J.R. BRUCE, S.J. CARTHEW, AND ENDRAS PTY LTD.

OPEN FILE

EXPLORATION ON E.L. 4850

DURING YEAR OCTOBER 1986 TO OCTOBER 1987

ARLTUNGA DISTRICT

ALICE SPRINGS AREA, N.T.

S. CARTHEW

ROCKS PROSPECTING AND ASSOCIATES

NOVEMBER 1987

OPEN FILE

NORTHERN TERRITORY GEOLOGICAL SURVEY

GR87/205
S. J. CARTHEW, J. R. BRUCE and ENDRAS PTY. LTD.
SLATEHOLE BORE - E.L.4850
LOCATION MAP

km 2 0 5 10 15 20 Scale 1:250,000
I. SUMMARY AND CONCLUSIONS

The mineralization at Bluey Silver Prospect is structurally emplaced stratabound ore that is at and near the surface, probably supergene enriched. Preliminary metallurgical investigations and bulk sampling results indicate to us that a potential buyer of the ore is available and that continued feasibility studies are warranted.

II. KEYWORDS

SILVER BASEMETALS THRUST ANTICLINE
III. INTRODUCTION

The Slatehole Bore Exploration Licence E.L. 4850 of 9 sub-blocks totalling an area of 12 square kilometres in the eastern Macdonel8 Ranges was granted to J.R. Bruce (40 of 100), S. J. Cartthew (40 of 100) and Endras Pty Ltd (20 of 100), on 29th October 1986. This E.L. is found in the northwest quadrant of the FERGUSSON RANGE 1:100,000 sheet, and is reached by bitumen road to Ross River Tourist Resort, and graded secondary road to Arltunga Historical Park and on to Atnarpa Station, approximately 110km east of Alice Springs. Our involvement in this licence is part of an in depth review of White Range and its surrounds for its diverse economic mineral potential.

This report details the regional assessment, work undertaken, project evaluation, and results of initial processing studies.

IV. TARGET CONCEPTS

This E.L. was applied for to evaluate the eastern portion of Bluey Silver Prospect found independently but at about the same time by J.R. Bruce and S.J. Cartthew, with the project being named after the former. At the time of discovery, Geoeko - Petrocarb held the western section and other parties the eastern portion. When the ground to the east became available, it was applied for by the current owners.

Other targets being considered are auriferous vein quartz associated with thrusting similar to that at nearby White Range.
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V. WORK UNDERTAKEN

During the first year the following work programme has been undertaken.

1) regional mapping, at 1:25,000 scale, of the E.L.
2) costeaining
3) sample analysis
4) bulk sample analysis
5) preliminary metal recovery investigations
6) application for bulk sample testing to N.T. D.M.E.
7) invitation to government officers to inspect the property.
REGIONAL GEOLOGY

The White Range Goldfield is located within the Arltunga Nappe Complex, which is a group of basement-cored nappes, formed during the Early Carboniferous Alice Springs Orogeny. This involved overthrusting, and sliding together with subordinate recumbent folding of the basal Adelaideon sediments. These nappes lie within a deformed zone some 80 kms. from east to west along the northern margin of the Amadeus Basin [Shaw et al 1971] and straddles an intracrustal suture as defined by regional gravity surveys [AnElloff and Shaw 1973].

The basement rocks are part of the Arunta Block which extends approximately 1000 km. east-west and 400 km. north-south. It consists of a cratonised complex of igneous, sedimentary and metamorphic rocks of Archean to Lower Proterozoic age, that have been intruded by granites early in the Carpentarrian. (Fig. 2)

The rocks have been divided into three divisions on the basis of gross lithological differences and are tentatively regarded as chronological or stratigraphic correlatives [Stewart and Warren 1977], [Stewart et al 1984].

They were deposited in three major, east-west trending, fault bounded tectonic zones [northern, central, and southern].

Division 1 consists of mafic and felsic granulites interpreted as chemical equivalents of a volcanic sequence that was deposited in a developing east-west graben structure on ensialic crust. In the Harts and Strangways Ranges, this granulite sequence is succeeded unconformably by rocks of amphibolite facies as part of the Central Tectonic Zone.

