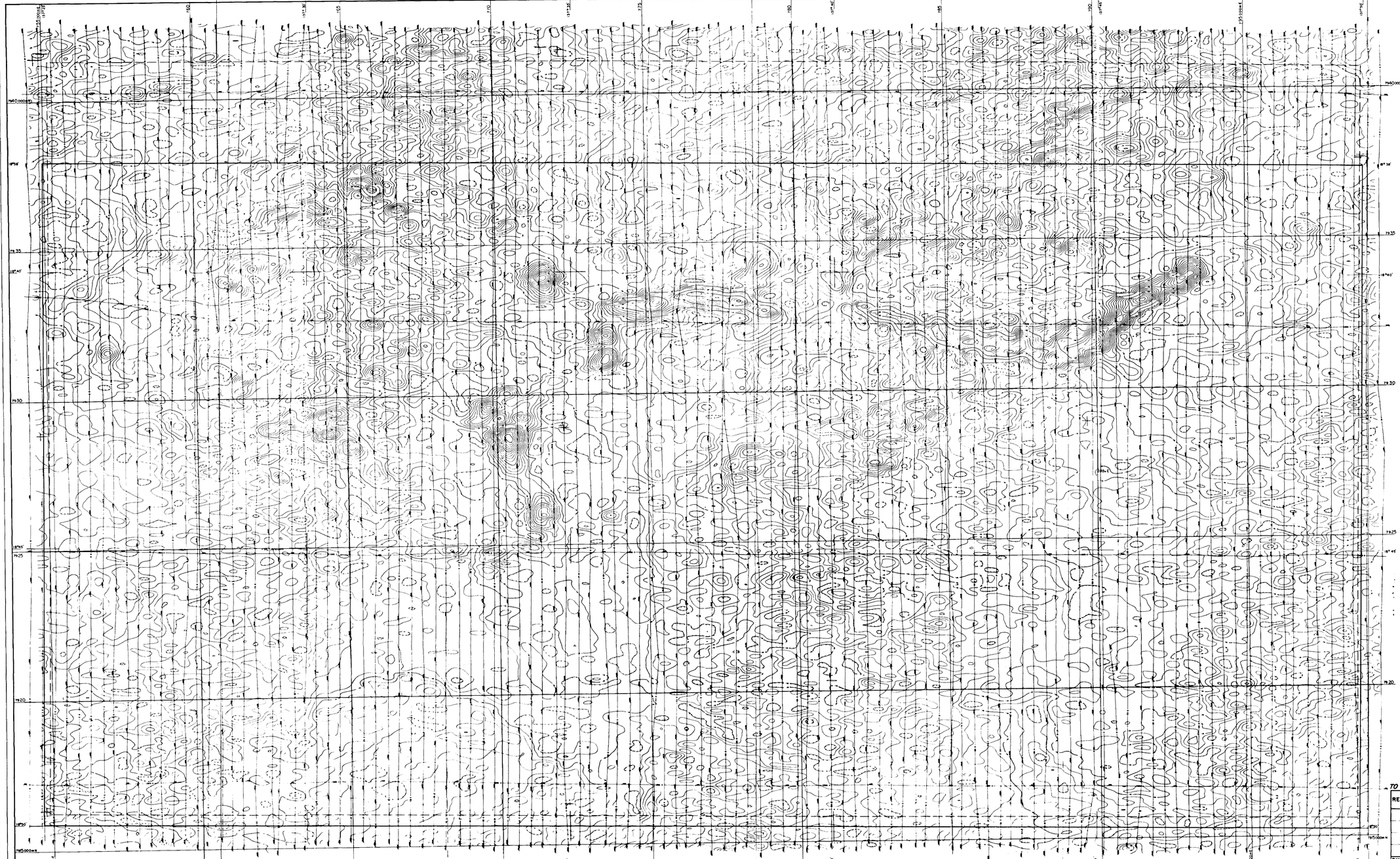
SCALE 1:50 000

1000 0 1000 2000 3000m

CARRARA RANGE PROJECT

EL 2112

RESIDUAL MAGNETIC INTENSITY CONTOURS



REFERENCE

Extent of flight area

Exploration Licence boundary

SURVEY AND COMPILATION BY

EG&G GEOMETRICS

PROFILE SENSITIVITY	50 COUNTS / INCH
FLIGHT ALTITUDE	80 METRES MTC
FLIGHT LINE SPACING	400 METRES
INSTRUMENTATION	EXPLORANIUM MODEL DIGRS-3001 WITH 1024 CUBIC INCH DETECTOR
FLOWN AND COMPILED	1979

