EXPLORATION ON THE PETROCARB JOINT VENTURE AREA.

ANNUAL REPORT FOR 1983.

BY

R.W. MARJORIBANKS.

OPEN FILE

ANACONDA AUSTRALIA INC. JANUARY, 1984.

NORTHERN TERRITORY GEOLOGICAL SURVEY
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INTRODUCTION

The Joint Venture area is located on the Jervois 100,000 Map Sheet (Huckitta 250,000 sheet) some 280 km ENE of Alice Springs, N.T. (see Figure 1).

The area consists of E.L's 3317, 3012 and 2890 held by Petrocarb Exploration N.L.

A Heads of Agreement between Anaconda Australia Inc and Petrocarb Exploration was entered into in late 1983 permitting Anaconda to commence the first phase of an exploration program over the property. This report presents the preliminary results of that program.

TARGETS SOUGHT

The principal mineralisation in the area occurs at Jervois where exploration has defined a resource of around 3 million tonnes at 3% Cu and 250,000 tonnes grading 10% Pb+Zn, 1.5% Cu, 170ppm Ag. Widespread tungsten mineralisation also occurs.

The mineralisation occurs as stratiform lodes, within a thick (100-500m) chlorite-magnetite-garnet-sulphide unit of great (around 14km) strike extent. This unit, or lode horizon, is a sedimentary iron formation, possibly of exhalite origin, which shows many similarities in its mineralogy, metal association, sedimentary and tectonic form, and age to the Broken Hill lode horizons of N.S.W.

The principal target in the district is thus a large, stratiform, massive Ag-Pb-Zn sulphide body similar to that at Broken Hill. The discovery of associated copper or tungsten mineralisation can be considered as a bonus resulting from the principal search.

The lode horizon at Jervois represents a prominent topographic, geophysical and geochemical anomaly. The area covered by this report is adjacent to the Jervois lode and could contain repetitions or extensions of the Jervois sequence. The area is largely non-outcropping with extensive sand and alluvium cover. It was considered that regional geophysics (interpretation of available aeromagnetics followed by an airborne EM survey) could rapidly define areas of interest for more detailed ground follow-up.
WORK UNDERTAKEN

Airmagnetic Interpretation.

High quality regional aeromagnetic data, published by the N.T. Survey at 100,000 scale is available for the Jervois sheet. A regional interpretation of this data was undertaken by Anaconda Geophysicist, C.J. Jewell, his report is presented in Figure 2 and in Appendix 1.

Jewell identified several areas with strong linear magnetic signature similar to that occurring over the Jervois Lodes. Numerous probable fold and fault structures were also defined.

On the basis of this work areas were selected for follow up by airborne E.M.

Input E.M. Survey.

The areas flown by this survey are shown on Figure 3. The work was undertaken by contractors Geoterrex Pty Ltd and their full report, relevant to the Petrocarb Joint Venture area, is included as Appendix 2 and Figure 4. The specifications of the survey are presented in the contractors report.

Proposed Future Exploration.

The INPUT survey has outlined a number of conductors, some of which may result from sulphide concentrations in bedrock. Most of these are in areas of no exposure or poor exposure. In the best available geological mapping (BMR Jervois 100,000 sheet) these areas have been interpreted on the basis of air-photo interpretation and so the interpretation may not be reliable. It is proposed to check the anomalies with a phased program. A decision to proceed or not occurs after each phase.

- Locate anomalies on low level colour photographs
- Field check all priority 2 and 3 anomalies
- Reconnaissance rock chip sampling, soil sampling
- Reconnaissance lines ground mag.

Decision Point
- 3 -

- Gridding
- RAB Drilling
- Bedrock geochemistry
- Ground magnetics
- Sirotem survey

Decision Point

Percussion drilling
APPENDIX 1

INTERPRETATION OF AEROMAGNETIC DATA ON THE JERVOIS 100,000 SHEET AREA

BY

C.J. JEWELL

(PROJECT GEOPHYSICIST, ANACONDA AUSTRALIA INC)
INTERPRETATION OF AEROMAGNETIC DATA ON THE JERVOIS 100,000 SHEET AREA

Available Data

The available regional data relevant to the Jervois area is located on 1:250,000 scale BMR aeromagnetic and gravity data covered by the Barrow Creek, Elkedra, Sandover River, Alcoota, Huckitta, Tobermory, Illogwa Creek and Hay River Sheets (see Fig. 1).