Division 2 consists of an argillaceous sequence in part sandy, now metamorphosed to greenschist facies that pass laterally into amphibolite facies equivalents of the Harts Range Group [Joklick 1955] and to granulite facies equivalents of Reynolds Range. This division was deposited with ensuing volcanic activity in troughs flanking the craton.
Fig. 1. Geological map of the Arunta Inlier showing major stratigraphic divisions and tectonic provinces. Large and small dots or dashes indicate known and inferred trends of lithologic layering, respectively. RZ = Redbank Deformed Zone, HZ = Harry Creek Deformed Zone, DZ = Daly-Mount Sanhill Fault Zone. WF = Walbanba Fault Zone. Initials in bottom left corners of sheet areas denote names as follows: AL, Alice Springs; BC, Barrow Creek; H, Hermannsburg; H3, Highland Rocks; HR, Hay River; HU, Hukittia; IC, Illogwa Creek; LM, Lake Mackay; LR, Landier River; M, McKeen; MD, Mount Davenport; M1, Mount Liebich; MP, Mount Peake; MR, Mount Rennie; MS, Mount Solitaire; MT, Mount Theo; N, Napperby; T, Tabornamy; TO, The Granites; W, Webb.
Division 3, which unconformably overlies Division 2, consists of more mature quartz rich sediments with minor volcanics, and completes the cycle of sedimentation.

The Metamorphic grade varies between low greenschist and granulite facies. Isotope dating indicates four widespread episodes of regional metamorphism, resulting from tectonism and/or granitic emplacement. The first, of granulite grade, is the Strangways Metamorphic Event, which occurred about 1800m years ago. The second and third, [Chewings Phase] generally of amphibolite grade, accompanied the granite intrusion of 1500 to 1600m years ago [Hurley et al 1964, Armsrong and Stewart 1975, Offe and Shaw 1983]. The fourth, the Ormiston Event of 1000 to 1100m years ago, produced migmatisation at a number of centres in the central part of the southern zone, and was closely followed by intrusion of syntectonic granites, dolerite dykes, and gabbroic bodies.

Following uplift and erosion, the Arunta Block forms basement to several intracratonic shallow-marine sedimentary basins of Adelaideon to Palaeozoic age (fig. 2). Epicontinental sands of the Heavitree Quartzite and equivalents were deposited unconformably over basement, and sedimentation continued with minor disconformity into the upper Palaeozoic, when the Alice Springs Orogeny (400m years ago) deformed both the basement and cover rocks. Widespread thrust faulting, isoclinal folding and nappes complexes were produced around the northern margins of the basins, accompanied by widespread metamorphism of the basement rocks. Carboniferous continental molasse material was then deposited together with the extensive peneplanation and localised ferricrete and silcrete formation. The Tertiary peneplain surface has since been uplifted and active erosion has resumed.
J.R. BRUCE, J.H. MULES, ENDRAS PTY. LTD.
LANDSAT INTERPRETATION
WHITE RANGE
VII. LOCAL GEOLOGY

E.L. 4850 is in the middle portion of the Redbank Deformation Zone where basement retrogressed tonalite and granite gneiss has been overthrust onto the Heavitree Quartzite and Bitter Springs Formation of Adelaidean age.

VII. 1) STRATIGRAPHY

Atnarpa Igneous Complex

The oldest lithologies within the E.L. belong to the Atnarpa Igneous Complex. This complex is a suite of tonalite, granite, granodiorite, and aplite that has been retrogressed to lower greenschist facies particularly along the thrust zone. This complex intrudes older lithologies, some of which have been found. Minor zones of banded iron formation, chloritic muscovite schists and mylonite have been found.

Heavitree Quartzite

The Heavitree Quartzite is the basal unit of the Amadeus Basin sediments of Adelaidean age. Within the licence, it is dominantly a silicified platy sandstone and siltstone that can overlie gritty sandstone.

Bitter Springs Formation

Conformably overlying the Heavitree Quartzite is the Bitter Springs Formation. Within the licence only the basal portions are exposed. It is composed siltstone, 20m thick, that grades into sandy carbonate and grey crystalline limestone.
VII. 2) STRUCTURE

This E.L. is part of the White Range Napp [Shaw et al 1984] in the Southern Zone of the Arunta Province. On the landsat scene (fig.3), the Wheel of Mundic Fault trends southwards from Mt. Chapman to the east side of White Range where it trends southwest into the Cattle Highway lineament [Carthew 1982]. There are four prominent lineaments recognized:

1) north-south trend
2) east-west trend
3) north-northwest trend
4) northeast trend.

At the local scale four generations of mesoscopic folds are present, [Shaw et al 1971] and are illustrated on Figure 4.

1) South-verging folds. (fold generation 1)
These folds are found in the ranges south of Paddy Hole Plain. They are open to closed flexural-slip folds with east-west subhorizontal axes, and vertical to north dipping axial planes. The folds verge south.

2) Recumbent folds. (fold generation 2)
The recumbent folds are found in the northern part of the nappe, coincident with the distribution of lineated quartzite. The size and style of the fold is dependent on the lithology. In the medium blocky quartzite, the folds range from 1m to 15m in amplitude, whereas in the laminated fine-grained upper beds and the poorly bedded schistose lower beds, the folds are a few centimetres in amplitude and invariably isoclinal. Most of these folds plunge north-northeast at about 10°. Associated with the recumbent folds are numerous boudins and mullions.
1. Period of nappé emplacement: inferred folding and thrusting.