GN

TO ACCOMPANY REPORT N° NT.315 F

PLATE 5

REVISION	DATE	REV. N° 0
		APPROVED
		DRAWN WS Como
		DATE March 1980
		GEOLOGY

DWG. N° SE 53-12 372 1910

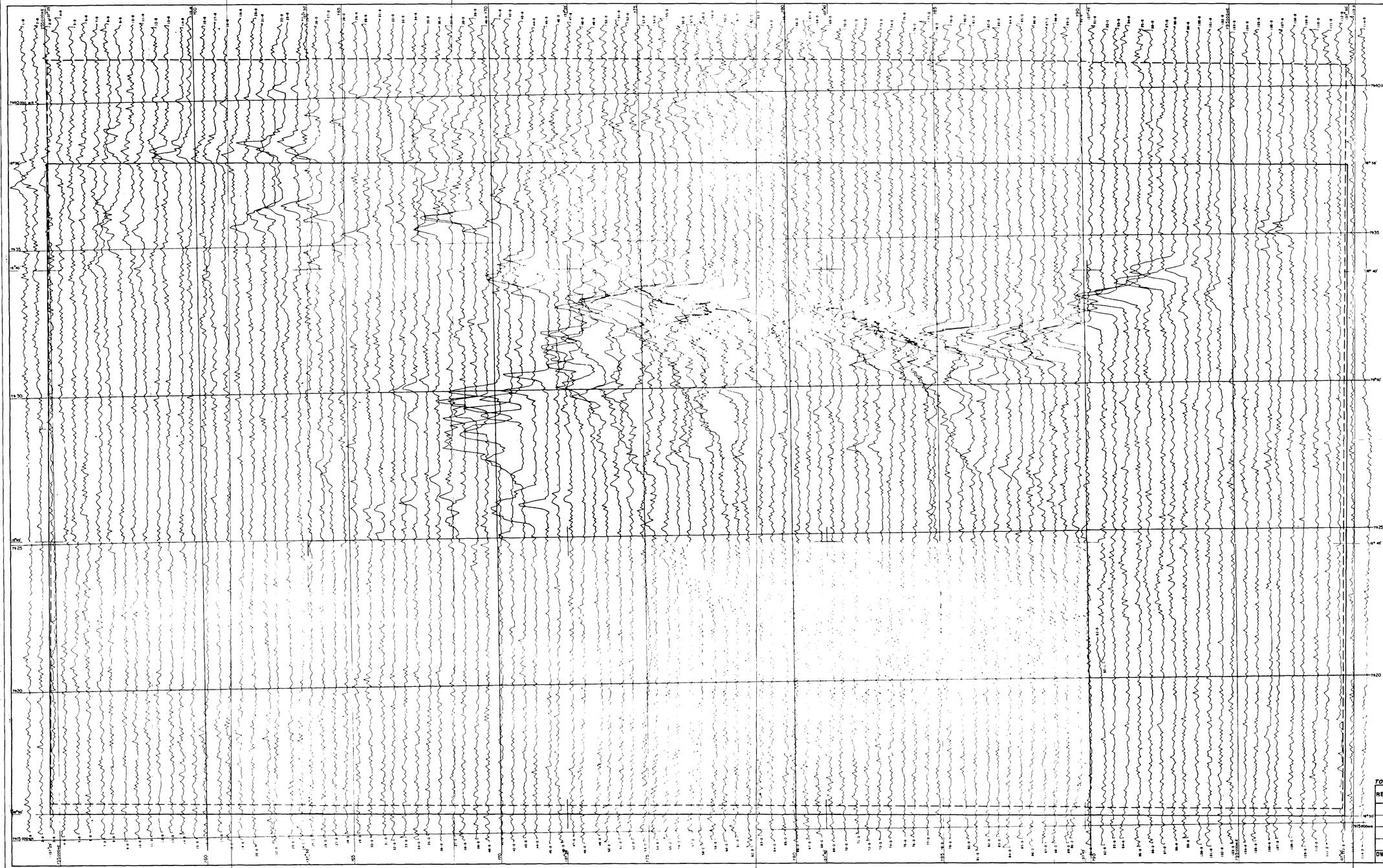
AFMECO PTY. LTD.