Also available for the interpretation were 1:250,000 scale geology and topography maps.

The smaller scale data available included geology and aeromagnetic maps at 1:100,000 and 1:50,000 scale.

Regional Data Interpretation

The aeromagnetic data indicates a pronounced northwesterly trend for magnetic anomalies across the central and southwestern parts of the Huckitta, Illogwa Creek and Hay River Sheets and a dominant east-west trend is observed on the Tobermory Sheet.

The east-west trend seen on the Tobermory Sheet appears to be abruptly truncated by the major northwesterly trend along a line which passes through the junction of the four sheets. (All interesting areas are located on sheet corners or near the map edges!)

However, evidence of a continuation of the east-west trend is seen on the western and northwestern part of the Huckitta Sheet, though modified slightly in the southwest to a more west-northwesterly trend.

The part of the Jervois area under investigation then appears as an approximately 7 kilometre wide block which cross-cuts the east-west trend.

This magnetic block however, is not continuous in the northwest-southeast direction, to the northwest of Jervois Range the magnetic response is much weaker and the outline of the magnetic units becomes diffuse.
Perpendicular (northeast-southwest) magnetic trends intersect the block and add to the complexity of the magnetic pattern.

South of Jervois Range on the Illogwa Creek Sheet, strong north-south magnetic trends are observed, these persist over the northern part of the sheet.

Southeast of Jervois Range the strong northwesterly trend continues to the centre of the Hay River Sheet, but a major north-south magnetic feature marks the boundary between the unit and a west-northwesterly trending magnetic response.

The regional gravity data for the Huckitta, Tobermory, Illogwa Creek and Hay River Sheets, indicates very similar overall trends to the aeromagnetic data. The east-west trend appears more dominant in the western part of the Huckitta Sheet and over most of the Tobermory Sheet. The strong north-easterly trend appears to be restricted to the northeastern part of the Huckitta Sheet and the northwestern part of the Tobermory Sheet, though some evidence of this trend is seen at the junction of the four sheets.

**Detailed Data Interpretation**

Detailed aeromagnetic data was available for the Jervois area at 1:100,000 and 1:50,000 scale.

**1:100,000 Scale Aeromagnetic Data**

The first part of the detailed interpretation was carried out on the 1:100,000 scale Jervois Range sheet. The map had previously been coloured to aid lithologic correlation and rock type identification. The colour scheme used had variable contour interval, but the main subdivisions were 500 nanoTesla apart with red representing the magnetic high areas and blue the magnetic low areas.

The magnetic response in the area is complex and highly variable. The northeastern and northwestern parts of the sheet contain intermediate to long wave length anomalies suggesting magnetic basement rocks at depth overlain by non-magnetic cover rocks. Faulting separates these areas from more magnetic units to the south and in the central northern part of the sheet (The Jervois Mine Area), Area I.
Small areas of low magnetic relief along the western margins of the sheet and narrow areas in the south are thought to represent non-magnetic granitic rocks. Elsewhere the magnetic response varies from -500 to +1500 nanoTesla, the more magnetic rock units tend to form continuous arcuate units and are thought to represent folded banded iron formation. The majority of these are folded into basin and dome shaped structures. The lower amplitude anomalies of approximately +250m to +500 nanoTesla anomalies tend to parallel the banded iron formation anomalies but it is unclear if they represent lower concentration, narrow versions of BIF at depth or represent a separate mafic unit in the basement. The lowest amplitude anomalies tend to exhibit variable orientation though some trend parallel to the higher amplitude anomalies forming similar arcuate bands.

Variation in the higher amplitude anomalies along strike may reflect changes in dip, thickness, magnetite content or depth. Offset and truncation of these units suggest faulting.

The main fault directions recognised in the area are northwesterly and northeasterly with subordinate north-south.

The Jervois Range area, Area I, is manifested as a central high amplitude magnetic anomaly in the form of a "J" with parallel lower amplitude anomalies to the east. The western edge of the unit is abruptly truncated due to faulting. The parallel low amplitude anomaly may represent a second BIF unit but this is uncertain from magnetic evidence alone.