2. Formation of (a) tight to isoclinal folds, or (b) tight to isoclinal, upright to inclined folds, or (c) both, simultaneously in some areas, elsewhere one dominates the other. Formation of axial-plane schistosity (S1) in basement and cover, and down-dip lineation, common to all three types.

3. Formation of close to tight upright folds with crenulation cleavage, (S2); S1 is folded by these folds, and sub-horizontal lineation forms by intersection of S1 and S2.

4. Formation of kinks, sigmoidal quartz veins, fractures, normal faults, and warps at Mt. Laughlen and the Georgina Range.

Fig. 4. Sequence of deformation events - White Range Nappé area. (after Shaw et al 1971)
3) Upright folds. (fold generation 3)

The third generation folds are east-west trending upright folds that fold the foliation, lineation, and recumbent folds in the quartzite. This fold style is only found in the northern part of the nappe, and characteristically refolds the S1 schistosity. Again, the fold morphology is related to lithology; folds in the blocky sandstone are open and concentric, with amplitudes and wavelengths of several metres, whereas folds in the finer grained units are tight to isoclinal, concentric to disharmonic, and up to 4m in amplitude.

4) Kink Bands. (fold generation 4)

Kink bands are only found in the northern parts of the nappe within the basal schistose beds of the quartzite. There are two sets of kink bands; one set striking east-west, and dipping steeply south, the other trends north-south and dips vertically. They are only centimetres thick.

BLUEY SILVER PROJECT EVALUATION

The Bluey Silver project continued to be evaluated. Whilst select samples of galena-secondary copper rich gossans can return spectacular values, our attention has been directed towards evaluation of a machinery mining operation. A sample of highly leached galena-secondary copper gossan returned the following values.

<table>
<thead>
<tr>
<th>Pb</th>
<th>Zn</th>
<th>Cu</th>
<th>Ag</th>
<th>Ni</th>
<th>Co</th>
<th>Mn</th>
<th>Ba</th>
<th>Sb</th>
<th>As</th>
<th>Au</th>
<th>WO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-1</td>
<td>55.6%</td>
<td>250</td>
<td>2.08%</td>
<td>3693</td>
<td>5</td>
<td>&lt;5</td>
<td>40</td>
<td>200</td>
<td>0.85%</td>
<td>0.28%</td>
<td>0.19</td>
</tr>
</tbody>
</table>

(values in ppm unless stated, and have been assayed by atomic absorption technique except the silver value which is by fire assay.)
## SILVER ORE ANALYSIS

<table>
<thead>
<tr>
<th>Element</th>
<th>Symbol</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copper</td>
<td>Cu</td>
<td>9.06%</td>
</tr>
<tr>
<td>Zinc</td>
<td>Zn</td>
<td>.95%</td>
</tr>
<tr>
<td>Silver</td>
<td>Ag</td>
<td>.47%</td>
</tr>
<tr>
<td>Lead</td>
<td>Pb</td>
<td>.15%</td>
</tr>
<tr>
<td>Antimony</td>
<td>Sb</td>
<td>2.42%</td>
</tr>
<tr>
<td>Barium</td>
<td>Ba</td>
<td>3.8%</td>
</tr>
<tr>
<td>Iron</td>
<td>Fe</td>
<td>1.15%</td>
</tr>
<tr>
<td>Arsenic</td>
<td>As</td>
<td>.72%</td>
</tr>
<tr>
<td>Cadmium</td>
<td>Cd</td>
<td>.07%</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>P</td>
<td>.22%</td>
</tr>
<tr>
<td>Manganese</td>
<td>Mn</td>
<td>95 PPM</td>
</tr>
<tr>
<td>Gold</td>
<td>Au</td>
<td>.45 PPM</td>
</tr>
<tr>
<td>Titanium</td>
<td>Ti</td>
<td>145 PPM</td>
</tr>
</tbody>
</table>

Chromium, Vanadium, Molybdenum, Nickel, Bismuth, Zirconium - Range 10 - 100 PPM.
Such results encouraged us to seek a mineral processing laboratory which could undertake preliminary metal recovery studies. We forwarded a 5kg parcel of metal rich gossan to Mineral Research and Development Pty Ltd. Results of their work are shown in the following table. They have indicated that a satisfactory silver recovery rate of greater than 80% could be achieved. Results of these preliminary investigations suggest that research should continue (Table 1).

A shallow dozer costean to expose the mineralized zone was made and the ore stockpiled. This work confirmed that the width of the mineralized zone varies between 0.5m and 1.0m wide, and is lying flat or dipping gently to the north.

The mineralized horizon is hosted in calcareous siltstones and sandy carbonates and is associated with barite, probably on a thrust structure.