SCALE 1:50 000

CARRARA RANGE PROJECT

EL 2112

URANIUM GAMA RAY INTENSITY CONTOURS



REFERENCE

Extent of flight area

Exploration Licence boundary

SURVEY & COMPILATION BY

EG & G GEOMETRICS

PROFILE SENSITIVITY	100 COUNTS/INCH
FLIGHT ALTITUDE	90 METRES MTC
FLIGHT LINE SPACING	400 METRE(S)
INSTRUMENTATION	EXPLORANIUM MODEL DIGRS-3001 WITH 1024 CUBIC INCH DETECTOR
FLOWN AND COMPILED	1979

GN

TO ACCOMPANY REPORT, N° NT. 315 F

PLATE 6

REVISION	DATE	APPROVED
		REV. N° 0
		DRAWN M.R.Cama
		DATE March 1980
		GEOLOGY

DWG. N° SE 53-12, 372, 1911

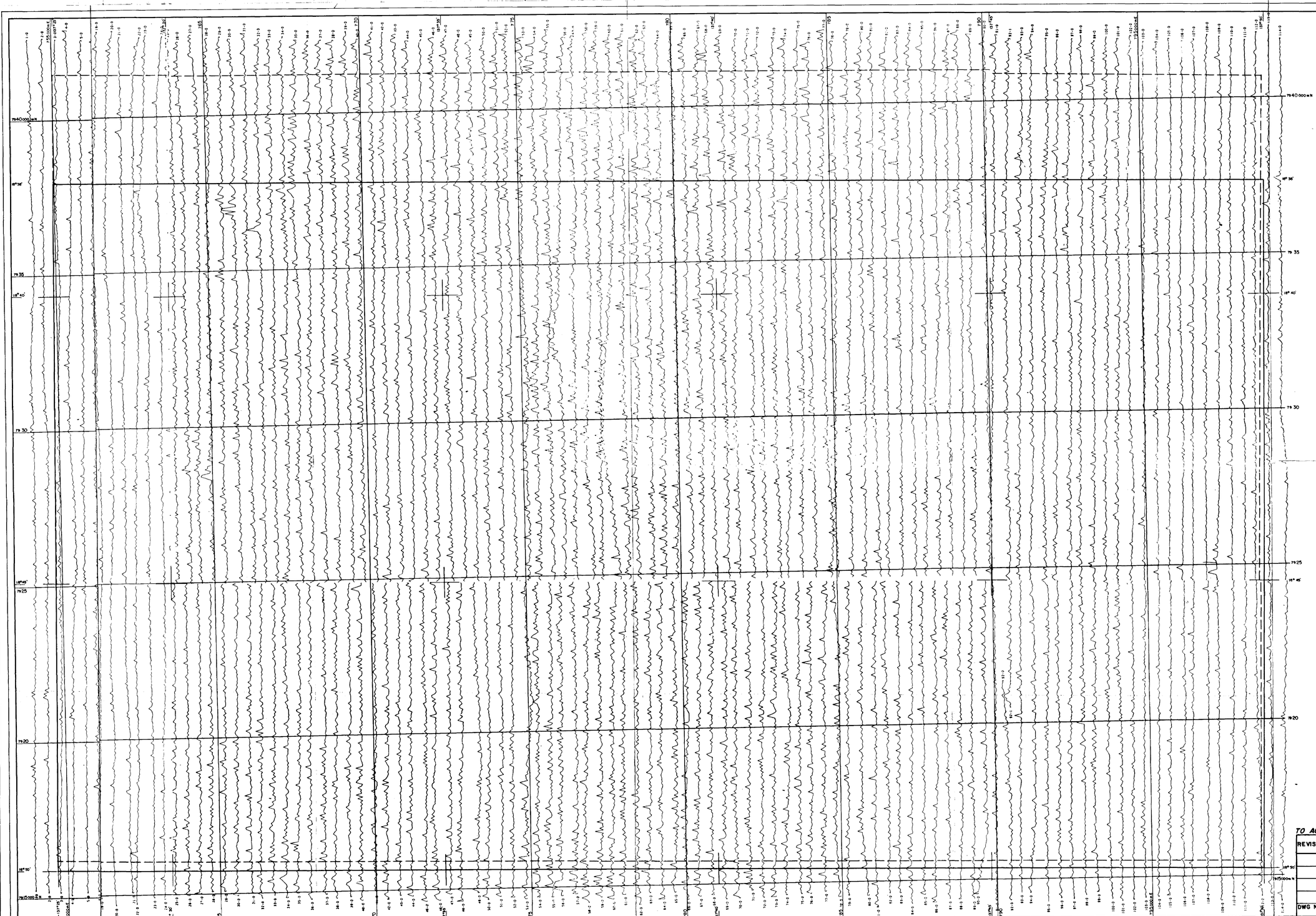
AFMECO PTY. LTD.