Similar magnetic patterns to the Jervois Range area are located to the south and southwest of the Jervois Range.

To the southwest of Jervois Range, Area II, the magnetic rocks form large arcuate bands up to 12 kilometres wide around the non-magnetic rocks. Within these large bands, the high and medium amplitude anomalies form arcuate folded structures which may be due to BIF.

The best defined of these occur to the southwest of the Jervois Range, elsewhere they tend to be dislocated and discontinuous.
South of the Jervois Range, Area III, an area mapped as granite exhibits similar arcuate bands within the main outline of the body. If this is a granitic rock then it is different in magnetic character to those areas thought to be granite on the western margins of the sheet.

The presence of the banding may be due to BIF in a basement block or remnants on roof pendants or skarn overlying a less magnetic body but this seems unlikely since magnetic response is generally high even away from the bands and would not be easily explained by interference of magnetic response from the bands. East of the body lower amplitude arcuate bands are observed forming a pattern which is separate but parallel to the banding within the body. As such the magnetic pattern shows many similarities with the Jervois Range and fewer similarities with known or expected response of other granites.

The more complex and disjointed part of the Jervois Sheet magnetic pattern occurs in a west-southwesterly block which separates the northern and southern arcuate banded areas. This block contains all the magnetic features found elsewhere but tends to be broken into smaller arcuate bands with limited continuity.

1:50,000 Scale Aeromagnetic Data

The 1:50,000 scale aeromagnetic data is available for parts of the Jervois Range area; they include Map 6152-2, 6152-3 and 6252-3. These maps contain detailed information on some of the main features of interest, notably the magnetic area south of Jervois Range where granitic rocks have been identified but the magnetic pattern is inconsistent with that interpretation. The major difficulty with the 1:50,000 scale data is the sparseness of annotated values on the map which prevents detailed discrimination of internal magnetic response changes and therefore lithologic variability.

Nevertheless, the probable banded nature of the magnetic pattern is evident and suggests that this area may be of some interest because of similarities with Area I; the Jervois Range area. The ground magnetic profiles over the area did not help to resolve the speculation about a second BIF unit, but neither could the possibility of such a unit be discounted.
APPENDIX 2

INTERPRETATION REPORT AIRBORNE ELECTROMAGNETIC AND MAGNETIC SURVEY.

BARRINGER "INPUT" SYSTEM

OF THE

JERVOIS RANGE AREA

BY

GEOTERREX PTY. LIMITED.
INTERPRETATION REPORT

AIRBORNE ELECTROMAGNETIC & MAGNETIC SURVEY

BARRINGER "INPUT" SYSTEM

OF THE

JERVOIS RANGE AREA

NORTHERN TERRITORY

FOR

ANACONDA AUSTRALIA INCORPORATED

BY

GEOTERREX PTY. LIMITED

(83-552)

Sydney, Australia
December, 1983  

G. Nader  
Geophysicist
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I. INTRODUCTION

During the period of October 22nd to October 25th, 1983, Geoterrex Pty. Limited flew a combined electromagnetic and magnetic survey over the Jervois Area of Northern Territory on behalf of Anaconda Australia Incorporated. The base for the duration of the survey was Alice Springs.

A total of 701.3 kilometres were flown at a flight line spacing of 500 metres. No tie lines were flown. The purpose of the survey was to search for massive sulphides.

The survey consisted of three blocks with the following specifications:

<table>
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<tr>
<th>AREA</th>
<th>NOMINAL LINE SPACING</th>
<th>LINE DIRECTION</th>
<th>LINE KM</th>
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<tr>
<td>A</td>
<td>500 m</td>
<td>NE-SW</td>
<td>257.3</td>
</tr>
<tr>
<td>C</td>
<td>500 m</td>
<td>N-S</td>
<td>164</td>
</tr>
<tr>
<td>C</td>
<td>500 m</td>
<td>E-W</td>
<td>280</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TOTAL</td>
<td>701.3 kms</td>
</tr>
</tbody>
</table>

The project was conducted with a Super Canso PBY-5A and under registration VH-EXG, which is operated by H.C. Sleigh Aviation for Geoterrex Pty. Limited and was equipped with:-

- a Barringer Mark V 12 channel INPUT EM system
- a Geometrics G803 nuclear precession magnetometer
- a Geoterrex Madacs digital acquisition system
- a Sperry RT 220 radar altimeter
- a 50 Hz monitor
- a Geocam 705 35mm continuous strip tracking camera
- a Honeywell 1912 visicorder

Navigation was by visual means from black and white government aerial photographs enlarged to a scale of 1:25,000. The aircraft was operated at a mean terrain clearance of 120 metres.