A 15kg sample from this stockpile has been forwarded to Mineral Research Laboratories. They have taken 15 splits to obtain reliability of results and forwarded a check sample to Comlabs. The assay results from Comlabs, whilst much lower, indicate the possible dilution effects that can be expected with machinery. However a value of 430g/t Ag has been obtained for sample M2006 (Table 2).

Mr. K. Morris, an estimator for mining projects with Theiss Mining Contractors, suggests that 10,000 tonnes of ore is apparent at or near to the surface.

With this information, we have invited representatives of N.T.G.S. to advise on environmental matters and how best to proceed. At the time of this report, six government officers have inspected the site. (Messrs. J. Rose, S. Leyland, J. Errity, J. Bastias, and L. Nichols.) All are agreed that the environmental impact from a mining operation would be negligible, and have advised that we seek written approval for bulk sample testing. (Appendix 1)
### Analytical Report

**JOB COM872181**

**Sample**

<table>
<thead>
<tr>
<th>Element</th>
<th>Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cu</td>
<td>ppm</td>
<td>4400</td>
</tr>
<tr>
<td>Pb</td>
<td>ppm</td>
<td>6900</td>
</tr>
<tr>
<td>Zn</td>
<td>ppm</td>
<td>650</td>
</tr>
<tr>
<td>Ni</td>
<td>ppm</td>
<td>20</td>
</tr>
<tr>
<td>Co</td>
<td>ppm</td>
<td>24</td>
</tr>
<tr>
<td>Bi</td>
<td>ppm</td>
<td>12</td>
</tr>
<tr>
<td>Cd</td>
<td>ppm</td>
<td>40</td>
</tr>
<tr>
<td>Ag</td>
<td>ppm</td>
<td>430</td>
</tr>
<tr>
<td>Mo</td>
<td>ppm</td>
<td>6</td>
</tr>
<tr>
<td>V</td>
<td>ppm</td>
<td>55</td>
</tr>
<tr>
<td>Fe</td>
<td>ppm</td>
<td>2.55</td>
</tr>
<tr>
<td>Mn</td>
<td>ppm</td>
<td>470</td>
</tr>
<tr>
<td>Cr</td>
<td>ppm</td>
<td>90</td>
</tr>
<tr>
<td>Li</td>
<td>ppm</td>
<td>10</td>
</tr>
</tbody>
</table>

**Scheme**

- AAS1B
- AAS1B
- AAS1B
- AAS1B

**Table 2**

**Sample**

<table>
<thead>
<tr>
<th>Element</th>
<th>Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sr</td>
<td>ppm</td>
<td>20</td>
</tr>
</tbody>
</table>

**Scheme**

- XRF1
FUTURE

We view the above results and discussions with the Mines Department personnel as encouraging, and wish to proceed in the further evaluation of Bluey Silver Prospect positively, but with caution.

REFERENCES

Carthew S.J. 1983

Shaw R.D. Stewart A.J. Rickard M.J. 1984
"Arltunga - Harts Range Region. 1:100,000 map commentary."

Shaw R.D. Stewart A.J. Yar Khan M. and Funk J.L. 1971
"Progress reports on detailed studies in the Arltunga Nappe Complex. N.T. B.M.R. record. 1971/6"

Stewart A.J. Shaw R.D. and Black 1984
"The Arunta Inlier: A complext ensialic mobile belt in Central Australia."

Stewart A.J. and Warren R.G. 1977
"The mineral potential of the Arunta Block."
Dear Sir,

Bulk Sample Extraction on EL 4850
at Bluey Silver Prospect, Arltunga.

We, Stephen J. Cartthew, John R. Bruce and Endras Pty. Ltd. have sent two parcels of complex silver-copper-antimony-lead ore of approximately 20 kg to Mineral Research Laboratories (M.R.L.), Adelaide whose preliminary results of metal extraction are favourable of further evaluate processing methods and metal extraction of a 1,000 tonne bulk sample.

To further exploration and metallurgical studies at the Bluey Silver Prospect, we seek written approval from the Department to send a 1,000 tonne bulk sample to Adelaide. Discussions with Mineral Research Laboratories (M.R.L.) and a fertilizer company who would like to buy the ore have reached a point where M.R.L. are prepared to send an independent person to sample and evaluate the resource and we to authorise a mining engineer to conduct studies on our behalf and further negotiations to point of sale of ore.

Mr. Shaun Leyland, Mining Technical Officer, Alice Springs and Tony Errity, Environmental Officer, Darwin have inspected the site and have advised us to write to you and peg a mineral claim over the area of concern.

Should you require further information a prompt reply before the onset of summer would be appreciated.

Yours faithfully,

ROCKS PROSPECTING & ASSOCIATES

[Signature]

70 Sunshine Avenue,
BRIGHTON, S.A. 5048
PH: 08 296-0015