SCALE 1:50 000

CARRARA RANGE PROJECT

EL 2112

POTASSIUM PROFILE



REFERENCE

Extent of flight area

Exploration Licence boundary

SURVEY AND COMPILATION BY

EG&G GEOMETRICS

PROFILE SENSITIVITY	50 COUNTS/INCH
FLIGHT ALTITUDE	80 METRES MTC
FLIGHT LINE SPACING	400 METRE(S)
INSTRUMENTATION	EXPLORANIUM MODEL DIGRS-3001 WITH 1024 CUBIC INCH DETECTOR
FLOWN AND COMPILED	1979

GN

TO ACCOMPANY REPORT N° NT 315 F

PLATE 7

REVISION	DATE	REV N° 0
		APPROVED
		DRAWN M.B. Como
		DATE March 1980
		GEOLOGY
		DWG N° SE 53-12. 372. 1863

AFMECO PTY. LTD.

SCALE 1 : 50 000 (1000 0 1000 2000 3000 m)

CARRARA RANGE PROJECT

EL 2112

URANIUM/THORIUM PROFILE

137°25'
18°38'
7936000mN
7915000mN
18°50'
137°25'
757000mE
787000mE
137°50'
18°38'
7936000mN
7915 000 mN
18° 50'
137°50'
26
Cz
Cu Pb
Th
Th Cu Pb
U Cu Pb
4430
4537
4438
4339
4343
3318
707

GN

CAINOZOIC	Cz	Soils undifferentiated	Geological boundary
	L	Laterite	Fault
MIDDLE CAMBRIAN	€	Camooweal Dolomite	Soil boundary
UPPER PROTEROZOIC		Constance Sandstone	Magnetic high trend
		Bluff Range Beds	Anomalous rock sample (Cu Pb)
MIDDLE PROTEROZOIC	CARRARA RANGE F.M.	Acid Volcanics	Anomalous drainage sample (Cu)
		Basic Volcanics	U/Th peak
		Sandstone	U gamma ray intensity contour with value in X background (5)
LOWER PROTEROZOIC		Murphy Metamorphics	Unconformity
			Horizontal Bedding
			Dip and strike of bedding (50)
			Area of high K gamma ray intensity

To Accompany Report No. NT 315F

PLATE 8

REVISION	DATE	REV N°.
		0

APPROVED
DRAWN M.B.Como
DATE March 1980
GEOLOGY G.O. Orridge
DWG. N°. SE53-12.372.1749

AFMECO PTY. LTD.

SCALE 1:50 000 0 1 2 km

CARRARA RANGE PROJECT
E.L. 2112
SUMMARY OF EXPLORATION RESULTS