Compilation and interpretation of data was performed in Sydney.
II. PERSONNEL

The following Geoterrex personnel participated in the field phase of the survey:

J. Edwards  Pilot
T. McKenzie  Co-Pilot
W. Mitchell  Aircraft Mechanic
L. Williams  Electronics Technician
M. Curtis/C. Worsley  Data Compilers
G. Butt  Geophysicist

The entire project was planned and supervised by G. Butt and G. Nader of Geoterrex Pty. Limited in consultation with Mr. T. Kerr of Anaconda Australia Incorporated.
III. DATA PRESENTATION

The geophysical data is presented in the following forms:

The maps are presented at a scale of 1:25,000.

- EM Anomaly Maps - map of selected conductors
- Original Analogue Records of EM, magnetic and altitude data.

EM Anomaly Map (Selected Conductor Map)

The EM Anomaly Map shows selected INPUT anomalies from the slow resolution channels identified during the field phase of the survey. The anomalies are plotted in their correct lateral positions (i.e. the 4.0 second lag between the six SRC INPUT response and true ground position has been accounted for) on the flight lines and grouped according to similarity of amplitude and shape from line to line. The boundaries of these anomalous zones are determined from the half peak amplitude width on Channel 4. A diamond symbol indicates the anomaly peak and hence whether the anomaly is symmetrical or not. The number at the upper left of the diamond is the ratio of Channel 4 to Channel 11 in parts per million of the primary field. The number at the upper right is the aircraft altitude in metres.

Any significant association between an INPUT magnetic anomaly is indicated by plotting the amplitude of the magnetic response beneath the diamond. If there is any offset between these peak responses an arrow indicating the direction of offset is drawn beneath the amplitude of the magnetic response.

During the course of data evaluation, groups of anomalies are outlined to show out interpretation of the extent of the geologically conductive zones. If any doubt exists the outlines are dashed. Conductors of interest are numbered to facilitate reference to the report.
The original visicorder records of the raw INPUT, altitude and magnetic data are presented bound in line number order. All calibration data is included and a copy of the analogue format is shown in Figure 2 of Appendix A.

The 4 rolls of negative 35mm continuous strip tracking film are delivered and labelled according to their flight number.

The controlled aerial photography, bearing all points, along with the tracking film is provided for accurate location of any follow-up investigation.

The flight logs which contain all relevant information regarding the collection of geophysical data are presented bound in flight order.

Instrument sensitivities and settings are tabulated in Appendix C attached to this report.
IV. INTERPRETATION - General

Commonly used interpretation techniques rely mainly on qualitative review of data and refer to anomaly shape, symmetry, strike extent and variability within conductive zones. The apparent conductivity, as determined by the rate of decay of the INPUT response, is an important criterion in our analysis of conductors. Other important factors taken into account include:

- the shape and size of the INPUT anomalies
- the strike length and degree or isolation of the conductor
- the estimated conductance of the conductor
- the form of conductors particularly with respect to direction and dip of geological and cultural structures
- the associated geophysical parameters such as aeromagnetics
- variation of response characteristics within a given conductor
- the geological environment and response of the system known to mineralisation.

Conductors delineated by an EM survey can be separated into categories based on their probable origins, namely bedrock, surficial and cultural.

The term cultural is used for those conductors thought to be due to any man-made construction. These are responses due to fences, telephone and powerlines, etc.

Surficial conductors refer to sources in the overburden, in the weathered portion of the bedrock or in those formations not usually considered as host material for sulphide orebodies. In the context of this report the word surficial should not be used in the geological sense but rather as a geophysical term.

The term bedrock conductors is reserved for those responses thought to originate from the unaltered portion of favourable rocks and which are usually caused by massive sulphides, graphites (carbonaceous material) magnetite and serpentine.
Quantitative analysis of INPUT data is restricted mainly to a general consideration of amplitudes and decay rates to establish depth and apparent conductivity. A plot of INPUT channel amplitudes versus channel delay time, permits the dependence of response on conductor geometry and size to be seen from another perspective. The response obtained from dipping sheet-like and horizontal strip conductors may be recognised as concave and linear curves respectively. It is possible, therefore, to distinguish between flat-lying surficial conductors and dipping bedrock conductors, although flat-lying bedrock features, in general, resemble the former.

Interference due to conductive overburden complicates the identification of bedrock conductors. It is expected that the decay pattern of a response due to a bedrock conductor embedded in or located below a flat-lying conducting medium, would consist of two distinct segments (plotted on a log-log scale) because of their differing rates of decay.

These segments become more pronounced for greater parametric difference between the overburden and bedrock conductor, but the method fails if there is little or no difference between overburden and target body. This method (Verma 1975*) is useful in areas of extensive high conductivity.

V. GEOLOGY

The regional geology which is covered by the Huckitta 1:250,000 geological map sheet contains Precambrian metamorphic and igneous rocks overlain by sedimentary sequences of younger Precambrian, Palaeozoic, uncertain Triassic and Tertiary ages.

The predominant rocks outcropping in the survey area consist of older Precambrian rocks of the Arunta Complex comprising a sequence of gneisses, schists, amphibolites, meta gabbros and intrusive granites. Outcrop appears to be limited in Area A where Quaternary sands and soils cover most of the area.

Three periods of structural deformation have been recognised within the vicinity of the Jervois Mine area where the "J" structure is thought to have occurred during the second period. Faulting in the survey area appears to be prominent.

Mineralisation is best illustrated in the Jervois sequence where varying amounts of copper, tungsten, lead, silver and zinc in metamorphic rocks are present.
VI. INTERPRETATION OF THE JERVOIS RANGE SURVEY DATA

The INPUT survey has delineated many formational zones (primarily within Area C) which correlate very well with the known geology of the area.

Area A.

Generally speaking, this area is electromagnetically conductive in which few INPUT zones have been selected. The conductive material is most likely calcareous soil derived from Palaeozoic carbonate rocks. The western extremity of this area is conspicuously resistive which is probably related to the undifferentiated metasediments of the Arunta Complex. Although no Priority 1 INPUT zones have been selected, Zone JA-1A is considered the most interesting and best geophysical indicator for the occurrence of sulphide mineralisation.

Finally, it should be borne out that within the normal guidelines which define the priority ratings of INPUT anomalies, no high priority potential targets have been defined in Area C. However, the project geophysicist should bear in mind that the association of sphalerite and galena in this environment, may not necessarily yield a strong conductive source, hence the INPUT signature may be significantly weaker. Gecotrex flew a profile across the known mineralisation sequence south of the Jervois Mine in which a weak three channel anomaly was recorded. Although the exact geographical relationship between the mineralisation and the weak INPUT anomaly was not known, it is obvious that no strong INPUT response is evident. The relevant flight path has been recovered on a 1:25,000 photograph and a copy of the respective INPUT analogue charts are included as Appendix D to this report.
INPUT Classification

In this section all selected conductors of interest are discussed and classified according to the following priority system:

**Priority 1** Zones satisfy most of the criteria associated with a bedrock source which could be due to massive sulphides. They contain responses indicating a moderate to highly conductive source and may be isolated or part of an extensive trend.

**Priority 2** Zones also satisfy most of the criteria associated with bedrock features but anomalies display characteristics such as faster rate of decay or broader width which preclude them being listed as Priority 1.

Zones which are rated as Priority 3 targets are almost certainly of surficial or cultural origin, but a small degree of uncertainty is present.

Initial interpretation was directed towards separating likely bedrock responses from those due to surficial or cultural sources. Surficial features possibly related to selective weathering of geological units are presented, but not discussed, as they provide an aid to geological mapping.

Priorities assigned to zones are made primarily on the merits of the INPUT responses, with some influence from the magnetic data. Geological and geochemical information must be further analysed to determine the ultimate priority for followup.

The priority rating system refers to the probability that the conductive source of given zones is related to massive sulphide mineralisation.
<table>
<thead>
<tr>
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<td>JA-1A</td>
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</table>

**TABLE 1**
ZONE JA-1

Priority 3

Line 204.1SW to Line 208.1SW

Fiducial 364428 Ratio 16000/1650
Fiducial 352740 Ratio 7400/650

Mag Association: No obvious association.

Location: Grassland region in southern portion of area.

Remarks: This is a northwest striking zone, characterised by broad, large amplitude anomalies with relatively fast decay rates. The conductive source is most likely of surficial origin.

Recommendations: Low priority.
ZONE JA-1A

Line 206.1SW
Fiducial 358400
Ratio 1800/300

Mag Association:
54nT magnetic high?

Location:
Grassland region in southern portion of area.

Remarks:
This is the most interesting anomaly in the entire area. The INPUT signature consists of two distinct peaks as clearly defined on the fast time constant channels. The selected and plotted anomaly peak to the east of this zone is most certainly of surficial origin as inferred from its very fast decay rate and large amplitude. In contrast the selected anomaly (designated JA-1A) exhibits a somewhat smaller amplitude and much slower decay rate which are important criteria for an interpreted bedrock source. Furthermore, a 54nT broad magnetic high can be correlated to the INPUT zone, however its direct relationship is not clear. The INPUT anomaly would normally have a high priority 1 rating, but because of its geographical location within a linear zone of strong surface conductors (JA-1), the zone has been downgraded.

Recommendations:
This zone should be carefully assessed. Ground magnetics and ground EM are both recommended for followup.
ZONE JA-2

Line 207.1NE  Fiducial 355590  Ratio 1800/300
Line 208.1SW  Fiducial 352480  Ratio 300/-

Mag Association: None.

Location: Grassland - southern portion of area.

Remarks: A north west trending zone has been selected here, comprising of small amplitude anomalies broadening in width on the later channels. The INPUT response is generally weak and poorly defined. The response on line 207.1NE has a moderate decay rate which is the main reason for rating this zone.

Recommendations: Low priority.
VII. CONCLUSIONS AND RECOMMENDATIONS

Table 1 summarizes the interpretation of the INPUT data and the classification of zones according to their priority in the search for conductive massive sulphides. The categorization is established primarily on the merits of the INPUT data with support from the magnetic and geological information.

Within the normal guidelines of INPUT interpretation, no high priority 1 zones have been outlined in either Area A or Area C.

In general, Area A is considered to be dominantly conductive and except for zone JA-1A this area is not considered to have any potential sulphide targets. Area C is far more suitable to electromagnetic prospecting and the INPUT survey has outlined many conductive zones and trends which correlate with the magnetics and the known geology. Although no Priority 1 targets have been selected it is considered that in the final assessment of followup targets, the project geophysicist or geologist should not disregard isolated weak two, three or four channel INPUT anomalies which occur in geologically prospective areas. In particular, if the sulphide target is a poor conductor then a weak EM response can be expected.

In conclusion, the INPUT system has proved to be an excellent mapping tool in which major structural trends have been delineated, it has also established that the Adelaidean cover is diagnostically more conductive than the older Precambrian sediments.

Respectfully submitted,

GEOTERREX PTY. LIMITED

GEORGE L. NADER

GEOPHYSICIST
July 6, 1984

The Secretary,
Department of Mines and Energy,
P.O. Box 2901,
DARWIN, N.T.  5794

Dear Sir,

RE: ANNUAL REPORT E.L.3012

In the last quarter of 1983, Anaconda undertook a regional exploration program to evaluate linear magnetic trends evident from aeromagnetic data published by the N.T. Geological Survey.

A large area (1403 km²) involving eight Exploration Licences was secured for exploration under two joint venture agreements. A further two small E.Ls. (4406 and 4407) were taken up by Anaconda to avoid "windows" in the total area (see Plan 9663 attached).

An aerial INPUT E.M. survey was flown and second order conductors were identified within E.L. 3317 only. The full report of this survey is included with the Annual Report submitted for this E.L. 3317.

Total expenditure on this project has been $95,945 which is dissected as follows:-

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</tbody>
</table>
This expenditure has been allocated amongst the 10 E.L.s. comprising the project on an area basis, and the estimated expenditure of E.L.3012 is thus $20,328.

We respectfully request that this report be considered in conjunction with the report on E.L. 3317.

We have previously advised that the Joint Ventures have both been terminated, and we trust you will find this Final Report satisfactory.

Yours faithfully,

G.R. BALL
Regional Mineral Landman